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Air Quality Technical Report for the ICTF Modernization Project, Long Beach, California

prepared for:

Union Pacific Railroad Company

December 2007

prepared by:

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EXECUTIVE SUMMARY

The Union Pacific Railroad Company (UPRR) is proposing to modernize its Intermodal Container Transfer Facility (ICTF) located in Long Beach, CA. As part of the Application for Project Approval (APA) for the ICTF Modernization Project (Project), an air emission inventory, quantifying emissions of criteria pollutants, specified toxic air contaminants (TACs) including Diesel particulate matter (DPM), and greenhouse gases from stationary, mobile, and portable equipment operating at the facility, has been prepared. Emission estimates have been prepared for the 2005 baseline year and Project Years 2010, 2012, 2014, and 2016; a 70 year project average emission rate has been estimated as well. The emission estimates for the future Project Years (2010-2016) take into account the phased construction of the modernized facility, the predicted increase in freight that will be handled at the modernized facility, and certain other future regulatory and voluntary emission reduction activities. Estimates were prepared in accordance with Section 3.0 of the *Draft Protocol for Air Emission Modeling and Human Health Risk Assessment for Intermodal Facilities at the Port of Los Angeles* (Environ, April 13, 2007).

At the request of the Joint Powers Authority (JPA), emissions from the nearby Dolores Yard have also been included in the inventory for the 2005 baseline and future Project Years. The Dolores Yard is a locomotive servicing facility that provides support to the ICTF and other UPRR Yards in the area. The Yards are physically separate facilities, but due to their close proximity to one another, they were treated as one facility for the emission inventories and the baseline dispersion modeling analysis. For the future Project Years, it was assumed that no infrastructure changes would be made at the Dolores Yard. The emissions from the Dolores Yard have been allocated into two categories, emissions related to ICTF operations and emissions not related to ICTF operations, based on car count projections provided by UPRR.[1]

Table ES-1 shows the facility-wide criteria pollutant and GHG emissions for the 2005 baseline year and the ICTF Project Years, as the Project is implemented over time.

[1] Personal communication with Lanny Schmid of UPRR on August 28, 2007.

Table ES-1 Overall Project Emissions ICTF Modernization Project					
Criteria Pollutants	Emissions (tpy)[a]				
	2005	2010	2012	2014	2016
ICTF Lifts (x 1000)	626	900	1,100	1,300	1,500
ROG	53.99	51.66	46.10	40.60	39.91
CO	234.11	219.88	179.32	170.06	175.69
NOx	601.23	350.96	273.80	250.92	258.10
PM_{10}	39.07	35.83	36.32	32.75	34.64
DPM	20.30	11.58	8.10	6.45	5.30
SOx	10.73	1.94	0.68	0.56	0.60
Greenhouse Gases	Emissions (metric tons/year)[a]				
	2005	2010	2012	2014	2016
CO_2	44,428.04	44,529.62	37,042.94	37,057.53	39,865.85
N_2O	0.51	0.54	0.54	0.57	0.60
CH_4	1.55	1.69	1.73	1.76	1.84
Total GHG as CO_2e[b]	44,618.69	44,732.51	37,246.67	37,271.19	40,090.49

Notes:

a. Includes emissions from the Dolores Yard.

b. Based on a global warming potential (GWP) of 310 for N_20 and 21 for CH_4, from CARB's Staff Report for the Mandatory Reporting of GHG Emissions Regulation (CARB, 2007).

As shown above, the Project will reduce emissions of all criteria pollutants and total GHGs as compared to the existing facility baseline year. These reductions will concurrently lower any existing predicted heath risk associated with ICTF operations.

An air dispersion modeling analysis was also conducted for 2005 baseline year. The purpose of the analysis was to estimate ground-level concentrations of DPM and other TACs emitted from Yard operations, at receptor locations near the Yards. All emission sources that were included in the inventory were also included in the dispersion modeling analysis. The air dispersion modeling was conducted using the AERMOD Gaussian plume dispersion model and surface meteorological data from the St. Peter and Paul School monitoring station in Wilmington, and cloud cover data from the Long Beach Daugherty Field station were used for this project.[2] The upper air data used in the

[2] ENVIRON. *Meteorological Data Selection and Processing Methodology for 2006 BNSF Designated Rail Yards*, Report 06-12910J, July 25, 2006.

modeling were obtained from Miramar Marine Corps Air Station. The meteorological data were processed using the AERMET program. The modeling analysis was conducted in accordance with the *Health Risk Assessment Guidance for Rail Yard and Intermodal Facilities* (July 2006), UPRR's *Modeling Protocol* (August 2006), and the *Preliminary Draft Protocol for Air Emission Modeling and Human Health Risk Assessment for Intermodal Facilities at the Port of Los Angeles* (ENVIRON, 2007)..

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PART I. INTRODUCTION

The Union Pacific Railroad Company (UPRR) is proposing to modernize its Intermodal Container Transfer Facility (ICTF) located in Long Beach, CA. As part of the Application for Project Approval (APA) for the ICTF Modernization Project (Project), an air emission inventory, quantifying emissions of criteria pollutants, specified toxic air contaminants (TACs) including Diesel particulate matter (DPM), and greenhouse gases from stationary, mobile, and portable equipment operating at the facility, has been prepared. Emission estimates have been prepared for the 2005 baseline year and Project Years 2010, 2012, 2014, and 2016. The emission estimates for the future Project Years (2010-2016) take into account the phased construction of the modernized facility, the predicted increase in freight that will be handled at the modernized facility, and certain other future regulatory and voluntary emission reduction activities. Estimates were prepared in accordance with Section 3.0 of the *Draft Protocol for Air Emission Modeling and Human Health Risk Assessment for Intermodal Facilities at the Port of Los Angeles* (Environ, April 13, 2007).

At the request of the Joint Powers Authority (JPA), emissions from the nearby Dolores Yard have also been included in the inventory for the 2005 baseline and future Project Years. The Dolores Yard is a locomotive servicing facility that provides support to the ICTF and other UPRR Yards in the area. The Yards are physically separate facilities, but due to their close proximity to one another, they were treated as one facility for the emission inventories and the baseline dispersion modeling analysis. For the future Project Years, it was assumed that no infrastructure changes would be made at the Dolores Yard. The emissions from the Dolores Yard were allocated into two categories, emissions related to ICTF operations and emissions not related to ICTF operations, based on car count projections provided by UPRR.[3] While, the overall activity level at Dolores is not expected to increase in the future Project years, operations will shift to incorporate more ICTF-related activities.

An air dispersion modeling analysis was also conducted for 2005 baseline year. The purpose of the analysis was to estimate ground-level concentrations of DPM and other TACs emitted from Yard operations, at receptor locations near the Yards. All emission sources that were included in the inventory were also included in the dispersion modeling analysis. The air dispersion modeling was conducted using the AERMOD Gaussian plume dispersion model and surface meteorological data from the St. Peter and Paul School monitoring station in Wilmington, and cloud cover data from the Long Beach Daugherty Field station were used for this project.[4] The upper air data used in the modeling were obtained from Miramar Marine Corps Air Station. The meteorological data were processed using the AERMET program. The modeling analysis was conducted in accordance with the *Health Risk Assessment Guidance for Rail Yard and Intermodal Facilities* (July 2006), UPRR's *Modeling Protocol* (August 2006), and the *Preliminary Draft Protocol for Air Emission Modeling and Human Health Risk Assessment for Intermodal Facilities at the Port of Los Angeles* (ENVIRON, 2007).

[3] Personal communication with Lanny Schmid of UPRR on August 28, 2007.
[4] ENVIRON. *Meteorological Data Selection and Processing Methodology for 2006 BNSF Designated Rail Yards*, Report 06-12910J, July 25, 2006.

PART II. FACILITY DESCRIPTION

A. Main Purpose of the Facility

The ICTF Yard is an intermodal container facility. Cargo includes intermodal containers and "manifest" cargo (mixed freight). Cargo containers and other freight are received, sorted, and distributed from the facility. Intermodal containers may arrive at the facility by truck to be loaded onto trains for transport to distant destinations, or arrive by train and unloaded onto chassis for transport by truck to local destinations. Cargo containers and chassis are also temporarily stored at the Yard. Facilities at the Yard include classification tracks, a gate complex for inbound and outbound intermodal truck traffic, intermodal loading and unloading tracks, a freight car repair shop, and various buildings and facilities supporting railroad and contractor operations.

The Dolores Yard serves two primary purposes: flat switching and locomotive servicing. At a flat switching yard, incoming and outbound train sections are stored in different track segments, and separated from and connected to other sections to build new trains. Dolores serves three separate types of trains: manifest (or mixed) freight trains that are handled within the Dolores Yard; intermodal trains that are handled at ICTF; and intermodal and other trains that ostensibly terminate or originate in the Yard, but are in reality handled at on-dock facilities within the Ports of Los Angeles and Long Beach.

The Dolores Yard is also a locomotive servicing facility, which includes a Service Track and a Locomotive Shop, to provide support to ICTF and other yards in the L.A. Basin. Operations include both basic service (refueling, sanding, cleaning, etc.) and major planned and unscheduled maintenance for locomotives serving Dolores, ICTF, and the on-dock facilities in the Ports. Other facilities and equipment at the Yard include a sand tower, Diesel fuel storage tanks, various oil storage tanks, and a wastewater treatment plant.

B. Types of Operations Performed at the Facilities

Activities at ICTF include receiving inbound trains, switching cars, loading and unloading intermodal trains, storage of intermodal containers and chassis, building and departing outbound trains, and repairing freight cars and intermodal containers/chassis. Activities at the Dolores Yard include receiving inbound trains, building and departing outbound trains, locomotive refueling, locomotive servicing, and sand tower operations. UPRR operates yard switcher locomotives within Dolores and ICTF to support many of these activities. In addition, Pacific Harbor Lines (PHL) operates yard switchers throughout the Ports (although not generally within the boundaries of the ICTF or Dolores Yards). The PHL switchers will pull train sections destined for on-dock handling from the south (or west) end of Dolores, and push train sections that were newly built on-dock back into the south end of Dolores.

The railroad track layout for Dolores and ICTF is primarily linear along a roughly north-south axis, with track to the north heading to central Los Angeles and points north and east, while track to the south heads into the Ports. The Alameda Corridor runs adjacent to the west side of Dolores, and there are leads into and out of Dolores at each end. The north end of the Dolores Yard contains the "900 Track," a series of parallel tracks approximately 1.4 miles long, as well as a lead from the Alameda Corridor into Dolores and subsequently ICTF. The south end of Dolores contains another set of multiple parallel tracks approximately 0.9 miles long known as the "300 Track." Both the 900 and 300 Tracks can be used to receive terminating trains or to build originating trains. ICTF is connected at its north end to the central section of Dolores and to the 900 Track. The tracks within ICTF are the principal intermodal loading and unloading tracks, and are serviced by rubber tire gantry (RTG) cranes and a variety of other cargo handling equipment.

C. Facility Operating Schedule

Both the ICTF and Dolores Yards operate 24 hours per day, 365 days per year.

PART III. MAP AND FACILITY PLOT PLAN

Figure 1
Location Map

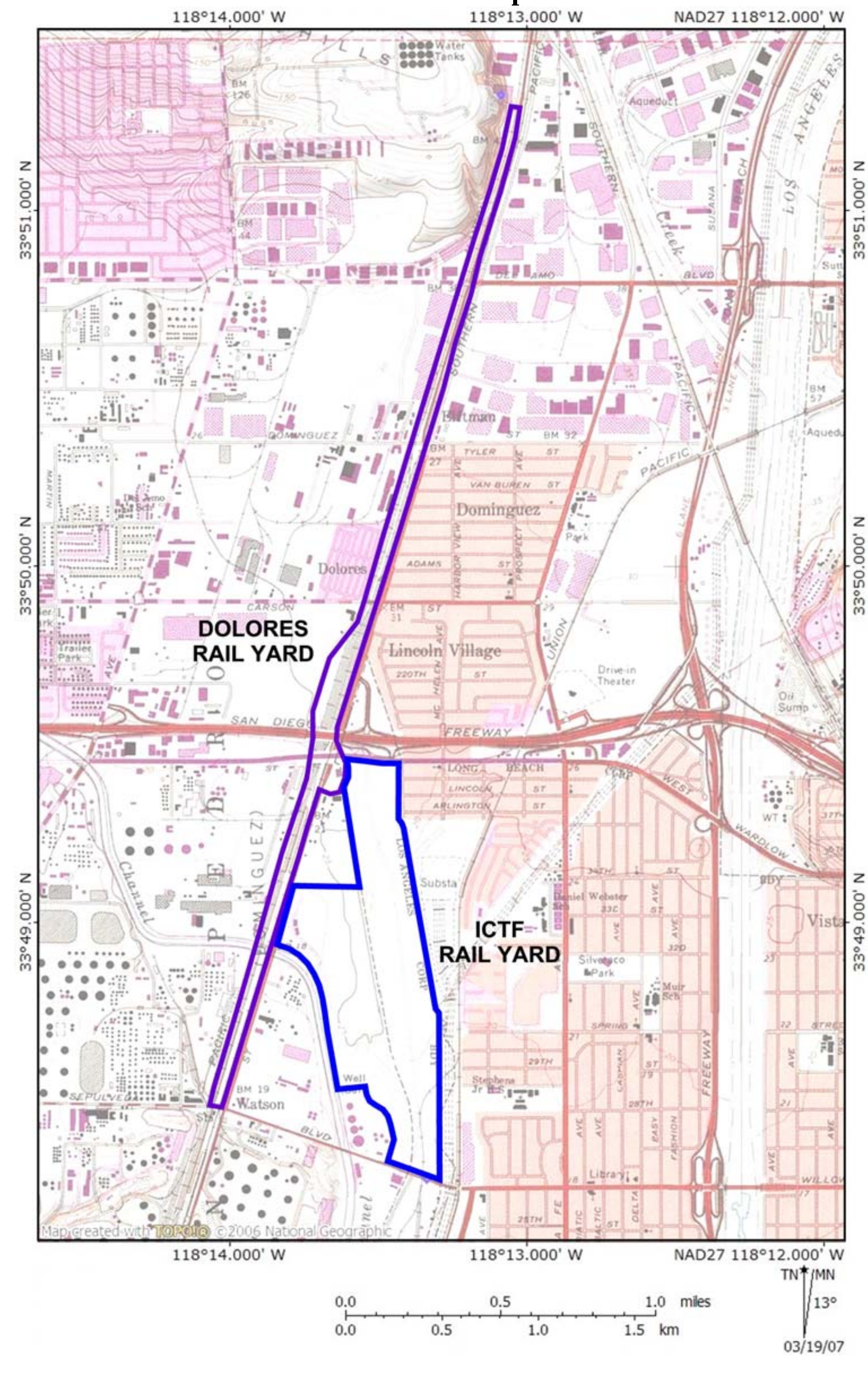

Figure 2
Dolores Rail Yard Layout – 2005 Baseline Year

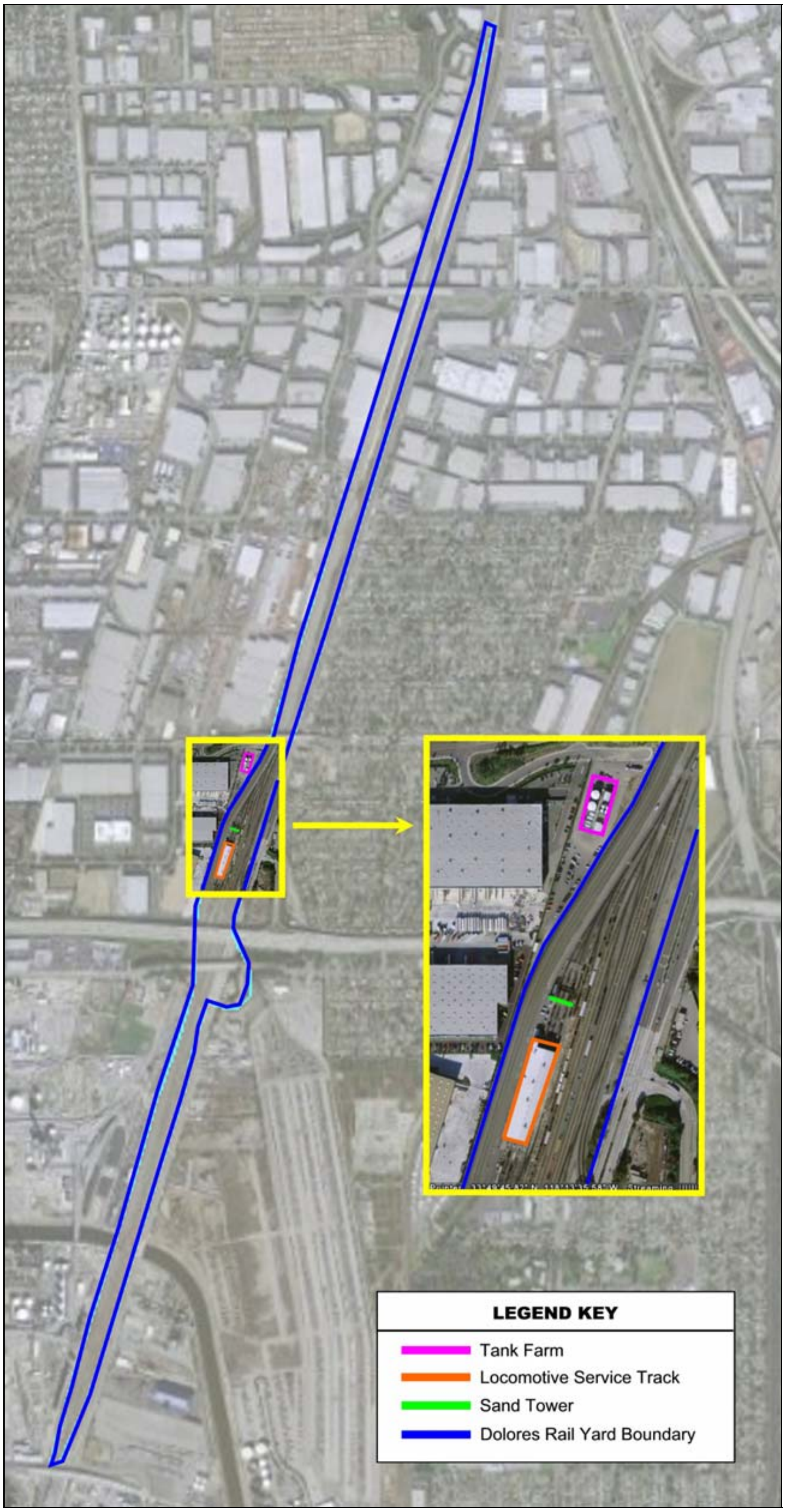

Figure 3
ICTF Rail Yard Layout – 2005 Baseline

PART IV. AIR EMISSIONS

The air emission inventories presented in this Report quantify criteria pollutant, toxic air contaminant (TAC), and greenhouse gas (GHG) emissions from the stationary, mobile, and portable sources located or operated at the ICTF and Dolores Yards. Criteria pollutants include reactive organic gases (ROG), carbon monoxide (CO), oxides of nitrogen (NOx), particulate matter less than 10 microns in diameter (PM_{10}), and oxides of sulfur (SOx). GHGs include carbon dioxide (CO_2), nitrous oxide (N_2O), and methane (CH_4)[5]. TACs include, but are not limited to, Diesel particulate matter (DPM) 1,3-butadiene, acetaldehyde, acrolein, benzene, cyclohexane, ethylbenzene, formaldehyde, styrene, toluene, and xylenes. Speciation profiles, from CARB's SPECIATE database,[6] were applied to the non-Diesel sources to calculate the TAC emissions. For Diesel sources, per CARB guidance, DPM was used as a surrogate for all TACs and a speciation profile was not used.

Emission inventories have been prepared for the 2005 baseline year and for Project Years 2010, 2012, 2014, and 2016. Emission sources include, but are not limited to, locomotives, heavy-heavy-duty (HHD) Diesel-fueled trucks, cargo handling equipment (CHE), heavy equipment, transport refrigeration units (TRUs) and refrigerated railcars (reefer cars), and fuel storage tanks.

Table 1 shows the facility-wide criteria pollutant and GHG emissions for the 2005 baseline year and the ICTF Project Years, as the Project is implemented over time.

As shown below, the Project will reduce emission from all criteria pollutants and total GHGs, compared to the existing facility baseline year. These reductions will concurrently lower any existing predicted heath risk associated with ICTF operations.

[5] CFC emissions from TRU and reefer car refrigerant loss were also calculated. See Parts IV.A.5, IV.B.5, IV.C.5, IV.D.5, and IV.E.5 for details.

[6] Available at http://www.arb.ca.gov/ei/speciate/speciate.htm.

Table 1 Overall Project Emissions ICTF Modernization Project					
Criteria Pollutants	Emissions (tpy)[a]				
	2005	2010	2012	2014	2016
ICTF Lifts (x 1000)	626	900	1,100	1,300	1,500
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CO	234.11	219.88	179.32	170.06	175.69
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PM_{10}	39.07	35.83	36.32	32.75	34.64
DPM	20.30	11.58	8.10	6.45	5.30
SOx	10.73	1.94	0.68	0.56	0.60
Greenhouse Gases	Emissions (metric tons/year)[a]				
	2005	2010	2012	2014	2016
CO_2	44,428.04	44,529.62	37,042.94	37,057.53	39,865.85
N_2O	0.51	0.54	0.54	0.57	0.60
CH_4	1.55	1.69	1.73	1.76	1.84
Total GHGs as CO_2e[b]	44,618.69	44,732.51	37,246.67	37,271.19	40,090.49

a. Includes emissions from the Dolores Yard.
b. Based on a global warming potential (GWP) of 310 for N_20 and 21 for CH_4, from CARB's Staff Report for the Mandatory Reporting of GHG Emissions Regulation (CARB, 2007).

Emissions inventories, by source category, for the 2005 baseline year and each Project Year (2010, 2012, 2014, and 2016) are presented below. The methodology and assumptions used to prepare the inventory for each source group and year are also discussed below.

A. 2005 Baseline Emissions Inventory

The 2005 baseline inventory quantified onsite criteria pollutant, GHG, and TAC emissions from emission sources at the ICTF and Dolores yards. Table 2 summarized the emissions, by source group, for the 2005 baseline year. The methodology and assumptions used to prepare the inventory for each source group are discussed in detail in Sections 1 through 18 below.

In addition to the total emissions from the ICTF and Dolores yards, Table 2 also shows emissions that are related to ICTF. The ICTF-related emissions include emissions that occur within the ICTF, such as emissions from CHE, plus the portion of the emissions from the Dolores Yard that are related to ICTF. The emissions were allocated based on the railcar data provided by UPRR.[7] The 2005 railcar activity was designated as either manifest freight, ICTF intermodal, or other intermodal. In 2005, 43% of the railcars entering the Dolores Yard included intermodal freight bound for ICTF. Therefore, it was assumed that 43% of the emissions from Dolores in 2005 were related to ICTF.

In addition to the onsite emissions, the emissions from locomotive and drayage truck activity during the 2005 baseline year were calculated for the following:

- Criteria pollutant and GHG emissions were calculated for operations within 0.5 miles of the facility;
- Criteria pollutant emissions were calculated for operations from the yard to the boundary of the South Coast Air Basin (SoCAB); and
- GHG emissions were calculated for operations from the yard to the California state line.

For emissions from UPRR and BNSF trains in the Alameda Corridor the primary activity indicator for these trains is fuel consumption calculated as the product of 71.9 million gross tons per mile (MGTM) and 1,296 gal/MGTM (UPRR's system-wide fuel consumption rate for 2005). To calculate emissions, gram-per-gallon emission factors were derived for the Dolores/ICTF intermodal locomotive model distribution operating on the EPA line-haul duty cycle. Notch-specific emission factors were calculated by dividing the gram per hour emission rates by the gallon per hour fuel consumption rates for each locomotive model, weighted by the model's fraction of the total model distribution.

The offsite emissions are summarized in Table 3 below. See Appendix A-8 for detailed calculations for locomotives and Appendix B-7 for detailed calculations for drayage trucks.

[7] Personal communication with Lanny Schmid of UPRR on August 28, 2007.

Table 2
Emissions by Source Category – ICTF and Dolores Rail Yards
2005 Baseline Year

Source Group	Emissions (tons/yr)						Emissions (metric tons/yr)		
	ROG	CO	NOx	PM_{10}	DPM	SOx	CO_2	N_2O	CH_4
Locomotives	18.86	39.55	350.77	8.04	8.04	8.21	18,526.10	0.47	1.46
Drayage Trucks	19.94	58.58	103.81	6.05	5.93	0.72	7,885.68	0.01	0.03
Cargo Handling Equipment	4.71	67.35	121.16	4.38	4.38	1.46	14,682.02	0.02	0.05
Heavy Equipment	0.86	11.58	9.38	0.40	0.38	0.07	975.96	0.00	0.00
TRUs and Reefer Cars[a]	6.06	14.33	13.47	1.51	1.51	0.14	1,417.94	0.00	0.01
Delivery Trucks	0.01	0.04	0.08	0.00	0.00	0.00	4.99	0.00	0.00
Yard Trucks	0.02	1.09	0.11	0.00	NA	0.00	448.71	0.00	0.00
IC Engines	0.07	0.18	0.84	0.06	0.06	0.06	27.63	0.00	0.00
Tanks	0.93	NA	NA	NA	NA	NA	NA	NA	NA
Refueling	0.38	NA	NA	NA	NA	NA	NA	NA	NA
Sand Tower	NA	NA	NA	0.00	NA	NA	NA	NA	NA
WWTP	0.00	NA	NA	NA	NA	NA	NA	NA	NA
Steam Cleaners	0.12	2.43	0.17	0.00	NA	0.00	92.78	0.00	0.00
Heater	0.00	0.07	0.08	0.01	NA	0.00	87.85	0.01	0.00
Propane Welder	0.00	0.22	0.14	0.00	NA	0.00	7.85	0.00	0.00
Miscellaneous Equipment	1.89	38.41	0.96	0.06	NA	0.05	87.67	0.00	0.00
Worker Vehicles	0.16	0.28	0.26	0.02	NA	0.00	182.86	0.00	0.00
Road Dust	NA	NA	NA	18.54	NA	NA	NA	NA	NA
Total	**53.99**	**234.11**	**601.23**	**39.07**	**20.30**	**10.73**	**44,428.04**	**0.51**	**1.55**
ICTF-related[b]	**43.44**	**206.68**	**410.21**	**34.16**	**15.96**	**6.29**	**34,170.73**	**0.26**	**0.78**

Notes:
a. In addition to the GHG emissions shown, CFC emissions from TRU refrigerant loss equal 0.177 metric tons per year.
b. The ICTF-related emissions include emissions that occur within ICTF plus a portion of the emissions from the Dolores Yard. The emissions from the Dolores Yard were allocated based on railcar counts provided by UPRR.

Table 3
Summary of Offsite Locomotive and Drayage Truck Emissions
2005 Baseline Year

Source	Emissions (tons/yr)						Emissions (metric tons/yr)		
	ROG	CO	NOx	PM_{10}	DPM	SOx	CO_2	N_2O	CH_4
Within 0.5 miles of the Yard									
Locomotives[a]	3.06	7.32	69.15	1.80	1.80	4.06	4,152.39	0.10	0.33
Drayage Trucks[b]	2.58	9.95	29.11	1.64	1.56	0.21	2,306.42	0.00	0.01
Total	**5.64**	**17.27**	**98.26**	**3.44**	**3.36**	**4.27**	**6,458.81**	**0.10**	**0.34**
Within SoCAB[c]									
Locomotives	45.79	109.46	1,034.38	26.90	26.90	60.73	62,113.43	1.56	4.88
Drayage Trucks	55.98	218.50	653.34	37.50	35.53	4.95	53,813.89	0.07	0.22
Total	**101.77**	**327.96**	**1,687.72**	**64.40**	**62.43**	**65.68**	**115,927.32**	**1.63**	**5.10**
To State Line[d]									
Locomotives	NA	NA	NA	NA	NA	NA	178,700.19	4.49	14.05
Drayage Trucks	NA	NA	NA	NA	NA	NA	180,521.54	0.25	0.75
Total	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**359,221.73**	**4.74**	**14.80**

Notes:

a. Includes locomotive emissions from the section of the Alameda corridor immediately adjacent to the Dolores yard plus emissions from locomotive operations on the Alameda corridor within 0.5 miles from the yard.

b. Includes emissions from drayage truck travel within 0.5 miles of the yard.

c. Includes locomotive and drayage emissions from the yard boundary to the boundary of the South Coast Air Basin.

d. Includes locomotive and drayage emissions from the yard boundary to the state line. The JPA only requested estimates of GHG emissions to the state line.

1. Locomotives

Equipment and Activity

Locomotive activities at the Yards fall into two basic categories: road power and yard operations. "Road power" units are locomotives used on inbound and outbound freight trains and are generally larger, higher horsepower units (3,000 to 6,000 hp). Locomotives used for operations within a rail yard are called switcher locomotives and are generally low horsepower units (1,500 to 3,000 hp).

Road Power – "Road power" activities include hauling through trains on the main line; pulling arriving trains into the yard, pulling departing trains out of the yard; and movement of locomotives to and from the Service Track. The Dolores and ICTF Yards handle both manifest freight trains and intermodal trains. Arriving trains enter the Dolores Yard and stop while the railcars are detached from the locomotive. Once the railcars have been detached, the locomotives move to the Service Track for refueling and other service.

Approximately half of the manifest freight trains that terminate at Dolores use 900 Track. The remaining half of the manifest trains arriving at Dolores use the 300 Track. Originating manifest freight trains are most commonly built in the 900 Track and depart from there. Power is brought to the trains from the Service Track just prior to departure. The train departs after completion of the Federal Railroad Administration (FRA) mandated safety inspections (e.g., air pressure and brakes) and the arrival of the train crew.

Intermodal freight is handled at ICTF. However, due to track congestion and current facilities, only about 20% of terminating intermodal freight trains enter ICTF directly. The majority of the intermodal trains, about 80%, terminate in the 300 Track at Dolores and are pushed into ICTF for handling. Some of the intermodal trains terminating at Dolores are pulled directly from the 300 Track to on-dock facilities within the Ports of

Los Angeles and Long Beach by switcher locomotives operated by Pacific Harbor Lines (PHL). Originating intermodal trains depart from either the 300 Track (approximately 20%) or the 900 Track (approximately 80%). The road power moves directly to service after arrival, and consists[8] for departing trains move to the trains from Service just prior to departure. As for terminating trains, some originating trains are handled on-dock rather than within ICTF.

Through trains are trains that nominally bypass Dolores using the section of the Alameda Corridor, a section of the main line adjacent to and on the west side of the Dolores Yard. The Alameda Corridor is the main rail line between the Ports of Los Angeles and Long Beach and central Los Angeles. Data show some through trains pass directly through the yard on the 300 and 900 Tracks, however, with some adding or dropping of rail cars or locomotives. In these cases, the locomotive consist is not disconnected nor moved to the Service Track. These so-called “set-outs” are counted separately from trains on the Alameda Corridor so that the emissions specifically associated with the “set-outs” can be calculated.

Power moves are groups of locomotives that are moved between yards to provide road power for departing trains. Although power moves may have as many as 10 or more locomotives, typically only one or two locomotives are actually operating. For emission calculations, power moves were assumed to have 1.5 operating locomotives (except for power moves involving just one locomotive).[9]

Table 4 shows the number of road power locomotives in operation (arrivals, departures, and through traffic) at ICTF and Dolores during the 2005 baseline year by locomotive model group and type of train, including both working and non-working units (i.e., units that are shut-down).

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[8] “Consist” is the term used in the railroad industry to describe the group of coupled locomotives that pull trains.

[9] UP personnel report that although the train data records for power moves may show all locomotives “working,” in actuality all locomotives except for one at the front and one at the rear end (and more commonly only one at the front end) are shut down, as they are not needed to pull a train that consists only of locomotives. Assuming 1.5 working locomotives per power move may slightly overestimate the actual average number of working locomotives per power move.

Table 4 **Locomotive Models (Road Power) Identified at ICTF and Dolores Rail Yards[a]** **2005 Baseline Year**									
Locomotive Model Group	Intermodal Trains			Non-Intermodal Trains			Power Moves		
	Thru	Arriving	Departing	Thru	Arriving	Departing	Thru	Arriving	Departing
Switch[b]	0	1	1	5	281	269	0	1	2
GP3x	0	14	3	404	2,034	2,054	0	5	24
GP4x	58	972	846	184	1,446	1,343	15	156	256
GP50	2	88	92	6	53	21	2	10	16
GP60	43	650	403	38	991	1,137	13	95	229
SD7x	411	5,091	3,529	148	832	735	18	410	552
SD90	1	14	16	6	49	49	1	8	15
Dash7	0	5	4	0	3	1	0	2	2
Dash8	62	1,035	900	46	303	186	2	114	169
Dash9	328	1,990	1,402	80	570	519	17	183	369
C60A	6	10	9	0	50	52	1	0	5
Unknown	11	124	113	6	44	32	0	16	27
Total	922	9,994	7,318	923	6,656	6,398	69	1,000	1,666

Notes:
a. Includes all locomotives identified on an arriving, departing, or through train, including both working and non-working units.
b. Does not include the switcher locomotives used for yard operations.

Table 5 summarizes the activity data for locomotives operating on trains at ICTF and Dolores during the 2005 baseline year. Power moves into and out of railyards occur under train symbols if the regular train crew is still in the locomotives following termination of a train. In addition, some power moves occur without train symbols if the power is being ferried between yards by "hostlers" and not regular train crews. Such power moves do not appear in the train database since they do not have train symbols assigned to them. To insure that the emissions calculations are based on the same number of locomotives arriving and departing from the yard in a given year, the number of arriving or departing power moves was adjusted upward by an amount such that the total number of arriving and departing locomotives is the same.

Table 5
Train Activity Summary – ICTF and Dolores Rail Yards
2005 Baseline Year

Train Type	East Bound			West Bound			Speed (mph)	Idle per Train (hours)	Idle per Setout (hours)
	No. of Trains	Locos per Train	No. of Setouts	No. of Trains	Locos per Train	No. of Setouts			
Intermodal Through	74	3.365	22	215	2.916	166	10	0	0.5
Intermodal Terminating	0	--	--	2,045	3.267	--	10	0.5	--
Intermodal Originating	3,557	2.663	--	0	--	--	10	0.5	--
Non-Intermodal Through	403	1.548	384	101	2.574	79	10	0	0.5
Non-Intermodal Terminating	865	1.751	--	1,824	2.438	--	10	0.5	--
Non-Intermodal Originating	2,145	2.297	--	865	1.837	--	10	0.5	--
Power Moves Through	17	2.941	--	7	2.286	--	10	0	--
Power Moves Terminating	393	3.074	--	424	3.495	--	10	0	--
Power Moves Originating	624	3.857	--	1,604	3.324	--	10	0	--

Notes:
a. In addition to the activities described above, ten switchers operate in the Yard.

<u>Yard Switching</u> – Yard operations include movements of intermodal and manifest freight cars within the Yard. At the ICTF and Dolores Yards, the yard operations are performed by 5 sets of two GP-38 switchers. Three of these sets are assigned to Dolores manifest freight activities as well as other nearby industry jobs. These sets work within the full length of Dolores approximately 15 hours per day each, with the remaining time spent working outside the Yard. The other two sets serve ICTF intermodal freight exclusively. One set works the "bottom end" or south end of the 300 Track, while the other works the "top end" including the north end of the 300 Track, the 900 Track, and the lead from Dolores into ICTF. These two sets are assumed to be working 23 hours per day each within their assigned areas.

<u>Service and Maintenance</u> – The Locomotive servicing and maintenance activities performed at the Dolores Yard involve both road power and yard locomotives. Service activities include idling associated with refueling, sanding, oiling, and waiting to move to outbound trains, with additional periods of idling and higher throttle settings during load test events following specific maintenance tasks. Following service, locomotives are taken as consists to departing trains. In order to be sure that the lead locomotive is facing in the correct direction, approximately 25% of locomotives leaving service travel to the "Wye"[10] at the south end of the 300 Track to "turn the power."

A separate database provided information on each locomotive handled by the Service Track and Shop at Dolores. These data show service events for all locomotives, including Dolores manifest freight units, ICTF intermodal units, and other units serviced for "on-dock" trains and other yards. Based on detailed information on the reason and type of service or maintenance performed, separate counts of service and maintenance activities were developed. Routine service of locomotives involves idling and short movements in the service area associated with sanding, refueling, oiling, and other service activities prior to their movement to the Ready Track where locomotives are consisted for outbound trains. Some locomotive service events occur elsewhere in the

[10] A "wye" is a set of track segments arranged in a triangular configuration with a lead at each corner. A consist can enter the "wye" from one lead, exit from another, then back up through the "wye" and out the other lead, and then return through the third leg of the triangle with the direction of the consist reversed.

Yard, with little or no idling, as only simple service items and refueling are involved. Depending on the type of maintenance, load testing prior to and after maintenance is performed. The number of these test events was determined based on the service codes for each locomotive maintenance event in the database. The specific nature (duration and throttle setting) of such load testing events is described in Table 6.

Table 6
Locomotive Service and Shop Releases and Load Tests – Dolores Rail Yard
2005 Baseline Year

Activity	Number of Events	Extra Non-ZTR Idling[a] (min)	ZTR and Non-ZTR Idling[b] (min)	N1 time (min)	N8 time (min)
Locomotive Pre-service	8,294	0	30	0	0
Locomotive Service	8,294	0	60	0	0
Ready Track	8,294	15	30	0	0
Yard Service	4,643	0	0	0	0
In Shop	2,815	0	30	0	0
Planned Maintenance Pre-Test	281	0	2	0	8
Planned Maintenance Post-Test	281	0	10	10	10
Quarterly Maintenance Test	430	0	2	0	8
Unscheduled Maintenance Diagnostic	6	0	10	0	10
Unscheduled Maintenance Post-Test	777	0	15	0	45

Notes:

a. "Extra Non-ZTR idling" duration is the number of minutes per event during which only locomotives not equipped with automated idling controls (ZTR SmartStart or AESS) are idling

b. "ZRT and Non-ZRT Idling" duration is the number of minutes per event during which all locomotives are idling, regardless of technology.

Emission Factors

Notch-specific criteria pollutant emission factors were assembled from a number of sources. These included emission factors presented in CARB's *Roseville Rail Yard Study* (October, 2004), as well as EPA certification data and other testing by Southwest Research Institute of newer-technology locomotives. Emission factors for HC and CO are shown in Tables 7 and 8. Emissions of HC and CO are not sensitive to fuel type.

Nitrogen oxides emissions are sensitive to the aromatic fraction of fuel, which is lower in all California fuel (regardless of and independent of sulfur content) than 47-state fuel. As discussed in Appendix A-7, the lower aromatic content of California fuel since the mid-1990s results in NOx emission rates approximately 6% lower than those for 47-state fuel. This factor was applied to the emission rates reported in locomotive testing using 47-state fuel to obtain emission factors for California fuel. The NOx emission factors for locomotives are shown in Table 9.

Fuel sulfur content affects the emission rates for Diesel particulate matter from locomotives. To develop emission inventories for locomotive activity, an initial collection of locomotive model- and notch-specific DPM emissions data were adjusted based on sulfur content. Although there is no official guidance available for calculating this effect, a draft CARB document provides equations to calculate the effect of sulfur content on DPM emission rates at specific throttle settings, and for 2-stroke and 4-stroke engines (Wong, undated). These equations can be used to calculate adjustment factors for different fuels as described in Appendix A-7. The adjustment factors are linear with sulfur content, allowing emission rates for a specific mixture of California and non-California fuels to be calculated as a weighted average of the emission rates for each of the fuels. Adjustment factors were developed and used to prepare tables of emission factors for two different fuel sulfur levels: 221 ppm for locomotives operated on California fuel; and 2,639 ppm for locomotives operating on non-California fuel. These results are shown in Tables 10 and 11. Sample emission calculations are shown in Appendix A-3 and A-4. The calculations of sulfur adjustments and the Wong Technical Memo are shown in Appendix A-7.

Table 7
Hydrocarbon Emission Factors (g/hr) for Locomotives – ICTF and Dolores Rail Yards
2005 Baseline Year

Model Group	Tier	Throttle Setting										Source[a]
		Idle	DB	N1	N2	N3	N4	N5	N6	N7	N8	
Switchers	N	99.0	145.0	93.2	116.5	145.2	194.0	274.4	377.1	521.4	666.1	EPA RSD[a]
GP-3x	N	124.1	269.0	121.5	149.9	188.5	261.3	371.5	468.8	651.6	807.1	EPA RSD[a]
GP-4x	N	185.0	295.3	155.4	201.5	247.0	320.5	423.7	611.0	878.1	1168.8	EPA RSD[a]
GP-50	N	76.0	279.0	39.0	209.0	311.6	351.8	487.8	663.8	932.6	1082.5	EPA RSD[a]
GP-60	N	113.4	158.4	11.6	175.6	304.1	408.3	500.4	645.7	1062.3	1351.0	EPA RSD[a]
GP-60	0	100.8	162.5	113.7	153.9	240.3	287.4	366.0	475.5	749.1	901.7	SwRI[b] (KCS733)
SD-7x	N	117.6	174.1	116.8	166.6	264.6	319.1	421.5	605.4	804.2	1052.2	SwRI[c]
SD-7x	0	62.2	64.6	90.9	138.5	297.6	393.4	500.9	894.2	1229.9	1433.4	GM EMD[d]
SD-7x	1	167.0	241.0	182.0	203.8	388.0	524.9	648.0	900.6	1115.3	1294.3	SwRI[e] (NS2630)
SD-7x	2	99.8	129.2	93.3	115.4	165.7	194.7	231.8	231.8	351.1	483.7	SwRI[e] (UP8353)
SD-90	0	340.4	247.4	227.1	403.9	948.2	1538.7	2371.2	1522.9	1703.8	3485.4	GM EMD[d]
Dash 7	N	259.1	422.4	124.7	98.9	276.1	286.7	346.6	499.0	697.5	750.0	EPA RSD[a]
Dash 8	0	268.6	627.2	330.8	357.8	394.8	418.8	655.4	613.6	737.7	861.2	GE[d]
Dash 9	N	212.6	239.7	138.1	200.8	403.4	389.8	572.3	740.8	908.0	1063.3	SWRI 2000
Dash 9	0	99.6	159.5	141.2	226.5	583.9	984.6	1452.4	869.8	998.5	1239.1	Average of GE & SwRI[f]
Dash 9	1	54.8	309.1	210.4	297.8	606.1	713.7	789.0	931.1	978.2	1094.0	SwRI[b] (CSXT595)
Dash 9	2	22.8	64.6	62.2	120.0	220.4	224.2	311.2	407.6	487.6	619.4	SwRI[b] (BNSF 7736)
C60-A	0	282.4	603.8	171.1	264.8	596.0	635.4	938.4	1164.9	1250.0	1624.2	GE[d] (UP7555)

Notes:
a. EPA Regulatory Support Document, “Locomotive Emissions Regulation,” Appendix B, 12/17/97, as tabulated by CARB and ENVIRON
b. Base emission rates provided by ENVIRON as part of the BNSF analyses for the Railyard MOU (Personal communication from Chris Lindhjem to R. Ireson, 2006) based on data produced in the AAR/SwRI Exhaust Plume Study (Personal communication from Steve Fritz to C. Lindhjem, 2006).
c. SwRI final report “Emissions Measurements – Locomotives” by Steve Fritz, August 1995.
d. Manufacturers’ emissions test data as tabulated by CARB.
e. Base SD-70 emission rates taken from data produced in the AAR/SwRI Exhaust Plume Study (Personal communication from Steve Fritz to R. Ireson, 2006, 2007).
f. Average of manufacturers’ emissions test data as tabulated by CARB and data from the AAR/SwRI Exhaust Plume Study, tabulated and calculated by ENVIRON.

Table 8
Carbon Monoxide Emission Factors (g/hr) for Locomotives – ICTF and Dolores Rail Yards
2005 Baseline Year

Model Group	Tier	Throttle Setting Idle	DB	N1	N2	N3	N4	N5	N6	N7	N8	Source[a]
Switchers	N	181.0	350.0	182.9	294.0	339.0	354.0	416.0	676.0	2085.0	5710.0	EPA RSD[a]
GP-3x	N	283.0	699.0	240.0	429.0	430.0	479.0	604.0	926.0	1773.0	3973.0	EPA RSD[a]
GP-4x	N	564.1	659.6	266.7	292.3	329.3	434.3	759.7	1911.9	5029.3	5907.3	EPA RSD[a]
GP-50	N	99.0	407.5	59.0	228.0	744.0	1083.0	1932.0	1743.0	1520.0	1817.0	EPA RSD[a]
GP-60	N	144.0	192.2	105.6	131.7	313.9	516.8	1108.4	2213.3	1699.6	1597.0	EPA RSD[a]
GP-60	0	96.6	232.6	146.8	185.5	247.9	347.1	945.3	2678.3	2442.8	1989.2	SwRI[b] (KCS733)
SD-7x	N	237.1	344.2	242.5	263.4	290.3	598.1	1209.6	2005.0	1733.0	2469.9	SwRI[c]
SD-7x	0	83.7	90.1	186.2	293.3	336.0	407.0	434.1	3045.8	1440.7	1515.3	GM EMD[d]
SD-7x	1	80.3	135.5	122.9	203.8	396.1	431.1	617.1	1734.3	1100.7	1732.4	SwRI[e] (NS2630)
SD-7x	2	289.2	524.1	225.9	234.2	288.9	310.5	374.1	374.1	744.8	1342.4	SwRI[e] (UP8353)
SD-90	0	252.7	263.2	233.5	351.4	973.9	3616.7	4498.6	5692.3	5386.1	2065.4	GM EMD[d]
Dash 7	N	354.0	532.0	198.7	338.1	1489.4	2949.1	5515.6	4550.9	3294.9	3000.0	EPA RSD[a]
Dash 8	0	366.5	1113.2	688.3	873.6	1974.0	2373.2	1843.2	1867.6	2011.8	2870.7	GE[d]
Dash 9	N	261.2	393.9	142.6	331.8	1485.9	4647.1	8054.7	10143.3	9510.9	10644.1	SWRI 2000
Dash 9	0	83.5	196.8	123.8	482.6	1121.2	6157.3	6713.1	3143.1	3790.3	4214.6	Average of GE & SwRI[f]
Dash 9	1	49.4	461.4	243.5	368.0	895.5	1505.0	1788.4	2014.4	2713.7	3356.1	SwRI[b] (CSXT595)
Dash 9	2	28.0	120.3	141.8	239.4	607.3	805.9	479.2	537.4	790.1	1033.9	SwRI[b] (BNSF 7736)
C60-A	0	233.4	568.0	220.9	407.4	1589.3	2033.3	2542.7	2370.0	1600.0	1124.5	GE[d] (UP7555)

Notes:
a. EPA Regulatory Support Document, "Locomotive Emissions Regulation," Appendix B, 12/17/97, as tabulated by CARB and ENVIRON.
b. Base emission rates provided by ENVIRON as part of the BNSF analyses for the Railyard MOU (Personal communication from Chris Lindhjem to R. Ireson, 2006) based on data produced in the AAR/SwRI Exhaust Plume Study (Personal communication from Steve Fritz to C. Lindhjem, 2006).
c. SwRI final report "Emissions Measurements – Locomotives" by Steve Fritz, August 1995.
d. Manufacturers' emissions test data as tabulated by CARB.
e. Base SD-70 emission rates taken from data produced in the AAR/SwRI Exhaust Plume Study (Personal communication from Steve Fritz to R. Ireson, 2006, 2007).
f. Average of manufacturers' emissions test data as tabulated by CARB and data from the AAR/SwRI Exhaust Plume Study, tabulated and calculated by ENVIRON.

Table 9
Nitrogen Oxides Emission Factors (g/hr) for Locomotives[a] – ICTF and Dolores Rail Yards
2005 Baseline Year

Model Group	Tier	Throttle Setting										Source[b]
		Idle	DB	N1	N2	N3	N4	N5	N6	N7	N8	
Switchers	N	987.0	3415.0	1239.8	2775.0	5715.6	9794.2	14135.0	17999.1	21891.0	24027.9	EPA RSD[b]
GP-3x	N	1247.0	2803.0	1824.8	4335.7	8137.0	12410.0	16974.0	23232.0	29605.0	34755.0	EPA RSD[b]
GP-4x	N	1635.1	4133.8	2807.7	6039.6	10180.2	15406.6	20892.3	25563.9	31186.9	36928.7	EPA RSD[b]
GP-50	N	999.0	2847.0	1104.0	7818.5	14060.0	18769.0	24388.0	42575.0	54573.0	57021.0	EPA RSD[b]
GP-60	N	1915.2	2290.8	3820.5	6624.5	11154.0	14765.5	18161.1	24209.1	39158.6	42295.5	EPA RSD[b]
GP-60	0	687.8	967.3	2267.0	4695.9	8500.6	11090.3	12849.7	13830.5	25626.3	27621.4	SwRI[c] (KCS733)
SD-7x	N	1475.4	1728.0	2532.7	5520.0	13366.7	21349.5	27710.4	43213.0	57587.4	56252.3	SwRI[d]
SD-7x	0	933.6	1066.4	2881.6	5381.8	9984.0	13308.2	14891.9	23611.8	31134.0	33417.6	GM EMD[e]
SD-7x	1	694.4	943.2	2028.9	2910.2	5231.1	7371.2	9468.0	15134.0	20925.3	26463.0	SwRI[f] (NS2630)
SD-7x	2	752.6	2896.9	2409.1	4038.4	5745.0	6600.0	7863.5	7863.5	14642.2	20133.2	SwRI[f] (UP8353)
SD-90	0	687.8	2572.9	2347.5	5626.9	12975.7	18571.9	25398.5	32729.7	42788.5	49746.1	GM EMD[e]
Dash 7	N	306.0	493.4	830.2	1416.4	5367.1	9738.2	16320.8	22974.0	25108.2	33000.0	EPA RSD[b]
Dash 8	0	746.5	2063.4	3403.4	4617.6	7426.0	9911.6	14745.6	18676.0	22800.4	29527.2	GE[e]
Dash 9	N	442.1	940.0	2121.0	5494.9	14999.2	22069.1	31371.6	36876.2	42904.6	46971.1	SWRI 2000
Dash 9	0	782.2	1010.3	2510.8	4806.2	13850.8	37326.0	27325.3	21113.3	25088.8	31154.3	Average of GE & SwRI[g]
Dash 9	1	375.9	2035.5	1538.4	4671.8	14368.6	16071.1	13854.8	18020.0	20886.3	23912.8	SwRI[b] (CSXT595)
Dash 9	2	347.6	656.7	1134.9	2730.2	5310.1	7246.1	9611.9	13454.9	16005.1	18565.9	SwRI[b] (BNSF 7736)
C60-A	0	571.9	1413.7	2027.5	5794.8	11306.0	17308.3	22996.4	28482.7	35651.8	42823.8	GE[e] (UP7555)

Notes:

a. Emission factors are based on test data for 47-state fuel. The emission factors for California fuel are 6% lower.
b. EPA Regulatory Support Document, "Locomotive Emissions Regulation," Appendix B, 12/17/97, as tabulated by CARB and ENVIRON.
c. Base emission rates provided by ENVIRON as part of the BNSF analyses for the Railyard MOU (Personal communication from Chris Lindhjem to R. Ireson, 2006) based on data produced in the AAR/SwRI Exhaust Plume Study (Personal communication from Steve Fritz to C. Lindhjem, 2006).
d. SwRI final report "Emissions Measurements – Locomotives" by Steve Fritz, August 1995.
e. Manufacturers' emissions test data as tabulated by CARB.
f. Base SD-70 emission rates taken from data produced in the AAR/SwRI Exhaust Plume Study (Personal communication from Steve Fritz to R. Ireson, 2006, 2007).
g. Average of manufacturers' emissions test data as tabulated by CARB and data from the AAR/SwRI Exhaust Plume Study, tabulated and calculated by ENVIRON.

Table 10
DPM Emission Factors (g/hr) for Locomotives – ICTF and Dolores Rail Yards
Adjusted for Fuel Sulfur Content of 221 ppm
2005 Baseline Year

Model Group	Tier	Throttle Setting										Source[a]
		Idle	DB	N1	N2	N3	N4	N5	N6	N7	N8	
Switchers	N	31.0	56.0	23.0	76.0	129.2	140.6	173.3	272.7	315.6	409.1	EPA RSD[a]
GP-3x	N	38.0	72.0	31.0	110.0	174.1	187.5	230.2	369.1	423.5	555.1	EPA RSD[a]
GP-4x	N	47.9	80.0	35.7	134.3	211.9	228.6	289.7	488.5	584.2	749.9	EPA RSD[a]
GP-50	N	26.0	64.1	51.3	142.5	282.3	275.2	339.6	587.7	663.5	847.2	EPA RSD[a]
GP-60	N	48.6	98.5	48.7	131.7	266.3	264.8	323.5	571.6	680.2	859.8	EPA RSD[a]
GP-60	0	21.1	25.4	37.6	75.5	224.1	311.5	446.4	641.6	1029.9	1205.1	SwRI[b] (KCS733)
SD-7x	N	24.0	4.8	41.0	65.7	146.8	215.0	276.8	331.8	434.7	538.0	SwRI[c]
SD-7x	0	14.8	15.1	36.8	61.1	215.7	335.9	388.6	766.8	932.1	1009.6	GM EMD[e]
SD-7x	1	29.2	31.8	37.1	66.2	205.3	261.7	376.5	631.4	716.4	774.0	SwRI[e] (NS2630)
SD-7x	2	24.4	59.5	38.3	134.2	254.4	265.7	289.0	488.2	614.7	643.0	SwRI[e] (UP8353)
SD-90	0	61.1	108.5	50.1	99.1	239.5	374.7	484.1	291.5	236.1	852.4	GM EMD[d]
Dash 7	N	65.0	180.5	108.2	121.2	306.9	292.4	297.5	255.3	249.0	307.7	EPA RSD[a]
Dash 8	0	37.0	147.5	86.0	133.1	248.7	261.6	294.1	318.5	347.1	450.7	GE[d]
Dash 9	N	32.1	53.9	54.2	108.1	187.7	258.0	332.5	373.2	359.5	517.0	SWRI 2000
Dash 9	0	33.8	50.7	56.1	117.4	195.7	235.4	552.7	489.3	449.6	415.1	Average of GE & SwRI[f]
Dash 9	1	16.9	88.4	62.1	140.2	259.5	342.2	380.4	443.5	402.7	570.0	SwRI[b] (CSXT595)
Dash 9	2	7.7	42.0	69.3	145.8	259.8	325.7	363.6	356.7	379.7	445.1	SwRI[b] (BNSF 7736)
C60-A	0	71.0	83.9	68.6	78.6	237.2	208.9	247.7	265.5	168.6	265.7	GE[e] (UP7555)

Notes:

a. EPA Regulatory Support Document, "Locomotive Emissions Regulation," Appendix B, 12/17/97, as tabulated by CARB and ENVIRON.
b. Base emission rates provided by ENVIRON as part of the BNSF analyses for the Railyard MOU (Personal communication from Chris Lindhjem to R. Ireson, 2006) based on data produced in the AAR/SwRI Exhaust Plume Study (Personal communication from Steve Fritz to C. Lindhjem, 2006).
c. SwRI final report "Emissions Measurements – Locomotives" by Steve Fritz, August 1995.
d. Manufacturers' emissions test data as tabulated by CARB.
e. Base SD-70 emission rates taken from data produced in the AAR/SwRI Exhaust Plume Study (Personal communication from Steve Fritz to R. Ireson, 2006, 2007).
f. Average of manufacturers' emissions test data as tabulated by CARB and data from the AAR/SwRI Exhaust Plume Study, tabulated and calculated by ENVIRON..

Table 11
DPM Emission Factors (g/hr) for Locomotives – ICTF and Dolores Rail Yards
Adjusted for Fuel Sulfur Content of 2,639 ppm
2005 Baseline Year

Model Group	Tier	Throttle Setting										Source[a]
		Idle	DB	N1	N2	N3	N4	N5	N6	N7	N8	
Switchers	N	31.0	56.0	23.0	76.0	136.9	156.6	197.4	303.4	341.2	442.9	EPA RSD[a]
GP-3x	N	38.0	72.0	31.0	110.0	184.5	208.8	262.2	410.8	457.9	601.1	EPA RSD[a]
GP-4x	N	47.9	80.0	35.7	134.3	224.5	254.6	330.0	543.7	631.6	812.1	EPA RSD[a]
GP-50	N	26.0	64.1	51.3	142.5	299.0	306.5	386.9	653.9	717.3	917.4	EPA RSD[a]
GP-60	N	48.6	98.5	48.7	131.7	282.1	294.9	368.5	636.1	735.4	931.0	EPA RSD[a]
GP-60	0	21.1	25.4	37.6	75.5	237.4	346.9	508.5	714.0	1113.4	1304.9	SwRI[b] (KCS733)
SD-7x	N	24.0	4.8	41.0	65.7	155.5	239.4	315.4	369.2	469.9	582.6	SwRI[c]
SD-7x	0	14.8	15.1	36.8	61.1	228.5	374.1	442.7	853.3	1007.8	1093.2	GM EMD[d]
SD-7x	1	29.2	31.8	37.1	66.2	217.5	291.5	428.9	702.6	774.5	838.1	SwRI[e] (NS2630)
SD-7x	2	24.4	59.5	38.3	134.2	269.4	295.9	329.2	543.3	664.6	696.2	SwRI[e] (UP8353)
SD-90	0	61.1	108.5	50.1	99.1	253.7	417.3	551.5	324.4	255.3	923.1	GM EMD[d]
Dash 7	N	65.0	180.5	108.2	121.2	352.7	323.1	327.1	293.7	325.3	405.4	EPA RSD[a]
Dash 8	0	37.0	147.5	86.0	133.1	285.9	289.1	323.3	366.4	453.5	593.8	GE[e]
Dash 9	N	32.1	53.9	54.2	108.1	215.7	285.1	365.6	429.3	469.7	681.2	SWRI 2000
Dash 9	0	33.8	50.7	56.1	117.4	224.9	260.1	607.7	562.9	587.4	546.9	Average of GE & SwRI[f]
Dash 9	1	16.9	88.4	62.1	140.2	298.2	378.1	418.3	510.2	526.2	751.1	SwRI[b] (CSXT595)
Dash 9	2	7.7	42.0	69.3	145.8	298.5	359.9	399.8	410.4	496.1	586.4	SwRI[b] (BNSF 7736)
C60-A	0	71.0	83.9	68.6	78.6	272.6	230.8	272.3	305.4	220.3	350.1	GE[d] (UP7555)

Notes:

a. EPA Regulatory Support Document, "Locomotive Emissions Regulation," Appendix B, 12/17/97, as tabulated by CARB and ENVIRON.
b. Base emission rates provided by ENVIRON as part of the BNSF analyses for the Railyard MOU (Personal communication from Chris Lindhjem to R. Ireson, 2006) based on data produced in the AAR/SwRI Exhaust Plume Study (Personal communication from Steve Fritz to C. Lindhjem, 2006).
c. SwRI final report "Emissions Measurements – Locomotives" by Steve Fritz, August 1995.
d. Manufacturers' emissions test data as tabulated by CARB.
e. Base SD-70 emission rates taken from data produced in the AAR/SwRI Exhaust Plume Study (Personal communication from Steve Fritz to R. Ireson, 2006, 2007).
f. Average of manufacturers' emissions test data as tabulated by CARB and data from the AAR/SwRI Exhaust Plume Study, tabulated and calculated by ENVIRON..

Data regarding the sulfur content of 2005 UPRR Diesel fuel deliveries within and outside of California were not available. To develop locomotive emission factors for different types of activities, estimates of fuel sulfur content were developed, and base case emission factors from the primary information sources (e.g., EPA certification data, with an assumed nominal fuel sulfur content of 3,000 ppm) were adjusted based on the estimated sulfur content of in-use fuels. The sulfur content of Diesel fuel varies with the type of fuel produced (e.g., California on-road fuel, 49-state off-road fuel, 49-state on-road fuel), the refinery configuration where it is produced, the sulfur content of the crude oil being refined, and the extent to which it may be mixed with fuel from other sources during transport. As a result, it is extremely difficult to determine with precision the sulfur content of the fuel being used by any given locomotive at a specific time, and assumptions were made to estimate sulfur content for different types of activities.

To estimate the fuel sulfur content for UPRR locomotives in California during 2005, the following assumptions were made:

- "Captive" locomotives and consists in use on local trains (e.g., commuter rail) use only Diesel fuel produced in California.
- Trains arriving and terminating at California railyards (with the exception of local trains) use fuel produced outside of California, and arrive with remaining fuel in their tanks at 10 percent of capacity.
- On arrival, consists are refueled with California Diesel fuel, resulting in a 90:10 mixture of California and non-California fuel, and this mixture is representative of fuel on departing trains as well as trains undergoing load testing (if conducted at a specific yard).
- The average composition of fuel used in through trains by-passing a yard, and in trains both arriving and departing from a yard on the same day is 50 percent California fuel and 50 percent non-California fuel.

In 2005, Chevron was Union Pacific Railroad's principal supplier of Diesel fuel in California. Chevron's California refineries produced only one grade ("low sulfur Diesel" or LSD) in 2005. Quarterly average sulfur content for these refineries ranged from 59 ppm to 400 ppm, with an average of 221 ppm.[11] This value is assumed to be representative of California fuel used by UPRR. Non-California Diesel fuel for 2005 is assumed to have a sulfur content of 2,639 ppm. This is the estimated 49-state average fuel sulfur content used by the U.S. Environmental Protection Agency in its 2004 regulatory impact analysis in support of regulation of nonroad Diesel engines (EPA, 2004).

The locomotive test data also report horsepower and fuel consumption rates by notch for each locomotive tested. The fuel consumption rates were used to calculate total fuel consumption by fuel type. Sulfur oxides emissions were calculated from fuel consumption and fuel sulfur content, assuming a constant factor of 8.83×10^{-4} grams of sulfur oxides per ppm sulfur in fuel per pound of fuel (e.g., a fuel rate of 100 lbs/hr of 100 ppm S fuel yields an emission rate of 8.83 g/hr of sulfur oxides).[12] SOx emission calculations include consideration of the fraction of fuel burned by sulfur content. Table 12 shows the fuel consumption rates in pounds per hour, and the SOx emission factors are shown in Table 13.

Emission factors for GHGs were calculated from CARB's recommended emission rates for Diesel locomotives.[13] Emission factors for CO_2, N_2O, and CH_4 are shown in Table 14.

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[11] Personal communication from Theron Hinckley of Chevron Products Company to Jon Germer of UPRR and Rob Ireson, December 13, 2006.
[12] This factor is calculated from the 2005 locomotive fuel usage, sulfur content and total emissions in Table 3.1-6a of the 2004 EPA regulatory impact analysis for non-road Diesel engine emissions regulations (EPA420-R-04-007), assuming a fuel density of 7.13 lbs/gallon, the density observed by SwRI for California low sulfur fuel in the CARB locomotive fuel effects study.
[13] Available at http://www.arb.ca.gov/cc/ccei/inventory/inventory.php

Table 12
Fuel Consumption Rates (lbs/hr) for Locomotives – ICTF and Dolores Rail Yards
2005 Baseline Year

Model Group	Tier	Throttle Setting										Source[a]
		Idle	DB	N1	N2	N3	N4	N5	N6	N7	N8	
Switchers	N	26.0	80.0	41.0	95.0	167.0	249.0	332.0	419.0	529.0	630.0	EPA RSD[a]
GP-3x	N	40.0	114.0	64.0	167.0	275.0	404.0	556.0	740.0	994.0	1177.0	EPA RSD[a]
GP-4x	N	279.0	126.0	296.0	361.0	432.0	528.0	657.0	827.0	1066.0	1186.0	EPA RSD[a]
GP-50	N	22.0	91.0	92.0	179.0	363.0	480.0	652.0	919.0	1136.0	1281.0	EPA RSD[a]
GP-60	N	23.0	134.0	88.0	167.0	351.0	478.0	635.0	888.0	1147.0	1328.0	EPA RSD[a]
GP-60	0	23.0	39.0	87.0	165.0	356.0	486.0	632.0	795.0	1202.0	1394.0	SwRI[b] (KCS733)
SD-7x	N	25.0	39.1	98.7	184.4	366.3	531.4	679.3	945.1	1213.2	1412.2	SwRI[c]
SD-7x	0	36.0	54.0	86.6	167.6	355.5	538.4	700.7	980.9	1200.3	1376.4	GM EMD[v]
SD-7x	1	27.5	43.0	91.0	167.0	357.6	517.2	700.8	987.6	1203.6	1366.8	SwRI[e] (NS2630)
SD-7x	2	33.9	133.5	106.8	234.5	433.5	600.5	767.5	767.5	1305.5	1523.5	SwRI[e] (UP8353)
SD-90	0	78.3	1209.8	141.2	291.3	546.0	790.3	1089.4	1400.4	1695.3	2035.3	GM EMD[d]
Dash 7	N	23.9	130.0	65.8	132.8	259.0	405.0	576.0	746.0	882.0	1090.0	EPA RSD[a]
Dash 8	0	25.9	188.9	74.6	163.8	314.5	486.0	685.6	891.6	1051.6	1308.0	GE[d]
Dash 9	N	22.9	41.9	81.0	189.3	395.3	571.5	798.2	1014.0	1240.1	1539.1	SWRI 2000
Dash 9	0	25.6	41.2	84.0	187.3	392.4	569.1	796.4	1009.5	1183.6	1535.8	Average of GE & SwRI[f]
Dash 9	1	19.8	54.6	86.4	185.0	373.0	512.0	725.0	945.0	1169.0	1470.0	SwRI[b] (CSXT595)
Dash 9	2	18.5	44.0	102.0	210.0	449.0	615.0	830.0	1067.0	1319.0	1609.0	SwRI[b] (BNSF 7736)
C60-A	0	29.8	52.7	82.6	257.7	542.4	781.1	1087.2	1385.2	1688.6	2141.3	GE[d] (UP7555)

Notes:

a. EPA Regulatory Support Document, "Locomotive Emissions Regulation," Appendix B, 12/17/97, as tabulated by CARB and ENVIRON
b. Base rates provided by ENVIRON as part of the BNSF analyses for the Railyard MOU (Personal communication from Chris Lindhjem to R. Ireson, 2006) based on data produced in the AAR/SwRI Exhaust Plume Study (Personal communication from Steve Fritz to C. Lindhjem, 2006).
c. SwRI final report "Emissions Measurements – Locomotives" by Steve Fritz, August 1995.
d. Manufacturers' emissions test data as tabulated by CARB.
e. Base SD-70 rates taken from data produced in the AAR/SwRI Exhaust Plume Study (Personal communication from Steve Fritz to R. Ireson, 2006, 2007).
f. Average of manufacturers' emissions test data as tabulated by CARB and data from the AAR/SwRI Exhaust Plume Study, tabulated and calculated by ENVIRON..

Table 13 SOx Emission Factors for Locomotives – ICTF and Dolores Rail Yards 2005 Baseline Year			
Fuel Sulfur Content (ppm)		SOx Emission Factor (g/lb of fuel)[a]	
CA Diesel	47-State Diesel	CA Diesel	47-State Diesel
221	2,639	0.195	2.33

Notes:
a. Based on 8.83×10^{-4} g of SOx per ppm-lb of fuel.

Table 14 GHG Emission Factors for Locomotives – ICTF and Dolores Rail Yards 2005 Baseline Year			
Operating Mode	Emission Factors (g/lb)		
	CO_2[a]	N_2O[b]	CH_4[b]
Traveling/Idling[b]	1,440	0.036	0.113

Notes:
a. From CARB's Greenhouse Gas Inventory. Available at http://www.arb.ca.gov/cc/ccei/inventory/inventory.php
b. Calculated from g/kg fuel factors in CARB's Greenhouse Gas Inventory using a fuel density of 3.19 kg/gallon as cited in the CARB inventory documentation.
c. Emission factors are based on fuel consumption; therefore, the same factors are used for both the traveling and idling modes.

<u>Emissions</u>

Emissions were calculated for the 2005 baseline year for UPRR-owned and -operated locomotives, as well as "foreign" locomotives[14] operating in the rail yard, and through trains on the main line. Procedures for calculating in-yard emissions followed the methods described in Ireson et al. (2005).[15] A copy of Ireson et al. is contained in Appendix A-6.

Emissions from locomotive activities were calculated based on the number of working locomotives, time spent in each notch setting, and locomotive model-group distributions,

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[14] Foreign locomotives are locomotives not owned by UPRR, including passenger trains and locomotives owned by other railroads that are brought onto the UPRR system via interchange.
[15] Ireson, R.G., M.J. Germer, L.A. Schmid (2005). "Development of Detailed Railyard Emissions to Capture Activity, Technology, and Operational Changes." Proceedings of the USEPA 14th Annual Emission Inventory Conference, *http://www.epa.gov/ttn/chief/conference/ei14/session8/ireson.pdf*, Las Vegas NV, April 14, 2006.

with model groups defined by manufacturer and engine type.[16] A separate calculation was performed for each type of locomotive activity, including line-haul or switcher locomotive operations, consist movements, locomotive refueling, and pre- and post-locomotive service and maintenance testing.

For road power locomotives, speed, movement duration, and throttle notch values were obtained from UPRR personnel for the ICTF and Dolores Yards for different types of activities. Movement durations were calculated from distance traveled and speed. Detailed counts of locomotive by model, technology tier, and train type are shown in Appendix A-1 and A-2. Maps detailing the principal locomotive routes at the Yards are contained in Appendix A-5.

For line haul operations, yard-specific average consist composition (number of units, number of units operating, model distribution, locomotive tier distribution, fraction equipped with auto start/stop technology[17]) was developed from UPRR data for different train types. The data showed that intermodal trains and power moves used predominately newer, high-horsepower SD-70 and Dash 9 locomotives, while non-intermodal trains used a mix of older medium- and high-horsepower and newer high-horsepower locomotives. Average horsepower was lowest among "dockside" non-intermodal trains (arriving from or departing toward the Ports of Los Angeles and Long Beach), with average horsepower for "landside" non-intermodal trains (arriving from or departing toward central Los Angeles) being somewhat higher. Therefore, locomotive model distributions were developed for these three separate groups for use in the emission calculations.

Movement speed, duration, and notch estimates were developed for arriving, departing, through train, and in-yard movements. All road power movements within the Yard were

[16] Emission estimates are based on the total number of working locomotives. Therefore, the total number of locomotives used in the emission calculations will be slightly lower than the total number of locomotives shown in Table 1. See Appendix A for detailed emission calculations

[17] There are two primary types of auto start/stop technology—"Auto Engine Start Stop" (AESS), which is factory-installed on recent model high horsepower units; and the ZTR "SmartStart" system (ZTR), which is a retrofit option for other locomotives. Both are programmed to turn off the Diesel engine after 15 to 30 minutes of idling, provided that various criteria (air pressure, battery charge, and others) are met. The engine automatically restarts if required by one of the monitored parameters. We assume that an AESS/ZTR-equipped locomotive will shut down after 30 minutes of idling in an extended idle event.

assumed to be at 10 mph in throttle notches 1 and 2 (50% each). Idle duration was estimated based on UPRR operator estimates for units not equipped with auto start/stop. Units that were equipped with AESS/ZTR technology were assumed to idle for 30 minutes per extended idle event, with other locomotives idling for the remaining duration of the event. Numbers of arrivals and departures were developed from UPRR data. Emissions were calculated separately for through intermodal trains, originating and terminating intermodal trains, non-intermodal trains through, originating and terminating, and power moves through, originating and terminating.

Based on information from UPRR personnel, yard switchers were assumed to operate on the full EPA switcher duty cycle. The duty cycle assumed for the different activities is shown in Table 15.

Table 15
Locomotive Duty Cycles – ICTF and Dolores Rail Yards2005
Baseline Year

Activity	Duty Cycle
Through Train Movement	N1 – 50%, N2- 50%
Movements within the Yard	N1 – 50%, N2- 50%
Yard Switcher Operations	USEPA Switch Duty Cycle[a]

Notes:
a. USEPA (1998) Regulatory Support Document

The criteria pollutant, DPM, and GHG emission estimates for locomotives operating at ICTF and Dolores during the 2005 baseline year are shown in Table 16. Detailed emissions calculations are shown in Appendix A-3.

Table 16 Criteria Pollutant, DPM, and GHG Emissions from Locomotives – ICTF and Dolores Rail Yards 2005 Baseline Year									
	Emissions (tons/yr)						Emissions (metric tons/yr)		
Activity	HC	CO	NOx	PM_{10}	DPM	SOx	CO_2	N_2O	CH_4
Train Activity	3.32	5.52	50.08	1.23	1.23	2.93	3,231	0.081	0.254
Yard Operations	11.44	26.72	256.11	5.57	5.57	1.79	12,018	0.302	0.945
Load Testing	0.97	2.73	25.13	0.59	0.59	0.46	1,470	0.037	0.116
Servicing Idling	3.13	4.58	19.46	0.65	0.65	3.03	1,807	0.045	0.142
Total	**18.86**	**39.55**	**350.77**	**8.04**	**8.04**	**8.21**	**18,526**	**0.47**	**1.46**

2. HHD Diesel-Fueled Drayage Trucks

A number of HHD Diesel-fueled drayage trucks operated at ICTF during the 2005 baseline year. The trucks are used to pick up and deliver intermodal cargo containers. The trucks are owned and operated by many large trucking companies and independent operators (draymen). Therefore, a fleet distribution is not available. For emission calculations, the EMFAC2007 model[18] default fleet distribution for HHD Diesel-fueled trucks operating in Los Angeles County was used.

Emissions from HHD Diesel-fueled drayage trucks are based on the number of truck trips, the length of each trip, and the amount of time spent idling. The number of truck trips was based on the 2005 lift count,[19] a gate count balancing factor,[20] and the assumption that 40% of the trucks entering ICTF with a container also leave the facility with a container.[21] See Appendix B-1 for a detailed discussion on the calculation methodology.

[18] Available at http://www.arb.ca.gov/msei/msei.htm.
[19] Provided by UPRR.
[20] The gate balancing factor is equal to the "in-gate" container count divided by the total number of containers passing through the "in-gate" and "out-gate" of ICTF. In 2005, the gate balancing factor was 63%.
[21] Personal communication from Greg Chiodo of HDR on September 24, 2007.

In addition to the traveling emissions, an average idling time of 30 minutes per HHD truck trip was assumed to account for emissions during truck queuing, staging, loading, and unloading. Based on discussions with the Intermodal Operations Manager, the average queuing time at the gate at ICTF is less than 10 minutes per truck. In addition to idling during queuing, it was assumed that each truck idles an average of 15 minutes per trip while the chassis is connected to/disconnected from the truck cab. An additional five minutes of idle per trip was included to account for any other delays. Table 17 summarizes the drayage truck activity data for the 2005 baseline year.

Table 17
Summary of HHD Drayage Truck Activity Data – ICTF Rail Yard
2005 Baseline Year

Number of HHD Truck Trips[a]	VMT per HHD Truck Trip (mi/trip)[b]	Annual VMT (mi/yr)	Annual Fuel Use (gal/yr)[c]	Idling Time	
				(min/trip)[d]	(hr/yr)
938,074	1.75	1,641,629.50	784,762	30	469,037

Notes:
a. Number of truck trips based on 2005 lift and were estimated by HDR. See Appendix B-1 for details.
b. Trip length estimated from aerial photos of the Yard.
c. Includes fuel used during traveling and idling.
d. Engineering estimate based on personal communication with the Intermodal Operations Manager for the ICTF, Commerce, LATC, and Oakland Yards.

Criteria pollutant and DPM emission factors for the HHD Diesel-fueled drayage trucks were obtained from CARB's EMFAC2007 model. The emissions from idling and traveling modes have been separated because different source treatments (point or volume sources) will be used in the air dispersion modeling analysis for these modes. A fleet average emission factor for traveling exhaust emissions was calculated using the EMFAC2007 model with the BURDEN output option. Since the fleet distribution is not known, the EMFAC2007 default distribution for Los Angeles County was used. Idling emission factors were calculated using the EMFAC2007 model with the EMFAC output option. The emission factors for the HHD Diesel-fueled drayage trucks are shown in Table 18. Detailed emission factor derivation calculations and the EMFAC2007 output are contained in Appendix B-2.

Table 18
Criteria Pollutant and DPM Emission Factors for HHD Diesel-Fueled Drayage Trucks – ICTF Rail Yard
2005 Baseline Year

Operating Mode	Fleet Average Emission Factors					
	ROG	CO	NOx	PM_{10}[c]	DPM[c]	SOx
Traveling (g/mi)[a]	6.40	17.23	28.68	2.53	2.47	0.24
Idling (g/hr)[b]	16.16	52.99	100.38	2.85	2.85	0.55

Notes:

a. Emission factors calculated using the EMFAC2007 model with the BURDEN output option. The default fleet distribution for Los Angeles County was used.

b. Emission factors calculated using the EMFAC2007 model with the EMFAC output option. The default fleet distribution for Los Angeles County was used.

c. The PM10 emission factor includes engine exhaust emissions along with brake and tire wear. The DPM emission factor includes engine exhaust emissions only.

Emission factors from CARB's *Draft Emission Factors for Mandatory Reporting Program* document (August 10, 2007)[22] were used to calculate GHG emissions from drayage truck operations. The GHG emission factors are based on fuel consumption, not activity (i.e. miles driven or hours of operation); therefore, the same factors are used to calculate emissions from both the traveling and idling modes. A fuel-specific carbon oxidization factor, from the CARB emission factor document, was also used to calculate CO_2 emissions. The GHG emission factors and the carbon oxidization factor used to calculate emissions from drayage trucks are shown in Table 19. A copy of CARB's *Draft Emission Factors for Mandatory Reporting Program* document is contained in Appendix C.

[22] Available at *http://www.arb.ca.gov/cc/ccei/reporting/reporting.htm*. On October 19, 2007, the CARB released revised GHG emission factors. The relevant CO_2 emission factors in the October draft document are slightly lower than the CO_2 emission factors in the August draft document. Therefore, the GHG emission estimates presented in this report were not revised to reflect the updated emission factors.

Table 19 **GHG Emission Factors for HHD Diesel-Fueled Drayage Trucks – ICTF Rail Yard 2005 Baseline Year**				
Operating Mode	Carbon Oxidization Factor (%)[a]	Emission Factors (kg/gal)[a]		
		CO_2	N_2O[c]	CH_4[c]
Traveling/Idling[b]	99.0	10.15	1.39×10^{-5}	4.16×10^{-5}

Notes:
a. From CARB's *Draft Emission Factors for Mandatory Reporting Program* document (August 10, 2007).
b. Emission factors are based on fuel consumption; therefore, the same factors are used for both the traveling and idling modes.
c. Based on a Diesel fuel HHV of 5.825 MMBtu/barrel (from *CARB Draft Emission Factors for Mandatory Reporting Programs*, August 10, 2007) and 42 gallons per barrel.

To calculate the emissions from drayage truck operations, the activity data shown in Table 17 was combined with the emission factors shown in Tables 18 and 19. The criteria pollutant, DPM, and GHG emission estimates for the HHD Diesel-fueled drayage trucks operating at ICTF during the 2005 baseline year are shown in Table 20. Detailed emissions calculations are shown in Appendix B-2.

Table 20 Criteria Pollutant, DPM, and GHG Emissions from HHD Diesel-Fueled Drayage Trucks – ICTF Rail Yard 2005 Baseline Year									
Operating Mode	Emission (tpy)						Emission (metric tons/yr)		
	ROG	CO	NOx	PM_{10}	DPM	SOx	CO_2	N_2O	CH_4
Traveling	11.58	31.18	51.91	4.58	4.46	0.44	4,782.00	0.01	0.02
Idling	8.36	27.40	51.90	1.47	1.47	0.28	3,103.68	0.00	0.01
Total	**19.94**	**58.58**	**103.81**	**6.05**	**5.93**	**0.72**	**7,885.68**	**0.01**	**0.03**

3. Cargo Handling Equipment (CHE)

A variety of Diesel-fueled heavy equipment is used to load, unload, and move cargo containers within ICTF. Emissions from CHE are based on the number and type of equipment, equipment model year, equipment size, and the annual hours of operation.

Table 21 provides the equipment specifications and the activity data[23] for CHE operating at ICTF during the 2005 baseline year.

Table 21
Equipment Specifications and Activity Data for Cargo Handling Equipment – ICTF Rail Yard
2005 Baseline Year

Equipment Type	Make/Model	Model Year	Rating (hp)	No. of Units	Hours of Operation (hr/yr/unit)[b]	Fuel Use (gal/yr)[f]
Forklift	Toyota 6FDU25	1997	85	1	730	1,285
RTG[a]	Mi Jack 850R	1997	300	1	2,448[c]	18,236
RTG[a]	Mi Jack 1000R	1988	250	1	2,448[c]	17,420
RTG[a]	Mi Jack 1000R	1995	300	4	2,448[c]	72,944
RTG[a]	Mi Jack 1000RC	2002	300	2	2,448[c]	36,472
RTG[a]	Mi Jack 1200R	2005	350	1	2,448[c]	21,275
Top Pick	Mi Jack PC-90	1972	335	1	208[d]	1,730
Top Pick	Taylor Tay-950	1988	350	1	2,190[d]	26,115
Top Pick	Taylor Tay-950	1989	350	1	2,190[d]	26,115
Yard Hostler	Capacity TJ5000	1999	150	15	468[e]	27,185
Yard Hostler	Capacity TJ5000	2005	173	58	4,680[e]	1,212,339
Total				**86**		**1,461,116**

Notes:

a. Rubber tire gantry crane.
b. Assumptions used to calculate the hours of operation were provided by UPRR staff.
c. Assumed each RTG operates 7 hours per day, based on data collected at the UPRR Commerce Rail Yard
d. Assumed the Taylor top picks operated 12 hours per day each and the Mi Jack top pick is used infrequently.
e. Assumed the 173 hp Yard Hostlers operate 4,680 hours per year each, based on data collected at the UPRR Commerce Rail Yard. The 150 hp Yard Hostlers are backup units; it was assumed they operate 10% of the time.
f. Fuel use is for all equipment units in each category.

[23] Actual operating data for RTGs and yard hostlers at ICTF during the 2005 calendar year was not available. Therefore, the 2005 hours of operation for RTGs and yard hostlers are based on data collected from maintenance records the UPRR Commerce Rail Yard. Operations at ICTF are not substantially different from the operations at Commerce. Therefore, the Commerce data are representative of operations at ICTF.

Equipment specific criteria pollutant and DPM emission factors for CHE were calculated by CARB staff using a spreadsheet based on the OFFROAD2007 model.[24] Emission factors from CARB's *Draft Emission Factors for Mandatory Reporting Program* document (August 10, 2007) were used to calculate GHG emissions from CHE operations. The GHG emission factors are based on fuel consumption and are not equipment-specific. A fuel-specific carbon oxidization factor, from the CARB emission factor document, was also used to calculate CO_2 emissions. The criteria pollutant emission factors, the GHG emission factors, and the carbon oxidization factor used to calculate emissions from the CHE are shown in Table 22. Detailed emission factor derivation calculations and the CARB spreadsheet are contained in Appendix D-1. A copy of CARB's *Draft Emission Factors for Mandatory Reporting Program* document is contained in Appendix C.

To calculate the emissions from CHE operations, the activity data shown in Table 21 were combined with the emission factors shown in Table 22. The criteria pollutant, DPM, and GHG emission estimates for the Diesel-fueled CHE operating at ICTF during the 2005 baseline year are shown in Table 23.

[24] *http://www.arb.ca.gov/msei/offroad/pubs/cargo_handling_equipment_draft.pdf*

Table 22
Criteria Pollutant, DPM, and GHG Emission Factors for Cargo Handling Equipment – ICTF Rail Yard
2005 Baseline Year

Equipment Type	Make/Model	Model Year	Carbon Oxidization Factor (%)[b]	Emission Factors (g/hp-hr)[a]						Emission Factors (kg/gal)[b]		
				VOC	CO	NOx	PM_{10}	DPM	SOx	CO_2	N_2O[c]	CH_4[c]
Forklift	Toyota 6FDU25	1997	99.0	0.80	3.74	8.82	0.68	0.68	0.06	10.15	1.39×10^{-5}	4.16×10^{-5}
RTG	Mi Jack 850R	1997	99.0	0.28	1.04	6.55	0.17	0.17	0.05	10.15	1.39×10^{-5}	4.16×10^{-5}
RTG	Mi Jack 1000R	1988	99.0	0.71	3.38	9.19	0.48	0.48	0.06	10.15	1.39×10^{-5}	4.16×10^{-5}
RTG	Mi Jack 1000R	1995	99.0	0.62	3.11	8.57	0.40	0.40	0.05	10.15	1.39×10^{-5}	4.16×10^{-5}
RTG	Mi Jack 1000RC	2002	99.0	0.11	0.97	4.48	0.10	0.10	0.05	10.15	1.39×10^{-5}	4.16×10^{-5}
RTG	Mi Jack 1200R	2005	99.0	0.07	0.93	3.84	0.09	0.09	0.05	10.15	1.39×10^{-5}	4.16×10^{-5}
Top Pick	Mi Jack PC-90	1972	99.0	1.25	6.18	15.59	0.90	0.90	0.06	10.15	1.39×10^{-5}	4.16×10^{-5}
Top Pick	Taylor Tay-950	1988	99.0	0.71	3.38	9.19	0.48	0.48	0.06	10.15	1.39×10^{-5}	4.16×10^{-5}
Top Pick	Taylor Tay-950	1989	99.0	0.69	3.34	9.11	0.47	0.47	0.06	10.15	1.39×10^{-5}	4.16×10^{-5}
Yard Hostler	Capacity TJ5000	1999	99.0	0.61	3.08	7.34	0.43	0.43	0.06	10.15	1.39×10^{-5}	4.16×10^{-5}
Yard Hostler	Capacity TJ5000	2005	99.0	0.12	2.75	4.28	0.14	0.14	0.06	10.15	1.39×10^{-5}	4.16×10^{-5}

Notes:
a. Criteria pollutant emission factors calculated by CARB staff using a spreadsheet based on the OFFROAD2007 model.
b. GHG emission factors and carbon oxidization factors from CARB's *Draft Emission Factors for Mandatory Reporting Program* document (August 10, 2007).
c. Emission factor based on a Diesel fuel HHV of 5.825 MMBtu/barrel (from CARB Draft Emission Factors for Mandatory Reporting Programs, August 10, 2007) and 42 gallons per barrel.

Table 23
Criteria Pollutant, DPM, and GHG Emissions from Cargo Handling Equipment – ICTF Rail Yard
2005 Baseline Year

Equipment Type	Make/Model	Model Year	Emission (tpy)						Emission (metric tons/yr)		
			VOC	CO	NOx	PM_{10}	DPM	SOx	CO_2	N_2O	CH_4
Forklift	Toyota 6FDU25	1997	0.02	0.08	0.18	0.01	0.01	0.00	12.91	0.00	0.00
RTG	Mi Jack 850R	1997	0.10	0.36	2.28	0.06	0.06	0.02	183.24	0.00	0.00
RTG	Mi Jack 1000R	1988	0.20	0.98	2.67	0.14	0.14	0.02	175.05	0.00	0.00
RTG	Mi Jack 1000R	1995	0.87	4.33	11.94	0.56	0.56	0.07	732.97	0.00	0.00
RTG	Mi Jack 1000RC	2002	0.08	0.68	3.12	0.07	0.07	0.04	366.49	0.00	0.00
RTG	Mi Jack 1200R	2005	0.03	0.38	1.56	0.04	0.04	0.02	213.78	0.00	0.00
Top Pick	Mi Jack PC-90	1972	0.04	0.20	0.51	0.03	0.03	0.00	17.39	0.00	0.00
Top Pick	Taylor Tay-950	1988	0.35	1.68	4.58	0.24	0.24	0.03	262.42	0.00	0.00
Top Pick	Taylor Tay-950	1989	0.35	1.66	4.54	0.23	0.23	0.03	262.42	0.00	0.00
Yard Hostler	Capacity TJ5000	1999	0.28	1.39	3.32	0.20	0.20	0.03	273.17	0.00	0.00
Yard Hostler	Capacity TJ5000	2005	2.41	55.60	86.46	2.80	2.80	1.21	12,182.19	0.02	0.05
Total			**4.71**	**67.35**	**121.16**	**4.38**	**4.38**	**1.46**	**14,682.02**	**0.02**	**0.05**

4. Heavy Equipment

In addition to the CHE discussed above, a variety of Diesel-fueled heavy equipment is used at ICTF for non-cargo-related activities at the Yard, such as RTG crane maintenance, handling of parts and Company material, and derailments. Also, two propane-fueled forklifts are used at the locomotive shop at the Dolores Yard.

Emissions from heavy equipment are based on the number and type of equipment, equipment model year, equipment size, and the annual hours of operation. Table 24 provides the equipment specifications and the activity data for heavy equipment operating at the ICTF and Dolores Yards during the 2005 baseline year.

Equipment specific criteria pollutant and DPM emission factors were calculated using CARB's OFFROAD2007[25] model. Emission factors from CARB's *Draft Emission Factors for Mandatory Reporting Program* document (August 10, 2007) were used to calculate GHG emissions from heavy equipment operations. The GHG emission factors are based on fuel type and consumption and are not equipment specific. A fuel-specific carbon oxidization factor, from the CARB emission factor document, was also used to calculate CO_2 emissions. The criteria pollutant, DPM, and GHG emission factors, as well as the carbon oxidization factor, used to calculate emissions from the heavy equipment are shown in Table 25. Detailed emission factor derivation calculations and the OFFROAD2007 output are contained in Appendix E-1. A copy of CARB's *Draft Emission Factors for Mandatory Reporting Program* document is contained in Appendix C.

To calculate the emissions from heavy equipment operations, the activity data shown in Table 24 was combined with the emission factors shown in Table 25. The criteria pollutant, DPM, and GHG emission estimates for the Diesel-fueled heavy equipment operating at ICTF and the propane-fueled forklifts operating at Dolores during the 2005 baseline year are shown in Table 26. Detailed emission calculations are shown in Appendix E-1.

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[25] The OFFROAD model is available at *http://www.arb.ca.gov/msei/offroad/offroad.htm*

Table 24
Equipment Specifications and Activity Data for Heavy Equipment – ICTF and Dolores Rail Yards
2005 Baseline Year

Yard	Location	Equipment Type	Make/Model	Fuel Type	Model Year	Rating (hp)	No. of Units	Hours of Operation (hr/yr/unit)[a]	Fuel Use (gal/yr)[f]
ICTF	Car Department	Crane	Grove RT600E	Diesel	2004	173	1	1,095[b]	5,392
ICTF	Crane Maintenance	Forklift	Taylor 850	Diesel	2005	155	2	7,300[c]	44,941
ICTF	Crane Maintenance	Forklift	Taylor 850	Diesel	1998	154	1	7,300[c]	22,326
ICTF	Crane Maintenance	Man Lift	Unknown	Diesel	1985	29	1	1,825[d]	1,817
Dolores	Locomotive Shop	Forklift	Yale GP060	Propane	Unknown	150	2	3,285[e]	38,441
Total							**7**		**112,918**

Notes:
a. Assumption used to calculate hours of operation from interviews with UPRR staff.
b. Assumed that the Grove crane operates 3 hours per day.
c. Assumed that the Taylor forklifts operate 20 per day each.
d. Assumed that the man lift operates 5 hours per day.
e. Assumed that the forklifts at the Dolores Yard operate 9 hours per day each.
f. The total fuel used by all units in each category.

Table 25
Criteria Pollutant, DPM, and GHG Emission Factors for Heavy Equipment – ICTF and Dolores Rail Yards
2005 Baseline Year

Yard	Equipment Type	Make/Model	Fuel Type	Model Year	Carbon Oxidization Factor (%)[c]	Emission Factor (g/bhp-hr)[a]						Emission Factor (kg/gal)[c]		
						ROG[b]	CO	NOx	PM_{10}	DPM	SOx	CO_2	N_2O[d]	CH_4[d]
ICTF	Crane	Grove RT600E	Diesel	2004	99.0	0.32	2.83	4.61	0.18	0.18	0.05	10.15	1.39×10^{-5}	4.16×10^{-5}
ICTF	Forklift	Taylor 850	Diesel	2005	99.0	0.22	2.76	4.26	0.14	0.14	0.05	10.15	1.39×10^{-5}	4.16×10^{-5}
ICTF	Forklift	Taylor 850	Diesel	1998	99.0	1.33	3.66	8.59	0.62	0.62	0.05	10.15	1.39×10^{-5}	4.16×10^{-5}
ICTF	Man Lift	Unknown	Diesel	1985	99.0	5.11	10.26	7.51	1.02	1.02	0.06	10.15	1.39×10^{-5}	4.16×10^{-5}
Dolores	Forklift	Yale GP060	Propane	ALL[e]	99.5	0.11	23.38	7.30	0.06	NA	0.00	5.95	3.74×10^{-5}	8.31×10^{-6}

Notes:

a. Criteria pollutant emission factors from the OFFROAD200 model.
b. Evaporative emissions for these sources are negligible.
c. GHG emission factors and carbon oxidization factor from CARB's *Draft Emission Factors for Mandatory Reporting Program* document (August 10, 2007).
d. Emission factors for Diesel fuel sources based on a Diesel fuel HHV of 5.825 MMBtu/barrel (from CARB Draft Emission Factors for Mandatory Reporting Programs, August 10, 2007) and 42 gallons per barrel. Emission factors for propane-fueled sources based on an LPG HHV of 91,300 Btu/gal (from the Transportation Energy Data Book: Edition 26, U.S. Department of Energy, 2007).
e. To obtain the criteria pollutant emission factors, the forklifts are modeled as the calendar year 2005 fleet average model year group from the OFFROAD2007 model.

Table 26 **Criteria Pollutant, DPM, and GHG Emissions from Heavy Equipment – ICTF and Dolores Rail Yards** **2005 Baseline Year**														
Yard	Equipment Type	Make/Model	Fuel Type	Model Year	Emissions (tons/year)						Emission (metric tons/year)		
					ROG	CO	NOx	PM_{10}	DPM	SOx	CO_2	N_2O	CH_4
ICTF	Crane	Grove RT600E	Diesel	2004	0.03	0.25	0.41	0.02	0.02	0.00	54.18	0.00	0.00
ICTF	Forklift	Taylor 850	Diesel	2005	0.16	2.07	3.19	0.10	0.10	0.04	451.59	0.00	0.00
ICTF	Forklift	Taylor 850	Diesel	1998	0.49	1.36	3.19	0.23	0.23	0.02	224.34	0.00	0.00
ICTF	Man Lift	Unknown	Diesel	1985	0.14	0.28	0.20	0.03	0.03	0.00	18.26	0.00	0.00
Dolores	Forklift	Yale GP060	Propane	ALL[e]	0.04	7.62	2.38	0.02	0.00	0.00	227.58	0.00	0.00
Total					**0.86**	**11.58**	**9.38**	**0.40**	**0.38**	**0.07**	**975.96**	**0.00**	**0.00**

CARB's speciation profile database[26] was used to determine the fraction of each TAC in the total ROG emissions from the propane-fueled forklifts. The database does not contain a profile for propane combusted in an internal combustion engine. Therefore, the speciation profile for natural gas-fired reciprocating engine [27] was used. All TACs listed in the most recent version of the Emission Inventory Criteria and Guidelines Report for the Air Toxics "Hot Spots" Program[28] have been included. The TAC speciation profile and annual emissions of each TAC are shown in Table 27. The relevant sections of the speciation profile database are included in Appendix E-1.

Table 27
TAC Emissions from Propane-Fueled Forklifts – Dolores Rail Yard
2005 Baseline Inventory

CAS	Pollutant[a]	Organic Fraction[b,c]	Emissions (tons/yr)
95636	1,2,4-trimethylbenzene	0.00001	3.21×10^{-7}
75070	acetaldehyde	0.00003	9.63×10^{-7}
71432	benzene	0.00010	3.53×10^{-6}
110827	cyclohexane	0.00001	3.21×10^{-7}
100414	ethylbenzene	0.00001	3.21×10^{-7}
74851	ethylene	0.00058	2.02×10^{-5}
50000	formaldehyde	0.00074	2.60×10^{-5}
108383	m-xylene	0.00001	3.21×10^{-7}
110543	n-hexane	0.00002	6.42×10^{-7}
95476	o-xylene	0.00001	3.21×10^{-7}
115071	propylene	0.00154	5.42×10^{-5}
108883	toluene	0.00004	1.28×10^{-6}
1330207	xylene	0.00002	6.42×10^{-7}
Total			$\mathbf{1.09 \times 10^{-4}}$

Notes:
a. Emissions were calculated for only those chemicals that were in both the CARB SPECIATE database and the AB 2588 list.
b. Organic fraction data are from CARB's SPECIATE database. Data are from profile #719 "I.C.E. reciprocating – natural gas". A speciation profile for propane was not included in the database.
c. Organic fraction is reported on a ROG basis using CARB's SPECIATE ROG/TOG ratio of 0.0914.

[26] Available at *http://www.arb.ca.gov/ei/speciate/speciate.htm*.
[27] Speciation profile number 719 was used to calculate TAC emissions from this source.
[28] Available at *http://www.arb.ca.gov/ab2588/2588guid.htm*.

5. TRUs and Reefer Cars

Transport refrigeration units (TRUs) and refrigerated railcars (reefer cars) are used to transport perishable and frozen goods. TRUs and reefer cars are transferred into and out of, and are temporarily stored at, ICTF. Criteria pollutant, DPM, and GHG emissions were calculated from the Diesel-fueled engines that power the refrigeration units on TRUs and reefer cars. GHG emissions from refrigerant loss were also calculated.

The TRUs are owned by a variety of independent shipping companies and equipment-specific data are not available. Therefore, the default Diesel engine equipment rating and distribution contained in the OFFROAD2007 model were used for emission calculations. It was assumed that the number of TRUs and reefer cars in the Yard at any one time remained constant during the year, with individual units cycling in and out of the Yard.

Emissions from TRUs and reefer cars are based on average size of the Diesel engines, the average number of units in the Yard, and the hours of operation for each engine.[29] Equipment specifications and activity data for TRUs and reefer cars are summarized in Table 28.

[29] The average hours of operation was obtained from CARB's *Staff Report: Initial Statement of Reasons for Proposed Rulemaking for Airborne Toxic Control Measure for In-Use Diesel-Fueled Transport Refrigeration Units (TRU) and TRU Generator Sets, and Facilities Where TRUs Operate*, October 2003. The Staff Report is available at *http://www.arb.ca.gov/regact/trude03/trude03.htm*.

Table 28
Equipment Specifications and Activity Data for TRUs and Reefer Cars – ICTF Rail Yard
2005 Baseline Year

Equipment Type	Average Rating (hp)[a]	Average No. of Units in Yard[b]	Hours of Operation (hr/day)[c]	Hours of Operation (hr/yr)[d]	Fuel Use (gal/yr)[e]
Container	28.56	70	4	1,460	121,471
Railcar	34	10	4	1,460	19,639

Notes:
a. Based on the average horsepower distribution in the OFFROAD2007 model.
b. UPRR staff estimates and car data reports indicate that there are approximately 35 TRUs and 2-5 reefer cars in the Yard at any given time. To be conservative, these estimates were increased by 100%.
c. From CARB's *Staff Report: Initial Statement of Reason for Proposed Rulemaking for Airborne Toxic Control Measure for In-Use Diesel-Fueled Transport Refrigeration Units (TRU) and TRU Generator Sets, and Facilities Where TRUs Operate* (October 2003).
d. It was assumed that the number of units and the annual hours of operation remain constant, with individual units cycling in and out of the Yard.
e. Fuel use is for all units in each category.

Criteria pollutant and DPM emission factors for the Diesel-fueled engines on TRUs and reefer cars are from the OFFROAD2007 model. Emission factors from CARB's *Draft Emission Factors for Mandatory Reporting Program* document (August 10, 2007) were used to calculate GHG emissions from TRU engine operations. A fuel-specific carbon oxidization factor, from the CARB emission factor document, was also used to calculate CO_2 emissions. The criteria pollutant, DPM, and GHG emission factors, as well as the carbon oxidation factor, used to calculate emissions from the TRUs and reefer cars are shown in Table 29. Detailed emission factor derivation calculations and the OFFROAD2007 output are contained in Appendix F-1. A copy of CARB's *Draft Emission Factors for Mandatory Reporting Program* document is contained in Appendix C.

To calculate the emissions from the operation of the Diesel-fueled engines on TRUs and reefer cars, the activity data shown in Table 28 were combined with the emission factors shown in Table 29. The criteria pollutant, DPM, and GHG emission estimates for the Diesel-fueled engines on TRUs and reefer cars operating at ICTF during the 2005 baseline year are shown in Table 30. Detailed emission calculations are shown in Appendix F-1.

Table 29
Criteria Pollutant, DPM, and GHG Emission Factors for Diesel-Fueled TRUs and Reefer Car Engines – ICTF Rail Yard
2005 Baseline Year

Equipment Type	Carbon Oxidization Factor (%)[d]	Emission Factors (g/hp-hr-unit)[a]						Emission Factors (kg/gal)[d]		
		VOC[b]	CO	NOx	PM_{10}	DPM	SOx[c]	CO_2	N_2O[e]	CH_4[e]
TRU	99.0	2.85	6.78	6.43	0.71	0.71	0.07	10.15	1.39×10^{-5}	4.16×10^{-5}
Reefer Car	99.0	3.23	7.49	6.71	0.79	0.79	0.07	10.15	1.39×10^{-5}	4.16×10^{-5}

Notes:

a. Emission factors from OFFROAD2007 model.
b. Evaporative emissions from this source are negligible.
c. Emission factor based on a Diesel fuel sulfur content of 130 ppm.
d. GHG emission factors and carbon oxidization factor are from CARB's *Draft Emission Factors for Mandatory Reporting Program* document (August 10, 2007).
e. Emission factors for Diesel fuel sources based on a Diesel fuel HHV of 5.825 MMBtu/barrel (from CARB Draft Emission Factors for Mandatory Reporting Programs, August 10, 2007) and 42 gallons per barrel

Table 30 Emissions from Diesel-Fueled TRUs and Reefer Car Engines – ICTF Rail Yard 2005 Baseline Year									
Equipment Type	Emissions (tons/yr)						Emissions (metric tons/yr)		
	VOC	CO	NOx	PM_{10}	DPM	SOx	CO_2	N_2O	CH_4
TRU	5.12	12.16	11.53	1.28	1.28	0.12	1,220.60	0.00	0.01
Reefer Car	0.94	2.17	1.95	0.23	0.23	0.02	197.35	0.00	0.00
Total	**6.06**	**14.33**	**13.47**	**1.51**	**1.51**	**0.14**	**1,417.94**	**0.00**	**0.01**

In addition to the GHG emissions from the Diesel-fueled engines on the TRUs and reefer cars, GHG emissions were calculated for refrigerant losses from TRUs. Emissions were calculated for HFC-125, HFC-134a, and HFC-143a, according to the methods outlined in the *Berths 136-147 (TraPac) Container Terminal Draft Environmental Impact Statement (EIS)/Environmental Impact Report (EIR)* (Port of Los Angeles, 2007).[30] The activity data, emission factors, and emissions from TRU and reefer car refrigerant loss are shown in Table 31.

[30] The TraPac EIS/R is available at *http://www.portoflosangeles.org/EIR/TraPac/eir_062907trapac.htm*.

Table 31
GHG Emissions from TRU and Reefer Car Refrigerant Loss – ICTF Rail Yard
2005 Baseline Year

Equipment Type	Avg. No. of Units in Yard[a]	Refrigerant Charge per Unit (kg)[b]	Annual Refrigerant Loss Rate (%)[c]	Annual Refrigerant Loss (kg/yr)	Emissions by Refrigerant[d,e] (metric tons/yr)		
					HFC-125	HFC-134a	HFC-143a
TRU	70	6.35	35%	155.58	0.034	0.081	0.040
Reefer Car	10	6.35	35%	22.23	0.005	0.012	0.006
Total	**80**			**177.81**	**0.039**	**0.092**	**0.046**

Notes:
a. See Table 26.
b. From *Berths 136-147 (TraPac) Container Terminal Project Draft EIS/EIR* (POLA, 2007).
c. POLA upper bound estimate, TraPac Draft EIS/EIR.
d. POLA estimate, TraPac Draft EIS/EIF.
e. Assumes a mix of refrigerants of 50% R404a and 50% HFC-134a; assumes R404a equals 52% HFC-143a, 44% HFC-125, and 4% HFC-134a.

6. HHD Diesel-Fueled Delivery Trucks

In addition to the drayage trucks, HHD trucks deliver Diesel fuel, oil, sand, and soap to the Dolores Yard and gasoline, Diesel fuel, and oil to ICTF. The trucks are owned by independent operators. Therefore, a fleet distribution is not available. For emission calculations, the EMFAC2007 model default fleet distribution for HHD Diesel-fueled trucks operating in Los Angeles County was used.

The annual number of delivery truck trips was calculated based on the facility gasoline, Diesel fuel, oil, and soap throughput and a tanker truck capacity of 8,000 gallons per truck. The annual number of sand delivery truck trips was based on discussions with UPRR staff. Per the Dolores Yard Operations Manager, the facility receives 2 to 3 sand deliveries per week. The VMT per trip was estimated from aerial photos of the Yards. Activity data for the HHD delivery trucks are summarized in Table 32.

Table 32
Activity Data for HHD Delivery Trucks – Dolores and ICTF Rail Yards
2005 Baseline Year

Yard	Delivery Type	Number of Trips[a,b]	VMT per Trip (mi/trip)[c]	Annual VMT (mi/yr)	Fuel Use (gal/yr)[d]	Idling Time (min/trip)[e]	Idling Time (hr/yr)
Dolores	Diesel Fuel	2,625	0.06	157.5	333.76	10	437.5
Dolores	Sand	156	2.2	343.2	150.85	30	78.0
Dolores	Oil	24	0.06	1.4	3.05	10	4.0
Dolores	Soap	3	0.06	0.2	0.36	10	0.5
ICTF	Gasoline	11	0.5	5.4	2.76	10	1.8
ICTF	Diesel Fuel	22	0.5	10.8	5.48	10	3.6
ICTF	Oil	2	0.5	1.0	0.51	10	0.3
Total		**2,843**		**519.5**	**496.8**		**525.7**

Notes:
a. Number of truck trips for liquid products based on the material throughput and a tanker truck volume of 8,000 gallons per truck.
b. Number of sand truck trips based on personal communication with UPRR staff.
c. VMT per trip estimated from aerial photos of each Yard.
d. Fuel use is for both traveling and idling modes and was calculated from EMFAC2007.
e. Engineering estimate based on personal communication with UPRR staff.

Criteria pollutant and DPM emission factors for the HHD Diesel-fueled delivery trucks were obtained from CARB's EMFAC2007 model. The emissions from idling and traveling modes have been separated because different source treatments (point or volume sources) will be used in the air dispersion modeling analysis for these modes. A fleet average emission factor for traveling exhaust emissions was calculated using the EMFAC2007 model with the BURDEN output option. Since the fleet distribution is not known, the EMFAC2007 default distribution for Los Angeles County was used. Idling emission factors were calculated using the EMFAC2007 model with the EMFAC output option. The emission factors for the HHD Diesel-fueled delivery trucks are shown in Table 33. Detailed emission factor derivation calculations and the EMFAC2007 output are contained in Appendix G-1.

Table 33
Criteria Pollutant and DPM Emission Factors for HHD Diesel-Fueled Delivery Trucks – ICTF and Dolores Rail Yard
2005 Baseline Year

Operating Mode	Fleet Average Emission Factors					
	ROG	CO	NOx	PM_{10} [c]	DPM [c]	SOx
Traveling (g/mi) [a]	6.40	17.23	28.68	2.53	2.47	0.24
Idling (g/hr) [b]	16.16	52.99	100.38	2.85	2.85	0.55

Notes:
a. Emission factors calculated using the EMFAC2007 model with the BURDEN output option. The default fleet distribution for Los Angeles County was used.
b. Emission factors calculated using the EMFAC2007 model with the EMFAC output option. The default fleet distribution for Los Angeles County was used.
c. The PM_{10} emission factor includes engine exhaust emissions along with brake and tire wear. The DPM emission factor includes engine exhaust emissions only.

Emission factors from CARB's *Draft Emission Factors for Mandatory Reporting Program* document (August 10, 2007) were used to calculate GHG emissions from delivery truck operations. The GHG emission factors are based on fuel consumption, not activity (i.e. miles driven or hours of operation); therefore, the same factors are used to calculate emissions from both the traveling and idling modes. A fuel-specific carbon oxidization factor, from the CARB emission factor document, was also used to calculate CO_2 emissions. The GHG emission factors for delivery trucks are shown in Table 34. A copy of CARB's *Draft Emission Factors for Mandatory Reporting Program* document is contained in Appendix C.

Table 34 GHG Emission Factors for HHD Diesel-Fueled Delivery Trucks – ICTF and Dolores Rail Yard 2005 Baseline Year				
Operating Mode	Carbon Oxidization Factor (%)[a]	Emission Factors (kg/gal)[a]		
		CO_2	N_2O[c]	CH_4[c]
Traveling/Idling[b]	99.0	10.15	1.39×10^{-5}	4.16×10^{-5}

Notes:

a. Emission factors and carbon oxidization factor from CARB's *Draft Emission Factors for Mandatory Reporting Program* document (August 10, 2007).

b. Emission factors are based on fuel consumption; therefore, the same factors are used for both the traveling and idling modes.

c. Based on a Diesel fuel HHV of 5.825 MMBtu/barrel (from *CARB Draft Emission Factors for Mandatory Reporting Programs*, August 10, 2007) and 42 gallons per barrel

To calculate the emissions from delivery truck operations, the activity data shown in Table 32 was combined with the emission factors shown in Tables 33 and 34. The criteria pollutant, DPM, and GHG emission estimates for the HHD Diesel-fueled delivery trucks operating at the ICTF and Dolores yards during the 2005 baseline year are shown in Table 35. Detailed emission calculations are shown in Appendix G-1.

Table 35 Criteria Pollutant, DPM, and GHG Emissions from HHD Diesel-Fueled Delivery Trucks – ICTF and Dolores Rail Yards 2005 Baseline Year									
Operating Mode	Emission (tpy)						Emission (metric tons/yr)		
	ROG	CO	NOx	PM_{10}	DPM	SOx	CO_2	N_2O	CH_4
Traveling	0.00	0.01	0.02	0.00	0.001	0.00	1.51	0.00	0.00
Idling	0.01	0.03	0.06	0.00	0.002	0.00	3.48	0.00	0.00
Total	**0.01**	**0.04**	**0.08**	**0.00**	**0.00**	**0.00**	**4.99**	**0.00**	**0.00**

7. <u>Yard Trucks</u>

A number of light duty and medium duty gasoline-fueled trucks are used by the staff at the ICTF and Dolores Yards. The annual number of miles driven was determined by dividing the vehicles odometer reading by the age of the vehicle or through interviews with UPRR staff. The equipment specifications and activity data for the yard trucks are summarized in Table 36.

Vehicle specific criteria pollutant emission factors for each yard truck were obtained from CARB's EMFAC2007 model. The emissions from idling and traveling modes have been separated because different source treatments (point or volume sources) will be used in the air dispersion modeling analysis for these modes. Traveling exhaust emission factors were calculated using the EMFAC2007 model with the BURDEN output option. Idling emission factors for the light-heavy duty and medium-heavy duty vehicles were calculated using the EMFAC2007 model with the EMFAC output option. The idling emissions from light duty trucks were negligible. The criteria pollutant emission factors for the yard trucks are shown in Table 37. Detailed emission factor derivation calculations and the EMFAC2007 output are contained in Appendix H-1.

Emission factors from CARB's *Draft Emission Factors for Mandatory Reporting Program* document (August 10, 2007) were used to calculate GHG emissions from yard trucks. The GHG emission factors are based on fuel consumption, not activity (i.e. miles driven or hours of operation); therefore, the same factors are used to calculate emissions from both the traveling and idling modes. A fuel-specific carbon oxidization factor, from the CARB emission factor document, was also used to calculate CO_2 emissions. The GHG emission factors and the carbon oxidization factor for yard trucks are shown in Table 38. A copy of CARB's *Draft Emission Factors for Mandatory Reporting Program* document is contained in Appendix C.

To calculate the emissions from yard truck operations, the activity data shown in Table 36 was combined with the emission factors shown in Tables 37 and 38. The criteria pollutant and GHG emission estimates for the yard trucks operating at the ICTF and Dolores yards during the 2005 baseline year are shown in Table 39. Detailed emission calculations are shown in Appendix H-1.

Table 36
Equipment Specifications and Activity Data for Gasoline-Fueled Yard Trucks – ICTF and Dolores Rail Yards
2005 Baseline Year

Yard	Equipment Type	Equipment ID	Vehicle Class	Make/Model	Model Year	Annual VMT (mi/yr)[a]	Fuel Use (gal/yr)[b]	Idling (hr/yr)[c]
ICTF	SUV	1915-53287	LDT	Jeep Cherokee	2000	73,000	6,874	NA
ICTF	Pickup Truck	1915-55536	LDT	Chevy Extended Cab	2003	73,000	6,847	NA
ICTF	SUV	1915-19952	LDT	Chevy Trailblazer 370	2003	73,000	6,847	NA
ICTF	Pickup Truck	1915-19971	LDT	Chevy Extended Cab	2004	73,000	6,834	NA
ICTF	Van	1915-19975	LHDT 1	Chevy 15 Passenger Van	2004	73,000	11,760	91.25
Dolores	Service Truck	73152	MHD	Chevy C4500	2003	12,644	2,146	91.25
Dolores	Mgr Truck	Unknown	LDT	Chevy Trailblazer	2004	45,000	4,213	NA
Dolores	Mgr Truck	73167	LDT	Chevy Blazer	2004	36,608	3,427	NA
Dolores	Pickup Truck	73396	LDT	Ford F-150	2005	23,756	2,219	NA

Notes:
a. Annual VMT estimated from either the odometer reading divided by the age of the vehicle or interviews with UPRR staff.
b. Calculated using the EMFAC2007 model.
c. Idling time is an engineering estimate. Idling emissions from light duty trucks are negligible, therefore, idling time data for these vehicles was not collected.

Table 37
Criteria Pollutant Emission Factors for Yard Trucks – ICTF and Dolores Rail Yards
2005 Baseline Year

Yard	Equipment Type	Make/Model	Vehicle Class	Model Year	Traveling Emission Factors (g/mi)[a]					Idling Emission Factors (g/hr)[b]				
					ROG	CO	NOx	PM_{10}	SOx	ROG	CO	NOx	PM_{10}	SOx
ICTF	SUV	Jeep Cherokee	LDT	2000	0.07	3.00	0.22	0.04	0.01	NA	NA	NA	NA	NA
ICTF	Pickup Truck	Chevy Ext. Cab	LDT	2003	0.05	1.97	0.16	0.03	0.01	NA	NA	NA	NA	NA
ICTF	SUV	Chevy Trailblazer	LDT	2003	0.05	1.97	0.16	0.03	0.01	NA	NA	NA	NA	NA
ICTF	Pickup Truck	Chevy Ext. Cab	LDT	2004	0.04	1.51	0.12	0.03	0.01	NA	NA	NA	NA	NA
ICTF	Van	Chevy Van	LHDT 1	2004	0.03	0.35	0.12	0.03	0.00	23.10	141.99	1.56	0.00	0.05
Dolores	Service Truck	Chevy C4500	MHD	2003	0.88	11.41	2.19	0.02	0.00	23.10	141.99	1.56	0.00	0.05
Dolores	Mgr Truck	Chevy Trailblazer	LDT	2004	0.05	1.97	0.16	0.03	0.01	NA	NA	NA	NA	NA
Dolores	Mgr Truck	Chevy Blazer	LDT	2004	0.05	1.97	0.16	0.03	0.01	NA	NA	NA	NA	NA
Dolores	Pickup Truck	Ford F-150	LDT	2005	0.02	0.89	0.07	0.02	0.01	NA	NA	NA	NA	NA

Notes:
a. Traveling exhaust emissions calculated using the EMFAC2007 model with the BURDEN output option at a vehicle speed of 15 mph.
b. Idling exhaust emissions factors for LHDT1 and MHD vehicles calculated using the EMFAC2007 model with the EMFAC output option. Idling exhaust emissions from light duty trucks (LDT) are negligible.

Table 38
GHG Emission Factors for Yard Trucks – ICTF and Dolores Rail Yards
2005 Baseline Year

Operating Mode	Carbon Oxidization Factor (%)[a]	Emission Factors (kg/gal)[a]		
		CO_2	N_2O[c]	CH_4[c]
Traveling/Idling[b]	99.0	8.87	1.23×10^{-5}	1.60×10^{-4}

Notes:
a. Emission factors and carbon oxidization factor from CARB's *Draft Emission Factors for Mandatory Reporting Program* document (August 10, 2007).
b. Emission factors are based on fuel consumption, therefore, the same factors are used for both the traveling and idling modes.
c. Based on a gasoline HHV of 122,697 Btu/gallon (from the Transportation Energy Data Book: Edition 26, U.S. Department of Energy, 2007).

Table 39
Criteria Pollutant and GHG Emissions from Yard Trucks – ICTF and Dolores Rail Yards
2005 Baseline Year

Yard	Equipment Type	Make/Model	Vehicle Class	Model Year	Emissions (tpy)					Emissions (metric tons/yr)		
					ROG	CO	NOx	PM_{10}	SOx	CO_2	N_2O	CH_4
ICTF	SUV	Jeep Cherokee	LDT	2000	0.01	0.24	0.02	0.00	0.00	60.36	0.00	0.00
ICTF	Pickup Truck	Chevy Ext. Cab	LDT	2003	0.00	0.16	0.01	0.00	0.00	60.12	0.00	0.00
ICTF	SUV	Chevy Trailblazer	LDT	2003	0.00	0.16	0.01	0.00	0.00	60.12	0.00	0.00
ICTF	Pickup Truck	Chevy Ext. Cab	LDT	2004	0.00	0.12	0.01	0.00	0.00	60.01	0.00	0.00
ICTF	Van	Chevy Van	LHDT 1	2004	0.00	0.04	0.01	0.00	0.00	103.27	0.00	0.00
Dolores	Service Truck	Chevy C4500	MHD	2003	0.01	0.17	0.03	0.00	0.00	18.84	0.00	0.00
Dolores	Mgr Truck	Chevy Trailblazer	LDT	2004	0.00	0.10	0.01	0.00	0.00	36.99	0.00	0.00
Dolores	Mgr Truck	Chevy Blazer	LDT	2004	0.00	0.08	0.01	0.00	0.00	30.09	0.00	0.00
Dolores	Pickup Truck	Ford F-150	LDT	2005	0.00	0.02	0.00	0.00	0.00	19.48	0.00	0.00
Total					**0.02**	**1.09**	**0.11**	**0.00**	**0.00**	**448.71**	**0.00**	**0.00**

CARB's speciation database was used to determine the fraction of each TAC in the total VOC emissions from each yard truck.[31] All TACs listed in the most recent version of the Emission Inventory Criteria and Guidelines Report for the Air Toxics "Hot Spots" Program were included. The TAC speciation profiles and emission rates for the yard trucks are shown in Table 40. A copy of the relevant sections of SPECIATE database and detailed calculations are included in Appendix H-1.

Table 40
TAC Emissions from Gasoline-Fueled Yard Trucks – ICTF and Dolores Rail Yards
2005 Baseline Year

CAS	Chemical Name[a]	Organic Fraction of VOC (by weight)[b]	Emissions (tons/yr)		
			ICTF	Dolores	Total
95636	1,2,4-trimethylbenzene	0.0120	2.49×10^{-4}	2.33×10^{-4}	4.82×10^{-4}
106990	1,3-butadiene	0.0068	1.41×10^{-4}	1.32×10^{-4}	2.72×10^{-4}
540841	2,2,4-trimethylpentane	0.0288	5.96×10^{-4}	5.58×10^{-4}	1.15×10^{-3}
75070	acetaldehyde	0.0035	7.20×10^{-5}	6.74×10^{-5}	1.39×10^{-4}
107028	acrolein (2-propenal)	0.0017	3.42×10^{-5}	3.20×10^{-5}	6.62×10^{-5}
71432	benzene	0.0309	6.38×10^{-4}	5.97×10^{-4}	1.24×10^{-3}
4170303	crotonaldehyde	0.0004	7.46×10^{-6}	6.98×10^{-6}	1.44×10^{-5}
110827	cyclohexane	0.0077	1.59×10^{-4}	1.48×10^{-4}	3.07×10^{-4}
100414	ethylbenzene	0.0131	2.71×10^{-4}	2.53×10^{-4}	5.24×10^{-4}
74851	ethylene	0.0794	1.64×10^{-3}	1.54×10^{-3}	3.18×10^{-3}
50000	formaldehyde	0.0197	4.08×10^{-4}	3.81×10^{-4}	7.89×10^{-4}
78795	isoprene	0.0018	3.66×10^{-5}	3.42×10^{-5}	7.08×10^{-5}
98828	isopropylbenzene (cumene)	0.0001	2.49×10^{-6}	2.33×10^{-6}	4.81×10^{-6}
67561	methyl alcohol	0.0015	3.15×10^{-5}	2.95×10^{-5}	6.11×10^{-5}
78933	methyl ethyl ketone (mek)	0.0002	4.71×10^{-6}	4.41×10^{-6}	9.12×10^{-6}
108383	m-xylene	0.0445	9.20×10^{-4}	8.61×10^{-4}	1.78×10^{-3}
91203	naphthalene	0.0006	1.22×10^{-5}	1.14×10^{-5}	2.36×10^{-5}
110543	n-hexane	0.0200	4.13×10^{-4}	3.86×10^{-4}	7.99×10^{-4}
95476	o-xylene	0.0155	3.20×10^{-4}	2.99×10^{-4}	6.19×10^{-4}
115071	propylene	0.0382	7.90×10^{-4}	7.40×10^{-4}	1.53×10^{-3}
100425	styrene	0.0015	3.17×10^{-5}	2.97×10^{-5}	6.14×10^{-5}
108883	toluene	0.0718	1.49×10^{-3}	1.39×10^{-3}	2.88×10^{-3}
Total			**8.26×10^{-3}**	**7.73×10^{-3}**	**1.60×10^{-2}**

Notes:
a. Organic fraction information is from CARB's SPECIATE database. Data used are from the "Cat stabilized exhaust 2005 SSD etoh 2% O (MTBE phaseout)" profile.
b. Organic fraction is reported on a ROG basis using CARB's SPECIATE ROG/TOG ratio of 0.8012.

[31] Speciation profile number 2105 was used to calculate TAC emissions from this source.

8. Diesel-Fueled IC Engines

A stationary Diesel-fueled emergency generator is located at the ICTF Yard office building to provide emergency power when electrical service from the local power provider is disrupted. The generator is a 269 horsepower, Diesel-fueled unit manufactured by Caterpillar. In addition to the generator, the ICTF mechanical department operates a portable 49 hp Diesel-fueled air compressor, manufactured by Ingersoll-Rand, at various locations within the Yard.

Emissions from the emergency generator and the air compressor are based on the rated capacity of the unit and the annual hours of operation. The equipment specifications and activity data for the emergency generator and air compressor are shown in Table 41.

Table 41
Equipment Specifications for Diesel-Fueled IC Engines – ICTF Rail Yard
2005 Baseline Year

Equipment Type	Make	Rating (hp)	Hours of Operation (hr/yr)[a,b]	Fuel Use (gal/yr)[c]
Emergency Generator	Caterpillar 3208	269	20	272
Air Compressor	Ingersoll-Rand	49	1,000	2,477

Notes:
a. Hours of operation for the emergency generator based on CARB's ATCM for Stationary Compression Ignition Engines. The ATCM limits non-emergency operation to 20 hours per year. UP personnel estimate that this engine is operated no more than 30 minutes/month. The 20 hours/yr estimate was used to be conservative.
b. Hours of operation for the air compressor are an engineering estimate.
c. Annual fuel use based on a bsfc of 7,000 Btu/hp-hr, a Diesel fuel HHV of 19,500 lb/Btu, and a Diesel fuel density of 7.1 lb/gal.

Criteria pollutant and DPM emission factors for the stationary emergency generator and portable air compressor are from AP-42, Table 3.3.-1 (10/96).[32] Emission factors from CARB's *Draft Emission Factors for Mandatory Reporting Program* document (August 10, 2007) were used to calculate GHG emissions from both units. A fuel-specific carbon oxidization factor, from the CARB emission factor document, was also used to calculate CO_2 emissions. The criteria pollutant, DPM, and GHG emission factors, as well as the

[32] Available at *http://www.epa.gov/ttn/chief/ap42/*.

carbon oxidization factor, used to calculate emissions from the Diesel-fueled IC engines are shown in Table 41. A copy of the relevant sections of AP-42 is contained in Appendix I-1. A copy of CARB's *Draft Emission Factors for Mandatory Reporting Program* document is contained in Appendix C.

To calculate the emissions from Diesel-fueled IC engine operations, the activity data shown in Table 41 was combined with the emission factors shown in Table 42. The criteria pollutant, DPM, and GHG emission estimates for the IC engines operating at the ICTF during the 2005 baseline year are shown in Table 43. Detailed emission calculations are shown in Appendix I-2.

Table 42
Criteria Pollutant, DPM, and GHG Emission Factors for the Diesel-Fueled IC Engines – ICTF Rail Yard
2005 Baseline Year

Unit	Carbon Oxidization Factor (%)	Emission Factors (g/hp-hr)[a]						Emission Factors (kg/gal)[b]		
		ROG	CO	NOx	PM_{10}	DPM	SOx	CO_2	N_2O[c]	CH_4[c]
Emergency Generator	99.0	1.14	3.03	14.06	1.00	1.00	0.93	10.15	1.39×10^{-5}	4.16×10^{-5}
Air Compressor	99.0	1.14	3.03	14.06	1.00	1.00	0.93	10.15	1.39×10^{-5}	4.16×10^{-5}

Notes:
a. Criteria pollutant and DPM emission factors from AP-42, Table 3.3-1, 10/96.
b. GHG emission factors from CARB's *Draft Emission Factors for Mandatory Reporting Program* document (August 10, 2007).
c. Based on a Diesel fuel HHV of 5.825 MMBtu/barrel (from *CARB Draft Emission Factors for Mandatory Reporting Programs*, August 10, 2007) and 42 gallons per barrel

Table 43
Criteria Pollutant, DPM, and GHG Emissions from the Diesel-Fueled IC Engines – ICTF Rail Yard
2005 Baseline Year

Unit	Emissions (tons/yr)						Emissions (metric tons/yr)		
	ROG	CO	NOx	PM_{10}	DPM	SOx	CO_2	N_2O[c]	CH_4[c]
Emergency Generator	0.01	0.02	0.08	0.01	0.01	0.01	2.73	0.00	0.00
Air Compressor	0.06	0.16	0.76	0.05	0.05	0.05	24.89	0.00	0.00
Total	**0.07**	**0.18**	**0.84**	**0.06**	**0.06**	**0.06**	**27.63**	**0.00**	**0.00**

9. Storage Tanks

There are many storage tanks at both the ICTF and Dolores Yards that are used to store liquid petroleum and other products such as Diesel fuel, gasoline, lubricating oils, and recovered oil. Emissions from the storage tanks are based on the size of the tank, material stored, and annual throughput. VOC emissions from the storage tanks were calculated using EPA's TANKS program.[33] The emissions from small oil tanks,[34] stormwater tanks, and the sludge tank were assumed to be negligible. Also, the TANKS program does not calculate emissions from oil storage tanks. Therefore, the emissions from oil storage tanks were estimated by modeling the liquid contents as Diesel fuel, resulting in conservative estimates. Equipment specifications, activity data, and the annual emissions from the storage tanks are shown in Table 44. The TANKS program output and detailed emission calculations are shown in Appendices J-1 and J-2.

[33] Available at *http://www.epa.gov/ttn/chief/ap42/ch07/index.html*.

[34] The TANKS program requires a minimum shell length of 5 feet for horizontal tanks and a minimum shell height of 5 feet for vertical tanks to calculate emissions. Emissions from tanks with a shell length/height of 5 feet are considered to be negligible.

Table 44
Storage Tank Specifications and Activity Data – ICTF and Dolores Rail Yards
2005 Baseline Year

Yard	Tank No.	Tank Location	Material Stored	Tank Capacity (gallons)	Tank Dimensions (ft)	Annual Throughput (gal/yr)	VOC Emissions (tpy)
ICTF	TNKD-9901	Crane Maintenance	Offroad Diesel	20,000	34.5 x 10	120,000[b]	0.004
ICTF	TBA-1	Crane Maintenance	CARB Diesel	1,000	7 x 4	52,000[b]	0.001
ICTF	TBA-2	Crane Maintenance	Gasoline	2,000	11.83 x 6.92 x 4.75	86,808[a]	0.71
ICTF	TBA-3	Tractor Maintenance	SAE 15W-40 Motor Oil	500	6 x 4	2,000[b]	0.0002
ICTF	TBA-4	Crane Maintenance	Used Oil	300	4 x 4	1,800[b]	neg.
ICTF	TBA-5	Crane Maintenance	Motor Oil	243	2.5 x 3 x 4.3	972[b]	neg.
ICTF	TBA-6	Crane Maintenance	Hydraulic Oil	300	6 x 2.5 x 3	1,200[b]	neg.
ICTF	TBA-7	Tractor Maintenance	Auto. Transmission Fluid	243	2.5 x 3 x 4.3	972[b]	neg.
ICTF	TBA-8	Tractor Maintenance	SAE 20W-50 Motor Oil	202	3 x 3 x 3	808[b]	neg.
ICTF	TBA-9	Tractor Maintenance	Used Motor Oil	300	4 x 2	1,200[b]	neg.
ICTF	TBA-10	Tractor Maintenance	Used Motor Oil	300	4 x 2	1,200[b]	neg.
ICTF	TBA-11	Tractor Maintenance	Hydraulic Oil	240	3 x 2.7 x 4.3	960[b]	neg.
Dolores	TNKD-0069	Tank Farm	Diesel	160,000	24 x 34	10,500,000[a]	0.10
Dolores	TNKD-0068	Tank Farm	Diesel	160,000	24 x 34	10,500,000[a]	0.10
Dolores	TNKO-0002	Tank Farm	Recovered Oil	10,000	16 x 10	40,000[b]	0.002
Dolores	TNKO-0003	Tank Farm	Drain Oil	12,000	20.5 x 10	48,000[b]	0.002
Dolores	TNKO-0004	Tank Farm	Journal Box Oil	8,000	21.3 x 8	32,000[b]	0.001
Dolores	TNKO-0001	Tank Farm	Lube Oil	12,000	20.5 x 10	48,000[b]	0.004
Dolores	TNKO-0184	Service Track	Recovered Oil	6,000	20.5 x 7	24,000[b]	0.002
Dolores	TNKS-0005	Tank Farm	Stormwater	25,000	30 x 12 x 12	980,100[a]	neg.
Dolores	TNKS-0006	Tank Farm	Stormwater	25,000	30 x 12 x 12	980,100[a]	neg.
Dolores	TNKS-0007	Tank Farm	Stormwater	25,000	30 x 12 x 12	980,100[a]	neg.

Table 44
Storage Tank Specifications and Activity Data – ICTF and Dolores Rail Yards
2005 Baseline Year

Yard	Tank No.	Tank Location	Material Stored	Tank Capacity (gallons)	Tank Dimensions (ft)	Annual Throughput (gal/yr)	VOC Emissions (tpy)
Dolores	TNKS-0008	Tank Farm	Stormwater	25,000	30 x 12 x 12	980,100[a]	neg.
Dolores	TNKS-0010	Tank Farm	Soap	8,000	8 x8	22,785[a]	NA
Dolores	NA	WWTP	Sludge	1,000	6.5 x 5 x 5	NA	neg.
Total VOC							**0.93**

Notes:
a. Annual throughput provided by UPRR.
b. Annual throughput based on the assumptions contained in Trinity Reports.
c. Emission calculations performed using the USEPA TANKS 4.0.9d program.
d. Emissions from small (the TANKS program requires a minimum shell length of 5 feet for horizontal tanks and a minimum shell height of 5 feet for vertical tanks) oil tanks, stormwater tanks, and the sludge tank were assumed to be negligible.
e. The VOC emissions for oil tanks were estimated by modeling the liquid contents as Diesel fuel, resulting in conservative estimates.

CARB's speciation database was used to determine the fraction of each TAC in the total VOC emissions from the storage tanks. CARB's speciation database does not include information on TAC fractions from Diesel fuel or lubricating oil storage tanks. Therefore, TAC emissions were calculated for the gasoline storage tank (Tank TBA-2) at ICTF only. All TACs listed in the most recent version of the Emission Inventory Criteria and Guidelines Report for the Air Toxics "Hot Spots" Program were included. The TAC speciation profile[35] and emission rates for Tank TBA-2 are shown in Table 45. The relevant sections of CARB's speciation database are included in Appendix J-1

Table 45
TAC Emissions from Gasoline Storage Tank – ICTF Rail Yard
2005 Baseline Year

CAS	Chemical Name	Organic Fraction of VOC (by weight)	Emissions (tons/yr)
540841	2,2,4-trimethylpentane	0.0130	9.27×10^{-3}
71432	benzene	0.0036	2.58×10^{-3}
110827	cyclohexane	0.0103	7.36×10^{-3}
100414	ethylbenzene	0.0012	8.45×10^{-4}
78784	isopentane	0.3747	2.67×10^{-1}
98828	isopropylbenzene (cumene)	0.0001	7.88×10^{-5}
108383	m-Xylene	0.0034	2.46×10^{-3}
110543	n-Hexane	0.0155	1.10×10^{-2}
95476	o-Xylene	0.0013	9.17×10^{-4}
106423	p-Xylene	0.0011	7.66×10^{-4}
108883	toluene	0.0171	1.22×10^{-2}
Total			$\mathbf{3.15 \times 10^{-1}}$

Notes:
a. The organic fraction information is from CARB's speciation database. Data are from the "Headspace vapors 1996 SSD etoh 2.0% (MTBE phaseout)" option.
b. Emissions were calculated only for chemicals that were in both CARB's speciation database and the AB 2588 list.
c. The organic fraction is reported on a ROG basis using CARB's SPECIATE ROG/TOG ratio of 0.9963.

10. Refueling Operations

Refueling operations occur at the crane maintenance area of ICTF and at the locomotive shop at the Dolores Yard. Refueling emissions are based on the type of fuel, annual fuel throughput, and VOC emission factors from *Supplemental Instructions for Liquid*

[35] Speciation profile number 661 was used to calculate TAC emissions from this source.

Organic Storage Tanks document of the South Coast Air Quality Management District's (SCAQMD) *General Instruction Book for the AQMD 2006-2007 Annual Emissions Reporting Program.*[36] The activity data, emission factors, and the VOC emissions from refueling operations during the 2005 baseline year are shown in Table 46. A copy of the relevant section of the SCAQMD document is contained in Appendix K-1. Detailed emission calculations are shown in Appendix K-2.

CARB's speciation database was used to determine the fraction of each TAC in the total VOC emissions from the refueling operations. CARB's speciation database does not include information on TAC fractions from Diesel fuel. Therefore, TAC emissions were calculated for the gasoline refueling operations at ICTF only.[37] All TACs listed in the most recent version of the Emission Inventory Criteria and Guidelines Report for the Air Toxics "Hot Spots" Program were included. The TAC speciation profile and emission rates for the gasoline refueling operations are shown in Table 47. A copy of the relevant sections of SPECIATE database are included in Appendix K-3.

[36] Available at *http://www.ecotek.com/aqmd/download.htm*.
[37] Speciation profile number 661 was used to calculate TAC emissions from this source.

Table 46
VOC Emissions from Refueling Operations – ICTF and Dolores Rail Yards
2005 Baseline Year

Yard	Tank No.	Tank Location	Material Stored	Throughput (gal/yr)[a]	VOC Emission Factor (lb/1000 gal)[b]	2005 VOC Emissions (tons/yr)
ICTF	TNKD-9901	Crane Maintenance	Offroad Diesel	120,000	0.028	0.002
ICTF	TBA-1	Crane Maintenance	CARB Diesel	52,000	0.028	0.001
ICTF	TBA-2	Crane Maintenance	Gasoline	86,808	1.8	0.078
Dolores	TNKD-0069	Tank Farm	Diesel	10,500,000	0.028	0.147
Dolores	TNKD-0068	Tank Farm	Diesel	10,500,000	0.028	0.147
Total						**0.375**

Notes:
a. See Table 44.
b. Emission factors from the *Supplemental Instructions for Liquid Organic Storage Tanks* document of the SCAQMD's *General Instruction Book for the AQMD 2006-2007 Annual Emissions Reporting Program.*

Table 47 TAC Emissions from Gasoline Refueling Operations – ICTF Rail Yard 2005 Baseline Year			
CAS	Chemical Name	Organic Fraction of VOC (by weight)	Emissions (tons/yr)
540841	2,2,4-trimethylpentane	0.0130	1.02×10^{-3}
71432	benzene	0.0036	2.82×10^{-4}
110827	cyclohexane	0.0103	8.06×10^{-4}
100414	ethylbenzene	0.0012	9.25×10^{-5}
78784	isopentane	0.3747	2.93×10^{-2}
98828	Isopropylbenzene (cumene)	0.0001	8.63×10^{-6}
108383	m-Xylene	0.0034	2.69×10^{-4}
110543	n-Hexane	0.0155	1.21×10^{-3}
95476	o-Xylene	0.0013	1.00×10^{-4}
106423	p-Xylene	0.0011	8.39×10^{-5}
108883	toluene	0.0171	1.33×10^{-3}
Total			**3.45×10^{-2}**

Notes:

a. The organic fraction information is from CARB's speciation database. Data are from the "Headspace vapors 1996 SSD etoh 2.0% (MTBE phaseout)" option.

b. Emissions were calculated only for chemicals that were in both CARB's speciation database and the AB 2588 list.

c. The organic fraction is reported on a ROG basis using CARB's SPECIATE ROG/TOG ratio of 0.9963.

11. Sand Tower

Locomotives use sand for traction and braking. The sand tower system located at the Dolores Yard consists of a storage system and a transfer system to dispense sand into locomotives. The storage system includes a pneumatic delivery system and a storage silo. The transfer system includes a pneumatic transfer system, an elevated receiving silo, and a moving hopper and gantry system. The system is equipped with a baghouse for emissions control.

Emissions from the sand tower are based on the annual sand throughput and PM_{10} emission factors from AP-42.[38] The pneumatic transfer system is similar to those used to unload cement at concrete batch plants. The gravity feed system is similar to the sand

[38] Available at *http://www.epa.gov/ttn/chief/ap42/*.

and aggregate transfer operations at concrete batch plants. Therefore, emissions will be calculated using the AP-42 emission factors for concrete batch plants. As previously discussed, the system is equipped with a baghouse; therefore, emission factors for a controlled system were used. The activity data, PM_{10} emission factors, and annual emission estimates for the sand tower are shown Table 48. The relevant sections of AP-42 are in Appendix L-1. Detailed emission calculations are shown in Appendix L-2.

Table 48
PM_{10} Emission Factors and Emission Rates for Sand Tower Operations – Dolores Rail Yard
2005 Baseline Year

Pollutant	Sand Throughput (tons/yr)[a]	Emission Factors (lb/ton)		Emissions (tons/yr)		
		Pneumatic Transfer[b]	Gravity Transfer[c]	Pneumatic Transfer	Gravity Transfer	Total
PM_{10}	3,120	0.00034	0.00099	0.001	0.002	0.002

Notes:
a. Annual throughput data provided by UPRR.
b. Emission factor from AP-42, Table 11.12-5, 6/06. Factor for controlled pneumatic cement unloading to elevated storage silo was used. The unit is equipped with a fabric filter.
c. Emission factor from AP-42, Table 11.12-5, 6/06. Factor for sand transfer was used.

12. Wastewater Treatment Plant

The Dolores Yard also has a wastewater treatment plant (WWTP) for pretreatment of wastewater generated by Yard operations prior to discharge to the public sewer. Equipment at the WWTP includes basins, two oil/water separators, a dissolved air flotation (DAF) unit, pumps, and storage tanks. Air emission sources at the WWTP are the basins, the oil/water separators, and the DAF. In 2005, the wastewater flow rate at the Dolores Yard was 980,100 gallons.[39]

Emissions from the WWTP are based on the annual wastewater flow rate and from the *Air Emission Inventory and Regulatory Analysis Report for Dolores Yard* (Trinity Consultants, December 2005). Emission rates, based on the 1999 wastewater flow rate,

[39] Personal communication from Brock Nelson of UPRR on August 28, 2006.

were calculated by Trinity Consultants using EPA's WATER9 program. The 2005 annual emissions were calculated by multiplying the emission rates, in grams per second, by the ratio of the 2005 wastewater flow rate to the 1999 wastewater flow rate. The emission rates, in grams per second, and the annual emissions, in tons per year, are shown in Table 49. Detailed emission calculations are shown in Appendix M.

Table 49
TAC Emissions from the Wastewater Treatment Plant – Dolores Rail Yard
2005 Baseline Year

Pollutant	Emission Rate (grams/sec)[b]	Emissions (tons/yr)[c]
benzene	5.10×10^{-7}	2.37×10^{-5}
bis (2-ethylhexyl) Phthalate	1.83×10^{-11}	8.52×10^{-10}
bromomethane	8.99×10^{-7}	4.18×10^{-5}
chloroform	6.30×10^{-7}	2.93×10^{-5}
ethylbenzene	3.04×10^{-6}	1.41×10^{-4}
methylene chloride	1.04×10^{-5}	4.84×10^{-4}
toluene	3.50×10^{-6}	1.63×10^{-4}
xylene	6.20×10^{-6}	2.89×10^{-4}
Total	$\mathbf{2.52 \times 10^{-5}}$	$\mathbf{1.17 \times 10^{-3}}$

Notes:
a. The 2005 wastewater flow rate (980,100 gallons) was provided by UPRR.
b. Emissions rates from the *Air Emission Inventory and Regulatory Analysis Report for the Dolores Yard* (Trinity Consultants, December 2005) and are based on the 1999 wastewater flow rate of 732,000 gallons.
c. Annual emissions for the 2005 baseline year were calculated by multiplying the emission rate, in grams per second, by the ratio of the 2005 wastewater flow rate to the 1999 wastewater flow rate.

13. Steam Cleaners

Portable steam cleaners are used for a variety of activities at the Dolores Yard. Emissions from steam cleaners are based on the hours of operation, the fuel type and rated capacity of the heater, and the fuel type and rated capacity of the pump. The equipment specifications and activity data for the steam cleaners operated at the Dolores Yard are shown in Table 50.

Table 50 Equipment Specifications for Steam Cleaners – Dolores Rail Yard 2005 Baseline Year							
Equipment Location	Make	Emission Unit	Fuel Type	Rating[a] (MMBtu/hr)	Rating[a] (hp)	Hours of Operation (hrs/yr)[b]	Fuel Use (gal/yr)
Service Track	Hydroblaster	Pump	Electric	NA	NA	1,000	NA
		Heater	Propane	0.35	NA	1,000	3,844[c]
Locomotive Shop	Hydroblaster	Pump	Electric	NA	NA	1,000	NA
		Heater	Propane	0.35	NA	1,000	3,844[c]
Locomotive Shop	Hydroblaster	Pump	Electric	NA	NA	1,000	NA
		Heater	Propane	0.35	NA	1,000	3,844[c]
Service Track	Hydroblaster	Pump[b]	Gasoline	NA	11	1,000	628[d]
		Heater	Propane	0.35	NA	1,000	3,844[c]

Notes:

a. Equipment rating provided by UPRR.
b. Hours of operation are an engineering estimate based on interviews with UPRR staff.
c. Based on a propane HHV of 3.824 MMBtu/barrel (from CARB Draft Emission Factors for Mandatory Reporting Programs, August 10, 2007) and 42 gallons per barrel.
d. Based on a bsfc of 7,000 Btu/hp-hr (from AP-42) and a gasoline HHV of 122,697 Btu/gal (from Transportation Energy Data Book, Edition 26, US DOE, 2007).

Criteria pollutant emission factors for the propane-fueled heaters and the gasoline-fueled pump are from AP-42 Table 1.5-1 (10/96) and Table 3.3-1 (10/96), respectively.[40] Emission factors from CARB's *Draft Emission Factors for Mandatory Reporting Program* document (August 10, 2007) were used to calculate GHG emissions from both the heaters and the pumps. A fuel-specific carbon oxidization factor, from the CARB emission factor document, was also used to calculate CO_2 emissions. The criteria pollutant emission factors for steam cleaners are shown in Table 51. The GHG emission factors and carbon oxidization factors are shown in Table 52. A copy of the relevant sections of AP-42 is contained in Appendix N-1. A copy of CARB's *Draft Emission Factors for Mandatory Reporting Program* document is contained in Appendix C.

[40] Available at *http://www.epa.gov/ttn/chief/ap42/*.

Table 51 Criteria Pollutant Emission Factors for Steam Cleaners – Dolores Rail Yard 2005 Baseline Year					
	Emission Factors				
Emission Unit	ROG	CO	NOx	PM_{10}	SOx[c]
Heater (lb/mgal)[a]	0.5	1.9	14.0	0.4	0.002
Pump (g/hp-hr)[b]	9.79	199.13	4.99	0.33	0.27

Notes:
a. Emission factors from AP-42, Table 1.5-1 (10/96).
b. Emission factors from AP-42, Table 3.3-1 (10/96).
c. Based on a propane sulfur content of 185 ppm and a density of 4.24 lb propane per gallon.

Table 52 GHG Emission Factors for Steam Cleaners – Dolores Rail Yard 2005 Baseline Year				
	Carbon Oxidization Factor	Emission Factors (kg/gal)[a]		
Emission Unit	(%)[a]	CO_2	N_2O	CH_4
Heater[b]	99.5	5.70	8.29×10^{-6}	3.73×10^{-5}
Pump[c]	99.0	8.87	1.60×10^{-4}	1.23×10^{-5}

Notes:
a. Emission factors and carbon oxidization factor from CARB's *Draft Emission Factors for Mandatory Reporting Program* document (August 10, 2007).
b. Emission factors for N_2O and CH_4 based on a propane HHV of 3.824 MMBtu/barrel (from CARB *Draft Emission Factors for Mandatory Reporting Programs*, August 10, 2007) and 42 gallons per barrel.
c. Emission factors for N_2O and CH_4 based on a gasoline HHV of 122,697 Btu/gallon (from Transportation Energy Data Book, Edition 26, US DOE, 2007).

To calculate the emissions from steam cleaning operations, the activity data shown in Table 50 was combined with the emission factors shown in Tables 51 and 52. The criteria pollutant and GHG emission estimates for the steam cleaners operating at the Dolores yard during the 2005 baseline year are shown in Table 53. Detailed emission calculations are shown in Appendix N-2.

Table 53 **Criteria Pollutant and GHG Emissions from Steam Cleaners – Dolores Rail Yard** **2005 Baseline Year**								
	Emission (tpy)					Emission (metric tons/yr)		
Emission Unit	ROG	CO	NOx	PM_{10}	SOx	CO_2	N_2O	CH_4
Heaters	0.00	0.02	0.11	0.00	0.00	87.21	0.00	0.00
Pumps	0.12	2.41	0.06	0.00	0.00	5.57	0.00	0.00
Total	**0.12**	**2.43**	**0.17**	**0.00**	**0.00**	**92.78**	**0.00**	**0.00**

CARB's speciation database was used to determine the fraction of each TAC in the total VOC emissions from the steam cleaning operations.[41] The SPECIATE database does not include a profile for propane-fueled boilers. Therefore, the speciation profile for natural gas-fired boilers was used to determine the TAC emissions from the steam cleaner heaters. All TACs listed in the most recent version of the Emission Inventory Criteria and Guidelines Report for the Air Toxics "Hot Spots" Program were included. The TAC speciation profiles and emission rates for the steam cleaning operations are shown in Table 54. A copy of the relevant sections of SPECIATE database are included in Appendix N-3.

Table 54 **TAC Emissions from Steam Cleaners – Dolores Rail Yard** **2005 Baseline Year**					
		Heaters[a]		Pumps[b]	
CAS	Chemical Name	Organic Fraction of VOC (by weight)[c]	Emissions (tons/yr)	Organic Fraction of VOC (by weight)[d]	Emissions (tons/yr)
95636	1,2,4-trimethylbenzene	-	-	0.0140	1.67×10^{-3}
106990	1,3-butadiene	-	-	0.0091	1.08×10^{-3}
540841	2,2,4-trimethylpentane	-	-	0.0222	2.63×10^{-3}
75070	acetaldehyde	-	-	0.0106	1.26×10^{-3}
107028	acrolein (2-propenal)	-	-	0.0020	2.38×10^{-4}
71432	benzene	0.0947	3.64×10^{-4}	0.0368	4.37×10^{-3}
4170303	crotonaldehyde	-	-	0.0014	1.72×10^{-4}
110827	cyclohexane	0.0237	9.11×10^{-5}	0.0050	5.95×10^{-4}
100414	ethylbenzene	-	-	0.0167	1.98×10^{-3}

[41] Speciation profile number 3 was used to calculate TAC emissions from the heaters and profile number 665 was used to calculate the TAC emissions from the pump.

Table 54 TAC Emissions from Steam Cleaners – Dolores Rail Yard 2005 Baseline Year					
		Heaters[a]		Pumps[b]	
CAS	Chemical Name	Organic Fraction of VOC (by weight)[c]	Emissions (tons/yr)	Organic Fraction of VOC (by weight)[d]	Emissions (tons/yr)
74851	ethylene	-	-	0.0996	1.18×10^{-2}
50000	formaldehyde	0.1895	7.28×10^{-4}	0.0327	3.88×10^{-3}
78795	isoprene	-	-	0.0016	1.85×10^{-4}
98828	isopropylbenzene (cumene)	-	-	0.0006	6.58×10^{-5}
67561	methyl alcohol	-	-	0.0038	4.53×10^{-4}
78933	methyl ethyl ketone (mek)	-	-	0.0007	7.88×10^{-5}
108383	m-xylene	-	-	0.0496	5.89×10^{-3}
91203	Naphthalene	-	-	0.0014	1.72×10^{-4}
110543	n-hexane	-	-	0.0146	1.73×10^{-3}
95476	o-xylene	-	-	0.0173	2.05×10^{-3}
115071	propylene	-	-	0.0546	6.48×10^{-3}
100425	styrene	-	-	0.0014	1.72×10^{-4}
108883	toluene	0.0474	1.82×10^{-4}	0.0756	8.98×10^{-3}
Total			**1.37×10^{-3}**		**5.60×10^{-2}**

Notes:
a. Organic fraction information is from CARB's SPECIATE database. Data used are from the "External combustion boiler – natural gas" profile. SPECIATE does not include a profile for propane-fueled boilers.
b. Organic fraction information is from CARB's SPECIATE database. Data used are from the "Non-cat stabilized exhaust 1996 SSD 2.0% etoh (MTBE phaseout)" profile.
c. Organic fraction is reported on a ROG basis using CARB's SPECIATE ROG/TOG ratio of 0.4222.
d. Organic fraction is reported on a ROG basis using CARB's SPECIATE ROG/TOG ratio of 0.9198

14. <u>Heater</u>

There is a natural gas-fired heater located at the ICTF administrative building. The heater is used to provide comfort heating for the building. Emissions from the heater are based on the equipment's rated capacity, fuel type, and hours of operation. The equipment specifications and activity data are shown in Table 55.

Table 55 **Equipment Specifications and Activity Data for Heaters – ICTF Rail Yard** **2005 Baseline Year**					
Location	Fuel Type	Rating (MMBtu/hr)	Hours of Operation (hr/yr)[a]	Fuel Use (MMBtu/yr)	Fuel Use (MMcf/yr)[b]
Admin. Building	Natural Gas	0.76	2,190	1,664.40	1.66

Notes:
a. Hours of operation equal to 3 months per year.
b. Annual fuel use based on a natural gas HHV of 1,000 Btu/scf.

Criteria pollutant emission factors were obtained from AP-42, Table 1.4-1 (7/98).[42] Emission factors from CARB's *Draft Emission Factors for Mandatory Reporting Program* document (August 10, 2007) were used to calculate GHG emissions. A fuel-specific carbon oxidization factor, from the CARB emission factor document, was also used to calculate CO_2 emissions. The criteria pollutant and GHG emission factors and the carbon oxidization factor used to calculate emissions from the heater are shown in Table 56. A copy of the relevant sections of AP-42 is contained in Appendix O-1. A copy of CARB's *Draft Emission Factors for Mandatory Reporting Program* document is contained in Appendix C.

Table 56 **Criteria Pollutant and GHG Emission Factors for Heaters – ICTF Rail Yard** **2005 Baseline Year**								
Carbon Oxidization Factor (%)[b]	Emission Factors (lb/MMcf)[a]					Emission Factors (kg/MMBtu)[b]		
	VOC	CO	NOx	PM_{10}	SOx	CO_2	N_2O	CH_4
99.5	5.50	84.00	100.0	7.60	0.60	53.05	5.90×10^{-3}	1.00×10^{-4}

Notes:
a. Criteria pollutant emission factors from AP-42, Table 1.4-1, 7/98.
b. GHG emission factors and the carbon oxidization factor from the Air Resources Board's *Draft Emission Factors for Mandatory Reporting Programs*, August 10, 2007.

To calculate the emissions from heater operations, the activity data shown in Table 55 was combined with the emission factors shown in Table 56. The criteria pollutant and GHG emission estimates for the heater at ICTF during the 2005 baseline year are shown in Table 57. Detailed emission calculations are shown in Appendix O-2.

[42] Available at *http://www.epa.gov/ttn/chief/ap42/*.

Table 57 Criteria Pollutant and GHG Emissions from Heaters – ICTF Rail Yard 2005 Baseline Year							
Emissions (tons/yr)					Emissions (metric tons/yr)		
VOC	CO	NOx	PM_{10}	SOx	CO_2	N_2O	CH_4
0.00	0.07	0.08	0.01	0.00	87.85	0.01	0.00

CARB's speciation profile for natural gas-fired boilers was used to determine the fraction of each TAC in the total VOC emissions from the heater.[43] All TACs listed in the most recent version of the Emission Inventory Criteria and Guidelines Report for the Air Toxics "Hot Spots" Program were included. The TAC speciation profiles and emission rates for the heater are shown in Table 58. A copy of the relevant sections of SPECIATE database are included in Appendix O-3.

Table 58 TAC Emissions from Heaters – ICTF Rail Yard 2005 Baseline Year			
CAS	Chemical Name[a]	Organic Fraction of VOC (by weight)[b]	Emissions (tons/yr)
71432	benzene	0.0947	4.34×10^{-4}
110827	cyclohexane	0.0237	1.08×10^{-4}
50000	formaldehyde	0.1895	8.67×10^{-4}
108883	toluene	0.0474	2.17×10^{-4}
Total			**1.63×10^{-3}**

Notes:
a. Organic fraction information is from CARB's SPECIATE database. Data used are from the "External combustion boiler – natural gas" profile.
b. Organic fraction is reported on a ROG basis using CARB's SPECIATE ROG/TOG ratio of 0.4222.

15. Propane-Fueled Welder

A propane-fueled welder is used for locomotive service and repair operations at the Dolores Yard. Emissions from the welder are based on the fuel type, rated capacity, and hours of operation for the unit. Equipment specification and activity data for the welder are shown in Table 59.

[43] Speciation profile number 3 was used to calculate TAC emissions from this source.

Table 59 Equipment Specifications and Activity Data for the Propane-Fueled Welder – Dolores Rail Yard 2005 Baseline Year					
Location	Fuel Type	Rating (hp)	Hours of Operation (hr/yr)[a]	Fuel Use[b]	
				(MMBtu/yr)	(gal/yr)
Service Track	Propane	18	1,000	126	1,383.89

Notes:
a. Hours of operation is an engineering estimate based on interviews with UPRR staff.
b. Annual fuel use based on a bsfc of 7,000 Btu/hp-hr (from AP-42), a propane HHV of 3,824 MMBtu/barrel (from CARB *Draft Emission Factors for Mandatory Reporting Programs*, August 10, 2007), and 42 gallons per barrel.

Criteria pollutant emission factors were obtained from AP-42, Table 3.2-3 (7/00).[44] Emission factors from CARB's *Draft Emission Factors for Mandatory Reporting Program* document (August 10, 2007) were used to calculate GHG emissions. A fuel-specific carbon oxidization factor, from the CARB emission factor document, was also used to calculate CO_2 emissions. The criteria pollutant and GHG emission factors, as well as the carbon oxidization factor, used to calculate emissions from the welder are shown in Table 60. A copy of the relevant sections of AP-42 is contained in Appendix P-1. A copy of CARB's *Draft Emission Factors for Mandatory Reporting Program* document is contained in Appendix C.

Table 60 Criteria Pollutant and GHG Emission Factors for Propane-Fueled Welder – Dolores Rail Yard 2005 Baseline Year								
Carbon Oxidization Factor (%)	Emission Factors (lb/MMBtu)[a]					Emission Factors (kg/gal)[b]		
	VOC	CO	NOx	PM_{10}	SOx	CO_2	N_2O[c]	CH_4[c]
99.5	2.96×10^{-2}	3.51	2.27	9.50×10^{-3}	5.88×10^{-4}	5.70	3.73×10^{-5}	8.29×10^{-6}

Notes:
a. Criteria pollutant emission factors from AP-42, Table 3.2-3, 7/00.
b. GHG emission factors from the Air Resources Board's *Draft Emission Factors for Mandatory Reporting Programs*, August 10, 2007.
c. Based on a propane HHV of 3.824 MMBtu/barrel (from CARB *Draft Emission Factors for Mandatory Reporting Programs*, August 10, 2007) and 42 gallons per barrel.

[44] Available at *http://www.epa.gov/ttn/chief/ap42/*.

To calculate the emissions from the welder, the activity data shown in Table 59 was combined with the emission factors shown in Table 60. The criteria pollutant and GHG emission estimates for the welder at Dolores during the 2005 baseline year are shown in Table 61. Detailed emission calculations are shown in Appendix P-2.

Table 61
Criteria Pollutant and GHG Emissions from the Propane-Fueled Welder – Dolores Rail Yard
2005 Baseline Year

Emissions (tons/yr)					Emissions (metric tons/yr)		
VOC	CO	NOx	PM_{10}	SOx	CO_2	N_2O	CH_4
0.002	0.221	0.143	0.001	0.000	7.85	0.00	0.00

CARB's speciation database was used to determine the fraction of each TAC in the total VOC emissions from the propane-fueled welder. The SPECIATE database does not include a profile for propane-fueled internal combustion engine. Therefore, the speciation profile for natural gas-fired reciprocating engine was used to determine the TAC emissions from the welder.[45] All TACs listed in the most recent version of the Emission Inventory Criteria and Guidelines Report for the Air Toxics "Hot Spots" Program were included. The TAC speciation profiles and emission rates for the heater are shown in Table 62. A copy of the relevant section of the SPECIATE database are included in Appendix P-3.

[45] Speciation profile number 719 was used to calculate emissions from this source.

Table 62 TAC Emissions from Propane-Fueled Welder – Dolores Rail Yard 2005 Baseline Year			
CAS	Chemical Name[a]	Organic Fraction of VOC (by weight)[b]	Emissions (tons/yr)
95636	1,2,4-trimethylbenzene	0.00001	1.70×10^{-8}
75070	acetaldehyde	0.00003	5.11×10^{-8}
71432	benzene	0.00010	1.87×10^{-7}
110827	cyclohexane	0.00001	1.70×10^{-8}
100414	ethylbenzene	0.00001	1.70×10^{-8}
74851	ethylene	0.00058	1.07×10^{-6}
50000	formaldehyde	0.00074	1.38×10^{-6}
108383	m-xylene	0.00001	1.70×10^{-8}
110543	n-hexane	0.00002	3.41×10^{-8}
95476	o-xylene	0.00001	1.70×10^{-8}
115071	propylene	0.00154	2.88×10^{-6}
108883	toluene	0.00004	6.82×10^{-8}
1330207	xylene	0.00002	3.41×10^{-8}
Total			**5.80×10^{-6}**

Notes:
a. Organic fraction information is from CARB's SPECIATE database. Data used are from the "I.C.E. reciprocating – natural gas" profile.
b. Organic fraction is reported on a ROG basis using CARB's SPECIATE ROG/TOG ratio of 0.0914.

16. <u>Miscellaneous Gasoline-Fueled Equipment</u>

A variety of portable, gasoline-fueled, small equipment is used at ICTF each day. Emissions from the portable equipment are based on the fuel type, rated capacity, and hours of operation of each unit. The equipment specification and activity data for miscellaneous gasoline-fueled equipment is shown in Table 63.

Table 63 Equipment Specifications and Activity Data for Miscellaneous Gasoline-Fueled Equipment – ICTF Rail Yard 2005 Baseline Year					
Equipment Location	Equipment Type	Number of Units	Rated Capacity (hp)	Hours of Operation (hr/yr)[b]	Fuel Use (gal/yr)[c]
WEBCO Area	Welder	1	8	1,000	456.41
Mechanical Dept.	Welder	1	13	1,000	741.66
Mechanical Dept.	Welder	1	12.5	1,000	713.14
Mechanical Dept.	Welder	1	18	1,000	1,026.92
Crane Maint.	Welder	1	20	1,000	1,141.02
Crane Maint.	Pressure Washer	1	18	1,000	1,026.92
WEBCO Area	Air Compressor	1	5.5	1,000	313.78
Mechanical Dept.	Air Compressor	1	30	1,000	1,711.53
Crane Maint.	Generator[a]	1	<50	1,000	2,852.56

Notes:
a. The exact rating of this unit could not be determined.
b. Hours of operation are an engineering estimate based on interviews with UPRR staff.
c. Fuel use based on a bsfc of 7,000 Btu/hp-hr (from AP-42) and a gasoline HHV of 122,697 Btu/gal (from Transportation Energy Data Book, Edition 26, US DOE, 2007).

Criteria pollutant emission factors were obtained from AP-42, Table 3.3-1 (10.96).[46] Emission factors from CARB's *Draft Emission Factors for Mandatory Reporting Program* document (August 10, 2007) were used to calculate GHG emissions. A fuel-specific carbon oxidization factor, from the CARB emission factor document, was also used to calculate CO_2 emissions. The criteria pollutant and GHG emission factors for the miscellaneous gasoline-fueled equipment are shown in Table 64. A copy of the relevant sections of AP-42 is contained in Appendix Q-1. A copy of CARB's *Draft Emission Factors for Mandatory Reporting Program* document is contained in Appendix C.

[46] Available at *http://www.epa.gov/ttn/chief/ap42/*.

Table 64 Criteria Pollutant and GHG Emission Factors for Miscellaneous Gasoline-Fueled Equipment – ICTF Rail Yard 2005 Baseline Year								
Carbon Oxidization Factor (%)	Emission Factors (g/bhp-hr)[a]					Emission Factors (kg/gal)[b]		
	VOC	CO	NOx	PM_{10}	SOx	CO_2	N_2O[c]	CH_4[c]
99.0	9.79	199.13	4.99	0.33	0.27	8.87	1.60×10^{-4}	1.23×10^{-5}

Notes:
a. Criteria pollutant emission factors from AP-42, Table 3.3-1, 10/96.
b. GHG emission factors from the Air Resources Board's *Draft Emission Factors for Mandatory Reporting Programs*, August 10, 2007.
c. Based on a gasoline HHV of 122,697 Btu/gal (from Transportation Energy Data Book, Edition 26, US DOE, 2007).

To calculate the emissions from miscellaneous gasoline-fueled equipment operations, the activity data shown in Table 63 was combined with the emission factors shown in Table 64. The criteria pollutant and GHG emission estimates for the miscellaneous equipment at ICTF during the 2005 baseline year are shown in Table 65. Equipment specific emission estimates are shown in Appendix Q-2.

Table 65 Criteria Pollutant and GHG Emissions from the Miscellaneous Gasoline-Fueled Equipment – ICTF Rail Yard 2005 Baseline Year							
Emissions (tons/yr)					Emissions (metric tons/yr)		
VOC	CO	NOx	PM_{10}	SOx	CO_2	N_2O	CH_4
1.89	38.41	0.96	0.06	0.05	87.67	0.00	0.00

CARB's speciation database was used to determine the fraction of each TAC in the total VOC emissions from each piece of equipment.[47] All TACs listed in the most recent version of the Emission Inventory Criteria and Guidelines Report for the Air Toxics "Hot Spots" Program were included. The TAC speciation profiles and emission rates for the miscellaneous equipment are shown in Table 66. A copy of the relevant section of the

[47] Speciation profile number 665 was used to calculate TAC emissions from this source.

SPECIATE database are included in Appendix Q-3. Equipment specific calculations are shown in Appendix Q-2.

Table 66 TAC Emissions from Miscellaneous Gasoline-Fueled Equipment – ICTF Rail Yard 2005 Baseline Year			
CAS	Chemical Name[a]	Organic Fraction of VOC (by weight)[b]	Emissions (tons/yr)
95636	1,2,4-trimethylbenzene	0.0140	2.65×10^{-2}
106990	1,3-butadiene	0.0091	1.71×10^{-2}
540841	2,2,4-trimethylpentane	0.0222	4.19×10^{-2}
75070	acetaldehyde	0.0106	2.00×10^{-2}
107028	acrolein (2-propenal)	0.0020	3.78×10^{-3}
71432	benzene	0.0368	6.95×10^{-2}
4170303	crotonaldehyde	0.0014	2.73×10^{-3}
110827	cyclohexane	0.0050	9.47×10^{-3}
100414	ethylbenzene	0.0167	3.16×10^{-2}
74851	ethylene	0.0996	1.88×10^{-1}
50000	formaldehyde	0.0327	6.17×10^{-2}
78795	isoprene	0.0016	2.94×10^{-3}
98828	isopropylbenzene (cumene)	0.0006	1.05×10^{-3}
67561	methyl alcohol	0.0038	7.21×10^{-3}
78933	methyl ethyl ketone (mek)	0.0007	1.25×10^{-3}
108383	m-xylene	0.0496	9.37×10^{-2}
91203	naphthalene	0.0014	2.73×10^{-3}
110543	n-hexane	0.0146	2.76×10^{-2}
95476	o-xylene	0.0173	3.26×10^{-2}
115071	propylene	0.0546	1.03×10^{-1}
100425	styrene	0.0014	2.73×10^{-3}
108883	toluene	0.0756	1.43×10^{-1}
Total			**8.90×10^{-1}**

Notes:
a. Organic fraction information is from CARB's SPECIATE database. Data used are from the "Non-cat stabilized exhaust 1996 SSD 2.0% etoh (MTBE phaseout)" profile.
b. Organic fraction is reported on a ROG basis using CARB's SPECIATE ROG/TOG ratio of 0.9198.

17. Worker Vehicles

Emissions were calculated from employee vehicles that arrive at and depart from the ICTF and Dolores Yards each day. The number of vehicle trips was based on employee force counts for each yard and assumes no ridesharing.[48] The miles per trip were estimated from aerial photos of the Yards and include on-site travel only. Activity data for worker vehicles is summarized in Table 67.

Table 67
Activity Data for Worker Vehicles – ICTF and Dolores Rail Yards
2005 Baseline Year

Yard	No. of Trips (trips/yr)[a]	VMT (mi/trip)[b]	VMT (mi/yr)	Fuel Use (gal/yr)[c]
ICTF	152,935	2.5	382,337.5	19,966
Dolores	32,850	0.5	16,425.0	858
Total	**185,785**		**398,762.5**	**20,824**

Notes:
a. Based on employee force count reports. Assumes no ridesharing and 365 work days per year.
b. VMT for onsite travel estimated from aerial photos of each yard.
c. Fuel use calculated from VMT and from fuel economy based on the EMFAC 2007 model with the BURDEN output option.

Fleet average criteria pollutant emission factor for traveling exhaust emissions were calculated using the EMFAC2007 model with the BURDEN output option. Since the model year distribution is not known, the EMFAC2007 default distribution for gasoline-fueled passenger cars and light duty trucks operating in Los Angeles County was used. Idling emissions were assumed to be negligible.

Emission factors from CARB's *Draft Emission Factors for Mandatory Reporting Program* document (August 10, 2007) were used to calculate GHG emissions from worker vehicles. A fuel-specific carbon oxidization factor, from the CARB emission factor document, was also used to calculate CO_2 emissions. The criteria pollutant and GHG emission factors, as well as the carbon oxidization factor, used to calculate emissions from worker vehicles are shown in Table 68. Detailed emission factor derivation calculations and the EMFAC2007 output are contained in Appendix R-1. A copy of CARB's *Draft Emission Factors for Mandatory Reporting Program* document is contained in Appendix C.

[48] Personal communication from Jon Germer of UPRR on August 24, 2007.

Table 68 Criteria Pollutant and GHG Emission Factors for Worker Vehicles – ICTF and Dolores Rail Yards 2005 Baseline Year								
Carbon Oxidization Factor (%)	Emission Factors (g/mi)[a]					Emission Factors (kg/gal)[b]		
	ROG	CO	NOx	PM_{10}	SOx	CO_2	N_2O[c]	CH_4[c]
99.0	0.36	0.63	0.59	0.04	0.00	8.87	1.23×10^{-5}	1.60×10^{-4}

Notes:

a. Criteria pollutant emission factors (g/mi) from EMFAC 2007 using the BURDEN output option. The EMFAC default model year distribution for L.A. County was used.

b. GHG emission factors from CARB's *Draft Emission Factors for Mandatory Reporting Program* document (August 10, 2007).

c. Based on a gasoline HHV of 122,697 Btu/gallon (from the Transportation Energy Data Book: Edition 26, U.S. Department of Energy, 2007).

To calculate the emissions from worker vehicles, the activity data shown in Table 67 were combined with the emission factors shown in Table 68. The criteria pollutant and GHG emission estimates for the worker vehicles at the ICTF and Dolores yards during the 2005 baseline year are shown in Table 69.

Table 69 Criteria Pollutant and GHG Emissions from Worker Vehicles – ICTF and Dolores Rail Yard 2005 Baseline Year								
Yard	Emissions (tons/yr)					Emissions (metric tons/yr)		
	ROG	CO	NOx	PM_{10}	SOx	CO_2	N_2O[c]	CH_4[c]
ICTF	0.15	0.27	0.25	0.02	0.00	175.33	0.00	0.00
Dolores	0.01	0.01	0.01	0.00	0.00	7.53	0.00	0.00
Total	**0.16**	**0.28**	**0.26**	**0.02**	**0.00**	**182.86**	**0.00**	**0.00**

CARB's speciation database was used to determine the fraction of each TAC in the total VOC emissions from each yard truck.[49] All TACs listed in the most recent version of the Emission Inventory Criteria and Guidelines Report for the Air Toxics "Hot Spots" Program were included. The TAC speciation profiles and emission rates for worker vehicles are shown in Table 70. A copy of the relevant section of SPECIATE database and detailed calculations are included in Appendix R-1.

[49] Speciation profile number 2105 was used to calculate TAC emissions from this source.

Table 70 TAC Emissions from Gasoline-Fueled Worker Vehicles – ICTF and Dolores Rail Yards 2005 Baseline Year					
CAS	Chemical Name[a]	Organic Fraction of VOC (by weight)[b]	Emissions (tons/yr)		
			ICTF	Dolores	Total
95636	1,2,4-trimethylbenzene	0.0120	1.81×10^{-3}	7.79×10^{-5}	1.89×10^{-3}
106990	1,3-butadiene	0.0068	1.03×10^{-3}	4.41×10^{-5}	1.07×10^{-3}
540841	2,2,4-trimethylpentane	0.0288	4.34×10^{-3}	1.87×10^{-4}	4.53×10^{-3}
75070	acetaldehyde	0.0035	5.25×10^{-4}	2.26×10^{-5}	5.48×10^{-4}
107028	acrolein (2-propenal)	0.0017	2.49×10^{-4}	1.07×10^{-5}	2.60×10^{-4}
71432	benzene	0.0309	4.65×10^{-3}	2.00×10^{-4}	4.85×10^{-3}
4170303	crotonaldehyde	0.0004	5.44×10^{-5}	2.34×10^{-6}	5.67×10^{-5}
110827	cyclohexane	0.0077	1.16×10^{-3}	4.96×10^{-5}	1.21×10^{-3}
100414	ethylbenzene	0.0131	1.97×10^{-3}	8.48×10^{-5}	2.06×10^{-3}
74851	ethylene	0.0794	1.20×10^{-2}	5.14×10^{-4}	1.25×10^{-2}
50000	formaldehyde	0.0197	2.97×10^{-3}	1.28×10^{-4}	3.10×10^{-3}
78795	isoprene	0.0018	2.67×10^{-4}	1.14×10^{-5}	2.78×10^{-4}
98828	isopropylbenzene (cumene)	0.0001	1.81×10^{-5}	7.78×10^{-7}	1.89×10^{-5}
67561	methyl alcohol	0.0015	2.30×10^{-4}	9.88×10^{-6}	2.40×10^{-4}
78933	methyl ethyl ketone (mek)	0.0002	3.44×10^{-5}	1.48×10^{-6}	3.58×10^{-5}
108383	m-xylene	0.0445	6.70×10^{-3}	2.88×10^{-4}	6.99×10^{-3}
91203	naphthalene	0.0006	8.87×10^{-5}	3.81×10^{-6}	9.25×10^{-5}
110543	n-hexane	0.0200	3.01×10^{-3}	1.29×10^{-4}	3.14×10^{-3}
95476	o-xylene	0.0155	2.33×10^{-3}	1.00×10^{-4}	2.43×10^{-3}
115071	propylene	0.0382	5.76×10^{-3}	2.47×10^{-4}	6.01×10^{-3}
100425	styrene	0.0015	2.31×10^{-4}	9.93×10^{-6}	2.41×10^{-4}
108883	toluene	0.0718	1.08×10^{-2}	4.65×10^{-4}	1.13×10^{-2}
Total			**6.02×10^{-2}**	**2.59×10^{-3}**	**6.28×10^{-2}**

Notes:

a. Organic fraction information is from CARB's SPECIATE database. Data used are from the "Cat stabilized exhaust 2005 SSD etoh 2% O (MTBE phaseout)" profile.

b. Organic fraction is reported on a ROG basis using CARB's SPECIATE ROG/TOG ratio of 0.8012.

18. Road Dust

Particulate matter emissions were calculated for paved roadways in both the ICTF and Dolores rail yards. Particulate emissions occur when loose material on road surfaces is resuspended as vehicles travel over a roadway. Emissions are based on the number of vehicles driving on the road, the length of the road, and the amount of loose material on the road surface.

A PM_{10} emission factor was calculated using the following equation from AP-42, Section 13.2.1 (11/06)[50] and the variables listed in Table 71.

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

Where,

E = PM_{10} emission factor (g/VMT)
k = particle size multiplier
sL= road surface silt loading (g/m^2)
W= average weight (tons) of the vehicles traveling on the road, and
C = emission factor for 1980's vehicle fleet exhaust, brake wear, and tire wear
P = number of "wet" days with at least 0.254 mm of precipitation during the averaging period
N = number of days in the averaging period

Table 71
Variable Used to Calculate PM_{10} Emission Factors for Roadway Emissions – ICTF and Dolores Rail Yards
2005 Baseline Year

Variable	Unit	Value	Reference
k	g/VMT	7.3	AP-42, Table 13.2-1.1, 11/06
sL	g/m^2	0.015	AP-42, Table 13.2.1-3, 11/06
W	tons	36.1	Trinity Report, Table 19-1
C	g/VMT	0.2119	AP-42, Table 13.2.1-2, 11/06
P	days	40	AP-42, Fig 13.2.1-2, 11/06
N	days	365	

Per UPRR staff, the paved roadways within the ICTF and Dolores rail yards are swept to remove loose material.[51] A control efficiency, based on street sweeping twice per week, was calculated using the methods outlined in the SCAQMD Staff Report for Rule 1186.[52] Table 72 summarizes the activity data, PM_{10} emission factor, control efficiency, and annual PM_{10} emissions from paved roadways in the ICTF and Dolores rail yards.

[50] Available at *http://www.epa.gov/ttn/chief/ap42/*.
[51] Personal communication with Duffy Exon.
[52] Available at *http://www.aqmd.gov/rules/support.html*.

Detailed emission factor derivation calculations, the relevant sections of AP-42, and the relevant sections of the SCAQMD staff report are contained in Appendix S-1. Detailed emission calculations are shown in Appendix S-2.

Table 72
PM_{10} Emissions from Roadways – ICTF and Dolores Rail Yards
2005 Baseline Year

Yard	Vehicle Type	Annual VMT (mi/yr)[a]	PM_{10} Emission Factor (g/VMT)[b]	Control Efficiency (%)[c]	PM_{10} Emissions (tons/yr)
ICTF	Drayage Trucks	1,641,629.38	12.11	45%	12.06
ICTF	Delivery Trucks	17.18	12.11	45%	0.00
ICTF	Yard Truck	365,000.00	12.11	45%	2.68
ICTF	Worker Vehicles	382,337.50	12.11	45%	2.81
Dolores	Delivery Trucks	502.31	12.11	45%	0.00
Dolores	Yard Truck	118,007.00	12.11	45%	0.87
Dolores	Worker Vehicles	16,425.00	12.11	45%	0.12
Total		**2,523,918.37**			**18.54**

Notes:
a. See Parts IV.A.2, IV.A.6, IV.A. 7 and IV.A. 17 for discussions on the calculation of annual VMT.
b. Calculated based on method outlined in AP-42, Section 13.2.1 and data shown in Table 71.
c. Calculated based on method contained in the SCAQMD Staff Report for Rule 1186 (1/97). Assumes street sweeping occurs twice per week.

B. 2010 Emissions Inventory

The Project Year 2010 inventory quantified onsite criteria pollutant, GHG, and TAC emissions from emission sources at the ICTF and Dolores Yards. Table 73 summarizes the emissions, by source group, for Project Year 2010. The methodology and assumptions used to prepare the inventory for each source group are discussed in detail in Sections 1 through 18 below.

Table 73
Emissions by Source Category – ICTF and Dolores Rail Yards
Project Year 2010

Source Group	Emissions (tons/yr)						Emissions (metric tons/yr)		
	ROG	CO	NOx	PM_{10}	DPM	SOx	CO_2	N_2O	CH_4
Locomotives	19.10	43.04	115.98	2.96	2.96	0.73	20,295.66	0.51	1.60
Drayage Trucks	21.21	65.02	132.21	5.34	5.17	0.11	10,915.29	0.02	0.05
Cargo Handling Equipment	3.14	40.78	75.87	2.45	2.45	0.96	9,535.20	0.00	0.03
Heavy Equipment	0.67	12.19	6.98	0.29	0.27	0.01	752.61	0.00	0.00
TRUs and Reefer Cars[a]	4.25	16.71	17.45	0.66	0.66	0.02	2,037.47	0.00	0.01
Delivery Trucks	0.01	0.04	0.07	0.00	0.00	0.00	4.97	0.00	0.00
Yard Trucks	0.00	0.63	0.06	0.00	NA	0.00	447.18	0.00	0.00
IC Engines	0.07	0.18	0.84	0.06	0.06	0.06	27.63	0.00	0.00
Tanks	0.77	NA	NA	NA	NA	NA	NA	NA	NA
Refueling	0.35	NA	NA	NA	NA	NA	NA	NA	NA
Sand Tower	NA	NA	NA	0.00	NA	NA	NA	NA	NA
WWTP	0.00	NA	NA	NA	NA	NA	NA	NA	NA
Steam Cleaners	0.12	2.43	0.17	0.01	NA	0.00	92.78	0.00	0.00
Heater	0.00	0.07	0.08	0.01	NA	0.00	87.85	0.01	0.00
Propane Welder	0.00	0.22	0.14	0.00	NA	0.00	7.85	0.00	0.00
Miscellaneous Equipment	1.89	38.41	0.96	0.06	NA	0.05	87.67	0.00	0.00
Worker Vehicles	0.08	0.16	0.15	0.02	NA	0.00	177.46	0.00	0.00
Road Dust	NA	NA	NA	23.97	NA	NA	NA	NA	NA
Total	**51.66**	**219.88**	**350.96**	**35.83**	**11.58**	**1.94**	**44,529.62**	**0.54**	**1.69**
ICTF-related[b]	**43.13**	**195.14**	**299.90**	**34.06**	**10.30**	**1.64**	**35,579.50**	**0.36**	**1.03**

Notes:
a. In addition to the GHG emissions shown, CFC emissions from TRU refrigerant loss equal 0.255 metric tons per year.
b. The ICTF-related emissions include emissions that occur within ICTF plus a portion of the emissions from the Dolores Yard. The emissions from the Dolores Yard were divided based on railcar counts provided by UPRR.

In addition to the total emissions from the ICTF and Dolores yards, Table 73 also shows emissions that are related to ICTF. The ICTF-related emissions include emissions that occur within the ICTF, such as emissions from CHE, plus the portion of the emissions from the Dolores Yard related to ICTF. The emissions were allocated based on the railcar data provided by UPRR.[53] The 2005 railcar activity was designated as either manifest freight, ICTF intermodal, or other intermodal. In 2010, it was estimated that 50% of the railcars entering the Dolores Yard will include freight bound for ICTF. Therefore, it was assumed that 50% of the emissions from Dolores will be related to ICTF in Project Year 2010.

1. Locomotives

For 2010, the amount of through train traffic in the yard is assumed to be constant relative to 2005. Future year emission calculations are intended for assessment of changes in in-yard activity, and do not include port-related activity in the Alameda Corridor mainline adjacent to Dolores.

Equipment and Activity

Road Power – In 2010, all train activity at ICTF/Dolores is expected to be intermodal freight.[54] The manifest freight that was previously handled at Dolores will be shifted to other yards in the L.A. Basin. To estimate the relative fraction of locomotive models and emission technologies for Project Year 2010, the locomotive model distribution for 2005 intermodal trains was adjusted to reflect the effect of new locomotive acquisitions and older locomotive retirements in the UPRR line-haul fleet. UPRR forecasts for acquisitions and retirements through 2009 were extrapolated to 2010 and 2012 to estimate the relative growth or shrinkage of the number of each locomotive model (defined by model group, emission control tier, and ZTR/AESS equipment) at the ICTF and Dolores Yards for those years. The resulting forecasts were then normalized by the total number of locomotives to generate year-specific model distributions.

[53] Personal communication with Lanny Schmid of UPRR on August 28, 2007.
[54] Personal communication with Lanny Schmid of UPRR on August 28, 2007.

The train data for the 2005 baseline year allow identification of intermodal and non-intermodal trains. The train data do not reflect whether the freight from the intermodal trains is handled at ICTF or at other on-dock facilities, however. UPRR estimates that in 2005, 43% of the rail cars handled at Dolores/ICTF were ICTF-related intermodal, 43% were on-dock intermodal, and 14% were Dolores manifest freight.[55] In 2010, UPRR estimates that 50% of cars will be ICTF-related intermodal and 50% will be on-dock intermodal.[56]

The total trailing tons of ICTF-related intermodal freight in 2010 is expected to grow in proportion to the total container lift count (900,000 in 2010 vs. 626,000 in 2005). To calculate train activity, the number of terminating and originating intermodal trains trailing tons was assumed to increase by the growth factor. At the same time, the average horsepower per intermodal line-haul locomotive decreased due to the projected changes in the locomotive fleet. This factor was applied to calculate a revised average number of locomotives per consist for 2010 intermodal trains.[57] The projected train activity for 2010 is shown in Table 74.

Table 74
Projected Train Activity – ICTF and Dolores Rail Yards
Project Year 2010

	East Bound			West Bound		
Train Type	No. of Trains	Locos per Train	No. of Setouts	No. of Trains	Locos per Train	No. of Setouts
Intermodal Through	74	3.238	22	215	2.806	166
Intermodal Terminating	0	--	--	2,939	3.144	--
Intermodal Originating	5,111	2.562	--	0	--	--
Power Moves Through	17	2.830	--	7	2.200	--
Power Moves Terminating	393	2.958	--	424	3.363	--
Power Moves Originating	413	3.711	--	1,604	3.199	--

[55] Personal communication with Lanny Schmid of UPRR on August 28, 2007.
[56] Personal communication with Lanny Schmid of UPRR on August 28, 2007.
[57] Assumes that the consists assigned to trains would maintain a constant ratio of available horsepower per trailing ton.

Yard Switching – During 2007, the 10 GP-38 switchers at ICTF and Dolores will be replaced by ULEL "gen-set switchers." The ULEL switchers will be used to perform all yard operations in 2010 and beyond. Yard switcher operations in Project Year 2010 were based on the assumption that the total work done (in horsepower-hours per year) is proportional to the total trailing tons of freight handled by the switchers.

In 2005 two of the five sets of GP-38s handled the ICTF-related intermodal freight (43% of the total freight) exclusively. The activity level (horsepower-hours per year) for these switchers was increased by the ratio of the predicted lift count for Project Year 2010 (900,000 lifts) to the actual 2005 lift count (626,339 lifts).

In the 2005 baseline year, the other three sets of switchers handled the remaining 57% (43% on-dock intermodal and 14% manifest freight) of the freight entering Dolores. It was assumed that the on-dock intermodal fraction was 75% (43% on-dock intermodal/57% of total freight) of the total work performed. The total 2010 activity for on-dock intermodal switchers was calculated by multiplying on-dock intermodal switcher activity (horsepower-hours per year) in the 2005 baseline year by the projected growth factor for on-dock freight. This growth factor is calculated as ratio of the predicted lift count for Project Year 2010 (900,000 lifts) to the actual 2005 lift count (626,339 lifts)[58]

Service and Maintenance – The Service Track and Locomotive Shop at the Dolores Yard were assumed to be operating at capacity during the 2005 baseline year. As discussed previously, the volume of ICTF-related operations at Dolores will increase from the baseline year, but the overall activity level of the Dolores yard will remain constant. Therefore, the number of locomotive service and load testing events was unchanged for Project Year 2010. See Table 6 in Part IV.A.1 for summary of the shop and service data for the 2005 baseline year.

[58] The levels of intermodal freight activity for on-dock and ICTF trains are assumed to be equal to one another in both 2005 and 2010. Therefore the ratio of ICTF lift counts for the two years serves as a surrogate for the growth factor for on-dock freight and associated yard switcher activity.

Emission Factors

The HC, CO, NOx, and GHG emission factors, as well as the fuel consumption rates for Project Year 2010, were unchanged from the 2005 baseline year. See Tables 7 through 9 in Part IV.A.1 for the HC, CO, and NOx emission factors, Table 14 in Part IV.A.1 for the GHG emission factors, and Table 12 in Part IV.A.1 for the fuel consumption data.

Fuel sulfur content for both California and 47-state Diesel fuel will decrease in the future. These changes affect both DPM and sulfur oxides emission factors for locomotives. By 2010, California fuel is assumed to have a sulfur content of 15 ppm, and this level is expected to remain constant into the future. The technical support document for the 2004 EPA non-road engine regulations (USEPA, 2004) projects 47-state fuel sulfur levels of 307 ppm in 2010. Using the same methods used for 2005 fuel-specific emission factors (see Part IV.A.1 for details), DPM emission factors were calculated for sulfur contents of 15 ppm and 307 ppm. The DPM emission factors for Project Year 2010 are shown in Tables 75 and 76.

Table 75
DPM Emission Factors (g/hr) for Locomotives – ICTF and Dolores Rail Yards
Adjusted for Fuel Sulfur Content of 15 ppm
Project Year 2010

Model Group	Tier	Throttle Setting										Source[a]
		Idle	DB	N1	N2	N3	N4	N5	N6	N7	N8	
Switchers	N	31	56	23	76	128.54	139.25	171.22	270.03	313.39	406.17	EPA RSD[a]
GP-3x	N	38	72	31	110	173.25	185.67	227.44	365.6	420.58	551.23	EPA RSD[a]
GP-4x	N	47.94	80.04	35.7	134.3	210.86	226.39	286.24	483.85	580.13	744.65	EPA RSD[a]
GP-50	N	26.01	64.08	51.25	142.5	280.83	272.54	335.59	582.01	658.89	841.2	EPA RSD[a]
GP-60	N	48.6	98.45	48.72	131.7	264.99	262.23	319.67	566.09	675.49	853.7	EPA RSD[a]
GP-60	0	21.1	25.4	37.6	75.5	222.99	308.45	441.08	635.46	1022.75	1196.56	SwRI[b] (KCS733)
SD-7x	N	24.02	4.84	40.99	65.75	146.04	212.89	273.54	328.6	431.68	534.22	SwRI[c]
SD-7x	0	14.78	15.14	36.81	61.11	214.6	332.67	383.98	759.46	925.7	1002.48	GM EMD[e]
SD-7x	1	29.2	31.8	37.1	66.2	204.26	259.15	372	625.29	711.45	768.55	SwRI[e] (NS2630)
SD-7x	2	24.4	59.5	38.3	134.2	253.07	263.09	285.54	483.52	610.44	638.44	SwRI[e] (UP8353)
SD-90	N	61.05	108.5	50.1	99.06	238.31	371.07	478.39	288.69	234.5	846.42	GM EMD[d]
Dash 7	N	64.95	180.48	108.23	121.22	302.99	289.8	295	252	242.49	299.37	EPA RSD[a]
Dash 8	N	36.95	147.52	86.04	133.12	245.59	259.27	291.57	314.39	338.07	438.47	GE[d]
Dash 9	N	32.11	53.89	54.22	108.11	185.32	255.69	329.72	368.38	350.09	502.99	SWRI 2000
Dash 9	0	33.84	50.67	56.09	117.36	193.18	233.34	548.02	483.06	437.87	403.85	Average of GE & SwRI[f]
Dash 9	1	16.9	88.4	62.1	140.2	256.2	339.17	377.19	437.85	392.21	554.62	SwRI[b] (CSXT595)
Dash 9	2	7.7	42	69.3	145.8	256.46	322.8	360.55	352.17	369.82	433.02	SwRI[b] (BNSF 7736)
C60-A	N	70.96	83.88	68.57	78.56	234.22	206.99	245.58	262.08	164.18	258.53	GE[e] (UP7555)

Notes:

a. EPA Regulatory Support Document, "Locomotive Emissions Regulation," Appendix B, 12/17/97, as tabulated by CARB and ENVIRON.
b. Base emission rates provided by ENVIRON as part of the BNSF analyses for the Railyard MOU (Personal communication from Chris Lindhjem to R. Ireson, 2006) based on data produced in the AAR/SwRI Exhaust Plume Study (Personal communication from Steve Fritz to C. Lindhjem, 2006).
c. SwRI final report "Emissions Measurements – Locomotives" by Steve Fritz, August 1995.
d. Manufacturers' emissions test data as tabulated by CARB.
e. Base SD-70 emission rates taken from data produced in the AAR/SwRI Exhaust Plume Study (Personal communication from Steve Fritz to R. Ireson, 2006, 2007).
f. Average of manufacturers' emissions test data as tabulated by CARB and data from the AAR/SwRI Exhaust Plume Study, tabulated and calculated by ENVIRON.

Table 76 DPM Emission Factors (g/hr) for Locomotives – ICTF and Dolores Rail Yards Adjusted for Fuel Sulfur Content of 307 ppm Project Year 2010												
Model Group	Tier	Throttle Setting										Source[a]
		Idle	DB	N1	N2	N3	N4	N5	N6	N7	N8	
Switchers	N	31	56	23	76	129.46	141.18	174.13	273.75	316.49	410.26	EPA RSD[a]
GP-3x	N	38	72	31	110	174.5	188.24	231.31	370.63	424.73	556.78	EPA RSD[a]
GP-4x	N	47.94	80.04	35.7	134.3	212.38	229.53	291.11	490.51	585.86	752.15	EPA RSD[a]
GP-50	N	26.01	64.08	51.25	142.5	282.85	276.32	341.3	590.02	665.39	849.68	EPA RSD[a]
GP-60	N	48.6	98.45	48.72	131.7	266.89	265.87	325.11	573.88	682.15	862.3	EPA RSD[a]
GP-60	0	21.1	25.4	37.6	75.5	224.59	312.73	448.59	644.2	1032.84	1208.62	SwRI[b] (KCS733)
SD-7x	N	24.02	4.84	40.99	65.75	147.09	215.85	278.19	333.12	435.94	539.6	SwRI[c]
SD-7x	0	14.78	15.14	36.81	61.11	216.15	337.28	390.51	769.9	934.84	1012.58	GM EMD[e]
SD-7x	1	29.2	31.8	37.1	66.2	205.74	262.74	378.33	633.89	718.47	776.29	SwRI[e] (NS2630)
SD-7x	2	24.4	59.5	38.3	134.2	254.89	266.74	290.39	490.17	616.46	644.88	SwRI[e] (UP8353)
SD-90	N	61.05	108.5	50.1	99.06	240.02	376.22	486.53	292.66	236.81	854.95	GM EMD[d]
Dash 7	N	64.95	180.48	108.23	121.22	308.52	293.5	298.58	256.64	251.7	311.17	EPA RSD[a]
Dash 8	N	36.95	147.52	86.04	133.12	250.07	262.58	295.1	320.17	350.92	455.75	GE[d]
Dash 9	N	32.11	53.89	54.22	108.11	188.7	258.96	333.72	375.16	363.4	522.82	SWRI 2000
Dash 9	0	33.84	50.67	56.09	117.36	196.7	236.32	554.65	491.94	454.51	419.77	Average of GE & SwRI[f]
Dash 9	1	16.9	88.4	62.1	140.2	260.88	343.5	381.76	445.91	407.12	576.48	SwRI[b] (CSXT595)
Dash 9	2	7.7	42	69.3	145.8	261.14	326.93	364.92	358.65	383.87	450.09	SwRI[b] (BNSF 7736)
C60-A	N	70.96	83.88	68.57	78.56	238.5	209.64	248.56	266.91	170.42	268.72	GE[e] (UP7555)

Notes:

a. EPA Regulatory Support Document, "Locomotive Emissions Regulation," Appendix B, 12/17/97, as tabulated by CARB and ENVIRON.
b. Base emission rates provided by ENVIRON as part of the BNSF analyses for the Railyard MOU (Personal communication from Chris Lindhjem to R. Ireson, 2006) based on data produced in the AAR/SwRI Exhaust Plume Study (Personal communication from Steve Fritz to C. Lindhjem, 2006).
c. SwRI final report "Emissions Measurements – Locomotives" by Steve Fritz, August 1995.
d. Manufacturers' emissions test data as tabulated by CARB.
e. Base SD-70 emission rates taken from data produced in the AAR/SwRI Exhaust Plume Study (Personal communication from Steve Fritz to R. Ireson, 2006, 2007).
f. Average of manufacturers' emissions test data as tabulated by CARB and data from the AAR/SwRI Exhaust Plume Study, tabulated and calculated by ENVIRON..

Sulfur oxides emission factors were calculated using the method discussed in Part IV. A.1, based on fuel sulfur contents of 15 and 307 ppm. The SOx emission factors for Project Year 2010 are shown in Table 77.

Table 77
SOx Emission Factors for Locomotives – ICTF and Dolores Rail Yards
Project Year 2010

Fuel Sulfur Content (ppm)		SOx Emission Factor (g/lb of fuel)[a]	
CA Diesel	47-State Diesel	CA Diesel	47-State Diesel
15	307	0.0132	0.271

Notes:
a. Based on 8.83×10^{-4} g of SOx per ppm-lb of fuel.

Emissions

Emissions were calculated for 2010 using the same methodology as the 2005 baseline year (See Part IV.A.1) and the emission factors detailed above. As previously discussed, the intermodal line-haul locomotive model distributions were adjusted based on UPRR acquisition and retirement projections. The number of locomotives per consist for different intermodal train events was adjusted downward in inverse proportion to the increase in average locomotive horsepower. Intermodal train activity (i.e., number of train events) was assumed to grow as a result of the increased lift counts at ICTF and the changes in the fraction of total intermodal activity associated with on-dock trains. The combined effect of these two adjustments results in a constant ratio of available consist horsepower per trailing ton of freight, and an increase in total activity in proportion to the projected growth in total trailing tons of freight.

Yard switching operations supporting ICTF for 2010 were projected to increase in proportion to the lift count projections. Yard switching operations supporting on-dock trains were projected to increase or decrease in proportion to the estimated changes in trailing tons of freight for those trains in those years. It was assumed that ULEL switcher locomotives were used for all switching activities in 2010. Table 78 shows locomotive emissions for Project Year 2010.

Table 78 Criteria Pollutant, DPM, and GHG Emissions from Locomotives – ICTF and Dolores Rail Yards Project Year 2010									
	Emissions (tons/yr)						Emissions (metric tons/yr)		
Activity	ROG	CO	NOx	PM_{10}	DPM	SOx	CO_2	N_2O	CH_4
Train Activity	2.12	3.93	33.48	1.02	1.02	0.30	2,442.90	0.06	0.19
Yard Operations	14.43	33.71	48.47	1.05	1.05	0.15	15,163.34	0.38	1.19
Load Testing	0.61	1.70	19.50	0.44	0.44	0.05	1,518.06	0.04	0.12
Service Idling	1.94	3.69	14.52	0.45	0.45	0.23	1,171.37	0.03	0.09
Total	**19.10**	**43.04**	**115.98**	**2.96**	**2.96**	**0.73**	**20,295.66**	**0.51**	**1.60**

2. <u>HHD Diesel-Fueled Drayage Trucks</u>

The 2010 calendar year emissions from HHD Diesel-fueled drayage trucks are based on the number of truck trips, the truck fleet distribution, the length of each trip, and the amount of time spent idling. The trucks are owned and operated by many large trucking companies and independent operators (draymen). Therefore, a fleet distribution is not available. For emission calculations, the EMFAC2007 model default fleet distribution for HHD Diesel-fueled trucks operating in Los Angeles County during calendar year 2010 was used. The number of truck trips was based on the predicted lift count for 2010,[59] a gate count balancing factor,[60] and the assumption that 40% of the trucks entering ICTF with a container also leave the facility with a container.[61] See Appendix B-1 for a detailed discussion on the calculation methodology.

[59] From the ICTF Modernization Plan.
[60] The gate balancing factor is equal to the "in-gate" container count divided by the total number of containers passing through the "in-gate" and "out-gate" of ICTF. In 2006, the gate balancing factor was 61%.
[61] Personal communication from Greg Chiodo of HDR on September 24, 2007.

Table 79 summarizes the activity data, such as annual VMT and idling time, for HHD Diesel-fueled drayage trucks operating at ICTF during Project Year 2010. In addition to the traveling emissions, emissions during truck queuing, staging, loading, and unloading were calculated. Based on discussions with the Intermodal Operations Manager, it was assumed that, on average, each truck idles a total of 30 minutes per trip, including 10 minutes of idling at the gate, 15 minutes of idling while chassis are connected/disconnected, and 5 minutes of idling for other delays. Based on discussions with UPRR staff,[62] it was assumed that trucks being served by the newly installed wide span gantry (WSG) cranes would have a shorter idling time, 20 minutes per trip, than trucks served by the traditional Diesel-fueled CHE. It was assumed that in 2010, 35% of the lifts would be performed by the WSG cranes and 65% of the lifts would be performed by the Diesel-fueled CHE.[63] Therefore, it was assumed that 35% of the truck trips would have a reduced idling time.

Table 79
Summary of HHD Drayage Truck Activity Data – ICTF Rail Yard
Project Year 2010

Number of HHD Truck Trips[a]	VMT per HHD Truck Trip (mi/trip)[b]	Annual VMT (mi/yr)	Fuel Use (gal/yr)[c]	Idling Time (min/trip)[d]	Idling Time (hr/yr)
1,360,800	1.75	2,381,400	1,086,261	30/20	601,020

Notes:
a. Number of truck trips based on predicted lift count for 2010 and were estimated by HDR.
b. Trip length estimated from aerial photos of the Yard.
c. Includes fuel used during traveling and idling.
d. Engineering estimate based on personal communication with the Intermodal Operations Manager for the ICTF, Commerce, LATC, and Oakland Yards. The operations of the WSG cranes will reduce idling to approximately 20 minutes per trip for 35% of the truck trips in 2010.

Calendar year 2010 criteria pollutant emission factors for the HHD Diesel-fueled drayage trucks were obtained from CARB's EMFAC2007 model. The emissions from idling and traveling modes were calculated separately. Fleet average emission factors for traveling

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[62] Personal communication with Lanny Schmid of UPRR on October 5, 2007. For trucks served by the WSGs, it was assumed trucks would idle a total of 20 minutes per trip - 10 minutes at the gate, 5 minutes while container is loaded/unloaded, and 5 minutes for miscellaneous delays.

[63] See section IV.B.3 for details.

exhaust emissions were calculated using the EMFAC2007 model with the BURDEN output option. Fleet average emission factors for idling were calculated using the EMFAC2007 model with the EMFAC output option. Since the fleet distribution is not known, the EMFAC2007 default distribution for Los Angeles County was used. The 2010 emission factors for the HHD Diesel-fueled drayage trucks are shown in Table 80. Detailed emission factor derivation calculations and the EMFAC2007 output are provided in Appendix B-3.

Table 80
Criteria Pollutant Emission Factors for HHD Diesel-Fueled Drayage Trucks – ICTF Rail Yard
Project Year 2010

Operating Mode	Fleet Average Emission Factors					
	ROG	CO	NOx	PM_{10}[c]	DPM[c]	SOx
Traveling (g/mi)[a]	4.93	12.58	22.54	1.58	1.52	0.03
Idling (g/hr)[b]	12.49	48.29	110.26	1.79	1.79	0.06

Notes:
a. Emission factors calculated for calendar year 2010 using the EMFAC2007 model with the BURDEN output option. The default fleet distribution for Los Angeles County was used.
b. Emission factors calculated for calendar year 2010 using the EMFAC2007 model with the EMFAC output option. The default fleet distribution for Los Angeles County was used.
c. The PM_{10} emission factor includes engine exhaust emissions along with brake and tire wear. The DPM emission factor includes engine exhaust emissions only.

Emission factors from CARB's *Draft Emission Factors for Mandatory Reporting Program* document (August 10, 2007) were used to calculate GHG emissions from drayage truck operations. The GHG emission factors are based on fuel consumption, not activity (i.e. miles driven or hours of operation), and are not model year-specific. Therefore, the same factors are used to calculate emissions from both the traveling and idling modes and for all model year trucks. A fuel-specific carbon oxidization factor, from the CARB emission factor document, was also used to calculate CO_2 emissions. The GHG emission factors and carbon oxidization factor used to calculate emissions from drayage trucks during calendar year 2010 are shown in Table 81. A copy of CARB's *Draft Emission Factors for Mandatory Reporting Program* document is contained in Appendix C.

Table 81 **GHG Emission Factors for HHD Diesel-Fueled Drayage Trucks – ICTF Rail Yard** **Project Year 2010**				
Operating Mode	Carbon Oxidization Factor (%)	Emission Factors (kg/gal)[a]		
		CO_2	N_2O[c]	CH_4[c]
Traveling/Idling[b]	99.0	10.15	1.39×10^{-5}	4.16×10^{-5}

Notes:

a. Emission factors from CARB's *Draft Emission Factors for Mandatory Reporting Program* document (August 10, 2007).

d. Emission factors are based on fuel consumption; therefore, the same factors are used for both the traveling and idling modes.

e. Based on a Diesel fuel HHV of 5.825 MMBtu/barrel (from *CARB Draft Emission Factors for Mandatory Reporting Programs*, August 10, 2007) and 42 gallons per barrel.

To calculate the 2010 calendar year emissions from drayage truck operations, the activity data shown in Table 79 were combined with the emission factors shown in Tables 80 and 81. Table 82 shows the criteria pollutant, DPM, and GHG emission estimates for the HHD Diesel-fueled drayage trucks operating at ICTF during the Project Year 2010.

Table 82 **Criteria Pollutant, DPM, and GHG Emissions from HHD Diesel-Fueled Drayage Trucks – ICTF Rail Yard** **Project Year 2010**									
Operating Mode	Emission (tons/yr)						Emissions (metric tons/yr)		
	ROG	CO	NOx	PM_{10}	DPM	SOx	CO_2	N_2O	CH_4
Traveling	12.94	33.03	59.17	4.15	3.98	0.07	6,938.26	0.01	0.03
Idling[a]	8.27	31.99	73.05	1.19	1.19	0.04	3,977.03	0.01	0.02
Total	**21.21**	**65.02**	**132.22**	**5.34**	**5.17**	**0.11**	**10,915.29**	**0.02**	**0.05**

Notes:

a. Based on 35% of the truck trips have an idling time of 20 minutes per trip and the remaining 65% of the truck trips are idling for 30 minutes per trip.

3. Cargo Handling Equipment (CHE)

A key component of the modernization project is the replacement of Diesel-fueled cargo handling equipment with 39 electric wide span gantry (WSG) cranes. The cranes will be installed in 3 sets of 13 cranes.[64] The first set of WSG cranes is expected to be operating

[64] Per the ICTF Modernization Plan.

at full capacity by 2010.[65] Therefore, a portion of the Diesel-fueled CHE will be retired from service in 2010 and the activity data for the remaining CHE will be adjusted to account for the addition of the WSG cranes.

The following general assumptions were used to calculate the number of pieces of Diesel-fueled CHE that will remain in operation in 2010 and the activity data for each unit.

- In 2010, the expected lift count for the ICTF is 900,000 lifts.[66]
- 13 of the WSG cranes will be operating at full capacity in 2010.[67] Each WSG crane is expected to perform 38,000 lifts. The per-crane lift count was calculated by dividing the maximum facility capacity after the modernization has been completed (1.5 million lifts/year) by the total number of WSG cranes (39 cranes) that will operate at ICTF after the modernization has been completed.
- A total of 494,000 lifts will be performed by the WSG cranes (38,000 lifts per crane x 13 cranes) in 2010.
- The Diesel-fueled CHE will perform the remaining 406,000 lifts in 2010.
- In the 2005 baseline year, the facility performed 626,339 lifts.[68] In 2010, the Diesel-fueled CHE will need to operate at 65% of the 2005 activity level (406,000/626,339).
- The forklift will remain at the facility for chassis stacking operations and there will be no change in the activity level for this unit.

The number of Diesel-fueled RTGs and the activity data for each unit were calculated as follows:

- In 2005, 10 units operated 7,665 hours each (9 units existed in 2005 and a 10th unit was added in 2006) for a total of 22,023 hours of RTG operation.[69]
- In 2010, the RTGs will operate at 65% of the 2005 rate, or 14,321 hours.

[65] Personal communication with Lanny Schmid of UPRR on August 21, 2007.
[66] Per ICTF Modernization Plan.
[67] Personal communication with Lanny Schmid of UPRR on August 21, 2007.
[68] 2005 lift count provided by Jon Germer of UPRR.
[69] Actual operating data for RTGs at ICTF during the 2005 calendar year was not available. Therefore, the 2005 hours of operation for RTGs are based on data collected from maintenance records at the UPRR Commerce Rail Yard. Operations at ICTF are not substantially different from the operations at Commerce. Therefore, the Commerce data are representative of operations at ICTF.

- Assuming each unit continues to operate at 2,448 hours per year each, 5.8 units would be needed in 2010.
- Assuming the 6 newest units will operate at the facility in 2010 and the hours of operation will be evenly allocated between the units, each unit will operate 2,387 hours.

The number of Diesel-fueled top picks and the activity data for each were calculated as follows:

- In 2005, 3 units operated a total of 4,588 hours (one unit is a backup unit and operated only 208 hours in 2005).[70]
- In 2010, the top picks need to operate at 65% of the 2005 rate, or 2,982 hours.
- Assuming the oldest unit would be retired and the hours would be evenly divided between the other 2 units, each unit will operate 1,491 hours.

The number of Diesel-fueled yard hostlers and the activity data for each were calculated as follows:

- In 2005, 73 units operated at total of 278,460 hours.[71]
- In 2010, the yard hostlers will operate at 65% of the 2005 rate, or 180,999 hours.
- Assuming each unit would operate at 4,680 hours per year, 39 hostlers would be needed in 2010.
- Assuming that 40 newest hostlers would remain in operation and the hours would be divided evenly between the units, each unit will operate 4,525 hours.

The CHE equipment specification and activity data for the Project Year 2010 are summarized in Table 83.

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[70] Per interviews with UPRR personnel, only one top pick is operated at a time. Top picks are operated for a total of 12 hours per day and the Mi Jack top pick is a backup unit and used infrequently.

[71] Actual operating data for yard hostlers at ICTF during the 2005 calendar year was not available. Therefore, the 2005 hours of operation for the yard hostlers are based on data collected from maintenance records at the UPRR Commerce Rail Yard. Operations at ICTF are not substantially different from the operations at Commerce. Therefore, the Commerce data are representative of operations at ICTF..

Table 83
Equipment Specifications and Activity Data for Cargo Handling Equipment – ICTF Rail Yard
Project Year 2010

Equipment Type[a]	Make/Model	Model Year	Rating (hp)	No. of Units[b]	Hours of Operation (hr/yr/unit)[b]	Fuel Use (gal/yr)[c]
Forklift	Toyota 6FDU25	1997	85	1	730	1,285
RTG	Mi Jack 1000R	1995	300	1	2,387	17,780
RTG	Mi Jack 850R	1997	300	1	2,387	17,780
RTG	Mi Jack 1000RC	2002	300	2	2,387	35,560
RTG	Mi Jack 1200R	2005	350	1	2,387	20,744
RTG	Mi Jack 1200R	2006	300	1	2,387	17,780
Top Pick	Taylor Tay-950	1988	350	1	1,491	17,780
Top Pick	Taylor Tay-950	1989	350	1	1,491	17,780
Yard Hostler	Capacity TJ5000	2005	173	40	4,525	808,400
WSG Crane	TBD	TBD	TBD	13	8,760	0
Total				**62**		**954,889**

Notes:
a. All equipment except the WSG Cranes is Diesel-fueled. The WSG Cranes will be electric.
b. See discussion above for details on how equipment counts and hours of operation were determined.
c. Fuel use is for all equipment units in each group. Fuel use is based on the equipment specific BSFC rate from the OFFROAD2007 model and a Diesel fuel density of 7.1 lb/gal.

Equipment specific criteria pollutant and DPM emission factors for the 2010 calendar year were calculated using a spreadsheet, developed by CARB staff, based on the OFFROAD2007 model. The DPM emission factors were adjusted, as needed, to show compliance with CARB's *Regulation for Mobile Cargo Handling Equipment at Ports and Intermodal Rail Yards* (CARB, 2005).[72] The Regulation has a phased compliance schedule based on equipment age and fleet model year distribution. Therefore, only a portion of the CHE at ICTF needed to be in compliance with the regulation by 2010. It was assumed that a Level 3 verified Diesel emission control strategy (VDECS),[73] with a minimum DPM reduction of 85%, was installed on each affected equipment unit.

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[72] Available at *http://www.arb.ca.gov/ports/cargo/cargo.htm*.
[73] Additional information on the VDECS Program is available at *http://www.arb.ca.gov/diesel/verdev/verdev.htm*.

Emission factors from CARB's *Draft Emission Factors for Mandatory Reporting Program* document (August 10, 2007) were used to calculate GHG emissions from CHE operations. The GHG emission factors are based on fuel consumption and are not equipment- or year-specific. A fuel-specific carbon oxidization factor, from the CARB emission factor document, was also used to calculate CO_2 emissions. The criteria pollutant emission factors, DPM, and GHG emission factors, as well as the carbon oxidization factor used to calculate emissions from the CHE, are shown in Table 84. Detailed emission factor derivation calculations and the CARB spreadsheet are contained in Appendix D-2. A copy of CARB's *Draft Emission Factors for Mandatory Reporting Program* document is contained in Appendix C.

To calculate the emissions from CHE operations, the activity data shown in Table 83 were combined with the emission factors shown in Table 84. The criteria pollutant, DPM, and GHG emission estimates for the Diesel-fueled CHE operating at ICTF during Project Year 2010 are shown in Table 85.

Table 84
Criteria Pollutant, DPM, and GHG Emission Factors for Cargo Handling Equipment – ICTF Rail Yard
Project Year 2010

Equipment Type	Make/Model	Model Year	Carbon Oxidization Factor (%)[c]	Emission Factors (g/hp-hr)[a]						Emission Factors (kg/gal)[c]		
				ROG	CO	NOx	PM_{10}	DPM[b]	SOx	CO_2	N_2O[d]	CH_4[d]
Forklift	Toyota 6FDU25	1997	99.0	0.99	3.49	8.75	*0.104*	*0.104*	0.06	10.15	1.39×10^{-5}	4.16×10^{-5}
RTG	Mi Jack 1000R	1995	99.0	0.68	2.70	8.17	0.380	0.380	0.05	10.15	1.39×10^{-5}	4.16×10^{-5}
RTG	Mi Jack 850R	1997	99.0	0.32	0.92	6.25	*0.023*	*0.023*	0.05	10.15	1.39×10^{-5}	4.16×10^{-5}
RTG	Mi Jack 1000RC	2002	99.0	0.14	0.92	4.51	0.110	0.110	0.05	10.15	1.39×10^{-5}	4.16×10^{-5}
RTG	Mi Jack 1200R	2005	99.0	0.10	0.92	4.00	*0.017*	*0.017*	0.05	10.15	1.39×10^{-5}	4.16×10^{-5}
RTG	Mi Jack 1200R	2006	99.0	0.10	0.92	2.45	0.110	0.110	0.05	10.15	1.39×10^{-5}	4.16×10^{-5}
Top Pick	Taylor Tay-950	1988	99.0	0.68	2.70	8.17	*0.057*	*0.057*	0.06	10.15	1.39×10^{-5}	4.16×10^{-5}
Top Pick	Taylor Tay-950	1989	99.0	0.68	2.70	8.17	*0.057*	*0.057*	0.06	10.15	1.39×10^{-5}	4.16×10^{-5}
Yard Hostler	Capacity TJ5000	2005	99.0	0.16	2.70	4.44	0.160	0.160	0.06	10.15	1.39×10^{-5}	4.16×10^{-5}
WSG Crane	TBD	TBD	99.0	0.00	0.00	0.00	0.000	0.000	0.00	0.00	0.00	0.00

Notes:

a. Criteria pollutant emission factors calculated using a spreadsheet, developed by CARB staff, based on the OFFROAD2007 model.

b. DPM emission factors that are shown in italics were adjusted for compliance with CARB's Regulation for Mobile Cargo Handling Equipment at Ports and Intermodal Rail Yards. It was assumed that a Level 3 VDECS (85% control) was installed on each affected unit.

c. GHG emission factors and carbon oxidization factors from CARB's *Draft Emission Factors for Mandatory Reporting Program* document (August 10, 2007).

d. Emission factor based on a Diesel fuel HHV of 5.825 MMBtu/barrel (from CARB Draft Emission Factors for Mandatory Reporting Programs, August 10, 2007) and 42 gallons per barrel.

Table 85 **Criteria Pollutant, DPM, and GHG Emissions from Cargo Handling Equipment – ICTF Rail Yard** **Project Year 2010**												
Equipment Type	Make/Model	Model Year	Emission (tpy)						Emission (metric tons/yr)		
			ROG	CO	NOx	PM_{10}	DPM	SOx	CO_2	N_2O	CH_4
Forklift	Toyota 6FDU25	1997	0.02	0.07	0.18	0.00	0.00	0.00	12.91	0.00	0.00
RTG	Mi Jack 850R	1997	0.23	0.92	2.77	0.13	0.13	0.02	178.66	0.00	0.00
RTG	Mi Jack 1000R	1995	0.11	0.31	2.12	0.01	0.01	0.02	178.66	0.00	0.00
RTG	Mi Jack 1000RC	2002	0.10	0.62	3.06	0.07	0.07	0.04	357.33	0.00	0.00
RTG	Mi Jack 1200R	2005	0.04	0.36	1.58	0.01	0.01	0.02	208.44	0.00	0.00
RTG	Mi Jack 1200R	2006	0.03	0.31	0.83	0.04	0.04	0.02	178.66	0.00	0.00
Top Pick	Taylor Tay-950	1988	0.23	0.92	2.77	0.02	0.02	0.02	178.66	0.00	0.00
Top Pick	Taylor Tay-950	1989	0.23	0.92	2.77	0.02	0.02	0.02	178.66	0.00	0.00
Yard Hostler	Capacity TJ5000	2005	2.15	36.35	59.77	2.15	2.15	0.80	8,123.21	0.00	0.03
WSG Crane	TBD	TBD	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total			**3.14**	**40.78**	**75.87**	**2.45**	**2.45**	**0.96**	**9,595.20**	**0.00**	**0.03**

4. Heavy Equipment

The Diesel-fueled heavy equipment is used at ICTF for non-cargo-related activities at the Yard, such as RTG crane maintenance, handling of parts and Company material, derailments, etc. Also, two propane-fueled forklifts are used at the locomotive shop at the Dolores Yard. It was assumed that the operations as the crane maintenance shop would be reduced over time as the use of Diesel-fueled RTG cranes is phased out, due to the installation of the electric WSG cranes. While maintenance will be required on the WSGs, the nature of those operations has not yet been determined and specifications for support equipment are not available. Also, the WSG cranes are stationary units. Therefore, maintenance will be performed at the location of each crane and not at a centralized facility.

The following assumptions were used to calculate the 2010 activity data for each piece of heavy equipment.

- Assumed no change from the 2005 baseline in the hours of operation for the Grove Crane and the propane-fueled forklifts at the Dolores Yard[74]. These units are used by the Car Department[75] and the Locomotive Shop, respectively, and their operation is not directly tied to cargo handling operations.
- Assumed RTG operations in 2010 would be 65% of the baseline operations, due to the installation of the WSG cranes. Therefore, the 2010 hours of operation for equipment at the Crane Maintenance facility (3 Taylor forklifts and 1 man lift) will also be reduced to 65% of the 2005 baseline year operations. As discussed above, maintenance will be required on the WSG cranes. The nature of the operations has not yet been determined. Also, since the WSG cranes will be stationary units, maintenance will not be performed at a centralized facility.

[74] Since the overall activity level at the Dolores Yard is expected to remain constant, it was assumed that the activity level for the forklifts would remain unchanged from the 2005 baseline year.
[75] Although, in theory, emissions from this activity may increase in proportion to the predicted increase in container lifts at ICTF, no information is available to support such calculations at this time. At worst, the increase in emissions might be less than 0.10 tpy of DPM.

- Assumed the 29 hp man lift, which operated during the baseline year, would be replaced in 2008 with a 50 hp unit. The new unit will comply with the emission requirements of CARB's CHE Regulation at the time of purchase.

The heavy equipment specification and activity data for Project Year 2010 are summarized in Table 86.

Table 86
Equipment Specifications and Activity Data for Heavy Equipment – ICTF and Dolores Rail Yards
Project Year 2010

Yard	Location	Equipment Type	Make/Model	Fuel Type	Model Year	Rating (hp)	No. of Units	Hours of Operation (hr/yr/unit)	Fuel Use (gal/yr)[c]
ICTF	Car Department	Crane	Grove RT600E	Diesel	2004	173	1	1,095[a]	5,392
ICTF	Crane Maintenance	Forklift	Taylor 850	Diesel	2005	155	2	4,745[b]	29,212
ICTF	Crane Maintenance	Forklift	Taylor 850	Diesel	1998	154	1	4,745[b]	14,512
ICTF	Crane Maintenance	Man Lift	TBD	Diesel	2008	50	1	1,825[a]	3,133
Dolores	Locomotive Shop	Forklift	Yale GP060	Propane	Unknown	150	2	3,285[a]	38,441
Total							**7**		**90,690**

Notes:
a. Assumed no change in hours of operation for the Grove Crane, the man lift, and Yale Forklifts.
b. Assumed the hours of operation for equipment at the crane maintenance facility were equal to 65% of the 2005 baseline hours. See discussion above for details.
c. The total fuel used by all units in each category.

Equipment specific criteria pollutant and DPM emission factors for Project Year 2010 were calculated using the OFFROAD2007 model. The DPM emission factors were adjusted, as needed, to show compliance with CARB's *Regulation for Mobile Cargo Handling Equipment at Ports and Intermodal Rail Yards* (CARB, 2005). The Regulation has a phased compliance schedule based on equipment age and fleet model year distribution. Therefore, only a portion of the heavy equipment at ICTF needs to be in compliance with the regulation by 2010. It was assumed that a Level 3 verified Diesel emission control strategy (VDECS), with a minimum DPM reduction of 85%, was installed on each affected equipment unit.

Emission factors from CARB's *Draft Emission Factors for Mandatory Reporting Program* document (August 10, 2007) were used to calculate GHG emissions from heavy equipment operations. The GHG emission factors are based on fuel consumption and are not equipment- or year-specific. A fuel-specific carbon oxidization factor, from the CARB emission factor document, was also used to calculate CO_2 emissions. The criteria pollutant emission factors, DPM, and GHG emission factors, as well as the carbon oxidization factor used to calculate emissions from the heavy equipment are shown in Table 84. Detailed emission factor derivation calculations and output from the OFFROAD2007 model are contained in Appendix E-2. A copy of CARB's *Draft Emission Factors for Mandatory Reporting Program* document is contained in Appendix C.

To calculate the emissions from CHE operations, the activity data shown in Table 86 were combined with the emission factors shown in Table 87. The criteria pollutant, DPM, and GHG emission estimates for the Diesel-fueled CHE operating at ICTF during Project Year 2010 are shown in Table 88.

CARB's speciation profile database was used to determine the fraction of each TAC in the total ROG emissions from the propane-fueled forklifts. The database does not contain a profile for propane combusted in an internal combustion engine. Therefore, the

Table 87
Criteria Pollutant, DPM, and GHG Emission Factors for Heavy Equipment – ICTF and Dolores Rail Yards
Project Year 2010

Yard	Equipment Type	Make/Model	Fuel Type	Model Year	Carbon Oxidization Factor (%)[c]	Emission Factor (g/bhp-hr)[a]						Emission Factor (kg/gal)[c]		
						ROG[b]	CO	NOx	PM_{10}	DPM	SOx	CO_2	N_2O[d]	CH_4[d]
ICTF	Crane	Grove RT600E	Diesel	2004	99.0	0.58	3.40	5.18	0.26	0.26	0.01	10.15	1.39×10^{-5}	4.16×10^{-5}
ICTF	Forklift	Taylor 850	Diesel	2005	99.0	0.53	3.47	4.87	0.23	0.23	0.01	10.15	1.39×10^{-5}	4.16×10^{-5}
ICTF	Forklift	Taylor 850	Diesel	1998	99.0	1.27	3.56	8.36	0.57	0.57	0.01	10.15	1.39×10^{-5}	4.16×10^{-5}
ICTF	Man Lift	Unknown	Diesel	2008	99.0	0.18	3.04	2.80	0.013	0.013	0.01	10.15	1.39×10^{-5}	4.16×10^{-5}
Dolores	Forklift	Yale GP060	Propane	ALL[e]	99.5	0.13	28.23	6.11	0.06	NA	0.00	5.95	3.74×10^{-5}	8.31×10^{-6}

Notes:
a. Criteria pollutant emission factors from the OFFROAD2007 model.
b. Evaporative emissions for these sources are negligible.
c. GHG emission factors and carbon oxidization factor from CARB's *Draft Emission Factors for Mandatory Reporting Program* document (August 10, 2007).
d. Emission factors for Diesel fuel sources based on a Diesel fuel HHV of 5.825 MMBtu/barrel (from CARB Draft Emission Factors for Mandatory Reporting Programs, August 10, 2007) and 42 gallons per barrel. Emission factors for propane-fueled sources based on an LPG HHV of 91,300 Btu/gal (from the Transportation Energy Data Book: Edition 26, U.S. Department of Energy, 2007).
e. To obtain the criteria pollutant emission factors, the forklifts are modeled as the calendar year 2010 fleet average model year group from the OFFROAD2007 model.

Table 88
Criteria Pollutant, DPM, and GHG Emissions from Heavy Equipment – ICTF and Dolores Rail Yards
Project Year 2010

Yard	Equipment Type	Make/Model	Fuel Type	Model Year	Emissions (tons/year)						Emission (metric tons/year)		
					ROG	CO	NOx	PM_{10}	DPM	SOx	CO_2	N_2O	CH_4
ICTF	Crane	Grove RT600E	Diesel	2004	0.05	0.31	0.46	0.02	0.02	0.00	54.18	0.00	0.00
ICTF	Forklift	Taylor 850	Diesel	2005	0.26	1.69	2.37	0.11	0.11	0.00	293.54	0.00	0.00
ICTF	Forklift	Taylor 850	Diesel	1998	0.31	0.86	2.02	0.14	0.14	0.00	145.82	0.00	0.00
ICTF	Man Lift	Unknown	Diesel	2008	0.01	0.14	0.13	0.00	0.00	0.00	31.49	0.00	0.00
Dolores	Forklift	Yale GP060	Propane	ALL	0.04	9.20	1.99	0.02	0.00	0.00	227.58	0.00	0.00
Total					**0.67**	**12.19**	**6.98**	**0.29**	**0.27**	**0.01**	**752.61**	**0.00**	**0.00**

speciation profile for natural gas-fired reciprocating engine was used.[76] All TACs listed in the most recent version of the Emission Inventory Criteria and Guidelines Report for the Air Toxics "Hot Spots" Program have been included. The TAC speciation profile and annual emissions of each TAC are shown in Table 89. The relevant sections of the speciation profile database are included in Appendix E-2.

Table 89
TAC Emissions from Propane-Fueled Forklifts – Dolores Rail Yard
Project Year 2010

CAS	Pollutant[a]	Organic Fraction[b,c]	Emissions (tons/yr)
95636	1,2,4-trimethylbenzene	0.00001	3.95×10^{-7}
75070	acetaldehyde	0.00003	1.19×10^{-6}
71432	benzene	0.00010	4.35×10^{-6}
110827	cyclohexane	0.00001	3.95×10^{-7}
100414	ethylbenzene	0.00001	3.95×10^{-7}
74851	ethylene	0.00058	2.49×10^{-5}
50000	formaldehyde	0.00074	3.20×10^{-5}
108383	m-xylene	0.00001	3.95×10^{-7}
110543	n-hexane	0.00002	7.90×10^{-7}
95476	o-xylene	0.00001	3.95×10^{-7}
115071	propylene	0.00154	6.68×10^{-5}
108883	toluene	0.00004	1.58×10^{-6}
1330207	xylene	0.00002	7.90×10^{-7}
Total			**1.34×10^{-4}**

Notes:
a. Emissions were calculated for only those chemicals that were in both the CARB SPECIATE database and the AB 2588 list.
b. Organic fraction data are from CARB's SPECIATE database. Data are from profile #719 "I.C.E. reciprocating – natural gas." A speciation profile for propane was not included in the database.
c. Organic fraction is reported on a ROG basis using CARB's SPECIATE ROG/TOG ratio of 0.0914.

[76] Speciation profile number 719 was used to calculate TAC emissions from this source.

5. TRUs and Reefer Cars

Criteria pollutant, DPM, and GHG emissions were calculated from the Diesel-fueled engines that power the refrigeration units on TRUs and reefer cars. In addition to the Diesel engine exhaust emissions, GHG emissions from refrigerant loss were also calculated.

The TRUs are owned by a variety of independent shipping companies and equipment-specific data are not available. Therefore, the default Diesel engine equipment rating and distribution contained in the OFFROAD2007 model were used for emission calculations. It was assumed that the number of TRUs and reefer cars in the Yard at any one time remained constant during the year, with individual units cycling in and out of the Yard.

Emissions from TRUs and reefer cars are based on average size of the Diesel engines, the average number of units in the Yard, and the hours of operation for each engine. The number of units in the yard during Project Year 2010 was calculated by multiplying the 2005 TRU count, based on UPRR car data reports, by the ratio of the 2010 lift count[77] to the 2005 lift count.[78] The equipment size and hours of operation for each unit were not changed from the 2005 baseline assumptions. Equipment specifications and activity data for TRUs and reefer cars are summarized in Table 90.

[77] Per the ICTF Modernization Plan.
[78] Provided by UPRR.

Table 90
Equipment Specifications and Activity Data for TRUs and Reefer Cars – ICTF Rail Yard
Project Year 2010

Equipment Type	Average Rating (hp)[a]	Average No. of Units in Yard[b]	Hours of Operation		Fuel Use (gal/yr)[e]
			(hr/day)[c]	(hr/yr)[d]	
Container	28.56	101	4	1,460	174,544
Railcar	34	14	4	1,460	28,220

Notes:

a. Based on the average horsepower distribution in the OFFROAD2007 model.

b. UPRR staff estimates and car data reports indicate that in 2005 there were approximately 35 TRUs and 2-5 reefer cars in the Yard at any given time. To be conservative, these estimates were increased by 100%. For 2010, the number of TRUs and reefer cars was equal to the No. of Units in 2005 x (2010 lift count/2005 lift count).

c. From CARB's *Staff Report: Initial Statement of Reason for Proposed Rulemaking for Airborne Toxic Control Measure for In-Use Diesel-Fueled Transport Refrigeration Units (TRU) and TRU Generator Sets, and Facilities Where TRUs Operate*, October 2003.

d. It was assumed that the number of units and the annual hours of operation remain constant, with individual units cycling in and out of the Yard.

e. Fuel use calculated based on the bsfc contained in the OFFROAD2007 model and a Diesel fuel density of 7.1 lb/gal. Fuel use shown is for all units in each category.

Criteria pollutant and DPM emission factors for the Diesel-fueled engines on TRUs and reefer cars are from the OFFROAD2007 model. The DPM emission factor was adjusted to show compliance with the CARB's Airborne Toxic Control Measure for In-Use Diesel-Fueled Transport Refrigeration Units (TRU) and TRU Generator Sets, and Facilities Where TRUs Operate (CARB, 2004).[79] Emission factors from CARB's *Draft Emission Factors for Mandatory Reporting Program* document (August 10, 2007) were used to calculate GHG emissions from TRU engine operations. A fuel-specific carbon oxidization factor, from the CARB emission factor document, was also used to calculate CO_2 emissions. The criteria pollutant, DPM, and GHG emission factors, as well as the carbon oxidation factor, used to calculate emissions from the TRUs and reefer cars, are shown in Table 91. Detailed emission factor derivation calculations and the OFFROAD2007 output are contained in Appendix F-2. A copy of CARB's *Draft Emission Factors for Mandatory Reporting Program* document is contained in Appendix C.

[79] Available at *http://www.arb.ca.gov/regact/trude03/fro1.pdf*

Table 91
Criteria Pollutant, DPM, and GHG Emission Factors for Diesel-Fueled TRUs and Reefer Car Engines – ICTF Rail Yard
Project Year 2010

Equipment Type	Carbon Oxidization Factor (%)[e]	Emission Factors (g/hp-hr-unit)[a]						Emission Factors (kg/gal)[d]		
		VOC[b]	CO	NOx	PM_{10}	DPM[c]	SOx[d]	CO_2	N_2O[f]	CH_4[f]
TRU	99.0	1.40	5.50	5.78	*0.22*	*0.22*	0.01	10.15	1.39×10^{-5}	4.16×10^{-5}
Reefer Car	99.0	1.55	6.05	6.14	*0.22*	*0.22*	0.01	10.15	1.39×10^{-5}	4.16×10^{-5}

Notes:

a. Emission factors from OFFROAD2007 model.
b. Evaporative emissions from this source are negligible.
c. DPM emission factor was adjusted to show compliance with the TRU ATCM. The LETRU emission factor from Table 3 of the ATCM was used.
d. Emission factor based on a Diesel fuel sulfur content of 130 ppm.
e. GHG emission factors and carbon oxidization factor from CARB's *Draft Emission Factors for Mandatory Reporting Program* document (August 10, 2007).
f. Emission factors for Diesel fuel sources based on a Diesel fuel HHV of 5.825 MMBtu/barrel (from CARB Draft Emission Factors for Mandatory Reporting Programs, August 10, 2007) and 42 gallons per barrel

To calculate the emissions from the operation of the Diesel-fueled engines on TRUs and reefer cars, the activity data shown in Table 87 were combined with the emission factors shown in Table 88. The criteria pollutant, DPM, and GHG emission estimates for the Diesel-fueled engines on TRUs and reefer cars operating at ICTF for Project Year 2010 are shown in Table 92.

Table 92
Emissions from Diesel-Fueled TRUs and Reefer Car Engines – ICTF Rail Yard
Project Year 2010

Equipment Type	Emissions (tons/yr)						Emissions (metric tons/yr)		
	VOC	CO	NOx	PM_{10}	DPM	SOx	CO_2	N_2O	CH_4
TRU	3.61	14.19	14.90	0.57	0.57	0.02	1,753.90	0.00	0.01
Reefer Car	0.65	2.52	2.56	0.09	0.09	0.00	283.57	0.00	0.00
Total	**4.25**	**16.71**	**17.45**	**0.66**	**0.66**	**0.02**	**2,037.47**	**0.00**	**0.01**

In addition to the GHG emissions from the Diesel-fueled engines on the TRUs and reefer cars, GHG emissions were calculated for refrigerant losses from TRUs. Emissions were calculated for HFC-125, HFC-134a, and HFC-143a, according to the methods outlined in the *Berths 136-147 (TraPac) Container Terminal Draft Environmental Impact Statement (EIS)/Environmental Impact Report (EIR)* (Port of Los Angeles, 2007) The activity data, emission factors, and emissions from TRU and reefer car refrigerant loss are shown in Table 93.

Table 93
GHG Emissions from TRU and Reefer Car Refrigerant Loss – ICTF Rail Yard
Project Year 2010

Equipment Type	Avg. No. of Units in Yard[a]	Refrigerant Charge per Unit (kg)[b]	Annual Refrigerant Loss Rate (%)[c]	Annual Refrigerant Loss (kg/yr)	Emissions by Refrigerant[d,e] (metric tons/yr)		
					HFC-125	HFC-134a	HFC-143a
TRU	101	6.35	35%	223.55	0.049	0.116	0.058
Reefer Car	14	6.35	35%	31.94	0.007	0.017	0.008
Total	**115**			**255.49**	**0.056**	**0.133**	**0.066**

Notes:
a. See Table 90.
b. From Berths 136-147 (TraPac) Container Terminal Project Draft EIS/EIR (POLA, 2007).
c. POLA upper bound estimate, TraPac Draft EIS/EIR.
d. POLA estimate, TraPac Draft EIS/EIR.
e. Assumes a mix of refrigerants of 50% R404a and 50% HFC-134a; assumes R404a equals 52% HFC-143a, 44% HFC-125, and 4% HFC-134a.

6. HHD Diesel-Fueled Delivery Trucks

The emission estimates for delivery trucks for Project Year 2010 are based on the annual number of deliveries and the VMT per trip. The annual number of delivery truck trips was calculated based on the facility gasoline, Diesel fuel, oil, and soap throughput and a tanker truck capacity of 8,000 gallons per truck. The annual number of sand delivery truck trips was based on the discussions with UPRR staff. Per the Dolores Yard Operations Manager, the facility receives 2 to 3 sand deliveries per week. For the 2010 emissions inventory, it was assumed that there were no changes in annual throughput from the 2005 baseline year for tanks located at the Dolores Yard since overall activity levels at the Dolores Yard is expected to remain constant. The storage tanks at ICTF are associated with the RTG and yard hostler maintenance facilities. Therefore, For tanks located at ICTF, it was assumed that the 2010 throughput for these tanks was 65% of the 2005 baseline throughput, based on the reduction in CHE and heavy equipment use due to the installation of the WSG cranes. The VMT per trip was estimated from aerial photos of the Yards and is unchanged from the 2005 baseline inventory. Activity data for the HHD delivery trucks is summarized in Table 94.

Table 94
Activity Data for HHD Delivery Trucks – ICTF and Dolores Rail Yards
Project Year 2010

Yard	Delivery Type	Number of Trips[a,b]	VMT per Trip (mi/trip)[c]	Annual VMT (mi/yr)	Fuel Use (gal/yr)[d]	Idling Time (min/trip)[e]	Idling Time (hr/yr)
Dolores	Diesel Fuel	2,625	0.06	157.50	334	10	437.50
Dolores	Sand	156	2.2	343.20	151	30	78.00
Dolores	Oil	24	0.06	1.44	3.1	10	4.00
Dolores	Soap	3	0.06	0.18	0.4	10	0.50
ICTF	Gasoline	8	0.5	4.00	2.0	10	1.33
ICTF	Diesel Fuel	14	0.5	7.00	3.6	10	2.33
ICTF	Oil	1	0.5	0.50	0.3	10	0.17
Total		**2,831**		**157.50**	**494**		**523.83**

Notes:
a. Number of truck trips for liquid products based on the material throughput and a tanker truck volume of 8,000 gallons per truck.
b. Number of sand truck trips based on personal communication with UPRR staff.
c. VMT per trip estimated from aerial photos of each Yard.
d. Fuel use is for both traveling and idling modes and was calculated from EMFAC2007.
e. Engineering estimate based on personal communication with UPRR staff.

Criteria pollutant and DPM emission factors for the HHD Diesel-fueled delivery trucks were obtained from CARB's EMFAC2007 model. The emissions from idling and traveling modes were calculated separately. Fleet average emission factors for traveling exhaust emissions were calculated using the EMFAC2007 model with the BURDEN output option. Fleet average emission factors for idling were calculated using the EMFAC2007 model with the EMFAC output option. Since the fleet distribution is not known, the EMFAC2007 default distribution for Los Angeles County was used. The criteria pollutant and DPM emission factors for the HHD Diesel-fueled delivery trucks are shown in Table 95. Detailed emission factor derivation calculations and the EMFAC2007 output are contained in Appendix G-2.

Table 95
Criteria Pollutant and DPM Emission Factors for HHD Diesel-Fueled Delivery Trucks – ICTF and Dolores Rail Yards
Project Year 2010

Operating Mode	Fleet Average Emission Factors					
	ROG	CO	NOx	PM_{10}[c]	DPM[c]	SOx
Traveling (g/mi)[a]	4.93	12.58	22.54	1.58	1.52	0.03
Idling (g/hr)[b]	12.49	48.29	110.26	1.79	1.79	0.06

Notes:
a. Emission factors calculated using the EMFAC2007 model with the BURDEN output option. The default fleet distribution for Los Angeles County was used.
b. Emission factors calculated using the EMFAC2007 model with the EMFAC output option. The default fleet distribution for Los Angeles County was used.
c. The PM_{10} emission factor includes engine exhaust emissions along with brake and tire wear. The DPM emission factor includes engine exhaust emissions only.

Emission factors from CARB's *Draft Emission Factors for Mandatory Reporting Program* document (August 10, 2007) were used to calculate GHG emissions from delivery truck operations. The GHG emission factors are based on fuel consumption, not activity (i.e. miles driven or hours of operation); therefore, the same factors are used to calculate emissions from both the traveling and idling modes. A fuel-specific carbon oxidization factor, from the CARB emission factor document, was also used to calculate CO_2 emissions. The GHG emission factors for delivery trucks are shown in Table 96. A copy of CARB's *Draft Emission Factors for Mandatory Reporting Program* document is contained in Appendix C.

Table 96 GHG Emission Factors for HHD Diesel-Fueled Delivery Trucks – ICTF and Dolores Rail Yards Project Year 2010				
Operating Mode	Carbon Oxidization Factor (%)[a]	Emission Factors (kg/gal)[a]		
		CO_2	N_2O[c]	CH_4[c]
Traveling/Idling[b]	99.0	10.15	1.39×10^{-5}	4.16×10^{-5}

Notes:

a. Emission factors and carbon oxidization factor from CARB's *Draft Emission Factors for Mandatory Reporting Program* document (August 10, 2007).

b. Emission factors are based on fuel consumption;, therefore, the same factors are used for both the traveling and idling modes.

c. Based on a Diesel fuel HHV of 5.825 MMBtu/barrel (from *CARB Draft Emission Factors for Mandatory Reporting Programs*, August 10, 2007) and 42 gallons per barrel

To calculate the emissions from delivery truck operations, the activity data shown in Table 94 were combined with the emission factors shown in Tables 95 and 96. The criteria pollutant, DPM, and GHG emission estimates for the HHD Diesel-fueled delivery trucks operating at the ICTF and Dolores yards for Project Year 2010 are shown in Table 97.

Table 97 Criteria Pollutant, DPM, and GHG Emissions from HHD Diesel-Fueled Delivery Trucks – ICTF and Dolores Rail Yards Project Year 2010									
Operating Mode	Emission (tpy)						Emission (metric tons/yr)		
	ROG	CO	NOx	PM_{10}	DPM	SOx	CO_2	N_2O	CH_4
Traveling	0.00	0.01	0.01	0.00	0.001	0.00	1.50	0.00	0.00
Idling	0.01	0.03	0.06	0.00	0.001	0.00	3.47	0.00	0.00
Total	**0.01**	**0.04**	**0.07**	**0.00**	**0.00**	**0.00**	**4.97**	**0.00**	**0.00**

7. <u>Yard Trucks</u>

A number of light duty and medium duty gasoline-fueled trucks are used by the staff at the ICTF and Dolores Yards. For the 2010 inventory, it was assumed that the number of vehicles, the fleet distribution (number of vehicles per weight class), and the annual VMT were unchanged from the 2005 baseline year. The 2010 emissions were based on a modified fleet average model year distribution. It was assumed that vehicles in the fleet were the same model years as existed in the 2005 baseline year or newer. For example, the 2005 fleet included a model year 2000 Jeep Cherokee. For the 2010 emission estimate, it was assumed this vehicle would be replaced at some time since 2005 with a newer vehicle. Therefore, this vehicle was assumed to be a model year 2000-2010 light duty truck. The equipment specifications and activity data for the yard trucks are summarized in Table 98.

Table 98
Equipment Specifications and Activity Data for Gasoline-Fueled Yard Trucks – ICTF and Dolores Rail Yards
Project Year 2010

Yard	Equipment Type	Equipment ID	Vehicle Class	Make/Model	Model Year[a]	Annual VMT (mi/yr)[b]	Fuel Use (gal/yr)[c]	Idling (hr/yr)[d]
ICTF	SUV	1915-53287	LDT	Jeep Cherokee	2000-2010	73,000	6,831	NA
ICTF	Pickup Truck	1915-55536	LDT	Chevy Extended Cab	2003-2010	73,000	6,801	NA
ICTF	SUV	1915-19952	LDT	Chevy Trailblazer 370	2003-2010	73,000	6,804	NA
ICTF	Pickup Truck	1915-19971	LDT	Chevy Extended Cab	2004-2010	73,000	6,796	NA
ICTF	Van	1915-19975	LHDT 1	Chevy 15 Passenger Van	2004-2010	73,000	11,777	91.25
Dolores	Service Truck	73152	MHD	Chevy C4500	2003-2010	12,644	2,095	91.25
Dolores	Mgr Truck	Unknown	LDT	Chevy Trailblazer	2004-2010	45,000	4,190	NA
Dolores	Mgr Truck	73167	LDT	Chevy Blazer	2004-2010	36,608	3,408	NA
Dolores	Pickup Truck	73396	LDT	Ford F-150	2005-2010	23,756	2,208	NA

Notes:
a. It was assumed that vehicles in the fleet were the same model years as existed in the 2005 baseline year or newer.
b. The 2005 VMT was estimated from either the odometer reading divided by the age of the vehicle or interviews with UPRR staff. Assumed no change in VMT from the 2005 baseline year.
c. Calculated using the EMFAC2007 model.
d. Idling time is an engineering estimate. Idling emissions from light duty trucks are negligible, therefore, idling time data for these vehicles was not collected.

Modified fleet average criteria pollutant emission factors were obtained from CARB's EMFAC2007 model for each vehicle. The emissions from idling and traveling modes were calculated separately. Traveling exhaust emission factors were calculated using the EMFAC2007 model with the BURDEN output option. Idling emission factors for the light-heavy duty and medium heavy duty vehicles were calculated using the EMFAC2007 model with the EMFAC output option. Idling emissions from light duty trucks were negligible. The 2010 criteria pollutant emission factors for the yard trucks are shown in Table 99. Detailed emission factor derivation calculations and the EMFAC2007 output are contained in Appendix H-2.

Table 99
Criteria Pollutant Emission Factors for Yard Trucks – ICTF and Dolores Rail Yards
Project Year 2010

Yard	Equipment Type	Make/Model	Vehicle Class	Model Year	Traveling Emission Factors (g/mi)[a]					Idling Emission Factors (g/hr)[b]				
					ROG	CO	NOx	PM_{10}	SOx	ROG	CO	NOx	PM_{10}	SOx
ICTF	SUV	Jeep Cherokee	LDT	2000-2010	0.05	1.91	0.14	0.04	0.01	NA	NA	NA	NA	NA
ICTF	Pickup Truck	Chevy Ext. Cab	LDT	2003-2010	0.03	1.15	0.08	0.04	0.01	NA	NA	NA	NA	NA
ICTF	SUV	Chevy Trailblazer	LDT	2003-2010	0.03	1.15	0.08	0.04	0.01	NA	NA	NA	NA	NA
ICTF	Pickup Truck	Chevy Ext. Cab	LDT	2004-2010	0.02	0.93	0.07	0.04	0.01	NA	NA	NA	NA	NA
ICTF	Van	Chevy Van	LHDT 1	2004-2010	0.02	0.38	0.13	0.04	0.01	24.66	146.40	1.62	0.00	0.05
Dolores	Service Truck	Chevy C4500	MHD	2003-2010	0.21	3.02	0.51	0.02	0.03	24.47	145.74	1.61	0.00	0.05
Dolores	Mgr Truck	Chevy Trailblazer	LDT	2004-2010	0.03	1.15	0.08	0.04	0.01	NA	NA	NA	NA	NA
Dolores	Mgr Truck	Chevy Blazer	LDT	2004-2010	0.03	1.15	0.08	0.04	0.01	NA	NA	NA	NA	NA
Dolores	Pickup Truck	Ford F-150	LDT	2005-2010	0.02	0.73	0.05	0.02	0.01	NA	NA	NA	NA	NA

Notes:

a. Traveling exhaust emissions calculated using the EMFAC2007 model with the BURDEN output option at a vehicle speed of 15 mph.

b. Idling exhaust emissions factors for LHDT1 and MHD vehicles calculated using the EMFAC2007 model with the EMFAC output option. Idling exhaust emissions from light duty trucks (LDT) are negligible.

Emission factors from CARB's *Draft Emission Factors for Mandatory Reporting Program* document (August 10, 2007) were used to calculate GHG emissions from yard trucks. The GHG emission factors are based on fuel consumption, not activity (i.e. miles driven or hours of operation), therefore, the same factors are used to calculate emissions from both the traveling and idling modes. A fuel-specific carbon oxidization factor, from the CARB emission factor document, was also used to calculate CO_2 emissions. The GHG emission factors and the carbon oxidization factor for yard trucks are shown in Table 100. A copy of CARB's *Draft Emission Factors for Mandatory Reporting Program* document is contained in Appendix C.

Table 100
GHG Emission Factors for Yard Trucks – ICTF and Dolores Rail Yards
Project Year 2010

Operating Mode	Carbon Oxidization Factor (%)[a]	Emission Factors (kg/gal)[a]		
		CO_2	N_2O[c]	CH_4[c]
Traveling/Idling[b]	99.0	8.87	1.23×10^{-5}	1.60×10^{-4}

Notes:
a. Emission factors and carbon oxidization factor from CARB's *Draft Emission Factors for Mandatory Reporting Program* document (August 10, 2007).
b. Emission factors are based on fuel consumption; therefore, the same factors are used for both the traveling and idling modes.
c. Based on a gasoline HHV of 122,697 Btu/gallon (from the Transportation Energy Data Book: Edition 26, U.S. Department of Energy, 2007).

To calculate the emissions from yard truck operations, the activity data shown in Table 98 were combined with the emission factors shown in Tables 99 and 100. The criteria pollutant and GHG emission estimates for the yard trucks operating at the ICTF and Dolores Yards for Project Year 2010 are shown in Table 101.

Table 101
Criteria Pollutant Emissions from Yard Trucks – ICTF and Dolores Rail Yards
Project Year 2010

Yard	Equipment Type	Make/Model	Vehicle Class	Model Year	Emissions (tpy)					Emissions (metric tons/yr)		
					ROG	CO	NOx	PM_{10}	SOx	CO_2	N_2O	CH_4
ICTF	SUV	Jeep Cherokee	LDT	2000-2010	0.00	0.15	0.01	0.00	0.00	59.98	0.00	0.00
ICTF	Pickup Truck	Chevy Ext. Cab	LDT	2003-2010	0.00	0.09	0.01	0.00	0.00	59.75	0.00	0.00
ICTF	SUV	Chevy Trailblazer	LDT	2003-2010	0.00	0.09	0.01	0.00	0.00	59.75	0.00	0.00
ICTF	Pickup Truck	Chevy Ext. Cab	LDT	2004-2010	0.00	0.08	0.01	0.00	0.00	59.68	0.00	0.00
ICTF	Van	Chevy Van	LHDT 1	2004-2010	0.00	0.04	0.01	0.00	0.00	103.47	0.00	0.00
Dolores	Service Truck	Chevy C4500	MHD	2003-2010	0.00	0.05	0.01	0.00	0.00	18.46	0.00	0.00
Dolores	Mgr Truck	Chevy Trailblazer	LDT	2004-2010	0.00	0.06	0.00	0.00	0.00	36.79	0.00	0.00
Dolores	Mgr Truck	Chevy Blazer	LDT	2004-2010	0.00	0.05	0.00	0.00	0.00	29.93	0.00	0.00
Dolores	Pickup Truck	Ford F-150	LDT	2005-2010	0.00	0.02	0.00	0.00	0.00	19.39	0.00	0.00
Total					**0.00**	**0.63**	**0.06**	**0.00**	**0.00**	**447.18**	**0.00**	**0.00**

CARB's speciation database was used to determine the fraction of each TAC in the total VOC emissions from each yard truck.[80] All TACs listed in the most recent version of the Emission Inventory Criteria and Guidelines Report for the Air Toxics "Hot Spots" Program were included. The TAC speciation profiles and emission rates for the yard trucks are shown in Table 102. A copy of the relevant section of the SPECIATE database is included in Appendix H-2.

Table 102
TAC Emissions from Gasoline-Fueled Yard Trucks – ICTF and Dolores Rail Yards
Project Year 2010

CAS	Chemical Name[a]	Organic Fraction of VOC (by weight)[b]	Emissions (tons/yr)		
			ICTF	Dolores	Total
95636	1,2,4-trimethylbenzene	0.0120	1.76×10^{-4}	1.02×10^{-4}	2.79×10^{-4}
106990	1,3-butadiene	0.0068	9.96×10^{-5}	5.80×10^{-5}	1.58×10^{-4}
540841	2,2,4-trimethylpentane	0.0288	4.22×10^{-4}	2.45×10^{-4}	6.67×10^{-4}
75070	acetaldehyde	0.0035	5.10×10^{-5}	2.97×10^{-5}	8.07×10^{-5}
107028	acrolein (2-propenal)	0.0017	2.42×10^{-5}	1.41×10^{-5}	3.83×10^{-5}
71432	benzene	0.0309	4.51×10^{-4}	2.63×10^{-4}	7.14×10^{-4}
4170303	crotonaldehyde	0.0004	5.28×10^{-6}	3.07×10^{-6}	8.35×10^{-6}
110827	cyclohexane	0.0077	1.12×10^{-4}	6.53×10^{-5}	1.78×10^{-4}
100414	ethylbenzene	0.0131	1.92×10^{-4}	1.12×10^{-4}	3.03×10^{-4}
74851	ethylene	0.0794	1.16×10^{-3}	6.76×10^{-4}	1.84×10^{-3}
50000	formaldehyde	0.0197	2.88×10^{-4}	1.68×10^{-4}	4.56×10^{-4}
78795	isoprene	0.0018	2.59×10^{-5}	1.51×10^{-5}	4.09×10^{-5}
98828	isopropylbenzene (cumene)	0.0001	1.76×10^{-6}	1.02×10^{-6}	2.78×10^{-6}
67561	methyl alcohol	0.0015	2.23×10^{-5}	1.30×10^{-5}	3.53×10^{-5}
78933	methyl ethyl ketone	0.0002	3.34×10^{-6}	1.94×10^{-6}	5.28×10^{-6}
108383	m-xylene	0.0445	6.51×10^{-4}	3.79×10^{-4}	1.03×10^{-3}
91203	naphthalene	0.0006	8.61×10^{-6}	5.02×10^{-6}	1.36×10^{-5}
110543	n-hexane	0.0200	2.92×10^{-4}	1.70×10^{-4}	4.62×10^{-4}
95476	o-xylene	0.0155	2.26×10^{-4}	1.32×10^{-4}	3.58×10^{-4}
115071	propylene	0.0382	5.59×10^{-4}	3.26×10^{-4}	8.85×10^{-4}
100425	styrene	0.0015	2.24×10^{-5}	1.31×10^{-5}	3.55×10^{-5}
108883	toluene	0.0718	1.05×10^{-3}	6.12×10^{-4}	1.66×10^{-3}
Total			$\mathbf{5.85 \times 10^{-3}}$	$\mathbf{3.40 \times 10^{-3}}$	$\mathbf{9.25 \times 10^{-3}}$

Notes:

a. Organic fraction information is from CARB's SPECIATE database. Data used are from the "Cat stabilized exhaust 2005 SSD etoh 2% O (MTBE phaseout)" profile.

b. Organic fraction is reported on a ROG basis using CARB's SPECIATE ROG/TOG ratio of 0.8012.

80 Speciation profile 2105 was used to calculate TAC emissions from this source.

8. Diesel-Fueled IC Engines

The 2010 calendar year emission estimates for the emergency generator and the air compressor are based on the rated capacity of each unit and the annual hours of operation. It was assumed that there was no change in the equipment specification, activity data, or emission factors for these units from the 2005 baseline year. See Part IV.A.8 for equipment specifications, activity data, and emission factors. The Project Year 2010 emissions are summarized in Table 103. Detailed emission calculations are contained in Appendix I-2.

Table 103
Criteria Pollutant, DPM, and GHG Emissions from the Diesel-Fueled IC Engines – ICTF Rail Yard
Project Year 2010

	Emissions (tons/yr)						Emissions (metric tons/yr)		
Unit	ROG	CO	NOx	PM_{10}	DPM	SOx	CO_2	N_2O^c	CH_4^c
Emergency Generator	0.01	0.02	0.08	0.01	0.01	0.01	2.73	0.00	0.00
Air Compressor	0.06	0.16	0.76	0.05	0.05	0.05	24.89	0.00	0.00
Total	**0.07**	**0.18**	**0.84**	**0.06**	**0.06**	**0.06**	**27.63**	**0.00**	**0.00**

9. Storage Tanks

There are many storage tanks at both the ICTF and Dolores Yards used to store liquid petroleum and other products such as Diesel fuel, gasoline, lubricating oils, and recovered oil. Emissions from the storage tanks are based on the size of the tank, material stored, and annual throughput. For the 2010 Project Year inventory, it was assumed that there was no change from the 2005 baseline throughput for storage tanks located at the Dolores Yard since overall activity levels at the Dolores Yard is expected to remain constant. Activity levels for the tanks at the ICTF RTG and yard hostler maintenance facilities were assumed to be 65% of the 2005 baseline activity due to the reduction in CHE and heavy equipment operations with the installation of the WSG cranes.[81] VOC emissions from the storage tanks were calculated using EPA's TANKS

[81] See Part IV.B.3 for discussion in the reduction in activity level.

program.[82] The emissions from small oil tanks,[83] stormwater tanks, and the sludge tank were assumed to be negligible. Also, the TANKS program does not calculate emissions from oil storage tanks. Therefore, the emissions from oil storage tanks were estimated by modeling the liquid contents as Diesel fuel, resulting in conservative estimates. Equipment specifications, activity data, and the annual emissions from the storage tanks are shown in Table 104. The TANKS program output are contained in Appendix J-1. Speciation profiles and detailed emission calculations are shown in Appendices J-2 and J-3, respectively.

[82] Available at *http://www.epa.gov/ttn/chief/ap42/ch07/index.html*.
[83] The TANKS program requires a minimum shell length of 5 feet for horizontal tanks and a minimum shell height of 5 feet for vertical tanks to calculate emissions. Emissions from tanks with a shell length/height of 5 feet are considered to be negligible.

Table 104 Storage Tank Specifications and Activity Data – ICTF and Dolores Rail Yards Project Year 2010							
Yard	Tank No.	Tank Location	Material Stored	Tank Capacity (gallons)	Tank Dimensions (ft)	Annual Throughput (gal/yr)[a,b]	VOC Emissions (tpy)[c,d,e]
ICTF	TNKD-9901	Crane Maintenance	Offroad Diesel	20,000	34.5 x 10	78,000	0.003
ICTF	TBA-1	Crane Maintenance	CARB Diesel	1,000	7 x 4	33,800	0.001
ICTF	TBA-2	Crane Maintenance	Gasoline	2,000	11.83 x 6.92 x 4.75	56,425	0.56
ICTF	TBA-3	Tractor Maintenance	SAE 15W-40 Motor Oil	500	6 x 4	1,300	0.0002
ICTF	TBA-4	Crane Maintenance	Used Oil	300	4 x 4	1,170	neg.
ICTF	TBA-5	Crane Maintenance	Motor Oil	243	2.5 x 3 x 4.3	631.8	neg.
ICTF	TBA-6	Crane Maintenance	Hydraulic Oil	300	6 x 2.5 x 3	780	neg.
ICTF	TBA-7	Tractor Maintenance	Auto. Transmission Fluid	243	2.5 x 3 x 4.3	631.8	neg.
ICTF	TBA-8	Tractor Maintenance	SAE 20W-50 Motor Oil	202	3 x 3 x 3	525.2	neg.
ICTF	TBA-9	Tractor Maintenance	Used Motor Oil	300	4 x 2	780	neg.
ICTF	TBA-10	Tractor Maintenance	Used Motor Oil	300	4 x 2	780	neg.
ICTF	TBA-11	Tractor Maintenance	Hydraulic Oil	240	3 x 2.7 x 4.3	624	neg.
Dolores	TNKD-0069	Tank Farm	Diesel	160,000	24 x 34	10,500,000	0.10
Dolores	TNKD-0068	Tank Farm	Diesel	160,000	24 x 34	10,500,000	0.10
Dolores	TNKO-0002	Tank Farm	Recovered Oil	10,000	16 x 10	40,000	0.002
Dolores	TNKO-0003	Tank Farm	Drain Oil	12,000	20.5 x 10	48,000	0.002
Dolores	TNKO-0004	Tank Farm	Journal Box Oil	8,000	21.3 x 8	32,000	0.001
Dolores	TNK0001	Tank Farm	Lube Oil	12,000	20.5 x 10	48,000	0.004
Dolores	TNKO-0184	Service Track	Recovered Oil	6,000	20.5 x 7	24,000	0.002
Dolores	TNKS-0005	Tank Farm	Stormwater	25,000	30 x 12 x 12	980,100	neg.
Dolores	TNKS-0006	Tank Farm	Stormwater	25,000	30 x 12 x 12	980,100	neg.
Dolores	TNKS-0007	Tank Farm	Stormwater	25,000	30 x 12 x 12	980,100	neg.
Dolores	TNKS-0008	Tank Farm	Stormwater	25,000	30 x 12 x 12	980,100	neg.
Dolores	TNKS-0010	Tank Farm	Soap	8,000	8 x8	22,785	NA
Dolores	NA	WWTP	Sludge	1,000	6.5 x 5 x 5	NA	neg.
Total VOC							**0.77**

Notes:

a. Annual throughput for ICTF tanks was equal to 65% of the 2005 throughput, based on the assumption that the Diesel-fueled CHE will be operating at 65% of the 2005 rate due to the installation of the electric WSG Cranes.

b. Assumed no change from the 2005 throughput for the tanks at Dolores.

c. Emission calculations performed using the USEPA TANKS 4.0.9d program.

d. Emissions from small (the TANKS program requires a minimum shell length of 5 feet for horizontal tanks and a minimum shell height of 5 feet for vertical tanks) oil tanks, stormwater tanks, and the sludge tank were assumed to be negligible.

e. The VOC emissions for oil tanks were estimated by modeling the liquid contents as Diesel fuel, resulting in conservative estimates.

CARB's speciation database was used to determine the fraction of each TAC in the total VOC emissions from the storage tanks. CARB's speciation database does not include information on TAC fractions from Diesel fuel or lubricating oil storage tanks. Therefore, TAC emissions were calculated for the gasoline storage tank (Tank TBA-2) at ICTF only. All TACs listed in the most recent version of the Emission Inventory Criteria and Guidelines Report for the Air Toxics "Hot Spots" Program were included. The TAC speciation profile[84] and emission rates for Tank TBA-2 are shown in Table 105. The relevant sections of CARB's speciation database are included in Appendix J-1

Table 105
TAC Emissions from Gasoline Storage Tank – ICTF Rail Yard
Project Year 2010

CAS	Chemical Name	Organic Fraction of VOC (by weight)	Emissions (tons/yr)
540841	2,2,4-trimethylpentane	0.0130	7.30×10^{-3}
71432	benzene	0.0036	2.03×10^{-3}
110827	cyclohexane	0.0103	5.80×10^{-3}
100414	ethylbenzene	0.0012	6.66×10^{-4}
78784	isopentane	0.3747	2.11×10^{-1}
98828	isopropylbenzene (cumene)	0.0001	6.20×10^{-5}
108383	m-Xylene	0.0034	1.93×10^{-3}
110543	n-Hexane	0.0155	8.69×10^{-3}
95476	o-Xylene	0.0013	7.22×10^{-4}
106423	p-Xylene	0.0011	6.03×10^{-4}
108883	toluene	0.0171	9.60×10^{-3}
Total			$\mathbf{2.48 \times 10^{-1}}$

Notes:
a. The organic fraction information is from CARB's speciation database. Data are from the "Headspace vapors 1996 SSD etoh 2.0% (MTBE phaseout)" option.
b. Emissions were calculated only for chemicals that were in both CARB's speciation database and the AB 2588 list.
c. The organic fraction is reported on a ROG basis using CARB's SPECIATE ROG/TOG ratio of 0.9963.

[84] Speciation profile number 661 was used to calculate TAC emissions from this source.

10. Refueling Operations

Refueling operations occur at the crane maintenance area of ICTF and at the locomotive shop the Dolores Yard. For the 2010 Project Year inventory, it was assumed that there was no change from the 2005 baseline throughput for refueling operations located at the Dolores Yard, since overall activity levels at the Dolores Yard is expected to remain constant. Activity levels for the refueling operations at the ICTF crane maintenance facility were assumed to be 65% of the 2005 baseline activity.[85] The activity data, emission factors, and the VOC emissions from refueling operations during Project Year 2010 are shown in Table 106.

[85] See Part IV.B.3 for discussion in the reduction in activity level.

Table 106
VOC Emissions from Refueling Operations – ICTF and Dolores Rail Yards
Project Year 2010

Yard	Tank No.	Tank Location	Material Stored	Throughput (gal/yr)[a]	VOC Emission Factor (lb/1000 gal)[b]	VOC Emissions (tons/yr)
ICTF	TNKD-9901	Crane Maintenance	Offroad Diesel	78,000	0.028	0.001
ICTF	TBA-1	Crane Maintenance	CARB Diesel	33,800	0.028	0.000
ICTF	TBA-2	Crane Maintenance	Gasoline	56,425	1.8	0.051
Dolores	TNKD-0069	Tank Farm	Diesel	10,500,000	0.028	0.147
Dolores	TNKD-0068	Tank Farm	Diesel	10,500,000	0.028	0.147
Total						**0.346**

Notes:
a. See Table 104.
b. Emission factors from the *Supplemental Instructions for Liquid Organic Storage Tanks* document of the SCAQMD's *General Instruction Book for the AQMD 2006-2007 Annual Emissions Reporting Program.*

CARB's speciation database was used to determine the fraction of each TAC in the total VOC emissions from the refueling operations. CARB's speciation database does not include information on TAC fractions from Diesel fuel. Therefore, TAC emissions were calculated for the gasoline refueling operations at ICTF only.[86] All TACs listed in the most recent version of the Emission Inventory Criteria and Guidelines Report for the Air Toxics "Hot Spots" Program were included. The TAC speciation profile and emission rates for the gasoline refueling operations are shown in Table 107. A copy of the *Supplemental Instructions for Liquid Organic Storage Tanks* document of the SCAQMD's *General Instruction Book for the AQMD 2006-2007 Annual Emissions Reporting Program* the relevant sections of SPECIATE database are included in Appendices K-1 and K-2. Detailed emission calculations are included in Appendix K-3.

Table 107
TAC Emissions from Gasoline Refueling Operations – ICTF Rail Yard
Project Year 2010

CAS	Chemical Name	Organic Fraction of VOC (by weight)	Emissions (tons/yr)
540841	2,2,4-trimethylpentane	0.0130	6.60×10^{-4}
71432	benzene	0.0036	1.83×10^{-4}
110827	cyclohexane	0.0103	5.24×10^{-4}
100414	ethylbenzene	0.0012	6.01×10^{-5}
78784	isopentane	0.3747	1.90×10^{-2}
98828	isopropylbenzene (cumene)	0.0001	5.61×10^{-6}
108383	m-Xylene	0.0034	1.75×10^{-4}
110543	n-Hexane	0.0155	7.85×10^{-4}
95476	o-Xylene	0.0013	6.52×10^{-5}
106423	p-Xylene	0.0011	5.45×10^{-5}
108883	toluene	0.0171	8.68×10^{-4}
Total			**2.24×10^{-2}**

Notes:

a. The organic fraction information is from CARB's speciation database. Data are from the "Headspace vapors 1996 SSD etoh 2.0% (MTBE phaseout)" option.

b. Emissions were calculated only for chemicals that were in both CARB's speciation database and the AB 2588 list.

c. The organic fraction is reported on a ROG basis using CARB's SPECIATE ROG/TOG ratio of 0.9963.

[86] Speciation profile number 661 was used to estimate TAC emissions from this source.

11. Sand Tower

The calendar year 2010 emissions estimates for sand tower operations are based on the annual sand throughput and PM_{10} emission factors from AP-42. It was assumed that there was no change in sand throughput or emission factors from the 2005 baseline year, since overall activity levels at the Dolores Yard is expected to remain constant. The activity data, PM_{10} emission factors, and annual emission estimates for the sand tower are shown Table 108. The relevant sections of AP-42 are in Appendix L-1. Detailed emission calculations are contained in Appendix L-2.

Table 108
PM_{10} Emission Factors and Emission Rates for Sand Tower Operations – Dolores Rail Yard
Project Year 2010

Pollutant	Sand Throughput (tons/yr)[a]	Emission Factors (lb/ton)		Emissions (tons/yr)		
		Pneumatic Transfer[b]	Gravity Transfer[c]	Pneumatic Transfer	Gravity Transfer	Total
PM_{10}	3,120	0.00034	0.00099	0.001	0.002	0.002

Notes:
a. Annual throughput data provided by UPRR.
b. Emission factor from AP-42, Table 11.12-5, 6/06. Factor for controlled pneumatic cement unloading to elevated storage silo was used. The unit is equipped with a fabric filter.
c. Emission factor from AP-42, Table 11.12-5, 6/06. Factor for sand transfer was used.

12. Wastewater Treatment Plant

The 2010 emissions estimates for the WWTP are based on the annual wastewater flow rate and from the *Air Emission Inventory and Regulatory Analysis Report for Dolores Yard* (Trinity Consultants, December 2005). It was assumed that there was no change in flow rate or emission rates from the 2005 baseline year since overall activity levels at the Dolores Yard is expected to remain constant. Emission rates, based on the 1999 wastewater flow rate, were calculated by Trinity Consultants using EPA's WATER9 program. The 2010 annual emissions were calculated by multiplying the emission rates, in grams per second, by the ratio of the 2010 wastewater flow rate to the 1999 wastewater flow rate. The emission rates, in grams per second, and the annual emissions, in tons per year, are shown in Table 109. Detailed emission calculations are shown in Appendix M.

Table 109
TAC Emissions from the Wastewater Treatment Plant – Dolores Rail Yard
Project Year 2010

Pollutant	Emission Rate (grams/sec)[b]	Emissions (tons/yr)[c]
benzene	5.10×10^{-7}	2.37×10^{-5}
bis (2-ethylhexyl) Phthalate	1.83×10^{-11}	8.52×10^{-10}
bromomethane	8.99×10^{-7}	4.18×10^{-5}
chloroform	6.30×10^{-7}	2.93×10^{-5}
ethylbenzene	3.04×10^{-6}	1.41×10^{-4}
methylene chloride	1.04×10^{-5}	4.84×10^{-4}
toluene	3.50×10^{-6}	1.63×10^{-4}
xylene	6.20×10^{-6}	2.89×10^{-4}
Total	$\mathbf{2.52 \times 10^{-5}}$	$\mathbf{1.17 \times 10^{-3}}$

Notes:

a. The 2005 wastewater flow rate (980,100 gallons) was provided by UPRR. Assumed no change in flow rate for the 2010 calendar year since overall activity levels at the Dolores Yard are expected to remain constant.

b. Emissions rates from the *Air Emission Inventory and Regulatory Analysis Report for the Dolores Yard* (Trinity Consultants, December 2005) and are based on the 1999 wastewater flow rate of 732,000 gallons. Assumed no change in emission rate from baseline year.

c. Annual emissions for the calendar year 2010 were calculated by multiplying the emission rate, in grams per second, by the ratio of the 2010 wastewater flow rate to the 1999 wastewater flow rate.

13. Steam Cleaners

Portable steam cleaners are used for a variety of activities at the Dolores Yard. The calendar year 2010 emission estimates for the steam cleaners are based on the hours of operation, the fuel type and rated capacity of the heater, and the fuel type and rated capacity of the pump. It was assumed there were no changes in equipment specifications, activity data (since overall activity levels at the Dolores Yard is expected to remain constant), or emission factors from the 2005 baseline year. See Part IV.A.13 for equipment specifications, activity data, and emission factors. The Project Year 2010 emissions are summarized in Table 110. Detailed emission calculations are contained in Appendix N-2.

Table 110 **Criteria Pollutant and GHG Emissions from Steam Cleaners – Dolores Rail Yard** **Project Year 2010**								
	Emission (tpy)					Emission (metric tons/yr)		
Emission Unit	ROG	CO	NOx	PM_{10}	SOx	CO_2	N_2O	CH_4
Heaters	0.004	0.02	0.11	0.003	0.00	87.21	0.00	0.00
Pumps	0.12	2.41	0.06	0.00	0.00	5.57	0.00	0.00
Total	**0.12**	**2.43**	**0.17**	**0.01**	**0.00**	**92.78**	**0.00**	**0.00**

CARB's speciation database was used to determine the fraction of each TAC in the total VOC emissions from the steam cleaning operations.[87] The SPECIATE database does not include a profile for propane-fueled boilers. Therefore, the speciation profile for natural gas-fired boilers was used to determine the TAC emissions from the steam cleaner heaters. All TACs listed in the most recent version of the Emission Inventory Criteria and Guidelines Report for the Air Toxics "Hot Spots" Program were included. The TAC speciation profiles and emission rates for the steam cleaning operations are shown in Table 111. A copy of the relevant section of SPECIATE database is included in Appendix N-3.

[87] Speciation profile number 3 was used to calculate TAC emissions from the heaters and profile number 665 was used to calculate the TAC emissions from the pump.

Table 111 TAC Emissions from Steam Cleaners – Dolores Rail Yard Project Year 2010					
		Heaters[a]		Pumps[b]	
CAS	Chemical Name	Organic Fraction of VOC (by weight)[c]	Emissions (tons/yr)	Organic Fraction of VOC (by weight)[d]	Emissions (tons/yr)
95636	1,2,4-trimethylbenzene	-	-	0.0140	1.67×10^{-3}
106990	1,3-butadiene	-	-	0.0091	1.08×10^{-3}
540841	2,2,4-trimethylpentane	-	-	0.0222	2.63×10^{-3}
75070	acetaldehyde	-	-	0.0106	1.26×10^{-3}
107028	acrolein (2-propenal)	-	-	0.0020	2.38×10^{-4}
71432	benzene	0.0947	3.64×10^{-4}	0.0368	4.37×10^{-3}
4170303	crotonaldehyde	-	-	0.0014	1.72×10^{-4}
110827	cyclohexane	0.0237	9.11×10^{-5}	0.0050	5.95×10^{-4}
100414	ethylbenzene	-	-	0.0167	1.98×10^{-3}
74851	ethylene	-	-	0.0996	1.18×10^{-2}
50000	formaldehyde	0.1895	7.28×10^{-4}	0.0327	3.88×10^{-3}
78795	isoprene	-	-	0.0016	1.85×10^{-4}
98828	isopropylbenzene (cumene)	-	-	0.0006	6.58×10^{-5}
67561	methyl alcohol	-	-	0.0038	4.53×10^{-4}
78933	methyl ethyl ketone (mek)	-	-	0.0007	7.88×10^{-5}
108383	m-xylene	-	-	0.0496	5.89×10^{-3}
91203	naphthalene	-	-	0.0014	1.72×10^{-4}
110543	n-hexane	-	-	0.0146	1.73×10^{-3}
95476	o-xylene	-	-	0.0173	2.05×10^{-3}
115071	propylene	-	-	0.0546	6.48×10^{-3}
100425	styrene	-	-	0.0014	1.72×10^{-4}
108883	toluene	0.0474	1.82×10^{-4}	0.0756	8.98×10^{-3}
Total			**1.37×10^{-3}**		**5.60×10^{-2}**

Notes:

a. Organic fraction information is from CARB's SPECIATE database. Data used are from the "External combustion boiler – natural gas" profile. SPECIATE does not include a profile for propane-fueled boilers.

b. Organic fraction information is from CARB's SPECIATE database. Data used are from the "Non-cat stabilized exhaust 1996 SSD 2.0% etoh (MTBE phaseout)" profile.

c. Organic fraction is reported on a ROG basis using CARB's SPECIATE ROG/TOG ratio of 0.4222.

d. Organic fraction is reported on a ROG basis using CARB's SPECIATE ROG/TOG ratio of 0.9198

14. Heater

There is a natural gas-fired heater located at the ICTF administrative building. For the 2010 Project Year emission estimates, it was assumed that there were no changes in equipment specification, activity data, or emission factors from the 2005 baseline year. See Part IV.A.14 for equipment specifications, activity data[88], and emission factors. The Project Year 2010 emissions are summarized in Table 112. Detailed emission calculations are contained in Appendix O-2.

Table 112
Criteria Pollutant and GHG Emissions from Heaters – ICTF Rail Yard
Project Year 2010

Emissions (tons/yr)					Emissions (metric tons/yr)		
VOC	CO	NOx	PM_{10}	SOx	CO_2	N_2O	CH_4
0.00	0.07	0.08	0.01	0.00	87.85	0.01	0.00

CARB's speciation profile for natural gas-fired boilers was used to determine the fraction of each TAC in the total VOC emissions from the heater.[89] All TACs listed in the most recent version of the Emission Inventory Criteria and Guidelines Report for the Air Toxics "Hot Spots" Program were included. The TAC speciation profiles and emission rates for the heater are shown in Table 113. A copy of the relevant sections of the SPECIATE database is included in Appendix O-3.

[88] The heater is used to provide comfort heat to the ICTF Administration Building and its use is not tied to cargo handling activities. Therefore, it was assumed that operation of this unit would not change from the baseline year.

[89] Speciation profile number 3 was used to calculate TAC emissions from this source.

Table 113 TAC Emissions from Heaters – ICTF Rail Yard Project Year 2010			
CAS	Chemical Name[a]	Organic Fraction of VOC (by weight)[b]	Emissions (tons/yr)
71432	benzene	0.0947	4.34×10^{-4}
110827	cyclohexane	0.0237	1.08×10^{-4}
50000	formaldehyde	0.1895	8.67×10^{-4}
108883	toluene	0.0474	2.17×10^{-4}
Total			**1.63×10^{-3}**

Notes:

a. Organic fraction information is from CARB's SPECIATE database. Data used are from the "External combustion boiler – natural gas" profile.

b. Organic fraction is reported on a ROG basis using CARB's SPECIATE ROG/TOG ratio of 0.4222.

15. Welders

A propane-fueled welder is used for locomotive service and repair operations at the Dolores Yard. For the 2010 Project Year emission estimates, it was assumed that there were no changes in equipment specification, activity data (since overall activity levels at the Dolores Yard is expected to remain constant), or emission factors from the 2005 baseline year. See Part IV.A.15 for equipment specifications, activity data, and emission factors. The Project Year 2010 emissions are summarized in Table 114. Detailed emission calculations are contained in Appendix P-2.

Table 114 Criteria Pollutant and GHG Emissions from the Propane-Fueled Welder – Dolores Rail Yard Project Year 2010							
Emissions (tons/yr)					Emissions (metric tons/yr)		
VOC	CO	NOx	PM_{10}	SOx	CO_2	N_2O	CH_4
0.002	0.221	0.143	0.001	0.000	7.85	0.00	0.00

CARB's speciation database was used to determine the fraction of each TAC in the total VOC emissions from the propane-fueled welder. The SPECIATE database does not include a profile for propane-fueled internal combustion engine. Therefore, the speciation profile for natural gas-fired reciprocating engine was used to determine the

TAC emissions from the welder.[90] All TACs listed in the most recent version of the Emission Inventory Criteria and Guidelines Report for the Air Toxics "Hot Spots" Program were included. The TAC speciation profiles and emission rates for the heater are shown in Table 115. A copy of the relevant section of SPECIATE database is included in Appendix P-3.

Table 115
TAC Emissions from Propane-Fueled Welder – Dolores Rail Yard
Project Year 2010

CAS	Chemical Name[a]	Organic Fraction of VOC (by weight)[b]	Emissions (tons/yr)
95636	1,2,4-trimethylbenzene	0.00001	1.70×10^{-8}
75070	acetaldehyde	0.00003	5.11×10^{-8}
71432	benzene	0.00010	1.87×10^{-7}
110827	cyclohexane	0.00001	1.70×10^{-8}
100414	ethylbenzene	0.00001	1.70×10^{-8}
74851	ethylene	0.00058	1.07×10^{-6}
50000	formaldehyde	0.00074	1.38×10^{-6}
108383	m-xylene	0.00001	1.70×10^{-8}
110543	n-hexane	0.00002	3.41×10^{-8}
95476	o-xylene	0.00001	1.70×10^{-8}
115071	propylene	0.00154	2.88×10^{-6}
108883	toluene	0.00004	6.82×10^{-8}
1330207	xylene	0.00002	3.41×10^{-8}
Total			$\mathbf{5.80 \times 10^{-6}}$

Notes:
a. Organic fraction information is from CARB's SPECIATE database. Data used are from the "I.C.E. reciprocating – natural gas" profile.
b. Organic fraction is reported on a ROG basis using CARB's SPECIATE ROG/TOG ratio of 0.0914.

16. Miscellaneous Gasoline-Fueled Equipment

A variety of portable, gasoline-fueled, small equipment is used at ICTF each day. For the 2010 Project Year emission estimates, it was assumed that there were no changes in equipment specification, or emission factors from the 2005 baseline year. While this equipment is used at ICTF, its operations are not tied to cargo handling activities. Therefore, it was assumed that there was no change in activity data from the 2005 baseline year. See Part IV.A.16 for equipment specifications, activity data, and emission

[90] Speciation profile number 3 was used to calculate TAC emissions from this source.

factors. The Project Year 2010 emissions are summarized in Table 116. Detailed emission calculations are contained in Appendix Q-2.

Table 116
Criteria Pollutant and GHG Emissions from the Miscellaneous Gasoline-Fueled Equipment – Dolores Rail Yard
Project Year 2010

Emissions (tons/yr)					Emissions (metric tons/yr)		
VOC	CO	NOx	PM_{10}	SOx	CO_2	N_2O	CH_4
1.89	38.41	0.96	0.06	0.05	87.67	0.00	0.00

CARB's speciation database was used to determine the fraction of each TAC in the total VOC emissions from each piece of equipment.[91] All TACs listed in the most recent version of the Emission Inventory Criteria and Guidelines Report for the Air Toxics "Hot Spots" Program were included. The TAC speciation profiles and emission rates for the miscellaneous equipment are shown in Table 117. Equipment specific calculations are shown in Appendix Q-2. A copy of the relevant sections of SPECIATE database is included in Appendix Q-3.

[91] Speciation profile 665 was used to calculate emissions from these sources.

Table 117 TAC Emissions from Miscellaneous Gasoline-Fueled Equipment – ICTF Rail Yard Project Year 2010			
CAS	Chemical Name[a]	Organic Fraction of VOC (by weight)[b]	Emissions (tons/yr)
95636	1,2,4-trimethylbenzene	0.0140	2.64×10^{-2}
106990	1,3-butadiene	0.0091	1.70×10^{-2}
540841	2,2,4-trimethylpentane	0.0222	4.16×10^{-2}
75070	acetaldehyde	0.0106	1.99×10^{-2}
107028	acrolein (2-propenal)	0.0020	3.76×10^{-3}
71432	benzene	0.0368	6.91×10^{-2}
4170303	crotonaldehyde	0.0014	2.72×10^{-3}
110827	cyclohexane	0.0050	9.41×10^{-3}
100414	ethylbenzene	0.0167	3.14×10^{-2}
74851	ethylene	0.0996	1.87×10^{-1}
50000	formaldehyde	0.0327	6.14×10^{-2}
78795	isoprene	0.0016	2.92×10^{-3}
98828	isopropylbenzene (cumene)	0.0006	1.04×10^{-3}
67561	methyl alcohol	0.0038	7.17×10^{-3}
78933	methyl ethyl ketone (mek)	0.0007	1.25×10^{-3}
108383	m-xylene	0.0496	9.31×10^{-2}
91203	naphthalene	0.0014	2.72×10^{-3}
110543	n-hexane	0.0146	2.74×10^{-2}
95476	o-xylene	0.0173	3.24×10^{-2}
115071	propylene	0.0546	1.03×10^{-1}
100425	styrene	0.0014	2.72×10^{-3}
108883	toluene	0.0756	1.42×10^{-1}
Total			

Notes:

a. Organic fraction information is from CARB's SPECIATE database. Data used are from the "Non-cat stabilized exhaust 1996 SSD 2.0% etoh (MTBE phaseout)" profile.

b. Organic fraction is reported on a ROG basis using CARB's SPECIATE ROG/TOG ratio of 0.9198.

17. Worker Vehicles

Emissions were calculated from employee vehicles that arrive at and depart from the ICTF and Dolores Yards each day. The number of vehicle trips was based on employee force counts for each yard and assumes no ridesharing. The miles per trip were estimated from aerial photos of the Yards and include on-site travel only. For the 2010 emission estimates, it was assumed that there were no changes in the number of employees from the 2005 baseline year based on discussions with UPRR staff. Activity data for worker vehicles is summarized in Table 118.

Table 118
Activity Data for Worker Vehicles – ICTF and Dolores Rail Yards
Project Year 2010

Yard	No. of Trips (trips/yr)[a]	VMT		Fuel Use (gal/yr)[c]
		(mi/trip)[b]	(mi/yr)	
ICTF	152,935	2.5	382,338	19,377
Dolores	32,850	0.5	16,425	833
Total	**185,785**		**398,763**	**20,210**

Notes:
a. The number of trips during the 2005 baseline year was based on employee force count reports. Assumes no ridesharing and 365 work days per year. Assumed no changes for 2010.
b. VMT for onsite travel estimated from aerial photos of each yard.
c. Fuel use for the 2010 calendar year was calculated from VMT and from fuel economy based on the EMFAC 2007 model with the BURDEN output option.

Fleet average criteria pollutant emission factor for traveling exhaust emissions were calculated using the EMFAC2007 model with the BURDEN output option. Since the model year distribution is not known, the EMFAC2007 default distribution for gasoline-fueled passenger cars and light duty trucks operating in Los Angeles County was used for the 2010 calendar year. Idling emissions were assumed to be negligible.

Emission factors from CARB's *Draft Emission Factors for Mandatory Reporting Program* document (August 10, 2007) were used to calculate GHG emissions from worker vehicles. A fuel-specific carbon oxidization factor, from the CARB emission factor document, was also used to calculate CO_2 emissions. The criteria pollutant and GHG emission factors, as well as the carbon oxidization factor, used to calculate emissions from worker vehicles are shown in Table 119. Detailed emission factor derivation calculations and the EMFAC2007 output are contained in Appendix R-2. A copy of CARB's *Draft Emission Factors for Mandatory Reporting Program* document is contained in Appendix C.

Table 119 Criteria Pollutant and GHG Emission Factors for Worker Vehicles – ICTF and Dolores Rail Yards Project Year 2010								
Carbon Oxidization Factor (%)	Emission Factors (g/mi)[a]					Emission Factors (kg/gal)[b]		
	ROG	CO	NOx	PM_{10}	SOx	CO_2	N_2O[c]	CH_4[c]
99.0	0.18	0.37	0.35	0.04	0.00	8.87	1.23×10^{-5}	1.60×10^{-4}

Notes:

a. Calendar year 2010 criteria pollutant emission factors (g/mi) from EMFAC 2007 using the BURDEN output option. The EMFAC default model year distribution for L.A. County was used.

b. GHG emission factors from CARB's *Draft Emission Factors for Mandatory Reporting Program* document (August 10, 2007).

c. Based on a gasoline HHV of 122,697 Btu/gallon (from the Transportation Energy Data Book: Edition 26, U.S. Department of Energy, 2007).

To calculate the emissions from worker vehicles, the activity data shown in Table 118 was combined with the emission factors shown in Table 119. The criteria pollutant and GHG emission estimates for the worker vehicles at the ICTF and Dolores yards during the Project Year 2010 are shown in Table 120.

Table 120 Criteria Pollutant and GHG Emissions from Worker Vehicles – ICTF and Dolores Rail Yards Project Year 2010								
Yard	Emissions (tons/yr)					Emissions (metric tons/yr)		
	ROG	CO	NOx	PM_{10}	SOx	CO_2	N_2O[c]	CH_4[c]
ICTF	0.08	0.16	0.15	0.02	0.00	170.15	0.00	0.00
Dolores	0.00	0.01	0.01	0.00	0.00	7.31	0.00	0.00
Total	**0.08**	**0.16**	**0.15**	**0.02**	**0.00**	**177.46**	**0.00**	**0.00**

CARB's speciation database was used to determine the fraction of each TAC in the total VOC emissions from each yard truck.[92] All TACs listed in the most recent version of the Emission Inventory Criteria and Guidelines Report for the Air Toxics "Hot Spots" Program were included. The TAC speciation profiles and emission rates for worker vehicles are shown in Table 121. A copy of the relevant section of SPECIATE database is included in Appendix R-2.

[92] Speciation profile number 2105 was used to calculate TAC emissions from this source.

Table 121
TAC Emissions from Gasoline-Fueled Worker Vehicles – ICTF and Dolores Rail Yards
Project Year 2010

CAS	Chemical Name[a]	Organic Fraction of VOC (by weight)[b]	Emissions (tons/yr)		
			ICTF	Dolores	Total
95636	1,2,4-trimethylbenzene	0.0120	9.35×10^{-4}	4.02×10^{-5}	9.75×10^{-4}
106990	1,3-butadiene	0.0068	5.29×10^{-4}	2.27×10^{-5}	5.52×10^{-4}
540841	2,2,4-trimethylpentane	0.0288	2.24×10^{-3}	9.62×10^{-5}	2.34×10^{-3}
75070	acetaldehyde	0.0035	2.71×10^{-4}	1.16×10^{-5}	2.82×10^{-4}
107028	acrolein (2-propenal)	0.0017	1.28×10^{-4}	5.52×10^{-6}	1.34×10^{-4}
71432	benzene	0.0309	2.40×10^{-3}	1.03×10^{-4}	2.50×10^{-3}
4170303	crotonaldehyde	0.0004	2.80×10^{-5}	1.20×10^{-6}	2.92×10^{-5}
110827	cyclohexane	0.0077	5.96×10^{-4}	2.56×10^{-5}	6.21×10^{-4}
100414	ethylbenzene	0.0131	1.02×10^{-3}	4.37×10^{-5}	1.06×10^{-3}
74851	ethylene	0.0794	6.17×10^{-3}	2.65×10^{-4}	6.44×10^{-3}
50000	formaldehyde	0.0197	1.53×10^{-3}	6.58×10^{-5}	1.60×10^{-3}
78795	isoprene	0.0018	1.37×10^{-4}	5.90×10^{-6}	1.43×10^{-4}
98828	isopropylbenzene (cumene)	0.0001	9.34×10^{-6}	4.01×10^{-7}	9.75×10^{-6}
67561	methyl alcohol	0.0015	1.19×10^{-4}	5.09×10^{-6}	1.24×10^{-4}
78933	methyl ethyl ketone (mek)	0.0002	1.77×10^{-5}	7.61×10^{-7}	1.85×10^{-5}
108383	m-xylene	0.0445	3.46×10^{-3}	1.48×10^{-4}	3.60×10^{-3}
91203	naphthalene	0.0006	4.57×10^{-5}	1.97×10^{-6}	4.77×10^{-5}
110543	n-hexane	0.0200	1.55×10^{-3}	6.66×10^{-5}	1.62×10^{-3}
95476	o-xylene	0.0155	1.20×10^{-3}	5.16×10^{-5}	1.25×10^{-3}
115071	propylene	0.0382	2.97×10^{-3}	1.28×10^{-4}	3.10×10^{-3}
100425	styrene	0.0015	1.19×10^{-4}	5.12×10^{-6}	1.24×10^{-4}
108883	toluene	0.0718	5.58×10^{-3}	2.40×10^{-4}	5.82×10^{-3}
Total			**3.11×10^{-2}**	**1.33×10^{-3}**	**3.24×10^{-2}**

Notes:

a. Organic fraction information is from CARB's SPECIATE database. Data used are from the "Cat stabilized exhaust 2005 SSD etoh 2% O (MTBE phaseout)" profile.

b. Organic fraction is reported on a ROG basis using CARB's SPECIATE ROG/TOG ratio of 0.8012.

18. Road Dust

Particulate matter emissions were calculated for paved roadways in both the ICTF and Dolores rail yards. Emissions for Project Year 2010 were calculated according to the methods outlined in AP-42, Section 13.2.1 and detailed in Part IV.A.18 of this report. Table 122 summarizes the activity data, PM_{10} emission factor, control efficiency, and annual PM_{10} emissions from paved roadways in the ICTF and Dolores rail yards. Detailed emission factor derivation calculations, the relevant sections of AP-42, and the relevant sections of the SCAQMD staff report are contained in Appendix S-1.

Table 122
PM_{10} Emissions from Roadways – ICTF and Dolores Rail Yards
Project Year 2010

Yard	Vehicle Type	Annual VMT (mi/yr)[a]	PM_{10} Emission Factor (g/VMT)[b]	Control Efficiency (%)[c]	PM_{10} Emissions (tons/yr)
ICTF	Drayage Trucks	2,381,400.00	12.11	45%	17.49
ICTF	Delivery Trucks	11.50	12.11	45%	0.00
ICTF	Yard Truck	365,000.00	12.11	45%	2.68
ICTF	Worker Vehicles	382,337.50	12.11	45%	2.81
Dolores	Delivery Trucks	502.32	12.11	45%	0.00
Dolores	Yard Truck	16,425.00	12.11	45%	0.12
Dolores	Worker Vehicles	118,007.00	12.11	45%	0.87
Total		**3,263,683.32**			**23.97**

Notes:
a. See Parts IV.B.2, IV.B.6, IV.B. 7 and IV.B. 17 for discussions on the calculation of annual VMT.
b. Calculated based on method outlined in AP-42, Section 13.2.1 and data shown in Table 71.
c. Calculated based on method contained in the SCAQMD Staff Report for Rule 1186 (1/97). Assumes street sweeping occurs twice per week.

C. 2012 Emissions Inventory

The Project Year 2012 inventory quantified onsite criteria pollutant, GHG, and TAC emissions from emission sources at the ICTF and Dolores yards. Table 123 summarized the emissions, by source group. The methodology and assumptions used to prepare the inventory for each source group are discussed in detail in Sections 1 through 18 below.

Table 123
Emissions by Source Category – ICTF and Dolores Rail Yards
Project Year 2012

Source Group	Emissions (tons/yr)						Emissions (metric tons/yr)		
	ROG	CO	NOx	PM_{10}	DPM	SOx	CO_2	N_2O	CH_4
Locomotives	19.78	44.77	118.21	3.03	3.03	0.41	21,071.22	0.53	1.66
Drayage Trucks	20.02	61.42	128.64	4.78	4.57	0.13	12,143.86	0.02	0.06
Cargo Handling Equipment	0.08	1.18	0.86	0.03	0.00	0.00	91.58	0.00	0.00
Heavy Equipment	0.12	10.67	2.80	0.02	0.00	0.00	313.25	0.00	0.00
TRUs and Reefer Cars[a]	3.46	18.88	20.84	0.44	0.44	0.03	2,490.25	0.00	0.01
Delivery Trucks	0.01	0.04	0.08	0.00	0.00	0.00	4.94	0.00	0.00
Yard Trucks	0.00	0.59	0.05	0.00	NA	0.00	446.70	0.00	0.00
IC Engines	0.07	0.18	0.84	0.06	0.06	0.06	27.63	0.00	0.00
Tanks	0.21	NA	NA	NA	NA	NA	NA	NA	NA
Refueling	0.29	NA	NA	NA	NA	NA	NA	NA	NA
Sand Tower	NA	NA	NA	0.00	NA	NA	NA	NA	NA
WWTP	0.00	NA	NA	NA	NA	NA	NA	NA	NA
Steam Cleaners	0.12	2.43	0.17	0.01	NA	0.00	92.78	0.00	0.00
Heater	0.00	0.07	0.08	0.01	NA	0.00	87.85	0.01	0.00
Propane Welder	0.00	0.22	0.14	0.00	NA	0.00	7.85	0.00	0.00
Miscellaneous Equipment	1.88	38.19	0.96	0.06	NA	0.05	87.17	0.00	0.00
Worker Vehicles	0.06	0.14	0.13	0.02	NA	0.00	177.86	0.00	0.00
Road Dust	NA	NA	NA	27.86	NA	NA	NA	NA	NA
Total	**46.10**	**179.32**	**273.80**	**36.32**	**8.10**	**0.68**	**37,042.94**	**0.54**	**1.73**
ICTF-related[b]	**39.12**	**158.88**	**232.57**	**34.90**	**7.08**	**0.55**	**29,700.77**	**0.38**	**1.17**

Notes:
a. In addition to the GHG emissions shown above, CFC emissions from TRU refrigerant loss equal 0.312 metric tons per year.
b. The ICTF-related emissions include emissions that occur within ICTF plus a portion of the emissions from the Dolores Yard. The emissions from the Dolores Yard were allocated based on railcar counts provided by UPRR.

In addition to the total emissions from the ICTF and Dolores yards, Table 123 also shows emissions that are related to ICTF. The ICTF-related emissions include emissions that occur within the ICTF, such as emissions from CHE, plus the portion of the emissions from the Dolores Yard that are related to ICTF. The emissions were divided based on the railcar data provided by UPRR.[93] The 2012 railcar activity was designated as either ICTF intermodal or other intermodal. In 2012, it was estimated that 60% of the railcars entering the Dolores Yard will include freight bound for ICTF. Therefore, it was assumed that 60% of the emissions from Dolores will be related to ICTF in Project Year 2012.

1. Locomotives

For 2012, the amount of through train traffic in the yard is assumed to be constant relative to 2005 levels. Future year emission calculations are intended for assessment of changes in in-yard activity, and do not include port-related activity in the Alameda Corridor mainline adjacent to the Dolores Yard.

Equipment and Activity

Road Power – In 2012, all train activity at ICTF/Dolores is expected to be intermodal freight.[94] The manifest freight that was previously handled at Dolores will be shifted to other yards in the L.A. Basin. To estimate the relative fraction of locomotive models and emission technologies for Project Year 2012, the locomotive model distribution for 2005 intermodal trains was adjusted to reflect the effect of new locomotive acquisitions and older locomotive retirements in the UPRR line-haul fleet. UPRR forecasts for acquisitions and retirements through 2009 were extrapolated to 2012 to estimate the relative growth or shrinkage of the number of each locomotive model (defined by model group, emission control tier, and ZTR/AESS equipment) at the ICTF and Dolores Yards for those years. The resulting forecasts were then normalized by the total number of locomotives to generate year-specific model distributions.

[93] Personal communication with Lanny Schmid of UPRR on August 28, 2007.
[94] Personal communication with Lanny Schmid of UPRR on August 28, 2007.

The train data for the 2005 baseline year allow identification of intermodal and non-intermodal trains. The train data do not reflect whether the freight from the intermodal trains is handled at ICTF or at other on-dock facilities, however. UPRR estimates that in 2005, 43% of the rail cars handled at Dolores/ICTF were ICTF-related intermodal, 43% were on-dock intermodal, and 14% were Dolores manifest freight.[95] In 2012, UPRR estimates that 60% of cars will be ICTF-related intermodal and 40% will be on-dock intermodal.[96]

The total trailing tons of ICTF-related intermodal freight in 2012 is expected to grow in proportion to the total container lift count (1,100,000 in 2012 vs. 626,000 in 2005). To calculate train activity, the number of terminating and originating intermodal trailing tons was assumed to increase by the growth factor. At the same time, the average horsepower per intermodal line-haul locomotive decreased due to the projected changes in the locomotive fleet. This factor was applied to calculate a revised average number of locomotives per consist for 2012 intermodal trains.[97] The projected train activity for 2012 is shown in Table 124.

Table 124
Projected Train Activity – ICTF and Dolores Rail Yards
Project Year 2012

Train Type	East Bound			West Bound		
	No. of Trains	Locos per Train	No. of Setouts	No. of Trains	Locos per Train	No. of Setouts
Intermodal Through	74	3.233	22	215	2.802	166
Intermodal Terminating	0	--	--	2,993	3.139	--
Intermodal Originating	5,206	2.559	--	0	--	--
Power Moves Through	17	2.826	--	7	2.197	--
Power Moves Terminating	393	2.953	--	424	3.358	--
Power Moves Originating	394	3.706	--	1,604	3.194	--

Yard Switching – During 2007, the 10 GP-38 switchers at ICTF and Dolores will be replaced by ULEL "gen-set switchers." The ULEL switchers will be used to perform all

95 Personal communication with Lanny Schmid of UPRR on August 28, 2007.
96 Personal communication with Lanny Schmid of UPRR on August 28, 2007.
97 Assumes that the consists assigned to trains would maintain a constant ratio of available horsepower per trailing ton.

of the yard operations in 2012. Yard switcher operations in Project Year 2012 were based on the assumption that the total work done (in horsepower-hours per year) is proportional to the total trailing tons of freight handled by the switchers.

In 2005 two of the five sets of GP-38s handled the ICTF-related intermodal freight (43% of the total freight) exclusively. The activity level (horsepower-hours per year) for these switchers was increased by the ratio of the predicted lift count for Project Year 2012 (1,100,000 lifts) to the actual 2005 lift count (626,339 lifts).

In the 2005 baseline year, the other three sets of switchers handled the remaining 57% (43% on-dock intermodal and 14% manifest freight) of the freight entering Dolores. It was assumed that the on-dock intermodal fraction was 75% (43% on-dock intermodal/57% of total freight) of the total work performed. The total 2012 activity for these switchers was calculated by multiplying on-dock intermodal activity (horsepower-hours per year) in the 2005 baseline year by the ratio the predicted lift count for Project Year 2012 (1,100,000 lifts) to the actual 2005 lift count (626,339 lifts).

Service and Maintenance – The Service Track and Locomotive Shop at the Dolores Yard were assumed to be operating at capacity during the 2005 baseline year. As discussed previously, the volume of ICTF-related operations at Dolores will increase from the baseline year, but the overall activity level of the Dolores yard will remain constant. Therefore, the number of locomotive service and load testing events was unchanged for Project Year 2012. See Table 6 in Part IV.A.1 for summary of the shop and service data for the 2005 baseline year.

Emission Factors

The HC, CO, NOx, and GHG emission factors, as well as the fuel consumption rates for Project Year 2012, were unchanged from the 2005 baseline year. See Tables 7 through 9 in Part IV.A.1 for the HC, CO, and NOx emission factors, Table 14 in Part IV.A.1 for the GHG emission factors, and Table 12 in Part IV.A.1 for the fuel consumption data.

Fuel sulfur content for both California and 47-state Diesel fuel will decrease in the future. These changes affect both DPM and sulfur oxides emission factors for locomotives. By 2010, California fuel is assumed to have a sulfur content of 15 ppm, and this level is expected to remain constant into the future. The technical support document for the 2004 EPA non-road engine regulations (USEPA, 2004) projects 47-state fuel sulfur levels of 123 ppm in 2012. Using the same methods used for 2005 fuel-specific emission factors (see Part IV.A.1 for details), DPM emission factors were calculated for sulfur levels of 15 ppm and 123 ppm. The DPM emission factors for Project Year 2012 are shown in Tables 125 and 126.

Table 125
DPM Emission Factors (g/hr) for Locomotives – ICTF and Dolores Rail Yards
Adjusted for Fuel Sulfur Content of 15 ppm
Project Year 2012

Model Group	Tier	Throttle Setting										Source[a]
		Idle	DB	N1	N2	N3	N4	N5	N6	N7	N8	
Switchers	N	31	56	23	76	128.54	139.25	171.22	270.03	313.39	406.17	EPA RSD[a]
GP-3x	N	38	72	31	110	173.25	185.67	227.44	365.6	420.58	551.23	EPA RSD[a]
GP-4x	N	47.94	80.04	35.7	134.3	210.86	226.39	286.24	483.85	580.13	744.65	EPA RSD[a]
GP-50	N	26.01	64.08	51.25	142.5	280.83	272.54	335.59	582.01	658.89	841.2	EPA RSD[a]
GP-60	N	48.6	98.45	48.72	131.7	264.99	262.23	319.67	566.09	675.49	853.7	EPA RSD[a]
GP-60	0	21.1	25.4	37.6	75.5	222.99	308.45	441.08	635.46	1022.75	1196.56	SwRI[b] (KCS733)
SD-7x	N	24.02	4.84	40.99	65.75	146.04	212.89	273.54	328.6	431.68	534.22	SwRI[c]
SD-7x	0	14.78	15.14	36.81	61.11	214.6	332.67	383.98	759.46	925.7	1002.48	GM EMD[e]
SD-7x	1	29.2	31.8	37.1	66.2	204.26	259.15	372	625.29	711.45	768.55	SwRI[e] (NS2630)
SD-7x	2	24.4	59.5	38.3	134.2	253.07	263.09	285.54	483.52	610.44	638.44	SwRI[e] (UP8353)
SD-90	N	61.05	108.5	50.1	99.06	238.31	371.07	478.39	288.69	234.5	846.42	GM EMD[d]
Dash 7	N	64.95	180.48	108.23	121.22	302.99	289.8	295	252	242.49	299.37	EPA RSD[a]
Dash 8	N	36.95	147.52	86.04	133.12	245.59	259.27	291.57	314.39	338.07	438.47	GE[d]
Dash 9	N	32.11	53.89	54.22	108.11	185.32	255.69	329.72	368.38	350.09	502.99	SWRI 2000
Dash 9	0	33.84	50.67	56.09	117.36	193.18	233.34	548.02	483.06	437.87	403.85	Average of GE & SwRI[f]
Dash 9	1	16.9	88.4	62.1	140.2	256.2	339.17	377.19	437.85	392.21	554.62	SwRI[b] (CSXT595)
Dash 9	2	7.7	42	69.3	145.8	256.46	322.8	360.55	352.17	369.82	433.02	SwRI[b] (BNSF 7736)
C60-A	N	70.96	83.88	68.57	78.56	234.22	206.99	245.58	262.08	164.18	258.53	GE[e] (UP7555)

Notes:

a. EPA Regulatory Support Document, "Locomotive Emissions Regulation," Appendix B, 12/17/97, as tabulated by CARB and ENVIRON.

b. Base emission rates provided by ENVIRON as part of the BNSF analyses for the Railyard MOU (Personal communication from Chris Lindhjem to R. Ireson, 2006) based on data produced in the AAR/SwRI Exhaust Plume Study (Personal communication from Steve Fritz to C. Lindhjem, 2006).

c. SwRI final report "Emissions Measurements – Locomotives" by Steve Fritz, August 1995.

d. Manufacturers' emissions test data as tabulated by CARB.

e. Base SD-70 emission rates taken from data produced in the AAR/SwRI Exhaust Plume Study (Personal communication from Steve Fritz to R. Ireson, 2006, 2007).

f. Average of manufacturers' emissions test data as tabulated by CARB and data from the AAR/SwRI Exhaust Plume Study, tabulated and calculated by ENVIRON..

Table 126
DPM Emission Factors (g/hr) for Locomotives – ICTF and Dolores Rail Yards
Adjusted for Fuel Sulfur Content of 123 ppm
Project Year 2012

Model Group	Tier	Throttle Setting										Source[a]
		Idle	DB	N1	N2	N3	N4	N5	N6	N7	N8	
Switchers	N	31	56	23	76	128.88	139.97	172.3	271.41	314.54	407.68	EPA RSD[a]
GP-3x	N	38	72	31	110	173.71	186.62	228.87	367.46	422.12	553.28	EPA RSD[a]
GP-4x	N	47.94	80.04	35.7	134.3	211.42	227.55	288.04	486.31	582.25	747.42	EPA RSD[a]
GP-50	N	26.01	64.08	51.25	142.5	281.58	273.94	337.7	584.97	661.29	844.34	EPA RSD[a]
GP-60	N	48.6	98.45	48.72	131.7	265.69	263.57	321.68	568.97	677.95	856.88	EPA RSD[a]
GP-60	0	21.1	25.4	37.6	75.5	223.58	310.04	443.86	638.69	1026.49	1201.02	SwRI[b] (KCS733)
SD-7x	N	24.02	4.84	40.99	65.75	146.43	213.99	275.26	330.27	433.25	536.21	SwRI[c]
SD-7x	0	14.78	15.14	36.81	61.11	215.18	334.37	386.39	763.32	929.08	1006.22	GM EMD[e]
SD-7x	1	29.2	31.8	37.1	66.2	204.81	260.48	374.34	628.47	714.05	771.41	SwRI[e] (NS2630)
SD-7x	2	24.4	59.5	38.3	134.2	253.75	264.44	287.33	485.98	612.66	640.82	SwRI[e] (UP8353)
SD-90	N	61.05	108.5	50.1	99.06	238.94	372.98	481.4	290.16	235.36	849.58	GM EMD[d]
Dash 7	N	64.95	180.48	108.23	121.22	305.04	291.17	296.33	253.72	245.9	303.73	EPA RSD[a]
Dash 8	N	36.95	147.52	86.04	133.12	247.24	260.5	292.88	316.53	342.82	444.86	GE[d]
Dash 9	N	32.11	53.89	54.22	108.11	186.57	256.9	331.2	370.89	355.01	510.32	SWRI 2000
Dash 9	0	33.84	50.67	56.09	117.36	194.48	234.44	550.47	486.34	444.03	409.74	Average of GE & SwRI[f]
Dash 9	1	16.9	88.4	62.1	140.2	257.93	340.77	378.88	440.83	397.73	562.7	SwRI[b] (CSXT595)
Dash 9	2	7.7	42	69.3	145.8	258.19	324.33	362.16	354.56	375.02	439.33	SwRI[b] (BNSF 7736)
C60-A	N	70.96	83.88	68.57	78.56	235.8	207.97	246.68	263.87	166.49	262.3	GE[e] (UP7555)

Notes:

a. EPA Regulatory Support Document, "Locomotive Emissions Regulation," Appendix B, 12/17/97, as tabulated by CARB and ENVIRON.

b. Base emission rates provided by ENVIRON as part of the BNSF analyses for the Railyard MOU (Personal communication from Chris Lindhjem to R. Ireson, 2006) based on data produced in the AAR/SwRI Exhaust Plume Study (Personal communication from Steve Fritz to C. Lindhjem, 2006).

c. SwRI final report "Emissions Measurements – Locomotives" by Steve Fritz, August 1995.

d. Manufacturers' emissions test data as tabulated by CARB.

e. Base SD-70 emission rates taken from data produced in the AAR/SwRI Exhaust Plume Study (Personal communication from Steve Fritz to R. Ireson, 2006, 2007).

f. Average of manufacturers' emissions test data as tabulated by CARB and data from the AAR/SwRI Exhaust Plume Study, tabulated and calculated by ENVIRON..

Sulfur oxides emission factors were calculated, using the method discussed in Part IV. A.1, based on fuel sulfur levels of 15 and 123 ppm. The SOx emission factors for Project Year 2010 are shown in Table 127.

Table 127
SOx Emission Factors for Locomotives – ICTF and Dolores Rail Yards
Project Year 2012

Fuel Sulfur Content (ppm)		SOx Emission Factor (g/lb of fuel)[a]	
CA Diesel	47-State Diesel	CA Diesel	47-State Diesel
15	123	0.0132	0.109

Notes:
a. Based on 8.83×10^{-4} g of SOx per ppm-lb of fuel.

Emissions

Emissions were calculated for 2012 using the same methodology as the 2005 baseline year (See Part IV.A.1) and the emission factors detailed above. As previously discussed, the intermodal line-haul locomotive model distributions was adjusted based on UPRR acquisition and retirement projections. The number of locomotives per consist for different intermodal train events was adjusted downward in inverse proportion to the increase in average locomotive horsepower. Intermodal train activity (i.e., number of train events) was assumed to grow as a result of the increased lift counts at ICTF and the changes in the fraction of total intermodal activity associated with on-dock trains. The combined effect of these two adjustment results in a constant ratio of available consist horsepower per trailing ton of freight, and an increase in total activity in proportion to the projected growth in total trailing tons of freight.

Yard switching operations supporting ICTF for 2012 were projected to increase in proportion to the lift count projections. Yard switching operations supporting on-dock trains were projected to increase or decrease in proportion to the estimated changes in trailing tons of freight for those trains in those years. It was assumed that ULEL switcher locomotive were used for all switching activities in 2012. Table 128 shows the locomotive emissions for Project Year 2012.

Table 128 Criteria Pollutant, DPM, and GHG Emissions from Locomotives – ICTF and Dolores Rail Yards Project Year 2012									
	Emissions (tons/yr)						Emissions (metric tons/yr)		
Activity	ROG	CO	NOx	PM_{10}	DPM	SOx	CO_2	N_2O	CH_4
Train Activity	2.11	3.99	33.58	1.04	1.04	0.13	2,472.90	0.06	0.19
Yard Operations	15.15	35.39	50.88	1.10	1.10	0.16	15,917.02	0.40	1.25
Load Testing	0.61	1.69	19.50	0.45	0.45	0.03	1,539.17	0.04	0.12
Service Idling	1.90	3.70	14.25	0.44	0.44	0.09	1,142.13	0.03	0.09
Total	**19.78**	**44.77**	**118.21**	**3.03**	**3.03**	**0.41**	**21,071.22**	**0.53**	**1.66**

2. HHD Diesel-Fueled Drayage Trucks

The 2012 calendar year emissions from HHD Diesel-fueled drayage trucks are based on the number of truck trips, the truck fleet distribution, the length of each trip, and the amount of time spent idling. The trucks are owned and operated by many large trucking companies and independent operators (draymen). Therefore, a fleet distribution is not available. For emission calculations, the EMFAC2007 model default fleet distribution for HHD Diesel-fueled trucks operating in Los Angeles County during calendar year 2012 was used. The number of truck trips was based on the predicted lift count for 2012,[98] a gate count balancing factor,[99] and the assumption that 40% of the trucks entering ICTF with a container also leave the facility with a container.[100] See Appendix B-1 for a detailed discussion on the calculation methodology.

Table 129 summarizes the activity data, such as annual VMT and idling time, for HHD Diesel-fueled drayage trucks operating at ICTF. Based on discussions with UPRR staff, it was assumed that, on average, each truck will idle a total of 20 minutes per trip, including 10 minutes of idling at the gate, 5 minutes of idling while containers are loaded or unloaded, and 5 minutes of idling for other delays. The total idling time per trip has

[98] Per the ICTF Modernization Plan.
[99] The gate balancing factor is equal to the "in-gate" container count divided by the total number of containers passing through the "in-gate" and "out-gate" of ICTF. In 2006, the gate balancing factor was 61%.
[100] Personal communication from Greg Chiodo of HDR on September 24, 2007.

been reduced for the 2005 baseline year due to the improved efficiency of the WSG cranes.

Table 129
Summary of HHD Drayage Truck Activity Data – ICTF Rail Yard
Project Year 2012

Number of HHD Truck Trips[a]	VMT per HHD Truck Trip (mi/trip)[b]	Annual VMT (mi/yr)	Fuel Use (gal/yr)[c]	Idling Time	
				(min/trip)[d]	(hr/yr)
1,663,200	1.75	2,910,600	1,208,524	20	554,400

Notes:
a. Number of truck trips based on predicted lift count for 2012 and was estimated by HDR.
b. Trip length estimated from aerial photos of the Yard.
c. Includes fuel used during traveling and idling.
d. Engineering estimate based on personal communication with the Intermodal Operations Manager for the ICTF, Commerce, LATC, and Oakland Yards. The operations of the WSG cranes will reduce idling to approximately 20 minutes per trip in 2012.

Calendar year 2012 criteria pollutant emission factors for the HHD Diesel-fueled drayage trucks were obtained from CARB's EMFAC2007 model. The emissions from idling and traveling modes were calculated separately. Fleet average emission factors for traveling exhaust emissions were calculated using the EMFAC2007 model with the BURDEN output option. Fleet average emission factors for idling were calculated using the EMFAC2007 model with the EMFAC output option. Since the fleet distribution is not known, the EMFAC2007 default distribution for Los Angeles County was used. The 2012 emission factors for the HHD Diesel-fueled drayage trucks are shown in Table 130. Detailed emission factor derivation calculations and the EMFAC2007 output are contained in Appendix B-4.

Table 130 Criteria Pollutant Emission Factors for HHD Diesel-Fueled Drayage Trucks – ICTF Rail Yard Project Year 2012						
	Fleet Average Emission Factors					
Operating Mode	ROG	CO	NOx	PM_{10}[c]	DPM[c]	SOx
Traveling (g/mi)[a]	4.08	10.25	18.49	1.21	1.15	0.03
Idling (g/hr)[b]	11.32	46.71	113.45	1.45	1.45	0.06

Notes:

a. Emission factors calculated for calendar year 2012 using the EMFAC2007 model with the BURDEN output option. The default fleet distribution for Los Angeles County was used.

b. Emission factors calculated for calendar year 2013 using the EMFAC2007 model with the EMFAC output option. The default fleet distribution for Los Angeles County was used.

c. The PM_{10} emission factor includes engine exhaust emissions along with brake and tire wear. The DPM emission factor includes engine exhaust emissions only.

Emission factors from CARB's *Draft Emission Factors for Mandatory Reporting Program* document (August 10, 2007) were used to calculate GHG emissions from drayage truck operations. The GHG emission factors are based on fuel consumption, not activity (i.e. miles driven or hours of operation), or model year. Therefore, the same factors are used to calculate emissions from both traveling and idling modes and for all model year trucks. A fuel-specific carbon oxidization factor, from the CARB emission factor document, was also used to calculate CO_2 emissions. The GHG emission factors and carbon oxidization factor used to calculate emissions from drayage trucks during Project Year 2012 are shown in Table 131. A copy of CARB's *Draft Emission Factors for Mandatory Reporting Program* document is contained in Appendix C.

Table 131 GHG Emission Factors for HHD Diesel-Fueled Drayage Trucks – ICTF Rail Yard Project Year 2012				
	Carbon Oxidization	Emission Factors (kg/gal)[a]		
Operating Mode	Factor (%)	CO_2	N_2O[c]	CH_4[c]
Traveling/Idling[b]	99.0	10.15	1.39×10^{-5}	4.16×10^{-5}

Notes:

a. Emission factors from CARB's *Draft Emission Factors for Mandatory Reporting Program* document (August 10, 2007).

b. Emission factors are based on fuel consumption; therefore, the same factors are used for both the traveling and idling modes.

c. Based on a Diesel fuel HHV of 5.825 MMBtu/barrel (from *CARB Draft Emission Factors for Mandatory Reporting Programs*, August 10, 2007) and 42 gallons per barrel.

To calculate the 2012 calendar year emissions from drayage truck operations, the activity data shown in Table 129 were combined with the emission factors shown in Tables 130 and 131. Table 132 shows the criteria pollutant, DPM, and GHG emission estimates for the HHD Diesel-fueled drayage trucks operating at ICTF during Project Year 2012.

Table 132
Criteria Pollutant, DPM, and GHG Emissions from HHD Diesel-Fueled Drayage Trucks – ICTF Rail Yard
Project Year 2012

Operating Mode	Emission (tons/yr)						Emissions (metric tons/yr)		
	ROG	CO	NOx	PM_{10}	DPM	SOx	CO_2	N_2O	CH_4
Traveling	13.10	32.88	59.31	3.89	3.68	0.09	8,475.32	0.01	0.04
Idling	6.92	28.54	69.33	0.89	0.89	0.04	3,668.54	0.01	0.02
Total	**20.02**	**61.42**	**128.64**	**4.78**	**4.57**	**0.13**	**12,143.86**	**0.02**	**0.06**

3. Cargo Handling Equipment (CHE)

A key component of the modernization project is the replacement of Diesel-fueled cargo handling equipment with 39 electric wide span gantry (WSG) cranes. The cranes will be installed in 3 sets of 13 cranes.[101] All 39 WSG cranes are expected to be operating at full capacity by 2012.[102] All of the Diesel-fueled CHE, except one forklift and one top pick, will be removed from the facility. The use of the forklift and the top pick will be limited to emergency operation only. In addition, two alternative-fueled yard hostlers[103] will be used for emergencies.

The following assumptions were used to determine the activity level for the Diesel-fueled CHE and the alternative-fueled yard hostlers.

- All 39 of the WSG cranes will be operating at full capacity in 2012.[104] Diesel-fueled CHE will be used for emergency operation only.
- The forklift and top pick will be used for a maximum of 1 hour per day each.

[101] Per ICTF Modernization Plan.
[102] Personal communication with Lanny Schmid of UPRR on August 21, 2007.
[103] The yard hostlers will be fueled with biodiesel, propane, or LNG.
[104] Personal communication with Lanny Schmid of UPRR on August 21, 2007.

- Two alternative-fueled yard hostlers will be used at the facility for emergencies. They will be fueled with biodiesel, propane, or LNG[105] and operation will not exceed 1 hour per day per unit.

The CHE equipment specification and activity data for Project Year 2012 are summarized in Table 133.

Table 133
Equipment Specifications and Activity Data for Cargo Handling Equipment – ICTF Rail Yard
Project Year 2012

Equipment Type	Make/Model	Model Year	Rating (hp)	No. of Units[c]	Hours of Operation (hr/yr/unit)	Fuel Use (gal/yr)
Forklift[a]	Toyota 6FDU25	1997	85	1	365	642[c]
Top Pick[a]	Taylor Tay-950	1989	350	1	365	4,352[c]
Yard Hostler[b]	TBD	2012	175	2	365	7,026[e]
WSG Crane	TBD	TBD	TBD	39	8,760	0[f]
Total				**43**		**12,020**

Notes:
a. This equipment will be Diesel-fueled and operated for emergency use only.
b. The yard hostlers will be fueled with biodiesel, propane, or LNG and be used for emergencies only.
c. Equipment counts are from the ICTF Modernization Plan.
d. Fuel use is based on the equipment specific BSFC rate from the OFFROAD2007 model and a Diesel fuel density of 7.1 lb/gal.
e. Fuel use is based on the equipment specific BSFC rate from the OFFROAD2007 model and an LPG density of 3.9 lb/gal.
f. The WSG cranes are electric.

Equipment specific criteria pollutant and DPM emission factors for the 2012 calendar year were calculated using a spreadsheet developed by CARB staff, based on the OFFROAD2007 model. The DPM emission factors were adjusted, as needed, to show compliance with CARB's *Regulation for Mobile Cargo Handling Equipment at Ports and Intermodal Rail Yards* (CARB, 2005).[106] It was assumed that a Level 3 verified Diesel emission control strategy (VDECS), with a minimum DPM reduction of 85%, was installed on each affected equipment unit.

[105] Emissions were calculated based on the use of LPG/LNG. The OFFROAD model does not distinguish between these fuels.
[106] Available at *http://www.arb.ca.gov/ports/cargo/cargo.htm*.

Emission factors from CARB's *Draft Emission Factors for Mandatory Reporting Program* document (August 10, 2007) were used to calculate GHG emissions from CHE operations. The GHG emission factors are based on fuel consumption and are not equipment or year specific. A fuel-specific carbon oxidization factor, from the CARB emission factor document, was also used to calculate CO_2 emissions. The criteria pollutant emission factors, DPM, and GHG emission factors, as well as the carbon oxidization factor used to calculate emissions from the CHE, are shown in Table 134. Detailed emission factor derivation calculations and the CARB spreadsheet are contained in Appendix D-3. A copy of CARB's *Draft Emission Factors for Mandatory Reporting Program* document is contained in Appendix C.

To calculate the emissions from CHE operations, the activity data shown in Table 133 were combined with the emission factors shown in Table 134. The criteria pollutant, DPM, and GHG emission estimates for the CHE operating at ICTF during Project Year 2012 are shown in Table 135.

Table 134
Criteria Pollutant, DPM, and GHG Emission Factors for Cargo Handling Equipment – ICTF Rail Yard
Project Year 2012

Equipment Type	Make/ Model	Model Year	Fuel Type	Carbon Oxidization Factor (%)[b]	Emission Factors (g/hp-hr)[a]						Emission Factors (kg/gal)[b]		
					ROG	CO	NOx	PM_{10}	DPM	SOx	CO_2	N_2O[c]	CH_4[c]
Forklift	Toyota 6FDU25	1997	Diesel	99.0	0.99	3.40	8.75	*0.10*	*0.10*	0.062	10.15	1.39×10^{-5}	4.16×10^{-5}
Top Pick	Taylor Tay-950	1989	Diesel	99.0	0.68	2.70	8.17	*0.06*	*0.06*	0.060	10.15	1.39×10^{-5}	4.16×10^{-5}
Yard Hostler	TBD	2012	LPG/LNG[d]	99.0	0.23	16.75	1.68	0.60	NA	0.00	5.95	9.02×10^{-6}	9.02×10^{-5}
WSG Crane	TBD	TBD	Electric	99.0	NA	NA	NA	NA	NA	NA	NA	NA	NA

Notes:

a. Criteria pollutant emission factors calculated using a spreadsheet, developed by CARB staff, based on the OFFROAD2007 model. DPM emission factors that are shown in italics were adjusted for compliance with CARB's Regulation for Mobile Cargo Handling Equipment at Ports and Intermodal Rail Yards. It was assumed that a Level 3 VDECS (85% control) was installed on each affected unit.

b. GHG emission factors and carbon oxidization factors from CARB's *Draft Emission Factors for Mandatory Reporting Program* document (August 10, 2007).

c. Emission factor based on a Diesel fuel HHV of 5.825 MMBtu/barrel (from CARB Draft Emission Factors for Mandatory Reporting Programs, August 10, 2007) and 42 gallons per barrel.

d. The yard hostlers will be fueled with biodiesel, propane, or LNG. Emissions were calculated based on the use of LPG/LNG. The OFFROAD model does not distinguish between these fuels. Emission factors for all potential fuels are shown in Section 1.5.1.7 of the ADP.

Table 135
Criteria Pollutant, DPM, and GHG Emissions from Cargo Handling Equipment – ICTF Rail Yard
Project Year 2012

Equipment Type	Make/Model	Model Year	Fuel Type	Emission (tpy)						Emission (metric tons/yr)		
				ROG	CO	NOx	PM_{10}	DPM	SOx	CO_2	N_2O	CH_4
Forklift	Toyota 6FDU25	1997	Diesel	0.01	0.04	0.09	0.00	0.00	0.00	6.45	0.00	0.00
Top Pick	Taylor Tay-950	1989	Diesel	0.06	0.22	0.68	0.00	0.00	0.00	43.74	0.00	0.00
Yard Hostler	Capacity TJ5000	2005	Alternative	0.01	0.92	0.09	0.03	0.00	0.00	41.39	0.00	0.00
WSG Crane	TBD	TBD	Electric	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total				**0.09**	**1.18**	**0.86**	**0.03**	**0.00**	**0.00**	**91.58**	**0.00**	**0.00**

CARB's speciation profile database was used to determine the fraction of each TAC in the total ROG emissions from the propane-fueled yard hostlers. The database does not contain a profile for propane combusted in an internal combustion engine. Therefore, the speciation profile for natural gas-fired reciprocating engines was used.[107] All TACs listed in the most recent version of the Emission Inventory Criteria and Guidelines Report for the Air Toxics "Hot Spots" Program have been included. The TAC speciation profile and annual emissions of each TAC are shown in Table 136. The relevant sections of the speciation profile database are included in Appendix D-3.

Table 136
TAC Emissions from Propane-Fueled Yard Hostlers – ICTF Rail Yard
Project Year 2012

CAS	Pollutant[a]	Organic Fraction[b,c]	Emissions (tons/yr)
95636	1,2,4-trimethylbenzene	0.00001	1.89×10^{-7}
75070	acetaldehyde	0.00003	5.67×10^{-7}
71432	benzene	0.00010	2.08×10^{-6}
110827	cyclohexane	0.00001	1.89×10^{-7}
100414	ethylbenzene	0.00001	1.89×10^{-7}
74851	ethylene	0.00058	1.19×10^{-5}
50000	formaldehyde	0.00074	1.53×10^{-5}
108383	m-xylene	0.00001	1.89×10^{-7}
110543	n-hexane	0.00002	3.78×10^{-7}
95476	o-xylene	0.00001	1.89×10^{-7}
115071	propylene	0.00154	3.20×10^{-5}
108883	toluene	0.00004	7.56×10^{-7}
1330207	xylene	0.00002	3.78×10^{-7}
Total			$\mathbf{6.43 \times 10^{-5}}$

Notes:
a. Emissions were calculated for only those chemicals that were in both the CARB SPECIATE database and the AB 2588 list.
b. Organic fraction data are from CARB's SPECIATE database. Data are from profile #719 "I.C.E. reciprocating – natural gas." A speciation profile for propane was not included in the database.
c. Organic fraction is reported on a ROG basis using CARB's SPECIATE ROG/TOG ratio of 0.0914.

4. Heavy Equipment

The Diesel-fueled heavy equipment is used at ICTF for non-cargo-related activities at the Yard, such as RTG crane maintenance, handling of parts and Company material,

[107] Speciation profile number 719 was used to calculate TAC emissions for these sources.

derailments, etc. Also, two propane-fueled forklifts are used at the locomotive shop at the Dolores Yard. It was assumed that by 2012, the crane maintenance shop would be closed due to the replacement of Diesel-fueled RTG cranes with the electric WSG cranes. While maintenance will be required on the WSG cranes, the nature of those operations has not yet been determined and specifications for support equipment are not available. Also, the WSG cranes are stationary units. Therefore, maintenance will not be performed at a centralized location.

The following assumptions were used to calculate the 2012 activity data for each piece of heavy equipment.

- No change in the hours of operation for the Grove Crane and the propane-fueled forklifts at the Dolores Yard. These units are used by the Car Department and the Locomotive Shop, respectively, and those operations are not tied to cargo handling operations.
- Since RTG operations were replaced by the WSG cranes, the crane maintenance shop would be closed and all associated Diesel-fueled equipment would be retired. As discussed above, maintenance will be required on the WSG cranes, but the nature of those operations has not yet been determined.
- The man lift would be retained and used in various locations within the Yard. Assumed no change in the hours of operation from the baseline year.

The heavy equipment specification and activity data for the Project Year 2012 are summarized in Table 137.

Table 137 Equipment Specifications and Activity Data for Heavy Equipment – ICTF and Dolores Rail Yards Project Year 2012									
Yard	Location	Equipment Type	Make/Model	Fuel Type	Model Year	Rating (hp)	No. of Units	Hours of Operation (hr/yr/unit)[a]	Fuel Use (gal/yr)[b]
ICTF	Car Department	Crane	Grove RT600E	Diesel	2004	173	1	1,095	5,392
ICTF	Various Locations	Man Lift	TBD	Diesel	2008	50	1	1,825	3,133
Dolores	Locomotive Shop	Forklift	Yale GP060	Propane	Unknown	150	2	3,285	38,441
Total							**4**		**46,966**

Notes:
a. Assumed no change from the 2005 baseline in hours of operation.
b. The total fuel used by all units in each category.

Equipment-specific criteria pollutant and DPM emission factors for Project Year 2012 were calculated using the OFFROAD2007 model. The DPM emission factors were adjusted, as needed, to show compliance with CARB's *Regulation for Mobile Cargo Handling Equipment at Ports and Intermodal Rail Yards* (CARB, 2005). It was assumed that a Level 3 verified Diesel emission control strategy (VDECS), with a minimum DPM reduction of 85%, was installed on each affected equipment unit.

Emission factors from CARB's *Draft Emission Factors for Mandatory Reporting Program* document (August 10, 2007) were used to calculate GHG emissions from heavy equipment operations. The GHG emission factors are based on fuel consumption and are not equipment or year specific. A fuel-specific carbon oxidization factor, from the CARB emission factor document, was also used to calculate CO_2 emissions. The criteria pollutant emission factors, DPM, and GHG emission factors, as well as the carbon oxidization factor used to calculate emissions from the heavy equipment are shown in Table 135. Detailed emission factor derivation calculations and the OFFROAD2007 output are contained in Appendix E-3. A copy of CARB's *Draft Emission Factors for Mandatory Reporting Program* document is contained in Appendix C.

To calculate the emissions from CHE operations, the activity data shown in Table 137 were combined with the emission factors shown in Table 138. The criteria pollutant, DPM, and GHG emission estimates for the Diesel-fueled CHE operating at ICTF during Project Year 2012 are shown in Table 139.

Table 138
Criteria Pollutant, DPM, and GHG Emission Factors for Heavy Equipment – ICTF and Dolores Rail Yards
Project Year 2012

Yard	Equipment Type	Make/ Model	Fuel Type	Model Year	Carbon Oxidization Factor (%)[c]	Emission Factor (g/bhp-hr)[a]						Emission Factor (kg/gal)[c]		
						ROG[b]	CO	NOx	PM_{10}	DPM	SOx	CO_2	N_2O[d]	CH_4[d]
ICTF	Crane	Grove RT600E	Diesel	2004	99.0	0.64	3.56	5.33	0.04	*0.04*	0.01	10.15	1.39×10^{-5}	4.16×10^{-5}
ICTF	Man Lift	Unknown	Diesel	2008	99.0	0.21	3.25	2.84	0.01	0.01	0.01	10.15	1.39×10^{-5}	4.16×10^{-5}
Dolores	Forklift	Yale GP060	Propane	ALL[e]	99.5	0.15	31.29	6.71	0.06	NA	0.00	5.95	3.74×10^{-5}	8.31×10^{-6}

Notes:

a. Criteria pollutant emission factors from the OFFROAD2007 model. DPM emission factors that are shown in italics were adjusted for compliance with CARB's Regulation for Mobile Cargo Handling Equipment at Ports and Intermodal Rail Yards. It was assumed that a Level 3 VDECS (85% control) was installed on each affected unit.

b. Evaporative emissions for these sources are negligible.

c. GHG emission factors and carbon oxidization factor from CARB's *Draft Emission Factors for Mandatory Reporting Program* document (August 10, 2007).

d. Emission factors for Diesel fuel sources based on a Diesel fuel HHV of 5.825 MMBtu/barrel (from CARB Draft Emission Factors for Mandatory Reporting Programs, August 10, 2007) and 42 gallons per barrel. Emission factors for propane-fueled sources based on an LPG HHV of 91,300 Btu/gal (from the Transportation Energy Data Book: Edition 26, U.S. Department of Energy, 2007).

e. To obtain the criteria pollutant emission factors, the forklifts are modeled as the calendar year 2012 fleet average model year group from the OFFROAD2007 model.

Table 139
Criteria Pollutant, DPM, and GHG Emissions from Heavy Equipment – ICTF and Dolores Rail Yards
Project Year 2012

Yard	Equipment Type	Make/Model	Fuel Type	Model Year	Emissions (tons/year)						Emission (metric tons/year)		
					ROG	CO	NOx	PM_{10}	DPM	SOx	CO_2	N_2O	CH_4
ICTF	Crane	Grove RT600E	Diesel	2004	0.06	0.32	0.48	0.00	0.00	0.00	54.18	0.00	0.00
ICTF	Man Lift	Unknown	Diesel	2008	0.01	0.15	0.13	0.00	0.00	0.00	31.49	0.00	0.00
Dolores	Forklift	Yale GP060	Propane	ALL	0.05	10.20	2.19	0.02	0.00	0.00	227.58	0.00	0.00
Total					**0.12**	**10.67**	**2.80**	**0.02**	**0.00**	**0.00**	**313.25**	**0.00**	**0.00**

CARB's speciation profile database was used to determine the fraction of each TAC in the total ROG emissions from the propane-fueled forklifts. The database does not contain a profile for propane combusted in an internal combustion engine. Therefore, the speciation profile for natural gas-fired reciprocating engine was used.[108] All TACs listed in the most recent version of the Emission Inventory Criteria and Guidelines Report for the Air Toxics "Hot Spots" Program have been included. The TAC speciation profile and annual emissions of each TAC are shown in Table 140. The relevant sections of the speciation profile database are included in Appendix E-3.

Table 140
TAC Emissions from Propane-Fueled Forklifts – Dolores Rail Yard
Project Year 2012

CAS	Pollutant[a]	Organic Fraction[b,c]	Emissions (tons/yr)
95636	1,2,4-trimethylbenzene	0.00001	4.61×10^{-7}
75070	acetaldehyde	0.00003	1.38×10^{-6}
71432	benzene	0.00010	5.07×10^{-6}
110827	cyclohexane	0.00001	4.61×10^{-7}
100414	ethylbenzene	0.00001	4.61×10^{-7}
74851	ethylene	0.00058	2.90×10^{-5}
50000	formaldehyde	0.00074	3.73×10^{-5}
108383	m-xylene	0.00001	4.61×10^{-7}
110543	n-hexane	0.00002	9.21×10^{-7}
95476	o-xylene	0.00001	4.61×10^{-7}
115071	propylene	0.00154	7.78×10^{-5}
108883	toluene	0.00004	1.84×10^{-6}
1330207	xylene	0.00002	9.21×10^{-7}
Total			$\mathbf{1.57 \times 10^{-4}}$

Notes:
a. Emissions were calculated for only those chemicals that were in both the CARB SPECIATE database and the AB 2588 list.
b. Organic fraction data are from CARB's SPECIATE database. Data are from profile #719 "I.C.E. reciprocating – natural gas." A speciation profile for propane was not included in the database.
c. Organic fraction is reported on a ROG basis using CARB's SPECIATE ROG/TOG ratio of 0.0914.

5. TRUs and Reefer Cars

Criteria pollutant, DPM, and GHG emissions were calculated from the Diesel-fueled engines that power the refrigeration units on TRUs and reefer cars. In addition to the

[108] Speciation profile number 719 was used to calculate TAC emissions for these sources.

Diesel engine exhaust emissions, GHG emissions from refrigerant loss were also calculated.

The TRUs are owned by a variety of independent shipping companies and equipment-specific data are not available. Therefore, the default Diesel engine equipment rating and distribution contained in the OFFROAD2007 model were used for emission calculations. It was assumed that the number of TRUs and reefer cars in the Yard at any one time remained constant during the year, with individual units cycling in and out of the Yard.

Emissions from TRUs and reefer cars are based on average size of the Diesel engines, the average number of units in the Yard, and the hours of operation for each engine. The number of units in the yard during the 2012 calendar year was calculated by multiplying the 2005 TRU count, based on UPRR car data reports, by the ratio of the predicted lift count for 2012[109] to the 2005 lift count.[110] The equipment size and hours of operation for each unit were not changed from the 2005 baseline assumptions. Equipment specifications and activity data for TRUs and reefer cars are summarized in Table 141.

Table 141
Equipment Specifications and Activity Data for TRUs and Reefer Cars – ICTF Rail Yard
Project Year 2012

Equipment Type	Average Rating (hp)[a]	Average No. of Units in Yard[b]	Hours of Operation (hr/day)[c]	Hours of Operation (hr/yr)[d]	Fuel Use (gal/yr)[e]
Container	28.56	123	4	1,460	213,331
Railcar	34	18	4	1,460	34,491

Notes:

a. Based on the average horsepower distribution in the OFFROAD2007 model.

b. UPRR staff estimates and car data reports indicate that in 2005 there were approximately 35 TRUs and 2-5 reefer cars in the Yard at any given time. To be conservative, these estimates were increased by 100%. For 2012, the number of TRUs and reefer cars was equal to the No. of Units in 2005 x (2012 lift count/2005 lift count).

c. From CARB's *Staff Report: Initial Statement of Reason for Proposed Rulemaking for Airborne Toxic Control Measure for In-Use Diesel-Fueled Transport Refrigeration Units (TRU) and TRU Generator Sets, and Facilities Where TRUs Operate*, October 2003.

d. It was assumed that the number of units and the annual hours of operation remain constant, with individual units cycling in and out of the Yard.

e. Fuel use calculated based on the BSFC contained in the OFFROAD2007 model and a Diesel fuel density of 7.1 lb/gal. Fuel use shown is for all units in each category.

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[109] From the ICTF Modernization Plan.

[110] Provided by UPRR.

Criteria pollutant and DPM emission factors for the Diesel-fueled engines on TRUs and reefer cars are from the OFFROAD2007 model. The DPM emission factor was adjusted to show compliance with the CARB's Airborne Toxic Control Measure for In-Use Diesel-Fueled Transport Refrigeration Units (TRU) and TRU Generator Sets, and Facilities Where TRUs Operate (CARB, 2004).[111] Emission factors from CARB's *Draft Emission Factors for Mandatory Reporting Program* document (August 10, 2007) were used to calculate GHG emissions from TRU engine operations. A fuel-specific carbon oxidization factor, from the CARB emission factor document, was also used to calculate CO_2 emissions. The criteria pollutant, DPM, and GHG emission factors, as well as the carbon oxidation factor, used to calculate emissions from the TRUs and reefer cars are shown in Table 142. Detailed emission factor derivation calculations and the OFFROAD2007 output are contained in Appendix F-3. A copy of CARB's *Draft Emission Factors for Mandatory Reporting Program* document is contained in Appendix C.

[111] Available at *http://www.arb.ca.gov/regact/trude03/fro1.pdf*

Table 142
Criteria Pollutant, DPM, and GHG Emission Factors for Diesel-Fueled TRUs and Reefer Car Engines – ICTF Rail Yard
Project Year 2012

Equipment Type	Carbon Oxidization Factor (%)[e]	Emission Factors (g/hp-hr-unit)[a]						Emission Factors (kg/gal)[d]		
		VOC[b]	CO	NOx	PM_{10}	DPM[c]	SOx[d]	CO_2	N_2O[f]	CH_4[f]
TRU	99.0	0.94	5.09	5.64	0.12	0.12	0.01	10.15	1.39×10^{-5}	4.16×10^{-5}
Reefer Car	99.0	1.01	5.57	6.01	0.12	0.12	0.01	10.15	1.39×10^{-5}	4.16×10^{-5}

Notes:
a. Emission factors from OFFROAD2007 model.
b. Evaporative emissions from this source are negligible.
c. DPM emission factor was adjusted to show compliance with the TRU ATCM. The average of the LETRU and ULETRU factors from Table 3 of the ATCM was used.
d. Emission factor based on a Diesel fuel sulfur content of 130 ppm.
e. GHG emission factors and carbon oxidization factor from CARB's *Draft Emission Factors for Mandatory Reporting Program* document (August 10, 2007).
f. Emission factors for Diesel fuel sources based on a Diesel fuel HHV of 5.825 MMBtu/barrel (from CARB Draft Emission Factors for Mandatory Reporting Programs, August 10, 2007) and 42 gallons per barrel

To calculate the emissions from the operation of the Diesel-fueled engines on TRUs and reefer cars, the activity data shown in Table 138 was combined with the emission factors shown in Table 139. The criteria pollutant, DPM, and GHG emission estimates for the Diesel-fueled engines on TRUs and reefer cars operating at ICTF during Project Year 2012 are shown in Table 143.

Table 143
Emissions from Diesel-Fueled TRUs and Reefer Car Engines – ICTF Rail Yard
Project Year 2012

Equipment Type	Emissions (tons/yr)						Emissions (metric tons/yr)		
	VOC	CO	NOx	PM_{10}	DPM	SOx	CO_2	N_2O	CH_4
TRU	2.95	16.04	17.78	0.38	0.38	0.03	2,143.66	0.00	0.01
Reefer Car	0.51	2.84	3.06	0.06	0.06	0.00	346.58	0.00	0.00
Total	**3.46**	**18.88**	**20.84**	**0.44**	**0.44**	**0.03**	**2,490.25**	**0.00**	**0.01**

In addition to the GHG emissions from the Diesel-fueled engines on the TRUs and reefer cars, GHG emissions were calculated for refrigerant losses from TRUs. Emissions were calculated for HFC-125, HFC-134a, and HFC-143a, according to the methods outlined in the *Berths 136-147 (TraPac) Container Terminal Draft Environmental Impact Statement (EIS)/Environmental Impact Report (EIR)* (Port of Los Angeles, 2007). The activity data, emission factors, and emissions from TRU and reefer car refrigerant loss are shown in Table 144.

Table 144
GHG Emissions from TRU and Reefer Car Refrigerant Loss – ICTF Rail Yard
Project Year 2012

Equipment Type	Avg. No. of Units in Yard[a]	Refrigerant Charge per Unit (kg)[b]	Annual Refrigerant Loss Rate (%)[c]	Annual Refrigerant Loss (kg/yr)	Emissions by Refrigerant[d,e] (metric tons/yr)		
					HFC-125	HFC-134a	HFC-143a
TRU	123	6.35	35%	273.23	0.060	0.142	0.071
Reefer Car	18	6.35	35%	39.03	0.009	0.020	0.010
Total	**140**			**312.26**	**0.069**	**0.162**	**0.081**

Notes:
a. See Table 138.
b. From Berths *136-147 (TraPac) Container Terminal Project Draft EIS/EIR* (POLA, 2007).
c. POLA upper bound estimate, TraPac Draft EIS/EIR.
d. POLA estimate, TraPac Draft EIS/EIR.
e. Assumes a mix of refrigerants of 50% R404a and 50% HFC-134a; assumes R404a equals 52% HFC-143a, 44% HFC-125, and 4% HFC-134a.

6. HHD Diesel-Fueled Delivery Trucks

In addition to the drayage trucks, HHD trucks deliver Diesel fuel, oil, sand, and soap to the Dolores Yard and gasoline, Diesel fuel, and oil to ICTF. The annual number of delivery truck trips was calculated based on the facility gasoline, Diesel fuel, oil, and soap throughput and a tanker truck capacity of 8,000 gallons per truck. The annual number of sand delivery truck trips was based on the discussions with UPRR staff. Per the Dolores Yard Operations Manager, the facility receives 2 to 3 sand deliveries per week. For the 2012 emissions inventory, it was assumed that there were no changes in annual throughput for tanks located at the Dolores Yard since overall activity levels at the Dolores Yard is expected to remain constant. For tanks located at ICTF, it was assumed that all of the previously existing tanks were removed and a new tank, for the alternative fuel was installed[112]. The VMT per trip was estimated from aerial photos of the Yards and is unchanged from the 2005 baseline inventory. Activity data for the HHD delivery trucks is summarized in Table 145.

Table 145
Activity Data for HHD Delivery Trucks – ICTF and Dolores Rail Yards
Project Year 2012

Yard	Delivery Type	Number of Trips[a,b]	VMT per Trip (mi/trip)[c]	Annual VMT (mi/yr)	Fuel Use (gal/yr)[d]	Idling Time (min/trip)[e]	Idling Time (hr/yr)
Dolores	Diesel Fuel	2,625	0.06	157.50	334	10	437.50
Dolores	Sand	156	2.2	343.20	151	30	78.00
Dolores	Oil	24	0.06	1.44	3	10	4.00
Dolores	Soap	3	0.06	0.17	0.4	10	0.47
ICTF	Alternative Fuel	3	0.5	1.25	0.6	10	0.42
Total		**2,810**		**503.56**	**489**		**520.4**

Notes:
a. Number of truck trips for liquid products based on the material throughput and a tanker truck volume of 8,000 gallons per truck.
b. Number of sand truck trips based on personal communication with UPRR staff.
c. VMT per trip estimated from aerial photos of each Yard.
d. Fuel use is for both traveling and idling modes and was calculated from EMFAC2007.
e. Engineering estimate based on personal communication with UPRR staff.

[112] Per the ICTF Modernization Plan.

Criteria pollutant and DPM emission factors for the HHD Diesel-fueled delivery trucks were obtained from CARB's EMFAC2007 model. The emissions from idling and traveling modes were calculated separately. Fleet average emission factors for traveling exhaust emissions were calculated using the EMFAC2007 model with the BURDEN output option. Fleet average emission factors for idling were calculated using the EMFAC2007 model with the EMFAC output option. Since the fleet distribution is not known, the EMFAC2007 default distribution for Los Angeles County was used. The criteria pollutant and DPM emission factors for the HHD Diesel-fueled delivery trucks are shown in Table 146. Detailed emission factor derivation calculations and the EMFAC2007 output are contained in Appendix G-3.

Table 146
Criteria Pollutant and DPM Emission Factors for HHD Diesel-Fueled Delivery Trucks – ICTF and Dolores Rail Yards
Project Year 2012

Operating Mode	Fleet Average Emission Factors					
	ROG	CO	NOx	PM_{10}[c]	DPM[c]	SOx
Traveling (g/mi)[a]	4.08	10.25	18.49	1.21	1.15	0.03
Idling (g/hr)[b]	11.32	46.71	113.45	1.45	1.45	0.06

Notes:
a. Emission factors calculated using the EMFAC2007 model with the BURDEN output option. The default fleet distribution for Los Angeles County was used.
b. Emission factors calculated using the EMFAC2007 model with the EMFAC output option. The default fleet distribution for Los Angeles County was used.
c. The PM_{10} emission factor includes engine exhaust emissions along with brake and tire wear. The DPM emission factor includes engine exhaust emissions only.

Emission factors from CARB's *Draft Emission Factors for Mandatory Reporting Program* document (August 10, 2007) were used to calculate GHG emissions from delivery truck operations. The GHG emission factors are based on fuel consumption, not activity (i.e. miles driven or hours of operation); therefore, the same factors are used to calculate emissions from both traveling and idling modes. A fuel-specific carbon oxidization factor, from the CARB emission factor document, was used to calculate CO_2 emissions. The GHG emission factors for delivery trucks are shown in Table 147. A copy of CARB's *Draft Emission Factors for Mandatory Reporting Program* document is contained in Appendix C.

Table 147 GHG Emission Factors for HHD Diesel-Fueled Delivery Trucks – ICTF and Dolores Rail Yards Project Year 2012				
Operating Mode	Carbon Oxidization Factor (%)[a]	Emission Factors (kg/gal)[a]		
		CO_2	N_2O[c]	CH_4[c]
Traveling/Idling[b]	99.0	10.15	1.39×10^{-5}	4.16×10^{-5}

Notes:
a. Emission factors and carbon oxidization factor from CARB's *Draft Emission Factors for Mandatory Reporting Program* document (August 10, 2007).
b. Emission factors are based on fuel consumption; therefore, the same factors are used for both the traveling and idling modes.
c. Based on a Diesel fuel HHV of 5.825 MMBtu/barrel (from *CARB Draft Emission Factors for Mandatory Reporting Programs*, August 10, 2007) and 42 gallons per barrel

To calculate the emissions from delivery truck operations, the activity data shown in Table 145 was combined with the emission factors shown in Tables 146 and 147. The criteria pollutant, DPM, and GHG emission estimates for the HHD Diesel-fueled delivery trucks operating at the ICTF and Dolores yards during Project Year 2012 are shown in Table 148.

Table 148 Criteria Pollutant, DPM, and GHG Emissions from HHD Diesel-Fueled Delivery Trucks – ICTF and Dolores Rail Yards Project Year 2012									
Operating Mode	Emission (tpy)						Emission (metric tons/yr)		
	ROG	CO	NOx	PM_{10}	DPM	SOx	CO_2	N_2O	CH_4
Traveling	0.00	0.01	0.01	0.00	0.001	0.00	1.47	0.00	0.00
Idling	0.01	0.03	0.07	0.00	0.001	0.00	3.44	0.00	0.00
Total	**0.01**	**0.04**	**0.08**	**0.00**	**0.00**	**0.00**	**4.94**	**0.00**	**0.00**

7. Yard Trucks

Many light duty and medium duty gasoline-fueled trucks are used by the staff at the ICTF and Dolores Yards. For the 2012 inventory, it was assumed that the number of vehicles, the fleet distribution (number of vehicles per weight class), and the annual VMT were unchanged from the 2005 baseline year. Emissions were based on a modified fleet average model year distribution. It was assumed that vehicles in the fleet were the same model years as existed in the 2005 baseline year or newer. For example, the 2005 fleet included a model year 2000 Jeep Cherokee. For the 2012 emission estimate, it was assumed this vehicle would be replaced at some time since 2005 with a newer vehicle. Therefore, this vehicle was assumed to be a model year 2000-2012 light duty truck. The equipment specifications and activity data for the yard trucks are summarized in Table 149.

Table 149
Equipment Specifications and Activity Data for Gasoline-Fueled Yard Trucks – ICTF and Dolores Rail Yards
Project Year 2012

Yard	Equipment Type	Equipment ID	Vehicle Class	Make/Model	Model Year[a]	Annual VMT (mi/yr)[b]	Fuel Use (gal/yr)[c]	Idling (hr/yr)[d]
ICTF	SUV	1915-53287	LDT	Jeep Cherokee	2000-2012	73,000	6,819	NA
ICTF	Pickup Truck	1915-55536	LDT	Chevy Extended Cab	2003-2012	73,000	6,791	NA
ICTF	SUV	1915-19952	LDT	Chevy Trailblazer 370	2003-2012	73,000	6,791	NA
ICTF	Pickup Truck	1915-19971	LDT	Chevy Extended Cab	2004-2012	73,000	6,783	NA
ICTF	Van	1915-19975	LHDT 1	Chevy 15 Passenger Van	2004-2012	73,000	11,795	91.25
Dolores	Service Truck	73152	MHD	Chevy C4500	2003-2012	12,644	2,099	91.25
Dolores	Mgr Truck	Unknown	LDT	Chevy Trailblazer	2004-2012	45,000	4,182	NA
Dolores	Mgr Truck	73167	LDT	Chevy Blazer	2004-2012	36,608	3,402	NA
Dolores	Pickup Truck	73396	LDT	Ford F-150	2005-2012	23,756	2,205	NA

Notes:

a. It was assumed that vehicles in the fleet were the same model years as existed in the 2005 baseline year or newer.
b. The 2005 VMT was estimated from either the odometer reading divided by the age of the vehicle or interviews with UPRR staff. Assumed no change in VMT from the 2005 baseline year.
c. Calculated using the EMFAC2007 model.
d. Idling time is an engineering estimate. Idling emissions from light duty trucks are negligible; therefore, idling time data for these vehicles was not collected.

Modified fleet average criteria pollutant emission factors were obtained from CARB's EMFAC2007 model for each vehicle. The emissions from idling and traveling modes were calculated separately. Traveling exhaust emission factors were calculated using the EMFAC2007 model with the BURDEN output option. Idling emission factors for the light-heavy duty and medium-heavy duty vehicles were calculated using the EMFAC2007 model with the EMFAC output option. The idling emissions from light duty trucks were negligible. The 2012 criteria pollutant emission factors for the yard trucks are shown in Table 150. Detailed emission factor derivation calculations and the EMFAC2007 output are contained in Appendix H-3.

Table 150
Criteria Pollutant Emission Factors for Yard Trucks – ICTF and Dolores Rail Yards
Project Year 2012

Yard	Equipment Type	Make/Model	Vehicle Class	Model Year	Traveling Emission Factors (g/mi)[a]					Idling Emission Factors (g/hr)[b]				
					ROG	CO	NOx	PM_{10}	SOx	ROG	CO	NOx	PM_{10}	SOx
ICTF	SUV	Jeep Cherokee	LDT	2000-2012	0.04	1.76	0.12	0.05	0.01	NA	NA	NA	NA	NA
ICTF	Pickup Truck	Chevy Ext. Cab	LDT	2003-2012	0.03	1.08	0.07	0.04	0.01	NA	NA	NA	NA	NA
ICTF	SUV	Chevy Trailblazer	LDT	2003-2012	0.03	1.08	0.07	0.04	0.01	NA	NA	NA	NA	NA
ICTF	Pickup Truck	Chevy Ext. Cab	LDT	2004-2012	0.02	0.90	0.06	0.04	0.01	NA	NA	NA	NA	NA
ICTF	Van	Chevy Van	LHDT 1	2004-2012	0.03	0.38	0.13	0.04	0.01	23.66	142.20	1.54	0.00	0.05
Dolores	Service Truck	Chevy C4500	MHD	2003-2012	0.20	2.60	0.43	0.02	0.02	23.78	142.64	1.55	0.00	0.05
Dolores	Mgr Truck	Chevy Trailblazer	LDT	2004-2012	0.03	1.08	0.07	0.04	0.01	NA	NA	NA	NA	NA
Dolores	Mgr Truck	Chevy Blazer	LDT	2004-2012	0.03	1.08	0.07	0.04	0.01	NA	NA	NA	NA	NA
Dolores	Pickup Truck	Ford F-150	LDT	2005-2012	0.02	0.73	0.05	0.02	0.01	NA	NA	NA	NA	NA

Notes:

a. Traveling exhaust emissions calculated using the EMFAC2007 model with the BURDEN output option at a vehicle speed of 15 mph.

b. Idling exhaust emissions factors for LHDT1 and MHD vehicles calculated using the EMFAC2007 model with the EMFAC output option. Idling exhaust emissions from light duty trucks (LDT) are negligible.

Emission factors from CARB's *Draft Emission Factors for Mandatory Reporting Program* document (August 10, 2007) were used to calculate GHG emissions from yard trucks. The GHG emission factors are based on fuel consumption, not activity (i.e. miles driven or hours of operation); therefore, the same factors are used to calculate emissions from both traveling and idling modes. A fuel-specific carbon oxidization factor, from the CARB emission factor document, was also used to calculate CO_2 emissions. The GHG emission factors and the carbon oxidization factor for yard trucks are shown in Table 151. A copy of CARB's *Draft Emission Factors for Mandatory Reporting Program* document is contained in Appendix C.

Table 151
GHG Emission Factors for Yard Trucks – ICTF and Dolores Rail Yards
Project Year 2012

Operating Mode	Carbon Oxidization Factor (%)[a]	Emission Factors (kg/gal)[a]		
		CO_2	N_2O[c]	CH_4[c]
Traveling/Idling[b]	99.0	8.87	1.23×10^{-5}	1.60×10^{-4}

Notes:
Emission factors and carbon oxidization factor from CARB's *Draft Emission Factors for Mandatory Reporting Program* document (August 10, 2007).
Emission factors are based on fuel consumption; therefore, the same factors are used for both traveling and idling modes.
Based on a gasoline HHV of 122,697 Btu/gallon (from the Transportation Energy Data Book: Edition 26, U.S. Department of Energy, 2007).

To calculate the emissions from yard truck operations, the activity data shown in Table 149 were combined with the emission factors shown in Tables 150 and 151. The criteria pollutant and GHG emission estimates for the yard trucks operating at the ICTF and Dolores yards during Project Year 2012 are shown in Table 152.

CARB's speciation database was used to determine the fraction of each TAC in the total VOC emissions from each yard truck.[113] All TACs listed in the most recent version of

[113] Speciation profile number 2105 was used to calculate emissions from this source.

Table 152
Criteria Pollutant Emissions from Yard Trucks – ICTF and Dolores Rail Yards
Project Year 2012

Yard	Equipment Type	Make/Model	Vehicle Class	Model Year	Emissions (tpy)					Emissions (metric tons/yr)		
					ROG	CO	NOx	PM_{10}	SOx	CO_2	N_2O	CH_4
ICTF	SUV	Jeep Cherokee	LDT	2000-2012	0.00	0.14	0.01	0.00	0.00	59.88	0.00	0.00
ICTF	Pickup Truck	Chevy Ext. Cab	LDT	2003-2012	0.00	0.09	0.01	0.00	0.00	59.64	0.00	0.00
ICTF	SUV	Chevy Trailblazer	LDT	2003-2012	0.00	0.09	0.01	0.00	0.00	59.64	0.00	0.00
ICTF	Pickup Truck	Chevy Ext. Cab	LDT	2004-2012	0.00	0.07	0.00	0.00	0.00	59.57	0.00	0.00
ICTF	Van	Chevy Van	LHDT 1	2004-2012	0.00	0.04	0.01	0.00	0.00	103.58	0.00	0.00
Dolores	Service Truck	Chevy C4500	MHD	2003-2012	0.00	0.05	0.01	0.00	0.00	18.44	0.00	0.00
Dolores	Mgr Truck	Chevy Trailblazer	LDT	2004-2012	0.00	0.05	0.00	0.00	0.00	36.72	0.00	0.00
Dolores	Mgr Truck	Chevy Blazer	LDT	2004-2012	0.00	0.04	0.00	0.00	0.00	29.87	0.00	0.00
Dolores	Pickup Truck	Ford F-150	LDT	2005-2012	0.00	0.02	0.00	0.00	0.00	19.36	0.00	0.00
Total					**0.00**	**0.59**	**0.05**	**0.00**	**0.00**	**446.70**	**0.00**	**0.00**

the Emission Inventory Criteria and Guidelines Report for the Air Toxics "Hot Spots" Program were included. The TAC speciation profiles and emission rates for the yard trucks are shown in Table 153. A copy of the relevant section of SPECIATE database is included in Appendix H-3.

Table 153
TAC Emissions from Gasoline-Fueled Yard Trucks – ICTF and Dolores Rail Yards
Project Year 2012

CAS	Chemical Name[a]	Organic Fraction of VOC (by weight)[b]	Emissions (tons/yr)		
			ICTF	Dolores	Total
95636	1,2,4-trimethylbenzene	0.0120	1.68×10^{-4}	9.79×10^{-5}	2.66×10^{-4}
106990	1,3-butadiene	0.0068	9.50×10^{-5}	5.54×10^{-5}	1.50×10^{-4}
540841	2,2,4-trimethylpentane	0.0288	4.02×10^{-4}	2.34×10^{-4}	6.37×10^{-4}
75070	acetaldehyde	0.0035	4.86×10^{-5}	2.83×10^{-5}	7.70×10^{-5}
107028	acrolein (2-propenal)	0.0017	2.31×10^{-5}	1.34×10^{-5}	3.65×10^{-5}
71432	benzene	0.0309	4.31×10^{-4}	2.51×10^{-4}	6.82×10^{-4}
4170303	crotonaldehyde	0.0004	5.03×10^{-6}	2.93×10^{-6}	7.97×10^{-6}
110827	cyclohexane	0.0077	1.07×10^{-4}	6.24×10^{-5}	1.69×10^{-4}
100414	ethylbenzene	0.0131	1.83×10^{-4}	1.06×10^{-4}	2.89×10^{-4}
74851	ethylene	0.0794	1.11×10^{-3}	6.46×10^{-4}	1.75×10^{-3}
50000	formaldehyde	0.0197	2.75×10^{-4}	1.60×10^{-4}	4.36×10^{-4}
78795	isoprene	0.0018	2.47×10^{-5}	1.44×10^{-5}	3.91×10^{-5}
98828	isopropylbenzene (cumene)	0.0001	1.68×10^{-6}	9.78×10^{-7}	2.66×10^{-6}
67561	methyl alcohol	0.0015	2.13×10^{-5}	1.24×10^{-5}	3.37×10^{-5}
78933	methyl ethyl ketone	0.0002	3.18×10^{-6}	1.85×10^{-6}	5.04×10^{-6}
108383	m-xylene	0.0445	6.21×10^{-4}	3.62×10^{-4}	9.82×10^{-4}
91203	naphthalene	0.0006	8.22×10^{-6}	4.79×10^{-6}	1.30×10^{-5}
110543	n-hexane	0.0200	2.79×10^{-4}	1.62×10^{-4}	4.41×10^{-4}
95476	o-xylene	0.0155	2.16×10^{-4}	1.26×10^{-4}	3.41×10^{-4}
115071	propylene	0.0382	5.34×10^{-4}	3.11×10^{-4}	8.44×10^{-4}
100425	styrene	0.0015	2.14×10^{-5}	1.25×10^{-5}	3.39×10^{-5}
108883	toluene	0.0718	1.00×10^{-3}	5.84×10^{-4}	1.59×10^{-3}
Total			**5.58×10^{-3}**	**3.25×10^{-3}**	**8.83×10^{-3}**

Notes:
a. Organic fraction information is from CARB's SPECIATE database. Data used are from the "Cat stabilized exhaust 2005 SSD etoh 2% O (MTBE phaseout)" profile.
b. Organic fraction is reported on a ROG basis using CARB's SPECIATE ROG/TOG ratio of 0.8012.

8. Diesel-Fueled IC Engines

The 2012 calendar year emission estimates for the emergency generator and the air compressor are based on the rated capacity of the unit and the annual hours of operation. It was assumed that there was no change in the equipment, activity, or emissions for these units from the 2005 baseline year. See Part IV.A.8 for equipment specifications, activity data, and emission factors. The Project Year 2012 emissions are summarized in Table 154. Detailed emission calculations are contained in Appendix I-2.

Table 154
Criteria Pollutant, DPM, and GHG Emissions from the Diesel-Fueled IC Engines – ICTF Rail Yard
Project Year 2012

	Emissions (tons/yr)						Emissions (metric tons/yr)		
Unit	ROG	CO	NOx	PM_{10}	DPM	SOx	CO_2	N_2O^c	CH_4^c
Emergency Generator	0.01	0.02	0.08	0.01	0.01	0.01	2.73	0.00	0.00
Air Compressor	0.06	0.16	0.76	0.05	0.05	0.05	24.89	0.00	0.00
Total	**0.07**	**0.18**	**0.84**	**0.06**	**0.06**	**0.06**	**27.63**	**0.00**	**0.00**

9. Storage Tanks

Many storage tanks at both the ICTF and Dolores Yards are used to store liquid petroleum and other products such as Diesel fuel, gasoline, lubricating oils, and recovered oil. Emissions from the storage tanks are based on the size of the tank, material stored, and annual throughput. For the 2012 Project Year inventory, it was assumed that there was no change from the 2005 baseline throughput for storage tanks located at the Dolores Yard since overall activity levels at the Dolores Yard is expected to remain constant. It was assumed that all previously existing tanks at ICTF were removed and one new tank, for storage of the alternative fuel for the hostlers, was installed[114]. VOC emissions from the storage tanks were calculated using EPA's TANKS

[114] Per the ICTF Modernization Plan.

program. The emissions from small oil tanks,[115] stormwater tanks, and the sludge tank were assumed to be negligible. Also, the TANKS program does not calculate emissions from oil storage tanks. Therefore, the emissions from oil storage tanks were estimated by modeling the liquid contents as Diesel fuel, resulting in conservative estimates. Equipment specifications, activity data, and the annual emissions from the storage tanks are shown in Table 155. The TANKS program output are in Appendix J-1. Speciation profiles and detailed emission calculations are shown in Appendices J-2 and J-3, respectively.

[115] The TANKS program requires a minimum shell length of 5 feet for horizontal tanks and a minimum shell height of 5 feet for vertical tanks to calculate emissions. Emissions from tanks with a shell length/height of 5 feet are considered to be negligible.

Table 155
Storage Tank Specifications and Activity Data – ICTF and Dolores Rail Yards
Project Year 2012

Yard	Tank No.	Tank Location	Material Stored	Tank Capacity (gallons)	Tank Dimensions (ft)	Annual Throughput (gal/yr)[a,b]	VOC Emissions (tpy)[c,d,e]
ICTF	New 1-a	Alt. Fuel – Hostlers	Biodiesel	500	5.5 x 4	20,000	0.0002
ICTF	New 1-b	Alt. Fuel – Hostlers	LPG or LNG	1,000	15 x 3.5	20,000	neg.
Dolores	TNKD-0069	Tank Farm	Diesel	160,000	24 x 34	10,500,000	0.10
Dolores	TNKD-0068	Tank Farm	Diesel	160,000	24 x 34	10,500,000	0.10
Dolores	TNKO-0002	Tank Farm	Recovered Oil	10,000	16 x 10	40,000	0.002
Dolores	TNKO-0003	Tank Farm	Drain Oil	12,000	20.5 x 10	48,000	0.002
Dolores	TNKO-0004	Tank Farm	Journal Box Oil	8,000	21.3 x 8	32,000	0.001
Dolores	TNKO-0001	Tank Farm	Lube Oil	12,000	20.5 x 10	48,000	0.004
Dolores	TNKO-0184	Service Track	Recovered Oil	6,000	20.5 x 7	24,000	0.002
Dolores	TNKS-0005	Tank Farm	Stormwater	25,000	30 x 12 x 12	980,100	neg.
Dolores	TNKS-0006	Tank Farm	Stormwater	25,000	30 x 12 x 12	980,100	neg.
Dolores	TNKS-0007	Tank Farm	Stormwater	25,000	30 x 12 x 12	980,100	neg.
Dolores	TNKS-0008	Tank Farm	Stormwater	25,000	30 x 12 x 12	980,100	neg.
Dolores	TNKS-0010	Tank Farm	Soap	8,000	8 x8	22,785	NA
Dolores	NA	WWTP	Sludge	1,000	6.5 x 5 x 5	NA	neg.
Total VOC							**0.21**

Notes:

a. Assumed all existing tanks at ICTF were removed by 2012. A new tank for the storage of the alternative fuel for the yard hostlers will be installed near the existing crane maintenance area. Two tank options, a biodiesel tanks or and LPG/LNG tank, were considered for the emission calculations. Only one of these tanks will be installed at the facility.
b. Assumed no change from the 2005 throughput for the tanks at Dolores.
c. Emission calculations performed using the USEPA TANKS 4.0.9d program.
d. Emissions from small (the TANKS program requires a minimum shell length of 5 feet for horizontal tanks and a minimum shell height of 5 feet for vertical tanks) oil tanks, stormwater tanks, and the sludge tank were assumed to be negligible.
e. The VOC emissions for oil tanks were estimated by modeling the liquid contents as Diesel fuel, resulting in conservative estimates.

10. Refueling Operations

Refueling operations occur at the crane maintenance area of ICTF and at the locomotive shop the Dolores Yard. Refueling emissions are based on the type of fuel, annual fuel throughput, and VOC emission factors from *Supplemental Instructions for Liquid Organic Storage Tanks* document of the South Coast Air Quality Management District's (SCAQMD) *General Instruction Book for the AQMD 2006-2007 Annual Emissions Reporting Program.* For the 2012 calendar year inventory, it was assumed that there was no change from the 2005 baseline throughput for refueling operations located at the Dolores Yard since overall activity levels at the Dolores Yard is expected to remain constant. By 2012, the crane maintenance facility at the ICTF crane maintenance will be closed and the associated tanks and refueling operations will no longer exist.[116] The activity data, emission factors, and the VOC emissions from refueling operations during calendar year 2012 are shown in Table 153. Detailed calculations are shown in Appendix K-3.

The CARB's speciation database does not include information on TAC fractions from Diesel fuel. Therefore, the TACs from the 2012 refueling operations were not calculated.

Table 156
VOC Emissions from Refueling Operations – ICTF and Dolores Rail Yards
Project Year 2012

Yard	Tank No.	Tank Location	Material Stored	Throughput (gal/yr)[a]	VOC Emission Factor (lb/1000 gal)[b]	VOC Emissions (tons/yr)
Dolores	TNKD-0069	Tank Farm	Diesel	10,500,000	0.028	0.147
Dolores	TNKD-0068	Tank Farm	Diesel	10,500,000	0.028	0.147
Total						**0.294**

Notes:
a. See Table 155.
b. Emission factors from the *Supplemental Instructions for Liquid Organic Storage Tanks* document of the SCAQMD's *General Instruction Book for the AQMD 2006-2007 Annual Emissions Reporting Program.*

[116] See Part IV.B.3 for discussion in the reduction in activity level.

11. Sand Tower

The calendar year 2012 emissions estimates for sand tower operations are based on the annual sand throughput and PM_{10} emission factors from AP-42. It was assumed that there was no change in sand throughput from the 2005 baseline year, since overall activity levels at the Dolores Yard is expected to remain constant. The activity data, PM_{10} emission factors, and annual emission estimates for the sand tower are shown Table 157. The relevant sections of AP-42 and detailed calculations are in Appendices L-1 and L-2.

Table 157
PM_{10} Emission Factors and Emission Rates for Sand Tower Operations – Dolores Rail Yard
Project Year 2012

Pollutant	Sand Throughput (tons/yr)[a]	Emission Factors (lb/ton)		Emissions (tons/yr)		
		Pneumatic Transfer[b]	Gravity Transfer[c]	Pneumatic Transfer	Gravity Transfer	Total
PM_{10}	3,120	0.00034	0.00099	0.001	0.002	0.002

Notes:
a. The 2005 annual throughput data provided by UPRR. Assumed no change from the baseline year for 2012.
b. Emission factor from AP-42, Table 11.12-5, 6/06. Factor for controlled pneumatic cement unloading to elevated storage silo was used. The unit is equipped with a fabric filter.
c. Emission factor from AP-42, Table 11.12-5, 6/06. Factor for sand transfer was used.

12. Wastewater Treatment Plant

The 2012 emissions estimates for the WWTP are based on the annual wastewater flow rate and from the *Air Emission Inventory and Regulatory Analysis Report for Dolores Yard* (Trinity Consultants, December 2005). It was assumed that there was no change in flow rate or emission rates from the 2005 baseline year, since overall activity levels at the Dolores Yard is expected to remain constant. Emission rates, based on the 1999 wastewater flow rate, were calculated by Trinity Consultants using EPA's WATER9 program. The 2012 annual emissions were calculated by multiplying the emission rates, in grams per second, by the ratio of the 2012 wastewater flow rate to the 1999 wastewater flow rate. The emission rates, in grams per second, and the annual emissions, in tons per year, are shown in Table 158. Detailed emission calculations are shown in Appendix M.

Table 158
TAC Emissions from the Wastewater Treatment Plant – Dolores Rail Yard
Project Year 2012

Pollutant	Emission Rate (grams/sec)[b]	Emissions (tons/yr)[c]
benzene	5.10×10^{-7}	2.37×10^{-5}
bis (2-ethylhexyl) Phthalate	1.83×10^{-11}	8.52×10^{-10}
bromomethane	8.99×10^{-7}	4.18×10^{-5}
chloroform	6.30×10^{-7}	2.93×10^{-5}
ethylbenzene	3.04×10^{-6}	1.41×10^{-4}
methylene chloride	1.04×10^{-5}	4.84×10^{-4}
toluene	3.50×10^{-6}	1.63×10^{-4}
xylene	6.20×10^{-6}	2.89×10^{-4}
Total	$\mathbf{2.52 \times 10^{-5}}$	$\mathbf{1.17 \times 10^{-3}}$

Notes:

a. The 2005 wastewater flow rate (980,100 gallons) was provided by UPRR. Assumed no change in flow rate for the 2012 calendar year.

b. Emissions rates from the *Air Emission Inventory and Regulatory Analysis Report for the Dolores Yard* (Trinity Consultants, December 2005) and are based on the 1999 wastewater flow rate of 732,000 gallons. Assumed no change in emission rate from baseline year,

c. Annual emissions for the calendar year 2012 were calculated by multiplying the emission rate, in grams per second, by the ratio of the 2012 wastewater flow rate to the 1999 wastewater flow rate.

13. Steam Cleaners

Portable steam cleaners are used for a variety of activities at the Dolores Yard. It was assumed there were no changes in equipment or activity data (since overall activity levels at the Dolores Yard is expected to remain constant) from the 2005 baseline year. See Part IV.A.13 for equipment specifications, activity data, and emission factors. The Project Year 2012 emissions are summarized in Table 159. Detailed emission calculations are contained in Appendix N-2.

Table 159 Criteria Pollutant and GHG Emissions from Steam Cleaners – Dolores Rail Yard Project Year 2012								
	Emission (tpy)					Emission (metric tons/yr)		
Emission Unit	ROG	CO	NOx	PM_{10}	SOx	CO_2	N_2O	CH_4
Heaters	0.004	0.02	0.11	0.003	0.00	87.21	0.00	0.00
Pumps	0.12	2.41	0.06	0.00	0.00	5.57	0.00	0.00
Total	**0.12**	**2.43**	**0.17**	**0.01**	**0.00**	**92.78**	**0.00**	**0.00**

CARB's speciation database was used to determine the fraction of each TAC in the total VOC emissions from the steam cleaning operations.[117] The SPECIATE database does not include a profile for propane-fueled boilers. Therefore, the speciation profile for natural gas-fired boilers was used to determine the TAC emissions from the steam cleaner heaters. All TACs listed in the most recent version of the Emission Inventory Criteria and Guidelines Report for the Air Toxics "Hot Spots" Program were included. The TAC speciation profiles and emission rates for the steam cleaning operations are shown in Table 160. A copy of the relevant sections of SPECIATE database and detailed calculations are included in Appendices N-2 and N-3.

[117] Speciation profile number 3 was used to calculate TAC emissions from the heaters and profile number 665 was used to calculate the TAC emissions from the pump.

Table 160 TAC Emissions from Steam Cleaners – Dolores Rail Yard Project Year 2012					
		Heaters[a]		Pumps[b]	
CAS	Chemical Name	Organic Fraction of VOC (by weight)[c]	Emissions (tons/yr)	Organic Fraction of VOC (by weight)[d]	Emissions (tons/yr)
95636	1,2,4-trimethylbenzene	-	-	0.0140	1.67×10^{-3}
106990	1,3-butadiene	-	-	0.0091	1.08×10^{-3}
540841	2,2,4-trimethylpentane	-	-	0.0222	2.63×10^{-3}
75070	acetaldehyde	-	-	0.0106	1.26×10^{-3}
107028	acrolein (2-propenal)	-	-	0.0020	2.38×10^{-4}
71432	benzene	0.0947	3.64×10^{-4}	0.0368	4.37×10^{-3}
4170303	crotonaldehyde	-	-	0.0014	1.72×10^{-4}
110827	cyclohexane	0.0237	9.11×10^{-5}	0.0050	5.95×10^{-4}
100414	ethylbenzene	-	-	0.0167	1.98×10^{-3}
74851	ethylene	-	-	0.0996	1.18×10^{-2}
50000	formaldehyde	0.1895	7.28×10^{-4}	0.0327	3.88×10^{-3}
78795	isoprene	-	-	0.0016	1.85×10^{-4}
98828	isopropylbenzene (cumene)	-	-	0.0006	6.58×10^{-5}
67561	methyl alcohol	-	-	0.0038	4.53×10^{-4}
78933	methyl ethyl ketone (mek)	-	-	0.0007	7.88×10^{-5}
108383	m-xylene	-	-	0.0496	5.89×10^{-3}
91203	naphthalene	-	-	0.0014	1.72×10^{-4}
110543	n-hexane	-	-	0.0146	1.73×10^{-3}
95476	o-xylene	-	-	0.0173	2.05×10^{-3}
115071	propylene	-	-	0.0546	6.48×10^{-3}
100425	styrene	-	-	0.0014	1.72×10^{-4}
108883	toluene	0.0474	1.82×10^{-4}	0.0756	8.98×10^{-3}
Total			**1.37×10^{-3}**		**5.60×10^{-2}**

Notes:

a. Organic fraction information is from CARB’s SPECIATE database. Data used are from the “External combustion boiler – natural gas” profile. SPECIATE does not include a profile for propane-fueled boilers.

b. Organic fraction information is from CARB’s SPECIATE database. Data used are from the “Non-cat stabilized exhaust 1996 SSD 2.0% etoh (MTBE phaseout)” profile.

c. Organic fraction is reported on a ROG basis using CARB’s SPECIATE ROG/TOG ratio of 0.4222.

d. Organic fraction is reported on a ROG basis using CARB’s SPECIATE ROG/TOG ratio of 0.9198

14. Heater

There is a natural gas-fired heater located at the ICTF administrative building. For the 2012 calendar year emission estimates, it was assumed that there were no changes in equipment of activity data from the 2005 baseline year[118]. See Part IV.A.14 for equipment specifications, activity data, and emission factors. The Project Year 2012 emissions are summarized in Table 161. Detailed emission calculations are contained in Appendix O-2.

Table 161
Criteria Pollutant and GHG Emissions from Heaters – ICTF Rail Yard
Project Year 2012

Emissions (tons/yr)					Emissions (metric tons/yr)		
VOC	CO	NOx	PM_{10}	SOx	CO_2	N_2O	CH_4
0.00	0.07	0.08	0.01	0.00	87.85	0.01	0.00

CARB's speciation profile for natural gas-fired boilers was used to determine the fraction of each TAC in the total VOC emissions from the heater.[119] All TACs listed in the most recent version of the Emission Inventory Criteria and Guidelines Report for the Air Toxics "Hot Spots" Program were included. The TAC speciation profiles and emission rates for the heater are shown in Table 162. A copy of the relevant sections of the SPECIATE database are included in Appendix O-3.

[118] The heater is used to provide comfort heat to the ICTF Administration Building and its use is not tied to cargo handling activities. Therefore, it was assumed that operation of this unit would not change from the baseline year

[119] Speciation profile number 3 was used to calculate TAC emissions from this source.

Table 162 TAC Emissions from Heaters – ICTF Rail Yard Project Year 2012			
CAS	Chemical Name[a]	Organic Fraction of VOC (by weight)[b]	Emissions (tons/yr)
71432	Benzene	0.0947	4.34×10^{-4}
110827	Cyclohexane	0.0237	1.08×10^{-4}
50000	formaldehyde	0.1895	8.67×10^{-4}
108883	Toluene	0.0474	2.17×10^{-4}
Total			**1.63×10^{-3}**

Notes:
a. Organic fraction information is from CARB's SPECIATE database. Data used are from the "External combustion boiler – natural gas" profile.
b. Organic fraction is reported on a ROG basis using CARB's SPECIATE ROG/TOG ratio of 0.4222.

15. Welders

A propane-fueled welder is used for locomotive service and repair operations at the Dolores Yard. For the 2012 calendar year emission estimates, it was assumed that there were no changes in equipment or activity (since overall activity levels at the Dolores Yard is expected to remain constant) from the 2005 baseline year. See Part IV.A.15 for equipment specifications, activity data, and emission factors. The Project Year 2012 emissions are summarized in Table 160. Detailed emission calculations are contained in Appendix P-2.

Table 163 Criteria Pollutant and GHG Emissions from the Propane-Fueled Welder – Dolores Rail Yard Project Year 2012							
Emissions (tons/yr)					Emissions (metric tons/yr)		
VOC	CO	NOx	PM_{10}	SOx	CO_2	N_2O	CH_4
0.002	0.221	0.143	0.001	0.000	7.85	0.00	0.00

CARB's speciation database was used to determine the fraction of each TAC in the total VOC emissions from the propane-fueled welder. The SPECIATE database does not include a profile for propane-fueled internal combustion engine. Therefore, the speciation profile for natural gas-fired reciprocating engines was used to determine the

TAC emissions from the welder.[120] All TACs listed in the most recent version of the Emission Inventory Criteria and Guidelines Report for the Air Toxics "Hot Spots" Program were included. The TAC speciation profiles and emission rates for the heater are shown in Table 164. A copy of the relevant section of SPECIATE database is included in Appendix P-3.

Table 164
TAC Emissions from Propane-Fueled Welder – Dolores Rail Yard
Project Year 2012

CAS	Chemical Name[a]	Organic Fraction of VOC (by weight)[b]	Emissions (tons/yr)
95636	1,2,4-trimethylbenzene	0.00001	1.70×10^{-8}
75070	acetaldehyde	0.00003	5.11×10^{-8}
71432	benzene	0.00010	1.87×10^{-7}
110827	cyclohexane	0.00001	1.70×10^{-8}
100414	ethylbenzene	0.00001	1.70×10^{-8}
74851	ethylene	0.00058	1.07×10^{-6}
50000	formaldehyde	0.00074	1.38×10^{-6}
108383	m-xylene	0.00001	1.70×10^{-8}
110543	n-hexane	0.00002	3.41×10^{-8}
95476	o-xylene	0.00001	1.70×10^{-8}
115071	propylene	0.00154	2.88×10^{-6}
108883	toluene	0.00004	6.82×10^{-8}
1330207	xylene	0.00002	3.41×10^{-8}
Total			**5.80×10^{-6}**

Notes:
a. Organic fraction information is from CARB's SPECIATE database. Data used are from the "I.C.E. reciprocating – natural gas" profile.
b. Organic fraction is reported on a ROG basis using CARB's SPECIATE ROG/TOG ratio of 0.0914.

16. Miscellaneous Gasoline-Fueled Equipment

A variety of portable, gasoline-fueled, small equipment is used at ICTF each day. The 2012 emission estimates assume no change in equipment from the 2005 baseline year. While this equipment is used at ICTF, its operations are not tied to cargo handling activities. Therefore, it was assumed that there was no change in activity data from the 2005 baseline year. See Part IV.A.16 for equipment specifications, activity data, and

[120] Speciation profile number 3 was used to calculate TAC emissions from this source.

emission factors. The Project Year 2012 emissions are summarized in Table 165. Detailed emission calculations are contained in Appendix Q-2.

Table 165 **Criteria Pollutant and GHG Emissions from the Miscellaneous Gasoline-Fueled Equipment – Dolores Rail Yard** **Project Year 2012**							
Emissions (tons/yr)					Emissions (metric tons/yr)		
VOC	CO	NOx	PM_{10}	SOx	CO_2	N_2O	CH_4
1.88	38.19	0.96	0.06	0.05	87.17	0.00	0.00

CARB's speciation database was used to determine the fraction of each TAC in the total VOC emissions from each piece of equipment.[121] All TACs listed in the most recent version of the Emission Inventory Criteria and Guidelines Report for the Air Toxics "Hot Spots" Program were included. The TAC speciation profiles and emission rates for the miscellaneous equipment are shown in Table 166. A copy of the relevant section of SPECIATE database is included in Appendix Q-3. Equipment specific calculations are shown in Appendix Q-2.

Table 166 **TAC Emissions from Miscellaneous Gasoline-Fueled Equipment – ICTF Rail Yard** **Project Year 2012**			
CAS	Chemical Name[a]	Organic Fraction of VOC (by weight)[b]	Emissions (tons/yr)
95636	1,2,4-trimethylbenzene	0.0140	2.64×10^{-2}
106990	1,3-butadiene	0.0091	1.70×10^{-2}
540841	2,2,4-trimethylpentane	0.0222	4.16×10^{-2}
75070	acetaldehyde	0.0106	1.99×10^{-2}
107028	acrolein (2-propenal)	0.0020	3.76×10^{-3}
71432	benzene	0.0368	6.91×10^{-2}
4170303	crotonaldehyde	0.0014	2.72×10^{-3}
110827	cyclohexane	0.0050	9.41×10^{-3}
100414	ethylbenzene	0.0167	3.14×10^{-2}
74851	ethylene	0.0996	1.87×10^{-1}
50000	formaldehyde	0.0327	6.14×10^{-2}
78795	isoprene	0.0016	2.92×10^{-3}

[121] Speciation profile number 665 was used to calculate TAC emissions from this source.

Table 166 TAC Emissions from Miscellaneous Gasoline-Fueled Equipment – ICTF Rail Yard Project Year 2012			
CAS	Chemical Name[a]	Organic Fraction of VOC (by weight)[b]	Emissions (tons/yr)
98828	isopropylbenzene (cumene)	0.0006	1.04×10^{-3}
67561	methyl alcohol	0.0038	7.17×10^{-3}
78933	methyl ethyl ketone (mek)	0.0007	1.25×10^{-3}
108383	m-xylene	0.0496	9.31×10^{-2}
91203	naphthalene	0.0014	2.72×10^{-3}
110543	n-hexane	0.0146	2.74×10^{-2}
95476	o-xylene	0.0173	3.24×10^{-2}
115071	propylene	0.0546	1.03×10^{-1}
100425	styrene	0.0014	2.72×10^{-3}
108883	toluene	0.0756	1.42×10^{-1}
Total			**8.85×10^{-1}**

Notes:
a. Organic fraction information is from CARB's SPECIATE database. Data used are from the "Non-cat stabilized exhaust 1996 SSD 2.0% etoh (MTBE phaseout)" profile.
b. Organic fraction is reported on a ROG basis using CARB's SPECIATE ROG/TOG ratio of 0.9198.

17. Worker Vehicles

Emissions were calculated from employee vehicles that arrive at and depart from the ICTF and Dolores Yards each day. The number of vehicle trips was based on employee force counts for each yard and assumes no ridesharing. The miles per trip were estimated from aerial photos of the Yards and include on-site travel only. For the 2012 emission estimates, it was assumed that there were no changes in the number of employees from the 2005 baseline year. Activity data for worker vehicles is summarized in Table 167.

Table 167
Activity Data for Worker Vehicles – ICTF and Dolores Rail Yards
Project Year 2012

Yard	No. of Trips (trips/yr)[a]	VMT		Fuel Use (gal/yr)[c]
		(mi/trip)[b]	(mi/yr)	
ICTF	152,935	2.5	382,338	19,421
Dolores	32,850	0.5	16,425	834
Total	**185,785**		**398,763**	**20,255**

Notes:
a. The number of trips during the 2005 baseline year was based on employee force count reports. Assumes no ridesharing and 365 work days per year. Assumed no changes for 2012.
b. VMT for onsite travel was estimated from aerial photos of each yard.
c. Fuel use for the 2012 calendar year was calculated from VMT and from fuel economy based on the EMFAC 2007 model with the BURDEN output option.

Fleet average criteria pollutant emission factor for traveling exhaust emissions were calculated using the EMFAC2007 model with the BURDEN output option. Since the model year distribution is not known, the EMFAC2007 default distribution for gasoline-fueled passenger cars and light duty trucks operating in Los Angeles County was used for the 2010 calendar year. Idling emissions were assumed to be negligible.

Emission factors from CARB's *Draft Emission Factors for Mandatory Reporting Program* document (August 10, 2007) were used to calculate GHG emissions from worker vehicles. A fuel-specific carbon oxidization factor, from the CARB emission factor document, was used to calculate CO_2 emissions. The criteria pollutant and GHG emission factors, as well as the carbon oxidization factor, used to calculate emissions from worker vehicles, are shown in Table 168. Detailed emission factor derivation calculations and the EMFAC2007 output are contained in Appendix R-3. A copy of CARB's *Draft Emission Factors for Mandatory Reporting Program* document is contained in Appendix C.

Table 168 Criteria Pollutant and GHG Emission Factors for Worker Vehicles – ICTF and Dolores Rail Yards Project Year 2012								
Carbon Oxidization Factor (%)	Emission Factors (g/mi)[a]					Emission Factors (kg/gal)[b]		
	ROG	CO	NOx	PM_{10}	SOx	CO_2	N_2O[c]	CH_4[c]
99.0	0.15	0.31	0.29	0.04	0.00	8.87	1.23×10^{-5}	1.60×10^{-4}

Notes:

a. Calendar year 2012 criteria pollutant emission factors (g/mi) from EMFAC 2007 using the BURDEN output option. The EMFAC default model year distribution for L.A. County was used.

b. GHG emission factors from CARB's *Draft Emission Factors for Mandatory Reporting Program* document (August 10, 2007).

c. Based on a gasoline HHV of 122,697 Btu/gallon (from the Transportation Energy Data Book: Edition 26, U.S. Department of Energy, 2007).

To calculate the emissions from worker vehicles, the activity data shown in Table 167 was combined with the emission factors shown in Table 168. The criteria pollutant and GHG emission estimates for the worker vehicles at the ICTF and Dolores yards during the Project Year 2012 are shown in Table 169.

Table 169 Criteria Pollutant and GHG Emissions from Worker Vehicles – ICTF and Dolores Rail Yard Project Year 2012								
Yard	Emissions (tons/yr)					Emissions (metric tons/yr)		
	ROG	CO	NOx	PM_{10}	SOx	CO_2	N_2O[c]	CH_4[c]
ICTF	0.06	0.13	0.12	0.02	0.00	170.54	0.00	0.00
Dolores	0.00	0.01	0.01	0.00	0.00	7.33	0.00	0.00
Total	**0.06**	**0.14**	**0.13**	**0.02**	**0.00**	**177.86**	**0.00**	**0.00**

CARB's speciation database was used to determine the fraction of each TAC in the total VOC emissions from each yard truck.[122] All TACs listed in the most recent version of the Emission Inventory Criteria and Guidelines Report for the Air Toxics "Hot Spots" Program were included. The TAC speciation profiles and emission rates for worker vehicles are shown in Table 170. A copy of the relevant section of SPECIATE database is included in Appendix R-3.

[122] Speciation profile number 2105 was used to calculate TAC emissions from this source.

Table 170 TAC Emissions from Gasoline-Fueled Worker Vehicles – ICTF and Dolores Rail Yards Project Year 2012					
CAS	Chemical Name[a]	Organic Fraction of VOC (by weight)[b]	Emissions (tons/yr)		
			ICTF	Dolores	Total
95636	1,2,4-trimethylbenzene	0.0120	7.42×10^{-4}	3.19×10^{-5}	7.74×10^{-4}
106990	1,3-butadiene	0.0068	4.20×10^{-4}	1.80×10^{-5}	4.38×10^{-4}
540841	2,2,4-trimethylpentane	0.0288	1.78×10^{-3}	7.64×10^{-5}	1.85×10^{-3}
75070	acetaldehyde	0.0035	2.15×10^{-4}	9.24×10^{-6}	2.24×10^{-4}
107028	acrolein (2-propenal)	0.0017	1.02×10^{-4}	4.38×10^{-6}	1.06×10^{-4}
71432	benzene	0.0309	1.90×10^{-3}	8.18×10^{-5}	1.99×10^{-3}
4170303	crotonaldehyde	0.0004	2.23×10^{-5}	9.56×10^{-7}	2.32×10^{-5}
110827	cyclohexane	0.0077	4.73×10^{-4}	2.03×10^{-5}	4.94×10^{-4}
100414	ethylbenzene	0.0131	8.08×10^{-4}	3.47×10^{-5}	8.43×10^{-4}
74851	ethylene	0.0794	4.90×10^{-3}	2.10×10^{-4}	5.11×10^{-3}
50000	formaldehyde	0.0197	1.22×10^{-3}	5.23×10^{-5}	1.27×10^{-3}
78795	isoprene	0.0018	1.09×10^{-4}	4.69×10^{-6}	1.14×10^{-4}
98828	isopropylbenzene (cumene)	0.0001	7.42×10^{-6}	3.19×10^{-7}	7.74×10^{-6}
67561	methyl alcohol	0.0015	9.41×10^{-5}	4.04×10^{-6}	9.82×10^{-5}
78933	methyl ethyl ketone (mek)	0.0002	1.41×10^{-5}	6.04×10^{-7}	1.47×10^{-5}
108383	m-xylene	0.0445	2.74×10^{-3}	1.18×10^{-4}	2.86×10^{-3}
91203	naphthalene	0.0006	3.63×10^{-5}	1.56×10^{-6}	3.79×10^{-5}
110543	n-hexane	0.0200	1.23×10^{-3}	5.29×10^{-5}	1.28×10^{-3}
95476	o-xylene	0.0155	9.54×10^{-4}	4.10×10^{-5}	9.95×10^{-4}
115071	propylene	0.0382	2.36×10^{-3}	1.01×10^{-4}	2.46×10^{-3}
100425	styrene	0.0015	9.46×10^{-5}	4.06×10^{-6}	9.87×10^{-5}
108883	toluene	0.0718	4.43×10^{-3}	1.90×10^{-4}	4.62×10^{-3}
Total			**2.47×10^{-2}**	**1.06×10^{-3}**	**2.57×10^{-2}**

Notes:
a. Organic fraction information is from CARB's SPECIATE database. Data used are from the "Cat stabilized exhaust 2005 SSD etoh 2% O (MTBE phaseout)" profile.
b. Organic fraction is reported on a ROG basis using CARB's SPECIATE ROG/TOG ratio of 0.8012.

18. Road Dust

Particulate matter emissions were calculated for paved roadways in both the ICTF and Dolores rail yards. Emissions for Project Year 2010 were calculated according to the methods outlined in AP-42, Section 13.2.1 and detailed in Part IV.A.18 of this report. Table 171 summarizes the activity data, PM_{10} emission factor, control efficiency, and annual PM_{10} emissions from paved roadways in the ICTF and Dolores rail yards.

Detailed emission factor derivation calculations, the relevant sections of AP-42, and the relevant sections of the SCAQMD staff report are contained in Appendices S-1 and S-2

Table 171
PM_{10} Emissions from Roadways – ICTF and Dolores Rail Yards
Project Year 2012

Yard	Vehicle Type	Annual VMT (mi/yr)[a]	PM_{10} Emission Factor (g/VMT)[b]	Control Efficiency (%)[c]	PM_{10} Emissions (tons/yr)
ICTF	Drayage Trucks	2,910,600	12.11	45%	21.38
ICTF	Delivery Trucks	1.25	12.11	45%	0.00
ICTF	Yard Truck	365,000	12.11	45%	2.68
ICTF	Worker Vehicles	382,337.5	12.11	45%	2.81
Dolores	Delivery Trucks	502.3	12.11	45%	0.00
Dolores	Yard Truck	16,425	12.11	45%	0.12
Dolores	Worker Vehicles	118,007	12.11	45%	0.87
Total		**3,792,873**			**27.86**

Notes:
a. See Parts IV.C.2, IV.C.6, IV.C. 7 and IV.C. 17 for discussions on the calculation of annual VMT.
b. Calculated based on method outlined in AP-42, Section 13.2.1 and data shown in Table 71.
c. Calculated based on method contained in the SCAQMD Staff Report for Rule 1186 (1/97). Assumes street sweeping occurs twice per week.

D. 2014 Emissions Inventory

The Project Year 2014 inventory quantifies onsite criteria pollutant, GHG, and TAC emissions from emission sources at the ICTF and Dolores yards. Table 172 summarizes the emissions by source group. The methodology and assumptions used to prepare the inventory for each source group are discussed in detail in Sections 1 through 18 below.

Table 172
Emissions by Source Category – ICTF and Dolores Rail Yards
Project Year 2014

Source Group	Emissions (tons/yr)						Emissions (metric tons/yr)		
	ROG	CO	NOx	PM_{10}	DPM	SOx	CO_2	N_2O	CH_4
Locomotives	19.83	46.38	117.18	2.85	2.85	0.30	21,803.34	0.55	1.71
Drayage Trucks	15.07	47.99	105.79	3.20	3.02	0.11	10974.66	0.01	0.04
Cargo Handling Equipment	0.09	1.22	0.87	0.03	0.00	0.00	91.58	0.00	0.00
Heavy Equipment	0.13	11.45	2.80	0.02	0.00	0.00	313.25	0.00	0.00
TRUs and Reefer Cars[a]	2.85	21.25	21.86	0.52	0.52	0.04	2943.02	0.00	0.01
Delivery Trucks	0.01	0.02	0.08	0.00	0.00	0.00	4.91	0.00	0.00
Yard Trucks	0.00	0.55	0.05	0.00	NA	0.00	446.25	0.00	0.00
IC Engines	0.07	0.18	0.84	0.06	0.06	0.06	27.63	0.00	0.00
Tanks	0.21	NA	NA	NA	NA	NA	NA	NA	NA
Refueling	0.29	NA	NA	NA	NA	NA	NA	NA	NA
Sand Tower	NA	NA	NA	0.00	NA	NA	NA	NA	NA
WWTP	0.00	NA	NA	NA	NA	NA	NA	NA	NA
Steam Cleaners	0.12	2.43	0.17	0.01	NA	0.00	92.78	0.00	0.00
Heater	0.00	0.07	0.08	0.01	NA	0.00	87.85	0.01	0.00
Propane Welder	0.00	0.22	0.14	0.00	NA	0.00	7.85	0.00	0.00
Miscellaneous Equipment	1.88	38.19	0.96	0.06	NA	0.05	87.17	0.00	0.00
Worker Vehicles	0.05	0.11	0.10	0.02	NA	0.00	177.49	0.00	0.00
Road Dust	NA	NA	NA	25.97	NA	NA	NA	NA	NA
Total	**40.60**	**170.06**	**250.92**	**32.75**	**6.45**	**0.56**	**37,057.53**	**0.57**	**1.76**
ICTF-related[b]	**34.47**	**152.04**	**214.98**	**31.63**	**5.60**	**0.48**	**30,383.36**	**0.42**	**1.27**

Notes:
a. In addition to the GHG emissions shown above, CFC emissions from TRU refrigerant loss equal 0.369 metric tons per year.
b. The ICTF-related emissions include emissions that occur within ICTF plus a portion of the emissions from the Dolores Yard. The emissions from the Dolores Yard were divided based on railcar counts provided by UPRR.

In addition to the total emissions from the ICTF and Dolores yards, Table 171 also shows emissions related to ICTF. The ICTF-related emissions include emissions that occur within the ICTF, such as emissions from CHE, plus the portion of the emissions from the Dolores Yard related to ICTF. The emissions were divided based on the railcar data provided by UPRR.[123] The 2014 railcar activity at Dolores was designated as either ICTF intermodal or other intermodal. In 2014, it was estimated that 70% of the railcars entering the Dolores Yard will include freight bound for ICTF. Therefore, it was assumed that 70% of the emissions from Dolores will be related to ICTF in Project Year 2014.

1. Locomotives

For 2014, the amount of through train traffic in the yard is assumed to be constant relative to 2005. Future year emission calculations are intended for assessment of changes in in-yard activity, and do not include port-related activity in the Alameda Corridor mainline adjacent to the Dolores Yard.

Road Power

Specific locomotive model distribution for years 2014 and later cannot be developed due to the anticipated availability of as-yet undeveloped locomotive technologies. Locomotive emissions for Project Year 2014 were calculated based on the 2012 emissions estimates, a growth factor, and control factors. The 2012 emission estimates (in tons per year) were multiplied by the ratio of the predicted lift count for 2014 (1,300,000 lifts) to the 2012 predicted lift count (1,100,000 lifts) to determine the growth in ICTF-related intermodal traffic. UPRR estimates that 70% of cars entering the Dolores Yard will be ICTF-related intermodal and 30% will be on-dock intermodal.[124] These factors were used to project the ICTF-related and on-dock intermodal activity levels for 2014.

[123] Personal communication with Lanny Schmid of UPRR on August 28, 2007.
[124] Personal communication with Lanny Schmid of UPRR on August 28, 2007.

The activity-based emission estimates were then adjusted by a control factor to account for the penetration of cleaner locomotives into the fleet over time. The control factors are based on the decrease in emissions relative to 2012. Control factors for HC, NOx, and DPM were calculated based on the USEPA line-haul locomotive emission and fuel combustion forecasts.[125] The 2007 EPA draft regulatory impact analysis (RIA) for proposed locomotive and marine engines (USEPA, 2007) presents projected emission inventories for all years from 2006 through 2040 for large line-haul locomotives. Emission forecasts are presented for CO for a baseline scenario (no new regulations), and $PM_{2.5}$, NOx, and HC for a control scenario (with the proposed regulations).[126] The proposed regulations are not expected to affect CO or SO_2 emissions. These forecasts are based on a growth rate of 1.6% per year in fuel consumption.[127] Using these forecasts normalized for the 1.6% growth rate, control factors can be calculated for emission rates in 2014 relative to 2012.

The 2014 sulfur oxides control factor was calculated from the projected reduction in 47-state fuel sulfur to 51 ppm from 123 ppm[128] in 2012 and the fractions of California fuel (61%) and 47-state fuel (39%) burned by line-haul locomotives at ICTF/Dolores. No changes in emission factors were assumed for CO or GHGs. The 2014 line haul locomotive control factors are shown in Table 173.

Table 173
Emission Control Factors for Line-Haul Locomotives – ICTF and Dolores Rail Yards[a]
Project Year 2014

HC[b]	CO[c]	NOx[b]	DPM[b]	SOx[d]	GHG[c]
0.864	1.00	0.943	0.876	0.507	1.00

Notes:
a. Control factors are relative to the 2012 emission rates.
b. Calculated based on the USEPA line-haul locomotive emission and fuel consumption forecasts.
c. Assumed no control for CO and GHG emissions.
d. Calculated from the projected reduction in 47-state fuel sulfur in 2012.

125 From USEPA, 2007.
126 pp. 81, 82, 86, 87, and 89 of Chapter 3 in EPA420-D-07-001.
127 p. 72 of Chapter 3 in EPA420-D-07-001.
128 From USEPA, 2004.

Yard Switching

During 2007, the 10 GP-38 switchers at ICTF and Dolores will be replaced by ULEL "gen-set switchers." The ULEL switchers will be used to perform all yard operations in 2014. The 2012 emission estimates (in tons per year) were multiplied by the ratio of the predicted lift count for 2014 (1,300,000 lifts) to the 2012 predicted lift count (1,100,000 lifts) to determine the growth in ICTF-related switcher activity. Yard switching activity in support of ICTF freight was assumed to grow in proportion to the number of lifts. Yard switching activity in support of on-dock freight was assumed to change in proportion to on-dock freight. This approach insures that the emissions for each year and each type of support reflect a constant ratio of yard switching bhp-hrs of work per trailing ton of freight handled. A control factor was not applied to switcher operations for 2014.

Service and Maintenance

The Service Track and Locomotive Shop at the Dolores Yard were assumed to be operating at capacity during the 2005 baseline year. As discussed previously, the volume of ICTF-related operations at Dolores will increase from the baseline year, but the overall activity level of the Dolores yard will remain constant. Therefore, the number of locomotive service and load testing events was unchanged for Project Year 2014. See Table 6 in Part IV.A.1 for summary of the shop and service data for the 2005 baseline year.

Emissions

As discussed above, the 2014 emissions were calculated based on 2012 emissions estimates, a growth factor, and pollutant specific control factors for those pollutants whose emission rates are expected to change. Table 174 shows the locomotive emissions for Project Year 2014.

Table 174 Criteria Pollutant, DPM, and GHG Emissions from Locomotives – ICTF and Dolores Rail Yards Project Year 2014									
	Emissions (tons/yr)						Emissions (metric tons/yr)		
Activity	ROG	CO	NOx	PM_{10}	DPM	SOx	CO_2	N_2O	CH_4
Train Activity	1.84	4.03	31.90	0.91	0.91	0.07	2,491.42	0.06	0.20
Yard Operations	15.79	36.90	53.05	1.15	1.15	0.17	16,595.80	0.42	1.30
Load Testing	0.53	1.71	18.62	0.40	0.40	0.01	1,559.16	0.04	0.12
Service Idling	1.67	3.74	13.61	0.39	0.39	0.05	1,156.96	0.03	0.09
Total	**19.83**	**46.39**	**117.18**	**2.85**	**2.85**	**0.29**	**21,803.35**	**0.55**	**1.71**

2. HHD Diesel-Fueled Drayage Trucks

The 2014 calendar year emissions from HHD Diesel-fueled drayage trucks are based on the number of truck trips, the truck fleet distribution, the length of each trip, and the amount of time spent idling. The number of truck trips was based on the predicted lift count for 2014,[129] a gate count balancing factor,[130] and the assumption that 40% of the trucks entering ICTF with a container also leave the facility with a container.[131] See Appendix B-1 for a detailed discussion on the calculation methodology.

Table 175 summarizes the activity data, such as annual VMT and idling time, for HHD Diesel-fueled drayage trucks operating at ICTF. In addition to the traveling emissions, an average idling time of 15 minutes per HHD truck trip was assumed to account for emissions during truck queuing, staging, loading and unloading. By 2014, a new intermodal entry gate will be built at ICTF. Drayage trucks will enter the facility from Alameda Street and exit the facility via the existing gate at Sepulveda Blvd. In addition, a computerized Automatic Gate System (AGS) will be used at the Alameda Street gate. Based on studies of similar systems, it was assumed that the installation of AGS will

[129] Provided by UPRR.
[130] The gate balancing factor is equal to the "in-gate" container count divided by the total number of containers passing through the "in-gate" and "out-gate" of ICTF. In 2006, the gate balancing factor was 61%.
[131] Personal communication from Greg Chiodo of HDR on September 24, 2007.

decrease drayage truck idling time at the gate by 50%.[132] Other facility modifications, such as the installation of the WSG cranes and the one-way traffic flow pattern, will also reduce drayage truck idling.

Table 175
Summary of HHD Drayage Truck Activity Data – ICTF Rail Yard
Project Year 2014

Number of HHD Truck Trips[a]	VMT per HHD Truck Trip (mi/trip)[b]	Annual VMT (mi/yr)	Fuel Use (gal/yr)[c]	Idling Time	
				(min/trip)[d]	(hr/yr)
1,965,600	1.35	2,653,560	1,092,169	15	491,400

Notes:
a. Number of truck trips based on predicted lift count for 2012 and were estimated by HDR. See Appendix B-1 for discussion.
b. Trip length estimated from aerial photos of the Yard.
c. Includes fuel used during traveling and idling.
d. Idling time per trip is an engineering estimate based on interviews with UPRR staff and expected reductions in idling due to facility improvements.

Project Year 2014 criteria pollutant emission factors for the HHD Diesel-fueled drayage trucks were obtained from CARB's EMFAC2007 model. The emissions from idling and traveling modes were calculated separately. Fleet average emission factor for traveling exhaust emissions were calculated using the EMFAC2007 model with the BURDEN output option. Fleet average emission factors for idling were calculated using the EMFAC2007 model with the EMFAC output option. Since the fleet distribution is not known, the EMFAC2007 default distribution for Los Angeles County was used. The 2014 emission factors for the HHD Diesel-fueled drayage trucks are shown in Table 176. Detailed emission factor derivation calculations and the EMFAC2007 output are contained in Appendix B-5.

[132] Personal communication with Lanny Schmid of UPRR on October 4, 2007. Truck idling time at the gate prior to the installation of the AGS was assumed to be 10 minutes per trip. Total idling time is equal to 15 minutes per trip – 5 minutes at the gate, 5 minutes of idling during container loading/unloading, and 5 minutes for miscellaneous delays.

Table 176 Criteria Pollutant Emission Factors for HHD Diesel-Fueled Drayage Trucks – ICTF Rail Yard Project Year 2014						
Operating Mode	Fleet Average Emission Factors					
	ROG	CO	NOx	PM_{10}[c]	DPM[c]	SOx
Traveling (g/mi)[a]	3.24	8.01	14.65	0.88	0.82	0.03
Idling (g/hr)[b]	10.32	45.32	116.19	1.14	1.14	0.06

Notes:
a. Emission factors calculated for calendar year 2014 using the EMFAC2007 model with the BURDEN output option. The default fleet distribution for Los Angeles County was used.
b. Emission factors calculated for calendar year 2014 using the EMFAC2007 model with the EMFAC output option. The default fleet distribution for Los Angeles County was used.
c. The PM_{10} emission factor includes engine exhaust emissions along with brake and tire wear. The DPM emission factor includes engine exhaust emissions only.

Emission factors from CARB's *Draft Emission Factors for Mandatory Reporting Program* document (August 10, 2007) were used to calculate GHG emissions from drayage truck operations. The GHG emission factors are based on fuel consumption, not activity (i.e. miles driven or hours of operation), or model year. Therefore, the same factors are used to calculate emissions from both the traveling and idling modes and for all model year trucks. A fuel-specific carbon oxidization factor, from the CARB emission factor document, was also used to calculate CO_2 emissions. The GHG emission factors and carbon oxidization factor used to calculate emissions from drayage trucks during Project Year 2014 are shown in Table 177. A copy of CARB's *Draft Emission Factors for Mandatory Reporting Program* document is contained in Appendix C.

Table 177 GHG Emission Factors for HHD Diesel-Fueled Drayage Trucks – ICTF Rail Yard Project Year 2014				
Operating Mode	Carbon Oxidization Factor (%)	Emission Factors (kg/gal)[a]		
		CO_2	N_2O[c]	CH_4[c]
Traveling/Idling[b]	99.0	10.15	1.39×10^{-5}	4.16×10^{-5}

Notes:
a. Emission factors from CARB's *Draft Emission Factors for Mandatory Reporting Program* document (August 10, 2007).
b. Emission factors are based on fuel consumption; therefore, the same factors are used for both traveling and idling modes.
c. Based on a Diesel fuel HHV of 5.825 MMBtu/barrel (from *CARB Draft Emission Factors for Mandatory Reporting Programs*, August 10, 2007) and 42 gallons per barrel.

To calculate Project Year 2014 emissions from drayage truck operations, the activity data shown in Table 175 were combined with the emission factors shown in Tables 176 and 177. Table 178 shows the criteria pollutant, DPM, and GHG emission estimates for the HHD Diesel-fueled drayage trucks operating at ICTF during Project Year 2014.

Table 178
Criteria Pollutant, DPM, and GHG Emissions from HHD Diesel-Fueled Drayage Trucks – ICTF Rail Yard
Project Year 2014

Operating Mode	Emission (tons/yr)						Emissions (metric tons/yr)		
	ROG	CO	NOx	PM_{10}	DPM	SOx	CO_2	N_2O	CH_4
Traveling	9.48	23.44	42.85	2.58	2.40	0.08	7,723.00	0.01	0.03
Idling	5.59	24.55	62.94	0.62	0.62	0.03	3,251.66	0.00	0.01
Total	**15.07**	**47.99**	**105.79**	**3.20**	**3.02**	**0.11**	**10,974.66**	**0.01**	**0.04**

3. Cargo Handling Equipment (CHE)

A key component of the modernization project is the replacement of Diesel-fueled cargo handling equipment with 39 electric wide span gantry (WSG) cranes. All 39 WSG cranes are expected to be operating at full capacity by 2012.[133] All of the Diesel-fueled CHE, except one forklift and one top pick, will be removed from the facility at that time. The use of the forklift and the top pick will be limited to emergency operation only. In addition, two alternative-fueled yard hostlers[134] will be used for emergencies. The CHE equipment specification and activity data for Project Year 2014 are summarized in Table 176.

[133] Personal communication with Lanny Schmid of UPRR on August 21, 2007.
[134] The yard hostlers will be fueled with biodiesel, propane, or LNG.

Table 179 Equipment Specifications and Activity Data for Cargo Handling Equipment – ICTF Rail Yard Project Year 2014						
Equipment Type	Make/Model	Model Year	Rating (hp)	No. of Units[c]	Hours of Operation (hr/yr/unit)	Fuel Use (gal/yr)
Forklift[a]	Toyota 6FDU25	1997	85	1	365	642[d]
Top Pick[a]	Taylor Tay-950	1989	350	1	365	4,352[d]
Yard Hostler[b]	TBD	2012	173	2	365	7,026[e]
WSG Crane	TBD	TBD	TBD	39	8,760	0[f]
Total				**43**		**12,020**

Notes:

a. This equipment will be Diesel-fueled and operated for emergency use only.
b. The yard hostlers will be fueled with biodiesel, propane, or LNG and be used for emergencies only.
c. Equipment counts are from the ICTF Modernization Plan.
d. Fuel use is based on the equipment specific bsfc rate from the OFFROAD2007 model and a Diesel fuel density of 7.1 lb/gal.
e. Fuel use is based on the equipment specific bsfc rate from the OFFROAD2007 model and an LPG density of 3.9 lb/gal.
f. The WSG cranes are electric.

Equipment-specific criteria pollutant and DPM emission factors for Project Year 2014 were calculated using a spreadsheet, developed by CARB staff, based on the OFFROAD2007 model. The DPM emission factors were adjusted, as needed, to show compliance with CARB's *Regulation for Mobile Cargo Handling Equipment at Ports and Intermodal Rail Yards* (CARB, 2005). It was assumed that a Level 3 verified Diesel emission control strategy (VDECS), with a minimum DPM reduction of 85%, was installed on each affected equipment unit.

Emission factors from CARB's *Draft Emission Factors for Mandatory Reporting Program* document (August 10, 2007) were used to calculate GHG emissions from CHE operations. The GHG emission factors are based on fuel consumption and are not equipment or year specific. A fuel-specific carbon oxidization factor, from the CARB emission factor document, was also used to calculate CO_2 emissions. The criteria pollutant emission factors, DPM, and GHG emission factors, as well as the carbon oxidization factor used to calculate emissions from the CHE, are shown in Table 180.

Detailed emission factor derivation calculations and the OFFROAD2007 output are contained in Appendix D-4. A copy of CARB's *Draft Emission Factors for Mandatory Reporting Program* document is contained in Appendix C.

To calculate the emissions from CHE operations, the activity data shown in Table 179 were combined with the emission factors shown in Table 180. The criteria pollutant, DPM, and GHG emission estimates for the CHE operating at ICTF during Project Year 2012 are shown in Table 181.

Table 180
Criteria Pollutant, DPM, and GHG Emission Factors for Cargo Handling Equipment – ICTF Rail Yard
Project Year 2014

Equipment Type	Make/ Model	Model Year	Fuel Type	Carbon Oxidization Factor (%)[b]	Emission Factors (g/hp-hr)[a]						Emission Factors (kg/gal)[b]		
					ROG	CO	NOx	PM_{10}	DPM	SOx	CO_2	N_2O[c]	CH_4[c]
Forklift	Toyota 6FDU25	1997	Diesel	99.0	0.990	3.49	8.75	*0.10*	*0.10*	0.062	10.15	1.39×10^{-5}	4.16×10^{-5}
Top Pick	Taylor Tay-950	1989	Diesel	99.0	0.68	2.70	8.17	*0.06*	*0.06*	0.060	10.15	1.39×10^{-5}	4.16×10^{-5}
Yard Hostler	TBD	2012	LPG/LNG[d]	99.0	0.32	17.41	1.87	0.60	0.00	0.00	5.95	9.02×10^{-6}	9.02×10^{-5}
WSG Crane	TBD	TBD	Electric	99.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Notes:

a. Criteria pollutant emission factors calculated using a spreadsheet, developed by CARB staff, based on the OFFROAD2007 model. DPM emission factors that are shown in italics were adjusted for compliance with *CARB's Regulation for Mobile Cargo Handling Equipment at Ports and Intermodal Rail Yards*. It was assumed that a Level 3 VDECS (85% control) was installed on each affected unit.

b. GHG emission factors and carbon oxidization factors from CARB's *Draft Emission Factors for Mandatory Reporting Program* document (August 10, 2007).

c. Emission factor based on a Diesel fuel HHV of 5.825 MMBtu/barrel (from CARB Draft Emission Factors for Mandatory Reporting Programs, August 10, 2007) and 42 gallons per barrel.

d. The yard hostlers will be fueled with biodiesel, propane, or LNG. Emissions were calculated based on the use of LPG/LNG. The OFFROAD model does not distinguish between these fuels. Emission factors for all potential fuels shown are in Section 1.5.1.7 of the ADP.

Table 181
Criteria Pollutant, DPM, and GHG Emissions from Cargo Handling Equipment – ICTF Rail Yard
Project Year 2014

Equipment Type	Make/Model	Model Year	Fuel Type	Emission (tpy)						Emission (metric tons/yr)		
				ROG	CO	NOx	PM_{10}	DPM	SOx	CO_2	N_2O	CH_4
Forklift	Toyota 6FDU25	1997	Diesel	0.01	0.04	0.09	0.00	0.00	0.00	6.45	0.00	0.00
Top Pick	Taylor Tay-950	1989	Diesel	0.06	0.22	0.68	0.00	0.00	0.00	43.74	0.00	0.00
Yard Hostler	TBD	2012	LPG/LNG	0.02	0.96	0.10	0.03	0.00	0.00	41.39	0.00	0.00
WSG Crane	TBD	TBD	Electric	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total				**0.09**	**1.22**	**0.87**	**0.03**	**0.00**	**0.00**	**91.58**	**0.00**	**0.00**

CARB's speciation profile database was used to determine the fraction of each TAC in the total ROG emissions from the propane-fueled yard hostlers. The database does not contain a profile for propane combusted in an internal combustion engine. Therefore, the speciation profile for natural gas-fired reciprocating engines was used.[135] All TACs listed in the most recent version of the Emission Inventory Criteria and Guidelines Report for the Air Toxics "Hot Spots" Program have been included. The TAC speciation profile and annual emissions of each TAC are shown in Table 182. The relevant sections of the speciation profile database are included in Appendix D-4.

Table 182
TAC Emissions from Propane-Fueled Yard Hostlers– ICTF Rail Yard
Project Year 2014

CAS	Pollutant[a]	Organic Fraction[b,c]	Emissions (tons/yr)
95636	1,2,4-trimethylbenzene	0.00001	2.71×10^{-7}
75070	acetaldehyde	0.00003	8.13×10^{-7}
71432	benzene	0.00010	2.98×10^{-6}
110827	cyclohexane	0.00001	2.71×10^{-7}
100414	ethylbenzene	0.00001	2.71×10^{-7}
74851	ethylene	0.00058	1.71×10^{-5}
50000	formaldehyde	0.00074	2.20×10^{-5}
108383	m-xylene	0.00001	2.71×10^{-7}
110543	n-hexane	0.00002	5.42×10^{-7}
95476	o-xylene	0.00001	2.71×10^{-7}
115071	propylene	0.00154	4.58×10^{-5}
108883	toluene	0.00004	1.08×10^{-6}
1330207	xylene	0.00002	5.42×10^{-7}
Total			$\mathbf{9.22 \times 10^{-5}}$

Notes:

a. Emissions were calculated for only those chemicals that were in both the CARB SPECIATE database and the AB 2588 list.

b. Organic fraction data are from CARB's SPECIATE database. Data are from profile #719 "I.C.E. reciprocating – natural gas." A speciation profile for propane was not included in the database.

c. Organic fraction is reported on a ROG basis using CARB's SPECIATE ROG/TOG ratio of 0.0914.

[135] Speciation profile number 3 was used to calculate TAC emissions for these sources.

4. <u>Heavy Equipment</u>

Diesel-fueled heavy equipment is used at ICTF for non-cargo-related activities at the Yard, such as maintenance, handling of parts and Company material, derailments, etc. Also, two propane-fueled forklifts are used at the locomotive shop at the Dolores Yard. The heavy equipment specification and activity data for the 2014 calendar year are summarized in Table 183.

Equipment-specific criteria pollutant and DPM emission factors for the 2014 calendar year were calculated using the OFFROAD2007 model. The DPM emission factors were adjusted, as needed, to show compliance with CARB's *Regulation for Mobile Cargo Handling Equipment at Ports and Intermodal Rail Yards* (CARB, 2005). It was assumed that a Level 3 verified Diesel emission control strategy (VDECS), with a minimum DPM reduction of 85%, was installed on each affected equipment unit.

Emission factors from CARB's *Draft Emission Factors for Mandatory Reporting Program* document (August 10, 2007) were used to calculate GHG emissions from heavy equipment operations. The GHG emission factors are based on fuel consumption and are not equipment or year specific. A fuel-specific carbon oxidization factor, from the CARB emission factor document, was also used to calculate CO_2 emissions. The criteria pollutant emission factors, DPM, and GHG emission factors, as well as the carbon oxidization factor used to calculate emissions from the heavy equipment are shown in Table 184. Detailed emission factor derivation calculations and the OFFROAD2007 output are contained in Appendix E-4. A copy of CARB's *Draft Emission Factors for Mandatory Reporting Program* document is contained in Appendix C.

To calculate the emissions from CHE operations, the activity data shown in Table 183 was combined with the emission factors shown in Table 184. The criteria pollutant, DPM, and GHG emission estimates for the Diesel-fueled CHE operating at ICTF during Project Year 2014 are shown in Table 185.

Table 183
Equipment Specifications and Activity Data for Heavy Equipment – ICTF and Dolores Rail Yards
Project Year 2014

Yard	Location	Equipment Type	Make/Model	Fuel Type	Model Year	Rating (hp)	No. of Units	Hours of Operation (hr/yr/unit)[a,]	Fuel Use (gal/yr)[b]
ICTF	Car Department	Crane	Grove RT600E	Diesel	2004	173	1	1,095	5,392
ICTF	Various Locations	Man Lift	TBD	Diesel	2008	50	1	1,825	3,133
Dolores	Locomotive Shop	Forklift	Yale GP060	Propane	Unknown	150	2	3,285	38,441
Total							**4**		**46,966**

Notes:
a. Assumed no change from the 2005 baseline in hours of operation for the Grove Crane and the Yale Forklifts.
b. The total fuel used by all units in each category.

Table 184
Criteria Pollutant, DPM, and GHG Emission Factors for Heavy Equipment – ICTF and Dolores Rail Yards
Project Year 2014

Yard	Equipment Type	Make/Model	Fuel Type	Model Year	Carbon Oxidization Factor (%)[c]	Emission Factor (g/bhp-hr)[a]						Emission Factor (kg/gal)[c]		
						ROG[b]	CO	NOx	PM_{10}	DPM	SOx	CO_2	N_2O[d]	CH_4[d]
ICTF	Crane	Grove RT600E	Diesel	2004	99.0	0.64	3.56	5.33	0.04	*0.04*	0.01	10.15	1.39×10^{-5}	4.16×10^{-5}
ICTF	Man Lift	TBD	Diesel	2008	99.0	0.25	3.46	2.88	0.01	0.01	0.01	10.15	1.39×10^{-5}	4.16×10^{-5}
Dolores	Forklift	Yale GP060	Propane	ALL[e]	99.5	0.18	33.65	6.72	0.06	NA	0.00	5.95	3.74×10^{-5}	8.31×10^{-6}

Notes:

a. Criteria pollutant emission factors from the OFFROAD2007 model. DPM emission factors that are shown in italics were adjusted for compliance with CARB's *Regulation for Mobile Cargo Handling Equipment at Ports and Intermodal Rail Yards*. It was assumed that a Level 3 VDECS (85% control) was installed on each affected unit.

b. Evaporative emissions for these sources are negligible.

c. GHG emission factors and carbon oxidization factor from CARB's *Draft Emission Factors for Mandatory Reporting Program* document (August 10, 2007).

d. Emission factors for Diesel fuel sources based on a Diesel fuel HHV of 5.825 MMBtu/barrel (from CARB Draft Emission Factors for Mandatory Reporting Programs, August 10, 2007) and 42 gallons per barrel. Emission factors for propane-fueled sources based on an LPG HHV of 91,300 Btu/gal (from the Transportation Energy Data Book: Edition 26, U.S. Department of Energy, 2007).

e. To obtain the criteria pollutant emission factors, the forklifts are modeled as the calendar year 2014 fleet average model year group from the OFFROAD2007 model.

Table 185
Criteria Pollutant, DPM, and GHG Emissions from Heavy Equipment – ICTF and Dolores Rail Yards
Project Year 2014

Yard	Equipment Type	Make/Model	Fuel Type	Model Year	Emissions (tons/year)						Emission (metric tons/year)		
					ROG	CO	NOx	PM_{10}	DPM	SOx	CO_2	N_2O	CH_4
ICTF	Crane	Grove RT600E	Diesel	2004	0.06	0.32	0.48	0.00	0.00	0.00	54.18	0.00	0.00
ICTF	Man Lift	TBD	Diesel	2008	0.01	0.16	0.13	0.00	0.00	0.00	31.49	0.00	0.00
Dolores	Forklift	Yale GP060	Propane	ALL	0.06	10.97	2.19	0.02	0.00	0.00	227.58	0.00	0.00
Total					**0.13**	**11.45**	**2.80**	**0.02**	**0.00**	**0.00**	**313.25**	**0.00**	**0.00**

CARB's speciation profile database was used to determine the fraction of each TAC in the total ROG emissions from the propane-fueled forklifts. The database does not contain a profile for propane combusted in an internal combustion engine. Therefore, the speciation profile for natural gas-fired reciprocating engines was used. All TACs listed in the most recent version of the Emission Inventory Criteria and Guidelines Report for the Air Toxics "Hot Spots" Program have been included. The TAC speciation profile and annual emissions of each TAC are shown in Table 186. The relevant sections of the speciation profile database are included in Appendix E-4.

Table 186
TAC Emissions from Propane-Fueled Forklifts – Dolores Rail Yard
Project Year 2014

CAS	Pollutant[a]	Organic Fraction[b,c]	Emissions (tons/yr)
95636	1,2,4-trimethylbenzene	0.00001	5.31×10^{-7}
75070	acetaldehyde	0.00003	1.59×10^{-6}
71432	benzene	0.00010	5.84×10^{-6}
110827	cyclohexane	0.00001	5.31×10^{-7}
100414	ethylbenzene	0.00001	5.31×10^{-7}
74851	ethylene	0.00058	3.35×10^{-5}
50000	formaldehyde	0.00074	4.30×10^{-5}
108383	m-xylene	0.00001	5.31×10^{-7}
110543	n-hexane	0.00002	1.06×10^{-6}
95476	o-xylene	0.00001	5.31×10^{-7}
115071	propylene	0.00154	8.98×10^{-5}
108883	toluene	0.00004	2.13×10^{-6}
1330207	xylene	0.00002	1.06×10^{-6}
Total			**1.81×10^{-4}**

Notes:

a. Emissions were calculated for only those chemicals that were in both the CARB SPECIATE database and the AB 2588 list.

b. Organic fraction data are from CARB's SPECIATE database. Data are from profile #719 "I.C.E. reciprocating – natural gas." A speciation profile for propane was not included in the database.

c. Organic fraction is reported on a ROG basis using CARB's SPECIATE ROG/TOG ratio of 0.0194.

5. TRUs and Reefer Cars

Criteria pollutant, DPM, and GHG emissions were calculated from the Diesel-fueled engines that power the refrigeration units on TRUs and reefer cars. In addition to the Diesel engine exhaust emissions, GHG emissions from refrigerant loss were also calculated.

The TRUs are owned by a variety of independent shipping companies and equipment-specific data are not available. Therefore, the default Diesel engine equipment rating and distribution contained in the OFFROAD2007 model were used for emission calculations. It was assumed that the number of TRUs and reefer cars in the Yard at any one time remained constant during the year, with individual units cycling in and out of the Yard.

Emissions from TRUs and reefer cars are based on the average size of the Diesel engines, the average number of units in the yard, and the hours of operation for each engine. The number of units in the yard during the 2014 calendar year was calculated by multiplying the 2005 TRU count, based on UPRR car data reports, by the ratio of the predicted lift count for 2014[136] to the 2005 lift count. The equipment size and hours of operation for each unit were not changed from the 2005 baseline assumptions. Equipment specifications and activity data for TRUs and reefer cars are summarized in Table 187.

[136] From the ICTF Modernization Plan.

Table 187
Equipment Specifications and Activity Data for TRUs and Reefer Cars – ICTF Rail Yard
Project Year 2014

Equipment Type	Average Rating (hp)[a]	Average No. of Units in Yard[b]	Hours of Operation		Fuel Use (gal/yr)[e]
			(hr/day)[c]	(hr/yr)[d]	
Container	28.56	145	4	1,460	252,119
Railcar	34	21	4	1,460	40,762

Notes:

a. Based on the average horsepower distribution in the OFFROAD2007 model.

b. UPRR staff estimates and car data reports indicate that in 2005 there were approximately 35 TRUs and 2-5 reefer cars in the Yard at any given time. To be conservative, these estimates were increased by 100%. For 2014, the number of TRUs and reefer cars was equal to the No. of Units in 2005 x (2014 lift count/2005 lift count).

c. From CARB's *Staff Report: Initial Statement of Reason for Proposed Rulemaking for Airborne Toxic Control Measure for In-Use Diesel-Fueled Transport Refrigeration Units (TRU) and TRU Generator Sets, and Facilities Where TRUs Operate*, October 2003.

d. It was assumed that the number of units and the annual hours of operation remain constant, with individual units cycling in and out of the Yard.

e. Fuel use was calculated based on the bsfc contained in the OFFROAD2007 model and a Diesel fuel density of 7.1 lb/gal. Fuel use shown is for all units in each category.

Criteria pollutant and DPM emission factors for the Diesel-fueled engines on TRUs and reefer cars are from the OFFROAD2007 model. The DPM emission factor was adjusted to show compliance with the CARB's *Airborne Toxic Control Measure for In-Use Diesel-Fueled Transport Refrigeration Units (TRU) and TRU Generator Sets, and Facilities Where TRUs Operate* (CARB, 2004).[137] Emission factors from CARB's *Draft Emission Factors for Mandatory Reporting Program* document (August 10, 2007) were used to calculate GHG emissions from TRU engine operations. A fuel-specific carbon oxidization factor, from the CARB emission factor document, was used to calculate CO_2 emissions. The criteria pollutant, DPM, and GHG emission factors, as well as the carbon oxidation factor, used to calculate emissions from the TRUs and reefer cars are shown in Table 188. Detailed emission factor derivation calculations and the OFFROAD2007 output are contained in Appendix F-4. A copy of CARB's *Draft Emission Factors for Mandatory Reporting Program* document is contained in Appendix C.

[137] Available at *http://www.arb.ca.gov/regact/trude03/fro1.pdf*

Table 188
Criteria Pollutant, DPM, and GHG Emission Factors for Diesel-Fueled TRUs and Reefer Car Engines – ICTF Rail Yard
Project Year 2014

Equipment Type	Carbon Oxidization Factor (%)[e]	Emission Factors (g/hp-hr-unit)[a]						Emission Factors (kg/gal)[d]		
		VOC[b]	CO	NOx	PM_{10}	DPM[c]	SOx[d]	CO_2	N_2O[f]	CH_4[f]
TRU	99.0	0.66	4.85	5.02	0.12	0.12	0.01	10.15	1.39×10^{-5}	4.16×10^{-5}
Reefer Car	99.0	0.68	5.29	5.29	0.12	0.12	0.01	10.15	1.39×10^{-5}	4.16×10^{-5}

Notes:
a. Emission factors from OFFROAD2007 model.
b. Evaporative emissions from this source are negligible.
c. DPM emission factor was adjusted to show compliance with the TRU ATCM. The average of the LETRU and ULETRU factors from Table 3 of the ATCM was used.
d. Emission factor was based on a Diesel fuel sulfur content of 130 ppm.
e. GHG emission factors and carbon oxidization factor are from CARB's *Draft Emission Factors for Mandatory Reporting Program* document (August 10, 2007).
f. Emission factors for Diesel fuel sources are based on a Diesel fuel HHV of 5.825 MMBtu/barrel (from CARB Draft Emission Factors for Mandatory Reporting Programs, August 10, 2007) and 42 gallons per barrel

To calculate the emissions from the operation of the Diesel-fueled engines on TRUs and reefer cars, the activity data shown in Table 187 were combined with the emission factors shown in Table 188. The criteria pollutant, DPM, and GHG emission estimates for the Diesel-fueled engines on TRUs and reefer cars operating at ICTF during Project Year 2014 are shown in Table 189.

Table 189
Emissions from Diesel-Fueled TRUs and Reefer Car Engines – ICTF Rail Yard
Project Year 2014

Equipment Type	Emissions (tons/yr)						Emissions (metric tons/yr)		
	VOC	CO	NOx	PM_{10}	DPM	SOx	CO_2	N_2O	CH_4
TRU	2.44	18.06	18.67	0.45	0.45	0.03	2,533.42	0.00	0.01
Reefer Car	0.41	3.18	3.18	0.07	0.07	0.01	409.60	0.00	0.00
Total	**2.85**	**21.25**	**21.86**	**0.52**	**0.52**	**0.04**	**2,943.02**	**0.00**	**0.01**

In addition to the GHG emissions from the Diesel-fueled engines on the TRUs and reefer cars, GHG emissions were calculated for refrigerant losses from TRUs. Emissions were calculated for HFC-125, HFC-134a, and HFC-143a, according to the methods outlined in the *Berths 136-147 (TraPac) Container Terminal Draft Environmental Impact Statement (EIS)/Environmental Impact Report (EIR)* (Port of Los Angeles, 2007). The activity data, emission factors, and emissions from TRU and reefer car refrigerant loss are shown in Table 190.

Table 190
GHG Emissions from TRU and Reefer Car Refrigerant Loss – ICTF Rail Yard
Project Year 2014

Equipment Type	Avg. No. of Units in Yard[a]	Refrigerant Charge per Unit (kg)[b]	Annual Refrigerant Loss Rate (%)[c]	Annual Refrigerant Loss (kg/yr)	Emissions by Refrigerant[d,e] (metric tons/yr)		
					HFC-125	HFC-134a	HFC-143a
TRU	145	6.35	35%	322.90	0.071	0.168	0.084
Reefer Car	21	6.35	35%	46.13	0.010	0.024	0.012
Total	**166**			**369.03**	**0.081**	**0.192**	**0.096**

Notes:
a. See Table 184.
b. From Berths *136-147 (TraPac) Container Terminal Project Draft EIS/EIR* (POLA, 2007).
c. POLA upper bound estimate, TraPac Draft EIS/EIR.
d. POLA estimate, TraPac Draft EIS/EIR.
e. Assumes a mix of refrigerants of 50% R404a and 50% HFC-134a; assumes R404a equals 52% HFC-143a, 44% HFC-125, and 4% HFC-134a.

6. HHD Diesel-Fueled Delivery Trucks

In addition to the drayage trucks, HHD trucks deliver Diesel fuel, oil, sand, and soap to the Dolores Yard and gasoline, Diesel fuel, and oil to ICTF. The annual number of delivery truck trips was calculated based on the facility gasoline, Diesel fuel, oil, and soap throughput and a tanker truck capacity of 8,000 gallons per truck. The annual number of sand delivery truck trips was based on the discussions with UPRR staff. Per the Dolores Yard Operations Manager, the facility receives 2 to 3 sand deliveries per week. For the 2014 emissions inventory, it was assumed that there were no changes in annual throughput for tanks located at the Dolores Yard or ICTF. The VMT per trip was estimated from aerial photos of the Yards and was unchanged from the 2005 baseline inventory. Activity data for the HHD delivery trucks is summarized in Table 191.

Table 191
Activity Data for HHD Delivery Trucks – ICTF and Dolores Rail Yards
Project Year 2014

Yard	Delivery Type	Number of Trips[a,b]	VMT per Trip (mi/trip)[c]	Annual VMT (mi/yr)	Fuel Use (gal/yr)[d]	Idling Time (min/trip)[e]	Idling Time (hr/yr)
Dolores	Diesel Fuel	2,625	0.06	157.50	333.7	10	437.50
Dolores	Sand	156	2.2	343.20	150.8	30	78.00
Dolores	Oil	24	0.06	1.44	3.1	10	4.00
Dolores	Soap	3	0.06	0.17	0.4	10	0.47
ICTF	Alternative Fuel	3	0.5	1.25	0.6	10	0.42
Total		**2,810**		**503.56**	**488.6**		**520.4**

Notes:
a. Number of truck trips for liquid products based on the material throughput and a tanker truck volume of 8,000 gallons per truck.
b. Number of sand truck trips based on personal communication with UPRR staff.
c. VMT per trip estimated from aerial photos of each Yard.
d. Fuel use is for both traveling and idling modes and was calculated from EMFAC2007.
e. Engineering estimate based on personal communication with UPRR staff.

Criteria pollutant and DPM emission factors for the HHD Diesel-fueled delivery trucks were obtained from CARB's EMFAC2007 model. The emissions from idling and traveling modes were calculated separately. Fleet average emission factors for traveling exhaust emissions were calculated using the EMFAC2007 model with the BURDEN output option. Fleet average emission factors for idling were calculated using the

EMFAC2007 model with the EMFAC output option. Since the fleet distribution is not known, the EMFAC2007 default distribution for Los Angeles County was used. The criteria pollutant and DPM emission factors for the HHD Diesel-fueled delivery trucks are shown in Table 192. Detailed emission factor derivation calculations and the EMFAC2007 output are contained in Appendix G-4.

Table 192
Criteria Pollutant and DPM Emission Factors for HHD Diesel-Fueled Delivery Trucks – ICTF and Dolores Rail Yard
Project Year 2014

Operating Mode	Fleet Average Emission Factors					
	ROG	CO	NOx	PM_{10}[c]	DPM[c]	SOx
Traveling (g/mi)[a]	3.24	8.01	14.65	0.88	0.82	0.03
Idling (g/hr)[b]	10.32	45.32	116.19	1.14	1.14	0.06

Notes:
a. Emission factors calculated using the EMFAC2007 model with the BURDEN output option. The default fleet distribution for Los Angeles County was used.
b. Emission factors calculated using the EMFAC2007 model with the EMFAC output option. The default fleet distribution for Los Angeles County was used.
c. The PM_{10} emission factor includes engine exhaust emissions along with brake and tire wear. The DPM emission factor includes engine exhaust emissions only.

Emission factors from CARB's *Draft Emission Factors for Mandatory Reporting Program* document (August 10, 2007) were used to calculate GHG emissions from delivery truck operations. The GHG emission factors are based on fuel consumption, not activity (i.e. miles driven or hours of operation), therefore, the same factors are used to calculate emissions from both the traveling and idling modes. A fuel-specific carbon oxidization factor, from the CARB emission factor document, was also used to calculate CO_2 emissions. The GHG emission factors for delivery trucks are shown in Table 193. A copy of CARB's *Draft Emission Factors for Mandatory Reporting Program* document is contained in Appendix C.

Table 193 GHG Emission Factors for HHD Diesel-Fueled Delivery Trucks – ICTF and Dolores Rail Yards Project Year 2014				
Operating Mode	Carbon Oxidization Factor (%)[a]	Emission Factors (kg/gal)[a]		
		CO_2	N_2O[c]	CH_4[c]
Traveling/Idling[b]	99.0	10.15	1.39×10^{-5}	4.16×10^{-5}

Notes:
a. Emission factors and carbon oxidization factor from CARB's *Draft Emission Factors for Mandatory Reporting Program* document (August 10, 2007).
b. Emission factors are based on fuel consumption; therefore, the same factors are used for both traveling and idling modes.
c. Based on a Diesel fuel HHV of 5.825 MMBtu/barrel (from *CARB Draft Emission Factors for Mandatory Reporting Programs*, August 10, 2007) and 42 gallons per barrel

To calculate the emissions from delivery truck operations, the activity data shown in Table 191 was combined with the emission factors shown in Tables 192 and 193. The criteria pollutant, DPM, and GHG emission estimates for the HHD Diesel-fueled delivery trucks operating at the ICTF and Dolores yards during Project Year 2014 are shown in Table 194.

Table 194 Criteria Pollutant, DPM, and GHG Emissions from HHD Diesel-Fueled Delivery Trucks – ICTF and Dolores Rail Yards Project Year 2014									
Operating Mode	Emission (tpy)						Emission (metric tons/yr)		
	ROG	CO	NOx	PM_{10}	DPM	SOx	CO_2	N_2O	CH_4
Traveling	0.00	0.00	0.01	0.00	0.000	0.00	1.47	0.00	0.00
Idling	0.01	0.02	0.07	0.00	0.001	0.00	3.44	0.00	0.00
Total	**0.01**	**0.02**	**0.08**	**0.00**	**0.00**	**0.00**	**4.91**	**0.00**	**0.00**

7. Yard Trucks

A number of light duty and medium duty gasoline-fueled trucks are used by the staff at the ICTF and Dolores Yards. For the 2014 inventory, it was assumed that the number of vehicles, the fleet distribution (number of vehicles per weight class), and the annual VMT were unchanged from the 2005 baseline year. Emissions were based on a modified fleet average model year distribution. It was assumed that vehicles in the fleet were the same model years as existed in the 2005 baseline year or newer. For example, the 2005 fleet included a model year 2000 Jeep Cherokee. For the 2014 emission estimate, it was assumed this vehicle would be replaced at some time since 2005 with a newer vehicle. Therefore, this vehicle was assumed to be a model year 2000-2014 light duty truck. The equipment specifications and activity data for the yard trucks are summarized in Table 195.

Table 195
Equipment Specifications and Activity Data for Gasoline-Fueled Yard Trucks – ICTF and Dolores Rail Yards
Project Year 2014

Yard	Equipment Type	Equipment ID	Vehicle Class	Make/Model	Model Year[a]	Annual VMT (mi/yr)[b]	Fuel Use (gal/yr)[c]	Idling (hr/yr)[d]
ICTF	SUV	1915-53287	LDT	Jeep Cherokee	2000-2014	73,000	6,806	NA
ICTF	Pickup Truck	1915-55536	LDT	Chevy Extended Cab	2003-2014	73,000	6,781	NA
ICTF	SUV	1915-19952	LDT	Chevy Trailblazer 370	2003-2014	73,000	6,781	NA
ICTF	Pickup Truck	1915-19971	LDT	Chevy Extended Cab	2004-2014	73,000	6,773	NA
ICTF	Van	1915-19975	LHDT 1	Chevy 15 Passenger Van	2004-2014	73,000	11,803	91.25
Dolores	Service Truck	73152	MHD	Chevy C4500	2003-2014	12,644	2,101	91.25
Dolores	Mgr Truck	Unknown	LDT	Chevy Trailblazer	2004-2014	45,000	4,175	NA
Dolores	Mgr Truck	73167	LDT	Chevy Blazer	2004-2014	36,608	3,397	NA
Dolores	Pickup Truck	73396	LDT	Ford F-150	2005-2014	23,756	2,202	NA

Notes:

a. It was assumed that vehicles in the fleet were the same model years as existed in the 2005 baseline year or newer.
b. The 2005 VMT was estimated from either the odometer reading divided by the age of the vehicle or interviews with UPRR staff. Assumed no change in VMT from the 2005 baseline year.
c. Calculated using the EMFAC2007 model.
d. Idling time is an engineering estimate. Idling emissions from light duty trucks are negligible; therefore, idling time data for these vehicles was not collected.

Modified fleet average criteria pollutant emission factors were obtained from CARB's EMFAC2007 model for each vehicle. The emissions from idling and traveling modes were calculated separately. Traveling exhaust emission factors were calculated using the EMFAC2007 model with the BURDEN output option. Idling emission factors for the light-heavy duty and medium heavy duty vehicles were calculated using the EMFAC2007 model with the EMFAC output option. Idling emissions from light duty trucks were negligible. The 2014 criteria pollutant emission factors for the yard trucks are shown in Table 196. Detailed emission factor derivation calculations and the EMFAC2007 output are contained in Appendix H-4.

Table 196
Criteria Pollutant Emission Factors for Yard Trucks – ICTF and Dolores Rail Yards
Project Year 2014

Yard	Equipment Type	Make/Model	Vehicle Class	Model Year	Traveling Emission Factors (g/mi)[a]					Idling Emission Factors (g/hr)[b]				
					ROG	CO	NOx	PM_{10}	SOx	ROG	CO	NOx	PM_{10}	SOx
ICTF	SUV	Jeep Cherokee	LDT	2000-2014	0.04	1.61	0.11	0.05	0.01	NA	NA	NA	NA	NA
ICTF	Pickup Truck	Chevy Ext. Cab	LDT	2003-2014	0.03	1.02	0.07	0.04	0.01	NA	NA	NA	NA	NA
ICTF	SUV	Chevy Trailblazer	LDT	2003-2014	0.03	1.02	0.07	0.04	0.01	NA	NA	NA	NA	NA
ICTF	Pickup Truck	Chevy Ext. Cab	LDT	2004-2014	0.02	0.86	0.06	0.04	0.01	NA	NA	NA	NA	NA
ICTF	Van	Chevy Van	LHDT 1	2004-2014	0.02	0.38	0.12	0.04	0.01	22.96	138.91	1.48	0.00	0.05
Dolores	Service Truck	Chevy C4500	MHD	2003-2014	0.15	2.22	0.37	0.02	0.02	23.25	140.05	1.50	0.00	0.05
Dolores	Mgr Truck	Chevy Trailblazer	LDT	2004-2014	0.03	1.02	0.07	0.04	0.01	NA	NA	NA	NA	NA
Dolores	Mgr Truck	Chevy Blazer	LDT	2004-2014	0.03	1.02	0.07	0.04	0.01	NA	NA	NA	NA	NA
Dolores	Pickup Truck	Ford F-150	LDT	2005-2014	0.02	0.72	0.05	0.02	0.01	NA	NA	NA	NA	NA

Notes:

a. Traveling exhaust emissions calculated using the EMFAC2007 model with the BURDEN output option at a vehicle speed of 15 mph.

b. Idling exhaust emissions factors for LHDT1 and MHD vehicles calculated using the EMFAC2007 model with the EMFAC output option. Idling exhaust emissions from light duty trucks (LDT) are negligible.

Emission factors from CARB's *Draft Emission Factors for Mandatory Reporting Program* document (August 10, 2007) were used to calculate GHG emissions from yard trucks. The GHG emission factors are based on fuel consumption, not activity (i.e. miles driven or hours of operation), therefore, the same factors are used to calculate emissions from both the traveling and idling modes. A fuel-specific carbon oxidization factor, from the CARB emission factor document, was also used to calculate CO_2 emissions. The GHG emission factors and the carbon oxidization factor for yard trucks are shown in Table 197. A copy of CARB's *Draft Emission Factors for Mandatory Reporting Program* document is contained in Appendix C.

Table 197
GHG Emission Factors for Yard Trucks – ICTF and Dolores Rail Yards
Project Year 2014

Operating Mode	Carbon Oxidization Factor (%)[a]	Emission Factors (kg/gal)[a]		
		CO_2	N_2O[c]	CH_4[c]
Traveling/Idling[b]	99.0	8.87	1.23×10^{-5}	1.60×10^{-4}

Notes:
a. Emission factors and carbon oxidization factor from CARB's *Draft Emission Factors for Mandatory Reporting Program* document (August 10, 2007).
b. Emission factors are based on fuel consumption; therefore, the same factors are used for both traveling and idling modes.
c. Based on a gasoline HHV of 122,697 Btu/gallon (from the Transportation Energy Data Book: Edition 26, U.S. Department of Energy, 2007).

To calculate the emissions from yard truck operations, the activity data shown in Table 195 was combined with the emission factors shown in Tables 196 and 197. The criteria pollutant and GHG emission estimates for the yard trucks operating at the ICTF and Dolores yards during Project Year 2014 are shown in Table 198.

Table 198
Criteria Pollutant Emissions from Yard Trucks – ICTF and Dolores Rail Yards
Project Year 2014

Yard	Equipment Type	Make/Model	Vehicle Class	Model Year	Emissions (tpy)					Emissions (metric tons/yr)		
					ROG	CO	NOx	PM_{10}	SOx	CO_2	N_2O	CH_4
ICTF	SUV	Jeep Cherokee	LDT	2000-2014	0.00	0.13	0.01	0.00	0.00	59.76	0.00	0.00
ICTF	Pickup Truck	Chevy Ext. Cab	LDT	2003-2014	0.00	0.08	0.01	0.00	0.00	59.54	0.00	0.00
ICTF	SUV	Chevy Trailblazer	LDT	2003-2014	0.00	0.08	0.01	0.00	0.00	59.54	0.00	0.00
ICTF	Pickup Truck	Chevy Ext. Cab	LDT	2004-2014	0.00	0.07	0.00	0.00	0.00	59.48	0.00	0.00
ICTF	Van	Chevy Van	LHDT 1	2004-2014	0.00	0.04	0.01	0.00	0.00	103.65	0.00	0.00
Dolores	Service Truck	Chevy C4500	MHD	2003-2014	0.00	0.04	0.01	0.00	0.00	18.46	0.00	0.00
Dolores	Mgr Truck	Chevy Trailblazer	LDT	2004-2014	0.00	0.05	0.00	0.00	0.00	36.66	0.00	0.00
Dolores	Mgr Truck	Chevy Blazer	LDT	2004-2014	0.00	0.04	0.00	0.00	0.00	29.83	0.00	0.00
Dolores	Pickup Truck	Ford F-150	LDT	2005-2014	0.00	0.02	0.00	0.00	0.00	19.33	0.00	0.00
Total					**0.00**	**0.55**	**0.05**	**0.00**	**0.00**	**446.25**	**0.00**	**0.00**

CARB's speciation database was used to determine the fraction of each TAC in the total VOC emissions from each yard truck.[138] All TACs listed in the most recent version of the Emission Inventory Criteria and Guidelines Report for the Air Toxics "Hot Spots" Program were included. The TAC speciation profiles and emission rates for the yard trucks are shown in Table 199. A copy of the relevant section of SPECIATE database is included in Appendix H-4.

Table 199
TAC Emissions from Gasoline-Fueled Yard Trucks – ICTF and Dolores Rail Yards
Project Year 2014

CAS	Chemical Name[a]	Organic Fraction of VOC (by weight)[b]	Emissions (tons/yr)		
			ICTF	Dolores	Total
95636	1,2,4-trimethylbenzene	0.0120	1.57×10^{-4}	8.73×10^{-5}	2.44×10^{-4}
106990	1,3-butadiene	0.0068	8.87×10^{-5}	4.94×10^{-5}	1.38×10^{-4}
540841	2,2,4-trimethylpentane	0.0288	3.75×10^{-4}	2.09×10^{-4}	5.84×10^{-4}
75070	Acetaldehyde	0.0035	4.54×10^{-5}	2.53×10^{-5}	7.07×10^{-5}
107028	acrolein (2-propenal)	0.0017	2.15×10^{-5}	1.20×10^{-5}	3.35×10^{-5}
71432	benzene	0.0309	4.02×10^{-4}	2.24×10^{-4}	6.26×10^{-4}
4170303	crotonaldehyde	0.0004	4.70×10^{-6}	2.62×10^{-6}	7.32×10^{-6}
110827	cyclohexane	0.0077	9.99×10^{-5}	5.57×10^{-5}	1.56×10^{-4}
100414	ethylbenzene	0.0131	1.71×10^{-4}	9.50×10^{-5}	2.66×10^{-4}
74851	ethylene	0.0794	1.03×10^{-3}	5.76×10^{-4}	1.61×10^{-3}
50000	formaldehyde	0.0197	2.57×10^{-4}	1.43×10^{-4}	4.00×10^{-4}
78795	isoprene	0.0018	2.30×10^{-5}	1.28×10^{-5}	3.59×10^{-5}
98828	isopropylbenzene (cumene)	0.0001	1.57×10^{-6}	8.73×10^{-7}	2.44×10^{-6}
67561	methyl alcohol	0.0015	1.99×10^{-5}	1.11×10^{-5}	3.09×10^{-5}
78933	methyl ethyl ketone	0.0002	2.97×10^{-6}	1.65×10^{-6}	4.62×10^{-6}
108383	m-xylene	0.0445	5.79×10^{-4}	3.23×10^{-4}	9.02×10^{-4}
91203	naphthalene	0.0006	7.67×10^{-6}	4.27×10^{-6}	1.19×10^{-5}
110543	n-hexane	0.0200	2.60×10^{-4}	1.45×10^{-4}	4.05×10^{-4}
95476	o-xylene	0.0155	2.01×10^{-4}	1.12×10^{-4}	3.13×10^{-4}
115071	propylene	0.0382	4.98×10^{-4}	2.77×10^{-4}	7.75×10^{-4}
100425	styrene	0.0015	2.00×10^{-5}	1.11×10^{-5}	3.11×10^{-5}
108883	toluene	0.0718	9.36×10^{-4}	5.22×10^{-4}	1.46×10^{-3}
Total			$\mathbf{5.21 \times 10^{-3}}$	$\mathbf{2.90 \times 10^{-3}}$	$\mathbf{8.11 \times 10^{-3}}$

Notes:

a. Organic fraction information is from CARB's SPECIATE database. Data used are from the "Cat stabilized exhaust 2005 SSD etoh 2% O (MTBE phaseout)" profile.

b. Organic fraction is reported on a ROG basis using CARB's SPECIATE ROG/TOG ratio of 0.8012.

[138] Speciation profile number 2105 was used to calculate TAC emissions from this source.

8. Diesel-Fueled IC Engines

The 2014 calendar year emission estimates for the emergency generator and the air compressor are based on the rated capacity of each unit and the annual hours of operation. It was assumed that there was no change in the equipment, activity, or emissions for these units from the 2005 baseline year. See Part IV.A.8 for equipment specifications, activity data, and emission factors. The Project Year 2014 emissions are summarized in Table 200. Detailed emission calculations are contained in Appendix I-2.

Table 200
Criteria Pollutant, DPM, and GHG Emissions from the Diesel-Fueled IC Engines – ICTF Rail Yard
Project Year 2014

Unit	Emissions (tons/yr)						Emissions (metric tons/yr)		
	ROG	CO	NOx	PM_{10}	DPM	SOx	CO_2	N_2O^c	CH_4^c
Emergency Generator	0.01	0.02	0.08	0.01	0.01	0.01	2.73	0.00	0.00
Air Compressor	0.06	0.16	0.76	0.05	0.05	0.05	24.89	0.00	0.00
Total	**0.07**	**0.18**	**0.84**	**0.06**	**0.06**	**0.06**	**27.63**	**0.00**	**0.00**

9. Storage Tanks

There are many storage tanks at both the ICTF and Dolores Yards used to store liquid petroleum and other products such as Diesel fuel, gasoline, lubricating oils, and recovered oil. Emissions from the storage tanks are based on the size of the tank, material stored, and annual throughput. For the 2014 Project Year inventory, it was assumed that there was no change from the 2005 baseline throughput for storage tanks located at the Dolores Yard since overall activity levels at the Yard are expected to remain constant) and no changes from 2012 for the tanks at ICTF. VOC emissions from the storage tanks were calculated using EPA's TANKS program.[139] The emissions from

[139] Available at *http://www.epa.gov/ttn/chief/ap42/ch07/index.html*.

small oil tanks,[140] stormwater tanks, and the sludge tank were assumed to be negligible. Also, the TANKS program does not calculate emissions from oil storage tanks. Therefore, the emissions from oil storage tanks were estimated by modeling the liquid contents as Diesel fuel, resulting in conservative estimates. Equipment specifications, activity data, and the annual emissions from the storage tanks are shown in Table 201. The TANKS program output is in Appendix J-1. Speciation profiles and detailed emission calculations are shown in Appendices J-2 and J-3, respectively.

[140] To calculate emissions, the TANKS program requires a minimum shell length of 5 feet for horizontal tanks and a minimum shell height of 5 feet for vertical tanks. Emissions from tanks with a shell length/height of 5 feet are considered to be negligible.

Table 201
Storage Tank Specifications and Activity Data – ICTF and Dolores Rail Yards
Project Year 2014

Yard	Tank No.	Tank Location	Material Stored	Tank Capacity (gallons)	Tank Dimensions (ft)	Annual Throughput (gal/yr)[a,b]	VOC Emissions (tpy)[c,d,e]
ICTF	New 1-a	Alt. Fuel – Hostlers	Biodiesel	500	5.5 x 4	20,000	0.0002
ICTF	New 1-b	Alt. Fuel – Hostlers	LPG or LNG	1,000	15 x 3.5	20,000	neg.
Dolores	TNKD-0069	Tank Farm	Diesel	160,000	24 x 34	10,500,000	0.10
Dolores	TNKD-0068	Tank Farm	Diesel	160,000	24 x 34	10,500,000	0.10
Dolores	TNKO-0002	Tank Farm	Recovered Oil	10,000	16 x 10	40,000	0.002
Dolores	TNKO-0003	Tank Farm	Drain Oil	12,000	20.5 x 10	48,000	0.002
Dolores	TNKO-0004	Tank Farm	Journal Box Oil	8,000	21.3 x 8	32,000	0.001
Dolores	TNKO-0001	Tank Farm	Lube Oil	12,000	20.5 x 10	48,000	0.004
Dolores	TNKO-0184	Service Track	Recovered Oil	6,000	20.5 x 7	24,000	0.002
Dolores	TNKS-0005	Tank Farm	Stormwater	25,000	30 x 12 x 12	980,100	neg.
Dolores	TNKS-0006	Tank Farm	Stormwater	25,000	30 x 12 x 12	980,100	neg.
Dolores	TNKS-0007	Tank Farm	Stormwater	25,000	30 x 12 x 12	980,100	neg.
Dolores	TNKS-0008	Tank Farm	Stormwater	25,000	30 x 12 x 12	980,100	neg.
Dolores	TNKS-0010	Tank Farm	Soap	8,000	8 x8	22,785	NA
Dolores	NA	WWTP	Sludge	1,000	6.5 x 5 x 5	NA	neg.
Total VOC							**0.21**

Notes:

a. Assumed all existing tanks at ICTF were removed by 2012. A new tank for the storage of the alternative fuel for the yard hostlers will be installed near the existing crane maintenance area. Two tank options, a biodiesel tanks or and LPG/LNG tank, were considered for the emission calculations. Only one of these tanks will be installed at the facility.

b. Assumed no change from the 2005 throughput for the tanks at Dolores.

c. Emission calculations performed using the USEPA TANKS 4.0.9d program.

d. Emissions from small (the TANKS program requires a minimum shell length of 5 feet for horizontal tanks and a minimum shell height of 5 feet for vertical tanks) oil tanks, stormwater tanks, and the sludge tank were assumed to be negligible.

e. The VOC emissions for oil tanks were estimated by modeling the liquid contents as Diesel fuel, resulting in conservative estimates.

10. Refueling Operations

Refueling operations occur at the locomotive shop the Dolores Yard. It was assumed that there was no change in the equipment, activity, or emission factors for these units from Project Year 2012. See Part IV.C.10 for equipment specifications, activity data data (since overall activity levels at the Dolores Yard are expected to remain constant), and emission factors. The Project Year 2014 emissions are summarized in Table 202. Detailed emission calculations are contained in Appendix K-3. The CARB's speciation database does not include information on TAC fractions from Diesel fuel. Therefore, the TACs from the 2014 refueling operations were not calculated

Table 202
VOC Emissions from Refueling Operations – ICTF and Dolores Rail Yards
Project Year 2014

Yard	Tank No.	Tank Location	Material Stored	Throughput (gal/yr)[a]	VOC Emission Factor (lb/1000 gal)[b]	VOC Emissions (tons/yr)
Dolores	TNKD-0069	Tank Farm	Diesel	10,500,000	0.028	0.147
Dolores	TNKD-0068	Tank Farm	Diesel	10,500,000	0.028	0.147
Total						**0.294**

Notes:
a. See Table 198.
b. Emission factors from the *Supplemental Instructions for Liquid Organic Storage Tanks* document of the SCAQMD's *General Instruction Book for the AQMD 2006-2007 Annual Emissions Reporting Program.*

11. Sand Tower

The calendar year 2014 emissions estimates for sand tower operations are based on the annual sand throughput and PM_{10} emission factors from AP-42. It was assumed that there was no change in sand throughput from the 2005 baseline year. The activity data (since overall activity levels at the Dolores Yard are expected to remain constant), PM_{10} emission factors, and annual emission estimates for the sand tower are shown Table 203.

The relevant sections of AP-42 and detailed emission calculations are in Appendices L-1 and L-2.

Table 203
PM_{10} Emission Factors and Emission Rates for Sand Tower Operations – Dolores Rail Yard
Project Year 2014

Pollutant	Sand Throughput (tons/yr)[a]	Emission Factors (lb/ton)		Emissions (tons/yr)		
		Pneumatic Transfer[b]	Gravity Transfer[c]	Pneumatic Transfer	Gravity Transfer	Total
PM_{10}	3,120	0.00034	0.00099	0.001	0.002	0.002

Notes:

a. The 2005 annual throughput data provided by UPRR. Assumed no change from the baseline year for 2014.

b. Emission factor from AP-42, Table 11.12-5, 6/06. Factor for controlled pneumatic cement unloading to elevated storage silo was used. The unit is equipped with a fabric filter.

c. Emission factor from AP-42, Table 11.12-5, 6/06. Factor for sand transfer was used.

12. Wastewater Treatment Plant

The 2014 emissions estimates for the WWTP are based on the annual wastewater flow rate and from the *Air Emission Inventory and Regulatory Analysis Report for Dolores Yard* (Trinity Consultants, December 2005). It was assumed that there was no change in flow rate or emission rates from the 2005 baseline year, since overall activity levels at the Yard are expected to remain constant. Emission rates, based on the 1999 wastewater flow rate, were calculated by Trinity Consultants using EPA's WATER9 program. The 2014 annual emissions were calculated by multiplying the emission rates, in grams per second, by the ratio of the 2014 wastewater flow rate to the 1999 wastewater flow rate. The emission rates, in grams per second, and the annual emissions, in tons per year, are shown in Table 204. Detailed emission calculations are shown in Appendix M.

Table 204 TAC Emissions from the Wastewater Treatment Plant – Dolores Rail Yard Project Year 2014		
Pollutant	Emission Rate (grams/sec)[b]	Emissions (tons/yr)[c]
benzene	5.10×10^{-7}	2.37×10^{-5}
bis (2-ethylhexyl) Phthalate	1.83×10^{-11}	8.52×10^{-10}
bromomethane	8.99×10^{-7}	4.18×10^{-5}
chloroform	6.30×10^{-7}	2.93×10^{-5}
ethylbenzene	3.04×10^{-6}	1.41×10^{-4}
methylene chloride	1.04×10^{-5}	4.84×10^{-4}
toluene	3.50×10^{-6}	1.63×10^{-4}
xylene	6.20×10^{-6}	2.89×10^{-4}
Total	**2.52×10^{-5}**	**1.17×10^{-3}**

Notes:

a. The 2005 wastewater flow rate (980,100 gallons) was provided by UPRR. Assumed no change in flow rate for the 2014 calendar year.

b. Emissions rates from the *Air Emission Inventory and Regulatory Analysis Report for the Dolores Yard* (Trinity Consultants, December 2005) and are based on the 1999 wastewater flow rate of 732,000 gallons. Assumed no change in emission rate from baseline year,

c. Annual emissions for the calendar year 2014 were calculated by multiplying the emission rate, in grams per second, by the ratio of the 2014 wastewater flow rate to the 1999 wastewater flow rate.

13. Steam Cleaners

Portable steam cleaners are used for a variety of activities at the Dolores Yard. The calendar year 2014 emission estimates for the steam cleaners are based on the hours of operation, the fuel type and rated capacity of the heater, and the fuel type and rated capacity of the pump. It was assumed there were no changes in equipment specifications, activity data (since overall activity levels at the Dolores Yard are expected to remain constant), or emission factors from the 2005 baseline year. See Part IV.A.13 for equipment specifications, activity data, and emission factors. The Project Year 2014 emissions are summarized in Table 205. Detailed emission calculations are contained in Appendix N-2.

Table 205 Criteria Pollutant and GHG Emissions from Steam Cleaners – Dolores Rail Yard Project Year 2014								
	Emission (tpy)					Emission (metric tons/yr)		
Emission Unit	ROG	CO	NOx	PM_{10}	SOx	CO_2	N_2O	CH_4
Heaters	0.004	0.02	0.11	0.003	0.00	87.21	0.00	0.00
Pumps	0.12	2.41	0.06	0.00	0.00	5.57	0.00	0.00
Total	**0.12**	**2.43**	**0.17**	**0.01**	**0.00**	**92.78**	**0.00**	**0.00**

CARB's speciation database was used to determine the fraction of each TAC in the total VOC emissions from the steam cleaning operations.[141] The SPECIATE database does not include a profile for propane-fueled boilers. Therefore, the speciation profile for natural gas-fired boilers was used to determine the TAC emissions from the steam cleaner heaters. All TACs listed in the most recent version of the Emission Inventory Criteria and Guidelines Report for the Air Toxics "Hot Spots" Program were included. The TAC speciation profiles and emission rates for the steam cleaning operations are shown in Table 206. A copy of the relevant section of the SPECIATE database is included in Appendix N-3.

[141] Speciation profile number 3 was used to calculate TAC emissions from the heaters and profile number 665 was used to calculate the TAC emissions from the pump.

Table 206
TAC Emissions from Steam Cleaners – Dolores Rail Yard
Project Year 2014

CAS	Chemical Name	Heaters[a]		Pumps[b]	
		Organic Fraction of VOC (by weight)[c]	Emissions (tons/yr)	Organic Fraction of VOC (by weight)[d]	Emissions (tons/yr)
95636	1,2,4-trimethylbenzene	-	-	0.0140	1.67×10^{-3}
106990	1,3-butadiene	-	-	0.0091	1.08×10^{-3}
540841	2,2,4-trimethylpentane	-	-	0.0222	2.63×10^{-3}
75070	acetaldehyde	-	-	0.0106	1.26×10^{-3}
107028	acrolein (2-propenal)	-	-	0.0020	2.38×10^{-4}
71432	benzene	0.0947	3.64×10^{-4}	0.0368	4.37×10^{-3}
4170303	crotonaldehyde	-	-	0.0014	1.72×10^{-4}
110827	cyclohexane	0.0237	9.11×10^{-5}	0.0050	5.95×10^{-4}
100414	ethylbenzene	-	-	0.0167	1.98×10^{-3}
74851	ethylene	-	-	0.0996	1.18×10^{-2}
50000	formaldehyde	0.1895	7.28×10^{-4}	0.0327	3.88×10^{-3}
78795	isoprene	-	-	0.0016	1.85×10^{-4}
98828	isopropylbenzene (cumene)	-	-	0.0006	6.58×10^{-5}
67561	methyl alcohol	-	-	0.0038	4.53×10^{-4}
78933	methyl ethyl ketone (mek)	-	-	0.0007	7.88×10^{-5}
108383	m-xylene	-	-	0.0496	5.89×10^{-3}
91203	naphthalene	-	-	0.0014	1.72×10^{-4}
110543	n-hexane	-	-	0.0146	1.73×10^{-3}
95476	o-xylene	-	-	0.0173	2.05×10^{-3}
115071	propylene	-	-	0.0546	6.48×10^{-3}
100425	styrene	-	-	0.0014	1.72×10^{-4}
108883	toluene	0.0474	1.82×10^{-4}	0.0756	8.98×10^{-3}
Total			**1.37×10^{-3}**		**5.60×10^{-2}**

Notes:
a. Organic fraction information is from CARB's SPECIATE database. Data used are from the "External combustion boiler – natural gas" profile. SPECIATE does not include a profile for propane-fueled boilers.
b. Organic fraction information is from CARB's SPECIATE database. Data used are from the "Non-cat stabilized exhaust 1996 SSD 2.0% etoh (MTBE phaseout)" profile.
c. Organic fraction is reported on a ROG basis using CARB's SPECIATE ROG/TOG ratio of 0.4222.
d. Organic fraction is reported on a ROG basis using CARB's SPECIATE ROG/TOG ratio of 0.9198

14. Heater

There is a natural gas-fired heater located at the ICTF administrative building, used to provide comfort heating for the building. Emissions from the heater are based on the equipment's rated capacity, fuel type, and the hours of operations. It was assumed there were no changes in equipment specifications, activity data[142], or emission factors from the 2005 baseline year. See Part IV.A.14 for equipment specifications, activity data, and emission factors. The Project Year 2014 emissions are summarized in Table 207. Detailed emission calculations are contained in Appendix O-2.

Table 207
Criteria Pollutant and GHG Emissions from Heaters – ICTF Rail Yard
Project Year 2014

Emissions (tons/yr)					Emissions (metric tons/yr)		
VOC	CO	NOx	PM_{10}	SOx	CO_2	N_2O	CH_4
0.00	0.07	0.08	0.01	0.00	87.85	0.01	0.00

CARB's speciation profile for natural gas-fired boilers was used to determine the fraction of each TAC in the total VOC emissions from the heater.[143] All TACs listed in the most recent version of the Emission Inventory Criteria and Guidelines Report for the Air Toxics "Hot Spots" Program were included. The TAC speciation profiles and emission rates for the heater are shown in Table 208. A copy of the relevant section of the SPECIATE database is included in Appendix O-3.

[142] The heater is used to provide comfort heat to the ICTF Administration Building and its use is not tied to cargo handling activities. Therefore, it was assumed that operation of this unit would not change from the baseline year

[143] Speciation profile number 3 was used to calculate emissions for this source.

Table 208 TAC Emissions from Heaters – ICTF Rail Yard Project Year 2014			
CAS	Chemical Name[a]	Organic Fraction of VOC (by weight)[b]	Emissions (tons/yr)
71432	Benzene	0.0947	4.34×10^{-4}
110827	Cyclohexane	0.0237	1.08×10^{-4}
50000	formaldehyde	0.1895	8.67×10^{-4}
108883	Toluene	0.0474	2.17×10^{-4}
Total			**1.63×10^{-3}**

Notes:
a. Organic fraction information is from CARB's SPECIATE database. Data used are from the "External combustion boiler – natural gas" profile.
b. Organic fraction is reported on a ROG basis using CARB's SPECIATE ROG/TOG ratio of 0.4222.

15. Welders

A propane-fueled welder is used for locomotive service and repair operations at the Dolores Yard. Emissions from the welder are based on the fuel type, rated capacity, and hours of operation for the unit. It was assumed there were no changes in equipment specifications, activity data (since overall activity levels at the Dolores Yard are expected to remain constant), or emission factors from the 2005 baseline year. See Part IV.A.15 for equipment specifications, activity data, and emission factors. The Project Year 2014 emissions are summarized in Table 209. Detailed emission calculations are contained in Appendix P-2.

Table 209 Criteria Pollutant and GHG Emissions from the Propane-Fueled Welder – Dolores Rail Yard Project Year 2014							
Emissions (tons/yr)					Emissions (metric tons/yr)		
VOC	CO	NOx	PM_{10}	SOx	CO_2	N_2O	CH_4
0.002	0.221	0.143	0.001	0.000	7.85	0.00	0.00

CARB's speciation database was used to determine the fraction of each TAC in the total VOC emissions from the propane-fueled welder. The SPECIATE database does not include a profile for propane-fueled internal combustion engine. Therefore, the speciation profile for natural gas-fired reciprocating engines was used to determine the TAC emissions from the welder. All TACs listed in the most recent version of the Emission Inventory Criteria and Guidelines Report for the Air Toxics "Hot Spots" Program were included. The TAC speciation profiles and emission rates for the heater are shown in Table 210. A copy of the relevant section of the SPECIATE database is included in Appendix P-3.

Table 210
TAC Emissions from Propane-Fueled Welder – Dolores Rail Yard
Project Year 2014

CAS	Chemical Name[a]	Organic Fraction of VOC (by weight)[b]	Emissions (tons/yr)
95636	1,2,4-trimethylbenzene	0.00001	1.70×10^{-8}
75070	acetaldehyde	0.00003	5.11×10^{-8}
71432	benzene	0.00010	1.87×10^{-7}
110827	cyclohexane	0.00001	1.70×10^{-8}
100414	ethylbenzene	0.00001	1.70×10^{-8}
74851	ethylene	0.00058	1.07×10^{-6}
50000	formaldehyde	0.00074	1.38×10^{-6}
108383	m-xylene	0.00001	1.70×10^{-8}
110543	n-hexane	0.00002	3.41×10^{-8}
95476	o-xylene	0.00001	1.70×10^{-8}
115071	propylene	0.00154	2.88×10^{-6}
108883	toluene	0.00004	6.82×10^{-8}
1330207	xylene	0.00002	3.41×10^{-8}
Total			$\mathbf{5.80 \times 10^{-6}}$

Notes:
a. Organic fraction information is from CARB's SPECIATE database. Data used are from the "I.C.E. reciprocating – natural gas" profile.
b. Organic fraction is reported on a ROG basis using CARB's SPECIATE ROG/TOG ratio of 0.0914.

16. Miscellaneous Gasoline-Fueled Equipment

A variety of portable, gasoline-fueled, small equipment is used at ICTF each day. Emissions from the portable equipment are based on the fuel type, rated capacity, and hours of operation of each unit. It was assumed there were no changes in equipment specifications or emission factors from the 2005 baseline year. While this equipment is used at ICTF, its operations are not tied to cargo handling activities. Therefore, it was assumed that there was no change in activity data from the 2005 baseline year. See Part

IV.A.16 for equipment specifications, activity data, and emission factors. The Project Year 2014 emissions are summarized in Table 211. Detailed emission calculations are contained in Appendix Q-2.

Table 211 **Criteria Pollutant and GHG Emissions from the Miscellaneous Gasoline-Fueled Equipment – Dolores Rail Yard** **Project Year 2014**							
Emissions (tons/yr)					Emissions (metric tons/yr)		
VOC	CO	NOx	PM_{10}	SOx	CO_2	N_2O	CH_4
1.88	38.19	0.96	0.06	0.05	87.17	0.00	0.00

CARB's speciation database was used to determine the fraction of each TAC in the total VOC emissions from each piece of equipment.[144] All TACs listed in the most recent version of the Emission Inventory Criteria and Guidelines Report for the Air Toxics "Hot Spots" Program were included. The TAC speciation profiles and emission rates for the miscellaneous equipment is shown in Table 212. A copy of the relevant section of the SPECIATE database is included in Appendix Q-3. Equipment specific calculations are shown in Appendix Q-2.

Table 212 **TAC Emissions from Miscellaneous Gasoline-Fueled Equipment – ICTF Rail Yard** **Project Year 2014**			
CAS	Chemical Name[a]	Organic Fraction of VOC (by weight)[b]	Emissions (tons/yr)
95636	1,2,4-trimethylbenzene	0.0140	2.64×10^{-2}
106990	1,3-butadiene	0.0091	1.70×10^{-2}
540841	2,2,4-trimethylpentane	0.0222	4.16×10^{-2}
75070	acetaldehyde	0.0106	1.99×10^{-2}
107028	acrolein (2-propenal)	0.0020	3.76×10^{-3}
71432	benzene	0.0368	6.91×10^{-2}
4170303	crotonaldehyde	0.0014	2.72×10^{-3}
110827	cyclohexane	0.0050	9.41×10^{-3}
100414	ethylbenzene	0.0167	3.14×10^{-2}
74851	ethylene	0.0996	1.87×10^{-1}
50000	formaldehyde	0.0327	6.14×10^{-2}

144 Speciation profile number 665 was used to calculate TAC emissions from these sources.

Table 212 TAC Emissions from Miscellaneous Gasoline-Fueled Equipment – ICTF Rail Yard Project Year 2014			
CAS	Chemical Name[a]	Organic Fraction of VOC (by weight)[b]	Emissions (tons/yr)
78795	isoprene	0.0016	2.92×10^{-3}
98828	isopropylbenzene (cumene)	0.0006	1.04×10^{-3}
67561	methyl alcohol	0.0038	7.17×10^{-3}
78933	methyl ethyl ketone (mek)	0.0007	1.25×10^{-3}
108383	m-xylene	0.0496	9.31×10^{-2}
91203	naphthalene	0.0014	2.72×10^{-3}
110543	n-hexane	0.0146	2.74×10^{-2}
95476	o-xylene	0.0173	3.24×10^{-2}
115071	propylene	0.0546	1.03×10^{-1}
100425	styrene	0.0014	2.72×10^{-3}
108883	toluene	0.0756	1.42×10^{-1}
Total			**8.85×10^{-1}**

Notes:

a. Organic fraction information is from CARB's SPECIATE database. Data used are from the "Non-cat stabilized exhaust 1996 SSD 2.0% etoh (MTBE phaseout)" profile.

b. Organic fraction is reported on a ROG basis using CARB's SPECIATE ROG/TOG ratio of 0.9198.

17. Worker Vehicles

Emissions were calculated from employee vehicles that arrive at and depart from the ICTF and Dolores Yards each day. The number of vehicle trips was based on employee force counts for each yard and assumes no ridesharing. The miles per trip were estimated from aerial photos of the Yards and include on-site travel only. For the 2014 emission estimates, it was assumed that there were no changes in the number of employees from the 2005 baseline year. Activity data for worker vehicles is summarized in Table 213.

Table 213
Activity Data for Worker Vehicles – ICTF and Dolores Rail Yards
Project Year 2014

Yard	No. of Trips (trips/yr)[a]	VMT (mi/trip)[b]	VMT (mi/yr)	Fuel Use (gal/yr)[c]
ICTF	152,935	2.5	382,338	19,380
Dolores	32,850	0.5	16,425	833
Total	**185,785**		**398,763**	**20,213**

Notes:

a. The number of trips during the 2005 baseline year was based on employee force count reports. Assumes no ridesharing and 365 work days per year. Assumed no changes for 2014.

b. VMT for onsite travel estimated from aerial photos of each yard.

c. Fuel use for the 2014 calendar year was calculated from VMT and from fuel economy based on the EMFAC 2007 model with the BURDEN output option.

Fleet average criteria pollutant emission factor for traveling exhaust emissions were calculated using the EMFAC2007 model with the BURDEN output option. Since the model year distribution is not known, the EMFAC2007 default distribution for gasoline-fueled passenger cars and light duty trucks operating in Los Angeles County was used for the 2014 calendar year. Idling emissions were assumed to be negligible.

Emission factors from CARB's *Draft Emission Factors for Mandatory Reporting Program* document (August 10, 2007) were used to calculate GHG emissions from worker vehicles. A fuel-specific carbon oxidization factor, from the CARB emission factor document, was also used to calculate CO_2 emissions. The criteria pollutant and GHG emission factors, as well as the carbon oxidization factor, used to calculate emissions from worker vehicles, are shown in Table 214. Detailed emission factor derivation calculations and the EMFAC2007 output are contained in Appendix R-4. A copy of CARB's *Draft Emission Factors for Mandatory Reporting Program* document is contained in Appendix C.

Table 214 **Criteria Pollutant and GHG Emission Factors for Worker Vehicles – ICTF and Dolores Rail Yards Project Year 2014**								
Carbon Oxidization Factor (%)	Emission Factors (g/mi)[a]					Emission Factors (kg/gal)[b]		
	ROG	CO	NOx	PM_{10}	SOx	CO_2	N_2O^c	CH_4^c
99.0	0.12	0.27	0.24	0.04	0.00	8.87	1.23×10^{-5}	1.60×10^{-4}

Notes:

a. Calendar year 2014 criteria pollutant emission factors (g/mi) from EMFAC 2007 using the BURDEN output option. The EMFAC default model year distribution for L.A. County was used.

b. GHG emission factors from CARB's *Draft Emission Factors for Mandatory Reporting Program* document (August 10, 2007).

c. Based on a gasoline HHV of 122,697 Btu/gallon (from the Transportation Energy Data Book: Edition 26, U.S. Department of Energy, 2007).

To calculate the emissions from worker vehicles, the activity data shown in Table 213 was combined with the emission factors shown in Table 214. The criteria pollutant and GHG emission estimates for the worker vehicles at the ICTF and Dolores yards during the Project Year 2014 are shown in Table 215.

Table 215 Criteria Pollutant and GHG Emissions from Worker Vehicles – ICTF and Dolores Rail Yards Project Year 2014								
Yard	Emissions (tons/yr)					Emissions (metric tons/yr)		
	ROG	CO	NOx	PM_{10}	SOx	CO_2	N_2O^c	CH_4^c
ICTF	0.05	0.11	0.10	0.02	0.00	170.18	0.00	0.00
Dolores	0.00	0.00	0.00	0.00	0.00	7.31	0.00	0.00
Total	**0.05**	**0.11**	**0.10**	**0.02**	**0.00**	**177.49**	**0.00**	**0.00**

CARB's speciation database was used to determine the fraction of each TAC in the total VOC emissions from worker vehicles.[145] All TACs listed in the most recent version of the Emission Inventory Criteria and Guidelines Report for the Air Toxics "Hot Spots" Program were included. The TAC speciation profiles and emission rates for worker vehicles are shown in Table 216. A copy of the relevant section of the SPECIATE database is included in Appendix R-4.

[145] Speciation profile number 2105 was used to calculate TAC emissions from this source.

Table 216 TAC Emissions from Gasoline-Fueled Worker Vehicles – ICTF and Dolores Rail Yards Project Year 2014					
		Organic Fraction of VOC (by weight)[b]	Emissions (tons/yr)		
CAS	Chemical Name[a]		ICTF	Dolores	Total
95636	1,2,4-trimethylbenzene	0.0120	5.90×10^{-4}	2.54×10^{-5}	6.15×10^{-4}
106990	1,3-butadiene	0.0068	3.34×10^{-4}	1.43×10^{-5}	3.48×10^{-4}
540841	2,2,4-trimethylpentane	0.0288	1.41×10^{-3}	6.07×10^{-5}	1.47×10^{-3}
75070	Acetaldehyde	0.0035	1.71×10^{-4}	7.34×10^{-6}	1.78×10^{-4}
107028	acrolein (2-propenal)	0.0017	8.11×10^{-5}	3.48×10^{-6}	8.46×10^{-5}
71432	Benzene	0.0309	1.51×10^{-3}	6.50×10^{-5}	1.58×10^{-3}
4170303	Crotonaldehyde	0.0004	1.77×10^{-5}	7.60×10^{-7}	1.85×10^{-5}
110827	Cyclohexane	0.0077	3.76×10^{-4}	1.62×10^{-5}	3.92×10^{-4}
100414	Ethylbenzene	0.0131	6.42×10^{-4}	2.76×10^{-5}	6.70×10^{-4}
74851	Ethylene	0.0794	3.89×10^{-3}	1.67×10^{-4}	4.06×10^{-3}
50000	Formaldehyde	0.0197	9.67×10^{-4}	4.15×10^{-5}	1.01×10^{-3}
78795	Isoprene	0.0018	8.67×10^{-5}	3.73×10^{-6}	9.05×10^{-5}
98828	Isopropylbenzene (cumene)	0.0001	5.90×10^{-6}	2.53×10^{-7}	6.15×10^{-6}
67561	methyl alcohol	0.0015	7.48×10^{-5}	3.21×10^{-6}	7.80×10^{-5}
78933	methyl ethyl ketone (mek)	0.0002	1.12×10^{-5}	4.80×10^{-7}	1.17×10^{-5}
108383	m-xylene	0.0445	2.18×10^{-3}	9.37×10^{-5}	2.27×10^{-3}
91203	Naphthalene	0.0006	2.89×10^{-5}	1.24×10^{-6}	3.01×10^{-5}
110543	n-hexane	0.0200	9.79×10^{-4}	4.21×10^{-5}	1.02×10^{-3}
95476	o-xylene	0.0155	7.58×10^{-4}	3.26×10^{-5}	7.90×10^{-4}
115071	Propylene	0.0382	1.87×10^{-3}	8.05×10^{-5}	1.96×10^{-3}
100425	Styrene	0.0015	7.52×10^{-5}	3.23×10^{-6}	7.84×10^{-5}
108883	Toluene	0.0718	3.52×10^{-3}	1.51×10^{-4}	3.68×10^{-3}
Total			$\mathbf{1.96 \times 10^{-2}}$	$\mathbf{8.42 \times 10^{-4}}$	$\mathbf{2.04 \times 10^{-2}}$

Notes:

a. Organic fraction information is from CARB's SPECIATE database. Data used are from the "Cat stabilized exhaust 2005 SSD etoh 2% O (MTBE phaseout)" profile.

b. Organic fraction is reported on a ROG basis using CARB's SPECIATE ROG/TOG ratio of 0.8012.

18. Road Dust

Particulate matter emissions were calculated for paved roadways in both the ICTF and Dolores rail yards. Particulate emissions occur when loose material on the road surfaces is resuspended as vehicles travel over a roadway. Emissions for Project Year 2014 were calculated according to the methods outlined in AP-42, Section 13.2.1 and detailed in Part IV.A.18 of this report. Table 217 summarizes the activity data, PM_{10} emission factor, control efficiency, and annual PM_{10} emissions from paved roadways in the ICTF and Dolores railyards. Detailed emission factor derivation calculations, the relevant sections of AP-42, and the relevant sections of the SCAQMD staff report are contained in Appendices S-1 and S-2.

Table 217
PM_{10} Emissions from Roadways – ICTF and Dolores Rail Yards
Project Year 2014

Yard	Vehicle Type	Annual VMT (mi/yr)[a]	PM_{10} Emission Factor (g/VMT)[b]	Control Efficiency (%)[c]	PM_{10} Emissions (tons/yr)
ICTF	Drayage Trucks	2,653,560	12.11	45%	19.49
ICTF	Delivery Trucks	1.25	12.11	45%	0.00
ICTF	Yard Truck	365,000	12.11	45%	2.68
ICTF	Worker Vehicles	382,337.5	12.11	45%	2.81
Dolores	Delivery Trucks	502.3	12.11	45%	0.00
Dolores	Yard Truck	16,425	12.11	45%	0.12
Dolores	Worker Vehicles	118,007	12.11	45%	0.87
Total		**3,535,833**			**25.97**

Notes:
a. See Parts IV.D.2, IV.D.6, IV.D. 7 and IV.D. 17 for discussions on the calculation of annual VMT.
b. Calculated based on method outlined in AP-42, Section 13.2.1 and data shown in Table 71.
c. Calculated based on method contained in the SCAQMD Staff Report for Rule 1186 (1/97). Assumes street sweeping occurs twice per week.

E. 2016 Emissions Inventory

The Project Year 2016 inventory quantified onsite criteria pollutant, GHG, and TAC emissions from emission sources at the ICTF and Dolores Yards. Table 218 summarized the emissions, by source group. The methodology and assumptions used to prepare the inventory for each source group are discussed in detail in Sections 1 through 18 below.

Table 218
Emissions by Source Category – ICTF and Dolores Rail Yards
Project Year 2016

Source Group	Emissions (tons/yr)						Emissions (metric tons/yr)		
	ROG	CO	NOx	PM_{10}	DPM	SOx	CO_2	N_2O	CH_4
Locomotives	19.83	47.89	116.26	2.67	2.67	0.30	22,475.88	0.57	1.77
Drayage Trucks	14.56	48.63	112.98	2.69	2.47	0.13	12,657.60	0.02	0.06
Cargo Handling Equipment	0.09	1.25	0.88	0.03	0.00	0.00	91.58	0.00	0.00
Heavy Equipment	0.14	12.17	3.01	0.02	0.00	0.00	313.25	0.00	0.00
TRUs and Reefer Cars[a]	2.68	24.02	22.58	0.10	0.10	0.04	3,395.79	0.00	0.01
Delivery Trucks	0.00	0.02	0.07	0.00	0.00	0.00	4.90	0.00	0.00
Yard Trucks	0.00	0.52	0.04	0.00	NA	0.00	445.66	0.00	0.00
IC Engines	0.07	0.18	0.84	0.06	0.06	0.06	27.63	0.00	0.00
Tanks	0.21	NA	NA	NA	NA	NA	NA	NA	NA
Refueling	0.29	NA	NA	NA	NA	NA	NA	NA	NA
Sand Tower	NA	NA	NA	0.00	NA	NA	NA	NA	NA
WWTP	0.00	NA	NA	NA	NA	NA	NA	NA	NA
Steam Cleaners	0.12	2.43	0.17	0.01	NA	0.00	92.78	0.00	0.00
Heater	0.00	0.07	0.08	0.01	NA	0.00	87.85	0.01	0.00
Propane Welder	0.00	0.22	0.14	0.00	NA	0.00	7.85	0.00	0.00
Miscellaneous Equipment	1.88	38.19	0.96	0.06	NA	0.05	87.17	0.00	0.00
Worker Vehicles	0.04	0.10	0.09	0.02	NA	0.00	177.91	0.00	0.00
Road Dust	NA	NA	NA	28.97	NA	NA	NA	NA	NA
Total	**39.91**	**175.69**	**258.10**	**34.64**	**5.30**	**0.60**	**39,865.85**	**0.60**	**1.84**
ICTF-related[b]	**35.24**	**161.80**	**230.79**	**33.85**	**4.70**	**0.53**	**34,607.49**	**0.47**	**1.44**

Notes:
a. In addition to the GHG emissions shown above, CFC emissions from TRU refrigerant loss equal 0.426 metric tons per year.
b. The ICTF-related emissions include emissions that occur within ICTF plus a portion of the emissions from the Dolores Yard. The emissions from the Dolores Yard were allocated based on railcar counts provided by UPRR.

In addition to the total emissions from the ICTF and Dolores Yards, Table 218 also shows emissions that are related to ICTF. The ICTF-related emissions include emissions that occur within the ICTF, such as emission from CHE, plus the portion of the emissions from the Dolores yard that related to ICTF. The emissions were allocated based on the railcar data provided by UPRR.[146] The 2016 railcar activity at Dolores was designated as either ICTF intermodal or other intermodal. In 2016, it was estimated that 80% of the railcars entering the Dolores Yard will include freight bound for ICTF. Therefore, it was assumed that 80% of the emissions from Dolores will be related to ICTF in Project Year 2016.

1. Locomotives

For 2016, the amount of through train traffic in the yard is assumed to be constant relative to 2005. Future year emission calculations are intended for assessment of changes in in-yard activity, and do not include port-related activity in the Alameda Corridor mainline adjacent to the Dolores yard.

Road Power –Specific locomotive model distribution for years 2016 and later cannot be developed due to the anticipated availability of as-yet undeveloped locomotive technologies. Locomotive emissions for Project Year 2016 were calculated based on the 2012 emissions estimates, a growth factor, and control factors. The 2012 emission estimates (in tons per year) were multiplied by the ratio of the predicted lift count for 2016 (1,500,000 lifts) to the 2012 predicted lift count (1,100,000 lifts) to determine the growth in ICTF-related intermodal traffic. UPRR estimates that 80% of cars entering the Dolores Yard will be ICTF-related intermodal and 20% will be on-dock intermodal.[147] These factors were used to project the ICTF-related and on-dock intermodal activity levels for 2016.

The activity-based emission estimates were then adjusted by a control factor to account for the penetration of cleaner locomotives in to the fleet over time. The control factors

[146] Personal communication with Lanny Schmid of UPRR on August 28, 2007.
[147] Personal communication with Lanny Schmid of UPRR on August 28, 2007.

are based on the decrease in emissions relative to 2012. Control factors for HC, NOx, and DPM were calculated based on the USEPA line-haul locomotive emission and fuel combustion forecasts.[148] The 2007 EPA draft regulatory impact analysis (RIA) for proposed locomotive and marine engines (USEPA, 2007) presents projected emission inventories for all years from 2006 through 2040 for large line-haul locomotives. Emission forecasts are presented for CO for a baseline scenario (no new regulations), and $PM_{2.5}$, NOx, and HC for a control scenario (with the proposed regulations).[149] The proposed regulations are not expected to affect CO or SO_2 emissions. These forecasts are based on a growth rate of 1.6% per year in fuel consumption.[150] Using these forecasts normalized for the 1.6% growth rate, control factors can be calculated for emission rates in 2016 relative to 2012.

The 2016 sulfur oxides control factor was calculated from the projected reduction in 47-state fuel sulfur to 51 ppm from 123 ppm[151] in 2012 and the fractions of California fuel (61%) and 47-state fuel (39%) burned by line-haul locomotives at ICTF/Dolores. No changes in emissions were assumed for CO or GHGs. The 2014 line haul locomotive control factors are shown in Table 219.

Table 219
Emission Control Factors for Line-Haul Locomotives – ICTF and Dolores Rail Yardsa
Project Year 2016

HC[b]	CO[c]	NOx[b]	DPM[b]	SOx[d]	GHG[c]
0.726	1.00	0.893	0.753	0.507	1.00

Notes:
a. Control factors are relative to the 2012 emission rates.
b. Calculated based on the USEPA line-haul locomotive emission and fuel consumption forecasts.
c. Assumed no control for CO and GHG emissions.
d. Calculated from the projected reduction in 47-state fuel sulfur in 2012.

[148] From USEPA, 2007.
[149] pp. 81, 82, 86, 87, and 89 of Chapter 3 in EPA420-D-07-001.
[150] p. 72 of Chapter 3 in EPA420-D-07-001.
[151] From USEPA, 2004.

Yard Switching – During 2007, the 10 GP-38 switchers at ICTF and Dolores will be replaced by ULEL "gen-set switchers." The ULEL switchers will be used to perform all of the yard operations in 2014. The 2012 emission estimates (in tons per year) were multiplied by the ratio of the predicted lift count for 2016 (1,500,000 lifts) to the 2012 predicted lift count (1,100,000 lifts) to determine the growth in ICTF-related switcher activity. Yard switching activity in support of ICTF freight was assumed to grow in proportion to the number of lifts. Yard switching activity in support of on-dock freight was assumed to change in proportion to on-dock freight. This approach insures that the emissions for each year and each type of support reflect a constant ratio of yard switching bhp-hrs of work per trailing ton of freight handled. A control factor was not applied to switcher operations for 2016.

Service and Maintenance – The Service Track and Locomotive Shop at the Dolores Yard were assumed to be operating at capacity during the 2005 baseline year. As discussed previously, the volume of ICTF-related operations at Dolores will increase from the baseline year, but the overall activity level of the Dolores yard will remain constant. Therefore, the number of locomotive service and load testing events was unchanged for Project Year 2016. See Table 6 in Part IV.A.1 for summary of the shop and service data for the 2005 baseline year.

Emissions

As discussed above, the 2016 emissions were calculated based on 2012 emissions estimates, a growth factor, and pollutant specific control factors for those pollutants whose emission rates are expected to change. Table 220 shows the locomotive emissions for Project Year 2014.

Table 220 Criteria Pollutant, DPM, and GHG Emissions from Locomotives – ICTF and Dolores Rail Yard Project Year 2016									
	Emissions (tons/yr)						Emissions (metric tons/yr)		
Activity	ROG	CO	NOx	PM_{10}	DPM	SOx	CO_2	N_2O	CH_4
Train Activity	1.56	4.06	30.36	0.79	0.79	0.07	2,501.65	0.06	0.20
Yard Operations	16.40	38.31	55.08	1.19	1.19	0.17	17,231.99	0.43	1.35
Load Testing	0.45	1.73	17.81	0.34	0.34	0.01	1,574.16	0.04	0.12
Service Idling	1.41	3.78	13.01	0.34	0.34	0.05	1,168.08	0.03	0.09
Total	**19.83**	**47.89**	**116.26**	**2.67**	**2.67**	**0.30**	**22,475.88**	**0.57**	**1.77**

2. HHD Diesel-Fueled Drayage Trucks

The 2016 calendar year emissions from HHD Diesel-fueled drayage trucks are based on the number of truck trips, the truck fleet distribution, the length of each trip, and the amount of time spent idling. The trucks are owned and operated by many large trucking companies and independent operators (draymen). Therefore, a fleet distribution is not available. For emission calculations, the EMFAC2007 model default fleet distribution for HHD Diesel-fueled trucks operating in Los Angeles County during Project Year 2016 was used. The number of truck trips was based on the predicted lift count for 2016,[152] a gate count balancing factor,[153] and the assumption that 40% of the trucks entering ICTF with a container also leave the facility with a container.[154] See Appendix B-1 for a detailed discussion on the calculation methodology.

[152] Provided by UPRR.
[153] The gate balancing factor is equal to the "in-gate" container count divided by the total number of containers passing through the "in-gate" and "out-gate" of ICTF. In 2006, the gate balancing factor was 61%.
[154] Personal communication from Greg Chiodo of HDR on September 24, 2007.

Table 221 summarizes the activity data, such as annual VMT and idling time, for HHD Diesel-fueled drayage trucks operating at ICTF. In addition to the traveling emissions, an average idling time of 15 minutes per HHD truck trip was assumed to account for emissions during truck queuing, staging, and container loading and/or unloading.[155]

Table 221
Summary of HHD Drayage Truck Activity Data – ICTF Rail Yard
Project Year 2016

Number of HHD Truck Trips[a]	VMT per HHD Truck Trip (mi/trip)[b]	Annual VMT (mi/yr)	Fuel Use (gal/yr)[c]	Idling Time	
				(min/trip)[d]	(hr/yr)
2,268,000	1.35	3,061,800	1,259,651	15	567,000

Notes:
a. Number of truck trips based on predicted lift count for 2016 and estimated by HDR. See Appendix B-1 for discussion.
b. Trip length estimated from aerial photos of the Yard.
c. Includes fuel used during traveling and idling.
d. Idling time per trip is an engineering estimate based on interviews with UPRR staff and expected reductions in idling due to facility improvements.

Calendar year 2016 criteria pollutant emission factors for the HHD Diesel-fueled drayage trucks were obtained from CARB's EMFAC2007 model. The emissions from idling and traveling modes were calculated separately. Fleet average emission factor for traveling exhaust emissions were calculated using the EMFAC2007 model with the BURDEN output option. Fleet average emission factors for idling were calculated using the EMFAC2007 model with the EMFAC output option. Since the fleet distribution is not known, the EMFAC2007 default distribution for Los Angeles County was used. The 2016 emission factors for the HHD Diesel-fueled drayage trucks are shown in Table 222. Detailed emission factor derivation calculations and the EMFAC2007 output are contained in Appendix B-6.

[155] See Part IV.D.2 for a discussion of idling duration.

Table 222 Criteria Pollutant Emission Factors for HHD Diesel-Fueled Drayage Trucks – ICTF Rail Yard Project Year 2016						
Operating Mode	Fleet Average Emission Factors					
	ROG	CO	NOx	PM_{10}[c]	DPM[c]	SOx
Traveling (g/mi)[a]	2.55	6.22	11.56	0.63	0.57	0.03
Idling (g/hr)[b]	9.54	44.20	118.34	0.88	0.88	0.06

Notes:
a. Emission factors calculated for calendar year 2016 using the EMFAC2007 model with the BURDEN output option. The default fleet distribution for Los Angeles County was used.
b. Emission factors calculated for calendar year 2016 using the EMFAC2007 model with the EMFAC output option. The default fleet distribution for Los Angeles County was used.
c. The PM_{10} emission factor includes engine exhaust emissions along with brake and tire wear. The DPM emission factor includes engine exhaust emissions only.

Emission factors from CARB's *Draft Emission Factors for Mandatory Reporting Program* document (August 10, 2007) were used to calculate GHG emissions from drayage truck operations. The GHG emission factors are based on fuel consumption, not activity (i.e. miles driven or hours of operation), or model year. Therefore, the same factors are used to calculate emissions from both the traveling and idling modes and for all model year trucks. A fuel-specific carbon oxidization factor, from the CARB emission factor document, was also used to calculate CO_2 emissions. The GHG emission factors and carbon oxidization factor used to calculate emissions from drayage trucks during Project Year 2016 are shown in Table 223. A copy of CARB's *Draft Emission Factors for Mandatory Reporting Program* document is contained in Appendix C.

Table 223 GHG Emission Factors for HHD Diesel-Fueled Drayage Trucks – ICTF Rail Yard Project Year 2016				
Operating Mode	Carbon Oxidization Factor (%)	Emission Factors (kg/gal)[a]		
		CO_2	N_2O[c]	CH_4[c]
Traveling/Idling[b]	99.0	10.15	1.39×10^{-5}	4.16×10^{-5}

Notes:
a. Emission factors from CARB's *Draft Emission Factors for Mandatory Reporting Program* document (August 10, 2007).
b. Emission factors are based on fuel consumption; therefore, the same factors are used for both traveling and idling modes.
c. Based on a Diesel fuel HHV of 5.825 MMBtu/barrel (from *CARB Draft Emission Factors for Mandatory Reporting Programs*, August 10, 2007) and 42 gallons per barrel.

To calculate the Project Year 2016 emissions from drayage truck operations, the activity data shown in Table 221 was combined with the emission factors shown in Tables 222 and 223. Table 224 shows the criteria pollutant, DPM, and GHG emission estimates for the HHD Diesel-fueled drayage trucks operating at ICTF during Project Year 2016.

Table 224
Criteria Pollutant, DPM, and GHG Emissions from HHD Diesel-Fueled Drayage Trucks – ICTF Rail Yard
Project Year 2016

Operating Mode	Emission (tons/yr)						Emissions (metric tons/yr)		
	ROG	CO	NOx	PM_{10}	DPM	SOx	CO_2	N_2O	CH_4
Traveling	8.60	21.00	39.00	2.14	1.92	0.09	8,905.69	0.01	0.04
Idling	5.96	27.63	73.97	0.55	0.55	0.04	3,751.91	0.01	0.02
Total	**14.56**	**48.63**	**112.98**	**2.69**	**2.47**	**0.13**	**12,657.60**	**0.02**	**0.06**

3. Cargo Handling Equipment (CHE)

A key component of the modernization project is the replacement of Diesel-fueled cargo handling equipment with 39 electric wide span gantry (WSG) cranes. The remaining Diesel-fueled and alternative fueled CHE will be used for emergency operation only. The CHE equipment specification and activity data for Project Year 2016 are summarized in Table 225.

Table 225 Equipment Specifications and Activity Data for Cargo Handling Equipment – ICTF Rail Yard Project Year 2016						
Equipment Type	Make/Model	Model Year	Rating (hp)	No. of Units[c]	Hours of Operation (hr/yr/unit)	Fuel Use (gal/yr)
Forklift[a]	Toyota 6FDU25	1997	85	1	365	642[d]
Top Pick[a]	Taylor Tay-950	1989	350	1	365	4,352[d]
Yard Hostler[b]	TBD	2012	175	2	365	7,026[e]
WSG Crane	TBD	TBD	TBD	39	8,760	0[f]
Total				**43**		**12,020**

Notes:
a. This equipment will be Diesel-fueled and operated for emergency use only.
b. The yard hostlers will be fueled with biodiesel, propane, or LNG and be used for emergencies only.
c. Equipment counts are from the ICTF Modernization Plan.
d. Fuel use is based on the equipment specific bsfc rate from the OFFROAD2007 model and a Diesel fuel density of 7.1 lb/gal.
e. Fuel use is based on the equipment specific bsfc rate from the OFFROAD 2007 model and a LPG density of 3.9 lb/gal.
f. The WSG cranes are electric.

Equipment-specific criteria pollutant and DPM emission factors for the 2016 calendar year were calculated using a spreadsheet, developed by CARB staff, based on the OFFROAD2007 model. The DPM emission factors were adjusted, as needed, to show compliance with CARB's *Regulation for Mobile Cargo Handling Equipment at Ports and Intermodal Rail Yards* (CARB, 2005).[156] It was assumed that a Level 3 verified Diesel emission control strategy (VDECS), with a minimum DPM reduction of 85%, was installed on each affected equipment unit.

Emission factors from CARB's *Draft Emission Factors for Mandatory Reporting Program* document (August 10, 2007) were used to calculate GHG emissions from CHE operations. The GHG emission factors are based on fuel consumption and are not equipment or year specific. A fuel-specific carbon oxidization factor, from the CARB emission factor document, was also used to calculate CO_2 emissions. The criteria pollutant emission factors, DPM, and GHG emission factors, as well as the carbon oxidization factor used to calculate emissions from the CHE, are shown in Table 226.

[156] Available at *http://www.arb.ca.gov/ports/cargo/cargo.htm*.

Detailed emission factor derivation calculations and the CARB spreadsheet are contained in Appendix D-5. A copy of CARB's *Draft Emission Factors for Mandatory Reporting Program* document is contained in Appendix C.

To calculate the emissions from CHE operations, the activity data shown in Table 225 were combined with the emission factors shown in Table 226. The criteria pollutant, DPM, and GHG emission estimates for the CHE operating at ICTF during project year 2016 are shown in Table 227.

Table 226
Criteria Pollutant, DPM, and GHG Emission Factors for Cargo Handling Equipment – ICTF Rail Yard
Project Year 2016

Equipment Type	Make/ Model	Model Year	Fuel Type	Carbon Oxidization Factor (%)[c]	Emission Factors (g/hp-hr)[a]						Emission Factors (kg/gal)[c]		
					ROG	CO	NOx	PM_{10}	DPM[b]	SOx	CO_2	N_2O[d]	CH_4[d]
Forklift	Toyota 6FDU25	1997	Diesel	99.0	0.99	3.49	8.75	*0.10*	*0.10*	0.06	10.15	1.39×10^{-5}	4.16×10^{-5}
Top Pick	Taylor Tay-950	1989	Diesel	99.0	0.68	2.70	8.17	*0.06*	*0.06*	0.06	10.15	1.39×10^{-5}	4.16×10^{-5}
Yard Hostler	TBD	2012	LPG/LNG[e]	99.0	0.42	18.0	2.06	0.60	NA	0.00	5.95	9.02×10^{-6}	9.02×10^{-5}
WSG Crane	TBD	TBD	Electric	99.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Notes:
a. Criteria pollutant emission factors calculated using a spreadsheet, developed by CARB staff, based on the OFFROAD2007 model.
b. DPM emission factors that are shown in italics were adjusted for compliance with CARB's Regulation for Mobile Cargo Handling Equipment at Ports and Intermodal Rail Yards. It was assumed that a Level 3 VDECS (85% control) was installed on each affected unit.
c. GHG emission factors and carbon oxidization factors from CARB's *Draft Emission Factors for Mandatory Reporting Program* document (August 10, 2007).
d. Emission factor based on a Diesel fuel HHV of 5.825 MMBtu/barrel (from CARB Draft Emission Factors for Mandatory Reporting Programs, August 10, 2007) and 42 gallons per barrel.
e. The yard hostlers will be fueled with biodiesel, propane, or LNG. Emissions were calculated based on the use of LPG/LNG. The OFFROAD model does not distinguish between these fuels. Emission factors for all potential fuels are shown in Section 1.5.1.7 of the ADP.

Table 227 Criteria Pollutant, DPM, and GHG Emissions from Cargo Handling Equipment – ICTF Rail Yard Project Year 2016												
Equipment Type	Make/Model	Model Year	Fuel Type	Emission (tpy)						Emission (metric tons/yr)		
				ROG	CO	NOx	PM_{10}	DPM	SOx	CO_2	N_2O	CH_4
Forklift	Toyota 6FDU25	1997	Diesel	0.01	0.04	0.09	0.00	0.00	0.00	6.45	0.00	0.00
Top Pick	Taylor Tay-950	1989	Diesel	0.06	0.22	0.68	0.00	0.00	0.00	43.74	0.00	0.00
Yard Hostler	TBD	2012	LPG/LNG	0.02	0.99	0.11	0.03	0.00	0.00	41.39	0.00	0.00
WSG Crane	TBD	TBD	Electric	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total				**0.09**	**1.25**	**0.88**	**0.03**	**0.00**	**0.00**	**91.58**	**0.00**	**0.00**

CARB's speciation profile database was used to determine the fraction of each TAC in the total ROG emissions from the propane-fueled yard hostlers. The database does not contain a profile for propane combusted in an internal combustion engine. Therefore, the speciation profile for natural gas-fired reciprocating engineswas used.[157] All TACs listed in the most recent version of the Emission Inventory Criteria and Guidelines Report for the Air Toxics "Hot Spots" Program have been included. The TAC speciation profile and annual emissions of each TAC are shown in Table 228. The relevant sections of the speciation profile database are included in Appendix D-5.

Table 228
TAC Emissions from Propane-Fueled Yard Hostlers – ICTF Rail Yard
Project Year 2016

CAS	Pollutant[a]	Organic Fraction[b,c]	Emissions (tons/yr)
95636	1,2,4-trimethylbenzene	0.00001	3.53×10^{-7}
75070	acetaldehyde	0.00003	1.06×10^{-6}
71432	benzene	0.00010	3.88×10^{-6}
110827	cyclohexane	0.00001	3.53×10^{-7}
100414	ethylbenzene	0.00001	3.53×10^{-7}
74851	ethylene	0.00058	2.22×10^{-5}
50000	formaldehyde	0.00074	2.86×10^{-5}
108383	m-xylene	0.00001	3.53×10^{-7}
110543	n-hexane	0.00002	7.06×10^{-7}
95476	o-xylene	0.00001	3.53×10^{-7}
115071	propylene	0.00154	5.97×10^{-5}
108883	toluene	0.00004	1.41×10^{-6}
1330207	xylene	0.00002	7.06×10^{-7}
Total			**1.20×10^{-4}**

Notes:
a. Emissions were calculated for only those chemicals that were in both the CARB SPECIATE database and the AB 2588 list.
b. Organic fraction data are from CARB's SPECIATE database. Data are from profile #719 "I.C.E. reciprocating – natural gas." A speciation profile for propane was not included in the database.
c. Organic fraction is reported on a ROG basis using CARB's SPECIATE ROG/TOG ratio of 0.0914.

[157] Speciation profile number 719 was used to calculate TAC emissions for these sources.

4. Heavy Equipment

The Diesel-fueled heavy equipment is used at ICTF for non-cargo-related activities at the Yard, such as maintenance, handling of parts and Company material, derailments, etc. Also, two propane-fueled forklifts are used at the locomotive shop at the Dolores Yard. The heavy equipment specification and activity data for Project Year 2016 are summarized in Table 229.

Table 229
Equipment Specifications and Activity Data for Heavy Equipment – ICTF and Dolores Rail Yards
Project Year 2016

Yard	Location	Equipment Type	Make/Model	Fuel Type	Model Year	Rating (hp)	No. of Units	Hours of Operation (hr/yr/unit)[a,]	Fuel Use (gal/yr)[b]
ICTF	Car Department	Crane	Grove RT600E	Diesel	2004	173	1	1,095	5,392
ICTF	Various Locations	Man Lift	TBD	Diesel	2008	50	1	1,825	3,133
Dolores	Locomotive Shop	Forklift	Yale GP060	Propane	Unknown	150	2	3,285	38,441
Total							**4**		**46,966**

Notes:
a. Assumed no change from the 2005 baseline in hours of operation.
b. The total fuel used by all units in each category.

Equipment-specific criteria pollutant and DPM emission factors for the 2016 calendar year were calculated using the OFFROAD2007 model. The DPM emission factors were adjusted, as needed, to show compliance with CARB's *Regulation for Mobile Cargo Handling Equipment at Ports and Intermodal Rail Yards* (CARB, 2005). It was assumed that a Level 3 verified Diesel emission control strategy (VDECS), with a minimum DPM reduction of 85%, was installed on each affected equipment unit.

Emission factors from CARB's *Draft Emission Factors for Mandatory Reporting Program* document (August 10, 2007) were used to calculate GHG emissions from heavy equipment operations. The GHG emission factors are based on fuel consumption and are not equipment or year specific. A fuel-specific carbon oxidization factor, from the CARB emission factor document, was also used to calculate CO_2 emissions. The criteria pollutant emission factors, DPM, and GHG emission factors, as well as the carbon oxidization factor used to calculate emissions from the heavy equipment are shown in Table 230. Detailed emission factor derivation calculations and the CARB spreadsheet are contained in Appendix E-5. A copy of CARB's *Draft Emission Factors for Mandatory Reporting Program* document is contained in Appendix C.

To calculate the emissions from CHE operations, the activity data shown in Table 229 were combined with the emission factors shown in Table 230. The criteria pollutant, DPM, and GHG emission estimates for the Diesel-fueled CHE operating at ICTF during Project Year 2016 are shown in Table 231.

Table 230
Criteria Pollutant, DPM, and GHG Emission Factors for Heavy Equipment – ICTF and Dolores Rail Yards
Project Year 2016

Yard	Equipment Type	Make/ Model	Fuel Type	Model Year	Carbon Oxidization Factor (%)[c]	Emission Factor (g/bhp-hr)[a]						Emission Factor (kg/gal)[c]		
						ROG[b]	CO	NOx	PM_{10}	DPM	SOx	CO_2	N_2O[d]	CH_4[d]
ICTF	Crane	Grove RT600E	Diesel	2004	99.0	0.64	3.56	5.33	0.04	*0.04*	0.01	10.15	1.39×10^{-5}	4.16×10^{-5}
ICTF	Man Lift	TBD	Diesel	2008	99.0	0.29	3.67	2.93	0.02	0.02	0.01	10.15	1.39×10^{-5}	4.16×10^{-5}
Dolores	Forklift	Yale GP060	Propane	ALL[e]	99.5	0.22	35.85	7.32	0.06	NA	0.00	5.95	3.74×10^{-5}	8.31×10^{-6}

Notes:
a. Criteria pollutant emission factors from the OFFROAD2007 model. DPM emission factors that are shown in italics were adjusted for compliance with CARB's Regulation for Mobile Cargo Handling Equipment at Ports and Intermodal Rail Yards. It was assumed that a Level 3 VDECS (85% control) was installed on each affected unit.
b. Evaporative emissions for these sources are negligible.
c. GHG emission factors and carbon oxidization factor from CARB's *Draft Emission Factors for Mandatory Reporting Program* document (August 10, 2007).
d. Emission factors for Diesel fuel sources based on a Diesel fuel HHV of 5.825 MMBtu/barrel (from CARB Draft Emission Factors for Mandatory Reporting Programs, August 10, 2007) and 42 gallons per barrel. Emission factors for propane-fueled sources based on an LPG HHV of 91,300 Btu/gal (from the Transportation Energy Data Book: Edition 26, U.S. Department of Energy, 2007).
e. To obtain the criteria pollutant emission factors, the forklifts are modeled as the calendar year 2016 fleet average model year group from the OFFROAD2007 model.

Table 231
Criteria Pollutant, DPM, and GHG Emissions from Heavy Equipment – ICTF and Dolores Rail Yards
Project Year 2016

Yard	Equipment Type	Make/Model	Fuel Type	Model Year	Emissions (tons/year)						Emission (metric tons/year)		
					ROG	CO	NOx	PM_{10}	DPM	SOx	CO_2	N_2O	CH_4
ICTF	Crane	Grove RT600E	Diesel	2004	0.06	0.32	0.48	0.00	0.00	0.00	54.18	0.00	0.00
ICTF	Man Lift	TBD	Diesel	2008	0.01	0.17	0.14	0.00	0.00	0.00	31.49	0.00	0.00
Dolores	Forklift	Yale GP060	Propane	ALL	0.07	11.68	2.39	0.02	0.00	0.00	227.58	0.00	0.00
Total					**0.14**	**12.17**	**3.01**	**0.02**	**0.00**	**0.00**	**313.25**	**0.00**	**0.00**

CARB's speciation profile database was used to determine the fraction of each TAC in the total ROG emissions from the propane-fueled forklifts.[158] The database does not contain a profile for propane combusted in an internal combustion engine. Therefore, the speciation profile for natural gas-fired reciprocating engines was used. All TACs listed in the most recent version of the Emission Inventory Criteria and Guidelines Report for the Air Toxics "Hot Spots" Program have been included. The TAC speciation profile and annual emissions of each TAC are shown in Table 232. The relevant sections of the speciation profile database are included in Appendix E-5.

Table 232
TAC Emissions from Propane-Fueled Forklifts – Dolores Yard
Project Year 2016

CAS	Pollutant[a]	Organic Fraction[b,c]	Emissions (tons/yr)
95636	1,2,4-trimethylbenzene	0.00001	6.50×10^{-7}
75070	acetaldehyde	0.00003	1.95×10^{-6}
71432	benzene	0.00010	7.15×10^{-6}
110827	cyclohexane	0.00001	6.50×10^{-7}
100414	ethylbenzene	0.00001	6.50×10^{-7}
74851	ethylene	0.00058	4.10×10^{-5}
50000	formaldehyde	0.00074	5.27×10^{-5}
108383	m-xylene	0.00001	6.50×10^{-7}
110543	n-hexane	0.00002	1.30×10^{-6}
95476	o-xylene	0.00001	6.50×10^{-7}
115071	propylene	0.00154	1.10×10^{-4}
108883	toluene	0.00004	2.60×10^{-6}
1330207	xylene	0.00002	1.30×10^{-6}
Total			$\mathbf{2.21 \times 10^{-4}}$

Notes:
a. Emissions were calculated for only those chemicals that were in both the CARB SPECIATE database and the AB 2588 list.
b. Organic fraction data are from CARB's SPECIATE database. Data are from profile #719 "I.C.E. reciprocating – natural gas." A speciation profile for propane was not included in the database.
c. Organic fraction is reported on a ROG basis using CARB's SPECIATE ROG/TOG ratio of 0.0914.

[158] Speciation profile number 719 was used to calculate TAC emissions for these sources.

5. TRUs and Reefer Cars

Criteria pollutant, DPM, and GHG emissions were calculated from the Diesel-fueled engines that power the refrigeration units on TRUs and reefer cars. In addition to the Diesel engine exhaust emissions, GHG emissions from refrigerant loss were also calculated.

The TRUs are owned by a variety of independent shipping companies and equipment-specific data are not available. Therefore, the default Diesel engine equipment rating and distribution contained in the OFFROAD2007 model were used for emission calculations. It was assumed that the number of TRUs and reefer cars in the Yard at any one time remained constant during the year, with individual units cycling in and out of the Yard.

Emissions from TRUs and reefer cars are based on average size of the Diesel engines, the average number of units in the Yard, and the hours of operation for each engine. The number of units in the yard during the 2016 calendar year was calculated by multiplying the 2005 TRU count, based on UPRR car data reports, by the ratio of the 2016 lift count[159] to the 2005 lift count. The equipment size and hours of operation for each unit were not changed from the 2005 baseline assumptions. Equipment specifications and activity data for TRUs and reefer cars are summarized in Table 233.

[159] From the ICTF Modernization Plan.

Table 233
Equipment Specifications and Activity Data for TRUs and Reefer Cars – ICTF Rail Yard
Project Year 2016

Equipment Type	Average Rating (hp)[a]	Average No. of Units in Yard[b]	Hours of Operation (hr/day)[c]	Hours of Operation (hr/yr)[d]	Fuel Use (gal/yr)[e]
Container	28.56	168	4	1,460	290,906
Railcar	34	24	4	1,460	47,033

Notes:

a. Based on the average horsepower distribution in the OFFROAD2007 model.

b. UPRR staff estimates and car data reports indicate that in 2005 there were approximately 35 TRUs and 2-5 reefer cars in the Yard at any given time. To be conservative, these estimates were increased by 100%. For 2016, the number of TRUs and reefer cars was equal to the No. of Units in 2005 x (2016 lift count/2005 lift count).

c. From CARB's *Staff Report: Initial Statement of Reason for Proposed Rulemaking for Airborne Toxic Control Measure for In-Use Diesel-Fueled Transport Refrigeration Units (TRU) and TRU Generator Sets, and Facilities Where TRUs Operate*, October 2003.

d. It was assumed that the number of units and the annual hours of operation remain constant, with individual units cycling in and out of the Yard.

e. Fuel use calculated based on the bsfc contained in the OFFROAD2007 model and Diesel fuel density of 7.1 lb/gal. Fuel use shown is for all units in each category.

Criteria pollutant and DPM emission factors for the Diesel-fueled engines on TRUs and reefer cars are from the OFFROAD2007 model. The DPM emission factor was adjusted to show compliance with the CARB's Airborne Toxic Control Measure for In-Use Diesel-Fueled Transport Refrigeration Units (TRU) and TRU Generator Sets, and Facilities Where TRUs Operate (CARB, 2004).[160] Emission factors from CARB's *Draft Emission Factors for Mandatory Reporting Program* document (August 10, 2007) were used to calculate GHG emissions from TRU engine operations. A fuel-specific carbon oxidization factor, from the CARB emission factor document, was used to calculate CO_2 emissions. The criteria pollutant, DPM, and GHG emission factors, as well as the carbon oxidation factor, used to calculate emissions from the TRUs and reefer cars, are shown in Table 234. Detailed emission factor derivation calculations and the OFFROAD2007 output are contained in Appendix F-5. A copy of CARB's *Draft Emission Factors for Mandatory Reporting Program* document is contained in Appendix C.

[160] Available at *http://www.arb.ca.gov/regact/trude03/fro1.pdf*

Table 234
Criteria Pollutant, DPM, and GHG Emission Factors for Diesel-Fueled TRUs and Reefer Car Engines – ICTF Rail Yard
Project Year 2016

Equipment Type	Carbon Oxidization Factor (%)[e]	Emission Factors (g/hp-hr-unit)[a]						Emission Factors (kg/gal)[d]		
		VOC[b]	CO	NOx	PM_{10}	DPM[c]	SOx[d]	CO_2	N_2O[f]	CH_4[f]
TRU	99.0	0.54	4.76	4.50	0.02	0.02	0.01	10.15	1.39×10^{-5}	4.16×10^{-5}
Reefer Car	99.0	0.54	5.17	4.68	0.02	0.02	0.01	10.15	1.39×10^{-5}	4.16×10^{-5}

Notes:

a. Emission factors from OFFROAD2007 model.
b. Evaporative emissions from this source are negligible.
c. DPM emission factor was adjusted to show compliance with the TRU ATCM. The ULETRU factor from Table 3 of the ATCM was used.
d. Emission factor based on a Diesel fuel sulfur content of 130 ppm.
e. GHG emission factors and carbon oxidization factor from CARB's *Draft Emission Factors for Mandatory Reporting Program* document (August 10, 2007).
f. Emission factors for Diesel fuel sources based on a Diesel fuel HHV of 5.825 MMBtu/barrel (from CARB Draft Emission Factors for Mandatory Reporting Programs, August 10, 2007) and 42 gallons per barrel

To calculate the emissions from the operation of the Diesel-fueled engines on TRUs and reefer cars, the activity data shown in Table 233 were combined with the emission factors shown in Table 234. The criteria pollutant, DPM, and GHG emission estimates for the Diesel-fueled engines on TRUs and reefer cars operating at ICTF during Project Year 2016 are shown in Table 235.

Table 235
Emissions from Diesel-Fueled TRUs and Reefer Car Engines – ICTF Rail Yard Project Year 2016

Equipment Type	Emissions (tons/yr)						Emissions (metric tons/yr)		
	VOC	CO	NOx	PM_{10}	DPM	SOx	CO_2	N_2O	CH_4
TRU	2.30	20.43	19.32	0.09	0.09	0.03	2,923.17	0.00	0.01
Reefer Car	0.37	3.59	3.25	0.01	0.01	0.01	472.62	0.00	0.00
Total	**2.68**	**24.02**	**22.58**	**0.10**	**0.10**	**0.04**	**3,395.79**	**0.00**	**0.01**

In addition to the GHG emissions from the Diesel-fueled engines on the TRUs and reefer cars, GHG emissions were calculated for refrigerant losses from TRUs. Emissions were calculated for HFC-125, HFC-134a, and HFC-143a, according to the methods outlined in the *Berths 136-147 (TraPac) Container Terminal Draft Environmental Impact Statement (EIS)/Environmental Impact Report (EIR)* (Port of Los Angeles, 2007). The activity data, emission factors, and emissions from TRU and reefer car refrigerant loss are shown in Table 236.

Table 236 GHG Emissions from TRU and Reefer Car Refrigerant Loss – ICTF Rail Yard Project Year 2016							
Equipment Type	Avg. No. of Units in Yard[a]	Refrigerant Charge per Unit (kg)[b]	Annual Refrigerant Loss Rate (%)[c]	Annual Refrigerant Loss (kg/yr)	Emissions by Refrigerant[d,e] (metric tons/yr)		
					HFC-125	HFC-134a	HFC-143a
TRU	168	6.35	35%	372.58	0.082	0.194	0.097
Reefer Car	24	6.35	35%	53.23	0.012	0.028	0.014
Total	**192**			**425.81**	**0.094**	**0.221**	**0.111**

Notes:

a. See Table 233.

b. From Berths *136-147 (TraPac) Container Terminal Project Draft EIS/EIR* (POLA, 2007).

c. POLA upper bound estimate, TraPac Draft EIS/EIR.

d. POLA estimate, TraPac Draft EIS/EIR.

e. Assumes a mix of refrigerants of 50% R404a and 50% HFC-134a; assumes R404a equals 52% HFC-143a, 44% HFC-125, and 4% HFC-134a.

6. HHD Diesel-Fueled Delivery Trucks

In addition to the drayage trucks, HHD trucks deliver Diesel fuel, oil, sand, and soap to the Dolores Yard and gasoline, Diesel fuel, and oil to ICTF. The annual number of delivery truck trips was calculated based on the facility gasoline, Diesel fuel, oil, and soap throughput and a tanker truck capacity of 8,000 gallons per truck. The annual number of sand delivery truck trips was based on the discussions with UPRR staff. Per the Dolores Yard Operations Manager, the facility receives 2 to 3 sand deliveries per week. The VMT per trip was estimated from aerial photos of the Yards and was unchanged from the 2005 baseline inventory. Activity data for the HHD delivery trucks are summarized in Table 237.

Table 237
Activity Data for HHD Delivery Trucks – ICTF and Dolores Rail Yards
Project Year 2016

Yard	Delivery Type	Number of Trips[a,b]	VMT per Trip (mi/trip)[c]	Annual VMT (mi/yr)	Fuel Use (gal/yr)[d]	Idling Time (min/trip)[e]	Idling Time (hr/yr)
Dolores	Diesel Fuel	2,625	0.06	157.50	333.7	10	437.50
Dolores	Sand	156	2.2	343.20	150.7	30	78.00
Dolores	Oil	24	0.06	1.44	3.1	10	4.00
Dolores	Soap	3	0.06	0.17	0.4	10	0.47
ICTF	Alternative Fuel	3	0.5	1.25	0.6	10	0.42
Total		**2,810**		**503.56**	**488.5**		**520.4**

Notes:
a. Number of truck trips for liquid products based on the material throughput and a tanker truck volume of 8,000 gallons per truck.
b. Number of sand truck trips based on personal communication with UPRR staff.
c. VMT per trip estimated from aerial photos of each Yard.
d. Fuel use is for both traveling and idling modes and was calculated from EMFAC2007.
e. Engineering estimate based on personal communication with UPRR staff.

Criteria pollutant and DPM emission factors for the HHD Diesel-fueled delivery trucks were obtained from CARB's EMFAC2007 model. The emissions from idling and traveling modes were calculated separately. Fleet average emission factors for traveling exhaust emissions were calculated using the EMFAC2007 model with the BURDEN output option. Fleet average emission factors for idling were calculated using the EMFAC2007 model with the EMFAC output option. Since the fleet distribution is not known, the EMFAC2007 default distribution for Los Angeles County was used. The criteria pollutant and DPM emission factors for the HHD Diesel-fueled delivery trucks are shown in Table 238. Detailed emission factor derivation calculations and the EMFAC2007 output are contained in Appendix G-5.

Table 238
Criteria Pollutant and DPM Emission Factors for HHD Diesel-Fueled Delivery Trucks – ICTF and Dolores Rail Yards
Project Year 2016

Operating Mode	Fleet Average Emission Factors					
	ROG	CO	NOx	PM_{10}[c]	DPM[c]	SOx
Traveling (g/mi)[a]	2.55	6.22	11.56	0.63	0.57	0.03
Idling (g/hr)[b]	9.54	44.20	118.34	0.88	0.88	0.06

Notes:
a. Emission factors calculated using the EMFAC2007 model with the BURDEN output option. The default fleet distribution for Los Angeles County was used.
b. Emission factors calculated using the EMFAC2007 model with the EMFAC output option. The default fleet distribution for Los Angeles County was used.
c. The PM_{10} emission factor includes engine exhaust emissions along with brake and tire wear. The DPM emission factor includes engine exhaust emissions only.

Emission factors from CARB's *Draft Emission Factors for Mandatory Reporting Program* document (August 10, 2007) were used to calculate GHG emissions from delivery truck operations. The GHG emission factors are based on fuel consumption, not activity (i.e. miles driven or hours of operation), therefore, the same factors are used to calculate emissions from both the traveling and idling modes. A fuel-specific carbon oxidization factor, from the CARB emission factor document, was used to calculate CO_2 emissions. The GHG emission factors for delivery trucks are shown in Table 239. A copy of CARB's *Draft Emission Factors for Mandatory Reporting Program* document is contained in Appendix C.

Table 239 GHG Emission Factors for HHD Diesel-Fueled Delivery Trucks – ICTF and Dolores Rail Yards Project Year 2016				
Operating Mode	Carbon Oxidization Factor (%)[a]	Emission Factors (kg/gal)[a]		
		CO_2	N_2O[c]	CH_4[c]
Traveling/Idling[b]	99.0	10.15	1.39×10^{-5}	4.16×10^{-5}

Notes:
a. Emission factors and carbon oxidization factor from CARB's *Draft Emission Factors for Mandatory Reporting Program* document (August 10, 2007).
b. Emission factors are based on fuel consumption; therefore, the same factors are used for both the traveling and idling modes.
c. Based on a Diesel fuel HHV of 5.825 MMBtu/barrel (from *CARB Draft Emission Factors for Mandatory Reporting Programs*, August 10, 2007) and 42 gallons per barrel

To calculate the emissions from delivery truck operations, the activity data shown in Table 237 was combined with the emission factors shown in Tables 238 and 239. The criteria pollutant, DPM, and GHG emission estimates for the HHD Diesel-fueled delivery trucks operating at the ICTF and Dolores yards during Project Year 2016 are shown in Table 240.

Table 240 Criteria Pollutant, DPM, and GHG Emissions from HHD Diesel-Fueled Delivery Trucks – ICTF and Dolores Rail Yards Project Year 2016									
Operating Mode	Emission (tpy)						Emission (metric tons/yr)		
	ROG	CO	NOx	PM_{10}	DPM	SOx	CO_2	N_2O	CH_4
Traveling	0.00	0.00	0.00	0.00	0.000	0.00	1.46	0.00	0.00
Idling	0.00	0.02	0.07	0.00	0.001	0.00	3.44	0.00	0.00
Total	**0.00**	**0.02**	**0.07**	**0.00**	**0.00**	**0.00**	**4.90**	**0.00**	**0.00**

7. Yard Trucks

A number of light duty and medium duty gasoline-fueled trucks are used by the staff at the ICTF and Dolores Yards. For the 2016 inventory, it was assumed that the number of vehicles, the fleet distribution (number of vehicles per weight class), and the annual VMT were unchanged from the 2005 baseline year. Emissions were based on a modified fleet average model year distribution. It was assumed that vehicles in the fleet were the same model years as existed in the 2005 baseline year or newer. For example, the 2005 fleet included a model year 2000 Jeep Cherokee. For the 2016 emission estimate, it was assumed this vehicle would be replaced at some time since 2005 with a newer vehicle. Therefore, this vehicle was assumed to be a model year 2000-2016 light duty truck. The equipment specifications and activity data for the yard trucks are summarized in Table 241.

Table 241
Equipment Specifications and Activity Data for Gasoline-Fueled Yard Trucks – ICTF and Dolores Rail Yards
Project Year 2016

Yard	Equipment Type	Equipment ID	Vehicle Class	Make/Model	Model Year[a]	Annual VMT (mi/yr)[b]	Fuel Use (gal/yr)[c]	Idling (hr/yr)[d]
ICTF	SUV	1915-53287	LDT	Jeep Cherokee	2000-2016	73,000	6,790	NA
ICTF	Pickup Truck	1915-55536	LDT	Chevy Extended Cab	2003-2016	73,000	6,766	NA
ICTF	SUV	1915-19952	LDT	Chevy Trailblazer 370	2003-2016	73,000	6,766	NA
ICTF	Pickup Truck	1915-19971	LDT	Chevy Extended Cab	2004-2016	73,000	6,760	NA
ICTF	Van	1915-19975	LHDT 1	Chevy 15 Passenger Van	2004-2016	73,000	11,814	91.25
Dolores	Service Truck	73152	MHD	Chevy C4500	2003-2016	12,644	2,102	91.25
Dolores	Mgr Truck	Unknown	LDT	Chevy Trailblazer	2004-2016	45,000	4,167	NA
Dolores	Mgr Truck	73167	LDT	Chevy Blazer	2004-2016	36,608	3,390	NA
Dolores	Pickup Truck	73396	LDT	Ford F-150	2005-2016	23,756	2,197	NA

Notes:
a. It was assumed that vehicles in the fleet were the same model years as existed in the 2005 baseline year or newer.
b. The 2005 VMT was estimated from either the odometer reading divided by the age of the vehicle or interviews with UPRR staff. Assumed no change in VMT from the 2005 baseline year.
c. Calculated using the EMFAC2007 model.
d. Idling time is an engineering estimate. Idling emissions from light duty trucks are negligible; therefore, idling time data for these vehicles was not collected.

Modified fleet average criteria pollutant emission factors were obtained from CARB's EMFAC2007 model for each vehicle. The emissions from idling and traveling modes were calculated separately. Traveling exhaust emission factors were calculated using the EMFAC2007 model with the BURDEN output option. Idling emission factors for the light-heavy duty and medium-heavy duty vehicles were calculated using the EMFAC2007 model with the EMFAC output option. The idling emissions from light duty trucks were negligible. The 2016 criteria pollutant emission factors for the yard trucks are shown in Table 242. Detailed emission factor derivation calculations and the EMFAC2007 output are contained in Appendix H-5.

Table 242
Criteria Pollutant Emission Factors for Yard Trucks – ICTF and Dolores Rail Yards
Project Year 2016

Yard	Equipment Type	Make/Model	Vehicle Class	Model Year	Traveling Emission Factors (g/mi)[a]					Idling Emission Factors (g/hr)[b]				
					ROG	CO	NOx	PM_{10}	SOx	ROG	CO	NOx	PM_{10}	SOx
ICTF	SUV	Jeep Cherokee	LDT	2000-2016	0.04	1.47	0.10	0.05	0.01	NA	NA	NA	NA	NA
ICTF	Pickup Truck	Chevy Ext. Cab	LDT	2003-2016	0.02	0.96	0.06	0.05	0.01	NA	NA	NA	NA	NA
ICTF	SUV	Chevy Trailblazer	LDT	2003-2016	0.02	0.96	0.06	0.05	0.01	NA	NA	NA	NA	NA
ICTF	Pickup Truck	Chevy Ext. Cab	LDT	2004-2016	0.02	0.83	0.05	0.04	0.01	NA	NA	NA	NA	NA
ICTF	Van	Chevy Van	LHDT 1	2004-2016	0.02	0.37	0.12	0.05	0.01	22.46	136.39	1.43	0.00	0.05
Dolores	Service Truck	Chevy C4500	MHD	2003-2016	0.14	1.84	0.29	0.02	0.02	22.81	137.80	1.46	0.00	0.05
Dolores	Mgr Truck	Chevy Trailblazer	LDT	2004-2016	0.02	0.96	0.06	0.05	0.01	NA	NA	NA	NA	NA
Dolores	Mgr Truck	Chevy Blazer	LDT	2004-2016	0.02	0.96	0.06	0.05	0.01	NA	NA	NA	NA	NA
Dolores	Pickup Truck	Ford F-150	LDT	2005-2016	0.02	0.72	0.05	0.02	0.01	NA	NA	NA	NA	NA

Notes:

a. Traveling exhaust emissions calculated using the EMFAC2007 model with the BURDEN output option at a vehicle speed of 15 mph.

b. Idling exhaust emissions factors for LHDT1 and MHD vehicles calculated using the EMFAC2007 model with the EMFAC output option. Idling exhaust emissions from light duty trucks (LDT) are negligible.

Emission factors from CARB's *Draft Emission Factors for Mandatory Reporting Program* document (August 10, 2007) were used to calculate GHG emissions from yard trucks. The GHG emission factors are based on fuel consumption, not activity (i.e. miles driven or hours of operation); therefore, the same factors are used to calculate emissions from both the traveling and idling modes. A fuel-specific carbon oxidization factor, from the CARB emission factor document, was also used to calculate CO_2 emissions. The GHG emission factors and the carbon oxidization factor for yard trucks are shown in Table 243. A copy of CARB's *Draft Emission Factors for Mandatory Reporting Program* document is contained in Appendix C.

Table 243
GHG Emission Factors for Yard Trucks – ICTF and Dolores Rail Yards
Project Year 2016

Operating Mode	Carbon Oxidization Factor (%)[a]	Emission Factors (kg/gal)[a]		
		CO_2	N_2O[c]	CH_4[c]
Traveling/Idling[b]	99.0	8.87	1.23×10^{-5}	1.60×10^{-4}

Notes:
a. Emission factors and carbon oxidization factor from CARB's *Draft Emission Factors for Mandatory Reporting Program* document (August 10, 2007).
b. Emission factors are based on fuel consumption; therefore, the same factors are used for both the traveling and idling modes.
c. Based on a gasoline HHV of 122,697 Btu/gallon (from the Transportation Energy Data Book: Edition 26, U.S. Department of Energy, 2007).

To calculate the emissions from yard truck operations, the activity data shown in Table 241 were combined with the emission factors shown in Tables 242 and 243. The criteria pollutant and GHG emission estimates for the yard trucks operating at the ICTF and Dolores yards during Project Year 2016 are shown in Table 244.

Table 244 Criteria Pollutant Emissions from Yard Trucks – ICTF and Dolores Rail Yards Project Year 2016												
Yard	Equipment Type	Make/Model	Vehicle Class	Model Year	Emissions (tpy)					Emissions (metric tons/yr)		
					ROG	CO	NOx	PM_{10}	SOx	CO_2	N_2O	CH_4
ICTF	SUV	Jeep Cherokee	LDT	2000-2016	0.00	0.12	0.01	0.00	0.00	59.62	0.00	0.00
ICTF	Pickup Truck	Chevy Ext. Cab	LDT	2003-2016	0.00	0.08	0.01	0.00	0.00	59.41	0.00	0.00
ICTF	SUV	Chevy Trailblazer	LDT	2003-2016	0.00	0.08	0.01	0.00	0.00	59.41	0.00	0.00
ICTF	Pickup Truck	Chevy Ext. Cab	LDT	2004-2016	0.00	0.07	0.00	0.00	0.00	59.36	0.00	0.00
ICTF	Van	Chevy Van	LHDT 1	2004-2016	0.00	0.04	0.01	0.00	0.00	103.75	0.00	0.00
Dolores	Service Truck	Chevy C4500	MHD	2003-2016	0.00	0.04	0.00	0.00	0.00	18.45	0.00	0.00
Dolores	Mgr Truck	Chevy Trailblazer	LDT	2004-2016	0.00	0.05	0.00	0.00	0.00	36.59	0.00	0.00
Dolores	Mgr Truck	Chevy Blazer	LDT	2004-2016	0.00	0.04	0.00	0.00	0.00	29.77	0.00	0.00
Dolores	Pickup Truck	Ford F-150	LDT	2005-2016	0.00	0.02	0.00	0.00	0.00	19.30	0.00	0.00
Total					**0.00**	**0.52**	**0.04**	**0.00**	**0.00**	**445.66**	**0.00**	**0.00**

CARB's speciation database was used to determine the fraction of each TAC in the total VOC emissions from each yard truck. All TACs listed in the most recent version of the Emission Inventory Criteria and Guidelines Report for the Air Toxics "Hot Spots" Program were included. The TAC speciation profiles and emission rates for the yard trucks are shown in Table 245. A copy of the relevant section of the SPECIATE database is included in Appendix H-5.

Table 245
TAC Emissions from Gasoline-Fueled Yard Trucks – ICTF and Dolores Rail Yards
Project Year 2016

CAS	Chemical Name[a]	Organic Fraction of VOC (by weight)[b]	Emissions (tons/yr)		
			ICTF	Dolores	Total
95636	1,2,4-trimethylbenzene	0.0120	1.51×10^{-4}	8.30×10^{-5}	2.34×10^{-4}
106990	1,3-butadiene	0.0068	8.57×10^{-5}	4.69×10^{-5}	1.33×10^{-4}
540841	2,2,4-trimethylpentane	0.0288	3.63×10^{-4}	1.99×10^{-4}	5.61×10^{-4}
75070	acetaldehyde	0.0035	4.39×10^{-5}	2.40×10^{-5}	6.79×10^{-5}
107028	acrolein (2-propenal)	0.0017	2.08×10^{-5}	1.14×10^{-5}	3.22×10^{-5}
71432	benzene	0.0309	3.89×10^{-4}	2.13×10^{-4}	6.01×10^{-4}
4170303	crotonaldehyde	0.0004	4.54×10^{-6}	2.49×10^{-6}	7.03×10^{-6}
110827	cyclohexane	0.0077	9.65×10^{-5}	5.29×10^{-5}	1.49×10^{-4}
100414	ethylbenzene	0.0131	1.65×10^{-4}	9.03×10^{-5}	2.55×10^{-4}
74851	ethylene	0.0794	1.00×10^{-3}	5.48×10^{-4}	1.55×10^{-3}
50000	formaldehyde	0.0197	2.48×10^{-4}	1.36×10^{-4}	3.84×10^{-4}
78795	isoprene	0.0018	2.23×10^{-5}	1.22×10^{-5}	3.45×10^{-5}
98828	isopropylbenzene (cumene)	0.0001	1.51×10^{-6}	8.29×10^{-7}	2.34×10^{-6}
67561	methyl alcohol	0.0015	1.92×10^{-5}	1.05×10^{-5}	2.97×10^{-5}
78933	methyl ethyl ketone	0.0002	2.87×10^{-6}	1.57×10^{-6}	4.44×10^{-6}
108383	m-xylene	0.0445	5.60×10^{-4}	3.07×10^{-4}	8.67×10^{-4}
91203	naphthalene	0.0006	7.41×10^{-6}	4.06×10^{-6}	1.15×10^{-5}
110543	n-hexane	0.0200	2.51×10^{-4}	1.38×10^{-4}	3.89×10^{-4}
95476	o-xylene	0.0155	1.95×10^{-4}	1.07×10^{-4}	3.01×10^{-4}
115071	propylene	0.0382	4.81×10^{-4}	2.64×10^{-4}	7.45×10^{-4}
100425	styrene	0.0015	1.93×10^{-5}	1.06×10^{-5}	2.99×10^{-5}
108883	toluene	0.0718	9.05×10^{-4}	4.96×10^{-4}	1.40×10^{-3}
Total			**5.03×10^{-3}**	**2.76×10^{-3}**	**7.79×10^{-3}**

Notes:

a. Organic fraction information is from CARB's SPECIATE database. Data used are from the "Cat stabilized exhaust 2005 SSD etoh 2% O (MTBE phaseout)" profile.

b. Organic fraction is reported on a ROG basis using CARB's SPECIATE ROG/TOG ratio of 0.8012.

8. Diesel-Fueled IC Engines

The 2016 calendar year emission estimates for the emergency generator and the air compressor are based on the rated capacity of each unit and the annual hours of operation. It was assumed that there was no change in the equipment, activity, or emissions for these units from the 2005 baseline year. See Part IV.A.8 for equipment specifications, activity data, and emission factors. The Project Year 2016 emissions are summarized in Table 246. Detailed emission calculations are contained in Appendix I-2.

Table 246
Criteria Pollutant, DPM, and GHG Emissions from the Diesel-Fueled IC Engines – ICTF Rail Yard
Project Year 2016

Unit	Emissions (tons/yr)						Emissions (metric tons/yr)		
	ROG	CO	NOx	PM_{10}	DPM	SOx	CO_2	N_2O^c	CH_4^c
Emergency Generator	0.01	0.02	0.08	0.01	0.01	0.01	2.73	0.00	0.00
Air Compressor	0.06	0.16	0.76	0.05	0.05	0.05	24.89	0.00	0.00
Total	**0.07**	**0.18**	**0.84**	**0.06**	**0.06**	**0.06**	**27.63**	**0.00**	**0.00**

9. Storage Tanks

There are a number of storage tanks at both the ICTF and Dolores Yards used to store liquid petroleum and other products such as Diesel fuel, gasoline, lubricating oils, and recovered oil. Emissions from the storage tanks are based on the size of the tank, material stored, and annual throughput. For the 2016 Project Year inventory, it was assumed that there was no change from the 2005 baseline throughput for storage tanks located at the Dolores Yard (since overall activity levels at the Dolores Yard are expected to remain constant) and no change from the 2012 throughput for tanks at ICTF. VOC emissions from the storage tanks were calculated using EPA's TANKS program. The emissions from small oil tanks,[161] stormwater tanks, and the sludge tank were assumed to be negligible. Also, the TANKS program does not calculate emissions from oil storage

[161] The TANKS program requires a minimum shell length of 5 feet for horizontal tanks and a minimum shell height of 5 feet for vertical tanks to calculate emissions. Emissions from tanks with a shell length/height of 5 feet are considered to be negligible.

tanks. Therefore, the emissions from oil storage tanks were estimated by modeling the liquid contents as Diesel fuel, resulting in conservative estimates. Equipment specifications, activity data, and the annual emissions from the storage tanks are shown in Table 247. The TANKS program output is in Appendix J-1. Speciation profiles and detailed emission calculations are shown in Appendices J-2 and J-3, respectively.

Table 247
Storage Tank Specifications and Activity Data – ICTF and Dolores Rail Yards
Project Year 2016

Yard	Tank No.	Tank Location	Material Stored	Tank Capacity (gallons)	Tank Dimensions (ft)	Annual Throughput (gal/yr)[a,b]	VOC Emissions (tpy)[c,d,e]
ICTF	New 1-a	Alt. Fuel – Hostlers	Biodiesel	500	5.5 x 4	20,000	0.0002
ICTF	New 1-b	Alt. Fuel – Hostlers	LPG or LNG	1,000	15 x 3.5	20,000	neg.
Dolores	TNKD-0069	Tank Farm	Diesel	160,000	24 x 34	10,500,000	0.10
Dolores	TNKD-0068	Tank Farm	Diesel	160,000	24 x 34	10,500,000	0.10
Dolores	TNKO-0002	Tank Farm	Recovered Oil	10,000	16 x 10	40,000	0.002
Dolores	TNKO-0003	Tank Farm	Drain Oil	12,000	20.5 x 10	48,000	0.002
Dolores	TNKO-0004	Tank Farm	Journal Box Oil	8,000	21.3 x 8	32,000	0.001
Dolores	TNKO-0001	Tank Farm	Lube Oil	12,000	20.5 x 10	48,000	0.004
Dolores	TNKO-0184	Service Track	Recovered Oil	6,000	20.5 x 7	24,000	0.002
Dolores	TNKS-0005	Tank Farm	Stormwater	25,000	30 x 12 x 12	980,100	neg.
Dolores	TNKS-0006	Tank Farm	Stormwater	25,000	30 x 12 x 12	980,100	neg.
Dolores	TNKS-0007	Tank Farm	Stormwater	25,000	30 x 12 x 12	980,100	neg.
Dolores	TNKS-0008	Tank Farm	Stormwater	25,000	30 x 12 x 12	980,100	neg.
Dolores	TNKS-0010	Tank Farm	Soap	8,000	8 x8	22,785	NA
Dolores	NA	WWTP	Sludge	1,000	6.5 x 5 x 5	NA	neg.
Total VOC							**0.21**

Notes:

a. Assumed all existing tanks at ICTF were removed by 2012. A new tank for the storage of the alternative fuel for the yard hostlers will be installed near the existing crane maintenance area. Two tank options, a biodiesel tanks or and LPG/LNG tank, were considered for the emission calculations. Only one of these tanks will be installed at the facility.

b. Assumed no change from the 2005 throughput for the tanks at Dolores.

c. Emission calculations performed using the USEPA TANKS 4.0.9d program.

d. Emissions from small (the TANKS program requires a minimum shell length of 5 feet for horizontal tanks and a minimum shell height of 5 feet for vertical tanks) oil tanks, stormwater tanks, and the sludge tank were assumed to be negligible.

e. The VOC emissions for oil tanks were estimated by modeling the liquid contents as Diesel fuel, resulting in conservative estimates.

10. Refueling Operations

Refueling operations occur at the locomotive shop the Dolores Yard. It was assumed that there was no change in the equipment, activity (since overall activity levels at the Dolores Yard are expected to remain constant), or emission factors for these units from Project Year 2012. See Part IV.C.10 for equipment specifications, activity data, and emission factors. The Project Year 2016 emissions are summarized in Table 248. Detailed emission calculations are contained in Appendix K-2. The CARB's speciation database does not include information on TAC fractions from Diesel fuel. Therefore, the TACs from the 2016 refueling operations were not calculated.

Table 248
VOC Emissions from Refueling Operations – ICTF and Dolores Rail Yards
Project Year 2016

Yard	Tank No.	Tank Location	Material Stored	Throughput (gal/yr)[a]	VOC Emission Factor (lb/1000 gal)[b]	VOC Emissions (tons/yr)
Dolores	TNKD-0069	Tank Farm	Diesel	10,500,000	0.028	0.147
Dolores	TNKD-0068	Tank Farm	Diesel	10,500,000	0.028	0.147
Total						**0.294**

Notes:
a. See Table 244.
b. Emission factors from the *Supplemental Instructions for Liquid Organic Storage Tanks* document of the SCAQMD's *General Instruction Book for the AQMD 2006-2007 Annual Emissions Reporting Program.*

11. Sand Tower

The calendar year 2016 emissions estimates for sand tower operations are based on the annual sand throughput and PM_{10} emission factors from AP-42. It was assumed that there was no change in sand throughput from the 2005 baseline year since the overall activity levels at the Dolores Yard are expected to remain constant. The activity data, PM_{10} emission factors, and annual emission estimates for the sand tower are shown in Table 249. The relevant sections of AP-42 and detailed calculations are in Appendices L-1 and L-2.

Table 249 PM_{10} Emission Factors and Emission Rates for Sand Tower Operations – Dolores Rail Yard Project Year 2016						
Pollutant	Sand Throughput (tons/yr)[a]	Emission Factors (lb/ton)		Emissions (tons/yr)		
		Pneumatic Transfer[b]	Gravity Transfer[c]	Pneumatic Transfer	Gravity Transfer	Total
PM_{10}	3,120	0.00034	0.00099	0.001	0.002	0.002

Notes:

a. The 2005 annual throughput data provided by UPRR. Assumed no change from the baseline year for 2016.

b. Emission factor from AP-42, Table 11.12-5, 6/06. Factor for controlled pneumatic cement unloading to elevated storage silo was used. The unit is equipped with a fabric filter.

c. Emission factor from AP-42, Table 11.12-5, 6/06. Factor for sand transfer was used.

12. Wastewater Treatment Plant

The 2016 emissions estimates for the WWTP are based on the annual wastewater flow rate and from the *Air Emission Inventory and Regulatory Analysis Report for Dolores Yard* (Trinity Consultants, December 2005). It was assumed that there was no change in flow rate or emission rates from the 2005 baseline year since the overall activity levels at the Dolores Yard are expected to remain constant. Emission rates, based on the 1999 wastewater flow rate, were calculated by Trinity Consultants using EPA's WATER9 program. The 2016 annual emissions were calculated by multiplying the emission rates, in grams per second, by the ratio of the 2016 wastewater flow rate to the 1999 wastewater flow rate. The emission rates, in grams per second, and the annual emissions, in tons per year, are shown in Table 250. Detailed emission calculations are shown in Appendix M.

Table 250 **TAC Emissions from the Wastewater Treatment Plant – Dolores Rail Yard Project Year 2016**		
Pollutant	Emission Rate (grams/sec)[b]	Emissions (tons/yr)[c]
benzene	5.10×10^{-7}	2.37×10^{-5}
bis (2-ethylhexyl) Phthalate	1.83×10^{-11}	8.52×10^{-10}
bromomethane	8.99×10^{-7}	4.18×10^{-5}
chloroform	6.30×10^{-7}	2.93×10^{-5}
ethylbenzene	3.04×10^{-6}	1.41×10^{-4}
methylene chloride	1.04×10^{-5}	4.84×10^{-4}
toluene	3.50×10^{-6}	1.63×10^{-4}
xylene	6.20×10^{-6}	2.89×10^{-4}
Total	$\mathbf{2.52 \times 10^{-5}}$	$\mathbf{1.17 \times 10^{-3}}$

Notes:

a. The 2005 wastewater flow rate (980,100 gallons) was provided by UPRR. Assumed no change in flow rate for the 2016 calendar year.

b. Emissions rates from the *Air Emission Inventory and Regulatory Analysis Report for the Dolores Yard* (Trinity Consultants, December 2005) and are based on the 1999 wastewater flow rate of 732,000 gallons. Assumed no change in emission rate from baseline year,

c. Annual emissions for the calendar year 2016 were calculated by multiplying the emission rate, in grams per second, by the ratio of the 2016 wastewater flow rate to the 1999 wastewater flow rate.

13. <u>Steam Cleaners</u>

Portable steam cleaners are used for a variety of activities at the Dolores Yard. It was assumed that there was no change in the equipment, activity (since overall activity levels at the Dolores Yard are expected to remain constant), or emissions for these units from the 2005 baseline year. See Part IV.A.13 for equipment specifications, activity data, and emission factors. The Project Year 2016 emissions are summarized in Table 251. Detailed emission calculations are contained in Appendix N-2.

Table 251 **Criteria Pollutant and GHG Emissions from Steam Cleaners – Dolores Rail Yard Project Year 2016**								
	Emission (tpy)					Emission (metric tons/yr)		
Emission Unit	ROG	CO	NOx	PM_{10}	SOx	CO_2	N_2O	CH_4
Heaters	0.004	0.02	0.11	0.003	0.00	87.21	0.00	0.00
Pumps	0.12	2.41	0.06	0.00	0.00	5.57	0.00	0.00
Total	**0.12**	**2.43**	**0.17**	**0.01**	**0.00**	**92.78**	**0.00**	**0.00**

CARB's speciation database was used to determine the fraction of each TAC in the total VOC emissions from the steam cleaning operations.[162] The SPECIATE database does not include a profile for propane-fueled boilers. Therefore, the speciation profile for natural gas-fired boilers was used to determine the TAC emissions from the steam cleaner heaters. All TACs listed in the most recent version of the Emission Inventory Criteria and Guidelines Report for the Air Toxics "Hot Spots" Program were included. The TAC speciation profiles and emission rates for the steam cleaning operations are shown in Table 252. A copy of the relevant section of the SPECIATE database are included in Appendix N-3.

[162] Speciation profile number 3 was used to calculate TAC emissions from the heaters and profile number 665 was used to calculate the TAC emissions from the pump.

Table 252
TAC Emissions from Steam Cleaners – Dolores Rail Yard
Project Year 2016

CAS	Chemical Name	Heaters[a]		Pumps[b]	
		Organic Fraction of VOC (by weight)[c]	Emissions (tons/yr)	Organic Fraction of VOC (by weight)[d]	Emissions (tons/yr)
95636	1,2,4-trimethylbenzene	-	-	0.0140	1.67×10^{-3}
106990	1,3-butadiene	-	-	0.0091	1.08×10^{-3}
540841	2,2,4-trimethylpentane	-	-	0.0222	2.63×10^{-3}
75070	acetaldehyde	-	-	0.0106	1.26×10^{-3}
107028	acrolein (2-propenal)	-	-	0.0020	2.38×10^{-4}
71432	benzene	0.0947	3.64×10^{-4}	0.0368	4.37×10^{-3}
4170303	crotonaldehyde	-	-	0.0014	1.72×10^{-4}
110827	cyclohexane	0.0237	9.11×10^{-5}	0.0050	5.95×10^{-4}
100414	ethylbenzene	-	-	0.0167	1.98×10^{-3}
74851	ethylene	-	-	0.0996	1.18×10^{-2}
50000	formaldehyde	0.1895	7.28×10^{-4}	0.0327	3.88×10^{-3}
78795	isoprene	-	-	0.0016	1.85×10^{-4}
98828	isopropylbenzene (cumene)	-	-	0.0006	6.58×10^{-5}
67561	methyl alcohol	-	-	0.0038	4.53×10^{-4}
78933	methyl ethyl ketone (mek)	-	-	0.0007	7.88×10^{-5}
108383	m-xylene	-	-	0.0496	5.89×10^{-3}
91203	naphthalene	-	-	0.0014	1.72×10^{-4}
110543	n-hexane	-	-	0.0146	1.73×10^{-3}
95476	o-xylene	-	-	0.0173	2.05×10^{-3}
115071	propylene	-	-	0.0546	6.48×10^{-3}
100425	styrene	-	-	0.0014	1.72×10^{-4}
108883	toluene	0.0474	1.82×10^{-4}	0.0756	8.98×10^{-3}
Total			**1.37×10^{-3}**		**5.60×10^{-2}**

Notes:
a. Organic fraction information is from CARB's SPECIATE database. Data used are from the "External combustion boiler – natural gas" profile. SPECIATE does not include a profile for propane-fueled boilers.
b. Organic fraction information is from CARB's SPECIATE database. Data used are from the "Non-cat stabilized exhaust 1996 SSD 2.0% etoh (MTBE phaseout)" profile.
c. Organic fraction is reported on a ROG basis using CARB's SPECIATE ROG/TOG ratio of 0.4222.
d. Organic fraction is reported on a ROG basis using CARB's SPECIATE ROG/TOG ratio of 0.9198

14. Heater

There is a natural gas-fired heater located at the ICTF administrative building. It was assumed that there was no change in the equipment, activity[163], or emission factors for this unit from the 2005 baseline year. See Part IV.A.14 for equipment specifications, activity data, and emission factors. The Project Year 2016 emissions are summarized in Table 253. Detailed emission calculations are contained in Appendix O-2.

Table 253
Criteria Pollutant and GHG Emissions from Heaters – ICTF Rail Yard
Project Year 2016

Emissions (tons/yr)					Emissions (metric tons/yr)		
VOC	CO	NOx	PM_{10}	SOx	CO_2	N_2O	CH_4
0.00	0.07	0.08	0.01	0.00	87.85	0.01	0.00

CARB's speciation profile for natural gas-fired boilers was used to determine the fraction of each TAC in the total VOC emissions from the heater.[164] All TACs listed in the most recent version of the Emission Inventory Criteria and Guidelines Report for the Air Toxics "Hot Spots" Program were included. The TAC speciation profiles and emission rates for the heater are shown in Table 254. A copy of the relevant section of the SPECIATE database is included in Appendix O-3.

[163] The heater is used to provide comfort heat to the ICTF Administration Building and its use is not tied to cargo handling activities. Therefore, it was assumed that operation of this unit would not change from the baseline year

[164] Speciation profile number 3 was used to calculate TAC emissions from this source.

Table 254 **TAC Emissions from Heaters – ICTF Rail Yard** **Project Year 2016**			
CAS	Chemical Name[a]	Organic Fraction of VOC (by weight)[b]	Emissions (tons/yr)
71432	Benzene	0.0947	4.34×10^{-4}
110827	Cyclohexane	0.0237	1.08×10^{-4}
50000	formaldehyde	0.1895	8.67×10^{-4}
108883	Toluene	0.0474	2.17×10^{-4}
Total			**1.63×10^{-3}**

Notes:
a. Organic fraction information is from CARB's SPECIATE database. Data used are from the "External combustion boiler – natural gas" profile.
b. Organic fraction is reported on a ROG basis using CARB's SPECIATE ROG/TOG ratio of 0.4222.

15. Welders

A propane-fueled welder is used for locomotive service and repair operations at the Dolores Yard. It was assumed that there was no change in the equipment, activity (since overall activity levels at the Dolores Yard are expected to remain constant), or emission factors for this unit from the 2005 baseline year. See Part IV.A.15 for equipment specifications, activity data, and emission factors. The Project Year 2016 emissions are summarized in Table 255. Detailed emission calculations are contained in Appendix P-2.

Table 255 **Criteria Pollutant and GHG Emissions from the Propane-Fueled Welder – Dolores Rail Yard** **Project Year 2016**							
Emissions (tons/yr)					Emissions (metric tons/yr)		
VOC	CO	NOx	PM_{10}	SOx	CO_2	N_2O	CH_4
0.002	0.221	0.143	0.001	0.000	7.85	0.00	0.00

CARB's speciation database was used to determine the fraction of each TAC in the total VOC emissions from the propane-fueled welder. The SPECIATE database does not include a profile for propane-fueled internal combustion engine. Therefore, the speciation profile for natural gas-fired reciprocating engines was used to determine the

TAC emissions from the welder.[165] All TACs listed in the most recent version of the Emission Inventory Criteria and Guidelines Report for the Air Toxics "Hot Spots" Program were included. The TAC speciation profiles and emission rates for the heater are shown in Table 256. A copy of the relevant section of the SPECIATE database is included in Appendix P-3.

Table 256
TAC Emissions from Propane-Fueled Welder – Dolores Rail Yard
Project Year 2016

CAS	Chemical Name[a]	Organic Fraction of VOC (by weight)[b]	Emissions (tons/yr)
95636	1,2,4-trimethylbenzene	0.00001	1.70×10^{-8}
75070	acetaldehyde	0.00003	5.11×10^{-8}
71432	benzene	0.00010	1.87×10^{-7}
110827	cyclohexane	0.00001	1.70×10^{-8}
100414	ethylbenzene	0.00001	1.70×10^{-8}
74851	ethylene	0.00058	1.07×10^{-6}
50000	formaldehyde	0.00074	1.38×10^{-6}
108383	m-xylene	0.00001	1.70×10^{-8}
110543	n-hexane	0.00002	3.41×10^{-8}
95476	o-xylene	0.00001	1.70×10^{-8}
115071	propylene	0.00154	2.88×10^{-6}
108883	toluene	0.00004	6.82×10^{-8}
1330207	xylene	0.00002	3.41×10^{-8}
Total			$\mathbf{5.80 \times 10^{-6}}$

Notes:
a. Organic fraction information is from CARB's SPECIATE database. Data used are from the "I.C.E. reciprocating engines – natural gas" profile.
b. Organic fraction is reported on a ROG basis using CARB's SPECIATE ROG/TOG ratio of 0.0914.

16. Miscellaneous Gasoline-Fueled Equipment

A variety of portable, gasoline-fueled, small equipment is used at ICTF each day. It was assumed that there was no change in the equipment or emission factors for these units from the 2005 baseline year. While this equipment is used at ICTF, its operations are not tied to cargo handling activities. Therefore, it was assumed that there was no change in activity data from the 2005 baseline year. See Part IV.A.16 for equipment specifications,

[165] Speciation profile number 3 was used to calculate TAC emissions from this source.

activity data, and emission factors. The Project Year 2016 emissions are summarized in Table 257. Detailed emission calculations are contained in Appendix Q-2.

Table 257
Criteria Pollutant and GHG Emissions from the Miscellaneous Gasoline-Fueled Equipment – Dolores Rail Yard
Project Year 2016

Emissions (tons/yr)					Emissions (metric tons/yr)		
VOC	CO	NOx	PM_{10}	SOx	CO_2	N_2O	CH_4
1.88	38.19	0.96	0.06	0.05	87.17	0.00	0.00

CARB's speciation database was used to determine the fraction of each TAC in the total VOC emissions from each piece of equipment.[166] All TACs listed in the most recent version of the Emission Inventory Criteria and Guidelines Report for the Air Toxics "Hot Spots" Program were included. The TAC speciation profiles and emission rates for the miscellaneous equipment are shown in Table 258. A copy of the relevant section of the SPECIATE database is included in Appendix Q-3. Equipment-specific calculations are shown in Appendix Q-2.

Table 258
TAC Emissions from Miscellaneous Gasoline-Fueled Equipment – ICTF Rail Yard
Project Year 2016

CAS	Chemical Name[a]	Organic Fraction of VOC (by weight)[b]	Emissions (tons/yr)
95636	1,2,4-trimethylbenzene	0.0140	2.64×10^{-2}
106990	1,3-butadiene	0.0091	1.70×10^{-2}
540841	2,2,4-trimethylpentane	0.0222	4.16×10^{-2}
75070	acetaldehyde	0.0106	1.99×10^{-2}
107028	acrolein (2-propenal)	0.0020	3.76×10^{-3}
71432	benzene	0.0368	6.91×10^{-2}
4170303	crotonaldehyde	0.0014	2.72×10^{-3}
110827	cyclohexane	0.0050	9.41×10^{-3}
100414	ethylbenzene	0.0167	3.14×10^{-2}
74851	ethylene	0.0996	1.87×10^{-1}
50000	formaldehyde	0.0327	6.14×10^{-2}

[166] Speciation profile number 665 was used to calculate TAC emissions from these sources.

Table 258 TAC Emissions from Miscellaneous Gasoline-Fueled Equipment – ICTF Rail Yard Project Year 2016			
CAS	Chemical Name[a]	Organic Fraction of VOC (by weight)[b]	Emissions (tons/yr)
78795	isoprene	0.0016	2.92×10^{-3}
98828	isopropylbenzene (cumene)	0.0006	1.04×10^{-3}
67561	methyl alcohol	0.0038	7.17×10^{-3}
78933	methyl ethyl ketone (mek)	0.0007	1.25×10^{-3}
108383	m-xylene	0.0496	9.31×10^{-2}
91203	naphthalene	0.0014	2.72×10^{-3}
110543	n-hexane	0.0146	2.74×10^{-2}
95476	o-xylene	0.0173	3.24×10^{-2}
115071	propylene	0.0546	1.03×10^{-1}
100425	styrene	0.0014	2.72×10^{-3}
108883	toluene	0.0756	1.42×10^{-1}
Total			**8.85×10^{-1}**

Notes:
a. Organic fraction information is from CARB's SPECIATE database. Data used are from the "Non-cat stabilized exhaust 1996 SSD 2.0% etoh (MTBE phaseout)" profile.
b. Organic fraction is reported on a ROG basis using CARB's SPECIATE ROG/TOG ratio of 0.9198.

17. <u>Worker Vehicles</u>

Emissions were calculated from employee vehicles that arrive at and depart from the ICTF and Dolores Yards each day. The number of vehicle trips was based on employee force counts for each yard and assumes no ridesharing. The miles per trip were estimated from aerial photos of the Yards and include on-site travel only. For the 2016 emission estimates, it was assumed that there were no changes in the number of employees from the 2005 baseline year. Activity data for worker vehicles is summarized in Table 259.

Table 259
Activity Data for Worker Vehicles – ICTF and Dolores Rail Yards
Project Year 2014

Yard	No. of Trips (trips/yr)[a]	VMT (mi/trip)[b]	VMT (mi/yr)	Fuel Use (gal/yr)[c]
ICTF	152,935	2.5	382,338	19,425
Dolores	32,850	0.5	16,425	835
Total	**185,785**		**398,763**	**20,259**

Notes:
a. The number of trips during the 2005 baseline year was based on employee force count reports. Assumes no ridesharing and 365 work days per year. Assumed no changes for 2016.
b. VMT for onsite travel estimated from aerial photos of each yard.
c. Fuel use for the 2016 calendar year was calculated from VMT and from fuel economy based on the EMFAC 2007 model with the BURDEN output option.

Fleet average criteria pollutant emission factors for traveling exhaust emissions were calculated using the EMFAC2007 model with the BURDEN output option. Since the model year distribution is not known, the EMFAC2007 default distribution for gasoline-fueled passenger cars and light duty trucks operating in Los Angeles County was used for the 2016 calendar year. Idling emissions were assumed to be negligible.

Emission factors from CARB's *Draft Emission Factors for Mandatory Reporting Program* document (August 10, 2007) were used to calculate GHG emissions from worker vehicles. A fuel-specific carbon oxidization factor, from the CARB emission factor document, was also used to calculate CO_2 emissions. The criteria pollutant and GHG emission factors, as well as the carbon oxidization factor, used to calculate emissions from worker vehicles are shown in Table 260. Detailed emission factor derivation calculations and the EMFAC2007 output are contained in Appendix R-5. A copy of CARB's *Draft Emission Factors for Mandatory Reporting Program* document is contained in Appendix C.

Table 260 Criteria Pollutant and GHG Emission Factors for Worker Vehicles – ICTF and Dolores Rail Yards Project Year 2016								
Carbon Oxidization Factor (%)	Emission Factors (g/mi)[a]					Emission Factors (kg/gal)[b]		
	ROG	CO	NOx	PM_{10}	SOx	CO_2	N_2O^c	CH_4^c
99.0	0.09	0.24	0.20	0.04	0.00	8.87	1.23×10^{-5}	1.60×10^{-4}

Notes:

a. Calendar year 2016 criteria pollutant emission factors (g/mi) from EMFAC 2007 using the BURDEN output option. The EMFAC default model year distribution for L.A. County was used.

b. GHG emission factors from CARB's *Draft Emission Factors for Mandatory Reporting Program* document (August 10, 2007).

c. Based on a gasoline HHV of 122,697 Btu/gallon (from the Transportation Energy Data Book: Edition 26, U.S. Department of Energy, 2007).

To calculate the emissions from worker vehicles, the activity data shown in Table 259 were combined with the emission factors shown in Table 260. The criteria pollutant and GHG emission estimates for the worker vehicles at the ICTF and Dolores yards during the Project Year 2016 are shown in Table 261.

Table 261 Criteria Pollutant and GHG Emissions from Worker Vehicles – ICTF and Dolores Rail Yards Project Year 2016								
Yard	Emissions (tons/yr)					Emissions (metric tons/yr)		
	ROG	CO	NOx	PM_{10}	SOx	CO_2	N_2O^c	CH_4^c
ICTF	0.04	0.10	0.09	0.02	0.00	170.58	0.00	0.00
Dolores	0.00	0.00	0.00	0.00	0.00	7.33	0.00	0.00
Total	**0.04**	**0.10**	**0.09**	**0.02**	**0.00**	**177.91**	**0.00**	**0.00**

CARB's speciation database was used to determine the fraction of each TAC in the total VOC emissions from worker vehicles.[167] All TACs listed in the most recent version of the Emission Inventory Criteria and Guidelines Report for the Air Toxics "Hot Spots" Program were included. The TAC speciation profiles and emission rates for worker vehicles are shown in Table 262. A copy of the relevant section of the SPECIATE database is included in Appendix R-3.

[167] Speciation profile number 2105 was used to calculate TAC emissions from this source.

Table 262 TAC Emissions from Gasoline-Fueled Worker Vehicles – ICTF and Dolores Rail Yards Project Year 2016					
		Organic Fraction of VOC (by weight)[b]	Emissions (tons/yr)		
CAS	Chemical Name[a]		ICTF	Dolores	Total
95636	1,2,4-trimethylbenzene	0.0120	4.77×10^{-4}	2.05×10^{-5}	4.98×10^{-4}
106990	1,3-butadiene	0.0068	2.70×10^{-4}	1.16×10^{-5}	2.82×10^{-4}
540841	2,2,4-trimethylpentane	0.0288	1.14×10^{-3}	4.91×10^{-5}	1.19×10^{-3}
75070	acetaldehyde	0.0035	1.38×10^{-4}	5.94×10^{-6}	1.44×10^{-4}
107028	acrolein (2-propenal)	0.0017	6.56×10^{-5}	2.82×10^{-6}	6.84×10^{-5}
71432	benzene	0.0309	1.22×10^{-3}	5.26×10^{-5}	1.28×10^{-3}
4170303	crotonaldehyde	0.0004	1.43×10^{-5}	6.15×10^{-7}	1.49×10^{-5}
110827	cyclohexane	0.0077	3.04×10^{-4}	1.31×10^{-5}	3.17×10^{-4}
100414	ethylbenzene	0.0131	5.19×10^{-4}	2.23×10^{-5}	5.42×10^{-4}
74851	ethylene	0.0794	3.15×10^{-3}	1.35×10^{-4}	3.29×10^{-3}
50000	formaldehyde	0.0197	7.82×10^{-4}	3.36×10^{-5}	8.16×10^{-4}
78795	isoprene	0.0018	7.02×10^{-5}	3.01×10^{-6}	7.32×10^{-5}
98828	isopropylbenzene (cumene)	0.0001	4.77×10^{-6}	2.05×10^{-7}	4.98×10^{-6}
67561	methyl alcohol	0.0015	6.05×10^{-5}	2.60×10^{-6}	6.31×10^{-5}
78933	methyl ethyl ketone (mek)	0.0002	9.04×10^{-6}	3.89×10^{-7}	9.43×10^{-6}
108383	m-xylene	0.0445	1.76×10^{-3}	7.58×10^{-5}	1.84×10^{-3}
91203	naphthalene	0.0006	2.34×10^{-5}	1.00×10^{-6}	2.44×10^{-5}
110543	n-hexane	0.0200	7.92×10^{-4}	3.40×10^{-5}	8.26×10^{-4}
95476	o-xylene	0.0155	6.13×10^{-4}	2.63×10^{-5}	6.39×10^{-4}
115071	propylene	0.0382	1.52×10^{-3}	2.61×10^{-5}	1.58×10^{-3}
100425	styrene	0.0015	6.08×10^{-5}	2.61×10^{-6}	6.34×10^{-5}
108883	toluene	0.0718	2.85×10^{-3}	1.22×10^{-4}	2.97×10^{-3}
Total			**1.59×10^{-2}**	**6.81×10^{-4}**	**1.65×10^{-2}**

Notes:

a. Organic fraction information is from CARB's SPECIATE database. Data used are from the "Cat stabilized exhaust 2005 SSD etoh 2% O (MTBE phaseout)" profile.

b. Organic fraction is reported on a ROG basis using CARB's SPECIATE ROG/TOG ratio of 0.8012.

18. Road Dust

Particulate matter emissions were calculated for paved roadways in both the ICTF and Dolores rail yards. Particulate emissions occur when loose material on road surfaces is resuspended as vehicles travel over a roadway. Emissions for Project Year 2016 were calculated according to the methods outlined in AP-42, Section 13.2.1 and detailed in Part IV.A.18 of this report. Table 263 summarizes the activity data, PM_{10} emission factor, control efficiency, and annual PM_{10} emissions from paved roadways in the ICTF and Dolores rail yards. Detailed emission factor derivation calculations, the relevant sections of AP-42, and the relevant sections of the SCAQMD staff report are contained in Appendices S-1 and S-2.

Table 263
PM_{10} Emissions from Roadways – ICTF and Dolores Rail Yards
Project Year 2016

Yard	Vehicle Type	Annual VMT (mi/yr)[a]	PM_{10} Emission Factor (g/VMT)[b]	Control Efficiency (%)[c]	PM_{10} Emissions (tons/yr)
ICTF	Drayage Trucks	3,061,800	12.11	45%	22.49
ICTF	Delivery Trucks	1.3	12.11	45%	0.00
ICTF	Yard Truck	365,000	12.11	45%	2.68
ICTF	Worker Vehicles	382,337	12.11	45%	2.81
Dolores	Delivery Trucks	502.3	12.11	45%	0.00
Dolores	Yard Truck	16,425	12.11	45%	0.12
Dolores	Worker Vehicles	118,007	12.11	45%	0.87
Total		**3,944,073**			**28.97**

Notes:
a. See Parts IV.E.2, IV.E.6, IV.E. 7 and IV.E.17 for discussions on the calculation of annual VMT.
b. Calculated based on method outlined in AP-42, Section 13.2.1 and data shown in Table 68.
c. Calculated based on method contained in the SCAQMD Staff Report for Rule 1186 (1/97). Assumes street sweeping occurs twice per week.

F. <u>70-Year Average (2010-2080) Emission Rates</u>

A 70-year average (2010-2080) emission rate was calculated for Diesel-fueled sources operating at the Yards. For the 70-year average calculations, it was assumed that the ICTF reaches maximum capacity in 2016 and the Dolores Yard was at capacity in 2005. It was assumed that there was no growth in operations after these points.

The locomotive emission rates were based on the calendar year emission rates from the USEPA's draft *Regulatory Impact Analysis (RIA): Control of Emissions of Air Pollution from Locomotive Engines and Marine Compression Ignition Engines Less than 30 Liters per Cylinder* (USEPA, 2007).[168] The RAI document only provides emission data out to calendar year 2040. Therefore, emission rates were held steady from 2040 through 2080.

[168] Available at *http://www.epa.gov/otaq/locomotv.htm#pns*

The drayage truck emission rates were calculated using the EMFAC2007 model. Emission rates were calculated for onsite travel only and an average speed of 15 mph was used. The EMFAC2007 model only provides emission factors only out to calendar year 2040. Therefore, emission rates were held steady from 2040 through 2080. The emission rate for delivery trucks is assumed to be the same as the emission rate for drayage trucks.

The emission rates for CHE were calculated from CARB's CHE emission spreadsheet. Beginning in 2012, the majority of the Diesel-fueled cargo handling equipment will be replaced by the WSG cranes. Therefore, the emission rate was held steady from 2012 through 2080.

The emission rates for heavy equipment were calculated based on OFFROAD2007 model. Beginning in 2012, the heavy equipment operation at ICTF will be greatly reduced and all units will be in compliance with CARB's CHE Regulation. Therefore, the emission rate for heavy equipment was held steady from 2012 through 2080.

The emission rates for TRUs were calculated based on the OFFROAD2007 model. By 2016, all units will be in compliance with the ULETRU standards in the TRU ATCM. Therefore, the emission rate for TRUs was held steady from 2016 through 2080.

The 70-year average emission rate for each source group is summarized in Table 264. Detailed emission calculations are shown in Appendix T.

Table 264 70-Year Average Emission Rates for Diesel-Fueled Equipment ICTF and Dolores Rail Yards									
	Emission Rates (tons/year)						Emission Rates (metric tons/year)		
Source	ROG	CO	NOx	PM_{10}	DPM	SOx	CO_2	N_2O	CH_4
Locomotives	17.63	47.69	79.21	1.77	1.77	0.31	22,385	0.56	1.76
Drayage Trucks	9.33	36.03	95.40	0.97	0.97	0.13	10,107.42	0.01	0.04
CHE	0.35	5.08	6.94	0.21	0.21	0.09	887.06	0.00	0.00
Heavy Equipment	0.15	12.14	3.12	0.01	0.01	0.00	326.27	0.00	0.00
TRU	2.75	23.59	22.37	0.14	0.14	0.04	3,319.27	0.00	0.01
Total	**30.21**	**124.53**	**207.04**	**3.10**	**3.10**	**13.44**	**37,025.02**	**0.57**	**1.81**
ICTF-Related[a]	**26.2**	**111.1**	**188.2**	**2.7**	**2.7**	**0.4**	**37,811.6**	**0.5**	**1.4**

Notes:

a. The ICTF-related emissions include emissions that occur within ICTF plus a portion of the emissions from the Dolores Yard. For the purposes of computing the 70-year average, the emissions from the Dolores Yard were allocated based on predicted railcar allocations for calendar year 2016.

PART V. AIR DISPERSION MODELING – 2005 BASELINE YEAR

An air dispersion modeling analysis was conducted for the Dolores and ICTF Yards. The Yards are physically separate facilities, but due to their close proximity to one another, they were treated as one facility for the emission inventory and dispersion modeling analysis. The purpose of the analysis was to estimate ground-level concentrations of DPM and other TACs, emitted from Yard operations, at receptor locations near the Yards. Air dispersion modeling was conducted in accordance with the *Health Risk Assessment Guidance for Rail Yard and Intermodal Facilities* (July 2006) and UPRR's *Modeling Protocol* (August 2006). Each aspect of the modeling is further described below.

A. Model Selection and Preparation

1. Modeled Sources and Source Treatment

All sources of DPM and other TACs were included in the dispersion modeling analysis. There are no TAC emissions from the sand tower or in road dust. Therefore, these sources were not included in the dispersion modeling analysis.

Emissions from mobile sources, low-level cargo handling equipment, heavy equipment, and moving locomotives were simulated as a series of volume sources along their corresponding travel routes and work areas. Idling and load testing of locomotives and elevated cargo handling equipment (RTGs) were simulated as a series of point sources within the areas where these events occur. The elevation for each source was interpolated from a 50 m grid of USGS terrain elevations. Table 265 shows the sources that were included in the modeling analysis and treatment used for each source. Assumptions used to spatially allocate emissions from locomotive operations within the Yard are included in Appendix A-4. Assumptions used to spatially allocate emissions from non-locomotive sources are contained in Appendix U. Figures 4 though 8 show the location of each source.

Table 265 Source Treatment for Air Dispersion Modeling – ICTF and Dolores Rail Yards 2005 Baseline Year	
Source[a,b]	Source Treatment
Locomotives (idling)	Point
Locomotives (traveling)	Volume
Drayage Trucks (idling)	Volume
Drayage Trucks (traveling)	Volume
Cargo Handling Equipment (low level)	Volume
Cargo Handling Equipment (RTGs)	Point
Heavy Equipment (idling)	Volume
Heavy Equipment (traveling)	Volume
TRUs and reefer cars	Volume
Delivery Trucks (idling and traveling)	Volume
Yard Trucks	Volume
Diesel-Fueled Emergency Generator	Volume
Diesel-Fueled Air Compressor	Volume
Storage Tanks	Point
Refueling	Point
WWTP	Volume
Steam Cleaners	Volume
Heater	Volume
Propane-Fueled Welder	Volume
Miscellaneous Gasoline-Fueled Equipment	Volume
Worker Vehicles	Volume

Notes:
a. See Figures 4 through 7 for source locations.
b. There are no TAC emissions from the sand tower or in road dust. Therefore, these sources were not included in the dispersion modeling analysis.

2. Model Selection

Selection of air dispersion models depends on many factors, including the type of emissions source (point, line, or volume) and type of terrain surrounding the emission source. The USEPA-approved guideline air dispersion model, AERMOD, was selected for this project. AERMOD is recommended by EPA as the preferred air dispersion model, and is the recommended model in CARB's *Health Risk Assessment Guidance for Rail Yard and Intermodal Facilities* (July 2006).

Figure 4
Consist Idling, RTG Operations, and Gasoline Storage Tank

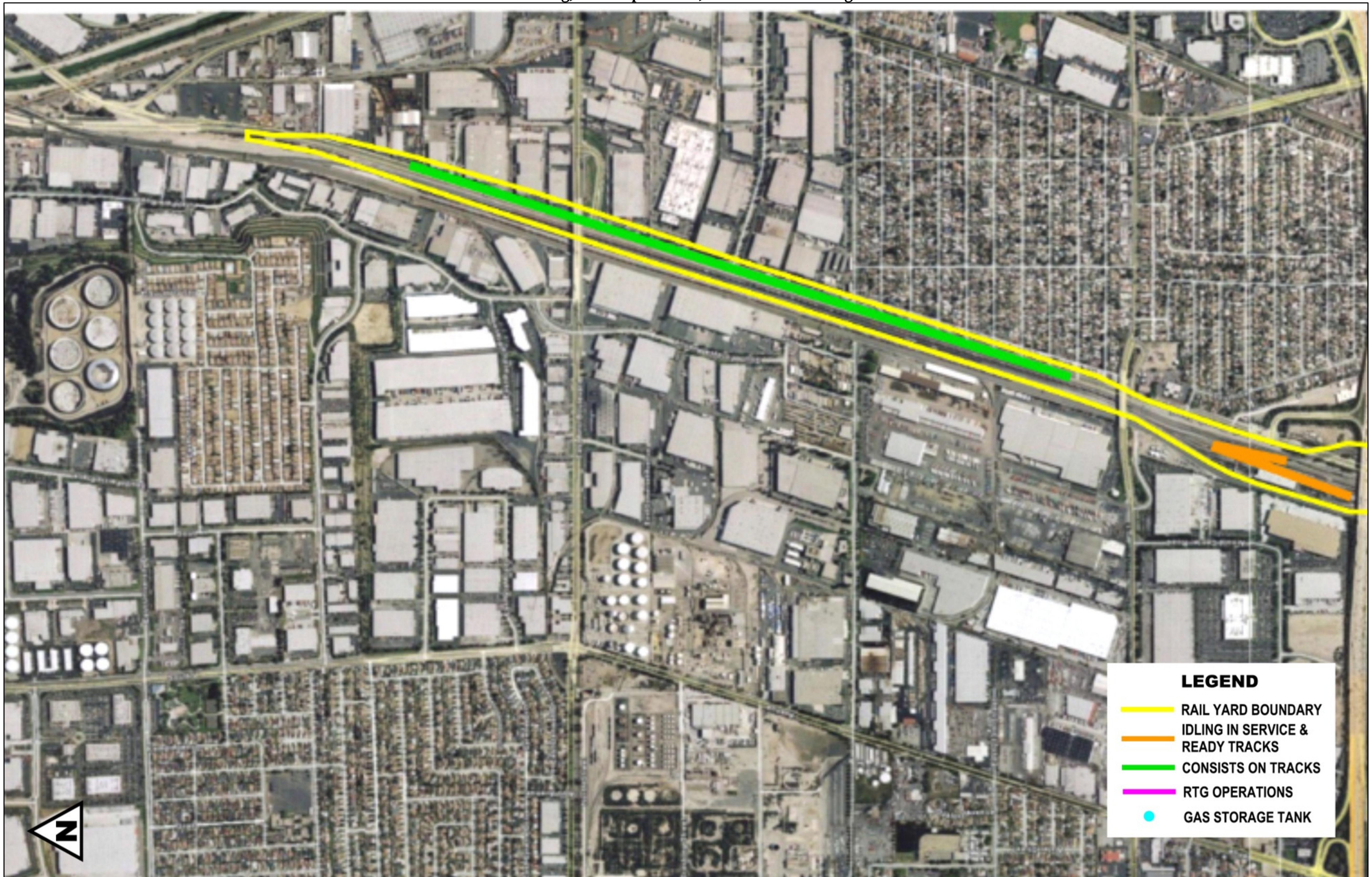


Figure 4
Consist Idling, RTG Operations, and Gasoline Storage Tank (continued)

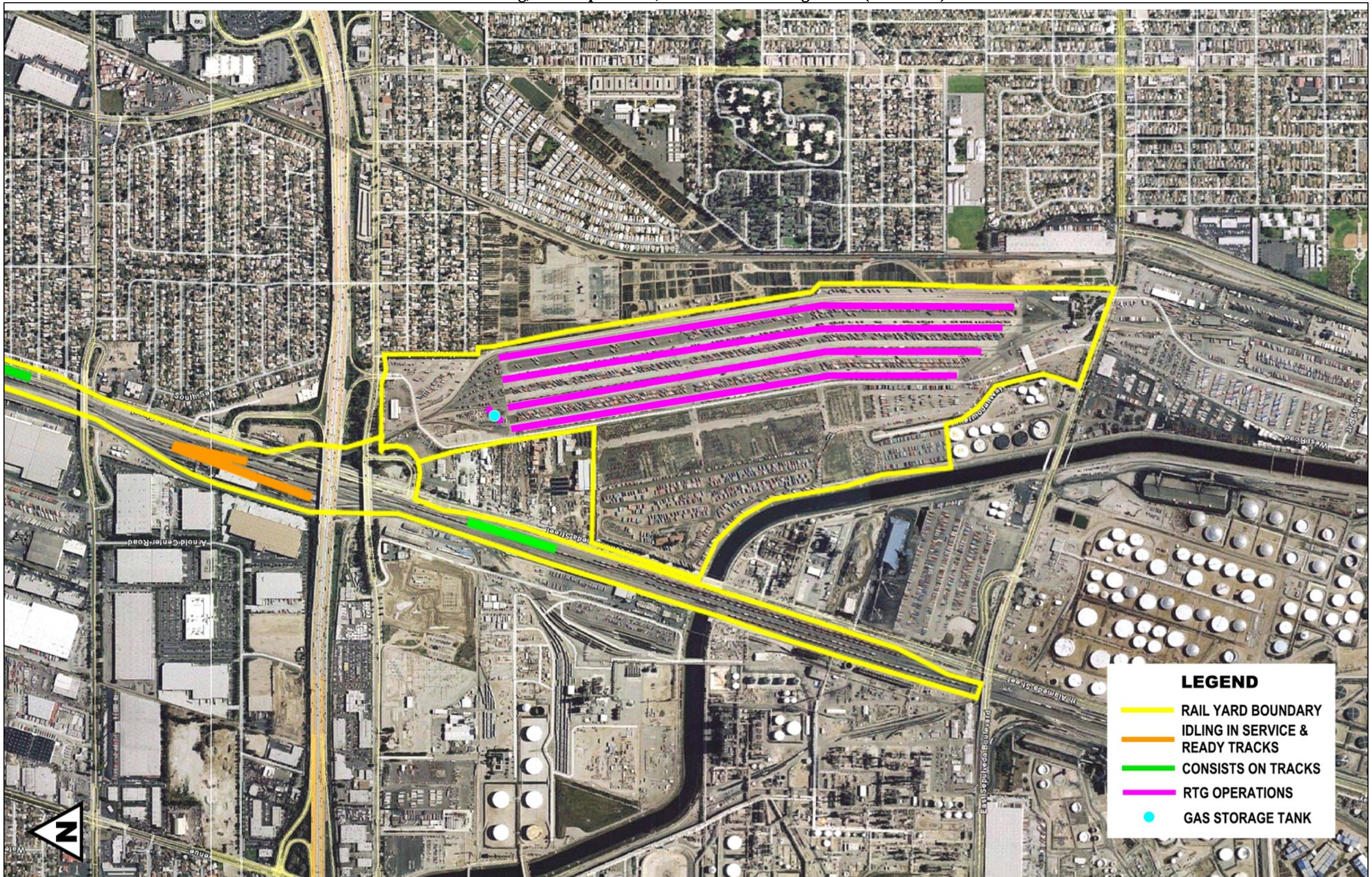


Figure 5
Diesel Trucks, Low-Level Cargo Handling Equipment and Heavy Equipment

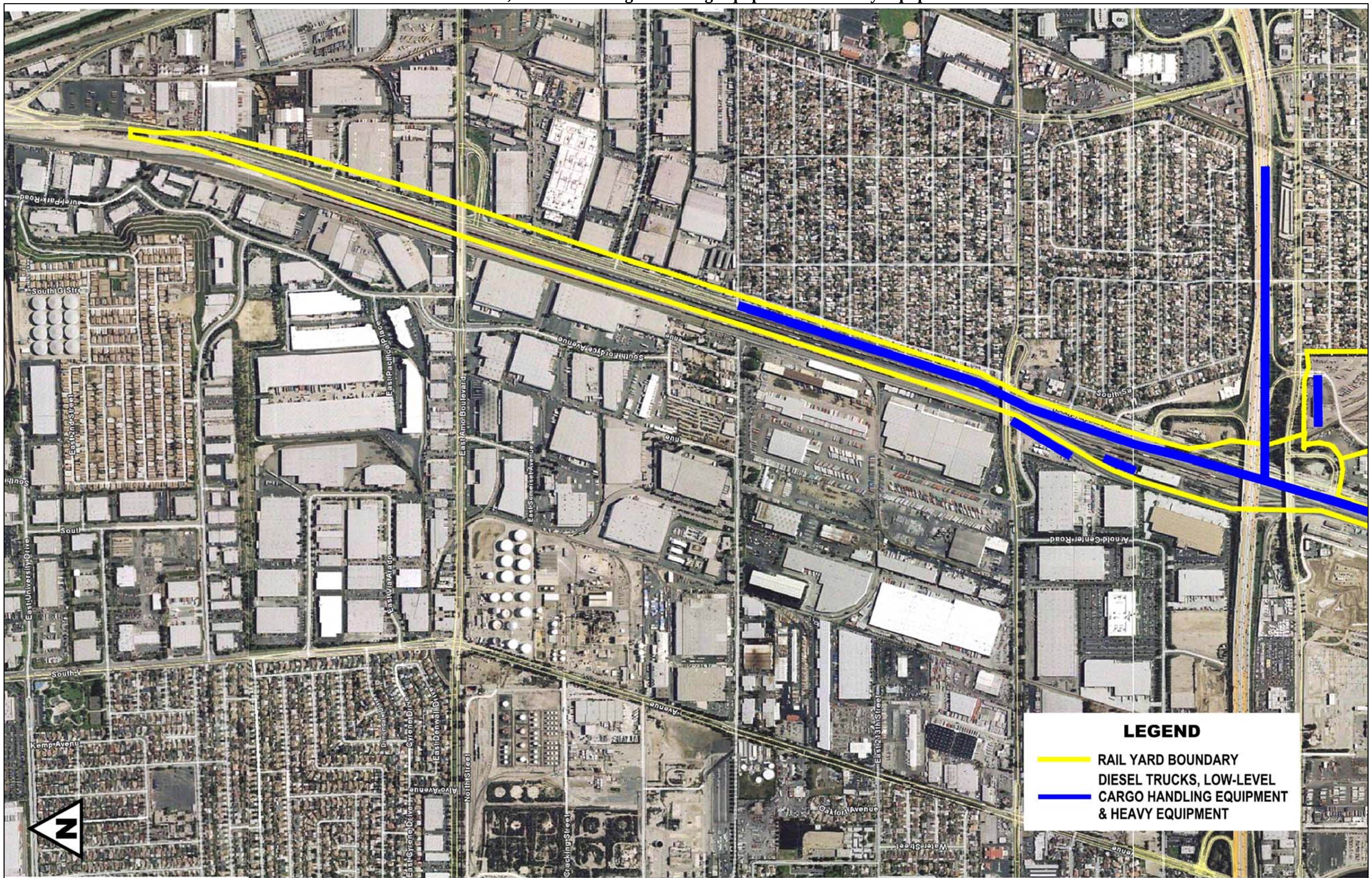


Figure 5
Diesel Trucks, Low-Level Cargo Handling Equipment and Heavy Equipment (continued)

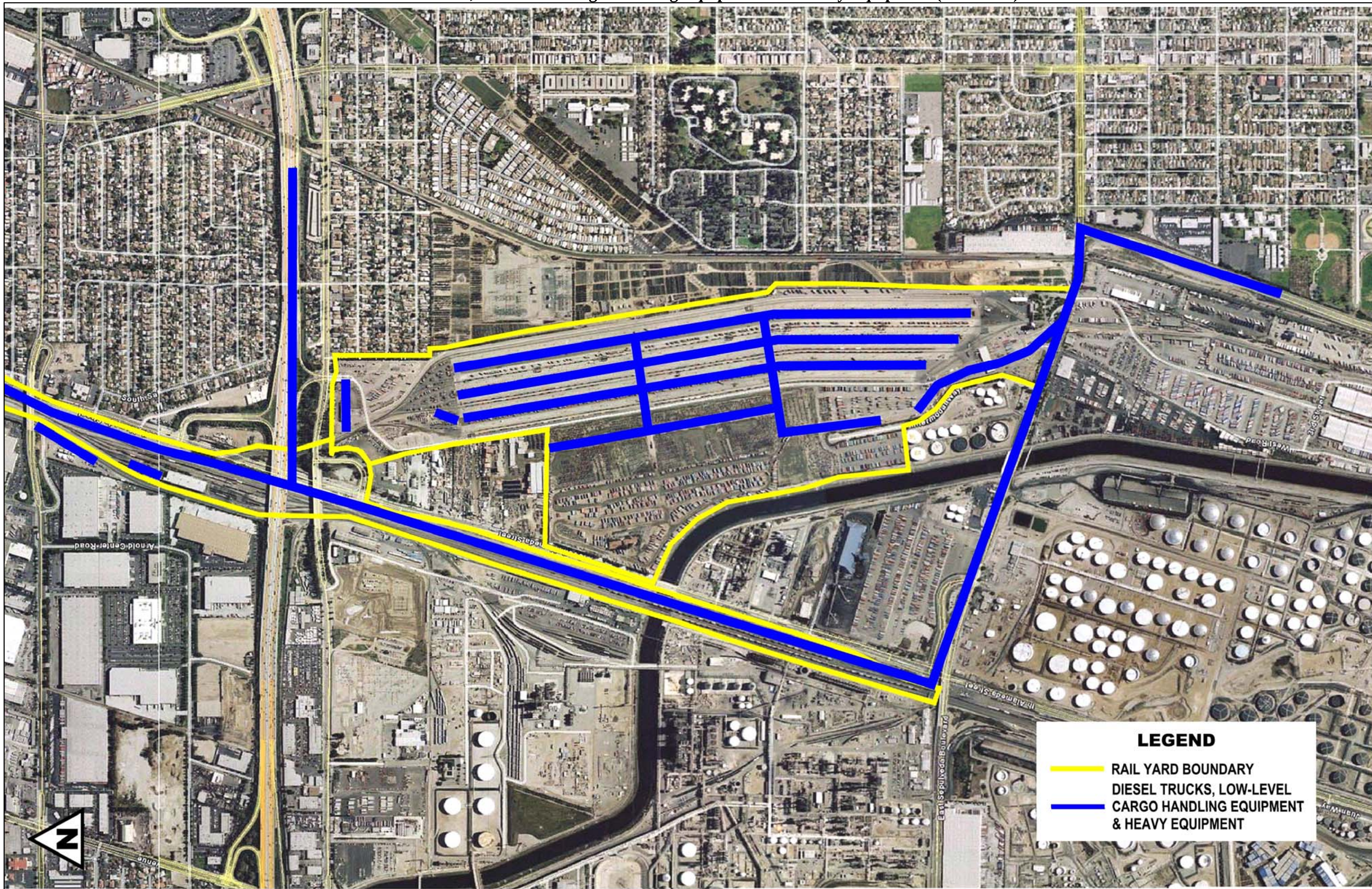


Figure 6
Yard Switching Operations

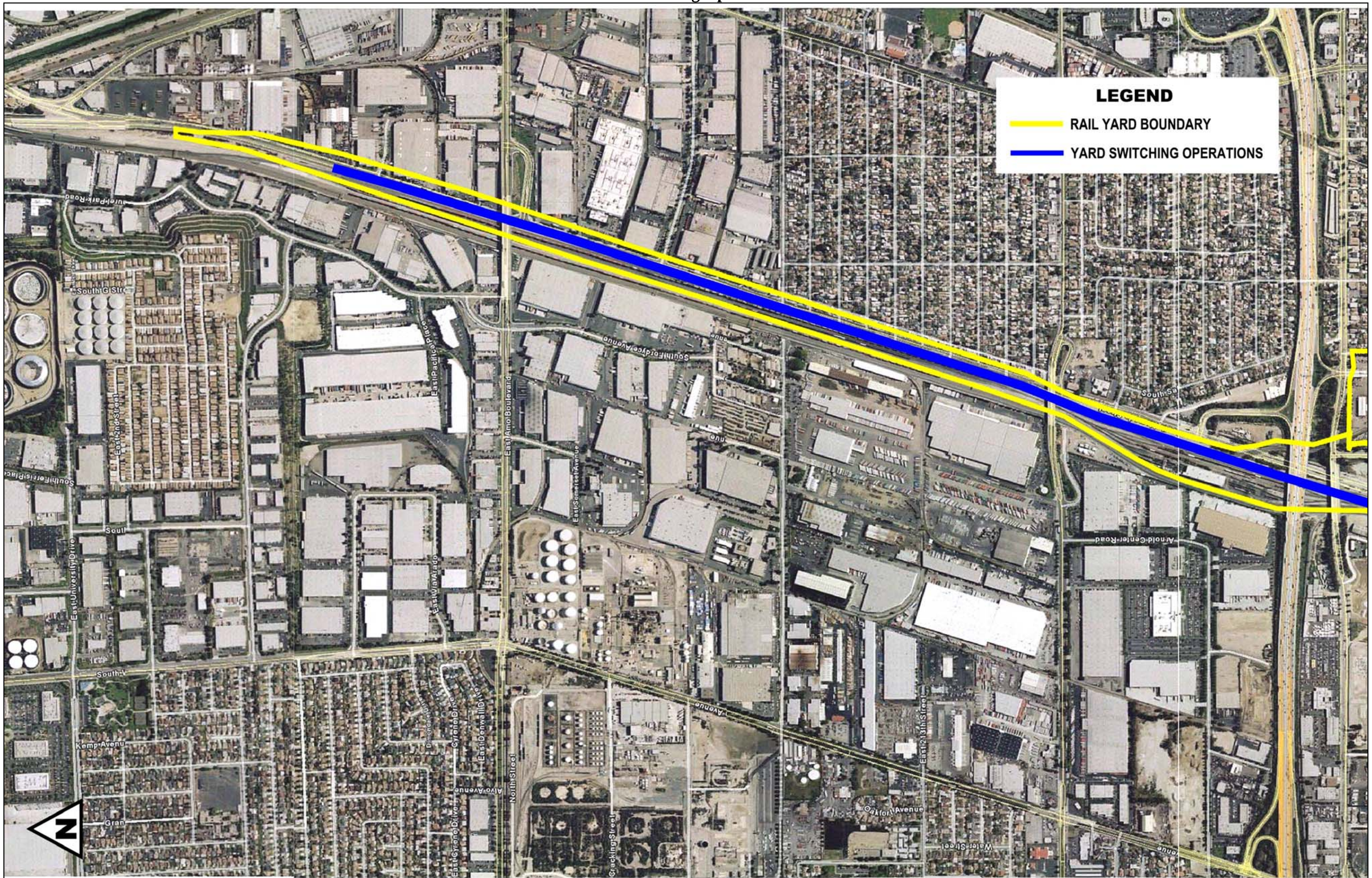


Figure 6
Yard Switching Operations (continued)

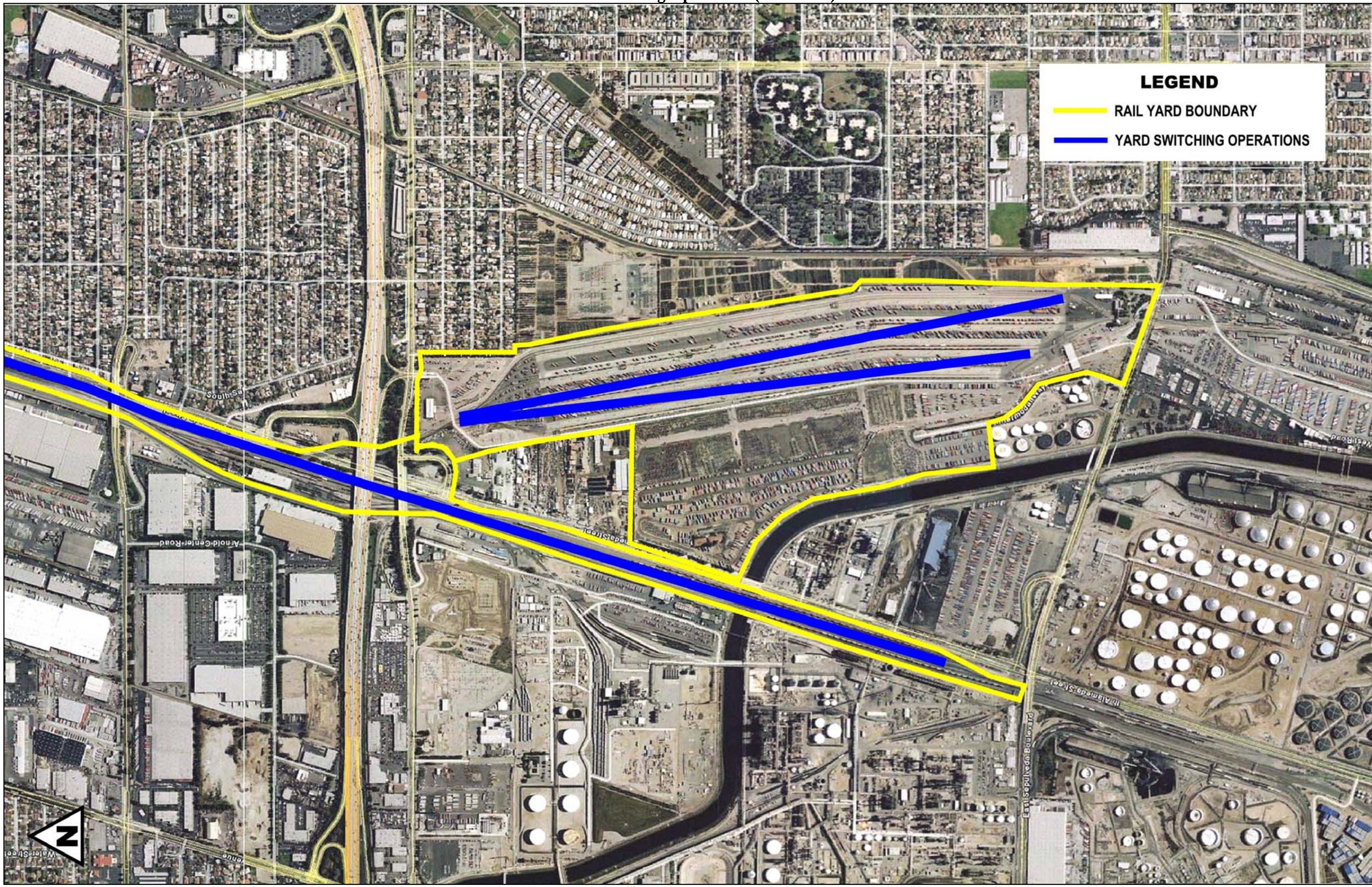


Figure 7
Consist Movement, Load Testing and Compressor and Generator

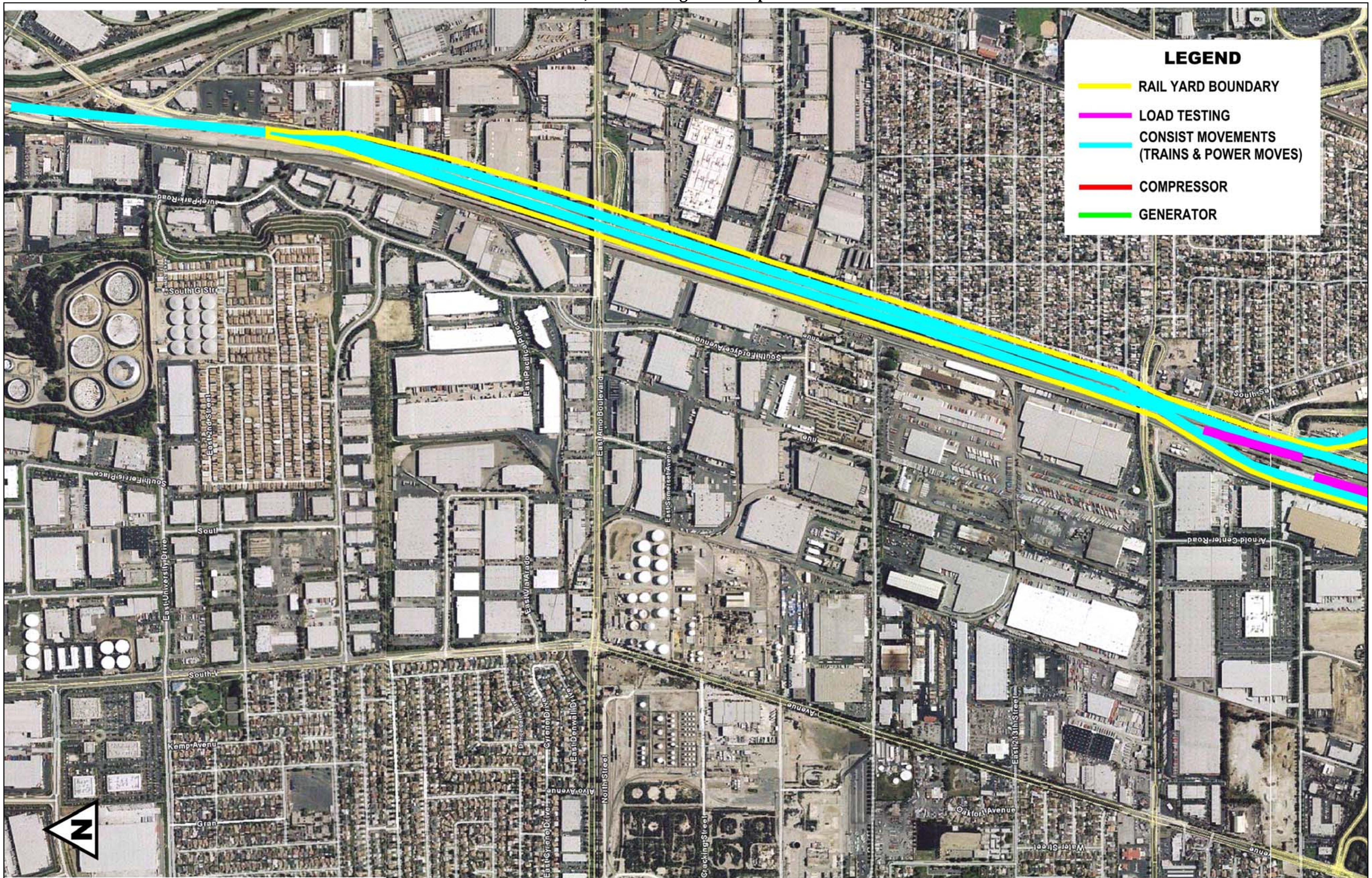
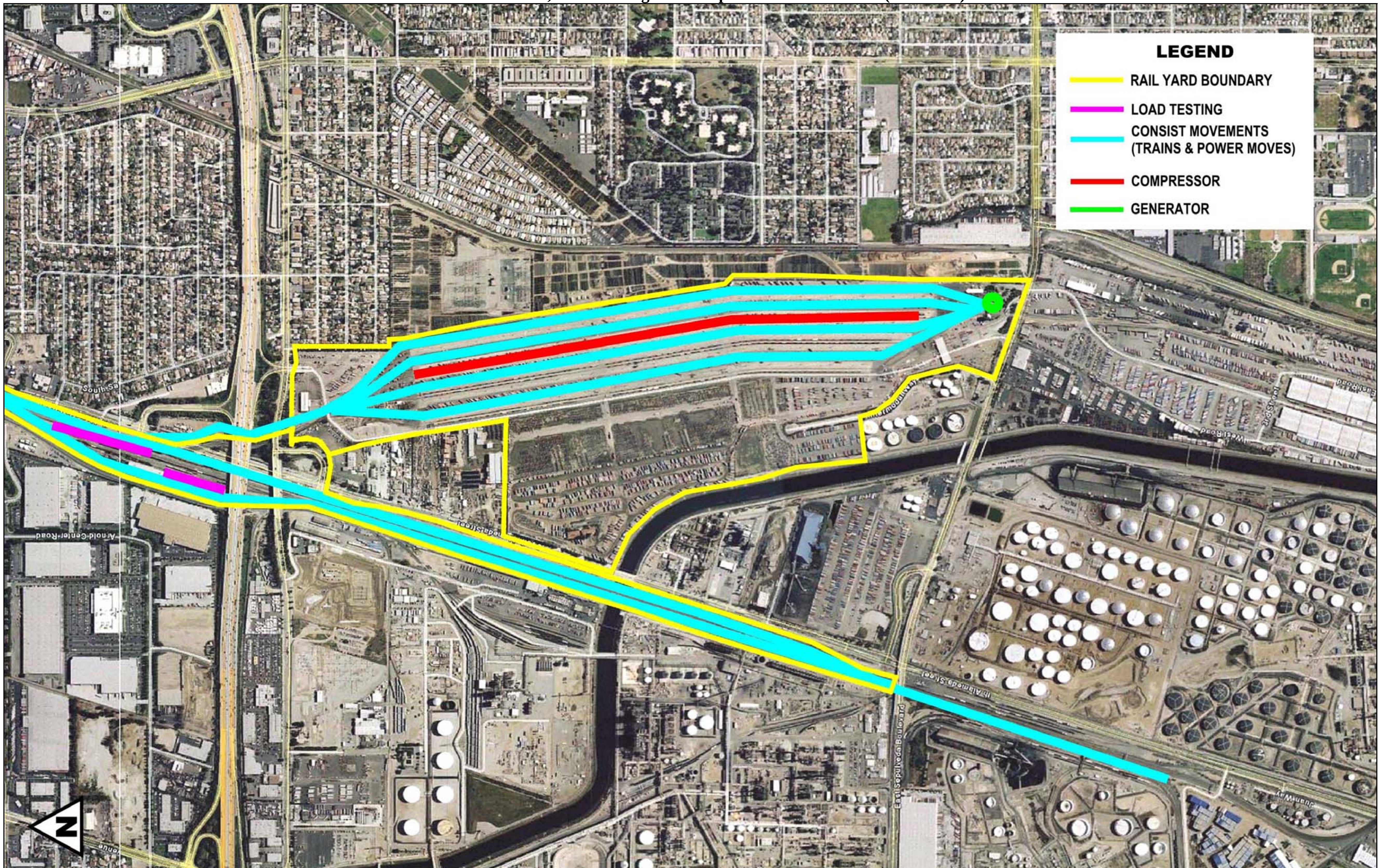


Figure 7
Consist Movement, Load Testing and Compressor and Generator (continued)



AERMOD is a steady-state,[169] multiple-source, Gaussian dispersion model designed for use with emission sources situated in terrain where ground elevations can exceed the release heights of the emission sources (i.e., complex terrain).[170] AERMOD was used with surface meteorological data from the St. Peter and Paul School in Wilmington, cloud cover from Long Beach Daugherty Field, and upper air data from the Miramar Marine Corps Air Station. AERMOD used these parameters to select the appropriate dispersion coefficients.

Standard AERMOD control parameters were used, including stack-tip downwash, non-screening mode, non-flat terrain, and sequential meteorological data check. Following USEPA guidance, the stack-tip downwash option adjusted the effective stack height downward following the methods of Briggs (1972) for stack exit velocities less than 1.5 times the wind speed at stack top.

Two AERMET preprocessors (Stages 1 and 2, and Stage 3) were used by ENVIRON[171] to prepare meteorological data for use in AERMOD. Albedo, surface roughness, and Bowen ratio[172] were estimated in multiple wind direction sectors surrounding the Yard.

3. Modeling Inputs

Modeling was based on the annual average emissions for each source as discussed in Part V.A.1 above. Diurnal and/or seasonal activity scalars were applied to locomotive

[169] The term "steady-state" means that the model assumes no variability in meteorological parameters over a one-hour time period.
[170] Federal Register, November 9, 2005; Volume 70, Number 216, Pages 68218-68261.
[171] Because of the relative proximity of the ICTF to BNSF's Watson/Wilmington rail yard, the same Wilmington meteorological data are being used in the air dispersion modeling conducted for both rail yards under the 2005 CARB MOU. A detailed description of the methodology used to develop the meteorological data are available in the following document: ENVIRON. *Meteorological Data Selection and Processing Methodology for 2006 BNSF Designated Rail Yards,* July 25, 2006. To maintain consistency, the same meteorological data was used for the dispersion modeling analysis for this project as was used for the dispersion modeling analysis under the MOU.
[172] The albedo of a specified surface is the ratio of the radiative flux reflected from the surface to the radiative flux incident on the surface. Flux is the amount of energy per unit time incident upon or crossing a unit area of a defined flat plane. For example, the albedo for snow and ice varies from 80% to 85% and the albedo for bare ground from 10% to 20%. Bowen ratio is the ratio of heat energy used for sensible heating (conduction and convection) of the air above a specified surface to the heat energy used for latent heating (evaporation of water or sublimation of snow) at the surface. The Bowen ratio ranges from 0.1 for the ocean surface to more than 2.0 for deserts; negative values are also possible.

activities. The following profiles were used in the modeling. See Appendix A-3 for the profiles used and Appendix I for a description of the methods used to develop them.

- A seasonal/diurnal activity profile was calculated for locomotive idling based on the number of arrivals and departures in each hour of the day and the number of arriving and departing trains in each season. Each hourly factor was based on the number of arrivals and departures in that hour and the average number of departures in that hour and the following hour. This approach captures the idling times for consists prior to departure. These factors were applied to consist idling for arriving and departing trains.
- A seasonal/diurnal activity profile was calculated for in-yard locomotive movements of road power using the same approach as for idling. In this case, however, only the number of arriving and departing trains in a single hour was used for that hour's factor.
- A seasonal profile was used for switching operations based on the same seasonal profile developed for train activity. No diurnal profile was used as yard switching operations continue throughout the day.
- A seasonal profile was applied to locomotive service and load test emissions based on monthly service release data.

The volume source release heights and vertical dispersion parameters (σ_z) were those used by CARB for the Truck Stop Scenario in Appendix VII of the Diesel Risk Reduction Plan for mobile vehicles and equipment other than locomotives. For locomotives, the release height and σ_z values used were those developed by CARB for daytime and nighttime locomotive movements in the Roseville Risk Assessment modeling. Stack parameters used to create the AERMOD input file for locomotive operations are shown in Table 266. Table 267 summarizes the modeling inputs used to create the AERMOD input file for each non-locomotive source at the Yard.

Table 266 Locomotive Modeling Inputs – ICTF and Dolores Rail Yards 2005 Baseline Year							
	Point/Idling Source Parameters				Volume Source Parameters		
Source	Stack Height (m)	Stack Diameter (m)	Exit Velocity (m/s)	Temp (° K)	σ_z (m)	σ_y[e] (m)	Release Height (m)
Locomotives (idling and load tests)[a]							
Road power at all yards-SD7x[b]	4.6	0.625	3.1	364	-	-	-
Load tests – N1[c]	4.6	0.625	8.0	420	-	-	-
Load tests – N8[c]	4.6	0.625	36.6	589	-	-	-
Yard locomotives	4.6	0.305	7.5	342	-	-	-
Locomotives (traveling)[d]							
Day[e]	-	-	-	-	2.6	20-50	5.6
Night[e]	-	-	-	-	6.79	20-50	14.6

Notes:

a. Stack parameters for stationary locomotives were taken from the CARB Roseville modeling analysis.
b. Idling road power stack parameters are those of the most prevalent locomotive model (SD-7x).
c. Load test stack parameters are those of the most prevalent locomotive model (SD-7x).
d. All locomotive movements for road power and yard locomotives while working are the day and night volume source parameters for moving locomotives from the CARB Roseville modeling analysis.
e. Lateral dispersion coefficient (σ_y) for moving locomotive volume sources was set to values between 20 and 50 m, depending on the spacing of sources in different areas of the Yard and proximity to Yard boundaries.

Table 267
Non-Locomotive Modeling Inputs – ICTF and Dolores Rail Yards
2005 Baseline Year

Source	Point/Idling Source Parameters				Volume Source Parameters		
	Stack Height (m)	Stack Diameter (m)	Exit Velocity (m/s)	Temp (° K)	σ_z (m)	σ_y[c] (m)	Release Height (m)
HHD Diesel-Fueled Trucks (Drayage and Delivery)	-	-	-	-	1.39	20-50	4.15
Cranes[a]	12.5	0.13	20	644.3	-	-	-
RTGs[a]	12.5	0.13	20	644.3	-	-	-
Top Picks[b]	-	-	-	-	1.39	20-50	4.15
Forklifts[b]	-	-	-	-	1.39	20-50	4.15
Manlift[b]	-	-	-	-	1.39	20-50	4.15
Yard Hostlers[b]	-	-	-	-	1.39	20-50	4.15
TRUs and Reefer Cars	-	-	-	-	1.39	20-50	4.15
Yard Trucks	-	-	-	-	1.39	50	4.15
Diesel-Fueled IC Engines	-	-	-	-	1.39	20-50	1.829
Storage Tanks	2.438	0.152	0.001	293.15	-	-	-
Refueling Operations	-	-	-	-	1.39	20	4.15
WWTP	-	-	-	-	2.6	11.63	5.6
Steam Cleaners	-	-	-	-	1.39	20	1.829
Heater	-	-	-	-	1.39	20	4.15
Propane –Fueled Welder	-	-	-	-	1.39	20	1.829
Miscellaneous Gasoline-Fueled Equipment	-	-	-	-	1.39	20-50	1.829
Worker Vehicles	-	-	-	-	1.39	20-50	4.15

Notes:
a. Stack parameters from equipment manufacturers.
b. Low level sources treated as volume sources using the release height and vertical dispersion parameter (σ_z) from the CARB Diesel Risk Reduction Plan (Sept. 13, 2000), Appendix VII, Table 2 (Truck stop scenario).
c. Low level source lateral dispersion parameter (σ_y) set to a value between 20 and 50 meters based on spacing between sources and proximity to the Yard boundary.

4. Meteorological Data Selection

The Yard does not monitor meteorological variables on site. Surface data from the St. Peter and Paul School monitoring station in Wilmington, and cloud cover data from the Long Beach Daugherty Field station were used for this project.[173] The upper air data used in the modeling were obtained from Miramar Marine Corps Air Station.

Because rail yards, and therefore emissions from locomotives, tend to be aligned linearly along the main track routes, the directions of prevailing surface winds were important to achieve representativeness of model predictions in the near field. For longer transport distances (e.g., 1 to 10 km), surface winds were still the primary consideration, with atmospheric stability also playing an important role. Due to the relatively low release heights and limited plume rise of rail yard sources, modeled concentrations are relatively insensitive to mixing heights, temperatures, and vertical temperature and wind profiles

Based on an evaluation of available meteorological data,[174] including the above criteria for representativeness, wind speed and direction and temperature data from St. Peter and Paul School in Wilmington, cloud cover data from the Long Beach Daugherty Field station, and upper air data from Miramar Marine Corps Air Station were processed in AERMET, the meteorological preprocessor for AERMOD.

As the only one-year sequence of satisfactory surface data available, twelve months from July 1, 2005 through June 30, 2006, of meteorological data from St. Peter and Paul School were processed with AERMET. It is not expected that year-to-year variability would cause significant differences in the modeled air quality impacts. This conclusion is based on modeling sensitivity analyses that were carried out using five years of meteorological data for the Stockton area. The five annual average concentration patterns were compared with one another and with the average predictions for the full five year period. Differences between these were found to be negligible in terms of spatial concentration patterns, locations of highest concentrations, and absolute concentrations. A similar result would be expected for meteorological conditions at

[173] ENVIRON. *Meteorological Data Selection and Processing Methodology for 2006 BNSF Designated Rail Yards*, Report 06-12910J, July 25, 2006.
[174] Ibid.

ICTF. At coastal locations such as ICTF, air flow patterns over the course of a year are expected to be at least as consistent as an inland location such as Stockton.

5. Model Domain and Receptor Grids

A domain size of 20 km by 20 km and coarse receptor grid of 500 m x 500 m were used for the modeling analysis. A fine grid of 50 m x 50 m surrounding the Yard was used for modeling within 300 m of the fence line. A medium-fine grid of 100 m x 100 m was used for receptors between 300 and 600 m of the fence line around the fine grid network, and a medium grid of 200 m x 200 m was used for receptor distances between 600 and 1000 m.

All receptors were identified by UTM coordinates. United States Geological Survey (USGS) 7.5 Minute digital elevation model (DEM) data were used to identify terrain heights at each receptor. Figures 9 and 10 show the outline of the Yard, along with the coarse and fine receptor grids.

Sensitive receptors, consisting of hospitals, schools, day-care centers, and elder care facilities, within a 1-mile radius of the Yard, were identified. Table 268 lists the address, elevation, and UTM coordinates for each sensitive receptor. Figure 11 shows the outline of the Yard and the location of each sensitive receptor identified in Table 268.

Table 268
Sensitive Receptor Locations – ICTF and Dolores Rail Yards
2005 Baseline Year

Receptor	Address	Elevation (m)	UTM-E (m)	UTM-N (m)
Birney Elementary School	710 W. Spring St., Long Beach, CA 90806	6.1	388723	3741906
Broadacres Elementary School	19424 South Broadacres Ave., Carson, CA 90746	27.1	385487	3746625
Colin L Powell Academy for Success	150 Victoria St., Long Beach, CA 90805	15.2	388674	3747490
Daniel Webster Elementary School	1755 W 32nd Way, Long Beach, CA 90810	7.9	387237	3742482
Del Amo Elementary School	21228 Water St., Carson, CA 90745	7.9	385285	3744613
Dominguez Elementary School	21250 Santa Fe Ave., Carson, CA 90810	10.7	387547	3744455
Elizabeth Hudson Elementary School	2335 Webster Ave, Long Beach, CA 90810	5.5	386913	3740724
James Garfield Elementary School	2240 Baltic Ave, Long Beach, CA 90810	5.2	387694	3740521
John Muir Elementary School	3038 Delta Ave, Long Beach, CA 90810	7.0	387916	3741941
Juan Rodriguez Cabrillo High School	2001 Santa Fe Ave, Long Beach, CA 90810	4.3	387013	3740052
Mary Bethune School	2101 San Gabriel Avenue, Long Beach, CA 90810	3.7	386731	3739865
Savannah Academy	2152 W Hill St, Long Beach, CA 90810	4.9	387079	3740317
St. Lucy School	2320 Cota Ave, Long Beach, CA 90810	5.5	387396	3740537
Sutter Elementary School	5075 Daisy Ave., Long Beach, CA 90805	12.2	388889	3746000
William Logan Stephens Middle School	1830 W Columbia St, Long Beach, CA 90810	6.4	387086	3741654
First Baptist Preschool and Daycare	2679 E Carson St, Carson, CA 90810	10.1	387219	3744170
Sanders Teeny Tiny Preschool	3211 Santa Fe Ave, Long Beach, CA 90810	7.9	387501	3742404
Little Greenwood Daycare	22114 S Carlerik Ave, Long Beach, CA 90810	10.1	387307	3743616
Blessing's Child Care	1422 E Bach St, Carson, CA 90745	7.3	384552	3743731
Santa Fe Convalescent	3294 Santa Fe Ave, Long Beach, CA 90810	7.9	387523	3742527

Notes:
a. UTM Coordinates are in Zone 11, NAD 83.

Figure 8
Coarse Modeling Grid – ICTF and Dolores Rail Yards
2005 Baseline Year

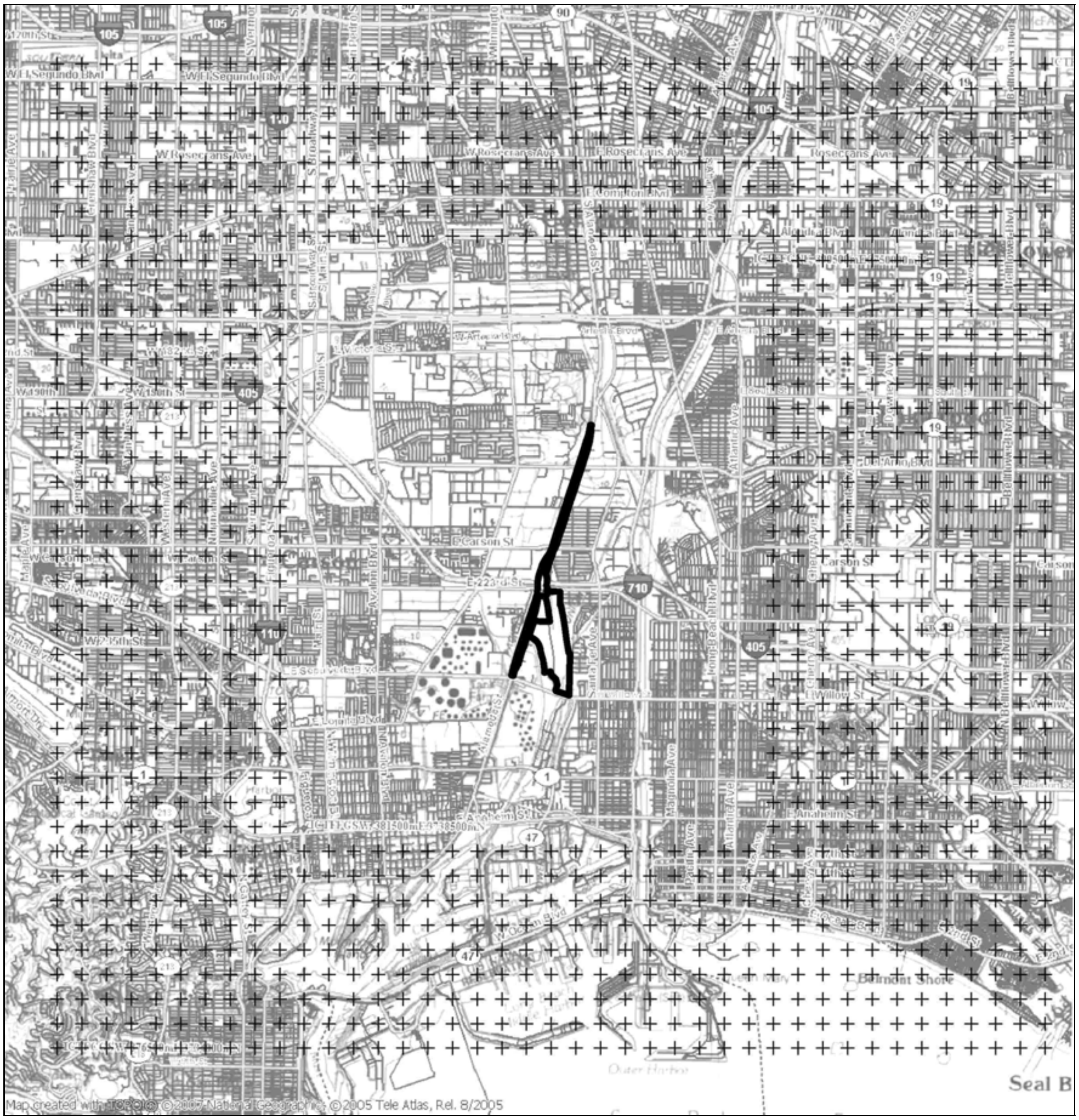


Figure 9
Fine Modeling Grid – ICTF and Dolores Rail Yards
2005 Baseline Year

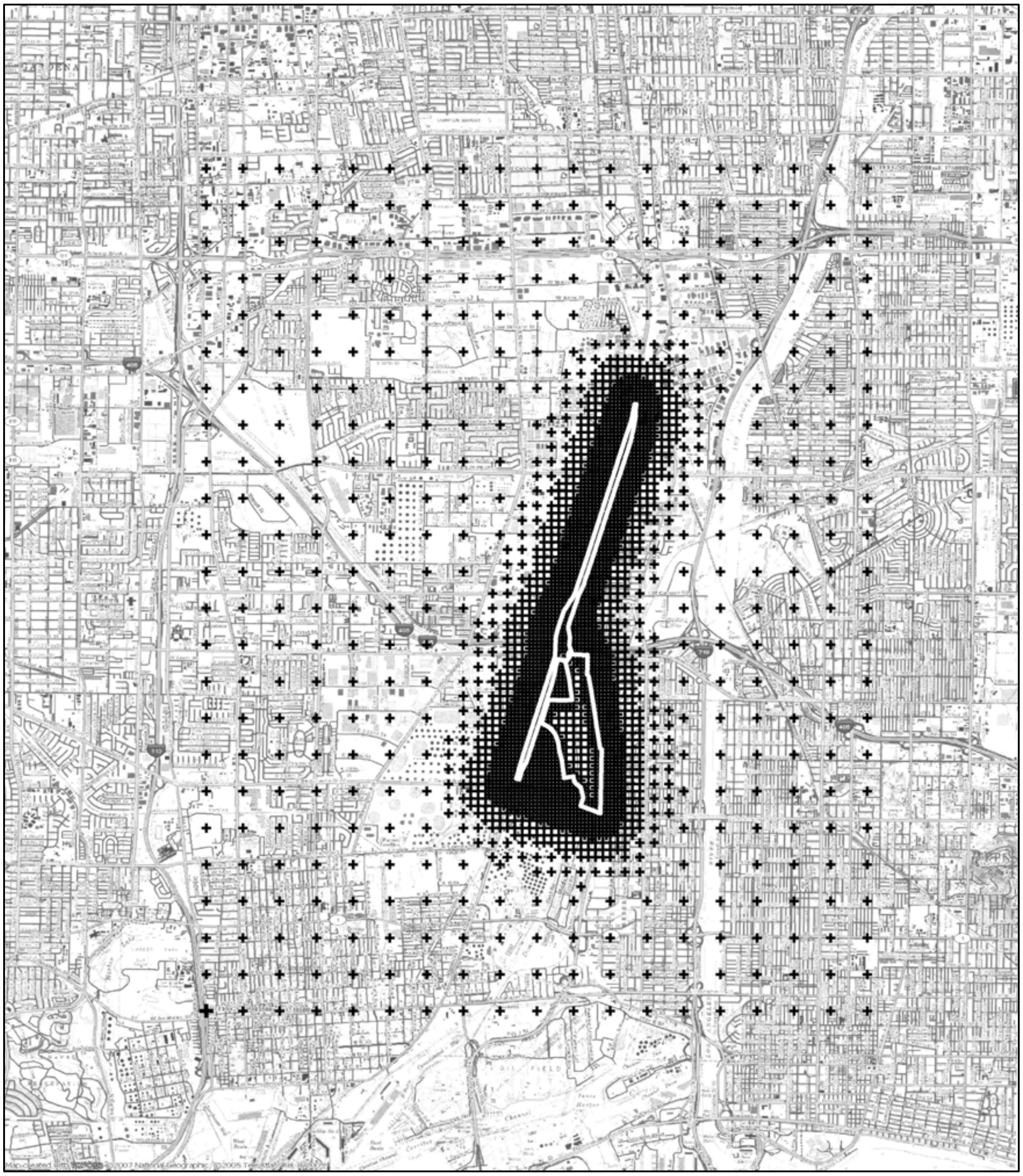
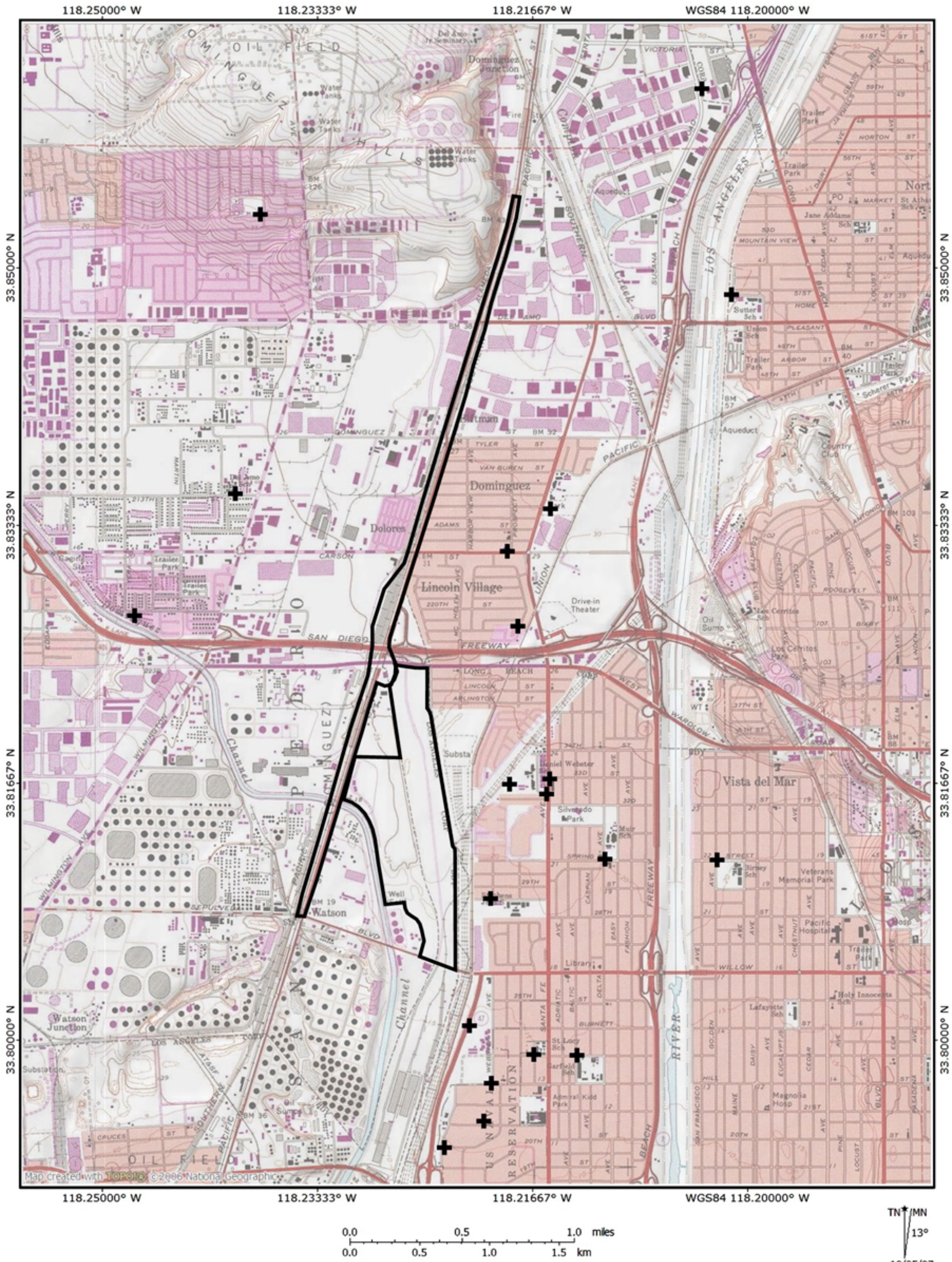


Figure 10
Sensitive Receptors – ICTF and Dolores Rail Yards
2005 Baseline Year



6. Dispersion Coefficients

Dispersion coefficients are used in air dispersion models to reflect the land use over which the pollutants are transported. The area surrounding the nearby BNSF Watson/Wilmington Rail Yard was divided into sectors to characterize the albedo, surface roughness and Bowen ratio[175]. These parameters were provided along with the meteorological data to the AERMET software. The resulting meteorological input file allowed AERMOD to select appropriate dispersion coefficients during its simulation of air dispersion. AERMOD also provides an urban input option to use the overall size of the Standard Metropolitan Statistical Area that contains the emission source (i.e., the Yard) in accounting for the urban heat island effect on the nocturnal convective boundary layer height. If the option is not selected, AERMOD defaults to rural dispersion coefficients. If the urban option is selected, but no surface roughness is specified (not to be confused with the surface roughness parameters already specified for sectors around the meteorological monitoring station and input to AERMET), AERMOD assigns a default "urban" surface roughness of 1 meter. For Dolores/ICTF, AERMOD was run with the urban option. If Dolores/ICTF were located further inland, based on CARB and USEPA guidance,[176] namely "*For urban areas adjacent to or near other urban areas, or part of urban corridors, the user should attempt to identify that part of the urban area that will contribute to the urban heat island plume affecting the source,*" the population of the Los Angeles Standard Metropolitan Statistical Area (SMSA) would have been considered appropriate for determining the urban heat island effect on the nocturnal convective boundary layer height. Due to the proximity of San Pedro Bay, however, a lower population was selected to avoid overestimation of the urban heat island effect. The population of this SMSA is approximately 14,000,000, so in this case, a population of one half this value, 7,000,000 was used. The surface roughness that characterizes this area was set to the URBANOPT default of 1 m. See Appendix J for additional discussion of this issue.

[175] As previously discussed, a meteorological data set, prepared by ENVIRON, for the BNSF Watson/Wilmington Yard was used for this project. The albedo, surface roughness, and Bowen ratio were characterized for the area surrounding the Watson/Wilmington Yard. The albedo, surface roughness, and Bowen ratio for the ICTF will be similar to those calculated for Watson/Wilmington Yard, due to the close proximity of Yards. Therefore, the parameters for the Watson/Wilmington Yard were used for this project.

[176] AERMOD Implementation Guide**,** September 27, 2005, *http://www.epa.gov/scram001/7thconf/aermod/aermod_implmtn_guide.pdf*

7. Building Downwash

Building downwash effects were considered for the Yards. Stack-tip downwash adjusted the effective stack height downward following the methods of Briggs (1972) when the stack exit velocity was less than 1.5 times the wind speed at stack top. The locomotives are the only structures in the Yards of sufficiently large size and close enough proximity to the modeled emission sources (i.e., their own stacks) to be entered into the Building Profile Input Program (BPIP) with one set of dimensions for a "standard" locomotive (24.2 m. long x 4.0 m. wide x 4.6 m. high).

B. Modeling Results

The AERMOD input and output files are provided under separate cover in an electronic format.

PART VI. REFERENCES

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APPENDIX A

LOCOMOTIVE DATA

APPENDIX A-1

LOCOMOTIVE MODEL, TIER, AND AUTO-START/STOP TECHNOLOGY FREQUENCY BY TRAIN TYPE

Appendix A-1
Locomotive Model, Tier, and Auto Start/Stop Technology Frequency by Train Type

Through IM Trains

EB arr 74

Technology	ZTR/AESS	Switch	GP3x	GP4x	GP50	GP60	SD7x	SD90	Dash7	Dash8	Dash9	C60A	Unknown
Pre Tier 0	No	0	0	27	0	12	2	0	0	19	25	0	2
Pre Tier 0	Yes	0	0	0	0	0	0	0	0	0	1	0	0
Tier 0	No	0	0	0	0	1	38	0	0	3	9	0	0
Tier 0	Yes	0	0	0	0	0	0	0	0	0	0	0	0
Tier 1	No	0	0	0	0	0	9	0	0	0	0	0	0
Tier 1	Yes	0	0	0	0	0	41	0	0	0	1	0	0
Tier 2	No	0	0	0	0	0	0	0	0	0	0	0	0
Tier 2	Yes	0	0	0	0	0	16	0	0	0	43	0	0

EB dep 74

Technology	ZTR/AESS	Switch	GP3x	GP4x	GP50	GP60	SD7x	SD90	Dash7	Dash8	Dash9	C60A	Unknown
Pre Tier 0	No	0	0	26	0	13	2	0	0	19	25	0	1
Pre Tier 0	Yes	0	0	0	0	0	0	0	0	0	1	0	0
Tier 0	No	0	0	0	0	1	38	0	0	3	9	0	0
Tier 0	Yes	0	0	0	0	0	0	0	0	0	0	0	0
Tier 1	No	0	0	0	0	0	9	0	0	0	0	0	0
Tier 1	Yes	0	0	0	0	0	40	0	0	0	1	0	0
Tier 2	No	0	0	0	0	0	0	0	0	0	0	0	0
Tier 2	Yes	0	0	0	0	0	16	0	0	0	43	0	0

WB arr 215

Technology	ZTR/AESS	Switch	GP3x	GP4x	GP50	GP60	SD7x	SD90	Dash7	Dash8	Dash9	C60A	Unknown
Pre Tier 0	No	0	0	26	2	19	1	1	0	32	41	0	6
Pre Tier 0	Yes	0	0	0	0	0	0	0	0	0	1	0	0
Tier 0	No	0	0	0	0	5	121	0	0	3	15	6	0
Tier 0	Yes	0	0	0	0	1	1	0	0	0	1	0	0
Tier 1	No	0	0	0	0	0	20	0	0	0	0	0	0
Tier 1	Yes	0	0	0	0	0	104	0	0	0	5	0	0
Tier 2	No	0	0	0	0	0	0	0	0	0	0	0	0
Tier 2	Yes	0	0	0	0	0	41	0	0	0	175	0	0

Appendix A-1
Locomotive Model, Tier, and Auto Start/Stop Technology Frequency by Train Type

WB dep 215

Technology	ZTR/AESS	Switch	GP3x	GP4x	GP50	GP60	SD7x	SD90	Dash7	Dash8	Dash9	C60A	Unknown
Pre Tier 0	**No**	0	0	26	2	19	1	1	0	32	40	0	6
Pre Tier 0	**Yes**	0	0	0	0	0	0	0	0	0	1	0	0
Tier 0	**No**	0	0	0	0	4	115	0	0	3	15	6	0
Tier 0	**Yes**	0	0	0	0	1	1	0	0	0	1	0	0
Tier 1	**No**	0	0	0	0	0	20	0	0	0	0	0	0
Tier 1	**Yes**	0	0	0	0	0	103	0	0	0	5	0	0
Tier 2	**No**	0	0	0	0	0	0	0	0	0	0	0	0
Tier 2	**Yes**	0	0	0	0	0	40	0	0	0	169	0	0

Arriving IM Trains

EB arr 0

Technology	ZTR/AESS	Switch	GP3x	GP4x	GP50	GP60	SD7x	SD90	Dash7	Dash8	Dash9	C60A	Unknown
Pre Tier 0	**No**	0	0	0	0	0	0	0	0	0	0	0	0
Pre Tier 0	**Yes**	0	0	0	0	0	0	0	0	0	0	0	0
Tier 0	**No**	0	0	0	0	0	0	0	0	0	0	0	0
Tier 0	**Yes**	0	0	0	0	0	0	0	0	0	0	0	0
Tier 1	**No**	0	0	0	0	0	0	0	0	0	0	0	0
Tier 1	**Yes**	0	0	0	0	0	0	0	0	0	0	0	0
Tier 2	**No**	0	0	0	0	0	0	0	0	0	0	0	0
Tier 2	**Yes**	0	0	0	0	0	0	0	0	0	0	0	0

EB dep 0

Technology	ZTR/AESS	Switch	GP3x	GP4x	GP50	GP60	SD7x	SD90	Dash7	Dash8	Dash9	C60A	Unknown
Pre Tier 0	**No**	0	0	0	0	0	0	0	0	0	0	0	0
Pre Tier 0	**Yes**	0	0	0	0	0	0	0	0	0	0	0	0
Tier 0	**No**	0	0	0	0	0	0	0	0	0	0	0	0
Tier 0	**Yes**	0	0	0	0	0	0	0	0	0	0	0	0
Tier 1	**No**	0	0	0	0	0	0	0	0	0	0	0	0
Tier 1	**Yes**	0	0	0	0	0	0	0	0	0	0	0	0
Tier 2	**No**	0	0	0	0	0	0	0	0	0	0	0	0
Tier 2	**Yes**	0	0	0	0	0	0	0	0	0	0	0	0

Appendix A-1
Locomotive Model, Tier, and Auto Start/Stop Technology Frequency by Train Type

WB arr 3557

Technology	ZTR/AESS	Switch	GP3x	GP4x	GP50	GP60	SD7x	SD90	Dash7	Dash8	Dash9	C60A	Unknown
Pre Tier 0	**No**	1	8	858	73	494	41	11	5	817	702	4	112
Pre Tier 0	**Yes**	0	2	1	0	0	0	0	0	0	62	0	0
Tier 0	**No**	0	0	24	1	106	2267	1	0	134	234	6	0
Tier 0	**Yes**	0	2	0	0	6	7	0	0	0	29	0	0
Tier 1	**No**	0	0	0	0	0	432	0	0	0	1	0	0
Tier 1	**Yes**	0	0	0	0	0	1777	0	0	0	54	0	0
Tier 2	**No**	0	0	0	0	0	0	0	0	0	0	0	0
Tier 2	**Yes**	0	0	0	0	0	382	0	0	0	819	0	0

WB dep 0

Technology	ZTR/AESS	Switch	GP3x	GP4x	GP50	GP60	SD7x	SD90	Dash7	Dash8	Dash9	C60A	Unknown
Pre Tier 0	**No**	0	0	0	0	0	0	0	0	0	0	0	0
Pre Tier 0	**Yes**	0	0	0	0	0	0	0	0	0	0	0	0
Tier 0	**No**	0	0	0	0	0	0	0	0	0	0	0	0
Tier 0	**Yes**	0	0	0	0	0	0	0	0	0	0	0	0
Tier 1	**No**	0	0	0	0	0	0	0	0	0	0	0	0
Tier 1	**Yes**	0	0	0	0	0	0	0	0	0	0	0	0
Tier 2	**No**	0	0	0	0	0	0	0	0	0	0	0	0
Tier 2	**Yes**	0	0	0	0	0	0	0	0	0	0	0	0

Departing IM Trains

EB arr 0

Technology	ZTR/AESS	Switch	GP3x	GP4x	GP50	GP60	SD7x	SD90	Dash7	Dash8	Dash9	C60A	Unknown
Pre Tier 0	**No**	0	0	0	0	0	0	0	0	0	0	0	0
Pre Tier 0	**Yes**	0	0	0	0	0	0	0	0	0	0	0	0
Tier 0	**No**	0	0	0	0	0	0	0	0	0	0	0	0
Tier 0	**Yes**	0	0	0	0	0	0	0	0	0	0	0	0
Tier 1	**No**	0	0	0	0	0	0	0	0	0	0	0	0
Tier 1	**Yes**	0	0	0	0	0	0	0	0	0	0	0	0
Tier 2	**No**	0	0	0	0	0	0	0	0	0	0	0	0
Tier 2	**Yes**	0	0	0	0	0	0	0	0	0	0	0	0

Appendix A-1
Locomotive Model, Tier, and Auto Start/Stop Technology Frequency by Train Type

EB dep 2045

Technology	ZTR/AESS	Switch	GP3x	GP4x	GP50	GP60	SD7x	SD90	Dash7	Dash8	Dash9	C60A	Unknown
Pre Tier 0	**No**	0	0	685	64	281	35	12	4	697	533	3	98
Pre Tier 0	**Yes**	0	0	0	0	0	0	0	0	0	49	0	0
Tier 0	**No**	0	0	14	2	69	1601	0	0	100	193	6	0
Tier 0	**Yes**	0	0	0	0	2	5	0	0	0	15	0	0
Tier 1	**No**	0	0	0	0	0	298	0	0	0	0	0	0
Tier 1	**Yes**	0	0	0	0	0	1199	0	0	0	20	0	0
Tier 2	**No**	0	0	0	0	0	0	0	0	0	0	0	0
Tier 2	**Yes**	0	0	0	0	0	193	0	0	0	502	0	0

WB arr 0

Technology	ZTR/AESS	Switch	GP3x	GP4x	GP50	GP60	SD7x	SD90	Dash7	Dash8	Dash9	C60A	Unknown
Pre Tier 0	**No**	0	0	0	0	0	0	0	0	0	0	0	0
Pre Tier 0	**Yes**	0	0	0	0	0	0	0	0	0	0	0	0
Tier 0	**No**	0	0	0	0	0	0	0	0	0	0	0	0
Tier 0	**Yes**	0	0	0	0	0	0	0	0	0	0	0	0
Tier 1	**No**	0	0	0	0	0	0	0	0	0	0	0	0
Tier 1	**Yes**	0	0	0	0	0	0	0	0	0	0	0	0
Tier 2	**No**	0	0	0	0	0	0	0	0	0	0	0	0
Tier 2	**Yes**	0	0	0	0	0	0	0	0	0	0	0	0

WB dep 0

Technology	ZTR/AESS	Switch	GP3x	GP4x	GP50	GP60	SD7x	SD90	Dash7	Dash8	Dash9	C60A	Unknown
Pre Tier 0	**No**	0	0	0	0	0	0	0	0	0	0	0	0
Pre Tier 0	**Yes**	0	0	0	0	0	0	0	0	0	0	0	0
Tier 0	**No**	0	0	0	0	0	0	0	0	0	0	0	0
Tier 0	**Yes**	0	0	0	0	0	0	0	0	0	0	0	0
Tier 1	**No**	0	0	0	0	0	0	0	0	0	0	0	0
Tier 1	**Yes**	0	0	0	0	0	0	0	0	0	0	0	0
Tier 2	**No**	0	0	0	0	0	0	0	0	0	0	0	0
Tier 2	**Yes**	0	0	0	0	0	0	0	0	0	0	0	0

Appendix A-1
Locomotive Model, Tier, and Auto Start/Stop Technology Frequency by Train Type

Through Non-IM Trains

EB arr 403

Technology	ZTR/AESS	Switch	GP3x	GP4x	GP50	GP60	SD7x	SD90	Dash7	Dash8	Dash9	C60A	Unknown
Pre Tier 0	No	0	190	126	4	4	0	5	0	3	8	0	4
Pre Tier 0	Yes	0	202	32	0	0	0	0	0	0	0	0	0
Tier 0	No	0	0	1	0	1	7	0	0	0	6	0	0
Tier 0	Yes	5	9	0	0	1	0	0	0	0	2	0	0
Tier 1	No	0	0	0	0	0	0	0	0	0	0	0	0
Tier 1	Yes	0	0	0	0	0	6	0	0	0	3	0	0
Tier 2	No	0	0	0	0	0	0	0	0	0	0	0	0
Tier 2	Yes	0	0	0	0	0	0	0	0	0	5	0	0

EB dep 403

Technology	ZTR/AESS	Switch	GP3x	GP4x	GP50	GP60	SD7x	SD90	Dash7	Dash8	Dash9	C60A	Unknown
Pre Tier 0	No	0	190	126	4	5	0	5	0	3	8	0	4
Pre Tier 0	Yes	0	202	32	0	0	0	0	0	0	0	0	0
Tier 0	No	0	0	1	0	1	7	0	0	0	6	0	0
Tier 0	Yes	5	9	0	0	1	0	0	0	0	2	0	0
Tier 1	No	0	0	0	0	0	0	0	0	0	0	0	0
Tier 1	Yes	0	0	0	0	0	6	0	0	0	3	0	0
Tier 2	No	0	0	0	0	0	0	0	0	0	0	0	0
Tier 2	Yes	0	0	0	0	0	0	0	0	0	5	0	0

WB arr 101

Technology	ZTR/AESS	Switch	GP3x	GP4x	GP50	GP60	SD7x	SD90	Dash7	Dash8	Dash9	C60A	Unknown
Pre Tier 0	No	0	0	20	2	17	2	1	0	32	20	0	1
Pre Tier 0	Yes	0	0	0	0	0	0	0	0	0	1	0	0
Tier 0	No	0	0	0	0	6	62	0	0	6	11	0	0
Tier 0	Yes	0	0	0	0	0	0	0	0	0	0	0	0
Tier 1	No	0	0	0	0	0	12	0	0	0	0	0	0
Tier 1	Yes	0	0	0	0	0	44	0	0	0	5	0	0
Tier 2	No	0	0	0	0	0	0	0	0	0	0	0	0
Tier 2	Yes	0	0	0	0	0	2	0	0	0	16	0	0

Appendix A-1
Locomotive Model, Tier, and Auto Start/Stop Technology Frequency by Train Type

WB dep	101												
Technology	**ZTR/AESS**	**Switch**	**GP3x**	**GP4x**	**GP50**	**GP60**	**SD7x**	**SD90**	**Dash7**	**Dash8**	**Dash9**	**C60A**	**Unknown**
Pre Tier 0	**No**	0	1	20	2	17	2	1	0	32	19	0	1
Pre Tier 0	**Yes**	0	0	0	0	0	0	0	0	0	1	0	0
Tier 0	**No**	0	0	0	0	6	61	0	0	6	11	0	0
Tier 0	**Yes**	0	0	0	0	0	0	0	0	0	0	0	0
Tier 1	**No**	0	0	0	0	0	12	0	0	0	0	0	0
Tier 1	**Yes**	0	0	0	0	0	44	0	0	0	5	0	0
Tier 2	**No**	0	0	0	0	0	0	0	0	0	0	0	0
Tier 2	**Yes**	0	0	0	0	0	2	0	0	0	16	0	0

Non-IM Arriving Trains

EB arr	865												
Technology	**ZTR/AESS**	**Switch**	**GP3x**	**GP4x**	**GP50**	**GP60**	**SD7x**	**SD90**	**Dash7**	**Dash8**	**Dash9**	**C60A**	**Unknown**
Pre Tier 0	**No**	5	465	311	2	7	0	0	0	14	6	0	6
Pre Tier 0	**Yes**	0	263	64	0	0	0	0	0	0	0	0	0
Tier 0	**No**	0	26	0	0	1	27	0	0	3	4	0	0
Tier 0	**Yes**	108	180	0	0	0	0	0	0	0	0	0	0
Tier 1	**No**	0	0	0	0	0	1	0	0	0	0	0	0
Tier 1	**Yes**	0	0	0	0	0	18	0	0	0	1	0	0
Tier 2	**No**	0	0	0	0	0	0	0	0	0	0	0	0
Tier 2	**Yes**	0	0	0	0	0	0	0	0	0	3	0	0

EB dep	0												
Technology	**ZTR/AESS**	**Switch**	**GP3x**	**GP4x**	**GP50**	**GP60**	**SD7x**	**SD90**	**Dash7**	**Dash8**	**Dash9**	**C60A**	**Unknown**
Pre Tier 0	**No**	0	0	0	0	0	0	0	0	0	0	0	0
Pre Tier 0	**Yes**	0	0	0	0	0	0	0	0	0	0	0	0
Tier 0	**No**	0	0	0	0	0	0	0	0	0	0	0	0
Tier 0	**Yes**	0	0	0	0	0	0	0	0	0	0	0	0
Tier 1	**No**	0	0	0	0	0	0	0	0	0	0	0	0
Tier 1	**Yes**	0	0	0	0	0	0	0	0	0	0	0	0
Tier 2	**No**	0	0	0	0	0	0	0	0	0	0	0	0
Tier 2	**Yes**	0	0	0	0	0	0	0	0	0	0	0	0

Appendix A-1
Locomotive Model, Tier, and Auto Start/Stop Technology Frequency by Train Type

WB arr 2145

Technology	ZTR/AESS	Switch	GP3x	GP4x	GP50	GP60	SD7x	SD90	Dash7	Dash8	Dash9	C60A	Unknown
Pre Tier 0	**No**	2	509	934	43	775	9	46	2	219	198	0	33
Pre Tier 0	**Yes**	0	289	70	0	1	0	0	0	0	8	0	0
Tier 0	**No**	0	20	15	0	183	374	1	0	37	112	48	0
Tier 0	**Yes**	166	245	0	0	6	1	0	0	0	40	0	0
Tier 1	**No**	0	0	0	0	0	73	0	0	0	3	0	0
Tier 1	**Yes**	0	0	0	0	0	275	0	0	0	129	0	0
Tier 2	**No**	0	0	0	0	0	0	0	0	0	0	0	0
Tier 2	**Yes**	0	0	0	0	0	19	0	0	0	42	0	0

WB dep 0

Technology	ZTR/AESS	Switch	GP3x	GP4x	GP50	GP60	SD7x	SD90	Dash7	Dash8	Dash9	C60A	Unknown
Pre Tier 0	**No**	0	0	0	0	0	0	0	0	0	0	0	0
Pre Tier 0	**Yes**	0	0	0	0	0	0	0	0	0	0	0	0
Tier 0	**No**	0	0	0	0	0	0	0	0	0	0	0	0
Tier 0	**Yes**	0	0	0	0	0	0	0	0	0	0	0	0
Tier 1	**No**	0	0	0	0	0	0	0	0	0	0	0	0
Tier 1	**Yes**	0	0	0	0	0	0	0	0	0	0	0	0
Tier 2	**No**	0	0	0	0	0	0	0	0	0	0	0	0
Tier 2	**Yes**	0	0	0	0	0	0	0	0	0	0	0	0

Non-IM Departing Trains

EB arr 0

Technology	ZTR/AESS	Switch	GP3x	GP4x	GP50	GP60	SD7x	SD90	Dash7	Dash8	Dash9	C60A	Unknown
Pre Tier 0	**No**	0	0	0	0	0	0	0	0	0	0	0	0
Pre Tier 0	**Yes**	0	0	0	0	0	0	0	0	0	0	0	0
Tier 0	**No**	0	0	0	0	0	0	0	0	0	0	0	0
Tier 0	**Yes**	0	0	0	0	0	0	0	0	0	0	0	0
Tier 1	**No**	0	0	0	0	0	0	0	0	0	0	0	0
Tier 1	**Yes**	0	0	0	0	0	0	0	0	0	0	0	0
Tier 2	**No**	0	0	0	0	0	0	0	0	0	0	0	0
Tier 2	**Yes**	0	0	0	0	0	0	0	0	0	0	0	0

Appendix A-1
Locomotive Model, Tier, and Auto Start/Stop Technology Frequency by Train Type

EB dep 1824

Technology	ZTR/AESS	Switch	GP3x	GP4x	GP50	GP60	SD7x	SD90	Dash7	Dash8	Dash9	C60A	Unknown
Pre Tier 0	No	3	519	803	13	869	11	44	1	107	127	0	21
Pre Tier 0	Yes	0	281	73	0	0	0	0	0	0	5	0	0
Tier 0	No	0	20	12	0	213	260	0	0	18	91	50	0
Tier 0	Yes	153	254	0	0	5	2	0	0	0	30	0	0
Tier 1	No	0	0	0	0	0	58	0	0	0	0	0	0
Tier 1	Yes	0	0	0	0	0	203	0	0	0	114	0	0
Tier 2	No	0	0	0	0	0	0	0	0	0	0	0	0
Tier 2	Yes	0	0	0	0	0	25	0	0	0	62	0	0

WB arr 0

Technology	ZTR/AESS	Switch	GP3x	GP4x	GP50	GP60	SD7x	SD90	Dash7	Dash8	Dash9	C60A	Unknown
Pre Tier 0	No	0	0	0	0	0	0	0	0	0	0	0	0
Pre Tier 0	Yes	0	0	0	0	0	0	0	0	0	0	0	0
Tier 0	No	0	0	0	0	0	0	0	0	0	0	0	0
Tier 0	Yes	0	0	0	0	0	0	0	0	0	0	0	0
Tier 1	No	0	0	0	0	0	0	0	0	0	0	0	0
Tier 1	Yes	0	0	0	0	0	0	0	0	0	0	0	0
Tier 2	No	0	0	0	0	0	0	0	0	0	0	0	0
Tier 2	Yes	0	0	0	0	0	0	0	0	0	0	0	0

WB dep 865

Technology	ZTR/AESS	Switch	GP3x	GP4x	GP50	GP60	SD7x	SD90	Dash7	Dash8	Dash9	C60A	Unknown
Pre Tier 0	No	6	469	316	3	6	2	0	0	16	9	0	6
Pre Tier 0	Yes	0	269	69	0	0	0	0	0	0	0	0	0
Tier 0	No	0	28	0	0	1	44	0	0	2	7	0	0
Tier 0	Yes	107	181	0	0	0	0	0	0	0	0	0	0
Tier 1	No	0	0	0	0	0	3	0	0	0	0	0	0
Tier 1	Yes	0	0	0	0	0	34	0	0	0	1	0	0
Tier 2	No	0	0	0	0	0	0	0	0	0	0	0	0
Tier 2	Yes	0	0	0	0	0	3	0	0	0	7	0	0

Appendix A-1
Locomotive Model, Tier, and Auto Start/Stop Technology Frequency by Train Type

Power Moves Through

EB arr 17

Technology	ZTR/AESS	Switch	GP3x	GP4x	GP50	GP60	SD7x	SD90	Dash7	Dash8	Dash9	C60A	Unknown
Pre Tier 0	No	0	0	14	2	8	0	0	0	1	2	0	0
Pre Tier 0	Yes	0	0	0	0	0	0	0	0	0	0	0	0
Tier 0	No	0	0	0	0	1	8	1	0	0	3	1	0
Tier 0	Yes	0	0	0	0	0	0	0	0	0	0	0	0
Tier 1	No	0	0	0	0	0	1	0	0	0	0	0	0
Tier 1	Yes	0	0	0	0	0	3	0	0	0	0	0	0
Tier 2	No	0	0	0	0	0	0	0	0	0	0	0	0
Tier 2	Yes	0	0	0	0	0	0	0	0	0	5	0	0

EB dep 17

Technology	ZTR/AESS	Switch	GP3x	GP4x	GP50	GP60	SD7x	SD90	Dash7	Dash8	Dash9	C60A	Unknown
Pre Tier 0	No	0	0	13	2	8	0	0	0	1	2	0	0
Pre Tier 0	Yes	0	0	0	0	0	0	0	0	0	0	0	0
Tier 0	No	0	0	0	0	0	6	1	0	0	3	1	0
Tier 0	Yes	0	0	0	0	0	0	0	0	0	0	0	0
Tier 1	No	0	0	0	0	0	0	0	0	0	0	0	0
Tier 1	Yes	0	0	0	0	0	3	0	0	0	0	0	0
Tier 2	No	0	0	0	0	0	0	0	0	0	0	0	0
Tier 2	Yes	0	0	0	0	0	0	0	0	0	5	0	0

WB arr 7

Technology	ZTR/AESS	Switch	GP3x	GP4x	GP50	GP60	SD7x	SD90	Dash7	Dash8	Dash9	C60A	Unknown
Pre Tier 0	No	0	0	0	0	4	0	0	0	1	4	0	0
Pre Tier 0	Yes	0	0	0	0	0	0	0	0	0	0	0	0
Tier 0	No	0	0	0	0	0	3	0	0	0	0	0	0
Tier 0	Yes	0	0	0	0	0	0	0	0	0	0	0	0
Tier 1	No	0	0	0	0	0	0	0	0	0	0	0	0
Tier 1	Yes	0	0	0	0	0	2	0	0	0	0	0	0
Tier 2	No	0	0	0	0	0	0	0	0	0	0	0	0
Tier 2	Yes	0	0	0	0	0	0	0	0	0	2	0	0

Appendix A-1
Locomotive Model, Tier, and Auto Start/Stop Technology Frequency by Train Type

WB dep 7

Technology	ZTR/AESS	Switch	GP3x	GP4x	GP50	GP60	SD7x	SD90	Dash7	Dash8	Dash9	C60A	Unknown
Pre Tier 0	**No**	0	0	0	0	4	0	0	0	1	4	0	0
Pre Tier 0	**Yes**	0	0	0	0	0	0	0	0	0	0	0	0
Tier 0	**No**	0	0	0	0	0	3	0	0	0	0	0	0
Tier 0	**Yes**	0	0	0	0	0	0	0	0	0	0	0	0
Tier 1	**No**	0	0	0	0	0	0	0	0	0	0	0	0
Tier 1	**Yes**	0	0	0	0	0	2	0	0	0	0	0	0
Tier 2	**No**	0	0	0	0	0	0	0	0	0	0	0	0
Tier 2	**Yes**	0	0	0	0	0	0	0	0	0	2	0	0

Power Moves Arriving

EB arr 0

Technology	ZTR/AESS	Switch	GP3x	GP4x	GP50	GP60	SD7x	SD90	Dash7	Dash8	Dash9	C60A	Unknown
Pre Tier 0	**No**	0	0	0	0	0	0	0	0	0	0	0	0
Pre Tier 0	**Yes**	0	0	0	0	0	0	0	0	0	0	0	0
Tier 0	**No**	0	0	0	0	0	0	0	0	0	0	0	0
Tier 0	**Yes**	0	0	0	0	0	0	0	0	0	0	0	0
Tier 1	**No**	0	0	0	0	0	0	0	0	0	0	0	0
Tier 1	**Yes**	0	0	0	0	0	0	0	0	0	0	0	0
Tier 2	**No**	0	0	0	0	0	0	0	0	0	0	0	0
Tier 2	**Yes**	0	0	0	0	0	0	0	0	0	0	0	0

EB dep 0

Technology	ZTR/AESS	Switch	GP3x	GP4x	GP50	GP60	SD7x	SD90	Dash7	Dash8	Dash9	C60A	Unknown
Pre Tier 0	**No**	0	0	0	0	0	0	0	0	0	0	0	0
Pre Tier 0	**Yes**	0	0	0	0	0	0	0	0	0	0	0	0
Tier 0	**No**	0	0	0	0	0	0	0	0	0	0	0	0
Tier 0	**Yes**	0	0	0	0	0	0	0	0	0	0	0	0
Tier 1	**No**	0	0	0	0	0	0	0	0	0	0	0	0
Tier 1	**Yes**	0	0	0	0	0	0	0	0	0	0	0	0
Tier 2	**No**	0	0	0	0	0	0	0	0	0	0	0	0
Tier 2	**Yes**	0	0	0	0	0	0	0	0	0	0	0	0

Appendix A-1

Locomotive Model, Tier, and Auto Start/Stop Technology Frequency by Train Type

WB arr 237

Technology	ZTR/AESS	Switch	GP3x	GP4x	GP50	GP60	SD7x	SD90	Dash7	Dash8	Dash9	C60A	Unknown
Pre Tier 0	No	0	2	135	9	76	4	7	1	82	73	0	12
Pre Tier 0	Yes	0	2	0	0	0	0	0	0	0	5	0	0
Tier 0	No	0	0	6	0	12	174	1	0	19	26	0	0
Tier 0	Yes	1	1	0	0	1	3	0	0	0	3	0	0
Tier 1	No	0	0	0	0	0	24	0	0	0	0	0	0
Tier 1	Yes	0	0	0	0	0	144	0	0	0	14	0	0
Tier 2	No	0	0	0	0	0	0	0	0	0	0	0	0
Tier 2	Yes	0	0	0	0	0	26	0	0	0	51	0	0

WB dep 0

Technology	ZTR/AESS	Switch	GP3x	GP4x	GP50	GP60	SD7x	SD90	Dash7	Dash8	Dash9	C60A	Unknown
Pre Tier 0	No	0	0	0	0	0	0	0	0	0	0	0	0
Pre Tier 0	Yes	0	0	0	0	0	0	0	0	0	0	0	0
Tier 0	No	0	0	0	0	0	0	0	0	0	0	0	0
Tier 0	Yes	0	0	0	0	0	0	0	0	0	0	0	0
Tier 1	No	0	0	0	0	0	0	0	0	0	0	0	0
Tier 1	Yes	0	0	0	0	0	0	0	0	0	0	0	0
Tier 2	No	0	0	0	0	0	0	0	0	0	0	0	0
Tier 2	Yes	0	0	0	0	0	0	0	0	0	0	0	0

Power Moves Departing

EB arr 0

Technology	ZTR/AESS	Switch	GP3x	GP4x	GP50	GP60	SD7x	SD90	Dash7	Dash8	Dash9	C60A	Unknown
Pre Tier 0	No	0	0	0	0	0	0	0	0	0	0	0	0
Pre Tier 0	Yes	0	0	0	0	0	0	0	0	0	0	0	0
Tier 0	No	0	0	0	0	0	0	0	0	0	0	0	0
Tier 0	Yes	0	0	0	0	0	0	0	0	0	0	0	0
Tier 1	No	0	0	0	0	0	0	0	0	0	0	0	0
Tier 1	Yes	0	0	0	0	0	0	0	0	0	0	0	0
Tier 2	No	0	0	0	0	0	0	0	0	0	0	0	0
Tier 2	Yes	0	0	0	0	0	0	0	0	0	0	0	0

Appendix A-1
Locomotive Model, Tier, and Auto Start/Stop Technology Frequency by Train Type

EB dep 424

Technology	ZTR/AESS	Switch	GP3x	GP4x	GP50	GP60	SD7x	SD90	Dash7	Dash8	Dash9	C60A	Unknown
Pre Tier 0	**No**	0	9	201	16	174	4	8	2	113	83	3	22
Pre Tier 0	**Yes**	0	5	6	0	1	0	0	0	0	8	0	0
Tier 0	**No**	0	1	9	0	31	242	2	0	23	52	2	0
Tier 0	**Yes**	2	2	0	0	1	1	0	0	0	22	0	0
Tier 1	**No**	0	0	0	0	0	42	0	0	0	4	0	0
Tier 1	**Yes**	0	0	0	0	0	193	0	0	0	84	0	0
Tier 2	**No**	0	0	0	0	0	0	0	0	0	0	0	0
Tier 2	**Yes**	0	0	0	0	0	28	0	0	0	86	0	0

WB arr 0

Technology	ZTR/AESS	Switch	GP3x	GP4x	GP50	GP60	SD7x	SD90	Dash7	Dash8	Dash9	C60A	Unknown
Pre Tier 0	**No**	0	0	0	0	0	0	0	0	0	0	0	0
Pre Tier 0	**Yes**	0	0	0	0	0	0	0	0	0	0	0	0
Tier 0	**No**	0	0	0	0	0	0	0	0	0	0	0	0
Tier 0	**Yes**	0	0	0	0	0	0	0	0	0	0	0	0
Tier 1	**No**	0	0	0	0	0	0	0	0	0	0	0	0
Tier 1	**Yes**	0	0	0	0	0	0	0	0	0	0	0	0
Tier 2	**No**	0	0	0	0	0	0	0	0	0	0	0	0
Tier 2	**Yes**	0	0	0	0	0	0	0	0	0	0	0	0

WB dep 0

Technology	ZTR/AESS	Switch	GP3x	GP4x	GP50	GP60	SD7x	SD90	Dash7	Dash8	Dash9	C60A	Unknown
Pre Tier 0	**No**	0	0	0	0	0	0	0	0	0	0	0	0
Pre Tier 0	**Yes**	0	0	0	0	0	0	0	0	0	0	0	0
Tier 0	**No**	0	0	0	0	0	0	0	0	0	0	0	0
Tier 0	**Yes**	0	0	0	0	0	0	0	0	0	0	0	0
Tier 1	**No**	0	0	0	0	0	0	0	0	0	0	0	0
Tier 1	**Yes**	0	0	0	0	0	0	0	0	0	0	0	0
Tier 2	**No**	0	0	0	0	0	0	0	0	0	0	0	0
Tier 2	**Yes**	0	0	0	0	0	0	0	0	0	0	0	0

APPENDIX A-2

LOCOMOTIVE MODEL DISTRIBUTION
BY TRAIN TYPE GROUPS

Appendix A2
Locomotive Model Distribution by Train Type Groups

All Intermodal Trains and Power Moves

Technology	ZTR/AESS	Switcher	GP-3x	GP-4x	SD-50	GP-60	SD-7x	SD-90	Dash 7	Dash 8	Dash 9	C-60
Pre Tier 0	No	0.00005	0.00099	0.10115	0.00863	0.05551	0.00452	0.00203	0.00062	0.09158	0.07604	0.00052
Pre Tier 0	Yes	0.00000	0.00047	0.00036	0.00000	0.00005	0.00000	0.00000	0.00000	0.00000	0.00655	0.00000
Tier 0	No	0.00000	0.00005	0.00275	0.00016	0.01169	0.23151	0.00026	0.00000	0.01466	0.02765	0.00109
Tier 0	Yes	0.00016	0.00026	0.00000	0.00000	0.00057	0.00088	0.00000	0.00000	0.00000	0.00364	0.00000
Tier 1	No	0.00000	0.00000	0.00000	0.00000	0.00000	0.04293	0.00000	0.00000	0.00000	0.00026	0.00000
Tier 1	Yes	0.00000	0.00000	0.00000	0.00000	0.00000	0.18000	0.00000	0.00000	0.00000	0.00925	0.00000
Tier 2	No	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
Tier 2	Yes	0.00000	0.00000	0.00000	0.00000	0.00000	0.03566	0.00000	0.00000	0.00000	0.08748	0.00000

WB Departing and EB Arriving Freight Trains

Technology	ZTR/AESS	Switcher	GP-3x	GP-4x	SD-50	GP-60	SD-7x	SD-90	Dash 7	Dash 8	Dash 9	C-60
Pre Tier 0	No	0.00296	0.30280	0.20286	0.00242	0.00458	0.00054	0.00135	0.00000	0.00889	0.00620	0.00000
Pre Tier 0	Yes	0.00000	0.19774	0.04445	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
Tier 0	No	0.00000	0.01455	0.00027	0.00000	0.00081	0.02101	0.00000	0.00000	0.00135	0.00458	0.00000
Tier 0	Yes	0.05927	0.09968	0.00000	0.00000	0.00027	0.00000	0.00000	0.00000	0.00000	0.00054	0.00000
Tier 1	No	0.00000	0.00000	0.00000	0.00000	0.00000	0.00108	0.00000	0.00000	0.00000	0.00000	0.00000
Tier 1	Yes	0.00000	0.00000	0.00000	0.00000	0.00000	0.01562	0.00000	0.00000	0.00000	0.00135	0.00000
Tier 2	No	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
Tier 2	Yes	0.00000	0.00000	0.00000	0.00000	0.00000	0.00081	0.00000	0.00000	0.00000	0.00404	0.00000

Appendix A2
Locomotive Model Distribution by Train Type Groups

EB Departing and WB Arriving Freight Trains

Technology	ZTR/AESS	Switcher	GP-3x	GP-4x	SD-50	GP-60	SD-7x	SD-90	Dash 7	Dash 8	Dash 9	C-60
Pre Tier 0	**No**	0.00052	0.10732	0.18342	0.00605	0.17340	0.00230	0.00950	0.00031	0.03737	0.03602	0.00000
Pre Tier 0	**Yes**	0.00000	0.05951	0.01493	0.00000	0.00010	0.00000	0.00000	0.00000	0.00000	0.00146	0.00000
Tier 0	**No**	0.00000	0.00418	0.00282	0.00000	0.04197	0.07266	0.00010	0.00000	0.00637	0.02234	0.01023
Tier 0	**Yes**	0.03330	0.05209	0.00000	0.00000	0.00115	0.00031	0.00000	0.00000	0.00000	0.00731	0.00000
Tier 1	**No**	0.00000	0.00000	0.00000	0.00000	0.00000	0.01493	0.00000	0.00000	0.00000	0.00031	0.00000
Tier 1	**Yes**	0.00000	0.00000	0.00000	0.00000	0.00000	0.05449	0.00000	0.00000	0.00000	0.02589	0.00000
Tier 2	**No**	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
Tier 2	**Yes**	0.00000	0.00000	0.00000	0.00000	0.00000	0.00480	0.00000	0.00000	0.00000	0.01253	0.00000

Yard Switching

Technology	ZTR/AESS	Switcher	GP-3x	GP-4x	SD-50	GP-60	SD-7x	SD-90	Dash 7	Dash 8	Dash 9	C-60
Pre Tier 0	**No**	0	1	0	0	0	0	0	0	0	0	0
Pre Tier 0	**Yes**	0	0	0	0	0	0	0	0	0	0	0
Tier 0	**No**	0	0	0	0	0	0	0	0	0	0	0
Tier 0	**Yes**	0	0	0	0	0	0	0	0	0	0	0
Tier 1	**No**	0	0	0	0	0	0	0	0	0	0	0
Tier 1	**Yes**	0	0	0	0	0	0	0	0	0	0	0
Tier 2	**No**	0	0	0	0	0	0	0	0	0	0	0
Tier 2	**Yes**	0	0	0	0	0	0	0	0	0	0	0

Appendix A2
Locomotive Model Distribution by Train Type Groups

Locomotives Services

Technology	ZTR/AESS	Switcher	GP-3x	GP-4x	SD-50	GP-60	SD-7x	SD-90	Dash 7	Dash 8	Dash 9	C-60
Pre Tier 0	No	0.00000	0.00544	0.13099	0.01379	0.03507	0.00556	0.00411	0.00085	0.10256	0.07886	0.00024
Pre Tier 0	Yes	0.00000	0.00895	0.00460	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00581	0.00000
Tier 0	No	0.00000	0.00024	0.00339	0.00024	0.00955	0.21601	0.00036	0.00000	0.02008	0.03157	0.00411
Tier 0	Yes	0.00169	0.00218	0.00000	0.00000	0.00060	0.00109	0.00000	0.00000	0.00000	0.00266	0.00000
Tier 1	No	0.00000	0.00000	0.00000	0.00000	0.00000	0.03205	0.00000	0.00000	0.00000	0.00000	0.00000
Tier 1	Yes	0.00000	0.00000	0.00000	0.00000	0.00000	0.17816	0.00000	0.00000	0.00000	0.00556	0.00000
Tier 2	No	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00012	0.00000
Tier 2	Yes	0.00000	0.00000	0.00000	0.00000	0.00000	0.03084	0.00000	0.00000	0.00000	0.06265	0.00000

Locomotives Load Tested

Technology	ZTR/AESS	Switcher	GP-3x	GP-4x	SD-50	GP-60	SD-7x	SD-90	Dash 7	Dash 8	Dash 9	C-60
Pre Tier 0	No	0.00000	0.00715	0.12470	0.01033	0.03813	0.00794	0.00556	0.00079	0.13503	0.07943	0.00000
Pre Tier 0	Yes	0.00000	0.01033	0.00715	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00635	0.00000
Tier 0	No	0.00000	0.00000	0.00397	0.00079	0.01191	0.20492	0.00079	0.00000	0.02621	0.03574	0.00397
Tier 0	Yes	0.00000	0.00318	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00238	0.00000
Tier 1	No	0.00000	0.00000	0.00000	0.00000	0.00000	0.02303	0.00000	0.00000	0.00000	0.00000	0.00000
Tier 1	Yes	0.00000	0.00000	0.00000	0.00000	0.00000	0.16362	0.00000	0.00000	0.00000	0.00635	0.00000
Tier 2	No	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
Tier 2	Yes	0.00000	0.00000	0.00000	0.00000	0.00000	0.03098	0.00000	0.00000	0.00000	0.04925	0.00000

APPENDIX A-3

SAMPLE CALCULATIONS

Appendix A-3
Sample Calculations

Activity Types

Description	Activity Code	Number of Events/Year	Locomotives per Consist	Number of Setouts	Emission Factor Group	Locomotives per Consist Working	Fraction of Calif. Fuel
EB Intermodal Through	1	74	3.365	22	1	3.365	0.90
WB Intermodal Through	3	215	2.916	166	1	2.916	0.50
EB Intermodal Terminating	5	0	0.000	0	1	0.000	0.90
WB Intermodal Terminating	6	3557	2.663	0	1	2.663	0.00
EB Intermodal Originating	7	2045	3.267	35	1	3.267	0.90
WB Intermodal Originating	8	0	0.000	0	1	0.000	0.90
EB Other Through	9	403	1.548	384	2	1.548	0.90
WB Other Through	11	101	2.574	79	3	2.574	0.90
EB Other Terminating	13	865	1.751	0	2	1.751	0.90
WB Other Terminating	14	2145	2.297	0	3	2.297	0.00
EB Other Originating	15	1824	2.438	75	3	2.438	0.90
WB Other originating	16	865	1.837	1	2	1.837	0.90
EB Power Moves Through	17	17	2.941	2	1	1.500	0.90
WB Power Moves Through	19	7	2.286	0	1	1.500	0.90
EB Power Moves Terminating	21	393	3.074	0	1	1.500	0.00
WB Power Moves Terminating	22	624	3.857	0	1	1.500	0.90
EB Power Moves Originating	23	424	3.495	3	1	1.500	0.90
WB Power Moves Originating	24	1604	3.324	0	1	1.500	0.90

Note: Alameda Corridor through train activity calculated separately from ACTA gross ton-mile data for UPRR and BNSF, UPRR's system-wide fuel consumption (gallons per ton-mile), and gram per gallon emission factors for the Dolores/ICTF intermodal locomotive fleet fleet in 2005.

Appendix A-3
Sample Calculations

Emission Factors Weighted by Model/Tier/ZTR Fractions - DPM g/hr per Locomotive

Consist Groups	Group ID	Idle-NonZTR	Idle-All	DB	N1	N2	N3	N4	N5	N6	N7	N8
California Fuel (221 ppm S)												
Intermodal Trains and Power Moves	1	20.58	29.05	54.30	48.10	99.01	222.45	281.58	355.98	550.94	636.84	732.27
Other Train EB Thru, EB Terminating, WB Originating	2	23.36	39.21	71.64	33.10	112.71	184.39	202.35	252.16	407.34	473.22	608.32
Other Train WB Thru, WB, Terminating, EB Originating	3	29.08	37.79	71.00	41.97	111.59	213.57	245.02	312.94	487.25	572.18	709.44
Yard Switching	4	38.00	38.00	72.00	31.00	110.00	174.13	187.48	230.17	369.15	423.51	555.15
47-State Fuel (2639 ppm S)												
Intermodal Trains and Power Moves	1	20.58	29.05	54.30	48.10	99.01	242.28	312.84	401.09	617.44	715.12	827.80
Other Train EB Thru, EB Terminating, WB Originating	2	23.36	39.21	71.64	33.10	112.71	195.87	225.31	286.88	453.66	513.91	661.64
Other Train WB Thru, WB, Terminating, EB Originating	3	29.08	37.79	71.00	41.97	111.59	229.50	272.52	354.17	544.51	631.92	785.75
Yard Switching	4	N/A -- Hump and trim sets operate on 100% California Fuel										

Note: Idle-NonZTR is the average per-locomotive idle emission rate for the fraction of locomotives not equipped with ZTR/Auto start-stop technology

Locomotive Model Distributions
Intermodal Trains and Power Moves

Technology	ZTR/AESS	Switcher	GP-3x	GP-4x	SD-50	GP-60	SD-7x	SD-90	Dash 7	Dash 8	Dash 9	C-60
Pre Tier 0	**No**	0.0001	0.0010	0.1012	0.0086	0.0555	0.0045	0.0020	0.0006	0.0916	0.0760	0.0005
Pre Tier 0	**Yes**	0.0000	0.0005	0.0004	0.0000	0.0001	0.0000	0.0000	0.0000	0.0000	0.0066	0.0000
Tier 0	**No**	0.0000	0.0001	0.0028	0.0002	0.0117	0.2315	0.0003	0.0000	0.0147	0.0277	0.0011
Tier 0	**Yes**	0.0002	0.0003	0.0000	0.0000	0.0006	0.0009	0.0000	0.0000	0.0000	0.0036	0.0000
Tier 1	**No**	0.0000	0.0000	0.0000	0.0000	0.0000	0.0429	0.0000	0.0000	0.0000	0.0003	0.0000
Tier 1	**Yes**	0.0000	0.0000	0.0000	0.0000	0.0000	0.1800	0.0000	0.0000	0.0000	0.0093	0.0000
Tier 2	**No**	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Tier 2	**Yes**	0.0000	0.0000	0.0000	0.0000	0.0000	0.0357	0.0000	0.0000	0.0000	0.0875	0.0000

Appendix A-3
Sample Calculations

Other Train EB Thru, EB Terminating, WB Originating

Technology	ZTR/AESS	Switcher	GP-3x	GP-4x	SD-50	GP-60	SD-7x	SD-90	Dash 7	Dash 8	Dash 9	C-60
Pre Tier 0	No	0.0030	0.3028	0.2029	0.0024	0.0046	0.0005	0.0014	0.0000	0.0089	0.0062	0.0000
Pre Tier 0	Yes	0.0000	0.1977	0.0445	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Tier 0	No	0.0000	0.0146	0.0003	0.0000	0.0008	0.0210	0.0000	0.0000	0.0014	0.0046	0.0000
Tier 0	Yes	0.0593	0.0997	0.0000	0.0000	0.0003	0.0000	0.0000	0.0000	0.0000	0.0005	0.0000
Tier 1	No	0.0000	0.0000	0.0000	0.0000	0.0000	0.0011	0.0000	0.0000	0.0000	0.0000	0.0000
Tier 1	Yes	0.0000	0.0000	0.0000	0.0000	0.0000	0.0156	0.0000	0.0000	0.0000	0.0014	0.0000
Tier 2	No	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Tier 2	Yes	0.0000	0.0000	0.0000	0.0000	0.0000	0.0008	0.0000	0.0000	0.0000	0.0040	0.0000

Other Train WB Thru, WB, Terminating, EB Originating

Technology	ZTR/AESS	Switcher	GP-3x	GP-4x	SD-50	GP-60	SD-7x	SD-90	Dash 7	Dash 8	Dash 9	C-60
Pre Tier 0	No	0.0005	0.1073	0.1834	0.0061	0.1734	0.0023	0.0095	0.0003	0.0374	0.0360	0.0000
Pre Tier 0	Yes	0.0000	0.0595	0.0149	0.0000	0.0001	0.0000	0.0000	0.0000	0.0000	0.0015	0.0000
Tier 0	No	0.0000	0.0042	0.0028	0.0000	0.0420	0.0727	0.0001	0.0000	0.0064	0.0223	0.0102
Tier 0	Yes	0.0333	0.0521	0.0000	0.0000	0.0012	0.0003	0.0000	0.0000	0.0000	0.0073	0.0000
Tier 1	No	0.0000	0.0000	0.0000	0.0000	0.0000	0.0149	0.0000	0.0000	0.0000	0.0003	0.0000
Tier 1	Yes	0.0000	0.0000	0.0000	0.0000	0.0000	0.0545	0.0000	0.0000	0.0000	0.0259	0.0000
Tier 2	No	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Tier 2	Yes	0.0000	0.0000	0.0000	0.0000	0.0000	0.0048	0.0000	0.0000	0.0000	0.0125	0.0000

Yard Switching

Technology	ZTR/AESS	Switcher	GP-3x	GP-4x	SD-50	GP-60	SD-7x	SD-90	Dash 7	Dash 8	Dash 9	C-60
Pre Tier 0	No	0.0000	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Pre Tier 0	Yes	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Tier 0	No	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Tier 0	Yes	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Tier 1	No	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Tier 1	Yes	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Tier 2	No	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Tier 2	Yes	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

Appendix A-3
Sample Calculations

Track Segment	Segment Number	Length (mi)	
North End Inlet Lead	1	0.195189	NendIn
Through Track 1	2	0.124009	ML1
Through Track 2	3	0.283696	ML2
Through Track 3	4	0.303405	ML3
Through Track 4	5	0.243976	ML4
Through Track 5	6	0.440504	ML5
Through Track 6	7	0.080956	ML6
Through Track 7	8	0.097993	ML7
Through Track 8	9	0.200691	ML8
Through Track 9	10	0.148838	ML9
Through Track 10	11	0.181881	ML10
Through Track 11	12	0.966906	ML11
Through Track 12	13	0.121125	ML12
Through Track ICTF Lead	14	0.049832	ML2IM
ICTF Inlet 1	15	0.07547	IMin1
ICTF Inlet 2	16	0.017837	IMin2
ICTF Inlet 3	17	0.058636	IMin3
ICTF Inlet 4	18	0.040822	IMin4
ICTF Inlet 5	19	0.099582	IMin5
West IM Track Inlet	20	0.175734	IMWin
West IM Track North	21	0.575068	IMWN
West IM Track South	22	0.25826	IMWS
#2 IM Track Inlet	23	0.17154	IM2in
#2 IM Track North	24	0.583713	IM2N
#2 IM Track South	25	0.310285	IM2S
#3 IM Track Inlet	26	0.177971	IM3in
#3 IM Track North	27	0.584395	IM3N
#3 IM Track South	28	0.367938	IM3S
East IM Track Inlet	29	0.196489	IMEin
East IM Track North	30	0.59928	IMEN
East IM Track South	31	0.361993	IMES
West IM Track South Lead	32	0.236448	IMWSin
#2 IM Track South Lead	33	0.165715	IM2Sin
#3 IM Track South Lead	34	0.107509	IM3Sin
East IM Track South Lead	35	0.115646	IMESin
900 Track North Inlet	36	0.093907	900Nin
900 Track North End	37	0.256369	900N20
900 Track Center	38	0.769108	900ctr
900 Track South End	39	0.256369	900S20
900 Track to Service South Inlet	40	0.549954	9002SvcSsplt
Service South Inlet to South Service	41	0.092052	SvcSplt2SvcS
Service South Inlet to Service North Inlet	42	0.27463	SvcSSplt2NSplt
Service North Inlet to Ready Track	43	0.143631	SvcNSplt2Rdy
Ready Track to 900 Track	44	0.416487	Rdy2900
Ready Track to Through Track 6	45	0.316654	Rdy2ML6
Ready Track to 300 Track	46	0.424593	Rdy2300
Ready Track to Through Track 11	47	0.314496	Rdy2ML11

Appendix A-3
Sample Calculations

Track Segment	Segment Number	Length (mi)	
Through Track 10 to 300 Track	48	0.110429	ML102300
300 Track North End	49	0.167208	300N20
300 Track Center	50	0.501623	300ctr
300 Track South End	51	0.167208	300S20
300 Track South Lead	52	0.109795	300Sin
Adjacent Alameda Corridor 1	53	0.139525	AC1
Adjacent Alameda Corridor 2	54	0.467126	AC2
Adjacent Alameda Corridor 3	55	1.034728	AC3
Adjacent Alameda Corridor 4	56	0.114405	AC4
Adjacent Alameda Corridor 5	57	0.144254	AC5
Adjacent Alameda Corridor 6	58	0.215233	AC6
Adjacent Alameda Corridor 7	59	0.158101	AC7
Adjacent Alameda Corridor 8	60	0.029687	AC8
Adjacent Alameda Corridor 9	61	1.085783	AC9
Service South Inlet to 300 Track	62	0.296304	SvxSSplt2300
900 Track to Through Track 8	63	0.197766	9002ML8
Yard Switching - 900 Track	64	1.69741	YdOps900
Yard Switching - 300 Track N End	65	0.424593	YdOps3N
Yard Switching - IM Tracks 1	66	1.062441	YdOpsIM1
Yard Switching - IM Tracks 2	67	1.129003	YdOpsIM2
Yard Switching - 300 Track S End	68	0.836038	YdsOps3S

Appendix A-3
Sample Calculations

Movement Type	Activity Code	Segment Number	Speed (mph)	Duty Cycle Number	Non-ZTR Idle Time (hrs)	ZTR Idle Time (hrs)	Fraction of Segment or Time Moving
EB Intermodal Through	1	1	15	1	0.000	0.000	1.000
"	1	2	15	1	0.000	0.000	1.000
"	1	3	15	1	0.000	0.000	1.000
"	1	4	15	1	0.000	0.000	1.000
"	1	5	15	1	0.000	0.000	1.000
"	1	6	15	1	0.000	0.000	1.000
"	1	7	15	1	0.000	0.000	1.000
"	1	8	10	2	0.000	0.000	1.000
"	1	9	10	2	0.000	0.000	1.000
"	1	10	10	2	0.000	0.000	1.000
"	1	11	10	2	0.000	0.000	1.000
"	1	12	10	2	0.000	0.000	1.000
"	1	13	10	2	0.000	0.000	1.000
"	-1	38	0	2	0.000	0.500	0.000
WB Intermodal Through	3	1	15	1	0.000	0.000	1.000
"	3	2	15	1	0.000	0.000	1.000
"	3	3	15	1	0.000	0.000	1.000
"	3	4	15	1	0.000	0.000	1.000
"	3	5	15	1	0.000	0.000	1.000
"	3	6	15	1	0.000	0.000	1.000
"	3	7	15	1	0.000	0.000	1.000
"	3	8	10	2	0.000	0.000	1.000
"	3	9	10	2	0.000	0.000	1.000
"	3	10	10	2	0.000	0.000	1.000
"	3	11	10	2	0.000	0.000	1.000
"	3	12	10	2	0.000	0.000	1.000
"	3	13	10	2	0.000	0.000	1.000
"	-3	38	0	2	0.000	0.500	0.000
EB Intermodal Terminating	5	52	10	2	0.000	0.000	1.000
"	5	51	10	2	0.000	0.000	1.000
"	5	50	10	2	0.000	0.000	1.000
"	5	-49	10	2	0.000	0.000	1.000
"	5	-62	10	2	0.000	0.000	1.000
"	5	-41	10	2	0.000	0.000	1.000
WB Intermodal Terminating	6	1	10	2	0.000	0.000	1.000
"	6	2	10	2	0.000	0.000	1.000
"	6	3	10	2	0.000	0.000	1.000
"	6	4	10	2	0.000	0.000	1.000
"	6	5	10	2	0.000	0.000	1.000
"	6	6	10	2	0.000	0.000	1.000
"	6	7	10	2	0.000	0.000	1.000
"	6	8	10	2	0.000	0.000	1.000
"	6	9	10	2	0.000	0.000	1.000
"	-6	38	0	2	0.000	0.500	0.000
"	6	14	10	2	0.000	0.000	0.200
"	6	15	10	2	0.000	0.000	0.200
"	6	16	10	2	0.000	0.000	0.200
"	6	17	10	2	0.000	0.000	0.200
"	6	18	10	2	0.000	0.000	0.200
"	6	19	10	2	0.000	0.000	0.200
"	6	20	10	2	0.000	0.000	0.050
"	6	21	10	2	0.000	0.000	0.050
"	6	22	10	2	0.000	0.000	0.050

Appendix A-3
Sample Calculations

Movement Type	Activity Code	Segment Number	Speed (mph)	Duty Cycle Number	Non-ZTR Idle Time (hrs)	ZTR Idle Time (hrs)	Fraction of Segment or Time Moving
"	6	23	10	2	0.000	0.000	0.050
"	6	24	10	2	0.000	0.000	0.050
"	6	25	10	2	0.000	0.000	0.050
"	6	26	10	2	0.000	0.000	0.050
"	6	27	10	2	0.000	0.000	0.050
"	6	28	10	2	0.000	0.000	0.050
"	6	29	10	2	0.000	0.000	0.050
"	6	30	10	2	0.000	0.000	0.050
"	6	31	10	2	0.000	0.000	0.050
"	6	-32	10	2	0.000	0.000	0.050
"	6	-33	10	2	0.000	0.000	0.050
"	6	-34	10	2	0.000	0.000	0.050
"	6	-35	10	2	0.000	0.000	0.050
"	6	-20	10	2	0.000	0.000	0.050
"	6	-21	10	2	0.000	0.000	0.050
"	6	-22	10	2	0.000	0.000	0.050
"	6	-23	10	2	0.000	0.000	0.050
"	6	-24	10	2	0.000	0.000	0.050
"	6	-25	10	2	0.000	0.000	0.050
"	6	-26	10	2	0.000	0.000	0.050
"	6	-27	10	2	0.000	0.000	0.050
"	6	-28	10	2	0.000	0.000	0.050
"	6	-29	10	2	0.000	0.000	0.050
"	6	-30	10	2	0.000	0.000	0.050
"	6	-31	10	2	0.000	0.000	0.050
"	6	-32	10	2	0.000	0.000	0.050
"	6	-33	10	2	0.000	0.000	0.050
"	6	-34	10	2	0.000	0.000	0.050
"	6	-35	10	2	0.000	0.000	0.050
"	6	-19	10	2	0.000	0.000	0.200
"	6	-18	10	2	0.000	0.000	0.200
"	6	-17	10	2	0.000	0.000	0.200
"	6	-16	10	2	0.000	0.000	0.200
"	6	-15	10	2	0.000	0.000	0.200
"	6	-14	10	2	0.000	0.000	0.200
"	6	-9	10	2	0.000	0.000	0.200
"	6	-8	10	2	0.000	0.000	0.200
"	6	-40	10	2	0.000	0.000	0.200
"	6	-41	10	2	0.000	0.000	0.200
"	6	10	10	2	0.000	0.000	0.800
"	6	48	10	2	0.000	0.000	0.800
"	6	49	10	2	0.000	0.000	0.800
"	6	50	10	2	0.000	0.000	0.800
"	6	51	10	2	0.000	0.000	0.800
"	6	-52	10	2	0.000	0.000	0.800
"	6	-52	10	2	0.000	0.000	0.800
"	6	-51	10	2	0.000	0.000	0.800
"	6	-50	10	2	0.000	0.000	0.800
"	6	-49	10	2	0.000	0.000	0.800
"	6	-62	10	2	0.000	0.000	0.800
"	6	-41	10	2	0.000	0.000	0.800
EB Intermodal Originating	7	-46	10	2	0.000	0.000	0.200
"	7	49	10	2	0.000	0.500	0.200

Movement Type	**Activity Code**	**Segment Number**	**Speed (mph)**	**Duty Cycle Number**	**Non-ZTR Idle Time (hrs)**	**ZTR Idle Time (hrs)**	**Fraction of Segment or Time Moving**
"	7	48	10	2	0.000	0.000	0.200
"	7	10	10	2	0.000	0.000	0.200
"	7	9	10	2	0.000	0.000	0.200
"	7	8	10	2	0.000	0.000	0.200
"	7	7	15	1	0.000	0.000	0.200
"	7	6	15	1	0.000	0.000	0.200
"	7	5	15	1	0.000	0.000	0.200
"	7	4	15	1	0.000	0.000	0.200
"	7	3	15	1	0.000	0.000	0.200
"	7	2	15	1	0.000	0.000	0.200
"	7	1	15	1	0.000	0.000	0.200
"	7	-44	10	2	0.000	0.000	0.800
"	7	-39	10	2	0.000	0.000	0.800
"	7	-38	10	2	0.000	0.000	0.800
"	7	37	10	2	0.000	0.500	0.800
"	7	36	10	2	0.000	0.000	0.800
"	7	1	10	2	0.000	0.000	0.800
"	-7	38	10	2	0.000	0.500	0.000
WB Intermodal Originating	8	-41	10	2	0.000	0.000	1.000
"	8	-62	10	2	0.000	0.000	1.000
"	8	-49	10	2	0.000	0.000	1.000
"	8	-50	10	2	0.000	0.000	1.000
"	8	51	10	2	0.000	0.500	1.000
"	8	52	10	2	0.000	0.000	1.000
EB Other Through	9	1	15	1	0.000	0.000	1.000
"	9	2	15	1	0.000	0.000	1.000
"	9	3	15	1	0.000	0.000	1.000
"	9	4	15	1	0.000	0.000	1.000
"	9	5	15	1	0.000	0.000	1.000
"	9	6	15	1	0.000	0.000	1.000
"	9	7	15	1	0.000	0.000	1.000
"	9	8	10	2	0.000	0.000	1.000
"	9	9	10	2	0.000	0.000	1.000
"	9	10	10	2	0.000	0.000	1.000
"	9	11	10	2	0.000	0.000	1.000
"	9	12	10	2	0.000	0.000	1.000
"	9	13	10	2	0.000	0.000	1.000
"	-9	38	0	2	0.000	0.500	0.000
WB Other Through	11	1	15	1	0.000	0.000	1.000
"	11	2	15	1	0.000	0.000	1.000
"	11	3	15	1	0.000	0.000	1.000
"	11	4	15	1	0.000	0.000	1.000
"	11	5	15	1	0.000	0.000	1.000
"	11	6	15	1	0.000	0.000	1.000
"	11	7	15	1	0.000	0.000	1.000
"	11	8	10	2	0.000	0.000	1.000
"	11	9	10	2	0.000	0.000	1.000
"	11	10	10	2	0.000	0.000	1.000
"	11	11	10	2	0.000	0.000	1.000
"	11	12	10	2	0.000	0.000	1.000
"	11	13	10	2	0.000	0.000	1.000
"	-11	38	0	2	0.000	0.500	0.000
EB Other Terminating	13	13	10	2	0.000	0.000	0.500

Appendix A-3
Sample Calculations

Movement Type	Activity Code	Segment Number	Speed (mph)	Duty Cycle Number	Non-ZTR Idle Time (hrs)	ZTR Idle Time (hrs)	Fraction of Segment or Time Moving
"	13	12	10	2	0.000	0.000	0.500
"	13	11	10	2	0.000	0.000	0.500
"	13	10	10	2	0.000	0.000	0.500
"	13	9	10	2	0.000	0.000	0.500
"	13	63	10	2	0.000	0.000	0.500
"	13	39	10	2	0.000	0.000	0.500
"	13	38	10	2	0.000	0.000	0.500
"	13	-37	10	2	0.000	0.000	0.500
"	13	-37	10	2	0.000	0.000	0.500
"	13	-38	10	2	0.000	0.000	0.500
"	13	-39	10	2	0.000	0.000	0.500
"	13	-40	10	2	0.000	0.000	0.500
"	13	-41	10	2	0.000	0.000	0.500
"	13	52	10	2	0.000	0.000	0.500
"	13	51	10	2	0.000	0.000	0.500
"	13	50	10	2	0.000	0.000	0.500
"	13	-49	10	2	0.000	0.000	0.500
"	13	-62	10	2	0.000	0.000	0.500
"	13	-41	10	2	0.000	0.000	0.500
WB Other Terminating	14	1	15	1	0.000	0.000	0.500
"	14	2	15	1	0.000	0.000	0.500
"	14	3	15	1	0.000	0.000	0.500
"	14	4	15	1	0.000	0.000	0.500
"	14	5	15	1	0.000	0.000	0.500
"	14	6	15	1	0.000	0.000	0.500
"	14	7	15	1	0.000	0.000	0.500
"	14	8	10	2	0.000	0.000	0.500
"	14	9	10	2	0.000	0.000	0.500
"	14	10	10	2	0.000	0.000	0.500
"	14	11	10	2	0.000	0.000	0.500
"	14	48	10	2	0.000	0.000	0.500
"	14	49	10	2	0.000	0.000	0.500
"	14	50	10	2	0.000	0.000	0.500
"	14	-51	10	2	0.000	0.000	0.500
"	14	-52	10	2	0.000	0.000	0.500
"	14	-52	10	2	0.000	0.000	0.500
"	14	-51	10	2	0.000	0.000	0.500
"	14	-50	10	2	0.000	0.000	0.500
"	14	-49	10	2	0.000	0.000	0.500
"	14	-62	10	2	0.000	0.000	0.500
"	14	-41	10	2	0.000	0.000	0.500
"	14	1	10	2	0.000	0.000	0.500
"	14	36	10	2	0.000	0.000	0.500
"	14	37	10	2	0.000	0.000	0.500
"	14	38	10	2	0.000	0.000	0.500
"	14	-39	10	2	0.000	0.000	0.500
"	14	-40	10	2	0.000	0.000	0.500
"	14	-41	10	2	0.000	0.000	0.500
EB Other Originating	15	-44	10	2	0.000	0.000	1.000
"	15	-39	10	2	0.000	0.000	1.000
"	15	-38	10	2	0.000	0.000	1.000
"	15	37	10	2	0.000	0.500	1.000
"	15	1	10	2	0.000	0.000	1.000

Appendix A-3
Sample Calculations

Movement Type	Activity Code	Segment Number	Speed (mph)	Duty Cycle Number	Non-ZTR Idle Time (hrs)	ZTR Idle Time (hrs)	Fraction of Segment or Time Moving
"	-15	38	10	2	0.000	0.500	0.000
WB Other originating	16	-44	10	2	0.000	0.000	1.000
"	16	-39	10	2	0.000	0.000	1.000
"	16	39	10	2	0.000	0.500	1.000
"	16	63	10	2	0.000	0.000	1.000
"	16	9	10	2	0.000	0.000	1.000
"	16	10	10	2	0.000	0.000	1.000
"	16	11	10	2	0.000	0.000	1.000
"	16	12	10	2	0.000	0.000	1.000
"	16	13	10	2	0.000	0.000	1.000
EB Power Moves Through	17	1	15	1	0.000	0.000	1.000
"	17	2	15	1	0.000	0.000	1.000
"	17	3	15	1	0.000	0.000	1.000
"	17	4	15	1	0.000	0.000	1.000
"	17	5	15	1	0.000	0.000	1.000
"	17	6	15	1	0.000	0.000	1.000
"	17	7	15	1	0.000	0.000	1.000
"	17	8	10	2	0.000	0.000	1.000
"	17	9	10	2	0.000	0.000	1.000
"	17	10	10	2	0.000	0.000	1.000
"	17	11	10	2	0.000	0.000	1.000
"	17	12	10	2	0.000	0.000	1.000
"	17	13	10	2	0.000	0.000	1.000
"	-17	38	0	2	0.000	0.500	0.000
WB Power Moves Through	19	1	15	1	0.000	0.000	1.000
"	19	2	15	1	0.000	0.000	1.000
"	19	3	15	1	0.000	0.000	1.000
"	19	4	15	1	0.000	0.000	1.000
"	19	5	15	1	0.000	0.000	1.000
"	19	6	15	1	0.000	0.000	1.000
"	19	7	15	1	0.000	0.000	1.000
"	19	8	10	2	0.000	0.000	1.000
"	19	9	10	2	0.000	0.000	1.000
"	19	10	10	2	0.000	0.000	1.000
"	19	11	10	2	0.000	0.000	1.000
"	19	12	10	2	0.000	0.000	1.000
"	19	13	10	2	0.000	0.000	1.000
EB Power Moves Terminating	21	-52	10	2	0.000	0.000	1.000
"	21	-51	10	2	0.000	0.000	1.000
"	21	-50	10	2	0.000	0.000	1.000
"	21	-49	10	2	0.000	0.000	1.000
"	21	-62	10	2	0.000	0.000	1.000
"	21	-41	10	2	0.000	0.000	1.000
WB Power Moves Terminating	22	-1	15	1	0.000	0.000	1.000

Appendix A-3
Sample Calculations

Movement Type	**Activity Code**	**Segment Number**	**Speed (mph)**	**Duty Cycle Number**	**Non-ZTR Idle Time (hrs)**	**ZTR Idle Time (hrs)**	**Fraction of Segment or Time Moving**
"	22	-2	15	1	0.000	0.000	1.000
"	22	-3	15	1	0.000	0.000	1.000
"	22	-4	15	1	0.000	0.000	1.000
"	22	-5	15	1	0.000	0.000	1.000
"	22	-6	15	1	0.000	0.000	1.000
"	22	-7	15	1	0.000	0.000	1.000
"	22	-45	10	2	0.000	0.000	1.000
"	22	-41	10	2	0.000	0.000	1.000
"	22	-41	10	2	0.000	0.000	1.000
EB Power Moves Originating	23	-45	10	2	0.000	0.000	1.000
"	23	-7	15	1	0.000	0.000	1.000
"	23	-6	15	1	0.000	0.000	1.000
"	23	-5	15	1	0.000	0.000	1.000
"	23	-4	15	1	0.000	0.000	1.000
"	23	-3	15	1	0.000	0.000	1.000
"	23	-2	15	1	0.000	0.000	1.000
"	23	-1	15	1	0.000	0.000	1.000
WB Power Moves Originating	24	-47	10	2	0.000	0.000	1.000
"	24	-12	10	2	0.000	0.000	1.000
"	24	-13	10	2	0.000	0.000	1.000

Notes

(1) Segment numbers listed as negative values are in-yard power moves from arriving trains to service or from service to departing trains
(2) Non-ZTR Idling is the duration of an idle event when units without ZTR continue to idle after ZTR-equipped units have shut down
(3) Idling All is the duration of idling during which all locomotives continue to idle
(4) Fraction of Segment Moving is the fraction of the length of the segment over which the movement occurs or the fraction of events moving on this route.
(5) Intermodal terminating trains are assumed to be distributed between the 300 Track (80%) and the four intermodal tracks in ICTF (20%)
(6) 80% of departing intermodal trains are assumed to depart from the 900 Track, and the other 20% from the 300 Track
(7) 50% of other trains arriving or departing are assumed to use the 900 Track, and the other 50% use the 300 Track
(8) Negative activity code values indicate an activity and segment where setout idling occurs

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Sample Calculations

Yard Operations	Activity Code	Segment Number	Duty Cycle Number	Non-ZTR Idle Time (hrs)	ZTR Idle Time (hrs)	Working Time or Fraction (hrs)
ICTF Yard Switchers - Top End	25	64	3	0	0	8.262714
"	25	66	3	0	0	5.171789
"	25	67	3	0	0	5.495802
"	25	68	3	0	0	4.069694
ICTF Yard Switchers - Bottom End	26	65	3	0	0	7.746634
"	26	68	3	0	0	15.25337
Dolores Yard Switchers	27	64	3	0	0	8.607437
"	27	65	3	0	0	2.15308
"	27	68	3	0	0	4.239483

Duty Cycles (Percent of Time by Notch)	Duty Cycle Number	Idle	DB	N1	N2	N3	N4	N5	N6	N7	N8
Through Track North End	1	0.0%	0.0%	0.0%	0.0%	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%
In Yard Movement	2	0.0%	0.0%	50.0%	50.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Yard Switching	3	59.8%	0.0%	12.4%	12.3%	5.8%	3.6%	3.6%	1.5%	0.2%	0.8%

Appendix A-3
Sample Calculations

Emission Factors Weighted by Model/Tier/ZTR Fractions - DPM g/hr per Locomotive

Locomotive Model Group	Group ID	Idle-NonZTR	Idle-All	DB	N1	N2	N3	N4	N5	N6	N7	N8
California Fuel (221 ppm S)												
Service	1	21.96	30.45	57.39	47.9	100.03	220.03	275.96	350.59	540.4	623.27	722.81
LoadTest	2	23.16	31.29	62.18	49.49	101.9	220.72	274.35	348.2	528.2	608.47	710.52
47-State Fuel (2639 ppm S)												
Service	1	21.96	30.45	57.39	47.9	100.03	239.56	306.61	395.05	605.63	699.85	816.91
LoadTest	2	23.16	31.29	62.18	49.49	101.9	240.94	304.75	391.96	592.43	686.25	806.85

Note: Idle-NonZTR is the average per-locomotive idle emission rate for the fraction of locomotives not equipped with ZTR/Auto start-stop technology

Service and Shop Activity

			Duration of Activity per Locomotive (minutes)											
Activity	**Number of Locomotives**	**Fraction of Calif. Fuel**	**Idle-NonZTR**	**Idle-All**	**DB**	**N1**	**N2**	**N3**	**N4**	**N5**	**N6**	**N7**	**N8**
Service - Inbound	8294	0.00	0	30	0	0	0	0	0	0	0	0	0
In Service	8294	0.00	0	60	0	0	0	0	0	0	0	0	0
Service - Post Service	8294	0.90	15	30	0	0	0	0	0	0	0	0	0
Pre-Shop Idling	2815	0.90	0	30	0	0	0	0	0	0	0	0	0
Pre-Maintenance Load Test	281	0.90	0	2	0	0	0	0	0	0	0	0	8
Post-Maintenance Load Test	281	0.90	0	10	0	10	0	0	0	0	0	0	10
Quarterly Maintenance Load Test	430	0.90	0	2	0	0	0	0	0	0	0	0	8
Unscheduled Mtc Diagnostic Test	6	0.90	0	10	0	0	0	0	0	0	0	0	10
Unscheduled Mtc Post Test	777	0.90	0	15	0	0	0	0	0	0	0	0	45

Appendix A-3
Sample Calculations

Locomotive Model Distributions
Locomotives Serviced

Technology	ZTR/AESS	Switcher	GP-3x	GP-4x	SD-50	GP-60	SD-7x	SD-90	Dash 7	Dash 8	Dash 9	C-60
Pre Tier 0	No	0.0000	0.0054	0.1310	0.0138	0.0351	0.0056	0.0041	0.0009	0.1026	0.0789	0.0002
Pre Tier 0	Yes	0.0000	0.0090	0.0046	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0058	0.0000
Tier 0	No	0.0000	0.0002	0.0034	0.0002	0.0096	0.2160	0.0004	0.0000	0.0201	0.0316	0.0041
Tier 0	Yes	0.0017	0.0022	0.0000	0.0000	0.0006	0.0011	0.0000	0.0000	0.0000	0.0027	0.0000
Tier 1	No	0.0000	0.0000	0.0000	0.0000	0.0000	0.0321	0.0000	0.0000	0.0000	0.0000	0.0000
Tier 1	Yes	0.0000	0.0000	0.0000	0.0000	0.0000	0.1782	0.0000	0.0000	0.0000	0.0056	0.0000
Tier 2	No	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0001	0.0000
Tier 2	Yes	0.0000	0.0000	0.0000	0.0000	0.0000	0.0308	0.0000	0.0000	0.0000	0.0627	0.0000

Locomotives Load Tested

Technology	ZTR/AESS	Switcher	GP-3x	GP-4x	SD-50	GP-60	SD-7x	SD-90	Dash 7	Dash 8	Dash 9	C-60
Pre Tier 0	No	0.0000	0.0072	0.1247	0.0103	0.0381	0.0079	0.0056	0.0008	0.1350	0.0794	0.0000
Pre Tier 0	Yes	0.0000	0.0103	0.0072	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0064	0.0000
Tier 0	No	0.0000	0.0000	0.0040	0.0008	0.0119	0.2049	0.0008	0.0000	0.0262	0.0357	0.0040
Tier 0	Yes	0.0000	0.0032	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0024	0.0000
Tier 1	No	0.0000	0.0000	0.0000	0.0000	0.0000	0.0230	0.0000	0.0000	0.0000	0.0000	0.0000
Tier 1	Yes	0.0000	0.0000	0.0000	0.0000	0.0000	0.1636	0.0000	0.0000	0.0000	0.0064	0.0000
Tier 2	No	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Tier 2	Yes	0.0000	0.0000	0.0000	0.0000	0.0000	0.0310	0.0000	0.0000	0.0000	0.0493	0.0000

Appendix A-3
Sample Calculations

Example 1 -- EB Departing Intermodal Trains

Parameter	Value
Activity Code	7
Number of Events	2045
Locomotives per Consist on Train	3.267
Number of Setouts	35
Locomotives per Consist Working During Power Moves	1.5
Emission Factor Group	1
Fraction of California Fuel	0.90

Route Followed	Activity Code	Segment Number	Length (miles)	Speed (mph)	Duty Cycle	Power Move	Non-ZTR Idle (hrs)	ZTR Idle (hrs)	Fraction of Segment Moving	Locomotive Hours Moving (Duty Cycle 1)	Locomotive Hours Moving (Duty Cycle 2)	Locomotive Hours NonZTR Idle	Locomotive Hours ZTR Idle
Ready Track to 300 Track	7	-46	0.424593	10	2	Y	0	0	0.2	0.00	56.73	0.00	0.00
300 Track North End	7	49	0.167208	10	2	N	0	0.5	0.2	0.00	22.34	0.00	3340.51
Through Track 10 to 300 Track	7	48	0.110429	10	2	N	0	0	0.2	0.00	14.76	0.00	0.00
Through Track 9	7	10	0.148838	10	2	N	0	0	0.2	0.00	19.89	0.00	0.00
Through Track 8	7	9	0.200691	10	2	N	0	0	0.2	0.00	26.82	0.00	0.00
Through Track 7	7	8	0.097993	10	2	N	0	0	0.2	0.00	13.09	0.00	0.00
Through Track 6	7	7	0.080956	15	1	N	0	0	0.2	7.21	0.00	0.00	0.00
Through Track 5	7	6	0.440504	15	1	N	0	0	0.2	39.24	0.00	0.00	0.00
Through Track 4	7	5	0.243976	15	1	N	0	0	0.2	21.73	0.00	0.00	0.00
Through Track 3	7	4	0.303405	15	1	N	0	0	0.2	27.03	0.00	0.00	0.00
Through Track 2	7	3	0.283696	15	1	N	0	0	0.2	25.27	0.00	0.00	0.00
Through Track 1	7	2	0.124009	15	1	N	0	0	0.2	11.05	0.00	0.00	0.00
North End Inlet Lead	7	1	0.195189	15	1	N	0	0	0.2	17.39	0.00	0.00	0.00
Ready Track to 900 Track	7	-44	0.416487	10	2	Y	0	0	0.8	0.00	222.60	0.00	0.00
900 Track South End	7	-39	0.256369	10	2	Y	0	0	0.8	0.00	137.02	0.00	0.00
900 Track Center	7	-38	0.769108	10	2	Y	0	0	0.8	0.00	411.07	0.00	0.00
900 Track North End	7	37	0.256369	10	2	N	0	0.5	0.8	0.00	137.02	0.00	3340.51
900 Track North Inlet	7	36	0.093907	10	2	N	0	0	0.8	0.00	50.19	0.00	0.00
North End Inlet Lead	7	1	0.195189	10	2	N	0	0	0.8	0.00	104.32	0.00	0.00
900 Track Center - Setouts	-7	38	0.769108	10	2	N	0	0.5	0	0.00	0.00	0.00	57.17
Total										*148.92*	*1215.87*	*0.00*	*6738.19*

Emission Factors	Group ID	Idle-NonZTR	Idle-All	DB	N1	N2	N3	N4	N5	N6	N7	N8
Departing IM Trains - CA Fuel	1	20.6	29.1	54.3	48.1	99.0	222.5	281.6	356.0	550.9	636.8	732.3
Departing IM Trains - 47-State Fuel	1	20.6	29.1	54.3	48.1	99.0	242.3	312.8	401.1	617.4	715.1	827.8
CA Fuel Fraction Adjusted Rates		*20.6*	*29.1*	*54.3*	*48.1*	*99.0*	*224.4*	*284.7*	*360.5*	*557.6*	*644.7*	*741.8*

Appendix A-3
Sample Calculations

	Duty Cycle											
Duty Cycle Moving	1	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00
	2	0.00	0.00	0.00	0.50	0.50	0.00	0.00	0.00	0.00	0.00	0.00
Weighted g/hr emissions	1	0.00	0.00	0.00	0.00	0.00	224.43	0.00	0.00	0.00	0.00	0.00
	2	0.00	0.00	0.00	24.05	49.51	0.00	0.00	0.00	0.00	0.00	0.00

	Moving (Duty Cycle 1)	Moving (Duty Cycle 2)	Idle-NonZTR	Idle-All
Emission Rate (g/hr)	224.43	73.56	20.58	29.05
Locomotive Hours	148.92	1215.87	0.00	6738.19
Total Emissions (g/yr)	**33422**	**89434**	**0**	**195744**

Example 2 -- Quarterly Maintenance Load Testing

Number of Quarterly Maintenance Load Tests	430
Fraction of Calif. Fuel	0.9

Emission Factors (g/hr)	**Group ID**	**Idle-NonZTR**	**Idle-All**	**DB**	**N1**	**N2**	**N3**	**N4**	**N5**	**N6**	**N7**	**N8**
Load Test - CA Fuel	2	23.16	31.29	62.18	49.49	101.90	220.72	274.35	348.20	528.20	608.47	710.52
Load Test - 47-State Fuel	2	23.16	31.29	62.18	49.49	101.9	240.94	304.75	391.96	592.43	686.25	806.85
CA Fuel Fraction Adjusted Rates		*23.16*	*31.29*	*62.18*	*49.49*	*101.90*	*222.74*	*277.39*	*352.58*	*534.62*	*616.25*	*720.15*

							Duration (minutes)					
Activity	**Number of Locomotives**	**Idle-NonZTR**	**Idle-All**	**DB**	**N1**	**N2**	**N3**	**N4**	**N5**	**N6**	**N7**	**N8**
Quarterly Maintenance Load Test	430	0	2	0	0	0	0	0	0	0	0	8
Emissions (g)												
Notch-Specific		0.0	448.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	41288.8

Total Emissions (g/yr)	**41737**

APPENDIX A-4

METHODOLOGY FOR ESTIMATING LOCOMOTIVE EMISSIONS AND GENERATING AERMOD EMISSION INPUTS

Appendix A-4

Methodology for Estimating Locomotive Emissions and Generating AERMOD Emission Inputs

Overview

This appendix describes the general procedures followed for developing locomotive emission inventories for the Union Pacific Railroad (UPRR) rail yards under the Memorandum of Understanding with the California Air Resources Board. It also describes the procedure by which the emission inputs are prepared for both locomotive and non-locomotive sources are used in AERMOD dispersion modeling.

EMISSION CALCULATIONS

This section describes the details of the development of activity inputs, emission factors, and emission estimates for locomotive operations. Separate procedures are followed for estimating activity associated with locomotives on trains, locomotive consist movements within a yard, service and shop activity (if occurring at a specific yard), and yard switching operations within a yard. Emission factors are developed for each of the types of locomotive activity based on the model and technology distribution of locomotives involved in each activity. Emission estimates are then developed for the activities and specific areas of a yard in which each activity occurs. The data used to calculate these emissions are included in the Appendix A-3 Excel workbook, which includes a "Sample Calculations" worksheet showing the linkages between the various activities, emission factors, and operating characteristics data.

Train Activity

Train activity data for emissions calculations include a number of separate components:

- The number of trains arriving, departing, or passing through a yard, broken down by type of train;
- The average composition of working locomotives in each consist[1], including the fraction of locomotives of different models, emissions technology tier, and automatic idling control equipment[2];
- The identification of routes followed for different types of train activities; and

[1] The term "consist" refers to the group of locomotives (typically between one and four) that provide power for a specific train.

[2] Two types of automatic idling control equipment are in use, known as ZTR SmartStart (typically retrofit equipment on low horsepower units) and AESS (typically factory installed on newer high horsepower units). Both are programmed to automatically shut off the engines of parked idling locomotives after a specified period of time, and to restart the unit if any of a number of operating parameters (battery state, air pressure, coolant temperature, etc.) reach specified thresholds.

- Identification of the speeds and throttle settings for different types of train activities in different locations.

The primary source of information for estimating train activity is a database identifying the arrival and departure of locomotives at a specific yard. This database identifies locomotives by their ID numbers and models, the status on the train (working or not working), and the specific train to which they are connected. From these data, the total numbers of trains of different types are identified based on train symbols, train dates, train origination and termination indicators, and dates and times of arrival and departure. For each type of train and activity, the average number of locomotives per consist is calculated along with the distribution of locomotive models, emission technology tiers, and automatic idling control equipment. A separate database of UPRR locomotives is consulted based on locomotive ID to determine the tier and date of any retrofits of automatic idling controls to complete the development of these model distributions. The activity data so derived are shown on the "Activities" worksheet in the Appendix A-3 Excel workbook, and the model and technology distributions are shown on the "Consist Emissions" worksheet.

The types of trains to be identified can vary from yard to yard. For all yards, through trains (which bypass the yard itself on mainline tracks adjacent to the yard) are identified. Depending on the yard, trains entering or departing from the yard can be of several types, including:

- Intermodal trains;
- Automobile trains;
- "Manifest" or freight trains;
- Local trains; and
- Power moves.

Power moves are trains consisting only of locomotives that are either arriving at the yard to be serviced or used for departing trains, or departing from the yard to be serviced at another location or used for trains departing from another location. The routes followed by each type of train on arrival and departure are identified in consultation with UPRR yard personnel, along with estimates of average speeds and duty cycles (fraction of time spent at different throttle settings) for different areas.

Specific track subsections are identified by UTM coordinates digitized from georeferenced aerial photographs. The segments identified and their lengths are shown on the "Track Segments" worksheet of Appendix A-3. For each train type, direction, and route, a listing of track segments, segment lengths, and duty cycles is developed. Duty cycles are shown on the "Consist Emissions" worksheet of Appendix A-3, and the segment speeds, duty cycles, idling durations are shown on the "Movements and Yard Operations" worksheet. This listing, along with the number of locomotives per consist and number of trains of each type, allows the number of locomotive hours in each duty cycle to be calculated for each section of track. For arriving and departing trains, estimates of the duration of idling were developed in consultation with UPRR personnel.

These idling periods were divided into two parts: the assumed amount of time that all locomotives in a consist would idle on arrival or departure, and the amount of time that only locomotives not equipped with automatic idle controls would idle. Idling periods were assigned to a segment of the arrival or departure track one fifth of the length of the track at the appropriate end.

Service and Shop Activity

If there is a service track and/or shop at a yard, locomotives (including both road power from trains as well as yard switchers) undergo a variety of activities at these locations. If present at a yard, details of the service and shop activity, model distributions, and emission factors are shown on the "Service and Shop" worksheet of Appendix A-3. Specific locomotive activities involve idling while awaiting or undergoing routine service (cleaning, refueling, oiling, sanding, and other minor maintenance), movement and idling between service and maintenance areas, and stationary load testing associated with specific types of maintenance events. A database of service events at individual yards identifies the number of service events during the year, the locomotive ID and model, and the nature of servicing performed. Routine servicing involves periods of idling prior to and during service, and additional idling prior to movement of consists to departing trains in the yard. Estimates of the duration of idling associated with servicing are developed in consultation with UPRR personnel. As was done for trains, these idling periods were separated into two parts: the average total duration of idling by all locomotives, and the average duration of additional idling by locomotives not equipped with automatic idling controls.

The database also specifically identifies load test events and the type of maintenance with which the load testing is associated. These types include planned maintenance at different intervals (e.g., quarterly, semiannual) as well as unscheduled maintenance that may involve both diagnostic load testing prior to maintenance and post-maintenance load testing. The duration of load test events in each throttle setting depends on the equipment available and types of maintenance performed at the yard. Estimates of these durations, as well as the identification of load testing activity by type of load test and the time and duration of any additional idling and movements, are developed in consultation with UPRR personnel.

A total number of events (servicing and load testing by location and type) are developed from these data, as are locomotive model and technology distributions for all locomotives serviced and for those specific locomotives undergoing load testing (if applicable). From these event counts and durations, the total number of hours of locomotive idling and higher throttle setting operation in different portions of the service areas are calculated for each of the two model distributions.

Yard Switcher Activity

In each yard, there are routine jobs assigned to individual switchers or sets of switchers. These activities are generally not tracked from hour to hour, but they occur routinely within yard boundaries during specified work shifts. Similarly, the specific yard switcher locomotive IDs assigned to these jobs are not routinely tracked, but these yard jobs are generally assigned to a specific model of low horsepower locomotive. From the assigned yard switcher jobs and shifts, and in consultation with UPRR personnel, an estimate of the hours per day of switcher operation in a yard are developed, along with the specific times of day when these activities occur (time of day assignments were made only if operation was less than 24 hour per day). Duty cycles for switching operation are also developed in consultation with local UPRR personnel. Depending on the type of activity and type of trains being handled in a yard, duty cycle estimates may vary. In the absence of more detailed information, the USEPA switcher duty cycle is assumed to be representative of each switcher's operation[3]. The total number of locomotive hours of operation for each model are calculated and assigned to the areas in which the units work. In some cases, yard jobs are assigned to specific areas within the yard and specific models of locomotives. In these cases, the switcher activities are assigned specifically to these areas of the yard.

Emission Factor Development

The locomotive model and technology group distributions derived in the development of activity data are grouped by type or types of activity with consideration for the level and nature of the activity. For example, a single distribution is used for through trains of all types, including power moves, while consist model distributions for different types of trains within a yard may be treated as separate distributions if they are handled in different areas of a yard. As shown in Part VII of this report, model-group-specific emission factors by throttle setting were developed based on emission test data and sulfur content adjustment factors. From these emission factors and the locomotive model and technology distributions for different types of trains and activities, weighted average emission factors are calculated for the "average" locomotive for that train type or activity on a gram per hour basis. For each train type or activity, two separate idle emission rates are calculated. The first is the straight weighted average emission rate for all locomotives, while the second is the weighted average only for the fraction of locomotives without automatic idle controls. Mathematically,

$$\overline{Q}(l) = \sum_{i=1}^{11}\sum_{j=1}^{4}\sum_{k=1}^{2} F(i,j,k)\cdot Q(i,j,l)$$

for *l* corresponding to idle through N8, and

$$\overline{Q}(l^*) = \sum_{i=1}^{11}\sum_{j=1}^{4} F(i,j,1)\cdot Q(i,j,l^*)$$

[3] USEPA (1998). Locomotive Emission Standards -- Regulatory Support Document. (Available at *www.epa.gov/otaq/regs/nonroad/locomotv/frm/locorsd.pdf*).

for idling emission rate during periods when only locomotives without automatic idle controls are idling

where

> $\overline{\overline{Q}}(l)$ = weighted average emission factor for throttle setting *l*
>
> $Q(i,j,l)$ = the base g/hr emission factor of a particular model group/technology class and throttle setting
>
> $F(i,j,k)$ = the fraction of locomotives of a particular model group/technology class
>
> *i* = model group index (Switcher, GP-3x, etc.)
>
> *j* = technology tier index (pre-Tier 0, Tier 0, Tier 1, Tier 2)
>
> *k* = automatic idle control status index (with or without)
>
> *l* = throttle setting (idle, N1, . . ., N8)
>
> *l** = index for idle throttle of locomotives without automatic idle controls.

Thus, for each defined locomotive model distribution, gram per hour emission factors are generated for each throttle setting.

Emission Calculations – Locomotive Movements

From the train activity analysis, the following data are available for each segment of track: track length of segment $L(i)$; speed $V(i)$; movement duty cycle $\mathbf{D}(i)$ (a vector of fractions of time spent in each throttle setting); number of trains of each type $N(j)$; and number of working locomotives per consist for each train type $C(j)$. For each type of train *j*, there is a set of throttle-specific emission factors $Q_j(l)$ for the "average" locomotive used on that train type. If a particular type of train or consist movement can follow multiple paths within the yard, the activity is allocated to sequences of track segments representing each such path. Total annual emissions $q_{tot}(i)$ for each segment are then calculated as

$$q_{tot}(i) = \frac{L(i)}{V(i)} \cdot \sum_j N(j) \cdot C(j) \sum_l D(i,l) \cdot Q_j(l) \,.$$

Emission Calculations – Locomotive Idling

Locomotive idling is calculated in a similar manner for road power and locomotives in service. For each train type and for service events, activity data provide a number of annual events $N(i)$, duration of idling by locomotives with ($T_{all}(i)$) and without ($T_{nZTR}(i)$) automatic idle control, and gram per hour emission rates for the "average" locomotive $Q_{all}(i)$, and the "average" locomotive excluding those with automatic idle controls $Q_{nZTR}(i)$. Total annual emissions are calculated as

$$q_{idle} = \sum_{i} N(i) \cdot C(i) \cdot (T_{all}(i) \cdot Q_{all}(i) + T_{nZTR}(i) \cdot Q_{nZTR}(i)) .$$

If a particular type of activity occurs at multiple locations within the yard (e.g., on multiple arrival or departure tracks), then the idling time is allocated to different segments of track as appropriate so that segment-specific emissions are obtained.

Emission Calculations – Load Testing

Load testing emissions are calculated separately for each throttle setting (idle, N1, and N8) using the weighted average emission factors for the load-tested units, the number of load tests of different types, and the duration of testing in each throttle setting for each type of test.

Emission Calculations – Yard Switcher Operations

Activity data provide the number and model group information for yard switchers, and the number of operating hours per day. Model-group-specific emission factors are multiplied by the duty cycle to generate weighted average gram per hour emissions for idling and for combined emissions from operation in notch 1 through notch 8. Emissions are calculated directly from the number of units, hours per day working, and duty cycle weighted emission factors for both idle and non-idle throttle settings during work shifts.

AERMOD EMISSION INPUT PREPARATION

Emissions from both locomotives and from other emission sources in a yard are allocated to multiple individual point or volume sources in AERMOD inputs. In addition to each type of activity's emission rates, the locations of emissions, the release parameters, and other inputs (e.g., building downwash parameters, temporal variation in emissions, etc.) are required by AERMOD. Emission inputs are prepared sequentially for different types of activities and the areas within which they occur. The source elevation for each point or volume source is interpolated from a high-resolution terrain file.

Locomotive Movements

For each type of locomotive movement, emissions calculated for each track segment are uniformly allocated to a series of evenly spaced volume sources along that track segment. The maximum spacing between sources is specified and the number of sources to be used for each segment is calculated from the segment length. The raw emission rate value in the AERMOD inputs (g/sec) is based directly on the annual emission total for the segment divided by the number of sources on that segment. For locomotive movements, separate day and night release parameters are needed. Therefore, each source is duplicated (but with a different source ID and parameters) in the AERMOD inputs, with temporal profile inputs (EMISFACT HROFDY) that use day time parameters from 0600-1800 and night time parameters for 1800-0600.

Locomotive Idling and Load Testing

Locomotive idling and load testing emissions are allocated to track segments in the same manner as locomotive movements, but as point, rather than volume, sources. Each source location may have up to three separate sources identified, with different stack parameters used for idle, notch 1, and notch 8. Building downwash inputs are assigned from a pre-prepared set of records for a typical locomotive's dimensions and the orientation of the track segment on which the emissions occur.

Yard Switcher Operations

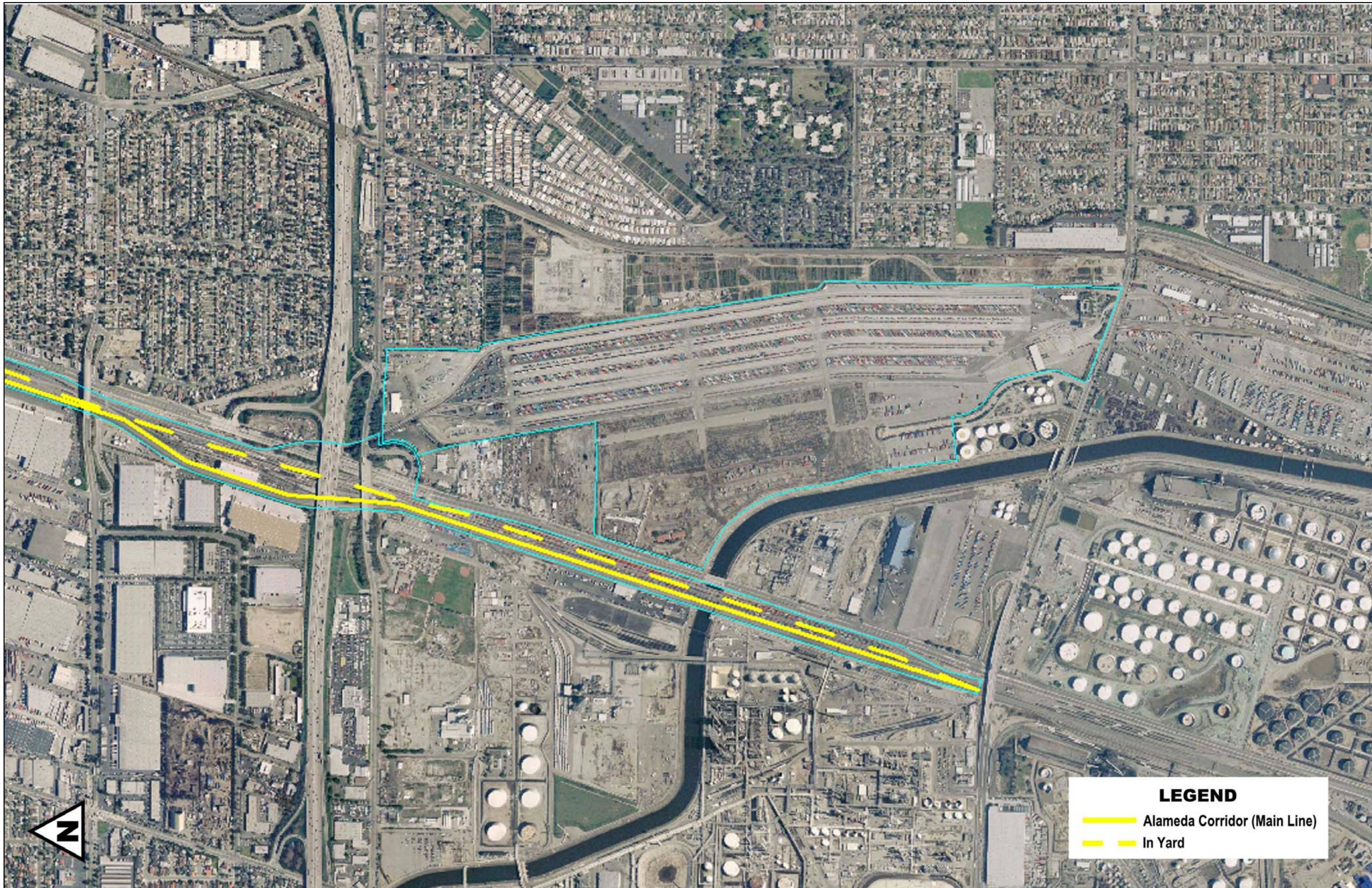
Yard switcher operations are allocated to areas within the yard based on the estimated time spent working in each area. As for locomotive movements, yard switcher emissions for a specific area are allocated uniformly to a number of volume sources on defined segments. Day and night operations are handled similarly to train and consist movements, with EMISFACT HROFDY records used to switch day and night volume source release parameters. Depending on their magnitude and distance from yard boundaries, the "working idling" emissions for yard switching may be added to the non-idle emissions from volume sources, or treated as a series of point sources, using stack parameters for the specific model group being used. If treated as point sources, building downwash inputs are prepared as for other locomotive idling and load testing.

APPENDIX A-5

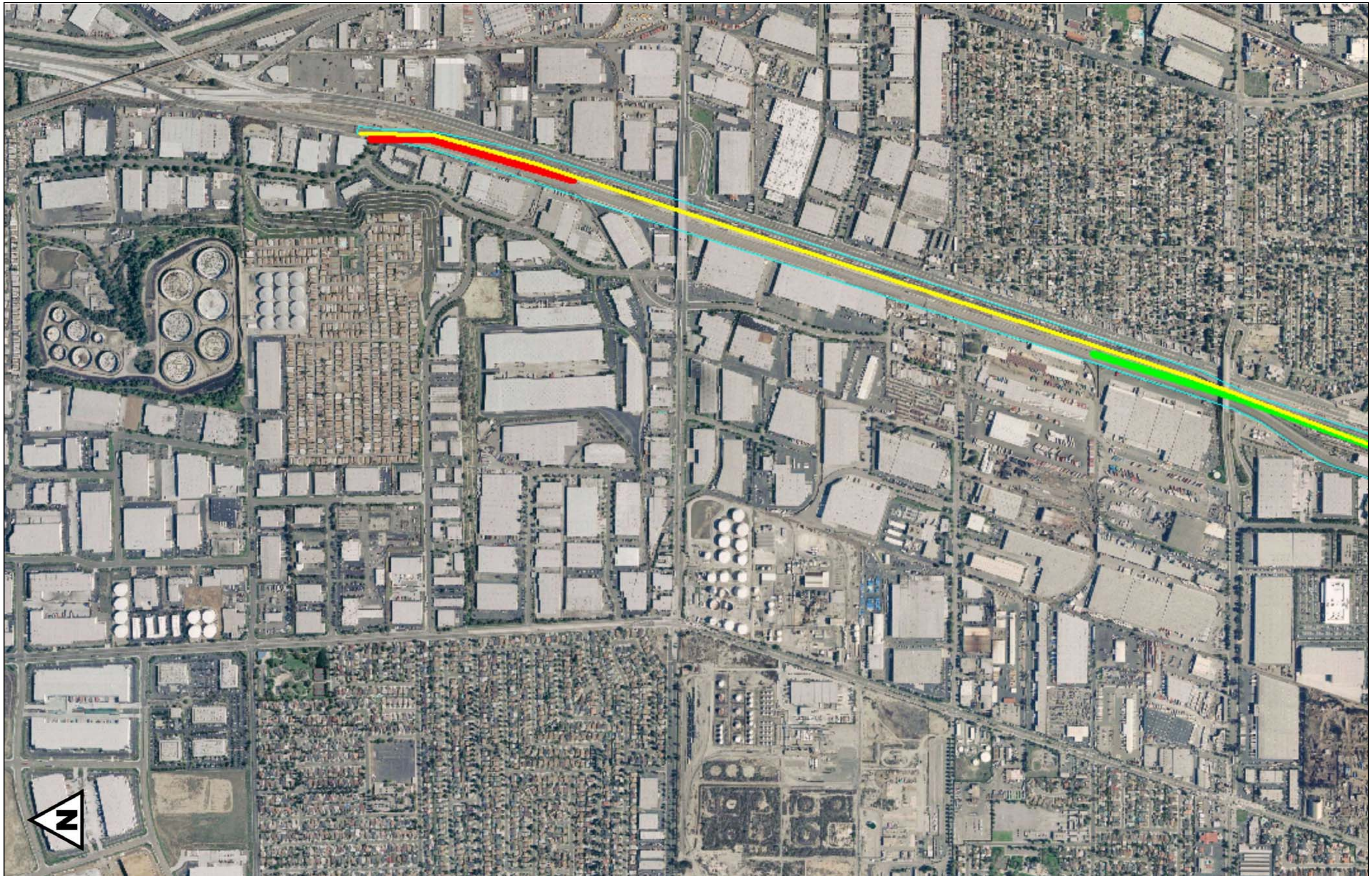
PRINCIPLE LOCOMOTIVE ROUTES

Appendix A-5
Through Train Routes

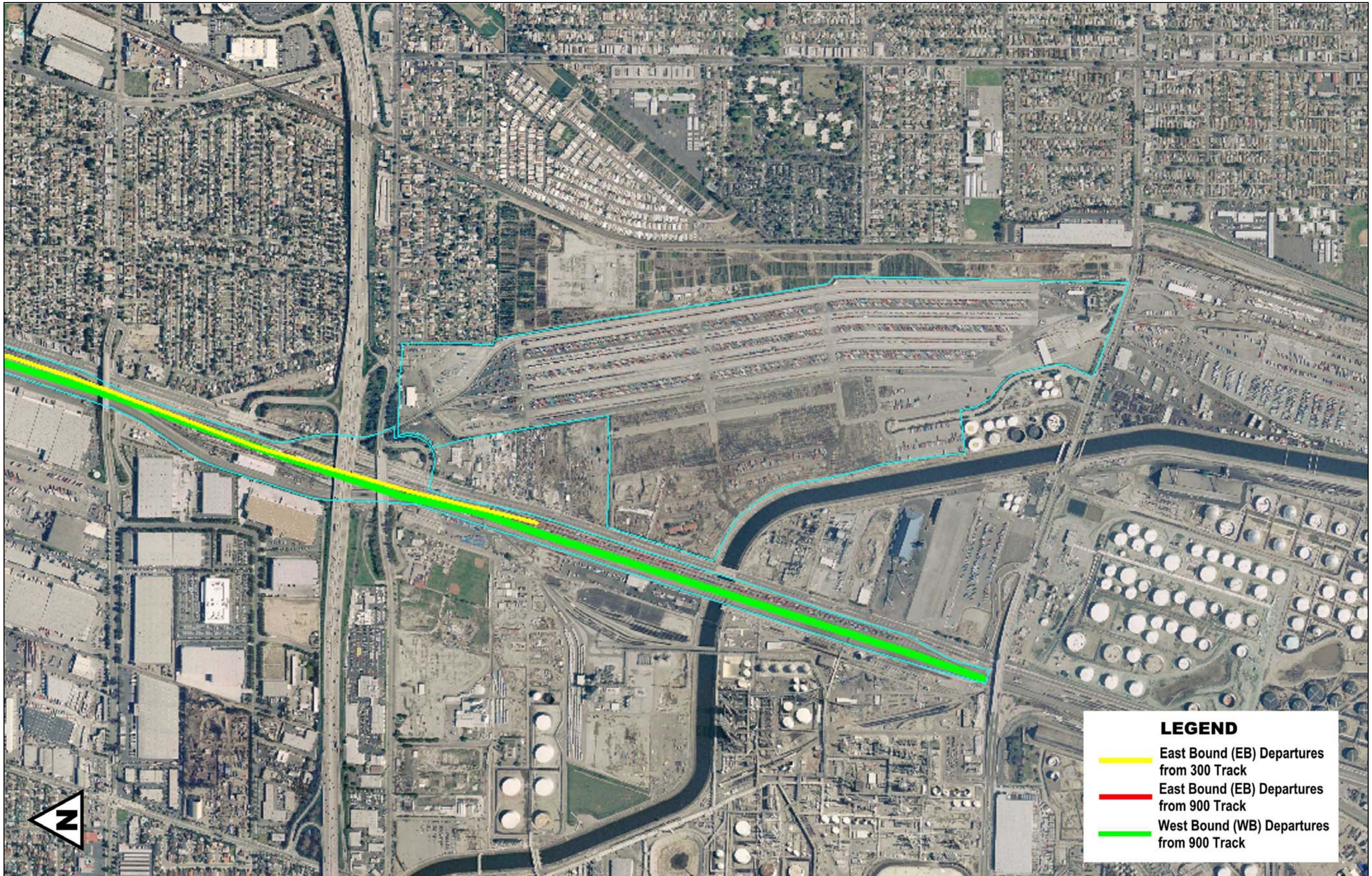
Appendix A-5
Through Train Routes (continued)



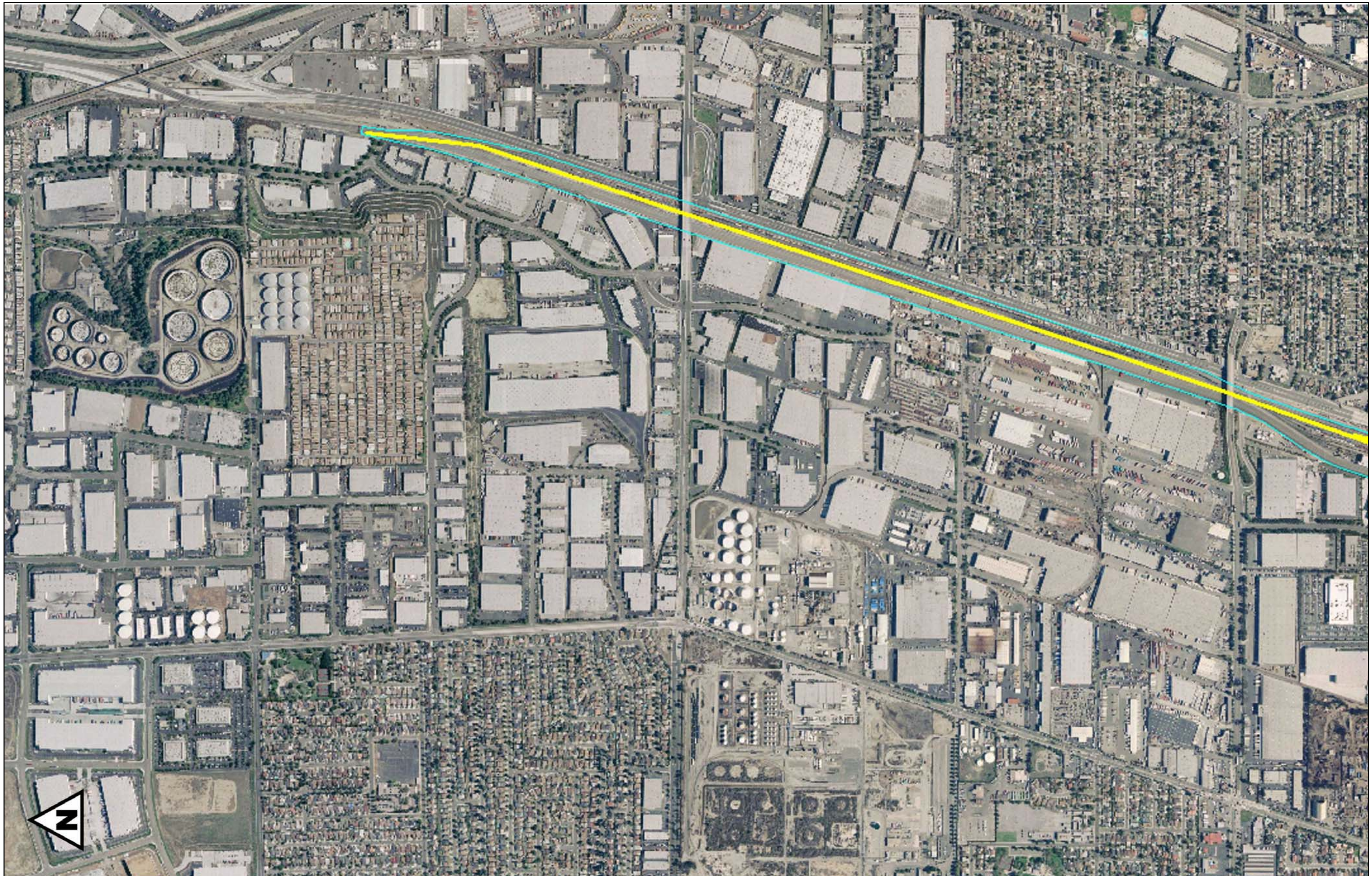
Appendix A-5
Departing Train Routes



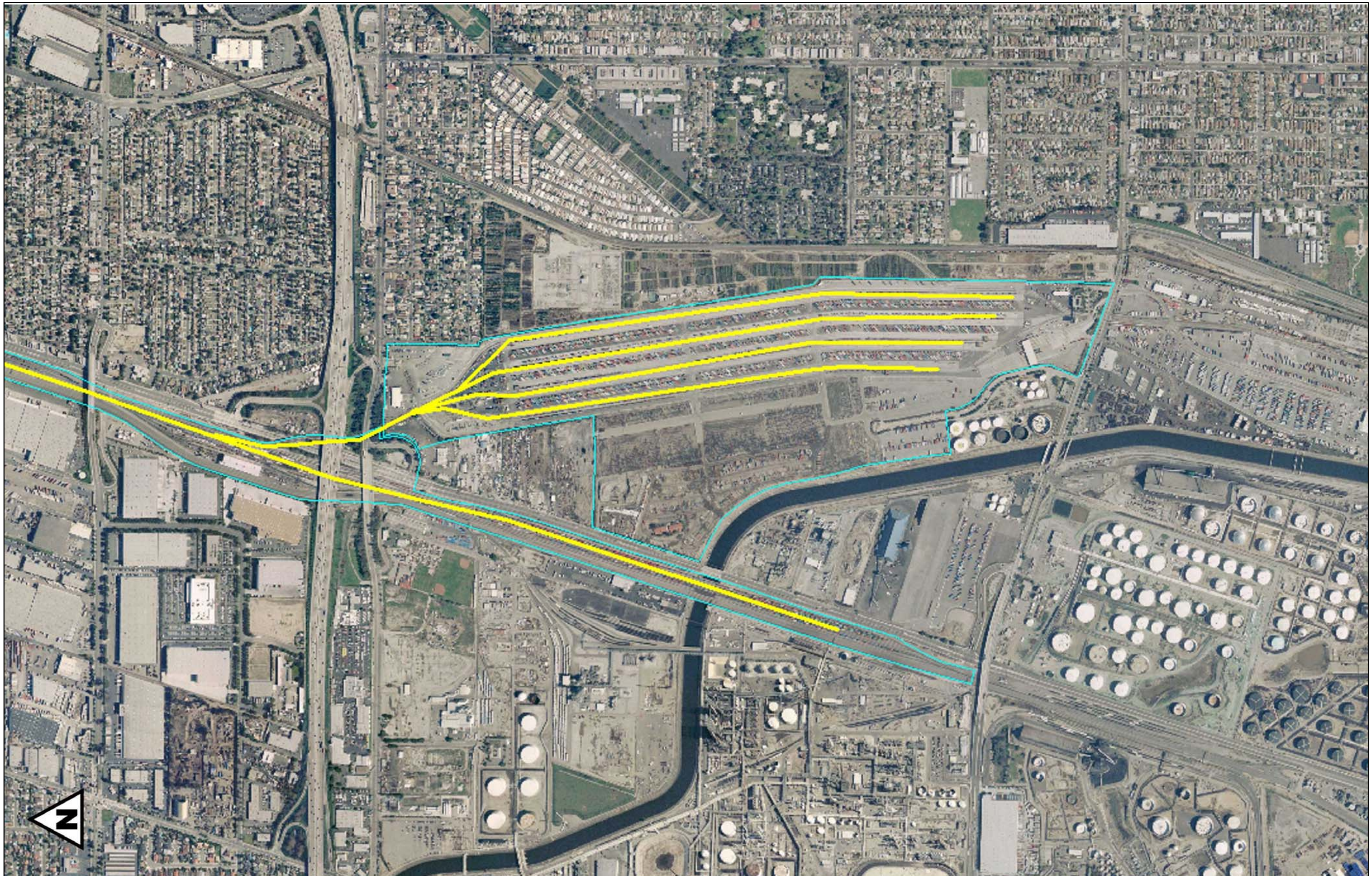
Appendix A-5
Departing Train Routes (continued)



Appendix A-5
Arriving Intermodal Train Routes

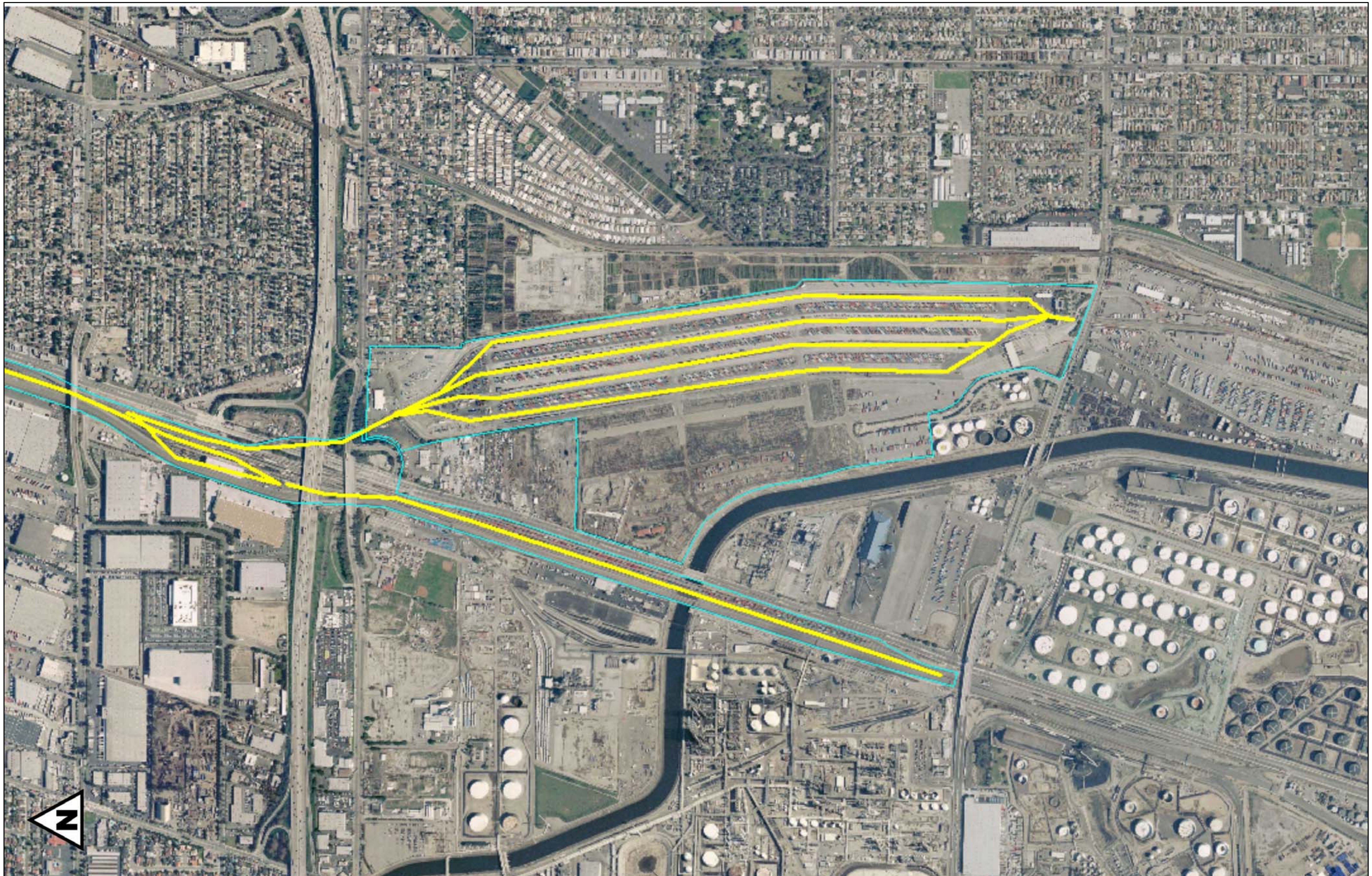


Appendix A-5
Arriving Intermodal Train Routes (continued)

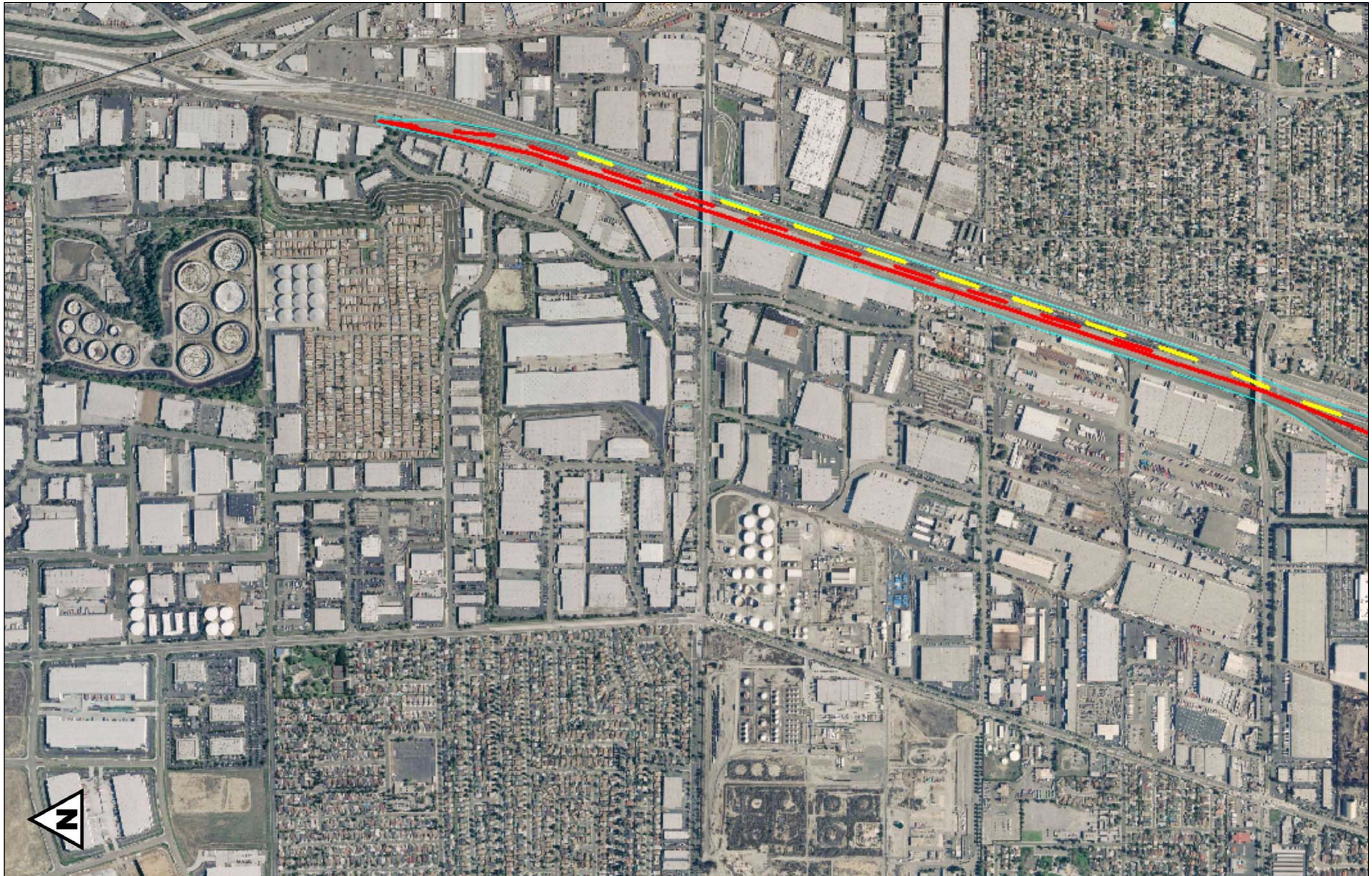


Appendix A-5
Consist Power Move Routes

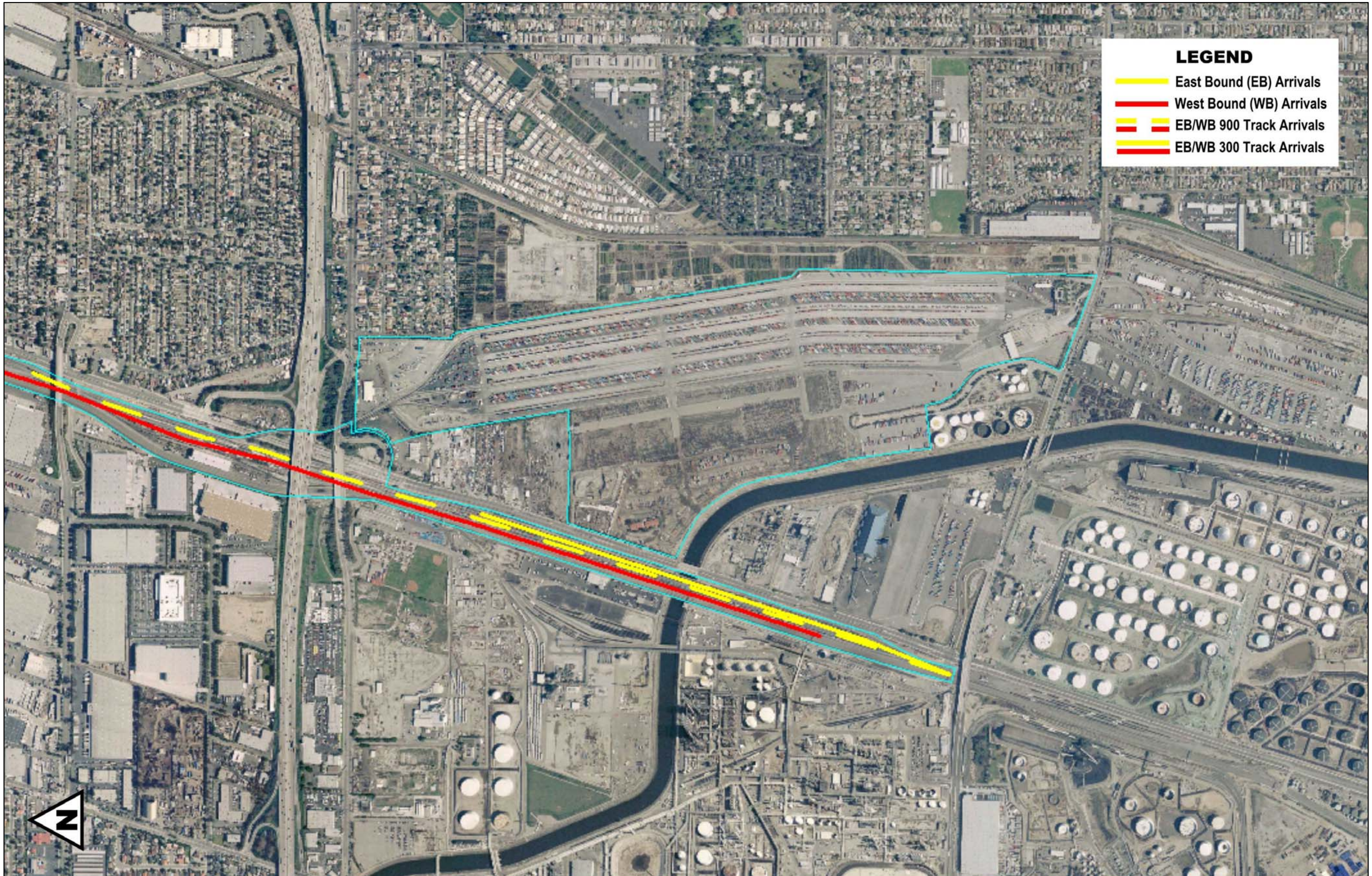
Appendix A-5
Consist Power Move Routes (continued)



Appendix A-5
Arriving Non-Intermodal Train Routes



Appendix A-5
Arriving Non-Intermodal Train Routes (continued)



APPENDIX A-6

IRESON ET AL

Development of Detailed Railyard Emissions to Capture Activity, Technology and Operational Changes

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ABSTRACT

Railyard operations involve a variety of complex activities, including inbound and outbound train movements, classification (i.e., separating cars from inbound trains for redirection to multiple destinations, and building new trains), and servicing locomotives. Standard locomotive duty cycles provide long-term average activity patterns for locomotive operations, but they are not appropriate for the specialized activities that occur within railyards or at locations such as ports, and emission densities in such areas can be high relative to those of line haul activities. There are significant emission rate differences between locomotive models, and differences in the types of service for which specific models are used. Data for throttle-specific emissions, activity levels, and locomotive models and operating practices can be used to provide more accurate emissions estimates for such operations. Such data are needed to quantify actual emissions changes in these high activity areas. A calculation scheme has been developed to generate detailed emission inventories based on the types of data that are collected for managing rail operations. This scheme allows improved accuracy in emissions estimation, and also provides a more reliable basis for bottom-up tracking of emissions changes over time. Factors that can be addressed include: changes in the distribution of locomotive models and control technology levels (e.g., increasing fractions of Tier 0, 1, and 2 locomotives) for both line haul and local operations; actual in-yard idling duration and reductions associated with auto-start-stop technologies; fuel quality effects; and detailed operating practices for switching and train-building operations. By providing detailed disaggregation of activity and emissions data, the method also makes it possible to quantify and evaluate the effects of specific emission reduction alternatives.

INTRODUCTION

Freight movement by rail is a key component of the U.S. transportation infrastructure. The combination of rail's low rolling resistance and the fuel-efficient turbocharged diesel engines used in modern locomotives make rail the most efficient mode of transport from both an emissions and economic perspective. Railyards located strategically through the nation's rail network are used to assemble and direct goods movement to their destinations. Railyards may handle dozens of trains per day, each powered by a "consist" of several locomotives. While in railyards, these locomotives are serviced and regrouped into new consists as needed for specific departing trains. In addition to train arrivals and departures and locomotive servicing, so-called "classification" yards separate rail cars in inbound trains into segments with different destinations, and build new trains with a common destination. This work is accomplished by switcher locomotives (typically of lower horsepower than the locomotives used for "line-haul" operations). Some railyards also have major locomotive repair facilities whose activities include load testing of locomotives prior to or after maintenance. Collectively, the locomotive operations associated with these activities can result in relatively high localized emission densities.

The Union Pacific Railroad (UPRR) is the largest railroad in North America, operating throughout the western two-thirds of the United States. It operates a number of railyards throughout its system, including the J. R. Davis Yard in Roseville, California. The Davis Yard is UPRR's largest classification yard in the western U.S. It is approximately one-quarter mile wide and four miles long, and is visited by over 40,000 locomotives per year. The California Air Resources Board (CARB) recently completed a detailed dispersion modeling study to estimate concentrations of diesel particulate matter in the vicinity of the railyard.[1] UPRR cooperated closely with CARB in this study, including the identification, retrieval and analysis of data needed to assemble a detailed emission inventory for railyard operations. This effort produced the most detailed emission inventory for railyard operations to-date, including empirically developed train counts, locomotive model distributions, locomotive service and maintenance activities, and dedicated on-site switching operations. The results of this effort have been further adapted to allow UPRR to track the effect of locomotive fleet modernization, freight volume, and operational changes on emissions, and to identify opportunities for further emission reductions at the Davis Yard.

RAILYARD ACTIVITY ESTIMATION

At state and national levels, locomotive emissions have been estimated using locomotive fleet population data and average locomotive emission factors, expressed in g/bhp-hr, in conjunction with fuel efficiency estimates and fuel consumption. For freight locomotives, the emission factors are typically derived using both a switching duty cycle and a line haul duty cycle, each of which gives the fraction of operating time locomotives spend at different throttle settings, referred to as notch positions.[2] These throttle settings (see Table 1) include idle, notches 1 through 8, and dynamic braking (in which the locomotive traction motors are used to generate power which is dissipated through resistor grids). While this approach can provide reasonable estimates for larger regions, neither the overall locomotive fleet composition nor the standard duty cycles accurately reflect the specific activities that occur within an individual railyard. The g/bhp-hr emission factors vary substantially between throttle settings and between locomotive models. Other confounding factors include: speed limits within yards (which preclude the high throttle settings used for line-haul activity outside of yards); locomotive load (consists commonly move within yards with only one locomotive pulling and no trailing cars); and time spent either shut down or idling. Classification activities are carried out with duty cycles that are unique to yard operations and may vary from yard to yard. To develop more accurate emissions estimates, it is necessary to explicitly identify railyard activities at the level of individual locomotives.

Table 1. Locomotive Duty Cycles.

	Throttle Position (Percent Time in Notch)									
Duty Cycle	**D.B.**	**Idle**	**N1**	**N2**	**N3**	**N4**	**N5**	**N6**	**N7**	**N8**
EPA Line-Haul	12.5	38.0	6.5	6.5	5.2	4.4	3.8	3.9	3.0	16.2
EPA Switch	0.0	59.8	12.4	12.3	5.8	3.6	3.6	1.5	0.2	0.8
Trim Operations	0.0	44.2	5.0	25.0	2.3	21.5	1.5	0.6	0.0	0.0
Hump Pull-Back	0.0	60.4	12.5	12.4	5.9	3.6	3.6	1.5	0.0	0.0
Hump Push	0.0	0.0	0.0	100	0.0	0.0	0.0	0.0	0.0	0.0
Consist Movement	0.0	0.0	50.0	50.0	0.0	0.0	0.0	0.0	0.0	0.0
Load Tests:										
10-Minute	0.0	20.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	80.0
15-Minute	0.0	33.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	66.7
30-Minute	0.0	33.3	33.3	0.0	0.0	0.0	0.0	0.0	0.0	33.3

To accomplish this, UPRR reviewed the types of databases available for its operations to identify where explicit emission-related activity information could be generated for the Davis Yard. UPRR operates approximately 7000 locomotives over a network spanning 23 states. Large amounts of data are generated and retained by UPRR for management purposes. These include tracking the location and status of capital assets (e.g., locomotives and rail cars), tracking performance of specific activities, and managing operations. These databases can be queried for data records specific to the Davis Yard, but their content does not directly relate to emissions. Where possible, data providing a complete record of emissions-related events (e.g., locomotive arrivals and departures) were identified and retrieved. Where 100 percent data for an activity could not be obtained (e.g., locomotive model number for each arriving locomotive), distributions were developed based on available data. In some cases, data are not available for specific types of emission events (e.g., the duration of idling for individual trains prior to departure). In these cases, UPRR yard personnel were consulted to derive estimates of averages or typical operating practices.

Railyard Operations – Inbound and Outbound Trains

The majority of locomotive activity in a railyard arises from inbound and outbound freight traffic. Following arrival, consists are decoupled from their trains in receiving areas and are either taken directly to outbound trains, or more commonly, are sent through servicing which can include washing, sanding, oiling, and minor maintenance prior to connecting to outbound trains. Some fraction of trains arriving at a yard simply pass through, possibly stopping briefly for a crew change. UPRR maintains a database that, when properly queried, can produce detailed information regarding both arriving and departing trains. Table 2 lists some of the key parameters that are available in this database. In this study, 12 months of data were obtained for all trains passing through the Davis Yard. The extracted data (over 60,000 records) included at least one record for every arriving and departing train, and each record contained specific information about a single locomotive, as well as other data for the train as a whole. The data were processed using a commercial relational database program and special purpose FORTRAN code to identify individual train arrivals and departures and train and consist characteristics.

Table 2. Selected Train Database Parameters.

	Used to Identify				
Parameter	Identification of Train Events	Location in Railyard	Consist Composition	Temporal Profile	Train Characteristics
Train Symbol	X	X			
Train Section	X				
Train Date	X				
Arrival or Departure	X	X			
Originating or Terminating	X	X			
Direction		X			
Crew Change?		X			
Arrival & Departure Times				X	
# of Locomotives			X		
# of Working Locomotives			X		
Trailing Tons					X
Locomotive ID #			X		
Locomotive Model			X		

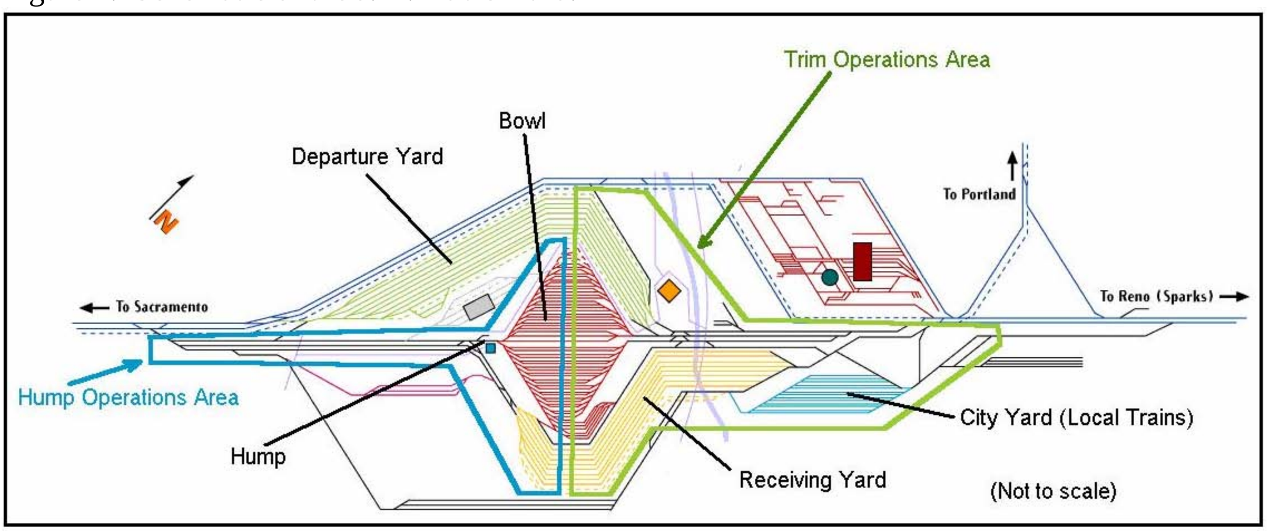
The parameters listed in Table 2 were used to calculate the number of trains by time of day arriving or departing from each area of the yard, as well as average composition of their consists (number of locomotives and distribution of locomotive models). The combination of train symbol, train segment, and train date provided a unique identifier for a single arrival or departure, and the individual locomotive models were tabulated to generate model distributions. Where necessary, working horsepower and total horsepower were used to estimate the number of working locomotives in the consist.

Emission calculations associated with inbound and outbound trains included both periods of movement within the yard boundaries and locomotive idling while consists we connected to their trains. Based on train direction and the location of its arrival or departure, moving emissions were based on calculations of time at different throttle settings based on distance traveled and estimated speed profiles, considering speed limits on different tracks. Yard operators provided estimates for the average duration of such idling for both inbound and outbound trains.

Railyard Operations – Classification

On arrival, inbound trains are "broken" into sections of rail cars destined for different outgoing trains. Figure 1 shows a schematic diagram of the Davis Yard including a large central "bowl" consisting of a large number of parallel tracks connected by automated switching controls to a single track to the west. Trains are pulled back to the west and then pushed to the "hump," a slightly elevated portion of track just west of the bowl. As cars pass over the hump, they are disconnected and roll by gravity into the appropriate track in the bowl. Dedicated special purpose locomotives, known as "hump sets," are used in this operation. Unlike most locomotives, these units have continuously variable throttles, rather than discrete throttle notch settings, to allow precise control of speed approaching the hump. Switching locomotives, known as "trim sets" are responsible for retrieving the train segments or trains being "built" in the bowl and moving them to the appropriate outbound track. The Davis Yard operates a fixed number of hump sets and trim sets at any given time, with backup sets standing by for shift changes and possible breakdowns.

Figure 1. Schematic of the J. R. Davis Yard.



Emission calculations for hump and trim operations were based on the number of working hump and trim sets at any given time, plus assumed idling times of standby units. For the hump sets, yard operators provided estimates of average pull-back and pushing times, and the duty cycles associated with these operations. For pull-back, based on distance and speed limits, the EPA switcher duty cycle, excluding notch 7 and 8 was used. Pushing is conducted at the equivalent of notch 2. For the trim sets, speed limits within the Yard preclude any high throttle setting operation, but there is a greater time spent in mid-throttle settings than reflected in the EPA switcher cycle. A revised duty cycle was developed for these units based on the EPA switcher duty cycle, with high throttle fractions (notches 7 and 8) excluded, but with increased notch 1 and notch 4 operating time. These duty cycles are also shown in Table 1.

Railyard Operations – Consist Movement, Service, Repair and Testing

After disconnecting from inbound trains, consists move to one of several servicing locations for refueling and other maintenance, following designated routes in the yard. Typically, one locomotive in each consist will pull the others, with throttle settings at notch 1 or 2. Based on distance and speed limits, movement times were estimated for each route, and emissions calculated using the number of locomotives following each route.

While being serviced, locomotives may be either idling or shut down. Locomotives must be idling while oil and other routine checks are performed. In addition, since locomotive engines are water-cooled and do not use antifreeze, they are commonly left idling during cold weather conditions. New idling reduction technologies known as SmartStart and AESS provide computer-controlled engine shut down and restart as necessary, considering temperature, air pressure, battery charge, and other parameters. Yard personnel provided estimates of the average potential duration of idling associated with different servicing events. Databases for service and maintenance activities maintained by UPRR provide details on the number and types of service events at different locations in the yard. As for train activity, these data were processed with a commercial relational database program and special purpose FORTRAN code to characterize and tabulate service events. These results were used in conjunction with data for the number of inbound and outbound consists to estimate total idling emissions for different service event types and locations. Following service, consists are dispatched to outbound trains. The same procedures were followed for estimating idle time, number of locomotives moving to each outbound area of the yard, and the duration of each movement for emission calculations.

In addition to routine service, the databases include service codes indicating periodic inspections of various types, as well as major maintenance activities requiring load testing of stationary locomotives. Several types of load tests are conducted, including planned maintenance pre- and post-tests, quarterly maintenance tests, and unscheduled maintenance diagnostic and post-repair tests. Depending on the test type and locomotive model, these tests include some period of idling, notch 1 operation, and notch 8 operation. Data are not collected on the exact duration of individual tests, so estimates of average duration for each throttle setting were provided by shop personnel, as shown in Table 1. The number of tests of each type for each locomotive model group were tabulated based on the service codes in the database for each service event.

Trends in Activity and Technology

The initial study was based on data from December 1999 through November 2000. Since that time, UPRR's locomotive fleet modernization program as well as changes in freight volumes have occurred. A subsequent data retrieval for the period from May 2003 through April 2004 was made, and emission calculations updated. A number of significant changes occurred over this 40-month period. The distribution of locomotive models in line-haul operation showed a substantial shift from older, lower horsepower units to new high horsepower units. The average number of locomotives per consist remained the same at about 3, but the higher horsepower allowed an increase in train capacity (trailing tons per train). The decrease in older units also resulted in a decrease in the frequency of major maintenance load testing. In addition to updating activity inputs (number of locomotives by model) for emission calculations, calculations were modified to reflect the penetration of new and retrofit technologies in the locomotive fleet, including SmartStart and AESS idling controls and Tier 0 and Tier 1 locomotives. UPRR data identifying the specific technologies installed on individual locomotives were matched with locomotive ID numbers in the train and servicing data retrievals to obtain a specific count of the number of locomotives of each model for which emissions reductions were achieved by these technologies. Historical temperature data for the Roseville area were used to estimate the fraction of time computer controls would require idling when the locomotive would otherwise be shut down.

EMISSION FACTORS

Data Sources

The study of the J. R. Davis Yard focused on diesel exhaust particulate matter emissions. At present, there is no unified database of emission test results for in-use locomotives. Appendix B of the USEPA's Regulatory Support Document for setting new emission standards for locomotives[2] contains a compilation of notch-specific emission factors. These data were supplemented by test data reported by Southwest Research Institute[3,4], as well as test data provided by locomotive manufacturers to assemble emission factors for each of 11 locomotive model groups.

There are dozens of specific locomotive model designations, and emissions tests are not available for all of them. However many models are expected to have nearly identical emission characteristics. Depending on their intended use, locomotives of different models may have different configurations (e.g., number of axles), but share a common diesel engine. For this project, 11 locomotive model groups were defined based on their engine models (manufacturer, horsepower, number of cylinders, and turbo- or super-charging of intake air). Table 3 lists these model groups and some of the typical locomotive models assigned to each group.

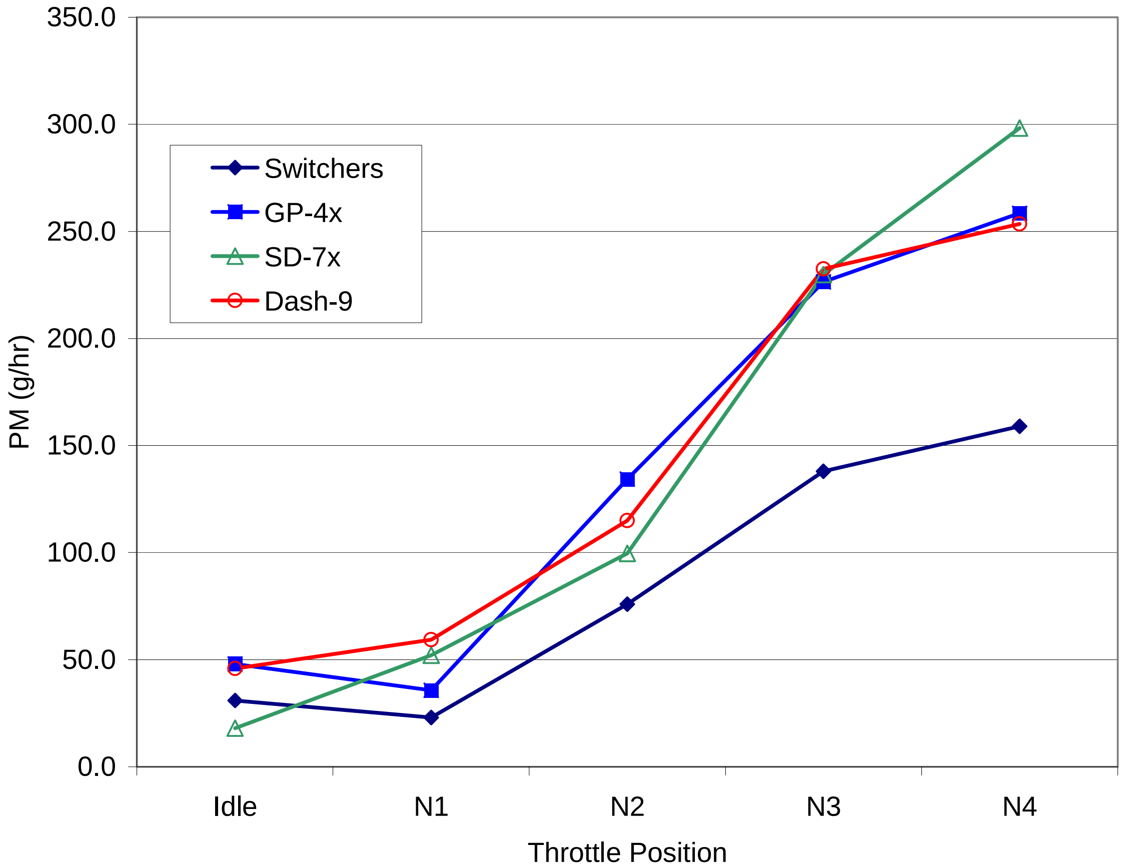
Table 3. Locomotive Model Groups

Model Group	Engine Family	Representative Models
Switchers	EMD 12-645E	GP-15, SW1500
GP-3x	EMD 16-645E	GP-30, GP-38
GP-4x	EMD 16-645E3B	GP-40, SD-40-2, SD-45-2
GP-50	EMD 16-645F3B	GP-50, SD-50M
GP-60	EMD 16-710G3A	GP-60, SD-60M
SD-7x	EMD 16-710G3B	SD-70MAC, SD-75
SD-90	EMD 16V265H	SD-90AC, SD-90-43AC
Dash-7	GE7FDL (12 cyl)	B23-7, B30-7, C36-7
Dash-8	GE7FDL (12 or 16 cyl)	B39-8, B40-8, C41-8
Dash-9	GE7FDL (16 cyl)	C44-9, C44AC
C60-A	GE7HDL	C60AC

Emission Factors and Fuel Effects

Figure 2 shows particulate matter (PM) emission factors for several of the more common locomotive model groups at the low to intermediate throttle settings typical of yard operations. As shown in the figure, emission rates generally increase with throttle setting. However, the older 3000 hp GP-4x series shows emissions comparable to (and in some cases, higher than) the newer 4000 to 4500 hp SD-7x and Dash-9 models. Due to the relatively large fraction of time locomotives spend at low throttle settings while in railyards, the relative differences in emission rates between models at these settings can significantly affect emissions estimates if locomotive model distributions change over time.

Figure 2. Locomotive PM Emission Factors (g/hr).

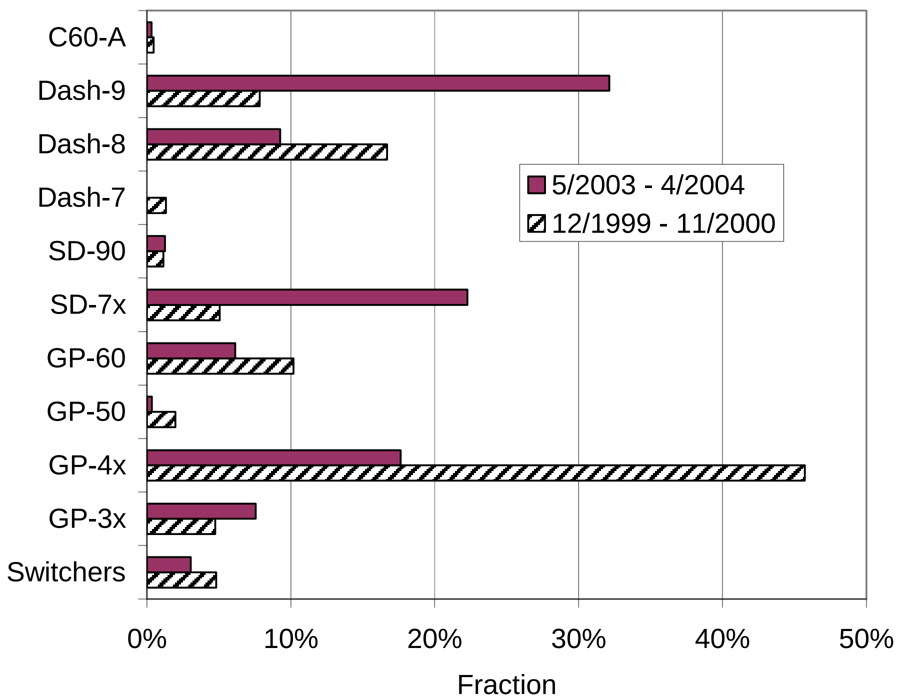


The emission factors used were based on tests using fuel typical of national off-road diesel. Initial emission estimates were derived by multiplying model-specific g/hr emission rates by the total hours of operation and locomotive model fraction for each activity within the yard. At the Davis Yard, over half of the diesel fuel dispensed to locomotives meets California on-road diesel fuel specifications (so-called “CARB diesel”). To account for the effect of fuel quality on emissions, estimates of the fraction of locally dispensed fuel burned by locomotives in different yard activities were developed. These ranged from 100 percent for hump and trim sets to zero percent for inbound line-haul units prior to refueling. These fractions were multiplied by the fraction of CARB diesel dispensed at the yard and an estimate of 14 percent reduction in PM emissions for locomotives burning CARB diesel to develop fuel effects adjustments for individual activities.

EMISSION TRENDS

Using the procedures described in the preceding sections, emissions estimates were developed for the December 1999 to November 2000 period, and the May 2003 to April 2004 period. During this period, significant changes in the UPRR locomotive fleet occurred, with the addition of new locomotives and the retirement of older units. Figure 3 shows the locomotive model distributions for all servicing events at the Davis Yard during these two periods. Service events include both the line-haul and local units arriving and departing on trains (which make up the bulk of these events), as well as the hump and trim sets. A significant increase in the relative fraction of high horsepower SD-7x and Dash-9 units is seen, and a corresponding decrease in the fraction of older GP-4x, GP-50, GP-60, Dash-7 and Dash-8 models. In addition to the fleet modernization, tabulations of specific emission control technologies on units serviced at the Davis Yard showed substantial penetration of new and retrofit technologies. Approximately 31 percent of locomotives serviced at the yard were equipped with computer-controlled shut-down and restart technology, resulting in reduced idling times. Also, approximately 27 percent of servicings were for Tier 0 locomotives, and approximately 25 percent were Tier 1 units. Although the Tier 0 and Tier 1 technologies are not expected to substantially reduce PM emissions, their nitrogen oxides emissions are lower. A few prototype Tier 2 units were observed in 2003 – 2004 data, and their reduced PM emissions will show benefits in the future.

Figure 3. Changes in Locomotive Model Distributions.



The freight volume passing through the yard also changed between these periods. Table 4 lists the percent change in the number of arriving and departing trains, locomotives, and trailing tons (a measure of freight volume). The number of trains and locomotives showed little change, however the trailing tons increased by approximately 15 percent, implying that the average train weight (and correspondingly, the required consist horsepower) increased. This is a result of the increased availability of high horsepower units in the UPRR fleet. A higher fraction of trains bypass the yard, either not stopping, or stopping only for crew changes.

Table 4. Percent Change in Yard Activity Levels from 12/1999 – 11/2000 to 5/2003 – 4/2004.

	Trains	**Locomotives**	**Trailing Tons**
Arrivals	-5.2%	-3.5%	--
Departures	-7.0%	-7.3%	--
Throughs (Bypassing the yard)	8.0%	6.8%	--
Total Arrivals and Departures	-0.3%	-0.9%	15.1%

The newer locomotive fleet also affected the level of load testing activity required. Table 5 lists the percent change in the number of load tests of different types, and the corresponding change in total locomotive testing time at idle, notch 1, and notch 8. The extended 30-minute post-maintenance tests were substantially reduced, and total hours of testing were reduced for the various throttle settings between 12 and 43 percent.

Table 5. Percent Change in Load Test Activity from 12/1999 – 11/2000 to 5/2003 – 4/2004.

10-Minute Tests	-18.9%
15-Minute Tests	14.6%
30-Minute Tests	-43.2%
Total Tests	-12.3%
Idling Hours	-20.6%
Notch 1 Hours	-43.2%
Notch 8 Hours	-12.0%

The combined net result of these changes is shown in Table 6. Between November 2000 and April 2003, total estimated PM emissions in the yard decreased by approximately 15 percent. Reductions in idling and movement emissions of about 20 percent were calculated, due to the combination of a newer, lower emitting locomotive fleet and the computer-controlled shutdown technologies (both retrofits and standard equipment on newer units). Hump and trim emissions were reduced by about 6 percent, and load testing emissions by about 14 percent.

Table 6. Emissions Changes from 12/1999 – 11/2000 to 5/2003 – 4/2004.

	Estimated Emissions (tons per year)		**Percent Change**
	12/1999 – 11/2000	**5/2003 – 4/2004**	
Idling and Movement of Trains	5.2	4.2	-20.3%
Idling and Movement of Consists	8.5	6.8	-20.2%
Testing	1.5	1.3	-14.1%
Hump and Trim	7.0	6.6	-5.7%
Total	22.3	18.9	-15.3%

CONCLUSIONS

Because of the unique features of each individual railyard, top-down methods (e.g., based only on tons of freight handled or number of arriving locomotives) cannot provide reliable estimates of railyard emissions. Yard-specific data are needed. In-yard activity patterns (and emissions) will vary between yards depending on factors such as: the type of yard (e.g., hump or flat switching classification yards, or intermodal facilities); the presence and capabilities of service tracks or locomotive repair shops; the types of freight handled; the location of the yard in the rail network; and yard configuration. The development of procedures for retrieving and analyzing activity data and locomotive characteristics for a specific railyard is a substantial improvement of alternatives based on top-down estimation. By obtaining disaggregate data for the range of specific activities occurring within railyards, it is possible to reliably estimate historical trends in emissions, as well as to evaluate the potential effects of operational changes and new technologies. Railyard operations cannot be treated in isolation, since these yards are only one component of complex national level systems. Nevertheless, the ability to assess the details of yard operations and their emissions provides an improved basis for environmental management decisions at both local and larger scales.

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KEY WORDS

Emission inventories
Locomotives
Railyards
Diesel

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APPENDIX A-7

SULFUR ADJUSTMENT CALCULATIONS

Appendix A-7

Development of Adjustment Factors for Locomotive DPM Emissions Based on Sulfur Content

Wong (undated) provides equations for estimating g/bhp-hr emission rates for 4-Stroke (GE) and 2-Stroke (EMD) locomotives. Rather than using these statistically derived estimates for absolute emissions when model- and notch-specific emission factors are available, we used these equations to develop *relative* emission rate changes for different sulfur levels. The basic form of the equation is

$$q = a \cdot S + b$$

Where,

q is the predicted g/bhp-hr emission rate of a locomotive at a specific throttle setting and sulfur content;

a and b are coefficients specific to a locomotive type (2- or 4-stroke) and throttle notch; and

S is the fuel sulfur content in ppm.

Thus, to calculate the emission adjustment factor for a specific fuel sulfur content, it is necessary to calculate the nominal emission rate q_0 for the baseline fuel sulfur content S_0, and the emission rate q_i for the fuel of interest with sulfur content S_i. This adjustment factor k_i is simply

$$k_i = 1 - \frac{(q_0 - q_i)}{q_0},$$

Where, q_0 and q_i are calculated using the equation above. Tables 1 and 2 give the values of the a and b coefficients for 4-stroke and 2-stroke locomotives. For throttle settings below notch 3, sulfur content is not expected to affect emission rates. The baseline emission rates from which actual emissions are estimated were derived from emission tests of different locomotive models. Although full documentation of fuels is not available for all of these tests, they are assumed to be representative of actual emissions of the different models running on 3,000 ppm sulfur EPA non-road Diesel fuel. For the purposes of modeling 2005 emissions, these factors are needed to adjust the baseline emission factors to emission factors representative of two fuels – 221 ppm and 2639 ppm. Table 3 shows the resulting correction factors for these two fuels by notch and engine type. To generate locomotive model-, throttle-, tier-, and fuel-specific emission factors, the base case (nominal 3,000 ppm S) emission factors in Table 4 were multiplied by the corresponding correction factors for throttle settings between notch 3 and notch 8.

Table 1 Sulfur Correction Coefficients for 4-Stroke Engines		
Throttle Setting	***a***	***b***
Notch 8	0.00001308	0.0967
Notch 7	0.00001102	0.0845
Notch 6	0.00000654	0.1037
Notch 5	0.00000548	0.1320
Notch 4	0.00000663	0.1513
Notch 3	0.00000979	0.1565

Table 2 Sulfur Correction Coefficients for 2-Stroke Engines		
Throttle Setting	***a***	***b***
Notch 8	0.0000123	0.3563
Notch 7	0.0000096	0.2840
Notch 6	0.0000134	0.2843
Notch 5	0.0000150	0.2572
Notch 4	0.0000125	0.2629
Notch 3	0.0000065	0.2635

Table 3

DPM Emission Adjustment Factors for Different Fuel Sulfur Levels

Throttle Setting	4-Stroke (GE)		2-Stroke (EMD)	
	2,639 ppm S	221 ppm S	2,639 ppm S	221 ppm S
Notch 8	0.9653	0.7326	0.9887	0.9131
Notch 7	0.9662	0.7395	0.9889	0.9147
Notch 6	0.9809	0.8526	0.9851	0.8852
Notch 5	0.9867	0.8974	0.9821	0.8621
Notch 4	0.9860	0.8924	0.9850	0.8844
Notch 3	0.9810	0.8536	0.9917	0.9362

Table 4
Base Case Locomotive Diesel Particulate Matter Emission Factors (g/hr)
(3,000 PPM Sulfur Assumed)

Model Group	Tier	Throttle Setting										Source[1]
		Idle	DB	N1	N2	N3	N4	N5	N6	N7	N8	
Switchers	N	31.0	56.0	23.0	76.0	138.0	159.0	201.0	308.0	345.0	448.0	ARB and ENVIRON
GP-3x	N	38.0	72.0	31.0	110.0	186.0	212.0	267.0	417.0	463.0	608.0	ARB and ENVIRON
GP-4x	N	47.9	80.0	35.7	134.3	226.4	258.5	336.0	551.9	638.6	821.3	ARB and ENVIRON
GP-50	N	26.0	64.1	51.3	142.5	301.5	311.2	394.0	663.8	725.3	927.8	ARB and ENVIRON
GP-60	N	48.6	98.5	48.7	131.7	284.5	299.4	375.3	645.7	743.6	941.6	ARB and ENVIRON
GP-60	0	21.1	25.4	37.6	75.5	239.4	352.2	517.8	724.8	1125.9	1319.8	KCS7332
SD-7x	N	24.0	4.8	41.0	65.7	156.8	243.1	321.1	374.8	475.2	589.2	ARB and ENVIRON
SD-7x	0	14.8	15.1	36.8	61.1	230.4	379.8	450.8	866.2	1019.1	1105.7	ARB and ENVIRON
SD-7x	1	29.2	31.8	37.1	66.2	219.3	295.9	436.7	713.2	783.2	847.7	NS2630[3]
SD-7x	2	55.4	59.5	38.3	134.2	271.7	300.4	335.2	551.5	672.0	704.2	UP8353[3]
SD-90	0	61.1	108.5	50.1	99.1	255.9	423.7	561.6	329.3	258.2	933.6	EMD 16V265H
Dash 7	N	65.0	180.5	108.2	121.2	359.5	327.7	331.5	299.4	336.7	420.0	ARB and ENVIRON
Dash 8	0	37.0	147.5	86.0	133.1	291.4	293.2	327.7	373.5	469.4	615.2	ARB and ENVIRON
Dash 9	N	32.1	53.9	54.2	108.1	219.9	289.1	370.6	437.7	486.1	705.7	SWRI 2000
Dash 9	0	33.8	50.7	56.1	117.4	229.2	263.8	615.9	573.9	608.0	566.6	Average of ARB & CN2508[1]
Dash 9	1	16.9	88.4	62.1	140.2	304.0	383.5	423.9	520.2	544.6	778.1	CSXT595[2]
Dash 9	2	7.7	42.0	69.3	145.8	304.3	365.0	405.2	418.4	513.5	607.5	BNSF 7736[2]
C60-A	0	71.0	83.9	68.6	78.6	277.9	234.1	276.0	311.4	228.0	362.7	ARB and ENVIRON

Notes:

1. Except as noted below, the base emission rates were originally developed for the ARB *Roseville Rail Yard Study* (October 2004)
2. Base emission rates provided by ENVIRON as part of the BNSF analyses for the Railyard MOU (Personal communication from Chris Lindhjem to R. Ireson, 2006) based on data produced in the AAR/SwRI Exhaust Plume Study (Personal communication from Steve Fritz to C. Lindhjem, 2006).
3. Base SD-70 emission rates taken from data produced in the AAR/SwRI Exhaust Plume Study (Personal communication from Steve Fritz to R. Ireson, 2006).

OFFROAD Modeling Change Technical Memo

SUBJECT: Changes to the Locomotive Inventory

LEAD: Walter Wong

Summary

The statewide locomotive emission inventory has not been updated since 2002. Using the Booz-Allen Hamilton's (BAH) study (Locomotive Emission Study) published in 1992 as a guideline (summary of inventory methodology can be found in Appendix A), staff updated the locomotive inventory.

The history of locomotive emission inventory updates began in 1992 using the results from the BAH report as the baseline inventory. In 2003, staff began updating the emissions inventory by revising the growth assumptions used in the inventory. The revised growth factors were incorporated into the ARB's 2003 Almanac Emission Inventory. With additional data, staff is proposing further update to the locomotive inventory to incorporate fuel correction factors, add passenger train data and Class III locomotives. Changes from updated locomotive activity data have made a significant impact on the total inventory (see Table 1).

Table 1. Impact of Changes on Statewide Locomotive Inventory

	Pre 2003 ARB Almanac Inventory (tons/day)			Revised Inventory (tons/day)			Difference (tons/day)		
Year	HC	NOx	PM	HC	NOx	PM	HC	NOx	PM
1987	7.2	158.8	3.6	7.2	158.8	3.6	0.0	0.0	0.0
2000	7.2	144.8	2.8	9.8	207.2	4.7	2.6	62.4	1.9
2010	7.2	77.8	2.8	9.5	131.9	4.2	2.3	54.1	1.4
2020	7.2	77.8	2.8	9.4	134.6	4.1	2.2	56.8	1.3

Reasons For Change

During the 2003 South Coast's State Implementation Plan (SIP) development process, industry consultants approached Air Resources Board (ARB) staff to refine the locomotive emissions inventory. Specifically, their concerns were related to the growth factors and fuel correction factors used in the inventory calculations. This document outlines how the locomotive emissions inventory was updated and the subsequent changes made to address industry's concerns.

Background : Baseline 1987 Locomotive Emissions Inventory (BAH report)

Locomotive operations can be characterized by the type of service performed. For emission inventory purposes, locomotives are classified into five different service types as defined in BAH's report.

Line-haul/intermodal – Intermodal locomotives generally operate at higher speeds and with higher power than other types and incorporate modern, high-speed engines.

Mixed/bulk – Mixed locomotives are the most common and operate with a wide range of power. They also perform line-haul duties.

Local/Short Haul – Local locomotives perform services that are a mixture of mixed freight and yard service. They operate with lower power and use older horsepower engines.

Yard/Switcher – Yard operations are used in switching locomotives and characterized by stop and start type movements. They operate with smaller engines and have the oldest locomotive engines.

Passenger – Passenger locomotives are generally high speed line haul type operations.

Categories of railroads are further explained by a precise revenue-based definition found in the regulations of the Surface Transportation Board (STB). Rail carriers are grouped into three classes for the purposes of accounting and reporting:

Class I –Carriers with annual operating revenues of $250 million or more

Class II – Carriers with annual operating revenues of less than $250 million but in excess of $20 million

Class III – Carriers with annual operating revenues of less than $20 million or less, and all switching companies regardless of operating revenues.

The threshold figures are adjusted annually for inflation using the base year of 1991.

The 1987 locomotive inventory as shown in Table 2 is taken from the BAH report prepared for the ARB entitled "Locomotive Emission Study" completed in 1992 (http://www.arb.ca.gov/app/library/libcc.php). Information was gathered from many sources including ARB, the South Coast Air Quality Management District, the California Energy Commission, the Association of American Railroads (AAR), locomotive and large engine manufacturers, and Southwest Research Institute. Railroad companies, such as Southern Pacific, Union Pacific, and Atchison, Topeka and Santa Fe (ATSF), provided emission factors, train operation data, and throttle position profiles for trains operating in their respective territories. Southwest Research Institute provided emission test data.

Table 2. 1987 Locomotive Inventory in Tons Per Day, Statewide, BAH report

TYPE	HC	CO	NOX	PM	SOX
Line-Haul/Intermodal	3.97	12.89	86.21	1.97	6.36
Short-Haul/Local	0.96	3.06	21.30	0.46	1.59
Mixed	1.51	4.85	37.34	0.81	2.76
Passenger	0.10	0.22	3.24	0.07	0.30
Yard/Switcher	0.62	1.57	10.69	0.24	0.58
Total	7.16	22.59	158.78	3.55	11.59

The assumed average fuel sulfur content is 2700 parts per million (ppm) obtained from the BAH report.

Current Growth Estimates

Prior to the 2003 South Coast SIP update, growth factors were based on employment data in the railroad industry. Staff believes that the use of historic employment data, which translates to a decline in emissions in future years, may be masking actual positive growth in locomotive operations. It may be assumed that the number of employees is declining due to increased efficiency.

Changes to the Locomotive Inventory

Summary of Growth in Emission Based on BAH Report

Growth is estimated based on train operation type and by several operating characteristics.

> Increased Rail Lube and Aerodynamics – this arises from reduction in friction and will help reduce power requirements.

Introduction of New Locomotives – older locomotive units will be replaced by newer models.

Changes in Traffic Level – the increase or decrease in railroad activity

In the BAH report, projected emission estimates for years 2000 and 2010 were based on the factors shown in Tables 3 and 4. A substantial part of the locomotive emission inventory forecast is based upon projections of rail traffic levels. BAH projected future rail traffic level as a function of population and economic growth in the state. BAH also projected growth in emission only to 2010.

Table 3. Changes in Emissions from 1987-2000 (Exhibit 4 p. 11 of the 8/92 Locomotive Emission Study Supplement) (1987 Base Year)

Train Operation Type	Increased Rail Lube and Aerodynamics	Introduction of New Locomotive	Changes in Traffic Levels	Cumulative Net Growth in Emissions
Intermodal	-7.0%	-8.0%	17.0%	2.0%
Mixed & Bulk	-7.0%	-8.0%	2.0%	-13.0%
Local	-3.0%	-3.0%	-2.0%	-8.0%
Yard	0.0%	-1.0%	-25.0%	-26.0%
Passenger	-7.0%	-8.0%	10.0%	-5.0%

Table 4. Changes in Emissions from 2001-2010 (Exhibit 4 p. 11 of the 8/92 Locomotive Emission Study Supplement) (2000 Base Year)

Train Operation Type	Increased Rail Lube and Aerodynamics	Improved Dispatching and Train Control	Introduction of New Locomotive	Changes in Traffic Levels	Cumulative Net Growth in Emissions
Intermodal	-2.0%	-3.0%	-8.0%	25.0%	12.0%
Mixed & Bulk	-2.0%	-3.0%	-8.0%	0.0%	-13.0%
Local	-1.0%	0.0%	-12.0%	-10.0%	-23.0%
Yard	0.0%	0.0%	-10.0%	-15.0%	-25.0%
Passenger	-2.0%	-3.0%	-8.0%	15.0%	2.0%

BAH added “Improved Dispatching and Train Control” to differentiate these impacts from the “Increased Rail Lubing” which helps to improve fuel efficiency from locomotive engines. Since train control techniques are emerging from the signal company research work, these assumed changes will not impact emission until year 2000.

Based on industry's input, staff recommends several changes to the locomotive emissions inventory. These include modifying growth factors, making adjustments to control factors reflecting the U. S. EPA regulations that went into effect in year 2000, incorporating fuel correction factors, adding smaller class III railroad and industrial locomotive, and updating passenger data.

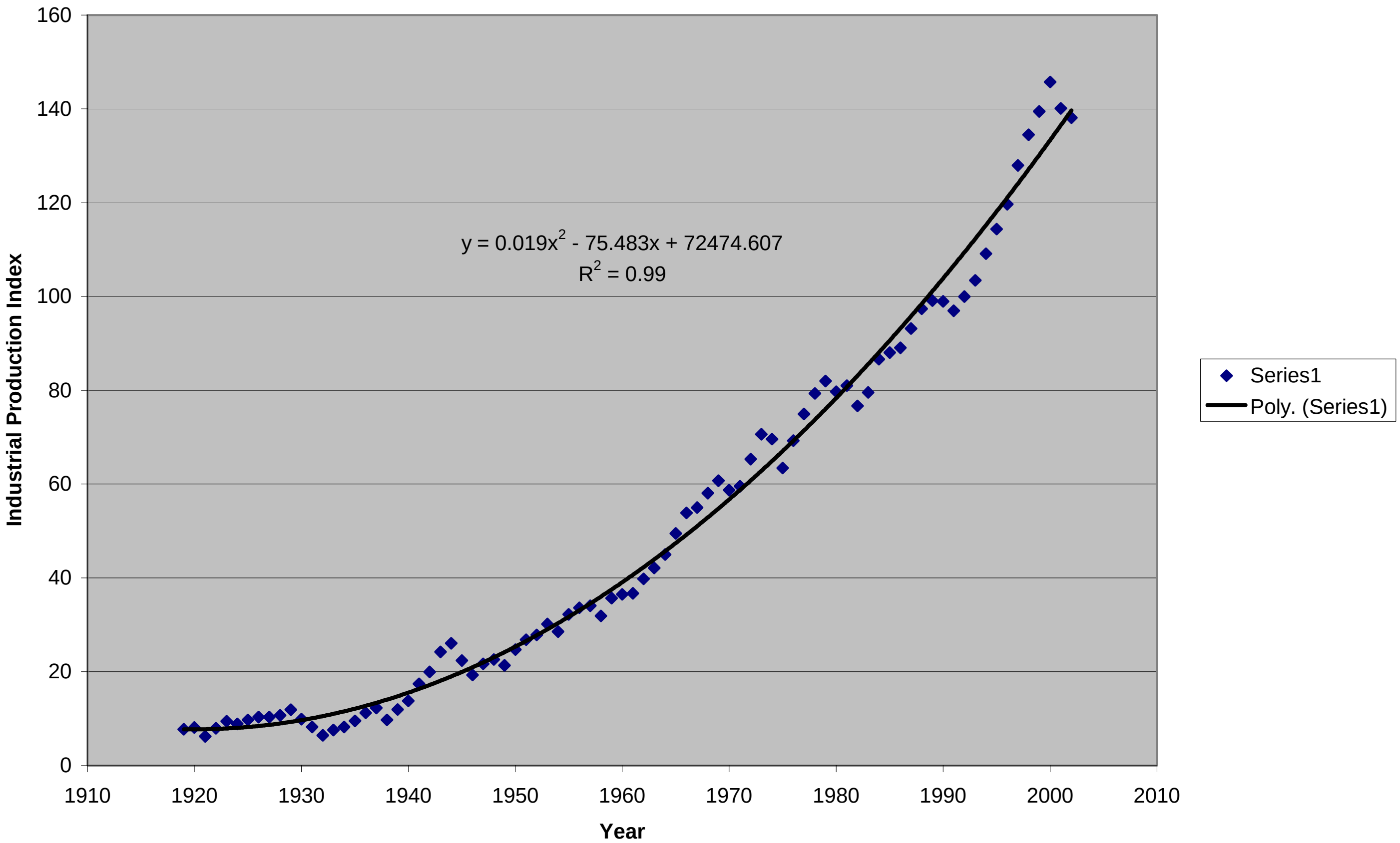
Revised Growth in Emissions

Staff revised the growth factors for locomotives based on new data that better reflect locomotive operations. This includes U.S. industrial production and various railroad statistics available from the AAR.

Based on historic data recently obtained from U.S. industrial productions and the AAR, the changes in traffic levels were revised. A better estimate for changes in traffic levels for locomotives can be made to the line-haul class of railroad, which are the intermodal and mixed and bulk type of locomotives, using industrial production and AAR's data.

Industrial production data is considered to be a surrogate for changes in traffic levels of the line-haul locomotive. It is assumed that railroad activity would increase in order to accommodate the need to move more product. Industrial production is the total output of U.S. factories and mines, and is a key economic indicator released monthly by the Federal Reserve Board. U.S. industrial production historical data from 1920 to 2002 was obtained and analyzed from government sources. Figure 1 shows the historical industrial production trend (Source : http://www.research.stlouisfed.org/fred2/series/INDPRO/3/Max). Statistical analysis was used to derive a polynomial equation to fit the data.

Figure 1. Long-term Industrial Production



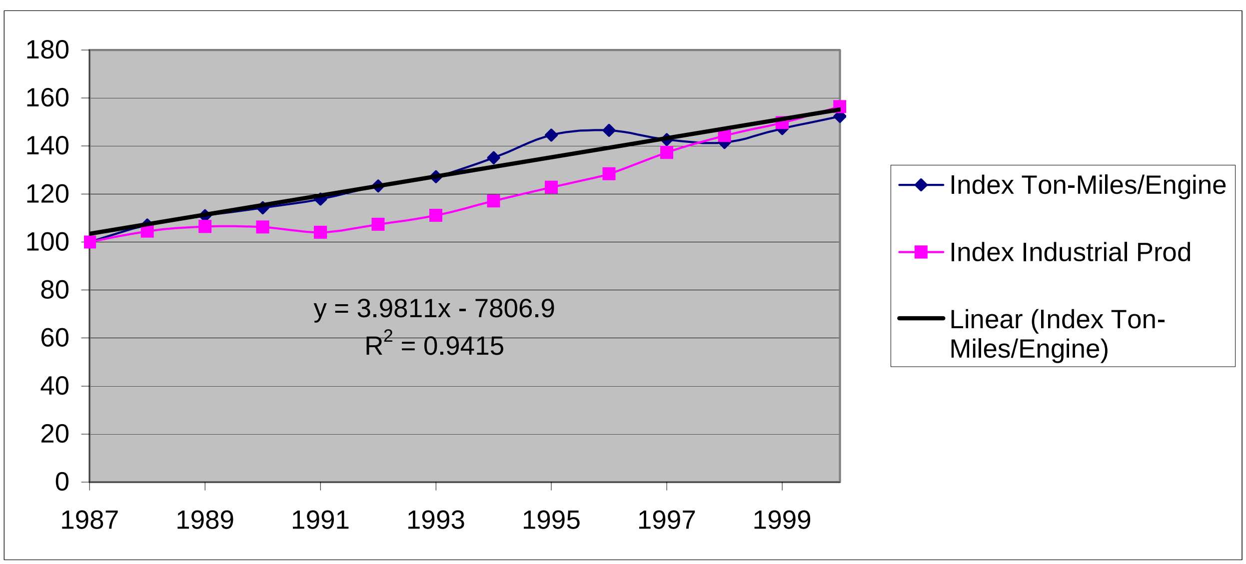
Another surrogate for growth is net ton-miles per engine. Consequently, staff analyzed railroad data from the AAR's Railroad Facts booklet (2001 edition). The booklet contains line-haul railroad statistics including financial status, operation and employment data, and usage profiles. Revenue ton-mile and locomotives in service data from the booklet were used to compute the net ton-miles per engine as shown in Table 5.

Table 5. Revenue Ton-Miles and Ton-Miles/Engine (AAR Railroad Facts 2001 edition)

Year	Locomotive Diesel in Service (US)	Revenue Ton-Miles	Ton-Miles/Engine
1987	19,647	943,747	48.04
1988	19,364	996,182	51.45
1989	19,015	1,013,841	53.32
1990	18,835	1,033,969	54.90
1991	18,344	1,038,875	56.63
1992	18,004	1,066,781	59.25
1993	18,161	1,109,309	61.08
1994	18,496	1,200,701	64.92
1995	18,810	1,305,688	69.41
1996	19,267	1,355,975	70.38
1997	19,682	1,348,926	68.54
1998	20,259	1,376,802	67.96
1999	20,254	1,433,461	70.77
2000	20,026	1,465,960	73.20

As shown in Figure 2, there is a relatively good correlation between net ton-miles per engine growth and industrial production. Because net ton-miles per engine data are compiled by the railroad industry and pertains directly to the railroad segment, staff believes that net ton-miles per engine will better characterize future traffic level changes.

Figure 2. Ton-miles/Engine vs. Industrial Production (index base year = 1987)



The ton-miles/engine data were projected to calculate the future growth rate of traffic level using a linear equation.

Staff also made changes to the "Increased Rail Lube and Aerodynamics" assumption shown in Tables 3 and 4. Rail lubing does not benefit the idling portion of locomotive activity. Since idling contributes 20% of the weighting in the line-haul duty cycle, staff reduced the rail lubing benefit by 20%. Meanwhile, improved dispatching and train control is assumed only to reduce engine idling. Therefore, staff reduced the improved dispatching benefit by 80%.

The benefit of the introduction of new locomotives to the fleet was decreased from the original BAH assumption. BAH assumed 50% penetration of the new engines by 2000. Literature research suggests that the new engines accounted for only about 34% of the fleet in 2000 (www.railwatch.com, http://utahrails.net/all-time/modern-index.php). These new engines are assumed to be 15% cleaner. Therefore, the benefit from new locomotive engines has been reduced to 5% (34% x 15% = 5% reduction).

Tables 6, 7, and 8 present the revised growth factors to be used to project the baseline (1987) locomotive emissions inventory into the future.

Table 6. ARB Revised Growth 1987-2000, ARB's 2003 Almanac Emission Inventory

Train Operation Type	Increased Rail Lube and Aerodynamics	Introduction of New Locos	Population Increase	Changes in Traffic Levels	Cumulative Net Growth in Emissions	Annual Growth
Intermodal	-5.6%	-5.1%	1.9%	50.0%	41.2%	2.69%
Mixed & Bulk	-5.6%	-5.1%	1.9%	50.0%	41.2%	2.69%
Local	-2.4%	0%	0%	-2.0%	-4.4%	-0.35%
Yard	0.0%	0%	0%	-25.0%	-25.0%	-2.19%
Passenger	-5.6%	0%	1.9%	10.0%	6.3%	0.47%

The benefit of new locomotives with cleaner burning engines is accounted for in the control factor from EPA's regulation beginning in 2001, which takes into account introduction of new locomotive engines meeting Tier I and Tier II standards.

Table 7. ARB Revised Growth 2001-2010 (2000 Base Year, ARB's 2003 Almanac Emission Inventory)

Train Operation Type	Increased Rail Lube and Aerodynamics	Improved Dispatching and Train Control	Changes in Traffic Levels	Cumulative Net Growth in Emissions	Annual Growth
Intermodal	-1.6%	-0.6%	22.5%	20.3%	1.87%
Mixed & Bulk	-1.6%	-0.6%	22.5%	20.3%	1.87%
Local	-0.8%	-0.6%	-10.0%	-11.4%	-1.20%
Yard	0.0%	0.0%	-15.0%	-15.0%	-1.61%
Passenger	-1.6%	0.0%	15.0%	13.4%	1.27%

Table 8. ARB Revised Growth 2010-2020 (2010 Base Year, ARB's 2003 Almanac Emission Inventory)

Train Operation Type	Increased Rail Lube and Aerodynamics	Improved Dispatching and Train Control	Changes in Traffic Levels	Cumulative Net Growth	Annual Growth
Intermodal	0.0%	0.0%	18.0%	18.0%	1.67%
Mixed & Bulk	0.0%	0.0%	18.0%	18.0%	1.67%
Local	0.0%	0.0%	0.0%	0.0%	0.00%
Yard	0.0%	0.0%	0.0%	0.0%	0.00%
Passenger	0.0%	0.0%	0.0%	0.0%	0.00%

In Table 8, staff assumes no benefit from aerodynamics and improved train controls. Staff seeks guidance from industry as to their input regarding future benefits.

Table 9. Revised Growth in Emissions (Base Year 1987)

Year	Intermodal	Mixed & Bulk	Local	Yard	Passenger
1987	1.00	1.00	1.00	1.00	1.00
1988	1.03	1.03	1.00	0.98	1.00
1989	1.05	1.05	0.99	0.96	1.01
1990	1.08	1.08	0.99	0.94	1.01
1991	1.11	1.11	0.99	0.92	1.02
1992	1.14	1.14	0.98	0.90	1.02
1993	1.17	1.17	0.98	0.88	1.03
1994	1.20	1.20	0.98	0.86	1.03
1995	1.24	1.24	0.97	0.84	1.04
1996	1.27	1.27	0.97	0.82	1.04
1997	1.30	1.30	0.97	0.80	1.05
1998	1.34	1.34	0.96	0.78	1.05
1999	1.38	1.38	0.96	0.77	1.06
2000	1.41	1.41	0.96	0.75	1.06
2001	1.44	1.44	0.94	0.74	1.08
2002	1.47	1.47	0.93	0.73	1.09
2003	1.49	1.49	0.92	0.71	1.10
2004	1.52	1.52	0.91	0.70	1.12
2005	1.55	1.55	0.90	0.69	1.13
2006	1.58	1.58	0.89	0.68	1.15
2007	1.61	1.61	0.88	0.67	1.16
2008	1.64	1.64	0.87	0.66	1.18
2009	1.67	1.67	0.86	0.65	1.19
2010	1.70	1.70	0.85	0.64	1.21
2011	1.73	1.73	0.85	0.64	1.21
2012	1.76	1.76	0.85	0.64	1.21
2013	1.79	1.79	0.85	0.64	1.21
2014	1.81	1.81	0.85	0.64	1.21
2015	1.85	1.85	0.85	0.64	1.21
2016	1.88	1.88	0.85	0.64	1.21
2017	1.91	1.91	0.85	0.64	1.21
2018	1.94	1.94	0.85	0.64	1.21
2019	1.97	1.97	0.85	0.64	1.21
2020	2.00	2.00	0.85	0.64	1.21

Control Factors for U.S. EPA regulation

In December 1997, the U.S. EPA finalized the locomotive emission standard regulation. The regulatory support document lists the control factors used (http://www.epa.gov/otaq/regs/nonroad/locomotv/frm/locorsd.pdf). Staff modified the control factors to incorporate the existing memorandum of understanding (http://www.arb.ca.gov/msprog/offroad/loco/loco.htm) between the South Coast AQMD and the railroads that operate in the region. Previously, one control factor was applied statewide. In the revised emissions inventory starting in 2010, a lower control factor reflecting the introduction of lower emitting locomotive engines in the SCAB region was applied. Tables 10 and 11 show the revised control factors. Road hauling definition as used by U.S. EPA applies to the line-haul/intermodal, mixed, and local/short haul train type in the emissions inventory.

Table 10. Revised Statewide Control Factors

Year	State Road Hauling HC	State Road Hauling NOx	State Road Hauling PM	State Switcher HC	State Switcher NOx	State Switcher PM	State Passenger HC	State Passenger NOx	State Passenger PM
1999	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
2000	1.00	0.99	1.00	1.00	1.00	1.00	1.00	1.00	1.00
2001	1.00	0.95	1.00	1.00	1.00	1.00	1.00	1.00	1.00
2002	1.00	0.88	1.00	1.00	0.98	1.00	1.00	0.98	1.00
2003	1.00	0.82	1.00	1.00	0.97	1.00	1.00	0.96	1.00
2004	1.00	0.75	1.00	1.00	0.95	1.00	1.00	0.94	1.00
2005	0.96	0.68	0.96	0.99	0.93	0.99	0.98	0.92	0.98
2006	0.92	0.62	0.92	0.99	0.91	0.99	0.96	0.90	0.96
2007	0.89	0.59	0.89	0.98	0.89	0.98	0.94	0.83	0.94
2008	0.87	0.57	0.86	0.98	0.87	0.97	0.92	0.76	0.92
2009	0.84	0.55	0.84	0.97	0.85	0.97	0.91	0.69	0.90
2010	0.82	0.54	0.81	0.96	0.83	0.96	0.89	0.62	0.88
2011	0.81	0.53	0.80	0.96	0.81	0.95	0.87	0.57	0.87
2012	0.80	0.53	0.79	0.95	0.79	0.94	0.85	0.56	0.85
2013	0.79	0.52	0.78	0.94	0.77	0.93	0.83	0.54	0.83
2014	0.77	0.51	0.76	0.94	0.75	0.93	0.82	0.53	0.81
2015	0.76	0.50	0.75	0.93	0.73	0.92	0.80	0.52	0.79
2016	0.75	0.50	0.74	0.92	0.71	0.91	0.78	0.51	0.77
2017	0.74	0.49	0.72	0.91	0.70	0.90	0.76	0.50	0.75
2018	0.73	0.48	0.71	0.90	0.69	0.89	0.74	0.49	0.73
2019	0.71	0.48	0.70	0.89	0.68	0.88	0.73	0.48	0.71
2020+	0.70	0.47	0.69	0.89	0.67	0.87	0.71	0.47	0.69

Table 11. Revised SCAB Control Factors

Year	SCAB Road Hauling HC	SCAB Road Hauling NOx	SCAB Road Hauling PM	SCAB Switcher HC	SCAB Switcher NOx	SCAB Switcher PM
1999	1.00	1.00	1.00	1.00	1.00	1.00
2000	1.00	0.99	1.00	1.00	1.00	1.00
2001	1.00	0.95	1.00	1.00	1.00	1.00
2002	1.00	0.88	1.00	1.00	0.98	1.00
2003	1.00	0.82	1.00	1.00	0.97	1.00
2004	1.00	0.75	1.00	1.00	0.95	1.00
2005	0.96	0.68	0.96	0.99	0.93	0.99
2006	0.92	0.62	0.92	0.99	0.91	0.99
2007	0.89	0.59	0.89	0.98	0.89	0.98
2008	0.87	0.57	0.86	0.98	0.87	0.97
2009	0.84	0.55	0.84	0.97	0.85	0.97
2010	0.82	0.36	0.81	0.96	0.36	0.96
2011	0.81	0.36	0.80	0.96	0.36	0.95
2012	0.80	0.36	0.79	0.95	0.36	0.94
2013	0.79	0.36	0.78	0.94	0.36	0.93
2014	0.77	0.36	0.76	0.94	0.36	0.93
2015	0.76	0.36	0.75	0.93	0.36	0.92
2016	0.75	0.36	0.74	0.92	0.36	0.91
2017	0.74	0.36	0.72	0.91	0.36	0.90
2018	0.73	0.36	0.71	0.90	0.36	0.89
2019	0.71	0.36	0.70	0.89	0.36	0.88
2020+	0.70	0.36	0.69	0.89	0.36	0.87

Addition of Class III Locomotive and Industrial/Military Locomotive

The annual hours operated by the class III railroads are shown in Table 12. The results were tabulated from ARB Stationary Source Division's (SSD) survey (http://www.arb.ca.gov/regact/carblohc/carblohc.htm) conducted to support regulation with regards to ARB ultra-clean diesel fuel.

Table 12. Short-Haul and Switcher Annual Hours for Class III Railroads

Air Basin	Operations	Population	Annual Hours Operated
Mountain Counties	SW	2	10214
Mojave Desert	L	10	27440
North Coast	L	3	5700
North Central Coast	L	1	1332
	SW	3	3996
Northeast Plateau	L	5	9892
South Coast	SW	21	75379
South Central Coast	L	5	3200
San Diego	L	4	5000
San Francisco	L	8	31600
	SW	4	5059
San Joaquin Valley	L	29	68780
	SW	19	72248
Sacramento Valley	L	6	11400
Total		120	331240

L = local short-haul, SW = switcher

The short-haul and switcher emission rate are derived from BAH report. The report cites studies from testing done at EPA and Southwest Research Institute.

Table 13. Short-Haul and Switcher Emission Rate

Emission Rate	Short-Haul (g/bhp-hr)	Switcher (g/bhp-hr)
HC	0.38	0.44
CO	1.61	1.45
NOx	12.86	15.82
PM	0.26	0.28
SOx	0.89	0.90
Fuel Rate (lb/hr)	120.00	60.00

Table 14. Statewide Summary of Industrial Locomotives

Air Basin	Number of Locomotives	Avg. HP	Avg. Age
Mojave Desert	9	1,138	56
Others	11	587	54
San Francisco	11	525	54
San Joaquin Valley	38	1,176	54
South Coast	24	1,290	55
TOTALS	93	1,055	55

Table 15. Statewide Summary of Military Locomotives

Air Basin	Number of Locomotives	Avg. HP	Avg. Age
Mojave Desert	7	900	50
Northeast Plateau	2	1,850	50
Sacramento Valley	1	500	50
San Diego	7	835	50
San Francisco	4	1525	47.5
San Joaquin Valley	2	400	50
South Central Coast	1	500	50
TOTALS	24	930	49.6

The data from the survey provides a reasonable depiction of railroad activities in 2003. To forecast and backcast, an assumption was made to keep the data constant and have no growth. More research is needed to quantify the growth projections of smaller, local railroad activities.

Update to Passenger Trains

ARB's survey of intrastate locomotives included passenger agency trains that operated within the state. Staff attempted to reconcile the survey results by calculating the operation schedules posted by the operating agency to obtain hours of operation and mileage information. The results of the survey and calculated operating hours were comparable. Table 16 lists the calculated annual hours operated and miles traveled used to estimate emissions.

Table 16. Passenger Trains Annual Miles and Hours

Air Basin	Annual Miles Operated	Annual Hours Operated
South Coast	3,700,795	92,392
South Central Coast	151,864	4,020
San Diego	914,893	25,278
San Francisco	2,578,862	77,944
San Joaquin Valley	674,824	17,313
Sacramento Valley	635,384	20,058
Total	8,656,621	237,006

The passenger train emission rate is derived from testing done at SWRI on several passenger locomotives.

Table 17. Passenger Train Emission Rate

Emission Rate	Passenger Train (g/bhp-hr)
HC	0.50
CO	0.69
Nox	12.83
PM	0.36
Sox	0.90
Fuel Rate (lb/hr)	455.00

Fuel Correction Factors

Aromatics

Previous studies quantifying the effects of lowering aromatic content are listed in Table 18. These studies tested four-stroke heavy-duty diesel engines (HDD). Although staff would have preferred to analyze data from tests performed on various locomotive engines to determine the effects of lower aromatics, these HDD tests are the best available resources to determine the fuel corrections factors due to lower aromatics.

Table 18. Effect of Lowering Aromatic Volume on PM Emission

STUDY	**Sulfur (ppm)**	**Aromatics (Volume %)**	**PM Reduction (%)**
Chevron (1984)	2,800	31	Baseline
Chevron (1984)	500	31	23.8
Chevron (1984)	500	20	32.2
Chevron (1984)	500	15	36.0
Chevron (1984)	500	10	39.9
CRC-SWRI (1988)	500	31	Baseline
CRC-SWRI (1988)	500	20	9
CRC-SWRI (1988)	500	15	13
CRC-SWRI (1988)	500	10	17

Source : http://www.arb.ca.gov/fuels/diesel/diesel.htm

Using a linear regression of the data from the Table 18, the PM reduction from a change in aromatic content can be described as :

<u>4-Stroke Engine</u>
PM reduction = [(Difference in Aromatic Volume) * 0.785 + 0.05666]/100

For 2-Stroke engines, staff used test data from SWRI's report published in 2000 entitled "Diesel Fuel Effects on Locomotive Exhaust Emissions" to estimate indirectly the potential PM reduction for 2-Stroke engines due to lower aromatics. Table 19 lists the summary of the test results.

Table 19. SWRI 2000 Study Summary Results

Locomotive Engine	Aromatic Changes (Volume %)	PM Difference (g/bhp-hr)	PM % Difference
4 Stroke	28.35 to 21.84	0.080	37.6%
2 Stroke	28.35 to 21.84	0.056	14.1%

Staff assumes that PM emission reduction from 2-Stroke engine will have a factor of 0.38 (14.1%/37.6%) to the 4-Stroke engine PM emission reduction.

Currently, the baseline locomotive emissions inventory assumes an aromatic total volume percent of 31%. Table 21 describes the changes in PM emission due to changes in total volume percent of aromatics.

Table 20. Examples of PM Reductions Due to Changes in Aromatic Total Volume Percent

Aromatic Volume Percent		PM Reduction	PM Reduction	PM Reduction
From	To	2 Stroke	4 Stroke	Composite
31	28	0.9%	2.4%	1.3%
31	19	3.6%	9.5%	5.1%
31	10	6.3%	16.5%	8.9%

*composite is 75% 2 Stroke Engine and 25% 4 Stroke Engine

Table 21,Table 22, and Table 23 show the PM emission reduction for the different type of fuels used in the state.

Table 21. PM Emission Percent Change of Line-Haul Due to Aromatics, Statewide

Calendar Year	CARB Aromatic Volume (%)	EPA Aromatic Volume (%)	Off-road Aromatic Volume (%)	Weighted Aromatic Volume (%)	PM Emission Percent Change
1992	31	31	31	31.00	0.00
1993	10	31	31	31.00	0.00
1994	10	31	31	31.00	0.00
1995	10	31	31	31.00	0.00
1996	10	31	31	31.00	0.00
1997	10	31	31	31.00	0.00
1998-2001	10	31	31	30.18	-0.004
2002-2006	10	31	31	29.05	-0.009
2007+	10	31	31	29.05	-0.009

Table 22. Class I Line Haul Weighted Aromatic Volume Percent by Air Basin

Interstate Locomotive	Air Basin	1993-2001 Weighted Aromatic	2002+ Weighted Aromatic
		Volume Percent	Volume Percent
Class I Line Haul	SCC	31.0	31.0
	MC	31.0	26.6
	MD	30.0	29.8
	NEP	31.0	27.9
	SC	31.0	31.0
	SF	28.6	23.1
	SJV	29.1	29.4
	SS	31.0	31.0
	SV	31.0	27.4

Table 23. PM Emission Reduction from Intrastate Locomotives Due to Aromatics by Air Basin, 1993+

Intrastate Locomotive	Air Basin	CARB Aromatic Volume Percent	EPA Aromatic Volume Percent	Nonroad Aromatic Volume Percent	Weighted Aromatic Volume Percent	PM Emission Reduction Percent
Class I Local/Switcher	SC	10	31	31	29.0	-0.9%
	SJV	10	31	31	25.2	-2.4%
	MD	10	31	31	31.0	0.0%
	BA	10	31	31	13.9	-7.2%
	SD	10	31	31	13.2	-7.5%
	SV	10	31	31	13.2	-7.5%
	SCC	10	31	31	13.2	-7.5%
Class III Local/Switcher	SC	10	31	31	31.0	0.0%
	SJV	10	31	31	18.6	-5.2%
	MD	10	31	31	10.0	-8.8%
	BA	10	31	31	10.0	-8.8%
	SD	10	31	31	10.0	-8.8%
	SV	10	31	31	10.0	-8.8%
	SCC	10	31	31	10.0	-8.8%
	NEP	10	31	31	26.6	-1.9%
	MC	10	31	31	31.0	0.0%
	NC	10	31	31	10.0	-8.8%
	NCC	10	31	31	10.0	-8.8%
Industrial/Military	SC	10	31	31	24.0	-3.0%
	SJV	10	31	31	24.0	-3.0%
	MD	10	31	31	24.0	-3.0%
	BA	10	31	31	24.0	-3.0%
	NEP	10	31	31	24.0	-3.0%
	SD	10	31	31	24.0	-3.0%
	SV	10	31	31	24.0	-3.0%
	SCC	10	31	31	24.0	-3.0%
Passenger	SC	10	31	31	10.8	-8.5%
	SJV	10	31	31	10.0	-8.8%
	BA	10	31	31	10.0	-8.8%
	SD	10	31	31	10.0	-8.8%
	SV	10	31	31	10.0	-8.8%
	SCC	10	31	31	12.1	-8.0%

Source : Fuel Estimate from http://www.arb.ca.gov/regact/carblohc/carblohc.htm

Sulfur

Currently, the baseline locomotive emissions inventory assumes an average fuel sulfur content of 2700 ppm. Industry has provided information on the sulfur content of the fuel that is currently being used by intrastate locomotives. Together with industry data and prior locomotive tests, staff believes a fuel correction factor should be incorporated into the model.

Table 24 shows the test data collected by the ARB, U.S. EPA, and others, where locomotive engines were tested on different fuel sulfur levels.

Table 24. Locomotive Engine Test with Different Sulfur Levels

Locomotive Engine	Fuel Properties Sulfur Content	Percent Change PM	Percent Change NOX	Percent Change CO	Percent Change HC	Source
EMD 12-645E3B	100/3300ppm	-0.29	-0.06	0.17	0.07	Fritz, 1991
GE DASH9-40C	330/3150ppm	-0.43	-0.07	-0.05	-0.18	Fritz (1995, EPA/SWRI)
MK 5000C	330/3150ppm	-0.71	-0.03	-0.03	-0.07	Fritz (1995, EPA/SWRI)
EMD 16-710G3B, SD70MAC	330/3150ppm	-0.38	-0.08	-0.30	-0.01	Fritz (1995, EPA/SWRI)
EMD SD70MAC	50/330ppm	-0.03	-0.04	0.07	0.01	Fritz (ARB/AAR, 2000)
EMD SD70MAC	50/4760ppm	-0.16	-0.06	0.08	0.03	Fritz (ARB/AAR, 2000)
EMD SD70MAC	330/4760ppm	-0.13	-0.03	0.01	0.01	Fritz (ARB/AAR, 2000)
GE DASH9-44CW	50/330ppm	-0.03	-0.03	-0.01	-0.04	Fritz (ARB/AAR, 2000)
GE DASH9-44CW	50/4760ppm	-0.39	-0.07	-0.02	0.02	Fritz (ARB/AAR, 2000)
GE DASH9-44CW	330/4760ppm	-0.38	-0.04	-0.02	0.06	Fritz (ARB/AAR, 2000)
GE DASH9-44CW	50/3190ppm	-0.27	-0.05	-0.03	0.01	Fritz (ARB/AAR, 2000)
GE DASH9-44CW	330/3190ppm	-0.25	-0.02	-0.02	0.04	Fritz (ARB/AAR, 2000)
GE DASH9-44CW	3190/4760ppm	-0.17	-.02	0.00	0.02	Fritz (ARB/AAR, 2000)
Average		-0.28	-0.05	-0.01	0.00	

From the above table, staff concluded that HC and CO emissions are not affected by different sulfur levels in the fuel. From these tests, staff computed the changes in PM emissions associated with changes in sulfur level. Staff corrected the PM emissions to account for the aromatic differences because the test data were not tested at the same aromatic volume percent. Because the locomotive engine testing was performed at various fuel sulfur levels (some at 330 ppm vs. 3190 ppm and some at 50 ppm vs. 3190 ppm), staff cannot assume the average percent change in PM emission is characteristics over the whole range of sulfur levels. From previous studies that staff has analyzed, it is possible to generate estimates of the percent change at various sulfur levels and throttle positions. Locomotive engines have 8 throttle positions plus dynamic braking and idle. During idle, braking, and throttle positions 1 and 2, there are no significant differences in emissions attributable to sulfur level. For the GE 4-

stroke engine, effect of sulfur on PM for throttle positions 3 to 8 can be defined by using the following equations:

<u>Equations to correct for PM for GE (4-Stroke) engines</u>

Notch 8 : PM (g/bhp-hr) = 0.00001308 * (sulfur level,ppm) + 0.0967
Notch 7 : PM (g/bhp-hr) = 0.00001102 * (sulfur level,ppm) + 0.0845
Notch 6 : PM (g/bhp-hr) = 0.00000654 * (sulfur level,ppm) + 0.1037
Notch 5 : PM (g/bhp-hr) = 0.00000548 * (sulfur level,ppm) + 0.1320
Notch 4 : PM (g/bhp-hr) = 0.00000663 * (sulfur level,ppm) + 0.1513
Notch 3 : PM (g/bhp-hr) = 0.00000979 * (sulfur level,ppm) + 0.1565

For the EMD 2-stroke engine, throttle positions 3 to 8 can be defined by using the following equations:

<u>Equations to correct for PM for EMD (2-Stroke) engines</u>

Notch 8 : PM (g/bhp-hr) = 0.0000123 * (sulfur level,ppm) + 0.3563
Notch 7 : PM (g/bhp-hr) = 0.0000096 * (sulfur level,ppm) + 0.2840
Notch 6 : PM (g/bhp-hr) = 0.0000134 * (sulfur level,ppm) + 0.2843
Notch 5 : PM (g/bhp-hr) = 0.0000150 * (sulfur level,ppm) + 0.2572
Notch 4 : PM (g/bhp-hr) = 0.0000125 * (sulfur level,ppm) + 0.2629
Notch 3 : PM (g/bhp-hr) = 0.0000065 * (sulfur level,ppm) + 0.2635

Table 25. Examples of PM Reductions Due to Changes in Sulfur Level

Sulfur Level (ppm)		PM Reduction	PM Reduction	PM Reduction
From	To	2 Stroke	4 Stroke	Composite
3100	1900	4.1%	8.4%	5.2%
3100	1300	6.1%	12.6%	7.7%
1300	330	3.5%	7.9%	4.6%
1300	140	4.2%	9.5%	5.5%
140	15	1.8%	4.0%	2.4%

*composite is 75% 2 Stroke Engine and 25% 4 Stroke Engine

Data provided by industry show that when operating in California, the three main types of diesel fuel used in locomotive engines consists of CARB diesel, EPA On-Highway diesel fuel, and EPA Off-road or High Sulfur diesel fuel. Four-stroke engines and two-stroke engines show different characteristics with respect to sulfur content. From the BAH report, 4-stroke engines make up about 25%, and 2-stroke engines make up about 75% of the locomotive engine fleet. Combining industry data, 4-stroke/2-stroke engine percent change and fleet makeup, Table 26 shows the percent change in PM emissions by year for the line-haul segment of the fleet.

Table 26. PM Emission Percent Change of Line-Haul Due to Sulfur, Statewide

Calendar Year	CARB Sulfur Content	EPA On-Highway Sulfur Content	EPA Off-road Sulfur Content	Weighted Fuel Sulfur Content	4-Stroke Engines PM Percent Change	2-Stroke Engines PM Percent Change	Weighted PM Emission Percent Change
1992	3100	3100	3100	3100	0.03	0.01	0.015
1993	500	330	3100	2919	0.02	0.01	0.009
1994	150	330	3100	2740	0.01	0.00	0.003
1995	140	330	3100	2557	-0.01	0.00	-0.006
1996	140	330	3100	2377	-0.02	-0.01	-0.014
1997	140	330	3100	2196	-0.04	-0.02	-0.022
1998-2001	140	330	3100	1899	-0.06	-0.03	-0.035
2002-2006	140	330	3100	1312	-0.10	-0.05	-0.061
2007+	15	15	330	129	-0.19	-0.09	-0.113

Table 27 and Table 28 provide further details of weighted fuel sulfur level by air basin. Weighted sulfur levels vary significantly from one air basin to another.

Table 27. Class I Line Haul Weighted Fuel Sulfur by Air Basin

Interstate Locomotive	Air Basin	1998 Weighted Sulfur	2002-2006 Weighted Sulfur	2007+ Weighted Sulfur
		ppm	ppm	ppm
Class I Line Haul	SCC	1023	467	31
	MC	2333	1149	113
	MD	2352	1767	180
	NEP	2560	1632	166
	SC	1985	1472	145
	SF	1711	899	88
	SJV	1600	868	78
	SS	2425	1328	129
	SV	2473	1456	147

Table 28. Intrastate Locomotives Weighted Fuel Sulfur by Air Basin

Intrastate Locomotive	Air Basin	1993 Weighted Sulfur	1994-2006 Weighted Sulfur	2007+ Weighted Sulfur
		ppm	ppm	ppm
Class I Local/Switcher	SC	346	312	15
	SJV	377	278	15
	MD	330	330	15
	BA	468	175	15
	SD	475	169	15
	SV	475	169	15
	SCC	475	169	15
Class III Local/Switcher	SC	388	388	21
	SJV	1016	804	80
	MD	500	140	15
	BA	500	140	15
	SD	500	140	15
	SV	500	140	15
	SCC	500	140	15
	NEP	2628	2553	264
	MC	1573	1573	152
	NC	500	140	15
	NCC	500	140	15
Industrial/Military	SC	1340	1220	120
	SJV	1340	1220	120
	MD	1340	1220	120
	BA	1340	1220	120
	NEP	1340	1220	120
	SD	1340	1220	120
	SV	1340	1220	120
	SCC	1340	1220	120
Passenger	SC	493	147	15
	SJV	500	140	15
	BA	500	140	15
	SD	500	140	15
	SV	500	140	15
	SCC	483	159	15

Appendix B,C, and D contains the fuel correction factors for PM, NOx, and SOx emissions by air basin.

Revised Locomotive Emission Inventory

Tables 29-31 shows the revised locomotive emission inventory for calendar years 2000,2010 and 2020.

Table 29. 2000 Statewide Locomotive Emission Inventory, tons/day

TYPE	HC	CO	NOx	PM	SOx
Intermodal/Line-Haul	5.61	18.21	113.03	2.68	6.22
Local/Short-Run	1.01	3.33	22.58	0.41	0.22
Mixed/Bulk	2.13	6.85	48.95	1.09	2.20
Passenger/Amtrak	0.53	1.01	12.21	0.29	0.05
Yard/Switcher	0.55	1.46	10.43	0.20	0.09
Total	9.83	30.86	207.20	4.67	8.78

Table 30. 2010 Statewide Locomotive Emission Inventory, tons/day

TYPE	HC	CO	NOx	PM	SOx
Intermodal/Line-Haul	5.56	21.90	71.35	2.40	0.60
Local/Short-Run	0.77	2.99	12.03	0.30	0.01
Mixed/Bulk	2.11	8.24	29.46	0.99	0.19
Passenger/Amtrak	0.58	1.14	12.29	0.31	0.02
Yard/Switcher	0.47	1.29	6.78	0.17	0.01
Total	9.49	35.56	131.91	4.17	0.83

Table 31. 2020 Statewide Locomotive Emission Inventory, tons/day

TYPE	HC	CO	NOx	PM	SOx
Intermodal/Line-Haul	5.60	25.84	74.33	2.38	0.71
Local/Short-Run	0.67	2.99	11.17	0.26	0.01
Mixed/Bulk	2.13	9.72	31.14	0.98	0.23
Passenger/Amtrak	0.56	1.14	11.72	0.30	0.02
Yard/Switcher	0.44	1.29	6.22	0.16	0.01
Total	9.40	40.98	134.58	4.08	0.98

Appendix A

Methodology to Calculate Locomotive Inventory

Methodology

The methodology and assumptions used for estimating locomotive emissions consists of several steps taken from the Booz-Allen Hamilton's Locomotive Emission Study report (http://www.arb.ca.gov/app/library/libcc.php). First, emission factor data from various engine manufacturers such as EMD and General Electric (GE) must be gathered to calculate average emission factors for locomotives operated by the railroad companies. Second, train operations data, including throttle position profiles and time spent on various types of operations from different railroad companies needs to be estimated. Finally, the locomotive emission inventory can be calculated using train operations data, emission factors, and throttle position profiles.

Step 1 – Average Emission Factors

Engine emission factors are required for the different locomotive engines manufactured by the major locomotive suppliers EMD or GE. Emission factors are obtained from testing done by either the engine manufacturers or by Southwest Research Institute, a consulting company that has performed many tests on locomotive engines. Table A-1 lists the available emission factors.

Table A-1. Available Emission Factors for Different Locomotive Engines

Engine Manufacturer	Engine Model	Locomotive Model
EMD	12-567BC	SW10
EMD	12-645E	SW1500,MP15,GP15-1
EMD	16-567C	GP9
EMD	16-645E	GP38,GP38-2, GP28
EMD	12-645E3B	GP39-2
EMD	12-645E3	GP39-2, SD39
EMD	16-645E3	GP40, SD40, F40PH
EMD	16-645E3B	GP40-2, SD40-2, SDF40-2, F40PH
EMD	16-645F3	GP40X, GP50, SD45
EMD	16-645F3B	SD50
EMD	20-645E3	SD45,SD45-2, F45, FP45
EMD	16-710G3	GP60, SD60, SD60M
GE	127FDL2500	B23-7
GE	127FDL3000	SF30B
GE	167FDL3000	C30-7, SF30C
GE	167FDL4000	B40-8

Source: BAH report, 1992

Next, the locomotive roster from the largest railroad companies operating in the state were obtained. Table A-2 lists the locomotive roster for railroad companies in 1987.

Table A-2. Locomotive Roster 1987

					Type of Service		
Railroad Company	Engine Manufacturer	Engine Model	Horspower Rating	Units	Line Haul	Local	Yard/Switcher
ATSF	EMD	16-567BC	1500	211			X
ATSF	EMD	16-567C	1750	53			X
ATSF	EMD	16-567D2	2000	71		X	X
ATSF	EMD	16-645E	2000	69		X	X
ATSF	EMD	12-645E3	2300	62		X	
ATSF	EMD	12-645E3B	2300	60		X	
ATSF	EMD	16-645E3	2500	231	X	X	
ATSF	EMD	16-645E3	3000	18	X	X	
ATSF	EMD	16-645E3B	3000	203	X	X	
ATSF	EMD	16-645F3	3500	52	X		
ATSF	EMD	16-645F3B	3600	15	X		
ATSF	EMD	20-645E3	3600	243	X		
ATSF	EMD	16-710G3	3800	20	X		
ATSF	GE	GE-12	2350	60		X	
ATSF	GE	GE-12	3000	10	X	X	
ATSF	GE	GE-16	3000	226	X	X	

ATSF	GE	GE-16	3600	43	X		
ATSF	GE	GE-16	3900	3	X		
ATSF	GE	GE-16	4000	20	X		
Union Pacific	EMD	16-645BC	1200	56			X
Union Pacific	EMD	12-567A	1200	12			X
Union Pacific	EMD	12-645E	1500	281			X
Union Pacific	EMD	16-567CE	1500	35			X
Union Pacific	EMD	16-645E	2000	365		X	X
Union Pacific	EMD	12-645E3C	2300	24		X	
Union Pacific	EMD	16-567D3A	2500	16		X	
Union Pacific	EMD	16-645E3	3000	828	X	X	
Union Pacific	EMD	16-645E3B	3000	446	X	X	
Union Pacific	EMD	16-645F3	3500	36	X		
Union Pacific	EMD	16-645F3B	3600	60	X		
Union Pacific	EMD	16-710G3	3800	227	X		
Union Pacific	GE	GE-12	2300	106		X	
Union Pacific	GE	GE-12	3000	57	X	X	
Union Pacific	GE	GE-16	3000	156	X	X	
Union Pacific	GE	GE-16	3750	60	X		
Union Pacific	GE	GE-16	3800	256	X		
Southern Pacific	EMD	12-567C	1200	11			X
Southern Pacific	EMD	12-645E	1500	286			X
Southern Pacific	EMD	16-567BC	1500	37			X
Southern Pacific	EMD	16-567C	1750	326		X	
Southern Pacific	EMD	16-567D2	2000	145		X	
Southern Pacific	EMD	16-645E	2000	84		X	
Southern Pacific	EMD	12-645E3	2300	12		X	
Southern Pacific	EMD	16-645E3	2500	137	X	X	
Southern Pacific	EMD	16-645E3	3000	92	X		
Southern Pacific	EMD	16-645E3B	3000	353	X		
Southern Pacific	EMD	16-645F3	3500	4	X		
Southern Pacific	EMD	20-645E3	3600	425	X		
Southern Pacific	EMD	16-710G3	3800	65	X		
Southern Pacific	GE	GE-12	2300	15		X	
Southern Pacific	GE	GE-12	3000	107	X		
Southern Pacific	GE	GE-16	3600	20	X		
Southern Pacific	GE	GE-16	3900	92	X		

Source : BAH report, 1992

Using the available emission factors and the locomotive rosters, the average emission factors for each class of service can be calculated. Emission factors for models that were not available were assigned an emission factor based on horsepower rating and the number of cylinders from similar engine models.

Step 2 – Throttle Position Profiles and Train Operations Data

The railroad companies provided throttle position profiles. Locomotive engines operate at eight different constant loads and speeds called throttle notches. In addition, several other settings (idle and dynamic brake) are also common. For line haul and local operations, profiles were obtained from Train Performance Calculation (TPC) data and actual event recorder data, which are summarized in the BAH report.

For line haul operations, the data was modified to account for additional idle time between dispatch. Data supplied by Atchison, Topeka and Santa Fe (ATSF) indicates that the turnaround time for line haul locomotives in yards is approximately eight hours.

For local operations, several assumptions were used to develop throttle profiles. First, ten hours was used as an average hours per assignment. Second, the additional average idle time per day per locomotive was assumed to be ten hours.

The switch engine duty cycle is based upon actual tape data supplied by the ATSF railroad company on a switch engine that operated over a 2-day period. Yard engines are assumed to operate 350 days per year, with 2 weeks off for inspections and maintenance.

Train operations data provided by the railroad companies included :

Line Haul	**Local**	**Yard/Switcher**
Train type	Average trailing tons	Number of units assigned
Number of runs per year	Number of runs per year	Number of assignments
Average horsepower	Average horsepower	Average horsepower
Average units	Average units	
Origin/destination	Origin/destination	
Link miles		

Step 3 – Calculate Locomotive Emission Inventory

Emission inventories are calculated on a train-by-train basis using train operations data, average emission factor, and throttle position profiles.

Emission Inventory = Emission factor x average horsepower x time in notch per train x number of runs per year

Appendix B
PM Fuel Correction Factor by Air Basin

Interstate Loc	Air Basin	PM Fuel Correction Factor														
		pre 1993	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007+
Class I Line H	SCC	1.000	0.991	0.982	0.973	0.964	0.955	0.937	0.931	0.925	0.919	0.913	0.913	0.913	0.913	0.913	0.883
	MC	1.000	0.998	0.996	0.994	0.992	0.990	0.987	0.971	0.955	0.939	0.923	0.923	0.923	0.923	0.923	0.867
	MD	1.000	0.998	0.995	0.993	0.991	0.988	0.984	0.978	0.973	0.967	0.962	0.962	0.962	0.962	0.962	0.884
	NEP	1.000	0.999	0.998	0.998	0.997	0.996	0.995	0.983	0.971	0.959	0.947	0.947	0.947	0.947	0.947	0.875
	SC	1.000	0.996	0.993	0.989	0.986	0.982	0.975	0.970	0.965	0.960	0.955	0.955	0.955	0.955	0.955	0.888
	SF	1.000	0.993	0.987	0.980	0.974	0.967	0.954	0.940	0.926	0.912	0.898	0.898	0.898	0.898	0.898	0.851
	SJV	1.000	0.993	0.986	0.979	0.972	0.965	0.952	0.944	0.937	0.930	0.923	0.923	0.923	0.923	0.923	0.878
	SS	1.000	0.999	0.997	0.996	0.995	0.993	0.991	0.980	0.970	0.959	0.949	0.949	0.949	0.949	0.949	0.887
	SV	1.000	0.993	0.986	0.979	0.972	0.965	0.952	0.948	0.945	0.942	0.939	0.939	0.939	0.939	0.939	0.873

Intrastate Loc	Air Basin	PM Fuel Correction Factor														
		pre 1993	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007+
Class I Local/	SC	1.000	0.890	0.889	0.889	0.889	0.889	0.889	0.889	0.889	0.889	0.889	0.889	0.889	0.889	0.889	0.865
	SJV	1.000	0.863	0.858	0.858	0.858	0.858	0.858	0.858	0.858	0.858	0.858	0.858	0.858	0.858	0.858	0.836
	MD	1.000	0.906	0.906	0.906	0.906	0.906	0.906	0.906	0.906	0.906	0.906	0.906	0.906	0.906	0.906	0.882
	BA	1.000	0.778	0.764	0.764	0.764	0.764	0.764	0.764	0.764	0.764	0.764	0.764	0.764	0.764	0.764	0.747
	SD	1.000	0.772	0.758	0.758	0.758	0.758	0.758	0.758	0.758	0.758	0.758	0.758	0.758	0.758	0.758	0.741
	SV	1.000	0.772	0.758	0.758	0.758	0.758	0.758	0.758	0.758	0.758	0.758	0.758	0.758	0.758	0.758	0.741
	SCC	1.000	0.772	0.758	0.758	0.758	0.758	0.758	0.758	0.758	0.758	0.758	0.758	0.758	0.758	0.758	0.741
Class III Loca	SC	1.000	0.909	0.909	0.909	0.909	0.909	0.909	0.909	0.909	0.909	0.909	0.909	0.909	0.909	0.909	0.882
	SJV	1.000	0.839	0.830	0.830	0.830	0.830	0.830	0.830	0.830	0.830	0.830	0.830	0.830	0.830	0.830	0.787
	MD	1.000	0.749	0.733	0.733	0.733	0.733	0.733	0.733	0.733	0.733	0.733	0.733	0.733	0.733	0.733	0.717
	BA	1.000	0.749	0.733	0.733	0.733	0.733	0.733	0.733	0.733	0.733	0.733	0.733	0.733	0.733	0.733	0.717
	SD	1.000	0.749	0.733	0.733	0.733	0.733	0.733	0.733	0.733	0.733	0.733	0.733	0.733	0.733	0.733	0.717
	SV	1.000	0.749	0.733	0.733	0.733	0.733	0.733	0.733	0.733	0.733	0.733	0.733	0.733	0.733	0.733	0.717
	SCC	1.000	0.749	0.733	0.733	0.733	0.733	0.733	0.733	0.733	0.733	0.733	0.733	0.733	0.733	0.733	0.717
	NEP	1.000	0.963	0.960	0.960	0.960	0.960	0.960	0.960	0.960	0.960	0.960	0.960	0.960	0.960	0.960	0.858
	MC	1.000	0.959	0.959	0.959	0.959	0.959	0.959	0.959	0.959	0.959	0.959	0.959	0.959	0.959	0.959	0.888
	NC	1.000	0.749	0.733	0.733	0.733	0.733	0.733	0.733	0.733	0.733	0.733	0.733	0.733	0.733	0.733	0.717
	NCC	1.000	0.749	0.733	0.733	0.733	0.733	0.733	0.733	0.733	0.733	0.733	0.733	0.733	0.733	0.733	0.722
Industrial/Milit	SC	1.000	0.894	0.889	0.889	0.889	0.889	0.889	0.889	0.889	0.889	0.889	0.889	0.889	0.889	0.889	0.831
	SJV	1.000	0.894	0.889	0.889	0.889	0.889	0.889	0.889	0.889	0.889	0.889	0.889	0.889	0.889	0.889	0.831
	MD	1.000	0.894	0.889	0.889	0.889	0.889	0.889	0.889	0.889	0.889	0.889	0.889	0.889	0.889	0.889	0.831
	BA	1.000	0.894	0.889	0.889	0.889	0.889	0.889	0.889	0.889	0.889	0.889	0.889	0.889	0.889	0.889	0.831
	NEP	1.000	0.894	0.889	0.889	0.889	0.889	0.889	0.889	0.889	0.889	0.889	0.889	0.889	0.889	0.889	0.831
	SD	1.000	0.894	0.889	0.889	0.889	0.889	0.889	0.889	0.889	0.889	0.889	0.889	0.889	0.889	0.889	0.831
	SV	1.000	0.894	0.889	0.889	0.889	0.889	0.889	0.889	0.889	0.889	0.889	0.889	0.889	0.889	0.889	0.831
	SCC	1.000	0.894	0.889	0.889	0.889	0.889	0.889	0.889	0.889	0.889	0.889	0.889	0.889	0.889	0.889	0.831
Passenger	SC	1.000	0.754	0.739	0.739	0.739	0.739	0.739	0.739	0.739	0.739	0.739	0.739	0.739	0.739	0.739	0.723
	SJV	1.000	0.749	0.733	0.733	0.733	0.733	0.733	0.733	0.733	0.733	0.733	0.733	0.733	0.733	0.733	0.717
	BA	1.000	0.749	0.733	0.733	0.733	0.733	0.733	0.733	0.733	0.733	0.733	0.733	0.733	0.733	0.733	0.717
	SD	1.000	0.749	0.733	0.733	0.733	0.733	0.733	0.733	0.733	0.733	0.733	0.733	0.733	0.733	0.733	0.717
	SV	1.000	0.749	0.733	0.733	0.733	0.733	0.733	0.733	0.733	0.733	0.733	0.733	0.733	0.733	0.733	0.717
	SCC	1.000	0.764	0.749	0.749	0.749	0.749	0.749	0.749	0.749	0.749	0.749	0.749	0.749	0.749	0.749	0.733

Appendix C
NOx Fuel Correction Factor by Air Basin

Interstate Loc	Air Basin	NOx Fuel Correction Factor pre 1993	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007+
Class I Line H	SCC	1.000	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940
	MC	1.000	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940
	MD	1.000	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940
	NEP	1.000	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940
	SC	1.000	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940
	SF	1.000	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940
	SJV	1.000	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940
	SS	1.000	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940
	SV	1.000	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940

Intrastate Loc	Air Basin	NOx Fuel Correction Factor pre 1993	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007+
Class I Local/	SC	1.000	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940
	SJV	1.000	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940
	MD	1.000	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940
	BA	1.000	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940
	SD	1.000	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940
	SV	1.000	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940
	SCC	1.000	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940
Class III Loca	SC	1.000	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940
	SJV	1.000	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940
	MD	1.000	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940
	BA	1.000	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940
	SD	1.000	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940
	SV	1.000	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940
	SCC	1.000	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940
	NEP	1.000	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940
	MC	1.000	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940
	NC	1.000	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940
	NCC	1.000	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940
Industrial/Milit	SC	1.000	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940
	SJV	1.000	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940
	MD	1.000	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940
	BA	1.000	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940
	NEP	1.000	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940
	SD	1.000	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940
	SV	1.000	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940
	SCC	1.000	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940
Passenger	SC	1.000	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940
	SJV	1.000	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940
	BA	1.000	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940
	SD	1.000	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940
	SV	1.000	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940
	SCC	1.000	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940	0.940

Appendix D
SOx Fuel Correction Factor by Air Basin

Interstate Loc	Air Basin	SOx Fuel Correction Factor															
		pre 1993	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007+
Class I Line H	SCC	1.000	0.896	0.793	0.689	0.586	0.482	0.379	0.327	0.276	0.225	0.173	0.173	0.173	0.173	0.173	0.011
	MC	1.000	0.977	0.955	0.932	0.909	0.887	0.864	0.755	0.645	0.535	0.426	0.426	0.426	0.426	0.426	0.042
	MD	1.000	0.979	0.957	0.936	0.914	0.893	0.871	0.817	0.763	0.709	0.654	0.654	0.654	0.654	0.654	0.067
	NEP	1.000	0.991	0.983	0.974	0.965	0.957	0.948	0.862	0.776	0.690	0.605	0.605	0.605	0.605	0.605	0.062
	SC	1.000	0.956	0.912	0.868	0.823	0.779	0.735	0.688	0.640	0.593	0.545	0.545	0.545	0.545	0.545	0.054
	SF	1.000	0.939	0.878	0.817	0.756	0.695	0.634	0.559	0.483	0.408	0.333	0.333	0.333	0.333	0.333	0.033
	SJV	1.000	0.932	0.864	0.796	0.728	0.660	0.593	0.525	0.457	0.389	0.322	0.322	0.322	0.322	0.322	0.029
	SS	1.000	0.983	0.966	0.949	0.932	0.915	0.898	0.797	0.695	0.594	0.492	0.492	0.492	0.492	0.492	0.048
	SV	1.000	0.986	0.972	0.958	0.944	0.930	0.916	0.822	0.728	0.634	0.539	0.539	0.539	0.539	0.539	0.054

Intrastate Loc	Air Basin	SOx Fuel Correction Factor															
		pre 1993	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007+
Class I Local/	SC	1.000	0.128	0.127	0.126	0.125	0.124	0.122	0.121	0.120	0.119	0.118	0.117	0.115	0.115	0.115	0.006
	SJV	1.000	0.139	0.136	0.133	0.130	0.126	0.123	0.120	0.116	0.113	0.110	0.106	0.103	0.103	0.103	0.006
	MD	1.000	0.122	0.122	0.122	0.122	0.122	0.122	0.122	0.122	0.122	0.122	0.122	0.122	0.122	0.122	0.006
	BA	1.000	0.173	0.164	0.154	0.144	0.134	0.124	0.114	0.104	0.095	0.085	0.075	0.065	0.065	0.065	0.006
	SD	1.000	0.176	0.165	0.155	0.145	0.135	0.124	0.114	0.104	0.093	0.083	0.073	0.062	0.062	0.062	0.006
	SV	1.000	0.176	0.165	0.155	0.145	0.135	0.124	0.114	0.104	0.093	0.083	0.073	0.062	0.062	0.062	0.006
	SCC	1.000	0.176	0.165	0.155	0.145	0.135	0.124	0.114	0.104	0.093	0.083	0.073	0.062	0.062	0.062	0.006
Class III Loca	SC	1.000	0.144	0.144	0.144	0.144	0.144	0.144	0.144	0.144	0.144	0.144	0.144	0.144	0.144	0.144	0.008
	SJV	1.000	0.376	0.369	0.362	0.355	0.348	0.341	0.333	0.326	0.319	0.312	0.305	0.298	0.298	0.298	0.029
	MD	1.000	0.185	0.173	0.161	0.149	0.137	0.125	0.112	0.100	0.088	0.076	0.064	0.052	0.052	0.052	0.006
	BA	1.000	0.185	0.173	0.161	0.149	0.137	0.125	0.112	0.100	0.088	0.076	0.064	0.052	0.052	0.052	0.006
	SD	1.000	0.185	0.173	0.161	0.149	0.137	0.125	0.112	0.100	0.088	0.076	0.064	0.052	0.052	0.052	0.006
	SV	1.000	0.185	0.173	0.161	0.149	0.137	0.125	0.112	0.100	0.088	0.076	0.064	0.052	0.052	0.052	0.006
	SCC	1.000	0.185	0.173	0.161	0.149	0.137	0.125	0.112	0.100	0.088	0.076	0.064	0.052	0.052	0.052	0.006
	NEP	1.000	0.973	0.971	0.968	0.966	0.963	0.961	0.958	0.956	0.953	0.951	0.948	0.946	0.946	0.946	0.098
	MC	1.000	0.583	0.583	0.583	0.583	0.583	0.583	0.583	0.583	0.583	0.583	0.583	0.583	0.583	0.583	0.056
	NC	1.000	0.185	0.173	0.161	0.149	0.137	0.125	0.112	0.100	0.088	0.076	0.064	0.052	0.052	0.052	0.006
	NCC	1.000	0.185	0.173	0.161	0.149	0.137	0.125	0.112	0.100	0.088	0.076	0.064	0.052	0.052	0.052	0.006
Industrial/Milit	SC	1.000	0.496	0.492	0.488	0.484	0.480	0.476	0.472	0.468	0.464	0.460	0.456	0.452	0.452	0.452	0.044
	SJV	1.000	0.496	0.492	0.488	0.484	0.480	0.476	0.472	0.468	0.464	0.460	0.456	0.452	0.452	0.452	0.044
	MD	1.000	0.496	0.492	0.488	0.484	0.480	0.476	0.472	0.468	0.464	0.460	0.456	0.452	0.452	0.452	0.044
	BA	1.000	0.496	0.492	0.488	0.484	0.480	0.476	0.472	0.468	0.464	0.460	0.456	0.452	0.452	0.452	0.044
	NEP	1.000	0.496	0.492	0.488	0.484	0.480	0.476	0.472	0.468	0.464	0.460	0.456	0.452	0.452	0.452	0.044
	SD	1.000	0.496	0.492	0.488	0.484	0.480	0.476	0.472	0.468	0.464	0.460	0.456	0.452	0.452	0.452	0.044
	SV	1.000	0.496	0.492	0.488	0.484	0.480	0.476	0.472	0.468	0.464	0.460	0.456	0.452	0.452	0.452	0.044
	SCC	1.000	0.496	0.492	0.488	0.484	0.480	0.476	0.472	0.468	0.464	0.460	0.456	0.452	0.452	0.452	0.044
Passenger	SC	1.000	0.183	0.171	0.159	0.148	0.136	0.124	0.113	0.101	0.090	0.078	0.066	0.055	0.055	0.055	0.006
	SJV	1.000	0.185	0.173	0.161	0.149	0.137	0.125	0.112	0.100	0.088	0.076	0.064	0.052	0.052	0.052	0.006
	BA	1.000	0.185	0.173	0.161	0.149	0.137	0.125	0.112	0.100	0.088	0.076	0.064	0.052	0.052	0.052	0.006
	SD	1.000	0.185	0.173	0.161	0.149	0.137	0.125	0.112	0.100	0.088	0.076	0.064	0.052	0.052	0.052	0.006
	SV	1.000	0.185	0.173	0.161	0.149	0.137	0.125	0.112	0.100	0.088	0.076	0.064	0.052	0.052	0.052	0.006
	SCC	1.000	0.179	0.168	0.157	0.146	0.135	0.124	0.113	0.103	0.092	0.081	0.070	0.059	0.059	0.059	0.006

APPENDIX A-8

DEATILED EMISSION CALCULATIONS, FOR
OFFSITE LOCOMOTIVE EMISSIONS
2005 BASELINE YEAR

UPRR 2005 On-Port Emissions Calculations

(based on PHL trailing ton-mile and train-mile data, and UPRR-observed locomotive model distribution)

Movements	Train Miles	Ton Miles	PM (tpy)	NOx (tpy)	HC (tpy)	CO (tpy)	SO2 (tpy)	CO2 (MTpy)	CH4 (MTpy)	N2O (MTpy)
Intermodal Movement	8583	35878774	**0.53**	**20.72**	**0.98**	**2.10**	**1.23**	**1271**	**0.100**	**0.032**
IM Power Moves	7597	0	**0.16**	**6.13**	**0.29**	**0.62**	**0.36**	**376**	**0.030**	**0.009**
Local	1558	2374345	**0.03**	**1.59**	**0.08**	**0.17**	**0.02**	**101**	**0.008**	**0.003**
Local Power Moves	447	0	**0.01**	**0.24**	**0.01**	**0.03**	**0.00**	**15**	**0.001**	**0.000**
Intermodal Idling										
	# of Trains									
Terminating	393		**0.01**	**0.27**	**0.04**	**0.06**	**0.02**	**22**	**0.002**	**0.001**
Originating	1604		**0.10**	**2.98**	**0.47**	**0.69**	**0.25**	**258**	**0.020**	**0.006**
Total			**0.83**	**31.92**	**1.87**	**3.67**	**1.88**	**2044**	**0.161**	**0.051**

UPRR 2005 Dolores/ICTF Emissions

(based on UPRR train and service data counts of locomotives by traintype and locomotive model)

(Note -- Does not include Alameda Corridor Traffic adjacent to Dolores)

ICTF	PM (tpy)	NOx (tpy)	HC (tpy)	CO (tpy)	SO2 (tpy)	CO2 (MTpy)	CH4 (MTpy)	N2O (MTpy)
Intermodal	**0.32**	**13.09**	**1.00**	**1.49**	**0.84**	**840**	**0.066**	**0.021**
Yard Switching	**2.82**	**129.46**	**5.78**	**13.51**	**0.91**	**6075**	**0.478**	**0.153**
Service Load Testing	**0.25**	**10.81**	**0.42**	**1.17**	**0.20**	**632**	**0.050**	**0.016**
Service Idling	**0.28**	**8.37**	**1.35**	**1.97**	**1.30**	**777**	**0.061**	**0.020**
Subtotal	**3.67**	**161.72**	**8.54**	**18.14**	**3.24**	**8325**	**0.654**	**0.209**

On-Dock Intermodal at Dolores	PM (tpy)	NOx (tpy)	HC (tpy)	CO (tpy)	SO2 (tpy)	CO2 (MTpy)	CH4 (MTpy)	N2O (MTpy)
Intermodal	**0.32**	**13.09**	**1.00**	**1.49**	**0.84**	**840**	**0.066**	**0.021**
Yard Switching	**2.08**	**95.54**	**4.27**	**9.97**	**0.67**	**4483**	**0.352**	**0.113**
Service Load Testing	**0.25**	**10.81**	**0.42**	**1.17**	**0.20**	**632**	**0.050**	**0.016**
Service Idling	**0.28**	**8.37**	**1.35**	**1.97**	**1.30**	**777**	**0.061**	**0.020**
Subtotal	**2.94**	**127.80**	**7.03**	**14.60**	**3.01**	**6733**	**0.529**	**0.169**

Manifest Freight (Dolores)	PM (tpy)	NOx (tpy)	HC (tpy)	CO (tpy)	SO2 (tpy)	CO2 (MTpy)	CH4 (MTpy)	N2O (MTpy)
Freight	**0.58**	**23.90**	**1.32**	**2.54**	**1.26**	**1550**	**0.122**	**0.039**
Yard Switching	**0.68**	**31.11**	**1.39**	**3.25**	**0.22**	**1460**	**0.115**	**0.037**
Service Load Testing	**0.08**	**3.52**	**0.14**	**0.38**	**0.06**	**206**	**0.016**	**0.005**
Service Idling	**0.09**	**2.72**	**0.44**	**0.64**	**0.42**	**253**	**0.020**	**0.006**
Subtotal	**1.43**	**61.25**	**3.29**	**6.81**	**1.97**	**3468**	**0.273**	**0.087**
Dolores/ICTF In-Yard Total	**8.04**	**350.77**	**18.86**	**39.55**	**8.21**	**18526**	**1.456**	**0.466**
Other Offsite (not within Dolores/ICTF)								
UP Line Haul from AC to SoCAB Boundary	**26.90**	**1034.38**	**45.79**	**109.46**	**60.73**	**62113**	**4.883**	**1.560**

UPRR 2005 Line-Haul Off-Port Emissions Calculations
(based on UPRR MGT data, emission factors for 2005 UPRR intermodal fleet distribution, and EPA line-haul duty cycle)
(GHG emissions based on UPRR fuel consumption and CARB emission factors)

Entry/Exit Point from SoCAB		Yuma	Cajon	Palmdale	Coast	
Fraction of Port Traffic		78.6%	17.8%	3.5%	0.1%	100%
Distance from Port to Exit Point	(add 3.9 mi. to ICTF number)	267.7	304.0	629.3	466.9	
Distance from ICTF to Exit Point		263.8	300.1	625.4	463.0	

UPRR Only -- Does not include BNSF		**MGT-Miles**			
MGT originating and terminating in Port terminals	**11.00**	2314	595	242	5
MGT originating and terminating at Dolores/ICTF	**36.83**	7638	1968	806	17

Total Port-Related Off Port MGT-Miles in California	**13585**

Emission factor using EPA line-haul duty cycle and 2005 UPRR ICTF/Port intermodal lcomotive fleet

2005 HC		
Fuel C-Rate Gal/Ton Mile	**0.001296**	
HC Emfac (g/gal)	**6.79**	
Total Port-Related Off Port Emissions in Basin	**119504534**	**g/yr**
	131.73	**TPY**

Emission factor using EPA line-haul duty cycle and 2005 UPRR ICTF/Port intermodal lcomotive fleet

2005 CO		
Fuel C-Rate Gal/Ton Mile	**0.001296**	
CO Emfac (g/gal)	**16.23**	
Total Port-Related Off Port Emissions in Basin	**285692736**	**g/yr**
	314.92	**TPY**

Emission factor using EPA line-haul duty cycle and 2005 UPRR ICTF/Port intermodal lcomotive fleet

2005 NOx		
Fuel C-Rate Gal/Ton Mile	**0.001296**	
NOx Emfac (g/gal)	**153.34**	
Total Port-Related Off Port Emissions in Basin	**2699754369**	**g/yr**
	2975.92	**TPY**

Emission factor using EPA line-haul duty cycle and 2005 UPRR ICTF/Port intermodal lcomotive fleet

2005 PM		
Fuel C-Rate Gal/Ton Mile	**0.001296**	
PM Emfac (g/gal)	**3.99**	
Total Port-Related Off Port Emissions in Basin	**70216234**	**g/yr**
	77.40	**TPY**

APPENDIX B

DIESEL-FUELED DRAYAGE TRUCKS

APPENDIX B-1

METHODOLOGY FOR DETERMINING THE NUMBER OF DRAYAGE TRUCK TRIPS PER YEAR

Appendix B-1

Methodology for Estimating the Number of Drayage Truck Trips per Year

Activity data is used to calculate emissions from HHD Diesel-fueled drayage trucks. Emissions were estimated based on the number of truck trips, the length of each trip, and the amount of time spent idling. The number of truck trips at ICTF for the 2005 baseline year and project years 2010, 2012, 2014, and 2016 were based on historic actual lift counts, gate counts for the facility, and forecasts of future lifts. The following terms are used in this assessment:

- Lift: This is the transfer of a container or trailer (empty or loaded) from a rail car to a truck chassis, or from a truck chassis to a rail car. This count does not include flips.
- Gate Count: This is the count of trailers (empty or loaded) and chassis with containers (empty or loaded) going past the plant gate. This count does not include bobtails (truck without a chassis) or trucks with an empty chassis (no container).

The 2005 lift count was multiplied by the gate balancing factor (GBF) to determine the number of containers that should have passed through the "in gate" (C_I) in 2005.

$$C_I = Lift\ Count\ x\ GBF$$

The GBF was calculating by dividing the number of containers passing through the "in gate" by the total gate count as follows:

$$GBF = \left(\frac{\text{"}in\ gate\text{"}\ count}{\text{"}in\ gate\text{"}\ count + \text{"}out\ gate\text{"}\ count} \right) x100$$

The GBF for 2005 was 62.8%, which means that roughly 63% of the total container passing though an ICTF gate passed though the "in gate". The GBF for 2006 was 61.2%.

The calculated "in gate" (C_I) value was subtracted from the total number of lifts to determine the number of containers that should have passed through the "out gate" (C_O) in 2005.

$$C_O = Lift\ Count - C_I$$

The calculated gate counts were compared with the actual facility gate counts to verify accuracy.

The minimum number of trucks trips is achieved when every truck that enters with a container also leaves with a container. The actual percentage of trucks that both enter and leave ICTF with a container is not known. Based on aerial photos of the ICTF and data contained in the Port of Los Angeles Baseline Traffic Study (Meyer, Mohaddis Associates, Inc., April 2004)[1] it was assumed that 40% of the trucks entering ICTF with a container also leave ICTF with a container[2]. This factor was used to calculate the number of bobtails and empty chassis that entered the facility (BI) and the number of bobtails and empty chassis that exited the facility (BO) based on the following formulas.

$$B_I = C_O - (C_I \; x \, 40\%)$$

$$B_O = C_I - (C_I \; x \, 40\%)$$

The total number of truck trips for 2005 was calculated as follows:

$$Trips = C_I + C_O + B_I + B_O$$

This method was used to calculate the number of drayage truck trips in future Project years, based on the predicted lift count for each year. The 2006 GBF was used for the future year calculations. Table 1 summarizes the lift count data and predicted number of drayage truck trips for 2005, 2010, 2012, 2014, and 2016.

Table 1
Summary of Lift Count and Truck Trip Data
ICTF Modernization Project

Calendar Year	Lift Count	Truck Trips
2005	626,339	938,074[a]
2010	900,000	1,360,800[b]
2012	1,100,000	1,663,200[b]
2014	1,300,000	1,965,600[b]
2016	1,500,000	2,268,000[b]

Notes:
a. Based on the 2005 GBF of 62.8%.
b. Based on the 2006 GBF of 61.2%

[1] Available at http://www.portoflosangeles.org/DOC/REPORT_Draft_Traffic_Baseline.pdf
[2] Personal communication from Greg Chiodo of HDR on September 24, 2007.

APPENDIX B-2

DEATILED EMISSION CALCULATIONS, EMISSION FACTOR DERIVATION AND EMFAC2007 OUTPUT FOR THE 2005 BASELINE YEAR

Summary of Emissions from HHD Diesel-Fueled Drayage Trucks
Dolores and ICTF Rail Yards, Long Beach, CA

Running Exhaust Emissions

Yard	Number of Truck Trips[1]	VMT per Trip[2]	VMT per Year	Fuel Use (gal/yr)[3]	Carbon Oxidation Factor[4]	2005 Emission Factors (g/mi)[5,6] ROG	CO	NOx	PM10[7]	DPM[7]	SOx	(kg/gal)[4] CO2	N2O[8]	CH4[8]	2005 Emissions (tpy) ROG	CO	NOx	PM10	DPM	SOx	(metric tons/yr) CO2	N2O	CH4
ICTF - Onsite	938,074	1.75	1,641,629.38	475,891.70	99%	6.40	17.23	28.68	2.53	2.47	0.24	10.15	1.39E-05	4.16E-05	11.58	31.18	51.91	4.58	4.46	0.44	4,782.00	0.01	0.02

Idling Exhaust Emissions

Yard	Number of Truck Trips	Idling[9] (mins/trip)	Idling[9] (hr/yr)	Fuel Use (gal/yr)[3]	Carbon Oxidation Factor[4]	2005 Emission Factors (g/hr)[10] ROG	CO	NOx	PM10	DPM	SOx	(kg/gal)[4] CO2	N2O[8]	CH4[8]	2005 Emissions (tpy) ROG	CO	NOx	PM10	DPM	SOx	(metric tons/yr) CO2	N2O	CH4
ICTF - Onsite	938,074	30	469,036.97	308,870	99%	16.16	52.99	100.38	2.85	2.85	0.55	10.15	1.39E-05	4.16E-05	8.36	27.40	51.90	1.47	1.47	0.28	3103.68	0.00	0.01

Notes:
1. Number of truck trips is based on the 2005 lift count and was calculated using a spreadsheet provided by HDR. See Appendix B for additional detail.
2. VMT per trip estimated from aerial photos.
3. Fuel use calculated using the EMFAC 2007 model with the BURDEN output opetion.
4. From the Air Resources Board's Draft *Emission Factors for Mandatory Reporting Programs*, August 10, 2007.
5. Running exhaust emission factors (g/mi) from EMFAC 2007 using the BURDEN output option. The EMFAC default model year distribution for L.A. County was used.
6. Emission factor calculations assumed an average speed of 15 mph.
7. The PM10 emission factor includes engine exhaust emissions along with brake and tire wear. The DPM emission factor includes engine exhaust emissions only.
8. Based on a diesel fuel HHV of 5.825 MMBtu/barrel (from ARB Draft Emission Factors for Mandatory Reporting Programs, August 10, 2007) and 42 gallons per barrel.
9. Idling time (mins/trip) per UPRR staff.
10. Idling exhaust emission factors from EMFAC 2007 using the EMFAC output option. The EMFAC default model year distribution for L.A. County was used.

Calculation of the Number of Drayage Truck Trips[1]
Dolores and ICTF Rail Yards, Long Beach, CA

Assumptions	CY 2005
Lifts per year (assumed equal gate count)[2]	626,339
Days Operation	360
In-gate count/Total gate count[3]	63%

% Trucks Arriving and Departing with a Container	0%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%
Trucks w/ Containers In (Ci)	393,255	393,255	393,255	393,255	393,255	393,255	393,255	393,255	393,255	393,255	393,255
Trucks w/ Containers Out (Co)	233,084	233,084	233,084	233,084	233,084	233,084	233,084	233,084	233,084	233,084	233,084
Bobtails and Bare Chassis Out (Bo)	393,255	353,930	314,604	275,279	235,953	196,628	160,171	160,171	160,171	160,171	160,171
Bobtails and Bare Chassis In (Bi)	233,084	193,758	154,433	115,107	75,782	36,456	0	0	0	0	0
Yearly Truck Trips (one-way)[4]	1,252,678	1,174,027	1,095,376	1,016,725	**938,074**	859,423	786,510	786,510	786,510	786,510	786,510
% Truck trips w/ Containers	50%	53%	57%	62%	67%	73%	80%	80%	80%	80%	80%

Notes:
1. Spreadsheet developed by Greg Chiodo of HDR.
2. The 2005 lift count was provided by UPRR.
3. Based on the 2005 gate count data provided by UPRR.
4. Per Greg Chiodo of HDR, it was assumed, based on aerial photos of the ICTF and data contained in the Port of Los Angeles Baseline Traffic Study (Meyer, Mohaddis Associates, Inc., April 2004), that 40% of the trucks entering ICTF with a container also leave ICTF with a container.

Title : Los Angeles County Avg Annual CYr 2005 Default Title
Version : Emfac2007 V2.3 Nov 1 2006 ** WIS Enabled **
Run Date : 2006/12/14 07:57:01
Scen Year: 2005 -- All model years in the range 1965 to 2005 selected
Season : Annual
Area : Los Angeles County Average
I/M Stat : Enhanced Interim (2005) -- Using I/M schedule for area 59 Los Angeles (SC)
Emissions: Tons Per Day
****

	HHDT-DSL
Vehicles	27425
VMT/1000	5538
Trips	138783
Reactive Organic Gas Emissions	
Run Exh	39.07
Idle Exh	0.82
Start Ex	0

Total Ex	39.9
Diurnal	0
Hot Soak	0
Running	0
Resting	0

Total	39.9
Carbon Monoxide Emissions	
Run Exh	105.2
Idle Exh	2.7
Start Ex	0

Total Ex	107.91
Oxides of Nitrogen Emissions	
Run Exh	175.11
Idle Exh	5.12
Start Ex	0

Total Ex	180.23
Carbon Dioxide Emissions (000)	
Run Exh	17.5
Idle Exh	0.34
Start Ex	0

Total Ex	17.84
PM10 Emissions	
Run Exh	15.05
Idle Exh	0.15
Start Ex	0

Total Ex	15.19
TireWear	0.22
BrakeWr	0.17

Total	15.59
Lead	0
SOx	1.48
Fuel Consumption (000 gallons)	
Gasoline	0
Diesel	1605.41

Title : Los Angeles County Avg Annual CYr 2005 Default Title
Version : Emfac2007 V2.3 Nov 1 2006
Run Date : 2006/12/14 08:09:32
Scen Year: 2005 -- All model years in the range 1965 to 2005 selected
Season : Annual
Area : Los Angeles
****

Year: 2005 -- Model Years 1965 to 2005 Inclusive --
Emfac2007 Emission Factors: V2.3 Nov 1 2006

County Average Los Angeles

Table 1: Running Exhaust Emissions (grams/mile; grams/idle-hour)

Pollutant Name: Reactive Org Gases Temperature: 65F Relative Humidity: 60%

Speed MPH	HHD NCAT	HHD CAT	HHD DSL	HHD ALL
0	0	0	16.163	15.188

Pollutant Name: Carbon Monoxide Temperature: 65F Relative Humidity: 60%

Speed MPH	HHD NCAT	HHD CAT	HHD DSL	HHD ALL
0	0	0	52.988	49.792

Pollutant Name: Oxides of Nitrogen Temperature: 65F Relative Humidity: 60%

Speed MPH	HHD NCAT	HHD CAT	HHD DSL	HHD ALL
0	0	0	100.382	94.327

Pollutant Name: Carbon Dioxide Temperature: 65F Relative Humidity: 60%

Speed MPH	HHD NCAT	HHD CAT	HHD DSL	HHD ALL
0	0	0	6617.134	6192.269

Pollutant Name: Sulfur Dioxide Temperature: 65F Relative Humidity: 60%

Speed MPH	HHD NCAT	HHD CAT	HHD DSL	HHD ALL
0	0	0	0.55	0.517

Pollutant Name: PM10 Temperature: 65F Relative Humidity: 60%

Speed MPH	HHD NCAT	HHD CAT	HHD DSL	HHD ALL
0	0	0	2.845	2.674

Pollutant Name: PM10 - Tire Wear Temperature: 65F Relative Humidity: 60%

Speed MPH	HHD NCAT	HHD CAT	HHD DSL	HHD ALL
0	0	0	0	0

Pollutant Name: PM10 - Break Wear Temperature: 65F Relative Humidity: 60%

Speed MPH	HHD NCAT	HHD CAT	HHD DSL	HHD ALL
0	0	0	0	0

APPENDIX B-3

DEATILED EMISSION CALCULATIONS, EMISSION FACTOR DERIVATION AND EMFAC2007 OUTPUT FOR PROJECT YEAR 2010

Summary of Emissions from HHD Diesel-Fueled Drayage Trucks
Dolores and ICTF Rail Yards, Long Beach, CA

Running Exhaust Emissions

					Carbon	2010 Emission Factors									2010 Emissions								
	Number of	VMT per	VMT per	Fuel Use	Oxidation	(g/mi)[5,6]						(kg/gal)[4]			(tpy)						(metric tons/yr)		
Yard	Truck Trips[1]	Trip[2]	Year	(gal/yr)[3]	Factor[4]	ROG	CO	NOx	PM10[7]	DPM[7]	SOx	CO2	N2O[8]	CH4[8]	ROG	CO	NOx	PM10	DPM	SOx	CO2	N2O	CH4
ICTF - Onsite	1,360,800	1.75	2,381,400	690,477	99%	4.93	12.58	22.54	1.58	1.52	0.03	10.15	1.39E-05	4.16E-05	12.94	33.03	59.17	4.15	3.98	0.07	6,938.26	0.01	0.03

Idling Exhaust Emissions

					Carbon	2010 Emission Factors									2010 Emissions								
	Number of	Idling[9]		Fuel Use	Oxidation	(g/hr)[10]						(kg/gal)[4]			(tpy)						(metric tons/yr)		
Yard	Truck Trips	(mins/trip)	(hr/yr)	(gal/yr)[3]	Factor[4]	ROG	CO	NOx	PM10	DPM	SOx	CO2	N2O[8]	CH4[8]	ROG	CO	NOx	PM10	DPM	SOx	CO2	N2O	CH4
ICTF - RTG	884,520	30	442,260	291,237	99%	12.49	48.29	110.26	1.79	1.79	0.06	10.15	1.39E-05	4.16E-05	6.09	23.54	53.75	0.87	0.87	0.03	2,926.50	0.00	0.01
ICTF - WSG	476,280	20	158,760	104,547	99%	12.49	48.29	110.26	1.79	1.79	0.06	10.15	1.39E-05	4.16E-05	2.19	8.45	19.30	0.31	0.31	0.01	1,050.54	0.00	0.00
Total	**1,360,800**		**601,020**	**395,784**											**8.27**	**31.99**	**73.05**	**1.19**	**1.19**	**0.04**	**3,977.03**	**0.01**	**0.02**

Notes:
1. Number of truck trips is based on the predicted lift count for 2010 and was calculated using a spreadsheet provided by HDR. See Appendix B for additional detail.
2. VMT per trip estimated from aerial photos.
3. Fuel use calculated using the EMFAC 2007 model with the BURDEN output option.
4. From the Air Resources Board's Draft *Emission Factors for Mandatory Reporting Programs*, August 10, 2007.
5. Running exhaust emission factors (g/mi) from EMFAC 2007 using the BURDEN output option. The EMFAC default model year distribution for L.A. County was used.
6. Emission factor calculations assumed an average speed of 15 mph.
7. The PM10 emission factor includes engine exhaust emissions along with brake and tire wear. The DPM emission factor includes engine exhaust emissions only.
8. Based on a diesel fuel HHV of 5.825 MMBtu/barrel (from ARB Draft Emission Factors for Mandatory Reporting Programs, August 10, 2007) and 42 gallons per barrel.
9. Idling time (mins/trip) per UPRR staff. It was assumed that the idling time for trucks served by the WSG cranes would be less than trucks served by the RTG cranes, due to increased efficiency of operations.
   See CHE subsheet for details on the RTG/WSG split.
10. Idling exhaust emission factors from EMFAC 2007 using the EMFAC output option. The EMFAC default model year distribution for L.A. County was used.

Calculation of the Number of Drayage Truck Trips[1]
Dolores and ICTF Rail Yards, Long Beach, CA

Assumptions	**CY 2010**
Lifts per year (assumed equal gate count)[2]	900,000
Days Operation	360
In-gate count/Total gate count[3]	61%

% Trucks Arriving and Departing with a Container	**0%**	**10%**	**20%**	**30%**	**40%**	**50%**	**60%**	**70%**	**80%**	**90%**	**100%**
Trucks w/ Containers In (Ci)	549,000	549,000	549,000	549,000	549,000	549,000	549,000	549,000	549,000	549,000	549,000
Trucks w/ Containers Out (Co)	351,000	351,000	351,000	351,000	351,000	351,000	351,000	351,000	351,000	351,000	351,000
Bobtails and Bare Chassis Out (Bo)	549,000	494,100	439,200	384,300	329,400	274,500	219,600	198,000	198,000	198,000	198,000
Bobtails and Bare Chassis In (Bi)	351,000	296,100	241,200	186,300	131,400	76,500	21,600	0	0	0	0
Yearly Truck Trips (one-way)[4]	1,800,000	1,690,200	1,580,400	1,470,600	**1,360,800**	1,251,000	1,141,200	1,098,000	1,098,000	1,098,000	1,098,000
% Truck trips w/ Containers	50%	53%	57%	61%	66%	72%	79%	82%	82%	82%	82%

Notes:
1. Spreadsheet developed by Greg Chiodo of HDR.
2. The 2010 lift count is the projected lift count from the ICTF Modernization Plan.
3. Based on the 2006 gate count data provided by UPRR.
4. Per Greg Chiodo of HDR, it was assumed, based on aerial photos of the ICTF and data contained in the Port of Los Angeles Baseline Traffic Study (Meyer, Mohaddis Associates, Inc., April 2004), that 40% of the trucks entering ICTF with a container also leave ICTF with a container.

Title : Los Angeles County Avg Annual CYr 2010 Default Title
Version : Emfac2007 V2.3 Nov 1 2006 ** WIS Enabled **
Run Date : 2007/03/22 14:30:08
Scen Year: 2010 -- All model years in the range 1966 to 2010 selected
Season : Annual
Area : Los Angeles County Average
I/M Stat : Enhanced Interim (2005) -- Using I/M schedule for area 59 Los Angeles (SC)
Emissions: Tons Per Day
****

	HHDT-DSL
Vehicles	24869
VMT/1000	4993
Trips	125849
Reactive Organic Gas Emissions	
Run Exh	27.13
Idle Exh	0.58
Start Ex	0

Total Ex	27.71
Diurnal	0
Hot Soak	0
Running	0
Resting	0

Total	27.71
Carbon Monoxide Emissions	
Run Exh	69.25
Idle Exh	2.23
Start Ex	0

Total Ex	71.48
Oxides of Nitrogen Emissions	
Run Exh	124.05
Idle Exh	5.1
Start Ex	0

Total Ex	129.15
Carbon Dioxide Emissions (000)	
Run Exh	15.78
Idle Exh	0.31
Start Ex	0

Total Ex	16.09
PM10 Emissions	
Run Exh	8.35
Idle Exh	0.08
Start Ex	0

Total Ex	8.43
TireWear	0.2
BrakeWr	0.16

Total	8.78
Lead	0
SOx	0.15
Fuel Consumption (000 gallons)	
Gasoline	0
Diesel	1447.7

Title : Los Angeles County Avg Annual CYr 2010 Default Title
Version : Emfac2007 V2.3 Nov 1 2006 ** WIS Enabled **
Run Date : 2007/08/10 13:45:16
Scen Year: 2010 -- All model years in the range 1966 to 2010 selected
Season : Annual
Area : Los Angeles
****
Year: 2010 -- Model Years 1966 to 2010 Inclusive --
Emfac2007 Emission Factors: V2.3 Nov 1 2006 ** WIS Enabled **

County Average Los Angeles

Table 1: Running Exhaust Emissions (grams/mile; grams/idle-hour)

Pollutant Name: Reactive Org Gases Temperature: 65F Relative Humidity: 60%

Speed MPH	HHD NCAT	HHD CAT	HHD DSL	HHD ALL
	0	0	0	12.487	11.967

Pollutant Name: Carbon Monoxide Temperature: 65F Relative Humidity: 60%

Speed MPH	HHD NCAT	HHD CAT	HHD DSL	HHD ALL
	0	0	0	48.291	46.283

Pollutant Name: Oxides of Nitrogen Temperature: 65F Relative Humidity: 60%

Speed MPH	HHD NCAT	HHD CAT	HHD DSL	HHD ALL
	0	0	0	110.258	105.673

Pollutant Name: Carbon Dioxide Temperature: 65F Relative Humidity: 60%

Speed MPH	HHD NCAT	HHD CAT	HHD DSL	HHD ALL
	0	0	0	6617.137	6341.961

Pollutant Name: Sulfur Dioxide Temperature: 65F Relative Humidity: 60%

Speed MPH	HHD NCAT	HHD CAT	HHD DSL	HHD ALL
	0	0	0	0.063	0.061

Pollutant Name: PM10 Temperature: 65F Relative Humidity: 60%

Speed MPH	HHD NCAT	HHD CAT	HHD DSL	HHD ALL
	0	0	0	1.792	1.718

Pollutant Name: PM10 - Tire Wear Temperature: 65F Relative Humidity: 60%

Speed MPH	HHD NCAT	HHD CAT	HHD DSL	HHD ALL
	0	0	0	0	0

Pollutant Name: PM10 - Brake Wear Temperature: 65F Relative Humidity: 60%

Speed MPH	HHD NCAT	HHD CAT	HHD DSL	HHD ALL
	0	0	0	0	0

APPENDIX B-4

DEATILED EMISSION CALCULATIONS, EMISSION FACTOR DERIVATION AND EMFAC2007 OUTPUT FOR PROJECT YEAR 2012

Summary of Emissions from HHD Diesel-Fueled Drayage Trucks
Dolores and ICTF Rail Yards, Long Beach, CA

Running Exhaust Emissions

					Carbon	2012 Emission Factors									2012 Emissions								
	Number of	VMT per	VMT per	Fuel Use	Oxidation	(g/mi)[5,6]						(kg/gal)[4]			(tpy)						(metric tons/yr)		
Yard	Truck Trips[1]	Trip[2]	Year	(gal/yr)[3]	Factor[4]	ROG	CO	NOx	PM10[7]	DPM[7]	SOx	CO2	N2O[8]	CH4[8]	ROG	CO	NOx	PM10	DPM	SOx	CO2	N2O	CH4
ICTF - Onsite	1,663,200	1.75	2,910,600.00	843,440.90	99%	4.08	10.25	18.49	1.21	1.15	0.03	10.15	1.39E-05	4.16E-05	13.10	32.88	59.31	3.89	3.68	0.09	8,475.32	0.01	0.04

Idling Exhaust Emissions

					Carbon	2012 Emission Factors									2012 Emissions								
	Number of	Idling[9]		Fuel Use	Oxidation	(g/hr)[10]						(kg/gal)[4]			(tpy)						(metric tons/yr)		
Yard	Truck Trips	(mins/trip)	(hr/yr)	(gal/yr)[3]	Factor[4]	ROG	CO	NOx	PM10	DPM	SOx	CO2	N2O[8]	CH4[8]	ROG	CO	NOx	PM10	DPM	SOx	CO2	N2O	CH4
ICTF - WSG	1,663,200	20	554,400.00	365,083	99%	11.32	46.71	113.45	1.45	1.45	0.06	10.15	1.39E-05	4.16E-05	6.92	28.54	69.33	0.89	0.89	0.04	3668.54	0.01	0.02

Notes:
1. Number of truck trips is based on the 2005 lift count and was calculated using a spreadsheet provided by HDR. See Appendix B for additional detail.
2. VMT per trip estimated from aerial photos.
3. Fuel use calculated using the EMFAC 2007 model with the BURDEN output option.
4. From the Air Resources Board's Draft *Emission Factors for Mandatory Reporting Programs*, August 10, 2007.
5. Running exhaust emission factors (g/mi) from EMFAC 2007 using the BURDEN output option. The EMFAC default model year distribution for L.A. County was used.
6. Emission factor calculations assumed an average speed of 15 mph.
7. The PM10 emission factor includes engine exhaust emissions along with brake and tire wear. The DPM emission factor includes engine exhaust emissions only.
8. Based on a diesel fuel HHV of 5.825 MMBtu/barrel (from ARB Draft Emission Factors for Mandatory Reporting Programs, August 10, 2007) and 42 gallons per barrel.
9. Idling time (mins/trip) per UPRR staff. Idling time has been reduced from the baseline due to the increased operational efficiency of the WSG cranes.
10. Idling exhaust emission factors from EMFAC 2007 using the EMFAC output option. The EMFAC default model year distribution for L.A. County was used.

Calculation of the Number of Drayage Truck Trips[1]
Dolores and ICTF Rail Yards, Long Beach, CA

Assumptions	CY 2012
Lifts per year (assumed equal gate count)[2]	1,100,000
Days Operation	360
In-gate count/Total gate count[3]	61%

% Trucks Arriving and Departing with a Container	0%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%
Trucks w/ Containers In (Ci)	671,000	671,000	671,000	671,000	671,000	671,000	671,000	671,000	671,000	671,000	671,000
Trucks w/ Containers Out (Co)	429,000	429,000	429,000	429,000	429,000	429,000	429,000	429,000	429,000	429,000	429,000
Bobtails and Bare Chassis Out (Bo)	671,000	603,900	536,800	469,700	402,600	335,500	268,400	242,000	242,000	242,000	242,000
Bobtails and Bare Chassis In (Bi)	429,000	361,900	294,800	227,700	160,600	93,500	26,400	0	0	0	0
Yearly Truck Trips (one-way)[4]	2,200,000	2,065,800	1,931,600	1,797,400	**1,663,200**	1,529,000	1,394,800	1,342,000	1,342,000	1,342,000	1,342,000
% Truck trips w/ Containers	50%	53%	57%	61%	66%	72%	79%	82%	82%	82%	82%

Notes:
1. Spreadsheet developed by Greg Chiodo of HDR.
2. The 2010 lift count is the projected lift count from the ICTF Modernization Plan.
3. Based on the 2006 gate count data provided by UPRR.
4. Per Greg Chiodo of HDR, it was assumed, based on aerial photos of the ICTF and data contained in the Port of Los Angeles Baseline Traffic Study (Meyer, Mohaddis Associates, Inc., April 2004), that 40% of the trucks entering ICTF with a container also leave ICTF with a container.

Title : Los Angeles County Avg Annual CYr 2012 Default Title
Version : Emfac2007 V2.3 Nov 1 2006 ** WIS Enabled **
Run Date : 2007/05/09 08:13:05
Scen Year: 2012 -- All model years in the range 1968 to 2012 selected
Season : Annual
Area : Los Angeles County Average
I/M Stat : Enhanced Interim (2005) -- Using I/M schedule for area 59 Los Angeles (SC)
Emissions: Tons Per Day
****

	HHDT-DSL
Vehicles	25950
VMT/1000	5333
Trips	131322
Reactive Organic Gas Emissions	
Run Exh	24
Idle Exh	0.55
Start Ex	0

Total Ex	24.55
Diurnal	0
Hot Soak	0
Running	0
Resting	0

Total	24.55
Carbon Monoxide Emissions	
Run Exh	60.24
Idle Exh	2.25
Start Ex	0

Total Ex	62.5
Oxides of Nitrogen Emissions	
Run Exh	108.68
Idle Exh	5.47
Start Ex	0

Total Ex	114.15
Carbon Dioxide Emissions (000)	
Run Exh	16.85
Idle Exh	0.32
Start Ex	0

Total Ex	17.17
PM10 Emissions	
Run Exh	6.74
Idle Exh	0.07
Start Ex	0

Total Ex	6.81
TireWear	0.21
BrakeWr	0.17

Total	7.19
Lead	0
SOx	0.16
Fuel Consumption (000 gallons)	
Gasoline	0
Diesel	1545.41

Title : Los Angeles County Avg Annual CYr 2012 Default Title
Version : Emfac2007 V2.3 Nov 1 2006 ** WIS Enabled **
Run Date : 2007/08/10 13:45:24
Scen Year: 2012 -- All model years in the range 1968 to 2012 selected
Season : Annual
Area : Los Angeles
****
Year: 2012 -- Model Years 1968 to 2012 Inclusive --
Emfac2007 Emission Factors: V2.3 Nov 1 2006 ** WIS Enabled **

County Average Los Angeles

Table 1: Running Exhaust Emissions (grams/mile; grams/idle-hour)

Pollutant Name: Reactive Org Gases Temperature: 65F Relative Humidity: 60%

Speed MPH	HHD NCAT	HHD CAT	HHD DSL	HHD ALL
	0	0	0	11.319	10.935

Pollutant Name: Carbon Monoxide Temperature: 65F Relative Humidity: 60%

Speed MPH	HHD NCAT	HHD CAT	HHD DSL	HHD ALL
	0	0	0	46.708	45.125

Pollutant Name: Oxides of Nitrogen Temperature: 65F Relative Humidity: 60%

Speed MPH	HHD NCAT	HHD CAT	HHD DSL	HHD ALL
	0	0	0	113.453	109.606

Pollutant Name: Carbon Dioxide Temperature: 65F Relative Humidity: 60%

Speed MPH	HHD NCAT	HHD CAT	HHD DSL	HHD ALL
	0	0	0	6617.136	6392.797

Pollutant Name: Sulfur Dioxide Temperature: 65F Relative Humidity: 60%

Speed MPH	HHD NCAT	HHD CAT	HHD DSL	HHD ALL
	0	0	0	0.063	0.061

Pollutant Name: PM10 Temperature: 65F Relative Humidity: 60%

Speed MPH	HHD NCAT	HHD CAT	HHD DSL	HHD ALL
	0	0	0	1.454	1.404

Pollutant Name: PM10 - Tire Wear Temperature: 65F Relative Humidity: 60%

Speed MPH	HHD NCAT	HHD CAT	HHD DSL	HHD ALL
	0	0	0	0	0

Pollutant Name: PM10 - Brake Wear Temperature: 65F Relative Humidity: 60%

Speed MPH	HHD NCAT	HHD CAT	HHD DSL	HHD ALL
	0	0	0	0	0

APPENDIX B-5

DEATILED EMISSION CALCULATIONS, EMISSION FACTOR DERIVATION AND EMFAC2007 OUTPUT FOR PROJECT YEAR 2014

Summary of Emissions from HHD Diesel-Fueled Drayage Trucks
Dolores and ICTF Rail Yards, Long Beach, CA

Running Exhaust Emissions

Yard	Number of Truck Trips[1]	VMT per Trip[2]	VMT per Year	Fuel Use (gal/yr)[3]	Carbon Oxidation Factor[4]	2014 Emission Factors (g/mi)[5,6] ROG	CO	NOx	PM10[7]	DPM[7]	SOx	2014 Emission Factors (kg/gal)[4] CO2	N2O[8]	CH4[8]	2014 Emissions (tpy) ROG	CO	NOx	PM10	DPM	SOx	2014 Emissions (metric tons/yr) CO2	N2O	CH4
ICTF - Onsite	1,965,600	1.35	2,653,560	768,572	99%	3.24	8.01	14.65	0.88	0.82	0.03	10.15	1.39E-05	4.16E-05	9.48	23.44	42.85	2.58	2.40	0.08	7,723.00	0.01	0.03

Idling Exhaust Emissions

Yard	Number of Truck Trips	Idling[9] (mins/trip)	Idling[9] (hr/yr)	Fuel Use (gal/yr)[3]	Carbon Oxidation Factor[4]	2014 Emission Factors (g/hr)[10] ROG	CO	NOx	PM10	DPM	SOx	2014 Emission Factors (kg/gal)[4] CO2	N2O[8]	CH4[8]	2014 Emissions (tpy) ROG	CO	NOx	PM10	DPM	SOx	2014 Emissions (metric tons/yr) CO2	N2O	CH4
ICTF - Onsite	1,965,600	15	491,400	323,597	99%	10.32	45.32	116.19	1.14	1.14	0.06	10.15	1.39E-05	4.16E-05	5.59	24.55	62.94	0.62	0.62	0.03	3,251.66	0.00	0.01

Notes:
1. Number of truck trips is based on the predicted lift count for 2014 and was calculated using a spreadsheet provided by HDR. See Appendix B for additional detail.
2. Average trip length estimated from aerial photos. Assumed all trucks will enter through the new Alameda St gate, travel through the facility, and exit the existing Sepulveda Blvd. gate.
3. Fuel use calculated using the EMFAC 2007 model with the BURDEN output option.
4. From the Air Resources Board's Draft *Emission Factors for Mandatory Reporting Programs*, August 10, 2007.
5. Running exhaust emission factors (g/mi) from EMFAC 2007 using the BURDEN output option. The EMFAC default model year distribution for L.A. County was used.
6. Emission factor calculations assumed an average speed of 15 mph.
7. The PM10 emission factor includes engine exhaust emissions along with brake and tire wear. The DPM emission factor includes engine exhaust emissions only.
8. Based on a diesel fuel HHV of 5.825 MMBtu/barrel (from ARB Draft Emission Factors for Mandatory Reporting Programs, August 10, 2007) and 42 gallons per barrel.
9. Truck idling per trip will be reduced beginning in 2014 due to installation/operation of the Automated Gate System (AGS).
10. Idling exhaust emission factors from EMFAC 2007 using the EMFAC output option. The EMFAC default model year distribution for L.A. County was used.

Calculation of the Number of Drayage Truck Trips[1]
Dolores and ICTF Rail Yards, Long Beach, CA

Assumptions	**CY 2014**
Lifts per year (assumed equal gate count)[2]	1,300,000
Days Operation	360
In-gate count/Total gate count[3]	61%

% Trucks Arriving and Departing with a Container	**0%**	**10%**	**20%**	**30%**	**40%**	**50%**	**60%**	**70%**	**80%**	**90%**	**100%**
Trucks w/ Containers In (Ci)	793,000	793,000	793,000	793,000	793,000	793,000	793,000	793,000	793,000	793,000	793,000
Trucks w/ Containers Out (Co)	507,000	507,000	507,000	507,000	507,000	507,000	507,000	507,000	507,000	507,000	507,000
Bobtails and Bare Chassis Out (Bo)	793,000	713,700	634,400	555,100	475,800	396,500	317,200	286,000	286,000	286,000	286,000
Bobtails and Bare Chassis In (Bi)	507,000	427,700	348,400	269,100	189,800	110,500	31,200	0	0	0	0
Yearly Truck Trips (one-way)[4]	2,600,000	2,441,400	2,282,800	2,124,200	**1,965,600**	1,807,000	1,648,400	1,586,000	1,586,000	1,586,000	1,586,000
% Truck trips w/ Containers	50%	53%	57%	61%	66%	72%	79%	82%	82%	82%	82%

Notes:
1. Spreadsheet developed by Greg Chiodo of HDR.
2. The 2010 lift count is the projected lift count from the ICTF Modernization Plan.
3. Based on the 2006 gate count data provided by UPRR.
4. Per Greg Chiodo of HDR, it was assumed, based on aerial photos of the ICTF and data contained in the Port of Los Angeles Baseline Traffic Study (Meyer, Mohaddis Associates, Inc., April 2004), that 40% of the trucks entering ICTF with a container also leave ICTF with a container.

Title : Los Angeles County Avg Annual CYr 2014 Default Title
Version : Emfac2007 V2.3 Nov 1 2006 ** WIS Enabled **
Run Date : 2007/05/09 08:18:35
Scen Year: 2014 -- All model years in the range 1970 to 2014 selected
Season : Annual
Area : Los Angeles County Average
I/M Stat : Enhanced Interim (2005) -- Using I/M schedule for area 59 Los Angeles (SC)
Emissions: Tons Per Day
****

	HHDT-DSL
Vehicles	27237
VMT/1000	5803
Trips	137834
Reactive Organic Gas Emissions	
Run Exh	20.73
Idle Exh	0.52
Start Ex	0

Total Ex	21.25
Diurnal	0
Hot Soak	0
Running	0
Resting	0

Total	21.25
Carbon Monoxide Emissions	
Run Exh	51.26
Idle Exh	2.3
Start Ex	0

Total Ex	53.55
Oxides of Nitrogen Emissions	
Run Exh	93.7
Idle Exh	5.89
Start Ex	0

Total Ex	99.58
Carbon Dioxide Emissions (000)	
Run Exh	18.34
Idle Exh	0.34
Start Ex	0

Total Ex	18.68
PM10 Emissions	
Run Exh	5.24
Idle Exh	0.06
Start Ex	0

Total Ex	5.29
TireWear	0.23
BrakeWr	0.18

Total	5.71
Lead	0
SOx	0.18
Fuel Consumption (000 gallons)	
Gasoline	0
Diesel	1680.77

Title : Los Angeles County Avg Annual CYr 2014 Default Title
Version : Emfac2007 V2.3 Nov 1 2006 ** WIS Enabled **
Run Date : 2007/08/10 13:45:36
Scen Year: 2014 -- All model years in the range 1970 to 2014 selected
Season : Annual
Area : Los Angeles
****
Year: 2014 -- Model Years 1970 to 2014 Inclusive --
Emfac2007 Emission Factors: V2.3 Nov 1 2006 ** WIS Enabled **

County Average Los Angeles

Table 1: Running Exhaust Emissions (grams/mile; grams/idle-hour)

Pollutant Name: Reactive Org Gases Temperature: 65F Relative Humidity: 60%

Speed MPH	HHD NCAT	HHD CAT	HHD DSL	HHD ALL
	0	0	0	10.324	10.044

Pollutant Name: Carbon Monoxide Temperature: 65F Relative Humidity: 60%

Speed MPH	HHD NCAT	HHD CAT	HHD DSL	HHD ALL
	0	0	0	45.319	44.09

Pollutant Name: Oxides of Nitrogen Temperature: 65F Relative Humidity: 60%

Speed MPH	HHD NCAT	HHD CAT	HHD DSL	HHD ALL
	0	0	0	116.194	113.043

Pollutant Name: Carbon Dioxide Temperature: 65F Relative Humidity: 60%

Speed MPH	HHD NCAT	HHD CAT	HHD DSL	HHD ALL
	0	0	0	6617.137	6437.659

Pollutant Name: Sulfur Dioxide Temperature: 65F Relative Humidity: 60%

Speed MPH	HHD NCAT	HHD CAT	HHD DSL	HHD ALL
	0	0	0	0.063	0.061

Pollutant Name: PM10 Temperature: 65F Relative Humidity: 60%

Speed MPH	HHD NCAT	HHD CAT	HHD DSL	HHD ALL
	0	0	0	1.144	1.113

Pollutant Name: PM10 - Tire Wear Temperature: 65F Relative Humidity: 60%

Speed MPH	HHD NCAT	HHD CAT	HHD DSL	HHD ALL
0	0	0	0	0

Pollutant Name: PM10 - Brake Wear Temperature: 65F Relative Humidity: 60%

Speed MPH	HHD NCAT	HHD CAT	HHD DSL	HHD ALL
0	0	0	0	0

APPENDIX B-6

DEATILED EMISSION CALCULATIONS, EMISSION FACTOR DERIVATION AND EMFAC2007 OUTPUT FOR PROJECT YEAR 2016

Summary of Emissions from HHD Diesel-Fueled Drayage Trucks
Dolores and ICTF Rail Yards, Long Beach, CA

Running Exhaust Emissions

					Carbon	2016 Emission Factors									2016 Emissions								
	Number of	VMT per	VMT per	Fuel Use	Oxidation	(g/mi)[5,6]						(kg/gal)[4]			(tpy)						(metric tons/yr)		
Yard	Truck Trips[1]	Trip[2]	Year	(gal/yr)[3]	Factor[4]	ROG	CO	NOx	PM10[7]	DPM[7]	SOx	CO2	N2O[8]	CH4[8]	ROG	CO	NOx	PM10	DPM	SOx	CO2	N2O	CH4
ICTF - Onsite	2,268,000	1.35	3,061,800.00	886,270.14	99%	2.55	6.22	11.56	0.63	0.57	0.03	10.15	1.39E-05	4.16E-05	8.60	21.00	39.00	2.14	1.92	0.09	8,905.69	0.01	0.04

Idling Exhaust Emissions

					Carbon	2016 Emission Factors									2016 Emissions								
	Number of	Idling[9]		Fuel Use	Oxidation	(g/hr)[10]						(kg/gal)[4]			(tpy)						(metric tons/yr)		
Yard	Truck Trips	(mins/trip)	(hr/yr)	(gal/yr)[3]	Factor[4]	ROG	CO	NOx	PM10	DPM	SOx	CO2	N2O[8]	CH4[8]	ROG	CO	NOx	PM10	DPM	SOx	CO2	N2O	CH4
ICTF - Onsite	2,268,000	15	567,000.00	373,381	99%	9.54	44.20	118.34	0.88	0.88	0.06	10.15	1.39E-05	4.16E-05	5.96	27.63	73.97	0.55	0.55	0.04	3,751.91	0.01	0.02

Notes:

1. Number of truck trips is based on the predicted lift count for 2016 and was calculated using a spreadsheet provided by HDR. See Appendix B for additional detail.
2. Average trip length estimated from aerial photos. Assumes trucks will enter through the new Alameda St gate, travel through the facility and exit the existing Sepulveda Blvd. gate.
3. Fuel use calculated using the EMFAC 2007 model with the BURDEN output option.
4. From the Air Resources Board's Draft *Emission Factors for Mandatory Reporting Programs*, August 10, 2007.
5. Running exhaust emission factors (g/mi) from EMFAC 2007 using the BURDEN output option. The EMFAC default model year distribution for L.A. County was used.
6. Emission factor calculations assumed an average speed of 15 mph.
7. The PM10 emission factor includes engine exhaust emissions along with brake and tire wear. The DPM emission factor includes engine exhaust emissions only.
8. Based on a diesel fuel HHV of 5.825 MMBtu/barrel (from ARB Draft Emission Factors for Mandatory Reporting Programs, August 10, 2007) and 42 gallons per barrel.
9. Truck idling per trip will be reduced beginning in 2014 due to installation/operation of the Automated Gate System (AGS).
10. Idling exhaust emission factors from EMFAC 2007 using the EMFAC output option. The EMFAC default model year distribution for L.A. County was used.

Calculation of the Number of Drayage Truck Trips[1]
Dolores and ICTF Rail Yards, Long Beach, CA

Assumptions	CY 2016
Lifts per year (assumed equal gate count)[2]	1,500,000
Days Operation	360
In-gate count/Total gate count[3]	61%

% Trucks Arriving and Departing with a Container	0%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%
Trucks w/ Containers In (Ci)	915,000	915,000	915,000	915,000	915,000	915,000	915,000	915,000	915,000	915,000	915,000
Trucks w/ Containers Out (Co)	585,000	585,000	585,000	585,000	585,000	585,000	585,000	585,000	585,000	585,000	585,000
Bobtails and Bare Chassis Out (Bo)	915,000	823,500	732,000	640,500	549,000	457,500	366,000	330,000	330,000	330,000	330,000
Bobtails and Bare Chassis In (Bi)	585,000	493,500	402,000	310,500	219,000	127,500	36,000	0	0	0	0
Yearly Truck Trips (one-way)[4]	3,000,000	2,817,000	2,634,000	2,451,000	**2,268,000**	2,085,000	1,902,000	1,830,000	1,830,000	1,830,000	1,830,000
% Truck trips w/ Containers	50%	53%	57%	61%	66%	72%	79%	82%	82%	82%	82%

Notes:
1. Spreadsheet developed by Greg Chiodo of HDR.
2. The 2010 lift count is the projected lift count from the ICTF Modernization Plan.
3. Based on the 2006 gate count data provided by UPRR.
4. Per Greg Chiodo of HDR, it was assumed, based on aerial photos of the ICTF and data contained in the Port of Los Angeles Baseline Traffic Study (Meyer, Mohaddis Associates, Inc., April 2004), that 40% of the trucks entering ICTF with a container also leave ICTF with a container.

Title : Los Angeles County Avg Annual CYr 2016 Default Title
Version : Emfac2007 V2.3 Nov 1 2006 ** WIS Enabled **
Run Date : 2007/05/09 08:24:31
Scen Year: 2016 -- All model years in the range 1972 to 2016 selected
Season : Annual
Area : Los Angeles County Average
I/M Stat : Enhanced Interim (2005) -- Using I/M schedule for area 59 Los Angeles (
Emissions: Tons Per Day
****

	HHDT-DSL
Vehicles	28354
VMT/1000	6265
Trips	143483
Reactive Organic Gas Emissions	
Run Exh	17.59
Idle Exh	0.5
Start Ex	0

Total Ex	18.09
Diurnal	0
Hot Soak	0
Running	0
Resting	0

Total	18.09
Carbon Monoxide Emissions	
Run Exh	42.96
Idle Exh	2.33
Start Ex	0

Total Ex	45.29
Oxides of Nitrogen Emissions	
Run Exh	79.81
Idle Exh	6.24
Start Ex	0

Total Ex	86.05
Carbon Dioxide Emissions (000)	
Run Exh	19.8
Idle Exh	0.35
Start Ex	0

Total Ex	20.15
PM10 Emissions	
Run Exh	3.93
Idle Exh	0.05
Start Ex	0

Total Ex	3.98
TireWear	0.25
BrakeWr	0.19

Total	4.42
Lead	0
SOx	0.19
Fuel Consumption (000 gallons)	
Gasoline	0
Diesel	1813.47

Title : Los Angeles County Avg Annual CYr 2016 Default Title
Version : Emfac2007 V2.3 Nov 1 2006 ** WIS Enabled **
Run Date : 2007/08/10 13:45:40
Scen Year: 2016 -- All model years in the range 1972 to 2016 selected
Season : Annual
Area : Los Angeles
****
Year: 2016 -- Model Years 1972 to 2016 Inclusive --
Emfac2007 Emission Factors: V2.3 Nov 1 2006 ** WIS Enabled **

County Average Los Angeles

Table 1: Running Exhaust Emissions (grams/mile; grams/idle-hour)

Pollutant Name: Reactive Org Gases Temperature: 65F Relative Humidity: 60%

Speed MPH	HHD NCAT	HHD CAT	HHD DSL	HHD ALL
	0	0	0	9.54	9.331

Pollutant Name: Carbon Monoxide Temperature: 65F Relative Humidity: 60%

Speed MPH	HHD NCAT	HHD CAT	HHD DSL	HHD ALL
0	0	0	44.203	43.235

Pollutant Name: Oxides of Nitrogen Temperature: 65F Relative Humidity: 60%

Speed MPH	HHD NCAT	HHD CAT	HHD DSL	HHD ALL
0	0	0	118.344	115.753

Pollutant Name: Carbon Dioxide Temperature: 65F Relative Humidity: 60%

Speed MPH	HHD NCAT	HHD CAT	HHD DSL	HHD ALL
0	0	0	6617.134	6472.218

Pollutant Name: Sulfur Dioxide Temperature: 65F Relative Humidity: 60%

Speed MPH	HHD NCAT	HHD CAT	HHD DSL	HHD ALL
0	0	0	0.063	0.062

Pollutant Name: PM10 Temperature: 65F Relative Humidity: 60%

Speed MPH	HHD NCAT	HHD CAT	HHD DSL	HHD ALL
0	0	0	0.883	0.863

Pollutant Name: PM10 - Tire Wear Temperature: 65F Relative Humidity: 60%

Speed MPH	HHD NCAT	HHD CAT	HHD DSL	HHD ALL
0	0	0	0	0

Pollutant Name: PM10 - Brake Wear Temperature: 65F Relative Humidity: 60%

Speed MPH	HHD NCAT	HHD CAT	HHD DSL	HHD ALL
0	0	0	0	0

APPENDIX B-7

DEATILED EMISSION CALCULATIONS, EMISSION FACTOR DERIVATION AND EMFAC2007 OUTPUT FOR OFFSITE DRAYAGE TRUCK EMISSIONS
2005 BASELINE YEAR

Summary of Emissions from Intermodal HHD Diesel-Fueled Truck Traffic within 0.5 Miles of Yard Boundaries
Dolores and ICTF Rail Yards, Long Beach, CA

					Carbon	2005 Emission Factors									2005 Emissions								
	Number of	VMT per	VMT per	Fuel Use	Oxidation	(g/mi)[6]						(kg/gal)[5]			(tpy)						(metric tons/yr)		
Road Segment	Truck Trips[1,2]	Trip[3]	Year	(gal/yr)[4]	Factor[5]	ROG	CO	NOx	PM10[7]	DPM[7]	SOx	CO2	N2O[8]	CH4[8]	ROG	CO	NOx	PM10	DPM	SOx	CO2	N2O	CH4
Route A																							
Gate - L of Sepulveda to T.I. Fwy Enterance	647,271	0.13	84,145.23	16,121.45	99%	1.95	7.53	22.04	1.24	1.18	0.16	10.15	1.39E-05	4.16E-05	0.18	0.70	2.04	0.12	0.11	0.01	162.00	2.24E-04	6.71E-04
S on T.I. Fwy	647,271	0.50	323,635.51	62,005.59	99%	1.95	7.53	22.04	1.24	1.18	0.16	10.15	1.39E-05	4.16E-05	0.70	2.69	7.86	0.44	0.42	0.06	623.06	8.60E-04	2.58E-03
Route B																							
Gate - R on Sepulveda to Alameda St	215,757	0.74	159,660.18	30,589.43	99%	1.95	7.53	22.04	1.24	1.18	0.16	10.15	1.39E-05	4.16E-05	0.34	1.33	3.88	0.22	0.21	0.03	307.38	4.24E-04	1.27E-03
R on Alameda to I-405	215,757	1.40	302,059.81	57,871.89	99%	1.95	7.53	22.04	1.24	1.18	0.16	10.15	1.39E-05	4.16E-05	0.65	2.51	7.34	0.41	0.39	0.05	581.53	8.03E-04	2.41E-03
I-405 S towards I-710	215,757	0.50	107,878.50	20,668.53	99%	1.95	7.53	22.04	1.24	1.18	0.16	10.15	1.39E-05	4.16E-05	0.23	0.90	2.62	0.15	0.14	0.02	207.69	2.87E-04	8.60E-04
Route C																							
Gate - R on Sepulveda to Alameda St	75,046	0.74	55,533.98	10,639.80	99%	1.95	7.53	22.04	1.24	1.18	0.16	10.15	1.39E-05	4.16E-05	0.12	0.46	1.35	0.08	0.07	0.01	106.91	1.48E-04	4.43E-04
R on Alameda towards West Basin Area	75,046	2.20	165,101.01	31,631.84	99%	1.95	7.53	22.04	1.24	1.18	0.16	10.15	1.39E-05	4.16E-05	0.36	1.37	4.01	0.23	0.21	0.03	317.85	4.39E-04	1.32E-03
Total	**938,074**														**2.58**	**9.95**	**29.11**	**1.64**	**1.56**	**0.21**	**2,306.42**	**3.18E-03**	**9.55E-03**

Notes:
1. Number of truck trips is equal to the total number of intermodal trucks multiplied by the percentage of trucks following each route.
2. Percentage of trucks following each route from the *Preliminary Traffic Study.*
3. VTM per trip was determined for each road segment from Google Earth.
4. Fuel use calculated using the EMFAC 2007 model with the BURDEN output option.
5. From the Air Resources Board's Draft *Emission Factors for Mandatory Reporting Programs*, August 10, 2007.
6. Emission factors include traveling and idling and are from EMFAC 2007 using the BURDEN output option. The EMFAC default model year and speed distributions for L.A. County were used.
7. The PM10 emission factor includes engine exhaust emissions along with brake and tire wear. The DPM emission factor includes engine exhaust emissions only.
8. Based on a diesel fuel HHV of 5.825 MMBtu/barrel (from ARB Draft Emission Factors for Mandatory Reporting Programs, August 10, 2007) and 42 gallons per barrel.

Summary of Emissions from Intermodal HHD Diesel-Fueled Truck Traffic within 0.5 Miles of Yard Boundaries
Dolores and ICTF Rail Yards, Long Beach, CA

Running Exhaust Emissions

					Carbon	2005 Emission Factors									2005 Emissions								
	Number of	VMT per	VMT per	Fuel Use	Oxidation	(g/mi)[6]						(kg/gal)[5]			(tpy)						(metric tons/yr)		
Road Segment	Truck Trips[1,2]	Trip[3]	Year	(gal/yr)[4]	Factor[5]	ROG	CO	NOx	PM10[7]	DPM[7]	SOx	CO2	N2O[8]	CH4[8]	ROG	CO	NOx	PM10	DPM	SOx	CO2	N2O	CH4
Route A																							
Gate - L of Sepulveda to T.I. Fwy Enterance	647,271	0.13	84,145.23	16,121.45	99%	1.82	7.09	21.20	1.22	1.15	0.16	10.15	1.39E-05	4.16E-05	0.17	0.66	1.97	0.11	0.11	0.01	162.00	2.24E-04	6.71E-04
S on T.I. Fwy, continue to Shipping Terminal, POLA	647,271	5.20	3,365,809.20	644,858.17	99%	1.82	7.09	21.20	1.22	1.15	0.16	10.15	1.39E-05	4.16E-05	6.74	26.31	78.67	4.52	4.28	0.60	6,479.86	8.94E-03	2.68E-02
Route B																							
Gate - R on Sepulveda to Alameda St	215,757	0.74	159,660.18	30,589.43	99%	1.82	7.09	21.20	1.22	1.15	0.16	10.15	1.39E-05	4.16E-05	0.32	1.25	3.73	0.21	0.20	0.03	307.38	4.24E-04	1.27E-03
R on Alameda to I-405, southbound	215,757	1.40	302,059.80	57,871.89	99%	1.82	7.09	21.20	1.22	1.15	0.16	10.15	1.39E-05	4.16E-05	0.60	2.36	7.06	0.41	0.38	0.05	581.53	8.03E-04	2.41E-03
50% Continue to Cajon Junction, CA (SoCAB boundary)	107,879	73.90	7,972,221.15	1,527,404.44	99%	1.82	7.09	21.20	1.22	1.15	0.16	10.15	1.39E-05	4.16E-05	15.96	62.32	186.34	10.70	10.13	1.41	15,348.12	2.12E-02	6.36E-02
50% Continue to Banning, CA (SoCAB boundary)	107,879	88.40	9,536,459.40	1,827,098.14	99%	1.82	7.09	21.20	1.22	1.15	0.16	10.15	1.39E-05	4.16E-05	19.10	74.55	222.90	12.79	12.12	1.69	18,359.60	2.53E-02	7.60E-02
Cajon Junction to NV border @I-15	107,879	163.00	17,584,195.50	3,368,970.56	99%	1.82	7.09	21.20	1.22	1.15	0.16	10.15	1.39E-05	4.16E-05	35.21	137.45	411.00	23.59	22.35	3.11	33,853.10	4.67E-02	1.40E-01
Banning to AZ border @I-10	107,879	141.00	15,210,868.50	2,914,262.88	99%	1.82	7.09	21.20	1.22	1.15	0.16	10.15	1.39E-05	4.16E-05	30.46	118.90	355.53	20.41	19.34	2.69	29,283.97	4.04E-02	1.21E-01
Route C																							
Gate - R on Sepulveda to Alameda St	75,046	0.74	55,534.04	10,639.81	99%	1.82	7.09	21.20	1.22	1.15	0.16	10.15	1.39E-05	4.16E-05	0.11	0.43	1.30	0.07	0.07	0.01	106.91	1.48E-04	4.43E-04
R on Alameda towards I-405 northbound	75,046	2.20	165,101.20	31,631.88	99%	1.82	7.09	21.20	1.22	1.15	0.16	10.15	1.39E-05	4.16E-05	0.33	1.29	3.86	0.22	0.21	0.03	317.85	4.39E-04	1.32E-03
Continue to Gorman, CA (SoCAB boundary)	75,046	84.10	6,311,368.60	1,209,200.33	99%	1.82	7.09	21.20	1.22	1.15	0.16	10.15	1.39E-05	4.16E-05	12.64	49.34	147.52	8.47	8.02	1.12	12,150.65	1.68E-02	5.03E-02
Gorman to Nevada border @ I-80	75,046	440.00	33,020,240.00	6,326,375.09	99%	1.82	7.09	21.20	1.22	1.15	0.16	10.15	1.39E-05	4.16E-05	66.12	258.12	771.79	44.30	41.98	5.84	63,570.58	8.77E-02	2.63E-01
	938,074																						
Total to SoCAB Boundary															**55.98**	**218.50**	**653.34**	**37.50**	**35.53**	**4.95**	**53,813.89**	**0.07**	**0.22**
Total to State Line															**187.77**	**732.98**	**2,191.65**	**125.80**	**119.20**	**16.59**	**180,521.54**	**0.25**	**0.75**

Notes:
1. Number of truck trips is equal to the total number of intermodal trucks multiplied by the percentage of trucks following each route.
2. Percentage of trucks following each route from the *Preliminary Traffic Study.*
3. VTM per trip was determined for each road segment from Google Earth.
4. Fuel use calculated using the EMFAC 2007 model with the BURDEN output option.
5. From the Air Resources Board's Draft *Emission Factors for Mandatory Reporting Programs*, August 10, 2007.
6. Running exhaust emission factors (g/mi) from EMFAC 2007 using the BURDEN output option. The EMFAC default model year and speed distributions for L.A. County were used.
7. The PM10 emission factor includes engine exhaust emissions along with brake and tire wear. The DPM emission factor includes engine exhaust emissions only.
8. Based on a diesel fuel HHV of 5.825 MMBtu/barrel (from ARB Draft Emission Factors for Mandatory Reporting Programs, August 10, 2007) and 42 gallons per barrel.
9. Idling time (mins/trip) are an engineering estimate.
10. Idling exhaust emission factors from EMFAC 2007 using the EMFAC output option. The EMFAC default model year distribution for L.A. County was used.

Title : Los Angeles County Avg Annual CYr 2005 Default Title
Version : Emfac2007 V2.3 Nov 1 2006
Run Date : 2007/08/22 09:21:49
Scen Year: 2005 -- All model years in the range 1965 to 2005 selected
Season : Annual
Area : Los Angeles County Average
I/M Stat : Enhanced Interim (2005) -- Using I/M schedule for area 59 Los Angeles (SC)
Emissions: Tons Per Day
****

	HHDT-DSL
Vehicles	27425
VMT/1000	5538
Trips	138783
Reactive Organic Gas Emissions	
Run Exh	11.09
Idle Exh	0.82
Start Ex	0

Total Ex	11.92
Diurnal	0
Hot Soak	0
Running	0
Resting	0

Total	11.92
Carbon Monoxide Emissions	
Run Exh	43.29
Idle Exh	2.7
Start Ex	0

Total Ex	45.99
Oxides of Nitrogen Emissions	
Run Exh	129.44
Idle Exh	5.12
Start Ex	0

Total Ex	134.56
Carbon Dioxide Emissions (000)	
Run Exh	11.45
Idle Exh	0.34
Start Ex	0

Total Ex	11.79
PM10 Emissions	
Run Exh	7.04
Idle Exh	0.15
Start Ex	0

Total Ex	7.19
TireWear	0.22
BrakeWr	0.17

Total	7.58
Lead	0
SOx	0.98
Fuel Consumption (000 gallons)	
Gasoline	0
Diesel	1061.03

APPENDIX C

CARB'S DRAFT GHG EMISSION FACTORS FOR
MANDATORY REPORTING PROGRAMS DOCUMENT

Air Resources Board
Draft Emission Factors for Mandatory Reporting Program

August 10, 2007

The following emission factors are being considered as part of the regulation for mandatory reporting for greenhouse gas emissions.

Please provide comments as appropriate.

Carbon Dioxide Emission Factors and Oxidation Rates for Stationary Combustion (kg/MMBtu or kg/gallon)

Fuel	kg CO_2/MMBtu (California)	kg CO_2/MMBtu (U.S.)	kg CO_2/gallon	Fraction of Carbon Oxidized
Coal and Natural Gas				
Residential Coal	92.77	95.33	NA	99.0%
Commercial Coal	92.77	95.33	NA	99.0%
Industrial Coking Coal	NA	93.72	NA	99.0%
Industrial Other Coal	93.00	93.98	NA	99.0%
Utility Coal	NA	94.45	NA	99.0%
Natural Gas	NA	53.05	NA	99.5%
Petroleum				
Distillate Fuel(Diesel)	NA	73.15	10.15	99.0%
Kerosene	NA	72.31	9.77	99.0%
Liquefied Petroleum Gas (LPG)	NA	62.30	5.95	99.0%
Motor Gasoline	NA	70.91	8.87	99.0%
Residual Fuel	NA	78.80	11.79	99.0%
Propane	NA	NA	5.70	99.5%
Butane	NA	NA	6.52	99.5%
Methanol(neat)	NA	NA	4.11	99.0%
Crude Oil	NA	74.18	10.24	99.0%
Still Gas	NA	64.20	NA	99.5%

Notes: Emission factors are based on complete combustion and high heating value (HHV). Emission factors for coking and utility coals are not given for California because they are not consumed in the state. Sources: Emission factors are derived from: California Energy Commission, Inventory of California Greenhouse Gas Emissions and Sinks: 1990-1999 (November 2002); and Energy Information Administration, Emissions of Greenhouse Gases in the United States 2000 (2001), Table B1, page 140. Propane and butane emission factors and fractions oxidized from U.S. Environmental Protection Agency, Compilation of Air Pollutant Emission Factors, AP-42, Fifth Edition. Methanol emission factor is calculated from the properties of the pure compounds; the fraction oxidized is assumed to be the same as for other liquid fuels.

Methane and Nitrous Oxide Emission Factors for Stationary Combustion by Sector and Fuel Type (kg/MMBtu)

NON-PETROLEUM FUELS			
Sector	**Fuel**	**kg CH_4/MMBtu**	**kg N_2O/MMBtu**
Industrial	Coal	0.0111	0.0016
	Petroleum	0.0022	0.0007
	Natural Gas	0.0059	0.0001
	Wood	0.0351	0.0047
Commercial/Institutional	Coal	0.0111	0.0016
	Petroleum	0.0111	0.0007
	Natural Gas	0.0059	0.0001
	Wood	0.3514	0.0047
Residential	Coal	0.3329	0.0016
	Petroleum	0.0111	0.0007
	Natural Gas	0.0059	0.0001
	Wood	0.3514	0.0047
PETROLEUM FUELS			
Sector	**Fuel**	**kg CH_4/MMBtu**	**kg N_2O/MMBtu**
Industrial	Distillate Fuel	0.0003	0.0001
	Kerosene	0.0003	0.0001
	Liquefied Petroleum Gas (LPG)	0.0002	0.0001
	Residual Fuel	0.0003	0.0001
Commercial/Institutional	Distillate Fuel	0.0014	0.0001
	Kerosene	0.0014	0.0001
	LPG	0.0010	0.0001
	MotorGasoline	0.0013	0.0001
	Residual Fuel	0.0015	0.0001
Residential	Distillate Fuel	0.0014	0.0001
	Kerosene	0.0014	0.0001
	LPG	0.0010	0.0001
	Motor Gasoline	0.0013	0.0001
	Propane	9.1 x 10-5	4.1 x 10-4
	Butane	9.1 x 10-5	4.1 x 10-4

Note: All emission factors have been converted to higher heating value (HHV), assuming LHV is 95% of HHV for coal and petroleum and is 90% of HHV for natural gas and wood.
Sources: Emission factors are derived from: U.S. EPA, "Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2000" (2002), Table C-2, page C-2. EPA obtained original emission factors from the Intergovernmental Panel on Climate Change, Revised IPCC Guidelines for National Greenhouse Gas Inventories: Reference Manual (1996), Tables 1-15 through 1-19, pages 1.53-1.57.

Table 5.2: Default Values for Heat Content, Carbon Content, and Fraction of Carbon Oxidized for Fuels used for Electric Power Generation

Fossil Fuel	Heat Content (HHV)	Carbon Content	Fraction Oxidized
Coal and Coke	**(MMBtu/Short Ton)**	**(kg C/MMBtu)**	
Anthracite Coal	25.09	28.26	0.990
Bituminous Coal	24.93	25.50	0.990
Sub bituminous Coal	17.25	26.49	0.990
Lignite Coal	14.21	26.35	0.990
Coke	24.80	27.85	0.990
Natural Gas	**(Btu/standard Ft^3)**	**(kg C/MMBtu)**	
Natural Gas	1,027.00	14.47	0.995
Petroleum	**(MMBtu/Barrel)**	**(kg C/MMBtu)**	
Distillate Oil	5.825	19.95	0.990
Residual Oil	6.287	21.49	0.990
Kerosene	5.670	19.72	0.990
Petroleum Coke	6.024	27.85	0.990
LPG	3.788	17.18	0.995
Ethane	2.916	16.25	0.995
Propane	3.824	17.20	0.995
Isobutane	4.162	17.75	0.995
n-Butane	4.328	17.72	0.995
Non-Fossil Fuel			
Solid	**(MMBtu/Short Ton)**	**(kg C/MMBtu)**	
Wood – dry	17.200	25.05	0.900
Gas	**(Btu/standard Ft^3)**	**(kg C/MMBtu)**	
Landfill gas	502.500	14.20	0.995
Waste water treatment biogas	Varies (obtain from operator)	14.20	0.995

MSW 41.69 kg of CO2/MMBtu

Table 10.1: Weighted Average Post Mining Fugitive CH_4 Emission Factors for Coal

Coal Mine Type	Emission Factor (scf CH4/ton)
Underground	44.3
Surface	4.8

Table 1.C.5. Carbon Dioxide Emission Coefficients for U.S. Natural Gas assuming 99.5 Percent Combusted

HHV Btu Content per Standard Cubic Foot	Emission Factor (metric tons carbon per billion Btu)	
	CO_2	Carbon
975 – 1,000	53.74	14.66
1,000 – 1,025	52.65	14.36
1,025 – 1,050	52.79	14.40
1,050 – 1,075	52.93	14.51
1,075 – 1,100	53.18	14.50

Source: Energy Information Administration, Documentation for Emissions of Greenhouse Gases in the United States 2003, May 2005, Table 6-5, p. 194, web site: www.eia.doe.gov/oiaf/1605/ggrpt/documentation/pdf/0638(2003).pdf.

95113(e)(1) Wastewater Treatment

Default MCF Values for Industrial Wastewater			
Type of Treatment and discharge pathway or system	**Comments**	**MCF**	**Range**
Untreated			
Sea, river and lake discharge	Rivers with high organic loading may turn anaerobic, however this is not considered here	0.1	0 0.2
Treated			
Aerobic treatment plant	Well maintained, some CH_4 may be emitted from settling basins	0	0 – 0.1
Aerobic treatment plant	Not well maintained, overloaded	0.3	0.2 – 0.4
Anaerobic digester for sludge	CH_4 recovery not considered here	0.8	0.8 – 1.0
Anaerobic reactor	CH_4 recovery not considered here	0.8	0.8 – 1.0
Anaerobic shallow lagoon	Depth less than 2 meters	0.2	0 – 0.3
Anaerobic deep lagoon	Depth more than 2 meters	0.8	0.8 – 1.0

MCF = methane correction factor – the fraction of waste treated anaerobically

B_0 = maximum CH4 producing capacity (kg CH4/kg COD)
Default factor = 0.25 kg CH_4/kg COD

COD = chemical oxygen demand (kg COD/m^3)
Default factor = 1.0 kg COD/m^3

EF_{N2O} = 0.005 kg N_2O-N/kg-N (Range 0.0005 – 0.25)

Source: IPCC 2006, IPCC, 2006 IPCC Guidelines for National Greenhouse Gas Inventories, Volume 5, Waste, Chapter 6: Wastewater Treatment and Discharge. Prepared by the National Greenhouse Gas Inventories Programme, Eggleston H.S., Buendia L., Miwa K., Ngara T. and Tanabe K. (eds).

95113(d)(4) Asphalt Production

Default emission factor for uncontrolled asphalt blowing

EF = 2,555 scf $CH_4/10^6$ bbl asphalt blown

Source: US EPA Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2005, Table A-127: 2005 CH_4 Emissions from Petroleum Refining, April 2007 USEPA #430-R-07-002

95113(d)(1)(B)

Coke burn rate material balance and conversion factors

K_1 = 0.2932 (kg-min)/(hr-dscm-%) or 0.0186 (lb-min)/(hr-dscf-%)
K_2 = 2.083 (kg-min)/(hr-dscm-%) or 0.1303 (lb-min)/(hr-dscf-%)
K_3 = 0.0994 (kg-min)/(hr-dscm-%) or 0.0062 (lb-min)/(hr-dscf-%)

Source: U.S. EPA Title 40CFR63.1564

95113(e)(4) Equipment Fugitive Emissions

Component type/service type	Default Zero Factor (kg/hr)	Correlation Equation (kg/hr)	Pegged Factor (kg/hr)	
			10,000 ppmv	100,000 ppmv
Valves	7.8E-06	2.27E-06(SV)^0.747	0.064	0.138
Pump seals	1.9E-05	5.07E-05(SV)^0.622	0.089	0.610
Others	4.0E-06	8.69E-06(SV)^0.642	0.082	0.138
Connectors	7.5E-06	1.53E-06(SV)^0.736	0.030	0.034
Flanges	3.1E-07	4.53E-06(SV)^0.706	0.095	0.095
Open-ended lines	2.0E-06	1.90E-06(SV)^0.724	0.033	0.082

Source: California Implementation Guidelines for Estimating Mass Emissions of Fugitive Hydrocarbon Leaks at Petroleum Facilities, February 1999, California Air Pollution Control Officers Association (CAPCOA) and California Air Resources Board

APPENDIX D

CARGO HANDLING EQUIPMENT

APPENDIX D-1

DEATILED EMISSION CALCULATIONS, EMISSION FACTOR DERIVATION AND OFFROAD2007 OUTPUT FOR THE 2005 BASELINE YEAR

Summary of Emissions from Cargo Handling Equipment
Dolores and ICTF Rail Yards, Long Beach, CA

Yard	Equipment Type	Make	Model	Engine Make	Engine Model	Model Year	No of Units	Rating (hp)	Hours of Operation (hrs/yr)[1,2,3]	BSFC (lb/bhp-hr)[4]	Fuel Use (gal/yr)[5]	Load Factor[6]	Carbon Oxidation Factor[7]	2005 Emission Factors (g/bhp-hr)[8]						2005 Emission Factors (kg/gal)[7]			2005 Emission Estimates (tons/yr)						2005 Emission Estimates (metric tons/yr)		
														HC	CO	NOx	PM10	DPM	SOx	CO2	N2O[9]	CH4[9]	ROG	CO	NOx	PM10	DPM	SOx	CO2	N2O	CH4
ICTF	Forklift	Toyota	6FDU25	Toyota	Unknown	1997	1	85	730	0.49	1,285	0.30	99%	0.803	3.741	8.818	0.679	0.679	0.062	10.15	1.39E-05	4.16E-05	0.02	0.08	0.18	0.01	0.01	0.00	12.91	0.00	0.00
ICTF	RTG #2	Mi Jack	850R	Detroit	DDEC	1997	1	300	2448	0.41	18,236	0.43	99%	0.281	1.035	6.547	0.165	0.165	0.052	10.15	1.39E-05	4.16E-05	0.10	0.36	2.28	0.06	0.06	0.02	183.24	0.00	0.00
ICTF	RTG #7	Mi Jack	1000R	Detroit	671N	1988	1	250	2448	0.47	17,420	0.43	99%	0.705	3.375	9.194	0.476	0.476	0.060	10.15	1.39E-05	4.16E-05	0.20	0.98	2.67	0.14	0.14	0.02	175.05	0.00	0.00
ICTF	RTG #15-18	Mi Jack	1000R	Detroit	671TA	1995	4	300	2448	0.41	72,944	0.43	99%	0.621	3.113	8.573	0.402	0.402	0.052	10.15	1.39E-05	4.16E-05	0.87	4.33	11.94	0.56	0.56	0.07	732.97	0.00	0.00
ICTF	RTG #19-20	Mi Jack	1000RC	Detroit	DDEC	2002	2	300	2448	0.41	36,472	0.43	99%	0.111	0.971	4.475	0.104	0.104	0.052	10.15	1.39E-05	4.16E-05	0.08	0.68	3.12	0.07	0.07	0.04	366.49	0.00	0.00
ICTF	RTG #21	Mi Jack	1200 R	Detroit	DDEC	2005	1	350	2448	0.41	21,275	0.43	99%	0.074	0.933	3.836	0.094	0.094	0.052	10.15	1.39E-05	4.16E-05	0.03	0.38	1.56	0.04	0.04	0.02	213.78	0.00	0.00
ICTF	Top Pick	Mi Jack	PC-90	Cummins	NA335	1972	1	335	208	0.41	1,730	0.43	99%	1.252	6.183	15.587	0.901	0.901	0.060	10.15	1.39E-05	4.16E-05	0.04	0.20	0.51	0.03	0.03	0.00	17.39	0.00	0.00
ICTF	Top Pick	Taylor	Tay-950	Cummins	L-10	1988	1	350	2190	0.41	26,115	0.59	99%	0.705	3.375	9.194	0.476	0.476	0.060	10.15	1.39E-05	4.16E-05	0.35	1.68	4.58	0.24	0.24	0.03	262.42	0.00	0.00
ICTF	Top Pick	Taylor	Tay-950	Cummins	L-10	1989	1	350	2190	0.41	26,115	0.59	99%	0.693	3.338	9.105	0.465	0.465	0.060	10.15	1.39E-05	4.16E-05	0.35	1.66	4.54	0.23	0.23	0.03	262.42	0.00	0.00
ICTF	Yard Hostler	Capacity	TJ5000	Caterpillar	3116	1999	15	150	468	0.47	27,185	0.39	99%	0.610	3.078	7.342	0.433	0.433	0.060	10.15	1.39E-05	4.16E-05	0.28	1.39	3.32	0.20	0.20	0.03	273.17	0.00	0.00
ICTF	Yard Hostler	Capacity	TJ5000	Caterpillar	3116	2005	58	173	4680	0.47	1,212,339	0.39	99%	0.119	2.754	4.283	0.139	0.139	0.060	10.15	1.39E-05	4.16E-05	2.41	55.60	86.46	2.80	2.80	1.21	12,182.19	0.02	0.05
Total							**86**				**1,461,116**												**4.71**	**67.35**	**121.16**	**4.38**	**4.38**	**1.46**	**14,682.02**	**0.02**	**0.06**

Notes:

1. Per UPRR personnel, only one top pick is operated at a time. Top picks are operated a total of 12 hours per day. The Mi Jack top pick is a backup and is used infrequently.
2. Assumed each RTG operates 7 hours per day, based on data collected at UPRR's Commerce Rail Yard.
3. Assumed the 173 hp Yard Hostlers operate 4,680 hours per year based on data collected at UPRR's Commerce Rail Yard. The 150 hp Yard Hostlers are backup units, it was assumed they operate 10% of the time.
4. Brake-specific fuel consumption (BSFC) from OFFROAD2007 model.
5. Calculation assumes density of Diesel fuel of 7.1 lb/gal.
6. Load factors for the RTGs and top picks are from OFFROAD2007 model. Load factor for the yard hostlers from personal communication with Harold Holmes of ARB and is based on a study conducted at the POLA/POLB.
7. From the Air Resources Board's Draft *Emission Factors for Mandatory Reporting Programs*, August 10, 2007.
8. Emission factors from CARB's Cargo Handling Equipment Emission Calculation Spreadsheet.
9. Based on a diesel fuel HHV of 5.825 MMBtu/barrel (from ARB Draft Emission Factors for Mandatory Reporting Programs, August 10, 2007) and 42 gallons per barrel.

Cal Year	Yard	Equipment Type	Code	Useful Life (hours)	Model Year	Age (years)	Population	HP	HP Bin	Yearly Operational Hrs	Cummulative Hours
2005	*(Example Calculation)*	*Yard Tractor onroad engine*	*9*	*8800*	*1985*	*21*	*2*	*500*	*500*	*1100*	*23100*
2005	ICTF	Forklift	3	14600	1997	9	1	85	120	730	6570
2005	ICTF	Crane	1	157680	1997	9	1	300	500	8760	78840
2005	ICTF	Crane	1	157680	1988	18	1	250	250	8760	157680
2005	ICTF	Crane	1	157680	1995	11	1	300	500	8760	96360
2005	ICTF	Crane	1	157680	1995	11	1	300	500	8760	96360
2005	ICTF	Crane	1	157680	1995	11	1	300	500	8760	96360
2005	ICTF	Crane	1	157680	1995	11	1	300	500	8760	96360
2005	ICTF	Crane	1	157680	2002	4	1	300	500	8760	35040
2005	ICTF	Crane	1	157680	2002	4	1	300	500	8760	35040
2005	ICTF	Crane	1	157680	2005	1	1	350	500	8760	8760
2005	ICTF	Material Handling Equip	4	3744	1972	34	1	335	500	208	7072
2005	ICTF	Material Handling Equip	4	39420	1988	18	1	350	500	2190	39420
2005	ICTF	Material Handling Equip	4	39420	1989	17	1	350	500	2190	37230
2005	ICTF	Yard Tractor offroad engine	8	17520	1999	7	15	150	175	2190	15330
2005	ICTF	Yard Tractor offroad engine	8	70080	2005	1	58	173	175	8760	8760

Emission Control Factor? (y/n)	Emission Control If no emission control leave blank	Load Factor	HPMY	HC EF	Emission Control HC EF	HC dr	FCF HC	CO EF	Emission Control CO EF	CO dr	NOX EF	Emission Control NOX EF
n		*0.65*	*5001985*	*1.30E+00*	*0.00E+00*	*0.000065*	*0.720000*	*1.55E+01*	*0.00E+00*	*0.000440*	*6.00E+00*	*0.00E+00*
n		0.30	1201997	9.90E-01	0.00E+00	0.000019	0.720000	3.49E+00	0.00E+00	0.000038	8.75E+00	0.00E+00
n		0.43	5001997	3.20E-01	0.00E+00	0.000001	0.720000	9.20E-01	0.00E+00	0.000001	6.25E+00	0.00E+00
n		0.43	2501988	6.80E-01	0.00E+00	0.000002	0.720000	2.70E+00	0.00E+00	0.000004	8.17E+00	0.00E+00
n		0.43	5001995	6.80E-01	0.00E+00	0.000002	0.720000	2.70E+00	0.00E+00	0.000004	8.17E+00	0.00E+00
n		0.43	5001995	6.80E-01	0.00E+00	0.000002	0.720000	2.70E+00	0.00E+00	0.000004	8.17E+00	0.00E+00
n		0.43	5001995	6.80E-01	0.00E+00	0.000002	0.720000	2.70E+00	0.00E+00	0.000004	8.17E+00	0.00E+00
n		0.43	5001995	6.80E-01	0.00E+00	0.000002	0.720000	2.70E+00	0.00E+00	0.000004	8.17E+00	0.00E+00
n		0.43	5002002	1.40E-01	0.00E+00	0.000000	0.720000	9.20E-01	0.00E+00	0.000001	4.51E+00	0.00E+00
n		0.43	5002002	1.40E-01	0.00E+00	0.000000	0.720000	9.20E-01	0.00E+00	0.000001	4.51E+00	0.00E+00
n		0.43	5002005	1.00E-01	0.00E+00	0.000000	0.720000	9.20E-01	0.00E+00	0.000001	4.00E+00	0.00E+00
n		0.59	5001972	9.50E-01	0.00E+00	0.000112	0.720000	4.20E+00	0.00E+00	0.000280	1.20E+01	0.00E+00
n		0.59	5001988	6.80E-01	0.00E+00	0.000008	0.720000	2.70E+00	0.00E+00	0.000017	8.17E+00	0.00E+00
n		0.59	5001989	6.80E-01	0.00E+00	0.000008	0.720000	2.70E+00	0.00E+00	0.000017	8.17E+00	0.00E+00
n		0.65	1751999	6.80E-01	0.00E+00	0.000011	0.720000	2.70E+00	0.00E+00	0.000025	6.90E+00	0.00E+00
n		0.65	1752005	1.60E-01	0.00E+00	0.000001	0.720000	2.70E+00	0.00E+00	0.000006	4.44E+00	0.00E+00

NOX dr	FCF NOX	PM EF	Emission Control PM EF	PM dr	FCF PM	SOX EF	Final EF_HC	Final EF_CO	Final EF_NOX	Final EF_SOX	Final EF_PM	TOG
0.000143	***0.930000***	***6.00E-01***	***0.00E+00***	***0.000046***	***0.750000***	***5.97E-02***	***2.02E+00***	***2.57E+01***	***8.66E+00***	***5.97E-02***	***1.24E+00***	***2.29E+00***
0.000084	0.948000	6.90E-01	0.00E+00	0.000021	0.822000	6.23E-02	8.03E-01	3.74E+00	8.82E+00	6.23E-02	6.79E-01	2.37E-02
0.000008	0.948000	1.50E-01	0.00E+00	0.000001	0.822000	5.21E-02	2.81E-01	1.04E+00	6.55E+00	5.21E-02	1.65E-01	5.04E-01
0.000011	0.930000	3.80E-01	0.00E+00	0.000002	0.750000	5.97E-02	7.05E-01	3.38E+00	9.19E+00	5.97E-02	4.76E-01	1.05E+00
0.000011	0.930000	3.80E-01	0.00E+00	0.000002	0.750000	5.21E-02	6.21E-01	3.11E+00	8.57E+00	5.21E-02	4.02E-01	1.11E+00
0.000011	0.930000	3.80E-01	0.00E+00	0.000002	0.750000	5.21E-02	6.21E-01	3.11E+00	8.57E+00	5.21E-02	4.02E-01	1.11E+00
0.000011	0.930000	3.80E-01	0.00E+00	0.000002	0.750000	5.21E-02	6.21E-01	3.11E+00	8.57E+00	5.21E-02	4.02E-01	1.11E+00
0.000011	0.930000	3.80E-01	0.00E+00	0.000002	0.750000	5.21E-02	6.21E-01	3.11E+00	8.57E+00	5.21E-02	4.02E-01	1.11E+00
0.000006	0.948000	1.10E-01	0.00E+00	0.000000	0.822000	5.21E-02	1.11E-01	9.71E-01	4.48E+00	5.21E-02	1.04E-01	1.98E-01
0.000006	0.948000	1.10E-01	0.00E+00	0.000000	0.822000	5.21E-02	1.11E-01	9.71E-01	4.48E+00	5.21E-02	1.04E-01	1.98E-01
0.000005	0.948000	1.10E-01	0.00E+00	0.000000	0.822000	5.21E-02	7.38E-02	9.33E-01	3.84E+00	5.21E-02	9.38E-02	1.54E-01
0.000673	0.930000	5.30E-01	0.00E+00	0.000095	0.750000	5.97E-02	1.25E+00	6.18E+00	1.56E+01	5.97E-02	9.01E-01	8.17E-02
0.000044	0.930000	3.80E-01	0.00E+00	0.000006	0.750000	5.97E-02	7.05E-01	3.38E+00	9.19E+00	5.97E-02	4.76E-01	5.06E-01
0.000044	0.930000	3.80E-01	0.00E+00	0.000006	0.750000	5.97E-02	6.93E-01	3.34E+00	9.11E+00	5.97E-02	4.65E-01	4.97E-01
0.000055	0.948000	3.80E-01	0.00E+00	0.000010	0.822000	5.97E-02	6.10E-01	3.08E+00	7.34E+00	5.97E-02	4.33E-01	3.10E+00
0.000009	0.948000	1.60E-01	0.00E+00	0.000001	0.822000	5.97E-02	1.19E-01	2.75E+00	4.28E+00	5.97E-02	1.39E-01	1.08E+01

Emissions (tons/year)							Emissions (tons/day)							
ROG	CO	NOX	SOX	PM	PM10	PM2.5	TOG	ROG	CO	NOX	SOX	PM	PM10	PM2.5
2.01E+00	***2.02E+01***	***6.82E+00***	***4.70E-02***	***9.78E-01***	***9.78E-01***	***8.99E-01***	***6.27E-03***	***5.50E-03***	***5.54E-02***	***1.87E-02***	***1.29E-04***	***2.68E-03***	***2.68E-03***	***2.46E-03***
2.08E-02	7.67E-02	1.81E-01	1.28E-03	1.39E-02	1.39E-02	1.28E-02	6.49E-05	5.70E-05	2.10E-04	4.95E-04	3.50E-06	3.82E-05	3.82E-05	3.51E-05
4.43E-01	1.29E+00	8.15E+00	6.49E-02	2.05E-01	2.05E-01	1.88E-01	1.38E-03	1.21E-03	3.53E-03	2.23E-02	1.78E-04	5.61E-04	5.61E-04	5.16E-04
9.25E-01	3.50E+00	9.53E+00	6.20E-02	4.94E-01	4.94E-01	4.54E-01	2.88E-03	2.53E-03	9.59E-03	2.61E-02	1.70E-04	1.35E-03	1.35E-03	1.24E-03
9.78E-01	3.87E+00	1.07E+01	6.49E-02	5.00E-01	5.00E-01	4.60E-01	3.05E-03	2.68E-03	1.06E-02	2.92E-02	1.78E-04	1.37E-03	1.37E-03	1.26E-03
9.78E-01	3.87E+00	1.07E+01	6.49E-02	5.00E-01	5.00E-01	4.60E-01	3.05E-03	2.68E-03	1.06E-02	2.92E-02	1.78E-04	1.37E-03	1.37E-03	1.26E-03
9.78E-01	3.87E+00	1.07E+01	6.49E-02	5.00E-01	5.00E-01	4.60E-01	3.05E-03	2.68E-03	1.06E-02	2.92E-02	1.78E-04	1.37E-03	1.37E-03	1.26E-03
9.78E-01	3.87E+00	1.07E+01	6.49E-02	5.00E-01	5.00E-01	4.60E-01	3.05E-03	2.68E-03	1.06E-02	2.92E-02	1.78E-04	1.37E-03	1.37E-03	1.26E-03
1.74E-01	1.21E+00	5.57E+00	6.49E-02	1.29E-01	1.29E-01	1.19E-01	5.43E-04	4.77E-04	3.31E-03	1.53E-02	1.78E-04	3.54E-04	3.54E-04	3.26E-04
1.74E-01	1.21E+00	5.57E+00	6.49E-02	1.29E-01	1.29E-01	1.19E-01	5.43E-04	4.77E-04	3.31E-03	1.53E-02	1.78E-04	3.54E-04	3.54E-04	3.26E-04
1.35E-01	1.35E+00	5.57E+00	7.57E-02	1.36E-01	1.36E-01	1.25E-01	4.23E-04	3.71E-04	3.71E-03	1.53E-02	2.07E-04	3.73E-04	3.73E-04	3.43E-04
7.17E-02	2.80E-01	7.06E-01	2.71E-03	4.08E-02	4.08E-02	3.75E-02	2.24E-04	1.97E-04	7.67E-04	1.93E-03	7.41E-06	1.12E-04	1.12E-04	1.03E-04
4.44E-01	1.68E+00	4.58E+00	2.98E-02	2.37E-01	2.37E-01	2.18E-01	1.39E-03	1.22E-03	4.61E-03	1.25E-02	8.15E-05	6.49E-04	6.49E-04	5.97E-04
4.37E-01	1.66E+00	4.53E+00	2.98E-02	2.32E-01	2.32E-01	2.13E-01	1.36E-03	1.20E-03	4.55E-03	1.24E-02	8.15E-05	6.35E-04	6.35E-04	5.84E-04
2.72E+00	1.09E+01	2.59E+01	2.11E-01	1.53E+00	1.53E+00	1.40E+00	8.48E-03	7.45E-03	2.97E-02	7.10E-02	5.77E-04	4.18E-03	4.18E-03	3.85E-03
9.49E+00	1.73E+02	2.69E+02	3.76E+00	8.73E+00	8.73E+00	8.03E+00	2.96E-02	2.60E-02	4.75E-01	7.38E-01	1.03E-02	2.39E-02	2.39E-02	2.20E-02

Type	Useful Life	Load Factor
Crane	18	0.43
Excavator	16	0.57
Forklift	20	0.30
Material Handling Equip	18	0.59
Other General Industrial Equip	16	0.51
Sweeper/Scrubber	16	0.68
Tractor/Loader/Backhoe	16	0.55
Yard Tractor offroad engine	8	0.65
Yard Tractor onroad engine	8	0.65

Fuel Correction Factor

t_fcf

	Calyr 1994 -2006		
Model Yr	NOX	PM	HC
1970	0.930	0.750	0.720
1971	0.930	0.750	0.720
1972	0.930	0.750	0.720
1973	0.930	0.750	0.720
1974	0.930	0.750	0.720
1975	0.930	0.750	0.720
1976	0.930	0.750	0.720
1977	0.930	0.750	0.720
1978	0.930	0.750	0.720
1979	0.930	0.750	0.720
1980	0.930	0.750	0.720
1981	0.930	0.750	0.720
1982	0.930	0.750	0.720
1983	0.930	0.750	0.720
1984	0.930	0.750	0.720
1985	0.930	0.750	0.720
1986	0.930	0.750	0.720
1987	0.930	0.750	0.720
1988	0.930	0.750	0.720
1989	0.930	0.750	0.720
1990	0.930	0.750	0.720
1991	0.930	0.750	0.720
1992	0.930	0.750	0.720
1993	0.930	0.750	0.720
1994	0.930	0.750	0.720
1995	0.930	0.750	0.720
1996	0.948	0.822	0.720
1997	0.948	0.822	0.720
1998	0.948	0.822	0.720
1999	0.948	0.822	0.720
2000	0.948	0.822	0.720
2001	0.948	0.822	0.720
2002	0.948	0.822	0.720
2003	0.948	0.822	0.720
2004	0.948	0.822	0.720
2005	0.948	0.822	0.720
2006	0.948	0.822	0.720
2007	0.948	0.822	0.720
2008	0.948	0.822	0.720
2009	0.948	0.822	0.720
2010	0.948	0.822	0.720
2011	0.948	0.822	0.720
2012	0.948	0.822	0.720
2013	0.948	0.822	0.720
2014	0.948	0.822	0.720
2015	0.948	0.822	0.720
2016	0.948	0.822	0.720
2017	0.948	0.822	0.720
2018	0.948	0.822	0.720

HP_dr

	Det. Rate			
HP	HC	CO	NOx	PM
50	51%	41%	6%	31%
120	28%	16%	14%	44%
175	28%	16%	14%	44%
250	44%	25%	21%	67%
500	44%	25%	21%	67%

***New Tier4 emfacs included with 43/57% split for 120 hp merged (diesel only)**

units = g/bhp hr

Lookup	Hp	Year	HC	CO	NOX	PM	CO2
251968	25	1968	1.84	5	6.92	0.764	10176.3
251969	25	1969	1.84	5	6.92	0.764	10176.3
251970	25	1970	1.84	5	6.92	0.764	10176.3
251971	25	1971	1.84	5	6.92	0.764	10176.3
251972	25	1972	1.84	5	6.92	0.764	10176.3
251973	25	1973	1.84	5	6.92	0.764	10176.3
251974	25	1974	1.84	5	6.92	0.764	10176.3
251975	25	1975	1.84	5	6.92	0.764	10176.3
251976	25	1976	1.84	5	6.92	0.764	10176.3
251977	25	1977	1.84	5	6.92	0.764	10176.3
251978	25	1978	1.84	5	6.92	0.764	10176.3
251979	25	1979	1.84	5	6.92	0.764	10176.3
251980	25	1980	1.84	5	6.92	0.764	10176.3
251981	25	1981	1.84	5	6.92	0.764	10176.3
251982	25	1982	1.84	5	6.92	0.764	10176.3
251983	25	1983	1.84	5	6.92	0.764	10176.3
251984	25	1984	1.84	5	6.92	0.764	10176.3
251985	25	1985	1.84	5	6.92	0.764	10176.3
251986	25	1986	1.84	5	6.92	0.764	10176.3
251987	25	1987	1.84	5	6.92	0.764	10176.3
251988	25	1988	1.84	5	6.92	0.764	10176.3
251989	25	1989	1.84	5	6.92	0.764	10176.3
251990	25	1990	1.84	5	6.92	0.764	10176.3
251991	25	1991	1.84	5	6.92	0.764	10176.3
251992	25	1992	1.84	5	6.92	0.764	10176.3
251993	25	1993	1.84	5	6.92	0.764	10176.3
251994	25	1994	1.84	5	6.92	0.764	10176.3
251995	25	1995	1.63	1.4	3.89	0.417	10176.3
251996	25	1996	1.63	1.4	3.89	0.417	10176.3
251997	25	1997	1.63	1.4	3.89	0.417	10176.3
251998	25	1998	1.63	1.4	3.89	0.417	10176.3
251999	25	1999	0.52	0.5	1.24	0.116	10176.3
252000	25	2000	0.52	0.5	1.24	0.116	10176.3
252001	25	2001	0.52	0.5	1.24	0.116	10176.3
252002	25	2002	0.52	0.5	1.24	0.116	10176.3
252003	25	2003	0.52	0.5	1.24	0.116	10176.3
252004	25	2004	0.52	0.5	1.24	0.116	10176.3
252005	25	2005	0.52	0.5	1.24	0.116	10176.3
252006	25	2006	0.52	0.5	1.24	0.116	10176.3
252007	25	2007	0.52	0.5	1.24	0.116	10176.3
252008	25	2008	0.52	0.5	1.24	0.116	10176.3
252009	25	2009	0.52	0.5	1.24	0.116	10176.3
252010	25	2010	0.52	0.5	1.24	0.116	10176.3
252011	25	2011	0.52	0.5	1.24	0.116	10176.3
252012	25	2012	0.52	0.5	1.24	0.116	10176.3
252013	25	2013	0.52	0.5	1.24	0.116	10176.3
252014	25	2014	0.52	0.5	1.24	0.116	10176.3
252015	25	2015	0.52	0.5	1.24	0.116	10176.3
252016	25	2016	0.52	0.5	1.24	0.116	10176.3
252017	25	2017	0.52	0.5	1.24	0.116	10176.3
252018	25	2018	0.52	0.5	1.24	0.116	10176.3
252019	25	2019	0.52	0.5	1.24	0.116	10176.3
252020	25	2020	0.52	0.5	1.24	0.116	10176.3
252021	25	2021	0.52	0.5	1.24	0.116	10176.3
252022	25	2022	0.52	0.5	1.24	0.116	10176.3
252023	25	2023	0.52	0.5	1.24	0.116	10176.3
252024	25	2024	0.52	0.5	1.24	0.116	10176.3
252025	25	2025	0.52	0.5	1.24	0.116	10176.3
252026	25	2026	0.52	0.5	1.24	0.116	10176.3
501969	50	1969	1.84	5	7	0.76	10176.3
501969	50	1969	1.84	5	7	0.76	10176.3
501970	50	1970	1.84	5	7	0.76	10176.3
501971	50	1971	1.84	5	7	0.76	10176.3
501972	50	1972	1.84	5	7	0.76	10176.3
501973	50	1973	1.84	5	7	0.76	10176.3
501974	50	1974	1.84	5	7	0.76	10176.3
501975	50	1975	1.84	5	7	0.76	10176.3
501976	50	1976	1.84	5	7	0.76	10176.3
501977	50	1977	1.84	5	7	0.76	10176.3
501978	50	1978	1.84	5	7	0.76	10176.3
501979	50	1979	1.84	5	7	0.76	10176.3
501980	50	1980	1.84	5	7	0.76	10176.3
501981	50	1981	1.84	5	7	0.76	10176.3
501982	50	1982	1.84	5	7	0.76	10176.3
501983	50	1983	1.84	5	7	0.76	10176.3
501984	50	1984	1.84	5	7	0.76	10176.3
501985	50	1985	1.84	5	7	0.76	10176.3
501986	50	1986	1.84	5	7	0.76	10176.3
501987	50	1987	1.84	5	7	0.76	10176.3
501988	50	1988	1.8	5	6.9	0.76	10176.3

501989	50	1989	1.8	5	6.9	0.76	10176.3
501990	50	1990	1.8	5	6.9	0.76	10176.3
501991	50	1991	1.8	5	6.9	0.76	10176.3
501992	50	1992	1.8	5	6.9	0.76	10176.3
501993	50	1993	1.8	5	6.9	0.76	10176.3
501994	50	1994	1.8	5	6.9	0.76	10176.3
501995	50	1995	1.8	5	6.9	0.76	10176.3
501996	50	1996	1.8	5	6.9	0.76	10176.3
501997	50	1997	1.8	5	6.9	0.76	10176.3
501998	50	1998	1.8	5	6.9	0.76	10176.3
501999	50	1999	1.45	4.1	5.55	0.6	10176.3
502000	50	2000	1.45	4.1	5.55	0.6	10176.3
502001	50	2001	1.45	4.1	5.55	0.6	10176.3
502002	50	2002	1.45	4.1	5.55	0.6	10176.3
502003	50	2003	1.45	4.1	5.55	0.6	10176.3
502004	50	2004	0.64	3.27	5.1	0.43	10176.3
502005	50	2005	0.37	3	4.95	0.38	10176.3
502006	50	2006	0.24	2.86	4.88	0.35	10176.3
502007	50	2007	0.24	2.86	4.88	0.35	10176.3
502008	50	2008	0.1	2.72	4.8	0.16	10176.3
502009	50	2009	0.1	2.72	4.8	0.16	10176.3
502010	50	2010	0.1	2.72	4.8	0.16	10176.3
502011	50	2011	0.1	2.72	4.8	0.16	10176.3
502012	50	2012	0.1	2.72	4.8	0.16	10176.3
502013	50	2013	0.1	2.72	2.9	0.01	10176.3
502014	50	2014	0.1	2.72	2.9	0.01	10176.3
502015	50	2015	0.1	2.72	2.9	0.01	10176.3
502016	50	2016	0.1	2.72	2.9	0.01	10176.3
502017	50	2017	0.1	2.72	2.9	0.01	10176.3
502018	50	2018	0.1	2.72	2.9	0.01	10176.3
502019	50	2019	0.1	2.72	2.9	0.01	10176.3
502020	50	2020	0.1	2.72	2.9	0.01	10176.3
502021	50	2021	0.1	2.72	2.9	0.01	10176.3
502022	50	2022	0.1	2.72	2.9	0.01	10176.3
502023	50	2023	0.1	2.72	2.9	0.01	10176.3
502024	50	2024	0.1	2.72	2.9	0.01	10176.3
502025	50	2025	0.1	2.72	2.9	0.01	10176.3
502026	50	2026	0.1	2.72	2.9	0.01	10176.3
1201968	120	1968	1.44	4.8	13	0.84	10176.3
1201969	120	1969	1.44	4.8	13	0.84	10176.3
1201970	120	1970	1.44	4.8	13	0.84	10176.3
1201971	120	1971	1.44	4.8	13	0.84	10176.3
1201972	120	1972	1.44	4.8	13	0.84	10176.3
1201973	120	1973	1.44	4.8	13	0.84	10176.3
1201974	120	1974	1.44	4.8	13	0.84	10176.3
1201975	120	1975	1.44	4.8	13	0.84	10176.3
1201976	120	1976	1.44	4.8	13	0.84	10176.3
1201977	120	1977	1.44	4.8	13	0.84	10176.3
1201978	120	1978	1.44	4.8	13	0.84	10176.3
1201979	120	1979	1.44	4.8	13	0.84	10176.3
1201980	120	1980	1.44	4.8	13	0.84	10176.3
1201981	120	1981	1.44	4.8	13	0.84	10176.3
1201982	120	1982	1.44	4.8	13	0.84	10176.3
1201983	120	1983	1.44	4.8	13	0.84	10176.3
1201984	120	1984	1.44	4.8	13	0.84	10176.3
1201985	120	1985	1.44	4.8	13	0.84	10176.3
1201986	120	1986	1.44	4.8	13	0.84	10176.3
1201987	120	1987	1.44	4.8	13	0.84	10176.3
1201988	120	1988	0.99	3.49	8.75	0.69	10176.3
1201989	120	1989	0.99	3.49	8.75	0.69	10176.3
1201990	120	1990	0.99	3.49	8.75	0.69	10176.3
1201991	120	1991	0.99	3.49	8.75	0.69	10176.3
1201992	120	1992	0.99	3.49	8.75	0.69	10176.3
1201993	120	1993	0.99	3.49	8.75	0.69	10176.3
1201994	120	1994	0.99	3.49	8.75	0.69	10176.3
1201995	120	1995	0.99	3.49	8.75	0.69	10176.3
1201996	120	1996	0.99	3.49	8.75	0.69	10176.3
1201997	120	1997	0.99	3.49	8.75	0.69	10176.3
1201998	120	1998	0.99	3.49	6.9	0.69	10176.3
1201999	120	1999	0.99	3.49	6.9	0.69	10176.3
1202000	120	2000	0.99	3.49	6.9	0.69	10176.3
1202001	120	2001	0.99	3.49	6.9	0.69	10176.3
1202002	120	2002	0.99	3.49	6.9	0.69	10176.3
1202003	120	2003	0.99	3.49	6.9	0.69	10176.3
1202004	120	2004	0.46	3.23	5.64	0.39	10176.3
1202005	120	2005	0.28	3.14	5.22	0.29	10176.3
1202006	120	2006	0.19	3.09	5.01	0.24	10176.3
1202007	120	2007	0.19	3.09	5.01	0.24	10176.3
1202008	120	2008	0.1	3.05	2.89	0.197	10176.3
1202009	120	2009	0.1	3.05	2.89	0.197	10176.3
1202010	120	2010	0.1	3.05	2.89	0.197	10176.3
1202011	120	2011	0.1	3.05	2.89	0.197	10176.3
1202012	120	2012	0.0943	3.05	2.5309	0.0659	10176.3
1202013	120	2013	0.0943	3.05	2.5309	0.01	10176.3

1202014	120	2014	0.0943	3.05	2.5309	0.01	10176.3
1202015	120	2015	0.0715	3.05	1.3966	0.01	10176.3
1202016	120	2016	0.0715	3.05	1.3966	0.01	10176.3
1202017	120	2017	0.0715	3.05	1.3966	0.01	10176.3
1202018	120	2018	0.0715	3.05	1.3966	0.01	10176.3
1202019	120	2019	0.0715	3.05	1.3966	0.01	10176.3
1202020	120	2020	0.0715	3.05	1.3966	0.01	10176.3
1202021	120	2021	0.0715	3.05	1.3966	0.01	10176.3
1202022	120	2022	0.0715	3.05	1.3966	0.01	10176.3
1202023	120	2023	0.0715	3.05	1.3966	0.01	10176.3
1202024	120	2024	0.0715	3.05	1.3966	0.01	10176.3
1202025	120	2025	0.0715	3.05	1.3966	0.01	10176.3
1202026	120	2026	0.0715	3.05	1.3966	0.01	10176.3
1751968	175	1968	1.32	4.4	14	0.77	10176.3
1751969	175	1969	1.32	4.4	14	0.77	10176.3
1751970	175	1970	1.1	4.4	13	0.66	10176.3
1751971	175	1971	1.1	4.4	13	0.66	10176.3
1751972	175	1972	1	4.4	12	0.55	10176.3
1751973	175	1973	1	4.4	12	0.55	10176.3
1751974	175	1974	1	4.4	12	0.55	10176.3
1751975	175	1975	1	4.4	12	0.55	10176.3
1751976	175	1976	1	4.4	12	0.55	10176.3
1751977	175	1977	1	4.4	12	0.55	10176.3
1751978	175	1978	1	4.4	12	0.55	10176.3
1751979	175	1979	1	4.4	12	0.55	10176.3
1751980	175	1980	0.94	4.3	11	0.55	10176.3
1751981	175	1981	0.94	4.3	11	0.55	10176.3
1751982	175	1982	0.94	4.3	11	0.55	10176.3
1751983	175	1983	0.94	4.3	11	0.55	10176.3
1751984	175	1984	0.94	4.3	11	0.55	10176.3
1751985	175	1985	0.88	4.2	11	0.55	10176.3
1751986	175	1986	0.88	4.2	11	0.55	10176.3
1751987	175	1987	0.88	4.2	11	0.55	10176.3
1751988	175	1988	0.68	2.7	8.17	0.38	10176.3
1751989	175	1989	0.68	2.7	8.17	0.38	10176.3
1751990	175	1990	0.68	2.7	8.17	0.38	10176.3
1751991	175	1991	0.68	2.7	8.17	0.38	10176.3
1751992	175	1992	0.68	2.7	8.17	0.38	10176.3
1751993	175	1993	0.68	2.7	8.17	0.38	10176.3
1751994	175	1994	0.68	2.7	8.17	0.38	10176.3
1751995	175	1995	0.68	2.7	8.17	0.38	10176.3
1751996	175	1996	0.68	2.7	8.17	0.38	10176.3
1751997	175	1997	0.68	2.7	6.9	0.38	10176.3
1751998	175	1998	0.68	2.7	6.9	0.38	10176.3
1751999	175	1999	0.68	2.7	6.9	0.38	10176.3
1752000	175	2000	0.68	2.7	6.9	0.38	10176.3
1752001	175	2001	0.68	2.7	6.9	0.38	10176.3
1752002	175	2002	0.68	2.7	6.9	0.38	10176.3
1752003	175	2003	0.33	2.7	5.26	0.24	10176.3
1752004	175	2004	0.22	2.7	4.72	0.19	10176.3
1752005	175	2005	0.16	2.7	4.44	0.16	10176.3
1752006	175	2006	0.16	2.7	4.44	0.16	10176.3
1752007	175	2007	0.1	2.7	2.45	0.14	10176.3
1752008	175	2008	0.1	2.7	2.45	0.14	10176.3
1752009	175	2009	0.1	2.7	2.45	0.14	10176.3
1752010	175	2010	0.1	2.7	2.45	0.14	10176.3
1752011	175	2011	0.1	2.7	2.45	0.14	10176.3
1752012	175	2012	0.09	2.7	2.27	0.01	10176.3
1752013	175	2013	0.09	2.7	2.27	0.01	10176.3
1752014	175	2014	0.09	2.7	2.27	0.01	10176.3
1752015	175	2015	0.05	2.7	0.27	0.01	10176.3
1752016	175	2016	0.05	2.7	0.27	0.01	10176.3
1752017	175	2017	0.05	2.7	0.27	0.01	10176.3
1752018	175	2018	0.05	2.7	0.27	0.01	10176.3
1752019	175	2019	0.05	2.7	0.27	0.01	10176.3
1752020	175	2020	0.05	2.7	0.27	0.01	10176.3
1752021	175	2021	0.05	2.7	0.27	0.01	10176.3
1752022	175	2022	0.05	2.7	0.27	0.01	10176.3
1752023	175	2023	0.05	2.7	0.27	0.01	10176.3
1752024	175	2024	0.05	2.7	0.27	0.01	10176.3
1752025	175	2025	0.05	2.7	0.27	0.01	10176.3
1752026	175	2026	0.05	2.7	0.27	0.01	10176.3
2501968	250	1968	1.32	4.4	14	0.77	10176.3
2501969	250	1969	1.32	4.4	14	0.77	10176.3
2501970	250	1970	1.1	4.4	13	0.66	10176.3
2501971	250	1971	1.1	4.4	13	0.66	10176.3
2501972	250	1972	1	4.4	12	0.55	10176.3
2501973	250	1973	1	4.4	12	0.55	10176.3
2501974	250	1974	1	4.4	12	0.55	10176.3
2501975	250	1975	1	4.4	12	0.55	10176.3
2501976	250	1976	1	4.4	12	0.55	10176.3
2501977	250	1977	1	4.4	12	0.55	10176.3
2501978	250	1978	1	4.4	12	0.55	10176.3
2501979	250	1979	1	4.4	12	0.55	10176.3

2501980	250	1980	0.94	4.3	11	0.55	10176.3
2501981	250	1981	0.94	4.3	11	0.55	10176.3
2501982	250	1982	0.94	4.3	11	0.55	10176.3
2501983	250	1983	0.94	4.3	11	0.55	10176.3
2501984	250	1984	0.94	4.3	11	0.55	10176.3
2501985	250	1985	0.88	4.2	11	0.55	10176.3
2501986	250	1986	0.88	4.2	11	0.55	10176.3
2501987	250	1987	0.88	4.2	11	0.55	10176.3
2501988	250	1988	0.68	2.7	8.17	0.38	10176.3
2501989	250	1989	0.68	2.7	8.17	0.38	10176.3
2501990	250	1990	0.68	2.7	8.17	0.38	10176.3
2501991	250	1991	0.68	2.7	8.17	0.38	10176.3
2501992	250	1992	0.68	2.7	8.17	0.38	10176.3
2501993	250	1993	0.68	2.7	8.17	0.38	10176.3
2501994	250	1994	0.68	2.7	8.17	0.38	10176.3
2501995	250	1995	0.68	2.7	8.17	0.38	10176.3
2501996	250	1996	0.32	0.92	6.25	0.15	10176.3
2501997	250	1997	0.32	0.92	6.25	0.15	10176.3
2501998	250	1998	0.32	0.92	6.25	0.15	10176.3
2501999	250	1999	0.32	0.92	6.25	0.15	10176.3
2502000	250	2000	0.32	0.92	6.25	0.15	10176.3
2502001	250	2001	0.32	0.92	6.25	0.15	10176.3
2502002	250	2002	0.32	0.92	6.25	0.15	10176.3
2502003	250	2003	0.19	0.92	5	0.12	10176.3
2502004	250	2004	0.14	0.92	4.58	0.11	10176.3
2502005	250	2005	0.12	0.92	4.38	0.11	10176.3
2502006	250	2006	0.12	0.92	4.38	0.11	10176.3
2502007	250	2007	0.1	0.92	2.45	0.11	10176.3
2502008	250	2008	0.1	0.92	2.45	0.11	10176.3
2502009	250	2009	0.1	0.92	2.45	0.11	10176.3
2502010	250	2010	0.1	0.92	2.45	0.11	10176.3
2502011	250	2011	0.07	0.92	1.36	0.01	10176.3
2502012	250	2012	0.07	0.92	1.36	0.01	10176.3
2502013	250	2013	0.07	0.92	1.36	0.01	10176.3
2502014	250	2014	0.05	0.92	0.27	0.01	10176.3
2502015	250	2015	0.05	0.92	0.27	0.01	10176.3
2502016	250	2016	0.05	0.92	0.27	0.01	10176.3
2502017	250	2017	0.05	0.92	0.27	0.01	10176.3
2502018	250	2018	0.05	0.92	0.27	0.01	10176.3
2502019	250	2019	0.05	0.92	0.27	0.01	10176.3
2502020	250	2020	0.05	0.92	0.27	0.01	10176.3
2502021	250	2021	0.05	0.92	0.27	0.01	10176.3
2502022	250	2022	0.05	0.92	0.27	0.01	10176.3
2502023	250	2023	0.05	0.92	0.27	0.01	10176.3
2502024	250	2024	0.05	0.92	0.27	0.01	10176.3
2502025	250	2025	0.05	0.92	0.27	0.01	10176.3
2502026	250	2026	0.05	0.92	0.27	0.01	10176.3
5001968	500	1968	1.26	4.2	14	0.74	10176.3
5001969	500	1969	1.26	4.2	14	0.74	10176.3
5001970	500	1970	1.05	4.2	13	0.63	10176.3
5001971	500	1971	1.05	4.2	13	0.63	10176.3
5001972	500	1972	0.95	4.2	12	0.53	10176.3
5001973	500	1973	0.95	4.2	12	0.53	10176.3
5001974	500	1974	0.95	4.2	12	0.53	10176.3
5001975	500	1975	0.95	4.2	12	0.53	10176.3
5001976	500	1976	0.95	4.2	12	0.53	10176.3
5001977	500	1977	0.95	4.2	12	0.53	10176.3
5001978	500	1978	0.95	4.2	12	0.53	10176.3
5001979	500	1979	0.95	4.2	12	0.53	10176.3
5001980	500	1980	0.9	4.2	11	0.53	10176.3
5001981	500	1981	0.9	4.2	11	0.53	10176.3
5001982	500	1982	0.9	4.2	11	0.53	10176.3
5001983	500	1983	0.9	4.2	11	0.53	10176.3
5001984	500	1984	0.9	4.2	11	0.53	10176.3
5001985	500	1985	0.84	4.1	11	0.53	10176.3
5001986	500	1986	0.84	4.1	11	0.53	10176.3
5001987	500	1987	0.84	4.1	11	0.53	10176.3
5001988	500	1988	0.68	2.7	8.17	0.38	10176.3
5001989	500	1989	0.68	2.7	8.17	0.38	10176.3
5001990	500	1990	0.68	2.7	8.17	0.38	10176.3
5001991	500	1991	0.68	2.7	8.17	0.38	10176.3
5001992	500	1992	0.68	2.7	8.17	0.38	10176.3
5001993	500	1993	0.68	2.7	8.17	0.38	10176.3
5001994	500	1994	0.68	2.7	8.17	0.38	10176.3
5001995	500	1995	0.68	2.7	8.17	0.38	10176.3
5001996	500	1996	0.32	0.92	6.25	0.15	10176.3
5001997	500	1997	0.32	0.92	6.25	0.15	10176.3
5001998	500	1998	0.32	0.92	6.25	0.15	10176.3
5001999	500	1999	0.32	0.92	6.25	0.15	10176.3
5002000	500	2000	0.32	0.92	6.25	0.15	10176.3
5002001	500	2001	0.19	0.92	4.95	0.12	10176.3
5002002	500	2002	0.14	0.92	4.51	0.11	10176.3
5002003	500	2003	0.12	0.92	4.29	0.11	10176.3
5002004	500	2004	0.12	0.92	4.29	0.11	10176.3

5002005	500	2005	0.1	0.92	4	0.11	10176.3
5002006	500	2006	0.1	0.92	2.45	0.11	10176.3
5002007	500	2007	0.1	0.92	2.45	0.11	10176.3
5002008	500	2008	0.1	0.92	2.45	0.11	10176.3
5002009	500	2009	0.1	0.92	2.45	0.11	10176.3
5002010	500	2010	0.1	0.92	2.45	0.11	10176.3
5002011	500	2011	0.07	0.92	1.36	0.01	10176.3
5002012	500	2012	0.07	0.92	1.36	0.01	10176.3
5002013	500	2013	0.07	0.92	1.36	0.01	10176.3
5002014	500	2014	0.05	0.92	0.27	0.01	10176.3
5002015	500	2015	0.05	0.92	0.27	0.01	10176.3
5002016	500	2016	0.05	0.92	0.27	0.01	10176.3
5002017	500	2017	0.05	0.92	0.27	0.01	10176.3
5002018	500	2018	0.05	0.92	0.27	0.01	10176.3
5002019	500	2019	0.05	0.92	0.27	0.01	10176.3
5002020	500	2020	0.05	0.92	0.27	0.01	10176.3
5002021	500	2021	0.05	0.92	0.27	0.01	10176.3
5002022	500	2022	0.05	0.92	0.27	0.01	10176.3
5002023	500	2023	0.05	0.92	0.27	0.01	10176.3
5002024	500	2024	0.05	0.92	0.27	0.01	10176.3
5002025	500	2025	0.05	0.92	0.27	0.01	10176.3
5002026	500	2026	0.05	0.92	0.27	0.01	10176.3
7501968	750	1968	1.26	4.2	14	0.74	10176.3
7501969	750	1969	1.26	4.2	14	0.74	10176.3
7501970	750	1970	1.05	4.2	13	0.63	10176.3
7501971	750	1971	1.05	4.2	13	0.63	10176.3
7501972	750	1972	0.95	4.2	12	0.53	10176.3
7501973	750	1973	0.95	4.2	12	0.53	10176.3
7501974	750	1974	0.95	4.2	12	0.53	10176.3
7501975	750	1975	0.95	4.2	12	0.53	10176.3
7501976	750	1976	0.95	4.2	12	0.53	10176.3
7501977	750	1977	0.95	4.2	12	0.53	10176.3
7501978	750	1978	0.95	4.2	12	0.53	10176.3
7501979	750	1979	0.95	4.2	12	0.53	10176.3
7501980	750	1980	0.9	4.2	11	0.53	10176.3
7501981	750	1981	0.9	4.2	11	0.53	10176.3
7501982	750	1982	0.9	4.2	11	0.53	10176.3
7501983	750	1983	0.9	4.2	11	0.53	10176.3
7501984	750	1984	0.9	4.2	11	0.53	10176.3
7501985	750	1985	0.84	4.1	11	0.53	10176.3
7501986	750	1986	0.84	4.1	11	0.53	10176.3
7501987	750	1987	0.84	4.1	11	0.53	10176.3
7501988	750	1988	0.68	2.7	8.17	0.38	10176.3
7501989	750	1989	0.68	2.7	8.17	0.38	10176.3
7501990	750	1990	0.68	2.7	8.17	0.38	10176.3
7501991	750	1991	0.68	2.7	8.17	0.38	10176.3
7501992	750	1992	0.68	2.7	8.17	0.38	10176.3
7501993	750	1993	0.68	2.7	8.17	0.38	10176.3
7501994	750	1994	0.68	2.7	8.17	0.38	10176.3
7501995	750	1995	0.68	2.7	8.17	0.38	10176.3
7501996	750	1996	0.32	0.92	6.25	0.15	10176.3
7501997	750	1997	0.32	0.92	6.25	0.15	10176.3
7501998	750	1998	0.32	0.92	6.25	0.15	10176.3
7501999	750	1999	0.32	0.92	6.25	0.15	10176.3
7502000	750	2000	0.32	0.92	6.25	0.15	10176.3
7502001	750	2001	0.32	0.92	6.25	0.15	10176.3
7502002	750	2002	0.19	0.92	4.95	0.12	10176.3
7502003	750	2003	0.14	0.92	4.51	0.11	10176.3
7502004	750	2004	0.12	0.92	4.29	0.11	10176.3
7502005	750	2005	0.12	0.92	4.29	0.11	10176.3
7502006	750	2006	0.1	0.92	2.45	0.11	10176.3
7502007	750	2007	0.1	0.92	2.45	0.11	10176.3
7502008	750	2008	0.1	0.92	2.45	0.11	10176.3
7502009	750	2009	0.1	0.92	2.45	0.11	10176.3
7502010	750	2010	0.1	0.92	2.45	0.11	10176.3
7502011	750	2011	0.07	0.92	1.36	0.01	10176.3
7502012	750	2012	0.07	0.92	1.36	0.01	10176.3
7502013	750	2013	0.07	0.92	1.36	0.01	10176.3
7502014	750	2014	0.05	0.92	0.27	0.01	10176.3
7502015	750	2015	0.05	0.92	0.27	0.01	10176.3
7502016	750	2016	0.05	0.92	0.27	0.01	10176.3
7502017	750	2017	0.05	0.92	0.27	0.01	10176.3
7502018	750	2018	0.05	0.92	0.27	0.01	10176.3
7502019	750	2019	0.05	0.92	0.27	0.01	10176.3
7502020	750	2020	0.05	0.92	0.27	0.01	10176.3
7502021	750	2021	0.05	0.92	0.27	0.01	10176.3
7502022	750	2022	0.05	0.92	0.27	0.01	10176.3
7502023	750	2023	0.05	0.92	0.27	0.01	10176.3
7502024	750	2024	0.05	0.92	0.27	0.01	10176.3
7502025	750	2025	0.05	0.92	0.27	0.01	10176.3
7502026	750	2026	0.05	0.92	0.27	0.01	10176.3
9991968	999	1968	1.26	4.2	14	0.74	10176.3
9991969	999	1969	1.26	4.2	14	0.74	10176.3
9991970	999	1970	1.05	4.2	13	0.63	10176.3

9991971	999	1971	1.05	4.2	13	0.63	10176.3
9991972	999	1972	0.95	4.2	12	0.53	10176.3
9991973	999	1973	0.95	4.2	12	0.53	10176.3
9991974	999	1974	0.95	4.2	12	0.53	10176.3
9991975	999	1975	0.95	4.2	12	0.53	10176.3
9991976	999	1976	0.95	4.2	12	0.53	10176.3
9991977	999	1977	0.95	4.2	12	0.53	10176.3
9991978	999	1978	0.95	4.2	12	0.53	10176.3
9991979	999	1979	0.95	4.2	12	0.53	10176.3
9991980	999	1980	0.9	4.2	11	0.53	10176.3
9991981	999	1981	0.9	4.2	11	0.53	10176.3
9991982	999	1982	0.9	4.2	11	0.53	10176.3
9991983	999	1983	0.9	4.2	11	0.53	10176.3
9991984	999	1984	0.9	4.2	11	0.53	10176.3
9991985	999	1985	0.84	4.1	11	0.53	10176.3
9991986	999	1986	0.84	4.1	11	0.53	10176.3
9991987	999	1987	0.84	4.1	11	0.53	10176.3
9991988	999	1988	0.68	2.7	8.17	0.38	10176.3
9991989	999	1989	0.68	2.7	8.17	0.38	10176.3
9991990	999	1990	0.68	2.7	8.17	0.38	10176.3
9991991	999	1991	0.68	2.7	8.17	0.38	10176.3
9991992	999	1992	0.68	2.7	8.17	0.38	10176.3
9991993	999	1993	0.68	2.7	8.17	0.38	10176.3
9991994	999	1994	0.68	2.7	8.17	0.38	10176.3
9991995	999	1995	0.68	2.7	8.17	0.38	10176.3
9991996	999	1996	0.68	2.7	8.17	0.38	10176.3
9991997	999	1997	0.68	2.7	8.17	0.38	10176.3
9991998	999	1998	0.68	2.7	8.17	0.38	10176.3
9991999	999	1999	0.68	2.7	8.17	0.38	10176.3
9992000	999	2000	0.32	0.92	6.25	0.15	10176.3
9992001	999	2001	0.32	0.92	6.25	0.15	10176.3
9992002	999	2002	0.32	0.92	6.25	0.15	10176.3
9992003	999	2003	0.32	0.92	6.25	0.15	10176.3
9992004	999	2004	0.32	0.92	6.25	0.15	10176.3
9992005	999	2005	0.32	0.92	6.25	0.15	10176.3
9992006	999	2006	0.19	0.92	4.95	0.12	10176.3
9992007	999	2007	0.14	0.92	4.51	0.11	10176.3
9992008	999	2008	0.12	0.92	4.29	0.11	10176.3
9992009	999	2009	0.12	0.92	4.29	0.11	10176.3
9992010	999	2010	0.1	0.92	4.08	0.11	10176.3
9992011	999	2011	0.1	0.92	2.36	0.06	10176.3
9992012	999	2012	0.1	0.92	2.36	0.06	10176.3
9992013	999	2013	0.1	0.92	2.36	0.06	10176.3
9992014	999	2014	0.1	0.92	2.36	0.06	10176.3
9992015	999	2015	0.05	0.92	2.36	0.02	10176.3
9992016	999	2016	0.05	0.92	2.36	0.02	10176.3
9992017	999	2017	0.05	0.92	2.36	0.02	10176.3
9992018	999	2018	0.05	0.92	2.36	0.02	10176.3
9992019	999	2019	0.05	0.92	2.36	0.02	10176.3
9992020	999	2020	0.05	0.92	2.36	0.02	10176.3
9992021	999	2021	0.05	0.92	2.36	0.02	10176.3
9992022	999	2022	0.05	0.92	2.36	0.02	10176.3
9992023	999	2023	0.05	0.92	2.36	0.02	10176.3
9992024	999	2024	0.05	0.92	2.36	0.02	10176.3
9992025	999	2025	0.05	0.92	2.36	0.02	10176.3
9992026	999	2026	0.05	0.92	2.36	0.02	10176.3

***New Tier4 emfacs included with 43/57% split for 120 hp merged (diesel only)**

units = g/bhp hr

Lookup	Hp	Year	HC	CO	NOX	PM	CO2
251968	25	1968	1.3	15.5	6	0.6	10176.3
251969	25	1969	1.3	15.5	6	0.6	10176.3
251970	25	1970	1.3	15.5	6	0.6	10176.3
251971	25	1971	1.3	15.5	6	0.6	10176.3
251972	25	1972	1.3	15.5	6	0.6	10176.3
251973	25	1973	1.3	15.5	6	0.6	10176.3
251974	25	1974	1.3	15.5	6	0.6	10176.3
251975	25	1975	1.3	15.5	6	0.6	10176.3
251976	25	1976	1.3	15.5	6	0.6	10176.3
251977	25	1977	1.3	15.5	6	0.6	10176.3
251978	25	1978	1.3	15.5	6	0.6	10176.3
251979	25	1979	1.3	15.5	6	0.6	10176.3
251980	25	1980	1.3	15.5	6	0.6	10176.3
251981	25	1981	1.3	15.5	6	0.6	10176.3
251982	25	1982	1.3	15.5	6	0.6	10176.3
251983	25	1983	1.3	15.5	6	0.6	10176.3
251984	25	1984	1.3	15.5	6	0.6	10176.3
251985	25	1985	1.3	15.5	6	0.6	10176.3
251986	25	1986	1.3	15.5	6	0.6	10176.3
251987	25	1987	1.3	15.5	6	0.6	10176.3
251988	25	1988	1.3	15.5	6	0.6	10176.3
251989	25	1989	1.3	15.5	6	0.6	10176.3
251990	25	1990	1.3	15.5	6	0.6	10176.3
251991	25	1991	1.3	15.5	5	0.25	10176.3
251992	25	1992	1.3	15.5	5	0.25	10176.3
251993	25	1993	1.3	15.5	5	0.25	10176.3
251994	25	1994	1.3	15.5	5	0.1	10176.3
251995	25	1995	1.3	15.5	5	0.1	10176.3
251996	25	1996	1.3	15.5	5	0.1	10176.3
251997	25	1997	1.3	15.5	5	0.1	10176.3
251998	25	1998	1.3	15.5	5	0.1	10176.3
251999	25	1999	1.3	15.5	5	0.1	10176.3
252000	25	2000	1.3	15.5	5	0.1	10176.3
252001	25	2001	1.3	15.5	5	0.1	10176.3
252002	25	2002	1.3	15.5	5	0.1	10176.3
252003	25	2003	1.3	15.5	5	0.1	10176.3
252004	25	2004	0.5	15.5	2	0.1	10176.3
252005	25	2005	0.5	15.5	2	0.1	10176.3
252006	25	2006	0.5	15.5	2	0.1	10176.3

252007	25	2007	0.14	15.5	2	0.01	10176.3
252008	25	2008	0.14	15.5	2	0.01	10176.3
252009	25	2009	0.14	15.5	2	0.01	10176.3
252010	25	2010	0.14	15.5	2	0.01	10176.3
252011	25	2011	0.14	15.5	2	0.01	10176.3
252012	25	2012	0.14	15.5	2	0.01	10176.3
252013	25	2013	0.14	15.5	2	0.01	10176.3
252014	25	2014	0.14	15.5	2	0.01	10176.3
252015	25	2015	0.14	15.5	2	0.01	10176.3
252016	25	2016	0.14	15.5	2	0.01	10176.3
252017	25	2017	0.14	15.5	2	0.01	10176.3
252018	25	2018	0.14	15.5	2	0.01	10176.3
252019	25	2019	0.14	15.5	2	0.01	10176.3
252020	25	2020	0.14	15.5	2	0.01	10176.3
252021	25	2021	0.14	15.5	2	0.01	10176.3
252022	25	2022	0.14	15.5	2	0.01	10176.3
252023	25	2023	0.14	15.5	2	0.01	10176.3
252024	25	2024	0.14	15.5	2	0.01	10176.3
252025	25	2025	0.14	15.5	2	0.01	10176.3
252026	25	2026	0.14	15.5	2	0.01	10176.3
501969	50	1969	1.3	15.5	6	0.6	10176.3
501969	50	1969	1.3	15.5	6	0.6	10176.3
501970	50	1970	1.3	15.5	6	0.6	10176.3
501971	50	1971	1.3	15.5	6	0.6	10176.3
501972	50	1972	1.3	15.5	6	0.6	10176.3
501973	50	1973	1.3	15.5	6	0.6	10176.3
501974	50	1974	1.3	15.5	6	0.6	10176.3
501975	50	1975	1.3	15.5	6	0.6	10176.3
501976	50	1976	1.3	15.5	6	0.6	10176.3
501977	50	1977	1.3	15.5	6	0.6	10176.3
501978	50	1978	1.3	15.5	6	0.6	10176.3
501979	50	1979	1.3	15.5	6	0.6	10176.3
501980	50	1980	1.3	15.5	6	0.6	10176.3
501981	50	1981	1.3	15.5	6	0.6	10176.3
501982	50	1982	1.3	15.5	6	0.6	10176.3
501983	50	1983	1.3	15.5	6	0.6	10176.3
501984	50	1984	1.3	15.5	6	0.6	10176.3
501985	50	1985	1.3	15.5	6	0.6	10176.3
501986	50	1986	1.3	15.5	6	0.6	10176.3
501987	50	1987	1.3	15.5	6	0.6	10176.3
501988	50	1988	1.3	15.5	6	0.6	10176.3
501989	50	1989	1.3	15.5	6	0.6	10176.3
501990	50	1990	1.3	15.5	6	0.6	10176.3

501991	50	1991	1.3	15.5	5	0.25	10176.3
501992	50	1992	1.3	15.5	5	0.25	10176.3
501993	50	1993	1.3	15.5	5	0.25	10176.3
501994	50	1994	1.3	15.5	5	0.1	10176.3
501995	50	1995	1.3	15.5	5	0.1	10176.3
501996	50	1996	1.3	15.5	5	0.1	10176.3
501997	50	1997	1.3	15.5	5	0.1	10176.3
501998	50	1998	1.3	15.5	5	0.1	10176.3
501999	50	1999	1.3	15.5	5	0.1	10176.3
502000	50	2000	1.3	15.5	5	0.1	10176.3
502001	50	2001	1.3	15.5	5	0.1	10176.3
502002	50	2002	1.3	15.5	5	0.1	10176.3
502003	50	2003	1.3	15.5	5	0.1	10176.3
502004	50	2004	0.5	15.5	2	0.1	10176.3
502005	50	2005	0.5	15.5	2	0.1	10176.3
502006	50	2006	0.5	15.5	2	0.1	10176.3
502007	50	2007	0.14	15.5	1.1	0.01	10176.3
502008	50	2008	0.14	15.5	1.1	0.01	10176.3
502009	50	2009	0.14	15.5	1.1	0.01	10176.3
502010	50	2010	0.14	15.5	0.2	0.01	10176.3
502011	50	2011	0.14	15.5	0.2	0.01	10176.3
502012	50	2012	0.14	15.5	0.2	0.01	10176.3
502013	50	2013	0.14	15.5	0.2	0.01	10176.3
502014	50	2014	0.14	15.5	0.2	0.01	10176.3
502015	50	2015	0.14	15.5	0.2	0.01	10176.3
502016	50	2016	0.14	15.5	0.2	0.01	10176.3
502017	50	2017	0.14	15.5	0.2	0.01	10176.3
502018	50	2018	0.14	15.5	0.2	0.01	10176.3
502019	50	2019	0.14	15.5	0.2	0.01	10176.3
502020	50	2020	0.14	15.5	0.2	0.01	10176.3
502021	50	2021	0.14	15.5	0.2	0.01	10176.3
502022	50	2022	0.14	15.5	0.2	0.01	10176.3
502023	50	2023	0.14	15.5	0.2	0.01	10176.3
502024	50	2024	0.14	15.5	0.2	0.01	10176.3
502025	50	2025	0.14	15.5	0.2	0.01	10176.3
502026	50	2026	0.14	15.5	0.2	0.01	10176.3
1201968	120	1968	1.3	15.5	6	0.6	10176.3
1201969	120	1969	1.3	15.5	6	0.6	10176.3
1201970	120	1970	1.3	15.5	6	0.6	10176.3
1201971	120	1971	1.3	15.5	6	0.6	10176.3
1201972	120	1972	1.3	15.5	6	0.6	10176.3
1201973	120	1973	1.3	15.5	6	0.6	10176.3
1201974	120	1974	1.3	15.5	6	0.6	10176.3

1201975	120	1975	1.3	15.5	6	0.6	10176.3
1201976	120	1976	1.3	15.5	6	0.6	10176.3
1201977	120	1977	1.3	15.5	6	0.6	10176.3
1201978	120	1978	1.3	15.5	6	0.6	10176.3
1201979	120	1979	1.3	15.5	6	0.6	10176.3
1201980	120	1980	1.3	15.5	6	0.6	10176.3
1201981	120	1981	1.3	15.5	6	0.6	10176.3
1201982	120	1982	1.3	15.5	6	0.6	10176.3
1201983	120	1983	1.3	15.5	6	0.6	10176.3
1201984	120	1984	1.3	15.5	6	0.6	10176.3
1201985	120	1985	1.3	15.5	6	0.6	10176.3
1201986	120	1986	1.3	15.5	6	0.6	10176.3
1201987	120	1987	1.3	15.5	6	0.6	10176.3
1201988	120	1988	1.3	15.5	6	0.6	10176.3
1201989	120	1989	1.3	15.5	6	0.6	10176.3
1201990	120	1990	1.3	15.5	6	0.6	10176.3
1201991	120	1991	1.3	15.5	5	0.25	10176.3
1201992	120	1992	1.3	15.5	5	0.25	10176.3
1201993	120	1993	1.3	15.5	5	0.25	10176.3
1201994	120	1994	1.3	15.5	5	0.1	10176.3
1201995	120	1995	1.3	15.5	5	0.1	10176.3
1201996	120	1996	1.3	15.5	5	0.1	10176.3
1201997	120	1997	1.3	15.5	5	0.1	10176.3
1201998	120	1998	1.3	15.5	5	0.1	10176.3
1201999	120	1999	1.3	15.5	5	0.1	10176.3
1202000	120	2000	1.3	15.5	5	0.1	10176.3
1202001	120	2001	1.3	15.5	5	0.1	10176.3
1202002	120	2002	1.3	15.5	5	0.1	10176.3
1202003	120	2003	1.3	15.5	5	0.1	10176.3
1202004	120	2004	0.5	15.5	2	0.1	10176.3
1202005	120	2005	0.5	15.5	2	0.1	10176.3
1202006	120	2006	0.5	15.5	2	0.1	10176.3
1202007	120	2007	0.14	15.5	1.1	0.01	10176.3
1202008	120	2008	0.14	15.5	1.1	0.01	10176.3
1202009	120	2009	0.14	15.5	1.1	0.01	10176.3
1202010	120	2010	0.14	15.5	0.2	0.01	10176.3
1202011	120	2011	0.14	15.5	0.2	0.01	10176.3
1202012	120	2012	0.14	15.5	0.2	0.01	10176.3
1202013	120	2013	0.14	15.5	0.2	0.01	10176.3
1202014	120	2014	0.14	15.5	0.2	0.01	10176.3
1202015	120	2015	0.14	15.5	0.2	0.01	10176.3
1202016	120	2016	0.14	15.5	0.2	0.01	10176.3
1202017	120	2017	0.14	15.5	0.2	0.01	10176.3

1202018	120	2018	0.14	15.5	0.2	0.01	10176.3
1202019	120	2019	0.14	15.5	0.2	0.01	10176.3
1202020	120	2020	0.14	15.5	0.2	0.01	10176.3
1202021	120	2021	0.14	15.5	0.2	0.01	10176.3
1202022	120	2022	0.14	15.5	0.2	0.01	10176.3
1202023	120	2023	0.14	15.5	0.2	0.01	10176.3
1202024	120	2024	0.14	15.5	0.2	0.01	10176.3
1202025	120	2025	0.14	15.5	0.2	0.01	10176.3
1202026	120	2026	0.14	15.5	0.2	0.01	10176.3
1751968	175	1968	1.3	15.5	6	0.6	10176.3
1751969	175	1969	1.3	15.5	6	0.6	10176.3
1751970	175	1970	1.3	15.5	6	0.6	10176.3
1751971	175	1971	1.3	15.5	6	0.6	10176.3
1751972	175	1972	1.3	15.5	6	0.6	10176.3
1751973	175	1973	1.3	15.5	6	0.6	10176.3
1751974	175	1974	1.3	15.5	6	0.6	10176.3
1751975	175	1975	1.3	15.5	6	0.6	10176.3
1751976	175	1976	1.3	15.5	6	0.6	10176.3
1751977	175	1977	1.3	15.5	6	0.6	10176.3
1751978	175	1978	1.3	15.5	6	0.6	10176.3
1751979	175	1979	1.3	15.5	6	0.6	10176.3
1751980	175	1980	1.3	15.5	6	0.6	10176.3
1751981	175	1981	1.3	15.5	6	0.6	10176.3
1751982	175	1982	1.3	15.5	6	0.6	10176.3
1751983	175	1983	1.3	15.5	6	0.6	10176.3
1751984	175	1984	1.3	15.5	6	0.6	10176.3
1751985	175	1985	1.3	15.5	6	0.6	10176.3
1751986	175	1986	1.3	15.5	6	0.6	10176.3
1751987	175	1987	1.3	15.5	6	0.6	10176.3
1751988	175	1988	1.3	15.5	6	0.6	10176.3
1751989	175	1989	1.3	15.5	6	0.6	10176.3
1751990	175	1990	1.3	15.5	6	0.6	10176.3
1751991	175	1991	1.3	15.5	5	0.25	10176.3
1751992	175	1992	1.3	15.5	5	0.25	10176.3
1751993	175	1993	1.3	15.5	5	0.25	10176.3
1751994	175	1994	1.3	15.5	5	0.1	10176.3
1751995	175	1995	1.3	15.5	5	0.1	10176.3
1751996	175	1996	1.3	15.5	5	0.1	10176.3
1751997	175	1997	1.3	15.5	5	0.1	10176.3
1751998	175	1998	1.3	15.5	5	0.1	10176.3
1751999	175	1999	1.3	15.5	5	0.1	10176.3
1752000	175	2000	1.3	15.5	5	0.1	10176.3
1752001	175	2001	1.3	15.5	5	0.1	10176.3

1752002	175	2002	1.3	15.5	5	0.1	10176.3
1752003	175	2003	1.3	15.5	5	0.1	10176.3
1752004	175	2004	0.5	15.5	2	0.1	10176.3
1752005	175	2005	0.5	15.5	2	0.1	10176.3
1752006	175	2006	0.5	15.5	2	0.1	10176.3
1752007	175	2007	0.14	15.5	1.1	0.01	10176.3
1752008	175	2008	0.14	15.5	1.1	0.01	10176.3
1752009	175	2009	0.14	15.5	1.1	0.01	10176.3
1752010	175	2010	0.14	15.5	0.2	0.01	10176.3
1752011	175	2011	0.14	15.5	0.2	0.01	10176.3
1752012	175	2012	0.14	15.5	0.2	0.01	10176.3
1752013	175	2013	0.14	15.5	0.2	0.01	10176.3
1752014	175	2014	0.14	15.5	0.2	0.01	10176.3
1752015	175	2015	0.14	15.5	0.2	0.01	10176.3
1752016	175	2016	0.14	15.5	0.2	0.01	10176.3
1752017	175	2017	0.14	15.5	0.2	0.01	10176.3
1752018	175	2018	0.14	15.5	0.2	0.01	10176.3
1752019	175	2019	0.14	15.5	0.2	0.01	10176.3
1752020	175	2020	0.14	15.5	0.2	0.01	10176.3
1752021	175	2021	0.14	15.5	0.2	0.01	10176.3
1752022	175	2022	0.14	15.5	0.2	0.01	10176.3
1752023	175	2023	0.14	15.5	0.2	0.01	10176.3
1752024	175	2024	0.14	15.5	0.2	0.01	10176.3
1752025	175	2025	0.14	15.5	0.2	0.01	10176.3
1752026	175	2026	0.14	15.5	0.2	0.01	10176.3
2501968	250	1968	1.3	15.5	6	0.6	10176.3
2501969	250	1969	1.3	15.5	6	0.6	10176.3
2501970	250	1970	1.3	15.5	6	0.6	10176.3
2501971	250	1971	1.3	15.5	6	0.6	10176.3
2501972	250	1972	1.3	15.5	6	0.6	10176.3
2501973	250	1973	1.3	15.5	6	0.6	10176.3
2501974	250	1974	1.3	15.5	6	0.6	10176.3
2501975	250	1975	1.3	15.5	6	0.6	10176.3
2501976	250	1976	1.3	15.5	6	0.6	10176.3
2501977	250	1977	1.3	15.5	6	0.6	10176.3
2501978	250	1978	1.3	15.5	6	0.6	10176.3
2501979	250	1979	1.3	15.5	6	0.6	10176.3
2501980	250	1980	1.3	15.5	6	0.6	10176.3
2501981	250	1981	1.3	15.5	6	0.6	10176.3
2501982	250	1982	1.3	15.5	6	0.6	10176.3
2501983	250	1983	1.3	15.5	6	0.6	10176.3
2501984	250	1984	1.3	15.5	6	0.6	10176.3
2501985	250	1985	1.3	15.5	6	0.6	10176.3

2501986	250	1986	1.3	15.5	6	0.6	10176.3
2501987	250	1987	1.3	15.5	6	0.6	10176.3
2501988	250	1988	1.3	15.5	6	0.6	10176.3
2501989	250	1989	1.3	15.5	6	0.6	10176.3
2501990	250	1990	1.3	15.5	6	0.6	10176.3
2501991	250	1991	1.3	15.5	5	0.25	10176.3
2501992	250	1992	1.3	15.5	5	0.25	10176.3
2501993	250	1993	1.3	15.5	5	0.25	10176.3
2501994	250	1994	1.3	15.5	5	0.1	10176.3
2501995	250	1995	1.3	15.5	5	0.1	10176.3
2501996	250	1996	1.3	15.5	5	0.1	10176.3
2501997	250	1997	1.3	15.5	5	0.1	10176.3
2501998	250	1998	1.3	15.5	5	0.1	10176.3
2501999	250	1999	1.3	15.5	5	0.1	10176.3
2502000	250	2000	1.3	15.5	5	0.1	10176.3
2502001	250	2001	1.3	15.5	5	0.1	10176.3
2502002	250	2002	1.3	15.5	5	0.1	10176.3
2502003	250	2003	1.3	15.5	5	0.1	10176.3
2502004	250	2004	0.5	15.5	2	0.1	10176.3
2502005	250	2005	0.5	15.5	2	0.1	10176.3
2502006	250	2006	0.5	15.5	2	0.1	10176.3
2502007	250	2007	0.14	15.5	1.1	0.01	10176.3
2502008	250	2008	0.14	15.5	1.1	0.01	10176.3
2502009	250	2009	0.14	15.5	1.1	0.01	10176.3
2502010	250	2010	0.14	15.5	0.2	0.01	10176.3
2502011	250	2011	0.14	15.5	0.2	0.01	10176.3
2502012	250	2012	0.14	15.5	0.2	0.01	10176.3
2502013	250	2013	0.14	15.5	0.2	0.01	10176.3
2502014	250	2014	0.14	15.5	0.2	0.01	10176.3
2502015	250	2015	0.14	15.5	0.2	0.01	10176.3
2502016	250	2016	0.14	15.5	0.2	0.01	10176.3
2502017	250	2017	0.14	15.5	0.2	0.01	10176.3
2502018	250	2018	0.14	15.5	0.2	0.01	10176.3
2502019	250	2019	0.14	15.5	0.2	0.01	10176.3
2502020	250	2020	0.14	15.5	0.2	0.01	10176.3
2502021	250	2021	0.14	15.5	0.2	0.01	10176.3
2502022	250	2022	0.14	15.5	0.2	0.01	10176.3
2502023	250	2023	0.14	15.5	0.2	0.01	10176.3
2502024	250	2024	0.14	15.5	0.2	0.01	10176.3
2502025	250	2025	0.14	15.5	0.2	0.01	10176.3
2502026	250	2026	0.14	15.5	0.2	0.01	10176.3
5001968	500	1968	1.3	15.5	6	0.6	10176.3
5001969	500	1969	1.3	15.5	6	0.6	10176.3

5001970	500	1970	1.3	15.5	6	0.6	10176.3
5001971	500	1971	1.3	15.5	6	0.6	10176.3
5001972	500	1972	1.3	15.5	6	0.6	10176.3
5001973	500	1973	1.3	15.5	6	0.6	10176.3
5001974	500	1974	1.3	15.5	6	0.6	10176.3
5001975	500	1975	1.3	15.5	6	0.6	10176.3
5001976	500	1976	1.3	15.5	6	0.6	10176.3
5001977	500	1977	1.3	15.5	6	0.6	10176.3
5001978	500	1978	1.3	15.5	6	0.6	10176.3
5001979	500	1979	1.3	15.5	6	0.6	10176.3
5001980	500	1980	1.3	15.5	6	0.6	10176.3
5001981	500	1981	1.3	15.5	6	0.6	10176.3
5001982	500	1982	1.3	15.5	6	0.6	10176.3
5001983	500	1983	1.3	15.5	6	0.6	10176.3
5001984	500	1984	1.3	15.5	6	0.6	10176.3
5001985	500	1985	1.3	15.5	6	0.6	10176.3
5001986	500	1986	1.3	15.5	6	0.6	10176.3
5001987	500	1987	1.3	15.5	6	0.6	10176.3
5001988	500	1988	1.3	15.5	6	0.6	10176.3
5001989	500	1989	1.3	15.5	6	0.6	10176.3
5001990	500	1990	1.3	15.5	6	0.6	10176.3
5001991	500	1991	1.3	15.5	5	0.25	10176.3
5001992	500	1992	1.3	15.5	5	0.25	10176.3
5001993	500	1993	1.3	15.5	5	0.25	10176.3
5001994	500	1994	1.3	15.5	5	0.1	10176.3
5001995	500	1995	1.3	15.5	5	0.1	10176.3
5001996	500	1996	1.3	15.5	5	0.1	10176.3
5001997	500	1997	1.3	15.5	5	0.1	10176.3
5001998	500	1998	1.3	15.5	5	0.1	10176.3
5001999	500	1999	1.3	15.5	5	0.1	10176.3
5002000	500	2000	1.3	15.5	5	0.1	10176.3
5002001	500	2001	1.3	15.5	5	0.1	10176.3
5002002	500	2002	1.3	15.5	5	0.1	10176.3
5002003	500	2003	1.3	15.5	5	0.1	10176.3
5002004	500	2004	0.5	15.5	2	0.1	10176.3
5002005	500	2005	0.5	15.5	2	0.1	10176.3
5002006	500	2006	0.5	15.5	2	0.1	10176.3
5002007	500	2007	0.14	15.5	1.1	0.01	10176.3
5002008	500	2008	0.14	15.5	1.1	0.01	10176.3
5002009	500	2009	0.14	15.5	1.1	0.01	10176.3
5002010	500	2010	0.14	15.5	0.2	0.01	10176.3
5002011	500	2011	0.14	15.5	0.2	0.01	10176.3
5002012	500	2012	0.14	15.5	0.2	0.01	10176.3

5002013	500	2013	0.14	15.5	0.2	0.01	10176.3
5002014	500	2014	0.14	15.5	0.2	0.01	10176.3
5002015	500	2015	0.14	15.5	0.2	0.01	10176.3
5002016	500	2016	0.14	15.5	0.2	0.01	10176.3
5002017	500	2017	0.14	15.5	0.2	0.01	10176.3
5002018	500	2018	0.14	15.5	0.2	0.01	10176.3
5002019	500	2019	0.14	15.5	0.2	0.01	10176.3
5002020	500	2020	0.14	15.5	0.2	0.01	10176.3
5002021	500	2021	0.14	15.5	0.2	0.01	10176.3
5002022	500	2022	0.14	15.5	0.2	0.01	10176.3
5002023	500	2023	0.14	15.5	0.2	0.01	10176.3
5002024	500	2024	0.14	15.5	0.2	0.01	10176.3
5002025	500	2025	0.14	15.5	0.2	0.01	10176.3
5002026	500	2026	0.14	15.5	0.2	0.01	10176.3
7501968	750	1968	1.3	15.5	6	0.6	10176.3
7501969	750	1969	1.3	15.5	6	0.6	10176.3
7501970	750	1970	1.3	15.5	6	0.6	10176.3
7501971	750	1971	1.3	15.5	6	0.6	10176.3
7501972	750	1972	1.3	15.5	6	0.6	10176.3
7501973	750	1973	1.3	15.5	6	0.6	10176.3
7501974	750	1974	1.3	15.5	6	0.6	10176.3
7501975	750	1975	1.3	15.5	6	0.6	10176.3
7501976	750	1976	1.3	15.5	6	0.6	10176.3
7501977	750	1977	1.3	15.5	6	0.6	10176.3
7501978	750	1978	1.3	15.5	6	0.6	10176.3
7501979	750	1979	1.3	15.5	6	0.6	10176.3
7501980	750	1980	1.3	15.5	6	0.6	10176.3
7501981	750	1981	1.3	15.5	6	0.6	10176.3
7501982	750	1982	1.3	15.5	6	0.6	10176.3
7501983	750	1983	1.3	15.5	6	0.6	10176.3
7501984	750	1984	1.3	15.5	6	0.6	10176.3
7501985	750	1985	1.3	15.5	6	0.6	10176.3
7501986	750	1986	1.3	15.5	6	0.6	10176.3
7501987	750	1987	1.3	15.5	6	0.6	10176.3
7501988	750	1988	1.3	15.5	6	0.6	10176.3
7501989	750	1989	1.3	15.5	6	0.6	10176.3
7501990	750	1990	1.3	15.5	6	0.6	10176.3
7501991	750	1991	1.3	15.5	5	0.25	10176.3
7501992	750	1992	1.3	15.5	5	0.25	10176.3
7501993	750	1993	1.3	15.5	5	0.25	10176.3
7501994	750	1994	1.3	15.5	5	0.1	10176.3
7501995	750	1995	1.3	15.5	5	0.1	10176.3
7501996	750	1996	1.3	15.5	5	0.1	10176.3

7501997	750	1997	1.3	15.5	5	0.1	10176.3
7501998	750	1998	1.3	15.5	5	0.1	10176.3
7501999	750	1999	1.3	15.5	5	0.1	10176.3
7502000	750	2000	1.3	15.5	5	0.1	10176.3
7502001	750	2001	1.3	15.5	5	0.1	10176.3
7502002	750	2002	1.3	15.5	5	0.1	10176.3
7502003	750	2003	1.3	15.5	5	0.1	10176.3
7502004	750	2004	0.5	15.5	2	0.1	10176.3
7502005	750	2005	0.5	15.5	2	0.1	10176.3
7502006	750	2006	0.5	15.5	2	0.1	10176.3
7502007	750	2007	0.14	15.5	1.1	0.01	10176.3
7502008	750	2008	0.14	15.5	1.1	0.01	10176.3
7502009	750	2009	0.14	15.5	1.1	0.01	10176.3
7502010	750	2010	0.14	15.5	0.2	0.01	10176.3
7502011	750	2011	0.14	15.5	0.2	0.01	10176.3
7502012	750	2012	0.14	15.5	0.2	0.01	10176.3
7502013	750	2013	0.14	15.5	0.2	0.01	10176.3
7502014	750	2014	0.14	15.5	0.2	0.01	10176.3
7502015	750	2015	0.14	15.5	0.2	0.01	10176.3
7502016	750	2016	0.14	15.5	0.2	0.01	10176.3
7502017	750	2017	0.14	15.5	0.2	0.01	10176.3
7502018	750	2018	0.14	15.5	0.2	0.01	10176.3
7502019	750	2019	0.14	15.5	0.2	0.01	10176.3
7502020	750	2020	0.14	15.5	0.2	0.01	10176.3
7502021	750	2021	0.14	15.5	0.2	0.01	10176.3
7502022	750	2022	0.14	15.5	0.2	0.01	10176.3
7502023	750	2023	0.14	15.5	0.2	0.01	10176.3
7502024	750	2024	0.14	15.5	0.2	0.01	10176.3
7502025	750	2025	0.14	15.5	0.2	0.01	10176.3
7502026	750	2026	0.14	15.5	0.2	0.01	10176.3
9991968	999	1968	1.3	15.5	6	0.6	10176.3
9991969	999	1969	1.3	15.5	6	0.6	10176.3
9991970	999	1970	1.3	15.5	6	0.6	10176.3
9991971	999	1971	1.3	15.5	6	0.6	10176.3
9991972	999	1972	1.3	15.5	6	0.6	10176.3
9991973	999	1973	1.3	15.5	6	0.6	10176.3
9991974	999	1974	1.3	15.5	6	0.6	10176.3
9991975	999	1975	1.3	15.5	6	0.6	10176.3
9991976	999	1976	1.3	15.5	6	0.6	10176.3
9991977	999	1977	1.3	15.5	6	0.6	10176.3
9991978	999	1978	1.3	15.5	6	0.6	10176.3
9991979	999	1979	1.3	15.5	6	0.6	10176.3
9991980	999	1980	1.3	15.5	6	0.6	10176.3

9991981	999	1981	1.3	15.5	6	0.6	10176.3
9991982	999	1982	1.3	15.5	6	0.6	10176.3
9991983	999	1983	1.3	15.5	6	0.6	10176.3
9991984	999	1984	1.3	15.5	6	0.6	10176.3
9991985	999	1985	1.3	15.5	6	0.6	10176.3
9991986	999	1986	1.3	15.5	6	0.6	10176.3
9991987	999	1987	1.3	15.5	6	0.6	10176.3
9991988	999	1988	1.3	15.5	6	0.6	10176.3
9991989	999	1989	1.3	15.5	6	0.6	10176.3
9991990	999	1990	1.3	15.5	6	0.6	10176.3
9991991	999	1991	1.3	15.5	5	0.25	10176.3
9991992	999	1992	1.3	15.5	5	0.25	10176.3
9991993	999	1993	1.3	15.5	5	0.25	10176.3
9991994	999	1994	1.3	15.5	5	0.1	10176.3
9991995	999	1995	1.3	15.5	5	0.1	10176.3
9991996	999	1996	1.3	15.5	5	0.1	10176.3
9991997	999	1997	1.3	15.5	5	0.1	10176.3
9991998	999	1998	1.3	15.5	5	0.1	10176.3
9991999	999	1999	1.3	15.5	5	0.1	10176.3
9992000	999	2000	1.3	15.5	5	0.1	10176.3
9992001	999	2001	1.3	15.5	5	0.1	10176.3
9992002	999	2002	1.3	15.5	5	0.1	10176.3
9992003	999	2003	1.3	15.5	5	0.1	10176.3
9992004	999	2004	0.5	15.5	2	0.1	10176.3
9992005	999	2005	0.5	15.5	2	0.1	10176.3
9992006	999	2006	0.5	15.5	2	0.1	10176.3
9992007	999	2007	0.14	15.5	1.1	0.01	10176.3
9992008	999	2008	0.14	15.5	1.1	0.01	10176.3
9992009	999	2009	0.14	15.5	1.1	0.01	10176.3
9992010	999	2010	0.14	15.5	0.2	0.01	10176.3
9992011	999	2011	0.14	15.5	0.2	0.01	10176.3
9992012	999	2012	0.14	15.5	0.2	0.01	10176.3
9992013	999	2013	0.14	15.5	0.2	0.01	10176.3
9992014	999	2014	0.14	15.5	0.2	0.01	10176.3
9992015	999	2015	0.14	15.5	0.2	0.01	10176.3
9992016	999	2016	0.14	15.5	0.2	0.01	10176.3
9992017	999	2017	0.14	15.5	0.2	0.01	10176.3
9992018	999	2018	0.14	15.5	0.2	0.01	10176.3
9992019	999	2019	0.14	15.5	0.2	0.01	10176.3
9992020	999	2020	0.14	15.5	0.2	0.01	10176.3
9992021	999	2021	0.14	15.5	0.2	0.01	10176.3
9992022	999	2022	0.14	15.5	0.2	0.01	10176.3
9992023	999	2023	0.14	15.5	0.2	0.01	10176.3

9992024	999	2024	0.14	15.5	0.2	0.01	10176.3
9992025	999	2025	0.14	15.5	0.2	0.01	10176.3
9992026	999	2026	0.14	15.5	0.2	0.01	10176.3

ARB Equipment	HP Bin	SOX (g SOX/hp-hr)
Excavator	50	0.0686448
Excavator	120	0.0622888
Excavator	175	0.0597464
Excavator	250	0.0597464
Excavator	500	0.0521192
Excavator	750	0.0533904
Crane	50	0.0686448
Crane	120	0.0622888
Crane	175	0.0597464
Crane	250	0.0597464
Crane	500	0.0521192
Crane	750	0.0533904
Crane	999	0.0533904
Forklift	50	0.0686448
Forklift	120	0.0622888
Forklift	175	0.0597464
Forklift	250	0.0597464
Forklift	500	0.0521192
Material Handling Equip	120	0.0597464
Other General Industrial Equip	50	0.0686448
Other General Industrial Equip	120	0.0622888
Other General Industrial Equip	175	0.0597464
Other General Industrial Equip	250	0.0597464
Other General Industrial Equip	500	0.0521192
Other General Industrial Equip	750	0.0533904
Other General Industrial Equip	999	0.0533904
Sweeper/Scrubber	50	0.0686448
Sweeper/Scrubber	120	0.0622888
Sweeper/Scrubber	175	0.0597464
Sweeper/Scrubber	250	0.0597464
Tractor/Loader/Backhoe	50	0.0686448
Tractor/Loader/Backhoe	120	0.0622888
Tractor/Loader/Backhoe	175	0.0597464
Tractor/Loader/Backhoe	250	0.0597464
Tractor/Loader/Backhoe	500	0.0597464
Tractor/Loader/Backhoe	750	0.0597464
Yard Tractor offroad engine	120	0.0622888
Yard Tractor offroad engine	175	0.0597464
Yard Tractor offroad engine	250	0.0597464
Yard Tractor offroad engine	750	0.0533904
Yard Tractor offroad engine	999	0.0533904
Yard Tractor onroad engine	120	0.0622888
Yard Tractor onroad engine	175	0.0597464
Yard Tractor onroad engine	250	0.0597464
Yard Tractor onroad engine	750	0.0533904
Yard Tractor onroad engine	999	0.0533904

Engine changes	Emission Changes %			
	HC	CO	NOx	PM
DOC	0.7	0.7	0	0.3
DPF (P)	0.9	0.9	0	0.85
DPF (A)	0	0	0	0.85
Emulsified Fuel	0	0	0.15	0.3
Emulsified Fuel+ DOC	0	0	0.2	0.5

Equipment Types	Code
Crane	1
Excavator	2
Forklift	3
Material Handling Equip	4
Other General Industrial Equ	5
Sweeper/Scrubber	6
Tractor/Loader/Backhoe	7
Yard Tractor offroad engine	8
Yard Tractor onroad engine	9

APPENDIX D-2

DEATILED EMISSION CALCULATIONS, EMISSION FACTOR DERIVATION AND OFFROAD2007 OUTPUT FOR PROJECT YEAR 2010

Summary of Emissions from Cargo Handling Equipment
Dolores and ICTF Rail Yards, Long Beach, CA

Yard	Equipment Type	Fuel Type	Make	Model	Model Year	No of Units	Rating (hp)	Hours of Operation (hrs/yr)[1-5]	BSFC (lb/bhp-hr)[6]	Fuel Use (gal/yr)[7]	Load Factor[8]	Carbon Oxidation Factor[9]	2010 Emission Factors (g/bhp-hr)[10,11] HC	CO	NOx	PM10	DPM	SOx	2010 Emission Factors (kg/gal)[9] CO2	N2O[12]	CH4[12]	2010 Emission Estimates (tons/yr) ROG	CO	NOx	PM10	DPM	SOx	2010 Emission Estimates (metric tons/yr) CO2	N2O	CH4
ICTF	Forklift	Diesel	Toyota	6FDU25	1997	1	85	730	0.49	1,285	0.30	99%	0.990	3.490	8.750	*0.104*	*0.104*	0.062	10.15	1.39E-05	4.16E-05	0.02	0.07	0.18	0.00	0.00	0.00	12.91	1.78E-05	0.00
ICTF	RTG #15-18	Diesel	Mi Jack	1000R	1995	1	300	2,387	0.41	17,780	0.43	99%	0.680	2.700	8.170	0.380	0.380	0.052	10.15	1.39E-05	4.16E-05	0.23	0.92	2.77	0.13	0.13	0.02	178.66	2.47E-04	0.00
ICTF	RTG #2	Diesel	Mi Jack	850R	1997	1	300	2,387	0.41	17,780	0.43	99%	0.320	0.920	6.250	*0.023*	*0.023*	0.052	10.15	1.39E-05	4.16E-05	0.11	0.31	2.12	0.01	0.01	0.02	178.66	2.47E-04	0.00
ICTF	RTG #19-20	Diesel	Mi Jack	1000RC	2002	2	300	2,387	0.41	35,560	0.43	99%	0.140	0.920	4.510	0.110	0.110	0.052	10.15	1.39E-05	4.16E-05	0.10	0.62	3.06	0.07	0.07	0.04	357.33	4.93E-04	0.00
ICTF	RTG #21	Diesel	Mi Jack	1200 R	2005	1	350	2,387	0.41	20,744	0.43	99%	0.100	0.920	4.000	*0.017*	*0.017*	0.052	10.15	1.39E-05	4.16E-05	0.04	0.36	1.58	0.01	0.01	0.02	208.44	2.88E-04	0.00
ICTF	RTG	Diesel	Mi Jack	1200 R	2006	1	300	2,387	0.41	17,780	0.43	99%	0.100	0.920	2.450	0.110	0.110	0.052	10.15	1.39E-05	4.16E-05	0.03	0.31	0.83	0.04	0.04	0.02	178.66	2.47E-04	0.00
ICTF	Top Pick	Diesel	Taylor	Tay-950	1988	1	350	1,491	0.41	17,780	0.59	99%	0.680	2.700	8.170	*0.057*	*0.057*	0.060	10.15	1.39E-05	4.16E-05	0.23	0.92	2.77	0.02	0.02	0.02	178.66	2.47E-04	0.00
ICTF	Top Pick	Diesel	Taylor	Tay-950	1989	1	350	1,491	0.41	17,780	0.59	99%	0.680	2.700	8.170	*0.057*	*0.057*	0.060	10.15	1.39E-05	4.16E-05	0.23	0.92	2.77	0.02	0.02	0.02	178.66	2.47E-04	0.00
ICTF	Yard Hostler	Diesel	Capacity	TJ5000	2005	40	173	4,525	0.47	808,400	0.39	99%	0.160	2.700	4.440	0.160	0.160	0.060	10.15	1.39E-05	4.16E-05	2.15	36.35	59.77	2.15	2.15	0.80	8,123.21	1.12E-02	0.03
ICTF	WSG	Electric	TBD	TBD	NA	13	NA	8760	0	0	0.00	0%	0.000	0.000	0.000	0.000	0.000	0.000	0.00	0.00E+00	0.00E+00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00E+00	0.00
Total						**62**				**954,889**												**3.14**	**40.78**	**75.87**	**2.45**	**2.45**	**0.96**	**9,595.20**	**0.01**	**0.04**

Notes:
1. Per UPRR, the facility will perform 900,000 lifts in 2010 and 13 of the WSG will be operating at full capacity by 2010. Assuming each WSG performed 38,000 lifts/yr (1.5 million/39 WSGs), 494,000 lifts will be performed by the WSGs in 2010. The diesel-fueled CHE must handle the remaining 406,000 lifts (900,000-494,000). In the 2005 baseline year, the facility performed 626,339 lifts. In 2010, the diesel-fueled CHE will need to operate at 65% of the 2005 throughput (406,000/626,339).
2. Assumed the forklift would remain for chassis stacking and there would be no change in operation from the baseline year.
3. RTG Operations - in 2005, 9 units operated 2,448 hrs each or a total of 22,023 hrs. In 2010, the RTGs would need to operate 14,321 hrs (22,023 x 65%). Assumed each unit continued to operate at a rate of 2,448 hrs/yr. Therefore, the equivalent of 5.85 units would be needed in 2010 (14,321/2448). Assumed the 6 newest units remained and the total hours of operation were evenly allocated between the units.
4. Top Pick Operations - in 2005, 3 units operated a total of 4,588 hours (one unit is a backup and operated only 208 hrs). In 2010, the top picks need to operate 2,982 hrs (4,588 x 65%). Assumed the oldest unit would be retired and the hours would be evenly divided between the other 2 units.
5. Yard Hostler Operations - in 2005, 73 units operated a total of 278,460 hrs. In 2010, the hostlers would need to operate a total of 180,999 (278,460 x 65%). Assumed each unit operated at 4,680 hrs a total of 39 hostlers would be needed. Assumed that the 40 newest hostlers would remain and the hours of operation would be divided evenly between the units.
6. Brake-specific fuel consumption (BSFC) from OFFROAD2007 model.
7. Calculation assumes density of Diesel fuel of 7.1 lb/gal.
8. Default load factors from OFFROAD 2007 model were used for RTGs and top picks. The load factor for yard hostlers was from personal communication with Harold Holmes of ARB and is based on a study conducted at the POLA/POLB.
9. From the Air Resources Board's Draft *Emission Factors for Mandatory Reporting Programs*, August 10, 2007.
10. Emission factors from CARB's Cargo Handling Equipment Emission Calculation Spreadsheet.
11. The DPM emission factors for the forklift, RTG #2, RTG #21, and both top picks were adjusted for compliance with the CHE Regulation. It was assumed that a Level 3 VDECS (85% control) was installed on each unit.
12. Based on a diesel fuel HHV of 5.825 MMBtu/barrel (from ARB Draft Emission Factors for Mandatory Reporting Programs, August 10, 2007) and 42 gallons per barrel.

Cal Year	Terminal ID	Equipment Type	Code	Fuel Type	Alternative Fuel Type	Number of Years with Alt Fuel	Fraction 2010 with Fuel Type	Fraction 2010 with Alternative Fuel Type	Useful Life (hours)	Model Year	Age (years)	Population	HP	HP Bin	Yearly Operational Hrs	Cummulative Hours with Fuel Type
2010	(Example Calculation)	Yard Tractor offroad	8	diesel	ULSD	0.5	0.50	0.50	24800	1997	9	1	230	250	3100	26350
2010	ICTF	Forklift	3	diesel	ULSD	6	1.00	0.00	14600	1997	14	1	85	120	730	5840
2010	ICTF	Crane	1	diesel	ULSD	6	1.00	0.00	157680	1997	14	1	300	500	8,760	70080
2010	ICTF	Crane	1	diesel	ULSD	6	1.00	0.00	157680	1988	23	1	250	250	8,760	148920
2010	ICTF	Crane	1	diesel	ULSD	6	1.00	0.00	157680	1995	16	1	300	500	8,760	87600
2010	ICTF	Crane	1	diesel	ULSD	6	1.00	0.00	157680	1995	16	1	300	500	8,760	87600
2010	ICTF	Crane	1	diesel	ULSD	6	1.00	0.00	157680	1995	16	1	300	500	8,760	87600
2010	ICTF	Crane	1	diesel	ULSD	6	1.00	0.00	157680	1995	16	1	300	500	8,760	87600
2010	ICTF	Crane	1	diesel	ULSD	6	1.00	0.00	157680	2002	9	1	300	500	8,760	26280
2010	ICTF	Crane	1	diesel	ULSD	6	1.00	0.00	157680	2002	9	1	300	500	8,760	26280
2010	ICTF	Crane	1	diesel	ULSD	6	1.00	0.00	157680	2005	6	1	350	500	8,760	0
	ICTF	Crane	1	diesel	ULSD	6	1.00	0.00	157680	2006	5	1	300	500	8,760	-8760
2010	ICTF	Material Handling Equip	4	diesel	ULSD	6	1.00	0.00	3744	1972	39	1	335	500	208	6864
2010	ICTF	Material Handling Equip	4	diesel	ULSD	6	1.00	0.00	39420	1988	23	1	350	500	2,190	37230
2010	ICTF	Material Handling Equip	4	diesel	ULSD	6	1.00	0.00	39420	1989	22	1	350	500	2,190	35040
2010	ICTF	Yard Tractor offroad	8	diesel	ULSD	6	1.00	0.00	17520	1999	12	15	150	175	2,190	13140
2010	ICTF	Yard Tractor offroad	8	diesel	ULSD	6	1.00	0.00	70080	2005	6	58	173	175	8,760	0

Alt Fuel Cumm Hours	Emission Control Factor? (y/n)	Emission Control	Fraction of Year with fuel with Emission Control	Fraction of Year with fuel without Emission Control	Fraction of Year with alt fuel with Emission Control	Fraction of Year with alt fuel without Emission Control	Load Factor	HPMY	HC EF	(alt fuel) HC EF	Emission Control HC EF	(alt fuel) Emission Control HC EF	HC dr	HC DR (alt fuel)	FCF HC	FCF HC (alt fuel)	CO EF	(alt fuel) CO EF
1550	y	DOC	0	1	0.66667	0.333333	0.65	2501997	0.3200	0.3200	0.0960	0.0960	0.000006	0.000006	0.72	0.72	0.9200	0.9200
4380	n		0	1			0.30	1201997	9.90E-01	9.90E-01	0.00E+00	0.00E+00	1.90E-05	1.90E-05	7.20E-01	7.20E-01	3.49E+00	3.49E+00
52560	n		0	1			0.43	5001997	3.20E-01	3.20E-01	0.00E+00	0.00E+00	8.93E-07	8.93E-07	7.20E-01	7.20E-01	9.20E-01	9.20E-01
52560	n		0	1			0.43	2501988	6.80E-01	6.80E-01	0.00E+00	0.00E+00	1.90E-06	1.90E-06	7.20E-01	7.20E-01	2.70E+00	2.70E+00
52560	n		0	1			0.43	5001995	6.80E-01	6.80E-01	0.00E+00	0.00E+00	1.90E-06	1.90E-06	7.20E-01	7.20E-01	2.70E+00	2.70E+00
52560	n		0	1			0.43	5001995	6.80E-01	6.80E-01	0.00E+00	0.00E+00	1.90E-06	1.90E-06	7.20E-01	7.20E-01	2.70E+00	2.70E+00
52560	n		0	1			0.43	5001995	6.80E-01	6.80E-01	0.00E+00	0.00E+00	1.90E-06	1.90E-06	7.20E-01	7.20E-01	2.70E+00	2.70E+00
52560	n		0	1			0.43	5001995	6.80E-01	6.80E-01	0.00E+00	0.00E+00	1.90E-06	1.90E-06	7.20E-01	7.20E-01	2.70E+00	2.70E+00
52560	n		0	1			0.43	5002002	1.40E-01	1.40E-01	0.00E+00	0.00E+00	3.91E-07	3.91E-07	7.20E-01	7.20E-01	9.20E-01	9.20E-01
52560	n		0	1			0.43	5002002	1.40E-01	1.40E-01	0.00E+00	0.00E+00	3.91E-07	3.91E-07	7.20E-01	7.20E-01	9.20E-01	9.20E-01
52560	n		0	1			0.43	5002005	1.00E-01	1.00E-01	0.00E+00	0.00E+00	2.79E-07	2.79E-07	7.20E-01	7.20E-01	9.20E-01	9.20E-01
52560	n		0	1			0.43	5002006	1.00E-01	1.00E-01	0.00E+00	0.00E+00	2.79E-07	2.79E-07	7.20E-01	7.20E-01	9.20E-01	9.20E-01
1248	n		0	1			0.59	5001972	9.50E-01	9.50E-01	0.00E+00	0.00E+00	1.12E-04	1.12E-04	7.20E-01	7.20E-01	4.20E+00	4.20E+00
13140	n		0	1			0.59	5001988	6.80E-01	6.80E-01	0.00E+00	0.00E+00	7.59E-06	7.59E-06	7.20E-01	7.20E-01	2.70E+00	2.70E+00
13140	n		0	1			0.59	5001989	6.80E-01	6.80E-01	0.00E+00	0.00E+00	7.59E-06	7.59E-06	7.20E-01	7.20E-01	2.70E+00	2.70E+00
13140	n		0	1			0.65	1751999	6.80E-01	6.80E-01	0.00E+00	0.00E+00	1.09E-05	1.09E-05	7.20E-01	7.20E-01	2.70E+00	2.70E+00
52560	n		0	1			0.65	1752005	1.60E-01	1.60E-01	0.00E+00	0.00E+00	6.39E-07	6.39E-07	7.20E-01	7.20E-01	2.70E+00	2.70E+00

Emission Control CO EF	(alt fuel) Emission Control CO EF	CO dr	CO dr (alt fuel)	FCF CO	NOX EF	(alt fuel) NOX EF	Emission Control NOX EF	(alt fuel) Emission Control NOX EF	NOX dr	NOX dr (alt fuel)	FCF NOX	FCF NOX (alt fuel)	PM EF	(alt fuel) PM EF	Emission Control PM EF	(alt fuel) Emission Control PM EF	PM dr
0.2760	0.2760	0.000009	0.000009	1.00	6.2500	6.2500	6.2500	6.2500	0.000053	0.000053	0.95	0.95	0.1500	0.1500	0.1050	0.1050	0.000004
0.00E+00	0.00E+00	3.82E-05	3.82E-05	1.00E+00	8.75E+00	8.75E+00	0.00E+00	0.00E+00	8.39E-05	8.39E-05	9.48E-01	9.48E-01	6.90E-01	0.6900	0.0000	0.0000	0.000021
0.00E+00	0.00E+00	1.46E-06	1.46E-06	1.00E+00	6.25E+00	6.25E+00	0.00E+00	0.00E+00	8.32E-06	8.32E-06	9.48E-01	9.48E-01	1.50E-01	0.1500	0.0000	0.0000	0.000001
0.00E+00	0.00E+00	4.28E-06	4.28E-06	1.00E+00	8.17E+00	8.17E+00	0.00E+00	0.00E+00	1.09E-05	1.09E-05	9.30E-01	9.30E-01	3.80E-01	0.3800	0.0000	0.0000	0.000002
0.00E+00	0.00E+00	4.28E-06	4.28E-06	1.00E+00	8.17E+00	8.17E+00	0.00E+00	0.00E+00	1.09E-05	1.09E-05	9.30E-01	9.30E-01	3.80E-01	0.3800	0.0000	0.0000	0.000002
0.00E+00	0.00E+00	4.28E-06	4.28E-06	1.00E+00	8.17E+00	8.17E+00	0.00E+00	0.00E+00	1.09E-05	1.09E-05	9.30E-01	9.30E-01	3.80E-01	0.3800	0.0000	0.0000	0.000002
0.00E+00	0.00E+00	4.28E-06	4.28E-06	1.00E+00	8.17E+00	8.17E+00	0.00E+00	0.00E+00	1.09E-05	1.09E-05	9.30E-01	9.30E-01	3.80E-01	0.3800	0.0000	0.0000	0.000002
0.00E+00	0.00E+00	4.28E-06	4.28E-06	1.00E+00	8.17E+00	8.17E+00	0.00E+00	0.00E+00	1.09E-05	1.09E-05	9.30E-01	9.30E-01	3.80E-01	0.3800	0.0000	0.0000	0.000002
0.00E+00	0.00E+00	1.46E-06	1.46E-06	1.00E+00	4.51E+00	4.51E+00	0.00E+00	0.00E+00	6.01E-06	6.01E-06	9.48E-01	9.48E-01	1.10E-01	0.1100	0.0000	0.0000	0.000000
0.00E+00	0.00E+00	1.46E-06	1.46E-06	1.00E+00	4.51E+00	4.51E+00	0.00E+00	0.00E+00	6.01E-06	6.01E-06	9.48E-01	9.48E-01	1.10E-01	0.1100	0.0000	0.0000	0.000000
0.00E+00	0.00E+00	1.46E-06	1.46E-06	1.00E+00	4.00E+00	4.00E+00	0.00E+00	0.00E+00	5.33E-06	5.33E-06	9.48E-01	9.48E-01	1.10E-01	0.1100	0.0000	0.0000	0.000000
0.00E+00	0.00E+00	1.46E-06	1.46E-06	1.00E+00	2.45E+00	2.45E+00	0.00E+00	0.00E+00	3.26E-06	3.26E-06	9.48E-01	9.48E-01	1.10E-01	0.1100	0.0000	0.0000	0.000000
0.00E+00	0.00E+00	2.80E-04	2.80E-04	1.00E+00	1.20E+01	1.20E+01	0.00E+00	0.00E+00	6.73E-04	6.73E-04	9.30E-01	9.30E-01	5.30E-01	0.5300	0.0000	0.0000	0.000095
0.00E+00	0.00E+00	1.71E-05	1.71E-05	1.00E+00	8.17E+00	8.17E+00	0.00E+00	0.00E+00	4.35E-05	4.35E-05	9.30E-01	9.30E-01	3.80E-01	0.3800	0.0000	0.0000	0.000006
0.00E+00	0.00E+00	1.71E-05	1.71E-05	1.00E+00	8.17E+00	8.17E+00	0.00E+00	0.00E+00	4.35E-05	4.35E-05	9.30E-01	9.30E-01	3.80E-01	0.3800	0.0000	0.0000	0.000006
0.00E+00	0.00E+00	2.47E-05	2.47E-05	1.00E+00	6.90E+00	6.90E+00	0.00E+00	0.00E+00	5.51E-05	5.51E-05	9.48E-01	9.48E-01	3.80E-01	0.3800	0.0000	0.0000	0.000010
0.00E+00	0.00E+00	6.16E-06	6.16E-06	1.00E+00	4.44E+00	4.44E+00	0.00E+00	0.00E+00	8.87E-06	8.87E-06	9.48E-01	9.48E-01	1.60E-01	0.1600	0.0000	0.0000	0.000001

PM dr (alt fuel)	FCF PM	FCF PM (alt fuel)	SOX EF	(alt fuel) SOX EF	TOG	ROG	CO	NOX	SOX	PM	PM10	PM2.5	TOG	ROG	CO	NOX	SOX	PM	PM10	PM2.5
0.000004	0.82	0.82	5.97E-02	6.40E-03	2.14E-01	1.88E-01	4.92E-01	3.74E+00	1.69E-02	1.04E-01	1.04E-01	9.57E-02	5.85E-04	5.14E-04	1.35E-03	1.02E-02	4.62E-05	2.85E-04	2.85E-04	2.62E-04
0.000021	0.82	0.82	6.23E-02	6.67E-03	2.52E-02	2.21E-02	7.96E-02	1.87E-01	1.28E-03	1.52E-02	1.52E-02	1.40E-02	6.90E-05	6.06E-05	2.18E-04	5.12E-04	3.50E-06	4.17E-05	4.17E-05	3.83E-05
0.000001	0.82	0.82	5.21E-02	5.58E-03	5.54E-01	4.87E-01	1.37E+00	8.58E+00	6.49E-02	2.33E-01	2.33E-01	2.15E-01	1.52E-03	1.33E-03	3.75E-03	2.35E-02	1.78E-04	6.39E-04	6.39E-04	5.88E-04
0.000002	0.75	0.75	5.97E-02	6.40E-03	1.14E+00	1.00E+00	3.69E+00	9.99E+00	6.20E-02	5.49E-01	5.49E-01	5.05E-01	3.13E-03	2.75E-03	1.01E-02	2.74E-02	1.70E-04	1.50E-03	1.50E-03	1.38E-03
0.000002	0.75	0.75	5.21E-02	5.58E-03	1.22E+00	1.07E+00	4.11E+00	1.12E+01	6.49E-02	5.66E-01	5.66E-01	5.21E-01	3.34E-03	2.94E-03	1.13E-02	3.07E-02	1.78E-04	1.55E-03	1.55E-03	1.43E-03
0.000002	0.75	0.75	5.21E-02	5.58E-03	1.22E+00	1.07E+00	4.11E+00	1.12E+01	6.49E-02	5.66E-01	5.66E-01	5.21E-01	3.34E-03	2.94E-03	1.13E-02	3.07E-02	1.78E-04	1.55E-03	1.55E-03	1.43E-03
0.000002	0.75	0.75	5.21E-02	5.58E-03	1.22E+00	1.07E+00	4.11E+00	1.12E+01	6.49E-02	5.66E-01	5.66E-01	5.21E-01	3.34E-03	2.94E-03	1.13E-02	3.07E-02	1.78E-04	1.55E-03	1.55E-03	1.43E-03
0.000002	0.75	0.75	5.21E-02	5.58E-03	1.22E+00	1.07E+00	4.11E+00	1.12E+01	6.49E-02	5.66E-01	5.66E-01	5.21E-01	3.34E-03	2.94E-03	1.13E-02	3.07E-02	1.78E-04	1.55E-03	1.55E-03	1.43E-03
0.000000	0.82	0.82	5.21E-02	5.58E-03	2.20E-01	1.94E-01	1.29E+00	5.88E+00	6.49E-02	1.50E-01	1.50E-01	1.38E-01	6.04E-04	5.30E-04	3.53E-03	1.61E-02	1.78E-04	4.12E-04	4.12E-04	3.79E-04
0.000000	0.82	0.82	5.21E-02	5.58E-03	2.20E-01	1.94E-01	1.29E+00	5.88E+00	6.49E-02	1.50E-01	1.50E-01	1.38E-01	6.04E-04	5.30E-04	3.53E-03	1.61E-02	1.78E-04	4.12E-04	4.12E-04	3.79E-04
0.000000	0.82	0.82	5.21E-02	5.58E-03	1.73E-01	1.52E-01	1.45E+00	5.89E+00	7.57E-02	1.61E-01	1.61E-01	1.48E-01	4.73E-04	4.15E-04	3.96E-03	1.61E-02	2.07E-04	4.40E-04	4.40E-04	4.05E-04
0.000000	0.82	0.82	5.21E-02	5.58E-03	1.45E-01	1.27E-01	1.22E+00	3.06E+00	6.49E-02	1.33E-01	1.33E-01	1.23E-01	3.97E-04	3.49E-04	3.35E-03	8.38E-03	1.78E-04	3.66E-04	3.66E-04	3.36E-04
0.000095	0.75	0.75	5.97E-02	6.40E-03	8.71E-02	7.65E-02	2.93E-01	7.35E-01	2.71E-03	4.41E-02	4.41E-02	4.06E-02	2.39E-04	2.10E-04	8.03E-04	2.01E-03	7.41E-06	1.21E-04	1.21E-04	1.11E-04
0.000006	0.75	0.75	5.97E-02	6.40E-03	5.49E-01	4.82E-01	1.77E+00	4.80E+00	2.98E-02	2.63E-01	2.63E-01	2.42E-01	1.50E-03	1.32E-03	4.86E-03	1.31E-02	8.15E-05	7.22E-04	7.22E-04	6.64E-04
0.000006	0.75	0.75	5.97E-02	6.40E-03	5.40E-01	4.74E-01	1.76E+00	4.76E+00	2.98E-02	2.58E-01	2.58E-01	2.38E-01	1.48E-03	1.30E-03	4.81E-03	1.30E-02	8.15E-05	7.07E-04	7.07E-04	6.51E-04
0.000010	0.82	0.82	5.97E-02	6.40E-03	3.53E+00	3.10E+00	1.18E+01	2.79E+01	2.11E-01	1.83E+00	1.83E+00	1.68E+00	9.68E-03	8.50E-03	3.24E-02	7.65E-02	5.77E-04	5.01E-03	5.01E-03	4.61E-03
0.000001	0.82	0.82	5.97E-02	6.40E-03	1.26E+01	1.11E+01	1.90E+02	2.93E+02	3.76E+00	1.10E+01	1.10E+01	1.01E+01	3.46E-02	3.04E-02	5.21E-01	8.02E-01	1.03E-02	3.02E-02	3.02E-02	2.77E-02

Type	Useful Life (yr)	Load Factor
Crane	18	0.43
Excavator	16	0.57
Forklift	20	0.30
Material Handling Equip	18	0.59
Other General Industrial Equipment	16	0.51
Sweeper/Scrubber	16	0.68
Tractor/Loader/Backhoe	16	0.55
Yard Tractor offroad	8	0.65
Yard Tractor onroad	8	0.65
Other General Industrial Equipment onroad	16	0.51

Diesel and ULSD Fuel Correction Factor

t_fcf

	Calyr 1994 -2006		
Model Yr	NOX	PM	HC
1968	0.930	0.750	0.720
1969	0.930	0.750	0.720
1970	0.930	0.750	0.720
1971	0.930	0.750	0.720
1972	0.930	0.750	0.720
1973	0.930	0.750	0.720
1974	0.930	0.750	0.720
1975	0.930	0.750	0.720
1976	0.930	0.750	0.720
1977	0.930	0.750	0.720
1978	0.930	0.750	0.720
1979	0.930	0.750	0.720
1980	0.930	0.750	0.720
1981	0.930	0.750	0.720
1982	0.930	0.750	0.720
1983	0.930	0.750	0.720
1984	0.930	0.750	0.720
1985	0.930	0.750	0.720
1986	0.930	0.750	0.720
1987	0.930	0.750	0.720
1988	0.930	0.750	0.720
1989	0.930	0.750	0.720
1990	0.930	0.750	0.720
1991	0.930	0.750	0.720
1992	0.930	0.750	0.720
1993	0.930	0.750	0.720
1994	0.930	0.750	0.720
1995	0.930	0.750	0.720
1996	0.948	0.822	0.720
1997	0.948	0.822	0.720
1998	0.948	0.822	0.720
1999	0.948	0.822	0.720
2000	0.948	0.822	0.720
2001	0.948	0.822	0.720
2002	0.948	0.822	0.720
2003	0.948	0.822	0.720
2004	0.948	0.822	0.720
2005	0.948	0.822	0.720
2006	0.948	0.822	0.720
2007	0.948	0.822	0.720
2008	0.948	0.822	0.720
2009	0.948	0.822	0.720
2010	0.948	0.822	0.720
2011	0.948	0.822	0.720
2012	0.948	0.822	0.720
2013	0.948	0.822	0.720
2014	0.948	0.822	0.720
2015	0.948	0.822	0.720
2016	0.948	0.822	0.720
2017	0.948	0.822	0.720
2018	0.948	0.822	0.720

HP_dr diesel fuel

	Det. Rate			
HP	HC	CO	NOx	PM
50	51%	41%	6%	31%
120	28%	16%	14%	44%
175	28%	16%	14%	44%
250	44%	25%	21%	67%
500	44%	25%	21%	67%

Gasoline Fuel Correction Factor

	Calyr 1996+		
Model Yr	NOX	CO	HC
1968	1.025	0.848	0.921
1969	1.025	0.848	0.921
1970	1.025	0.848	0.921
1971	1.025	0.848	0.921
1972	1.025	0.848	0.921
1973	1.025	0.848	0.921
1974	1.025	0.848	0.921
1975	1.025	0.848	0.921
1976	1.025	0.848	0.921
1977	1.025	0.848	0.921
1978	1.025	0.848	0.921
1979	1.025	0.848	0.921
1980	1.025	0.848	0.921
1981	1.025	0.848	0.921
1982	1.025	0.848	0.921
1983	1.025	0.848	0.921
1984	1.025	0.848	0.921
1985	1.025	0.848	0.921
1986	1.025	0.848	0.921
1987	1.025	0.848	0.921
1988	1.025	0.848	0.921
1989	1.025	0.848	0.921
1990	1.025	0.848	0.921
1991	1.025	0.848	0.921
1992	1.025	0.848	0.921
1993	1.025	0.848	0.921
1994	1.025	0.848	0.921
1995	1.025	0.848	0.921
1996	1.000	1.000	1.000
1997	1.000	1.000	1.000
1998	1.000	1.000	1.000
1999	1.000	1.000	1.000
2000	1.000	1.000	1.000
2001	1.000	1.000	1.000
2002	1.000	1.000	1.000
2003	1.000	1.000	1.000
2004	1.000	1.000	1.000
2005	1.000	1.000	1.000

Engine changes	Emission Changes %			
	HC	CO	NOx	PM
DOC	0.70	0.70	0.00	0.30
DPF (P)	0.90	0.90	0.00	0.85
DPF (A)	0.00	0.00	0.00	0.85
Emulsified Fuel	-0.23	-0.10	0.15	0.30
DOC+emulsified fuel	0.63	0.67	0.20	0.50
DOC + PurinNOx	0.63	0.67	0.20	0.50
O2 Diesel	-0.75	0.10	0.02	0.20
DOC + O2Diesel	0.48	0.73	0.02	0.44

Equipment Types	Code
Crane	**1**
Excavator	**2**
Forklift	**3**
Material Handling Equip	**4**
Other General Industrial Equipment	**5**
Sweeper/Scrubbers	**6**
Tractor/Loader/Backhoe	**7**
Yard Tractor offroad	**8**
Yard Tractor onroad	**9**
Other General Industrial Equipment onroad	**10**

***New Tier4 emfacs included with 43/57% split for 120 hp merged (diesel only)**

units = g/bhp hr

Lookup	Hp	Year	HC	CO	NOX	PM
251968	25	1968	1.84	5	6.92	0.764
251969	25	1969	1.84	5	6.92	0.764
251970	25	1970	1.84	5	6.92	0.764
251971	25	1971	1.84	5	6.92	0.764
251972	25	1972	1.84	5	6.92	0.764
251973	25	1973	1.84	5	6.92	0.764
251974	25	1974	1.84	5	6.92	0.764
251975	25	1975	1.84	5	6.92	0.764
251976	25	1976	1.84	5	6.92	0.764
251977	25	1977	1.84	5	6.92	0.764
251978	25	1978	1.84	5	6.92	0.764
251979	25	1979	1.84	5	6.92	0.764
251980	25	1980	1.84	5	6.92	0.764
251981	25	1981	1.84	5	6.92	0.764
251982	25	1982	1.84	5	6.92	0.764
251983	25	1983	1.84	5	6.92	0.764
251984	25	1984	1.84	5	6.92	0.764
251985	25	1985	1.84	5	6.92	0.764
251986	25	1986	1.84	5	6.92	0.764
251987	25	1987	1.84	5	6.92	0.764
251988	25	1988	1.84	5	6.92	0.764
251989	25	1989	1.84	5	6.92	0.764
251990	25	1990	1.84	5	6.92	0.764
251991	25	1991	1.84	5	6.92	0.764
251992	25	1992	1.84	5	6.92	0.764
251993	25	1993	1.84	5	6.92	0.764
251994	25	1994	1.84	5	6.92	0.764
251995	25	1995	1.63	1.4	3.89	0.417
251996	25	1996	1.63	1.4	3.89	0.417
251997	25	1997	1.63	1.4	3.89	0.417
251998	25	1998	1.63	1.4	3.89	0.417
251999	25	1999	0.52	0.5	1.24	0.116
252000	25	2000	0.52	0.5	1.24	0.116
252001	25	2001	0.52	0.5	1.24	0.116
252002	25	2002	0.52	0.5	1.24	0.116
252003	25	2003	0.52	0.5	1.24	0.116
252004	25	2004	0.52	0.5	1.24	0.116
252005	25	2005	0.52	0.5	1.24	0.116
252006	25	2006	0.52	0.5	1.24	0.116
252007	25	2007	0.52	0.5	1.24	0.116
252008	25	2008	0.52	0.5	1.24	0.116
252009	25	2009	0.52	0.5	1.24	0.116
252010	25	2010	0.52	0.5	1.24	0.116
252011	25	2011	0.52	0.5	1.24	0.116
252012	25	2012	0.52	0.5	1.24	0.116
252013	25	2013	0.52	0.5	1.24	0.116
252014	25	2014	0.52	0.5	1.24	0.116
252015	25	2015	0.52	0.5	1.24	0.116
252016	25	2016	0.52	0.5	1.24	0.116
252017	25	2017	0.52	0.5	1.24	0.116
252018	25	2018	0.52	0.5	1.24	0.116
252019	25	2019	0.52	0.5	1.24	0.116
252020	25	2020	0.52	0.5	1.24	0.116
252021	25	2021	0.52	0.5	1.24	0.116
252022	25	2022	0.52	0.5	1.24	0.116

Lookup	Hp	Year	HC	CO	NOX	PM
252023	25	2023	0.52	0.5	1.24	0.116
252024	25	2024	0.52	0.5	1.24	0.116
252025	25	2025	0.52	0.5	1.24	0.116
252026	25	2026	0.52	0.5	1.24	0.116
501969	50	1969	1.84	5	7	0.76
501969	50	1969	1.84	5	7	0.76
501970	50	1970	1.84	5	7	0.76
501971	50	1971	1.84	5	7	0.76
501972	50	1972	1.84	5	7	0.76
501973	50	1973	1.84	5	7	0.76
501974	50	1974	1.84	5	7	0.76
501975	50	1975	1.84	5	7	0.76
501976	50	1976	1.84	5	7	0.76
501977	50	1977	1.84	5	7	0.76
501978	50	1978	1.84	5	7	0.76
501979	50	1979	1.84	5	7	0.76
501980	50	1980	1.84	5	7	0.76
501981	50	1981	1.84	5	7	0.76
501982	50	1982	1.84	5	7	0.76
501983	50	1983	1.84	5	7	0.76
501984	50	1984	1.84	5	7	0.76
501985	50	1985	1.84	5	7	0.76
501986	50	1986	1.84	5	7	0.76
501987	50	1987	1.84	5	7	0.76
501988	50	1988	1.8	5	6.9	0.76
501989	50	1989	1.8	5	6.9	0.76
501990	50	1990	1.8	5	6.9	0.76
501991	50	1991	1.8	5	6.9	0.76
501992	50	1992	1.8	5	6.9	0.76
501993	50	1993	1.8	5	6.9	0.76
501994	50	1994	1.8	5	6.9	0.76
501995	50	1995	1.8	5	6.9	0.76
501996	50	1996	1.8	5	6.9	0.76
501997	50	1997	1.8	5	6.9	0.76
501998	50	1998	1.8	5	6.9	0.76
501999	50	1999	1.45	4.1	5.55	0.6
502000	50	2000	1.45	4.1	5.55	0.6
502001	50	2001	1.45	4.1	5.55	0.6
502002	50	2002	1.45	4.1	5.55	0.6
502003	50	2003	1.45	4.1	5.55	0.6
502004	50	2004	0.64	3.27	5.1	0.43
502005	50	2005	0.37	3	4.95	0.38
502006	50	2006	0.24	2.86	4.88	0.35
502007	50	2007	0.24	2.86	4.88	0.35
502008	50	2008	0.1	2.72	4.8	0.16
502009	50	2009	0.1	2.72	4.8	0.16
502010	50	2010	0.1	2.72	4.8	0.16
502011	50	2011	0.1	2.72	4.8	0.16
502012	50	2012	0.1	2.72	4.8	0.16
502013	50	2013	0.1	2.72	2.9	0.01
502014	50	2014	0.1	2.72	2.9	0.01
502015	50	2015	0.1	2.72	2.9	0.01
502016	50	2016	0.1	2.72	2.9	0.01
502017	50	2017	0.1	2.72	2.9	0.01
502018	50	2018	0.1	2.72	2.9	0.01
502019	50	2019	0.1	2.72	2.9	0.01
502020	50	2020	0.1	2.72	2.9	0.01
502021	50	2021	0.1	2.72	2.9	0.01

Lookup	Hp	Year	HC	CO	NOX	PM
502022	50	2022	0.1	2.72	2.9	0.01
502023	50	2023	0.1	2.72	2.9	0.01
502024	50	2024	0.1	2.72	2.9	0.01
502025	50	2025	0.1	2.72	2.9	0.01
502026	50	2026	0.1	2.72	2.9	0.01
1201968	120	1968	1.44	4.8	13	0.84
1201969	120	1969	1.44	4.8	13	0.84
1201970	120	1970	1.44	4.8	13	0.84
1201971	120	1971	1.44	4.8	13	0.84
1201972	120	1972	1.44	4.8	13	0.84
1201973	120	1973	1.44	4.8	13	0.84
1201974	120	1974	1.44	4.8	13	0.84
1201975	120	1975	1.44	4.8	13	0.84
1201976	120	1976	1.44	4.8	13	0.84
1201977	120	1977	1.44	4.8	13	0.84
1201978	120	1978	1.44	4.8	13	0.84
1201979	120	1979	1.44	4.8	13	0.84
1201980	120	1980	1.44	4.8	13	0.84
1201981	120	1981	1.44	4.8	13	0.84
1201982	120	1982	1.44	4.8	13	0.84
1201983	120	1983	1.44	4.8	13	0.84
1201984	120	1984	1.44	4.8	13	0.84
1201985	120	1985	1.44	4.8	13	0.84
1201986	120	1986	1.44	4.8	13	0.84
1201987	120	1987	1.44	4.8	13	0.84
1201988	120	1988	0.99	3.49	8.75	0.69
1201989	120	1989	0.99	3.49	8.75	0.69
1201990	120	1990	0.99	3.49	8.75	0.69
1201991	120	1991	0.99	3.49	8.75	0.69
1201992	120	1992	0.99	3.49	8.75	0.69
1201993	120	1993	0.99	3.49	8.75	0.69
1201994	120	1994	0.99	3.49	8.75	0.69
1201995	120	1995	0.99	3.49	8.75	0.69
1201996	120	1996	0.99	3.49	8.75	0.69
1201997	120	1997	0.99	3.49	8.75	0.69
1201998	120	1998	0.99	3.49	6.9	0.69
1201999	120	1999	0.99	3.49	6.9	0.69
1202000	120	2000	0.99	3.49	6.9	0.69
1202001	120	2001	0.99	3.49	6.9	0.69
1202002	120	2002	0.99	3.49	6.9	0.69
1202003	120	2003	0.99	3.49	6.9	0.69
1202004	120	2004	0.46	3.23	5.64	0.39
1202005	120	2005	0.28	3.14	5.22	0.29
1202006	120	2006	0.19	3.09	5.01	0.24
1202007	120	2007	0.19	3.09	5.01	0.24
1202008	120	2008	0.1	3.05	2.89	0.197
1202009	120	2009	0.1	3.05	2.89	0.197
1202010	120	2010	0.1	3.05	2.89	0.197
1202011	120	2011	0.1	3.05	2.89	0.197
1202012	120	2012	0.0943	3.05	2.5309	0.0659
1202013	120	2013	0.0943	3.05	2.5309	0.01
1202014	120	2014	0.0943	3.05	2.5309	0.01
1202015	120	2015	0.0715	3.05	1.3966	0.01
1202016	120	2016	0.0715	3.05	1.3966	0.01
1202017	120	2017	0.0715	3.05	1.3966	0.01
1202018	120	2018	0.0715	3.05	1.3966	0.01
1202019	120	2019	0.0715	3.05	1.3966	0.01
1202020	120	2020	0.0715	3.05	1.3966	0.01

Lookup	Hp	Year	HC	CO	NOX	PM
1202021	120	2021	0.0715	3.05	1.3966	0.01
1202022	120	2022	0.0715	3.05	1.3966	0.01
1202023	120	2023	0.0715	3.05	1.3966	0.01
1202024	120	2024	0.0715	3.05	1.3966	0.01
1202025	120	2025	0.0715	3.05	1.3966	0.01
1202026	120	2026	0.0715	3.05	1.3966	0.01
1751968	175	1968	1.32	4.4	14	0.77
1751969	175	1969	1.32	4.4	14	0.77
1751970	175	1970	1.1	4.4	13	0.66
1751971	175	1971	1.1	4.4	13	0.66
1751972	175	1972	1	4.4	12	0.55
1751973	175	1973	1	4.4	12	0.55
1751974	175	1974	1	4.4	12	0.55
1751975	175	1975	1	4.4	12	0.55
1751976	175	1976	1	4.4	12	0.55
1751977	175	1977	1	4.4	12	0.55
1751978	175	1978	1	4.4	12	0.55
1751979	175	1979	1	4.4	12	0.55
1751980	175	1980	0.94	4.3	11	0.55
1751981	175	1981	0.94	4.3	11	0.55
1751982	175	1982	0.94	4.3	11	0.55
1751983	175	1983	0.94	4.3	11	0.55
1751984	175	1984	0.94	4.3	11	0.55
1751985	175	1985	0.88	4.2	11	0.55
1751986	175	1986	0.88	4.2	11	0.55
1751987	175	1987	0.88	4.2	11	0.55
1751988	175	1988	0.68	2.7	8.17	0.38
1751989	175	1989	0.68	2.7	8.17	0.38
1751990	175	1990	0.68	2.7	8.17	0.38
1751991	175	1991	0.68	2.7	8.17	0.38
1751992	175	1992	0.68	2.7	8.17	0.38
1751993	175	1993	0.68	2.7	8.17	0.38
1751994	175	1994	0.68	2.7	8.17	0.38
1751995	175	1995	0.68	2.7	8.17	0.38
1751996	175	1996	0.68	2.7	8.17	0.38
1751997	175	1997	0.68	2.7	6.9	0.38
1751998	175	1998	0.68	2.7	6.9	0.38
1751999	175	1999	0.68	2.7	6.9	0.38
1752000	175	2000	0.68	2.7	6.9	0.38
1752001	175	2001	0.68	2.7	6.9	0.38
1752002	175	2002	0.68	2.7	6.9	0.38
1752003	175	2003	0.33	2.7	5.26	0.24
1752004	175	2004	0.22	2.7	4.72	0.19
1752005	175	2005	0.16	2.7	4.44	0.16
1752006	175	2006	0.16	2.7	4.44	0.16
1752007	175	2007	0.1	2.7	2.45	0.14
1752008	175	2008	0.1	2.7	2.45	0.14
1752009	175	2009	0.1	2.7	2.45	0.14
1752010	175	2010	0.1	2.7	2.45	0.14
1752011	175	2011	0.1	2.7	2.45	0.14
1752012	175	2012	0.09	2.7	2.27	0.01
1752013	175	2013	0.09	2.7	2.27	0.01
1752014	175	2014	0.09	2.7	2.27	0.01
1752015	175	2015	0.05	2.7	0.27	0.01
1752016	175	2016	0.05	2.7	0.27	0.01
1752017	175	2017	0.05	2.7	0.27	0.01
1752018	175	2018	0.05	2.7	0.27	0.01
1752019	175	2019	0.05	2.7	0.27	0.01

Lookup	Hp	Year	HC	CO	NOX	PM
1752020	175	2020	0.05	2.7	0.27	0.01
1752021	175	2021	0.05	2.7	0.27	0.01
1752022	175	2022	0.05	2.7	0.27	0.01
1752023	175	2023	0.05	2.7	0.27	0.01
1752024	175	2024	0.05	2.7	0.27	0.01
1752025	175	2025	0.05	2.7	0.27	0.01
1752026	175	2026	0.05	2.7	0.27	0.01
2501968	250	1968	1.32	4.4	14	0.77
2501969	250	1969	1.32	4.4	14	0.77
2501970	250	1970	1.1	4.4	13	0.66
2501971	250	1971	1.1	4.4	13	0.66
2501972	250	1972	1	4.4	12	0.55
2501973	250	1973	1	4.4	12	0.55
2501974	250	1974	1	4.4	12	0.55
2501975	250	1975	1	4.4	12	0.55
2501976	250	1976	1	4.4	12	0.55
2501977	250	1977	1	4.4	12	0.55
2501978	250	1978	1	4.4	12	0.55
2501979	250	1979	1	4.4	12	0.55
2501980	250	1980	0.94	4.3	11	0.55
2501981	250	1981	0.94	4.3	11	0.55
2501982	250	1982	0.94	4.3	11	0.55
2501983	250	1983	0.94	4.3	11	0.55
2501984	250	1984	0.94	4.3	11	0.55
2501985	250	1985	0.88	4.2	11	0.55
2501986	250	1986	0.88	4.2	11	0.55
2501987	250	1987	0.88	4.2	11	0.55
2501988	250	1988	0.68	2.7	8.17	0.38
2501989	250	1989	0.68	2.7	8.17	0.38
2501990	250	1990	0.68	2.7	8.17	0.38
2501991	250	1991	0.68	2.7	8.17	0.38
2501992	250	1992	0.68	2.7	8.17	0.38
2501993	250	1993	0.68	2.7	8.17	0.38
2501994	250	1994	0.68	2.7	8.17	0.38
2501995	250	1995	0.68	2.7	8.17	0.38
2501996	250	1996	0.32	0.92	6.25	0.15
2501997	250	1997	0.32	0.92	6.25	0.15
2501998	250	1998	0.32	0.92	6.25	0.15
2501999	250	1999	0.32	0.92	6.25	0.15
2502000	250	2000	0.32	0.92	6.25	0.15
2502001	250	2001	0.32	0.92	6.25	0.15
2502002	250	2002	0.32	0.92	6.25	0.15
2502003	250	2003	0.19	0.92	5	0.12
2502004	250	2004	0.14	0.92	4.58	0.11
2502005	250	2005	0.12	0.92	4.38	0.11
2502006	250	2006	0.12	0.92	4.38	0.11
2502007	250	2007	0.1	0.92	2.45	0.11
2502008	250	2008	0.1	0.92	2.45	0.11
2502009	250	2009	0.1	0.92	2.45	0.11
2502010	250	2010	0.1	0.92	2.45	0.11
2502011	250	2011	0.07	0.92	1.36	0.01
2502012	250	2012	0.07	0.92	1.36	0.01
2502013	250	2013	0.07	0.92	1.36	0.01
2502014	250	2014	0.05	0.92	0.27	0.01
2502015	250	2015	0.05	0.92	0.27	0.01
2502016	250	2016	0.05	0.92	0.27	0.01
2502017	250	2017	0.05	0.92	0.27	0.01
2502018	250	2018	0.05	0.92	0.27	0.01

Lookup	Hp	Year	HC	CO	NOX	PM
2502019	250	2019	0.05	0.92	0.27	0.01
2502020	250	2020	0.05	0.92	0.27	0.01
2502021	250	2021	0.05	0.92	0.27	0.01
2502022	250	2022	0.05	0.92	0.27	0.01
2502023	250	2023	0.05	0.92	0.27	0.01
2502024	250	2024	0.05	0.92	0.27	0.01
2502025	250	2025	0.05	0.92	0.27	0.01
2502026	250	2026	0.05	0.92	0.27	0.01
5001968	500	1968	1.26	4.2	14	0.74
5001969	500	1969	1.26	4.2	14	0.74
5001970	500	1970	1.05	4.2	13	0.63
5001971	500	1971	1.05	4.2	13	0.63
5001972	500	1972	0.95	4.2	12	0.53
5001973	500	1973	0.95	4.2	12	0.53
5001974	500	1974	0.95	4.2	12	0.53
5001975	500	1975	0.95	4.2	12	0.53
5001976	500	1976	0.95	4.2	12	0.53
5001977	500	1977	0.95	4.2	12	0.53
5001978	500	1978	0.95	4.2	12	0.53
5001979	500	1979	0.95	4.2	12	0.53
5001980	500	1980	0.9	4.2	11	0.53
5001981	500	1981	0.9	4.2	11	0.53
5001982	500	1982	0.9	4.2	11	0.53
5001983	500	1983	0.9	4.2	11	0.53
5001984	500	1984	0.9	4.2	11	0.53
5001985	500	1985	0.84	4.1	11	0.53
5001986	500	1986	0.84	4.1	11	0.53
5001987	500	1987	0.84	4.1	11	0.53
5001988	500	1988	0.68	2.7	8.17	0.38
5001989	500	1989	0.68	2.7	8.17	0.38
5001990	500	1990	0.68	2.7	8.17	0.38
5001991	500	1991	0.68	2.7	8.17	0.38
5001992	500	1992	0.68	2.7	8.17	0.38
5001993	500	1993	0.68	2.7	8.17	0.38
5001994	500	1994	0.68	2.7	8.17	0.38
5001995	500	1995	0.68	2.7	8.17	0.38
5001996	500	1996	0.32	0.92	6.25	0.15
5001997	500	1997	0.32	0.92	6.25	0.15
5001998	500	1998	0.32	0.92	6.25	0.15
5001999	500	1999	0.32	0.92	6.25	0.15
5002000	500	2000	0.32	0.92	6.25	0.15
5002001	500	2001	0.19	0.92	4.95	0.12
5002002	500	2002	0.14	0.92	4.51	0.11
5002003	500	2003	0.12	0.92	4.29	0.11
5002004	500	2004	0.12	0.92	4.29	0.11
5002005	500	2005	0.1	0.92	4	0.11
5002006	500	2006	0.1	0.92	2.45	0.11
5002007	500	2007	0.1	0.92	2.45	0.11
5002008	500	2008	0.1	0.92	2.45	0.11
5002009	500	2009	0.1	0.92	2.45	0.11
5002010	500	2010	0.1	0.92	2.45	0.11
5002011	500	2011	0.07	0.92	1.36	0.01
5002012	500	2012	0.07	0.92	1.36	0.01
5002013	500	2013	0.07	0.92	1.36	0.01
5002014	500	2014	0.05	0.92	0.27	0.01
5002015	500	2015	0.05	0.92	0.27	0.01
5002016	500	2016	0.05	0.92	0.27	0.01
5002017	500	2017	0.05	0.92	0.27	0.01

Lookup	Hp	Year	HC	CO	NOX	PM
5002018	500	2018	0.05	0.92	0.27	0.01
5002019	500	2019	0.05	0.92	0.27	0.01
5002020	500	2020	0.05	0.92	0.27	0.01
5002021	500	2021	0.05	0.92	0.27	0.01
5002022	500	2022	0.05	0.92	0.27	0.01
5002023	500	2023	0.05	0.92	0.27	0.01
5002024	500	2024	0.05	0.92	0.27	0.01
5002025	500	2025	0.05	0.92	0.27	0.01
5002026	500	2026	0.05	0.92	0.27	0.01
7501968	750	1968	1.26	4.2	14	0.74
7501969	750	1969	1.26	4.2	14	0.74
7501970	750	1970	1.05	4.2	13	0.63
7501971	750	1971	1.05	4.2	13	0.63
7501972	750	1972	0.95	4.2	12	0.53
7501973	750	1973	0.95	4.2	12	0.53
7501974	750	1974	0.95	4.2	12	0.53
7501975	750	1975	0.95	4.2	12	0.53
7501976	750	1976	0.95	4.2	12	0.53
7501977	750	1977	0.95	4.2	12	0.53
7501978	750	1978	0.95	4.2	12	0.53
7501979	750	1979	0.95	4.2	12	0.53
7501980	750	1980	0.9	4.2	11	0.53
7501981	750	1981	0.9	4.2	11	0.53
7501982	750	1982	0.9	4.2	11	0.53
7501983	750	1983	0.9	4.2	11	0.53
7501984	750	1984	0.9	4.2	11	0.53
7501985	750	1985	0.84	4.1	11	0.53
7501986	750	1986	0.84	4.1	11	0.53
7501987	750	1987	0.84	4.1	11	0.53
7501988	750	1988	0.68	2.7	8.17	0.38
7501989	750	1989	0.68	2.7	8.17	0.38
7501990	750	1990	0.68	2.7	8.17	0.38
7501991	750	1991	0.68	2.7	8.17	0.38
7501992	750	1992	0.68	2.7	8.17	0.38
7501993	750	1993	0.68	2.7	8.17	0.38
7501994	750	1994	0.68	2.7	8.17	0.38
7501995	750	1995	0.68	2.7	8.17	0.38
7501996	750	1996	0.32	0.92	6.25	0.15
7501997	750	1997	0.32	0.92	6.25	0.15
7501998	750	1998	0.32	0.92	6.25	0.15
7501999	750	1999	0.32	0.92	6.25	0.15
7502000	750	2000	0.32	0.92	6.25	0.15
7502001	750	2001	0.32	0.92	6.25	0.15
7502002	750	2002	0.19	0.92	4.95	0.12
7502003	750	2003	0.14	0.92	4.51	0.11
7502004	750	2004	0.12	0.92	4.29	0.11
7502005	750	2005	0.12	0.92	4.29	0.11
7502006	750	2006	0.1	0.92	2.45	0.11
7502007	750	2007	0.1	0.92	2.45	0.11
7502008	750	2008	0.1	0.92	2.45	0.11
7502009	750	2009	0.1	0.92	2.45	0.11
7502010	750	2010	0.1	0.92	2.45	0.11
7502011	750	2011	0.07	0.92	1.36	0.01
7502012	750	2012	0.07	0.92	1.36	0.01
7502013	750	2013	0.07	0.92	1.36	0.01
7502014	750	2014	0.05	0.92	0.27	0.01
7502015	750	2015	0.05	0.92	0.27	0.01
7502016	750	2016	0.05	0.92	0.27	0.01

Lookup	Hp	Year	HC	CO	NOX	PM
7502017	750	2017	0.05	0.92	0.27	0.01
7502018	750	2018	0.05	0.92	0.27	0.01
7502019	750	2019	0.05	0.92	0.27	0.01
7502020	750	2020	0.05	0.92	0.27	0.01
7502021	750	2021	0.05	0.92	0.27	0.01
7502022	750	2022	0.05	0.92	0.27	0.01
7502023	750	2023	0.05	0.92	0.27	0.01
7502024	750	2024	0.05	0.92	0.27	0.01
7502025	750	2025	0.05	0.92	0.27	0.01
7502026	750	2026	0.05	0.92	0.27	0.01
9991968	999	1968	1.26	4.2	14	0.74
9991969	999	1969	1.26	4.2	14	0.74
9991970	999	1970	1.05	4.2	13	0.63
9991971	999	1971	1.05	4.2	13	0.63
9991972	999	1972	0.95	4.2	12	0.53
9991973	999	1973	0.95	4.2	12	0.53
9991974	999	1974	0.95	4.2	12	0.53
9991975	999	1975	0.95	4.2	12	0.53
9991976	999	1976	0.95	4.2	12	0.53
9991977	999	1977	0.95	4.2	12	0.53
9991978	999	1978	0.95	4.2	12	0.53
9991979	999	1979	0.95	4.2	12	0.53
9991980	999	1980	0.9	4.2	11	0.53
9991981	999	1981	0.9	4.2	11	0.53
9991982	999	1982	0.9	4.2	11	0.53
9991983	999	1983	0.9	4.2	11	0.53
9991984	999	1984	0.9	4.2	11	0.53
9991985	999	1985	0.84	4.1	11	0.53
9991986	999	1986	0.84	4.1	11	0.53
9991987	999	1987	0.84	4.1	11	0.53
9991988	999	1988	0.68	2.7	8.17	0.38
9991989	999	1989	0.68	2.7	8.17	0.38
9991990	999	1990	0.68	2.7	8.17	0.38
9991991	999	1991	0.68	2.7	8.17	0.38
9991992	999	1992	0.68	2.7	8.17	0.38
9991993	999	1993	0.68	2.7	8.17	0.38
9991994	999	1994	0.68	2.7	8.17	0.38
9991995	999	1995	0.68	2.7	8.17	0.38
9991996	999	1996	0.68	2.7	8.17	0.38
9991997	999	1997	0.68	2.7	8.17	0.38
9991998	999	1998	0.68	2.7	8.17	0.38
9991999	999	1999	0.68	2.7	8.17	0.38
9992000	999	2000	0.32	0.92	6.25	0.15
9992001	999	2001	0.32	0.92	6.25	0.15
9992002	999	2002	0.32	0.92	6.25	0.15
9992003	999	2003	0.32	0.92	6.25	0.15
9992004	999	2004	0.32	0.92	6.25	0.15
9992005	999	2005	0.32	0.92	6.25	0.15
9992006	999	2006	0.19	0.92	4.95	0.12
9992007	999	2007	0.14	0.92	4.51	0.11
9992008	999	2008	0.12	0.92	4.29	0.11
9992009	999	2009	0.12	0.92	4.29	0.11
9992010	999	2010	0.1	0.92	4.08	0.11
9992011	999	2011	0.1	0.92	2.36	0.06
9992012	999	2012	0.1	0.92	2.36	0.06
9992013	999	2013	0.1	0.92	2.36	0.06
9992014	999	2014	0.1	0.92	2.36	0.06
9992015	999	2015	0.05	0.92	2.36	0.02

Lookup	Hp	Year	HC	CO	NOX	PM
9992016	999	2016	0.05	0.92	2.36	0.02
9992017	999	2017	0.05	0.92	2.36	0.02
9992018	999	2018	0.05	0.92	2.36	0.02
9992019	999	2019	0.05	0.92	2.36	0.02
9992020	999	2020	0.05	0.92	2.36	0.02
9992021	999	2021	0.05	0.92	2.36	0.02
9992022	999	2022	0.05	0.92	2.36	0.02
9992023	999	2023	0.05	0.92	2.36	0.02
9992024	999	2024	0.05	0.92	2.36	0.02
9992025	999	2025	0.05	0.92	2.36	0.02
9992026	999	2026	0.05	0.92	2.36	0.02

units = g/bhp hr

Lookup	Hp	Year	HC	HC DR	CO	CO DR	NOX	NOX DR	PM	PM DR	fuel/engine type
151994	15	1994	3.96	4.20E-03	240	1.44E-02	1.77	4.48E-04	0.09	9.54E-05	C4
151998	15	1998	1.56	4.20E-03	300	1.44E-02	8.44	4.48E-04	0.9	9.54E-05	C4
152040	15	2040	0.5	4.20E-03	100	1.44E-02	2.7	4.48E-04	0.25	9.54E-05	C4
251994	25	1994	3.96	4.12E-03	240	1.42E-02	1.77	4.41E-04	0.09	9.37E-05	C4
251998	25	1998	1.56	4.12E-03	300	1.42E-02	8.44	4.41E-04	0.9	9.37E-05	C4
252040	25	2040	0.5	4.12E-03	100	1.42E-02	2.7	4.41E-04	0.25	9.37E-05	C4
501983	50	1983	1.38	1.51E-04	7.02	4.75E-04	13	6.62E-05	0.06	0.00E+00	C4
502000	50	2000	1.38	1.51E-04	7.02	4.75E-04	13	6.62E-05	0.06	0.00E+00	C4
502001	50	2001	1.16	1.59E-04	7.02	4.75E-04	10.4	1.56E-04	0.06	0.00E+00	C4
502002	50	2002	0.93	1.66E-04	7.02	4.75E-04	7.79	2.45E-04	0.06	0.00E+00	C4
502003	50	2003	0.71	1.74E-04	7.02	4.75E-04	5.19	3.35E-04	0.06	0.00E+00	C4
502006	50	2006	0.14	1.06E-04	7.02	4.75E-04	1.95	2.76E-04	0.06	0.00E+00	C4
502040	50	2040	0.14	7.24E-05	7.02	4.75E-04	1.95	1.10E-04	0.06	0.00E+00	C4
1201983	120	1983	1.55	1.69E-04	19.72	1.34E-03	10.53	5.33E-05	0.06	0.00E+00	C4
1202000	120	2000	1.55	1.69E-04	19.72	1.34E-03	10.53	5.33E-05	0.06	0.00E+00	C4
1202001	120	2001	1.28	1.72E-04	19.72	1.34E-03	8.54	1.46E-04	0.06	0.00E+00	C4
1202002	120	2002	1.02	1.75E-04	19.72	1.34E-03	6.56	2.39E-04	0.06	0.00E+00	C4
1202003	120	2003	0.75	1.78E-04	19.72	1.34E-03	4.57	3.31E-04	0.06	0.00E+00	C4
1202006	120	2006	0.16	1.03E-04	19.72	1.34E-03	1.58	3.50E-04	0.06	0.00E+00	C4
1202040	120	2040	0.16	6.90E-05	19.72	1.34E-03	1.58	1.84E-04	0.06	0.00E+00	C4
1751983	175	1983	1.38	3.53E-05	16.47	8.62E-04	10.51	1.04E-04	0.06	0.00E+00	C4
1752000	175	2000	1.38	3.53E-05	16.47	8.62E-04	10.51	1.04E-04	0.06	0.00E+00	C4
1752001	175	2001	1.16	3.55E-05	16.47	8.62E-04	8.53	9.08E-05	0.06	0.00E+00	C4
1752002	175	2002	0.94	3.57E-05	16.47	8.62E-04	6.54	7.77E-05	0.06	0.00E+00	C4
1752003	175	2003	0.71	3.58E-05	16.47	8.62E-04	4.56	6.45E-05	0.06	0.00E+00	C4
1752006	175	2006	0.14	1.06E-04	16.47	8.62E-04	1.58	2.64E-04	0.06	0.00E+00	C4
1752040	175	2040	0.14	3.60E-05	16.47	8.62E-04	1.58	5.13E-05	0.06	0.00E+00	C4
2501983	250	1983	1.38	3.53E-05	16.47	8.62E-04	10.51	1.04E-04	0.06	0.00E+00	C4
2502000	250	2000	1.38	3.53E-05	16.47	8.62E-04	10.51	1.04E-04	0.06	0.00E+00	C4
2502001	250	2001	1.16	3.55E-05	16.47	8.62E-04	8.53	9.08E-05	0.06	0.00E+00	C4
2502002	250	2002	0.94	3.57E-05	16.47	8.62E-04	6.54	7.77E-05	0.06	0.00E+00	C4
2502003	250	2003	0.71	3.58E-05	16.47	8.62E-04	4.56	6.45E-05	0.06	0.00E+00	C4
2502006	250	2006	0.14	1.06E-04	16.47	8.62E-04	1.58	2.64E-04	0.06	0.00E+00	C4
2502040	250	2040	0.14	3.60E-05	16.47	8.62E-04	1.58	5.13E-05	0.06	0.00E+00	C4
5001983	500	1983	1.38	3.53E-05	16.47	8.62E-04	10.51	1.04E-04	0.06	0.00E+00	C4
5002000	500	2000	1.38	3.53E-05	16.47	8.62E-04	10.51	1.04E-04	0.06	0.00E+00	C4
5002001	500	2001	1.16	3.55E-05	16.47	8.62E-04	8.53	9.08E-05	0.06	0.00E+00	C4
5002002	500	2002	0.94	3.57E-05	16.47	8.62E-04	6.54	7.77E-05	0.06	0.00E+00	C4
5002003	500	2003	0.71	3.58E-05	16.47	8.62E-04	4.56	6.45E-05	0.06	0.00E+00	C4
5002007	500	2007	0.14	1.06E-04	16.47	8.62E-04	1.58	2.64E-04	0.06	0.00E+00	C4
5002040	500	2040	0.14	3.60E-05	16.47	8.62E-04	1.58	5.13E-05	0.06	0.00E+00	C4

units = g/bhp hr

Lookup	Hp	Year	HC	HC DR	CO	CO DR	NOX	NOX DR	PM	PM DR	fuel/engine type
51994	5	1994	26.44	0.0948	504.25	0.52	2.12	0.000239	0.74	0.0026	G4
51995	5	1995	7.28	0.0565	272.56	-0.067	2.32	0.0031	0.74	0.0026	G4
52001	5	2001	7.28	0.0565	317.99	-0.067	2.32	0.0031	0.74	0.0026	G4
52006	5	2006	6	0.0144	235.77	-0.385	2.7	0.00649	0.74	0.0026	G4
52040	5	2040	3.66	0.0182	235.77	-0.385	0.86	0.00496	0.74	0.0026	G4
151994	15	1994	7.46	0.0178	393.1	0.0337	3.48	0.00133	0.14	0.0002	G4
151995	15	1995	4.56	0.0207	234.54	0.0895	2.84	0	0.14	0.0002	G4
152001	15	2001	4.56	0.0207	273.63	0.0895	2.84	0	0.14	0.0002	G4
152007	15	2007	3.9	0.00469	224.66	0	2.9	0.00347	0.14	0.0002	G4
152040	15	2040	2.51	0.00388	224.66	0	1.86	0.00264	0.14	0.0002	G4
251994	25	1994	7.46	0.0141	393.1	0.0276	3.48	0.00109	0.14	0.0002	G4
251995	25	1995	4.42	0.0166	243.17	0.0345	2.32	0	0.14	0.0002	G4
252001	25	2001	4.42	0.0166	283.69	0.0345	2.32	0	0.14	0.0002	G4
252007	25	2007	4.12	0.00495	238.46	0	2.68	0.00321	0.14	0.0002	G4
252040	25	2040	2.64	0.00336	238.46	0	1.71	0.00324	0.14	0.0002	G4
501983	50	1983	3.76	0.000412	89.9	0.00555	8.01	4.06E-05	0.06	0	G4
502000	50	2000	3.76	0.000412	89.9	0.00555	8.01	4.06E-05	0.06	0	G4
502001	50	2001	2.96	0.000348	78.09	0.0201	6.91	0.000144	0.06	0	G4
502002	50	2002	2.34	0.000374	81.78	0.0197	5.52	0.000308	0.06	0	G4
502003	50	2003	1.62	0.000316	71.03	0.0193	4.52	0.000402	0.06	0	G4
502006	50	2006	0.71	0.000169	38.19	0.019	1.33	0.000471	0.06	0	G4
502040	50	2040	0.71	0.000138	38.19	0.019	1.33	0.00032	0.06	0	G4
1201983	120	1983	2.63	0.000287	43.8	0.0029	11.84	6.01E-05	0.06	0	G4
1202000	120	2000	2.63	0.000287	43.8	0.0029	11.84	6.01E-05	0.06	0	G4
1202001	120	2001	2.08	0.000256	41.08	0.004	9.58	0.000163	0.06	0	G4
1202002	120	2002	1.54	0.000225	39.72	0.00455	7.32	0.000266	0.06	0	G4
1202003	120	2003	0.99	0.000194	38.36	0.0051	5.06	0.000368	0.06	0	G4
1202006	120	2006	0.26	8.14E-05	8.76	0.00565	1.78	0.000207	0.06	0	G4
1202040	120	2040	0.26	4.74E-05	8.76	0.00565	1.78	0.000145	0.06	0	G4
1751983	175	1983	1.61	4.15E-05	20.8	0.000815	12.94	0.000127	0.06	0	G4
1752000	175	2000	1.61	4.15E-05	20.8	0.000815	12.94	0.000127	0.06	0	G4
1752001	175	2001	1.33	3.98E-05	20.8	0.000815	10.29	0.000109	0.06	0	G4
1752002	175	2002	1.06	3.81E-05	20.8	0.000815	7.64	9.17E-05	0.06	0	G4
1752003	175	2003	0.78	3.64E-05	20.8	0.000815	4.98	0.000074	0.06	0	G4
1752006	175	2006	0.16	0.000102	20.8	0.000815	1.94	0.000278	0.06	0	G4
1752040	175	2040	0.16	3.47E-05	20.8	0.000815	1.94	5.63E-05	0.06	0	G4
2501983	250	1983	1.61	4.15E-05	20.8	0.000815	12.94	0.000127	0.06	0	G4
2502000	250	2000	1.61	4.15E-05	20.8	0.000815	12.94	0.000127	0.06	0	G4
2502001	250	2001	1.33	3.98E-05	20.8	0.000815	10.29	0.000109	0.06	0	G4
2502002	250	2002	1.06	3.81E-05	20.8	0.000815	7.64	9.17E-05	0.06	0	G4
2502003	250	2003	0.78	3.64E-05	20.8	0.000815	4.98	0.000074	0.06	0	G4
2502006	250	2006	0.16	0.000102	20.8	0.000815	1.94	0.000278	0.06	0	G4
2502040	250	2040	0.16	3.47E-05	20.8	0.000815	1.94	5.63E-05	0.06	0	G4
5001983	500	1983	1.61	4.15E-05	20.8	0.000815	12.94	0.000127	0.06	0	G4
5002000	500	2000	1.61	4.15E-05	20.8	0.000815	12.94	0.000127	0.06	0	G4
5002001	500	2001	1.33	3.98E-05	20.8	0.000815	10.29	0.000109	0.06	0	G4
5002002	500	2002	1.06	3.81E-05	20.8	0.000815	7.64	9.17E-05	0.06	0	G4
5002003	500	2003	0.78	3.64E-05	20.8	0.000815	4.98	0.000074	0.06	0	G4
5002006	500	2006	0.16	0.000102	20.8	0.000815	1.94	0.000278	0.06	0	G4
5002040	500	2040	0.16	3.47E-05	20.8	0.000815	1.94	5.63E-05	0.06	0	G4

units = g/bhp hr

Lookup	**Hp**	**Year**	**HC**	**CO**	**NOX**	**PM**
251968	25	1968	0.61	5.00	3.04	0.53
251969	25	1969	0.61	5.00	3.04	0.53
251970	25	1970	0.61	5.00	3.04	0.53
251971	25	1971	0.61	5.00	3.04	0.53
251972	25	1972	0.61	5.00	3.04	0.53
251973	25	1973	0.61	5.00	3.04	0.53
251974	25	1974	0.61	5.00	3.04	0.53
251975	25	1975	0.61	5.00	3.04	0.53
251976	25	1976	0.61	5.00	3.04	0.53
251977	25	1977	0.61	5.00	3.04	0.53
251978	25	1978	0.61	5.00	3.04	0.53
251979	25	1979	0.61	5.00	3.04	0.53
251980	25	1980	0.61	5.00	3.04	0.53
251981	25	1981	0.61	5.00	3.04	0.53
251982	25	1982	0.61	5.00	3.04	0.53
251983	25	1983	0.61	5.00	3.04	0.53
251984	25	1984	0.61	5.00	3.04	0.53
251985	25	1985	0.61	5.00	3.04	0.53
251986	25	1986	0.61	5.00	3.04	0.53
251987	25	1987	0.61	5.00	3.04	0.53
251988	25	1988	0.61	5.00	3.04	0.53
251989	25	1989	0.61	5.00	3.04	0.53
251990	25	1990	0.61	5.00	3.04	0.53
251991	25	1991	0.61	5.00	3.04	0.53
251992	25	1992	0.61	5.00	3.04	0.53
251993	25	1993	0.61	5.00	3.04	0.53
251994	25	1994	0.61	5.00	3.04	0.53
251995	25	1995	0.54	1.40	1.71	0.29
251996	25	1996	0.54	1.40	1.71	0.29
251997	25	1997	0.54	1.40	1.71	0.29
251998	25	1998	0.54	1.40	1.71	0.29
251999	25	1999	0.17	0.50	0.55	0.08
252000	25	2000	0.17	0.50	0.55	0.08
252001	25	2001	0.17	0.50	0.55	0.08
252002	25	2002	0.17	0.50	0.55	0.08
252003	25	2003	0.17	0.50	0.55	0.08
252004	25	2004	0.17	0.50	0.55	0.08
252005	25	2005	0.17	0.50	0.55	0.08
252006	25	2006	0.17	0.50	0.55	0.08
252007	25	2007	0.17	0.50	0.55	0.08
252008	25	2008	0.17	0.50	0.55	0.08
252009	25	2009	0.17	0.50	0.55	0.08
252010	25	2010	0.17	0.50	0.55	0.08
252011	25	2011	0.17	0.50	0.55	0.08
252012	25	2012	0.17	0.50	0.55	0.08
252013	25	2013	0.17	0.50	0.55	0.08
252014	25	2014	0.17	0.50	0.55	0.08
252015	25	2015	0.17	0.50	0.55	0.08

Lookup	Hp	Year	HC	CO	NOX	PM
252016	25	2016	0.17	0.50	0.55	0.08
252017	25	2017	0.17	0.50	0.55	0.08
252018	25	2018	0.17	0.50	0.55	0.08
252019	25	2019	0.17	0.50	0.55	0.08
252020	25	2020	0.17	0.50	0.55	0.08
252021	25	2021	0.17	0.50	0.55	0.08
252022	25	2022	0.17	0.50	0.55	0.08
252023	25	2023	0.17	0.50	0.55	0.08
252024	25	2024	0.17	0.50	0.55	0.08
252025	25	2025	0.17	0.50	0.55	0.08
252026	25	2026	0.17	0.50	0.55	0.08
501969	50	1969	0.61	5.00	3.08	0.53
501969	50	1969	0.61	5.00	3.08	0.53
501970	50	1970	0.61	5.00	3.08	0.53
501971	50	1971	0.61	5.00	3.08	0.53
501972	50	1972	0.61	5.00	3.08	0.53
501973	50	1973	0.61	5.00	3.08	0.53
501974	50	1974	0.61	5.00	3.08	0.53
501975	50	1975	0.61	5.00	3.08	0.53
501976	50	1976	0.61	5.00	3.08	0.53
501977	50	1977	0.61	5.00	3.08	0.53
501978	50	1978	0.61	5.00	3.08	0.53
501979	50	1979	0.61	5.00	3.08	0.53
501980	50	1980	0.61	5.00	3.08	0.53
501981	50	1981	0.61	5.00	3.08	0.53
501982	50	1982	0.61	5.00	3.08	0.53
501983	50	1983	0.61	5.00	3.08	0.53
501984	50	1984	0.61	5.00	3.08	0.53
501985	50	1985	0.61	5.00	3.08	0.53
501986	50	1986	0.61	5.00	3.08	0.53
501987	50	1987	0.61	5.00	3.08	0.53
501988	50	1988	0.59	5.00	3.04	0.53
501989	50	1989	0.59	5.00	3.04	0.53
501990	50	1990	0.59	5.00	3.04	0.53
501991	50	1991	0.59	5.00	3.04	0.53
501992	50	1992	0.59	5.00	3.04	0.53
501993	50	1993	0.59	5.00	3.04	0.53
501994	50	1994	0.59	5.00	3.04	0.53
501995	50	1995	0.59	5.00	3.04	0.53
501996	50	1996	0.59	5.00	3.04	0.53
501997	50	1997	0.59	5.00	3.04	0.53
501998	50	1998	0.59	5.00	3.04	0.53
501999	50	1999	0.48	4.10	2.44	0.42
502000	50	2000	0.48	4.10	2.44	0.42
502001	50	2001	0.48	4.10	2.44	0.42
502002	50	2002	0.48	4.10	2.44	0.42
502003	50	2003	0.48	4.10	2.44	0.42
502004	50	2004	0.21	3.27	2.24	0.30
502005	50	2005	0.12	3.00	2.18	0.27
502006	50	2006	0.08	2.86	2.15	0.25
502007	50	2007	0.08	2.86	2.15	0.25

Lookup	Hp	Year	HC	CO	NOX	PM
502008	50	2008	0.03	2.72	2.11	0.11
502009	50	2009	0.03	2.72	2.11	0.11
502010	50	2010	0.03	2.72	2.11	0.11
502011	50	2011	0.03	2.72	2.11	0.11
502012	50	2012	0.03	2.72	2.11	0.11
502013	50	2013	0.03	2.72	1.28	0.01
502014	50	2014	0.03	2.72	1.28	0.01
502015	50	2015	0.03	2.72	1.28	0.01
502016	50	2016	0.03	2.72	1.28	0.01
502017	50	2017	0.03	2.72	1.28	0.01
502018	50	2018	0.03	2.72	1.28	0.01
502019	50	2019	0.03	2.72	1.28	0.01
502020	50	2020	0.03	2.72	1.28	0.01
502021	50	2021	0.03	2.72	1.28	0.01
502022	50	2022	0.03	2.72	1.28	0.01
502023	50	2023	0.03	2.72	1.28	0.01
502024	50	2024	0.03	2.72	1.28	0.01
502025	50	2025	0.03	2.72	1.28	0.01
502026	50	2026	0.03	2.72	1.28	0.01
1201968	120	1968	0.48	4.80	5.72	0.59
1201969	120	1969	0.48	4.80	5.72	0.59
1201970	120	1970	0.48	4.80	5.72	0.59
1201971	120	1971	0.48	4.80	5.72	0.59
1201972	120	1972	0.48	4.80	5.72	0.59
1201973	120	1973	0.48	4.80	5.72	0.59
1201974	120	1974	0.48	4.80	5.72	0.59
1201975	120	1975	0.48	4.80	5.72	0.59
1201976	120	1976	0.48	4.80	5.72	0.59
1201977	120	1977	0.48	4.80	5.72	0.59
1201978	120	1978	0.48	4.80	5.72	0.59
1201979	120	1979	0.48	4.80	5.72	0.59
1201980	120	1980	0.48	4.80	5.72	0.59
1201981	120	1981	0.48	4.80	5.72	0.59
1201982	120	1982	0.48	4.80	5.72	0.59
1201983	120	1983	0.48	4.80	5.72	0.59
1201984	120	1984	0.48	4.80	5.72	0.59
1201985	120	1985	0.48	4.80	5.72	0.59
1201986	120	1986	0.48	4.80	5.72	0.59
1201987	120	1987	0.48	4.80	5.72	0.59
1201988	120	1988	0.33	3.49	3.85	0.48
1201989	120	1989	0.33	3.49	3.85	0.48
1201990	120	1990	0.33	3.49	3.85	0.48
1201991	120	1991	0.33	3.49	3.85	0.48
1201992	120	1992	0.33	3.49	3.85	0.48
1201993	120	1993	0.33	3.49	3.85	0.48
1201994	120	1994	0.33	3.49	3.85	0.48
1201995	120	1995	0.33	3.49	3.85	0.48
1201996	120	1996	0.33	3.49	3.85	0.48
1201997	120	1997	0.33	3.49	3.85	0.48
1201998	120	1998	0.33	3.49	3.04	0.48
1201999	120	1999	0.33	3.49	3.04	0.48

Lookup	Hp	Year	HC	CO	NOX	PM
1202000	120	2000	0.33	3.49	3.04	0.48
1202001	120	2001	0.33	3.49	3.04	0.48
1202002	120	2002	0.33	3.49	3.04	0.48
1202003	120	2003	0.33	3.49	3.04	0.48
1202004	120	2004	0.15	3.23	2.48	0.27
1202005	120	2005	0.09	3.14	2.30	0.20
1202006	120	2006	0.06	3.09	2.20	0.17
1202007	120	2007	0.06	3.09	2.20	0.17
1202008	120	2008	0.03	3.05	1.27	0.14
1202009	120	2009	0.03	3.05	1.27	0.14
1202010	120	2010	0.03	3.05	1.27	0.14
1202011	120	2011	0.03	3.05	1.27	0.14
1202012	120	2012	0.03	3.05	1.11	0.05
1202013	120	2013	0.03	3.05	1.11	0.01
1202014	120	2014	0.03	3.05	1.11	0.01
1202015	120	2015	0.02	3.05	0.61	0.01
1202016	120	2016	0.02	3.05	0.61	0.01
1202017	120	2017	0.02	3.05	0.61	0.01
1202018	120	2018	0.02	3.05	0.61	0.01
1202019	120	2019	0.02	3.05	0.61	0.01
1202020	120	2020	0.02	3.05	0.61	0.01
1202021	120	2021	0.02	3.05	0.61	0.01
1202022	120	2022	0.02	3.05	0.61	0.01
1202023	120	2023	0.02	3.05	0.61	0.01
1202024	120	2024	0.02	3.05	0.61	0.01
1202025	120	2025	0.02	3.05	0.61	0.01
1202026	120	2026	0.02	3.05	0.61	0.01
1751968	175	1968	0.44	4.40	6.16	0.54
1751969	175	1969	0.44	4.40	6.16	0.54
1751970	175	1970	0.36	4.40	5.72	0.46
1751971	175	1971	0.36	4.40	5.72	0.46
1751972	175	1972	0.33	4.40	5.28	0.39
1751973	175	1973	0.33	4.40	5.28	0.39
1751974	175	1974	0.33	4.40	5.28	0.39
1751975	175	1975	0.33	4.40	5.28	0.39
1751976	175	1976	0.33	4.40	5.28	0.39
1751977	175	1977	0.33	4.40	5.28	0.39
1751978	175	1978	0.33	4.40	5.28	0.39
1751979	175	1979	0.33	4.40	5.28	0.39
1751980	175	1980	0.31	4.30	4.84	0.39
1751981	175	1981	0.31	4.30	4.84	0.39
1751982	175	1982	0.31	4.30	4.84	0.39
1751983	175	1983	0.31	4.30	4.84	0.39
1751984	175	1984	0.31	4.30	4.84	0.39
1751985	175	1985	0.29	4.20	4.84	0.39
1751986	175	1986	0.29	4.20	4.84	0.39
1751987	175	1987	0.29	4.20	4.84	0.39
1751988	175	1988	0.22	2.70	3.59	0.27
1751989	175	1989	0.22	2.70	3.59	0.27
1751990	175	1990	0.22	2.70	3.59	0.27
1751991	175	1991	0.22	2.70	3.59	0.27

Lookup	Hp	Year	HC	CO	NOX	PM
1751992	175	1992	0.22	2.70	3.59	0.27
1751993	175	1993	0.22	2.70	3.59	0.27
1751994	175	1994	0.22	2.70	3.59	0.27
1751995	175	1995	0.22	2.70	3.59	0.27
1751996	175	1996	0.22	2.70	3.59	0.27
1751997	175	1997	0.22	2.70	3.04	0.27
1751998	175	1998	0.22	2.70	3.04	0.27
1751999	175	1999	0.22	2.70	3.04	0.27
1752000	175	2000	0.22	2.70	3.04	0.27
1752001	175	2001	0.22	2.70	3.04	0.27
1752002	175	2002	0.22	2.70	3.04	0.27
1752003	175	2003	0.11	2.70	2.31	0.17
1752004	175	2004	0.07	2.70	2.08	0.13
1752005	175	2005	0.05	2.70	1.95	0.11
1752006	175	2006	0.05	2.70	1.95	0.11
1752007	175	2007	0.03	2.70	1.08	0.10
1752008	175	2008	0.03	2.70	1.08	0.10
1752009	175	2009	0.03	2.70	1.08	0.10
1752010	175	2010	0.03	2.70	1.08	0.10
1752011	175	2011	0.03	2.70	1.08	0.10
1752012	175	2012	0.03	2.70	1.00	0.01
1752013	175	2013	0.03	2.70	1.00	0.01
1752014	175	2014	0.03	2.70	1.00	0.01
1752015	175	2015	0.02	2.70	0.12	0.01
1752016	175	2016	0.02	2.70	0.12	0.01
1752017	175	2017	0.02	2.70	0.12	0.01
1752018	175	2018	0.02	2.70	0.12	0.01
1752019	175	2019	0.02	2.70	0.12	0.01
1752020	175	2020	0.02	2.70	0.12	0.01
1752021	175	2021	0.02	2.70	0.12	0.01
1752022	175	2022	0.02	2.70	0.12	0.01
1752023	175	2023	0.02	2.70	0.12	0.01
1752024	175	2024	0.02	2.70	0.12	0.01
1752025	175	2025	0.02	2.70	0.12	0.01
1752026	175	2026	0.02	2.70	0.12	0.01
2501968	250	1968	0.44	4.40	6.16	0.54
2501969	250	1969	0.44	4.40	6.16	0.54
2501970	250	1970	0.36	4.40	5.72	0.46
2501971	250	1971	0.36	4.40	5.72	0.46
2501972	250	1972	0.33	4.40	5.28	0.39
2501973	250	1973	0.33	4.40	5.28	0.39
2501974	250	1974	0.33	4.40	5.28	0.39
2501975	250	1975	0.33	4.40	5.28	0.39
2501976	250	1976	0.33	4.40	5.28	0.39
2501977	250	1977	0.33	4.40	5.28	0.39
2501978	250	1978	0.33	4.40	5.28	0.39
2501979	250	1979	0.33	4.40	5.28	0.39
2501980	250	1980	0.31	4.30	4.84	0.39
2501981	250	1981	0.31	4.30	4.84	0.39
2501982	250	1982	0.31	4.30	4.84	0.39
2501983	250	1983	0.31	4.30	4.84	0.39

Lookup	Hp	Year	HC	CO	NOX	PM
2501984	250	1984	0.31	4.30	4.84	0.39
2501985	250	1985	0.29	4.20	4.84	0.39
2501986	250	1986	0.29	4.20	4.84	0.39
2501987	250	1987	0.29	4.20	4.84	0.39
2501988	250	1988	0.22	2.70	3.59	0.27
2501989	250	1989	0.22	2.70	3.59	0.27
2501990	250	1990	0.22	2.70	3.59	0.27
2501991	250	1991	0.22	2.70	3.59	0.27
2501992	250	1992	0.22	2.70	3.59	0.27
2501993	250	1993	0.22	2.70	3.59	0.27
2501994	250	1994	0.22	2.70	3.59	0.27
2501995	250	1995	0.22	2.70	3.59	0.27
2501996	250	1996	0.11	0.92	2.75	0.11
2501997	250	1997	0.11	0.92	2.75	0.11
2501998	250	1998	0.11	0.92	2.75	0.11
2501999	250	1999	0.11	0.92	2.75	0.11
2502000	250	2000	0.11	0.92	2.75	0.11
2502001	250	2001	0.11	0.92	2.75	0.11
2502002	250	2002	0.11	0.92	2.75	0.11
2502003	250	2003	0.06	0.92	2.20	0.08
2502004	250	2004	0.05	0.92	2.02	0.08
2502005	250	2005	0.04	0.92	1.93	0.08
2502006	250	2006	0.04	0.92	1.93	0.08
2502007	250	2007	0.03	0.92	1.08	0.08
2502008	250	2008	0.03	0.92	1.08	0.08
2502009	250	2009	0.03	0.92	1.08	0.08
2502010	250	2010	0.03	0.92	1.08	0.08
2502011	250	2011	0.02	0.92	0.60	0.01
2502012	250	2012	0.02	0.92	0.60	0.01
2502013	250	2013	0.02	0.92	0.60	0.01
2502014	250	2014	0.02	0.92	0.12	0.01
2502015	250	2015	0.02	0.92	0.12	0.01
2502016	250	2016	0.02	0.92	0.12	0.01
2502017	250	2017	0.02	0.92	0.12	0.01
2502018	250	2018	0.02	0.92	0.12	0.01
2502019	250	2019	0.02	0.92	0.12	0.01
2502020	250	2020	0.02	0.92	0.12	0.01
2502021	250	2021	0.02	0.92	0.12	0.01
2502022	250	2022	0.02	0.92	0.12	0.01
2502023	250	2023	0.02	0.92	0.12	0.01
2502024	250	2024	0.02	0.92	0.12	0.01
2502025	250	2025	0.02	0.92	0.12	0.01
2502026	250	2026	0.02	0.92	0.12	0.01
5001968	500	1968	0.42	4.20	6.16	0.52
5001969	500	1969	0.42	4.20	6.16	0.52
5001970	500	1970	0.35	4.20	5.72	0.44
5001971	500	1971	0.35	4.20	5.72	0.44
5001972	500	1972	0.31	4.20	5.28	0.37
5001973	500	1973	0.31	4.20	5.28	0.37
5001974	500	1974	0.31	4.20	5.28	0.37
5001975	500	1975	0.31	4.20	5.28	0.37

Lookup	Hp	Year	HC	CO	NOX	PM
5001976	500	1976	0.31	4.20	5.28	0.37
5001977	500	1977	0.31	4.20	5.28	0.37
5001978	500	1978	0.31	4.20	5.28	0.37
5001979	500	1979	0.31	4.20	5.28	0.37
5001980	500	1980	0.30	4.20	4.84	0.37
5001981	500	1981	0.30	4.20	4.84	0.37
5001982	500	1982	0.30	4.20	4.84	0.37
5001983	500	1983	0.30	4.20	4.84	0.37
5001984	500	1984	0.30	4.20	4.84	0.37
5001985	500	1985	0.28	4.10	4.84	0.37
5001986	500	1986	0.28	4.10	4.84	0.37
5001987	500	1987	0.28	4.10	4.84	0.37
5001988	500	1988	0.22	2.70	3.59	0.27
5001989	500	1989	0.22	2.70	3.59	0.27
5001990	500	1990	0.22	2.70	3.59	0.27
5001991	500	1991	0.22	2.70	3.59	0.27
5001992	500	1992	0.22	2.70	3.59	0.27
5001993	500	1993	0.22	2.70	3.59	0.27
5001994	500	1994	0.22	2.70	3.59	0.27
5001995	500	1995	0.22	2.70	3.59	0.27
5001996	500	1996	0.11	0.92	2.75	0.11
5001997	500	1997	0.11	0.92	2.75	0.11
5001998	500	1998	0.11	0.92	2.75	0.11
5001999	500	1999	0.11	0.92	2.75	0.11
5002000	500	2000	0.11	0.92	2.75	0.11
5002001	500	2001	0.06	0.92	2.18	0.08
5002002	500	2002	0.05	0.92	1.98	0.08
5002003	500	2003	0.04	0.92	1.89	0.08
5002004	500	2004	0.04	0.92	1.89	0.08
5002005	500	2005	0.03	0.92	1.76	0.08
5002006	500	2006	0.03	0.92	1.08	0.08
5002007	500	2007	0.03	0.92	1.08	0.08
5002008	500	2008	0.03	0.92	1.08	0.08
5002009	500	2009	0.03	0.92	1.08	0.08
5002010	500	2010	0.03	0.92	1.08	0.08
5002011	500	2011	0.02	0.92	0.60	0.01
5002012	500	2012	0.02	0.92	0.60	0.01
5002013	500	2013	0.02	0.92	0.60	0.01
5002014	500	2014	0.02	0.92	0.12	0.01
5002015	500	2015	0.02	0.92	0.12	0.01
5002016	500	2016	0.02	0.92	0.12	0.01
5002017	500	2017	0.02	0.92	0.12	0.01
5002018	500	2018	0.02	0.92	0.12	0.01
5002019	500	2019	0.02	0.92	0.12	0.01
5002020	500	2020	0.02	0.92	0.12	0.01
5002021	500	2021	0.02	0.92	0.12	0.01
5002022	500	2022	0.02	0.92	0.12	0.01
5002023	500	2023	0.02	0.92	0.12	0.01
5002024	500	2024	0.02	0.92	0.12	0.01
5002025	500	2025	0.02	0.92	0.12	0.01
5002026	500	2026	0.02	0.92	0.12	0.01

Lookup	Hp	Year	HC	CO	NOX	PM
7501968	750	1968	0.42	4.20	6.16	0.52
7501969	750	1969	0.42	4.20	6.16	0.52
7501970	750	1970	0.35	4.20	5.72	0.44
7501971	750	1971	0.35	4.20	5.72	0.44
7501972	750	1972	0.31	4.20	5.28	0.37
7501973	750	1973	0.31	4.20	5.28	0.37
7501974	750	1974	0.31	4.20	5.28	0.37
7501975	750	1975	0.31	4.20	5.28	0.37
7501976	750	1976	0.31	4.20	5.28	0.37
7501977	750	1977	0.31	4.20	5.28	0.37
7501978	750	1978	0.31	4.20	5.28	0.37
7501979	750	1979	0.31	4.20	5.28	0.37
7501980	750	1980	0.30	4.20	4.84	0.37
7501981	750	1981	0.30	4.20	4.84	0.37
7501982	750	1982	0.30	4.20	4.84	0.37
7501983	750	1983	0.30	4.20	4.84	0.37
7501984	750	1984	0.30	4.20	4.84	0.37
7501985	750	1985	0.28	4.10	4.84	0.37
7501986	750	1986	0.28	4.10	4.84	0.37
7501987	750	1987	0.28	4.10	4.84	0.37
7501988	750	1988	0.22	2.70	3.59	0.27
7501989	750	1989	0.22	2.70	3.59	0.27
7501990	750	1990	0.22	2.70	3.59	0.27
7501991	750	1991	0.22	2.70	3.59	0.27
7501992	750	1992	0.22	2.70	3.59	0.27
7501993	750	1993	0.22	2.70	3.59	0.27
7501994	750	1994	0.22	2.70	3.59	0.27
7501995	750	1995	0.22	2.70	3.59	0.27
7501996	750	1996	0.11	0.92	2.75	0.11
7501997	750	1997	0.11	0.92	2.75	0.11
7501998	750	1998	0.11	0.92	2.75	0.11
7501999	750	1999	0.11	0.92	2.75	0.11
7502000	750	2000	0.11	0.92	2.75	0.11
7502001	750	2001	0.11	0.92	2.75	0.11
7502002	750	2002	0.06	0.92	2.18	0.08
7502003	750	2003	0.05	0.92	1.98	0.08
7502004	750	2004	0.04	0.92	1.89	0.08
7502005	750	2005	0.04	0.92	1.89	0.08
7502006	750	2006	0.03	0.92	1.08	0.08
7502007	750	2007	0.03	0.92	1.08	0.08
7502008	750	2008	0.03	0.92	1.08	0.08
7502009	750	2009	0.03	0.92	1.08	0.08
7502010	750	2010	0.03	0.92	1.08	0.08
7502011	750	2011	0.02	0.92	0.60	0.01
7502012	750	2012	0.02	0.92	0.60	0.01
7502013	750	2013	0.02	0.92	0.60	0.01
7502014	750	2014	0.02	0.92	0.12	0.01
7502015	750	2015	0.02	0.92	0.12	0.01
7502016	750	2016	0.02	0.92	0.12	0.01
7502017	750	2017	0.02	0.92	0.12	0.01
7502018	750	2018	0.02	0.92	0.12	0.01

Lookup	Hp	Year	HC	CO	NOX	PM
7502019	750	2019	0.02	0.92	0.12	0.01
7502020	750	2020	0.02	0.92	0.12	0.01
7502021	750	2021	0.02	0.92	0.12	0.01
7502022	750	2022	0.02	0.92	0.12	0.01
7502023	750	2023	0.02	0.92	0.12	0.01
7502024	750	2024	0.02	0.92	0.12	0.01
7502025	750	2025	0.02	0.92	0.12	0.01
7502026	750	2026	0.02	0.92	0.12	0.01
9991968	999	1968	0.42	4.20	6.16	0.52
9991969	999	1969	0.42	4.20	6.16	0.52
9991970	999	1970	0.35	4.20	5.72	0.44
9991971	999	1971	0.35	4.20	5.72	0.44
9991972	999	1972	0.31	4.20	5.28	0.37
9991973	999	1973	0.31	4.20	5.28	0.37
9991974	999	1974	0.31	4.20	5.28	0.37
9991975	999	1975	0.31	4.20	5.28	0.37
9991976	999	1976	0.31	4.20	5.28	0.37
9991977	999	1977	0.31	4.20	5.28	0.37
9991978	999	1978	0.31	4.20	5.28	0.37
9991979	999	1979	0.31	4.20	5.28	0.37
9991980	999	1980	0.30	4.20	4.84	0.37
9991981	999	1981	0.30	4.20	4.84	0.37
9991982	999	1982	0.30	4.20	4.84	0.37
9991983	999	1983	0.30	4.20	4.84	0.37
9991984	999	1984	0.30	4.20	4.84	0.37
9991985	999	1985	0.28	4.10	4.84	0.37
9991986	999	1986	0.28	4.10	4.84	0.37
9991987	999	1987	0.28	4.10	4.84	0.37
9991988	999	1988	0.22	2.70	3.59	0.27
9991989	999	1989	0.22	2.70	3.59	0.27
9991990	999	1990	0.22	2.70	3.59	0.27
9991991	999	1991	0.22	2.70	3.59	0.27
9991992	999	1992	0.22	2.70	3.59	0.27
9991993	999	1993	0.22	2.70	3.59	0.27
9991994	999	1994	0.22	2.70	3.59	0.27
9991995	999	1995	0.22	2.70	3.59	0.27
9991996	999	1996	0.22	2.70	3.59	0.27
9991997	999	1997	0.22	2.70	3.59	0.27
9991998	999	1998	0.22	2.70	3.59	0.27
9991999	999	1999	0.22	2.70	3.59	0.27
9992000	999	2000	0.11	0.92	2.75	0.11
9992001	999	2001	0.11	0.92	2.75	0.11
9992002	999	2002	0.11	0.92	2.75	0.11
9992003	999	2003	0.11	0.92	2.75	0.11
9992004	999	2004	0.11	0.92	2.75	0.11
9992005	999	2005	0.11	0.92	2.75	0.11
9992006	999	2006	0.06	0.92	2.18	0.08
9992007	999	2007	0.05	0.92	1.98	0.08
9992008	999	2008	0.04	0.92	1.89	0.08
9992009	999	2009	0.04	0.92	1.89	0.08
9992010	999	2010	0.03	0.92	1.80	0.08

Lookup	Hp	Year	HC	CO	NOX	PM
9992011	999	2011	0.03	0.92	1.04	0.04
9992012	999	2012	0.03	0.92	1.04	0.04
9992013	999	2013	0.03	0.92	1.04	0.04
9992014	999	2014	0.03	0.92	1.04	0.04
9992015	999	2015	0.02	0.92	1.04	0.01
9992016	999	2016	0.02	0.92	1.04	0.01
9992017	999	2017	0.02	0.92	1.04	0.01
9992018	999	2018	0.02	0.92	1.04	0.01
9992019	999	2019	0.02	0.92	1.04	0.01
9992020	999	2020	0.02	0.92	1.04	0.01
9992021	999	2021	0.02	0.92	1.04	0.01
9992022	999	2022	0.02	0.92	1.04	0.01
9992023	999	2023	0.02	0.92	1.04	0.01
9992024	999	2024	0.02	0.92	1.04	0.01
9992025	999	2025	0.02	0.92	1.04	0.01
9992026	999	2026	0.02	0.92	1.04	0.01

ARB Equipment	Code	HP Bin	concat	SOX (g SOX/hp-hr)
Other General Industrial Equipment onroad	10	120	10120	0.0622888
Other General Industrial Equipment onroad	10	175	10175	0.0597464
Other General Industrial Equipment onroad	10	250	10250	0.0597464
Other General Industrial Equipment onroad	10	50	1050	0.0686448
Other General Industrial Equipment onroad	10	500	10500	0.0521192
Other General Industrial Equipment onroad	10	750	10750	0.0533904
Other General Industrial Equipment onroad	10	999	10999	0.0533904
Crane	1	120	1120	0.0622888
Crane	1	175	1175	0.0597464
Crane	1	250	1250	0.0597464
Crane	1	50	150	0.0686448
Crane	1	500	1500	0.0521192
Crane	1	750	1750	0.0533904
Crane	1	999	1999	0.0533904
Excavator	2	120	2120	0.0622888
Excavator	2	175	2175	0.0597464
Excavator	2	250	2250	0.0597464
Excavator	2	50	250	0.0686448
Excavator	2	500	2500	0.0521192
Excavator	2	750	2750	0.0533904
Forklift	3	120	3120	0.0622888
Forklift	3	175	3175	0.0597464
Forklift	3	250	3250	0.0597464
Forklift	3	50	350	0.0686448
Forklift	3	500	3500	0.0521192
Material Handling Equip	4	120	4120	0.0597464
Other General Industrial Equipment	5	120	5120	0.0622888
Other General Industrial Equipment	5	175	5175	0.0597464
Other General Industrial Equipment	5	250	5250	0.0597464
Other General Industrial Equipment	5	50	550	0.0686448
Other General Industrial Equipment	5	500	5500	0.0521192
Other General Industrial Equipment	5	750	5750	0.0533904
Other General Industrial Equipment	5	999	5999	0.0533904
Sweeper/Scrubbers	6	120	6120	0.0622888
Sweeper/Scrubbers	6	175	6175	0.0597464
Sweeper/Scrubbers	6	250	6250	0.0597464
Sweeper/Scrubbers	6	50	650	0.0686448
Tractor/Loader/Backhoe	7	120	7120	0.0622888
Tractor/Loader/Backhoe	7	175	7175	0.0597464
Tractor/Loader/Backhoe	7	250	7250	0.0597464
Tractor/Loader/Backhoe	7	50	750	0.0686448
Tractor/Loader/Backhoe	7	500	7500	0.0597464
Tractor/Loader/Backhoe	7	750	7750	0.0597464
Yard Tractor offroad	8	120	8120	0.0622888
Yard Tractor offroad	8	175	8175	0.0597464
Yard Tractor offroad	8	250	8250	0.0597464
Yard Tractor offroad	8	750	8750	0.0533904
Yard Tractor offroad	8	999	8999	0.0533904
Yard Tractor onroad	9	120	9120	0.0622888
Yard Tractor onroad	9	175	9175	0.0597464
Yard Tractor onroad	9	250	9250	0.0597464
Yard Tractor onroad	9	750	9750	0.0533904
Yard Tractor onroad	9	999	9999	0.0533904

ARB Equipment	Code	HP Bin	concat	SOX (g SOX/hp-hr)
Other General Industrial Equipment onroad	10	120	10120	0.0066738
Other General Industrial Equipment onroad	10	175	10175	0.0064014
Other General Industrial Equipment onroad	10	250	10250	0.0064014
Other General Industrial Equipment onroad	10	50	1050	0.0073548
Other General Industrial Equipment onroad	10	500	10500	0.0055842
Other General Industrial Equipment onroad	10	750	10750	0.0057204
Other General Industrial Equipment onroad	10	999	10999	0.0057204
Crane	1	120	1120	0.0066738
Crane	1	175	1175	0.0064014
Crane	1	250	1250	0.0064014
Crane	1	50	150	0.0073548
Crane	1	500	1500	0.0055842
Crane	1	750	1750	0.0057204
Crane	1	999	1999	0.0057204
Excavator	2	120	2120	0.0066738
Excavator	2	175	2175	0.0064014
Excavator	2	250	2250	0.0064014
Excavator	2	50	250	0.0073548
Excavator	2	500	2500	0.0055842
Excavator	2	750	2750	0.0057204
Forklift	3	120	3120	0.0066738
Forklift	3	175	3175	0.0064014
Forklift	3	250	3250	0.0064014
Forklift	3	50	350	0.0073548
Forklift	3	500	3500	0.0055842
Material Handling Equip	4	120	4120	0.0064014
Other General Industrial Equipment	5	120	5120	0.0066738
Other General Industrial Equipment	5	175	5175	0.0064014
Other General Industrial Equipment	5	250	5250	0.0064014
Other General Industrial Equipment	5	50	550	0.0073548
Other General Industrial Equipment	5	500	5500	0.0055842
Other General Industrial Equipment	5	750	5750	0.0057204
Other General Industrial Equipment	5	999	5999	0.0057204
Sweeper/Scrubbers	6	120	6120	0.0066738
Sweeper/Scrubbers	6	175	6175	0.0064014
Sweeper/Scrubbers	6	250	6250	0.0064014
Sweeper/Scrubbers	6	50	650	0.0073548
Tractor/Loader/Backhoe	7	120	7120	0.0066738
Tractor/Loader/Backhoe	7	175	7175	0.0064014
Tractor/Loader/Backhoe	7	250	7250	0.0064014
Tractor/Loader/Backhoe	7	50	750	0.0073548
Tractor/Loader/Backhoe	7	500	7500	0.0064014
Tractor/Loader/Backhoe	7	750	7750	0.0064014
Yard Tractor offroad	8	120	8120	0.0066738
Yard Tractor offroad	8	175	8175	0.0064014
Yard Tractor offroad	8	250	8250	0.0064014
Yard Tractor offroad	8	750	8750	0.0057204
Yard Tractor offroad	8	999	8999	0.0057204
Yard Tractor onroad	9	120	9120	0.0066738
Yard Tractor onroad	9	175	9175	0.0064014
Yard Tractor onroad	9	250	9250	0.0064014
Yard Tractor onroad	9	750	9750	0.0057204
Yard Tractor onroad	9	999	9999	0.0057204

ARB Equipment	Code	HP Bin	concat	SOX (g SOX/hp-hr)
Crane	1	120	1120	0.007491
Crane	1	175	1175	0.007491
Crane	1	50	150	0.009534
Forklift	3	120	3120	0.007491
Forklift	3	175	3175	0.007491
Forklift	3	50	350	0.009534
Other General Industrial Equipme	5	120	5120	0.007491
Other General Industrial Equipme	5	175	5175	0.007491
Other General Industrial Equipme	5	50	550	0.009534
Sweeper/Scrubbers	6	120	6120	0.007491
Sweeper/Scrubbers	6	175	6175	0.007491
Sweeper/Scrubbers	6	50	650	0.009534
Tractor/Loader/Backhoe	7	120	7120	0.007491

APPENDIX D-3

DEATILED EMISSION CALCULATIONS, EMISSION FACTOR DERIVATION, OFFROAD2007 OUTPUT, AND THE SPECIATION PROFILE FOR PROJECT YEAR 2012

Summary of Emissions from Cargo Handling Equipment
Dolores and ICTF Rail Yards, Long Beach, CA

								Hours of				Carbon
	Equipment	Fuel			Model	No of	Rating	Operation	BSFC	Fuel Use	Load	Oxidation
Yard	Type	Type	Make	Model	Year	Units	(hp)	(hrs/yr)[1,2,3]	(lb/bhp-hr)[4]	(gal/yr)[5]	Factor[6]	Factor[7]
ICTF	Forklift	Diesel	Toyota	6FDU25	1997	1	85	365	0.49	642	0.30	99%
ICTF	Top Pick	Diesel	Taylor	Tay-950	1989	1	350	365	0.41	4,352	0.59	99%
ICTF	Yard Hostler	LPG/LNG	TBD	TBD	2012	2	175	365	0.55	7,026	0.39	99%
ICTF	WSG Crane	Electric	TBD	TBD	NA	39	NA	8760	0	0	NA	0%
Total						**43**						

	2012 Emission Factors									2012 Emission Estimates								
	(g/bhp-hr)[8]						(kg/gal)[7]			(tons/yr)						(metric tons/yr)		
Yard / Equipment Type	HC	CO	NOx	PM10	DPM	SOx	CO2	N2O[9,10]	CH4[9,10]	ROG	CO	NOx	PM10	DPM	SOx	CO2	N2O	CH4
ICTF Forklift	0.990	3.490	8.750	*0.104*	*0.104*	0.062	10.15	1.39E-05	4.16E-05	0.01	0.04	0.09	0.00	0.00	0.00	6.45	8.91E-06	2.67E-05
ICTF Top Pick	0.680	2.700	8.170	*0.057*	*0.057*	0.060	10.15	1.39E-05	4.16E-05	0.06	0.22	0.68	0.00	0.00	0.00	43.74	6.04E-05	1.81E-04
ICTF Yard Hostler	0.226	16.752	1.676	0.600	0.000	0.000	5.95	9.02E-06	9.02E-05	0.01	0.92	0.09	0.03	0.00	0.00	41.39	6.34E-05	6.34E-04
ICTF WSG Crane	0.000	0.000	0.000	0.000	0.000	0.000	0.00	0.00E+00	0.00E+00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00E+00	0.00E+00
Total										**0.08**	**1.18**	**0.86**	**0.04**	**0.01**	**0.01**	**91.58**	**1.33E-04**	**8.42E-04**

Notes:
1. By 2012 the majority of the diesel-fueled CHE will be replaced by electric WSG cranes.
2. The remaining diesel-fueled forklift and top pick will be for emergency use only.
3. Two alternative fueled (LPG, LNG, or biodiesel) yard hostlers will be onsite for emergency use only.
4. Brake-specific fuel consumption (BSFC) from OFFROAD2007 model.
5. Calculation assumes density of Diesel fuel of 7.1 lb/gal or an LPG density of 3.9 lb/gal.
6. Default load factors from OFFROAD 2007 model was used for the top pick. The load factor for the yard hostlers was from personal communication with Harold Holmes of ARB and is based on a study conducted at the POLA/POLB.
7. From the Air Resources Board's Draft *Emission Factors for Mandatory Reporting Programs*, August 10, 2007.
8. Emission factors are from CARB's Cargo Handling Equipment Emission Calculation Spreadsheet. The DPM emission factors were adjusted for compliance with the CHE Regulation. It was assumed that a Level 3 VDECS (85% control) was installed on each unit.
9. Based on a diesel fuel HHV of 5.825 MMBtu/barrel (from ARB Draft Emission Factors for Mandatory Reporting Programs, August 10, 2007) and 42 gallons per barrel.
10. Based on a LPG HHV of 3.788 MMBtu/barrel (from ARB Draft Emission Factors for Mandatory Reporting Programs, August 10, 2007) and 42 gallons per barrel.

Toxic Air Contaminant Emissions from the Propane-Fueled Yard Hostlers
Dolores and ICTF Rail Yards, Long Beach, CA

Profile[1]	CAS	Chemical Name	Organic Fraction	2012 Emissions (tpy)
719	95636	1,2,4-trimethylbenzene	0.00001	1.89E-07
719	75070	acetaldehyde	0.00003	5.67E-07
719	71432	benzene	0.00010	2.08E-06
719	110827	cyclohexane	0.00001	1.89E-07
719	100414	ethylbenzene	0.00001	1.89E-07
719	74851	ethylene	0.00058	1.19E-05
719	50000	formaldehyde	0.00074	1.53E-05
719	108383	m-xylene	0.00001	1.89E-07
719	110543	n-hexane	0.00002	3.78E-07
719	95476	o-xylene	0.00001	1.89E-07
719	115071	propylene	0.00154	3.20E-05
719	108883	toluene	0.00004	7.56E-07
719	1330207	xylene	0.00002	3.78E-07
Total				**6.43E-05**

Notes:
1. Organic fraction from ARBs SPECIATE database. Data is from "ICE-reciprocating - natural gas" option. The SPECIATE database does not include a profile for propane-fueled engines.
2. Emissions were calculated for only chemicals that were in both the SPECIATE database and the AB2588 list.
3. Organic fraction reported on a ROG basis using ARB's Speciate ROG/TOG ratio (0.0914).

Cal Year	Terminal ID	Equipment Type	Code	Fuel Type	Alternative Fuel Type	Number of Years with Alt Fuel	Fraction 2012 with Fuel Type	Fraction 2012 with Alternative Fuel Type	Useful Life (hours)	Model Year	Age (years)	Population	HP	HP Bin	Yearly Operational Hrs	Cummulative Hours with Fuel Type
				gasoline or diesel	ULSD, LPG, electric battery, diesel-electric											
2012	(Example Calculation)	Yard Tractor offroad	8	diesel	ULSD	0.5	0.50	0.50	24800	1997	16	1	230	250	3100	48050
2012	ICTF	Forklift	3	diesel	ULSD	8	1.00	0.00	14600	1997	16	1	85	120	730	5840
2012	ICTF	Crane	1	diesel	ULSD	8	1.00	0.00	157680	1997	16	1	300	500	8,760	70080
2012	ICTF	Crane	1	diesel	ULSD	8	1.00	0.00	157680	1988	25	1	250	250	8,760	148920
2012	ICTF	Crane	1	diesel	ULSD	8	1.00	0.00	157680	1995	18	1	300	500	8,760	87600
2012	ICTF	Crane	1	diesel	ULSD	8	1.00	0.00	157680	1995	18	1	300	500	8,760	87600
2012	ICTF	Crane	1	diesel	ULSD	8	1.00	0.00	157680	1995	18	1	300	500	8,760	87600
2012	ICTF	Crane	1	diesel	ULSD	8	1.00	0.00	157680	1995	18	1	300	500	8,760	87600
2012	ICTF	Crane	1	diesel	ULSD	8	1.00	0.00	157680	2002	11	1	300	500	8,760	26280
2012	ICTF	Crane	1	diesel	ULSD	8	1.00	0.00	157680	2002	11	1	300	500	8,760	26280
2012	ICTF	Crane	1	diesel	ULSD	8	1.00	0.00	157680	2005	8	1	350	500	8,760	0
2012	ICTF	Crane	1	diesel	ULSD	7	1.00	0.00	157680	2006	7	1	300	500	8,760	0
2012	ICTF	Material Handling Equip	4	diesel	ULSD	8	1.00	0.00	3744	1972	41	1	335	500	208	6864
2012	ICTF	Material Handling Equip	4	diesel	ULSD	8	1.00	0.00	39420	1988	25	1	350	500	2,190	37230
2012	ICTF	Material Handling Equip	4	diesel	ULSD	8	1.00	0.00	39420	1989	24	1	350	500	2,190	35040
2012	ICTF	Yard Tractor offroad	8	diesel	ULSD	8	1.00	0.00	17520	1999	14	15	150	175	2,190	13140
2012	ICTF	Yard Tractor offroad	8	diesel	ULSD	8	1.00	0.00	70080	2005	8	58	173	175	8,760	0

		If no emission control leave blank															
Alt Fuel Cumm Hours	Emission Control Factor? (y/n)	Emission Control	Fraction of Year with fuel with Emission Control	Fraction of Year with fuel without Emission Control	Fraction of Year with alt fuel with Emission Control	Fraction of Year with alt fuel without Emission Control	Load Factor	HPMY	HC EF	(alt fuel) HC EF	Emission Control HC EF	(alt fuel) Emission Control HC EF	HC dr	HC DR (alt fuel)	FCF HC	FCF HC (alt fuel)	CO EF
1550	y	DOC	0	1	0.66667	0.333333	0.65	2501997	0.3200	0.3200	0.0960	0.0960	0.000006	0.000006	0.72	0.72	0.9200
5840	n		0	1			0.30	1201997	9.90E-01	9.90E-01	0.00E+00	0.00E+00	1.90E-05	1.90E-05	7.20E-01	7.20E-01	3.49E+00
70080	n		0	1			0.43	5001997	3.20E-01	3.20E-01	0.00E+00	0.00E+00	8.93E-07	8.93E-07	7.20E-01	7.20E-01	9.20E-01
70080	n		0	1			0.43	2501988	6.80E-01	6.80E-01	0.00E+00	0.00E+00	1.90E-06	1.90E-06	7.20E-01	7.20E-01	2.70E+00
70080	n		0	1			0.43	5001995	6.80E-01	6.80E-01	0.00E+00	0.00E+00	1.90E-06	1.90E-06	7.20E-01	7.20E-01	2.70E+00
70080	n		0	1			0.43	5001995	6.80E-01	6.80E-01	0.00E+00	0.00E+00	1.90E-06	1.90E-06	7.20E-01	7.20E-01	2.70E+00
70080	n		0	1			0.43	5001995	6.80E-01	6.80E-01	0.00E+00	0.00E+00	1.90E-06	1.90E-06	7.20E-01	7.20E-01	2.70E+00
70080	n		0	1			0.43	5001995	6.80E-01	6.80E-01	0.00E+00	0.00E+00	1.90E-06	1.90E-06	7.20E-01	7.20E-01	2.70E+00
70080	n		0	1			0.43	5002002	1.40E-01	1.40E-01	0.00E+00	0.00E+00	3.91E-07	3.91E-07	7.20E-01	7.20E-01	9.20E-01
70080	n		0	1			0.43	5002002	1.40E-01	1.40E-01	0.00E+00	0.00E+00	3.91E-07	3.91E-07	7.20E-01	7.20E-01	9.20E-01
70080	n		0	1			0.43	5002005	1.00E-01	1.00E-01	0.00E+00	0.00E+00	2.79E-07	2.79E-07	7.20E-01	7.20E-01	9.20E-01
61320	n		0	1			0.43	5002006	1.00E-01	1.00E-01	0.00E+00	0.00E+00	2.79E-07	2.79E-07	7.20E-01	7.20E-01	9.20E-01
1664	n		0	1			0.59	5001972	9.50E-01	9.50E-01	0.00E+00	0.00E+00	1.12E-04	1.12E-04	7.20E-01	7.20E-01	4.20E+00
17520	n		0	1			0.59	5001988	6.80E-01	6.80E-01	0.00E+00	0.00E+00	7.59E-06	7.59E-06	7.20E-01	7.20E-01	2.70E+00
17520	n		0	1			0.59	5001989	6.80E-01	6.80E-01	0.00E+00	0.00E+00	7.59E-06	7.59E-06	7.20E-01	7.20E-01	2.70E+00
17520	n		0	1			0.65	1751999	6.80E-01	6.80E-01	0.00E+00	0.00E+00	1.09E-05	1.09E-05	7.20E-01	7.20E-01	2.70E+00
70080	n		0	1			0.65	1752005	1.60E-01	1.60E-01	0.00E+00	0.00E+00	6.39E-07	6.39E-07	7.20E-01	7.20E-01	2.70E+00

(alt fuel) CO EF	Emission Control CO EF	(alt fuel) Emission Control CO EF	CO dr	CO dr (alt fuel)	FCF CO	NOX EF	(alt fuel) NOX EF	Emission Control NOX EF	(alt fuel) Emission Control NOX EF	NOX dr	NOX dr (alt fuel)	FCF NOX	FCF NOX (alt fuel)	PM EF	(alt fuel) PM EF	Emission Control PM EF	(alt fuel) Emission Control PM EF
0.9200	0.2760	0.2760	0.000009	0.000009	1.00	6.2500	6.2500	6.2500	6.2500	0.000053	0.000053	0.95	0.95	0.1500	0.1500	0.1050	0.1050
3.49E+00	0.00E+00	0.00E+00	3.82E-05	3.82E-05	1.00E+00	8.75E+00	8.75E+00	0.00E+00	0.00E+00	8.39E-05	8.39E-05	9.48E-01	9.48E-01	6.90E-01	0.6900	0.0000	0.0000
9.20E-01	0.00E+00	0.00E+00	1.46E-06	1.46E-06	1.00E+00	6.25E+00	6.25E+00	0.00E+00	0.00E+00	8.32E-06	8.32E-06	9.48E-01	9.48E-01	1.50E-01	0.1500	0.0000	0.0000
2.70E+00	0.00E+00	0.00E+00	4.28E-06	4.28E-06	1.00E+00	8.17E+00	8.17E+00	0.00E+00	0.00E+00	1.09E-05	1.09E-05	9.30E-01	9.30E-01	3.80E-01	0.3800	0.0000	0.0000
2.70E+00	0.00E+00	0.00E+00	4.28E-06	4.28E-06	1.00E+00	8.17E+00	8.17E+00	0.00E+00	0.00E+00	1.09E-05	1.09E-05	9.30E-01	9.30E-01	3.80E-01	0.3800	0.0000	0.0000
2.70E+00	0.00E+00	0.00E+00	4.28E-06	4.28E-06	1.00E+00	8.17E+00	8.17E+00	0.00E+00	0.00E+00	1.09E-05	1.09E-05	9.30E-01	9.30E-01	3.80E-01	0.3800	0.0000	0.0000
2.70E+00	0.00E+00	0.00E+00	4.28E-06	4.28E-06	1.00E+00	8.17E+00	8.17E+00	0.00E+00	0.00E+00	1.09E-05	1.09E-05	9.30E-01	9.30E-01	3.80E-01	0.3800	0.0000	0.0000
2.70E+00	0.00E+00	0.00E+00	4.28E-06	4.28E-06	1.00E+00	8.17E+00	8.17E+00	0.00E+00	0.00E+00	1.09E-05	1.09E-05	9.30E-01	9.30E-01	3.80E-01	0.3800	0.0000	0.0000
9.20E-01	0.00E+00	0.00E+00	1.46E-06	1.46E-06	1.00E+00	4.51E+00	4.51E+00	0.00E+00	0.00E+00	6.01E-06	6.01E-06	9.48E-01	9.48E-01	1.10E-01	0.1100	0.0000	0.0000
9.20E-01	0.00E+00	0.00E+00	1.46E-06	1.46E-06	1.00E+00	4.51E+00	4.51E+00	0.00E+00	0.00E+00	6.01E-06	6.01E-06	9.48E-01	9.48E-01	1.10E-01	0.1100	0.0000	0.0000
9.20E-01	0.00E+00	0.00E+00	1.46E-06	1.46E-06	1.00E+00	4.00E+00	4.00E+00	0.00E+00	0.00E+00	5.33E-06	5.33E-06	9.48E-01	9.48E-01	1.10E-01	0.1100	0.0000	0.0000
9.20E-01	0.00E+00	0.00E+00	1.46E-06	1.46E-06	1.00E+00	2.45E+00	2.45E+00	0.00E+00	0.00E+00	3.26E-06	3.26E-06	9.48E-01	9.48E-01	1.10E-01	0.1100	0.0000	0.0000
4.20E+00	0.00E+00	0.00E+00	2.80E-04	2.80E-04	1.00E+00	1.20E+01	1.20E+01	0.00E+00	0.00E+00	6.73E-04	6.73E-04	9.30E-01	9.30E-01	5.30E-01	0.5300	0.0000	0.0000
2.70E+00	0.00E+00	0.00E+00	1.71E-05	1.71E-05	1.00E+00	8.17E+00	8.17E+00	0.00E+00	0.00E+00	4.35E-05	4.35E-05	9.30E-01	9.30E-01	3.80E-01	0.3800	0.0000	0.0000
2.70E+00	0.00E+00	0.00E+00	1.71E-05	1.71E-05	1.00E+00	8.17E+00	8.17E+00	0.00E+00	0.00E+00	4.35E-05	4.35E-05	9.30E-01	9.30E-01	3.80E-01	0.3800	0.0000	0.0000
2.70E+00	0.00E+00	0.00E+00	2.47E-05	2.47E-05	1.00E+00	6.90E+00	6.90E+00	0.00E+00	0.00E+00	5.51E-05	5.51E-05	9.48E-01	9.48E-01	3.80E-01	0.3800	0.0000	0.0000
2.70E+00	0.00E+00	0.00E+00	6.16E-06	6.16E-06	1.00E+00	4.44E+00	4.44E+00	0.00E+00	0.00E+00	8.87E-06	8.87E-06	9.48E-01	9.48E-01	1.60E-01	0.1600	0.0000	0.0000

						Emissions (tons/year)								Emissions (tons/day)							
PM dr	PM dr (alt fuel)	FCF PM	FCF PM (alt fuel)	SOX EF	(alt fuel) SOX EF	TOG	ROG	CO	NOX	SOX	PM	PM10	PM2.5	TOG	ROG	CO	NOX	SOX	PM	PM10	PM2.5
0.000004	0.000004	0.82	0.82	5.97E-02	6.40E-03	2.79E-01	2.45E-01	5.95E-01	4.29E+00	1.69E-02	1.41E-01	1.41E-01	1.30E-01	7.64E-04	6.71E-04	1.63E-03	1.18E-02	4.62E-05	3.86E-04	3.86E-04	3.55E-04
0.000021	0.000021	0.82	0.82	6.23E-02	6.67E-03	2.58E-02	2.26E-02	8.07E-02	1.89E-01	1.28E-03	1.57E-02	1.57E-02	1.45E-02	7.06E-05	6.20E-05	2.21E-04	5.18E-04	3.50E-06	4.31E-05	4.31E-05	3.96E-05
0.000001	0.000001	0.82	0.82	5.21E-02	5.58E-03	5.74E-01	5.05E-01	1.40E+00	8.75E+00	6.49E-02	2.45E-01	2.45E-01	2.25E-01	1.57E-03	1.38E-03	3.83E-03	2.40E-02	1.78E-04	6.71E-04	6.71E-04	6.17E-04
0.000002	0.000002	0.75	0.75	5.97E-02	6.40E-03	1.18E+00	1.03E+00	3.77E+00	1.02E+01	6.20E-02	5.71E-01	5.71E-01	5.25E-01	3.23E-03	2.84E-03	1.03E-02	2.79E-02	1.70E-04	1.56E-03	1.56E-03	1.44E-03
0.000002	0.000002	0.75	0.75	5.21E-02	5.58E-03	1.26E+00	1.11E+00	4.20E+00	1.14E+01	6.49E-02	5.92E-01	5.92E-01	5.45E-01	3.46E-03	3.04E-03	1.15E-02	3.13E-02	1.78E-04	1.62E-03	1.62E-03	1.49E-03
0.000002	0.000002	0.75	0.75	5.21E-02	5.58E-03	1.26E+00	1.11E+00	4.20E+00	1.14E+01	6.49E-02	5.92E-01	5.92E-01	5.45E-01	3.46E-03	3.04E-03	1.15E-02	3.13E-02	1.78E-04	1.62E-03	1.62E-03	1.49E-03
0.000002	0.000002	0.75	0.75	5.21E-02	5.58E-03	1.26E+00	1.11E+00	4.20E+00	1.14E+01	6.49E-02	5.92E-01	5.92E-01	5.45E-01	3.46E-03	3.04E-03	1.15E-02	3.13E-02	1.78E-04	1.62E-03	1.62E-03	1.49E-03
0.000002	0.000002	0.75	0.75	5.21E-02	5.58E-03	1.26E+00	1.11E+00	4.20E+00	1.14E+01	6.49E-02	5.92E-01	5.92E-01	5.45E-01	3.46E-03	3.04E-03	1.15E-02	3.13E-02	1.78E-04	1.62E-03	1.62E-03	1.49E-03
0.000000	0.000000	0.82	0.82	5.21E-02	5.58E-03	2.29E-01	2.01E-01	1.32E+00	6.00E+00	6.49E-02	1.59E-01	1.59E-01	1.46E-01	6.28E-04	5.52E-04	3.62E-03	1.64E-02	1.78E-04	4.35E-04	4.35E-04	4.00E-04
0.000000	0.000000	0.82	0.82	5.21E-02	5.58E-03	2.29E-01	2.01E-01	1.32E+00	6.00E+00	6.49E-02	1.59E-01	1.59E-01	1.46E-01	6.28E-04	5.52E-04	3.62E-03	1.64E-02	1.78E-04	4.35E-04	4.35E-04	4.00E-04
0.000000	0.000000	0.82	0.82	5.21E-02	5.58E-03	1.80E-01	1.58E-01	1.48E+00	6.02E+00	7.57E-02	1.70E-01	1.70E-01	1.57E-01	4.93E-04	4.33E-04	4.07E-03	1.65E-02	2.07E-04	4.67E-04	4.67E-04	4.29E-04
0.000000	0.000000	0.82	0.82	5.21E-02	5.58E-03	1.51E-01	1.33E-01	1.26E+00	3.13E+00	6.49E-02	1.42E-01	1.42E-01	1.31E-01	4.14E-04	3.64E-04	3.44E-03	8.57E-03	1.78E-04	3.89E-04	3.89E-04	3.58E-04
0.000095	0.000095	0.75	0.75	5.97E-02	6.40E-03	8.93E-02	7.84E-02	2.98E-01	7.47E-01	2.71E-03	4.55E-02	4.55E-02	4.18E-02	2.45E-04	2.15E-04	8.18E-04	2.05E-03	7.41E-06	1.25E-04	1.25E-04	1.15E-04
0.000006	0.000006	0.75	0.75	5.97E-02	6.40E-03	5.66E-01	4.97E-01	1.81E+00	4.89E+00	2.98E-02	2.74E-01	2.74E-01	2.52E-01	1.55E-03	1.36E-03	4.96E-03	1.34E-02	8.15E-05	7.51E-04	7.51E-04	6.91E-04
0.000006	0.000006	0.75	0.75	5.97E-02	6.40E-03	5.57E-01	4.89E-01	1.79E+00	4.84E+00	2.98E-02	2.69E-01	2.69E-01	2.47E-01	1.53E-03	1.34E-03	4.91E-03	1.33E-02	8.15E-05	7.36E-04	7.36E-04	6.77E-04
0.000010	0.000010	0.82	0.82	5.97E-02	6.40E-03	3.71E+00	3.26E+00	1.22E+01	2.87E+01	2.11E-01	1.95E+00	1.95E+00	1.79E+00	1.02E-02	8.92E-03	3.34E-02	7.87E-02	5.77E-04	5.34E-03	5.34E-03	4.92E-03
0.000001	0.000001	0.82	0.82	5.97E-02	6.40E-03	1.34E+01	1.17E+01	1.97E+02	3.02E+02	3.76E+00	1.19E+01	1.19E+01	1.10E+01	3.66E-02	3.22E-02	5.40E-01	8.27E-01	1.03E-02	3.26E-02	3.26E-02	3.00E-02

Type	Useful Life (yr)	Load Factor
Crane	18	0.43
Excavator	16	0.57
Forklift	20	0.30
Material Handling Equip	18	0.59
Other General Industrial Equipment	16	0.51
Sweeper/Scrubber	16	0.68
Tractor/Loader/Backhoe	16	0.55
Yard Tractor offroad	8	0.65
Yard Tractor onroad	8	0.65
Other General Industrial Equipment onroad	16	0.51

Diesel and ULSD Fuel Correction Factor

t_fcf

	Calyr 1994 -2006		
Model Yr	**NOX**	**PM**	**HC**
1968	0.930	0.750	0.720
1969	0.930	0.750	0.720
1970	0.930	0.750	0.720
1971	0.930	0.750	0.720
1972	0.930	0.750	0.720
1973	0.930	0.750	0.720
1974	0.930	0.750	0.720
1975	0.930	0.750	0.720
1976	0.930	0.750	0.720
1977	0.930	0.750	0.720
1978	0.930	0.750	0.720
1979	0.930	0.750	0.720
1980	0.930	0.750	0.720
1981	0.930	0.750	0.720
1982	0.930	0.750	0.720
1983	0.930	0.750	0.720
1984	0.930	0.750	0.720
1985	0.930	0.750	0.720
1986	0.930	0.750	0.720
1987	0.930	0.750	0.720
1988	0.930	0.750	0.720
1989	0.930	0.750	0.720
1990	0.930	0.750	0.720
1991	0.930	0.750	0.720
1992	0.930	0.750	0.720
1993	0.930	0.750	0.720
1994	0.930	0.750	0.720
1995	0.930	0.750	0.720
1996	0.948	0.822	0.720
1997	0.948	0.822	0.720
1998	0.948	0.822	0.720
1999	0.948	0.822	0.720
2000	0.948	0.822	0.720
2001	0.948	0.822	0.720
2002	0.948	0.822	0.720
2003	0.948	0.822	0.720
2004	0.948	0.822	0.720
2005	0.948	0.822	0.720
2006	0.948	0.822	0.720
2007	0.948	0.822	0.720
2008	0.948	0.822	0.720
2009	0.948	0.822	0.720
2010	0.948	0.822	0.720
2011	0.948	0.822	0.720
2012	0.948	0.822	0.720
2013	0.948	0.822	0.720
2014	0.948	0.822	0.720
2015	0.948	0.822	0.720
2016	0.948	0.822	0.720
2017	0.948	0.822	0.720
2018	0.948	0.822	0.720

HP_dr diesel fuel

	Det. Rate			
HP	**HC**	**CO**	**NOx**	**PM**
50	51%	41%	6%	31%
120	28%	16%	14%	44%
175	28%	16%	14%	44%
250	44%	25%	21%	67%
500	44%	25%	21%	67%

Gasoline Fuel Correction Factor

	Calyr 1996+		
Model Yr	NOX	CO	HC
1968	1.025	0.848	0.921
1969	1.025	0.848	0.921
1970	1.025	0.848	0.921
1971	1.025	0.848	0.921
1972	1.025	0.848	0.921
1973	1.025	0.848	0.921
1974	1.025	0.848	0.921
1975	1.025	0.848	0.921
1976	1.025	0.848	0.921
1977	1.025	0.848	0.921
1978	1.025	0.848	0.921
1979	1.025	0.848	0.921
1980	1.025	0.848	0.921
1981	1.025	0.848	0.921
1982	1.025	0.848	0.921
1983	1.025	0.848	0.921
1984	1.025	0.848	0.921
1985	1.025	0.848	0.921
1986	1.025	0.848	0.921
1987	1.025	0.848	0.921
1988	1.025	0.848	0.921
1989	1.025	0.848	0.921
1990	1.025	0.848	0.921
1991	1.025	0.848	0.921
1992	1.025	0.848	0.921
1993	1.025	0.848	0.921
1994	1.025	0.848	0.921
1995	1.025	0.848	0.921
1996	1.000	1.000	1.000
1997	1.000	1.000	1.000
1998	1.000	1.000	1.000
1999	1.000	1.000	1.000
2000	1.000	1.000	1.000
2001	1.000	1.000	1.000
2002	1.000	1.000	1.000
2003	1.000	1.000	1.000
2004	1.000	1.000	1.000
2005	1.000	1.000	1.000

Engine changes	**Emission Changes %**			
	HC	**CO**	**NOx**	**PM**
DOC	0.70	0.70	0.00	0.30
DPF (P)	0.90	0.90	0.00	0.85
DPF (A)	0.00	0.00	0.00	0.85
Emulsified Fuel	-0.23	-0.10	0.15	0.30
DOC+emulsified fuel	0.63	0.67	0.20	0.50
DOC + PurinNOx	0.63	0.67	0.20	0.50
O2 Diesel	-0.75	0.10	0.02	0.20
DOC + O2Diesel	0.48	0.73	0.02	0.44

Equipment Types	**Code**
Crane	**1**
Excavator	**2**
Forklift	**3**
Material Handling Equip	**4**
Other General Industrial Equipment	**5**
Sweeper/Scrubbers	**6**
Tractor/Loader/Backhoe	**7**
Yard Tractor offroad	**8**
Yard Tractor onroad	**9**
Other General Industrial Equipment onroad	**10**

***New Tier4 emfacs included with 43/57% split for 120 hp merged (diesel only)**

units = g/bhp hr

Lookup	Hp	Year	HC	CO	NOX	PM
251968	25	1968	1.84	5	6.92	0.764
251969	25	1969	1.84	5	6.92	0.764
251970	25	1970	1.84	5	6.92	0.764
251971	25	1971	1.84	5	6.92	0.764
251972	25	1972	1.84	5	6.92	0.764
251973	25	1973	1.84	5	6.92	0.764
251974	25	1974	1.84	5	6.92	0.764
251975	25	1975	1.84	5	6.92	0.764
251976	25	1976	1.84	5	6.92	0.764
251977	25	1977	1.84	5	6.92	0.764
251978	25	1978	1.84	5	6.92	0.764
251979	25	1979	1.84	5	6.92	0.764
251980	25	1980	1.84	5	6.92	0.764
251981	25	1981	1.84	5	6.92	0.764
251982	25	1982	1.84	5	6.92	0.764
251983	25	1983	1.84	5	6.92	0.764
251984	25	1984	1.84	5	6.92	0.764
251985	25	1985	1.84	5	6.92	0.764
251986	25	1986	1.84	5	6.92	0.764
251987	25	1987	1.84	5	6.92	0.764
251988	25	1988	1.84	5	6.92	0.764
251989	25	1989	1.84	5	6.92	0.764
251990	25	1990	1.84	5	6.92	0.764
251991	25	1991	1.84	5	6.92	0.764
251992	25	1992	1.84	5	6.92	0.764
251993	25	1993	1.84	5	6.92	0.764
251994	25	1994	1.84	5	6.92	0.764
251995	25	1995	1.63	1.4	3.89	0.417
251996	25	1996	1.63	1.4	3.89	0.417
251997	25	1997	1.63	1.4	3.89	0.417
251998	25	1998	1.63	1.4	3.89	0.417
251999	25	1999	0.52	0.5	1.24	0.116
252000	25	2000	0.52	0.5	1.24	0.116
252001	25	2001	0.52	0.5	1.24	0.116
252002	25	2002	0.52	0.5	1.24	0.116
252003	25	2003	0.52	0.5	1.24	0.116
252004	25	2004	0.52	0.5	1.24	0.116
252005	25	2005	0.52	0.5	1.24	0.116
252006	25	2006	0.52	0.5	1.24	0.116
252007	25	2007	0.52	0.5	1.24	0.116
252008	25	2008	0.52	0.5	1.24	0.116
252009	25	2009	0.52	0.5	1.24	0.116
252010	25	2010	0.52	0.5	1.24	0.116
252011	25	2011	0.52	0.5	1.24	0.116
252012	25	2012	0.52	0.5	1.24	0.116
252013	25	2013	0.52	0.5	1.24	0.116
252014	25	2014	0.52	0.5	1.24	0.116
252015	25	2015	0.52	0.5	1.24	0.116
252016	25	2016	0.52	0.5	1.24	0.116
252017	25	2017	0.52	0.5	1.24	0.116
252018	25	2018	0.52	0.5	1.24	0.116
252019	25	2019	0.52	0.5	1.24	0.116
252020	25	2020	0.52	0.5	1.24	0.116
252021	25	2021	0.52	0.5	1.24	0.116
252022	25	2022	0.52	0.5	1.24	0.116

Lookup	Hp	Year	HC	CO	NOX	PM
252023	25	2023	0.52	0.5	1.24	0.116
252024	25	2024	0.52	0.5	1.24	0.116
252025	25	2025	0.52	0.5	1.24	0.116
252026	25	2026	0.52	0.5	1.24	0.116
501969	50	1969	1.84	5	7	0.76
501969	50	1969	1.84	5	7	0.76
501970	50	1970	1.84	5	7	0.76
501971	50	1971	1.84	5	7	0.76
501972	50	1972	1.84	5	7	0.76
501973	50	1973	1.84	5	7	0.76
501974	50	1974	1.84	5	7	0.76
501975	50	1975	1.84	5	7	0.76
501976	50	1976	1.84	5	7	0.76
501977	50	1977	1.84	5	7	0.76
501978	50	1978	1.84	5	7	0.76
501979	50	1979	1.84	5	7	0.76
501980	50	1980	1.84	5	7	0.76
501981	50	1981	1.84	5	7	0.76
501982	50	1982	1.84	5	7	0.76
501983	50	1983	1.84	5	7	0.76
501984	50	1984	1.84	5	7	0.76
501985	50	1985	1.84	5	7	0.76
501986	50	1986	1.84	5	7	0.76
501987	50	1987	1.84	5	7	0.76
501988	50	1988	1.8	5	6.9	0.76
501989	50	1989	1.8	5	6.9	0.76
501990	50	1990	1.8	5	6.9	0.76
501991	50	1991	1.8	5	6.9	0.76
501992	50	1992	1.8	5	6.9	0.76
501993	50	1993	1.8	5	6.9	0.76
501994	50	1994	1.8	5	6.9	0.76
501995	50	1995	1.8	5	6.9	0.76
501996	50	1996	1.8	5	6.9	0.76
501997	50	1997	1.8	5	6.9	0.76
501998	50	1998	1.8	5	6.9	0.76
501999	50	1999	1.45	4.1	5.55	0.6
502000	50	2000	1.45	4.1	5.55	0.6
502001	50	2001	1.45	4.1	5.55	0.6
502002	50	2002	1.45	4.1	5.55	0.6
502003	50	2003	1.45	4.1	5.55	0.6
502004	50	2004	0.64	3.27	5.1	0.43
502005	50	2005	0.37	3	4.95	0.38
502006	50	2006	0.24	2.86	4.88	0.35
502007	50	2007	0.24	2.86	4.88	0.35
502008	50	2008	0.1	2.72	4.8	0.16
502009	50	2009	0.1	2.72	4.8	0.16
502010	50	2010	0.1	2.72	4.8	0.16
502011	50	2011	0.1	2.72	4.8	0.16
502012	50	2012	0.1	2.72	4.8	0.16
502013	50	2013	0.1	2.72	2.9	0.01
502014	50	2014	0.1	2.72	2.9	0.01
502015	50	2015	0.1	2.72	2.9	0.01
502016	50	2016	0.1	2.72	2.9	0.01
502017	50	2017	0.1	2.72	2.9	0.01
502018	50	2018	0.1	2.72	2.9	0.01
502019	50	2019	0.1	2.72	2.9	0.01
502020	50	2020	0.1	2.72	2.9	0.01
502021	50	2021	0.1	2.72	2.9	0.01

Lookup	Hp	Year	HC	CO	NOX	PM
502022	50	2022	0.1	2.72	2.9	0.01
502023	50	2023	0.1	2.72	2.9	0.01
502024	50	2024	0.1	2.72	2.9	0.01
502025	50	2025	0.1	2.72	2.9	0.01
502026	50	2026	0.1	2.72	2.9	0.01
1201968	120	1968	1.44	4.8	13	0.84
1201969	120	1969	1.44	4.8	13	0.84
1201970	120	1970	1.44	4.8	13	0.84
1201971	120	1971	1.44	4.8	13	0.84
1201972	120	1972	1.44	4.8	13	0.84
1201973	120	1973	1.44	4.8	13	0.84
1201974	120	1974	1.44	4.8	13	0.84
1201975	120	1975	1.44	4.8	13	0.84
1201976	120	1976	1.44	4.8	13	0.84
1201977	120	1977	1.44	4.8	13	0.84
1201978	120	1978	1.44	4.8	13	0.84
1201979	120	1979	1.44	4.8	13	0.84
1201980	120	1980	1.44	4.8	13	0.84
1201981	120	1981	1.44	4.8	13	0.84
1201982	120	1982	1.44	4.8	13	0.84
1201983	120	1983	1.44	4.8	13	0.84
1201984	120	1984	1.44	4.8	13	0.84
1201985	120	1985	1.44	4.8	13	0.84
1201986	120	1986	1.44	4.8	13	0.84
1201987	120	1987	1.44	4.8	13	0.84
1201988	120	1988	0.99	3.49	8.75	0.69
1201989	120	1989	0.99	3.49	8.75	0.69
1201990	120	1990	0.99	3.49	8.75	0.69
1201991	120	1991	0.99	3.49	8.75	0.69
1201992	120	1992	0.99	3.49	8.75	0.69
1201993	120	1993	0.99	3.49	8.75	0.69
1201994	120	1994	0.99	3.49	8.75	0.69
1201995	120	1995	0.99	3.49	8.75	0.69
1201996	120	1996	0.99	3.49	8.75	0.69
1201997	120	1997	0.99	3.49	8.75	0.69
1201998	120	1998	0.99	3.49	6.9	0.69
1201999	120	1999	0.99	3.49	6.9	0.69
1202000	120	2000	0.99	3.49	6.9	0.69
1202001	120	2001	0.99	3.49	6.9	0.69
1202002	120	2002	0.99	3.49	6.9	0.69
1202003	120	2003	0.99	3.49	6.9	0.69
1202004	120	2004	0.46	3.23	5.64	0.39
1202005	120	2005	0.28	3.14	5.22	0.29
1202006	120	2006	0.19	3.09	5.01	0.24
1202007	120	2007	0.19	3.09	5.01	0.24
1202008	120	2008	0.1	3.05	2.89	0.197
1202009	120	2009	0.1	3.05	2.89	0.197
1202010	120	2010	0.1	3.05	2.89	0.197
1202011	120	2011	0.1	3.05	2.89	0.197
1202012	120	2012	0.0943	3.05	2.5309	0.0659
1202013	120	2013	0.0943	3.05	2.5309	0.01
1202014	120	2014	0.0943	3.05	2.5309	0.01
1202015	120	2015	0.0715	3.05	1.3966	0.01
1202016	120	2016	0.0715	3.05	1.3966	0.01
1202017	120	2017	0.0715	3.05	1.3966	0.01
1202018	120	2018	0.0715	3.05	1.3966	0.01
1202019	120	2019	0.0715	3.05	1.3966	0.01
1202020	120	2020	0.0715	3.05	1.3966	0.01

Lookup	Hp	Year	HC	CO	NOX	PM
1202021	120	2021	0.0715	3.05	1.3966	0.01
1202022	120	2022	0.0715	3.05	1.3966	0.01
1202023	120	2023	0.0715	3.05	1.3966	0.01
1202024	120	2024	0.0715	3.05	1.3966	0.01
1202025	120	2025	0.0715	3.05	1.3966	0.01
1202026	120	2026	0.0715	3.05	1.3966	0.01
1751968	175	1968	1.32	4.4	14	0.77
1751969	175	1969	1.32	4.4	14	0.77
1751970	175	1970	1.1	4.4	13	0.66
1751971	175	1971	1.1	4.4	13	0.66
1751972	175	1972	1	4.4	12	0.55
1751973	175	1973	1	4.4	12	0.55
1751974	175	1974	1	4.4	12	0.55
1751975	175	1975	1	4.4	12	0.55
1751976	175	1976	1	4.4	12	0.55
1751977	175	1977	1	4.4	12	0.55
1751978	175	1978	1	4.4	12	0.55
1751979	175	1979	1	4.4	12	0.55
1751980	175	1980	0.94	4.3	11	0.55
1751981	175	1981	0.94	4.3	11	0.55
1751982	175	1982	0.94	4.3	11	0.55
1751983	175	1983	0.94	4.3	11	0.55
1751984	175	1984	0.94	4.3	11	0.55
1751985	175	1985	0.88	4.2	11	0.55
1751986	175	1986	0.88	4.2	11	0.55
1751987	175	1987	0.88	4.2	11	0.55
1751988	175	1988	0.68	2.7	8.17	0.38
1751989	175	1989	0.68	2.7	8.17	0.38
1751990	175	1990	0.68	2.7	8.17	0.38
1751991	175	1991	0.68	2.7	8.17	0.38
1751992	175	1992	0.68	2.7	8.17	0.38
1751993	175	1993	0.68	2.7	8.17	0.38
1751994	175	1994	0.68	2.7	8.17	0.38
1751995	175	1995	0.68	2.7	8.17	0.38
1751996	175	1996	0.68	2.7	8.17	0.38
1751997	175	1997	0.68	2.7	6.9	0.38
1751998	175	1998	0.68	2.7	6.9	0.38
1751999	175	1999	0.68	2.7	6.9	0.38
1752000	175	2000	0.68	2.7	6.9	0.38
1752001	175	2001	0.68	2.7	6.9	0.38
1752002	175	2002	0.68	2.7	6.9	0.38
1752003	175	2003	0.33	2.7	5.26	0.24
1752004	175	2004	0.22	2.7	4.72	0.19
1752005	175	2005	0.16	2.7	4.44	0.16
1752006	175	2006	0.16	2.7	4.44	0.16
1752007	175	2007	0.1	2.7	2.45	0.14
1752008	175	2008	0.1	2.7	2.45	0.14
1752009	175	2009	0.1	2.7	2.45	0.14
1752010	175	2010	0.1	2.7	2.45	0.14
1752011	175	2011	0.1	2.7	2.45	0.14
1752012	175	2012	0.09	2.7	2.27	0.01
1752013	175	2013	0.09	2.7	2.27	0.01
1752014	175	2014	0.09	2.7	2.27	0.01
1752015	175	2015	0.05	2.7	0.27	0.01
1752016	175	2016	0.05	2.7	0.27	0.01
1752017	175	2017	0.05	2.7	0.27	0.01
1752018	175	2018	0.05	2.7	0.27	0.01
1752019	175	2019	0.05	2.7	0.27	0.01

Lookup	Hp	Year	HC	CO	NOX	PM
1752020	175	2020	0.05	2.7	0.27	0.01
1752021	175	2021	0.05	2.7	0.27	0.01
1752022	175	2022	0.05	2.7	0.27	0.01
1752023	175	2023	0.05	2.7	0.27	0.01
1752024	175	2024	0.05	2.7	0.27	0.01
1752025	175	2025	0.05	2.7	0.27	0.01
1752026	175	2026	0.05	2.7	0.27	0.01
2501968	250	1968	1.32	4.4	14	0.77
2501969	250	1969	1.32	4.4	14	0.77
2501970	250	1970	1.1	4.4	13	0.66
2501971	250	1971	1.1	4.4	13	0.66
2501972	250	1972	1	4.4	12	0.55
2501973	250	1973	1	4.4	12	0.55
2501974	250	1974	1	4.4	12	0.55
2501975	250	1975	1	4.4	12	0.55
2501976	250	1976	1	4.4	12	0.55
2501977	250	1977	1	4.4	12	0.55
2501978	250	1978	1	4.4	12	0.55
2501979	250	1979	1	4.4	12	0.55
2501980	250	1980	0.94	4.3	11	0.55
2501981	250	1981	0.94	4.3	11	0.55
2501982	250	1982	0.94	4.3	11	0.55
2501983	250	1983	0.94	4.3	11	0.55
2501984	250	1984	0.94	4.3	11	0.55
2501985	250	1985	0.88	4.2	11	0.55
2501986	250	1986	0.88	4.2	11	0.55
2501987	250	1987	0.88	4.2	11	0.55
2501988	250	1988	0.68	2.7	8.17	0.38
2501989	250	1989	0.68	2.7	8.17	0.38
2501990	250	1990	0.68	2.7	8.17	0.38
2501991	250	1991	0.68	2.7	8.17	0.38
2501992	250	1992	0.68	2.7	8.17	0.38
2501993	250	1993	0.68	2.7	8.17	0.38
2501994	250	1994	0.68	2.7	8.17	0.38
2501995	250	1995	0.68	2.7	8.17	0.38
2501996	250	1996	0.32	0.92	6.25	0.15
2501997	250	1997	0.32	0.92	6.25	0.15
2501998	250	1998	0.32	0.92	6.25	0.15
2501999	250	1999	0.32	0.92	6.25	0.15
2502000	250	2000	0.32	0.92	6.25	0.15
2502001	250	2001	0.32	0.92	6.25	0.15
2502002	250	2002	0.32	0.92	6.25	0.15
2502003	250	2003	0.19	0.92	5	0.12
2502004	250	2004	0.14	0.92	4.58	0.11
2502005	250	2005	0.12	0.92	4.38	0.11
2502006	250	2006	0.12	0.92	4.38	0.11
2502007	250	2007	0.1	0.92	2.45	0.11
2502008	250	2008	0.1	0.92	2.45	0.11
2502009	250	2009	0.1	0.92	2.45	0.11
2502010	250	2010	0.1	0.92	2.45	0.11
2502011	250	2011	0.07	0.92	1.36	0.01
2502012	250	2012	0.07	0.92	1.36	0.01
2502013	250	2013	0.07	0.92	1.36	0.01
2502014	250	2014	0.05	0.92	0.27	0.01
2502015	250	2015	0.05	0.92	0.27	0.01
2502016	250	2016	0.05	0.92	0.27	0.01
2502017	250	2017	0.05	0.92	0.27	0.01
2502018	250	2018	0.05	0.92	0.27	0.01

Lookup	Hp	Year	HC	CO	NOX	PM
2502019	250	2019	0.05	0.92	0.27	0.01
2502020	250	2020	0.05	0.92	0.27	0.01
2502021	250	2021	0.05	0.92	0.27	0.01
2502022	250	2022	0.05	0.92	0.27	0.01
2502023	250	2023	0.05	0.92	0.27	0.01
2502024	250	2024	0.05	0.92	0.27	0.01
2502025	250	2025	0.05	0.92	0.27	0.01
2502026	250	2026	0.05	0.92	0.27	0.01
5001968	500	1968	1.26	4.2	14	0.74
5001969	500	1969	1.26	4.2	14	0.74
5001970	500	1970	1.05	4.2	13	0.63
5001971	500	1971	1.05	4.2	13	0.63
5001972	500	1972	0.95	4.2	12	0.53
5001973	500	1973	0.95	4.2	12	0.53
5001974	500	1974	0.95	4.2	12	0.53
5001975	500	1975	0.95	4.2	12	0.53
5001976	500	1976	0.95	4.2	12	0.53
5001977	500	1977	0.95	4.2	12	0.53
5001978	500	1978	0.95	4.2	12	0.53
5001979	500	1979	0.95	4.2	12	0.53
5001980	500	1980	0.9	4.2	11	0.53
5001981	500	1981	0.9	4.2	11	0.53
5001982	500	1982	0.9	4.2	11	0.53
5001983	500	1983	0.9	4.2	11	0.53
5001984	500	1984	0.9	4.2	11	0.53
5001985	500	1985	0.84	4.1	11	0.53
5001986	500	1986	0.84	4.1	11	0.53
5001987	500	1987	0.84	4.1	11	0.53
5001988	500	1988	0.68	2.7	8.17	0.38
5001989	500	1989	0.68	2.7	8.17	0.38
5001990	500	1990	0.68	2.7	8.17	0.38
5001991	500	1991	0.68	2.7	8.17	0.38
5001992	500	1992	0.68	2.7	8.17	0.38
5001993	500	1993	0.68	2.7	8.17	0.38
5001994	500	1994	0.68	2.7	8.17	0.38
5001995	500	1995	0.68	2.7	8.17	0.38
5001996	500	1996	0.32	0.92	6.25	0.15
5001997	500	1997	0.32	0.92	6.25	0.15
5001998	500	1998	0.32	0.92	6.25	0.15
5001999	500	1999	0.32	0.92	6.25	0.15
5002000	500	2000	0.32	0.92	6.25	0.15
5002001	500	2001	0.19	0.92	4.95	0.12
5002002	500	2002	0.14	0.92	4.51	0.11
5002003	500	2003	0.12	0.92	4.29	0.11
5002004	500	2004	0.12	0.92	4.29	0.11
5002005	500	2005	0.1	0.92	4	0.11
5002006	500	2006	0.1	0.92	2.45	0.11
5002007	500	2007	0.1	0.92	2.45	0.11
5002008	500	2008	0.1	0.92	2.45	0.11
5002009	500	2009	0.1	0.92	2.45	0.11
5002010	500	2010	0.1	0.92	2.45	0.11
5002011	500	2011	0.07	0.92	1.36	0.01
5002012	500	2012	0.07	0.92	1.36	0.01
5002013	500	2013	0.07	0.92	1.36	0.01
5002014	500	2014	0.05	0.92	0.27	0.01
5002015	500	2015	0.05	0.92	0.27	0.01
5002016	500	2016	0.05	0.92	0.27	0.01
5002017	500	2017	0.05	0.92	0.27	0.01

Lookup	Hp	Year	HC	CO	NOX	PM
5002018	500	2018	0.05	0.92	0.27	0.01
5002019	500	2019	0.05	0.92	0.27	0.01
5002020	500	2020	0.05	0.92	0.27	0.01
5002021	500	2021	0.05	0.92	0.27	0.01
5002022	500	2022	0.05	0.92	0.27	0.01
5002023	500	2023	0.05	0.92	0.27	0.01
5002024	500	2024	0.05	0.92	0.27	0.01
5002025	500	2025	0.05	0.92	0.27	0.01
5002026	500	2026	0.05	0.92	0.27	0.01
7501968	750	1968	1.26	4.2	14	0.74
7501969	750	1969	1.26	4.2	14	0.74
7501970	750	1970	1.05	4.2	13	0.63
7501971	750	1971	1.05	4.2	13	0.63
7501972	750	1972	0.95	4.2	12	0.53
7501973	750	1973	0.95	4.2	12	0.53
7501974	750	1974	0.95	4.2	12	0.53
7501975	750	1975	0.95	4.2	12	0.53
7501976	750	1976	0.95	4.2	12	0.53
7501977	750	1977	0.95	4.2	12	0.53
7501978	750	1978	0.95	4.2	12	0.53
7501979	750	1979	0.95	4.2	12	0.53
7501980	750	1980	0.9	4.2	11	0.53
7501981	750	1981	0.9	4.2	11	0.53
7501982	750	1982	0.9	4.2	11	0.53
7501983	750	1983	0.9	4.2	11	0.53
7501984	750	1984	0.9	4.2	11	0.53
7501985	750	1985	0.84	4.1	11	0.53
7501986	750	1986	0.84	4.1	11	0.53
7501987	750	1987	0.84	4.1	11	0.53
7501988	750	1988	0.68	2.7	8.17	0.38
7501989	750	1989	0.68	2.7	8.17	0.38
7501990	750	1990	0.68	2.7	8.17	0.38
7501991	750	1991	0.68	2.7	8.17	0.38
7501992	750	1992	0.68	2.7	8.17	0.38
7501993	750	1993	0.68	2.7	8.17	0.38
7501994	750	1994	0.68	2.7	8.17	0.38
7501995	750	1995	0.68	2.7	8.17	0.38
7501996	750	1996	0.32	0.92	6.25	0.15
7501997	750	1997	0.32	0.92	6.25	0.15
7501998	750	1998	0.32	0.92	6.25	0.15
7501999	750	1999	0.32	0.92	6.25	0.15
7502000	750	2000	0.32	0.92	6.25	0.15
7502001	750	2001	0.32	0.92	6.25	0.15
7502002	750	2002	0.19	0.92	4.95	0.12
7502003	750	2003	0.14	0.92	4.51	0.11
7502004	750	2004	0.12	0.92	4.29	0.11
7502005	750	2005	0.12	0.92	4.29	0.11
7502006	750	2006	0.1	0.92	2.45	0.11
7502007	750	2007	0.1	0.92	2.45	0.11
7502008	750	2008	0.1	0.92	2.45	0.11
7502009	750	2009	0.1	0.92	2.45	0.11
7502010	750	2010	0.1	0.92	2.45	0.11
7502011	750	2011	0.07	0.92	1.36	0.01
7502012	750	2012	0.07	0.92	1.36	0.01
7502013	750	2013	0.07	0.92	1.36	0.01
7502014	750	2014	0.05	0.92	0.27	0.01
7502015	750	2015	0.05	0.92	0.27	0.01
7502016	750	2016	0.05	0.92	0.27	0.01

Lookup	Hp	Year	HC	CO	NOX	PM
7502017	750	2017	0.05	0.92	0.27	0.01
7502018	750	2018	0.05	0.92	0.27	0.01
7502019	750	2019	0.05	0.92	0.27	0.01
7502020	750	2020	0.05	0.92	0.27	0.01
7502021	750	2021	0.05	0.92	0.27	0.01
7502022	750	2022	0.05	0.92	0.27	0.01
7502023	750	2023	0.05	0.92	0.27	0.01
7502024	750	2024	0.05	0.92	0.27	0.01
7502025	750	2025	0.05	0.92	0.27	0.01
7502026	750	2026	0.05	0.92	0.27	0.01
9991968	999	1968	1.26	4.2	14	0.74
9991969	999	1969	1.26	4.2	14	0.74
9991970	999	1970	1.05	4.2	13	0.63
9991971	999	1971	1.05	4.2	13	0.63
9991972	999	1972	0.95	4.2	12	0.53
9991973	999	1973	0.95	4.2	12	0.53
9991974	999	1974	0.95	4.2	12	0.53
9991975	999	1975	0.95	4.2	12	0.53
9991976	999	1976	0.95	4.2	12	0.53
9991977	999	1977	0.95	4.2	12	0.53
9991978	999	1978	0.95	4.2	12	0.53
9991979	999	1979	0.95	4.2	12	0.53
9991980	999	1980	0.9	4.2	11	0.53
9991981	999	1981	0.9	4.2	11	0.53
9991982	999	1982	0.9	4.2	11	0.53
9991983	999	1983	0.9	4.2	11	0.53
9991984	999	1984	0.9	4.2	11	0.53
9991985	999	1985	0.84	4.1	11	0.53
9991986	999	1986	0.84	4.1	11	0.53
9991987	999	1987	0.84	4.1	11	0.53
9991988	999	1988	0.68	2.7	8.17	0.38
9991989	999	1989	0.68	2.7	8.17	0.38
9991990	999	1990	0.68	2.7	8.17	0.38
9991991	999	1991	0.68	2.7	8.17	0.38
9991992	999	1992	0.68	2.7	8.17	0.38
9991993	999	1993	0.68	2.7	8.17	0.38
9991994	999	1994	0.68	2.7	8.17	0.38
9991995	999	1995	0.68	2.7	8.17	0.38
9991996	999	1996	0.68	2.7	8.17	0.38
9991997	999	1997	0.68	2.7	8.17	0.38
9991998	999	1998	0.68	2.7	8.17	0.38
9991999	999	1999	0.68	2.7	8.17	0.38
9992000	999	2000	0.32	0.92	6.25	0.15
9992001	999	2001	0.32	0.92	6.25	0.15
9992002	999	2002	0.32	0.92	6.25	0.15
9992003	999	2003	0.32	0.92	6.25	0.15
9992004	999	2004	0.32	0.92	6.25	0.15
9992005	999	2005	0.32	0.92	6.25	0.15
9992006	999	2006	0.19	0.92	4.95	0.12
9992007	999	2007	0.14	0.92	4.51	0.11
9992008	999	2008	0.12	0.92	4.29	0.11
9992009	999	2009	0.12	0.92	4.29	0.11
9992010	999	2010	0.1	0.92	4.08	0.11
9992011	999	2011	0.1	0.92	2.36	0.06
9992012	999	2012	0.1	0.92	2.36	0.06
9992013	999	2013	0.1	0.92	2.36	0.06
9992014	999	2014	0.1	0.92	2.36	0.06
9992015	999	2015	0.05	0.92	2.36	0.02

Lookup	Hp	Year	HC	CO	NOX	PM
9992016	999	2016	0.05	0.92	2.36	0.02
9992017	999	2017	0.05	0.92	2.36	0.02
9992018	999	2018	0.05	0.92	2.36	0.02
9992019	999	2019	0.05	0.92	2.36	0.02
9992020	999	2020	0.05	0.92	2.36	0.02
9992021	999	2021	0.05	0.92	2.36	0.02
9992022	999	2022	0.05	0.92	2.36	0.02
9992023	999	2023	0.05	0.92	2.36	0.02
9992024	999	2024	0.05	0.92	2.36	0.02
9992025	999	2025	0.05	0.92	2.36	0.02
9992026	999	2026	0.05	0.92	2.36	0.02

units = g/bhp hr

Lookup	Hp	Year	HC	HC DR	CO	CO DR	NOX	NOX DR	PM	PM DR	fuel/engine type
151994	15	1994	3.96	4.20E-03	240	1.44E-02	1.77	4.48E-04	0.09	9.54E-05	C4
151998	15	1998	1.56	4.20E-03	300	1.44E-02	8.44	4.48E-04	0.9	9.54E-05	C4
152040	15	2040	0.5	4.20E-03	100	1.44E-02	2.7	4.48E-04	0.25	9.54E-05	C4
251994	25	1994	3.96	4.12E-03	240	1.42E-02	1.77	4.41E-04	0.09	9.37E-05	C4
251998	25	1998	1.56	4.12E-03	300	1.42E-02	8.44	4.41E-04	0.9	9.37E-05	C4
252040	25	2040	0.5	4.12E-03	100	1.42E-02	2.7	4.41E-04	0.25	9.37E-05	C4
501983	50	1983	1.38	1.51E-04	7.02	4.75E-04	13	6.62E-05	0.06	0.00E+00	C4
502000	50	2000	1.38	1.51E-04	7.02	4.75E-04	13	6.62E-05	0.06	0.00E+00	C4
502001	50	2001	1.16	1.59E-04	7.02	4.75E-04	10.4	1.56E-04	0.06	0.00E+00	C4
502002	50	2002	0.93	1.66E-04	7.02	4.75E-04	7.79	2.45E-04	0.06	0.00E+00	C4
502003	50	2003	0.71	1.74E-04	7.02	4.75E-04	5.19	3.35E-04	0.06	0.00E+00	C4
502006	50	2006	0.14	1.06E-04	7.02	4.75E-04	1.95	2.76E-04	0.06	0.00E+00	C4
502040	50	2040	0.14	7.24E-05	7.02	4.75E-04	1.95	1.10E-04	0.06	0.00E+00	C4
1201983	120	1983	1.55	1.69E-04	19.72	1.34E-03	10.53	5.33E-05	0.06	0.00E+00	C4
1202000	120	2000	1.55	1.69E-04	19.72	1.34E-03	10.53	5.33E-05	0.06	0.00E+00	C4
1202001	120	2001	1.28	1.72E-04	19.72	1.34E-03	8.54	1.46E-04	0.06	0.00E+00	C4
1202002	120	2002	1.02	1.75E-04	19.72	1.34E-03	6.56	2.39E-04	0.06	0.00E+00	C4
1202003	120	2003	0.75	1.78E-04	19.72	1.34E-03	4.57	3.31E-04	0.06	0.00E+00	C4
1202006	120	2006	0.16	1.03E-04	19.72	1.34E-03	1.58	3.50E-04	0.06	0.00E+00	C4
1202040	120	2040	0.16	6.90E-05	19.72	1.34E-03	1.58	1.84E-04	0.06	0.00E+00	C4
1751983	175	1983	1.38	3.53E-05	16.47	8.62E-04	10.51	1.04E-04	0.06	0.00E+00	C4
1752000	175	2000	1.38	3.53E-05	16.47	8.62E-04	10.51	1.04E-04	0.06	0.00E+00	C4
1752001	175	2001	1.16	3.55E-05	16.47	8.62E-04	8.53	9.08E-05	0.06	0.00E+00	C4
1752002	175	2002	0.94	3.57E-05	16.47	8.62E-04	6.54	7.77E-05	0.06	0.00E+00	C4
1752003	175	2003	0.71	3.58E-05	16.47	8.62E-04	4.56	6.45E-05	0.06	0.00E+00	C4
1752006	175	2006	0.14	1.06E-04	16.47	8.62E-04	1.58	2.64E-04	0.06	0.00E+00	C4
1752040	175	2040	0.14	3.60E-05	16.47	8.62E-04	1.58	5.13E-05	0.06	0.00E+00	C4
2501983	250	1983	1.38	3.53E-05	16.47	8.62E-04	10.51	1.04E-04	0.06	0.00E+00	C4
2502000	250	2000	1.38	3.53E-05	16.47	8.62E-04	10.51	1.04E-04	0.06	0.00E+00	C4
2502001	250	2001	1.16	3.55E-05	16.47	8.62E-04	8.53	9.08E-05	0.06	0.00E+00	C4
2502002	250	2002	0.94	3.57E-05	16.47	8.62E-04	6.54	7.77E-05	0.06	0.00E+00	C4
2502003	250	2003	0.71	3.58E-05	16.47	8.62E-04	4.56	6.45E-05	0.06	0.00E+00	C4
2502006	250	2006	0.14	1.06E-04	16.47	8.62E-04	1.58	2.64E-04	0.06	0.00E+00	C4
2502040	250	2040	0.14	3.60E-05	16.47	8.62E-04	1.58	5.13E-05	0.06	0.00E+00	C4
5001983	500	1983	1.38	3.53E-05	16.47	8.62E-04	10.51	1.04E-04	0.06	0.00E+00	C4
5002000	500	2000	1.38	3.53E-05	16.47	8.62E-04	10.51	1.04E-04	0.06	0.00E+00	C4
5002001	500	2001	1.16	3.55E-05	16.47	8.62E-04	8.53	9.08E-05	0.06	0.00E+00	C4
5002002	500	2002	0.94	3.57E-05	16.47	8.62E-04	6.54	7.77E-05	0.06	0.00E+00	C4
5002003	500	2003	0.71	3.58E-05	16.47	8.62E-04	4.56	6.45E-05	0.06	0.00E+00	C4
5002007	500	2007	0.14	1.06E-04	16.47	8.62E-04	1.58	2.64E-04	0.06	0.00E+00	C4
5002040	500	2040	0.14	3.60E-05	16.47	8.62E-04	1.58	5.13E-05	0.06	0.00E+00	C4

units = g/bhp hr

Lookup	Hp	Year	HC	HC DR	CO	CO DR	NOX	NOX DR	PM	PM DR	fuel/engine type
51994	5	1994	26.44	0.0948	504.25	0.52	2.12	0.000239	0.74	0.0026	G4
51995	5	1995	7.28	0.0565	272.56	-0.067	2.32	0.0031	0.74	0.0026	G4
52001	5	2001	7.28	0.0565	317.99	-0.067	2.32	0.0031	0.74	0.0026	G4
52006	5	2006	6	0.0144	235.77	-0.385	2.7	0.00649	0.74	0.0026	G4
52040	5	2040	3.66	0.0182	235.77	-0.385	0.86	0.00496	0.74	0.0026	G4
151994	15	1994	7.46	0.0178	393.1	0.0337	3.48	0.00133	0.14	0.0002	G4
151995	15	1995	4.56	0.0207	234.54	0.0895	2.84	0	0.14	0.0002	G4
152001	15	2001	4.56	0.0207	273.63	0.0895	2.84	0	0.14	0.0002	G4
152007	15	2007	3.9	0.00469	224.66	0	2.9	0.00347	0.14	0.0002	G4
152040	15	2040	2.51	0.00388	224.66	0	1.86	0.00264	0.14	0.0002	G4
251994	25	1994	7.46	0.0141	393.1	0.0276	3.48	0.00109	0.14	0.0002	G4
251995	25	1995	4.42	0.0166	243.17	0.0345	2.32	0	0.14	0.0002	G4
252001	25	2001	4.42	0.0166	283.69	0.0345	2.32	0	0.14	0.0002	G4
252007	25	2007	4.12	0.00495	238.46	0	2.68	0.00321	0.14	0.0002	G4
252040	25	2040	2.64	0.00336	238.46	0	1.71	0.00324	0.14	0.0002	G4
501983	50	1983	3.76	0.000412	89.9	0.00555	8.01	4.06E-05	0.06	0	G4
502000	50	2000	3.76	0.000412	89.9	0.00555	8.01	4.06E-05	0.06	0	G4
502001	50	2001	2.96	0.000348	78.09	0.0201	6.91	0.000144	0.06	0	G4
502002	50	2002	2.34	0.000374	81.78	0.0197	5.52	0.000308	0.06	0	G4
502003	50	2003	1.62	0.000316	71.03	0.0193	4.52	0.000402	0.06	0	G4
502006	50	2006	0.71	0.000169	38.19	0.019	1.33	0.000471	0.06	0	G4
502040	50	2040	0.71	0.000138	38.19	0.019	1.33	0.00032	0.06	0	G4
1201983	120	1983	2.63	0.000287	43.8	0.0029	11.84	6.01E-05	0.06	0	G4
1202000	120	2000	2.63	0.000287	43.8	0.0029	11.84	6.01E-05	0.06	0	G4
1202001	120	2001	2.08	0.000256	41.08	0.004	9.58	0.000163	0.06	0	G4
1202002	120	2002	1.54	0.000225	39.72	0.00455	7.32	0.000266	0.06	0	G4
1202003	120	2003	0.99	0.000194	38.36	0.0051	5.06	0.000368	0.06	0	G4
1202006	120	2006	0.26	8.14E-05	8.76	0.00565	1.78	0.000207	0.06	0	G4
1202040	120	2040	0.26	4.74E-05	8.76	0.00565	1.78	0.000145	0.06	0	G4
1751983	175	1983	1.61	4.15E-05	20.8	0.000815	12.94	0.000127	0.06	0	G4
1752000	175	2000	1.61	4.15E-05	20.8	0.000815	12.94	0.000127	0.06	0	G4
1752001	175	2001	1.33	3.98E-05	20.8	0.000815	10.29	0.000109	0.06	0	G4
1752002	175	2002	1.06	3.81E-05	20.8	0.000815	7.64	9.17E-05	0.06	0	G4
1752003	175	2003	0.78	3.64E-05	20.8	0.000815	4.98	0.000074	0.06	0	G4
1752006	175	2006	0.16	0.000102	20.8	0.000815	1.94	0.000278	0.06	0	G4
1752040	175	2040	0.16	3.47E-05	20.8	0.000815	1.94	5.63E-05	0.06	0	G4
2501983	250	1983	1.61	4.15E-05	20.8	0.000815	12.94	0.000127	0.06	0	G4
2502000	250	2000	1.61	4.15E-05	20.8	0.000815	12.94	0.000127	0.06	0	G4
2502001	250	2001	1.33	3.98E-05	20.8	0.000815	10.29	0.000109	0.06	0	G4
2502002	250	2002	1.06	3.81E-05	20.8	0.000815	7.64	9.17E-05	0.06	0	G4
2502003	250	2003	0.78	3.64E-05	20.8	0.000815	4.98	0.000074	0.06	0	G4
2502006	250	2006	0.16	0.000102	20.8	0.000815	1.94	0.000278	0.06	0	G4
2502040	250	2040	0.16	3.47E-05	20.8	0.000815	1.94	5.63E-05	0.06	0	G4
5001983	500	1983	1.61	4.15E-05	20.8	0.000815	12.94	0.000127	0.06	0	G4
5002000	500	2000	1.61	4.15E-05	20.8	0.000815	12.94	0.000127	0.06	0	G4
5002001	500	2001	1.33	3.98E-05	20.8	0.000815	10.29	0.000109	0.06	0	G4
5002002	500	2002	1.06	3.81E-05	20.8	0.000815	7.64	9.17E-05	0.06	0	G4
5002003	500	2003	0.78	3.64E-05	20.8	0.000815	4.98	0.000074	0.06	0	G4
5002006	500	2006	0.16	0.000102	20.8	0.000815	1.94	0.000278	0.06	0	G4
5002040	500	2040	0.16	3.47E-05	20.8	0.000815	1.94	5.63E-05	0.06	0	G4

units = g/bhp hr

Lookup	Hp	Year	HC	CO	NOX	PM
251968	25	1968	0.61	5.00	3.04	0.53
251969	25	1969	0.61	5.00	3.04	0.53
251970	25	1970	0.61	5.00	3.04	0.53
251971	25	1971	0.61	5.00	3.04	0.53
251972	25	1972	0.61	5.00	3.04	0.53
251973	25	1973	0.61	5.00	3.04	0.53
251974	25	1974	0.61	5.00	3.04	0.53
251975	25	1975	0.61	5.00	3.04	0.53
251976	25	1976	0.61	5.00	3.04	0.53
251977	25	1977	0.61	5.00	3.04	0.53
251978	25	1978	0.61	5.00	3.04	0.53
251979	25	1979	0.61	5.00	3.04	0.53
251980	25	1980	0.61	5.00	3.04	0.53
251981	25	1981	0.61	5.00	3.04	0.53
251982	25	1982	0.61	5.00	3.04	0.53
251983	25	1983	0.61	5.00	3.04	0.53
251984	25	1984	0.61	5.00	3.04	0.53
251985	25	1985	0.61	5.00	3.04	0.53
251986	25	1986	0.61	5.00	3.04	0.53
251987	25	1987	0.61	5.00	3.04	0.53
251988	25	1988	0.61	5.00	3.04	0.53
251989	25	1989	0.61	5.00	3.04	0.53
251990	25	1990	0.61	5.00	3.04	0.53
251991	25	1991	0.61	5.00	3.04	0.53
251992	25	1992	0.61	5.00	3.04	0.53
251993	25	1993	0.61	5.00	3.04	0.53
251994	25	1994	0.61	5.00	3.04	0.53
251995	25	1995	0.54	1.40	1.71	0.29
251996	25	1996	0.54	1.40	1.71	0.29
251997	25	1997	0.54	1.40	1.71	0.29
251998	25	1998	0.54	1.40	1.71	0.29
251999	25	1999	0.17	0.50	0.55	0.08
252000	25	2000	0.17	0.50	0.55	0.08
252001	25	2001	0.17	0.50	0.55	0.08
252002	25	2002	0.17	0.50	0.55	0.08
252003	25	2003	0.17	0.50	0.55	0.08
252004	25	2004	0.17	0.50	0.55	0.08
252005	25	2005	0.17	0.50	0.55	0.08
252006	25	2006	0.17	0.50	0.55	0.08
252007	25	2007	0.17	0.50	0.55	0.08
252008	25	2008	0.17	0.50	0.55	0.08
252009	25	2009	0.17	0.50	0.55	0.08
252010	25	2010	0.17	0.50	0.55	0.08
252011	25	2011	0.17	0.50	0.55	0.08
252012	25	2012	0.17	0.50	0.55	0.08
252013	25	2013	0.17	0.50	0.55	0.08
252014	25	2014	0.17	0.50	0.55	0.08
252015	25	2015	0.17	0.50	0.55	0.08

Lookup	Hp	Year	HC	CO	NOX	PM
252016	25	2016	0.17	0.50	0.55	0.08
252017	25	2017	0.17	0.50	0.55	0.08
252018	25	2018	0.17	0.50	0.55	0.08
252019	25	2019	0.17	0.50	0.55	0.08
252020	25	2020	0.17	0.50	0.55	0.08
252021	25	2021	0.17	0.50	0.55	0.08
252022	25	2022	0.17	0.50	0.55	0.08
252023	25	2023	0.17	0.50	0.55	0.08
252024	25	2024	0.17	0.50	0.55	0.08
252025	25	2025	0.17	0.50	0.55	0.08
252026	25	2026	0.17	0.50	0.55	0.08
501969	50	1969	0.61	5.00	3.08	0.53
501969	50	1969	0.61	5.00	3.08	0.53
501970	50	1970	0.61	5.00	3.08	0.53
501971	50	1971	0.61	5.00	3.08	0.53
501972	50	1972	0.61	5.00	3.08	0.53
501973	50	1973	0.61	5.00	3.08	0.53
501974	50	1974	0.61	5.00	3.08	0.53
501975	50	1975	0.61	5.00	3.08	0.53
501976	50	1976	0.61	5.00	3.08	0.53
501977	50	1977	0.61	5.00	3.08	0.53
501978	50	1978	0.61	5.00	3.08	0.53
501979	50	1979	0.61	5.00	3.08	0.53
501980	50	1980	0.61	5.00	3.08	0.53
501981	50	1981	0.61	5.00	3.08	0.53
501982	50	1982	0.61	5.00	3.08	0.53
501983	50	1983	0.61	5.00	3.08	0.53
501984	50	1984	0.61	5.00	3.08	0.53
501985	50	1985	0.61	5.00	3.08	0.53
501986	50	1986	0.61	5.00	3.08	0.53
501987	50	1987	0.61	5.00	3.08	0.53
501988	50	1988	0.59	5.00	3.04	0.53
501989	50	1989	0.59	5.00	3.04	0.53
501990	50	1990	0.59	5.00	3.04	0.53
501991	50	1991	0.59	5.00	3.04	0.53
501992	50	1992	0.59	5.00	3.04	0.53
501993	50	1993	0.59	5.00	3.04	0.53
501994	50	1994	0.59	5.00	3.04	0.53
501995	50	1995	0.59	5.00	3.04	0.53
501996	50	1996	0.59	5.00	3.04	0.53
501997	50	1997	0.59	5.00	3.04	0.53
501998	50	1998	0.59	5.00	3.04	0.53
501999	50	1999	0.48	4.10	2.44	0.42
502000	50	2000	0.48	4.10	2.44	0.42
502001	50	2001	0.48	4.10	2.44	0.42
502002	50	2002	0.48	4.10	2.44	0.42
502003	50	2003	0.48	4.10	2.44	0.42
502004	50	2004	0.21	3.27	2.24	0.30
502005	50	2005	0.12	3.00	2.18	0.27
502006	50	2006	0.08	2.86	2.15	0.25
502007	50	2007	0.08	2.86	2.15	0.25

Lookup	Hp	Year	HC	CO	NOX	PM
502008	50	2008	0.03	2.72	2.11	0.11
502009	50	2009	0.03	2.72	2.11	0.11
502010	50	2010	0.03	2.72	2.11	0.11
502011	50	2011	0.03	2.72	2.11	0.11
502012	50	2012	0.03	2.72	2.11	0.11
502013	50	2013	0.03	2.72	1.28	0.01
502014	50	2014	0.03	2.72	1.28	0.01
502015	50	2015	0.03	2.72	1.28	0.01
502016	50	2016	0.03	2.72	1.28	0.01
502017	50	2017	0.03	2.72	1.28	0.01
502018	50	2018	0.03	2.72	1.28	0.01
502019	50	2019	0.03	2.72	1.28	0.01
502020	50	2020	0.03	2.72	1.28	0.01
502021	50	2021	0.03	2.72	1.28	0.01
502022	50	2022	0.03	2.72	1.28	0.01
502023	50	2023	0.03	2.72	1.28	0.01
502024	50	2024	0.03	2.72	1.28	0.01
502025	50	2025	0.03	2.72	1.28	0.01
502026	50	2026	0.03	2.72	1.28	0.01
1201968	120	1968	0.48	4.80	5.72	0.59
1201969	120	1969	0.48	4.80	5.72	0.59
1201970	120	1970	0.48	4.80	5.72	0.59
1201971	120	1971	0.48	4.80	5.72	0.59
1201972	120	1972	0.48	4.80	5.72	0.59
1201973	120	1973	0.48	4.80	5.72	0.59
1201974	120	1974	0.48	4.80	5.72	0.59
1201975	120	1975	0.48	4.80	5.72	0.59
1201976	120	1976	0.48	4.80	5.72	0.59
1201977	120	1977	0.48	4.80	5.72	0.59
1201978	120	1978	0.48	4.80	5.72	0.59
1201979	120	1979	0.48	4.80	5.72	0.59
1201980	120	1980	0.48	4.80	5.72	0.59
1201981	120	1981	0.48	4.80	5.72	0.59
1201982	120	1982	0.48	4.80	5.72	0.59
1201983	120	1983	0.48	4.80	5.72	0.59
1201984	120	1984	0.48	4.80	5.72	0.59
1201985	120	1985	0.48	4.80	5.72	0.59
1201986	120	1986	0.48	4.80	5.72	0.59
1201987	120	1987	0.48	4.80	5.72	0.59
1201988	120	1988	0.33	3.49	3.85	0.48
1201989	120	1989	0.33	3.49	3.85	0.48
1201990	120	1990	0.33	3.49	3.85	0.48
1201991	120	1991	0.33	3.49	3.85	0.48
1201992	120	1992	0.33	3.49	3.85	0.48
1201993	120	1993	0.33	3.49	3.85	0.48
1201994	120	1994	0.33	3.49	3.85	0.48
1201995	120	1995	0.33	3.49	3.85	0.48
1201996	120	1996	0.33	3.49	3.85	0.48
1201997	120	1997	0.33	3.49	3.85	0.48
1201998	120	1998	0.33	3.49	3.04	0.48
1201999	120	1999	0.33	3.49	3.04	0.48

Lookup	Hp	Year	HC	CO	NOX	PM
1202000	120	2000	0.33	3.49	3.04	0.48
1202001	120	2001	0.33	3.49	3.04	0.48
1202002	120	2002	0.33	3.49	3.04	0.48
1202003	120	2003	0.33	3.49	3.04	0.48
1202004	120	2004	0.15	3.23	2.48	0.27
1202005	120	2005	0.09	3.14	2.30	0.20
1202006	120	2006	0.06	3.09	2.20	0.17
1202007	120	2007	0.06	3.09	2.20	0.17
1202008	120	2008	0.03	3.05	1.27	0.14
1202009	120	2009	0.03	3.05	1.27	0.14
1202010	120	2010	0.03	3.05	1.27	0.14
1202011	120	2011	0.03	3.05	1.27	0.14
1202012	120	2012	0.03	3.05	1.11	0.05
1202013	120	2013	0.03	3.05	1.11	0.01
1202014	120	2014	0.03	3.05	1.11	0.01
1202015	120	2015	0.02	3.05	0.61	0.01
1202016	120	2016	0.02	3.05	0.61	0.01
1202017	120	2017	0.02	3.05	0.61	0.01
1202018	120	2018	0.02	3.05	0.61	0.01
1202019	120	2019	0.02	3.05	0.61	0.01
1202020	120	2020	0.02	3.05	0.61	0.01
1202021	120	2021	0.02	3.05	0.61	0.01
1202022	120	2022	0.02	3.05	0.61	0.01
1202023	120	2023	0.02	3.05	0.61	0.01
1202024	120	2024	0.02	3.05	0.61	0.01
1202025	120	2025	0.02	3.05	0.61	0.01
1202026	120	2026	0.02	3.05	0.61	0.01
1751968	175	1968	0.44	4.40	6.16	0.54
1751969	175	1969	0.44	4.40	6.16	0.54
1751970	175	1970	0.36	4.40	5.72	0.46
1751971	175	1971	0.36	4.40	5.72	0.46
1751972	175	1972	0.33	4.40	5.28	0.39
1751973	175	1973	0.33	4.40	5.28	0.39
1751974	175	1974	0.33	4.40	5.28	0.39
1751975	175	1975	0.33	4.40	5.28	0.39
1751976	175	1976	0.33	4.40	5.28	0.39
1751977	175	1977	0.33	4.40	5.28	0.39
1751978	175	1978	0.33	4.40	5.28	0.39
1751979	175	1979	0.33	4.40	5.28	0.39
1751980	175	1980	0.31	4.30	4.84	0.39
1751981	175	1981	0.31	4.30	4.84	0.39
1751982	175	1982	0.31	4.30	4.84	0.39
1751983	175	1983	0.31	4.30	4.84	0.39
1751984	175	1984	0.31	4.30	4.84	0.39
1751985	175	1985	0.29	4.20	4.84	0.39
1751986	175	1986	0.29	4.20	4.84	0.39
1751987	175	1987	0.29	4.20	4.84	0.39
1751988	175	1988	0.22	2.70	3.59	0.27
1751989	175	1989	0.22	2.70	3.59	0.27
1751990	175	1990	0.22	2.70	3.59	0.27
1751991	175	1991	0.22	2.70	3.59	0.27

Lookup	Hp	Year	HC	CO	NOX	PM
1751992	175	1992	0.22	2.70	3.59	0.27
1751993	175	1993	0.22	2.70	3.59	0.27
1751994	175	1994	0.22	2.70	3.59	0.27
1751995	175	1995	0.22	2.70	3.59	0.27
1751996	175	1996	0.22	2.70	3.59	0.27
1751997	175	1997	0.22	2.70	3.04	0.27
1751998	175	1998	0.22	2.70	3.04	0.27
1751999	175	1999	0.22	2.70	3.04	0.27
1752000	175	2000	0.22	2.70	3.04	0.27
1752001	175	2001	0.22	2.70	3.04	0.27
1752002	175	2002	0.22	2.70	3.04	0.27
1752003	175	2003	0.11	2.70	2.31	0.17
1752004	175	2004	0.07	2.70	2.08	0.13
1752005	175	2005	0.05	2.70	1.95	0.11
1752006	175	2006	0.05	2.70	1.95	0.11
1752007	175	2007	0.03	2.70	1.08	0.10
1752008	175	2008	0.03	2.70	1.08	0.10
1752009	175	2009	0.03	2.70	1.08	0.10
1752010	175	2010	0.03	2.70	1.08	0.10
1752011	175	2011	0.03	2.70	1.08	0.10
1752012	175	2012	0.03	2.70	1.00	0.01
1752013	175	2013	0.03	2.70	1.00	0.01
1752014	175	2014	0.03	2.70	1.00	0.01
1752015	175	2015	0.02	2.70	0.12	0.01
1752016	175	2016	0.02	2.70	0.12	0.01
1752017	175	2017	0.02	2.70	0.12	0.01
1752018	175	2018	0.02	2.70	0.12	0.01
1752019	175	2019	0.02	2.70	0.12	0.01
1752020	175	2020	0.02	2.70	0.12	0.01
1752021	175	2021	0.02	2.70	0.12	0.01
1752022	175	2022	0.02	2.70	0.12	0.01
1752023	175	2023	0.02	2.70	0.12	0.01
1752024	175	2024	0.02	2.70	0.12	0.01
1752025	175	2025	0.02	2.70	0.12	0.01
1752026	175	2026	0.02	2.70	0.12	0.01
2501968	250	1968	0.44	4.40	6.16	0.54
2501969	250	1969	0.44	4.40	6.16	0.54
2501970	250	1970	0.36	4.40	5.72	0.46
2501971	250	1971	0.36	4.40	5.72	0.46
2501972	250	1972	0.33	4.40	5.28	0.39
2501973	250	1973	0.33	4.40	5.28	0.39
2501974	250	1974	0.33	4.40	5.28	0.39
2501975	250	1975	0.33	4.40	5.28	0.39
2501976	250	1976	0.33	4.40	5.28	0.39
2501977	250	1977	0.33	4.40	5.28	0.39
2501978	250	1978	0.33	4.40	5.28	0.39
2501979	250	1979	0.33	4.40	5.28	0.39
2501980	250	1980	0.31	4.30	4.84	0.39
2501981	250	1981	0.31	4.30	4.84	0.39
2501982	250	1982	0.31	4.30	4.84	0.39
2501983	250	1983	0.31	4.30	4.84	0.39

Lookup	Hp	Year	HC	CO	NOX	PM
2501984	250	1984	0.31	4.30	4.84	0.39
2501985	250	1985	0.29	4.20	4.84	0.39
2501986	250	1986	0.29	4.20	4.84	0.39
2501987	250	1987	0.29	4.20	4.84	0.39
2501988	250	1988	0.22	2.70	3.59	0.27
2501989	250	1989	0.22	2.70	3.59	0.27
2501990	250	1990	0.22	2.70	3.59	0.27
2501991	250	1991	0.22	2.70	3.59	0.27
2501992	250	1992	0.22	2.70	3.59	0.27
2501993	250	1993	0.22	2.70	3.59	0.27
2501994	250	1994	0.22	2.70	3.59	0.27
2501995	250	1995	0.22	2.70	3.59	0.27
2501996	250	1996	0.11	0.92	2.75	0.11
2501997	250	1997	0.11	0.92	2.75	0.11
2501998	250	1998	0.11	0.92	2.75	0.11
2501999	250	1999	0.11	0.92	2.75	0.11
2502000	250	2000	0.11	0.92	2.75	0.11
2502001	250	2001	0.11	0.92	2.75	0.11
2502002	250	2002	0.11	0.92	2.75	0.11
2502003	250	2003	0.06	0.92	2.20	0.08
2502004	250	2004	0.05	0.92	2.02	0.08
2502005	250	2005	0.04	0.92	1.93	0.08
2502006	250	2006	0.04	0.92	1.93	0.08
2502007	250	2007	0.03	0.92	1.08	0.08
2502008	250	2008	0.03	0.92	1.08	0.08
2502009	250	2009	0.03	0.92	1.08	0.08
2502010	250	2010	0.03	0.92	1.08	0.08
2502011	250	2011	0.02	0.92	0.60	0.01
2502012	250	2012	0.02	0.92	0.60	0.01
2502013	250	2013	0.02	0.92	0.60	0.01
2502014	250	2014	0.02	0.92	0.12	0.01
2502015	250	2015	0.02	0.92	0.12	0.01
2502016	250	2016	0.02	0.92	0.12	0.01
2502017	250	2017	0.02	0.92	0.12	0.01
2502018	250	2018	0.02	0.92	0.12	0.01
2502019	250	2019	0.02	0.92	0.12	0.01
2502020	250	2020	0.02	0.92	0.12	0.01
2502021	250	2021	0.02	0.92	0.12	0.01
2502022	250	2022	0.02	0.92	0.12	0.01
2502023	250	2023	0.02	0.92	0.12	0.01
2502024	250	2024	0.02	0.92	0.12	0.01
2502025	250	2025	0.02	0.92	0.12	0.01
2502026	250	2026	0.02	0.92	0.12	0.01
5001968	500	1968	0.42	4.20	6.16	0.52
5001969	500	1969	0.42	4.20	6.16	0.52
5001970	500	1970	0.35	4.20	5.72	0.44
5001971	500	1971	0.35	4.20	5.72	0.44
5001972	500	1972	0.31	4.20	5.28	0.37
5001973	500	1973	0.31	4.20	5.28	0.37
5001974	500	1974	0.31	4.20	5.28	0.37
5001975	500	1975	0.31	4.20	5.28	0.37

Lookup	Hp	Year	HC	CO	NOX	PM
5001976	500	1976	0.31	4.20	5.28	0.37
5001977	500	1977	0.31	4.20	5.28	0.37
5001978	500	1978	0.31	4.20	5.28	0.37
5001979	500	1979	0.31	4.20	5.28	0.37
5001980	500	1980	0.30	4.20	4.84	0.37
5001981	500	1981	0.30	4.20	4.84	0.37
5001982	500	1982	0.30	4.20	4.84	0.37
5001983	500	1983	0.30	4.20	4.84	0.37
5001984	500	1984	0.30	4.20	4.84	0.37
5001985	500	1985	0.28	4.10	4.84	0.37
5001986	500	1986	0.28	4.10	4.84	0.37
5001987	500	1987	0.28	4.10	4.84	0.37
5001988	500	1988	0.22	2.70	3.59	0.27
5001989	500	1989	0.22	2.70	3.59	0.27
5001990	500	1990	0.22	2.70	3.59	0.27
5001991	500	1991	0.22	2.70	3.59	0.27
5001992	500	1992	0.22	2.70	3.59	0.27
5001993	500	1993	0.22	2.70	3.59	0.27
5001994	500	1994	0.22	2.70	3.59	0.27
5001995	500	1995	0.22	2.70	3.59	0.27
5001996	500	1996	0.11	0.92	2.75	0.11
5001997	500	1997	0.11	0.92	2.75	0.11
5001998	500	1998	0.11	0.92	2.75	0.11
5001999	500	1999	0.11	0.92	2.75	0.11
5002000	500	2000	0.11	0.92	2.75	0.11
5002001	500	2001	0.06	0.92	2.18	0.08
5002002	500	2002	0.05	0.92	1.98	0.08
5002003	500	2003	0.04	0.92	1.89	0.08
5002004	500	2004	0.04	0.92	1.89	0.08
5002005	500	2005	0.03	0.92	1.76	0.08
5002006	500	2006	0.03	0.92	1.08	0.08
5002007	500	2007	0.03	0.92	1.08	0.08
5002008	500	2008	0.03	0.92	1.08	0.08
5002009	500	2009	0.03	0.92	1.08	0.08
5002010	500	2010	0.03	0.92	1.08	0.08
5002011	500	2011	0.02	0.92	0.60	0.01
5002012	500	2012	0.02	0.92	0.60	0.01
5002013	500	2013	0.02	0.92	0.60	0.01
5002014	500	2014	0.02	0.92	0.12	0.01
5002015	500	2015	0.02	0.92	0.12	0.01
5002016	500	2016	0.02	0.92	0.12	0.01
5002017	500	2017	0.02	0.92	0.12	0.01
5002018	500	2018	0.02	0.92	0.12	0.01
5002019	500	2019	0.02	0.92	0.12	0.01
5002020	500	2020	0.02	0.92	0.12	0.01
5002021	500	2021	0.02	0.92	0.12	0.01
5002022	500	2022	0.02	0.92	0.12	0.01
5002023	500	2023	0.02	0.92	0.12	0.01
5002024	500	2024	0.02	0.92	0.12	0.01
5002025	500	2025	0.02	0.92	0.12	0.01
5002026	500	2026	0.02	0.92	0.12	0.01

Lookup	Hp	Year	HC	CO	NOX	PM
7501968	750	1968	0.42	4.20	6.16	0.52
7501969	750	1969	0.42	4.20	6.16	0.52
7501970	750	1970	0.35	4.20	5.72	0.44
7501971	750	1971	0.35	4.20	5.72	0.44
7501972	750	1972	0.31	4.20	5.28	0.37
7501973	750	1973	0.31	4.20	5.28	0.37
7501974	750	1974	0.31	4.20	5.28	0.37
7501975	750	1975	0.31	4.20	5.28	0.37
7501976	750	1976	0.31	4.20	5.28	0.37
7501977	750	1977	0.31	4.20	5.28	0.37
7501978	750	1978	0.31	4.20	5.28	0.37
7501979	750	1979	0.31	4.20	5.28	0.37
7501980	750	1980	0.30	4.20	4.84	0.37
7501981	750	1981	0.30	4.20	4.84	0.37
7501982	750	1982	0.30	4.20	4.84	0.37
7501983	750	1983	0.30	4.20	4.84	0.37
7501984	750	1984	0.30	4.20	4.84	0.37
7501985	750	1985	0.28	4.10	4.84	0.37
7501986	750	1986	0.28	4.10	4.84	0.37
7501987	750	1987	0.28	4.10	4.84	0.37
7501988	750	1988	0.22	2.70	3.59	0.27
7501989	750	1989	0.22	2.70	3.59	0.27
7501990	750	1990	0.22	2.70	3.59	0.27
7501991	750	1991	0.22	2.70	3.59	0.27
7501992	750	1992	0.22	2.70	3.59	0.27
7501993	750	1993	0.22	2.70	3.59	0.27
7501994	750	1994	0.22	2.70	3.59	0.27
7501995	750	1995	0.22	2.70	3.59	0.27
7501996	750	1996	0.11	0.92	2.75	0.11
7501997	750	1997	0.11	0.92	2.75	0.11
7501998	750	1998	0.11	0.92	2.75	0.11
7501999	750	1999	0.11	0.92	2.75	0.11
7502000	750	2000	0.11	0.92	2.75	0.11
7502001	750	2001	0.11	0.92	2.75	0.11
7502002	750	2002	0.06	0.92	2.18	0.08
7502003	750	2003	0.05	0.92	1.98	0.08
7502004	750	2004	0.04	0.92	1.89	0.08
7502005	750	2005	0.04	0.92	1.89	0.08
7502006	750	2006	0.03	0.92	1.08	0.08
7502007	750	2007	0.03	0.92	1.08	0.08
7502008	750	2008	0.03	0.92	1.08	0.08
7502009	750	2009	0.03	0.92	1.08	0.08
7502010	750	2010	0.03	0.92	1.08	0.08
7502011	750	2011	0.02	0.92	0.60	0.01
7502012	750	2012	0.02	0.92	0.60	0.01
7502013	750	2013	0.02	0.92	0.60	0.01
7502014	750	2014	0.02	0.92	0.12	0.01
7502015	750	2015	0.02	0.92	0.12	0.01
7502016	750	2016	0.02	0.92	0.12	0.01
7502017	750	2017	0.02	0.92	0.12	0.01
7502018	750	2018	0.02	0.92	0.12	0.01

Lookup	Hp	Year	HC	CO	NOX	PM
7502019	750	2019	0.02	0.92	0.12	0.01
7502020	750	2020	0.02	0.92	0.12	0.01
7502021	750	2021	0.02	0.92	0.12	0.01
7502022	750	2022	0.02	0.92	0.12	0.01
7502023	750	2023	0.02	0.92	0.12	0.01
7502024	750	2024	0.02	0.92	0.12	0.01
7502025	750	2025	0.02	0.92	0.12	0.01
7502026	750	2026	0.02	0.92	0.12	0.01
9991968	999	1968	0.42	4.20	6.16	0.52
9991969	999	1969	0.42	4.20	6.16	0.52
9991970	999	1970	0.35	4.20	5.72	0.44
9991971	999	1971	0.35	4.20	5.72	0.44
9991972	999	1972	0.31	4.20	5.28	0.37
9991973	999	1973	0.31	4.20	5.28	0.37
9991974	999	1974	0.31	4.20	5.28	0.37
9991975	999	1975	0.31	4.20	5.28	0.37
9991976	999	1976	0.31	4.20	5.28	0.37
9991977	999	1977	0.31	4.20	5.28	0.37
9991978	999	1978	0.31	4.20	5.28	0.37
9991979	999	1979	0.31	4.20	5.28	0.37
9991980	999	1980	0.30	4.20	4.84	0.37
9991981	999	1981	0.30	4.20	4.84	0.37
9991982	999	1982	0.30	4.20	4.84	0.37
9991983	999	1983	0.30	4.20	4.84	0.37
9991984	999	1984	0.30	4.20	4.84	0.37
9991985	999	1985	0.28	4.10	4.84	0.37
9991986	999	1986	0.28	4.10	4.84	0.37
9991987	999	1987	0.28	4.10	4.84	0.37
9991988	999	1988	0.22	2.70	3.59	0.27
9991989	999	1989	0.22	2.70	3.59	0.27
9991990	999	1990	0.22	2.70	3.59	0.27
9991991	999	1991	0.22	2.70	3.59	0.27
9991992	999	1992	0.22	2.70	3.59	0.27
9991993	999	1993	0.22	2.70	3.59	0.27
9991994	999	1994	0.22	2.70	3.59	0.27
9991995	999	1995	0.22	2.70	3.59	0.27
9991996	999	1996	0.22	2.70	3.59	0.27
9991997	999	1997	0.22	2.70	3.59	0.27
9991998	999	1998	0.22	2.70	3.59	0.27
9991999	999	1999	0.22	2.70	3.59	0.27
9992000	999	2000	0.11	0.92	2.75	0.11
9992001	999	2001	0.11	0.92	2.75	0.11
9992002	999	2002	0.11	0.92	2.75	0.11
9992003	999	2003	0.11	0.92	2.75	0.11
9992004	999	2004	0.11	0.92	2.75	0.11
9992005	999	2005	0.11	0.92	2.75	0.11
9992006	999	2006	0.06	0.92	2.18	0.08
9992007	999	2007	0.05	0.92	1.98	0.08
9992008	999	2008	0.04	0.92	1.89	0.08
9992009	999	2009	0.04	0.92	1.89	0.08
9992010	999	2010	0.03	0.92	1.80	0.08

Lookup	Hp	Year	HC	CO	NOX	PM
9992011	999	2011	0.03	0.92	1.04	0.04
9992012	999	2012	0.03	0.92	1.04	0.04
9992013	999	2013	0.03	0.92	1.04	0.04
9992014	999	2014	0.03	0.92	1.04	0.04
9992015	999	2015	0.02	0.92	1.04	0.01
9992016	999	2016	0.02	0.92	1.04	0.01
9992017	999	2017	0.02	0.92	1.04	0.01
9992018	999	2018	0.02	0.92	1.04	0.01
9992019	999	2019	0.02	0.92	1.04	0.01
9992020	999	2020	0.02	0.92	1.04	0.01
9992021	999	2021	0.02	0.92	1.04	0.01
9992022	999	2022	0.02	0.92	1.04	0.01
9992023	999	2023	0.02	0.92	1.04	0.01
9992024	999	2024	0.02	0.92	1.04	0.01
9992025	999	2025	0.02	0.92	1.04	0.01
9992026	999	2026	0.02	0.92	1.04	0.01

ARB Equipment	Code	HP Bin	concat	SOX (g SOX/hp-hr)
Other General Industrial Equipment onroad	10	120	10120	0.0622888
Other General Industrial Equipment onroad	10	175	10175	0.0597464
Other General Industrial Equipment onroad	10	250	10250	0.0597464
Other General Industrial Equipment onroad	10	50	1050	0.0686448
Other General Industrial Equipment onroad	10	500	10500	0.0521192
Other General Industrial Equipment onroad	10	750	10750	0.0533904
Other General Industrial Equipment onroad	10	999	10999	0.0533904
Crane	1	120	1120	0.0622888
Crane	1	175	1175	0.0597464
Crane	1	250	1250	0.0597464
Crane	1	50	150	0.0686448
Crane	1	500	1500	0.0521192
Crane	1	750	1750	0.0533904
Crane	1	999	1999	0.0533904
Excavator	2	120	2120	0.0622888
Excavator	2	175	2175	0.0597464
Excavator	2	250	2250	0.0597464
Excavator	2	50	250	0.0686448
Excavator	2	500	2500	0.0521192
Excavator	2	750	2750	0.0533904
Forklift	3	120	3120	0.0622888
Forklift	3	175	3175	0.0597464
Forklift	3	250	3250	0.0597464
Forklift	3	50	350	0.0686448
Forklift	3	500	3500	0.0521192
Material Handling Equip	4	120	4120	0.0597464
Other General Industrial Equipment	5	120	5120	0.0622888
Other General Industrial Equipment	5	175	5175	0.0597464
Other General Industrial Equipment	5	250	5250	0.0597464
Other General Industrial Equipment	5	50	550	0.0686448
Other General Industrial Equipment	5	500	5500	0.0521192
Other General Industrial Equipment	5	750	5750	0.0533904
Other General Industrial Equipment	5	999	5999	0.0533904
Sweeper/Scrubbers	6	120	6120	0.0622888
Sweeper/Scrubbers	6	175	6175	0.0597464
Sweeper/Scrubbers	6	250	6250	0.0597464
Sweeper/Scrubbers	6	50	650	0.0686448
Tractor/Loader/Backhoe	7	120	7120	0.0622888
Tractor/Loader/Backhoe	7	175	7175	0.0597464
Tractor/Loader/Backhoe	7	250	7250	0.0597464
Tractor/Loader/Backhoe	7	50	750	0.0686448
Tractor/Loader/Backhoe	7	500	7500	0.0597464
Tractor/Loader/Backhoe	7	750	7750	0.0597464
Yard Tractor offroad	8	120	8120	0.0622888
Yard Tractor offroad	8	175	8175	0.0597464
Yard Tractor offroad	8	250	8250	0.0597464
Yard Tractor offroad	8	750	8750	0.0533904
Yard Tractor offroad	8	999	8999	0.0533904
Yard Tractor onroad	9	120	9120	0.0622888
Yard Tractor onroad	9	175	9175	0.0597464
Yard Tractor onroad	9	250	9250	0.0597464
Yard Tractor onroad	9	750	9750	0.0533904
Yard Tractor onroad	9	999	9999	0.0533904

ARB Equipment	Code	HP Bin	concat	SOX (g SOX/hp-hr)
Other General Industrial Equipment onroad	10	120	10120	0.0066738
Other General Industrial Equipment onroad	10	175	10175	0.0064014
Other General Industrial Equipment onroad	10	250	10250	0.0064014
Other General Industrial Equipment onroad	10	50	1050	0.0073548
Other General Industrial Equipment onroad	10	500	10500	0.0055842
Other General Industrial Equipment onroad	10	750	10750	0.0057204
Other General Industrial Equipment onroad	10	999	10999	0.0057204
Crane	1	120	1120	0.0066738
Crane	1	175	1175	0.0064014
Crane	1	250	1250	0.0064014
Crane	1	50	150	0.0073548
Crane	1	500	1500	0.0055842
Crane	1	750	1750	0.0057204
Crane	1	999	1999	0.0057204
Excavator	2	120	2120	0.0066738
Excavator	2	175	2175	0.0064014
Excavator	2	250	2250	0.0064014
Excavator	2	50	250	0.0073548
Excavator	2	500	2500	0.0055842
Excavator	2	750	2750	0.0057204
Forklift	3	120	3120	0.0066738
Forklift	3	175	3175	0.0064014
Forklift	3	250	3250	0.0064014
Forklift	3	50	350	0.0073548
Forklift	3	500	3500	0.0055842
Material Handling Equip	4	120	4120	0.0064014
Other General Industrial Equipment	5	120	5120	0.0066738
Other General Industrial Equipment	5	175	5175	0.0064014
Other General Industrial Equipment	5	250	5250	0.0064014
Other General Industrial Equipment	5	50	550	0.0073548
Other General Industrial Equipment	5	500	5500	0.0055842
Other General Industrial Equipment	5	750	5750	0.0057204
Other General Industrial Equipment	5	999	5999	0.0057204
Sweeper/Scrubbers	6	120	6120	0.0066738
Sweeper/Scrubbers	6	175	6175	0.0064014
Sweeper/Scrubbers	6	250	6250	0.0064014
Sweeper/Scrubbers	6	50	650	0.0073548
Tractor/Loader/Backhoe	7	120	7120	0.0066738
Tractor/Loader/Backhoe	7	175	7175	0.0064014
Tractor/Loader/Backhoe	7	250	7250	0.0064014
Tractor/Loader/Backhoe	7	50	750	0.0073548
Tractor/Loader/Backhoe	7	500	7500	0.0064014
Tractor/Loader/Backhoe	7	750	7750	0.0064014
Yard Tractor offroad	8	120	8120	0.0066738
Yard Tractor offroad	8	175	8175	0.0064014
Yard Tractor offroad	8	250	8250	0.0064014
Yard Tractor offroad	8	750	8750	0.0057204
Yard Tractor offroad	8	999	8999	0.0057204
Yard Tractor onroad	9	120	9120	0.0066738
Yard Tractor onroad	9	175	9175	0.0064014
Yard Tractor onroad	9	250	9250	0.0064014
Yard Tractor onroad	9	750	9750	0.0057204
Yard Tractor onroad	9	999	9999	0.0057204

ARB Equipment	Code	HP Bin	concat	SOX (g SOX/hp-hr)
Crane	1	120	1120	0.007491
Crane	1	175	1175	0.007491
Crane	1	50	150	0.009534
Forklift	3	120	3120	0.007491
Forklift	3	175	3175	0.007491
Forklift	3	50	350	0.009534
Other General Industrial Equipme	5	120	5120	0.007491
Other General Industrial Equipme	5	175	5175	0.007491
Other General Industrial Equipme	5	50	550	0.009534
Sweeper/Scrubbers	6	120	6120	0.007491
Sweeper/Scrubbers	6	175	6175	0.007491
Sweeper/Scrubbers	6	50	650	0.009534
Tractor/Loader/Backhoe	7	120	7120	0.007491

APPENDIX D-4

DEATILED EMISSION CALCULATIONS, EMISSION FACTOR DERIVATION, OFFROAD2007 OUTPUT, AND THE SPECIATION PROFILE FOR PROJECT YEAR 2014

Summary of Emissions from Cargo Handling Equipment
Dolores and ICTF Rail Yards, Long Beach, CA

								Hours of				Carbon	2014 Emission Factors									2014 Emission Estimates								
	Equipment	Fuel			Model	No of	Rating	Operation	BSFC	Fuel Use	Load	Oxidation	(g/bhp-hr)[8]						(kg/gal)[7]			(tons/yr)						(metric tons/yr)		
Yard	Type	Type	Make	Model	Year	Units	(hp)	(hrs/yr)[1,2,3]	(lb/bhp-hr)[4]	(gal/yr)[5]	Factor[6]	Factor[7]	HC	CO	NOx	PM10	DPM	SOx	CO2	N2O[9,10]	CH4[9,10]	ROG	CO	NOx	PM10	DPM	SOx	CO2	N2O	CH4
ICTF	Forklift	Diesel	Toyota	6FDU25	1997	1	85	365	0.49	642	0.30	99%	0.990	3.490	8.750	*0.104*	*0.104*	0.062	10.15	1.39E-05	4.16E-05	0.01	0.04	0.09	0.00	0.00	0.00	6.45	0.00	0.00
ICTF	Top Pick	Diesel	Taylor	Tay-950	1989	1	350	365	0.41	4,352	0.59	99%	0.680	2.700	8.170	*0.057*	*0.057*	0.060	10.15	1.39E-05	4.16E-05	0.06	0.22	0.68	0.00	0.00	0.00	43.74	0.00	0.00
ICTF	Yard Hostler	LPG/LNG	TBD	TBD	2012	2	175	365	0.55	7,026	0.39	99%	0.324	17.414	1.869	0.600	0.000	0.000	5.95	9.02E-06	9.02E-05	0.02	0.96	0.10	0.03	0.00	0.00	41.39	0.00	0.00
ICTF	WSG Crane	Electric	TBD	TBD	NA	39	NA	8760	0	0	NA	0%	0.000	0.000	0.000	0.000	0.000	0.000	0.00	0.00E+00	0.00E+00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total						**43**				**12,021**												**0.08**	**1.22**	**0.87**	**0.04**	**0.01**	**0.01**	**91.58**	**0.00**	**0.00**

Notes:
1. By 2012 the majority of the diesel-fueled CHE will be replaced by electric WSG cranes.
2. The remaining diesel-fueled forklift and top pick will be for emergency use only.
3. Two alternative fueled (LPG, LNG, or biodiesel) yard hostlers will be for emergency use only.
4. Brake-specific fuel consumption (BSFC) from OFFROAD2007 model.
5. Calculation assumes density of Diesel fuel of 7.1 lb/gal or an LPG density of 3.9 lb/gal.
6. Default load factors from OFFROAD 2007 model was used for the top pick. The load factor for the yard hostlers was from personal communication with Harold Holmes of ARB and is based on a study conducted at the POLA/POLB.
7. From the Air Resources Board's Draft *Emission Factors for Mandatory Reporting Programs*, August 10, 2007.
8. Emission factors are from CARB's Cargo Handling Equipment Emission Calculation Spreadsheet. The DPM emission factors were adjusted for compliance with the CHE Regulation. It was assumed that a Level 3 VDECS (85% control) was installed on each unit.
9. Based on a diesel fuel HHV of 5.825 MMBtu/barrel (from ARB Draft Emission Factors for Mandatory Reporting Programs, August 10, 2007) and 42 gallons per barrel.
10. Based on a LPG HHV of 3.788 MMBtu/barrel (from ARB Draft Emission Factors for Mandatory Reporting Programs, August 10, 2007) and 42 gallons per barrel.

Toxic Air Contaminant Emissions from the Propane-Fueled Yard Hostlers
Dolores and ICTF Rail Yards, Long Beach, CA

Profile[1]	CAS	Chemical Name	Organic Fraction	2014 Emissions (tpy)
719	95636	1,2,4-trimethylbenzene	0.00001	2.71E-07
719	75070	acetaldehyde	0.00003	8.13E-07
719	71432	benzene	0.00010	2.98E-06
719	110827	cyclohexane	0.00001	2.71E-07
719	100414	ethylbenzene	0.00001	2.71E-07
719	74851	ethylene	0.00058	1.71E-05
719	50000	formaldehyde	0.00074	2.20E-05
719	108383	m-xylene	0.00001	2.71E-07
719	110543	n-hexane	0.00002	5.42E-07
719	95476	o-xylene	0.00001	2.71E-07
719	115071	propylene	0.00154	4.58E-05
719	108883	toluene	0.00004	1.08E-06
719	1330207	xylene	0.00002	5.42E-07
Total				**9.22E-05**

Notes:

1. Organic fraction from ARBs SPECIATE database. Data is from "ICE-reciprocating - natural gas" option. The SPECIATE database does not include a profile for propane-fueled engines.
2. Emissions were calculated for only chemicals that were in both the SPECIATE database and the AB2588 list.
3. Organic fraction reported on a ROG basis using ARB's Speciate ROG/TOG ratio (0.0914)

				gasoline or diesel	ULSD, LPG, electric battery, diesel-electric											
Cal Year	**Terminal ID**	**Equipment Type**	**Code**	**Fuel Type**	**Alternative Fuel Type**	**Number of Years with Alt Fuel**	**Fraction 2014 with Fuel Type**	**Fraction 2014 with Alternative Fuel Type**	**Useful Life (hours)**	**Model Year**	**Age (years)**	**Population**	**HP**	**HP Bin**	**Yearly Operational Hrs**	**Cummulative Hours with Fuel Type**
2014	(Example Calculation)	Yard Tractor offroad	8	diesel	ULSD	0.5	0.50	0.50	24800	1997	18	1	230	250	3100	54250
2014	ICTF	Forklift	3	diesel	ULSD	10	1.00	0.00	14600	1997	18	1	85	120	730	5840
2014	ICTF	Crane	1	diesel	ULSD	10	1.00	0.00	157680	1997	18	1	300	500	8,760	70080
2014	ICTF	Crane	1	diesel	ULSD	10	1.00	0.00	157680	1988	27	1	250	250	8,760	148920
2014	ICTF	Crane	1	diesel	ULSD	10	1.00	0.00	157680	1995	20	1	300	500	8,760	87600
2014	ICTF	Crane	1	diesel	ULSD	10	1.00	0.00	157680	1995	20	1	300	500	8,760	87600
2014	ICTF	Crane	1	diesel	ULSD	10	1.00	0.00	157680	1995	20	1	300	500	8,760	87600
2014	ICTF	Crane	1	diesel	ULSD	10	1.00	0.00	157680	1995	20	1	300	500	8,760	87600
2014	ICTF	Crane	1	diesel	ULSD	10	1.00	0.00	157680	2002	13	1	300	500	8,760	26280
2014	ICTF	Crane	1	diesel	ULSD	10	1.00	0.00	157680	2002	13	1	300	500	8,760	26280
2014	ICTF	Crane	1	diesel	ULSD	10	1.00	0.00	157680	2005	10	1	350	500	8,760	0
2014	ICTF	Crane	1	diesel	ULSD	9	1.00	0.00	157698	2006	9	1	300	500	8,761	0
2014	ICTF	Material Handling Equip	4	diesel	ULSD	10	1.00	0.00	3744	1972	43	1	335	500	208	6864
2014	ICTF	Material Handling Equip	4	diesel	ULSD	10	1.00	0.00	39420	1988	27	1	350	500	2,190	37230
2014	ICTF	Material Handling Equip	4	diesel	ULSD	10	1.00	0.00	39420	1989	26	1	350	500	2,190	35040
2014	ICTF	Yard Tractor offroad	8	diesel	ULSD	10	1.00	0.00	17520	1999	16	15	150	175	2,190	13140
2014	ICTF	Yard Tractor offroad	8	diesel	ULSD	10	1.00	0.00	70080	2005	10	58	173	175	8,760	0

		If no emission control leave blank															
Alt Fuel Cumm Hours	Emission Control Factor? (y/n)	Emission Control	Fraction of Year with fuel with Emission Control	Fraction of Year with fuel without Emission Control	Fraction of Year with alt fuel with Emission Control	Fraction of Year with alt fuel without Emission Control	Load Factor	HPMY	HC EF	(alt fuel) HC EF	Emission Control HC EF	(alt fuel) Emission Control HC EF	HC dr	HC DR (alt fuel)	FCF HC	FCF HC (alt fuel)	CO EF
1550	y	DOC	0	1	0.66667	0.333333	0.65	2501997	0.3200	0.3200	0.0960	0.0960	0.000006	0.000006	0.72	0.72	0.9200
7300	n		0	1			0.30	1201997	9.90E-01	9.90E-01	0.00E+00	0.00E+00	1.90E-05	1.90E-05	7.20E-01	7.20E-01	3.49E+00
87600	n		0	1			0.43	5001997	3.20E-01	3.20E-01	0.00E+00	0.00E+00	8.93E-07	8.93E-07	7.20E-01	7.20E-01	9.20E-01
87600	n		0	1			0.43	2501988	6.80E-01	6.80E-01	0.00E+00	0.00E+00	1.90E-06	1.90E-06	7.20E-01	7.20E-01	2.70E+00
87600	n		0	1			0.43	5001995	6.80E-01	6.80E-01	0.00E+00	0.00E+00	1.90E-06	1.90E-06	7.20E-01	7.20E-01	2.70E+00
87600	n		0	1			0.43	5001995	6.80E-01	6.80E-01	0.00E+00	0.00E+00	1.90E-06	1.90E-06	7.20E-01	7.20E-01	2.70E+00
87600	n		0	1			0.43	5001995	6.80E-01	6.80E-01	0.00E+00	0.00E+00	1.90E-06	1.90E-06	7.20E-01	7.20E-01	2.70E+00
87600	n		0	1			0.43	5001995	6.80E-01	6.80E-01	0.00E+00	0.00E+00	1.90E-06	1.90E-06	7.20E-01	7.20E-01	2.70E+00
87600	n		0	1			0.43	5002002	1.40E-01	1.40E-01	0.00E+00	0.00E+00	3.91E-07	3.91E-07	7.20E-01	7.20E-01	9.20E-01
87600	n		0	1			0.43	5002002	1.40E-01	1.40E-01	0.00E+00	0.00E+00	3.91E-07	3.91E-07	7.20E-01	7.20E-01	9.20E-01
87600	n		0	1			0.43	5002005	1.00E-01	1.00E-01	0.00E+00	0.00E+00	2.79E-07	2.79E-07	7.20E-01	7.20E-01	9.20E-01
78849	n		0	1			0.43	5002006	1.00E-01	1.00E-01	0.00E+00	0.00E+00	2.79E-07	2.79E-07	7.20E-01	7.20E-01	9.20E-01
2080	n		0	1			0.59	5001972	9.50E-01	9.50E-01	0.00E+00	0.00E+00	1.12E-04	1.12E-04	7.20E-01	7.20E-01	4.20E+00
21900	n		0	1			0.59	5001988	6.80E-01	6.80E-01	0.00E+00	0.00E+00	7.59E-06	7.59E-06	7.20E-01	7.20E-01	2.70E+00
21900	n		0	1			0.59	5001989	6.80E-01	6.80E-01	0.00E+00	0.00E+00	7.59E-06	7.59E-06	7.20E-01	7.20E-01	2.70E+00
21900	n		0	1			0.65	1751999	6.80E-01	6.80E-01	0.00E+00	0.00E+00	1.09E-05	1.09E-05	7.20E-01	7.20E-01	2.70E+00
87600	n		0	1			0.65	1752005	1.60E-01	1.60E-01	0.00E+00	0.00E+00	6.39E-07	6.39E-07	7.20E-01	7.20E-01	2.70E+00

(alt fuel) CO EF	Emission Control CO EF	(alt fuel) Emission Control CO EF	CO dr	CO dr (alt fuel)	FCF CO	NOX EF	(alt fuel) NOX EF	Emission Control NOX EF	(alt fuel) Emission Control NOX EF	NOX dr	NOX dr (alt fuel)	FCF NOX	FCF NOX (alt fuel)	PM EF	(alt fuel) PM EF	Emission Control PM EF	(alt fuel) Emission Control PM EF
0.9200	0.2760	0.2760	0.000009	0.000009	1.00	6.2500	6.2500	6.2500	6.2500	0.000053	0.000053	0.95	0.95	0.1500	0.1500	0.1050	0.1050
3.49E+00	0.00E+00	0.00E+00	3.82E-05	3.82E-05	1.00E+00	8.75E+00	8.75E+00	0.00E+00	0.00E+00	8.39E-05	8.39E-05	9.48E-01	9.48E-01	6.90E-01	0.6900	0.0000	0.0000
9.20E-01	0.00E+00	0.00E+00	1.46E-06	1.46E-06	1.00E+00	6.25E+00	6.25E+00	0.00E+00	0.00E+00	8.32E-06	8.32E-06	9.48E-01	9.48E-01	1.50E-01	0.1500	0.0000	0.0000
2.70E+00	0.00E+00	0.00E+00	4.28E-06	4.28E-06	1.00E+00	8.17E+00	8.17E+00	0.00E+00	0.00E+00	1.09E-05	1.09E-05	9.30E-01	9.30E-01	3.80E-01	0.3800	0.0000	0.0000
2.70E+00	0.00E+00	0.00E+00	4.28E-06	4.28E-06	1.00E+00	8.17E+00	8.17E+00	0.00E+00	0.00E+00	1.09E-05	1.09E-05	9.30E-01	9.30E-01	3.80E-01	0.3800	0.0000	0.0000
2.70E+00	0.00E+00	0.00E+00	4.28E-06	4.28E-06	1.00E+00	8.17E+00	8.17E+00	0.00E+00	0.00E+00	1.09E-05	1.09E-05	9.30E-01	9.30E-01	3.80E-01	0.3800	0.0000	0.0000
2.70E+00	0.00E+00	0.00E+00	4.28E-06	4.28E-06	1.00E+00	8.17E+00	8.17E+00	0.00E+00	0.00E+00	1.09E-05	1.09E-05	9.30E-01	9.30E-01	3.80E-01	0.3800	0.0000	0.0000
2.70E+00	0.00E+00	0.00E+00	4.28E-06	4.28E-06	1.00E+00	8.17E+00	8.17E+00	0.00E+00	0.00E+00	1.09E-05	1.09E-05	9.30E-01	9.30E-01	3.80E-01	0.3800	0.0000	0.0000
9.20E-01	0.00E+00	0.00E+00	1.46E-06	1.46E-06	1.00E+00	4.51E+00	4.51E+00	0.00E+00	0.00E+00	6.01E-06	6.01E-06	9.48E-01	9.48E-01	1.10E-01	0.1100	0.0000	0.0000
9.20E-01	0.00E+00	0.00E+00	1.46E-06	1.46E-06	1.00E+00	4.51E+00	4.51E+00	0.00E+00	0.00E+00	6.01E-06	6.01E-06	9.48E-01	9.48E-01	1.10E-01	0.1100	0.0000	0.0000
9.20E-01	0.00E+00	0.00E+00	1.46E-06	1.46E-06	1.00E+00	4.00E+00	4.00E+00	0.00E+00	0.00E+00	5.33E-06	5.33E-06	9.48E-01	9.48E-01	1.10E-01	0.1100	0.0000	0.0000
9.20E-01	0.00E+00	0.00E+00	1.46E-06	1.46E-06	1.00E+00	2.45E+00	2.45E+00	0.00E+00	0.00E+00	3.26E-06	3.26E-06	9.48E-01	9.48E-01	1.10E-01	0.1100	0.0000	0.0000
4.20E+00	0.00E+00	0.00E+00	2.80E-04	2.80E-04	1.00E+00	1.20E+01	1.20E+01	0.00E+00	0.00E+00	6.73E-04	6.73E-04	9.30E-01	9.30E-01	5.30E-01	0.5300	0.0000	0.0000
2.70E+00	0.00E+00	0.00E+00	1.71E-05	1.71E-05	1.00E+00	8.17E+00	8.17E+00	0.00E+00	0.00E+00	4.35E-05	4.35E-05	9.30E-01	9.30E-01	3.80E-01	0.3800	0.0000	0.0000
2.70E+00	0.00E+00	0.00E+00	1.71E-05	1.71E-05	1.00E+00	8.17E+00	8.17E+00	0.00E+00	0.00E+00	4.35E-05	4.35E-05	9.30E-01	9.30E-01	3.80E-01	0.3800	0.0000	0.0000
2.70E+00	0.00E+00	0.00E+00	2.47E-05	2.47E-05	1.00E+00	6.90E+00	6.90E+00	0.00E+00	0.00E+00	5.51E-05	5.51E-05	9.48E-01	9.48E-01	3.80E-01	0.3800	0.0000	0.0000
2.70E+00	0.00E+00	0.00E+00	6.16E-06	6.16E-06	1.00E+00	4.44E+00	4.44E+00	0.00E+00	0.00E+00	8.87E-06	8.87E-06	9.48E-01	9.48E-01	1.60E-01	0.1600	0.0000	0.0000

						Emissions (tons/year)								Emissions (tons/day)							
PM dr	PM dr (alt fuel)	FCF PM	FCF PM (alt fuel)	SOX EF	(alt fuel) SOX EF	TOG	ROG	CO	NOX	SOX	PM	PM10	PM2.5	TOG	ROG	CO	NOX	SOX	PM	PM10	PM2.5
0.000004	0.000004	0.82	0.82	5.97E-02	6.40E-03	2.97E-01	2.61E-01	6.24E-01	4.45E+00	1.69E-02	1.52E-01	1.52E-01	1.39E-01	8.15E-04	7.16E-04	1.71E-03	1.22E-02	4.62E-05	4.15E-04	4.15E-04	3.82E-04
0.000021	0.000021	0.82	0.82	6.23E-02	6.67E-03	2.63E-02	2.31E-02	8.19E-02	1.91E-01	1.28E-03	1.62E-02	1.62E-02	1.49E-02	7.22E-05	6.34E-05	2.24E-04	5.25E-04	3.50E-06	4.45E-05	4.45E-05	4.09E-05
0.000001	0.000001	0.82	0.82	5.21E-02	5.58E-03	5.95E-01	5.22E-01	1.43E+00	8.92E+00	6.49E-02	2.56E-01	2.56E-01	2.36E-01	1.63E-03	1.43E-03	3.92E-03	2.44E-02	1.78E-04	7.02E-04	7.02E-04	6.46E-04
0.000002	0.000002	0.75	0.75	5.97E-02	6.40E-03	1.21E+00	1.07E+00	3.85E+00	1.04E+01	6.20E-02	5.93E-01	5.93E-01	5.45E-01	3.33E-03	2.92E-03	1.05E-02	2.84E-02	1.70E-04	1.62E-03	1.62E-03	1.49E-03
0.000002	0.000002	0.75	0.75	5.21E-02	5.58E-03	1.31E+00	1.15E+00	4.29E+00	1.17E+01	6.49E-02	6.19E-01	6.19E-01	5.69E-01	3.58E-03	3.14E-03	1.18E-02	3.20E-02	1.78E-04	1.70E-03	1.70E-03	1.56E-03
0.000002	0.000002	0.75	0.75	5.21E-02	5.58E-03	1.31E+00	1.15E+00	4.29E+00	1.17E+01	6.49E-02	6.19E-01	6.19E-01	5.69E-01	3.58E-03	3.14E-03	1.18E-02	3.20E-02	1.78E-04	1.70E-03	1.70E-03	1.56E-03
0.000002	0.000002	0.75	0.75	5.21E-02	5.58E-03	1.31E+00	1.15E+00	4.29E+00	1.17E+01	6.49E-02	6.19E-01	6.19E-01	5.69E-01	3.58E-03	3.14E-03	1.18E-02	3.20E-02	1.78E-04	1.70E-03	1.70E-03	1.56E-03
0.000002	0.000002	0.75	0.75	5.21E-02	5.58E-03	1.31E+00	1.15E+00	4.29E+00	1.17E+01	6.49E-02	6.19E-01	6.19E-01	5.69E-01	3.58E-03	3.14E-03	1.18E-02	3.20E-02	1.78E-04	1.70E-03	1.70E-03	1.56E-03
0.000000	0.000000	0.82	0.82	5.21E-02	5.58E-03	2.38E-01	2.09E-01	1.35E+00	6.13E+00	6.49E-02	1.67E-01	1.67E-01	1.54E-01	6.52E-04	5.73E-04	3.70E-03	1.68E-02	1.78E-04	4.57E-04	4.57E-04	4.21E-04
0.000000	0.000000	0.82	0.82	5.21E-02	5.58E-03	2.38E-01	2.09E-01	1.35E+00	6.13E+00	6.49E-02	1.67E-01	1.67E-01	1.54E-01	6.52E-04	5.73E-04	3.70E-03	1.68E-02	1.78E-04	4.57E-04	4.57E-04	4.21E-04
0.000000	0.000000	0.82	0.82	5.21E-02	5.58E-03	1.87E-01	1.65E-01	1.52E+00	6.15E+00	7.57E-02	1.80E-01	1.80E-01	1.66E-01	5.13E-04	4.51E-04	4.17E-03	1.68E-02	2.07E-04	4.94E-04	4.94E-04	4.54E-04
0.000000	0.000000	0.82	0.82	5.21E-02	5.58E-03	1.57E-01	1.38E-01	1.29E+00	3.19E+00	6.49E-02	1.50E-01	1.50E-01	1.38E-01	4.31E-04	3.79E-04	3.53E-03	8.75E-03	1.78E-04	4.12E-04	4.12E-04	3.79E-04
0.000095	0.000095	0.75	0.75	5.97E-02	6.40E-03	9.15E-02	8.04E-02	3.04E-01	7.59E-01	2.71E-03	4.68E-02	4.68E-02	4.31E-02	2.51E-04	2.20E-04	8.32E-04	2.08E-03	7.41E-06	1.28E-04	1.28E-04	1.18E-04
0.000006	0.000006	0.75	0.75	5.97E-02	6.40E-03	5.83E-01	5.12E-01	1.85E+00	4.98E+00	2.98E-02	2.85E-01	2.85E-01	2.62E-01	1.60E-03	1.40E-03	5.07E-03	1.36E-02	8.15E-05	7.80E-04	7.80E-04	7.17E-04
0.000006	0.000006	0.75	0.75	5.97E-02	6.40E-03	5.74E-01	5.05E-01	1.83E+00	4.93E+00	2.98E-02	2.79E-01	2.79E-01	2.57E-01	1.57E-03	1.38E-03	5.01E-03	1.35E-02	8.15E-05	7.65E-04	7.65E-04	7.04E-04
0.000010	0.000010	0.82	0.82	5.97E-02	6.40E-03	3.88E+00	3.41E+00	1.26E+01	2.95E+01	2.11E-01	2.07E+00	2.07E+00	1.91E+00	1.06E-02	9.34E-03	3.44E-02	8.09E-02	5.77E-04	5.68E-03	5.68E-03	5.22E-03
0.000001	0.000001	0.82	0.82	5.97E-02	6.40E-03	1.41E+01	1.24E+01	2.04E+02	3.11E+02	3.76E+00	1.28E+01	1.28E+01	1.18E+01	3.86E-02	3.39E-02	5.59E-01	8.53E-01	1.03E-02	3.51E-02	3.51E-02	3.23E-02

Type	Useful Life (yr)	Load Factor
Crane	18	0.43
Excavator	16	0.57
Forklift	20	0.30
Material Handling Equip	18	0.59
Other General Industrial Equipment	16	0.51
Sweeper/Scrubber	16	0.68
Tractor/Loader/Backhoe	16	0.55
Yard Tractor offroad	8	0.65
Yard Tractor onroad	8	0.65
Other General Industrial Equipment onroad	16	0.51

Diesel and ULSD Fuel Correction Factor

t_fcf

	Calyr 1994 -2006		
Model Yr	NOX	PM	HC
1968	0.930	0.750	0.720
1969	0.930	0.750	0.720
1970	0.930	0.750	0.720
1971	0.930	0.750	0.720
1972	0.930	0.750	0.720
1973	0.930	0.750	0.720
1974	0.930	0.750	0.720
1975	0.930	0.750	0.720
1976	0.930	0.750	0.720
1977	0.930	0.750	0.720
1978	0.930	0.750	0.720
1979	0.930	0.750	0.720
1980	0.930	0.750	0.720
1981	0.930	0.750	0.720
1982	0.930	0.750	0.720
1983	0.930	0.750	0.720
1984	0.930	0.750	0.720
1985	0.930	0.750	0.720
1986	0.930	0.750	0.720
1987	0.930	0.750	0.720
1988	0.930	0.750	0.720
1989	0.930	0.750	0.720
1990	0.930	0.750	0.720
1991	0.930	0.750	0.720
1992	0.930	0.750	0.720
1993	0.930	0.750	0.720
1994	0.930	0.750	0.720
1995	0.930	0.750	0.720
1996	0.948	0.822	0.720
1997	0.948	0.822	0.720
1998	0.948	0.822	0.720
1999	0.948	0.822	0.720
2000	0.948	0.822	0.720
2001	0.948	0.822	0.720
2002	0.948	0.822	0.720
2003	0.948	0.822	0.720
2004	0.948	0.822	0.720
2005	0.948	0.822	0.720
2006	0.948	0.822	0.720
2007	0.948	0.822	0.720
2008	0.948	0.822	0.720
2009	0.948	0.822	0.720
2010	0.948	0.822	0.720
2011	0.948	0.822	0.720
2012	0.948	0.822	0.720
2013	0.948	0.822	0.720
2014	0.948	0.822	0.720
2015	0.948	0.822	0.720
2016	0.948	0.822	0.720
2017	0.948	0.822	0.720
2018	0.948	0.822	0.720

HP_dr diesel fuel

	Det. Rate			
HP	HC	CO	NOx	PM
50	51%	41%	6%	31%
120	28%	16%	14%	44%
175	28%	16%	14%	44%
250	44%	25%	21%	67%
500	44%	25%	21%	67%

Gasoline Fuel Correction Factor

	Calyr 1996+		
Model Yr	NOX	CO	HC
1968	1.025	0.848	0.921
1969	1.025	0.848	0.921
1970	1.025	0.848	0.921
1971	1.025	0.848	0.921
1972	1.025	0.848	0.921
1973	1.025	0.848	0.921
1974	1.025	0.848	0.921
1975	1.025	0.848	0.921
1976	1.025	0.848	0.921
1977	1.025	0.848	0.921
1978	1.025	0.848	0.921
1979	1.025	0.848	0.921
1980	1.025	0.848	0.921
1981	1.025	0.848	0.921
1982	1.025	0.848	0.921
1983	1.025	0.848	0.921
1984	1.025	0.848	0.921
1985	1.025	0.848	0.921
1986	1.025	0.848	0.921
1987	1.025	0.848	0.921
1988	1.025	0.848	0.921
1989	1.025	0.848	0.921
1990	1.025	0.848	0.921
1991	1.025	0.848	0.921
1992	1.025	0.848	0.921
1993	1.025	0.848	0.921
1994	1.025	0.848	0.921
1995	1.025	0.848	0.921
1996	1.000	1.000	1.000
1997	1.000	1.000	1.000
1998	1.000	1.000	1.000
1999	1.000	1.000	1.000
2000	1.000	1.000	1.000
2001	1.000	1.000	1.000
2002	1.000	1.000	1.000
2003	1.000	1.000	1.000
2004	1.000	1.000	1.000
2005	1.000	1.000	1.000

Engine changes	Emission Changes %			
	HC	CO	NOx	PM
DOC	0.70	0.70	0.00	0.30
DPF (P)	0.90	0.90	0.00	0.85
DPF (A)	0.00	0.00	0.00	0.85
Emulsified Fuel	-0.23	-0.10	0.15	0.30
DOC+emulsified fuel	0.63	0.67	0.20	0.50
DOC + PurinNOx	0.63	0.67	0.20	0.50
O2 Diesel	-0.75	0.10	0.02	0.20
DOC + O2Diesel	0.48	0.73	0.02	0.44

Equipment Types	Code
Crane	**1**
Excavator	**2**
Forklift	**3**
Material Handling Equip	**4**
Other General Industrial Equipment	**5**
Sweeper/Scrubbers	**6**
Tractor/Loader/Backhoe	**7**
Yard Tractor offroad	**8**
Yard Tractor onroad	**9**
Other General Industrial Equipment onroad	**10**

***New Tier4 emfacs included with 43/57% split for 120 hp merged (diesel only)**

units = g/bhp hr

Lookup	Hp	Year	HC	CO	NOX	PM
251968	25	1968	1.84	5	6.92	0.764
251969	25	1969	1.84	5	6.92	0.764
251970	25	1970	1.84	5	6.92	0.764
251971	25	1971	1.84	5	6.92	0.764
251972	25	1972	1.84	5	6.92	0.764
251973	25	1973	1.84	5	6.92	0.764
251974	25	1974	1.84	5	6.92	0.764
251975	25	1975	1.84	5	6.92	0.764
251976	25	1976	1.84	5	6.92	0.764
251977	25	1977	1.84	5	6.92	0.764
251978	25	1978	1.84	5	6.92	0.764
251979	25	1979	1.84	5	6.92	0.764
251980	25	1980	1.84	5	6.92	0.764
251981	25	1981	1.84	5	6.92	0.764
251982	25	1982	1.84	5	6.92	0.764
251983	25	1983	1.84	5	6.92	0.764
251984	25	1984	1.84	5	6.92	0.764
251985	25	1985	1.84	5	6.92	0.764
251986	25	1986	1.84	5	6.92	0.764
251987	25	1987	1.84	5	6.92	0.764
251988	25	1988	1.84	5	6.92	0.764
251989	25	1989	1.84	5	6.92	0.764
251990	25	1990	1.84	5	6.92	0.764
251991	25	1991	1.84	5	6.92	0.764
251992	25	1992	1.84	5	6.92	0.764
251993	25	1993	1.84	5	6.92	0.764
251994	25	1994	1.84	5	6.92	0.764
251995	25	1995	1.63	1.4	3.89	0.417
251996	25	1996	1.63	1.4	3.89	0.417
251997	25	1997	1.63	1.4	3.89	0.417
251998	25	1998	1.63	1.4	3.89	0.417
251999	25	1999	0.52	0.5	1.24	0.116
252000	25	2000	0.52	0.5	1.24	0.116
252001	25	2001	0.52	0.5	1.24	0.116
252002	25	2002	0.52	0.5	1.24	0.116
252003	25	2003	0.52	0.5	1.24	0.116
252004	25	2004	0.52	0.5	1.24	0.116
252005	25	2005	0.52	0.5	1.24	0.116
252006	25	2006	0.52	0.5	1.24	0.116
252007	25	2007	0.52	0.5	1.24	0.116
252008	25	2008	0.52	0.5	1.24	0.116
252009	25	2009	0.52	0.5	1.24	0.116
252010	25	2010	0.52	0.5	1.24	0.116
252011	25	2011	0.52	0.5	1.24	0.116
252012	25	2012	0.52	0.5	1.24	0.116
252013	25	2013	0.52	0.5	1.24	0.116
252014	25	2014	0.52	0.5	1.24	0.116
252015	25	2015	0.52	0.5	1.24	0.116
252016	25	2016	0.52	0.5	1.24	0.116
252017	25	2017	0.52	0.5	1.24	0.116
252018	25	2018	0.52	0.5	1.24	0.116
252019	25	2019	0.52	0.5	1.24	0.116
252020	25	2020	0.52	0.5	1.24	0.116
252021	25	2021	0.52	0.5	1.24	0.116
252022	25	2022	0.52	0.5	1.24	0.116

Lookup	Hp	Year	HC	CO	NOX	PM
252023	25	2023	0.52	0.5	1.24	0.116
252024	25	2024	0.52	0.5	1.24	0.116
252025	25	2025	0.52	0.5	1.24	0.116
252026	25	2026	0.52	0.5	1.24	0.116
501969	50	1969	1.84	5	7	0.76
501969	50	1969	1.84	5	7	0.76
501970	50	1970	1.84	5	7	0.76
501971	50	1971	1.84	5	7	0.76
501972	50	1972	1.84	5	7	0.76
501973	50	1973	1.84	5	7	0.76
501974	50	1974	1.84	5	7	0.76
501975	50	1975	1.84	5	7	0.76
501976	50	1976	1.84	5	7	0.76
501977	50	1977	1.84	5	7	0.76
501978	50	1978	1.84	5	7	0.76
501979	50	1979	1.84	5	7	0.76
501980	50	1980	1.84	5	7	0.76
501981	50	1981	1.84	5	7	0.76
501982	50	1982	1.84	5	7	0.76
501983	50	1983	1.84	5	7	0.76
501984	50	1984	1.84	5	7	0.76
501985	50	1985	1.84	5	7	0.76
501986	50	1986	1.84	5	7	0.76
501987	50	1987	1.84	5	7	0.76
501988	50	1988	1.8	5	6.9	0.76
501989	50	1989	1.8	5	6.9	0.76
501990	50	1990	1.8	5	6.9	0.76
501991	50	1991	1.8	5	6.9	0.76
501992	50	1992	1.8	5	6.9	0.76
501993	50	1993	1.8	5	6.9	0.76
501994	50	1994	1.8	5	6.9	0.76
501995	50	1995	1.8	5	6.9	0.76
501996	50	1996	1.8	5	6.9	0.76
501997	50	1997	1.8	5	6.9	0.76
501998	50	1998	1.8	5	6.9	0.76
501999	50	1999	1.45	4.1	5.55	0.6
502000	50	2000	1.45	4.1	5.55	0.6
502001	50	2001	1.45	4.1	5.55	0.6
502002	50	2002	1.45	4.1	5.55	0.6
502003	50	2003	1.45	4.1	5.55	0.6
502004	50	2004	0.64	3.27	5.1	0.43
502005	50	2005	0.37	3	4.95	0.38
502006	50	2006	0.24	2.86	4.88	0.35
502007	50	2007	0.24	2.86	4.88	0.35
502008	50	2008	0.1	2.72	4.8	0.16
502009	50	2009	0.1	2.72	4.8	0.16
502010	50	2010	0.1	2.72	4.8	0.16
502011	50	2011	0.1	2.72	4.8	0.16
502012	50	2012	0.1	2.72	4.8	0.16
502013	50	2013	0.1	2.72	2.9	0.01
502014	50	2014	0.1	2.72	2.9	0.01
502015	50	2015	0.1	2.72	2.9	0.01
502016	50	2016	0.1	2.72	2.9	0.01
502017	50	2017	0.1	2.72	2.9	0.01
502018	50	2018	0.1	2.72	2.9	0.01
502019	50	2019	0.1	2.72	2.9	0.01
502020	50	2020	0.1	2.72	2.9	0.01
502021	50	2021	0.1	2.72	2.9	0.01

Lookup	Hp	Year	HC	CO	NOX	PM
502022	50	2022	0.1	2.72	2.9	0.01
502023	50	2023	0.1	2.72	2.9	0.01
502024	50	2024	0.1	2.72	2.9	0.01
502025	50	2025	0.1	2.72	2.9	0.01
502026	50	2026	0.1	2.72	2.9	0.01
1201968	120	1968	1.44	4.8	13	0.84
1201969	120	1969	1.44	4.8	13	0.84
1201970	120	1970	1.44	4.8	13	0.84
1201971	120	1971	1.44	4.8	13	0.84
1201972	120	1972	1.44	4.8	13	0.84
1201973	120	1973	1.44	4.8	13	0.84
1201974	120	1974	1.44	4.8	13	0.84
1201975	120	1975	1.44	4.8	13	0.84
1201976	120	1976	1.44	4.8	13	0.84
1201977	120	1977	1.44	4.8	13	0.84
1201978	120	1978	1.44	4.8	13	0.84
1201979	120	1979	1.44	4.8	13	0.84
1201980	120	1980	1.44	4.8	13	0.84
1201981	120	1981	1.44	4.8	13	0.84
1201982	120	1982	1.44	4.8	13	0.84
1201983	120	1983	1.44	4.8	13	0.84
1201984	120	1984	1.44	4.8	13	0.84
1201985	120	1985	1.44	4.8	13	0.84
1201986	120	1986	1.44	4.8	13	0.84
1201987	120	1987	1.44	4.8	13	0.84
1201988	120	1988	0.99	3.49	8.75	0.69
1201989	120	1989	0.99	3.49	8.75	0.69
1201990	120	1990	0.99	3.49	8.75	0.69
1201991	120	1991	0.99	3.49	8.75	0.69
1201992	120	1992	0.99	3.49	8.75	0.69
1201993	120	1993	0.99	3.49	8.75	0.69
1201994	120	1994	0.99	3.49	8.75	0.69
1201995	120	1995	0.99	3.49	8.75	0.69
1201996	120	1996	0.99	3.49	8.75	0.69
1201997	120	1997	0.99	3.49	8.75	0.69
1201998	120	1998	0.99	3.49	6.9	0.69
1201999	120	1999	0.99	3.49	6.9	0.69
1202000	120	2000	0.99	3.49	6.9	0.69
1202001	120	2001	0.99	3.49	6.9	0.69
1202002	120	2002	0.99	3.49	6.9	0.69
1202003	120	2003	0.99	3.49	6.9	0.69
1202004	120	2004	0.46	3.23	5.64	0.39
1202005	120	2005	0.28	3.14	5.22	0.29
1202006	120	2006	0.19	3.09	5.01	0.24
1202007	120	2007	0.19	3.09	5.01	0.24
1202008	120	2008	0.1	3.05	2.89	0.197
1202009	120	2009	0.1	3.05	2.89	0.197
1202010	120	2010	0.1	3.05	2.89	0.197
1202011	120	2011	0.1	3.05	2.89	0.197
1202012	120	2012	0.0943	3.05	2.5309	0.0659
1202013	120	2013	0.0943	3.05	2.5309	0.01
1202014	120	2014	0.0943	3.05	2.5309	0.01
1202015	120	2015	0.0715	3.05	1.3966	0.01
1202016	120	2016	0.0715	3.05	1.3966	0.01
1202017	120	2017	0.0715	3.05	1.3966	0.01
1202018	120	2018	0.0715	3.05	1.3966	0.01
1202019	120	2019	0.0715	3.05	1.3966	0.01
1202020	120	2020	0.0715	3.05	1.3966	0.01

Lookup	Hp	Year	HC	CO	NOX	PM
1202021	120	2021	0.0715	3.05	1.3966	0.01
1202022	120	2022	0.0715	3.05	1.3966	0.01
1202023	120	2023	0.0715	3.05	1.3966	0.01
1202024	120	2024	0.0715	3.05	1.3966	0.01
1202025	120	2025	0.0715	3.05	1.3966	0.01
1202026	120	2026	0.0715	3.05	1.3966	0.01
1751968	175	1968	1.32	4.4	14	0.77
1751969	175	1969	1.32	4.4	14	0.77
1751970	175	1970	1.1	4.4	13	0.66
1751971	175	1971	1.1	4.4	13	0.66
1751972	175	1972	1	4.4	12	0.55
1751973	175	1973	1	4.4	12	0.55
1751974	175	1974	1	4.4	12	0.55
1751975	175	1975	1	4.4	12	0.55
1751976	175	1976	1	4.4	12	0.55
1751977	175	1977	1	4.4	12	0.55
1751978	175	1978	1	4.4	12	0.55
1751979	175	1979	1	4.4	12	0.55
1751980	175	1980	0.94	4.3	11	0.55
1751981	175	1981	0.94	4.3	11	0.55
1751982	175	1982	0.94	4.3	11	0.55
1751983	175	1983	0.94	4.3	11	0.55
1751984	175	1984	0.94	4.3	11	0.55
1751985	175	1985	0.88	4.2	11	0.55
1751986	175	1986	0.88	4.2	11	0.55
1751987	175	1987	0.88	4.2	11	0.55
1751988	175	1988	0.68	2.7	8.17	0.38
1751989	175	1989	0.68	2.7	8.17	0.38
1751990	175	1990	0.68	2.7	8.17	0.38
1751991	175	1991	0.68	2.7	8.17	0.38
1751992	175	1992	0.68	2.7	8.17	0.38
1751993	175	1993	0.68	2.7	8.17	0.38
1751994	175	1994	0.68	2.7	8.17	0.38
1751995	175	1995	0.68	2.7	8.17	0.38
1751996	175	1996	0.68	2.7	8.17	0.38
1751997	175	1997	0.68	2.7	6.9	0.38
1751998	175	1998	0.68	2.7	6.9	0.38
1751999	175	1999	0.68	2.7	6.9	0.38
1752000	175	2000	0.68	2.7	6.9	0.38
1752001	175	2001	0.68	2.7	6.9	0.38
1752002	175	2002	0.68	2.7	6.9	0.38
1752003	175	2003	0.33	2.7	5.26	0.24
1752004	175	2004	0.22	2.7	4.72	0.19
1752005	175	2005	0.16	2.7	4.44	0.16
1752006	175	2006	0.16	2.7	4.44	0.16
1752007	175	2007	0.1	2.7	2.45	0.14
1752008	175	2008	0.1	2.7	2.45	0.14
1752009	175	2009	0.1	2.7	2.45	0.14
1752010	175	2010	0.1	2.7	2.45	0.14
1752011	175	2011	0.1	2.7	2.45	0.14
1752012	175	2012	0.09	2.7	2.27	0.01
1752013	175	2013	0.09	2.7	2.27	0.01
1752014	175	2014	0.09	2.7	2.27	0.01
1752015	175	2015	0.05	2.7	0.27	0.01
1752016	175	2016	0.05	2.7	0.27	0.01
1752017	175	2017	0.05	2.7	0.27	0.01
1752018	175	2018	0.05	2.7	0.27	0.01
1752019	175	2019	0.05	2.7	0.27	0.01

Lookup	Hp	Year	HC	CO	NOX	PM
1752020	175	2020	0.05	2.7	0.27	0.01
1752021	175	2021	0.05	2.7	0.27	0.01
1752022	175	2022	0.05	2.7	0.27	0.01
1752023	175	2023	0.05	2.7	0.27	0.01
1752024	175	2024	0.05	2.7	0.27	0.01
1752025	175	2025	0.05	2.7	0.27	0.01
1752026	175	2026	0.05	2.7	0.27	0.01
2501968	250	1968	1.32	4.4	14	0.77
2501969	250	1969	1.32	4.4	14	0.77
2501970	250	1970	1.1	4.4	13	0.66
2501971	250	1971	1.1	4.4	13	0.66
2501972	250	1972	1	4.4	12	0.55
2501973	250	1973	1	4.4	12	0.55
2501974	250	1974	1	4.4	12	0.55
2501975	250	1975	1	4.4	12	0.55
2501976	250	1976	1	4.4	12	0.55
2501977	250	1977	1	4.4	12	0.55
2501978	250	1978	1	4.4	12	0.55
2501979	250	1979	1	4.4	12	0.55
2501980	250	1980	0.94	4.3	11	0.55
2501981	250	1981	0.94	4.3	11	0.55
2501982	250	1982	0.94	4.3	11	0.55
2501983	250	1983	0.94	4.3	11	0.55
2501984	250	1984	0.94	4.3	11	0.55
2501985	250	1985	0.88	4.2	11	0.55
2501986	250	1986	0.88	4.2	11	0.55
2501987	250	1987	0.88	4.2	11	0.55
2501988	250	1988	0.68	2.7	8.17	0.38
2501989	250	1989	0.68	2.7	8.17	0.38
2501990	250	1990	0.68	2.7	8.17	0.38
2501991	250	1991	0.68	2.7	8.17	0.38
2501992	250	1992	0.68	2.7	8.17	0.38
2501993	250	1993	0.68	2.7	8.17	0.38
2501994	250	1994	0.68	2.7	8.17	0.38
2501995	250	1995	0.68	2.7	8.17	0.38
2501996	250	1996	0.32	0.92	6.25	0.15
2501997	250	1997	0.32	0.92	6.25	0.15
2501998	250	1998	0.32	0.92	6.25	0.15
2501999	250	1999	0.32	0.92	6.25	0.15
2502000	250	2000	0.32	0.92	6.25	0.15
2502001	250	2001	0.32	0.92	6.25	0.15
2502002	250	2002	0.32	0.92	6.25	0.15
2502003	250	2003	0.19	0.92	5	0.12
2502004	250	2004	0.14	0.92	4.58	0.11
2502005	250	2005	0.12	0.92	4.38	0.11
2502006	250	2006	0.12	0.92	4.38	0.11
2502007	250	2007	0.1	0.92	2.45	0.11
2502008	250	2008	0.1	0.92	2.45	0.11
2502009	250	2009	0.1	0.92	2.45	0.11
2502010	250	2010	0.1	0.92	2.45	0.11
2502011	250	2011	0.07	0.92	1.36	0.01
2502012	250	2012	0.07	0.92	1.36	0.01
2502013	250	2013	0.07	0.92	1.36	0.01
2502014	250	2014	0.05	0.92	0.27	0.01
2502015	250	2015	0.05	0.92	0.27	0.01
2502016	250	2016	0.05	0.92	0.27	0.01
2502017	250	2017	0.05	0.92	0.27	0.01
2502018	250	2018	0.05	0.92	0.27	0.01

Lookup	Hp	Year	HC	CO	NOX	PM
2502019	250	2019	0.05	0.92	0.27	0.01
2502020	250	2020	0.05	0.92	0.27	0.01
2502021	250	2021	0.05	0.92	0.27	0.01
2502022	250	2022	0.05	0.92	0.27	0.01
2502023	250	2023	0.05	0.92	0.27	0.01
2502024	250	2024	0.05	0.92	0.27	0.01
2502025	250	2025	0.05	0.92	0.27	0.01
2502026	250	2026	0.05	0.92	0.27	0.01
5001968	500	1968	1.26	4.2	14	0.74
5001969	500	1969	1.26	4.2	14	0.74
5001970	500	1970	1.05	4.2	13	0.63
5001971	500	1971	1.05	4.2	13	0.63
5001972	500	1972	0.95	4.2	12	0.53
5001973	500	1973	0.95	4.2	12	0.53
5001974	500	1974	0.95	4.2	12	0.53
5001975	500	1975	0.95	4.2	12	0.53
5001976	500	1976	0.95	4.2	12	0.53
5001977	500	1977	0.95	4.2	12	0.53
5001978	500	1978	0.95	4.2	12	0.53
5001979	500	1979	0.95	4.2	12	0.53
5001980	500	1980	0.9	4.2	11	0.53
5001981	500	1981	0.9	4.2	11	0.53
5001982	500	1982	0.9	4.2	11	0.53
5001983	500	1983	0.9	4.2	11	0.53
5001984	500	1984	0.9	4.2	11	0.53
5001985	500	1985	0.84	4.1	11	0.53
5001986	500	1986	0.84	4.1	11	0.53
5001987	500	1987	0.84	4.1	11	0.53
5001988	500	1988	0.68	2.7	8.17	0.38
5001989	500	1989	0.68	2.7	8.17	0.38
5001990	500	1990	0.68	2.7	8.17	0.38
5001991	500	1991	0.68	2.7	8.17	0.38
5001992	500	1992	0.68	2.7	8.17	0.38
5001993	500	1993	0.68	2.7	8.17	0.38
5001994	500	1994	0.68	2.7	8.17	0.38
5001995	500	1995	0.68	2.7	8.17	0.38
5001996	500	1996	0.32	0.92	6.25	0.15
5001997	500	1997	0.32	0.92	6.25	0.15
5001998	500	1998	0.32	0.92	6.25	0.15
5001999	500	1999	0.32	0.92	6.25	0.15
5002000	500	2000	0.32	0.92	6.25	0.15
5002001	500	2001	0.19	0.92	4.95	0.12
5002002	500	2002	0.14	0.92	4.51	0.11
5002003	500	2003	0.12	0.92	4.29	0.11
5002004	500	2004	0.12	0.92	4.29	0.11
5002005	500	2005	0.1	0.92	4	0.11
5002006	500	2006	0.1	0.92	2.45	0.11
5002007	500	2007	0.1	0.92	2.45	0.11
5002008	500	2008	0.1	0.92	2.45	0.11
5002009	500	2009	0.1	0.92	2.45	0.11
5002010	500	2010	0.1	0.92	2.45	0.11
5002011	500	2011	0.07	0.92	1.36	0.01
5002012	500	2012	0.07	0.92	1.36	0.01
5002013	500	2013	0.07	0.92	1.36	0.01
5002014	500	2014	0.05	0.92	0.27	0.01
5002015	500	2015	0.05	0.92	0.27	0.01
5002016	500	2016	0.05	0.92	0.27	0.01
5002017	500	2017	0.05	0.92	0.27	0.01

Lookup	Hp	Year	HC	CO	NOX	PM
5002018	500	2018	0.05	0.92	0.27	0.01
5002019	500	2019	0.05	0.92	0.27	0.01
5002020	500	2020	0.05	0.92	0.27	0.01
5002021	500	2021	0.05	0.92	0.27	0.01
5002022	500	2022	0.05	0.92	0.27	0.01
5002023	500	2023	0.05	0.92	0.27	0.01
5002024	500	2024	0.05	0.92	0.27	0.01
5002025	500	2025	0.05	0.92	0.27	0.01
5002026	500	2026	0.05	0.92	0.27	0.01
7501968	750	1968	1.26	4.2	14	0.74
7501969	750	1969	1.26	4.2	14	0.74
7501970	750	1970	1.05	4.2	13	0.63
7501971	750	1971	1.05	4.2	13	0.63
7501972	750	1972	0.95	4.2	12	0.53
7501973	750	1973	0.95	4.2	12	0.53
7501974	750	1974	0.95	4.2	12	0.53
7501975	750	1975	0.95	4.2	12	0.53
7501976	750	1976	0.95	4.2	12	0.53
7501977	750	1977	0.95	4.2	12	0.53
7501978	750	1978	0.95	4.2	12	0.53
7501979	750	1979	0.95	4.2	12	0.53
7501980	750	1980	0.9	4.2	11	0.53
7501981	750	1981	0.9	4.2	11	0.53
7501982	750	1982	0.9	4.2	11	0.53
7501983	750	1983	0.9	4.2	11	0.53
7501984	750	1984	0.9	4.2	11	0.53
7501985	750	1985	0.84	4.1	11	0.53
7501986	750	1986	0.84	4.1	11	0.53
7501987	750	1987	0.84	4.1	11	0.53
7501988	750	1988	0.68	2.7	8.17	0.38
7501989	750	1989	0.68	2.7	8.17	0.38
7501990	750	1990	0.68	2.7	8.17	0.38
7501991	750	1991	0.68	2.7	8.17	0.38
7501992	750	1992	0.68	2.7	8.17	0.38
7501993	750	1993	0.68	2.7	8.17	0.38
7501994	750	1994	0.68	2.7	8.17	0.38
7501995	750	1995	0.68	2.7	8.17	0.38
7501996	750	1996	0.32	0.92	6.25	0.15
7501997	750	1997	0.32	0.92	6.25	0.15
7501998	750	1998	0.32	0.92	6.25	0.15
7501999	750	1999	0.32	0.92	6.25	0.15
7502000	750	2000	0.32	0.92	6.25	0.15
7502001	750	2001	0.32	0.92	6.25	0.15
7502002	750	2002	0.19	0.92	4.95	0.12
7502003	750	2003	0.14	0.92	4.51	0.11
7502004	750	2004	0.12	0.92	4.29	0.11
7502005	750	2005	0.12	0.92	4.29	0.11
7502006	750	2006	0.1	0.92	2.45	0.11
7502007	750	2007	0.1	0.92	2.45	0.11
7502008	750	2008	0.1	0.92	2.45	0.11
7502009	750	2009	0.1	0.92	2.45	0.11
7502010	750	2010	0.1	0.92	2.45	0.11
7502011	750	2011	0.07	0.92	1.36	0.01
7502012	750	2012	0.07	0.92	1.36	0.01
7502013	750	2013	0.07	0.92	1.36	0.01
7502014	750	2014	0.05	0.92	0.27	0.01
7502015	750	2015	0.05	0.92	0.27	0.01
7502016	750	2016	0.05	0.92	0.27	0.01

Lookup	Hp	Year	HC	CO	NOX	PM
7502017	750	2017	0.05	0.92	0.27	0.01
7502018	750	2018	0.05	0.92	0.27	0.01
7502019	750	2019	0.05	0.92	0.27	0.01
7502020	750	2020	0.05	0.92	0.27	0.01
7502021	750	2021	0.05	0.92	0.27	0.01
7502022	750	2022	0.05	0.92	0.27	0.01
7502023	750	2023	0.05	0.92	0.27	0.01
7502024	750	2024	0.05	0.92	0.27	0.01
7502025	750	2025	0.05	0.92	0.27	0.01
7502026	750	2026	0.05	0.92	0.27	0.01
9991968	999	1968	1.26	4.2	14	0.74
9991969	999	1969	1.26	4.2	14	0.74
9991970	999	1970	1.05	4.2	13	0.63
9991971	999	1971	1.05	4.2	13	0.63
9991972	999	1972	0.95	4.2	12	0.53
9991973	999	1973	0.95	4.2	12	0.53
9991974	999	1974	0.95	4.2	12	0.53
9991975	999	1975	0.95	4.2	12	0.53
9991976	999	1976	0.95	4.2	12	0.53
9991977	999	1977	0.95	4.2	12	0.53
9991978	999	1978	0.95	4.2	12	0.53
9991979	999	1979	0.95	4.2	12	0.53
9991980	999	1980	0.9	4.2	11	0.53
9991981	999	1981	0.9	4.2	11	0.53
9991982	999	1982	0.9	4.2	11	0.53
9991983	999	1983	0.9	4.2	11	0.53
9991984	999	1984	0.9	4.2	11	0.53
9991985	999	1985	0.84	4.1	11	0.53
9991986	999	1986	0.84	4.1	11	0.53
9991987	999	1987	0.84	4.1	11	0.53
9991988	999	1988	0.68	2.7	8.17	0.38
9991989	999	1989	0.68	2.7	8.17	0.38
9991990	999	1990	0.68	2.7	8.17	0.38
9991991	999	1991	0.68	2.7	8.17	0.38
9991992	999	1992	0.68	2.7	8.17	0.38
9991993	999	1993	0.68	2.7	8.17	0.38
9991994	999	1994	0.68	2.7	8.17	0.38
9991995	999	1995	0.68	2.7	8.17	0.38
9991996	999	1996	0.68	2.7	8.17	0.38
9991997	999	1997	0.68	2.7	8.17	0.38
9991998	999	1998	0.68	2.7	8.17	0.38
9991999	999	1999	0.68	2.7	8.17	0.38
9992000	999	2000	0.32	0.92	6.25	0.15
9992001	999	2001	0.32	0.92	6.25	0.15
9992002	999	2002	0.32	0.92	6.25	0.15
9992003	999	2003	0.32	0.92	6.25	0.15
9992004	999	2004	0.32	0.92	6.25	0.15
9992005	999	2005	0.32	0.92	6.25	0.15
9992006	999	2006	0.19	0.92	4.95	0.12
9992007	999	2007	0.14	0.92	4.51	0.11
9992008	999	2008	0.12	0.92	4.29	0.11
9992009	999	2009	0.12	0.92	4.29	0.11
9992010	999	2010	0.1	0.92	4.08	0.11
9992011	999	2011	0.1	0.92	2.36	0.06
9992012	999	2012	0.1	0.92	2.36	0.06
9992013	999	2013	0.1	0.92	2.36	0.06
9992014	999	2014	0.1	0.92	2.36	0.06
9992015	999	2015	0.05	0.92	2.36	0.02

Lookup	Hp	Year	HC	CO	NOX	PM
9992016	999	2016	0.05	0.92	2.36	0.02
9992017	999	2017	0.05	0.92	2.36	0.02
9992018	999	2018	0.05	0.92	2.36	0.02
9992019	999	2019	0.05	0.92	2.36	0.02
9992020	999	2020	0.05	0.92	2.36	0.02
9992021	999	2021	0.05	0.92	2.36	0.02
9992022	999	2022	0.05	0.92	2.36	0.02
9992023	999	2023	0.05	0.92	2.36	0.02
9992024	999	2024	0.05	0.92	2.36	0.02
9992025	999	2025	0.05	0.92	2.36	0.02
9992026	999	2026	0.05	0.92	2.36	0.02

units = g/bhp hr

Lookup	Hp	Year	HC	HC DR	CO	CO DR	NOX	NOX DR	PM	PM DR	fuel/engine type
151994	15	1994	3.96	4.20E-03	240	1.44E-02	1.77	4.48E-04	0.09	9.54E-05	C4
151998	15	1998	1.56	4.20E-03	300	1.44E-02	8.44	4.48E-04	0.9	9.54E-05	C4
152040	15	2040	0.5	4.20E-03	100	1.44E-02	2.7	4.48E-04	0.25	9.54E-05	C4
251994	25	1994	3.96	4.12E-03	240	1.42E-02	1.77	4.41E-04	0.09	9.37E-05	C4
251998	25	1998	1.56	4.12E-03	300	1.42E-02	8.44	4.41E-04	0.9	9.37E-05	C4
252040	25	2040	0.5	4.12E-03	100	1.42E-02	2.7	4.41E-04	0.25	9.37E-05	C4
501983	50	1983	1.38	1.51E-04	7.02	4.75E-04	13	6.62E-05	0.06	0.00E+00	C4
502000	50	2000	1.38	1.51E-04	7.02	4.75E-04	13	6.62E-05	0.06	0.00E+00	C4
502001	50	2001	1.16	1.59E-04	7.02	4.75E-04	10.4	1.56E-04	0.06	0.00E+00	C4
502002	50	2002	0.93	1.66E-04	7.02	4.75E-04	7.79	2.45E-04	0.06	0.00E+00	C4
502003	50	2003	0.71	1.74E-04	7.02	4.75E-04	5.19	3.35E-04	0.06	0.00E+00	C4
502006	50	2006	0.14	1.06E-04	7.02	4.75E-04	1.95	2.76E-04	0.06	0.00E+00	C4
502040	50	2040	0.14	7.24E-05	7.02	4.75E-04	1.95	1.10E-04	0.06	0.00E+00	C4
1201983	120	1983	1.55	1.69E-04	19.72	1.34E-03	10.53	5.33E-05	0.06	0.00E+00	C4
1202000	120	2000	1.55	1.69E-04	19.72	1.34E-03	10.53	5.33E-05	0.06	0.00E+00	C4
1202001	120	2001	1.28	1.72E-04	19.72	1.34E-03	8.54	1.46E-04	0.06	0.00E+00	C4
1202002	120	2002	1.02	1.75E-04	19.72	1.34E-03	6.56	2.39E-04	0.06	0.00E+00	C4
1202003	120	2003	0.75	1.78E-04	19.72	1.34E-03	4.57	3.31E-04	0.06	0.00E+00	C4
1202006	120	2006	0.16	1.03E-04	19.72	1.34E-03	1.58	3.50E-04	0.06	0.00E+00	C4
1202040	120	2040	0.16	6.90E-05	19.72	1.34E-03	1.58	1.84E-04	0.06	0.00E+00	C4
1751983	175	1983	1.38	3.53E-05	16.47	8.62E-04	10.51	1.04E-04	0.06	0.00E+00	C4
1752000	175	2000	1.38	3.53E-05	16.47	8.62E-04	10.51	1.04E-04	0.06	0.00E+00	C4
1752001	175	2001	1.16	3.55E-05	16.47	8.62E-04	8.53	9.08E-05	0.06	0.00E+00	C4
1752002	175	2002	0.94	3.57E-05	16.47	8.62E-04	6.54	7.77E-05	0.06	0.00E+00	C4
1752003	175	2003	0.71	3.58E-05	16.47	8.62E-04	4.56	6.45E-05	0.06	0.00E+00	C4
1752006	175	2006	0.14	1.06E-04	16.47	8.62E-04	1.58	2.64E-04	0.06	0.00E+00	C4
1752040	175	2040	0.14	3.60E-05	16.47	8.62E-04	1.58	5.13E-05	0.06	0.00E+00	C4
2501983	250	1983	1.38	3.53E-05	16.47	8.62E-04	10.51	1.04E-04	0.06	0.00E+00	C4
2502000	250	2000	1.38	3.53E-05	16.47	8.62E-04	10.51	1.04E-04	0.06	0.00E+00	C4
2502001	250	2001	1.16	3.55E-05	16.47	8.62E-04	8.53	9.08E-05	0.06	0.00E+00	C4
2502002	250	2002	0.94	3.57E-05	16.47	8.62E-04	6.54	7.77E-05	0.06	0.00E+00	C4
2502003	250	2003	0.71	3.58E-05	16.47	8.62E-04	4.56	6.45E-05	0.06	0.00E+00	C4
2502006	250	2006	0.14	1.06E-04	16.47	8.62E-04	1.58	2.64E-04	0.06	0.00E+00	C4
2502040	250	2040	0.14	3.60E-05	16.47	8.62E-04	1.58	5.13E-05	0.06	0.00E+00	C4
5001983	500	1983	1.38	3.53E-05	16.47	8.62E-04	10.51	1.04E-04	0.06	0.00E+00	C4
5002000	500	2000	1.38	3.53E-05	16.47	8.62E-04	10.51	1.04E-04	0.06	0.00E+00	C4
5002001	500	2001	1.16	3.55E-05	16.47	8.62E-04	8.53	9.08E-05	0.06	0.00E+00	C4
5002002	500	2002	0.94	3.57E-05	16.47	8.62E-04	6.54	7.77E-05	0.06	0.00E+00	C4
5002003	500	2003	0.71	3.58E-05	16.47	8.62E-04	4.56	6.45E-05	0.06	0.00E+00	C4
5002007	500	2007	0.14	1.06E-04	16.47	8.62E-04	1.58	2.64E-04	0.06	0.00E+00	C4
5002040	500	2040	0.14	3.60E-05	16.47	8.62E-04	1.58	5.13E-05	0.06	0.00E+00	C4

units = g/bhp hr

Lookup	Hp	Year	HC	HC DR	CO	CO DR	NOX	NOX DR	PM	PM DR	fuel/engine type
51994	5	1994	26.44	0.0948	504.25	0.52	2.12	0.000239	0.74	0.0026	G4
51995	5	1995	7.28	0.0565	272.56	-0.067	2.32	0.0031	0.74	0.0026	G4
52001	5	2001	7.28	0.0565	317.99	-0.067	2.32	0.0031	0.74	0.0026	G4
52006	5	2006	6	0.0144	235.77	-0.385	2.7	0.00649	0.74	0.0026	G4
52040	5	2040	3.66	0.0182	235.77	-0.385	0.86	0.00496	0.74	0.0026	G4
151994	15	1994	7.46	0.0178	393.1	0.0337	3.48	0.00133	0.14	0.0002	G4
151995	15	1995	4.56	0.0207	234.54	0.0895	2.84	0	0.14	0.0002	G4
152001	15	2001	4.56	0.0207	273.63	0.0895	2.84	0	0.14	0.0002	G4
152007	15	2007	3.9	0.00469	224.66	0	2.9	0.00347	0.14	0.0002	G4
152040	15	2040	2.51	0.00388	224.66	0	1.86	0.00264	0.14	0.0002	G4
251994	25	1994	7.46	0.0141	393.1	0.0276	3.48	0.00109	0.14	0.0002	G4
251995	25	1995	4.42	0.0166	243.17	0.0345	2.32	0	0.14	0.0002	G4
252001	25	2001	4.42	0.0166	283.69	0.0345	2.32	0	0.14	0.0002	G4
252007	25	2007	4.12	0.00495	238.46	0	2.68	0.00321	0.14	0.0002	G4
252040	25	2040	2.64	0.00336	238.46	0	1.71	0.00324	0.14	0.0002	G4
501983	50	1983	3.76	0.000412	89.9	0.00555	8.01	4.06E-05	0.06	0	G4
502000	50	2000	3.76	0.000412	89.9	0.00555	8.01	4.06E-05	0.06	0	G4
502001	50	2001	2.96	0.000348	78.09	0.0201	6.91	0.000144	0.06	0	G4
502002	50	2002	2.34	0.000374	81.78	0.0197	5.52	0.000308	0.06	0	G4
502003	50	2003	1.62	0.000316	71.03	0.0193	4.52	0.000402	0.06	0	G4
502006	50	2006	0.71	0.000169	38.19	0.019	1.33	0.000471	0.06	0	G4
502040	50	2040	0.71	0.000138	38.19	0.019	1.33	0.00032	0.06	0	G4
1201983	120	1983	2.63	0.000287	43.8	0.0029	11.84	6.01E-05	0.06	0	G4
1202000	120	2000	2.63	0.000287	43.8	0.0029	11.84	6.01E-05	0.06	0	G4
1202001	120	2001	2.08	0.000256	41.08	0.004	9.58	0.000163	0.06	0	G4
1202002	120	2002	1.54	0.000225	39.72	0.00455	7.32	0.000266	0.06	0	G4
1202003	120	2003	0.99	0.000194	38.36	0.0051	5.06	0.000368	0.06	0	G4
1202006	120	2006	0.26	8.14E-05	8.76	0.00565	1.78	0.000207	0.06	0	G4
1202040	120	2040	0.26	4.74E-05	8.76	0.00565	1.78	0.000145	0.06	0	G4
1751983	175	1983	1.61	4.15E-05	20.8	0.000815	12.94	0.000127	0.06	0	G4
1752000	175	2000	1.61	4.15E-05	20.8	0.000815	12.94	0.000127	0.06	0	G4
1752001	175	2001	1.33	3.98E-05	20.8	0.000815	10.29	0.000109	0.06	0	G4
1752002	175	2002	1.06	3.81E-05	20.8	0.000815	7.64	9.17E-05	0.06	0	G4
1752003	175	2003	0.78	3.64E-05	20.8	0.000815	4.98	0.000074	0.06	0	G4
1752006	175	2006	0.16	0.000102	20.8	0.000815	1.94	0.000278	0.06	0	G4
1752040	175	2040	0.16	3.47E-05	20.8	0.000815	1.94	5.63E-05	0.06	0	G4
2501983	250	1983	1.61	4.15E-05	20.8	0.000815	12.94	0.000127	0.06	0	G4
2502000	250	2000	1.61	4.15E-05	20.8	0.000815	12.94	0.000127	0.06	0	G4
2502001	250	2001	1.33	3.98E-05	20.8	0.000815	10.29	0.000109	0.06	0	G4
2502002	250	2002	1.06	3.81E-05	20.8	0.000815	7.64	9.17E-05	0.06	0	G4
2502003	250	2003	0.78	3.64E-05	20.8	0.000815	4.98	0.000074	0.06	0	G4
2502006	250	2006	0.16	0.000102	20.8	0.000815	1.94	0.000278	0.06	0	G4
2502040	250	2040	0.16	3.47E-05	20.8	0.000815	1.94	5.63E-05	0.06	0	G4
5001983	500	1983	1.61	4.15E-05	20.8	0.000815	12.94	0.000127	0.06	0	G4
5002000	500	2000	1.61	4.15E-05	20.8	0.000815	12.94	0.000127	0.06	0	G4
5002001	500	2001	1.33	3.98E-05	20.8	0.000815	10.29	0.000109	0.06	0	G4
5002002	500	2002	1.06	3.81E-05	20.8	0.000815	7.64	9.17E-05	0.06	0	G4
5002003	500	2003	0.78	3.64E-05	20.8	0.000815	4.98	0.000074	0.06	0	G4
5002006	500	2006	0.16	0.000102	20.8	0.000815	1.94	0.000278	0.06	0	G4
5002040	500	2040	0.16	3.47E-05	20.8	0.000815	1.94	5.63E-05	0.06	0	G4

units = g/bhp hr

Lookup	Hp	Year	HC	CO	NOX	PM
251968	25	1968	0.61	5.00	3.04	0.53
251969	25	1969	0.61	5.00	3.04	0.53
251970	25	1970	0.61	5.00	3.04	0.53
251971	25	1971	0.61	5.00	3.04	0.53
251972	25	1972	0.61	5.00	3.04	0.53
251973	25	1973	0.61	5.00	3.04	0.53
251974	25	1974	0.61	5.00	3.04	0.53
251975	25	1975	0.61	5.00	3.04	0.53
251976	25	1976	0.61	5.00	3.04	0.53
251977	25	1977	0.61	5.00	3.04	0.53
251978	25	1978	0.61	5.00	3.04	0.53
251979	25	1979	0.61	5.00	3.04	0.53
251980	25	1980	0.61	5.00	3.04	0.53
251981	25	1981	0.61	5.00	3.04	0.53
251982	25	1982	0.61	5.00	3.04	0.53
251983	25	1983	0.61	5.00	3.04	0.53
251984	25	1984	0.61	5.00	3.04	0.53
251985	25	1985	0.61	5.00	3.04	0.53
251986	25	1986	0.61	5.00	3.04	0.53
251987	25	1987	0.61	5.00	3.04	0.53
251988	25	1988	0.61	5.00	3.04	0.53
251989	25	1989	0.61	5.00	3.04	0.53
251990	25	1990	0.61	5.00	3.04	0.53
251991	25	1991	0.61	5.00	3.04	0.53
251992	25	1992	0.61	5.00	3.04	0.53
251993	25	1993	0.61	5.00	3.04	0.53
251994	25	1994	0.61	5.00	3.04	0.53
251995	25	1995	0.54	1.40	1.71	0.29
251996	25	1996	0.54	1.40	1.71	0.29
251997	25	1997	0.54	1.40	1.71	0.29
251998	25	1998	0.54	1.40	1.71	0.29
251999	25	1999	0.17	0.50	0.55	0.08
252000	25	2000	0.17	0.50	0.55	0.08
252001	25	2001	0.17	0.50	0.55	0.08
252002	25	2002	0.17	0.50	0.55	0.08
252003	25	2003	0.17	0.50	0.55	0.08
252004	25	2004	0.17	0.50	0.55	0.08
252005	25	2005	0.17	0.50	0.55	0.08
252006	25	2006	0.17	0.50	0.55	0.08
252007	25	2007	0.17	0.50	0.55	0.08
252008	25	2008	0.17	0.50	0.55	0.08
252009	25	2009	0.17	0.50	0.55	0.08
252010	25	2010	0.17	0.50	0.55	0.08
252011	25	2011	0.17	0.50	0.55	0.08
252012	25	2012	0.17	0.50	0.55	0.08
252013	25	2013	0.17	0.50	0.55	0.08
252014	25	2014	0.17	0.50	0.55	0.08
252015	25	2015	0.17	0.50	0.55	0.08

Lookup	Hp	Year	HC	CO	NOX	PM
252016	25	2016	0.17	0.50	0.55	0.08
252017	25	2017	0.17	0.50	0.55	0.08
252018	25	2018	0.17	0.50	0.55	0.08
252019	25	2019	0.17	0.50	0.55	0.08
252020	25	2020	0.17	0.50	0.55	0.08
252021	25	2021	0.17	0.50	0.55	0.08
252022	25	2022	0.17	0.50	0.55	0.08
252023	25	2023	0.17	0.50	0.55	0.08
252024	25	2024	0.17	0.50	0.55	0.08
252025	25	2025	0.17	0.50	0.55	0.08
252026	25	2026	0.17	0.50	0.55	0.08
501969	50	1969	0.61	5.00	3.08	0.53
501969	50	1969	0.61	5.00	3.08	0.53
501970	50	1970	0.61	5.00	3.08	0.53
501971	50	1971	0.61	5.00	3.08	0.53
501972	50	1972	0.61	5.00	3.08	0.53
501973	50	1973	0.61	5.00	3.08	0.53
501974	50	1974	0.61	5.00	3.08	0.53
501975	50	1975	0.61	5.00	3.08	0.53
501976	50	1976	0.61	5.00	3.08	0.53
501977	50	1977	0.61	5.00	3.08	0.53
501978	50	1978	0.61	5.00	3.08	0.53
501979	50	1979	0.61	5.00	3.08	0.53
501980	50	1980	0.61	5.00	3.08	0.53
501981	50	1981	0.61	5.00	3.08	0.53
501982	50	1982	0.61	5.00	3.08	0.53
501983	50	1983	0.61	5.00	3.08	0.53
501984	50	1984	0.61	5.00	3.08	0.53
501985	50	1985	0.61	5.00	3.08	0.53
501986	50	1986	0.61	5.00	3.08	0.53
501987	50	1987	0.61	5.00	3.08	0.53
501988	50	1988	0.59	5.00	3.04	0.53
501989	50	1989	0.59	5.00	3.04	0.53
501990	50	1990	0.59	5.00	3.04	0.53
501991	50	1991	0.59	5.00	3.04	0.53
501992	50	1992	0.59	5.00	3.04	0.53
501993	50	1993	0.59	5.00	3.04	0.53
501994	50	1994	0.59	5.00	3.04	0.53
501995	50	1995	0.59	5.00	3.04	0.53
501996	50	1996	0.59	5.00	3.04	0.53
501997	50	1997	0.59	5.00	3.04	0.53
501998	50	1998	0.59	5.00	3.04	0.53
501999	50	1999	0.48	4.10	2.44	0.42
502000	50	2000	0.48	4.10	2.44	0.42
502001	50	2001	0.48	4.10	2.44	0.42
502002	50	2002	0.48	4.10	2.44	0.42
502003	50	2003	0.48	4.10	2.44	0.42
502004	50	2004	0.21	3.27	2.24	0.30
502005	50	2005	0.12	3.00	2.18	0.27
502006	50	2006	0.08	2.86	2.15	0.25
502007	50	2007	0.08	2.86	2.15	0.25

Lookup	Hp	Year	HC	CO	NOX	PM
502008	50	2008	0.03	2.72	2.11	0.11
502009	50	2009	0.03	2.72	2.11	0.11
502010	50	2010	0.03	2.72	2.11	0.11
502011	50	2011	0.03	2.72	2.11	0.11
502012	50	2012	0.03	2.72	2.11	0.11
502013	50	2013	0.03	2.72	1.28	0.01
502014	50	2014	0.03	2.72	1.28	0.01
502015	50	2015	0.03	2.72	1.28	0.01
502016	50	2016	0.03	2.72	1.28	0.01
502017	50	2017	0.03	2.72	1.28	0.01
502018	50	2018	0.03	2.72	1.28	0.01
502019	50	2019	0.03	2.72	1.28	0.01
502020	50	2020	0.03	2.72	1.28	0.01
502021	50	2021	0.03	2.72	1.28	0.01
502022	50	2022	0.03	2.72	1.28	0.01
502023	50	2023	0.03	2.72	1.28	0.01
502024	50	2024	0.03	2.72	1.28	0.01
502025	50	2025	0.03	2.72	1.28	0.01
502026	50	2026	0.03	2.72	1.28	0.01
1201968	120	1968	0.48	4.80	5.72	0.59
1201969	120	1969	0.48	4.80	5.72	0.59
1201970	120	1970	0.48	4.80	5.72	0.59
1201971	120	1971	0.48	4.80	5.72	0.59
1201972	120	1972	0.48	4.80	5.72	0.59
1201973	120	1973	0.48	4.80	5.72	0.59
1201974	120	1974	0.48	4.80	5.72	0.59
1201975	120	1975	0.48	4.80	5.72	0.59
1201976	120	1976	0.48	4.80	5.72	0.59
1201977	120	1977	0.48	4.80	5.72	0.59
1201978	120	1978	0.48	4.80	5.72	0.59
1201979	120	1979	0.48	4.80	5.72	0.59
1201980	120	1980	0.48	4.80	5.72	0.59
1201981	120	1981	0.48	4.80	5.72	0.59
1201982	120	1982	0.48	4.80	5.72	0.59
1201983	120	1983	0.48	4.80	5.72	0.59
1201984	120	1984	0.48	4.80	5.72	0.59
1201985	120	1985	0.48	4.80	5.72	0.59
1201986	120	1986	0.48	4.80	5.72	0.59
1201987	120	1987	0.48	4.80	5.72	0.59
1201988	120	1988	0.33	3.49	3.85	0.48
1201989	120	1989	0.33	3.49	3.85	0.48
1201990	120	1990	0.33	3.49	3.85	0.48
1201991	120	1991	0.33	3.49	3.85	0.48
1201992	120	1992	0.33	3.49	3.85	0.48
1201993	120	1993	0.33	3.49	3.85	0.48
1201994	120	1994	0.33	3.49	3.85	0.48
1201995	120	1995	0.33	3.49	3.85	0.48
1201996	120	1996	0.33	3.49	3.85	0.48
1201997	120	1997	0.33	3.49	3.85	0.48
1201998	120	1998	0.33	3.49	3.04	0.48
1201999	120	1999	0.33	3.49	3.04	0.48

Lookup	Hp	Year	HC	CO	NOX	PM
1202000	120	2000	0.33	3.49	3.04	0.48
1202001	120	2001	0.33	3.49	3.04	0.48
1202002	120	2002	0.33	3.49	3.04	0.48
1202003	120	2003	0.33	3.49	3.04	0.48
1202004	120	2004	0.15	3.23	2.48	0.27
1202005	120	2005	0.09	3.14	2.30	0.20
1202006	120	2006	0.06	3.09	2.20	0.17
1202007	120	2007	0.06	3.09	2.20	0.17
1202008	120	2008	0.03	3.05	1.27	0.14
1202009	120	2009	0.03	3.05	1.27	0.14
1202010	120	2010	0.03	3.05	1.27	0.14
1202011	120	2011	0.03	3.05	1.27	0.14
1202012	120	2012	0.03	3.05	1.11	0.05
1202013	120	2013	0.03	3.05	1.11	0.01
1202014	120	2014	0.03	3.05	1.11	0.01
1202015	120	2015	0.02	3.05	0.61	0.01
1202016	120	2016	0.02	3.05	0.61	0.01
1202017	120	2017	0.02	3.05	0.61	0.01
1202018	120	2018	0.02	3.05	0.61	0.01
1202019	120	2019	0.02	3.05	0.61	0.01
1202020	120	2020	0.02	3.05	0.61	0.01
1202021	120	2021	0.02	3.05	0.61	0.01
1202022	120	2022	0.02	3.05	0.61	0.01
1202023	120	2023	0.02	3.05	0.61	0.01
1202024	120	2024	0.02	3.05	0.61	0.01
1202025	120	2025	0.02	3.05	0.61	0.01
1202026	120	2026	0.02	3.05	0.61	0.01
1751968	175	1968	0.44	4.40	6.16	0.54
1751969	175	1969	0.44	4.40	6.16	0.54
1751970	175	1970	0.36	4.40	5.72	0.46
1751971	175	1971	0.36	4.40	5.72	0.46
1751972	175	1972	0.33	4.40	5.28	0.39
1751973	175	1973	0.33	4.40	5.28	0.39
1751974	175	1974	0.33	4.40	5.28	0.39
1751975	175	1975	0.33	4.40	5.28	0.39
1751976	175	1976	0.33	4.40	5.28	0.39
1751977	175	1977	0.33	4.40	5.28	0.39
1751978	175	1978	0.33	4.40	5.28	0.39
1751979	175	1979	0.33	4.40	5.28	0.39
1751980	175	1980	0.31	4.30	4.84	0.39
1751981	175	1981	0.31	4.30	4.84	0.39
1751982	175	1982	0.31	4.30	4.84	0.39
1751983	175	1983	0.31	4.30	4.84	0.39
1751984	175	1984	0.31	4.30	4.84	0.39
1751985	175	1985	0.29	4.20	4.84	0.39
1751986	175	1986	0.29	4.20	4.84	0.39
1751987	175	1987	0.29	4.20	4.84	0.39
1751988	175	1988	0.22	2.70	3.59	0.27
1751989	175	1989	0.22	2.70	3.59	0.27
1751990	175	1990	0.22	2.70	3.59	0.27
1751991	175	1991	0.22	2.70	3.59	0.27

Lookup	Hp	Year	HC	CO	NOX	PM
1751992	175	1992	0.22	2.70	3.59	0.27
1751993	175	1993	0.22	2.70	3.59	0.27
1751994	175	1994	0.22	2.70	3.59	0.27
1751995	175	1995	0.22	2.70	3.59	0.27
1751996	175	1996	0.22	2.70	3.59	0.27
1751997	175	1997	0.22	2.70	3.04	0.27
1751998	175	1998	0.22	2.70	3.04	0.27
1751999	175	1999	0.22	2.70	3.04	0.27
1752000	175	2000	0.22	2.70	3.04	0.27
1752001	175	2001	0.22	2.70	3.04	0.27
1752002	175	2002	0.22	2.70	3.04	0.27
1752003	175	2003	0.11	2.70	2.31	0.17
1752004	175	2004	0.07	2.70	2.08	0.13
1752005	175	2005	0.05	2.70	1.95	0.11
1752006	175	2006	0.05	2.70	1.95	0.11
1752007	175	2007	0.03	2.70	1.08	0.10
1752008	175	2008	0.03	2.70	1.08	0.10
1752009	175	2009	0.03	2.70	1.08	0.10
1752010	175	2010	0.03	2.70	1.08	0.10
1752011	175	2011	0.03	2.70	1.08	0.10
1752012	175	2012	0.03	2.70	1.00	0.01
1752013	175	2013	0.03	2.70	1.00	0.01
1752014	175	2014	0.03	2.70	1.00	0.01
1752015	175	2015	0.02	2.70	0.12	0.01
1752016	175	2016	0.02	2.70	0.12	0.01
1752017	175	2017	0.02	2.70	0.12	0.01
1752018	175	2018	0.02	2.70	0.12	0.01
1752019	175	2019	0.02	2.70	0.12	0.01
1752020	175	2020	0.02	2.70	0.12	0.01
1752021	175	2021	0.02	2.70	0.12	0.01
1752022	175	2022	0.02	2.70	0.12	0.01
1752023	175	2023	0.02	2.70	0.12	0.01
1752024	175	2024	0.02	2.70	0.12	0.01
1752025	175	2025	0.02	2.70	0.12	0.01
1752026	175	2026	0.02	2.70	0.12	0.01
2501968	250	1968	0.44	4.40	6.16	0.54
2501969	250	1969	0.44	4.40	6.16	0.54
2501970	250	1970	0.36	4.40	5.72	0.46
2501971	250	1971	0.36	4.40	5.72	0.46
2501972	250	1972	0.33	4.40	5.28	0.39
2501973	250	1973	0.33	4.40	5.28	0.39
2501974	250	1974	0.33	4.40	5.28	0.39
2501975	250	1975	0.33	4.40	5.28	0.39
2501976	250	1976	0.33	4.40	5.28	0.39
2501977	250	1977	0.33	4.40	5.28	0.39
2501978	250	1978	0.33	4.40	5.28	0.39
2501979	250	1979	0.33	4.40	5.28	0.39
2501980	250	1980	0.31	4.30	4.84	0.39
2501981	250	1981	0.31	4.30	4.84	0.39
2501982	250	1982	0.31	4.30	4.84	0.39
2501983	250	1983	0.31	4.30	4.84	0.39

Lookup	Hp	Year	HC	CO	NOX	PM
2501984	250	1984	0.31	4.30	4.84	0.39
2501985	250	1985	0.29	4.20	4.84	0.39
2501986	250	1986	0.29	4.20	4.84	0.39
2501987	250	1987	0.29	4.20	4.84	0.39
2501988	250	1988	0.22	2.70	3.59	0.27
2501989	250	1989	0.22	2.70	3.59	0.27
2501990	250	1990	0.22	2.70	3.59	0.27
2501991	250	1991	0.22	2.70	3.59	0.27
2501992	250	1992	0.22	2.70	3.59	0.27
2501993	250	1993	0.22	2.70	3.59	0.27
2501994	250	1994	0.22	2.70	3.59	0.27
2501995	250	1995	0.22	2.70	3.59	0.27
2501996	250	1996	0.11	0.92	2.75	0.11
2501997	250	1997	0.11	0.92	2.75	0.11
2501998	250	1998	0.11	0.92	2.75	0.11
2501999	250	1999	0.11	0.92	2.75	0.11
2502000	250	2000	0.11	0.92	2.75	0.11
2502001	250	2001	0.11	0.92	2.75	0.11
2502002	250	2002	0.11	0.92	2.75	0.11
2502003	250	2003	0.06	0.92	2.20	0.08
2502004	250	2004	0.05	0.92	2.02	0.08
2502005	250	2005	0.04	0.92	1.93	0.08
2502006	250	2006	0.04	0.92	1.93	0.08
2502007	250	2007	0.03	0.92	1.08	0.08
2502008	250	2008	0.03	0.92	1.08	0.08
2502009	250	2009	0.03	0.92	1.08	0.08
2502010	250	2010	0.03	0.92	1.08	0.08
2502011	250	2011	0.02	0.92	0.60	0.01
2502012	250	2012	0.02	0.92	0.60	0.01
2502013	250	2013	0.02	0.92	0.60	0.01
2502014	250	2014	0.02	0.92	0.12	0.01
2502015	250	2015	0.02	0.92	0.12	0.01
2502016	250	2016	0.02	0.92	0.12	0.01
2502017	250	2017	0.02	0.92	0.12	0.01
2502018	250	2018	0.02	0.92	0.12	0.01
2502019	250	2019	0.02	0.92	0.12	0.01
2502020	250	2020	0.02	0.92	0.12	0.01
2502021	250	2021	0.02	0.92	0.12	0.01
2502022	250	2022	0.02	0.92	0.12	0.01
2502023	250	2023	0.02	0.92	0.12	0.01
2502024	250	2024	0.02	0.92	0.12	0.01
2502025	250	2025	0.02	0.92	0.12	0.01
2502026	250	2026	0.02	0.92	0.12	0.01
5001968	500	1968	0.42	4.20	6.16	0.52
5001969	500	1969	0.42	4.20	6.16	0.52
5001970	500	1970	0.35	4.20	5.72	0.44
5001971	500	1971	0.35	4.20	5.72	0.44
5001972	500	1972	0.31	4.20	5.28	0.37
5001973	500	1973	0.31	4.20	5.28	0.37
5001974	500	1974	0.31	4.20	5.28	0.37
5001975	500	1975	0.31	4.20	5.28	0.37

Lookup	Hp	Year	HC	CO	NOX	PM
5001976	500	1976	0.31	4.20	5.28	0.37
5001977	500	1977	0.31	4.20	5.28	0.37
5001978	500	1978	0.31	4.20	5.28	0.37
5001979	500	1979	0.31	4.20	5.28	0.37
5001980	500	1980	0.30	4.20	4.84	0.37
5001981	500	1981	0.30	4.20	4.84	0.37
5001982	500	1982	0.30	4.20	4.84	0.37
5001983	500	1983	0.30	4.20	4.84	0.37
5001984	500	1984	0.30	4.20	4.84	0.37
5001985	500	1985	0.28	4.10	4.84	0.37
5001986	500	1986	0.28	4.10	4.84	0.37
5001987	500	1987	0.28	4.10	4.84	0.37
5001988	500	1988	0.22	2.70	3.59	0.27
5001989	500	1989	0.22	2.70	3.59	0.27
5001990	500	1990	0.22	2.70	3.59	0.27
5001991	500	1991	0.22	2.70	3.59	0.27
5001992	500	1992	0.22	2.70	3.59	0.27
5001993	500	1993	0.22	2.70	3.59	0.27
5001994	500	1994	0.22	2.70	3.59	0.27
5001995	500	1995	0.22	2.70	3.59	0.27
5001996	500	1996	0.11	0.92	2.75	0.11
5001997	500	1997	0.11	0.92	2.75	0.11
5001998	500	1998	0.11	0.92	2.75	0.11
5001999	500	1999	0.11	0.92	2.75	0.11
5002000	500	2000	0.11	0.92	2.75	0.11
5002001	500	2001	0.06	0.92	2.18	0.08
5002002	500	2002	0.05	0.92	1.98	0.08
5002003	500	2003	0.04	0.92	1.89	0.08
5002004	500	2004	0.04	0.92	1.89	0.08
5002005	500	2005	0.03	0.92	1.76	0.08
5002006	500	2006	0.03	0.92	1.08	0.08
5002007	500	2007	0.03	0.92	1.08	0.08
5002008	500	2008	0.03	0.92	1.08	0.08
5002009	500	2009	0.03	0.92	1.08	0.08
5002010	500	2010	0.03	0.92	1.08	0.08
5002011	500	2011	0.02	0.92	0.60	0.01
5002012	500	2012	0.02	0.92	0.60	0.01
5002013	500	2013	0.02	0.92	0.60	0.01
5002014	500	2014	0.02	0.92	0.12	0.01
5002015	500	2015	0.02	0.92	0.12	0.01
5002016	500	2016	0.02	0.92	0.12	0.01
5002017	500	2017	0.02	0.92	0.12	0.01
5002018	500	2018	0.02	0.92	0.12	0.01
5002019	500	2019	0.02	0.92	0.12	0.01
5002020	500	2020	0.02	0.92	0.12	0.01
5002021	500	2021	0.02	0.92	0.12	0.01
5002022	500	2022	0.02	0.92	0.12	0.01
5002023	500	2023	0.02	0.92	0.12	0.01
5002024	500	2024	0.02	0.92	0.12	0.01
5002025	500	2025	0.02	0.92	0.12	0.01
5002026	500	2026	0.02	0.92	0.12	0.01

Lookup	Hp	Year	HC	CO	NOX	PM
7501968	750	1968	0.42	4.20	6.16	0.52
7501969	750	1969	0.42	4.20	6.16	0.52
7501970	750	1970	0.35	4.20	5.72	0.44
7501971	750	1971	0.35	4.20	5.72	0.44
7501972	750	1972	0.31	4.20	5.28	0.37
7501973	750	1973	0.31	4.20	5.28	0.37
7501974	750	1974	0.31	4.20	5.28	0.37
7501975	750	1975	0.31	4.20	5.28	0.37
7501976	750	1976	0.31	4.20	5.28	0.37
7501977	750	1977	0.31	4.20	5.28	0.37
7501978	750	1978	0.31	4.20	5.28	0.37
7501979	750	1979	0.31	4.20	5.28	0.37
7501980	750	1980	0.30	4.20	4.84	0.37
7501981	750	1981	0.30	4.20	4.84	0.37
7501982	750	1982	0.30	4.20	4.84	0.37
7501983	750	1983	0.30	4.20	4.84	0.37
7501984	750	1984	0.30	4.20	4.84	0.37
7501985	750	1985	0.28	4.10	4.84	0.37
7501986	750	1986	0.28	4.10	4.84	0.37
7501987	750	1987	0.28	4.10	4.84	0.37
7501988	750	1988	0.22	2.70	3.59	0.27
7501989	750	1989	0.22	2.70	3.59	0.27
7501990	750	1990	0.22	2.70	3.59	0.27
7501991	750	1991	0.22	2.70	3.59	0.27
7501992	750	1992	0.22	2.70	3.59	0.27
7501993	750	1993	0.22	2.70	3.59	0.27
7501994	750	1994	0.22	2.70	3.59	0.27
7501995	750	1995	0.22	2.70	3.59	0.27
7501996	750	1996	0.11	0.92	2.75	0.11
7501997	750	1997	0.11	0.92	2.75	0.11
7501998	750	1998	0.11	0.92	2.75	0.11
7501999	750	1999	0.11	0.92	2.75	0.11
7502000	750	2000	0.11	0.92	2.75	0.11
7502001	750	2001	0.11	0.92	2.75	0.11
7502002	750	2002	0.06	0.92	2.18	0.08
7502003	750	2003	0.05	0.92	1.98	0.08
7502004	750	2004	0.04	0.92	1.89	0.08
7502005	750	2005	0.04	0.92	1.89	0.08
7502006	750	2006	0.03	0.92	1.08	0.08
7502007	750	2007	0.03	0.92	1.08	0.08
7502008	750	2008	0.03	0.92	1.08	0.08
7502009	750	2009	0.03	0.92	1.08	0.08
7502010	750	2010	0.03	0.92	1.08	0.08
7502011	750	2011	0.02	0.92	0.60	0.01
7502012	750	2012	0.02	0.92	0.60	0.01
7502013	750	2013	0.02	0.92	0.60	0.01
7502014	750	2014	0.02	0.92	0.12	0.01
7502015	750	2015	0.02	0.92	0.12	0.01
7502016	750	2016	0.02	0.92	0.12	0.01
7502017	750	2017	0.02	0.92	0.12	0.01
7502018	750	2018	0.02	0.92	0.12	0.01

Lookup	Hp	Year	HC	CO	NOX	PM
7502019	750	2019	0.02	0.92	0.12	0.01
7502020	750	2020	0.02	0.92	0.12	0.01
7502021	750	2021	0.02	0.92	0.12	0.01
7502022	750	2022	0.02	0.92	0.12	0.01
7502023	750	2023	0.02	0.92	0.12	0.01
7502024	750	2024	0.02	0.92	0.12	0.01
7502025	750	2025	0.02	0.92	0.12	0.01
7502026	750	2026	0.02	0.92	0.12	0.01
9991968	999	1968	0.42	4.20	6.16	0.52
9991969	999	1969	0.42	4.20	6.16	0.52
9991970	999	1970	0.35	4.20	5.72	0.44
9991971	999	1971	0.35	4.20	5.72	0.44
9991972	999	1972	0.31	4.20	5.28	0.37
9991973	999	1973	0.31	4.20	5.28	0.37
9991974	999	1974	0.31	4.20	5.28	0.37
9991975	999	1975	0.31	4.20	5.28	0.37
9991976	999	1976	0.31	4.20	5.28	0.37
9991977	999	1977	0.31	4.20	5.28	0.37
9991978	999	1978	0.31	4.20	5.28	0.37
9991979	999	1979	0.31	4.20	5.28	0.37
9991980	999	1980	0.30	4.20	4.84	0.37
9991981	999	1981	0.30	4.20	4.84	0.37
9991982	999	1982	0.30	4.20	4.84	0.37
9991983	999	1983	0.30	4.20	4.84	0.37
9991984	999	1984	0.30	4.20	4.84	0.37
9991985	999	1985	0.28	4.10	4.84	0.37
9991986	999	1986	0.28	4.10	4.84	0.37
9991987	999	1987	0.28	4.10	4.84	0.37
9991988	999	1988	0.22	2.70	3.59	0.27
9991989	999	1989	0.22	2.70	3.59	0.27
9991990	999	1990	0.22	2.70	3.59	0.27
9991991	999	1991	0.22	2.70	3.59	0.27
9991992	999	1992	0.22	2.70	3.59	0.27
9991993	999	1993	0.22	2.70	3.59	0.27
9991994	999	1994	0.22	2.70	3.59	0.27
9991995	999	1995	0.22	2.70	3.59	0.27
9991996	999	1996	0.22	2.70	3.59	0.27
9991997	999	1997	0.22	2.70	3.59	0.27
9991998	999	1998	0.22	2.70	3.59	0.27
9991999	999	1999	0.22	2.70	3.59	0.27
9992000	999	2000	0.11	0.92	2.75	0.11
9992001	999	2001	0.11	0.92	2.75	0.11
9992002	999	2002	0.11	0.92	2.75	0.11
9992003	999	2003	0.11	0.92	2.75	0.11
9992004	999	2004	0.11	0.92	2.75	0.11
9992005	999	2005	0.11	0.92	2.75	0.11
9992006	999	2006	0.06	0.92	2.18	0.08
9992007	999	2007	0.05	0.92	1.98	0.08
9992008	999	2008	0.04	0.92	1.89	0.08
9992009	999	2009	0.04	0.92	1.89	0.08
9992010	999	2010	0.03	0.92	1.80	0.08

Lookup	Hp	Year	HC	CO	NOX	PM
9992011	999	2011	0.03	0.92	1.04	0.04
9992012	999	2012	0.03	0.92	1.04	0.04
9992013	999	2013	0.03	0.92	1.04	0.04
9992014	999	2014	0.03	0.92	1.04	0.04
9992015	999	2015	0.02	0.92	1.04	0.01
9992016	999	2016	0.02	0.92	1.04	0.01
9992017	999	2017	0.02	0.92	1.04	0.01
9992018	999	2018	0.02	0.92	1.04	0.01
9992019	999	2019	0.02	0.92	1.04	0.01
9992020	999	2020	0.02	0.92	1.04	0.01
9992021	999	2021	0.02	0.92	1.04	0.01
9992022	999	2022	0.02	0.92	1.04	0.01
9992023	999	2023	0.02	0.92	1.04	0.01
9992024	999	2024	0.02	0.92	1.04	0.01
9992025	999	2025	0.02	0.92	1.04	0.01
9992026	999	2026	0.02	0.92	1.04	0.01

ARB Equipment	Code	HP Bin	concat	SOX (g SOX/hp-hr)
Other General Industrial Equipment onroad	10	120	10120	0.0622888
Other General Industrial Equipment onroad	10	175	10175	0.0597464
Other General Industrial Equipment onroad	10	250	10250	0.0597464
Other General Industrial Equipment onroad	10	50	1050	0.0686448
Other General Industrial Equipment onroad	10	500	10500	0.0521192
Other General Industrial Equipment onroad	10	750	10750	0.0533904
Other General Industrial Equipment onroad	10	999	10999	0.0533904
Crane	1	120	1120	0.0622888
Crane	1	175	1175	0.0597464
Crane	1	250	1250	0.0597464
Crane	1	50	150	0.0686448
Crane	1	500	1500	0.0521192
Crane	1	750	1750	0.0533904
Crane	1	999	1999	0.0533904
Excavator	2	120	2120	0.0622888
Excavator	2	175	2175	0.0597464
Excavator	2	250	2250	0.0597464
Excavator	2	50	250	0.0686448
Excavator	2	500	2500	0.0521192
Excavator	2	750	2750	0.0533904
Forklift	3	120	3120	0.0622888
Forklift	3	175	3175	0.0597464
Forklift	3	250	3250	0.0597464
Forklift	3	50	350	0.0686448
Forklift	3	500	3500	0.0521192
Material Handling Equip	4	120	4120	0.0597464
Other General Industrial Equipment	5	120	5120	0.0622888
Other General Industrial Equipment	5	175	5175	0.0597464
Other General Industrial Equipment	5	250	5250	0.0597464
Other General Industrial Equipment	5	50	550	0.0686448
Other General Industrial Equipment	5	500	5500	0.0521192
Other General Industrial Equipment	5	750	5750	0.0533904
Other General Industrial Equipment	5	999	5999	0.0533904
Sweeper/Scrubbers	6	120	6120	0.0622888
Sweeper/Scrubbers	6	175	6175	0.0597464
Sweeper/Scrubbers	6	250	6250	0.0597464
Sweeper/Scrubbers	6	50	650	0.0686448
Tractor/Loader/Backhoe	7	120	7120	0.0622888
Tractor/Loader/Backhoe	7	175	7175	0.0597464
Tractor/Loader/Backhoe	7	250	7250	0.0597464
Tractor/Loader/Backhoe	7	50	750	0.0686448
Tractor/Loader/Backhoe	7	500	7500	0.0597464
Tractor/Loader/Backhoe	7	750	7750	0.0597464
Yard Tractor offroad	8	120	8120	0.0622888
Yard Tractor offroad	8	175	8175	0.0597464
Yard Tractor offroad	8	250	8250	0.0597464
Yard Tractor offroad	8	750	8750	0.0533904
Yard Tractor offroad	8	999	8999	0.0533904
Yard Tractor onroad	9	120	9120	0.0622888
Yard Tractor onroad	9	175	9175	0.0597464
Yard Tractor onroad	9	250	9250	0.0597464
Yard Tractor onroad	9	750	9750	0.0533904
Yard Tractor onroad	9	999	9999	0.0533904

ARB Equipment	Code	HP Bin	concat	SOX (g SOX/hp-hr)
Other General Industrial Equipment onroad	10	120	10120	0.0066738
Other General Industrial Equipment onroad	10	175	10175	0.0064014
Other General Industrial Equipment onroad	10	250	10250	0.0064014
Other General Industrial Equipment onroad	10	50	1050	0.0073548
Other General Industrial Equipment onroad	10	500	10500	0.0055842
Other General Industrial Equipment onroad	10	750	10750	0.0057204
Other General Industrial Equipment onroad	10	999	10999	0.0057204
Crane	1	120	1120	0.0066738
Crane	1	175	1175	0.0064014
Crane	1	250	1250	0.0064014
Crane	1	50	150	0.0073548
Crane	1	500	1500	0.0055842
Crane	1	750	1750	0.0057204
Crane	1	999	1999	0.0057204
Excavator	2	120	2120	0.0066738
Excavator	2	175	2175	0.0064014
Excavator	2	250	2250	0.0064014
Excavator	2	50	250	0.0073548
Excavator	2	500	2500	0.0055842
Excavator	2	750	2750	0.0057204
Forklift	3	120	3120	0.0066738
Forklift	3	175	3175	0.0064014
Forklift	3	250	3250	0.0064014
Forklift	3	50	350	0.0073548
Forklift	3	500	3500	0.0055842
Material Handling Equip	4	120	4120	0.0064014
Other General Industrial Equipment	5	120	5120	0.0066738
Other General Industrial Equipment	5	175	5175	0.0064014
Other General Industrial Equipment	5	250	5250	0.0064014
Other General Industrial Equipment	5	50	550	0.0073548
Other General Industrial Equipment	5	500	5500	0.0055842
Other General Industrial Equipment	5	750	5750	0.0057204
Other General Industrial Equipment	5	999	5999	0.0057204
Sweeper/Scrubbers	6	120	6120	0.0066738
Sweeper/Scrubbers	6	175	6175	0.0064014
Sweeper/Scrubbers	6	250	6250	0.0064014
Sweeper/Scrubbers	6	50	650	0.0073548
Tractor/Loader/Backhoe	7	120	7120	0.0066738
Tractor/Loader/Backhoe	7	175	7175	0.0064014
Tractor/Loader/Backhoe	7	250	7250	0.0064014
Tractor/Loader/Backhoe	7	50	750	0.0073548
Tractor/Loader/Backhoe	7	500	7500	0.0064014
Tractor/Loader/Backhoe	7	750	7750	0.0064014
Yard Tractor offroad	8	120	8120	0.0066738
Yard Tractor offroad	8	175	8175	0.0064014
Yard Tractor offroad	8	250	8250	0.0064014
Yard Tractor offroad	8	750	8750	0.0057204
Yard Tractor offroad	8	999	8999	0.0057204
Yard Tractor onroad	9	120	9120	0.0066738
Yard Tractor onroad	9	175	9175	0.0064014
Yard Tractor onroad	9	250	9250	0.0064014
Yard Tractor onroad	9	750	9750	0.0057204
Yard Tractor onroad	9	999	9999	0.0057204

ARB Equipment	Code	HP Bin	concat	SOX (g SOX/hp-hr)
Crane	1	120	1120	0.007491
Crane	1	175	1175	0.007491
Crane	1	50	150	0.009534
Forklift	3	120	3120	0.007491
Forklift	3	175	3175	0.007491
Forklift	3	50	350	0.009534
Other General Industrial Equipm	5	120	5120	0.007491
Other General Industrial Equipm	5	175	5175	0.007491
Other General Industrial Equipm	5	50	550	0.009534
Sweeper/Scrubbers	6	120	6120	0.007491
Sweeper/Scrubbers	6	175	6175	0.007491
Sweeper/Scrubbers	6	50	650	0.009534
Tractor/Loader/Backhoe	7	120	7120	0.007491

APPENDIX D-5

DEATILED EMISSION CALCULATIONS, EMISSION FACTOR DERIVATION, OFFROAD2007 OUTPUT, AND THE SPECIATION PROFILE FOR PROJECT YEAR 2016

Summary of Emissions from Cargo Handling Equipment
Dolores and ICTF Rail Yards, Long Beach, CA

Yard	Equipment Type	Fuel Type	Make	Model	Model Year	No of Units	Rating (hp)	Hours of Operation (hrs/yr)[1,2,3]	BSFC (lb/bhp-hr)[4]	Fuel Use (gal/yr)[5]	Load Factor[6]	Carbon Oxidation Factor[7]
ICTF	Forklift	Diesel	Toyota	6FDU25	1997	1	85	365	0.49	642	0.30	99%
ICTF	Top Pick	Diesel	Taylor	Tay-950	1989	1	350	365	0.41	4,352	0.59	99%
ICTF	Yard Hostler	LPG/LNG	TBD	TBD	2012	2	175	365	0.55	7,026	0.39	99%
ICTF	WSG Crane	Electric	TBD	TBD	NA	39	NA	8760	0	0	NA	0%
Total						**43**				**12,021**		

Yard	Equipment Type	2016 Emission Factors (g/bhp-hr)[8,9]						2016 Emission Factors (kg/gal)[7]		
		HC	CO	NOx	PM10	DPM	SOx	CO2	N2O[10]	CH4[10]
ICTF	Forklift	0.990	3.490	8.750	*0.104*	*0.104*	0.062	10.15	1.39E-05	4.16E-05
ICTF	Top Pick	0.680	2.700	8.170	*0.057*	*0.057*	0.060	10.15	1.39E-05	4.16E-05
ICTF	Yard Hostler	0.422	18.043	2.062	0.600	0.000	0.000	5.95	9.02E-06	9.02E-05
ICTF	WSG Crane	0.000	0.000	0.000	0.000	0.000	0.000	0.00	0.00E+00	0.00E+00
Total										

Yard	Equipment Type	2016 Emission Estimates (tons/yr)						2016 Emission Estimates (metric tons/yr)		
		ROG	CO	NOx	PM10	DPM	SOx	CO2	N2O	CH4
ICTF	Forklift	0.01	0.04	0.09	0.00	0.00	0.00	6.45	8.91E-06	2.67E-05
ICTF	Top Pick	0.06	0.22	0.68	0.00	0.00	0.00	43.74	6.04E-05	1.81E-04
ICTF	Yard Hostler	0.02	0.99	0.11	0.03	0.00	0.00	41.39	6.34E-05	6.34E-04
ICTF	WSG Crane	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00E+00	0.00E+00
Total		**0.09**	**1.25**	**0.88**	**0.04**	**0.006**	**0.01**	**91.58**	**1.33E-04**	**8.42E-04**

Notes:
1. By 2012 the majority of the diesel-fueled CHE will be replaced by electric WSG cranes.
2. The remaining diesel-fueled forklift and top pick will be for emergency use only.
3. Two alternative fueled (LPG, LNG, or biodiesel) yard hostlers will be for emergency use only.
4. Brake-specific fuel consumption (BSFC) from OFFROAD2007 model.
5. Calculation assumes density of Diesel fuel of 7.1 lb/gal or an LPG density of 3.9 lb/gal.
6. Default load factors from OFFROAD 2007 model was used for the top pick. The load factor for the yard hostlers was from personal communication with Harold Holmes of ARB and is based on a study conducted at the POLA/POLB.
7. From the Air Resources Board's Draft *Emission Factors for Mandatory Reporting Programs*, August 10, 2007.
8. Emission factors are from CARB's Cargo Handling Equipment Emission Calculation Spreadsheet. The DPM emission factors were adjusted for compliance with the CHE Regulation. It was assumed that a Level 3 VDECS (85% control) was installed on each unit.
9. Based on a diesel fuel HHV of 5.825 MMBtu/barrel (from ARB Draft Emission Factors for Mandatory Reporting Programs, August 10, 2007) and 42 gallons per barrel.
10. Based on a LPG HHV of 3.788 MMBtu/barrel (from ARB Draft Emission Factors for Mandatory Reporting Programs, August 10, 2007) and 42 gallons per barrel.

Toxic Air Contaminant Emissions from the Propane-Fueled Yard Hostlers
Dolores and ICTF Rail Yards, Long Beach, CA

Profile[1]	CAS	Chemical Name	Organic Fraction	2016 Emissions (tpy)
719	95636	1,2,4-trimethylbenzene	0.00001	3.53E-07
719	75070	acetaldehyde	0.00003	1.06E-06
719	71432	benzene	0.00010	3.88E-06
719	110827	cyclohexane	0.00001	3.53E-07
719	100414	ethylbenzene	0.00001	3.53E-07
719	74851	ethylene	0.00058	2.22E-05
719	50000	formaldehyde	0.00074	2.86E-05
719	108383	m-xylene	0.00001	3.53E-07
719	110543	n-hexane	0.00002	7.06E-07
719	95476	o-xylene	0.00001	3.53E-07
719	115071	propylene	0.00154	5.97E-05
719	108883	toluene	0.00004	1.41E-06
719	1330207	xylene	0.00002	7.06E-07
Total				**1.20E-04**

Notes:
1. Organic fraction from ARBs SPECIATE database. Data is from "ICE-reciprocating - natural gas" option. The SPECIATE database does not include a profile for propane-fueled engines.
2. Emissions were calculated for only chemicals that were in both the SPECIATE database and the AB2588 list.
3. Organic fraction reported on a ROG basis using ARB's Speciate ROG/TOG ratio (0.0914)

				gasoline or diesel	ULSD, LPG, electric battery, diesel-electric												
Cal Year	**Terminal ID**	**Equipment Type**	**Code**	**Fuel Type**	**Alternative Fuel Type**	**Number of Years with Alt Fuel**	**Fraction 2016 with Fuel Type**	**Fraction 2016 with Alternative Fuel Type**	**Useful Life (hours)**	**Model Year**	**Age (years)**	**Population**	**HP**	**HP Bin**	**Yearly Operational Hrs**	**Cummulative Hours with Fuel Type**	
2016	(Example Calculation)	Yard Tractor offroad	8	diesel	ULSD	0.5	0.50	0.50	24800	1997	20	1	230	250	3100	60450	
2016	ICTF	Forklift	3	diesel	ULSD	12	1.00	0.00	14600	1997	20	1	85	120	730	5840	
2016	ICTF	Crane	1	diesel	ULSD	12	1.00	0.00	157680	1997	20	1	300	500	8,760	70080	
2016	ICTF	Crane	1	diesel	ULSD	12	1.00	0.00	157680	1988	29	1	250	250	8,760	148920	
2016	ICTF	Crane	1	diesel	ULSD	12	1.00	0.00	157680	1995	22	1	300	500	8,760	87600	
2016	ICTF	Crane	1	diesel	ULSD	12	1.00	0.00	157680	1995	22	1	300	500	8,760	87600	
2016	ICTF	Crane	1	diesel	ULSD	12	1.00	0.00	157680	1995	22	1	300	500	8,760	87600	
2016	ICTF	Crane	1	diesel	ULSD	12	1.00	0.00	157680	1995	22	1	300	500	8,760	87600	
2016	ICTF	Crane	1	diesel	ULSD	12	1.00	0.00	157680	2002	15	1	300	500	8,760	26280	
2016	ICTF	Crane	1	diesel	ULSD	12	1.00	0.00	157680	2002	15	1	300	500	8,760	26280	
2016	ICTF	Crane	1	diesel	ULSD	12	1.00	0.00	157680	2005	12	1	350	500	8,760	0	
2016	ICTF	Crane	1	diesel	ULSD	11	1.00	0.00	157698	2006	11	1	300	500	8,761	0	
2016	ICTF	Material Handling Equip	4	diesel	ULSD	12	1.00	0.00	3744	1972	45	1	335	500	208	6864	
2016	ICTF	Material Handling Equip	4	diesel	ULSD	12	1.00	0.00	39420	1988	29	1	350	500	2,190	37230	
2016	ICTF	Material Handling Equip	4	diesel	ULSD	12	1.00	0.00	39420	1989	28	1	350	500	2,190	35040	
2016	ICTF	Yard Tractor offroad	8	diesel	ULSD	12	1.00	0.00	17520	1999	18	15	150	175	2,190	13140	
2016	ICTF	Yard Tractor offroad	8	diesel	ULSD	12	1.00	0.00	70080	2005	12	58	173	175	8,760	0	

		If no emission control leave blank															
Alt Fuel Cumm Hours	Emission Control Factor? (y/n)	Emission Control	Fraction of Year with fuel with Emission Control	Fraction of Year with fuel without Emission Control	Fraction of Year with alt fuel with Emission Control	Fraction of Year with alt fuel without Emission Control	Load Factor	HPMY	HC EF	(alt fuel) HC EF	Emission Control HC EF	(alt fuel) Emission Control HC EF	HC dr	HC DR (alt fuel)	FCF HC	FCF HC (alt fuel)	CO EF
1550	y	DOC	0	1	0.66667	0.333333	0.65	2501997	0.3200	0.3200	0.0960	0.0960	0.000006	0.000006	0.72	0.72	0.9200
8760	n		0	1			0.30	1201997	9.90E-01	9.90E-01	0.00E+00	0.00E+00	1.90E-05	1.90E-05	7.20E-01	7.20E-01	3.49E+00
105120	n		0	1			0.43	5001997	3.20E-01	3.20E-01	0.00E+00	0.00E+00	8.93E-07	8.93E-07	7.20E-01	7.20E-01	9.20E-01
105120	n		0	1			0.43	2501988	6.80E-01	6.80E-01	0.00E+00	0.00E+00	1.90E-06	1.90E-06	7.20E-01	7.20E-01	2.70E+00
105120	n		0	1			0.43	5001995	6.80E-01	6.80E-01	0.00E+00	0.00E+00	1.90E-06	1.90E-06	7.20E-01	7.20E-01	2.70E+00
105120	n		0	1			0.43	5001995	6.80E-01	6.80E-01	0.00E+00	0.00E+00	1.90E-06	1.90E-06	7.20E-01	7.20E-01	2.70E+00
105120	n		0	1			0.43	5001995	6.80E-01	6.80E-01	0.00E+00	0.00E+00	1.90E-06	1.90E-06	7.20E-01	7.20E-01	2.70E+00
105120	n		0	1			0.43	5001995	6.80E-01	6.80E-01	0.00E+00	0.00E+00	1.90E-06	1.90E-06	7.20E-01	7.20E-01	2.70E+00
105120	n		0	1			0.43	5002002	1.40E-01	1.40E-01	0.00E+00	0.00E+00	3.91E-07	3.91E-07	7.20E-01	7.20E-01	9.20E-01
105120	n		0	1			0.43	5002002	1.40E-01	1.40E-01	0.00E+00	0.00E+00	3.91E-07	3.91E-07	7.20E-01	7.20E-01	9.20E-01
105120	n		0	1			0.43	5002005	1.00E-01	1.00E-01	0.00E+00	0.00E+00	2.79E-07	2.79E-07	7.20E-01	7.20E-01	9.20E-01
96371	n		0	1			0.43	5002006	1.00E-01	1.00E-01	0.00E+00	0.00E+00	2.79E-07	2.79E-07	7.20E-01	7.20E-01	9.20E-01
2496	n		0	1			0.59	5001972	9.50E-01	9.50E-01	0.00E+00	0.00E+00	1.12E-04	1.12E-04	7.20E-01	7.20E-01	4.20E+00
26280	n		0	1			0.59	5001988	6.80E-01	6.80E-01	0.00E+00	0.00E+00	7.59E-06	7.59E-06	7.20E-01	7.20E-01	2.70E+00
26280	n		0	1			0.59	5001989	6.80E-01	6.80E-01	0.00E+00	0.00E+00	7.59E-06	7.59E-06	7.20E-01	7.20E-01	2.70E+00
26280	n		0	1			0.65	1751999	6.80E-01	6.80E-01	0.00E+00	0.00E+00	1.09E-05	1.09E-05	7.20E-01	7.20E-01	2.70E+00
105120	n		0	1			0.65	1752005	1.60E-01	1.60E-01	0.00E+00	0.00E+00	6.39E-07	6.39E-07	7.20E-01	7.20E-01	2.70E+00

(alt fuel) CO EF	Emission Control CO EF	(alt fuel) Emission Control CO EF	CO dr	CO dr (alt fuel)	FCF CO	NOX EF	(alt fuel) NOX EF	Emission Control NOX EF	(alt fuel) Emission Control NOX EF	NOX dr	NOX dr (alt fuel)	FCF NOX	FCF NOX (alt fuel)	PM EF	(alt fuel) PM EF	Emission Control PM EF	(alt fuel) Emission Control PM EF
0.9200	0.2760	0.2760	0.000009	0.000009	1.00	6.2500	6.2500	6.2500	6.2500	0.000053	0.000053	0.95	0.95	0.1500	0.1500	0.1050	0.1050
3.49E+00	0.00E+00	0.00E+00	3.82E-05	3.82E-05	1.00E+00	8.75E+00	8.75E+00	0.00E+00	0.00E+00	8.39E-05	8.39E-05	9.48E-01	9.48E-01	6.90E-01	0.6900	0.0000	0.0000
9.20E-01	0.00E+00	0.00E+00	1.46E-06	1.46E-06	1.00E+00	6.25E+00	6.25E+00	0.00E+00	0.00E+00	8.32E-06	8.32E-06	9.48E-01	9.48E-01	1.50E-01	0.1500	0.0000	0.0000
2.70E+00	0.00E+00	0.00E+00	4.28E-06	4.28E-06	1.00E+00	8.17E+00	8.17E+00	0.00E+00	0.00E+00	1.09E-05	1.09E-05	9.30E-01	9.30E-01	3.80E-01	0.3800	0.0000	0.0000
2.70E+00	0.00E+00	0.00E+00	4.28E-06	4.28E-06	1.00E+00	8.17E+00	8.17E+00	0.00E+00	0.00E+00	1.09E-05	1.09E-05	9.30E-01	9.30E-01	3.80E-01	0.3800	0.0000	0.0000
2.70E+00	0.00E+00	0.00E+00	4.28E-06	4.28E-06	1.00E+00	8.17E+00	8.17E+00	0.00E+00	0.00E+00	1.09E-05	1.09E-05	9.30E-01	9.30E-01	3.80E-01	0.3800	0.0000	0.0000
2.70E+00	0.00E+00	0.00E+00	4.28E-06	4.28E-06	1.00E+00	8.17E+00	8.17E+00	0.00E+00	0.00E+00	1.09E-05	1.09E-05	9.30E-01	9.30E-01	3.80E-01	0.3800	0.0000	0.0000
2.70E+00	0.00E+00	0.00E+00	4.28E-06	4.28E-06	1.00E+00	8.17E+00	8.17E+00	0.00E+00	0.00E+00	1.09E-05	1.09E-05	9.30E-01	9.30E-01	3.80E-01	0.3800	0.0000	0.0000
9.20E-01	0.00E+00	0.00E+00	1.46E-06	1.46E-06	1.00E+00	4.51E+00	4.51E+00	0.00E+00	0.00E+00	6.01E-06	6.01E-06	9.48E-01	9.48E-01	1.10E-01	0.1100	0.0000	0.0000
9.20E-01	0.00E+00	0.00E+00	1.46E-06	1.46E-06	1.00E+00	4.51E+00	4.51E+00	0.00E+00	0.00E+00	6.01E-06	6.01E-06	9.48E-01	9.48E-01	1.10E-01	0.1100	0.0000	0.0000
9.20E-01	0.00E+00	0.00E+00	1.46E-06	1.46E-06	1.00E+00	4.00E+00	4.00E+00	0.00E+00	0.00E+00	5.33E-06	5.33E-06	9.48E-01	9.48E-01	1.10E-01	0.1100	0.0000	0.0000
9.20E-01	0.00E+00	0.00E+00	1.46E-06	1.46E-06	1.00E+00	2.45E+00	2.45E+00	0.00E+00	0.00E+00	3.26E-06	3.26E-06	9.48E-01	9.48E-01	1.10E-01	0.1100	0.0000	0.0000
4.20E+00	0.00E+00	0.00E+00	2.80E-04	2.80E-04	1.00E+00	1.20E+01	1.20E+01	0.00E+00	0.00E+00	6.73E-04	6.73E-04	9.30E-01	9.30E-01	5.30E-01	0.5300	0.0000	0.0000
2.70E+00	0.00E+00	0.00E+00	1.71E-05	1.71E-05	1.00E+00	8.17E+00	8.17E+00	0.00E+00	0.00E+00	4.35E-05	4.35E-05	9.30E-01	9.30E-01	3.80E-01	0.3800	0.0000	0.0000
2.70E+00	0.00E+00	0.00E+00	1.71E-05	1.71E-05	1.00E+00	8.17E+00	8.17E+00	0.00E+00	0.00E+00	4.35E-05	4.35E-05	9.30E-01	9.30E-01	3.80E-01	0.3800	0.0000	0.0000
2.70E+00	0.00E+00	0.00E+00	2.47E-05	2.47E-05	1.00E+00	6.90E+00	6.90E+00	0.00E+00	0.00E+00	5.51E-05	5.51E-05	9.48E-01	9.48E-01	3.80E-01	0.3800	0.0000	0.0000
2.70E+00	0.00E+00	0.00E+00	6.16E-06	6.16E-06	1.00E+00	4.44E+00	4.44E+00	0.00E+00	0.00E+00	8.87E-06	8.87E-06	9.48E-01	9.48E-01	1.60E-01	0.1600	0.0000	0.0000

						Emissions (tons/year)								Emissions (tons/day)							
PM dr	PM dr (alt fuel)	FCF PM	FCF PM (alt fuel)	SOX EF	(alt fuel) SOX EF	TOG	ROG	CO	NOX	SOX	PM	PM10	PM2.5	TOG	ROG	CO	NOX	SOX	PM	PM10	PM2.5
0.000004	0.000004	0.82	0.82	5.97E-02	6.40E-03	3.16E-01	2.78E-01	6.53E-01	4.61E+00	1.69E-02	1.62E-01	1.62E-01	1.49E-01	8.66E-04	7.61E-04	1.79E-03	1.26E-02	4.62E-05	4.44E-04	4.44E-04	4.08E-04
0.000021	0.000021	0.82	0.82	6.23E-02	6.67E-03	2.69E-02	2.37E-02	8.30E-02	1.94E-01	1.28E-03	1.67E-02	1.67E-02	1.54E-02	7.38E-05	6.48E-05	2.27E-04	5.31E-04	3.50E-06	4.59E-05	4.59E-05	4.22E-05
0.000001	0.000001	0.82	0.82	5.21E-02	5.58E-03	6.15E-01	5.40E-01	1.46E+00	9.09E+00	6.49E-02	2.68E-01	2.68E-01	2.46E-01	1.68E-03	1.48E-03	4.01E-03	2.49E-02	1.78E-04	7.33E-04	7.33E-04	6.75E-04
0.000002	0.000002	0.75	0.75	5.97E-02	6.40E-03	1.25E+00	1.10E+00	3.93E+00	1.05E+01	6.20E-02	6.15E-01	6.15E-01	5.65E-01	3.42E-03	3.01E-03	1.08E-02	2.89E-02	1.70E-04	1.68E-03	1.68E-03	1.55E-03
0.000002	0.000002	0.75	0.75	5.21E-02	5.58E-03	1.35E+00	1.19E+00	4.39E+00	1.19E+01	6.49E-02	6.45E-01	6.45E-01	5.94E-01	3.70E-03	3.25E-03	1.20E-02	3.26E-02	1.78E-04	1.77E-03	1.77E-03	1.63E-03
0.000002	0.000002	0.75	0.75	5.21E-02	5.58E-03	1.35E+00	1.19E+00	4.39E+00	1.19E+01	6.49E-02	6.45E-01	6.45E-01	5.94E-01	3.70E-03	3.25E-03	1.20E-02	3.26E-02	1.78E-04	1.77E-03	1.77E-03	1.63E-03
0.000002	0.000002	0.75	0.75	5.21E-02	5.58E-03	1.35E+00	1.19E+00	4.39E+00	1.19E+01	6.49E-02	6.45E-01	6.45E-01	5.94E-01	3.70E-03	3.25E-03	1.20E-02	3.26E-02	1.78E-04	1.77E-03	1.77E-03	1.63E-03
0.000002	0.000002	0.75	0.75	5.21E-02	5.58E-03	1.35E+00	1.19E+00	4.39E+00	1.19E+01	6.49E-02	6.45E-01	6.45E-01	5.94E-01	3.70E-03	3.25E-03	1.20E-02	3.26E-02	1.78E-04	1.77E-03	1.77E-03	1.63E-03
0.000000	0.000000	0.82	0.82	5.21E-02	5.58E-03	2.47E-01	2.17E-01	1.38E+00	6.25E+00	6.49E-02	1.75E-01	1.75E-01	1.61E-01	6.76E-04	5.94E-04	3.79E-03	1.71E-02	1.78E-04	4.80E-04	4.80E-04	4.42E-04
0.000000	0.000000	0.82	0.82	5.21E-02	5.58E-03	2.47E-01	2.17E-01	1.38E+00	6.25E+00	6.49E-02	1.75E-01	1.75E-01	1.61E-01	6.76E-04	5.94E-04	3.79E-03	1.71E-02	1.78E-04	4.80E-04	4.80E-04	4.42E-04
0.000000	0.000000	0.82	0.82	5.21E-02	5.58E-03	1.95E-01	1.71E-01	1.56E+00	6.28E+00	7.57E-02	1.90E-01	1.90E-01	1.75E-01	5.33E-04	4.69E-04	4.27E-03	1.72E-02	2.07E-04	5.20E-04	5.20E-04	4.79E-04
0.000000	0.000000	0.82	0.82	5.21E-02	5.58E-03	1.64E-01	1.44E-01	1.32E+00	3.26E+00	6.49E-02	1.59E-01	1.59E-01	1.46E-01	4.49E-04	3.94E-04	3.62E-03	8.94E-03	1.78E-04	4.35E-04	4.35E-04	4.00E-04
0.000095	0.000095	0.75	0.75	5.97E-02	6.40E-03	9.37E-02	8.23E-02	3.09E-01	7.71E-01	2.71E-03	4.81E-02	4.81E-02	4.43E-02	2.57E-04	2.25E-04	8.47E-04	2.11E-03	7.41E-06	1.32E-04	1.32E-04	1.21E-04
0.000006	0.000006	0.75	0.75	5.97E-02	6.40E-03	6.00E-01	5.27E-01	1.89E+00	5.06E+00	2.98E-02	2.95E-01	2.95E-01	2.72E-01	1.64E-03	1.44E-03	5.17E-03	1.39E-02	8.15E-05	8.09E-04	8.09E-04	7.44E-04
0.000006	0.000006	0.75	0.75	5.97E-02	6.40E-03	5.91E-01	5.20E-01	1.87E+00	5.02E+00	2.98E-02	2.90E-01	2.90E-01	2.67E-01	1.62E-03	1.42E-03	5.12E-03	1.38E-02	8.15E-05	7.94E-04	7.94E-04	7.31E-04
0.000010	0.000010	0.82	0.82	5.97E-02	6.40E-03	4.05E+00	3.56E+00	1.30E+01	3.03E+01	2.11E-01	2.19E+00	2.19E+00	2.02E+00	1.11E-02	9.76E-03	3.55E-02	8.31E-02	5.77E-04	6.01E-03	6.01E-03	5.53E-03
0.000001	0.000001	0.82	0.82	5.97E-02	6.40E-03	1.48E+01	1.30E+01	2.11E+02	3.20E+02	3.76E+00	1.37E+01	1.37E+01	1.26E+01	4.06E-02	3.57E-02	5.77E-01	8.78E-01	1.03E-02	3.76E-02	3.76E-02	3.46E-02

Type	Useful Life (yr)	Load Factor
Crane	18	0.43
Excavator	16	0.57
Forklift	20	0.30
Material Handling Equip	18	0.59
Other General Industrial Equipment	16	0.51
Sweeper/Scrubber	16	0.68
Tractor/Loader/Backhoe	16	0.55
Yard Tractor offroad	8	0.65
Yard Tractor onroad	8	0.65
Other General Industrial Equipment onroad	16	0.51

Diesel and ULSD Fuel Correction Factor

t_fcf

	Calyr 1994 -2006		
Model Yr	**NOX**	**PM**	**HC**
1968	0.930	0.750	0.720
1969	0.930	0.750	0.720
1970	0.930	0.750	0.720
1971	0.930	0.750	0.720
1972	0.930	0.750	0.720
1973	0.930	0.750	0.720
1974	0.930	0.750	0.720
1975	0.930	0.750	0.720
1976	0.930	0.750	0.720
1977	0.930	0.750	0.720
1978	0.930	0.750	0.720
1979	0.930	0.750	0.720
1980	0.930	0.750	0.720
1981	0.930	0.750	0.720
1982	0.930	0.750	0.720
1983	0.930	0.750	0.720
1984	0.930	0.750	0.720
1985	0.930	0.750	0.720
1986	0.930	0.750	0.720
1987	0.930	0.750	0.720
1988	0.930	0.750	0.720
1989	0.930	0.750	0.720
1990	0.930	0.750	0.720
1991	0.930	0.750	0.720
1992	0.930	0.750	0.720
1993	0.930	0.750	0.720
1994	0.930	0.750	0.720
1995	0.930	0.750	0.720
1996	0.948	0.822	0.720
1997	0.948	0.822	0.720
1998	0.948	0.822	0.720
1999	0.948	0.822	0.720
2000	0.948	0.822	0.720
2001	0.948	0.822	0.720
2002	0.948	0.822	0.720
2003	0.948	0.822	0.720
2004	0.948	0.822	0.720
2005	0.948	0.822	0.720
2006	0.948	0.822	0.720
2007	0.948	0.822	0.720
2008	0.948	0.822	0.720
2009	0.948	0.822	0.720
2010	0.948	0.822	0.720
2011	0.948	0.822	0.720
2012	0.948	0.822	0.720
2013	0.948	0.822	0.720
2014	0.948	0.822	0.720
2015	0.948	0.822	0.720
2016	0.948	0.822	0.720
2017	0.948	0.822	0.720
2018	0.948	0.822	0.720

HP_dr diesel fuel

	Det. Rate			
HP	**HC**	**CO**	**NOx**	**PM**
50	51%	41%	6%	31%
120	28%	16%	14%	44%
175	28%	16%	14%	44%
250	44%	25%	21%	67%
500	44%	25%	21%	67%

Gasoline Fuel Correction Factor

	Calyr 1996+		
Model Yr	NOX	CO	HC
1968	1.025	0.848	0.921
1969	1.025	0.848	0.921
1970	1.025	0.848	0.921
1971	1.025	0.848	0.921
1972	1.025	0.848	0.921
1973	1.025	0.848	0.921
1974	1.025	0.848	0.921
1975	1.025	0.848	0.921
1976	1.025	0.848	0.921
1977	1.025	0.848	0.921
1978	1.025	0.848	0.921
1979	1.025	0.848	0.921
1980	1.025	0.848	0.921
1981	1.025	0.848	0.921
1982	1.025	0.848	0.921
1983	1.025	0.848	0.921
1984	1.025	0.848	0.921
1985	1.025	0.848	0.921
1986	1.025	0.848	0.921
1987	1.025	0.848	0.921
1988	1.025	0.848	0.921
1989	1.025	0.848	0.921
1990	1.025	0.848	0.921
1991	1.025	0.848	0.921
1992	1.025	0.848	0.921
1993	1.025	0.848	0.921
1994	1.025	0.848	0.921
1995	1.025	0.848	0.921
1996	1.000	1.000	1.000
1997	1.000	1.000	1.000
1998	1.000	1.000	1.000
1999	1.000	1.000	1.000
2000	1.000	1.000	1.000
2001	1.000	1.000	1.000
2002	1.000	1.000	1.000
2003	1.000	1.000	1.000
2004	1.000	1.000	1.000
2005	1.000	1.000	1.000

Engine changes	Emission Changes %			
	HC	CO	NOx	PM
DOC	0.70	0.70	0.00	0.30
DPF (P)	0.90	0.90	0.00	0.85
DPF (A)	0.00	0.00	0.00	0.85
Emulsified Fuel	-0.23	-0.10	0.15	0.30
DOC+emulsified fuel	0.63	0.67	0.20	0.50
DOC + PurinNOx	0.63	0.67	0.20	0.50
O2 Diesel	-0.75	0.10	0.02	0.20
DOC + O2Diesel	0.48	0.73	0.02	0.44

Equipment Types	Code
Crane	**1**
Excavator	**2**
Forklift	**3**
Material Handling Equip	**4**
Other General Industrial Equipment	**5**
Sweeper/Scrubbers	**6**
Tractor/Loader/Backhoe	**7**
Yard Tractor offroad	**8**
Yard Tractor onroad	**9**
Other General Industrial Equipment onroad	**10**

***New Tier4 emfacs included with 43/57% split for 120 hp merged (diesel only)**

units = g/bhp hr

Lookup	Hp	Year	HC	CO	NOX	PM
251968	25	1968	1.84	5	6.92	0.764
251969	25	1969	1.84	5	6.92	0.764
251970	25	1970	1.84	5	6.92	0.764
251971	25	1971	1.84	5	6.92	0.764
251972	25	1972	1.84	5	6.92	0.764
251973	25	1973	1.84	5	6.92	0.764
251974	25	1974	1.84	5	6.92	0.764
251975	25	1975	1.84	5	6.92	0.764
251976	25	1976	1.84	5	6.92	0.764
251977	25	1977	1.84	5	6.92	0.764
251978	25	1978	1.84	5	6.92	0.764
251979	25	1979	1.84	5	6.92	0.764
251980	25	1980	1.84	5	6.92	0.764
251981	25	1981	1.84	5	6.92	0.764
251982	25	1982	1.84	5	6.92	0.764
251983	25	1983	1.84	5	6.92	0.764
251984	25	1984	1.84	5	6.92	0.764
251985	25	1985	1.84	5	6.92	0.764
251986	25	1986	1.84	5	6.92	0.764
251987	25	1987	1.84	5	6.92	0.764
251988	25	1988	1.84	5	6.92	0.764
251989	25	1989	1.84	5	6.92	0.764
251990	25	1990	1.84	5	6.92	0.764
251991	25	1991	1.84	5	6.92	0.764
251992	25	1992	1.84	5	6.92	0.764
251993	25	1993	1.84	5	6.92	0.764
251994	25	1994	1.84	5	6.92	0.764
251995	25	1995	1.63	1.4	3.89	0.417
251996	25	1996	1.63	1.4	3.89	0.417
251997	25	1997	1.63	1.4	3.89	0.417
251998	25	1998	1.63	1.4	3.89	0.417
251999	25	1999	0.52	0.5	1.24	0.116
252000	25	2000	0.52	0.5	1.24	0.116
252001	25	2001	0.52	0.5	1.24	0.116
252002	25	2002	0.52	0.5	1.24	0.116
252003	25	2003	0.52	0.5	1.24	0.116
252004	25	2004	0.52	0.5	1.24	0.116
252005	25	2005	0.52	0.5	1.24	0.116
252006	25	2006	0.52	0.5	1.24	0.116
252007	25	2007	0.52	0.5	1.24	0.116
252008	25	2008	0.52	0.5	1.24	0.116
252009	25	2009	0.52	0.5	1.24	0.116
252010	25	2010	0.52	0.5	1.24	0.116
252011	25	2011	0.52	0.5	1.24	0.116
252012	25	2012	0.52	0.5	1.24	0.116
252013	25	2013	0.52	0.5	1.24	0.116
252014	25	2014	0.52	0.5	1.24	0.116
252015	25	2015	0.52	0.5	1.24	0.116
252016	25	2016	0.52	0.5	1.24	0.116
252017	25	2017	0.52	0.5	1.24	0.116
252018	25	2018	0.52	0.5	1.24	0.116
252019	25	2019	0.52	0.5	1.24	0.116
252020	25	2020	0.52	0.5	1.24	0.116
252021	25	2021	0.52	0.5	1.24	0.116
252022	25	2022	0.52	0.5	1.24	0.116

Lookup	Hp	Year	HC	CO	NOX	PM
252023	25	2023	0.52	0.5	1.24	0.116
252024	25	2024	0.52	0.5	1.24	0.116
252025	25	2025	0.52	0.5	1.24	0.116
252026	25	2026	0.52	0.5	1.24	0.116
501969	50	1969	1.84	5	7	0.76
501969	50	1969	1.84	5	7	0.76
501970	50	1970	1.84	5	7	0.76
501971	50	1971	1.84	5	7	0.76
501972	50	1972	1.84	5	7	0.76
501973	50	1973	1.84	5	7	0.76
501974	50	1974	1.84	5	7	0.76
501975	50	1975	1.84	5	7	0.76
501976	50	1976	1.84	5	7	0.76
501977	50	1977	1.84	5	7	0.76
501978	50	1978	1.84	5	7	0.76
501979	50	1979	1.84	5	7	0.76
501980	50	1980	1.84	5	7	0.76
501981	50	1981	1.84	5	7	0.76
501982	50	1982	1.84	5	7	0.76
501983	50	1983	1.84	5	7	0.76
501984	50	1984	1.84	5	7	0.76
501985	50	1985	1.84	5	7	0.76
501986	50	1986	1.84	5	7	0.76
501987	50	1987	1.84	5	7	0.76
501988	50	1988	1.8	5	6.9	0.76
501989	50	1989	1.8	5	6.9	0.76
501990	50	1990	1.8	5	6.9	0.76
501991	50	1991	1.8	5	6.9	0.76
501992	50	1992	1.8	5	6.9	0.76
501993	50	1993	1.8	5	6.9	0.76
501994	50	1994	1.8	5	6.9	0.76
501995	50	1995	1.8	5	6.9	0.76
501996	50	1996	1.8	5	6.9	0.76
501997	50	1997	1.8	5	6.9	0.76
501998	50	1998	1.8	5	6.9	0.76
501999	50	1999	1.45	4.1	5.55	0.6
502000	50	2000	1.45	4.1	5.55	0.6
502001	50	2001	1.45	4.1	5.55	0.6
502002	50	2002	1.45	4.1	5.55	0.6
502003	50	2003	1.45	4.1	5.55	0.6
502004	50	2004	0.64	3.27	5.1	0.43
502005	50	2005	0.37	3	4.95	0.38
502006	50	2006	0.24	2.86	4.88	0.35
502007	50	2007	0.24	2.86	4.88	0.35
502008	50	2008	0.1	2.72	4.8	0.16
502009	50	2009	0.1	2.72	4.8	0.16
502010	50	2010	0.1	2.72	4.8	0.16
502011	50	2011	0.1	2.72	4.8	0.16
502012	50	2012	0.1	2.72	4.8	0.16
502013	50	2013	0.1	2.72	2.9	0.01
502014	50	2014	0.1	2.72	2.9	0.01
502015	50	2015	0.1	2.72	2.9	0.01
502016	50	2016	0.1	2.72	2.9	0.01
502017	50	2017	0.1	2.72	2.9	0.01
502018	50	2018	0.1	2.72	2.9	0.01
502019	50	2019	0.1	2.72	2.9	0.01
502020	50	2020	0.1	2.72	2.9	0.01
502021	50	2021	0.1	2.72	2.9	0.01

Lookup	Hp	Year	HC	CO	NOX	PM
502022	50	2022	0.1	2.72	2.9	0.01
502023	50	2023	0.1	2.72	2.9	0.01
502024	50	2024	0.1	2.72	2.9	0.01
502025	50	2025	0.1	2.72	2.9	0.01
502026	50	2026	0.1	2.72	2.9	0.01
1201968	120	1968	1.44	4.8	13	0.84
1201969	120	1969	1.44	4.8	13	0.84
1201970	120	1970	1.44	4.8	13	0.84
1201971	120	1971	1.44	4.8	13	0.84
1201972	120	1972	1.44	4.8	13	0.84
1201973	120	1973	1.44	4.8	13	0.84
1201974	120	1974	1.44	4.8	13	0.84
1201975	120	1975	1.44	4.8	13	0.84
1201976	120	1976	1.44	4.8	13	0.84
1201977	120	1977	1.44	4.8	13	0.84
1201978	120	1978	1.44	4.8	13	0.84
1201979	120	1979	1.44	4.8	13	0.84
1201980	120	1980	1.44	4.8	13	0.84
1201981	120	1981	1.44	4.8	13	0.84
1201982	120	1982	1.44	4.8	13	0.84
1201983	120	1983	1.44	4.8	13	0.84
1201984	120	1984	1.44	4.8	13	0.84
1201985	120	1985	1.44	4.8	13	0.84
1201986	120	1986	1.44	4.8	13	0.84
1201987	120	1987	1.44	4.8	13	0.84
1201988	120	1988	0.99	3.49	8.75	0.69
1201989	120	1989	0.99	3.49	8.75	0.69
1201990	120	1990	0.99	3.49	8.75	0.69
1201991	120	1991	0.99	3.49	8.75	0.69
1201992	120	1992	0.99	3.49	8.75	0.69
1201993	120	1993	0.99	3.49	8.75	0.69
1201994	120	1994	0.99	3.49	8.75	0.69
1201995	120	1995	0.99	3.49	8.75	0.69
1201996	120	1996	0.99	3.49	8.75	0.69
1201997	120	1997	0.99	3.49	8.75	0.69
1201998	120	1998	0.99	3.49	6.9	0.69
1201999	120	1999	0.99	3.49	6.9	0.69
1202000	120	2000	0.99	3.49	6.9	0.69
1202001	120	2001	0.99	3.49	6.9	0.69
1202002	120	2002	0.99	3.49	6.9	0.69
1202003	120	2003	0.99	3.49	6.9	0.69
1202004	120	2004	0.46	3.23	5.64	0.39
1202005	120	2005	0.28	3.14	5.22	0.29
1202006	120	2006	0.19	3.09	5.01	0.24
1202007	120	2007	0.19	3.09	5.01	0.24
1202008	120	2008	0.1	3.05	2.89	0.197
1202009	120	2009	0.1	3.05	2.89	0.197
1202010	120	2010	0.1	3.05	2.89	0.197
1202011	120	2011	0.1	3.05	2.89	0.197
1202012	120	2012	0.0943	3.05	2.5309	0.0659
1202013	120	2013	0.0943	3.05	2.5309	0.01
1202014	120	2014	0.0943	3.05	2.5309	0.01
1202015	120	2015	0.0715	3.05	1.3966	0.01
1202016	120	2016	0.0715	3.05	1.3966	0.01
1202017	120	2017	0.0715	3.05	1.3966	0.01
1202018	120	2018	0.0715	3.05	1.3966	0.01
1202019	120	2019	0.0715	3.05	1.3966	0.01
1202020	120	2020	0.0715	3.05	1.3966	0.01

Lookup	Hp	Year	HC	CO	NOX	PM
1202021	120	2021	0.0715	3.05	1.3966	0.01
1202022	120	2022	0.0715	3.05	1.3966	0.01
1202023	120	2023	0.0715	3.05	1.3966	0.01
1202024	120	2024	0.0715	3.05	1.3966	0.01
1202025	120	2025	0.0715	3.05	1.3966	0.01
1202026	120	2026	0.0715	3.05	1.3966	0.01
1751968	175	1968	1.32	4.4	14	0.77
1751969	175	1969	1.32	4.4	14	0.77
1751970	175	1970	1.1	4.4	13	0.66
1751971	175	1971	1.1	4.4	13	0.66
1751972	175	1972	1	4.4	12	0.55
1751973	175	1973	1	4.4	12	0.55
1751974	175	1974	1	4.4	12	0.55
1751975	175	1975	1	4.4	12	0.55
1751976	175	1976	1	4.4	12	0.55
1751977	175	1977	1	4.4	12	0.55
1751978	175	1978	1	4.4	12	0.55
1751979	175	1979	1	4.4	12	0.55
1751980	175	1980	0.94	4.3	11	0.55
1751981	175	1981	0.94	4.3	11	0.55
1751982	175	1982	0.94	4.3	11	0.55
1751983	175	1983	0.94	4.3	11	0.55
1751984	175	1984	0.94	4.3	11	0.55
1751985	175	1985	0.88	4.2	11	0.55
1751986	175	1986	0.88	4.2	11	0.55
1751987	175	1987	0.88	4.2	11	0.55
1751988	175	1988	0.68	2.7	8.17	0.38
1751989	175	1989	0.68	2.7	8.17	0.38
1751990	175	1990	0.68	2.7	8.17	0.38
1751991	175	1991	0.68	2.7	8.17	0.38
1751992	175	1992	0.68	2.7	8.17	0.38
1751993	175	1993	0.68	2.7	8.17	0.38
1751994	175	1994	0.68	2.7	8.17	0.38
1751995	175	1995	0.68	2.7	8.17	0.38
1751996	175	1996	0.68	2.7	8.17	0.38
1751997	175	1997	0.68	2.7	6.9	0.38
1751998	175	1998	0.68	2.7	6.9	0.38
1751999	175	1999	0.68	2.7	6.9	0.38
1752000	175	2000	0.68	2.7	6.9	0.38
1752001	175	2001	0.68	2.7	6.9	0.38
1752002	175	2002	0.68	2.7	6.9	0.38
1752003	175	2003	0.33	2.7	5.26	0.24
1752004	175	2004	0.22	2.7	4.72	0.19
1752005	175	2005	0.16	2.7	4.44	0.16
1752006	175	2006	0.16	2.7	4.44	0.16
1752007	175	2007	0.1	2.7	2.45	0.14
1752008	175	2008	0.1	2.7	2.45	0.14
1752009	175	2009	0.1	2.7	2.45	0.14
1752010	175	2010	0.1	2.7	2.45	0.14
1752011	175	2011	0.1	2.7	2.45	0.14
1752012	175	2012	0.09	2.7	2.27	0.01
1752013	175	2013	0.09	2.7	2.27	0.01
1752014	175	2014	0.09	2.7	2.27	0.01
1752015	175	2015	0.05	2.7	0.27	0.01
1752016	175	2016	0.05	2.7	0.27	0.01
1752017	175	2017	0.05	2.7	0.27	0.01
1752018	175	2018	0.05	2.7	0.27	0.01
1752019	175	2019	0.05	2.7	0.27	0.01

Lookup	Hp	Year	HC	CO	NOX	PM
1752020	175	2020	0.05	2.7	0.27	0.01
1752021	175	2021	0.05	2.7	0.27	0.01
1752022	175	2022	0.05	2.7	0.27	0.01
1752023	175	2023	0.05	2.7	0.27	0.01
1752024	175	2024	0.05	2.7	0.27	0.01
1752025	175	2025	0.05	2.7	0.27	0.01
1752026	175	2026	0.05	2.7	0.27	0.01
2501968	250	1968	1.32	4.4	14	0.77
2501969	250	1969	1.32	4.4	14	0.77
2501970	250	1970	1.1	4.4	13	0.66
2501971	250	1971	1.1	4.4	13	0.66
2501972	250	1972	1	4.4	12	0.55
2501973	250	1973	1	4.4	12	0.55
2501974	250	1974	1	4.4	12	0.55
2501975	250	1975	1	4.4	12	0.55
2501976	250	1976	1	4.4	12	0.55
2501977	250	1977	1	4.4	12	0.55
2501978	250	1978	1	4.4	12	0.55
2501979	250	1979	1	4.4	12	0.55
2501980	250	1980	0.94	4.3	11	0.55
2501981	250	1981	0.94	4.3	11	0.55
2501982	250	1982	0.94	4.3	11	0.55
2501983	250	1983	0.94	4.3	11	0.55
2501984	250	1984	0.94	4.3	11	0.55
2501985	250	1985	0.88	4.2	11	0.55
2501986	250	1986	0.88	4.2	11	0.55
2501987	250	1987	0.88	4.2	11	0.55
2501988	250	1988	0.68	2.7	8.17	0.38
2501989	250	1989	0.68	2.7	8.17	0.38
2501990	250	1990	0.68	2.7	8.17	0.38
2501991	250	1991	0.68	2.7	8.17	0.38
2501992	250	1992	0.68	2.7	8.17	0.38
2501993	250	1993	0.68	2.7	8.17	0.38
2501994	250	1994	0.68	2.7	8.17	0.38
2501995	250	1995	0.68	2.7	8.17	0.38
2501996	250	1996	0.32	0.92	6.25	0.15
2501997	250	1997	0.32	0.92	6.25	0.15
2501998	250	1998	0.32	0.92	6.25	0.15
2501999	250	1999	0.32	0.92	6.25	0.15
2502000	250	2000	0.32	0.92	6.25	0.15
2502001	250	2001	0.32	0.92	6.25	0.15
2502002	250	2002	0.32	0.92	6.25	0.15
2502003	250	2003	0.19	0.92	5	0.12
2502004	250	2004	0.14	0.92	4.58	0.11
2502005	250	2005	0.12	0.92	4.38	0.11
2502006	250	2006	0.12	0.92	4.38	0.11
2502007	250	2007	0.1	0.92	2.45	0.11
2502008	250	2008	0.1	0.92	2.45	0.11
2502009	250	2009	0.1	0.92	2.45	0.11
2502010	250	2010	0.1	0.92	2.45	0.11
2502011	250	2011	0.07	0.92	1.36	0.01
2502012	250	2012	0.07	0.92	1.36	0.01
2502013	250	2013	0.07	0.92	1.36	0.01
2502014	250	2014	0.05	0.92	0.27	0.01
2502015	250	2015	0.05	0.92	0.27	0.01
2502016	250	2016	0.05	0.92	0.27	0.01
2502017	250	2017	0.05	0.92	0.27	0.01
2502018	250	2018	0.05	0.92	0.27	0.01

Lookup	Hp	Year	HC	CO	NOX	PM
2502019	250	2019	0.05	0.92	0.27	0.01
2502020	250	2020	0.05	0.92	0.27	0.01
2502021	250	2021	0.05	0.92	0.27	0.01
2502022	250	2022	0.05	0.92	0.27	0.01
2502023	250	2023	0.05	0.92	0.27	0.01
2502024	250	2024	0.05	0.92	0.27	0.01
2502025	250	2025	0.05	0.92	0.27	0.01
2502026	250	2026	0.05	0.92	0.27	0.01
5001968	500	1968	1.26	4.2	14	0.74
5001969	500	1969	1.26	4.2	14	0.74
5001970	500	1970	1.05	4.2	13	0.63
5001971	500	1971	1.05	4.2	13	0.63
5001972	500	1972	0.95	4.2	12	0.53
5001973	500	1973	0.95	4.2	12	0.53
5001974	500	1974	0.95	4.2	12	0.53
5001975	500	1975	0.95	4.2	12	0.53
5001976	500	1976	0.95	4.2	12	0.53
5001977	500	1977	0.95	4.2	12	0.53
5001978	500	1978	0.95	4.2	12	0.53
5001979	500	1979	0.95	4.2	12	0.53
5001980	500	1980	0.9	4.2	11	0.53
5001981	500	1981	0.9	4.2	11	0.53
5001982	500	1982	0.9	4.2	11	0.53
5001983	500	1983	0.9	4.2	11	0.53
5001984	500	1984	0.9	4.2	11	0.53
5001985	500	1985	0.84	4.1	11	0.53
5001986	500	1986	0.84	4.1	11	0.53
5001987	500	1987	0.84	4.1	11	0.53
5001988	500	1988	0.68	2.7	8.17	0.38
5001989	500	1989	0.68	2.7	8.17	0.38
5001990	500	1990	0.68	2.7	8.17	0.38
5001991	500	1991	0.68	2.7	8.17	0.38
5001992	500	1992	0.68	2.7	8.17	0.38
5001993	500	1993	0.68	2.7	8.17	0.38
5001994	500	1994	0.68	2.7	8.17	0.38
5001995	500	1995	0.68	2.7	8.17	0.38
5001996	500	1996	0.32	0.92	6.25	0.15
5001997	500	1997	0.32	0.92	6.25	0.15
5001998	500	1998	0.32	0.92	6.25	0.15
5001999	500	1999	0.32	0.92	6.25	0.15
5002000	500	2000	0.32	0.92	6.25	0.15
5002001	500	2001	0.19	0.92	4.95	0.12
5002002	500	2002	0.14	0.92	4.51	0.11
5002003	500	2003	0.12	0.92	4.29	0.11
5002004	500	2004	0.12	0.92	4.29	0.11
5002005	500	2005	0.1	0.92	4	0.11
5002006	500	2006	0.1	0.92	2.45	0.11
5002007	500	2007	0.1	0.92	2.45	0.11
5002008	500	2008	0.1	0.92	2.45	0.11
5002009	500	2009	0.1	0.92	2.45	0.11
5002010	500	2010	0.1	0.92	2.45	0.11
5002011	500	2011	0.07	0.92	1.36	0.01
5002012	500	2012	0.07	0.92	1.36	0.01
5002013	500	2013	0.07	0.92	1.36	0.01
5002014	500	2014	0.05	0.92	0.27	0.01
5002015	500	2015	0.05	0.92	0.27	0.01
5002016	500	2016	0.05	0.92	0.27	0.01
5002017	500	2017	0.05	0.92	0.27	0.01

Lookup	Hp	Year	HC	CO	NOX	PM
5002018	500	2018	0.05	0.92	0.27	0.01
5002019	500	2019	0.05	0.92	0.27	0.01
5002020	500	2020	0.05	0.92	0.27	0.01
5002021	500	2021	0.05	0.92	0.27	0.01
5002022	500	2022	0.05	0.92	0.27	0.01
5002023	500	2023	0.05	0.92	0.27	0.01
5002024	500	2024	0.05	0.92	0.27	0.01
5002025	500	2025	0.05	0.92	0.27	0.01
5002026	500	2026	0.05	0.92	0.27	0.01
7501968	750	1968	1.26	4.2	14	0.74
7501969	750	1969	1.26	4.2	14	0.74
7501970	750	1970	1.05	4.2	13	0.63
7501971	750	1971	1.05	4.2	13	0.63
7501972	750	1972	0.95	4.2	12	0.53
7501973	750	1973	0.95	4.2	12	0.53
7501974	750	1974	0.95	4.2	12	0.53
7501975	750	1975	0.95	4.2	12	0.53
7501976	750	1976	0.95	4.2	12	0.53
7501977	750	1977	0.95	4.2	12	0.53
7501978	750	1978	0.95	4.2	12	0.53
7501979	750	1979	0.95	4.2	12	0.53
7501980	750	1980	0.9	4.2	11	0.53
7501981	750	1981	0.9	4.2	11	0.53
7501982	750	1982	0.9	4.2	11	0.53
7501983	750	1983	0.9	4.2	11	0.53
7501984	750	1984	0.9	4.2	11	0.53
7501985	750	1985	0.84	4.1	11	0.53
7501986	750	1986	0.84	4.1	11	0.53
7501987	750	1987	0.84	4.1	11	0.53
7501988	750	1988	0.68	2.7	8.17	0.38
7501989	750	1989	0.68	2.7	8.17	0.38
7501990	750	1990	0.68	2.7	8.17	0.38
7501991	750	1991	0.68	2.7	8.17	0.38
7501992	750	1992	0.68	2.7	8.17	0.38
7501993	750	1993	0.68	2.7	8.17	0.38
7501994	750	1994	0.68	2.7	8.17	0.38
7501995	750	1995	0.68	2.7	8.17	0.38
7501996	750	1996	0.32	0.92	6.25	0.15
7501997	750	1997	0.32	0.92	6.25	0.15
7501998	750	1998	0.32	0.92	6.25	0.15
7501999	750	1999	0.32	0.92	6.25	0.15
7502000	750	2000	0.32	0.92	6.25	0.15
7502001	750	2001	0.32	0.92	6.25	0.15
7502002	750	2002	0.19	0.92	4.95	0.12
7502003	750	2003	0.14	0.92	4.51	0.11
7502004	750	2004	0.12	0.92	4.29	0.11
7502005	750	2005	0.12	0.92	4.29	0.11
7502006	750	2006	0.1	0.92	2.45	0.11
7502007	750	2007	0.1	0.92	2.45	0.11
7502008	750	2008	0.1	0.92	2.45	0.11
7502009	750	2009	0.1	0.92	2.45	0.11
7502010	750	2010	0.1	0.92	2.45	0.11
7502011	750	2011	0.07	0.92	1.36	0.01
7502012	750	2012	0.07	0.92	1.36	0.01
7502013	750	2013	0.07	0.92	1.36	0.01
7502014	750	2014	0.05	0.92	0.27	0.01
7502015	750	2015	0.05	0.92	0.27	0.01
7502016	750	2016	0.05	0.92	0.27	0.01

Lookup	Hp	Year	HC	CO	NOX	PM
7502017	750	2017	0.05	0.92	0.27	0.01
7502018	750	2018	0.05	0.92	0.27	0.01
7502019	750	2019	0.05	0.92	0.27	0.01
7502020	750	2020	0.05	0.92	0.27	0.01
7502021	750	2021	0.05	0.92	0.27	0.01
7502022	750	2022	0.05	0.92	0.27	0.01
7502023	750	2023	0.05	0.92	0.27	0.01
7502024	750	2024	0.05	0.92	0.27	0.01
7502025	750	2025	0.05	0.92	0.27	0.01
7502026	750	2026	0.05	0.92	0.27	0.01
9991968	999	1968	1.26	4.2	14	0.74
9991969	999	1969	1.26	4.2	14	0.74
9991970	999	1970	1.05	4.2	13	0.63
9991971	999	1971	1.05	4.2	13	0.63
9991972	999	1972	0.95	4.2	12	0.53
9991973	999	1973	0.95	4.2	12	0.53
9991974	999	1974	0.95	4.2	12	0.53
9991975	999	1975	0.95	4.2	12	0.53
9991976	999	1976	0.95	4.2	12	0.53
9991977	999	1977	0.95	4.2	12	0.53
9991978	999	1978	0.95	4.2	12	0.53
9991979	999	1979	0.95	4.2	12	0.53
9991980	999	1980	0.9	4.2	11	0.53
9991981	999	1981	0.9	4.2	11	0.53
9991982	999	1982	0.9	4.2	11	0.53
9991983	999	1983	0.9	4.2	11	0.53
9991984	999	1984	0.9	4.2	11	0.53
9991985	999	1985	0.84	4.1	11	0.53
9991986	999	1986	0.84	4.1	11	0.53
9991987	999	1987	0.84	4.1	11	0.53
9991988	999	1988	0.68	2.7	8.17	0.38
9991989	999	1989	0.68	2.7	8.17	0.38
9991990	999	1990	0.68	2.7	8.17	0.38
9991991	999	1991	0.68	2.7	8.17	0.38
9991992	999	1992	0.68	2.7	8.17	0.38
9991993	999	1993	0.68	2.7	8.17	0.38
9991994	999	1994	0.68	2.7	8.17	0.38
9991995	999	1995	0.68	2.7	8.17	0.38
9991996	999	1996	0.68	2.7	8.17	0.38
9991997	999	1997	0.68	2.7	8.17	0.38
9991998	999	1998	0.68	2.7	8.17	0.38
9991999	999	1999	0.68	2.7	8.17	0.38
9992000	999	2000	0.32	0.92	6.25	0.15
9992001	999	2001	0.32	0.92	6.25	0.15
9992002	999	2002	0.32	0.92	6.25	0.15
9992003	999	2003	0.32	0.92	6.25	0.15
9992004	999	2004	0.32	0.92	6.25	0.15
9992005	999	2005	0.32	0.92	6.25	0.15
9992006	999	2006	0.19	0.92	4.95	0.12
9992007	999	2007	0.14	0.92	4.51	0.11
9992008	999	2008	0.12	0.92	4.29	0.11
9992009	999	2009	0.12	0.92	4.29	0.11
9992010	999	2010	0.1	0.92	4.08	0.11
9992011	999	2011	0.1	0.92	2.36	0.06
9992012	999	2012	0.1	0.92	2.36	0.06
9992013	999	2013	0.1	0.92	2.36	0.06
9992014	999	2014	0.1	0.92	2.36	0.06
9992015	999	2015	0.05	0.92	2.36	0.02

Lookup	Hp	Year	HC	CO	NOX	PM
9992016	999	2016	0.05	0.92	2.36	0.02
9992017	999	2017	0.05	0.92	2.36	0.02
9992018	999	2018	0.05	0.92	2.36	0.02
9992019	999	2019	0.05	0.92	2.36	0.02
9992020	999	2020	0.05	0.92	2.36	0.02
9992021	999	2021	0.05	0.92	2.36	0.02
9992022	999	2022	0.05	0.92	2.36	0.02
9992023	999	2023	0.05	0.92	2.36	0.02
9992024	999	2024	0.05	0.92	2.36	0.02
9992025	999	2025	0.05	0.92	2.36	0.02
9992026	999	2026	0.05	0.92	2.36	0.02

units = g/bhp hr

Lookup	Hp	Year	HC	HC DR	CO	CO DR	NOX	NOX DR	PM	PM DR	fuel/engine type
151994	15	1994	3.96	4.20E-03	240	1.44E-02	1.77	4.48E-04	0.09	9.54E-05	C4
151998	15	1998	1.56	4.20E-03	300	1.44E-02	8.44	4.48E-04	0.9	9.54E-05	C4
152040	15	2040	0.5	4.20E-03	100	1.44E-02	2.7	4.48E-04	0.25	9.54E-05	C4
251994	25	1994	3.96	4.12E-03	240	1.42E-02	1.77	4.41E-04	0.09	9.37E-05	C4
251998	25	1998	1.56	4.12E-03	300	1.42E-02	8.44	4.41E-04	0.9	9.37E-05	C4
252040	25	2040	0.5	4.12E-03	100	1.42E-02	2.7	4.41E-04	0.25	9.37E-05	C4
501983	50	1983	1.38	1.51E-04	7.02	4.75E-04	13	6.62E-05	0.06	0.00E+00	C4
502000	50	2000	1.38	1.51E-04	7.02	4.75E-04	13	6.62E-05	0.06	0.00E+00	C4
502001	50	2001	1.16	1.59E-04	7.02	4.75E-04	10.4	1.56E-04	0.06	0.00E+00	C4
502002	50	2002	0.93	1.66E-04	7.02	4.75E-04	7.79	2.45E-04	0.06	0.00E+00	C4
502003	50	2003	0.71	1.74E-04	7.02	4.75E-04	5.19	3.35E-04	0.06	0.00E+00	C4
502006	50	2006	0.14	1.06E-04	7.02	4.75E-04	1.95	2.76E-04	0.06	0.00E+00	C4
502040	50	2040	0.14	7.24E-05	7.02	4.75E-04	1.95	1.10E-04	0.06	0.00E+00	C4
1201983	120	1983	1.55	1.69E-04	19.72	1.34E-03	10.53	5.33E-05	0.06	0.00E+00	C4
1202000	120	2000	1.55	1.69E-04	19.72	1.34E-03	10.53	5.33E-05	0.06	0.00E+00	C4
1202001	120	2001	1.28	1.72E-04	19.72	1.34E-03	8.54	1.46E-04	0.06	0.00E+00	C4
1202002	120	2002	1.02	1.75E-04	19.72	1.34E-03	6.56	2.39E-04	0.06	0.00E+00	C4
1202003	120	2003	0.75	1.78E-04	19.72	1.34E-03	4.57	3.31E-04	0.06	0.00E+00	C4
1202006	120	2006	0.16	1.03E-04	19.72	1.34E-03	1.58	3.50E-04	0.06	0.00E+00	C4
1202040	120	2040	0.16	6.90E-05	19.72	1.34E-03	1.58	1.84E-04	0.06	0.00E+00	C4
1751983	175	1983	1.38	3.53E-05	16.47	8.62E-04	10.51	1.04E-04	0.06	0.00E+00	C4
1752000	175	2000	1.38	3.53E-05	16.47	8.62E-04	10.51	1.04E-04	0.06	0.00E+00	C4
1752001	175	2001	1.16	3.55E-05	16.47	8.62E-04	8.53	9.08E-05	0.06	0.00E+00	C4
1752002	175	2002	0.94	3.57E-05	16.47	8.62E-04	6.54	7.77E-05	0.06	0.00E+00	C4
1752003	175	2003	0.71	3.58E-05	16.47	8.62E-04	4.56	6.45E-05	0.06	0.00E+00	C4
1752006	175	2006	0.14	1.06E-04	16.47	8.62E-04	1.58	2.64E-04	0.06	0.00E+00	C4
1752040	175	2040	0.14	3.60E-05	16.47	8.62E-04	1.58	5.13E-05	0.06	0.00E+00	C4
2501983	250	1983	1.38	3.53E-05	16.47	8.62E-04	10.51	1.04E-04	0.06	0.00E+00	C4
2502000	250	2000	1.38	3.53E-05	16.47	8.62E-04	10.51	1.04E-04	0.06	0.00E+00	C4
2502001	250	2001	1.16	3.55E-05	16.47	8.62E-04	8.53	9.08E-05	0.06	0.00E+00	C4
2502002	250	2002	0.94	3.57E-05	16.47	8.62E-04	6.54	7.77E-05	0.06	0.00E+00	C4
2502003	250	2003	0.71	3.58E-05	16.47	8.62E-04	4.56	6.45E-05	0.06	0.00E+00	C4
2502006	250	2006	0.14	1.06E-04	16.47	8.62E-04	1.58	2.64E-04	0.06	0.00E+00	C4
2502040	250	2040	0.14	3.60E-05	16.47	8.62E-04	1.58	5.13E-05	0.06	0.00E+00	C4
5001983	500	1983	1.38	3.53E-05	16.47	8.62E-04	10.51	1.04E-04	0.06	0.00E+00	C4
5002000	500	2000	1.38	3.53E-05	16.47	8.62E-04	10.51	1.04E-04	0.06	0.00E+00	C4
5002001	500	2001	1.16	3.55E-05	16.47	8.62E-04	8.53	9.08E-05	0.06	0.00E+00	C4
5002002	500	2002	0.94	3.57E-05	16.47	8.62E-04	6.54	7.77E-05	0.06	0.00E+00	C4
5002003	500	2003	0.71	3.58E-05	16.47	8.62E-04	4.56	6.45E-05	0.06	0.00E+00	C4
5002007	500	2007	0.14	1.06E-04	16.47	8.62E-04	1.58	2.64E-04	0.06	0.00E+00	C4
5002040	500	2040	0.14	3.60E-05	16.47	8.62E-04	1.58	5.13E-05	0.06	0.00E+00	C4

units = g/bhp hr

Lookup	Hp	Year	HC	HC DR	CO	CO DR	NOX	NOX DR	PM	PM DR	fuel/engine type
51994	5	1994	26.44	0.0948	504.25	0.52	2.12	0.000239	0.74	0.0026	G4
51995	5	1995	7.28	0.0565	272.56	-0.067	2.32	0.0031	0.74	0.0026	G4
52001	5	2001	7.28	0.0565	317.99	-0.067	2.32	0.0031	0.74	0.0026	G4
52006	5	2006	6	0.0144	235.77	-0.385	2.7	0.00649	0.74	0.0026	G4
52040	5	2040	3.66	0.0182	235.77	-0.385	0.86	0.00496	0.74	0.0026	G4
151994	15	1994	7.46	0.0178	393.1	0.0337	3.48	0.00133	0.14	0.0002	G4
151995	15	1995	4.56	0.0207	234.54	0.0895	2.84	0	0.14	0.0002	G4
152001	15	2001	4.56	0.0207	273.63	0.0895	2.84	0	0.14	0.0002	G4
152007	15	2007	3.9	0.00469	224.66	0	2.9	0.00347	0.14	0.0002	G4
152040	15	2040	2.51	0.00388	224.66	0	1.86	0.00264	0.14	0.0002	G4
251994	25	1994	7.46	0.0141	393.1	0.0276	3.48	0.00109	0.14	0.0002	G4
251995	25	1995	4.42	0.0166	243.17	0.0345	2.32	0	0.14	0.0002	G4
252001	25	2001	4.42	0.0166	283.69	0.0345	2.32	0	0.14	0.0002	G4
252007	25	2007	4.12	0.00495	238.46	0	2.68	0.00321	0.14	0.0002	G4
252040	25	2040	2.64	0.00336	238.46	0	1.71	0.00324	0.14	0.0002	G4
501983	50	1983	3.76	0.000412	89.9	0.00555	8.01	4.06E-05	0.06	0	G4
502000	50	2000	3.76	0.000412	89.9	0.00555	8.01	4.06E-05	0.06	0	G4
502001	50	2001	2.96	0.000348	78.09	0.0201	6.91	0.000144	0.06	0	G4
502002	50	2002	2.34	0.000374	81.78	0.0197	5.52	0.000308	0.06	0	G4
502003	50	2003	1.62	0.000316	71.03	0.0193	4.52	0.000402	0.06	0	G4
502006	50	2006	0.71	0.000169	38.19	0.019	1.33	0.000471	0.06	0	G4
502040	50	2040	0.71	0.000138	38.19	0.019	1.33	0.00032	0.06	0	G4
1201983	120	1983	2.63	0.000287	43.8	0.0029	11.84	6.01E-05	0.06	0	G4
1202000	120	2000	2.63	0.000287	43.8	0.0029	11.84	6.01E-05	0.06	0	G4
1202001	120	2001	2.08	0.000256	41.08	0.004	9.58	0.000163	0.06	0	G4
1202002	120	2002	1.54	0.000225	39.72	0.00455	7.32	0.000266	0.06	0	G4
1202003	120	2003	0.99	0.000194	38.36	0.0051	5.06	0.000368	0.06	0	G4
1202006	120	2006	0.26	8.14E-05	8.76	0.00565	1.78	0.000207	0.06	0	G4
1202040	120	2040	0.26	4.74E-05	8.76	0.00565	1.78	0.000145	0.06	0	G4
1751983	175	1983	1.61	4.15E-05	20.8	0.000815	12.94	0.000127	0.06	0	G4
1752000	175	2000	1.61	4.15E-05	20.8	0.000815	12.94	0.000127	0.06	0	G4
1752001	175	2001	1.33	3.98E-05	20.8	0.000815	10.29	0.000109	0.06	0	G4
1752002	175	2002	1.06	3.81E-05	20.8	0.000815	7.64	9.17E-05	0.06	0	G4
1752003	175	2003	0.78	3.64E-05	20.8	0.000815	4.98	0.000074	0.06	0	G4
1752006	175	2006	0.16	0.000102	20.8	0.000815	1.94	0.000278	0.06	0	G4
1752040	175	2040	0.16	3.47E-05	20.8	0.000815	1.94	5.63E-05	0.06	0	G4
2501983	250	1983	1.61	4.15E-05	20.8	0.000815	12.94	0.000127	0.06	0	G4
2502000	250	2000	1.61	4.15E-05	20.8	0.000815	12.94	0.000127	0.06	0	G4
2502001	250	2001	1.33	3.98E-05	20.8	0.000815	10.29	0.000109	0.06	0	G4
2502002	250	2002	1.06	3.81E-05	20.8	0.000815	7.64	9.17E-05	0.06	0	G4
2502003	250	2003	0.78	3.64E-05	20.8	0.000815	4.98	0.000074	0.06	0	G4
2502006	250	2006	0.16	0.000102	20.8	0.000815	1.94	0.000278	0.06	0	G4
2502040	250	2040	0.16	3.47E-05	20.8	0.000815	1.94	5.63E-05	0.06	0	G4
5001983	500	1983	1.61	4.15E-05	20.8	0.000815	12.94	0.000127	0.06	0	G4
5002000	500	2000	1.61	4.15E-05	20.8	0.000815	12.94	0.000127	0.06	0	G4
5002001	500	2001	1.33	3.98E-05	20.8	0.000815	10.29	0.000109	0.06	0	G4
5002002	500	2002	1.06	3.81E-05	20.8	0.000815	7.64	9.17E-05	0.06	0	G4
5002003	500	2003	0.78	3.64E-05	20.8	0.000815	4.98	0.000074	0.06	0	G4
5002006	500	2006	0.16	0.000102	20.8	0.000815	1.94	0.000278	0.06	0	G4
5002040	500	2040	0.16	3.47E-05	20.8	0.000815	1.94	5.63E-05	0.06	0	G4

units = g/bhp hr

Lookup	Hp	Year	HC	CO	NOX	PM
251968	25	1968	0.61	5.00	3.04	0.53
251969	25	1969	0.61	5.00	3.04	0.53
251970	25	1970	0.61	5.00	3.04	0.53
251971	25	1971	0.61	5.00	3.04	0.53
251972	25	1972	0.61	5.00	3.04	0.53
251973	25	1973	0.61	5.00	3.04	0.53
251974	25	1974	0.61	5.00	3.04	0.53
251975	25	1975	0.61	5.00	3.04	0.53
251976	25	1976	0.61	5.00	3.04	0.53
251977	25	1977	0.61	5.00	3.04	0.53
251978	25	1978	0.61	5.00	3.04	0.53
251979	25	1979	0.61	5.00	3.04	0.53
251980	25	1980	0.61	5.00	3.04	0.53
251981	25	1981	0.61	5.00	3.04	0.53
251982	25	1982	0.61	5.00	3.04	0.53
251983	25	1983	0.61	5.00	3.04	0.53
251984	25	1984	0.61	5.00	3.04	0.53
251985	25	1985	0.61	5.00	3.04	0.53
251986	25	1986	0.61	5.00	3.04	0.53
251987	25	1987	0.61	5.00	3.04	0.53
251988	25	1988	0.61	5.00	3.04	0.53
251989	25	1989	0.61	5.00	3.04	0.53
251990	25	1990	0.61	5.00	3.04	0.53
251991	25	1991	0.61	5.00	3.04	0.53
251992	25	1992	0.61	5.00	3.04	0.53
251993	25	1993	0.61	5.00	3.04	0.53
251994	25	1994	0.61	5.00	3.04	0.53
251995	25	1995	0.54	1.40	1.71	0.29
251996	25	1996	0.54	1.40	1.71	0.29
251997	25	1997	0.54	1.40	1.71	0.29
251998	25	1998	0.54	1.40	1.71	0.29
251999	25	1999	0.17	0.50	0.55	0.08
252000	25	2000	0.17	0.50	0.55	0.08
252001	25	2001	0.17	0.50	0.55	0.08
252002	25	2002	0.17	0.50	0.55	0.08
252003	25	2003	0.17	0.50	0.55	0.08
252004	25	2004	0.17	0.50	0.55	0.08
252005	25	2005	0.17	0.50	0.55	0.08
252006	25	2006	0.17	0.50	0.55	0.08
252007	25	2007	0.17	0.50	0.55	0.08
252008	25	2008	0.17	0.50	0.55	0.08
252009	25	2009	0.17	0.50	0.55	0.08
252010	25	2010	0.17	0.50	0.55	0.08
252011	25	2011	0.17	0.50	0.55	0.08
252012	25	2012	0.17	0.50	0.55	0.08
252013	25	2013	0.17	0.50	0.55	0.08
252014	25	2014	0.17	0.50	0.55	0.08
252015	25	2015	0.17	0.50	0.55	0.08

Lookup	Hp	Year	HC	CO	NOX	PM
252016	25	2016	0.17	0.50	0.55	0.08
252017	25	2017	0.17	0.50	0.55	0.08
252018	25	2018	0.17	0.50	0.55	0.08
252019	25	2019	0.17	0.50	0.55	0.08
252020	25	2020	0.17	0.50	0.55	0.08
252021	25	2021	0.17	0.50	0.55	0.08
252022	25	2022	0.17	0.50	0.55	0.08
252023	25	2023	0.17	0.50	0.55	0.08
252024	25	2024	0.17	0.50	0.55	0.08
252025	25	2025	0.17	0.50	0.55	0.08
252026	25	2026	0.17	0.50	0.55	0.08
501969	50	1969	0.61	5.00	3.08	0.53
501969	50	1969	0.61	5.00	3.08	0.53
501970	50	1970	0.61	5.00	3.08	0.53
501971	50	1971	0.61	5.00	3.08	0.53
501972	50	1972	0.61	5.00	3.08	0.53
501973	50	1973	0.61	5.00	3.08	0.53
501974	50	1974	0.61	5.00	3.08	0.53
501975	50	1975	0.61	5.00	3.08	0.53
501976	50	1976	0.61	5.00	3.08	0.53
501977	50	1977	0.61	5.00	3.08	0.53
501978	50	1978	0.61	5.00	3.08	0.53
501979	50	1979	0.61	5.00	3.08	0.53
501980	50	1980	0.61	5.00	3.08	0.53
501981	50	1981	0.61	5.00	3.08	0.53
501982	50	1982	0.61	5.00	3.08	0.53
501983	50	1983	0.61	5.00	3.08	0.53
501984	50	1984	0.61	5.00	3.08	0.53
501985	50	1985	0.61	5.00	3.08	0.53
501986	50	1986	0.61	5.00	3.08	0.53
501987	50	1987	0.61	5.00	3.08	0.53
501988	50	1988	0.59	5.00	3.04	0.53
501989	50	1989	0.59	5.00	3.04	0.53
501990	50	1990	0.59	5.00	3.04	0.53
501991	50	1991	0.59	5.00	3.04	0.53
501992	50	1992	0.59	5.00	3.04	0.53
501993	50	1993	0.59	5.00	3.04	0.53
501994	50	1994	0.59	5.00	3.04	0.53
501995	50	1995	0.59	5.00	3.04	0.53
501996	50	1996	0.59	5.00	3.04	0.53
501997	50	1997	0.59	5.00	3.04	0.53
501998	50	1998	0.59	5.00	3.04	0.53
501999	50	1999	0.48	4.10	2.44	0.42
502000	50	2000	0.48	4.10	2.44	0.42
502001	50	2001	0.48	4.10	2.44	0.42
502002	50	2002	0.48	4.10	2.44	0.42
502003	50	2003	0.48	4.10	2.44	0.42
502004	50	2004	0.21	3.27	2.24	0.30
502005	50	2005	0.12	3.00	2.18	0.27
502006	50	2006	0.08	2.86	2.15	0.25
502007	50	2007	0.08	2.86	2.15	0.25

Lookup	Hp	Year	HC	CO	NOX	PM
502008	50	2008	0.03	2.72	2.11	0.11
502009	50	2009	0.03	2.72	2.11	0.11
502010	50	2010	0.03	2.72	2.11	0.11
502011	50	2011	0.03	2.72	2.11	0.11
502012	50	2012	0.03	2.72	2.11	0.11
502013	50	2013	0.03	2.72	1.28	0.01
502014	50	2014	0.03	2.72	1.28	0.01
502015	50	2015	0.03	2.72	1.28	0.01
502016	50	2016	0.03	2.72	1.28	0.01
502017	50	2017	0.03	2.72	1.28	0.01
502018	50	2018	0.03	2.72	1.28	0.01
502019	50	2019	0.03	2.72	1.28	0.01
502020	50	2020	0.03	2.72	1.28	0.01
502021	50	2021	0.03	2.72	1.28	0.01
502022	50	2022	0.03	2.72	1.28	0.01
502023	50	2023	0.03	2.72	1.28	0.01
502024	50	2024	0.03	2.72	1.28	0.01
502025	50	2025	0.03	2.72	1.28	0.01
502026	50	2026	0.03	2.72	1.28	0.01
1201968	120	1968	0.48	4.80	5.72	0.59
1201969	120	1969	0.48	4.80	5.72	0.59
1201970	120	1970	0.48	4.80	5.72	0.59
1201971	120	1971	0.48	4.80	5.72	0.59
1201972	120	1972	0.48	4.80	5.72	0.59
1201973	120	1973	0.48	4.80	5.72	0.59
1201974	120	1974	0.48	4.80	5.72	0.59
1201975	120	1975	0.48	4.80	5.72	0.59
1201976	120	1976	0.48	4.80	5.72	0.59
1201977	120	1977	0.48	4.80	5.72	0.59
1201978	120	1978	0.48	4.80	5.72	0.59
1201979	120	1979	0.48	4.80	5.72	0.59
1201980	120	1980	0.48	4.80	5.72	0.59
1201981	120	1981	0.48	4.80	5.72	0.59
1201982	120	1982	0.48	4.80	5.72	0.59
1201983	120	1983	0.48	4.80	5.72	0.59
1201984	120	1984	0.48	4.80	5.72	0.59
1201985	120	1985	0.48	4.80	5.72	0.59
1201986	120	1986	0.48	4.80	5.72	0.59
1201987	120	1987	0.48	4.80	5.72	0.59
1201988	120	1988	0.33	3.49	3.85	0.48
1201989	120	1989	0.33	3.49	3.85	0.48
1201990	120	1990	0.33	3.49	3.85	0.48
1201991	120	1991	0.33	3.49	3.85	0.48
1201992	120	1992	0.33	3.49	3.85	0.48
1201993	120	1993	0.33	3.49	3.85	0.48
1201994	120	1994	0.33	3.49	3.85	0.48
1201995	120	1995	0.33	3.49	3.85	0.48
1201996	120	1996	0.33	3.49	3.85	0.48
1201997	120	1997	0.33	3.49	3.85	0.48
1201998	120	1998	0.33	3.49	3.04	0.48
1201999	120	1999	0.33	3.49	3.04	0.48

Lookup	Hp	Year	HC	CO	NOX	PM
1202000	120	2000	0.33	3.49	3.04	0.48
1202001	120	2001	0.33	3.49	3.04	0.48
1202002	120	2002	0.33	3.49	3.04	0.48
1202003	120	2003	0.33	3.49	3.04	0.48
1202004	120	2004	0.15	3.23	2.48	0.27
1202005	120	2005	0.09	3.14	2.30	0.20
1202006	120	2006	0.06	3.09	2.20	0.17
1202007	120	2007	0.06	3.09	2.20	0.17
1202008	120	2008	0.03	3.05	1.27	0.14
1202009	120	2009	0.03	3.05	1.27	0.14
1202010	120	2010	0.03	3.05	1.27	0.14
1202011	120	2011	0.03	3.05	1.27	0.14
1202012	120	2012	0.03	3.05	1.11	0.05
1202013	120	2013	0.03	3.05	1.11	0.01
1202014	120	2014	0.03	3.05	1.11	0.01
1202015	120	2015	0.02	3.05	0.61	0.01
1202016	120	2016	0.02	3.05	0.61	0.01
1202017	120	2017	0.02	3.05	0.61	0.01
1202018	120	2018	0.02	3.05	0.61	0.01
1202019	120	2019	0.02	3.05	0.61	0.01
1202020	120	2020	0.02	3.05	0.61	0.01
1202021	120	2021	0.02	3.05	0.61	0.01
1202022	120	2022	0.02	3.05	0.61	0.01
1202023	120	2023	0.02	3.05	0.61	0.01
1202024	120	2024	0.02	3.05	0.61	0.01
1202025	120	2025	0.02	3.05	0.61	0.01
1202026	120	2026	0.02	3.05	0.61	0.01
1751968	175	1968	0.44	4.40	6.16	0.54
1751969	175	1969	0.44	4.40	6.16	0.54
1751970	175	1970	0.36	4.40	5.72	0.46
1751971	175	1971	0.36	4.40	5.72	0.46
1751972	175	1972	0.33	4.40	5.28	0.39
1751973	175	1973	0.33	4.40	5.28	0.39
1751974	175	1974	0.33	4.40	5.28	0.39
1751975	175	1975	0.33	4.40	5.28	0.39
1751976	175	1976	0.33	4.40	5.28	0.39
1751977	175	1977	0.33	4.40	5.28	0.39
1751978	175	1978	0.33	4.40	5.28	0.39
1751979	175	1979	0.33	4.40	5.28	0.39
1751980	175	1980	0.31	4.30	4.84	0.39
1751981	175	1981	0.31	4.30	4.84	0.39
1751982	175	1982	0.31	4.30	4.84	0.39
1751983	175	1983	0.31	4.30	4.84	0.39
1751984	175	1984	0.31	4.30	4.84	0.39
1751985	175	1985	0.29	4.20	4.84	0.39
1751986	175	1986	0.29	4.20	4.84	0.39
1751987	175	1987	0.29	4.20	4.84	0.39
1751988	175	1988	0.22	2.70	3.59	0.27
1751989	175	1989	0.22	2.70	3.59	0.27
1751990	175	1990	0.22	2.70	3.59	0.27
1751991	175	1991	0.22	2.70	3.59	0.27

Lookup	Hp	Year	HC	CO	NOX	PM
1751992	175	1992	0.22	2.70	3.59	0.27
1751993	175	1993	0.22	2.70	3.59	0.27
1751994	175	1994	0.22	2.70	3.59	0.27
1751995	175	1995	0.22	2.70	3.59	0.27
1751996	175	1996	0.22	2.70	3.59	0.27
1751997	175	1997	0.22	2.70	3.04	0.27
1751998	175	1998	0.22	2.70	3.04	0.27
1751999	175	1999	0.22	2.70	3.04	0.27
1752000	175	2000	0.22	2.70	3.04	0.27
1752001	175	2001	0.22	2.70	3.04	0.27
1752002	175	2002	0.22	2.70	3.04	0.27
1752003	175	2003	0.11	2.70	2.31	0.17
1752004	175	2004	0.07	2.70	2.08	0.13
1752005	175	2005	0.05	2.70	1.95	0.11
1752006	175	2006	0.05	2.70	1.95	0.11
1752007	175	2007	0.03	2.70	1.08	0.10
1752008	175	2008	0.03	2.70	1.08	0.10
1752009	175	2009	0.03	2.70	1.08	0.10
1752010	175	2010	0.03	2.70	1.08	0.10
1752011	175	2011	0.03	2.70	1.08	0.10
1752012	175	2012	0.03	2.70	1.00	0.01
1752013	175	2013	0.03	2.70	1.00	0.01
1752014	175	2014	0.03	2.70	1.00	0.01
1752015	175	2015	0.02	2.70	0.12	0.01
1752016	175	2016	0.02	2.70	0.12	0.01
1752017	175	2017	0.02	2.70	0.12	0.01
1752018	175	2018	0.02	2.70	0.12	0.01
1752019	175	2019	0.02	2.70	0.12	0.01
1752020	175	2020	0.02	2.70	0.12	0.01
1752021	175	2021	0.02	2.70	0.12	0.01
1752022	175	2022	0.02	2.70	0.12	0.01
1752023	175	2023	0.02	2.70	0.12	0.01
1752024	175	2024	0.02	2.70	0.12	0.01
1752025	175	2025	0.02	2.70	0.12	0.01
1752026	175	2026	0.02	2.70	0.12	0.01
2501968	250	1968	0.44	4.40	6.16	0.54
2501969	250	1969	0.44	4.40	6.16	0.54
2501970	250	1970	0.36	4.40	5.72	0.46
2501971	250	1971	0.36	4.40	5.72	0.46
2501972	250	1972	0.33	4.40	5.28	0.39
2501973	250	1973	0.33	4.40	5.28	0.39
2501974	250	1974	0.33	4.40	5.28	0.39
2501975	250	1975	0.33	4.40	5.28	0.39
2501976	250	1976	0.33	4.40	5.28	0.39
2501977	250	1977	0.33	4.40	5.28	0.39
2501978	250	1978	0.33	4.40	5.28	0.39
2501979	250	1979	0.33	4.40	5.28	0.39
2501980	250	1980	0.31	4.30	4.84	0.39
2501981	250	1981	0.31	4.30	4.84	0.39
2501982	250	1982	0.31	4.30	4.84	0.39
2501983	250	1983	0.31	4.30	4.84	0.39

Lookup	Hp	Year	HC	CO	NOX	PM
2501984	250	1984	0.31	4.30	4.84	0.39
2501985	250	1985	0.29	4.20	4.84	0.39
2501986	250	1986	0.29	4.20	4.84	0.39
2501987	250	1987	0.29	4.20	4.84	0.39
2501988	250	1988	0.22	2.70	3.59	0.27
2501989	250	1989	0.22	2.70	3.59	0.27
2501990	250	1990	0.22	2.70	3.59	0.27
2501991	250	1991	0.22	2.70	3.59	0.27
2501992	250	1992	0.22	2.70	3.59	0.27
2501993	250	1993	0.22	2.70	3.59	0.27
2501994	250	1994	0.22	2.70	3.59	0.27
2501995	250	1995	0.22	2.70	3.59	0.27
2501996	250	1996	0.11	0.92	2.75	0.11
2501997	250	1997	0.11	0.92	2.75	0.11
2501998	250	1998	0.11	0.92	2.75	0.11
2501999	250	1999	0.11	0.92	2.75	0.11
2502000	250	2000	0.11	0.92	2.75	0.11
2502001	250	2001	0.11	0.92	2.75	0.11
2502002	250	2002	0.11	0.92	2.75	0.11
2502003	250	2003	0.06	0.92	2.20	0.08
2502004	250	2004	0.05	0.92	2.02	0.08
2502005	250	2005	0.04	0.92	1.93	0.08
2502006	250	2006	0.04	0.92	1.93	0.08
2502007	250	2007	0.03	0.92	1.08	0.08
2502008	250	2008	0.03	0.92	1.08	0.08
2502009	250	2009	0.03	0.92	1.08	0.08
2502010	250	2010	0.03	0.92	1.08	0.08
2502011	250	2011	0.02	0.92	0.60	0.01
2502012	250	2012	0.02	0.92	0.60	0.01
2502013	250	2013	0.02	0.92	0.60	0.01
2502014	250	2014	0.02	0.92	0.12	0.01
2502015	250	2015	0.02	0.92	0.12	0.01
2502016	250	2016	0.02	0.92	0.12	0.01
2502017	250	2017	0.02	0.92	0.12	0.01
2502018	250	2018	0.02	0.92	0.12	0.01
2502019	250	2019	0.02	0.92	0.12	0.01
2502020	250	2020	0.02	0.92	0.12	0.01
2502021	250	2021	0.02	0.92	0.12	0.01
2502022	250	2022	0.02	0.92	0.12	0.01
2502023	250	2023	0.02	0.92	0.12	0.01
2502024	250	2024	0.02	0.92	0.12	0.01
2502025	250	2025	0.02	0.92	0.12	0.01
2502026	250	2026	0.02	0.92	0.12	0.01
5001968	500	1968	0.42	4.20	6.16	0.52
5001969	500	1969	0.42	4.20	6.16	0.52
5001970	500	1970	0.35	4.20	5.72	0.44
5001971	500	1971	0.35	4.20	5.72	0.44
5001972	500	1972	0.31	4.20	5.28	0.37
5001973	500	1973	0.31	4.20	5.28	0.37
5001974	500	1974	0.31	4.20	5.28	0.37
5001975	500	1975	0.31	4.20	5.28	0.37

Lookup	Hp	Year	HC	CO	NOX	PM
5001976	500	1976	0.31	4.20	5.28	0.37
5001977	500	1977	0.31	4.20	5.28	0.37
5001978	500	1978	0.31	4.20	5.28	0.37
5001979	500	1979	0.31	4.20	5.28	0.37
5001980	500	1980	0.30	4.20	4.84	0.37
5001981	500	1981	0.30	4.20	4.84	0.37
5001982	500	1982	0.30	4.20	4.84	0.37
5001983	500	1983	0.30	4.20	4.84	0.37
5001984	500	1984	0.30	4.20	4.84	0.37
5001985	500	1985	0.28	4.10	4.84	0.37
5001986	500	1986	0.28	4.10	4.84	0.37
5001987	500	1987	0.28	4.10	4.84	0.37
5001988	500	1988	0.22	2.70	3.59	0.27
5001989	500	1989	0.22	2.70	3.59	0.27
5001990	500	1990	0.22	2.70	3.59	0.27
5001991	500	1991	0.22	2.70	3.59	0.27
5001992	500	1992	0.22	2.70	3.59	0.27
5001993	500	1993	0.22	2.70	3.59	0.27
5001994	500	1994	0.22	2.70	3.59	0.27
5001995	500	1995	0.22	2.70	3.59	0.27
5001996	500	1996	0.11	0.92	2.75	0.11
5001997	500	1997	0.11	0.92	2.75	0.11
5001998	500	1998	0.11	0.92	2.75	0.11
5001999	500	1999	0.11	0.92	2.75	0.11
5002000	500	2000	0.11	0.92	2.75	0.11
5002001	500	2001	0.06	0.92	2.18	0.08
5002002	500	2002	0.05	0.92	1.98	0.08
5002003	500	2003	0.04	0.92	1.89	0.08
5002004	500	2004	0.04	0.92	1.89	0.08
5002005	500	2005	0.03	0.92	1.76	0.08
5002006	500	2006	0.03	0.92	1.08	0.08
5002007	500	2007	0.03	0.92	1.08	0.08
5002008	500	2008	0.03	0.92	1.08	0.08
5002009	500	2009	0.03	0.92	1.08	0.08
5002010	500	2010	0.03	0.92	1.08	0.08
5002011	500	2011	0.02	0.92	0.60	0.01
5002012	500	2012	0.02	0.92	0.60	0.01
5002013	500	2013	0.02	0.92	0.60	0.01
5002014	500	2014	0.02	0.92	0.12	0.01
5002015	500	2015	0.02	0.92	0.12	0.01
5002016	500	2016	0.02	0.92	0.12	0.01
5002017	500	2017	0.02	0.92	0.12	0.01
5002018	500	2018	0.02	0.92	0.12	0.01
5002019	500	2019	0.02	0.92	0.12	0.01
5002020	500	2020	0.02	0.92	0.12	0.01
5002021	500	2021	0.02	0.92	0.12	0.01
5002022	500	2022	0.02	0.92	0.12	0.01
5002023	500	2023	0.02	0.92	0.12	0.01
5002024	500	2024	0.02	0.92	0.12	0.01
5002025	500	2025	0.02	0.92	0.12	0.01
5002026	500	2026	0.02	0.92	0.12	0.01

Lookup	Hp	Year	HC	CO	NOX	PM
7501968	750	1968	0.42	4.20	6.16	0.52
7501969	750	1969	0.42	4.20	6.16	0.52
7501970	750	1970	0.35	4.20	5.72	0.44
7501971	750	1971	0.35	4.20	5.72	0.44
7501972	750	1972	0.31	4.20	5.28	0.37
7501973	750	1973	0.31	4.20	5.28	0.37
7501974	750	1974	0.31	4.20	5.28	0.37
7501975	750	1975	0.31	4.20	5.28	0.37
7501976	750	1976	0.31	4.20	5.28	0.37
7501977	750	1977	0.31	4.20	5.28	0.37
7501978	750	1978	0.31	4.20	5.28	0.37
7501979	750	1979	0.31	4.20	5.28	0.37
7501980	750	1980	0.30	4.20	4.84	0.37
7501981	750	1981	0.30	4.20	4.84	0.37
7501982	750	1982	0.30	4.20	4.84	0.37
7501983	750	1983	0.30	4.20	4.84	0.37
7501984	750	1984	0.30	4.20	4.84	0.37
7501985	750	1985	0.28	4.10	4.84	0.37
7501986	750	1986	0.28	4.10	4.84	0.37
7501987	750	1987	0.28	4.10	4.84	0.37
7501988	750	1988	0.22	2.70	3.59	0.27
7501989	750	1989	0.22	2.70	3.59	0.27
7501990	750	1990	0.22	2.70	3.59	0.27
7501991	750	1991	0.22	2.70	3.59	0.27
7501992	750	1992	0.22	2.70	3.59	0.27
7501993	750	1993	0.22	2.70	3.59	0.27
7501994	750	1994	0.22	2.70	3.59	0.27
7501995	750	1995	0.22	2.70	3.59	0.27
7501996	750	1996	0.11	0.92	2.75	0.11
7501997	750	1997	0.11	0.92	2.75	0.11
7501998	750	1998	0.11	0.92	2.75	0.11
7501999	750	1999	0.11	0.92	2.75	0.11
7502000	750	2000	0.11	0.92	2.75	0.11
7502001	750	2001	0.11	0.92	2.75	0.11
7502002	750	2002	0.06	0.92	2.18	0.08
7502003	750	2003	0.05	0.92	1.98	0.08
7502004	750	2004	0.04	0.92	1.89	0.08
7502005	750	2005	0.04	0.92	1.89	0.08
7502006	750	2006	0.03	0.92	1.08	0.08
7502007	750	2007	0.03	0.92	1.08	0.08
7502008	750	2008	0.03	0.92	1.08	0.08
7502009	750	2009	0.03	0.92	1.08	0.08
7502010	750	2010	0.03	0.92	1.08	0.08
7502011	750	2011	0.02	0.92	0.60	0.01
7502012	750	2012	0.02	0.92	0.60	0.01
7502013	750	2013	0.02	0.92	0.60	0.01
7502014	750	2014	0.02	0.92	0.12	0.01
7502015	750	2015	0.02	0.92	0.12	0.01
7502016	750	2016	0.02	0.92	0.12	0.01
7502017	750	2017	0.02	0.92	0.12	0.01
7502018	750	2018	0.02	0.92	0.12	0.01

Lookup	Hp	Year	HC	CO	NOX	PM
7502019	750	2019	0.02	0.92	0.12	0.01
7502020	750	2020	0.02	0.92	0.12	0.01
7502021	750	2021	0.02	0.92	0.12	0.01
7502022	750	2022	0.02	0.92	0.12	0.01
7502023	750	2023	0.02	0.92	0.12	0.01
7502024	750	2024	0.02	0.92	0.12	0.01
7502025	750	2025	0.02	0.92	0.12	0.01
7502026	750	2026	0.02	0.92	0.12	0.01
9991968	999	1968	0.42	4.20	6.16	0.52
9991969	999	1969	0.42	4.20	6.16	0.52
9991970	999	1970	0.35	4.20	5.72	0.44
9991971	999	1971	0.35	4.20	5.72	0.44
9991972	999	1972	0.31	4.20	5.28	0.37
9991973	999	1973	0.31	4.20	5.28	0.37
9991974	999	1974	0.31	4.20	5.28	0.37
9991975	999	1975	0.31	4.20	5.28	0.37
9991976	999	1976	0.31	4.20	5.28	0.37
9991977	999	1977	0.31	4.20	5.28	0.37
9991978	999	1978	0.31	4.20	5.28	0.37
9991979	999	1979	0.31	4.20	5.28	0.37
9991980	999	1980	0.30	4.20	4.84	0.37
9991981	999	1981	0.30	4.20	4.84	0.37
9991982	999	1982	0.30	4.20	4.84	0.37
9991983	999	1983	0.30	4.20	4.84	0.37
9991984	999	1984	0.30	4.20	4.84	0.37
9991985	999	1985	0.28	4.10	4.84	0.37
9991986	999	1986	0.28	4.10	4.84	0.37
9991987	999	1987	0.28	4.10	4.84	0.37
9991988	999	1988	0.22	2.70	3.59	0.27
9991989	999	1989	0.22	2.70	3.59	0.27
9991990	999	1990	0.22	2.70	3.59	0.27
9991991	999	1991	0.22	2.70	3.59	0.27
9991992	999	1992	0.22	2.70	3.59	0.27
9991993	999	1993	0.22	2.70	3.59	0.27
9991994	999	1994	0.22	2.70	3.59	0.27
9991995	999	1995	0.22	2.70	3.59	0.27
9991996	999	1996	0.22	2.70	3.59	0.27
9991997	999	1997	0.22	2.70	3.59	0.27
9991998	999	1998	0.22	2.70	3.59	0.27
9991999	999	1999	0.22	2.70	3.59	0.27
9992000	999	2000	0.11	0.92	2.75	0.11
9992001	999	2001	0.11	0.92	2.75	0.11
9992002	999	2002	0.11	0.92	2.75	0.11
9992003	999	2003	0.11	0.92	2.75	0.11
9992004	999	2004	0.11	0.92	2.75	0.11
9992005	999	2005	0.11	0.92	2.75	0.11
9992006	999	2006	0.06	0.92	2.18	0.08
9992007	999	2007	0.05	0.92	1.98	0.08
9992008	999	2008	0.04	0.92	1.89	0.08
9992009	999	2009	0.04	0.92	1.89	0.08
9992010	999	2010	0.03	0.92	1.80	0.08

Lookup	Hp	Year	HC	CO	NOX	PM
9992011	999	2011	0.03	0.92	1.04	0.04
9992012	999	2012	0.03	0.92	1.04	0.04
9992013	999	2013	0.03	0.92	1.04	0.04
9992014	999	2014	0.03	0.92	1.04	0.04
9992015	999	2015	0.02	0.92	1.04	0.01
9992016	999	2016	0.02	0.92	1.04	0.01
9992017	999	2017	0.02	0.92	1.04	0.01
9992018	999	2018	0.02	0.92	1.04	0.01
9992019	999	2019	0.02	0.92	1.04	0.01
9992020	999	2020	0.02	0.92	1.04	0.01
9992021	999	2021	0.02	0.92	1.04	0.01
9992022	999	2022	0.02	0.92	1.04	0.01
9992023	999	2023	0.02	0.92	1.04	0.01
9992024	999	2024	0.02	0.92	1.04	0.01
9992025	999	2025	0.02	0.92	1.04	0.01
9992026	999	2026	0.02	0.92	1.04	0.01

ARB Equipment	Code	HP Bin	concat	SOX (g SOX/hp-hr)
Other General Industrial Equipment onroad	10	120	10120	0.0622888
Other General Industrial Equipment onroad	10	175	10175	0.0597464
Other General Industrial Equipment onroad	10	250	10250	0.0597464
Other General Industrial Equipment onroad	10	50	1050	0.0686448
Other General Industrial Equipment onroad	10	500	10500	0.0521192
Other General Industrial Equipment onroad	10	750	10750	0.0533904
Other General Industrial Equipment onroad	10	999	10999	0.0533904
Crane	1	120	1120	0.0622888
Crane	1	175	1175	0.0597464
Crane	1	250	1250	0.0597464
Crane	1	50	150	0.0686448
Crane	1	500	1500	0.0521192
Crane	1	750	1750	0.0533904
Crane	1	999	1999	0.0533904
Excavator	2	120	2120	0.0622888
Excavator	2	175	2175	0.0597464
Excavator	2	250	2250	0.0597464
Excavator	2	50	250	0.0686448
Excavator	2	500	2500	0.0521192
Excavator	2	750	2750	0.0533904
Forklift	3	120	3120	0.0622888
Forklift	3	175	3175	0.0597464
Forklift	3	250	3250	0.0597464
Forklift	3	50	350	0.0686448
Forklift	3	500	3500	0.0521192
Material Handling Equip	4	120	4120	0.0597464
Other General Industrial Equipment	5	120	5120	0.0622888
Other General Industrial Equipment	5	175	5175	0.0597464
Other General Industrial Equipment	5	250	5250	0.0597464
Other General Industrial Equipment	5	50	550	0.0686448
Other General Industrial Equipment	5	500	5500	0.0521192
Other General Industrial Equipment	5	750	5750	0.0533904
Other General Industrial Equipment	5	999	5999	0.0533904
Sweeper/Scrubbers	6	120	6120	0.0622888
Sweeper/Scrubbers	6	175	6175	0.0597464
Sweeper/Scrubbers	6	250	6250	0.0597464
Sweeper/Scrubbers	6	50	650	0.0686448
Tractor/Loader/Backhoe	7	120	7120	0.0622888
Tractor/Loader/Backhoe	7	175	7175	0.0597464
Tractor/Loader/Backhoe	7	250	7250	0.0597464
Tractor/Loader/Backhoe	7	50	750	0.0686448
Tractor/Loader/Backhoe	7	500	7500	0.0597464
Tractor/Loader/Backhoe	7	750	7750	0.0597464
Yard Tractor offroad	8	120	8120	0.0622888
Yard Tractor offroad	8	175	8175	0.0597464
Yard Tractor offroad	8	250	8250	0.0597464
Yard Tractor offroad	8	750	8750	0.0533904
Yard Tractor offroad	8	999	8999	0.0533904
Yard Tractor onroad	9	120	9120	0.0622888
Yard Tractor onroad	9	175	9175	0.0597464
Yard Tractor onroad	9	250	9250	0.0597464
Yard Tractor onroad	9	750	9750	0.0533904
Yard Tractor onroad	9	999	9999	0.0533904

ARB Equipment	Code	HP Bin	concat	SOX (g SOX/hp-hr)
Other General Industrial Equipment onroad	10	120	10120	0.0066738
Other General Industrial Equipment onroad	10	175	10175	0.0064014
Other General Industrial Equipment onroad	10	250	10250	0.0064014
Other General Industrial Equipment onroad	10	50	1050	0.0073548
Other General Industrial Equipment onroad	10	500	10500	0.0055842
Other General Industrial Equipment onroad	10	750	10750	0.0057204
Other General Industrial Equipment onroad	10	999	10999	0.0057204
Crane	1	120	1120	0.0066738
Crane	1	175	1175	0.0064014
Crane	1	250	1250	0.0064014
Crane	1	50	150	0.0073548
Crane	1	500	1500	0.0055842
Crane	1	750	1750	0.0057204
Crane	1	999	1999	0.0057204
Excavator	2	120	2120	0.0066738
Excavator	2	175	2175	0.0064014
Excavator	2	250	2250	0.0064014
Excavator	2	50	250	0.0073548
Excavator	2	500	2500	0.0055842
Excavator	2	750	2750	0.0057204
Forklift	3	120	3120	0.0066738
Forklift	3	175	3175	0.0064014
Forklift	3	250	3250	0.0064014
Forklift	3	50	350	0.0073548
Forklift	3	500	3500	0.0055842
Material Handling Equip	4	120	4120	0.0064014
Other General Industrial Equipment	5	120	5120	0.0066738
Other General Industrial Equipment	5	175	5175	0.0064014
Other General Industrial Equipment	5	250	5250	0.0064014
Other General Industrial Equipment	5	50	550	0.0073548
Other General Industrial Equipment	5	500	5500	0.0055842
Other General Industrial Equipment	5	750	5750	0.0057204
Other General Industrial Equipment	5	999	5999	0.0057204
Sweeper/Scrubbers	6	120	6120	0.0066738
Sweeper/Scrubbers	6	175	6175	0.0064014
Sweeper/Scrubbers	6	250	6250	0.0064014
Sweeper/Scrubbers	6	50	650	0.0073548
Tractor/Loader/Backhoe	7	120	7120	0.0066738
Tractor/Loader/Backhoe	7	175	7175	0.0064014
Tractor/Loader/Backhoe	7	250	7250	0.0064014
Tractor/Loader/Backhoe	7	50	750	0.0073548
Tractor/Loader/Backhoe	7	500	7500	0.0064014
Tractor/Loader/Backhoe	7	750	7750	0.0064014
Yard Tractor offroad	8	120	8120	0.0066738
Yard Tractor offroad	8	175	8175	0.0064014
Yard Tractor offroad	8	250	8250	0.0064014
Yard Tractor offroad	8	750	8750	0.0057204
Yard Tractor offroad	8	999	8999	0.0057204
Yard Tractor onroad	9	120	9120	0.0066738
Yard Tractor onroad	9	175	9175	0.0064014
Yard Tractor onroad	9	250	9250	0.0064014
Yard Tractor onroad	9	750	9750	0.0057204
Yard Tractor onroad	9	999	9999	0.0057204

ARB Equipment	Code	HP Bin	concat	SOX (g SOX/hp-hr)
Crane	1	120	1120	0.007491
Crane	1	175	1175	0.007491
Crane	1	50	150	0.009534
Forklift	3	120	3120	0.007491
Forklift	3	175	3175	0.007491
Forklift	3	50	350	0.009534
Other General Industrial Equipme	5	120	5120	0.007491
Other General Industrial Equipme	5	175	5175	0.007491
Other General Industrial Equipme	5	50	550	0.009534
Sweeper/Scrubbers	6	120	6120	0.007491
Sweeper/Scrubbers	6	175	6175	0.007491
Sweeper/Scrubbers	6	50	650	0.009534
Tractor/Loader/Backhoe	7	120	7120	0.007491

APPENDIX E

HEAVY EQUIPMENT

APPENDIX E-1

DEATILED EMISSION CALCULATIONS, EMISSION FACTOR DERIVATION, OFFROAD2007 OUTPUT, AND THE SPECIATION PROFILE FOR THE 2005 BASELINE YEAR

Summary of Emissions from Heavy Equipment
Dolores and ICTF Rail Yards, Long Beach, CA

									Hours of				Carbon	2005 Emission Factors									VOC Evaporative Emissions[9]		2005 Emission Estimates								
		Equipment				Fuel	No of	Rating	Operation	BSFC	Fuel Use	Load	Oxidation	(g/bhp-hr)[6]						(kg/gal)[5]					(tons/yr)						(metric tons/yr)		
Yard	Location	Type	Make	Model	Year	Type	Units	(hp)	(hr/yr)[1]	(lb/bhp-hr)[2]	(gal/yr)[3]	Factor[4]	Factor[5]	ROG	CO	NOx	PM10	DPM	SOx	CO2	N2O[7,8]	CH4[7,8]	Part 1 (lb/hr)	Part 2 (lb/yr)	ROG	CO	NOx	PM10	DPM	SOx	CO2	N2O	CH4
ICTF	Car Dept.	Crane	Grove	RT600E	2004	Diesel	1	173	1095	0.47	5,392	0.43	99%	0.32	2.83	4.61	0.18	0.18	0.05	10.15	1.39E-05	4.16E-05	-	-	0.03	0.25	0.41	0.02	0.02	0.00	54.18	7.48E-05	2.24E-04
ICTF	Crane Maint	Forklift	Taylor	850	2005	Diesel	2	155	7300	0.47	44,941	0.30	99%	0.22	2.76	4.26	0.14	0.14	0.05	10.15	1.39E-05	4.16E-05	-	-	0.16	2.07	3.19	0.10	0.10	0.04	451.59	6.23E-04	1.87E-03
ICTF	Crane Maint	Forklift	Taylor	850	1998	Diesel	1	154	7300	0.47	22,326	0.30	99%	1.33	3.66	8.59	0.62	0.62	0.05	10.15	1.39E-05	4.16E-05	-	-	0.49	1.36	3.19	0.23	0.23	0.02	224.34	3.10E-04	9.29E-04
ICTF	Crane Maint.	Man Lift	Unknown	Unknown	1985	Diesel	1	29	1825	0.53	1,817	0.46	99%	5.11	10.26	7.51	1.02	1.02	0.06	10.15	1.39E-05	4.16E-05	-	-	0.14	0.28	0.20	0.03	0.03	0.00	18.26	2.52E-05	7.56E-05
Dolores	Locomotive Shop	Forklift	Yale	GP-060	ALL[10]	Propane	2	150	3285	0.55	38,441	0.30	99.5%	0.11	23.38	7.30	0.06	0.00	0.00	5.95	3.74E-05	8.31E-06	-	-	0.04	7.62	2.38	0.02	0.00	0.00	227.58	1.44E-03	3.19E-04
Total							**7**				**112,918**														**0.86**	**11.58**	**9.38**	**0.40**	**0.38**	**0.07**	**975.96**	**2.47E-03**	**3.42E-03**

Notes
1. Hours of operation provided by UPRR personnel.
2. Brake-specific fuel consumption (BSFC) from OFFROAD2007 model.
3. Calculation assumes density of Diesel fuel of 7.1 lb/gal, LPG =4.23 lb/gal @15 oC (Sources: e-LPG.com, Lange Gas)
4. Default load factors from OFFROAD 2007 model.
5. From the Air Resources Board's Draft *Emission Factors for Mandatory Reporting Programs*, August 10, 2007.
6. Emission factors (g/bhp-hr) from the OFFROAD2007 model.
7. Based on a Diesel fuel HHV of 5.825 MMBtu/barrel (from ARB Draft Emission Factors for Mandatory Reporting Programs, August 10, 2007) and 42 gallons per barrel.
8. Based on a LPG HHV of 91,300 BTU/gal (Source: TRANSPORTATION ENERGY DATA BOOK: EDITION 26, U.S. Department of Energy, 2007).
9. Evaporative emissions were calculated from the OFFROAD 2007 model and are negligible.
10. Dolores forklifts are modeled as the calendar year 2005 fleet average model year group from the OFFROAD2007 model.

Toxic Air Contaminant Emissions from the Propane-Fueled Forklifts
Dolores and ICTF Rail Yards, Long Beach, CA

Profile[1]	CAS	Chemical Name	Organic Fraction	Emissions (tpy)
719	95636	1,2,4-trimethylbenzene	0.00001	3.21E-07
719	75070	acetaldehyde	0.00003	9.63E-07
719	71432	benzene	0.00010	3.53E-06
719	110827	cyclohexane	0.00001	3.21E-07
719	100414	ethylbenzene	0.00001	3.21E-07
719	74851	ethylene	0.00058	2.02E-05
719	50000	formaldehyde	0.00074	2.60E-05
719	108383	m-xylene	0.00001	3.21E-07
719	110543	n-hexane	0.00002	6.42E-07
719	95476	o-xylene	0.00001	3.21E-07
719	115071	propylene	0.00154	5.42E-05
719	108883	toluene	0.00004	1.28E-06
719	1330207	xylene	0.00002	6.42E-07
Total				**1.09E-04**

Notes:
1. Organic fraction from ARBs SPECIATE database. Data is from "ICE-reciprocating - natural gas" option. The SPECIATE database does not include a profile for propane-fueled engines.
2. Emissions were calculated for only chemicals that were in both the SPECIATE database and the AB2588 list.
3. Organic fraction reported on a ROG basis using ARB's Speciate ROG/TOG ratio (0.0914)

OFFROAD Output for Heavy Equipment
2005 Baseline Year

Cnty	SCC	HP	MYr	ROG-Exhaust	CO-Exhaust	NOx-Exhaust	CO2-Exhaust	SO2-Exhaust	PM-Exhaust
Los Angeles	2270002045	175	2004	0.000736677	0.006443459	0.01047755	1.292062	0.000124522	0.000402465
Los Angeles	2270003020	175	2005	0.001858381	0.02332204	0.03597733	4.794742	0.000462093	0.001183285
Los Angeles	2270003020	175	2005	0.001858381	0.02332204	0.03597733	4.794742	0.000462093	0.001183285
Los Angeles	2270003020	175	1998	0.01351128	0.03723847	0.08729408	5.775983	0.00055666	0.006287591
Los Angeles	2270003010	50	1985	0.001313469	0.0026366	0.001930473	0.1460658	1.61737E-05	0.000262881

Crankcase	FuelCons.	Activity	LF	HPAvg	ROG/ROG	ROG (lb/hp-hr)	CO (lb/hp-hr)	NOx (lb/hp-hr)	SOx (lb/hp-hr)	PM (lb/hp-hr)
		32.19191	0.43	149	1	0.000714341	0.006248094	0.010159873	0.000120747	0.000390263
		171.2285	0.3	149	1	0.000485603	0.006094147	0.009401028	0.000120747	0.000309197
		171.2285	0.3	149	1	0.000485603	0.006094147	0.009401028	0.000120747	0.000309197
		206.2702	0.3	149	1	0.002930775	0.008077516	0.018935238	0.000120747	0.001363861
		14.90837	0.46	34	1	0.011266342	0.022615559	0.016558722	0.00013873	0.002254873

OFFROAD Output for Propane-Fueled Fork Lifts

Cnty	SubR	SCC	HP	TechType	MYr	Population	ROG-Exhaust	CO-Exhaust	NOx-Exhaust	CO2-Exhaust	SO2-Exhaust	PM-Exhaust
Los Angeles	SC	2266003020	175		ALL		7.49E-03	1.63E+00	5.08E-01	4.69E+01	0.00E+00	4.17E-03
Los Angeles	SC	2266003020	175		>=2006		3.19E-03	6.80E-01	1.47E-01	1.62E+01	0.00E+00	1.45E-03
Los Angeles	SC	2266003020	175		>=2006		1.36E-03	2.76E-01	5.91E-02	5.95E+00	0.00E+00	5.29E-04
Los Angeles	SC	2266003020	175		>=2006		6.89E-04	1.30E-01	2.60E-02	2.61E+00	0.00E+00	2.32E-04
Los Angeles	SC	2266003020	175		>=2006		2.73E-04	4.48E-02	9.16E-03	8.43E-01	0.00E+00	7.50E-05

Crankcase	FuelCons.	Activity	LF	HPAvg	ROG/ROG	ROG (g/hp-hr)	CO (g/hp-hr)	NOx (g/hp-hr)	SOx (g/hp-hr)	PM (g/hp-hr)
		1.44E+03	0.3	146	1	0.107718497	23.3770918	7.29875177	0	0.059999991
		4.99E+02	0.3	146	1	0.13262965	28.22981102	6.112357281	0	0.059998108
		1.83E+02	0.3	146	1	0.154597113	31.29116273	6.709967865	0	0.060004578
		8.00E+01	0.3	146	1	0.178385095	33.6481004	6.72406002	0	0.060001163
		2.59E+01	0.3	146	1	0.218214866	35.85245788	7.324376197	0	0.059986439

APPENDIX E-2

DEATILED EMISSION CALCULATIONS, EMISSION FACTOR DERIVATION, OFFROAD2007 OUTPUT, AND THE SPECIATION PROFILE FOR PROJECT YEAR 2010

Summary of Emissions from Heavy Equipment
Dolores and ICTF Rail Yards, Long Beach, CA

									Hours of				Carbon	2010 Emission Factors									VOC Evaporative		2010 Emission Estimates								
		Equipment				Fuel	No of	Rating	Operation	BSFC	Fuel Use	Load	Oxidation	(g/bhp-hr)[6]						(kg/gal)[5]			Emissions[10]		(tons/yr)						(metric tons/yr)		
Yard	Location	Type	Make	Model	Year	Type	Units	(hp)	(hr/yr)[1]	(lb/bhp-hr)[2]	(gal/yr)[3]	Factor[4]	Factor[5]	HC	CO	NOx	PM10	DPM[7]	SOx	CO2	N2O[8,9]	CH4[8,9]	Part 1 (lb/hr)	Part 2 (lb/yr)	ROG	CO	NOx	PM10	DPM	SOx	CO2	N2O	CH4
ICTF	Car Dept.	Crane	Grove	RT600E	2004	Diesel	1	173	1,095	0.47	5,392	0.43	99%	0.58	3.40	5.18	0.26	0.26	0.01	10.15	1.39E-05	4.16E-05	-	-	0.05	0.31	0.46	0.02	0.02	0.00	54.18	7.48E-05	2.24E-04
ICTF	Crane Maint	Forklift	Taylor	850	2005	Diesel	2	155	4,745	0.47	29,212	0.30	99%	0.53	3.47	4.87	0.23	0.23	0.01	10.15	1.39E-05	4.16E-05	-	-	0.26	1.69	2.37	0.11	0.11	0.00	293.54	4.05E-04	1.22E-03
ICTF	Crane Maint	Forklift	Taylor	850	1998	Diesel	1	154	4,745	0.47	14,512	0.30	99%	1.27	3.56	8.36	0.57	0.57	0.01	10.15	1.39E-05	4.16E-05	-	-	0.31	0.86	2.02	0.14	0.14	0.00	145.82	2.01E-04	6.04E-04
ICTF	Crane Maint.	Man Lift	Unknown	Unknown	2008	Diesel	1	50	1,825	0.53	3,133	0.46	99%	0.18	3.04	2.80	0.013	0.013	0.01	10.15	1.39E-05	4.16E-05	-	-	0.01	0.14	0.13	0.00	0.00	0.00	31.49	4.35E-05	1.30E-04
Dolores	Locomotive Shop	Forklift	Yale	GP-060	ALL[11]	Propane	2	150	3,285	0.55	38,441	0.30	99.5%	0.13	28.23	6.11	0.06	NA	0.00	5.95	3.74E-05	8.31E-06	-	-	0.04	9.20	1.99	0.02	0.00	0.00	227.58	1.44E-03	3.19E-04
Total							**7**																		**0.67**	**12.19**	**6.98**	**0.29**	**0.27**	**0.01**	**752.61**	**2.16E-03**	**2.49E-03**

Notes
1. Hours of operation for 2005 were provided by UPRR personnel. The 2010 hours of operation, except for the Grove Crane and Dolores forklifts, are equal to 65% of the 2005 hours, based on the assumption that the diesel-fueled CHE will be operating at 65% of the 2005 rate due to the installation of the electric WSG cranes. Assumed no change from 2005 for the Grove Crane and Dolores forklift operations.
2. Brake-specific fuel consumption (BSFC) from OFFROAD2007 model.
3. Calculation assumes density of Diesel fuel of 7.1 lb/gal, LPG =4.23 lb/gal @15 C (Sources: e-LPG.com, Lange Gas)
4. Default load factors from OFFROAD 2007 model.
5. From the Air Resources Board's Draft *Emission Factors for Mandatory Reporting Programs*, August 10, 2007.
6. Emission factors (g/bhp-hr) from the OFFROAD2007 model.
7. It was assumed that the previous 29 hp manlift would be replaced with a new unit to comply with the CHE Regulation. Based on dicussions with UPRR staff, it was assumed the new unit would be larger and would be equipped with a Tier 4 engine that would meet the requirments of the CHE Regulation without after treatment.
8. Based on a Diesel fuel HHV of 5.825 MMBtu/barrel (from ARB Draft Emission Factors for Mandatory Reporting Programs, August 10, 2007) and 42 gallons per barrel.
9. Based on a LPG HHV of 91,300 BTU/gal (Source: TRANSPORTATION ENERGY DATA BOOK: EDITION 26, U.S. Department of Energy, 2007).
10. Evaporative emissions were calculated from the OFFROAD 2007 model and are negligible.
11. Dolores forklifts are modeled as the calendar year 2005 fleet average model year group from the OFFROAD2007 model.

Toxic Air Contaminant Emissions from the Propane-Fueled Forklifts
Dolores and ICTF Rail Yards, Long Beach, CA

Profile[1]	CAS	Chemical Name	Organic Fraction	2010 Emissions (tpy)
719	95636	1,2,4-trimethylbenzene	0.00001	3.95E-07
719	75070	acetaldehyde	0.00003	1.19E-06
719	71432	benzene	0.00010	4.35E-06
719	110827	cyclohexane	0.00001	3.95E-07
719	100414	ethylbenzene	0.00001	3.95E-07
719	74851	ethylene	0.00058	2.49E-05
719	50000	formaldehyde	0.00074	3.20E-05
719	108383	m-xylene	0.00001	3.95E-07
719	110543	n-hexane	0.00002	7.90E-07
719	95476	o-xylene	0.00001	3.95E-07
719	115071	propylene	0.00154	6.68E-05
719	108883	toluene	0.00004	1.58E-06
719	1330207	xylene	0.00002	7.90E-07
Total				**1.34E-04**

Notes:
1. Organic fraction from ARBs SPECIATE database. Data is from "ICE-reciprocating - natural gas" option. The SPECIATE database does not include a profile for propane-fueled engines.
2. Emissions were calculated for only chemicals that were in both the SPECIATE database and the AB2588 list.
3. Organic fraction reported on a ROG basis using ARB's Speciate ROG/TOG ratio (0.0914)

OFFROAD Output for Heavy Equipment
Project Year 2010

Cnty	SCC	HP	MYr	ROG-Exhaust	CO-Exhaust	NOx-Exhaust	CO2-Exhaust	SO2-Exhaust	PM-Exhaust
Los Angeles	2270002045	175	2004	7.58E-04	4.48E-03	6.81E-03	7.48E-01	8.42E-06	3.40E-04
Los Angeles	2270003020	175	2005	3.99E-03	2.63E-02	3.69E-02	4.31E+00	4.85E-05	1.74E-03
Los Angeles	2270003020	175	2005	3.99E-03	2.63E-02	3.69E-02	4.31E+00	4.85E-05	1.74E-03
Los Angeles	2270003020	175	1998	5.24E-03	1.46E-02	3.44E-02	2.34E+00	2.63E-05	2.34E-03
Los Angeles	2270003010	50	1985	4.78E-04	9.61E-04	7.11E-04	5.40E-02	6.98E-07	9.22E-05

Crankcase	FuelCons.	Activity	LF	HPAvg	ROG/ROG	ROG (lb/hp-hr)	CO (lb/hp-hr)	NOx (lb/hp-hr)	SOx (lb/hp-hr)	PM (lb/hp-hr)
		18.64	0.43	149	1	0.001268727	0.007500045	0.011410421	1.4099E-05	0.000569111
		153.78	0.3	149	1	0.00116026	0.007652435	0.010737554	1.4097E-05	0.000506952
		153.78	0.3	149	1	0.00116026	0.007652435	0.010737554	1.4097E-05	0.000506952
		83.5	0.3	149	1	0.002805551	0.007841595	0.018434096	1.40975E-05	0.001254372
		5.51	0.46	34	1	0.011094984	0.022303466	0.016493133	1.61885E-05	0.00213873

CY	Season	AvgDays	Code	Equipment	Fuel	MaxHP	Class	C/R	Pre	Hand	Port	County	Air Basin	Air Dist.
2010	Annual	Mon-Sun	2270002045	Cranes	D	175	Construction and Mining Equipment	U	P	NHH	P	Los Angeles	SC	SC
2010	Annual	Mon-Sun	2270003020	Forklifts	D	175	Industrial Equipment	U	P	NHH	NP	Los Angeles	SC	SC
2010	Annual	Mon-Sun	2270003020	Forklifts	D	175	Industrial Equipment	U	P	NHH	NP	Los Angeles	SC	SC
2010	Annual	Mon-Sun	2270003020	Forklifts	D	175	Industrial Equipment	U	P	NHH	NP	Los Angeles	SC	SC
2010	Annual	Mon-Sun	2270003010	Aerial Lifts	D	50	Industrial Equipment	U	P	NHH	NP	Los Angeles	SC	SC

MY	Population	Activity	Consumption	ROG Exhaust	CO Exhaust	NOX Exhaust	CO2 Exhaust	SO2 Exhaust	PM Exhaust	N2O Exhaust	CH4 Exhaust
2004	5.1	18.64	68.3	7.58E-04	4.48E-03	6.81E-03	7.48E-01	8.42E-06	3.40E-04	0.00E+00	6.84E-05
2005	31.16	153.78	392.98	3.99E-03	2.63E-02	3.69E-02	4.31E+00	4.85E-05	1.74E-03	0.00E+00	3.60E-04
2005	31.16	153.78	392.98	3.99E-03	2.63E-02	3.69E-02	4.31E+00	4.85E-05	1.74E-03	0.00E+00	3.60E-04
1998	16.92	83.5	214.6	5.24E-03	1.46E-02	3.44E-02	2.34E+00	2.63E-05	2.34E-03	0.00E+00	4.72E-04
1985	5.23	5.51	5.17	4.78E-04	9.61E-04	7.11E-04	5.40E-02	6.98E-07	9.22E-05	0.00E+00	4.31E-05

OFFROAD Output for Tier 4 Man Lift

Cnty	SubR	SCC	HP	TechType	MYr	Population	ROG-Exhaust	CO-Exhaust	NOx-Exhaust	CO2-Exhaust	SO2-Exhaust
Los Angeles					2008		0.000159413	0.002756289	0.004227595	0.5156102	6.66555E-06
Los Angeles					2008		0.000187577	0.002866699	0.004174383	0.5012876	6.4804E-06
Los Angeles					2008		0.000213413	0.002959962	0.004108531	0.4859042	6.28153E-06
Los Angeles					2008		0.000234841	0.003010886	0.003997758	0.4657466	6.02094E-06

PM-Exhaust	Crankcase	FuelCons.	Activity	LF	HPAvg	ROG/ROG	ROG (lb/hp-hr)	CO (lb/hp-hr)	NOx (lb/hp-hr)	SOx (lb/hp-hr)	PM (lb/hp-hr)
0.000126166			52.63	0.46	34	1	0.000387331	0.006697067	0.006163175	1.61956E-05	2.75896E-05
0.000129165			51.16	0.46	34	1	0.000468859	0.007165472	0.00626046	1.61981E-05	2.9057E-05
0.000131505			49.59	0.46	34	1	0.000550326	0.007632824	0.006356777	1.61981E-05	3.052E-05
0.000132092			47.54	0.46	34	1	0.000631697	0.008098944	0.006452111	1.61957E-05	3.19782E-05
							1	1	0.6	1	0.09

APPENDIX E-3

DEATILED EMISSION CALCULATIONS, EMISSION FACTOR DERIVATION, OFFROAD2007 OUTPUT, AND THE SPECIATION PROFILE FOR PROJECT YEAR 2012

Summary of Emissions from Heavy Equipment
Dolores and ICTF Rail Yards, Long Beach, CA

														2012 Emission Factors									VOC Evaporative Emissions[10]		2012 Emission Estimates								
		Equipment				Fuel	No of	Rating	Hours of Operation	BSFC	Fuel Use	Load	Carbon Oxidation	(g/bhp-hr)[6]						(kg/gal)[5]					(tons/yr)						(metric tons/yr)		
Yard	Location	Type	Make	Model	Year	Type	Units	(hp)	(hr/yr)[1]	(lb/bhp-hr)[2]	(gal/yr)[3]	Factor[4]	Factor[5]	ROG	CO	NOx	PM10	DPM[7]	SOx	CO2	N2O[8,9]	CH4[8,9]	Part 1 (lb/hr)	Part 2 (lb/yr)	ROG	CO	NOx	PM10	DPM	SOx	CO2	N2O	CH4
ICTF	Car Dept.	Crane	Grove	RT600E	2004	Diesel	1	173	1095	0.47	5,392	0.43	99%	0.64	3.56	5.33	0.04	*0.04*	0.01	10.15	1.39E-05	4.16E-05	-	-	0.06	0.32	0.48	0.00	0.00	0.00	54.18	7.48E-05	2.24E-04
ICTF	Various Locations	Man Lift	Unknown	Unknown	2008	Diesel	1	50	1825	0.53	3,133	0.46	99%	0.21	3.25	2.84	0.01	0.013	0.01	10.15	1.39E-05	4.16E-05	-	-	0.01	0.15	0.13	0.00	0.00	0.00	31.49	4.35E-05	1.30E-04
Dolores	Locomotive Shop	Forklift	Yale	GP-060	ALL[11]	Propane	2	150	3285	0.55	38,441	0.30	99.5%	0.15	31.29	6.71	0.06	0.00	0.00	5.95	3.74E-05	8.31E-06	-	-	0.05	10.20	2.19	0.02	0.00	0.00	227.58	1.44E-03	3.19E-04
Total							**4**																		**0.12**	**10.67**	**2.80**	**0.02**	**0.00**	**0.00**	**313.25**	**1.56E-03**	**6.74E-04**

Notes
1. Hours of operation provided by UPRR personnel. Assumed no change in operations from the baseline year.
2. Brake-specific fuel consumption (BSFC) from OFFROAD2007 model.
3. Calculation assumes density of Diesel fuel of 7.1 lb/gal, LPG =4.23 lb/gal @15 C (Sources: e-LPG.com, Lange Gas)
4. Default load factors from OFFROAD 2007 model.
5. From the Air Resources Board's Draft *Emission Factors for Mandatory Reporting Programs*, August 10, 2007.
6. Emission factors (g/bhp-hr) from the OFFROAD2007 model.
7. The DPM emission factor for the Grove crane was adjusted for compliance with the CHE Regulation. It was assumed that a Level 3 VDECS (85% control) was installed.
8. Based on a Diesel fuel HHV of 5.825 MMBtu/barrel (from ARB Draft Emission Factors for Mandatory Reporting Programs, August 10, 2007) and 42 gallons per barrel.
9. Based on a LPG HHV of 91,300 BTU/gal (Source: TRANSPORTATION ENERGY DATA BOOK: EDITION 26, U.S. Department of Energy, 2007).
10. Evaporative emissions were calculated from the OFFROAD 2007 model and are negligible.
11. Dolores forklifts are modeled as the calendar year 2005 fleet average model year group from the OFFROAD2007 model.

Toxic Air Contaminant Emissions from the Propane-Fueled Forklifts
Dolores and ICTF Rail Yards, Long Beach, CA

Profile[1]	CAS	Chemical Name	Organic Fraction	2012 Emissions (tpy)
719	95636	1,2,4-trimethylbenzene	0.00001	4.61E-07
719	75070	acetaldehyde	0.00003	1.38E-06
719	71432	benzene	0.00010	5.07E-06
719	110827	cyclohexane	0.00001	4.61E-07
719	100414	ethylbenzene	0.00001	4.61E-07
719	74851	ethylene	0.00058	2.90E-05
719	50000	formaldehyde	0.00074	3.73E-05
719	108383	m-xylene	0.00001	4.61E-07
719	110543	n-hexane	0.00002	9.21E-07
719	95476	o-xylene	0.00001	4.61E-07
719	115071	propylene	0.00154	7.78E-05
719	108883	toluene	0.00004	1.84E-06
719	1330207	xylene	0.00002	9.21E-07
Total				**1.57E-04**

Notes:
1. Organic fraction from ARBs SPECIATE database. Data is from "ICE-reciprocating - natural gas" option. The SPECIATE database does not include a profile for propane-fueled engines.
2. Emissions were calculated for only chemicals that were in both the SPECIATE database and the AB2588 list.
3. Organic fraction reported on a ROG basis using ARB's Speciate ROG/TOG ratio (0.0914)

OFFROAD Output for Heavy Equipment
Project Year 2012

Cnty	SCC	HP	MYr	ROG-Exhaust	CO-Exhaust	NOx-Exhaust	CO2-Exhaust	SO2-Exhaust	PM-Exhaust
Los Angeles	2270002045	175	2004	7.93E-04	4.38E-03	6.56E-03	7.00E-01	7.88E-06	3.47E-04
Los Angeles	2270003020	175	2005	4.06E-03	2.56E-02	3.56E-02	4.10E+00	4.61E-05	1.74E-03
Los Angeles	2270003020	175	2005	4.06E-03	2.56E-02	3.56E-02	4.10E+00	4.61E-05	1.74E-03
Los Angeles	2270003020	175	1998	3.10E-03	8.66E-03	2.04E-02	1.38E+00	1.56E-05	1.39E-03
Los Angeles	2270003010	50	1985	2.97E-04	5.94E-04	4.27E-04	3.21E-02	4.15E-07	5.67E-05

Crankcase	FuelCons.	Activity	LF	HPAvg	ROG/ROG	ROG (lb/hp-hr)	CO (lb/hp-hr)	NOx (lb/hp-hr)	SOx (lb/hp-hr)	PM (lb/hp-hr)
		17.44	0.43	149	1	0.00142017	0.007841001	0.011750116	1.40964E-05	0.00062079
		146.24	0.3	149	1	0.00124208	0.007841601	0.010899952	1.40975E-05	0.000531945
		146.24	0.3	149	1	0.00124208	0.007841601	0.010899952	1.40975E-05	0.000531945
		49.43	0.3	149	1	0.002805446	0.0078413	0.018433407	1.40969E-05	0.001254326
		3.28	0.46	34	1	0.011572481	0.023169932	0.01665718	1.61874E-05	0.002210336

CY	Season	AvgDays	Code	Equipment	Fuel	MaxHP	Class	C/R	Pre	Hand	Port	County	Air Basin	Air Dist.
2012	Annual	Mon-Sun	2270002045	Cranes	D	175	Construction and Mining Equipment	U	P	NHH	P	Los Angeles	SC	SC
2012	Annual	Mon-Sun	2270003020	Forklifts	D	175	Industrial Equipment	U	P	NHH	NP	Los Angeles	SC	SC
2012	Annual	Mon-Sun	2270003020	Forklifts	D	175	Industrial Equipment	U	P	NHH	NP	Los Angeles	SC	SC
2012	Annual	Mon-Sun	2270003020	Forklifts	D	175	Industrial Equipment	U	P	NHH	NP	Los Angeles	SC	SC
2012	Annual	Mon-Sun	2270003010	Aerial Lifts	D	50	Industrial Equipment	U	P	NHH	NP	Los Angeles	SC	SC

MY	Population	Activity	Consumption	ROG Exhaust	CO Exhaust	NOX Exhaust	CO2 Exhaust	SO2 Exhaust	PM Exhaust	N2O Exhaust	CH4 Exhaust
2004	4.94	17.44	63.95	7.93E-04	4.38E-03	6.56E-03	7.00E-01	7.88E-06	3.47E-04	0.00E+00	7.16E-05
2005	29.63	146.24	373.91	4.06E-03	2.56E-02	3.56E-02	4.10E+00	4.61E-05	1.74E-03	0.00E+00	3.66E-04
2005	29.63	146.24	373.91	4.06E-03	2.56E-02	3.56E-02	4.10E+00	4.61E-05	1.74E-03	0.00E+00	3.66E-04
1998	10.01	49.43	127.03	3.10E-03	8.66E-03	2.04E-02	1.38E+00	1.56E-05	1.39E-03	0.00E+00	2.80E-04
1985	3.11	3.28	3.09	2.97E-04	5.94E-04	4.27E-04	3.21E-02	4.15E-07	5.67E-05	0.00E+00	2.68E-05

OFFROAD Output for Tier 4 Man Lift

Cnty	SubR	SCC	HP	TechType	MYr	Population	ROG-Exhaust	CO-Exhaust	NOx-Exhaust	CO2-Exhaust	SO2-Exhaust
Los Angeles					2008		0.000159413	0.002756289	0.004227595	0.5156102	6.66555E-06
Los Angeles					2008		0.000187577	0.002866699	0.004174383	0.5012876	6.4804E-06
Los Angeles					2008		0.000213413	0.002959962	0.004108531	0.4859042	6.28153E-06
Los Angeles					2008		0.000234841	0.003010886	0.003997758	0.4657466	6.02094E-06

PM-Exhaust	Crankcase	FuelCons.	Activity	LF	HPAvg	ROG/ROG	ROG (lb/hp-hr)	CO (lb/hp-hr)	NOx (lb/hp-hr)	SOx (lb/hp-hr)	PM (lb/hp-hr)
0.000126166			52.63	0.46	34	1	0.000387331	0.006697067	0.006163175	1.61956E-05	2.75896E-05
0.000129165			51.16	0.46	34	1	0.000468859	0.007165472	0.00626046	1.61981E-05	2.9057E-05
0.000131505			49.59	0.46	34	1	0.000550326	0.007632824	0.006356777	1.61981E-05	3.052E-05
0.000132092			47.54	0.46	34	1	0.000631697	0.008098944	0.006452111	1.61957E-05	3.19782E-05
							1	1	0.6	1	0.09

APPENDIX E-4

DEATILED EMISSION CALCULATIONS, EMISSION FACTOR DERIVATION, OFFROAD2007 OUTPUT, AND THE SPECIATION PROFILE FOR PROJECT YEAR 2014

Summary of Emissions from Heavy Equipment
Dolores and ICTF Rail Yards, Long Beach, CA

									Hours of				Carbon	2014 Emission Factors									VOC Evaporative		2014 Emission Estimates								
		Equipment				Fuel	No of	Rating	Operation	BSFC	Fuel Use	Load	Oxidation	(g/bhp-hr)[6]						(kg/gal)[5]			Emissions[10]		(tons/yr)						(metric tons/yr)		
Yard	Location	Type	Make	Model	Year	Type	Units	(hp)	(hr/yr)[1]	(lb/bhp-hr)[2]	(gal/yr)[3]	Factor[4]	Factor[5]	HC	CO	NOx	PM10	DPM[7]	SOx	CO2	N2O[8,9]	CH4[8,9]	Part 1 (lb/hr)	Part 2 (lb/yr)	ROG	CO	NOx	PM10	DPM	SOx	CO2	N2O	CH4
ICTF	Car Dept.	Crane	Grove	RT600E	2004	Diesel	1	173	1095	0.47	5,392	0.43	99%	0.64	3.56	5.33	*0.04*	*0.04*	0.01	10.15	1.39E-05	4.16E-05	-	-	0.06	0.32	0.48	0.00	0.00	0.00	54.18	7.48E-05	2.24E-04
ICTF	Various Locations	Man Lift	Unknown	Unknown	2008	Diesel	1	50	1825	0.53	3,133	0.46	99%	0.25	3.46	2.88	0.014	0.014	0.01	10.15	1.39E-05	4.16E-05	-	-	0.01	0.16	0.13	0.00	0.00	0.00	31.49	4.35E-05	1.30E-04
Dolores	Locomotive Shop	Forklift	Yale	GP-060	ALL[11]	Propane	2	150	3285	0.55	38,441	0.30	99.5%	0.18	33.65	6.72	0.06	0.00	0.00	5.95	3.74E-05	8.31E-06	-	-	0.06	10.97	2.19	0.02	0.00	0.00	227.58	1.44E-03	3.19E-04
Total							**4**																		**0.13**	**11.45**	**2.80**	**0.02**	**0.004**	**0.00**	**313.25**	**1.56E-03**	**6.74E-04**

Notes
1. Hours of operation provided by UPRR personnel. Assumed no change in operations from the baseline year.
2. Brake-specific fuel consumption (BSFC) from OFFROAD2007 model.
3. Calculation assumes density of Diesel fuel of 7.1 lb/gal, LPG =4.23 lb/gal @15 C (Sources: e-LPG.com, Lange Gas)
4. Default load factors from OFFROAD 2007 model.
5. From the Air Resources Board's Draft *Emission Factors for Mandatory Reporting Programs*, August 10, 2007.
6. Emission factors (g/bhp-hr) from the OFFROAD2007 model.
7. The DPM emission factor for the Grove crane was adjusted for compliance with the CHE Regulation. It was assumed that a Level 3 VDECS (85% control) was installed.
8. Based on a Diesel fuel HHV of 5.825 MMBtu/barrel (from ARB Draft Emission Factors for Mandatory Reporting Programs, August 10, 2007) and 42 gallons per barrel.
9. Based on a LPG HHV of 91,300 BTU/gal (Source: TRANSPORTATION ENERGY DATA BOOK: EDITION 26, U.S. Department of Energy, 2007).
10. Evaporative emissions were calculated from the OFFROAD 2007 model and are negligible.
11. Dolores forklifts are modeled as the calendar year 2005 fleet average model year group from the OFFROAD2007 model.

Toxic Air Contaminant Emissions from the Propane-Fueled Forklifts
Dolores and ICTF Rail Yards, Long Beach, CA

Profile[1]	CAS	Chemical Name	Organic Fraction	2014 Emissions (tpy)
719	95636	1,2,4-trimethylbenzene	0.00001	5.31E-07
719	75070	acetaldehyde	0.00003	1.59E-06
719	71432	benzene	0.00010	5.84E-06
719	110827	cyclohexane	0.00001	5.31E-07
719	100414	ethylbenzene	0.00001	5.31E-07
719	74851	ethylene	0.00058	3.35E-05
719	50000	formaldehyde	0.00074	4.30E-05
719	108383	m-xylene	0.00001	5.31E-07
719	110543	n-hexane	0.00002	1.06E-06
719	95476	o-xylene	0.00001	5.31E-07
719	115071	propylene	0.00154	8.98E-05
719	108883	toluene	0.00004	2.13E-06
719	1330207	xylene	0.00002	1.06E-06
Total				**1.81E-04**

Notes:
1. Organic fraction from ARBs SPECIATE database. Data is from "ICE-reciprocating - natural gas" option. The SPECIATE database does not include a profile for propane-fueled engines.
2. Emissions were calculated for only chemicals that were in both the SPECIATE database and the AB2588 list.
3. Organic fraction reported on a ROG basis using ARB's Speciate ROG/TOG ratio (0.0914)

OFFROAD Output for Heavy Equipment
Project Year 2014

Cnty	SCC	HP	MYr	ROG-Exhaust	CO-Exhaust	NOx-Exhaust	CO2-Exhaust	SO2-Exhaust	PM-Exhaust
Los Angeles	2270002045	175	2004	7.39E-04	4.08E-03	6.12E-03	6.52E-01	7.34E-06	3.23E-04
Los Angeles	2270003020	175	2005	3.77E-03	2.38E-02	3.31E-02	3.81E+00	4.28E-05	1.62E-03
Los Angeles	2270003020	175	2005	3.77E-03	2.38E-02	3.31E-02	3.81E+00	4.28E-05	1.62E-03
Los Angeles	2270003020	175	1998	2.17E-03	6.06E-03	1.42E-02	9.68E-01	1.09E-05	9.69E-04
Los Angeles	2270003010	50	1985	1.73E-04	3.45E-04	2.42E-04	1.80E-02	2.33E-07	3.28E-05

Crankcase	FuelCons.	Activity	LF	HPAvg	ROG/ROG	ROG (lb/hp-hr)	CO (lb/hp-hr)	NOx (lb/hp-hr)	SOx (lb/hp-hr)	PM (lb/hp-hr)
		16.25	0.43	149	1	0.001420381	0.007842169	0.011751864	1.40985E-05	0.000620882
		135.97	0.3	149	1	0.00124204	0.007841343	0.010899591	1.4097E-05	0.000531927
		135.97	0.3	149	1	0.00124204	0.007841343	0.010899591	1.4097E-05	0.000531927
		34.55	0.3	149	1	0.00280569	0.007841985	0.018435015	1.40982E-05	0.001254435
		1.84	0.46	34	1	0.012029822	0.023996212	0.016793159	1.61592E-05	0.00227813

CY	Season	AvgDays	Code	Equipment	Fuel	MaxHP	Class	C/R	Pre	Hand	Port	County	Air Basin	Air Dist.
2014	Annual	Mon-Sun	2270002045	Cranes	D	175	Construction and Mining Equipment	U	P	NHH	P	Los Angeles	SC	SC
2014	Annual	Mon-Sun	2270003020	Forklifts	D	175	Industrial Equipment	U	P	NHH	NP	Los Angeles	SC	SC
2014	Annual	Mon-Sun	2270003020	Forklifts	D	175	Industrial Equipment	U	P	NHH	NP	Los Angeles	SC	SC
2014	Annual	Mon-Sun	2270003020	Forklifts	D	175	Industrial Equipment	U	P	NHH	NP	Los Angeles	SC	SC
2014	Annual	Mon-Sun	2270003010	Aerial Lifts	D	50	Industrial Equipment	U	P	NHH	NP	Los Angeles	SC	SC

MY	Population	Activity	Consumption	ROG Exhaust	CO Exhaust	NOX Exhaust	CO2 Exhaust	SO2 Exhaust	PM Exhaust	N2O Exhaust	CH4 Exhaust
2004	4.78	16.25	59.59	7.39E-04	4.08E-03	6.12E-03	6.52E-01	7.34E-06	3.23E-04	0.00E+00	6.67E-05
2005	27.55	135.97	347.64	3.77E-03	2.38E-02	3.31E-02	3.81E+00	4.28E-05	1.62E-03	0.00E+00	3.41E-04
2005	27.55	135.97	347.64	3.77E-03	2.38E-02	3.31E-02	3.81E+00	4.28E-05	1.62E-03	0.00E+00	3.41E-04
1998	7	34.55	88.8	2.17E-03	6.06E-03	1.42E-02	9.68E-01	1.09E-05	9.69E-04	0.00E+00	1.95E-04
1985	1.74	1.84	1.73	1.73E-04	3.45E-04	2.42E-04	1.80E-02	2.33E-07	3.28E-05	0.00E+00	1.56E-05

OFFROAD Output for Tier 4 Man Lift

Cnty	SubR	SCC	HP	TechType	MYr	Population	ROG-Exhaust	CO-Exhaust	NOx-Exhaust	CO2-Exhaust	SO2-Exhaust
Los Angeles					2008		0.000159413	0.002756289	0.004227595	0.5156102	6.66555E-06
Los Angeles					2008		0.000187577	0.002866699	0.004174383	0.5012876	6.4804E-06
Los Angeles					2008		0.000213413	0.002959962	0.004108531	0.4859042	6.28153E-06
Los Angeles					2008		0.000234841	0.003010886	0.003997758	0.4657466	6.02094E-06

PM-Exhaust	Crankcase	FuelCons.	Activity	LF	HPAvg	ROG/ROG	ROG (lb/hp-hr)	CO (lb/hp-hr)	NOx (lb/hp-hr)	SOx (lb/hp-hr)	PM (lb/hp-hr)
0.000126166			52.63	0.46	34	1	0.000387331	0.006697067	0.006163175	1.61956E-05	2.75896E-05
0.000129165			51.16	0.46	34	1	0.000468859	0.007165472	0.00626046	1.61981E-05	2.9057E-05
0.000131505			49.59	0.46	34	1	0.000550326	0.007632824	0.006356777	1.61981E-05	3.052E-05
0.000132092			47.54	0.46	34	1	0.000631697	0.008098944	0.006452111	1.61957E-05	3.19782E-05
							1	1	0.6	1	0.09

APPENDIX E-5

DEATILED EMISSION CALCULATIONS, EMISSION FACTOR DERIVATION, OFFROAD2007 OUTPUT, AND THE SPECIATION PROFILE FOR PROJECT YEAR 2016

Summary of Emissions from Heavy Equipment
Dolores and ICTF Rail Yards, Long Beach, CA

Yard	Location	Equipment Type	Make	Model	Year	Fuel Type	No of Units	Rating (hp)	Hours of Operation (hr/yr)[1]	BSFC (lb/bhp-hr)[2]	Fuel Use (gal/yr)[3]	Load Factor[4]	Carbon Oxidation Factor[5]
ICTF	Car Dept.	Crane	Grove	RT600E	2004	Diesel	1	173	1095	0.47	5,392	0.43	99%
ICTF	Various Locations	Man Lift	Unknown	Unknown	2008	Diesel	1	50	1825	0.53	3,133	0.46	99%
Dolores	Locomotive Shop	Forklift	Yale	GP-060	ALL[11]	Propane	2	150	3285	0.55	38,441	0.30	99.5%
Total							**4**						

Yard	2016 Emission Factors (g/bhp-hr)[6]						2016 Emission Factors (kg/gal)[5]			VOC Evaporative Emissions[10]		2016 Emission Estimates (tons/yr)						2016 Emission Estimates (metric tons/yr)		
	ROG	CO	NOx	PM10	DPM[7]	SOx	CO2	N2O[8,9]	CH4[8,9]	Part 1 (lb/hr)	Part 2 (lb/yr)	ROG	CO	NOx	PM10	DPM	SOx	CO2	N2O	CH4
ICTF	0.64	3.56	5.33	*0.04*	*0.04*	0.01	10.15	1.39E-05	4.16E-05	-	-	0.06	0.32	0.48	0.00	0.00	0.00	54.18	7.48E-05	2.24E-04
ICTF	0.29	3.67	2.93	0.015	0.015	0.01	10.15	1.39E-05	4.16E-05	-	-	0.01	0.17	0.14	0.00	0.00	0.00	31.49	4.35E-05	1.30E-04
Dolores	0.22	35.85	7.32	0.06	0.00	0.00	5.95	3.74E-05	8.31E-06			0.07	11.68	2.39	0.02	0.00	0.00	227.58	1.44E-03	3.19E-04
Total												**0.14**	**12.17**	**3.00**	**0.02**	**0.00**	**0.00**	**313.25**	**1.56E-03**	**6.74E-04**

Notes:
1. Hours of operation provided by UPRR personnel. Assumed no change in operations from the baseline year.
2. Brake-specific fuel consumption (BSFC) from OFFROAD2007 model.
3. Calculation assumes density of Diesel fuel of 7.1 lb/gal, LPG =4.23 lb/gal @15 C (Sources: e-LPG.com, Lange Gas)
4. Default load factors from OFFROAD 2007 model.
5. From the Air Resources Board's Draft *Emission Factors for Mandatory Reporting Programs*, August 10, 2007.
6. Emission factors (g/bhp-hr) from the OFFROAD2007 model.
7. The DPM emission factor for the Grove crane was adjusted for compliance with the CHE Regulation. It was assumed that a Level 3 VDECS (85% control) was installed.
8. Based on a Diesel fuel HHV of 5.825 MMBtu/barrel (from ARB Draft Emission Factors for Mandatory Reporting Programs, August 10, 2007) and 42 gallons per barrel.
9. Based on a LPG HHV of 91,300 BTU/gal (Source: TRANSPORTATION ENERGY DATA BOOK: EDITION 26, U.S. Department of Energy, 2007).
10. Evaporative emissions were calculated from the OFFROAD 2007 model and are negligible.
11. Dolores forklifts are modeled as the calendar year 2005 fleet average model year group from the OFFROAD2007 model.

Toxic Air Contaminant Emissions from the Propane-Fueled Forklifts
Dolores and ICTF Rail Yards, Long Beach, CA

Profile[1]	CAS	Chemical Name	Organic Fraction	2016 Emissions (tpy)
719	95636	1,2,4-trimethylbenzene	0.00001	6.50E-07
719	75070	acetaldehyde	0.00003	1.95E-06
719	71432	benzene	0.00010	7.15E-06
719	110827	cyclohexane	0.00001	6.50E-07
719	100414	ethylbenzene	0.00001	6.50E-07
719	74851	ethylene	0.00058	4.10E-05
719	50000	formaldehyde	0.00074	5.27E-05
719	108383	m-xylene	0.00001	6.50E-07
719	110543	n-hexane	0.00002	1.30E-06
719	95476	o-xylene	0.00001	6.50E-07
719	115071	propylene	0.00154	1.10E-04
719	108883	toluene	0.00004	2.60E-06
719	1330207	xylene	0.00002	1.30E-06
Total				**2.21E-04**

Notes:
1. Organic fraction from ARBs SPECIATE database. Data is from "ICE-reciprocating - natural gas" option. The SPECIATE database does not include a profile for propane-fueled engines.
2. Emissions were calculated for only chemicals that were in both the SPECIATE database and the AB2588 list.
3. Organic fraction reported on a ROG basis using ARB's Speciate ROG/TOG ratio (0.0914)

OFFROAD Output for Heavy Equipment
Project Year 2016

Cnty	SCC	HP	MYr	ROG-Exhaust	CO-Exhaust	NOx-Exhaust	CO2-Exhaust	SO2-Exhaust	PM-Exhaust
Los Angeles	2270002045	175	2004	6.85E-04	3.78E-03	5.67E-03	6.04E-01	6.80E-06	2.99E-04
Los Angeles	2270003020	175	2005	3.28E-03	2.07E-02	2.88E-02	3.31E+00	3.72E-05	1.40E-03
Los Angeles	2270003020	175	2005	3.28E-03	2.07E-02	2.88E-02	3.31E+00	3.72E-05	1.40E-03
Los Angeles	2270003020	175	1998	1.53E-03	4.29E-03	1.01E-02	6.85E-01	7.71E-06	6.86E-04
Los Angeles	2270003010	50	1985	3.17E-05	6.30E-05	4.34E-05	3.21E-03	4.15E-08	5.97E-06

Crankcase	FuelCons.	Activity	LF	HPAvg	ROG/ROG	ROG (lb/hp-hr)	CO (lb/hp-hr)	NOx (lb/hp-hr)	SOx (lb/hp-hr)	PM (lb/hp-hr)
		15.06	0.43	149	1	0.001420026	0.007840209	0.011748927	1.4095E-05	0.000620727
		118.16	0.3	149	1	0.001242043	0.007841364	0.010899622	1.40971E-05	0.000531929
		118.16	0.3	149	1	0.001242043	0.007841364	0.010899622	1.40971E-05	0.000531929
		24.47	0.3	149	1	0.002806026	0.00784292	0.018437204	1.40999E-05	0.001254585
		0.33	0.46	34	1	0.01227487	0.024431601	0.016823115	1.60892E-05	0.002312846

CY	Season	AvgDays	Code	Equipment	Fuel	MaxHP	Class	C/R	Pre	Hand	Port	County	Air Basin	Air Dist.
2016	Annual	Mon-Sun	2270002045	Cranes	D	175	Construction and Mining Equipment	U	P	NHH	P	Los Angeles	SC	SC
2016	Annual	Mon-Sun	2270003020	Forklifts	D	175	Industrial Equipment	U	P	NHH	NP	Los Angeles	SC	SC
2016	Annual	Mon-Sun	2270003020	Forklifts	D	175	Industrial Equipment	U	P	NHH	NP	Los Angeles	SC	SC
2016	Annual	Mon-Sun	2270003020	Forklifts	D	175	Industrial Equipment	U	P	NHH	NP	Los Angeles	SC	SC
2016	Annual	Mon-Sun	2270003010	Aerial Lifts	D	50	Industrial Equipment	U	P	NHH	NP	Los Angeles	SC	SC

MY	Population	Activity	Consumption	ROG Exhaust	CO Exhaust	NOX Exhaust	CO2 Exhaust	SO2 Exhaust	PM Exhaust	N2O Exhaust	CH4 Exhaust
2004	4.6	15.06	55.21	6.85E-04	3.78E-03	5.67E-03	6.04E-01	6.80E-06	2.99E-04	0.00E+00	6.18E-05
2005	23.94	118.16	302.11	3.28E-03	2.07E-02	2.88E-02	3.31E+00	3.72E-05	1.40E-03	0.00E+00	2.96E-04
2005	23.94	118.16	302.11	3.28E-03	2.07E-02	2.88E-02	3.31E+00	3.72E-05	1.40E-03	0.00E+00	2.96E-04
1998	4.96	24.47	62.9	1.53E-03	4.29E-03	1.01E-02	6.85E-01	7.71E-06	6.86E-04	0.00E+00	1.38E-04
1985	0.31	0.33	0.31	3.17E-05	6.30E-05	4.34E-05	3.21E-03	4.15E-08	5.97E-06	0.00E+00	2.86E-06

OFFROAD Output for Tier 4 Man Lift

Cnty	SubR	SCC	HP	TechType	MYr	Population	ROG-Exhaust	CO-Exhaust	NOx-Exhaust	CO2-Exhaust	SO2-Exhaust
Los Angeles					2008		0.000159413	0.002756289	0.004227595	0.5156102	6.66555E-06
Los Angeles					2008		0.000187577	0.002866699	0.004174383	0.5012876	6.4804E-06
Los Angeles					2008		0.000213413	0.002959962	0.004108531	0.4859042	6.28153E-06
Los Angeles					2008		0.000234841	0.003010886	0.003997758	0.4657466	6.02094E-06

PM-Exhaust	Crankcase	FuelCons.	Activity	LF	HPAvg	ROG/ROG	ROG (lb/hp-hr)	CO (lb/hp-hr)	NOx (lb/hp-hr)	SOx (lb/hp-hr)	PM (lb/hp-hr)
0.000126166			52.63	0.46	34	1	0.000387331	0.006697067	0.006163175	1.61956E-05	2.75896E-05
0.000129165			51.16	0.46	34	1	0.000468859	0.007165472	0.00626046	1.61981E-05	2.9057E-05
0.000131505			49.59	0.46	34	1	0.000550326	0.007632824	0.006356777	1.61981E-05	3.052E-05
0.000132092			47.54	0.46	34	1	0.000631697	0.008098944	0.006452111	1.61957E-05	3.19782E-05
							1	1	0.6	1	0.09

APPENDIX F

TRUS AND REEFER CARS

APPENDIX F-1

DEATILED EMISSION CALCULATIONS, EMISSION FACTOR DERIVATION, AND OFFROAD2007 OUTPUT, FOR THE 2005 BASELINE YEAR

Summary of Emissions from Transport Refrigeration Units and Refrigerated Railcars
Dolores and ICTF Rail Yards, Long Beach, CA

TRU	Average		Average						Carbon	2005 Emission Factors									VOC Evaporative		2005 Emission Estimates								
Equip	Rating	Fuel	No. Units	Hours of Operation		BSFC	Fuel Use	Load	Oxidation	(g/bhp-hr)[9]						(kg/gal)[8]			Emission Factors[11]		(tons/yr)						(metric tons/yr)		
Type	(hp)[1]	Type	in Yard[2]	(hr/day)[3]	(hr/yr)[4]	(lb/bhp-hr)[5]	(gal/yr)[6]	Factor[7]	Factor[8]	HC	CO	NOx	PM10	DPM	SOx	CO2	N2O[10]	CH4[10]	Part 1 (lb/hr)	Part 2 (lb/yr)	ROG	CO	NOx	PM10	DPM	SOx	CO2	N2O	CH4
Container	28.56	Diesel	70	4	1,460	0.53	121,471	0.56	99%	2.85	6.78	6.43	0.71	0.71	0.07	10.15	1.39E-05	4.16E-05	-	-	5.12	12.16	11.53	1.28	1.28	0.12	1,220.60	0.00	0.01
Railcar	34	Diesel	10	4	1,460	0.53	19,639	0.53	99%	3.23	7.49	6.71	0.79	0.79	0.07	10.15	1.39E-05	4.16E-05	-	-	0.94	2.17	1.95	0.23	0.23	0.02	197.35	0.00	0.00
Total			**80**		**2,920**																**6.06**	**14.33**	**13.47**	**1.51**	**1.51**	**0.14**	**1,417.94**	**0.00**	**0.01**

Notes:

1. Based on the average horsepower distribution in the OFFROAD 2007 model.
2. UPRR staff estimate that there are 35-37 TRUs and 2-5 reefer cars and in the Yard at any given time. To be conservative, these estimates were increased by 100%.
3. From CARB's Staff Report: ISOR, ATCM for TRUs, Section V.a.2.
4. It was assumed that the number of units and the annual hours of operations remains constant, with individual units cycling in and out of the yard.
5. Brake-specific fuel consumption (BSFC) from OFFROAD2007 model.
6. Calculation assumes density of Diesel fuel of 7.1 lb/gal.
7. Load factors are the default factors from the OFFROAD 2007 model.
8. From the Air Resources Board's Draft *Emission Factors for Mandatory Reporting Programs*, August 10, 2007.
9. Emission factors in g/bhp-hr are from OFFROAD 2006 model.
10. Based on a diesel fuel HHV of 5.825 MMBtu/barrel (from ARB Draft Emission Factors for Mandatory Reporting Programs, August 10, 2007) and 42 gallons per barrel.
11. Evaporative emissions were calculated from the OFFROAD 2007 model and are negligible.

Summary of Emissions from TRU Refrigerant Loss
Dolores and ICTF Rail Yards, Long Beach, CA

TRU Equip Type	Daily Average No. Units in Yard[1]	Refrigerant Charge per Unit (kg)[2]	Annual Refrigerant Loss Rate (%)[3]	Annual Refrigerant Loss (kg/yr)	Emissions by Refrigerant[4,5] (metric tons/yr)		
					HFC-125	HFC-134a	HFC-143a
Container	70	6.35	35%	155.58	0.034	0.081	0.040
Railcar	10	6.35	35%	22.23	0.005	0.012	0.006
Total	**80**				**0.039**	**0.092**	**0.046**

1. UPRR staff estimate that there are 35-37 TRUs and 2-5 reefer cars and in the Yard at any given time. To be conservative, these estimates were increased by 100%.
2. POLA estimate, *Berths 136-147 (TraPac) Container Terminal Project, Draft Environmental Impact Statement (EIS)/Environmental Impact Report (EIR)* . The TraPac DEIS/R is available at http://www.portoflosangeles.org/EIR/TraPac/eir_062907trapac.htm.
3. POLA upper bound estimate, TraPac draft EIS/R.
4. POLA estimate, TraPac draft EIS/R.
5. Assumes mix of refrigerants of 50% R404a and 50% HFC-134a; assumes R404a equals 52% HFC-143a, 44% HFC-125, 4% HFC-134a.

CY	Season	AvgDays	Code	Equipment	Fuel	MaxHP	Class	C/R	Pre
2005	Annual	Mon-Sun	2.27E+09	Transport Refrigeration Units	D	15	Transport Refrigeration Units	U	N
2005	Annual	Mon-Sun	2.27E+09	Transport Refrigeration Units	D	25	Transport Refrigeration Units	U	N
2005	Annual	Mon-Sun	2.27E+09	Transport Refrigeration Units	D	50	Transport Refrigeration Units	U	N

Hand	Port	County	Air Basin	Air Dist.	Population	Activity	Consumption	ROG Exhaust	CO Exhaust	NOX Exhaust
NHH	NP	Los Angeles	SC	SC	1.15E+03	3.27E+03	1.20E+03	2.07E-02	8.80E-02	1.44E-01
NHH	NP	Los Angeles	SC	SC	4.49E+02	1.28E+03	7.96E+02	1.32E-02	4.58E-02	8.56E-02
NHH	NP	Los Angeles	SC	SC	8.18E+03	3.29E+04	3.98E+04	2.11E+00	4.89E+00	4.38E+00
								ROG Exhaust	CO Exhaust	NOX Exhaust
						0-15	lb/hr	1.26E-02	5.38E-02	8.79E-02
						15-25	lb/hr	2.06E-02	7.16E-02	1.34E-01
						25-50	lb/hr	1.28E-01	2.97E-01	2.67E-01
						container	lb/hr	0.100144986	0.237934225	0.225580552
						rail	lb/hr	0.128462617	0.297410608	0.266558642
						container	lb/hp-hr	0.006289645	0.014943552	0.014167675
						rail	lb/hp-hr	0.007128891	0.016504473	0.014792377
						0-15	lb/hp-hr	0.001974637	0.008409021	0.013736294
						15-25	lb/hp-hr	0.001895241	0.006580025	0.012312135
						25-50	lb/hp-hr	0.007128891	0.016504473	0.014792377

CO2 Exhaust	SO2 Exhaust	PM Exhaust	N2O Exhaust	CH4 Exhaust	
1.31E+01	1.42E-03	9.22E-03	0.00E+00	1.86E-03	
8.71E+00	9.47E-04	5.41E-03	0.00E+00	1.19E-03	
4.26E+02	4.71E-02	5.13E-01	0.00E+00	1.90E-01	
CO2 Exhaust	SO2 Exhaust	PM Exhaust	load	avg hp	container
8.02E+00	8.71E-04	5.64E-03	0.64	10	0.17
1.36E+01	1.48E-03	8.46E-03	0.64	17	0.08
2.59E+01	2.87E-03	3.12E-02	0.53	34	0.75
21.87652896	0.002417326	0.025063786	0.5575	28.56	
25.89716742	0.002867557	0.031237629	0.53	34	
1.37396396	0.000151821	0.001574141			
1.437134707	0.000159132	0.001733498			
1.252887439	0.000136161	0.000881526			
1.252885877	0.000136161	0.000777189			
1.437134707	0.000159132	0.001733498			

APPENDIX F-2

DEATILED EMISSION CALCULATIONS, EMISSION FACTOR DERIVATION, AND OFFROAD2007 OUTPUT, FOR PROJECT YEAR 2010

Summary of Emissions from Transport Refrigeration Units and Refrigerated Railcars
Dolores and ICTF Rail Yards, Long Beach, CA

TRU	Average		Average						Carbon	2010 Emission Factors									VOC Evaporative		2010 Emission Estimates								
Equip	Rating	Fuel	No. Units	Hours of Operation		BSFC	Fuel Use	Load	Oxidation	(g/bhp-hr)[10]						(kg/gal)[9]			Emission Factors[13]		(tons/yr)						(metric tons/yr)		
Type	(hp)[1]	Type	in Yard[2,3]	(hr/day)[4]	(hr/yr)[5]	(lb/bhp-hr)[6]	(gal/yr)[7]	Factor[8]	Factor[9]	ROG	CO	NOx	PM10[11]	DPM[11]	SOx	CO2	N2O[12]	CH4[12]	Part 1 (lb/hr)	Part 2 (lb/yr)	ROG	CO	NOx	PM10	DPM	SOx	CO2	N2O	CH4
Container	28.56	Diesel	101	4	1,460	0.53	174,544	0.56	99%	1.40	5.50	5.78	0.22	0.22	0.01	10.15	1.39E-05	4.16E-05	-	-	3.61	14.19	14.90	0.57	0.57	0.02	1,753.90	0.00	0.01
Railcar	34	Diesel	14	4	1,460	0.53	28,220	0.53	99%	1.55	6.05	6.14	0.22	0.22	0.01	10.15	1.39E-05	4.16E-05	-	-	0.65	2.52	2.56	0.09	0.09	0.00	283.57	0.00	0.00
Total			**115**		**2,920**																**4.25**	**16.71**	**17.45**	**0.66**	**0.66**	**0.02**	**2,037.47**	**0.00**	**0.01**

Notes:
1. Based on the average horsepower distribution in the OFFROAD2007 model.
2. UPRR staff estimate that there are 35-37 TRUs and 2-5 reefer cars and in the Yard at any given time during the 2005 baseline year. To be conservative, these estimates were increased by 100%.
3. For 2010, the number of TRUs and reefer cars was equal to the No. of Units in 2005 x (2010 lift count/2005 lift count).
4. From CARB's Staff Report: ISOR, ATCM for TRUs, Section V.a.2.
5. It was assumed that the number of units and the annual hours of operations remains constant, with individual units cycling in and out of the yard.
6. Brake-specific fuel consumption (BSFC) from OFFROAD2007 model.
7. Calculation assumes density of Diesel fuel of 7.1 lb/gal.
8. Load factors are the default factors from the OFFROAD2007 model.
9. From the Air Resources Board's Draft *Emission Factors for Mandatory Reporting Programs*, August 10, 2007.
10. The ROG, CO, NOx, and SOx emission factors in g/bhp-hr are from OFFROAD2007 model.
11. Emission factor from TRU ATCM, Table 3.
12. Based on a diesel fuel HHV of 5.825 MMBtu/barrel (from ARB Draft Emission Factors for Mandatory Reporting Programs, August 10, 2007) and 42 gallons per barrel.
13. Evaporative emissions were calculated from the OFFROAD2007 model and are negligible.

Summary of Emissions from TRU Refrigerant Loss
Dolores and ICTF Rail Yards, Long Beach, CA

TRU Equip Type	Daily Average No. Units in Yard[1,2]	Refrigerant Charge per Unit (kg)[3]	Annual Refrigerant Loss Rate (%)[4]	Annual Refrigerant Loss (kg/yr)	2010 Emissions by Refrigerant[5,6] (metric tons/yr)		
					HFC-125	HFC-134a	HFC-143a
Container	101	6.35	35%	223.55	0.049	0.116	0.058
Railcar	14	6.35	35%	31.94	0.007	0.017	0.008
Total	**115**				**0.056**	**0.133**	**0.066**

Notes:
1. UPRR staff estimate that there are 35-37 TRUs and 2-5 reefer cars and in the Yard at any given time during the 2005 baseline year. To be conservative, these estimates were increased by 100%.
2. For 2010, the number of TRUs and reefer cars was equal to the No. of Units in 2005 x (2010 lift count/2005 lift count).
3. POLA estimate, *Berths 136-147 (TraPac) Container Terminal Project, Draft Environmental Impact Statement (EIS)/Environmental Impact Report (EIR)* . The TraPac DEIS/R is available at http://www.portoflosangeles.org/EIR/TraPac/eir_062907trapac.htm.
4. POLA upper bound estimate, TraPac draft EIS/R.
5. POLA estimate, TraPac draft EIS/R.
6. Assumes mix of refrigerants of 50% R404a and 50% HFC-134a; assumes R404a equals 52% HFC-143a, 44% HFC-125, 4% HFC-134a.

CY	Season	AvgDays	Code	Equipment	Fuel	MaxHP	Class	C/R	Pre	Hand	Port	County	Air Basin
2010	Annual	Mon-Sun	2270009005	Transport Refrigeration Units	D	15	Transport Refrigeration Units	U	N	NHH	NP	Los Angeles	SC
2010	Annual	Mon-Sun	2270009005	Transport Refrigeration Units	D	25	Transport Refrigeration Units	U	N	NHH	NP	Los Angeles	SC
2010	Annual	Mon-Sun	2270009005	Transport Refrigeration Units	D	50	Transport Refrigeration Units	U	N	NHH	NP	Los Angeles	SC

Air Dist.	Population	Activity	Consumption	ROG Exhaust	CO Exhaust	NOX Exhaust	CO2 Exhaust	SO2 Exhaust	PM Exhaust	N2O Exhaust	CH4 Exhaust	
SC	1.44E+03	4.09E+03	1.50E+03	1.90E-02	1.01E-01	1.34E-01	1.64E+01	2.08E-04	7.52E-03	0.00E+00	1.72E-03	
SC	5.22E+02	1.49E+03	9.23E+02	1.28E-02	4.27E-02	8.35E-02	1.01E+01	1.29E-04	4.37E-03	0.00E+00	1.15E-03	
SC	1.05E+04	4.24E+04	5.06E+04	1.30E+00	5.09E+00	5.16E+00	5.49E+02	7.09E-03	4.10E-01	0.00E+00	1.18E-01	
				ROG Exhaust	CO Exhaust	NOX Exhaust	CO2 Exhaust	SO2 Exhaust	PM Exhaust	load	avg hp	container
		0-15	lb/hr	9.29E-03	4.93E-02	6.54E-02	8.02E+00	1.02E-04	3.67E-03	0.64	10	0.17
		15-25	lb/hr	1.72E-02	5.74E-02	1.12E-01	1.36E+01	1.73E-04	5.88E-03	0.64	17	0.08
		25-50	lb/hr	6.16E-02	2.40E-01	2.44E-01	2.59E+01	3.35E-04	1.94E-02	0.53	34	0.75
		container	lb/hr	0.049142662	0.193221222	0.202899929	21.87652744	0.000282222	0.015610829	0.5575	28.56	
		rail	lb/hr	0.061585734	0.24031718	0.243736454	25.89716551	0.000334786	0.019354791	0.53	34	
		container	lb/hp-hr	0.003086424	0.012135334	0.012743209	1.373963864	1.7725E-05	0.000980444			
		rail	lb/hp-hr	0.003417632	0.013336137	0.013525885	1.437134601	1.85786E-05	0.001074073			
		0-15	lb/hp-hr	0.001451749	0.007709784	0.010212188	1.252887055	1.58968E-05	0.000573813			
		15-25	lb/hp-hr	0.001578422	0.005279289	0.010324826	1.252886252	1.58967E-05	0.000540473			
		25-50	lb/hp-hr	0.003417632	0.013336137	0.013525885	1.437134601	1.85786E-05	0.001074073			

APPENDIX F-3

DEATILED EMISSION CALCULATIONS, EMISSION FACTOR DERIVATION, AND OFFROAD2007 OUTPUT, FOR PROJECT YEAR 2012

Summary of Emissions from Transport Refrigeration Units and Refrigerated Railcars
Dolores and ICTF Rail Yards, Long Beach, CA

TRU	Average		Average						Carbon	2012 Emission Factors									VOC Evaporative		2012 Emission Estimates								
Equip	Rating	Fuel	No. Units	Hours of Operation		BSFC	Fuel Use	Load	Oxidation	(g/bhp-hr)[10]						(kg/gal)[9]			Emission Factors[13]		(tons/yr)						(metric tons/yr)		
Type	(hp)[1]	Type	in Yard[2,3]	(hr/day)[4]	(hr/yr)[5]	(lb/bhp-hr)[6]	(gal/yr)[7]	Factor[8]	Factor[9]	ROG	CO	NOx	PM10[11]	DPM[11]	SOx	CO2	N2O[12]	CH4[12]	Part 1 (lb/hr)	Part 2 (lb/yr)	ROG	CO	NOx	PM10	DPM	SOx	CO2	N2O	CH4
Container	28.56	Diesel	123	4	1,460	0.53	213,331	0.56	99%	0.94	5.09	5.64	0.12	0.12	0.01	10.15	1.39E-05	4.16E-05	-	-	2.95	16.04	17.78	0.38	0.38	0.03	2,143.66	0.003	0.009
Railcar	34	Diesel	18	4	1,460	0.53	34,491	0.53	99%	1.01	5.57	6.01	0.12	0.12	0.01	10.15	1.39E-05	4.16E-05	-	-	0.51	2.84	3.06	0.06	0.06	0.00	346.58	0.000	0.001
Total			**140**		**2,920**																**3.46**	**18.88**	**20.84**	**0.44**	**0.44**	**0.03**	**2,490.25**	**0.003**	**0.010**

Notes:
1. Based on the average horsepower distribution in the OFFROAD2007 model.
2. UPRR staff estimate that there are 35-37 TRUs and 2-5 reefer cars and in the Yard at any given time during the 2005 baseline year. To be conservative, these estimates were increased by 100%.
3. For 2012, the number of TRUs and reefer cars was equal to the No. of Units in 2005 x (2012 lift count/2005 lift count).
4. From CARB's Staff Report: ISOR, ATCM for TRUs, Section V.a.2.
5. It was assumed that the number of units and the annual hours of operations remains constant, with individual units cycling in and out of the yard.
6. Brake-specific fuel consumption (BSFC) from OFFROAD2007 model.
7. Calculation assumes density of Diesel fuel of 7.1 lb/gal.
8. Load factors are the default factors from the OFFROAD2007 model.
9. From the Air Resources Board's Draft *Emission Factors for Mandatory Reporting Programs,* August 10, 2007.
10. The ROG, CO, Nox, and SOx emission factors in g/bhp-hr are from OFFROAD2007 model.
11. DPM emission factor from TRU ATCM, Table 3 - average of the LETRU and ULETRU factors.
12. Based on a diesel fuel HHV of 5.825 MMBtu/barrel (from ARB Draft Emission Factors for Mandatory Reporting Programs, August 10, 2007) and 42 gallons per barrel.
13. Evaporative emissions were calculated from the OFFROAD2007 model and are negligible.

Summary of Emissions from TRU Refrigerant Loss
Dolores and ICTF Rail Yards, Long Beach, CA

TRU Equip Type	Daily Average No. Units in Yard[1,2]	Refrigerant Charge per Unit (kg)[3]	Annual Refrigerant Loss Rate (%)[4]	Annual Refrigerant Loss (kg/yr)	2012 Emissions by Refrigerant[5,6] (metric tons/yr)		
					HFC-125	HFC-134a	HFC-143a
Container	123	6.35	35%	273.23	0.060	0.142	0.071
Railcar	18	6.35	35%	39.03	0.009	0.020	0.010
Total	**140**			**312.26**	**0.069**	**0.162**	**0.081**

Notes:
1. UPRR staff estimate that there are 35-37 TRUs and 2-5 reefer cars and in the Yard at any given time during the 2005 baseline year. To be conservative, these estimates were increased by 100%.
2. For 2012, the number of TRUs and reefer cars was equal to the No. of Units in 2005 x (2012 lift count/2005 lift count).
3. POLA estimate, *Berths 136-147 (TraPac) Container Terminal Project, Draft Environmental Impact Statement (EIS)/Environmental Impact Report (EIR)*. The TraPac DEIS/R is available at http://www.portoflosangeles.org/EIR/TraPac/eir_062907trapac.htm.
4. POLA upper bound estimate, TraPac draft EIS/R.
5. POLA estimate, TraPac draft EIS/R.
6. Assumes mix of refrigerants of 50% R404a and 50% HFC-134a; assumes R404a equals 52% HFC-143a, 44% HFC-125, 4% HFC-134a.

CY	Season	AvgDays	Code	Equipment	Fuel	MaxHP	Class	C/R	Pre	Hand	Port	County	Air Basin
2012	Annual	Mon-Sun	2270009005	Transport Refrigeration Units	D	15	Transport Refrigeration Units	U	N	NHH	NP	Los Angeles	SC
2012	Annual	Mon-Sun	2270009005	Transport Refrigeration Units	D	25	Transport Refrigeration Units	U	N	NHH	NP	Los Angeles	SC
2012	Annual	Mon-Sun	2270009005	Transport Refrigeration Units	D	50	Transport Refrigeration Units	U	N	NHH	NP	Los Angeles	SC

Air Dist.	Population	Activity	Consumption	ROG Exhaust	CO Exhaust	NOX Exhaust	CO2 Exhaust	SO2 Exhaust	PM Exhaust	N2O Exhaust	CH4 Exhaust		
SC	1.57E+03	4.48E+03	1.64E+03	1.96E-02	1.10E-01	1.38E-01	1.79E+01	2.28E-04	6.85E-03	0.00E+00	1.76E-03		
SC	5.54E+02	1.58E+03	9.80E+02	1.32E-02	4.44E-02	8.50E-02	1.08E+01	1.36E-04	3.98E-03	0.00E+00	1.19E-03		
SC	1.17E+04	4.69E+04	5.58E+04	9.39E-01	5.19E+00	5.60E+00	6.07E+02	7.85E-03	3.49E-01	0.00E+00	8.48E-02		
				ROG Exhaust	CO Exhaust	NOX Exhaust	CO2 Exhaust	SO2 Exhaust	PM Exhaust	load	avg hp		container
		0-15	lb/hr	8.74E-03	4.90E-02	6.14E-02	8.02E+00	1.02E-04	3.06E-03	0.64	10		0.17
		15-25	lb/hr	1.67E-02	5.63E-02	1.08E-01	1.36E+01	1.73E-04	5.05E-03	0.64	17		0.08
		25-50	lb/hr	4.01E-02	2.21E-01	2.39E-01	2.59E+01	3.35E-04	1.49E-02	0.53	34		0.75
		container	lb/hr	0.032870591	0.178756783	0.198069177	21.87652286	0.000282221	0.012082	0.5575	28.56		
		rail	lb/hr	0.040061193	0.221227588	0.238668741	25.89716074	0.000334786	0.014877052	0.53	34		
		container	lb/hp-hr	0.00206445	0.01122689	0.012439812	1.373963577	1.7725E-05	0.000758815				
		rail	lb/hp-hr	0.002223152	0.012276781	0.013244658	1.437134336	1.85786E-05	0.000825586				
		0-15	lb/hp-hr	0.001365253	0.007657849	0.009600591	1.252886441	1.58968E-05	0.000478249				
		15-25	lb/hp-hr	0.001538719	0.005175037	0.009905995	1.252885871	1.58968E-05	0.000464013				
		25-50	lb/hp-hr	0.002223152	0.012276781	0.013244658	1.437134336	1.85786E-05	0.000825586				

APPENDIX F-4

DEATILED EMISSION CALCULATIONS, EMISSION FACTOR DERIVATION, AND OFFROAD2007 OUTPUT, FOR PROJECT YEAR 2014

Summary of Emissions from Transport Refrigeration Units and Refrigerated Railcars
Dolores and ICTF Rail Yards, Long Beach, CA

TRU Equip Type	Average Rating (hp)[1]	Fuel Type	Average No. Units in Yard[2,3]	Hours of Operation		BSFC	Fuel Use	Load Factor[8]	Carbon Oxidation Factor[9]	2014 Emission Factors									VOC Evaporative Emission Factors[13]		2014 Emission Estimates								
										(g/bhp-hr)[10]						(kg/gal)[9]					(tons/yr)						(metric tons/yr)		
				(hr/day)[4]	(hr/yr)[5]	(lb/bhp-hr)[6]	(gal/yr)[7]			ROG	CO	NOx	PM10[11]	DPM[11]	SOx	CO2	N2O[12]	CH4[12]	Part 1 (lb/hr)	Part 2 (lb/yr)	ROG	CO	NOx	PM10	DPM	SOx	CO2	N2O	CH4
Container	28.56	Diesel	145	4	1,460	0.53	252,119	0.56	99%	0.66	4.85	5.02	0.12	0.12	0.01	10.15	1.39E-05	4.16E-05	-	-	2.44	18.06	18.67	0.45	0.45	0.03	2,533.42	0.00	0.01
Railcar	34	Diesel	21	4	1,460	0.53	40,762	0.53	99%	0.68	5.29	5.29	0.12	0.12	0.01	10.15	1.39E-05	4.16E-05	-	-	0.41	3.18	3.18	0.07	0.07	0.01	409.60	0.00	0.00
Total			**166**		**2,920**																**2.85**	**21.25**	**21.86**	**0.52**	**0.52**	**0.04**	**2,943.02**	**0.00**	**0.01**

Notes:
1. Based on the average horsepower distribution in the OFFROAD2007 model.
2. In 2005, UPRR staff estimate that there are 35-37 TRUs and 2-5 reefer cars and in the Yard at any given time during the 2005 baseline year. To be conservative, these estimates were increased by 100%.
3. For 2014, the number of TRUs and reefer cars was equal to the No. of Units in 2005 x (2014 lift count/2005 lift count).
4. From CARB's Staff Report: ISOR, ATCM for TRUs, Section V.a.2.
5. It was assumed that the number of units and the annual hours of operations remains constant, with individual units cycling in and out of the yard.
6. Brake-specific fuel consumption (BSFC) from OFFROAD2007 model.
7. Calculation assumes density of Diesel fuel of 7.1 lb/gal.
8. Load factors are the default factors from the OFFROAD2007 model.
9. From the Air Resources Board's Draft *Emission Factors for Mandatory Reporting Programs*, August 10, 2007.
10. The ROG, CO, NOx, and SOx emission factors in g/bhp-hr are from OFFROAD2007 model.
11. DPM emission factor from TRU ATCM, Table 3 - average of the LETRU and ULETRU factors.
12. Based on a diesel fuel HHV of 5.825 MMBtu/barrel (from ARB Draft Emission Factors for Mandatory Reporting Programs, August 10, 2007) and 42 gallons per barrel.
13. Evaporative emissions were calculated from the OFFROAD2007 model and are negligible.

Summary of Emissions from TRU Refrigerant Loss
Dolores and ICTF Rail Yards, Long Beach, CA

TRU Equip Type	Daily Average No. Units in Yard[1,2]	Refrigerant Charge per Unit (kg)[3]	Annual Refrigerant Loss Rate (%)[4]	Annual Refrigerant Loss (kg/yr)	2014 Emissions by Refrigerant[5,6] (metric tons/yr)		
					HFC-125	HFC-134a	HFC-143a
Container	145	6.35	35%	322.90	0.071	0.168	0.084
Railcar	21	6.35	35%	46.13	0.010	0.024	0.012
Total	**166**			**369.03**	**0.081**	**0.192**	**0.096**

Notes:
1. UPRR staff estimate that there are 35-37 TRUs and 2-5 reefer cars and in the Yard at any given time during the 2005 baseline year. To be conservative, these estimates were increased by 100%.
2. For 2014, the number of TRUs and reefer cars was equal to the No. of Units in 2005 x (2014 lift count/2005 lift coun
3. POLA estimate, *Berths 136-147 (TraPac) Container Terminal Project, Draft Environmental Impact Statement (EIS)/Environmental Impact Report (EIR)* . The TraPac DEIS/R is available at http://www.portoflosangeles.org/EIR/TraPac/eir_062907trapac.htm.
4. POLA upper bound estimate, TraPac draft EIS/R.
5. POLA estimate, TraPac draft EIS/R.
6. Assumes mix of refrigerants of 50% R404a and 50% HFC-134a; assumes R404a equals 52% HFC-143a, 44% HFC-125, 4% HFC-134a.

CY	Season	AvgDays	Code	Equipment	Fuel	MaxHP	Class	C/R	Pre	Hand	Port	County	Air Basin
2014	Annual	Mon-Sun	2270009005	Transport Refrigeration Units	D	15	Transport Refrigeration Units	U	N	NHH	NP	Los Angeles	SC
2014	Annual	Mon-Sun	2270009005	Transport Refrigeration Units	D	25	Transport Refrigeration Units	U	N	NHH	NP	Los Angeles	SC
2014	Annual	Mon-Sun	2270009005	Transport Refrigeration Units	D	50	Transport Refrigeration Units	U	N	NHH	NP	Los Angeles	SC

Air Dist.	Population	Activity	Consumption	ROG Exhaust	CO Exhaust	NOX Exhaust	CO2 Exhaust	SO2 Exhaust	PM Exhaust	N2O Exhaust	CH4 Exhaust	
SC	1.72E+03	4.90E+03	1.79E+03	2.07E-02	1.20E-01	1.46E-01	1.96E+01	2.49E-04	6.48E-03	0.00E+00	1.87E-03	
SC	5.88E+02	1.68E+03	1.04E+03	1.39E-02	4.70E-02	8.81E-02	1.14E+01	1.45E-04	3.74E-03	0.00E+00	1.25E-03	
SC	1.29E+04	5.19E+04	6.16E+04	7.02E-01	5.45E+00	5.45E+00	6.72E+02	8.69E-03	2.52E-01	0.00E+00	6.33E-02	
				ROG Exhaust	CO Exhaust	NOX Exhaust	CO2 Exhaust	SO2 Exhaust	PM Exhaust	load	avg hp	container
		0-15	lb/hr	8.45E-03	4.90E-02	5.94E-02	8.02E+00	1.02E-04	2.65E-03	0.64	10	0.17
		15-25	lb/hr	1.65E-02	5.61E-02	1.05E-01	1.36E+01	1.73E-04	4.47E-03	0.64	17	0.08
		25-50	lb/hr	2.70E-02	2.10E-01	2.10E-01	2.59E+01	3.35E-04	9.72E-03	0.53	34	0.75
		container	lb/hr	0.023045732	0.170311947	0.176075597	21.87653039	0.000282221	0.008095603	0.5575	28.56	
		rail	lb/hr	0.027047236	0.209997228	0.210072825	25.89716989	0.000334786	0.009717975	0.53	34	
		container	lb/hp-hr	0.001447396	0.010696508	0.011058497	1.37396405	1.7725E-05	0.000508448			
		rail	lb/hp-hr	0.001500957	0.011653564	0.011657759	1.437134844	1.85786E-05	0.000539288			
		0-15	lb/hp-hr	0.001320858	0.007650224	0.009285956	1.252886219	1.58968E-05	0.000413456			
		15-25	lb/hp-hr	0.001520234	0.005159218	0.009671252	1.252886914	1.58968E-05	0.00041048			
		25-50	lb/hp-hr	0.001500957	0.011653564	0.011657759	1.437134844	1.85786E-05	0.000539288			

APPENDIX F-5

DEATILED EMISSION CALCULATIONS, EMISSION FACTOR DERIVATION, AND OFFROAD2007 OUTPUT, FOR PROJECT YEAR 2016

Summary of Emissions from Transport Refrigeration Units and Refrigerated Railcars
Dolores and ICTF Rail Yards, Long Beach, CA

TRU Equip Type	Average Rating (hp)[1]	Fuel Type	Average No. Units in Yard[2,3]	Hours of Operation		BSFC (lb/bhp-hr)[6]	Fuel Use (gal/yr)[7]	Load Factor[8]	Carbon Oxidation Factor[9]	2016 Emission Factors (g/bhp-hr)[10]					
				(hr/day)[4]	(hr/yr)[5]					ROG	CO	NOx	PM10[11]	DPM[11]	SOx
Container	28.56	Diesel	168	4	1,460	0.53	290,906	0.56	99%	0.54	4.76	4.50	0.02	0.02	0.01
Railcar	34	Diesel	24	4	1,460	0.53	47,033	0.53	99%	0.54	5.17	4.68	0.02	0.02	0.01
Total			**192**		**2,920**										

TRU Equip Type	2016 Emission Factors (kg/gal)[9]			VOC Evaporative Emission Factors[13]		2016 Emission Estimates (tons/yr)						2016 Emission Estimates (metric tons/yr)		
	CO2	N2O[12]	CH4[12]	Part 1 (lb/hr)	Part 2 (lb/yr)	ROG	CO	NOx	PM10	DPM	SOx	CO2	N2O	CH4
Container	10.15	1.39E-05	4.16E-05	-	-	2.30	20.43	19.32	0.09	0.09	0.03	2,923.17	0.00	0.01
Railcar	10.15	1.39E-05	4.16E-05	-	-	0.37	3.59	3.25	0.01	0.01	0.01	472.62	0.00	0.00
Total						**2.68**	**24.02**	**22.58**	**0.10**	**0.10**	**0.04**	**3,395.79**	**0.00**	**0.01**

Notes:
1. Based on the average horsepower distribution in the OFFROAD2007 model.
2. In 2005, UPRR staff estimate that there are 35-37 TRUs and 2-5 reefer cars and in the Yard at any given time during the 2005 baseline year. To be conservative, these estimates were increased by 100%.
3. For 2016, the number of TRUs and reefer cars was equal to the No. of Units in 2005 x (2016 lift count/2005 lift count).
4. From CARB's Staff Report: ISOR, ATCM for TRUs, Section V.a.2.
5. It was assumed that the number of units and the annual hours of operations remains constant, with individual units cycling in and out of the yard.
6. Brake-specific fuel consumption (BSFC) from OFFROAD2007 model.
7. Calculation assumes density of Diesel fuel of 7.1 lb/gal.
8. Load factors are the default factors from the OFFROAD2007 model.
9. From the Air Resources Board's Draft *Emission Factors for Mandatory Reporting Programs*, August 10, 2007.
10. The ROG, CO, NOx, and SOx emission factors in g/bhp-hr are from OFFROAD2007 model.
11. DPM emission factor from TRU ATCM, Table 3 - value for ULETRU was used.
12. Based on a diesel fuel HHV of 5.825 MMBtu/barrel (from ARB Draft Emission Factors for Mandatory Reporting Programs, August 10, 2007) and 42 gallons per barrel.
13. Evaporative emissions were calculated from the OFFROAD2007 model and are negligible.

Summary of Emissions from TRU Refrigerant Loss
Dolores and ICTF Rail Yards, Long Beach, CA

TRU Equip Type	Daily Average No. Units in Yard[1,2]	Refrigerant Charge per Unit (kg)[3]	Annual Refrigerant Loss Rate (%)[4]	Annual Refrigerant Loss (kg/yr)	2016 Emissions by Refrigerant[5,6] (metric tons/yr)		
					HFC-125	HFC-134a	HFC-143a
Container	168	6.35	35%	372.58	0.082	0.194	0.097
Railcar	24	6.35	35%	53.23	0.012	0.028	0.014
Total	**192**			**425.81**	**0.094**	**0.221**	**0.111**

Notes:
1. UPRR staff estimate that there are 35-37 TRUs and 2-5 reefer cars and in the Yard at any given time during the 2005 baseline year. To be conservative, these estimates were increased by 100%.
2. For 2016, the number of TRUs and reefer cars was equal to the No. of Units in 2005 x (2016 lift count/2005 lift coun
3. POLA estimate, *Berths 136-147 (TraPac) Container Terminal Project, Draft Environmental Impact Statement (EIS)/Environmental Impact Report (EIR)* . The TraPac DEIS/R is available at http://www.portoflosangeles.org/EIR/TraPac/eir_062907trapac.htm.
4. POLA upper bound estimate, TraPac draft EIS/R.
5. POLA estimate, TraPac draft EIS/R.
6. Assumes mix of refrigerants of 50% R404a and 50% HFC-134a; assumes R404a equals 52% HFC-143a, 44% HFC-125, 4% HFC-134a.

CY	Season	AvgDays	Code	Equipment	Fuel	MaxHP	Class	C/R	Pre	Hand	Port	County	Air Basin
2016	Annual	Mon-Sun	2270009005	Transport Refrigeration Units	D	15	Transport Refrigeration Units	U	N	NHH	NP	Los Angeles	SC
2016	Annual	Mon-Sun	2270009005	Transport Refrigeration Units	D	25	Transport Refrigeration Units	U	N	NHH	NP	Los Angeles	SC
2016	Annual	Mon-Sun	2270009005	Transport Refrigeration Units	D	50	Transport Refrigeration Units	U	N	NHH	NP	Los Angeles	SC

Air Dist.	Population	Activity	Consumption	ROG Exhaust	CO Exhaust	NOX Exhaust	CO2 Exhaust	SO2 Exhaust	PM Exhaust	N2O Exhaust	CH4 Exhaust	
SC	1.88E+03	5.36E+03	1.96E+03	2.23E-02	1.31E-01	1.57E-01	2.15E+01	2.72E-04	6.46E-03	0.00E+00	2.02E-03	
SC	6.24E+02	1.78E+03	1.10E+03	1.46E-02	4.99E-02	9.27E-02	1.21E+01	1.54E-04	3.65E-03	0.00E+00	1.32E-03	
SC	1.43E+04	5.74E+04	6.80E+04	6.16E-01	5.90E+00	5.35E+00	7.44E+02	9.62E-03	1.72E-01	0.00E+00	5.56E-02	
				ROG Exhaust	CO Exhaust	NOX Exhaust	CO2 Exhaust	SO2 Exhaust	PM Exhaust	load	avg hp	container
		0-15	lb/hr	8.34E-03	4.90E-02	5.86E-02	8.02E+00	1.02E-04	2.41E-03	0.64	10	0.17
		15-25	lb/hr	1.65E-02	5.61E-02	1.04E-01	1.36E+01	1.73E-04	4.11E-03	0.64	17	0.08
		25-50	lb/hr	2.14E-02	2.05E-01	1.86E-01	2.59E+01	3.35E-04	5.99E-03	0.53	34	0.75
		container	lb/hr	0.01881906	0.166934172	0.157886	21.87652727	0.000282221	0.0052275	0.5575	28.56	
		rail	lb/hr	0.021445096	0.205494263	0.186110928	25.89716487	0.000334786	0.005985032	0.53	34	
		container	lb/hp-hr	0.001181938	0.010484366	0.009916092	1.373963854	1.7725E-05	0.000328315			
		rail	lb/hp-hr	0.001190072	0.011403677	0.01032802	1.437134566	1.85786E-05	0.000332133			
		0-15	lb/hp-hr	0.001303463	0.007650037	0.009162564	1.252886595	1.58968E-05	0.000376927			
		15-25	lb/hp-hr	0.001513179	0.005158817	0.009574831	1.252887183	1.58968E-05	0.000377562			
		25-50	lb/hp-hr	0.001190072	0.011403677	0.01032802	1.437134566	1.85786E-05	0.000332133			

CY	Season	AvgDays	Code	Equipment	Fuel	MaxHP	Class	C/R	Pre	Hand	Port	County	Air Basin
2016	Annual	Mon-Sun	2270009005	Transport Refrigeration Units	D	15	Transport Refrigeration Units	U	N	NHH	NP	Los Angeles	SC
2016	Annual	Mon-Sun	2270009005	Transport Refrigeration Units	D	25	Transport Refrigeration Units	U	N	NHH	NP	Los Angeles	SC
2016	Annual	Mon-Sun	2270009005	Transport Refrigeration Units	D	50	Transport Refrigeration Units	U	N	NHH	NP	Los Angeles	SC

Air Dist.	Population	Activity	Consumption	ROG Exhaust	CO Exhaust	NOX Exhaust	CO2 Exhaust	SO2 Exhaust	PM Exhaust	N2O Exhaust	CH4 Exhaust	
SC	1.88E+03	5.36E+03	1.96E+03	2.23E-02	1.31E-01	1.57E-01	2.15E+01	2.72E-04	6.46E-03	0.00E+00	2.02E-03	
SC	6.24E+02	1.78E+03	1.10E+03	1.46E-02	4.99E-02	9.27E-02	1.21E+01	1.54E-04	3.65E-03	0.00E+00	1.32E-03	
SC	1.43E+04	5.74E+04	6.80E+04	6.16E-01	5.90E+00	5.35E+00	7.44E+02	9.62E-03	1.72E-01	0.00E+00	5.56E-02	
				ROG Exhaust	CO Exhaust	NOX Exhaust	CO2 Exhaust	SO2 Exhaust	PM Exhaust	load	avg hp	container
		0-15	lb/hr	8.34E-03	4.90E-02	5.86E-02	8.02E+00	1.02E-04	2.41E-03	0.64	10	0.17
		15-25	lb/hr	1.65E-02	5.61E-02	1.04E-01	1.36E+01	1.73E-04	4.11E-03	0.64	17	0.08
		25-50	lb/hr	2.14E-02	2.05E-01	1.86E-01	2.59E+01	3.35E-04	5.99E-03	0.53	34	0.75
		container	lb/hr	0.01881906	0.166934172	0.157886	21.87652727	0.000282221	0.0052275	0.5575	28.56	
		rail	lb/hr	0.021445096	0.205494263	0.186110928	25.89716487	0.000334786	0.005985032	0.53	34	
		container	lb/hp-hr	0.001181938	0.010484366	0.009916092	1.373963854	1.7725E-05	0.000328315			
		rail	lb/hp-hr	0.001190072	0.011403677	0.01032802	1.437134566	1.85786E-05	0.000332133			
		0-15	lb/hp-hr	0.001303463	0.007650037	0.009162564	1.252886595	1.58968E-05	0.000376927			
		15-25	lb/hp-hr	0.001513179	0.005158817	0.009574831	1.252887183	1.58968E-05	0.000377562			
		25-50	lb/hp-hr	0.001190072	0.011403677	0.01032802	1.437134566	1.85786E-05	0.000332133			

APPENDIX G

DIESEL-FUELED DELIVERY TRUCKS

APPENDIX G-1

DEATILED EMISSION CALCULATIONS, EMISSION FACTOR DERIVATION AND EMFAC2007 OUTPUT FOR THE 2005 BASELINE YEAR

Summary of Emissions from Intermodal HHD Diesel-Fueled Delivery Trucks
Dolores and ICTF Rail Yards, Long Beach, CA

Running Exhaust Emissions

		Truck	VMT per			Carbon	2005 Emission Factors									2005 Emission Estimates								
	Delivery	Trips	Trip	VMT per	Fuel Use	Oxidation	(g/mi)[7,8]						(kg/gal)[6]			(tons/yr)						(metric tons/yr)		
Yard	Type	(trips/yr)[1,2,3]	(mi/trip)[4]	Year	(gal/yr)[5]	Factor[6]	ROG	CO	NOx	PM10[9]	DPM[9]	SOx	CO2	N2O[10]	CH4[10]	ROG	CO	NOx	PM10	DPM	SOx	CO2	N2O	CH4
Dolores	Diesel Fuel	2,625	0.06	157.50	45.66	99%	6.40	17.23	28.68	2.53	2.47	0.24	10.15	1.39E-05	4.16E-05	0.00	0.00	0.00	0.00	0.00	0.00	0.46	6.33E-07	1.90E-06
Dolores	Sand	156	2.2	343.20	99.49	99%	6.40	17.23	28.68	2.53	2.47	0.24	10.15	1.39E-05	4.16E-05	0.00	0.01	0.01	0.00	0.00	0.00	1.00	1.38E-06	4.14E-06
Dolores	Oil	24	0.06	1.44	0.42	99%	6.40	17.23	28.68	2.53	2.47	0.24	10.15	1.39E-05	4.16E-05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5.79E-09	1.74E-08
Dolores	Soap	3	0.06	0.17	0.05	99%	6.40	17.23	28.68	2.53	2.47	0.24	10.15	1.39E-05	4.16E-05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	6.87E-10	2.06E-09
ICTF	Gasoline	11	0.5	5.43	1.57	99%	6.40	17.23	28.68	2.53	2.47	0.24	10.15	1.39E-05	4.16E-05	0.00	0.00	0.00	0.00	0.00	0.00	0.02	2.18E-08	6.54E-08
ICTF	Diesel Fuel	22	0.5	10.75	3.12	99%	6.40	17.23	28.68	2.53	2.47	0.24	10.15	1.39E-05	4.16E-05	0.00	0.00	0.00	0.00	0.00	0.00	0.03	4.32E-08	1.30E-07
ICTF	Oil	2	0.5	1.00	0.29	99%	6.40	17.23	28.68	2.53	2.47	0.24	10.15	1.39E-05	4.16E-05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.02E-09	1.21E-08
Total		**2,842**		**519.49**	**150.59**											**0.00**	**0.01**	**0.02**	**0.00**	**0.001**	**0.00**	**1.51**	**2.09E-06**	**6.27E-06**

Idling Exhaust Emissions

						Carbon	2005 Emission Factors									2005 Emission Estimates								
	Delivery	Number of	Idling		Fuel Use	Oxidation	(g/hr)[12]						(kg/gal)[6]			(tons/yr)						(metric tons/yr)		
Yard	Type	Truck Trips	(mins/trip)[11]	(hr/yr)	(gal/yr)[5]	Factor[6]	ROG	CO	NOx	PM10	DPM	SOx	CO2	N2O[10]	CH4[10]	ROG	CO	NOx	PM10	DPM	SOx	CO2	N2O	CH4
Dolores	Diesel Fuel	2,625	10	437.50	288.10	99%	16.16	52.99	100.38	2.85	2.85	0.55	10.15	1.39E-05	4.16E-05	0.01	0.03	0.05	0.00	0.00	0.00	2.89	4.00E-06	1.20E-05
Dolores	Sand	156	30	78.00	51.36	99%	16.16	52.99	100.38	2.85	2.85	0.55	10.15	1.39E-05	4.16E-05	0.00	0.00	0.01	0.00	0.00	0.00	0.52	7.12E-07	2.14E-06
Dolores	Oil	24	10	4.00	2.63	99%	16.16	52.99	100.38	2.85	2.85	0.55	10.15	1.39E-05	4.16E-05	0.00	0.00	0.00	0.00	0.00	0.00	0.03	3.65E-08	1.10E-07
Dolores	Soap	3	10	0.47	0.31	99%	16.16	52.99	100.38	2.85	2.85	0.55	10.15	1.39E-05	4.16E-05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.34E-09	1.30E-08
ICTF	Gasoline	11	10	1.81	1.19	99%	16.16	52.99	100.38	2.85	2.85	0.55	10.15	1.39E-05	4.16E-05	0.00	0.00	0.00	0.00	0.00	0.00	0.01	1.65E-08	4.95E-08
ICTF	Diesel Fuel	22	10	3.58	2.36	99%	16.16	52.99	100.38	2.85	2.85	0.55	10.15	1.39E-05	4.16E-05	0.00	0.00	0.00	0.00	0.00	0.00	0.02	3.27E-08	9.82E-08
ICTF	Oil	2	10	0.33	0.22	99%	16.16	52.99	100.38	2.85	2.85	0.55	10.15	1.39E-05	4.16E-05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.04E-09	9.13E-09
Total				**525.70**	**346.18**											**0.01**	**0.03**	**0.06**	**0.00**	**0.002**	**0.00**	**3.48**	**4.80E-06**	**1.44E-05**

Notes:
1. Annual Diesel fuel delivery truck trips based on 1.76 million gallons of fuel delivered per month and 8,000 gallons per truck.
2. Annual gasoline fuel delivery truck trips based on 86,800 gallons of gasoline used per year and 8,000 gallons per truck.
3. Annual sand delivery truck trips are based on 3 trucks per week, per UPRR staff.
4. VMT per truck trip estimated from Google Earth, for onsite travel only.
5. Fuel use calculated using the EMFAC 2007 model with the BURDEN output opetion.
6. From the Air Resources Board's Draft *Emission Factors for Mandatory Reporting Programs,* August 10, 2007.
7. Running exhaust emission factors (g/mi) from EMFAC 2007 using the BURDEN output option. The EMFAC default model year distribution for L.A. County was used.
8. Emission factor calculations assumed an average speed of 15 mph.
9. The PM10 emission factor includes engine exhaust emissions along with brake and tire wear. The DPM emission factor includes engine exhaust emissions only.
10. Based on a diesel fuel HHV of 5.825 MMBtu/barrel (from ARB Draft Emission Factors for Mandatory Reporting Programs, August 10, 2007) and 42 gallons per barrel.
11. Engineering estimate based on personal observation.
12. Idling exhaust emission factors from EMFAC 2007 using the EMFAC output option. The EMFAC default model year distribution for L.A. County was used.

Title : Los Angeles County Avg Annual CYr 2005 Default Title
Version : Emfac2007 V2.3 Nov 1 2006 ** WIS Enabled **
Run Date : 2006/12/14 07:57:01
Scen Year: 2005 -- All model years in the range 1965 to 2005 selected
Season : Annual
Area : Los Angeles County Average
I/M Stat : Enhanced Interim (2005) -- Using I/M schedule for area 59 Los Angeles (SC)
Emissions: Tons Per Day
****

	HHDT-DSL
Vehicles	27425
VMT/1000	5538
Trips	138783
Reactive Organic Gas Emissions	
Run Exh	39.07
Idle Exh	0.82
Start Ex	0

Total Ex	39.9
Diurnal	0
Hot Soak	0
Running	0
Resting	0

Total	39.9
Carbon Monoxide Emissions	
Run Exh	105.2
Idle Exh	2.7
Start Ex	0

Total Ex	107.91
Oxides of Nitrogen Emissions	
Run Exh	175.11
Idle Exh	5.12
Start Ex	0

Total Ex	180.23
Carbon Dioxide Emissions (000)	
Run Exh	17.5
Idle Exh	0.34
Start Ex	0

Total Ex	17.84
PM10 Emissions	
Run Exh	15.05
Idle Exh	0.15
Start Ex	0

Total Ex	15.19
TireWear	0.22
BrakeWr	0.17

Total	15.59
Lead	0
SOx	1.48
Fuel Consumption (000 gallons)	
Gasoline	0
Diesel	1605.41

Title : Los Angeles County Avg Annual CYr 2005 Default Title
Version : Emfac2007 V2.3 Nov 1 2006
Run Date : 2006/12/14 08:09:32
Scen Year: 2005 -- All model years in the range 1965 to 2005 selected
Season : Annual
Area : Los Angeles
****
Year: 2005 -- Model Years 1965 to 2005 Inclusive --
Emfac2007 Emission Factors: V2.3 Nov 1 2006

County Average Los Angeles

Table 1: Running Exhaust Emissions (grams/mile; grams/idle-hour)

Pollutant Name: Reactive Org Gases Temperature: 65F Relative Humidity: 60%

Speed MPH	HHD NCAT	HHD CAT	HHD DSL	HHD ALL
0	0	0	16.163	15.188

Pollutant Name: Carbon Monoxide Temperature: 65F Relative Humidity: 60%

Speed MPH	HHD NCAT	HHD CAT	HHD DSL	HHD ALL
0	0	0	52.988	49.792

Pollutant Name: Oxides of Nitrogen Temperature: 65F Relative Humidity: 60%

Speed MPH	HHD NCAT	HHD CAT	HHD DSL	HHD ALL
0	0	0	100.382	94.327

Pollutant Name: Carbon Dioxide Temperature: 65F Relative Humidity: 60%

Speed MPH	HHD NCAT	HHD CAT	HHD DSL	HHD ALL
0	0	0	6617.134	6192.269

Pollutant Name: Sulfur Dioxide Temperature: 65F Relative Humidity: 60%

Speed MPH	HHD NCAT	HHD CAT	HHD DSL	HHD ALL
0	0	0	0.55	0.517

Pollutant Name: PM10 Temperature: 65F Relative Humidity: 60%

Speed MPH	HHD NCAT	HHD CAT	HHD DSL	HHD ALL
0	0	0	2.845	2.674

Pollutant Name: PM10 - Tire Wear Temperature: 65F Relative Humidity: 60%

Speed MPH	HHD NCAT	HHD CAT	HHD DSL	HHD ALL
0	0	0	0	0

Pollutant Name: PM10 - Break Wear Temperature: 65F Relative Humidity: 60%

Speed MPH	HHD NCAT	HHD CAT	HHD DSL	HHD ALL
0	0	0	0	0

APPENDIX G-2

DEATILED EMISSION CALCULATIONS, EMISSION FACTOR DERIVATION AND EMFAC2007 OUTPUT FOR PROJECT YEAR 2010

Summary of Emissions from Intermodal HHD Diesel-Fueled Delivery Trucks
Dolores and ICTF Rail Yards, Long Beach, CA

Running Exhaust Emissions

	Delivery	Truck Trips	VMT per Trip	VMT per	Fuel Use	Carbon Oxidation	2010 Emission Factors									2010 Emission Estimates								
							(g/mi)[7,8]						(kg/gal)[6]			(tons/yr)						(metric tons/yr)		
Yard	Type	(trips/yr)[1,2,3]	(mi/trip)[4]	Year	(gal/yr)[5]	Factor[6]	ROG	CO	NOx	PM10[9]	DPM[9]	SOx	CO2	N2O[10]	CH4[10]	ROG	CO	NOx	PM10	DPM	SOx	CO2	N2O	CH4
Dolores	Diesel Fuel	2,625	0.06	157.50	45.67	99%	4.93	12.58	22.54	1.58	1.52	0.03	10.15	1.39E-05	4.16E-05	0.00	0.00	0.00	0.00	0.00	0.00	0.46	6.33E-07	1.90E-06
Dolores	Sand	156	2.2	343.20	99.51	99%	4.93	12.58	22.54	1.58	1.52	0.03	10.15	1.39E-05	4.16E-05	0.00	0.00	0.01	0.00	0.00	0.00	1.00	1.38E-06	4.14E-06
Dolores	Oil	24	0.06	1.44	0.42	99%	4.93	12.58	22.54	1.58	1.52	0.03	10.15	1.39E-05	4.16E-05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5.79E-09	1.74E-08
Dolores	Soap	3	0.06	0.18	0.05	99%	4.93	12.58	22.54	1.58	1.52	0.03	10.15	1.39E-05	4.16E-05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	7.24E-10	2.17E-09
ICTF	Gasoline	8	0.5	4.00	1.16	99%	4.93	12.58	22.54	1.58	1.52	0.03	10.15	1.39E-05	4.16E-05	0.00	0.00	0.00	0.00	0.00	0.00	0.01	1.61E-08	4.83E-08
ICTF	Diesel Fuel	14	0.5	7.00	2.03	99%	4.93	12.58	22.54	1.58	1.52	0.03	10.15	1.39E-05	4.16E-05	0.00	0.00	0.00	0.00	0.00	0.00	0.02	2.81E-08	8.44E-08
ICTF	Oil	1	0.5	0.50	0.14	99%	4.93	12.58	22.54	1.58	1.52	0.03	10.15	1.39E-05	4.16E-05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.01E-09	6.03E-09
Total		**2,831**		**513.82**	**148.98**											**0.00**	**0.01**	**0.01**	**0.00**	**0.001**	**0.00**	**1.50**	**2.07E-06**	**6.20E-06**

Idling Exhaust Emissions

	Delivery	Number of	Idling		Fuel Use	Carbon Oxidation	2010 Emission Factors									2010 Emission Estimates								
							(g/hr)[12]						(kg/gal)[6]			(tons/yr)						(metric tons/yr)		
Yard	Type	Truck Trips	(mins/trip)[11]	(hr/yr)	(gal/yr)[5]	Factor[6]	ROG	CO	NOx	PM10	DPM	SOx	CO2	N2O[10]	CH4[10]	ROG	CO	NOx	PM10	DPM	SOx	CO2	N2O	CH4
Dolores	Diesel Fuel	2,625	10	437.50	288.10	99%	12.49	48.29	110.26	1.79	1.79	0.06	10.15	1.39E-05	4.16E-05	0.01	0.02	0.05	0.00	0.00	0.00	2.89	4.00E-06	1.20E-05
Dolores	Sand	156	30	78.00	51.36	99%	12.49	48.29	110.26	1.79	1.79	0.06	10.15	1.39E-05	4.16E-05	0.00	0.00	0.01	0.00	0.00	0.00	0.52	7.12E-07	2.14E-06
Dolores	Oil	24	10	4.00	2.63	99%	12.49	48.29	110.26	1.79	1.79	0.06	10.15	1.39E-05	4.16E-05	0.00	0.00	0.00	0.00	0.00	0.00	0.03	3.65E-08	1.10E-07
Dolores	Soap	3	10	0.50	0.33	99%	12.49	48.29	110.26	1.79	1.79	0.06	10.15	1.39E-05	4.16E-05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.57E-09	1.37E-08
ICTF	Gasoline	8	10	1.33	0.88	99%	12.49	48.29	110.26	1.79	1.79	0.06	10.15	1.39E-05	4.16E-05	0.00	0.00	0.00	0.00	0.00	0.00	0.01	1.22E-08	3.65E-08
ICTF	Diesel Fuel	14	10	2.33	1.54	99%	12.49	48.29	110.26	1.79	1.79	0.06	10.15	1.39E-05	4.16E-05	0.00	0.00	0.00	0.00	0.00	0.00	0.02	2.13E-08	6.39E-08
ICTF	Oil	1	10	0.17	0.11	99%	12.49	48.29	110.26	1.79	1.79	0.06	10.15	1.39E-05	4.16E-05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.52E-09	4.57E-09
Total				**523.83**	**344.95**											**0.01**	**0.03**	**0.06**	**0.00**	**0.001**	**0.00**	**3.47**	**4.78E-06**	**1.44E-05**

Notes:
1. Diesel fuel delivery truck trips based on the annual fuel throughput and 8,000 gallons per truck.
2. Gasoline fuel delivery truck trips based on the annual gasoline throughput and 8,000 gallons per truck.
3. Annual sand delivery truck trips are based on 3 trucks per week, per UPRR staff.
4. VMT per truck trip estimated from aerial photos, for onsite travel only.
5. Fuel use calculated using the EMFAC 2007 model with the BURDEN output option.
6. From the Air Resources Board's Draft *Emission Factors for Mandatory Reporting Programs*, August 10, 2007.
7. Running exhaust emission factors (g/mi) from EMFAC 2007 using the BURDEN output option. The EMFAC default model year distribution for L.A. County was used.
8. Emission factor calculations assumed an average speed of 15 mph.
9. The PM10 emission factor includes engine exhaust emissions along with brake and tire wear. The DPM emission factor includes engine exhaust emissions only.
10. Based on a diesel fuel HHV of 5.825 MMBtu/barrel (from ARB Draft Emission Factors for Mandatory Reporting Programs, August 10, 2007) and 42 gallons per barrel.
11. Engineering estimate based on personal observation.
12. Idling exhaust emission factors from EMFAC 2007 using the EMFAC output option. The EMFAC default model year distribution for L.A. County was used.

Title : Los Angeles County Avg Annual CYr 2010 Default Title
Version : Emfac2007 V2.3 Nov 1 2006 ** WIS Enabled **
Run Date : 2007/03/22 14:30:08
Scen Year: 2010 -- All model years in the range 1966 to 2010 selected
Season : Annual
Area : Los Angeles County Average
I/M Stat : Enhanced Interim (2005) -- Using I/M schedule for area 59 Los Angeles (SC)
Emissions: Tons Per Day
****

	HHDT-DSL
Vehicles	24869
VMT/1000	4993
Trips	125849
Reactive Organic Gas Emissions	
Run Exh	27.13
Idle Exh	0.58
Start Ex	0

Total Ex	27.71
Diurnal	0
Hot Soak	0
Running	0
Resting	0

Total	27.71
Carbon Monoxide Emissions	
Run Exh	69.25
Idle Exh	2.23
Start Ex	0

Total Ex	71.48
Oxides of Nitrogen Emissions	
Run Exh	124.05
Idle Exh	5.1
Start Ex	0

Total Ex	129.15
Carbon Dioxide Emissions (000)	
Run Exh	15.78
Idle Exh	0.31
Start Ex	0

Total Ex	16.09
PM10 Emissions	
Run Exh	8.35
Idle Exh	0.08
Start Ex	0

Total Ex	8.43
TireWear	0.2
BrakeWr	0.16

Total	8.78
Lead	0
SOx	0.15
Fuel Consumption (000 gallons)	
Gasoline	0
Diesel	1447.7

Title : Los Angeles County Avg Annual CYr 2010 Default Title
Version : Emfac2007 V2.3 Nov 1 2006 ** WIS Enabled **
Run Date : 2007/08/10 13:45:16
Scen Year: 2010 -- All model years in the range 1966 to 2010 selected
Season : Annual
Area : Los Angeles
****
Year: 2010 -- Model Years 1966 to 2010 Inclusive --
Emfac2007 Emission Factors: V2.3 Nov 1 2006 ** WIS Enabled **

County Average Los Angeles

Table 1: Running Exhaust Emissions (grams/mile; grams/idle-hour)

Pollutant Name: Reactive Org Gases Temperature: 65F Relative Humidity: 60%

Speed MPH	HHD NCAT	HHD CAT	HHD DSL	HHD ALL
0	0	0	12.487	11.967

Pollutant Name: Carbon Monoxide Temperature: 65F Relative Humidity: 60%

Speed MPH	HHD NCAT	HHD CAT	HHD DSL	HHD ALL
0	0	0	48.291	46.283

Pollutant Name: Oxides of Nitrogen Temperature: 65F Relative Humidity: 60%

Speed MPH	HHD NCAT	HHD CAT	HHD DSL	HHD ALL
0	0	0	110.258	105.673

Pollutant Name: Carbon Dioxide Temperature: 65F Relative Humidity: 60%

Speed MPH	HHD NCAT	HHD CAT	HHD DSL	HHD ALL
0	0	0	6617.137	6341.961

Pollutant Name: Sulfur Dioxide Temperature: 65F Relative Humidity: 60%

Speed MPH	HHD NCAT	HHD CAT	HHD DSL	HHD ALL
0	0	0	0.063	0.061

Pollutant Name: PM10 Temperature: 65F Relative Humidity: 60%

Speed MPH	HHD NCAT	HHD CAT	HHD DSL	HHD ALL
0	0	0	1.792	1.718

Pollutant Name: PM10 - Tire Wear Temperature: 65F Relative Humidity: 60%

Speed MPH	HHD NCAT	HHD CAT	HHD DSL	HHD ALL
0	0	0	0	0

Pollutant Name: PM10 - Brake Wear Temperature: 65F Relative Humidity: 60%

Speed MPH	HHD NCAT	HHD CAT	HHD DSL	HHD ALL
0	0	0	0	0

APPENDIX G-3

DEATILED EMISSION CALCULATIONS, EMISSION FACTOR DERIVATION AND EMFAC2007 OUTPUT FOR PROJECT YEAR 2012

Summary of Emissions from Intermodal HHD Diesel-Fueled Delivery Trucks
Dolores and ICTF Rail Yards, Long Beach, CA

Running Exhaust Emissions

		Truck	VMT per			Carbon	2012 Emission Factors									2012 Emission Estimates								
	Delivery	Trips	Trip	VMT per	Fuel Use	Oxidation	(g/mi)[6.7]						(kg/gal)[5]			(tons/yr)						(metric tons/yr)		
Yard	Type	(trips/yr)[1,2]	(mi/trip)[3]	Year	(gal/yr)[4]	Factor[5]	ROG	CO	NOx	PM10[8]	DPM[8]	SOx	CO2	N2O[9]	CH4[9]	ROG	CO	NOx	PM10	DPM	SOx	CO2	N2O	CH4
Dolores	Diesel Fuel	2,625	0.06	157.50	45.64	99%	4.08	10.25	18.49	1.21	1.15	0.03	10.15	1.39E-05	4.16E-05	0.00	0.00	0.00	0.00	0.00	0.00	0.46	6.33E-07	1.90E-06
Dolores	Sand	156	2.2	343.20	99.45	99%	4.08	10.25	18.49	1.21	1.15	0.03	10.15	1.39E-05	4.16E-05	0.00	0.00	0.01	0.00	0.00	0.00	1.00	1.38E-06	4.14E-06
Dolores	Oil	24	0.06	1.44	0.42	99%	4.08	10.25	18.49	1.21	1.15	0.03	10.15	1.39E-05	4.16E-05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5.79E-09	1.74E-08
Dolores	Soap	3	0.06	0.17	0.05	99%	4.08	10.25	18.49	1.21	1.15	0.03	10.15	1.39E-05	4.16E-05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	6.87E-10	2.06E-09
ICTF	Alt. Fuel	3	0.5	1.25	0.36	99%	4.08	10.25	18.49	1.21	1.15	0.03	10.15	1.39E-05	4.16E-05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5.02E-09	1.51E-08
Total		**2,810**		**503.56**												**0.00**	**0.01**	**0.01**	**0.00**	**0.001**	**0.00**	**1.47**	**2.02E-06**	**6.07E-06**

Idling Exhaust Emissions

						Carbon	2012 Emission Factors									2012 Emission Estimates								
	Delivery	Number of	Idling		Fuel Use	Oxidation	(g/hr)[11]						(kg/gal)[5]			(tons/yr)						(metric tons/yr)		
Yard	Type	Truck Trips	(mins/trip)[10]	(hr/yr)	(gal/yr)[4]	Factor[5]	ROG	CO	NOx	PM10	DPM	SOx	CO2	N2O[9]	CH4[19]	ROG	CO	NOx	PM10	DPM	SOx	CO2	N2O	CH4
Dolores	Diesel Fuel	2,625	10	437.50	288.10	99%	11.32	46.71	113.45	1.45	1.45	0.06	10.15	1.39E-05	4.16E-05	0.01	0.02	0.05	0.00	0.00	0.00	2.89	4.00E-06	1.20E-05
Dolores	Sand	156	30	78.00	51.36	99%	11.32	46.71	113.45	1.45	1.45	0.06	10.15	1.39E-05	4.16E-05	0.00	0.00	0.01	0.00	0.00	0.00	0.52	7.12E-07	2.14E-06
Dolores	Oil	24	10	4.00	2.63	99%	11.32	46.71	113.45	1.45	1.45	0.06	10.15	1.39E-05	4.16E-05	0.00	0.00	0.00	0.00	0.00	0.00	0.03	3.65E-08	1.10E-07
Dolores	Soap	3	10	0.47	0.31	99%	11.32	46.71	113.45	1.45	1.45	0.06	10.15	1.39E-05	4.16E-05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.34E-09	1.30E-08
ICTF	Gasoline	3	10	0.42	0.27	99%	11.32	46.71	113.45	1.45	1.45	0.06	10.15	1.39E-05	4.16E-05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.81E-09	1.14E-08
Total				**520.39**												**0.01**	**0.03**	**0.07**	**0.00**	**0.001**	**0.00**	**3.44**	**4.75E-06**	**1.43E-05**

Notes:
1. Liquid fuel delivery truck trips based on the annual tank throughput and a tanker truck volume of 8,000 gallons per truck.
2. Annual sand delivery truck trips are based on 3 trucks per week, per UPRR staff.
3. VMT per truck trip estimated from Google Earth, for onsite travel only.
4. Fuel use calculated using the EMFAC 2007 model with the BURDEN output option.
5. From the Air Resources Board's Draft *Emission Factors for Mandatory Reporting Programs,* August 10, 2007.
6. Running exhaust emission factors (g/mi) from EMFAC 2007 using the BURDEN output option. The EMFAC default model year distribution for L.A. County was used.
7. Emission factor calculations assumed an average speed of 15 mph.
8. The PM10 emission factor includes engine exhaust emissions along with brake and tire wear. The DPM emission factor includes engine exhaust emissions only.
9. Based on a diesel fuel HHV of 5.825 MMBtu/barrel (from ARB Draft Emission Factors for Mandatory Reporting Programs, August 10, 2007) and 42 gallons per barrel.
10. Engineering estimate based on personal observation.
11. Idling exhaust emission factors from EMFAC 2007 using the EMFAC output option. The EMFAC default model year distribution for L.A. County was used.

Title : Los Angeles County Avg Annual CYr 2012 Default Title
Version : Emfac2007 V2.3 Nov 1 2006 ** WIS Enabled **
Run Date : 2007/05/09 08:13:05
Scen Year: 2012 -- All model years in the range 1968 to 2012 selected
Season : Annual
Area : Los Angeles County Average
I/M Stat : Enhanced Interim (2005) -- Using I/M schedule for area 59 Los Angeles (SC)
Emissions: Tons Per Day
****

	HHDT-DSL
Vehicles	25950
VMT/1000	5333
Trips	131322
Reactive Organic Gas Emissions	
Run Exh	24
Idle Exh	0.55
Start Ex	0

Total Ex	24.55
Diurnal	0
Hot Soak	0
Running	0
Resting	0

Total	24.55
Carbon Monoxide Emissions	
Run Exh	60.24
Idle Exh	2.25
Start Ex	0

Total Ex	62.5
Oxides of Nitrogen Emissions	
Run Exh	108.68
Idle Exh	5.47
Start Ex	0

Total Ex	114.15
Carbon Dioxide Emissions (000)	
Run Exh	16.85
Idle Exh	0.32
Start Ex	0

Total Ex	17.17
PM10 Emissions	
Run Exh	6.74
Idle Exh	0.07
Start Ex	0

Total Ex	6.81
TireWear	0.21
BrakeWr	0.17

Total	7.19
Lead	0
SOx	0.16
Fuel Consumption (000 gallons)	
Gasoline	0
Diesel	1545.41

Title : Los Angeles County Avg Annual CYr 2012 Default Title
Version : Emfac2007 V2.3 Nov 1 2006 ** WIS Enabled **
Run Date : 2007/08/10 13:45:24
Scen Year: 2012 -- All model years in the range 1968 to 2012 selected
Season : Annual
Area : Los Angeles
****
Year: 2012 -- Model Years 1968 to 2012 Inclusive --
Emfac2007 Emission Factors: V2.3 Nov 1 2006 ** WIS Enabled **

County Average Los Angeles

Table 1: Running Exhaust Emissions (grams/mile; grams/idle-hour)

Pollutant Name: Reactive Org Gases Temperature: 65F Relative Humidity: 60%

Speed MPH	HHD NCAT	HHD CAT	HHD DSL	HHD ALL
	0	0	0	11.319	10.935

Pollutant Name: Carbon Monoxide Temperature: 65F Relative Humidity: 60%

Speed MPH	HHD NCAT	HHD CAT	HHD DSL	HHD ALL
0	0	0	46.708	45.125

Pollutant Name: Oxides of Nitrogen Temperature: 65F Relative Humidity: 60%

Speed MPH	HHD NCAT	HHD CAT	HHD DSL	HHD ALL
0	0	0	113.453	109.606

Pollutant Name: Carbon Dioxide Temperature: 65F Relative Humidity: 60%

Speed MPH	HHD NCAT	HHD CAT	HHD DSL	HHD ALL
0	0	0	6617.136	6392.797

Pollutant Name: Sulfur Dioxide Temperature: 65F Relative Humidity: 60%

Speed MPH	HHD NCAT	HHD CAT	HHD DSL	HHD ALL
0	0	0	0.063	0.061

Pollutant Name: PM10 Temperature: 65F Relative Humidity: 60%

Speed MPH	HHD NCAT	HHD CAT	HHD DSL	HHD ALL
0	0	0	1.454	1.404

Pollutant Name: PM10 - Tire Wear Temperature: 65F Relative Humidity: 60%

Speed MPH	HHD NCAT	HHD CAT	HHD DSL	HHD ALL
0	0	0	0	0

Pollutant Name: PM10 - Brake Wear Temperature: 65F Relative Humidity: 60%

Speed MPH	HHD NCAT	HHD CAT	HHD DSL	HHD ALL
0	0	0	0	0

APPENDIX G-4

DEATILED EMISSION CALCULATIONS, EMISSION FACTOR DERIVATION AND EMFAC2007 OUTPUT FOR PROJECT YEAR 2014

Summary of Emissions from Intermodal HHD Diesel-Fueled Delivery Trucks
Dolores and ICTF Rail Yards, Long Beach, CA

Running Exhaust Emissions

		Truck	VMT per			Carbon	2014 Emission Factors									2014 Emission Estimates								
	Delivery	Trips	Trip	VMT per	Fuel Use	Oxidation	(g/mi)[6,7]						(kg/gal)[5]			(tons/yr)						(metric tons/yr)		
Yard	Type	(trips/yr)[1,2]	(mi/trip)[3]	Year	(gal/yr)[4]	Factor[5]	ROG	CO	NOx	PM10[8]	DPM[8]	SOx	CO2	N2O[9]	CH4[9]	ROG	CO	NOx	PM10	DPM	SOx	CO2	N2O	CH4
Dolores	Diesel Fuel	2,625	0.06	157.50	45.62	99%	3.24	8.01	14.65	0.88	0.82	0.03	10.15	1.39E-05	4.16E-05	0.00	0.00	0.00	0.00	0.00	0.00	0.46	6.33E-07	1.90E-06
Dolores	Sand	156	2.2	343.20	99.40	99%	3.24	8.01	14.65	0.88	0.82	0.03	10.15	1.39E-05	4.16E-05	0.00	0.00	0.01	0.00	0.00	0.00	1.00	1.38E-06	4.14E-06
Dolores	Oil	24	0.06	1.44	0.42	99%	3.24	8.01	14.65	0.88	0.82	0.03	10.15	1.39E-05	4.16E-05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5.78E-09	1.74E-08
Dolores	Soap	3	0.06	0.17	0.05	99%	3.24	8.01	14.65	0.88	0.82	0.03	10.15	1.39E-05	4.16E-05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	6.86E-10	2.06E-09
ICTF	Alt. Fuel	3	0.5	1.25	0.36	99%	3.24	8.01	14.65	0.88	0.82	0.03	10.15	1.39E-05	4.16E-05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5.02E-09	1.51E-08
Total		**2,810**		**503.56**												**0.00**	**0.00**	**0.01**	**0.00**	**0.000**	**0.00**	**1.47**	**2.02E-06**	**6.07E-06**

Idling Exhaust Emissions

						Carbon	2014 Emission Factors									2014 Emission Estimates								
	Delivery	Number of	Idling		Fuel Use	Oxidation	(g/hr)[11]						(kg/gal)[5]			(tons/yr)						(metric tons/yr)		
Yard	Type	Truck Trips	(mins/trip)[10]	(hr/yr)	(gal/yr)[4]	Factor[5]	ROG	CO	NOx	PM10	DPM	SOx	CO2	N2O[9]	CH4[9]	ROG	CO	NOx	PM10	DPM	SOx	CO2	N2O	CH4
Dolores	Diesel Fuel	2,625	10	437.50	288.10	99%	10.32	45.32	116.19	1.14	1.14	0.06	10.15	1.39E-05	4.16E-05	0.00	0.02	0.06	0.00	0.00	0.00	2.89	4.00E-06	1.20E-05
Dolores	Sand	156	30	78.00	51.36	99%	10.32	45.32	116.19	1.14	1.14	0.06	10.15	1.39E-05	4.16E-05	0.00	0.00	0.01	0.00	0.00	0.00	0.52	7.12E-07	2.14E-06
Dolores	Oil	24	10	4.00	2.63	99%	10.32	45.32	116.19	1.14	1.14	0.06	10.15	1.39E-05	4.16E-05	0.00	0.00	0.00	0.00	0.00	0.00	0.03	3.65E-08	1.10E-07
Dolores	Soap	3	10	0.47	0.31	99%	10.32	45.32	116.19	1.14	1.14	0.06	10.15	1.39E-05	4.16E-05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.34E-09	1.30E-08
ICTF	Alt. Fuel	3	10	0.42	0.27	99%	10.32	45.32	116.19	1.14	1.14	0.06	10.15	1.39E-05	4.16E-05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.81E-09	1.14E-08
Total				**520.39**												**0.01**	**0.03**	**0.07**	**0.00**	**0.001**	**0.00**	**3.44**	**4.75E-06**	**1.43E-05**

Notes:
1. Liquid fuel delivery truck trips based on the annual tank throughput and a tanker truck volume of 8,000 gallons per truck.
2. Annual sand delivery truck trips are based on 3 trucks per week, per UPRR staff.
3. VMT per truck trip estimated from aerial photos, for onsite travel only.
4. Fuel use calculated using the EMFAC 2007 model with the BURDEN output option.
5. From the Air Resources Board's Draft *Emission Factors for Mandatory Reporting Programs,* August 10, 2007.
6. Running exhaust emission factors (g/mi) from EMFAC 2007 using the BURDEN output option. The EMFAC default model year distribution for L.A. County was used.
7. Emission factor calculations assumed an average speed of 15 mph.
8. The PM10 emission factor includes engine exhaust emissions along with brake and tire wear. The DPM emission factor includes engine exhaust emissions only.
9. Based on a diesel fuel HHV of 5.825 MMBtu/barrel (from ARB Draft Emission Factors for Mandatory Reporting Programs, August 10, 2007) and 42 gallons per barrel.
10. Engineering estimate based on personal observation.
11. Idling exhaust emission factors from EMFAC 2007 using the EMFAC output option. The EMFAC default model year distribution for L.A. County was used.

Title   : Los Angeles County Avg Annual CYr 2014 Default Title
Version : Emfac2007 V2.3 Nov 1 2006 ** WIS Enabled **
Run Date : 2007/05/09 08:18:35
Scen Year: 2014 -- All model years in the range 1970 to 2014 selected
Season   : Annual
Area   : Los Angeles County Average
I/M Stat : Enhanced Interim (2005) -- Using I/M schedule for area 59 Los Angeles (SC)
Emissions: Tons Per Day
****

	HHDT-DSL
Vehicles	27237
VMT/1000	5803
Trips	137834
Reactive Organic Gas Emissions	
Run Exh	20.73
Idle Exh	0.52
Start Ex	0

Total Ex	21.25
Diurnal	0
Hot Soak	0
Running	0
Resting	0

Total	21.25
Carbon Monoxide Emissions	
Run Exh	51.26
Idle Exh	2.3
Start Ex	0

Total Ex	53.55
Oxides of Nitrogen Emissions	
Run Exh	93.7
Idle Exh	5.89
Start Ex	0

Total Ex	99.58
Carbon Dioxide Emissions (000)	
Run Exh	18.34
Idle Exh	0.34
Start Ex	0

Total Ex	18.68
PM10 Emissions	
Run Exh	5.24
Idle Exh	0.06
Start Ex	0

Total Ex	5.29
TireWear	0.23
BrakeWr	0.18

Total	5.71
Lead	0
SOx	0.18
Fuel Consumption (000 gallons)	
Gasoline	0
Diesel	1680.77

Title : Los Angeles County Avg Annual CYr 2014 Default Title
Version : Emfac2007 V2.3 Nov 1 2006 ** WIS Enabled **
Run Date : 2007/08/10 13:45:36
Scen Year: 2014 -- All model years in the range 1970 to 2014 selected
Season : Annual
Area : Los Angeles
****

Year: 2014 -- Model Years 1970 to 2014 Inclusive --
Emfac2007 Emission Factors: V2.3 Nov 1 2006 ** WIS Enabled **

County Average Los Angeles

Table 1: Running Exhaust Emissions (grams/mile; grams/idle-hour)

Pollutant Name: Reactive Org Gases Temperature: 65F Relative Humidity: 60%

Speed MPH	HHD NCAT	HHD CAT	HHD DSL	HHD ALL
	0	0	0	10.324	10.044

Pollutant Name: Carbon Monoxide Temperature: 65F Relative Humidity: 60%

Speed MPH	HHD NCAT	HHD CAT	HHD DSL	HHD ALL
	0	0	0	45.319	44.09

Pollutant Name: Oxides of Nitrogen Temperature: 65F Relative Humidity: 60%

Speed MPH	HHD NCAT	HHD CAT	HHD DSL	HHD ALL
	0	0	0	116.194	113.043

Pollutant Name: Carbon Dioxide Temperature: 65F Relative Humidity: 60%

Speed MPH	HHD NCAT	HHD CAT	HHD DSL	HHD ALL
	0	0	0	6617.137	6437.659

Pollutant Name: Sulfur Dioxide Temperature: 65F Relative Humidity: 60%

Speed MPH	HHD NCAT	HHD CAT	HHD DSL	HHD ALL
	0	0	0	0.063	0.061

Pollutant Name: PM10 Temperature: 65F Relative Humidity: 60%

Speed MPH	HHD NCAT	HHD CAT	HHD DSL	HHD ALL
	0	0	0	1.144	1.113

Pollutant Name: PM10 - Tire Wear Temperature: 65F Relative Humidity: 60%

Speed MPH	HHD NCAT	HHD CAT	HHD DSL	HHD ALL
	0	0	0	0	0

Pollutant Name: PM10 - Brake Wear Temperature: 65F Relative Humidity: 60%

Speed MPH	HHD NCAT	HHD CAT	HHD DSL	HHD ALL
	0	0	0	0	0

APPENDIX G-5

DEATILED EMISSION CALCULATIONS, EMISSION FACTOR DERIVATION AND EMFAC2007 OUTPUT FOR PROJECT YEAR 2016

Summary of Emissions from Intermodal HHD Diesel-Fueled Delivery Trucks
Dolores and ICTF Rail Yards, Long Beach, CA

Running Exhaust Emissions

		Truck	VMT per			Carbon	2016 Emission Factors									2016 Emission Estimates								
	Delivery	Trips	Trip	VMT per	Fuel Use	Oxidation	(g/mi)[6,7]						(kg/gal)[5]			(tons/yr)						(metric tons/yr)		
Yard	Type	(trips/yr)[1,2]	(mi/trip)[3]	Year	(gal/yr)[4]	Factor[5]	ROG	CO	NOx	PM10[8]	DPM[8]	SOx	CO2	N2O[9]	CH4[9]	ROG	CO	NOx	PM10	DPM	SOx	CO2	N2O	CH4
Dolores	Diesel Fuel	2,625	0.06	157.50	45.59	99%	2.55	6.22	11.56	0.63	0.57	0.03	10.15	1.39E-05	4.16E-05	0.00	0.00	0.00	0.00	0.00	0.00	0.46	6.32E-07	1.90E-06
Dolores	Sand	156	2.2	343.20	99.34	99%	2.55	6.22	11.56	0.63	0.57	0.03	10.15	1.39E-05	4.16E-05	0.00	0.00	0.00	0.00	0.00	0.00	1.00	1.38E-06	4.13E-06
Dolores	Oil	24	0.06	1.44	0.42	99%	2.55	6.22	11.56	0.63	0.57	0.03	10.15	1.39E-05	4.16E-05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5.78E-09	1.73E-08
Dolores	Soap	3	0.06	0.17	0.05	99%	2.55	6.22	11.56	0.63	0.57	0.03	10.15	1.39E-05	4.16E-05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	6.86E-10	2.06E-09
ICTF	Alt. Fuel	3	0.5	1.25	0.36	99%	2.55	6.22	11.56	0.63	0.57	0.03	10.15	1.39E-05	4.16E-05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5.02E-09	1.51E-08
Total		**2,810**		**503.56**	**145.76**											**0.00**	**0.00**	**0.01**	**0.00**	**0.000**	**0.00**	**1.46**	**2.02E-06**	**6.06E-06**

Idling Exhaust Emissions

						Carbon	2016 Emission Factors									2016 Emission Estimates								
	Delivery	Number of	Idling		Fuel Use	Oxidation	(g/hr)[11]						(kg/gal)[5]			(tons/yr)						(metric tons/yr)		
Yard	Type	Truck Trips	(mins/trip)[10]	(hr/yr)	(gal/yr)[4]	Factor[5]	ROG	CO	NOx	PM10	DPM	SOx	CO2	N2O[9]	CH4[9]	ROG	CO	NOx	PM10	DPM	SOx	CO2	N2O	CH4
Dolores	Diesel Fuel	2,625	10	437.50	288.10	99%	9.54	44.20	118.34	0.88	0.88	0.06	10.15	1.39E-05	4.16E-05	0.00	0.02	0.06	0.00	0.00	0.00	2.89	4.00E-06	1.20E-05
Dolores	Sand	156	30	78.00	51.36	99%	9.54	44.20	118.34	0.88	0.88	0.06	10.15	1.39E-05	4.16E-05	0.00	0.00	0.01	0.00	0.00	0.00	0.52	7.12E-07	2.14E-06
Dolores	Oil	24	10	4.00	2.63	99%	9.54	44.20	118.34	0.88	0.88	0.06	10.15	1.39E-05	4.16E-05	0.00	0.00	0.00	0.00	0.00	0.00	0.03	3.65E-08	1.10E-07
Dolores	Soap	3	10	0.47	0.31	99%	9.54	44.20	118.34	0.88	0.88	0.06	10.15	1.39E-05	4.16E-05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.34E-09	1.30E-08
ICTF	Alt. Fuel	3	10	0.42	0.27	99%	9.54	44.20	118.34	0.88	0.88	0.06	10.15	1.39E-05	4.16E-05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.81E-09	1.14E-08
Total				**520.39**	**342.69**											**0.01**	**0.03**	**0.07**	**0.00**	**0.001**	**0.00**	**3.44**	**4.75E-06**	**1.43E-05**

Notes:
1. Liquid fuel delivery truck trips based on the annual tank throughput and a tanker truck volume of 8,000 gallons per truck.
2. Annual sand delivery truck trips are based on 3 trucks per week, per UPRR staff.
3. VMT per truck trip estimated from Google Earth, for onsite travel only.
4. Fuel use calculated using the EMFAC 2007 model with the BURDEN output option.
5. From the Air Resources Board's Draft *Emission Factors for Mandatory Reporting Programs,* August 10, 2007.
6. Running exhaust emission factors (g/mi) from EMFAC 2007 using the BURDEN output option. The EMFAC default model year distribution for L.A. County was used.
7. Emission factor calculations assumed an average speed of 15 mph.
8. The PM10 emission factor includes engine exhaust emissions along with brake and tire wear. The DPM emission factor includes engine exhaust emissions only.
9. Based on a diesel fuel HHV of 5.825 MMBtu/barrel (from ARB Draft Emission Factors for Mandatory Reporting Programs, August 10, 2007) and 42 gallons per barrel.
10. Engineering estimate based on personal observation.
11. Idling exhaust emission factors from EMFAC 2007 using the EMFAC output option. The EMFAC default model year distribution for L.A. County was used.

Title : Los Angeles County Avg Annual CYr 2016 Default Title
Version : Emfac2007 V2.3 Nov 1 2006 ** WIS Enabled **
Run Date : 2007/05/09 08:24:31
Scen Year: 2016 -- All model years in the range 1972 to 2016 selected
Season : Annual
Area : Los Angeles County Average
I/M Stat : Enhanced Interim (2005) -- Using I/M schedule for area 59 Los Angeles (
Emissions: Tons Per Day
****

	HHDT-DSL
Vehicles	28354
VMT/1000	6265
Trips	143483
Reactive Organic Gas Emissions	
Run Exh	17.59
Idle Exh	0.5
Start Ex	0

Total Ex	18.09
Diurnal	0
Hot Soak	0
Running	0
Resting	0

Total	18.09
Carbon Monoxide Emissions	
Run Exh	42.96
Idle Exh	2.33
Start Ex	0

Total Ex	45.29
Oxides of Nitrogen Emissions	
Run Exh	79.81
Idle Exh	6.24
Start Ex	0

Total Ex	86.05
Carbon Dioxide Emissions (000)	
Run Exh	19.8
Idle Exh	0.35
Start Ex	0

Total Ex	20.15
PM10 Emissions	
Run Exh	3.93
Idle Exh	0.05
Start Ex	0

Total Ex	3.98
TireWear	0.25
BrakeWr	0.19

Total	4.42
Lead	0
SOx	0.19
Fuel Consumption (000 gallons)	
Gasoline	0
Diesel	1813.47

Title : Los Angeles County Avg Annual CYr 2016 Default Title
Version : Emfac2007 V2.3 Nov 1 2006 ** WIS Enabled **
Run Date : 2007/08/10 13:45:40
Scen Year: 2016 -- All model years in the range 1972 to 2016 selected
Season : Annual
Area : Los Angeles
****
Year: 2016 -- Model Years 1972 to 2016 Inclusive --
Emfac2007 Emission Factors: V2.3 Nov 1 2006 ** WIS Enabled **

County Average Los Angeles

Table 1: Running Exhaust Emissions (grams/mile; grams/idle-hour)

Pollutant Name: Reactive Org Gases Temperature: 65F Relative Humidity: 60%

Speed MPH	HHD NCAT	HHD CAT	HHD DSL	HHD ALL
	0	0	0	9.54	9.331

Pollutant Name: Carbon Monoxide Temperature: 65F Relative Humidity: 60%

Speed MPH	HHD NCAT	HHD CAT	HHD DSL	HHD ALL
0	0	0	44.203	43.235

Pollutant Name: Oxides of Nitrogen Temperature: 65F Relative Humidity: 60%

Speed MPH	HHD NCAT	HHD CAT	HHD DSL	HHD ALL
0	0	0	118.344	115.753

Pollutant Name: Carbon Dioxide Temperature: 65F Relative Humidity: 60%

Speed MPH	HHD NCAT	HHD CAT	HHD DSL	HHD ALL
0	0	0	6617.134	6472.218

Pollutant Name: Sulfur Dioxide Temperature: 65F Relative Humidity: 60%

Speed MPH	HHD NCAT	HHD CAT	HHD DSL	HHD ALL
0	0	0	0.063	0.062

Pollutant Name: PM10 Temperature: 65F Relative Humidity: 60%

Speed MPH	HHD NCAT	HHD CAT	HHD DSL	HHD ALL
0	0	0	0.883	0.863

Pollutant Name: PM10 - Tire Wear Temperature: 65F Relative Humidity: 60%

Speed MPH	HHD NCAT	HHD CAT	HHD DSL	HHD ALL
0	0	0	0	0

Pollutant Name: PM10 - Brake Wear Temperature: 65F Relative Humidity: 60%

Speed MPH	HHD NCAT	HHD CAT	HHD DSL	HHD ALL
0	0	0	0	0

APPENDIX H

GASOLINE-FUELED YARD TRUCKS

APPENDIX H-1

DEATILED EMISSION CALCULATIONS, EMISSION FACTOR DERIVATION, EMFAC2007 OUTPUT, AND SPECIATION PROFILE FOR THE 2005 BASELINE YEAR

Summary of Emissions from Yard Trucks
Dolores and ICTF Rail Yards, Long Beach, CA

Running Exhaust Emissions

								Annual		Carbon	2005 Emission Factors								2005 Emission Estimates							
	Equipment	Equipment	Vehicle			Fuel	Model	VMT	Fuel Use	Oxidation	(g/mi)[4,5]					(kg/gal)[3]			(tons/yr)					(metric tons/yr)		
Yard	Type	Owner/ID	Class	Make	Model	Type	Year	(mi/yr)[1]	(gal/yr)[2]	Factor[3]	ROG	CO	NOx	PM10	SOx	CO2	N2O[6]	CH4[6]	ROG	CO	NOx	PM10	SOx	CO2	N2O	CH4
ICTF	SUV	1915-53287	LDT	Jeep	Cherokee XHTH74	Gasoline	2000	73,000	6,873.59	99%	0.07	3.00	0.22	0.04	0.01	8.87	1.23E-05	1.60E-04	0.01	0.24	0.02	0.00	0.00	60.36	8.43E-05	1.10E-03
ICTF	Pickup Truck	1915-55536	LDT	Chevy	Extended Cab	Gasoline	2003	73,000	6,846.85	99%	0.05	1.97	0.16	0.03	0.01	8.87	1.23E-05	1.60E-04	0.00	0.16	0.01	0.00	0.00	60.12	8.40E-05	1.09E-03
ICTF	SUV	1915-19952	LDT	Chevy	Trailblazer 370	Gasoline	2003	73,000	6,846.85	99%	0.05	1.97	0.16	0.03	0.01	8.87	1.23E-05	1.60E-04	0.00	0.16	0.01	0.00	0.00	60.12	8.40E-05	1.09E-03
ICTF	Pickup Truck	1915-19971	LDT	Chevy	Extended Cab	Gasoline	2004	73,000	6,833.98	99%	0.04	1.51	0.12	0.03	0.01	8.87	1.23E-05	1.60E-04	0.00	0.12	0.01	0.00	0.00	60.01	8.39E-05	1.09E-03
ICTF	Van	1915-19975	LHDT 1	Chevy	15 Passenger Van	Gasoline	2004	73,000	11,710.13	99%	0.03	0.35	0.12	0.03	0.00	8.87	1.23E-05	1.60E-04	0.00	0.03	0.01	0.00	0.00	102.83	1.44E-04	1.87E-03
Dolores	Service Truck	73152	MHD	Chevy	Chevy C4500	Gasoline	2003	12,644	2,096.37	99%	0.88	11.41	2.19	0.02	0.00	8.87	1.23E-05	1.60E-04	0.01	0.16	0.03	0.00	0.00	18.41	2.57E-05	3.34E-04
Dolores	Mgr Truck	Unknown	LDT	Chevy	Trailblazer	Gasoline	2004	45,000	4,212.73	99%	0.05	1.97	0.16	0.03	0.01	8.87	1.23E-05	1.60E-04	0.00	0.10	0.01	0.00	0.00	36.99	5.17E-05	6.72E-04
Dolores	Mgr Truck	73167	LDT	Chevy	Blazer	Gasoline	2004	36,608	3,427.10	99%	0.05	1.97	0.16	0.03	0.01	8.87	1.23E-05	1.60E-04	0.00	0.08	0.01	0.00	0.00	30.09	4.20E-05	5.47E-04
Dolores	Pickup Truck	73396	LDT	Ford	F-150	Gasoline	2005	23,756	2,218.91	99%	0.02	0.89	0.07	0.02	0.01	8.87	1.23E-05	1.60E-04	0.00	0.02	0.00	0.00	0.00	19.48	2.72E-05	3.54E-04
Total								**483,007**											**0.04**	**1.07**	**0.11**	**0.02**	**0.00**	**448.43**	**0.0006**	**0.0081**

Idling Exhaust Emissions

										Carbon	2005 Emission Factors								2005 Emission Estimates							
	Equipment	Equip.	Vehicle			Fuel	Model	Idling[7]	Fuel Use	Oxidation	(g/hr)[8]					(kg/gal)[3]			(tons/yr)					(metric tons/yr)		
Yard	Type	Owner/ID	Class	Make	Model	Type	Year	(hr/yr)	(gal/yr)	Factor[3]	ROG	CO	NOx	PM10	SOx	CO2	N2O[6]	CH4[6]	ROG	CO	NOx	PM10	SOx	CO2	N2O	CH4
ICTF	Van	1915-19975	LHDT 1	Chevy	15 Passenger Van	Gasoline	2004	91.25	49.64	99%	23.10	141.99	1.56	0.00	0.05	8.87	1.23E-05	1.60E-04	0.00	0.01	0.00	0.00	0.00	0.44	6.09E-07	7.92E-06
Dolores	Service Truck	73152	MHD	Chevy	Chevy C4500	Gasoline	2003	91.25	49.64	99%	23.10	141.99	1.56	0.00	0.05	8.87	1.23E-05	1.60E-04	0.00	0.01	0.00	0.00	0.00	0.44	6.09E-07	7.92E-06
Total																			**0.00**	**0.03**	**0.00**	**0.00**	**0.00**	**0.87**	**1.22E-06**	**1.58E-05**

Notes:
1. Annual VMT estimated by UPRR personnel.
2. Fuel use calculated using the EMFAC2007 model with the BURDEN output option.
3. From the Air Resources Board's Draf *Emission Factors for Mandatory Reporting Programs,* August 10, 2007.
4. Running exhaust emissions calculated using the EMFAC2007 model with the BURDEN output option.
5. Running exhaust emission factor calculations assumed an average speed of 15 mph.
6. Based on a gasoline HHV of 122,697 Btu/gal (Source: Transportation Energy Data Book: Edition 26, U.S. Department of Energy, 2007).
7. Idling time (hr/yr) is an engineering estimate.
8. Idling exhaust emissions factors for LHDT1 and MHD vehicles calculated using the EMFAC2007 model with the EMFAC output option.
9. Idling exhaust emissions from LDT vehicles are negligible.

Summary of TAC Emissions from Gasoline-Fueled Yard Trucks
Dolores and ICTF Rail Yards, Long Beach, CA

			Organic	2005 Emissions (tpy)		
Profile[1]	CAS	Chemical Name	Fraction	Dolores	ICTF	Total
2105	95636	1,2,4-trimethylbenzene	0.0120	2.33E-04	2.49E-04	4.82E-04
2105	106990	1,3-butadiene	0.0068	1.32E-04	1.41E-04	2.72E-04
2105	540841	2,2,4-trimethylpentane	0.0288	5.58E-04	5.96E-04	1.15E-03
2105	75070	acetaldehyde	0.0035	6.74E-05	7.20E-05	1.39E-04
2105	107028	acrolein (2-propenal)	0.0017	3.20E-05	3.42E-05	6.62E-05
2105	71432	benzene	0.0309	5.97E-04	6.38E-04	1.24E-03
2105	4170303	crotonaldehyde	0.0004	6.98E-06	7.46E-06	1.44E-05
2105	110827	cyclohexane	0.0077	1.48E-04	1.59E-04	3.07E-04
2105	100414	ethylbenzene	0.0131	2.53E-04	2.71E-04	5.24E-04
2105	74851	ethylene	0.0794	1.54E-03	1.64E-03	3.18E-03
2105	50000	formaldehyde	0.0197	3.81E-04	4.08E-04	7.89E-04
2105	78795	isoprene	0.0018	3.42E-05	3.66E-05	7.08E-05
2105	98828	isopropylbenzene (cumene)	0.0001	2.33E-06	2.49E-06	4.81E-06
2105	67561	methyl alcohol	0.0015	2.95E-05	3.15E-05	6.11E-05
2105	78933	methyl ethyl ketone (mek) (2-butanone)	0.0002	4.41E-06	4.71E-06	9.12E-06
2105	108383	m-xylene	0.0445	8.61E-04	9.20E-04	1.78E-03
2105	91203	naphthalene	0.0006	1.14E-05	1.22E-05	2.36E-05
2105	110543	n-hexane	0.0200	3.86E-04	4.13E-04	7.99E-04
2105	95476	o-xylene	0.0155	2.99E-04	3.20E-04	6.19E-04
2105	115071	propylene	0.0382	7.40E-04	7.90E-04	1.53E-03
2105	100425	styrene	0.0015	2.97E-05	3.17E-05	6.14E-05
2105	108883	toluene	0.0718	1.39E-03	1.49E-03	2.88E-03
Total				**7.73E-03**	**8.26E-03**	**1.60E-02**

Notes:
1. Organic fraction from ARBs SPECIATE database. Data is from "Cat stabilzed exhaust 2005 SSD etoh 2% O (MTBE phaseout)" option.
2. Emissions were calculated for only chemicals that were in both the SPECIATE database and the AB2588 list.
3. Organic fraction reported on a ROG basis using ARB's Speciate ROG/TOG ratio (0.8012).

Title : Los Angeles County Avg Annual CYr 2005 Default Title
Version : Emfac2007 V2.3 Nov 1 2006 ** WIS Enabled **
Run Date : 2007/08/22 11:59:54
Scen Year: 2005 -- Model year 2000 selected
Season : Annual
Area : Los Angeles County Average
I/M Stat : Enhanced Interim (2005) -- Using I/M schedule for area 59 Los Ar
Emissions: Tons Per Day
****

	LDT1-CAT
Vehicles	45056
VMT/1000	1700
Trips	291486
Reactive Organic Gas Emissions	
Run Exh	0.13
Idle Exh	0
Start Ex	0.08

Total Ex	0.2
Diurnal	0.01
Hot Soak	0.01
Running	0.04
Resting	0.01

Total	0.27
Carbon Monoxide Emissions	
Run Exh	5.62
Idle Exh	0
Start Ex	1.37

Total Ex	6.99
Oxides of Nitrogen Emissions	
Run Exh	0.42
Idle Exh	0
Start Ex	0.12

Total Ex	0.53
Carbon Dioxide Emissions (000)	
Run Exh	1.52
Idle Exh	0
Start Ex	0.03

Total Ex	1.55
PM10 Emissions	
Run Exh	0.04
Idle Exh	0
Start Ex	0

Total Ex	0.04
TireWear	0.01
BrakeWr	0.02

Total	0.08
Lead	0
SOx	0.02
Fuel Consumption (000 gallons)	
Gasoline	160.07
Diesel	0

Title : Los Angeles County Avg Annual CYr 2005 Default Title
Version : Emfac2007 V2.3 Nov 1 2006 ** WIS Enabled **
Run Date : 2007/08/22 12:00:45
Scen Year: 2005 -- Model year 2003 selected
Season : Annual
Area : Los Angeles County Average
I/M Stat : Enhanced Interim (2005) -- Using I/M schedule for area 59 Los Angeles (SC)
Emissions: Tons Per Day
****

	LDT1-CAT
Vehicles	27369
VMT/1000	1176
Trips	178428
Reactive Organic Gas Emissions	
Run Exh	0.06
Idle Exh	0
Start Ex	0.03

Total Ex	0.09
Diurnal	0
Hot Soak	0
Running	0.01
Resting	0

Total	0.11
Carbon Monoxide Emissions	
Run Exh	2.55
Idle Exh	0
Start Ex	0.51

Total Ex	3.05
Oxides of Nitrogen Emissions	
Run Exh	0.21
Idle Exh	0
Start Ex	0.05

Total Ex	0.26
Carbon Dioxide Emissions (000)	
Run Exh	1.05
Idle Exh	0
Start Ex	0.02

Total Ex	1.07
PM10 Emissions	
Run Exh	0.02
Idle Exh	0
Start Ex	0

Total Ex	0.02
TireWear	0.01
BrakeWr	0.02

Total	0.04
Lead	0
SOx	0.01
Fuel Consumption (000 gallons)	
Gasoline	110.3
Diesel	0

Title : Los Angeles County Avg Annual CYr 2005 Default Title
Version : Emfac2007 V2.3 Nov 1 2006 ** WIS Enabled **
Run Date : 2007/09/06 11:14:27
Scen Year: 2005 -- Model year 2003 selected
Season : Annual
Area : Los Angeles County Average
I/M Stat : Enhanced Interim (2005) -- Using I/M schedule for area 59 Los Angeles (SC)
Emissions: Tons Per Day
****

	MHDT-CAT
Vehicles	834
VMT/1000	62
Trips	38088
Reactive Organic Gas Emissions	
Run Exh	0.06
Idle Exh	0
Start Ex	0.04

Total Ex	0.1
Diurnal	0
Hot Soak	0
Running	0
Resting	0

Total	0.1
Carbon Monoxide Emissions	
Run Exh	0.78
Idle Exh	0.01
Start Ex	0.68

Total Ex	1.47
Oxides of Nitrogen Emissions	
Run Exh	0.15
Idle Exh	0
Start Ex	0.09

Total Ex	0.24
Carbon Dioxide Emissions (000)	
Run Exh	0.1
Idle Exh	0
Start Ex	0

Total Ex	0.1
PM10 Emissions	
Run Exh	0
Idle Exh	0
Start Ex	0

Total Ex	0
TireWear	0
BrakeWr	0

Total	0
Lead	0
SOx	0
Fuel Consumption (000 gallons)	
Gasoline	10.28
Diesel	0

Title : Los Angeles County Avg Annual CYr 2005 Default Title
Version : Emfac2007 V2.3 Nov 1 2006
Run Date : 2007/09/06 11:15:11
Scen Year: 2005 -- Model year 2003 selected
Season : Annual
Area : Statewide totals
****
Year: 2005 -- Model Years 2003 to 2003 Inclusive --
Emfac2007 Emission Factors: V2.3 Nov 1 2006

State Average State Average

Table 1: Running Exhaust Emissions (grams/mile; grams/idle-hour)

Pollutant Name: Reactive Org Gases Temperature: 65F Relative Humidity: 60%

Speed MPH	MHD NCAT	MHD CAT	MHD DSL	MHD ALL
0	0	23.103	3.173	6.012

Pollutant Name: Carbon Monoxide Temperature: 65F Relative Humidity: 60%

Speed MPH	MHD NCAT	MHD CAT	MHD DSL	MHD ALL
0	0	141.992	26.3	42.777

Pollutant Name: Oxides of Nitrogen Temperature: 65F Relative Humidity: 60%

Speed MPH	MHD NCAT	MHD CAT	MHD DSL	MHD ALL
0	0	1.561	75.051	64.584

Pollutant Name: Carbon Dioxide Temperature: 65F Relative Humidity: 60%

Speed MPH	MHD NCAT	MHD CAT	MHD DSL	MHD ALL
0	0	4776.9	4098	4194.691

Pollutant Name: Sulfur Dioxide Temperature: 65F Relative Humidity: 60%

Speed MPH	MHD NCAT	MHD CAT	MHD DSL	MHD ALL
0	0	0.049	0.358	0.314

Pollutant Name: PM10 Temperature: 65F Relative Humidity: 60%

Speed MPH	MHD NCAT	MHD CAT	MHD DSL	MHD ALL
0	0	0	0.753	0.646

Pollutant Name: PM10 - Tire Wear Temperature: 65F Relative Humidity: 60%

Speed MPH	MHD NCAT	MHD CAT	MHD DSL	MHD ALL
0	0	0	0	0

Pollutant Name: PM10 - Brake Wear Temperature: 65F Relative Humidity: 60%

Speed MPH	MHD NCAT	MHD CAT	MHD DSL	MHD ALL
0	0	0	0	0

Pollutant Name: Gasoline - mi/gal Temperature: 65F Relative Humidity: 60%

Speed MPH	MHD NCAT	MHD CAT	MHD DSL	MHD ALL
0	0	0	0	0

Pollutant Name: Diesel - mi/gal Temperature: 65F Relative Humidity: 60%

Speed MPH	MHD NCAT	MHD CAT	MHD DSL	MHD ALL
0	0	0	0	0

Title : Los Angeles County Avg Annual CYr 2005 Default Title
Version : Emfac2007 V2.3 Nov 1 2006 ** WIS Enabled **
Run Date : 2007/08/22 12:02:11
Scen Year: 2005 -- Model year 2004 selected
Season : Annual
Area : Los Angeles County Average
I/M Stat : Enhanced Interim (2005) -- Using I/M schedule for area 59 Los Angeles (SC)
Emissions: Tons Per Day
****

	LDT1-CAT	LHDT1-CAT
Vehicles	26388	4585
VMT/1000	1214	315
Trips	172560	151611
Reactive Organic Gas Emissions		
Run Exh	0.05	0.01
Idle Exh	0	0.01
Start Ex	0.02	0.02
	-------	-------
Total Ex	0.07	0.04
Diurnal	0	0
Hot Soak	0	0
Running	0.01	0
Resting	0	0
	-------	-------
Total	0.09	0.04
Carbon Monoxide Emissions		
Run Exh	2.02	0.12
Idle Exh	0	0.04
Start Ex	0.38	0.39
	-------	-------
Total Ex	2.4	0.55
Oxides of Nitrogen Emissions		
Run Exh	0.16	0.04
Idle Exh	0	0
Start Ex	0.03	0.25
	-------	-------
Total Ex	0.18	0.29
Carbon Dioxide Emissions (000)		
Run Exh	1.09	0.48
Idle Exh	0	0
Start Ex	0.02	0.01
	-------	-------
Total Ex	1.11	0.49
PM10 Emissions		
Run Exh	0.01	0
Idle Exh	0	0
Start Ex	0	0
	-------	-------
Total Ex	0.01	0
TireWear	0.01	0
BrakeWr	0.02	0
	-------	-------
Total	0.04	0.01
Lead	0	0
SOx	0.01	0
Fuel Consumption (000 gallons)		
Gasoline	113.65	50.53
Diesel	0	0

Title : Statewide totals Avg Annual CYr 2005 Default Title
Version : Emfac2007 V2.3 Nov 1 2006
Run Date : 2007/08/22 12:37:17
Scen Year: 2005 -- Model year 2004 selected
Season : Annual
Area : Statewide totals
****
Year: 2005 -- Model Years 2004 to 2004 Inclusive --
Emfac2007 Emission Factors: V2.3 Nov 1 2006

State Average State Average

Table 1: Running Exhaust Emissions (grams/mile; grams/idle-hour)

Pollutant Name: Reactive Org Gases Temperature: 65F Relative Humidity: 60%

Speed MPH	LHD1 NCAT	LHD1 CAT	LHD1 DSL	LHD1 ALL
0	0	23.103	3.173	10.704

Pollutant Name: Carbon Monoxide Temperature: 65F Relative Humidity: 60%

Speed MPH	LHD1 NCAT	LHD1 CAT	LHD1 DSL	LHD1 ALL
0	0	141.992	26.3	70.016

Pollutant Name: Oxides of Nitrogen Temperature: 65F Relative Humidity: 60%

Speed MPH	LHD1 NCAT	LHD1 CAT	LHD1 DSL	LHD1 ALL
0	0	1.561	75.051	47.281

Pollutant Name: Carbon Dioxide Temperature: 65F Relative Humidity: 60%

Speed MPH	LHD1 NCAT	LHD1 CAT	LHD1 DSL	LHD1 ALL
0	0	4776.9	4098	4354.536

Pollutant Name: Sulfur Dioxide Temperature: 65F Relative Humidity: 60%

Speed MPH	LHD1 NCAT	LHD1 CAT	LHD1 DSL	LHD1 ALL
0	0	0.049	0.358	0.241

Pollutant Name: PM10 Temperature: 65F Relative Humidity: 60%

Speed MPH	LHD1 NCAT	LHD1 CAT	LHD1 DSL	LHD1 ALL
0	0	0	0.753	0.468

Pollutant Name: PM10 - Tire Wear Temperature: 65F Relative Humidity: 60%

Speed MPH	LHD1 NCAT	LHD1 CAT	LHD1 DSL	LHD1 ALL
0	0	0	0	0

Pollutant Name: PM10 - Brake Wear Temperature: 65F Relative Humidity: 60%

Speed MPH	LHD1 NCAT	LHD1 CAT	LHD1 DSL	LHD1 ALL
0	0	0	0	0

Pollutant Name: Gasoline - mi/gal Temperature: 65F Relative Humidity: 60%

Speed MPH	LHD1 NCAT	LHD1 CAT	LHD1 DSL	LHD1 ALL
0	0	0	0	0

Pollutant Name: Diesel - mi/gal Temperature: 65F Relative Humidity: 60%

Speed MPH	LHD1 NCAT	LHD1 CAT	LHD1 DSL	LHD1 ALL
0	0	0	0	0

Title : Los Angeles County Avg Annual CYr 2005 Default Title
Version : Emfac2007 V2.3 Nov 1 2006 ** WIS Enabled **
Run Date : 2007/09/06 11:16:23
Scen Year: 2005 -- Model year 2005 selected
Season : Annual
Area : Los Angeles County Average
I/M Stat : Enhanced Interim (2005) -- Using I/M schedule for area 59 Los Angeles (SC)
Emissions: Tons Per Day
****

	LDT1-CAT
Vehicles	29451
VMT/1000	1509
Trips	193179
Reactive Organic Gas Emissions	
Run Exh	0.04
Idle Exh	0
Start Ex	0.01

Total Ex	0.05
Diurnal	0
Hot Soak	0
Running	0.01
Resting	0

Total	0.06
Carbon Monoxide Emissions	
Run Exh	1.48
Idle Exh	0
Start Ex	0.21

Total Ex	1.7
Oxides of Nitrogen Emissions	
Run Exh	0.11
Idle Exh	0
Start Ex	0.01

Total Ex	0.12
Carbon Dioxide Emissions (000)	
Run Exh	1.35
Idle Exh	0
Start Ex	0.02

Total Ex	1.37
PM10 Emissions	
Run Exh	0.01
Idle Exh	0
Start Ex	0

Total Ex	0.01
TireWear	0.01
BrakeWr	0.02

Total	0.04
Lead	0
SOx	0.01
Fuel Consumption (000 gallons)	
Gasoline	140.95
Diesel	0

APPENDIX H-2

DEATILED EMISSION CALCULATIONS, EMISSION FACTOR DERIVATION, EMFAC2007 OUTPUT, AND SPECIATION PROFILE FOR PROJECT YEAR 2010

Summary of Emissions from Yard Trucks
Dolores and ICTF Rail Yards, Long Beach, CA

Running Exhaust Emissions

				Annual		Carbon	2010 Emission Factors								2010 Emission Estimates							
	Vehicle	Fuel	Model	VMT	Fuel Use	Oxidation	(g/mi)[5,6]					(kg/gal)[4]			(tons/yr)					(metric tons/yr)		
Yard	Class[1]	Type[1]	Year[2]	(mi/yr)[3]	(gal/yr)[4]	Factor[5]	ROG	CO	NOx	PM10	SOx	CO2	N2O[7]	CH4[7]	ROG	CO	NOx	PM10	SOx	CO2	N2O	CH4
ICTF	LDT	Gasoline	2000-2010	73,000	6,830.96	99%	0.05	1.91	0.14	0.04	0.01	8.87	1.23E-05	1.60E-04	0.00	0.15	0.01	0.00	0.00	59.98	8.38E-05	1.09E-03
ICTF	LDT	Gasoline	2003-2010	73,000	6,803.95	99%	0.03	1.15	0.08	0.04	0.01	8.87	1.23E-05	1.60E-04	0.00	0.09	0.01	0.00	0.00	59.75	8.35E-05	1.09E-03
ICTF	LDT	Gasoline	2003-2010	73,000	6,803.95	99%	0.03	1.15	0.08	0.04	0.01	8.87	1.23E-05	1.60E-04	0.00	0.09	0.01	0.00	0.00	59.75	8.35E-05	1.09E-03
ICTF	LDT	Gasoline	2004-2010	73,000	6,795.77	99%	0.02	0.93	0.07	0.04	0.01	8.87	1.23E-05	1.60E-04	0.00	0.08	0.01	0.00	0.00	59.68	8.34E-05	1.08E-03
ICTF	LHDT 1	Gasoline	2004-2010	73,000	11,733.31	99%	0.02	0.38	0.13	0.04	0.01	8.87	1.23E-05	1.60E-04	0.00	0.03	0.01	0.00	0.00	103.03	1.44E-04	1.87E-03
Dolores	MHD	Gasoline	2003-2010	12,644	2,051.68	99%	0.21	3.02	0.51	0.02	0.03	8.87	1.23E-05	1.60E-04	0.00	0.04	0.01	0.00	0.00	18.02	2.52E-05	3.27E-04
Dolores	LDT	Gasoline	2004-2010	45,000	4,189.18	99%	0.03	1.15	0.08	0.04	0.01	8.87	1.23E-05	1.60E-04	0.00	0.06	0.00	0.00	0.00	36.79	5.14E-05	6.68E-04
Dolores	LDT	Gasoline	2004-2010	36,608	3,407.94	99%	0.03	1.15	0.08	0.04	0.01	8.87	1.23E-05	1.60E-04	0.00	0.05	0.00	0.00	0.00	29.93	4.18E-05	5.44E-04
Dolores	LDT	Gasoline	2005-2010	23,756	2,208.28	99%	0.02	0.73	0.05	0.02	0.01	8.87	1.23E-05	1.60E-04	0.00	0.02	0.00	0.00	0.00	19.39	2.71E-05	3.52E-04
Total				**483,007**											**0.02**	**0.61**	**0.06**	**0.02**	**0.00**	**446.31**	**0.0006**	**0.0081**

Idling Exhaust Emissions

						Carbon	2010 Emission Factors								2010 Emission Estimates							
	Vehicle	Fuel	Model	Idling[8]	Fuel Use	Oxidation	(g/hr)[9,10]					(kg/gal)[4]			(tons/yr)					(metric tons/yr)		
Yard	Class	Type	Year	(hr/yr)	(gal/yr)	Factor[3]	ROG	CO	NOx	PM10	SOx	CO2	N2O[7]	CH4[7]	ROG	CO	NOx	PM10	SOx	CO2	N2O	CH4
ICTF	LHDT 1	Gasoline	2004-2010	91.25	49.64	99%	24.66	146.40	1.62	0.00	0.05	8.87	1.23E-05	1.60E-04	0.00	0.01	0.00	0.00	0.00	0.44	6.09E-07	7.92E-06
Dolores	MHD	Gasoline	2003-2010	91.25	49.64	99%	24.47	145.74	1.61	0.00	0.05	8.87	1.23E-05	1.60E-04	0.00	0.01	0.00	0.00	0.00	0.44	6.09E-07	7.92E-06
Total															**0.00**	**0.03**	**0.00**	**0.00**	**0.00**	**0.87**	**1.22E-06**	**1.58E-05**

Notes:
1. Assumed the same number and types of vehicles as the 2005 baseline year.
2. Emissions for the 2010 calendar year were based on a fleet average emission factor. Emission factors were generated for a fleet consisting of the vehicles model years existing in 2005 and 2010. For example, in 2005, there was a MY 2000 Jeep Cherokee operating at the Yard. For the 2010 emission estimates, I assumed that this vehicle could be replaced at some time with a newer vehicle of any make and model.
2. Annual VMT estimated by UPRR personnel for the 2005 baseline year. Assumed no change in annual VMT for 2010.
3. Fuel use calculated using the EMFAC2007 model with the BURDEN output option.
4. From the Air Resources Board's Draft *Emission Factors for Mandatory Reporting Programs,* August 10, 2007.
5. Running exhaust emissions calculated using the EMFAC2007 model with the BURDEN output option.
6. Running exhaust emission factor calculations assumed an average speed of 15 mph.
7. Based on a gasoline HHV of 122,697 Btu/gal (Source: Transportation Energy Data Book: Edition 26, U.S. Department of Energy, 2007).
8. Idling time (hr/yr) is an engineering estimate.
9. Idling exhaust emissions factors for LHDT1 and MHD vehicles calculated using the EMFAC2007 model with the EMFAC output option.
10. Idling exhaust emissions from LDT vehicles are negligible.

Summary of TAC Emissions from Gasoline-Fueled Yard Trucks
Dolores and ICTF Rail Yards, Long Beach, CA

Profile[1]	CAS	Chemical Name	Organic Fraction	2010 Emissions (tpy)		
				Dolores	ICTF	Total
2105	95636	1,2,4-trimethylbenzene	0.0120	1.02E-04	1.76E-04	**2.79E-04**
2105	106990	1,3-butadiene	0.0068	5.80E-05	9.96E-05	**1.58E-04**
2105	540841	2,2,4-trimethylpentane	0.0288	2.45E-04	4.22E-04	**6.67E-04**
2105	75070	acetaldehyde	0.0035	2.97E-05	5.10E-05	**8.07E-05**
2105	107028	acrolein (2-propenal)	0.0017	1.41E-05	2.42E-05	**3.83E-05**
2105	71432	benzene	0.0309	2.63E-04	4.51E-04	**7.14E-04**
2105	4170303	crotonaldehyde	0.0004	3.07E-06	5.28E-06	**8.35E-06**
2105	110827	cyclohexane	0.0077	6.53E-05	1.12E-04	**1.78E-04**
2105	100414	ethylbenzene	0.0131	1.12E-04	1.92E-04	**3.03E-04**
2105	74851	ethylene	0.0794	6.76E-04	1.16E-03	**1.84E-03**
2105	50000	formaldehyde	0.0197	1.68E-04	2.88E-04	**4.56E-04**
2105	78795	isoprene	0.0018	1.51E-05	2.59E-05	**4.09E-05**
2105	98828	isopropylbenzene (cumene)	0.0001	1.02E-06	1.76E-06	**2.78E-06**
2105	67561	methyl alcohol	0.0015	1.30E-05	2.23E-05	**3.53E-05**
2105	78933	methyl ethyl ketone (mek) (2-butanone)	0.0002	1.94E-06	3.34E-06	**5.28E-06**
2105	108383	m-xylene	0.0445	3.79E-04	6.51E-04	**1.03E-03**
2105	91203	naphthalene	0.0006	5.02E-06	8.61E-06	**1.36E-05**
2105	110543	n-hexane	0.0200	1.70E-04	2.92E-04	**4.62E-04**
2105	95476	o-xylene	0.0155	1.32E-04	2.26E-04	**3.58E-04**
2105	115071	propylene	0.0382	3.26E-04	5.59E-04	**8.85E-04**
2105	100425	styrene	0.0015	1.31E-05	2.24E-05	**3.55E-05**
2105	108883	toluene	0.0718	6.12E-04	1.05E-03	**1.66E-03**
Total				**3.40E-03**	**5.85E-03**	**9.25E-03**

Notes:
1. Organic fraction from ARBs SPECIATE database. Data is from "Cat stabilzed exhaust 2005 SSD etoh 2% O (MTBE phaseout)" option.
2. Emissions were calculated for only chemicals that were in both the SPECIATE database and the AB2588 list.
3. Organic fraction reported on a ROG basis using ARB's Speciate ROG/TOG ratio (0.8012).

Title : Los Angeles County Avg Annual CYr 2010 Default Title
Version : Emfac2007 V2.3 Nov 1 2006 ** WIS Enabled **
Run Date : 2007/09/06 15:25:43
Scen Year: 2010 -- All model years in the range 2000 to 2010 selected
Season : Annual
Area : Los Angeles County Average
I/M Stat : Enhanced Interim (2005) -- Using I/M schedule for area 59 Los Angeles (SC)
Emissions: Tons Per Day
****

	LDT1-CAT
Vehicles	275939
VMT/1000	10616
Trips	1776700
Reactive Organic Gas Emissions	
Run Exh	0.53
Idle Exh	0
Start Ex	0.29

Total Ex	0.82
Diurnal	0.04
Hot Soak	0.12
Running	0.39
Resting	0.05

Total	1.43
Carbon Monoxide Emissions	
Run Exh	22.37
Idle Exh	0
Start Ex	5.49

Total Ex	27.86
Oxides of Nitrogen Emissions	
Run Exh	1.58
Idle Exh	0
Start Ex	0.43

Total Ex	2.01
Carbon Dioxide Emissions (000)	
Run Exh	9.48
Idle Exh	0
Start Ex	0.18

Total Ex	9.66
PM10 Emissions	
Run Exh	0.27
Idle Exh	0
Start Ex	0.01

Total Ex	0.27
TireWear	0.09
BrakeWr	0.15

Total	0.51
Lead	0
SOx	0.09
Fuel Consumption (000 gallons)	
Gasoline	993.39
Diesel	0

Title : Los Angeles County Avg Annual CYr 2010 Default Title
Version : Emfac2007 V2.3 Nov 1 2006 ** WIS Enabled **
Run Date : 2007/09/06 17:13:52
Scen Year: 2010 -- All model years in the range 2003 to 2010 selected
Season : Annual
Area : Los Angeles County Average
I/M Stat : Enhanced Interim (2005) -- Using I/M schedule for area 59 Los Angeles (SC)
Emissions: Tons Per Day
****

	LDT1-CAT
Vehicles	177404
VMT/1000	7286
Trips	1151520
Reactive Organic Gas Emissions	
Run Exh	0.23
Idle Exh	0
Start Ex	0.11

Total Ex	0.33
Diurnal	0.01
Hot Soak	0.03
Running	0.13
Resting	0.01

Total	0.52
Carbon Monoxide Emissions	
Run Exh	9.26
Idle Exh	0
Start Ex	1.92

Total Ex	11.19
Oxides of Nitrogen Emissions	
Run Exh	0.66
Idle Exh	0
Start Ex	0.14

Total Ex	0.8
Carbon Dioxide Emissions (000)	
Run Exh	6.5
Idle Exh	0
Start Ex	0.11

Total Ex	6.61
PM10 Emissions	
Run Exh	0.14
Idle Exh	0
Start Ex	0

Total Ex	0.14
TireWear	0.06
BrakeWr	0.1

Total	0.3
Lead	0
SOx	0.06
Fuel Consumption (000 gallons)	
Gasoline	679.09
Diesel	0

Title : Los Angeles County Avg Annual CYr 2010 Default Title
Version : Emfac2007 V2.3 Nov 1 2006 ** WIS Enabled **
Run Date : 2007/09/06 15:59:50
Scen Year: 2010 -- All model years in the range 2003 to 2010 selected
Season : Annual
Area : Los Angeles County Average
I/M Stat : Enhanced Interim (2005) -- Using I/M schedule for area 59 Los Angeles (SC)
Emissions: Tons Per Day
****

	MHDT-CAT
Vehicles	4804
VMT/1000	339
Trips	219401
Reactive Organic Gas Emissions	
Run Exh	0.08
Idle Exh	0.01
Start Ex	0.11

Total Ex	0.21
Diurnal	0
Hot Soak	0
Running	0.01
Resting	0

Total	0.21
Carbon Monoxide Emissions	
Run Exh	1.13
Idle Exh	0.07
Start Ex	1.83

Total Ex	3.02
Oxides of Nitrogen Emissions	
Run Exh	0.19
Idle Exh	0
Start Ex	0.27

Total Ex	0.46
Carbon Dioxide Emissions (000)	
Run Exh	0.52
Idle Exh	0
Start Ex	0.01

Total Ex	0.53
PM10 Emissions	
Run Exh	0.01
Idle Exh	0
Start Ex	0

Total Ex	0.01
TireWear	0
BrakeWr	0

Total	0.02
Lead	0
SOx	0.01
Fuel Consumption (000 gallons)	
Gasoline	55.01
Diesel	0

Title : Statewide totals Avg Annual CYr 2010 Default Title
Version : Emfac2007 V2.3 Nov 1 2006
Run Date : 2007/09/06 16:16:12
Scen Year: 2010 -- All model years in the range 2003 to 2010 selected
Season : Annual
Area : Statewide totals
****

Year: 2010 -- Model Years 2003 to 2010 Inclusive --
Emfac2007 Emission Factors: V2.3 Nov 1 2006

State Average State Average

Table 1: Running Exhaust Emissions (grams/mile; grams/idle-hour)

Pollutant Name: Reactive Org Gases Temperature: 65F Relative Humidity: 60%

Speed MPH	MHD NCAT	MHD CAT	MHD DSL	MHD ALL
0	0	24.473	3.173	6.465

Pollutant Name: Carbon Monoxide Temperature: 65F Relative Humidity: 60%

Speed MPH	MHD NCAT	MHD CAT	MHD DSL	MHD ALL
0	0	145.737	26.3	44.761

Pollutant Name: Oxides of Nitrogen Temperature: 65F Relative Humidity: 60%

Speed MPH	MHD NCAT	MHD CAT	MHD DSL	MHD ALL
0	0	1.611	75.051	63.699

Pollutant Name: Carbon Dioxide Temperature: 65F Relative Humidity: 60%

Speed MPH	MHD NCAT	MHD CAT	MHD DSL	MHD ALL
0	0	4776.9	4098	4202.938

Pollutant Name: Sulfur Dioxide Temperature: 65F Relative Humidity: 60%

Speed MPH	MHD NCAT	MHD CAT	MHD DSL	MHD ALL
0	0	0.049	0.039	0.041

Pollutant Name: PM10 Temperature: 65F Relative Humidity: 60%

Speed MPH	MHD NCAT	MHD CAT	MHD DSL	MHD ALL
0	0	0	0.749	0.633

Pollutant Name: PM10 - Tire Wear Temperature: 65F Relative Humidity: 60%

Speed MPH	MHD NCAT	MHD CAT	MHD DSL	MHD ALL
0	0	0	0	0

Pollutant Name: PM10 - Brake Wear Temperature: 65F Relative Humidity: 60%

Speed MPH	MHD NCAT	MHD CAT	MHD DSL	MHD ALL
0	0	0	0	0

Pollutant Name: Gasoline - mi/gal Temperature: 65F Relative Humidity: 60%

Speed MPH	MHD NCAT	MHD CAT	MHD DSL	MHD ALL
0	0	0	0	0

Pollutant Name: Diesel - mi/gal Temperature: 65F Relative Humidity: 60%

Speed MPH	MHD NCAT	MHD CAT	MHD DSL	MHD ALL
0	0	0	0	0

Title : Los Angeles County Avg Annual CYr 2010 Default Title
Version : Emfac2007 V2.3 Nov 1 2006 ** WIS Enabled **
Run Date : 2007/09/06 17:09:18
Scen Year: 2010 -- All model years in the range 2004 to 2010 selected
Season : Annual
Area : Los Angeles County Average
I/M Stat : Enhanced Interim (2005) -- Using I/M schedule for area 59 Los Angeles (SC)
Emissions: Tons Per Day
****

	LDT1-CAT	LHDT1-CAT
Vehicles	155260	29682
VMT/1000	6499	1835
Trips	1009370	981475
Reactive Organic Gas Emissions		
Run Exh	0.17	0.05
Idle Exh	0	0.04
Start Ex	0.07	0.18
	-------	-------
Total Ex	0.24	0.28
Diurnal	0.01	0
Hot Soak	0.02	0
Running	0.09	0.02
Resting	0.01	0
	-------	-------
Total	0.37	0.3
Carbon Monoxide Emissions		
Run Exh	6.68	0.77
Idle Exh	0	0.26
Start Ex	1.26	2.6
	-------	-------
Total Ex	7.95	3.62
Oxides of Nitrogen Emissions		
Run Exh	0.47	0.27
Idle Exh	0	0
Start Ex	0.08	1.84
	-------	-------
Total Ex	0.54	2.12
Carbon Dioxide Emissions (000)		
Run Exh	5.8	2.82
Idle Exh	0	0.01
Start Ex	0.1	0.05
	-------	-------
Total Ex	5.9	2.87
PM10 Emissions		
Run Exh	0.11	0.03
Idle Exh	0	0
Start Ex	0	0
	-------	-------
Total Ex	0.11	0.03
TireWear	0.06	0.02
BrakeWr	0.09	0.03
	-------	-------
Total	0.26	0.08
Lead	0	0
SOx	0.06	0.03
Fuel Consumption (000 gallons)		
Gasoline	605.01	294.94
Diesel	0	0

Title : Statewide totals Avg Annual CYr 2010 Default Title
Version : Emfac2007 V2.3 Nov 1 2006
Run Date : 2007/09/06 15:53:36
Scen Year: 2010 -- All model years in the range 2004 to 2010 selected
Season : Annual
Area : Statewide totals
****
Year: 2010 -- Model Years 2004 to 2010 Inclusive --
Emfac2007 Emission Factors: V2.3 Nov 1 2006

State Average State Average

Table 1: Running Exhaust Emissions (grams/mile; grams/idle-hour)

Pollutant Name: Reactive Org Gases Temperature: 65F Relative Humidity: 60%

Speed MPH	LHD1 NCAT	LHD1 CAT	LHD1 DSL	LHD1 ALL
0	0	24.66	3.173	18.366

Pollutant Name: Carbon Monoxide Temperature: 65F Relative Humidity: 60%

Speed MPH	LHD1 NCAT	LHD1 CAT	LHD1 DSL	LHD1 ALL
0	0	146.402	26.3	111.22

Pollutant Name: Oxides of Nitrogen Temperature: 65F Relative Humidity: 60%

Speed MPH	LHD1 NCAT	LHD1 CAT	LHD1 DSL	LHD1 ALL
0	0	1.623	75.051	23.133

Pollutant Name: Carbon Dioxide Temperature: 65F Relative Humidity: 60%

Speed MPH	LHD1 NCAT	LHD1 CAT	LHD1 DSL	LHD1 ALL
0	0	4776.9	4098	4578.027

Pollutant Name: Sulfur Dioxide Temperature: 65F Relative Humidity: 60%

Speed MPH	LHD1 NCAT	LHD1 CAT	LHD1 DSL	LHD1 ALL
0	0	0.049	0.039	0.046

Pollutant Name: PM10 Temperature: 65F Relative Humidity: 60%

Speed MPH	LHD1 NCAT	LHD1 CAT	LHD1 DSL	LHD1 ALL
0	0	0	0.74	0.217

Pollutant Name: PM10 - Tire Wear Temperature: 65F Relative Humidity: 60%

Speed MPH	LHD1 NCAT	LHD1 CAT	LHD1 DSL	LHD1 ALL
0	0	0	0	0

Pollutant Name: PM10 - Brake Wear Temperature: 65F Relative Humidity: 60%

Speed MPH	LHD1 NCAT	LHD1 CAT	LHD1 DSL	LHD1 ALL
0	0	0	0	0

Pollutant Name: Gasoline - mi/gal Temperature: 65F Relative Humidity: 60%

Speed MPH	LHD1 NCAT	LHD1 CAT	LHD1 DSL	LHD1 ALL
0	0	0	0	0

Pollutant Name: Diesel - mi/gal Temperature: 65F Relative Humidity: 60%

Speed MPH	LHD1 NCAT	LHD1 CAT	LHD1 DSL	LHD1 ALL
0	0	0	0	0

Title : Los Angeles County Avg Annual CYr 2010 Default Title
Version : Emfac2007 V2.3 Nov 1 2006 ** WIS Enabled **
Run Date : 2007/09/06 17:14:35
Scen Year: 2010 -- All model years in the range 2005 to 2010 selected
Season : Annual
Area : Los Angeles County Average
I/M Stat : Enhanced Interim (2005) -- Using I/M schedule for area 59 Los Angeles (SC)
Emissions: Tons Per Day
****

	LDT1-CAT
Vehicles	133913
VMT/1000	5719
Trips	871906
Reactive Organic Gas Emissions	
Run Exh	0.12
Idle Exh	0
Start Ex	0.04

Total Ex	0.16
Diurnal	0
Hot Soak	0.01
Running	0.07
Resting	0

Total	0.25
Carbon Monoxide Emissions	
Run Exh	4.59
Idle Exh	0
Start Ex	0.75

Total Ex	5.34
Oxides of Nitrogen Emissions	
Run Exh	0.32
Idle Exh	0
Start Ex	0.04

Total Ex	0.36
Carbon Dioxide Emissions (000)	
Run Exh	5.1
Idle Exh	0
Start Ex	0.09

Total Ex	5.18
PM10 Emissions	
Run Exh	0.09
Idle Exh	0
Start Ex	0

Total Ex	0.09
TireWear	0.05
BrakeWr	0.08

Total	0.22
Lead	0
SOx	0.05
Fuel Consumption (000 gallons)	
Gasoline	531.63
Diesel	0

APPENDIX H-3

DEATILED EMISSION CALCULATIONS, EMISSION FACTOR DERIVATION, EMFAC2007 OUTPUT, AND SPECIATION PROFILE FOR PROJECT YEAR 2012

Summary of Emissions from Yard Trucks
Dolores and ICTF Rail Yards, Long Beach, CA

Running Exhaust Emissions

Yard	Vehicle Class[1]	Fuel Type[1]	Model Year[2]	Annual VMT (mi/yr)[3]	Fuel Use (gal/yr)[4]	Carbon Oxidation Factor[5]	2012 Emission Factors (g/mi)[5,6]					2012 Emission Factors (kg/gal)[4]			2012 Emission Estimates (tons/yr)					2012 Emission Estimates (metric tons/yr)		
							ROG	CO	NOx	PM10	SOx	CO2	N2O[7]	CH4[7]	ROG	CO	NOx	PM10	SOx	CO2	N2O	CH4
ICTF	LDT	Gasoline	2000-2012	73,000	6,818.55	99%	0.04	1.76	0.12	0.05	0.01	8.87	1.23E-05	1.60E-04	0.00	0.14	0.01	0.00	0.00	59.88	8.37E-05	1.09E-03
ICTF	LDT	Gasoline	2003-2012	73,000	6,791.28	99%	0.03	1.08	0.07	0.04	0.01	8.87	1.23E-05	1.60E-04	0.00	0.09	0.01	0.00	0.00	59.64	8.33E-05	1.08E-03
ICTF	LDT	Gasoline	2003-2012	73,000	6,791.28	99%	0.03	1.08	0.07	0.04	0.01	8.87	1.23E-05	1.60E-04	0.00	0.09	0.01	0.00	0.00	59.64	8.33E-05	1.08E-03
ICTF	LDT	Gasoline	2004-2012	73,000	6,783.33	99%	0.02	0.90	0.06	0.04	0.01	8.87	1.23E-05	1.60E-04	0.00	0.07	0.00	0.00	0.00	59.57	8.32E-05	1.08E-03
ICTF	LHDT 1	Gasoline	2004-2012	73,000	11,745.75	99%	0.03	0.38	0.13	0.04	0.01	8.87	1.23E-05	1.60E-04	0.00	0.03	0.01	0.00	0.00	103.14	1.44E-04	1.87E-03
Dolores	MHD	Gasoline	2003-2012	12,644	2,049.56	99%	0.20	2.60	0.43	0.02	0.02	8.87	1.23E-05	1.60E-04	0.00	0.04	0.01	0.00	0.00	18.00	2.51E-05	3.27E-04
Dolores	LDT	Gasoline	2004-2012	45,000	4,181.51	99%	0.03	1.08	0.07	0.04	0.01	8.87	1.23E-05	1.60E-04	0.00	0.05	0.00	0.00	0.00	36.72	5.13E-05	6.67E-04
Dolores	LDT	Gasoline	2004-2012	36,608	3,401.70	99%	0.03	1.08	0.07	0.04	0.01	8.87	1.23E-05	1.60E-04	0.00	0.04	0.00	0.00	0.00	29.87	4.17E-05	5.43E-04
Dolores	LDT	Gasoline	2005-2012	23,756	2,204.83	99%	0.02	0.73	0.05	0.02	0.01	8.87	1.23E-05	1.60E-04	0.00	0.02	0.00	0.00	0.00	19.36	2.71E-05	3.52E-04
Total				**483,007**											**0.02**	**0.57**	**0.05**	**0.02**	**0.00**	**445.81**	**0.0006**	**0.0081**

Idling Exhaust Emissions

Yard	Vehicle Class	Fuel Type	Model Year	Idling[8] (hr/yr)	Fuel Use (gal/yr)	Carbon Oxidation Factor[3]	2012 Emission Factors (g/hr)[9,10]					2012 Emission Factors (kg/gal)[4]			2012 Emission Estimates (tons/yr)					2012 Emission Estimates (metric tons/yr)		
							ROG	CO	NOx	PM10	SOx	CO2	N2O[7]	CH4[7]	ROG	CO	NOx	PM10	SOx	CO2	N2O	CH4
ICTF	LHDT 1	Gasoline	2004-2012	91.25	49.64	99%	23.66	142.20	1.54	0.00	0.05	8.87	1.23E-05	1.60E-04	0.00	0.01	0.00	0.00	0.00	0.44	6.09E-07	7.92E-06
Dolores	MHD	Gasoline	2003-2012	91.25	49.64	99%	23.78	142.64	1.55	0.00	0.05	8.87	1.23E-05	1.60E-04	0.00	0.01	0.00	0.00	0.00	0.44	6.09E-07	7.92E-06
Total															**0.00**	**0.03**	**0.00**	**0.00**	**0.00**	**0.87**	**1.22E-06**	**1.58E-05**

Notes:

1. Assumed the same number and types of vehicles as the 2005 baseline year.
2. Emissions for the 2012 calendar year were based on a fleet average emission factor. Emission factors were generated for a fleet consisting of the vehicles model years existing in 2005 and 2012. For example, in 2005, there was a MY 2000 Jeep Cherokee operating at the Yard. For the 2012 emission estimates, I assumed that this vehicle could be replaced at some time with a newer vehicle of any make and model.
2. Annual VMT estimated by UPRR personnel for the 2005 baseline year. Assumed no change in annual VMT for 2012.
3. Fuel use calculated using the EMFAC2007 model with the BURDEN output option.
4. From the Air Resources Board's Draft *Emission Factors for Mandatory Reporting Programs,* August 10, 2007.
5. Running exhaust emissions calculated using the EMFAC2007 model with the BURDEN output option.
6. Running exhaust emission factor calculations assumed an average speed of 15 mph.
7. Based on a gasoline HHV of 122,697 Btu/gal (Source: Transportation Energy Data Book: Edition 26, U.S. Department of Energy, 2007).
8. Idling time (hr/yr) is an engineering estimate.
9. Idling exhaust emissions factors for LHDT1 and MHD vehicles calculated using the EMFAC2007 model with the EMFAC output option.
10. Idling exhaust emissions from LDT vehicles are negligible.

Summary of TAC Emissions from Gasoline-Fueled Yard Trucks
Dolores and ICTF Rail Yards, Long Beach, CA

			Organic	2012 Emissions (tpy)		
Profile[1]	CAS	Chemical Name	Fraction	Dolores	ICTF	Total
2105	95636	1,2,4-trimethylbenzene	0.0120	9.79E-05	1.68E-04	2.66E-04
2105	106990	1,3-butadiene	0.0068	5.54E-05	9.50E-05	1.50E-04
2105	540841	2,2,4-trimethylpentane	0.0288	2.34E-04	4.02E-04	6.37E-04
2105	75070	acetaldehyde	0.0035	2.83E-05	4.86E-05	7.70E-05
2105	107028	acrolein (2-propenal)	0.0017	1.34E-05	2.31E-05	3.65E-05
2105	71432	benzene	0.0309	2.51E-04	4.31E-04	6.82E-04
2105	4170303	crotonaldehyde	0.0004	2.93E-06	5.03E-06	7.97E-06
2105	110827	cyclohexane	0.0077	6.24E-05	1.07E-04	1.69E-04
2105	100414	ethylbenzene	0.0131	1.06E-04	1.83E-04	2.89E-04
2105	74851	ethylene	0.0794	6.46E-04	1.11E-03	1.75E-03
2105	50000	formaldehyde	0.0197	1.60E-04	2.75E-04	4.36E-04
2105	78795	isoprene	0.0018	1.44E-05	2.47E-05	3.91E-05
2105	98828	isopropylbenzene (cumene)	0.0001	9.78E-07	1.68E-06	2.66E-06
2105	67561	methyl alcohol	0.0015	1.24E-05	2.13E-05	3.37E-05
2105	78933	methyl ethyl ketone (mek) (2-butanone)	0.0002	1.85E-06	3.18E-06	5.04E-06
2105	108383	m-xylene	0.0445	3.62E-04	6.21E-04	9.82E-04
2105	91203	naphthalene	0.0006	4.79E-06	8.22E-06	1.30E-05
2105	110543	n-hexane	0.0200	1.62E-04	2.79E-04	4.41E-04
2105	95476	o-xylene	0.0155	1.26E-04	2.16E-04	3.41E-04
2105	115071	propylene	0.0382	3.11E-04	5.34E-04	8.44E-04
2105	100425	styrene	0.0015	1.25E-05	2.14E-05	3.39E-05
2105	108883	toluene	0.0718	5.84E-04	1.00E-03	1.59E-03
Total				**3.25E-03**	**5.58E-03**	**8.83E-03**

Notes:
1. Organic fraction from ARBs SPECIATE database. Data is from "Cat stabilzed exhaust 2005 SSD etoh 2% O (MTBE phaseout)" option.
2. Emissions were calculated for only chemicals that were in both the SPECIATE database and the AB2588 list.
3. Organic fraction reported on a ROG basis using ARB's Speciate ROG/TOG ratio (0.8012).

Title : Los Angeles County Avg Annual CYr 2012 Default Title
Version : Emfac2007 V2.3 Nov 1 2006 ** WIS Enabled **
Run Date : 2007/09/14 15:11:30
Scen Year: 2012 -- All model years in the range 2000 to 2012 selected
Season : Annual
Area : Los Angeles County Average
I/M Stat : Enhanced Interim (2005) -- Using I/M schedule for area 59 Los Angeles (SC)
Emissions: Tons Per Day
****

	LDT1-CAT
Vehicles	309142
VMT/1000	11663
Trips	1980440
Reactive Organic Gas Emissions	
Run Exh	0.54
Idle Exh	0
Start Ex	0.29

Total Ex	0.84
Diurnal	0.05
Hot Soak	0.16
Running	0.52
Resting	0.06

Total	1.63
Carbon Monoxide Emissions	
Run Exh	22.64
Idle Exh	0
Start Ex	5.61

Total Ex	28.25
Oxides of Nitrogen Emissions	
Run Exh	1.54
Idle Exh	0
Start Ex	0.42

Total Ex	1.97
Carbon Dioxide Emissions (000)	
Run Exh	10.4
Idle Exh	0
Start Ex	0.2

Total Ex	10.59
PM10 Emissions	
Run Exh	0.32
Idle Exh	0
Start Ex	0.01

Total Ex	0.33
TireWear	0.1
BrakeWr	0.16

Total	0.6
Lead	0
SOx	0.1
Fuel Consumption (000 gallons)	
Gasoline	1089.38
Diesel	0

Title : Los Angeles County Avg Annual CYr 2012 Default Title
Version : Emfac2007 V2.3 Nov 1 2006 ** WIS Enabled **
Run Date : 2007/09/14 15:16:21
Scen Year: 2012 -- All model years in the range 2003 to 2012 selected
Season : Annual
Area : Los Angeles County Average
I/M Stat : Enhanced Interim (2005) -- Using I/M schedule for area 59 Los Angeles (SC)
Emissions: Tons Per Day
****

	LDT1-CAT
Vehicles	217949
VMT/1000	8706
Trips	1409810
Reactive Organic Gas Emissions	
Run Exh	0.26
Idle Exh	0
Start Ex	0.12

Total Ex	0.37
Diurnal	0.02
Hot Soak	0.05
Running	0.21
Resting	0.02

Total	0.67
Carbon Monoxide Emissions	
Run Exh	10.39
Idle Exh	0
Start Ex	2.18

Total Ex	12.57
Oxides of Nitrogen Emissions	
Run Exh	0.71
Idle Exh	0
Start Ex	0.14

Total Ex	0.86
Carbon Dioxide Emissions (000)	
Run Exh	7.75
Idle Exh	0
Start Ex	0.14

Total Ex	7.89
PM10 Emissions	
Run Exh	0.19
Idle Exh	0
Start Ex	0

Total Ex	0.19
TireWear	0.08
BrakeWr	0.12

Total	0.39
Lead	0
SOx	0.08
Fuel Consumption (000 gallons)	
Gasoline	809.93
Diesel	0

Title : Los Angeles County Avg Annual CYr 2012 Default Title
Version : Emfac2007 V2.3 Nov 1 2006 ** WIS Enabled **
Run Date : 2007/09/14 15:33:25
Scen Year: 2012 -- All model years in the range 2003 to 2012 selected
Season : Annual
Area : Los Angeles County Average
I/M Stat : Enhanced Interim (2005) -- Using I/M schedule for area 59 Los Angeles (SC)
Emissions: Tons Per Day
****

	MHDT-CAT
Vehicles	5952
VMT/1000	404
Trips	271834
Reactive Organic Gas Emissions	
Run Exh	0.09
Idle Exh	0.01
Start Ex	0.13

Total Ex	0.23
Diurnal	0
Hot Soak	0
Running	0.01
Resting	0

Total	0.25
Carbon Monoxide Emissions	
Run Exh	1.16
Idle Exh	0.08
Start Ex	2.13

Total Ex	3.38
Oxides of Nitrogen Emissions	
Run Exh	0.19
Idle Exh	0
Start Ex	0.32

Total Ex	0.51
Carbon Dioxide Emissions (000)	
Run Exh	0.62
Idle Exh	0
Start Ex	0.01

Total Ex	0.63
PM10 Emissions	
Run Exh	0.01
Idle Exh	0
Start Ex	0

Total Ex	0.01
TireWear	0.01
BrakeWr	0.01

Total	0.02
Lead	0
SOx	0.01
Fuel Consumption (000 gallons)	
Gasoline	65.49
Diesel	0

Title : Statewide totals Avg Annual CYr 2012 Default Title
Version : Emfac2007 V2.3 Nov 1 2006
Run Date : 2007/09/10 12:55:07
Scen Year: 2012 -- All model years in the range 2003 to 2012 selected
Season : Annual
Area : Statewide totals
****
Year: 2012 -- Model Years 2003 to 2012 Inclusive --
Emfac2007 Emission Factors: V2.3 Nov 1 2006

State Average State Average

Table 1: Running Exhaust Emissions (grams/mile; grams/idle-hour)

Pollutant Name: Reactive Org Gases Temperature: 65F Relative Humidity: 60%

Speed MPH	MHD NCAT	MHD CAT	MHD DSL	MHD ALL
0	0	23.783	3.173	6.487

Pollutant Name: Carbon Monoxide Temperature: 65F Relative Humidity: 60%

Speed MPH	MHD NCAT	MHD CAT	MHD DSL	MHD ALL
0	0	142.639	26.3	45.008

Pollutant Name: Oxides of Nitrogen Temperature: 65F Relative Humidity: 60%

Speed MPH	MHD NCAT	MHD CAT	MHD DSL	MHD ALL
0	0	1.551	75.051	63.232

Pollutant Name: Carbon Dioxide Temperature: 65F Relative Humidity: 60%

Speed MPH	MHD NCAT	MHD CAT	MHD DSL	MHD ALL
0	0	4776.9	4098	4207.172

Pollutant Name: Sulfur Dioxide Temperature: 65F Relative Humidity: 60%

Speed MPH	MHD NCAT	MHD CAT	MHD DSL	MHD ALL
0	0	0.049	0.039	0.041

Pollutant Name: PM10 Temperature: 65F Relative Humidity: 60%

Speed MPH	MHD NCAT	MHD CAT	MHD DSL	MHD ALL
0	0	0	0.761	0.638

Pollutant Name: PM10 - Tire Wear Temperature: 65F Relative Humidity: 60%

Speed MPH	MHD NCAT	MHD CAT	MHD DSL	MHD ALL
0	0	0	0	0

Pollutant Name: PM10 - Brake Wear Temperature: 65F Relative Humidity: 60%

Speed MPH	MHD NCAT	MHD CAT	MHD DSL	MHD ALL
0	0	0	0	0

Pollutant Name: Gasoline - mi/gal Temperature: 65F Relative Humidity: 60%

Speed MPH	MHD NCAT	MHD CAT	MHD DSL	MHD ALL
0	0	0	0	0

Pollutant Name: Diesel - mi/gal Temperature: 65F Relative Humidity: 60%

Speed MPH	MHD NCAT	MHD CAT	MHD DSL	MHD ALL
0	0	0	0	0

Title : Los Angeles County Avg Annual CYr 2012 Default Title
Version : Emfac2007 V2.3 Nov 1 2006 ** WIS Enabled **
Run Date : 2007/09/14 15:28:56
Scen Year: 2012 -- All model years in the range 2004 to 2012 selected
Season : Annual
Area : Los Angeles County Average
I/M Stat : Enhanced Interim (2005) -- Using I/M schedule for area 59 Los Angeles (SC)
Emissions: Tons Per Day
****

	LDT1-CAT	LHDT1-CAT
Vehicles	197013	37170
VMT/1000	7997	2176
Trips	1276880	1229090
Reactive Organic Gas Emissions		
Run Exh	0.2	0.06
Idle Exh	0	0.05
Start Ex	0.08	0.23
	-------	-------
Total Ex	0.28	0.34
Diurnal	0.01	0
Hot Soak	0.03	0.01
Running	0.16	0.05
Resting	0.01	0
	-------	-------
Total	0.5	0.4
Carbon Monoxide Emissions		
Run Exh	7.9	0.91
Idle Exh	0	0.31
Start Ex	1.52	3.16
	-------	-------
Total Ex	9.42	4.39
Oxides of Nitrogen Emissions		
Run Exh	0.53	0.31
Idle Exh	0	0
Start Ex	0.09	2.26
	-------	-------
Total Ex	0.62	2.57
Carbon Dioxide Emissions (000)		
Run Exh	7.12	3.34
Idle Exh	0	0.01
Start Ex	0.13	0.06
	-------	-------
Total Ex	7.24	3.41
PM10 Emissions		
Run Exh	0.16	0.04
Idle Exh	0	0
Start Ex	0	0
	-------	-------
Total Ex	0.16	0.04
TireWear	0.07	0.03
BrakeWr	0.11	0.03
	-------	-------
Total	0.34	0.1
Lead	0	0
SOx	0.07	0.03
Fuel Consumption (000 gallons)		
Gasoline	743.1	350.12
Diesel	0	0

Title : Statewide totals Avg Annual CYr 2012 Default Title
Version : Emfac2007 V2.3 Nov 1 2006
Run Date : 2007/09/10 12:53:52
Scen Year: 2012 -- All model years in the range 2004 to 2012 selected
Season : Annual
Area : Statewide totals
****
Year: 2012 -- Model Years 2004 to 2012 Inclusive --
Emfac2007 Emission Factors: V2.3 Nov 1 2006

State Average State Average

Table 1: Running Exhaust Emissions (grams/mile; grams/idle-hour)

Pollutant Name: Reactive Org Gases Temperature: 65F Relative Humidity: 60%

Speed MPH	LHD1 NCAT	LHD1 CAT	LHD1 DSL	LHD1 ALL
0	0	23.664	3.173	18.199

Pollutant Name: Carbon Monoxide Temperature: 65F Relative Humidity: 60%

Speed MPH	LHD1 NCAT	LHD1 CAT	LHD1 DSL	LHD1 ALL
0	0	142.195	26.3	111.287

Pollutant Name: Oxides of Nitrogen Temperature: 65F Relative Humidity: 60%

Speed MPH	LHD1 NCAT	LHD1 CAT	LHD1 DSL	LHD1 ALL
0	0	1.543	75.051	21.147

Pollutant Name: Carbon Dioxide Temperature: 65F Relative Humidity: 60%

Speed MPH	LHD1 NCAT	LHD1 CAT	LHD1 DSL	LHD1 ALL
0	0	4776.899	4098	4595.84

Pollutant Name: Sulfur Dioxide Temperature: 65F Relative Humidity: 60%

Speed MPH	LHD1 NCAT	LHD1 CAT	LHD1 DSL	LHD1 ALL
0	0	0.049	0.039	0.046

Pollutant Name: PM10 Temperature: 65F Relative Humidity: 60%

Speed MPH	LHD1 NCAT	LHD1 CAT	LHD1 DSL	LHD1 ALL
0	0	0	0.749	0.2

Pollutant Name: PM10 - Tire Wear Temperature: 65F Relative Humidity: 60%

Speed MPH	LHD1 NCAT	LHD1 CAT	LHD1 DSL	LHD1 ALL
0	0	0	0	0

Pollutant Name: PM10 - Brake Wear Temperature: 65F Relative Humidity: 60%

Speed MPH	LHD1 NCAT	LHD1 CAT	LHD1 DSL	LHD1 ALL
0	0	0	0	0

Pollutant Name: Gasoline - mi/gal Temperature: 65F Relative Humidity: 60%

Speed MPH	LHD1 NCAT	LHD1 CAT	LHD1 DSL	LHD1 ALL
0	0	0	0	0

Pollutant Name: Diesel - mi/gal Temperature: 65F Relative Humidity: 60%

Speed MPH	LHD1 NCAT	LHD1 CAT	LHD1 DSL	LHD1 ALL
0	0	0	0	0

Title : Los Angeles County Avg Annual CYr 2012 Default Title
Version : Emfac2007 V2.3 Nov 1 2006 ** WIS Enabled **
Run Date : 2007/09/14 15:23:33
Scen Year: 2012 -- All model years in the range 2005 to 2012 selected
Season : Annual
Area : Los Angeles County Average
I/M Stat : Enhanced Interim (2005) -- Using I/M schedule for area 59 Los Angeles (SC)
Emissions: Tons Per Day
****

	LDT1-CAT
Vehicles	176613
VMT/1000	7290
Trips	1146540
Reactive Organic Gas Emissions	
Run Exh	0.15
Idle Exh	0
Start Ex	0.05

Total Ex	0.21
Diurnal	0.01
Hot Soak	0.02
Running	0.12
Resting	0.01

Total	0.36
Carbon Monoxide Emissions	
Run Exh	5.85
Idle Exh	0
Start Ex	0.99

Total Ex	6.84
Oxides of Nitrogen Emissions	
Run Exh	0.4
Idle Exh	0
Start Ex	0.05

Total Ex	0.45
Carbon Dioxide Emissions (000)	
Run Exh	6.48
Idle Exh	0
Start Ex	0.11

Total Ex	6.6
PM10 Emissions	
Run Exh	0.13
Idle Exh	0
Start Ex	0

Total Ex	0.14
TireWear	0.06
BrakeWr	0.1

Total	0.3
Lead	0
SOx	0.06
Fuel Consumption (000 gallons)	
Gasoline	676.61
Diesel	0

APPENDIX H-4

DEATILED EMISSION CALCULATIONS, EMISSION FACTOR DERIVATION, EMFAC2007 OUTPUT, AND SPECIATION PROFILE FOR PROJECT YEAR 2014

Summary of Emissions from Yard Trucks
Dolores and ICTF Rail Yards, Long Beach, CA

Running Exhaust Emissions

				Annual		Carbon	2014 Emission Factors								2014 Emission Estimates							
	Vehicle	Fuel	Model	VMT	Fuel Use	Oxidation	(g/mi)[5,6]					(kg/gal)[4]			(tons/yr)					(metric tons/yr)		
Yard	Class[1]	Type[1]	Year[2]	(mi/yr)[3]	(gal/yr)[4]	Factor[5]	ROG	CO	NOx	PM10	SOx	CO2	N2O[7]	CH4[7]	ROG	CO	NOx	PM10	SOx	CO2	N2O	CH4
ICTF	LDT	Gasoline	2000-2014	73,000	6,805.55	99%	0.04	1.61	0.11	0.05	0.01	8.87	1.23E-05	1.60E-04	0.00	0.13	0.01	0.00	0.00	59.76	8.35E-05	1.09E-03
ICTF	LDT	Gasoline	2003-2014	73,000	6,780.57	99%	0.03	1.02	0.07	0.04	0.01	8.87	1.23E-05	1.60E-04	0.00	0.08	0.01	0.00	0.00	59.54	8.32E-05	1.08E-03
ICTF	LDT	Gasoline	2003-2014	73,000	6,780.57	99%	0.03	1.02	0.07	0.04	0.01	8.87	1.23E-05	1.60E-04	0.00	0.08	0.01	0.00	0.00	59.54	8.32E-05	1.08E-03
ICTF	LDT	Gasoline	2004-2014	73,000	6,773.07	99%	0.02	0.86	0.06	0.04	0.01	8.87	1.23E-05	1.60E-04	0.00	0.07	0.00	0.00	0.00	59.48	8.31E-05	1.08E-03
ICTF	LHDT 1	Gasoline	2004-2014	73,000	11,752.97	99%	0.02	0.38	0.12	0.04	0.01	8.87	1.23E-05	1.60E-04	0.00	0.03	0.01	0.00	0.00	103.21	1.44E-04	1.87E-03
Dolores	MHD	Gasoline	2003-2014	12,644	2,051.81	99%	0.15	2.22	0.37	0.02	0.02	8.87	1.23E-05	1.60E-04	0.00	0.03	0.01	0.00	0.00	18.02	2.52E-05	3.27E-04
Dolores	LDT	Gasoline	2004-2014	45,000	4,175.18	99%	0.03	1.02	0.07	0.04	0.01	8.87	1.23E-05	1.60E-04	0.00	0.05	0.00	0.00	0.00	36.66	5.12E-05	6.66E-04
Dolores	LDT	Gasoline	2004-2014	36,608	3,396.56	99%	0.03	1.02	0.07	0.04	0.01	8.87	1.23E-05	1.60E-04	0.00	0.04	0.00	0.00	0.00	29.83	4.17E-05	5.42E-04
Dolores	LDT	Gasoline	2005-2014	23,756	2,201.81	99%	0.02	0.72	0.05	0.02	0.01	8.87	1.23E-05	1.60E-04	0.00	0.02	0.00	0.00	0.00	19.33	2.70E-05	3.51E-04
Total				**483,007**											**0.02**	**0.53**	**0.05**	**0.02**	**0.00**	**445.37**	**0.0006**	**0.0081**

Idling Exhaust Emissions

						Carbon	2014 Emission Factors								2014 Emission Estimates							
	Vehicle	Fuel	Model	Idling [8]	Fuel Use	Oxidation	(g/hr)[9,10]					(kg/gal)[4]			(tons/yr)					(metric tons/yr)		
Yard	Class	Type	Year	(hr/yr)	(gal/yr)	Factor[3]	ROG	CO	NOx	PM10	SOx	CO2	N2O[7]	CH4[7]	ROG	CO	NOx	PM10	SOx	CO2	N2O	CH4
ICTF	LHDT 1	Gasoline	2004-2014	91.25	49.64	99%	22.96	138.91	1.48	0.00	0.05	8.87	1.23E-05	1.60E-04	0.00	0.01	0.00	0.00	0.00	0.44	6.09E-07	7.92E-06
Dolores	MHD	Gasoline	2003-2014	91.25	49.64	99%	23.25	140.05	1.50	0.00	0.05	8.87	1.23E-05	1.60E-04	0.00	0.01	0.00	0.00	0.00	0.44	6.09E-07	7.92E-06
Total															**0.00**	**0.03**	**0.00**	**0.00**	**0.00**	**0.87**	**1.22E-06**	**1.58E-05**

Notes:

1. Assumed the same number and types of vehicles as the 2005 baseline year.
2. Emissions for the 2014 calendar year were based on a fleet average emission factor. Emission factors were generated for a fleet consisting of the vehicles model years existing in 2005 and 2014. For example, in 2005, there was a MY 2000 Jeep Cherokee operating at the Yard. For the 2014 emission estimates, I assumed that this vehicle could be replaced at some time with a newer vehicle of any make and model.
2. Annual VMT estimated by PURR personnel for the 2005 baseline year. Assumed no change in annual VMT for 2014.
3. Fuel use calculated using the EMFAC2007 model with the BURDEN output option.
4. From the Air Resources Board's Draft *Emission Factors for Mandatory Reporting Programs,* August 10, 2007.
5. Running exhaust emissions calculated using the EMFAC2007 model with the BURDEN output option.
6. Running exhaust emission factor calculations assumed an average speed of 15 mph.
7. Based on a gasoline HHV of 122,697 Btu/gal (Source: Transportation Energy Data Book: Edition 26, U.S. Department of Energy, 2007).
8. Idling time (hr/yr) is an engineering estimate.
9. Idling exhaust emissions factors for LHDT1 and MHD vehicles calculated using the EMFAC2007 model with the AMFAC output option.
10. Idling exhaust emissions from LDT vehicles are negligible.

Summary of TAC Emissions from Gasoline-Fueled Yard Trucks
Dolores and ICTF Rail Yards, Long Beach, CA

Profile[1]	CAS	Chemical Name	Organic Fraction	2014 Emissions (tpy)		
				Dolores	ICTF	Total
2105	95636	1,2,4-trimethylbenzene	0.0120	8.73E-05	1.57E-04	2.44E-04
2105	106990	1,3-butadiene	0.0068	4.94E-05	8.87E-05	1.38E-04
2105	540841	2,2,4-trimethylpentane	0.0288	2.09E-04	3.75E-04	5.84E-04
2105	75070	acetaldehyde	0.0035	2.53E-05	4.54E-05	7.07E-05
2105	107028	acrolein (2-propenal)	0.0017	1.20E-05	2.15E-05	3.35E-05
2105	71432	benzene	0.0309	2.24E-04	4.02E-04	6.26E-04
2105	4170303	crotonaldehyde	0.0004	2.62E-06	4.70E-06	7.32E-06
2105	110827	cyclohexane	0.0077	5.57E-05	9.99E-05	1.56E-04
2105	100414	ethylbenzene	0.0131	9.50E-05	1.71E-04	2.66E-04
2105	74851	ethylene	0.0794	5.76E-04	1.03E-03	1.61E-03
2105	50000	formaldehyde	0.0197	1.43E-04	2.57E-04	4.00E-04
2105	78795	isoprene	0.0018	1.28E-05	2.30E-05	3.59E-05
2105	98828	isopropylbenzene (cumene)	0.0001	8.73E-07	1.57E-06	2.44E-06
2105	67561	methyl alcohol	0.0015	1.11E-05	1.99E-05	3.09E-05
2105	78933	methyl ethyl ketone (mek) (2-butanone)	0.0002	1.65E-06	2.97E-06	4.62E-06
2105	108383	m-xylene	0.0445	3.23E-04	5.79E-04	9.02E-04
2105	91203	naphthalene	0.0006	4.27E-06	7.67E-06	1.19E-05
2105	110543	n-hexane	0.0200	1.45E-04	2.60E-04	4.05E-04
2105	95476	o-xylene	0.0155	1.12E-04	2.01E-04	3.13E-04
2105	115071	propylene	0.0382	2.77E-04	4.98E-04	7.75E-04
2105	100425	styrene	0.0015	1.11E-05	2.00E-05	3.11E-05
2105	108883	toluene	0.0718	5.22E-04	9.36E-04	1.46E-03
Total				**2.90E-03**	**5.21E-03**	**8.11E-03**

Notes:

1. Organic fraction from ARBs SPECIATE database. Data is from "Cat stabilzed exhaust 2005 SSD etoh 2% O (MTBE phaseout)" option.
2. Emissions were calculated for only chemicals that were in both the SPECIATE database and the AB2588 list.
3. Organic fraction reported on a ROG basis using ARB's Speciate ROG/TOG ratio (0.8012).

Title : Los Angeles County Avg Annual CYr 2014 Default Title
Version : Emfac2007 V2.3 Nov 1 2006 ** WIS Enabled **
Run Date : 2007/09/16 09:13:47
Scen Year: 2014 -- All model years in the range 2000 to 2014 selected
Season : Annual
Area : Los Angeles County Average
I/M Stat : Enhanced Interim (2005) -- Using I/M schedule for area 59 Los Angeles (SC)
Emissions: Tons Per Day
****

	LDT1-CAT
Vehicles	339495
VMT/1000	12604
Trips	2164500
Reactive Organic Gas Emissions	
Run Exh	0.54
Idle Exh	0
Start Ex	0.29

Total Ex	0.83
Diurnal	0.06
Hot Soak	0.19
Running	0.64
Resting	0.07

Total	1.79
Carbon Monoxide Emissions	
Run Exh	22.35
Idle Exh	0
Start Ex	5.52

Total Ex	27.87
Oxides of Nitrogen Emissions	
Run Exh	1.48
Idle Exh	0
Start Ex	0.4

Total Ex	1.88
Carbon Dioxide Emissions (000)	
Run Exh	11.22
Idle Exh	0
Start Ex	0.21

Total Ex	11.43
PM10 Emissions	
Run Exh	0.37
Idle Exh	0
Start Ex	0.01

Total Ex	0.39
TireWear	0.11
BrakeWr	0.17

Total	0.67
Lead	0
SOx	0.11
Fuel Consumption (000 gallons)	
Gasoline	1175.03
Diesel	0

Title : Los Angeles County Avg Annual CYr 2014 Default Title
Version : Emfac2007 V2.3 Nov 1 2006 ** WIS Enabled **
Run Date : 2007/09/16 09:20:45
Scen Year: 2014 -- All model years in the range 2003 to 2014 selected
Season : Annual
Area : Los Angeles County Average
I/M Stat : Enhanced Interim (2005) -- Using I/M schedule for area 59 Los Angeles (SC)
Emissions: Tons Per Day
****

	LDT1-CAT
Vehicles	257314
VMT/1000	10033
Trips	1657620
Reactive Organic Gas Emissions	
Run Exh	0.28
Idle Exh	0
Start Ex	0.12

Total Ex	0.4
Diurnal	0.02
Hot Soak	0.07
Running	0.3
Resting	0.03

Total	0.83
Carbon Monoxide Emissions	
Run Exh	11.25
Idle Exh	0
Start Ex	2.36

Total Ex	13.62
Oxides of Nitrogen Emissions	
Run Exh	0.76
Idle Exh	0
Start Ex	0.15

Total Ex	0.9
Carbon Dioxide Emissions (000)	
Run Exh	8.92
Idle Exh	0
Start Ex	0.16

Total Ex	9.08
PM10 Emissions	
Run Exh	0.24
Idle Exh	0
Start Ex	0.01

Total Ex	0.25
TireWear	0.09
BrakeWr	0.14

Total	0.47
Lead	0
SOx	0.09
Fuel Consumption (000 gallons)	
Gasoline	931.91
Diesel	0

Title : Los Angeles County Avg Annual CYr 2014 Default Title
Version : Emfac2007 V2.3 Nov 1 2006 ** WIS Enabled **
Run Date : 2007/09/16 09:51:05
Scen Year: 2014 -- All model years in the range 2003 to 2014 selected
Season : Annual
Area : Los Angeles County Average
I/M Stat : Enhanced Interim (2005) -- Using I/M schedule for area 59 Los Angeles (SC)
Emissions: Tons Per Day
****

	MHDT-CAT
Vehicles	7171
VMT/1000	469
Trips	327496
Reactive Organic Gas Emissions	
Run Exh	0.08
Idle Exh	0.02
Start Ex	0.16

Total Ex	0.26
Diurnal	0
Hot Soak	0
Running	0.02
Resting	0

Total	0.28
Carbon Monoxide Emissions	
Run Exh	1.15
Idle Exh	0.09
Start Ex	2.44

Total Ex	3.68
Oxides of Nitrogen Emissions	
Run Exh	0.19
Idle Exh	0
Start Ex	0.36

Total Ex	0.55
Carbon Dioxide Emissions (000)	
Run Exh	0.72
Idle Exh	0
Start Ex	0.01

Total Ex	0.74
PM10 Emissions	
Run Exh	0.01
Idle Exh	0
Start Ex	0

Total Ex	0.01
TireWear	0.01
BrakeWr	0.01

Total	0.03
Lead	0
SOx	0.01
Fuel Consumption (000 gallons)	
Gasoline	76.11
Diesel	0

Title : Statewide totals Avg Annual CYr 2014 Default Title
Version : Emfac2007 V2.3 Nov 1 2006
Run Date : 2007/09/16 09:55:16
Scen Year: 2014 -- All model years in the range 2003 to 2014 selected
Season : Annual
Area : Statewide totals
****
Year: 2014 -- Model Years 2003 to 2014 Inclusive --
Emfac2007 Emission Factors: V2.3 Nov 1 2006

State Average State Average

Table 1: Running Exhaust Emissions (grams/mile; grams/idle-hour)

Pollutant Name: Reactive Org Gases Temperature: 65F Relative Humidity: 60%

Speed MPH	MHD NCAT	MHD CAT	MHD DSL	MHD ALL
0	0	23.25	3.173	6.498

Pollutant Name: Carbon Monoxide Temperature: 65F Relative Humidity: 60%

Speed MPH	MHD NCAT	MHD CAT	MHD DSL	MHD ALL
0	0	140.051	26.3	45.137

Pollutant Name: Oxides of Nitrogen Temperature: 65F Relative Humidity: 60%

Speed MPH	MHD NCAT	MHD CAT	MHD DSL	MHD ALL
0	0	1.5	75.051	62.871

Pollutant Name: Carbon Dioxide Temperature: 65F Relative Humidity: 60%

Speed MPH	MHD NCAT	MHD CAT	MHD DSL	MHD ALL
0	0	4776.9	4098	4210.426

Pollutant Name: Sulfur Dioxide Temperature: 65F Relative Humidity: 60%

Speed MPH	MHD NCAT	MHD CAT	MHD DSL	MHD ALL
0	0	0.049	0.039	0.041

Pollutant Name: PM10 Temperature: 65F Relative Humidity: 60%

Speed MPH	MHD NCAT	MHD CAT	MHD DSL	MHD ALL
0	0	0	0.769	0.642

Pollutant Name: PM10 - Tire Wear Temperature: 65F Relative Humidity: 60%

Speed MPH	MHD NCAT	MHD CAT	MHD DSL	MHD ALL
0	0	0	0	0

Pollutant Name: PM10 - Brake Wear Temperature: 65F Relative Humidity: 60%

Speed MPH	MHD NCAT	MHD CAT	MHD DSL	MHD ALL
0	0	0	0	0

Pollutant Name: Gasoline - mi/gal Temperature: 65F Relative Humidity: 60%

Speed MPH	MHD NCAT	MHD CAT	MHD DSL	MHD ALL
0	0	0	0	0

Pollutant Name: Diesel - mi/gal Temperature: 65F Relative Humidity: 60%

Speed MPH	MHD NCAT	MHD CAT	MHD DSL	MHD ALL
0	0	0	0	0

Title : Los Angeles County Avg Annual CYr 2014 Default Title
Version : Emfac2007 V2.3 Nov 1 2006 ** WIS Enabled **
Run Date : 2007/09/16 09:29:00
Scen Year: 2014 -- All model years in the range 2004 to 2014 selected
Season : Annual
Area : Los Angeles County Average
I/M Stat : Enhanced Interim (2005) -- Using I/M schedule for area 59 Los Angeles (SC)
Emissions: Tons Per Day
****

	LDT1-CAT	LHDT1-CAT
Vehicles	237946	44875
VMT/1000	9404	2531
Trips	1536380	1483860
Reactive Organic Gas Emissions		
Run Exh	0.23	0.06
Idle Exh	0	0.06
Start Ex	0.09	0.28
	-------	-------
Total Ex	0.32	0.4
Diurnal	0.02	0
Hot Soak	0.05	0.01
Running	0.24	0.1
Resting	0.02	0
	-------	-------
Total	0.65	0.52
Carbon Monoxide Emissions		
Run Exh	8.93	1.05
Idle Exh	0	0.37
Start Ex	1.73	3.75
	-------	-------
Total Ex	10.66	5.17
Oxides of Nitrogen Emissions		
Run Exh	0.59	0.34
Idle Exh	0	0
Start Ex	0.09	2.64
	-------	-------
Total Ex	0.69	2.99
Carbon Dioxide Emissions (000)		
Run Exh	8.35	3.88
Idle Exh	0	0.01
Start Ex	0.15	0.07
	-------	-------
Total Ex	8.5	3.97
PM10 Emissions		
Run Exh	0.21	0.05
Idle Exh	0	0
Start Ex	0.01	0
	-------	-------
Total Ex	0.22	0.06
TireWear	0.08	0.03
BrakeWr	0.13	0.03
	-------	-------
Total	0.43	0.12
Lead	0	0
SOx	0.08	0.04
Fuel Consumption (000 gallons)		
Gasoline	872.52	407.49
Diesel	0	0

Title : Statewide totals Avg Annual CYr 2014 Default Title
Version : Emfac2007 V2.3 Nov 1 2006
Run Date : 2007/09/16 09:53:00
Scen Year: 2014 -- All model years in the range 2004 to 2014 selected
Season : Annual
Area : Statewide totals
****
Year: 2014 -- Model Years 2004 to 2014 Inclusive --
Emfac2007 Emission Factors: V2.3 Nov 1 2006

State Average State Average

Table 1: Running Exhaust Emissions (grams/mile; grams/idle-hour)

Pollutant Name: Reactive Org Gases Temperature: 65F Relative Humidity: 60%

Speed MPH	LHD1 NCAT	LHD1 CAT	LHD1 DSL	LHD1 ALL
0	0	22.957	3.173	17.991

Pollutant Name: Carbon Monoxide Temperature: 65F Relative Humidity: 60%

Speed MPH	LHD1 NCAT	LHD1 CAT	LHD1 DSL	LHD1 ALL
0	0	138.91	26.3	110.643

Pollutant Name: Oxides of Nitrogen Temperature: 65F Relative Humidity: 60%

Speed MPH	LHD1 NCAT	LHD1 CAT	LHD1 DSL	LHD1 ALL
0	0	1.478	75.051	19.946

Pollutant Name: Carbon Dioxide Temperature: 65F Relative Humidity: 60%

Speed MPH	LHD1 NCAT	LHD1 CAT	LHD1 DSL	LHD1 ALL
0	0	4776.899	4097.999	4606.487

Pollutant Name: Sulfur Dioxide Temperature: 65F Relative Humidity: 60%

Speed MPH	LHD1 NCAT	LHD1 CAT	LHD1 DSL	LHD1 ALL
0	0	0.049	0.039	0.046

Pollutant Name: PM10 Temperature: 65F Relative Humidity: 60%

Speed MPH	LHD1 NCAT	LHD1 CAT	LHD1 DSL	LHD1 ALL
0	0	0	0.755	0.189

Pollutant Name: PM10 - Tire Wear Temperature: 65F Relative Humidity: 60%

Speed MPH	LHD1 NCAT	LHD1 CAT	LHD1 DSL	LHD1 ALL
0	0	0	0	0

Pollutant Name: PM10 - Brake Wear Temperature: 65F Relative Humidity: 60%

Speed MPH	LHD1 NCAT	LHD1 CAT	LHD1 DSL	LHD1 ALL
0	0	0	0	0

Pollutant Name: Gasoline - mi/gal Temperature: 65F Relative Humidity: 60%

Speed MPH	LHD1 NCAT	LHD1 CAT	LHD1 DSL	LHD1 ALL
0	0	0	0	0

Pollutant Name: Diesel - mi/gal Temperature: 65F Relative Humidity: 60%

Speed MPH	LHD1 NCAT	LHD1 CAT	LHD1 DSL	LHD1 ALL
0	0	0	0	0

Title : Los Angeles County Avg Annual CYr 2014 Default Title
Version : Emfac2007 V2.3 Nov 1 2006 ** WIS Enabled **
Run Date : 2007/09/16 09:43:07
Scen Year: 2014 -- All model years in the range 2005 to 2014 selected
Season : Annual
Area : Los Angeles County Average
I/M Stat : Enhanced Interim (2005) -- Using I/M schedule for area 59 Los Angeles (SC)
Emissions: Tons Per Day
****

	LDT1-CAT
Vehicles	218856
VMT/1000	8771
Trips	1415940
Reactive Organic Gas Emissions	
Run Exh	0.18
Idle Exh	0
Start Ex	0.06

Total Ex	0.25
Diurnal	0.01
Hot Soak	0.03
Running	0.19
Resting	0.01

Total	0.49
Carbon Monoxide Emissions	
Run Exh	6.98
Idle Exh	0
Start Ex	1.2

Total Ex	8.18
Oxides of Nitrogen Emissions	
Run Exh	0.47
Idle Exh	0
Start Ex	0.06

Total Ex	0.52
Carbon Dioxide Emissions (000)	
Run Exh	7.79
Idle Exh	0
Start Ex	0.14

Total Ex	7.93
PM10 Emissions	
Run Exh	0.18
Idle Exh	0
Start Ex	0

Total Ex	0.19
TireWear	0.08
BrakeWr	0.12

Total	0.39
Lead	0
SOx	0.08
Fuel Consumption (000 gallons)	
Gasoline	812.95
Diesel	0

APPENDIX H-5

DEATILED EMISSION CALCULATIONS, EMISSION FACTOR DERIVATION, EMFAC2007 OUTPUT, AND SPECIATION PROFILE FOR PROJECT YEAR 2016

Summary of Emissions from Yard Trucks
Dolores and ICTF Rail Yards, Long Beach, CA

Running Exhaust Emissions

				Annual		Carbon	2016 Emission Factors								2016 Emission Estimates							
	Vehicle	Fuel	Model	VMT	Fuel Use	Oxidation	(g/mi)[5,6]					(kg/gal)[4]			(tons/yr)					(metric tons/yr)		
Yard	Class[1]	Type[1]	Year[2]	(mi/yr)[3]	(gal/yr)[4]	Factor[5]	ROG	CO	NOx	PM10	SOx	CO2	N2O[7]	CH4[7]	ROG	CO	NOx	PM10	SOx	CO2	N2O	CH4
ICTF	LDT	Gasoline	2000-2016	73,000	6,789.61	99%	0.04	1.47	0.10	0.05	0.01	8.87	1.23E-05	1.60E-04	0.00	0.12	0.01	0.00	0.00	59.62	8.33E-05	1.08E-03
ICTF	LDT	Gasoline	2003-2016	73,000	6,766.08	99%	0.02	0.96	0.06	0.05	0.01	8.87	1.23E-05	1.60E-04	0.00	0.08	0.01	0.00	0.00	59.41	8.30E-05	1.08E-03
ICTF	LDT	Gasoline	2003-2016	73,000	6,766.08	99%	0.02	0.96	0.06	0.05	0.01	8.87	1.23E-05	1.60E-04	0.00	0.08	0.01	0.00	0.00	59.41	8.30E-05	1.08E-03
ICTF	LDT	Gasoline	2004-2016	73,000	6,759.70	99%	0.02	0.83	0.05	0.04	0.01	8.87	1.23E-05	1.60E-04	0.00	0.07	0.00	0.00	0.00	59.36	8.29E-05	1.08E-03
ICTF	LHDT 1	Gasoline	2004-2016	73,000	11,764.73	99%	0.02	0.37	0.12	0.05	0.01	8.87	1.23E-05	1.60E-04	0.00	0.03	0.01	0.00	0.00	103.31	1.44E-04	1.88E-03
Dolores	MHD	Gasoline	2003-2016	12,644	2,050.98	99%	0.14	1.84	0.29	0.02	0.02	8.87	1.23E-05	1.60E-04	0.00	0.03	0.00	0.00	0.00	18.01	2.52E-05	3.27E-04
Dolores	LDT	Gasoline	2004-2016	45,000	4,166.94	99%	0.02	0.96	0.06	0.05	0.01	8.87	1.23E-05	1.60E-04	0.00	0.05	0.00	0.00	0.00	36.59	5.11E-05	6.65E-04
Dolores	LDT	Gasoline	2004-2016	36,608	3,389.85	99%	0.02	0.96	0.06	0.05	0.01	8.87	1.23E-05	1.60E-04	0.00	0.04	0.00	0.00	0.00	29.77	4.16E-05	5.41E-04
Dolores	LDT	Gasoline	2005-2016	23,756	2,197.41	99%	0.02	0.72	0.05	0.02	0.01	8.87	1.23E-05	1.60E-04	0.00	0.02	0.00	0.00	0.00	19.30	2.70E-05	3.51E-04
Total				**483,007**											**0.01**	**0.50**	**0.04**	**0.02**	**0.00**	**444.78**	**0.0006**	**0.0081**

Idling Exhaust Emissions

						Carbon	2016 Emission Factors								2016 Emission Estimates							
	Vehicle	Fuel	Model	Idling[8]	Fuel Use	Oxidation	(g/hr)[9,10]					(kg/gal)[4]			(tons/yr)					(metric tons/yr)		
Yard	Class	Type	Year	(hr/yr)	(gal/yr)	Factor[3]	ROG	CO	NOx	PM10	SOx	CO2	N2O[7]	CH4[7]	ROG	CO	NOx	PM10	SOx	CO2	N2O	CH4
ICTF	LHDT 1	Gasoline	2004-2016	91.25	49.64	99%	22.46	136.39	1.43	0.00	0.05	8.87	1.23E-05	1.60E-04	0.00	0.01	0.00	0.00	0.00	0.44	6.09E-07	7.92E-06
Dolores	MHD	Gasoline	2003-2016	91.25	49.64	99%	22.81	137.80	1.46	0.00	0.05	8.87	1.23E-05	1.60E-04	0.00	0.01	0.00	0.00	0.00	0.44	6.09E-07	7.92E-06
Total															**0.00**	**0.03**	**0.00**	**0.00**	**0.00**	**0.87**	**1.22E-06**	**1.58E-05**

Notes:
1. Assumed the same number and types of vehicles as the 2005 baseline year.
2. Emissions for the 2014 calendar year were based on a fleet average emission factor. Emission factors were generated for a fleet consisting of the vehicles model years existing in 2005 and 2014. For example, in 2005, there was a MY 2000 Jeep Cherokee operating at the Yard. For the 2014 emission estimates, I assumed that this vehicle could be replaced at some time with a newer vehicle of any make and model.
2. Annual VMT estimated by UPRR personnel for the 2005 baseline year. Assumed no change in annual VMT for 2014.
3. Fuel use calculated using the EMFAC2007 model with the BURDEN output option.
4. From the Air Resources Board's Draft *Emission Factors for Mandatory Reporting Programs,* August 10, 2007.
5. Running exhaust emissions calculated using the EMFAC2007 model with the BURDEN output option.
6. Running exhaust emission factor calculations assumed an average speed of 15 mph.
7. Based on a gasoline HHV of 122,697 Btu/gal (Source: Transportation Energy Data Book: Edition 26, U.S. Department of Energy, 2007).
8. Idling time (hr/yr) is an engineering estimate.
9. Idling exhaust emissions factors for LHDT1 and MHD vehicles calculated using the EMFAC2007 model with the EMFAC output option.
10. Idling exhaust emissions from LDT vehicles are negligible.

Summary of TAC Emissions from Gasoline-Fueled Yard Trucks
Dolores and ICTF Rail Yards, Long Beach, CA

			Organic	2016 Emissions (tpy)		
Profile[1]	CAS	Chemical Name	Fraction	Dolores	ICTF	Total
2105	95636	1,2,4-trimethylbenzene	0.0120	8.30E-05	1.51E-04	2.34E-04
2105	106990	1,3-butadiene	0.0068	4.69E-05	8.57E-05	1.33E-04
2105	540841	2,2,4-trimethylpentane	0.0288	1.99E-04	3.63E-04	5.61E-04
2105	75070	acetaldehyde	0.0035	2.40E-05	4.39E-05	6.79E-05
2105	107028	acrolein (2-propenal)	0.0017	1.14E-05	2.08E-05	3.22E-05
2105	71432	benzene	0.0309	2.13E-04	3.89E-04	6.01E-04
2105	4170303	crotonaldehyde	0.0004	2.49E-06	4.54E-06	7.03E-06
2105	110827	cyclohexane	0.0077	5.29E-05	9.65E-05	1.49E-04
2105	100414	ethylbenzene	0.0131	9.03E-05	1.65E-04	2.55E-04
2105	74851	ethylene	0.0794	5.48E-04	1.00E-03	1.55E-03
2105	50000	formaldehyde	0.0197	1.36E-04	2.48E-04	3.84E-04
2105	78795	isoprene	0.0018	1.22E-05	2.23E-05	3.45E-05
2105	98828	isopropylbenzene (cumene)	0.0001	8.29E-07	1.51E-06	2.34E-06
2105	67561	methyl alcohol	0.0015	1.05E-05	1.92E-05	2.97E-05
2105	78933	methyl ethyl ketone (mek) (2-butanone)	0.0002	1.57E-06	2.87E-06	4.44E-06
2105	108383	m-xylene	0.0445	3.07E-04	5.60E-04	8.67E-04
2105	91203	naphthalene	0.0006	4.06E-06	7.41E-06	1.15E-05
2105	110543	n-hexane	0.0200	1.38E-04	2.51E-04	3.89E-04
2105	95476	o-xylene	0.0155	1.07E-04	1.95E-04	3.01E-04
2105	115071	propylene	0.0382	2.64E-04	4.81E-04	7.45E-04
2105	100425	styrene	0.0015	1.06E-05	1.93E-05	2.99E-05
2105	108883	toluene	0.0718	4.96E-04	9.05E-04	1.40E-03
Total				**2.76E-03**	**5.03E-03**	**7.79E-03**

Notes:
1. Organic fraction from ARBs SPECIATE database. Data is from "Cat stabilzed exhaust 2005 SSD etoh 2% O (MTBE phaseout)" option.
2. Emissions were calculated for only chemicals that were in both the SPECIATE database and the AB2588 list.
3. Organic fraction reported on a ROG basis using ARB's Speciate ROG/TOG ratio (0.8012).

Title : Los Angeles County Avg Annual CYr 2016 Default Title
Version : Emfac2007 V2.3 Nov 1 2006 ** WIS Enabled **
Run Date : 2007/09/16 10:03:09
Scen Year: 2016 -- All model years in the range 2000 to 2016 selected
Season : Annual
Area : Los Angeles County Average
I/M Stat : Enhanced Interim (2005) -- Using I/M schedule for area 59 Los Angeles (SC)
Emissions: Tons Per Day
****

	LDT1-CAT
Vehicles	365349
VMT/1000	13366
Trips	2318780
Reactive Organic Gas Emissions	
Run Exh	0.53
Idle Exh	0
Start Ex	0.27

Total Ex	0.8
Diurnal	0.07
Hot Soak	0.22
Running	0.74
Resting	0.08

Total	1.9
Carbon Monoxide Emissions	
Run Exh	21.66
Idle Exh	0
Start Ex	5.29

Total Ex	26.96
Oxides of Nitrogen Emissions	
Run Exh	1.41
Idle Exh	0
Start Ex	0.36

Total Ex	1.77
Carbon Dioxide Emissions (000)	
Run Exh	11.87
Idle Exh	0
Start Ex	0.23

Total Ex	12.1
PM10 Emissions	
Run Exh	0.42
Idle Exh	0
Start Ex	0.02

Total Ex	0.44
TireWear	0.12
BrakeWr	0.18

Total	0.74
Lead	0
SOx	0.12
Fuel Consumption (000 gallons)	
Gasoline	1243.15
Diesel	0

Title : Los Angeles County Avg Annual CYr 2016 Default Title
Version : Emfac2007 V2.3 Nov 1 2006 ** WIS Enabled **
Run Date : 2007/09/16 10:09:17
Scen Year: 2016 -- All model years in the range 2003 to 2016 selected
Season : Annual
Area : Los Angeles County Average
I/M Stat : Enhanced Interim (2005) -- Using I/M schedule for area 59 Los Angeles (SC)
Emissions: Tons Per Day
****

	LDT1-CAT
Vehicles	292799
VMT/1000	11169
Trips	1877810
Reactive Organic Gas Emissions	
Run Exh	0.3
Idle Exh	0
Start Ex	0.13

Total Ex	0.43
Diurnal	0.03
Hot Soak	0.09
Running	0.39
Resting	0.04

Total	0.97
Carbon Monoxide Emissions	
Run Exh	11.86
Idle Exh	0
Start Ex	2.47

Total Ex	14.33
Oxides of Nitrogen Emissions	
Run Exh	0.78
Idle Exh	0
Start Ex	0.14

Total Ex	0.93
Carbon Dioxide Emissions (000)	
Run Exh	9.9
Idle Exh	0
Start Ex	0.18

Total Ex	10.09
PM10 Emissions	
Run Exh	0.29
Idle Exh	0
Start Ex	0.01

Total Ex	0.3
TireWear	0.1
BrakeWr	0.15

Total	0.56
Lead	0
SOx	0.1
Fuel Consumption (000 gallons)	
Gasoline	1035.21
Diesel	0

Title : Los Angeles County Avg Annual CYr 2014 Default Title
Version : Emfac2007 V2.3 Nov 1 2006 ** WIS Enabled **
Run Date : 2007/09/16 10:28:23
Scen Year: 2016 -- All model years in the range 2003 to 2016 selected
Season : Annual
Area : Los Angeles County Average
I/M Stat : Enhanced Interim (2005) -- Using I/M schedule for area 59 Los Angeles (SC)
Emissions: Tons Per Day
****

	MHDT-CAT
Vehicles	8342
VMT/1000	528
Trips	380986
Reactive Organic Gas Emissions	
Run Exh	0.08
Idle Exh	0.02
Start Ex	0.17

Total Ex	0.27
Diurnal	0
Hot Soak	0
Running	0.03
Resting	0

Total	0.3
Carbon Monoxide Emissions	
Run Exh	1.07
Idle Exh	0.11
Start Ex	2.68

Total Ex	3.85
Oxides of Nitrogen Emissions	
Run Exh	0.17
Idle Exh	0
Start Ex	0.39

Total Ex	0.57
Carbon Dioxide Emissions (000)	
Run Exh	0.81
Idle Exh	0
Start Ex	0.02

Total Ex	0.83
PM10 Emissions	
Run Exh	0.01
Idle Exh	0
Start Ex	0

Total Ex	0.02
TireWear	0.01
BrakeWr	0.01

Total	0.03
Lead	0
SOx	0.01
Fuel Consumption (000 gallons)	
Gasoline	85.65
Diesel	0

Title : Statewide totals Avg Annual CYr 2016 Default Title
Version : Emfac2007 V2.3 Nov 1 2006
Run Date : 2007/09/16 10:32:38
Scen Year: 2016 -- All model years in the range 2003 to 2016 selected
Season : Annual
Area : Statewide totals
****
Year: 2016 -- Model Years 2003 to 2016 Inclusive --
Emfac2007 Emission Factors: V2.3 Nov 1 2006

State Average State Average

Table 1: Running Exhaust Emissions (grams/mile; grams/idle-hour)

Pollutant Name: Reactive Org Gases Temperature: 65F Relative Humidity: 60%

Speed MPH	MHD NCAT	MHD CAT	MHD DSL	MHD ALL
0	0	22.81	3.173	6.497

Pollutant Name: Carbon Monoxide Temperature: 65F Relative Humidity: 60%

Speed MPH	MHD NCAT	MHD CAT	MHD DSL	MHD ALL
0	0	137.804	26.3	45.173

Pollutant Name: Oxides of Nitrogen Temperature: 65F Relative Humidity: 60%

Speed MPH	MHD NCAT	MHD CAT	MHD DSL	MHD ALL
0	0	1.458	75.051	62.595

Pollutant Name: Carbon Dioxide Temperature: 65F Relative Humidity: 60%

Speed MPH	MHD NCAT	MHD CAT	MHD DSL	MHD ALL
0	0	4776.9	4098	4212.907

Pollutant Name: Sulfur Dioxide Temperature: 65F Relative Humidity: 60%

Speed MPH	MHD NCAT	MHD CAT	MHD DSL	MHD ALL
0	0	0.049	0.039	0.041

Pollutant Name: PM10 Temperature: 65F Relative Humidity: 60%

Speed MPH	MHD NCAT	MHD CAT	MHD DSL	MHD ALL
0	0	0	0.776	0.645

Pollutant Name: PM10 - Tire Wear Temperature: 65F Relative Humidity: 60%

Speed MPH	MHD NCAT	MHD CAT	MHD DSL	MHD ALL
0	0	0	0	0

Pollutant Name: PM10 - Brake Wear Temperature: 65F Relative Humidity: 60%

Speed MPH	MHD NCAT	MHD CAT	MHD DSL	MHD ALL
0	0	0	0	0

Pollutant Name: Gasoline - mi/gal Temperature: 65F Relative Humidity: 60%

Speed MPH	MHD NCAT	MHD CAT	MHD DSL	MHD ALL
0	0	0	0	0

Pollutant Name: Diesel - mi/gal Temperature: 65F Relative Humidity: 60%

Speed MPH	MHD NCAT	MHD CAT	MHD DSL	MHD ALL
0	0	0	0	0

Title : Los Angeles County Avg Annual CYr 2016 Default Title
Version : Emfac2007 V2.3 Nov 1 2006 ** WIS Enabled **
Run Date : 2007/09/16 10:15:55
Scen Year: 2016 -- All model years in the range 2004 to 2016 selected
Season : Annual
Area : Los Angeles County Average
I/M Stat : Enhanced Interim (2005) -- Using I/M schedule for area 59 Los Angeles (SC)
Emissions: Tons Per Day
****

	LDT1-CAT	LHDT1-CAT
Vehicles	275322	52097
VMT/1000	10621	2843
Trips	1769980	1722660
Reactive Organic Gas Emissions		
Run Exh	0.25	0.07
Idle Exh	0	0.07
Start Ex	0.1	0.32
	-------	-------
Total Ex	0.35	0.46
Diurnal	0.02	0
Hot Soak	0.07	0.02
Running	0.32	0.17
Resting	0.03	0
	-------	-------
Total	0.78	0.65
Carbon Monoxide Emissions		
Run Exh	9.76	1.16
Idle Exh	0	0.43
Start Ex	1.88	4.29
	-------	-------
Total Ex	11.64	5.87
Oxides of Nitrogen Emissions		
Run Exh	0.64	0.37
Idle Exh	0	0
Start Ex	0.1	2.96
	-------	-------
Total Ex	0.73	3.33
Carbon Dioxide Emissions (000)		
Run Exh	9.41	4.36
Idle Exh	0	0.01
Start Ex	0.17	0.09
	-------	-------
Total Ex	9.59	4.46
PM10 Emissions		
Run Exh	0.26	0.07
Idle Exh	0	0
Start Ex	0.01	0
	-------	-------
Total Ex	0.27	0.07
TireWear	0.09	0.04
BrakeWr	0.15	0.04
	-------	-------
Total	0.51	0.15
Lead	0	0
SOx	0.09	0.04
Fuel Consumption (000 gallons)		
Gasoline	983.49	458.18
Diesel	0	0

Title : Statewide totals Avg Annual CYr 2016 Default Title
Version : Emfac2007 V2.3 Nov 1 2006
Run Date : 2007/09/16 10:31:06
Scen Year: 2016 -- All model years in the range 2004 to 2016 selected
Season : Annual
Area : Statewide totals
****

Year: 2016 -- Model Years 2004 to 2016 Inclusive --
Emfac2007 Emission Factors: V2.3 Nov 1 2006

State Average State Average

Table 1: Running Exhaust Emissions (grams/mile; grams/idle-hour)

Pollutant Name: Reactive Org Gases Temperature: 65F Relative Humidity: 60%

Speed MPH	LHD1 NCAT	LHD1 CAT	LHD1 DSL	LHD1 ALL
0	0	22.459	3.173	17.843

Pollutant Name: Carbon Monoxide Temperature: 65F Relative Humidity: 60%

Speed MPH	LHD1 NCAT	LHD1 CAT	LHD1 DSL	LHD1 ALL
0	0	136.393	26.3	110.043

Pollutant Name: Oxides of Nitrogen Temperature: 65F Relative Humidity: 60%

Speed MPH	LHD1 NCAT	LHD1 CAT	LHD1 DSL	LHD1 ALL
0	0	1.431	75.051	19.052

Pollutant Name: Carbon Dioxide Temperature: 65F Relative Humidity: 60%

Speed MPH	LHD1 NCAT	LHD1 CAT	LHD1 DSL	LHD1 ALL
0	0	4776.9	4098	4614.409

Pollutant Name: Sulfur Dioxide Temperature: 65F Relative Humidity: 60%

Speed MPH	LHD1 NCAT	LHD1 CAT	LHD1 DSL	LHD1 ALL
0	0	0.049	0.039	0.046

Pollutant Name: PM10 Temperature: 65F Relative Humidity: 60%

Speed MPH	LHD1 NCAT	LHD1 CAT	LHD1 DSL	LHD1 ALL
0	0	0	0.76	0.182

Pollutant Name: PM10 - Tire Wear Temperature: 65F Relative Humidity: 60%

Speed MPH	LHD1 NCAT	LHD1 CAT	LHD1 DSL	LHD1 ALL
0	0	0	0	0

Pollutant Name: PM10 - Brake Wear Temperature: 65F Relative Humidity: 60%

Speed MPH	LHD1 NCAT	LHD1 CAT	LHD1 DSL	LHD1 ALL
0	0	0	0	0

Pollutant Name: Gasoline - mi/gal Temperature: 65F Relative Humidity: 60%

Speed MPH	LHD1 NCAT	LHD1 CAT	LHD1 DSL	LHD1 ALL
0	0	0	0	0

Pollutant Name: Diesel - mi/gal Temperature: 65F Relative Humidity: 60%

Speed MPH	LHD1 NCAT	LHD1 CAT	LHD1 DSL	LHD1 ALL
0	0	0	0	0

Title : Los Angeles County Avg Annual CYr 2016 Default Title
Version : Emfac2007 V2.3 Nov 1 2006 ** WIS Enabled **
Run Date : 2007/09/16 10:22:19
Scen Year: 2016 -- All model years in the range 2005 to 2016 selected
Season : Annual
Area : Los Angeles County Average
I/M Stat : Enhanced Interim (2005) -- Using I/M schedule for area 59 Los Angeles (SC)
Emissions: Tons Per Day
****

	LDT1-CAT
Vehicles	257801
VMT/1000	10063
Trips	1661010
Reactive Organic Gas Emissions	
Run Exh	0.21
Idle Exh	0
Start Ex	0.07

Total Ex	0.28
Diurnal	0.01
Hot Soak	0.05
Running	0.27
Resting	0.02

Total	0.63
Carbon Monoxide Emissions	
Run Exh	7.95
Idle Exh	0
Start Ex	1.39

Total Ex	9.34
Oxides of Nitrogen Emissions	
Run Exh	0.53
Idle Exh	0
Start Ex	0.06

Total Ex	0.59
Carbon Dioxide Emissions (000)	
Run Exh	8.91
Idle Exh	0
Start Ex	0.16

Total Ex	9.08
PM10 Emissions	
Run Exh	0.24
Idle Exh	0
Start Ex	0.01

Total Ex	0.24
TireWear	0.09
BrakeWr	0.14

Total	0.47
Lead	0
SOx	0.09
Fuel Consumption (000 gallons)	
Gasoline	930.84
Diesel	0

APPENDIX I

DIESEL-FUELED I.C. ENGINES

APPENDIX I-1

AP-42 SECTION 3.3

3.3 Gasoline And Diesel Industrial Engines

3.3.1 General

The engine category addressed by this section covers a wide variety of industrial applications of both gasoline and diesel internal combustion (IC) engines such as aerial lifts, fork lifts, mobile refrigeration units, generators, pumps, industrial sweepers/scrubbers, material handling equipment (such as conveyors), and portable well-drilling equipment. The three primary fuels for reciprocating IC engines are gasoline, diesel fuel oil (No.2), and natural gas. Gasoline is used primarily for mobile and portable engines. Diesel fuel oil is the most versatile fuel and is used in IC engines of all sizes. The rated power of these engines covers a rather substantial range, up to 250 horsepower (hp) for gasoline engines and up to 600 hp for diesel engines. (Diesel engines greater than 600 hp are covered in Section 3.4, "Large Stationary Diesel And All Stationary Dual-fuel Engines".) Understandably, substantial differences in engine duty cycles exist. It was necessary, therefore, to make reasonable assumptions concerning usage in order to formulate some of the emission factors.

3.3.2 Process Description

All reciprocating IC engines operate by the same basic process. A combustible mixture is first compressed in a small volume between the head of a piston and its surrounding cylinder. The mixture is then ignited, and the resulting high-pressure products of combustion push the piston through the cylinder. This movement is converted from linear to rotary motion by a crankshaft. The piston returns, pushing out exhaust gases, and the cycle is repeated.

There are 2 methods used for stationary reciprocating IC engines: compression ignition (CI) and spark ignition (SI). This section deals with both types of reciprocating IC engines. All diesel-fueled engines are compression ignited, and all gasoline-fueled engines are spark ignited.

In CI engines, combustion air is first compression heated in the cylinder, and diesel fuel oil is then injected into the hot air. Ignition is spontaneous because the air temperature is above the autoignition temperature of the fuel. SI engines initiate combustion by the spark of an electrical discharge. Usually the fuel is mixed with the air in a carburetor (for gasoline) or at the intake valve (for natural gas), but occasionally the fuel is injected into the compressed air in the cylinder.

CI engines usually operate at a higher compression ratio (ratio of cylinder volume when the piston is at the bottom of its stroke to the volume when it is at the top) than SI engines because fuel is not present during compression; hence there is no danger of premature autoignition. Since engine thermal efficiency rises with increasing pressure ratio (and pressure ratio varies directly with compression ratio), CI engines are more efficient than SI engines. This increased efficiency is gained at the expense of poorer response to load changes and a heavier structure to withstand the higher pressures.[1]

3.3.3 Emissions

Most of the pollutants from IC engines are emitted through the exhaust. However, some total organic compounds (TOC) escape from the crankcase as a result of blowby (gases that are vented from the oil pan after they have escaped from the cylinder past the piston rings) and from the fuel tank and carburetor because of evaporation. Nearly all of the TOCs from diesel CI engines enter the

atmosphere from the exhaust. Evaporative losses are insignificant in diesel engines due to the low volatility of diesel fuels.

The primary pollutants from internal combustion engines are oxides of nitrogen (NO_x), total organic compounds (TOC), carbon monoxide (CO), and particulates, which include both visible (smoke) and nonvisible emissions. Nitrogen oxide formation is directly related to high pressures and temperatures during the combustion process and to the nitrogen content, if any, of the fuel. The other pollutants, HC, CO, and smoke, are primarily the result of incomplete combustion. Ash and metallic additives in the fuel also contribute to the particulate content of the exhaust. Sulfur oxides (SO_x) also appear in the exhaust from IC engines. The sulfur compounds, mainly sulfur dioxide (SO_2), are directly related to the sulfur content of the fuel.[2]

3.3.3.1 Nitrogen Oxides -

Nitrogen oxide formation occurs by two fundamentally different mechanisms. The predominant mechanism with internal combustion engines is thermal NO_x which arises from the thermal dissociation and subsequent reaction of nitrogen (N_2) and oxygen (O_2) molecules in the combustion air. Most thermal NO_x is formed in the high-temperature region of the flame from dissociated molecular nitrogen in the combustion air. Some NO_x, called prompt NO_x, is formed in the early part of the flame from reaction of nitrogen intermediary species, and HC radicals in the flame. The second mechanism, fuel NO_x, stems from the evolution and reaction of fuel-bound nitrogen compounds with oxygen. Gasoline, and most distillate oils have no chemically-bound fuel N_2 and essentially all NO_x formed is thermal NO_x.

3.3.3.2 Total Organic Compounds -

The pollutants commonly classified as hydrocarbons are composed of a wide variety of organic compounds and are discharged into the atmosphere when some of the fuel remains unburned or is only partially burned during the combustion process. Most unburned hydrocarbon emissions result from fuel droplets that were transported or injected into the quench layer during combustion. This is the region immediately adjacent to the combustion chamber surfaces, where heat transfer outward through the cylinder walls causes the mixture temperatures to be too low to support combustion.

Partially burned hydrocarbons can occur because of poor air and fuel homogeneity due to incomplete mixing, before or during combustion; incorrect air/fuel ratios in the cylinder during combustion due to maladjustment of the engine fuel system; excessively large fuel droplets (diesel engines); and low cylinder temperature due to excessive cooling (quenching) through the walls or early cooling of the gases by expansion of the combustion volume caused by piston motion before combustion is completed.[2]

3.3.3.3 Carbon Monoxide -

Carbon monoxide is a colorless, odorless, relatively inert gas formed as an intermediate combustion product that appears in the exhaust when the reaction of CO to CO_2 cannot proceed to completion. This situation occurs if there is a lack of available oxygen near the hydrocarbon (fuel) molecule during combustion, if the gas temperature is too low, or if the residence time in the cylinder is too short. The oxidation rate of CO is limited by reaction kinetics and, as a consequence, can be accelerated only to a certain extent by improvements in air and fuel mixing during the combustion process.[2-3]

3.3.3.4 Smoke and Particulate Matter -

White, blue, and black smoke may be emitted from IC engines. Liquid particulates appear as white smoke in the exhaust during an engine cold start, idling, or low load operation. These are formed in the quench layer adjacent to the cylinder walls, where the temperature is not high enough to ignite the fuel. Blue smoke is emitted when lubricating oil leaks, often past worn piston rings, into the combustion chamber and is partially burned. Proper maintenance is the most effective method of preventing blue smoke emissions from all types of IC engines. The primary constituent of black smoke is agglomerated carbon particles (soot) formed in regions of the combustion mixtures that are oxygen deficient.[2]

3.3.3.5 Sulfur Oxides -

Sulfur oxides emissions are a function of only the sulfur content in the fuel rather than any combustion variables. In fact, during the combustion process, essentially all the sulfur in the fuel is oxidized to SO_2. The oxidation of SO_2 gives sulfur trioxide (SO_3), which reacts with water to give sulfuric acid (H_2SO_4), a contributor to acid precipitation. Sulfuric acid reacts with basic substances to give sulfates, which are fine particulates that contribute to PM-10 and visibility reduction. Sulfur oxide emissions also contribute to corrosion of the engine parts.[2-3]

3.3.4 Control Technologies

Control measures to date are primarily directed at limiting NO_x and CO emissions since they are the primary pollutants from these engines. From a NO_x control viewpoint, the most important distinction between different engine models and types of reciprocating engines is whether they are rich-burn or lean-burn. Rich-burn engines have an air-to-fuel ratio operating range that is near stoichiometric or fuel-rich of stoichiometric and as a result the exhaust gas has little or no excess oxygen. A lean-burn engine has an air-to-fuel operating range that is fuel-lean of stoichiometric; therefore, the exhaust from these engines is characterized by medium to high levels of O_2. The most common NO_x control technique for diesel and dual-fuel engines focuses on modifying the combustion process. However, selective catalytic reduction (SCR) and nonselective catalytic reduction (NSCR) which are post-combustion techniques are becoming available. Controls for CO have been partly adapted from mobile sources.[4]

Combustion modifications include injection timing retard (ITR), preignition chamber combustion (PCC), air-to-fuel ratio adjustments, and derating. Injection of fuel into the cylinder of a CI engine initiates the combustion process. Retarding the timing of the diesel fuel injection causes the combustion process to occur later in the power stroke when the piston is in the downward motion and combustion chamber volume is increasing. By increasing the volume, the combustion temperature and pressure are lowered, thereby lowering NO_x formation. ITR reduces NO_x from all diesel engines; however, the effectiveness is specific to each engine model. The amount of NO_x reduction with ITR diminishes with increasing levels of retard.[4]

Improved swirl patterns promote thorough air and fuel mixing and may include a precombustion chamber (PCC). A PCC is an antechamber that ignites a fuel-rich mixture that propagates to the main combustion chamber. The high exit velocity from the PCC results in improved mixing and complete combustion of the lean air/fuel mixture which lowers combustion temperature, thereby reducing NO_x emissions.[4]

The air-to-fuel ratio for each cylinder can be adjusted by controlling the amount of fuel that enters each cylinder. At air-to-fuel ratios less than stoichiometric (fuel-rich), combustion occurs under conditions of insufficient oxygen which causes NO_x to decrease because of lower oxygen and lower temperatures. Derating involves restricting the engine operation to lower than normal levels of power production for the given application. Derating reduces cylinder pressures and temperatures, thereby lowering NO_x formation rates.[4]

SCR is an add-on NO_x control placed in the exhaust stream following the engine and involves injecting ammonia (NH_3) into the flue gas. The NH_3 reacts with NO_x in the presence of a catalyst to form water and nitrogen. The effectiveness of SCR depends on fuel quality and engine duty cycle (load fluctuations). Contaminants in the fuel may poison or mask the catalyst surface causing a reduction or termination in catalyst activity. Load fluctuations can cause variations in exhaust temperature and NO_x concentration which can create problems with the effectiveness of the SCR system.[4]

NSCR is often referred to as a three-way conversion catalyst system because the catalyst reactor simultaneously reduces NO_x, CO, and HC and involves placing a catalyst in the exhaust stream of the engine. The reaction requires that the O_2 levels be kept low and that the engine be operated at fuel-rich air-to-fuel ratios.[4]

The most accurate method for calculating such emissions is on the basis of "brake-specific" emission factors (pounds per horsepower-hour [lb/hp-hr]). Emissions are the product of the brake-specific emission factor, the usage in hours, the rated power available, and the load factor (the power actually used divided by the power available). However, for emission inventory purposes, it is often easier to assess this activity on the basis of fuel used.

Once reasonable usage and duty cycles for this category were ascertained, emission values were aggregated to arrive at the factors for criteria and organic pollutants presented. Factors in Table 3.3-1 are in pounds per million British thermal unit (lb/MMBtu). Emission data for a specific design type were weighted according to estimated material share for industrial engines. The emission factors in these tables, because of their aggregate nature, are most appropriately applied to a population of industrial engines rather than to an individual power plant. Table 3.3-2 shows unweighted speciated organic compound and air toxic emission factors based upon only 2 engines. Their inclusion in this section is intended for rough order-of-magnitude estimates only.

Table 3.3-3 summarizes whether the various diesel emission reduction technologies (some of which may be applicable to gasoline engines) will generally increase or decrease the selected parameter. These technologies are categorized into fuel modifications, engine modifications, and exhaust after-treatments. Current data are insufficient to quantify the results of the modifications. Table 3.3-3 provides general information on the trends of changes on selected parameters.

3.3.5 Updates Since the Fifth Edition

The Fifth Edition was released in January 1995. Revisions to this section since that date are summarized below. For further detail, consult the memoranda describing each supplement or the background report for this section.

Supplement A, February 1996

No changes.

Supplement B, October 1996

- Text was revised concerning emissions and controls.
- The CO_2 emission factor was adjusted to reflect 98.5 percent conversion efficiency.

Table 3.3-1. EMISSION FACTORS FOR UNCONTROLLED GASOLINE AND DIESEL INDUSTRIAL ENGINES[a]

Pollutant	Gasoline Fuel (SCC 2-02-003-01, 2-03-003-01)		Diesel Fuel (SCC 2-02-001-02, 2-03-001-01)		EMISSION FACTOR RATING
	Emission Factor (lb/hp-hr) (power output)	Emission Factor (lb/MMBtu) (fuel input)	Emission Factor (lb/hp-hr) (power output)	Emission Factor (lb/MMBtu) (fuel input)	
NO_x	0.011	1.63	0.031	4.41	D
CO	0.439	62.7	6.68 E-03	0.95	D
SO_x	5.91 E-04	0.084	2.05 E-03	0.29	D
PM-10[b]	7.21 E-04	0.10	2.20 E-03	0.31	D
CO_2[c]	1.08	154	1.15	164	B
Aldehydes	4.85 E-04	0.07	4.63 E-04	0.07	D
TOC					
Exhaust	0.015	2.10	2.47 E-03	0.35	D
Evaporative	6.61 E-04	0.09	0.00	0.00	E
Crankcase	4.85 E-03	0.69	4.41 E-05	0.01	E
Refueling	1.08 E-03	0.15	0.00	0.00	E

[a] References 2,5-6,9-14. When necessary, an average brake-specific fuel consumption (BSFC) of 7,000 Btu/hp-hr was used to convert from lb/MMBtu to lb/hp-hr. To convert from lb/hp-hr to kg/kw-hr, multiply by 0.608. To convert from lb/MMBtu to ng/J, multiply by 430. SCC = Source Classification Code. TOC = total organic compounds.

[b] PM-10 = particulate matter less than or equal to 10 µm aerodynamic diameter. All particulate is assumed to be ≤ 1 µm in size.

[c] Assumes 99% conversion of carbon in fuel to CO_2 with 87 weight % carbon in diesel, 86 weight % carbon in gasoline, average BSFC of 7,000 Btu/hp-hr, diesel heating value of 19,300 Btu/lb, and gasoline heating value of 20,300 Btu/lb.

Table 3.3-2. SPECIATED ORGANIC COMPOUND EMISSION FACTORS FOR UNCONTROLLED DIESEL ENGINES[a]

EMISSION FACTOR RATING: E

Pollutant	Emission Factor (Fuel Input) (lb/MMBtu)
Benzene[b]	9.33 E-04
Toluene[b]	4.09 E-04
Xylenes[b]	2.85 E-04
Propylene	2.58 E-03
1,3-Butadiene[b,c]	<3.91 E-05
Formaldehyde[b]	1.18 E-03
Acetaldehyde[b]	7.67 E-04
Acrolein[b]	<9.25 E-05
Polycyclic aromatic hydrocarbons (PAH)	
Naphthalene[b]	8.48 E-05
Acenaphthylene	<5.06 E-06
Acenaphthene	<1.42 E-06
Fluorene	2.92 E-05
Phenanthrene	2.94 E-05
Anthracene	1.87 E-06
Fluoranthene	7.61 E-06
Pyrene	4.78 E-06
Benzo(a)anthracene	1.68 E-06
Chrysene	3.53 E-07
Benzo(b)fluoranthene	<9.91 E-08
Benzo(k)fluoranthene	<1.55 E-07
Benzo(a)pyrene	<1.88 E-07
Indeno(1,2,3-cd)pyrene	<3.75 E-07
Dibenz(a,h)anthracene	<5.83 E-07
Benzo(g,h,l)perylene	<4.89 E-07
TOTAL PAH	1.68 E-04

[a] Based on the uncontrolled levels of 2 diesel engines from References 6-7. Source Classification Codes 2-02-001-02, 2-03-001-01. To convert from lb/MMBtu to ng/J, multiply by 430.
[b] Hazardous air pollutant listed in the *Clean Air Act*.
[c] Based on data from 1 engine.

Table 3.3-3. EFFECT OF VARIOUS EMISSION CONTROL TECHNOLOGIES ON DIESEL ENGINES[a]

Technology	Affected Parameter	
	Increase	Decrease
Fuel modifications		
Sulfur content increase	PM, wear	
Aromatic content increase	PM, NO_x	
Cetane number		PM, NO_x
10% and 90% boiling point		PM
Fuel additives		PM, NO_x
Water/Fuel emulsions		NO_x
Engine modifications		
Injection timing retard	PM, BSFC	NO_x, power
Fuel injection pressure	PM, NO_x	
Injection rate control		NO_x, PM
Rapid spill nozzles		PM
Electronic timing & metering		NO_x, PM
Injector nozzle geometry		PM
Combustion chamber modifications		NO_x, PM
Turbocharging	PM, power	NO_x
Charge cooling		NO_x
Exhaust gas recirculation	PM, power, wear	NO_x
Oil consumption control		PM, wear
Exhaust after-treatment		
Particulate traps		PM
Selective catalytic reduction		NO_x
Oxidation catalysts		TOC, CO, PM

[a] Reference 8. PM = particulate matter. BSFC = brake-specific fuel consumption.

References For Section 3.3

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APPENDIX I-2

DEATILED EMISSION CALCULATIONS FOR THE
2005 BASELINE YEAR AND PROJECT YEARS 2010-2016

Summary of Emissions from Diesel-Fueled Internal Combustion Engines
Dolores and ICTF Rail Yards, Long Beach, CA

						Hours of		Carbon	2005 Emission Factors									2005 Emission Estimates								
					Rating	Operation	Fuel Use	Oxidation	(g/bhp-hr)[5]						(kg/gal)[4]			(tons/yr)						(metric tons/yr)		
Yard	Location	Equipment Type	Make	Fuel Type	(hp)	(hr/yr)[1,2]	(gal/yr)[3]	Factor[4]	ROG	CO	NOx	PM10	DPM	SOx	CO2	N2O[6]	CH4[6]	ROG	CO	NOx	PM10	DPM	SOx	CO2	N2O	CH4
ICTF	Administrative Building	Emergency Generator	Cat 3208	Diesel	269	20	272.01	99%	1.14	3.03	14.06	1.00	1.00	0.93	10.15	1.39E-05	4.16E-05	0.01	0.02	0.08	0.01	0.01	0.01	2.73	3.77E-06	1.13E-05
ICTF	Mechanical Department	Air Compressor	Ingersoll-Rand	Diesel	49	1000	2477.43	99%	1.14	3.03	14.06	1.00	1.00	0.93	10.15	1.39E-05	4.16E-05	0.06	0.16	0.76	0.05	0.05	0.05	24.89	3.44E-05	1.03E-04
Total																		**0.07**	**0.18**	**0.84**	**0.06**	**0.06**	**0.06**	**27.63**	**3.81E-05**	**1.14E-04**

Notes:

1. Hours of operation for the emergency generator based on CARB's ATCM for Stationary Compression Ignition Engines. The ATCM limits non-emergency operation to 20 hours per year. UP personnel estimate that this engine is operated no more than 30 minutes/month. The 20 hours/yr estimate was used to be conservative.
2. Hours of operation for the air compressor is an engineering estimate.
3. Annual fuel use based on a BSFC of 7,000 Btu/hp-hr, a Diesel fuel HHV of 19,500 lb/Btu, and a Diesel fuel density of 7.1 lb/gal.
4. From the Air Resources Board's Draf *Emission Factors for Mandatory Reporting Programs,* August 10, 2007*.*
5. Emission factors, in g/bhp-hr, from AP-42, Table 3.3-1, 10/96.
6. Based on a diesel fuel HHV of 5.825 MMBtu/barrel (from ARB Draft Emission Factors for Mandatory Reporting Programs, August 10, 2007) and 42 gallons per barrel.

Summary of Emissions from Diesel-Fueled Internal Combustion Engines
Dolores and ICTF Rail Yards, Long Beach, CA

						Hours of		Carbon	2010 Emission Factors									2010 Emission Estimates								
					Rating	Operation	Fuel Use	Oxidation	(g/bhp-hr)[5]						(kg/gal)[4]			(tons/yr)						(metric tons/yr)		
Yard	Location	Equipment Type	Make	Fuel Type	(hp)	(hr/yr)[1,2]	(gal/yr)[3]	Factor[4]	HC	CO	NOx	PM10	DPM	SOx	CO2	N2O[6]	CH4[6]	ROG	CO	NOx	PM10	DPM	SOx	CO2	N2O	CH4
ICTF	Administrative Building	Emergency Generator	Cat 3208	Diesel	269	20	272.01	99%	1.14	3.03	14.06	1.00	1.00	0.93	10.15	1.39E-05	4.16E-05	0.01	0.02	0.08	0.01	0.01	0.01	2.73	3.77E-06	1.13E-05
ICTF	Mechanical Department	Air Compressor	Ingersoll-Rand	Diesel	49	1000	2477.43	99%	1.14	3.03	14.06	1.00	1.00	0.93	10.15	1.39E-05	4.16E-05	0.06	0.16	0.76	0.05	0.05	0.05	24.89	3.44E-05	1.03E-04
Total																		**0.07**	**0.18**	**0.84**	**0.06**	**0.06**	**0.06**	**27.63**	**3.81E-05**	**1.14E-04**

Notes:

1. Hours of operation for the emergency generator based on CARB's ATCM for Stationary Compression Ignition Engines. The ATCM limits non-emergency operation to 20 hours per year. UP personnel estimate this engine is operated no more than 30 minutes/month. The 20 hours/yr estimate was used to be conservative. Assumed no increase in operations from the baseline year.
2. Hours of operation for the air compressor is an engineering estimate. Assumed no increase in operation from the baseline year.
3. Annual fuel use based on a BSFC of 7,000 Btu/hp-hr, a Diesel fuel HHV of 19,500 lb/Btu, and a Diesel fuel density of 7.1 lb/gal.
4. From the Air Resources Board's Draft *Emission Factors for Mandatory Reporting Programs,* August 10, 2007.
5. Emission factors, in g/bhp-hr, from AP-42, Table 3.3-1, 10/96.
6. Based on a diesel fuel HHV of 5.825 MMBtu/barrel (from ARB Draft Emission Factors for Mandatory Reporting Programs, August 10, 2007) and 42 gallons per barrel.

Summary of Emissions from Diesel-Fueled Internal Combustion Engines
Dolores and ICTF Rail Yards, Long Beach, CA

									2012 Emission Factors									2012 Emission Estimates								
									(g/bhp-hr)[5]						(kg/gal)[4]			(tons/yr)						(metric tons/yr)		
Yard	Location	Equipment Type	Make	Fuel Type	Rating (hp)	Hours of Operation (hr/yr)[1,2]	Fuel Use (gal/yr)[3]	Carbon Oxidation Factor[4]	HC	CO	NOx	PM10	DPM	SOx	CO2	N2O[6]	CH4[6]	ROG	CO	NOx	PM10	DPM	SOx	CO2	N2O	CH4
ICTF	Administrative Building	Emergency Generator	Cat 3208	Diesel	269	20	272.01	99%	1.14	3.03	14.06	1.00	1.00	0.93	10.15	1.39E-05	4.16E-05	0.01	0.02	0.08	0.01	0.01	0.01	2.73	3.77E-06	1.13E-05
ICTF	Mechanical Department	Air Compressor	Ingersoll-Rand	Diesel	49	1000	2477.43	99%	1.14	3.03	14.06	1.00	1.00	0.93	10.15	1.39E-05	4.16E-05	0.06	0.16	0.76	0.05	0.05	0.05	24.89	3.44E-05	1.03E-04
Total																		**0.07**	**0.18**	**0.84**	**0.06**	**0.06**	**0.06**	**27.63**	**3.81E-05**	**1.14E-04**

Notes:

1. Hours of operation for the emergency generator based on CARB's ATCM for Stationary Compression Ignition Engines. The ATCM limits non-emergency operation to 20 hours per year. UP personnel estimate that this engine is operated no more than 30 minutes/month. The 20 hours/yr estimate was used to be conservative. Assumed no increase in operations from the baseline year.
2. Hours of operation for the air compressor is an engineering estimate. Assumed no increase in operation from the baseline year.
3. Annual fuel use based on a BSFC of 7,000 Btu/hp-hr, a Diesel fuel HHV of 19,500 lb/Btu, and a Diesel fuel density of 7.1 lb/gal.
4. From the Air Resources Board's Draft *Emission Factors for Mandatory Reporting Programs,* August 10, 2007.
5. Emission factors, in g/bhp-hr, from AP-42, Table 3.3-1, 10/96.
6. Based on a diesel fuel HHV of 5.825 MMBtu/barrel (from ARB Draft Emission Factors for Mandatory Reporting Programs, August 10, 2007) and 42 gallons per barrel.

Summary of Emissions from Diesel-Fueled Internal Combustion Engines
Dolores and ICTF Rail Yards, Long Beach, CA

						Hours of		Carbon	2014 Emission Factors									2014 Emission Estimates								
					Rating	Operation	Fuel Use	Oxidation	(g/bhp-hr)[5]						(kg/gal)[4]			(tons/yr)						(metric tons/yr)		
Yard	Location	Equipment Type	Make	Fuel Type	(hp)	(hr/yr)[1,2]	(gal/yr)[3]	Factor[4]	HC	CO	NOx	PM10	DPM	SOx	CO2	N2O[6]	CH4[6]	ROG	CO	NOx	PM10	DPM	SOx	CO2	N2O	CH4
ICTF	Administrative Building	Emergency Generator	Cat 3208	Diesel	269	20	272.01	99%	1.14	3.03	14.06	1.00	1.00	0.93	10.15	1.39E-05	4.16E-05	0.01	0.02	0.08	0.01	0.01	0.01	2.73	3.77E-06	1.13E-05
ICTF	Mechanical Department	Air Compressor	Ingersoll-Rand	Diesel	49	1000	2477.43	99%	1.14	3.03	14.06	1.00	1.00	0.93	10.15	1.39E-05	4.16E-05	0.06	0.16	0.76	0.05	0.05	0.05	24.89	3.44E-05	1.03E-04
Total																		**0.07**	**0.18**	**0.84**	**0.06**	**0.06**	**0.06**	**27.63**	**3.81E-05**	**1.14E-04**

Notes:
1. Hours of operation for the emergency generator based on CARB's ATCM for Stationary Compression Ignition Engines. The ATCM limits non-emergency operation to 20 hours per year. UP personnel estimate that this engine is operated no more than 30 minutes/month. The 20 hours/yr estimate was used to be conservative. Assumed no increase in operations from the baseline year.
2. Hours of operation for the air compressor is an engineering estimate. Assumed no increase in operation from the baseline year.
3. Annual fuel use based on a BSFC of 7,000 Btu/hp-hr, a Diesel fuel HHV of 19,500 lb/Btu, and a Diesel fuel density of 7.1 lb/gal.
4. From the Air Resources Board's Draft *Emission Factors for Mandatory Reporting Programs*, August 10, 2007.
5. Emission factors, in g/bhp-hr, from AP-42, Table 3.3-1, 10/96.
6. Based on a diesel fuel HHV of 5.825 MMBtu/barrel (from ARB Draft Emission Factors for Mandatory Reporting Programs, August 10, 2007) and 42 gallons per barrel.

Summary of Emissions from Diesel-Fueled Internal Combustion Engines
Dolores and ICTF Rail Yards, Long Beach, CA

						Hours of		Carbon	2016 Emission Factors									2016 Emission Estimates					
					Rating	Operation	Fuel Use	Oxidation	(g/bhp-hr)[5]						(kg/gal)[4]			(tons/yr)					
Yard	Location	Equipment Type	Make	Fuel Type	(hp)	(hr/yr)[1,2]	(gal/yr)[3]	Factor[4]	HC	CO	NOx	PM10	DPM	SOx	CO2	N2O[6]	CH4[6]	ROG	CO	NOx	PM10	DPM	SOx
ICTF	Administrative Building	Emergency Generator	Cat 3208	Diesel	269	20	272.01	99%	1.14	3.03	14.06	1.00	1.00	0.93	10.15	1.39E-05	4.16E-05	0.01	0.02	0.08	0.01	0.01	0.01
ICTF	Mechanical Department	Air Compressor	Ingersoll-Rand	Diesel	49	1000	2477.43	99%	1.14	3.03	14.06	1.00	1.00	0.93	10.15	1.39E-05	4.16E-05	0.06	0.16	0.76	0.05	0.05	0.05
Total																		**0.07**	**0.18**	**0.84**	**0.06**	**0.06**	**0.06**

Notes:
1. Hours of operation for the emergency generator based on CARB's ATCM for Stationary Compression Ignition Engines. The ATCM limits non-emergency operation to 20 hours per year. UP personnel estimate that this engine is operated no more than 30 minutes/month. The 20 hours/yr estimate was used to be conservative. Assumed no increase in operations from the baseline year.
2. Hours of operation for the air compressor is an engineering estimate. Assumed no increase in operation from the baseline year.
3. Annual fuel use based on a BSFC of 7,000 Btu/hp-hr, a Diesel fuel HHV of 19,500 lb/Btu, and a Diesel fuel density of 7.1 lb/gal.
4. From the Air Resources Board's Draft *Emission Factors for Mandatory Reporting Programs*, August 10, 2007.

APPENDIX J

STORAGE TANKS

APPENDIX J-1

TANKS OUTPUT FOR THE 2005 BASELINE YEAR AND PROJECT YEARS 2010-2016

TANKS 4.0.9d
Emissions Report - Detail Format
Tank Indentification and Physical Characteristics

Identification

User Identification:	TNKD-9901
City:	Long Beach
State:	California
Company:	UPRR
Type of Tank:	Horizontal Tank
Description:	

Tank Dimensions

Shell Length (ft):		34.50
Diameter (ft):		10.00
Volume (gallons):		20,000.00
Turnovers:		6.00
Net Throughput(gal/yr):		120,000.00
Is Tank Heated (y/n):	N	
Is Tank Underground (y/n):	N	

Paint Characteristics

Shell Color/Shade:	White/White
Shell Condition	Good

Breather Vent Settings

Vacuum Settings (psig):	-0.03
Pressure Settings (psig)	0.03

Meterological Data used in Emissions Calculations: Long Beach, California (Avg Atmospheric Pressure = 14.7 psia)

TANKS 4.0.9d
Emissions Report - Detail Format
Liquid Contents of Storage Tank

TNKD-9901 - Horizontal Tank
Long Beach, California

Mixture/Component	Month	Daily Liquid Surf. Temperature (deg F) Avg.	Min.	Max.	Liquid Bulk Temp (deg F)	Vapor Pressure (psia) Avg.	Min.	Max.	Vapor Mol. Weight.	Liquid Mass Fract.	Vapor Mass Fract.	Mol. Weight	Basis for Vapor Pressure Calculations
Distillate fuel oil no. 2	All	66.43	60.99	71.87	64.33	0.0081	0.0067	0.0096	130.0000			188.00	Option 1: VP60 = .0065 VP70 = .009

TANKS 4.0.9d
Emissions Report - Detail Format
Detail Calculations (AP-42)

TNKD-9901 - Horizontal Tank
Long Beach, California

Annual Emission Calcaulations

Standing Losses (lb):	4.3947
Vapor Space Volume (cu ft):	1,725.8749
Vapor Density (lb/cu ft):	0.0002
Vapor Space Expansion Factor:	0.0374
Vented Vapor Saturation Factor:	0.9979
Tank Vapor Space Volume:	
Vapor Space Volume (cu ft):	1,725.8749
Tank Diameter (ft):	10.0000
Effective Diameter (ft):	20.9640
Vapor Space Outage (ft):	5.0000
Tank Shell Length (ft):	34.5000
Vapor Density	
Vapor Density (lb/cu ft):	0.0002
Vapor Molecular Weight (lb/lb-mole):	130.0000
Vapor Pressure at Daily Average Liquid Surface Temperature (psia):	0.0081
Daily Avg. Liquid Surface Temp. (deg. R):	526.1003
Daily Average Ambient Temp. (deg. F):	64.3083
Ideal Gas Constant R (psia cuft / (lb-mol-deg R)):	10.731
Liquid Bulk Temperature (deg. R):	523.9983
Tank Paint Solar Absorptance (Shell):	0.1700
Daily Total Solar Insulation Factor (Btu/sqft day):	1,571.6498
Vapor Space Expansion Factor	
Vapor Space Expansion Factor:	0.0374
Daily Vapor Temperature Range (deg. R):	21.7491
Daily Vapor Pressure Range (psia):	0.0028
Breather Vent Press. Setting Range(psia):	0.0600
Vapor Pressure at Daily Average Liquid Surface Temperature (psia):	0.0081
Vapor Pressure at Daily Minimum Liquid Surface Temperature (psia):	0.0067
Vapor Pressure at Daily Maximum Liquid Surface Temperature (psia):	0.0096
Daily Avg. Liquid Surface Temp. (deg R):	526.1003
Daily Min. Liquid Surface Temp. (deg R):	520.6630
Daily Max. Liquid Surface Temp. (deg R):	531.5375
Daily Ambient Temp. Range (deg. R):	19.8167
Vented Vapor Saturation Factor	
Vented Vapor Saturation Factor:	0.9979
Vapor Pressure at Daily Average Liquid: Surface Temperature (psia):	0.0081
Vapor Space Outage (ft):	5.0000
Working Losses (lb):	3.0114
Vapor Molecular Weight (lb/lb-mole):	130.0000
Vapor Pressure at Daily Average Liquid Surface Temperature (psia):	0.0081
Annual Net Throughput (gal/yr.):	120,000.0000

Annual Turnovers:	6.0000
Turnover Factor:	1.0000
Tank Diameter (ft):	10.0000
Working Loss Product Factor:	1.0000
Total Losses (lb):	7.4061

TANKS 4.0.9d
Emissions Report - Detail Format
Individual Tank Emission Totals

Emissions Report for: Annual

TNKD-9901 - Horizontal Tank
Long Beach, California

	Losses(lbs)		
Components	Working Loss	Breathing Loss	Total Emissions
Distillate fuel oil no. 2	3.01	4.39	7.41

TANKS 4.0.9d
Emissions Report - Detail Format
Tank Indentification and Physical Characteristics

Identification

User Identification:	ICTF - TBA-1
City:	Long Beach
State:	California
Company:	UPRR
Type of Tank:	Horizontal Tank
Description:	

Tank Dimensions

Shell Length (ft):		7.00
Diameter (ft):		5.00
Volume (gallons):		1,000.00
Turnovers:		52.00
Net Throughput(gal/yr):		52,000.00
Is Tank Heated (y/n):	N	
Is Tank Underground (y/n):	N	

Paint Characteristics

Shell Color/Shade:	White/White
Shell Condition	Good

Breather Vent Settings

Vacuum Settings (psig):	-0.03
Pressure Settings (psig)	0.03

Meterological Data used in Emissions Calculations: Long Beach, California (Avg Atmospheric Pressure = 14.7 psia)

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TANKS 4.0.9d
Emissions Report - Detail Format
Liquid Contents of Storage Tank

ICTF - TBA-1 - Horizontal Tank
Long Beach, California

Mixture/Component	Month	Daily Liquid Surf. Temperature (deg F) Avg.	Min.	Max.	Liquid Bulk Temp (deg F)	Vapor Pressure (psia) Avg.	Min.	Max.	Vapor Mol. Weight.	Liquid Mass Fract.	Vapor Mass Fract.	Mol. Weight	Basis for Vapor Pressure Calculations
Distillate fuel oil no. 2	All	66.43	60.99	71.87	64.33	0.0081	0.0067	0.0096	130.0000			188.00	Option 1: VP60 = .0065 VP70 = .009

TANKS 4.0.9d
Emissions Report - Detail Format
Detail Calculations (AP-42)

ICTF - TBA-1 - Horizontal Tank
Long Beach, California

Annual Emission Calcaulations

Standing Losses (lb):	0.2232
Vapor Space Volume (cu ft):	87.5444
Vapor Density (lb/cu ft):	0.0002
Vapor Space Expansion Factor:	0.0374
Vented Vapor Saturation Factor:	0.9989
Tank Vapor Space Volume:	
Vapor Space Volume (cu ft):	87.5444
Tank Diameter (ft):	5.0000
Effective Diameter (ft):	6.6773
Vapor Space Outage (ft):	2.5000
Tank Shell Length (ft):	7.0000
Vapor Density	
Vapor Density (lb/cu ft):	0.0002
Vapor Molecular Weight (lb/lb-mole):	130.0000
Vapor Pressure at Daily Average Liquid Surface Temperature (psia):	0.0081
Daily Avg. Liquid Surface Temp. (deg. R):	526.1003
Daily Average Ambient Temp. (deg. F):	64.3083
Ideal Gas Constant R (psia cuft / (lb-mol-deg R)):	10.731
Liquid Bulk Temperature (deg. R):	523.9983
Tank Paint Solar Absorptance (Shell):	0.1700
Daily Total Solar Insulation Factor (Btu/sqft day):	1,571.6498
Vapor Space Expansion Factor	
Vapor Space Expansion Factor:	0.0374
Daily Vapor Temperature Range (deg. R):	21.7491
Daily Vapor Pressure Range (psia):	0.0028
Breather Vent Press. Setting Range(psia):	0.0600
Vapor Pressure at Daily Average Liquid Surface Temperature (psia):	0.0081
Vapor Pressure at Daily Minimum Liquid Surface Temperature (psia):	0.0067
Vapor Pressure at Daily Maximum Liquid Surface Temperature (psia):	0.0096
Daily Avg. Liquid Surface Temp. (deg R):	526.1003
Daily Min. Liquid Surface Temp. (deg R):	520.6630
Daily Max. Liquid Surface Temp. (deg R):	531.5375
Daily Ambient Temp. Range (deg. R):	19.8167
Vented Vapor Saturation Factor	
Vented Vapor Saturation Factor:	0.9989
Vapor Pressure at Daily Average Liquid: Surface Temperature (psia):	0.0081
Vapor Space Outage (ft):	2.5000
Working Losses (lb):	0.9703
Vapor Molecular Weight (lb/lb-mole):	130.0000
Vapor Pressure at Daily Average Liquid Surface Temperature (psia):	0.0081
Annual Net Throughput (gal/yr.):	52,000.0000

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Annual Turnovers:	52.0000
Turnover Factor:	0.7436
Tank Diameter (ft):	5.0000
Working Loss Product Factor:	1.0000
Total Losses (lb):	1.1935

TANKS 4.0.9d
Emissions Report - Detail Format
Individual Tank Emission Totals

Emissions Report for: Annual

ICTF - TBA-1 - Horizontal Tank
Long Beach, California

	Losses(lbs)		
Components	Working Loss	Breathing Loss	Total Emissions
Distillate fuel oil no. 2	0.97	0.22	1.19

TANKS 4.0.9d
Emissions Report - Detail Format
Tank Indentification and Physical Characteristics

Identification

User Identification:	ICTF - TBA 2
City:	Long Beach
State:	California
Company:	UPRR
Type of Tank:	Horizontal Tank
Description:	

Tank Dimensions

Shell Length (ft):		12.00
Diameter (ft):		7.00
Volume (gallons):		2,000.00
Turnovers:		0.00
Net Throughput(gal/yr):		86,808.00
Is Tank Heated (y/n):	N	
Is Tank Underground (y/n):	N	

Paint Characteristics

Shell Color/Shade:	White/White
Shell Condition	Good

Breather Vent Settings

Vacuum Settings (psig):	-0.03
Pressure Settings (psig)	0.03

Meterological Data used in Emissions Calculations: Long Beach, California (Avg Atmospheric Pressure = 14.7 psia)

TANKS 4.0.9d
Emissions Report - Detail Format
Liquid Contents of Storage Tank

ICTF - TBA 2 - Horizontal Tank
Long Beach, California

Mixture/Component	Month	Daily Liquid Surf. Temperature (deg F) Avg.	Min.	Max.	Liquid Bulk Temp (deg F)	Vapor Pressure (psia) Avg.	Min.	Max.	Vapor Mol. Weight.	Liquid Mass Fract.	Vapor Mass Fract.	Mol. Weight	Basis for Vapor Pressure Calculations
Gasoline (RVP 10)	All	66.43	60.99	71.87	64.33	5.8655	5.2864	6.4943	66.0000			92.00	Option 4: RVP=10, ASTM Slope=3

TANKS 4.0.9d
Emissions Report - Detail Format
Detail Calculations (AP-42)

ICTF - TBA 2 - Horizontal Tank
Long Beach, California

Annual Emission Calcaulations

Standing Losses (lb):	603.7306
Vapor Space Volume (cu ft):	294.1491
Vapor Density (lb/cu ft):	0.0686
Vapor Space Expansion Factor:	0.1712
Vented Vapor Saturation Factor:	0.4789
Tank Vapor Space Volume:	
Vapor Space Volume (cu ft):	294.1491
Tank Diameter (ft):	7.0000
Effective Diameter (ft):	10.3444
Vapor Space Outage (ft):	3.5000
Tank Shell Length (ft):	12.0000
Vapor Density	
Vapor Density (lb/cu ft):	0.0686
Vapor Molecular Weight (lb/lb-mole):	66.0000
Vapor Pressure at Daily Average Liquid Surface Temperature (psia):	5.8655
Daily Avg. Liquid Surface Temp. (deg. R):	526.1003
Daily Average Ambient Temp. (deg. F):	64.3083
Ideal Gas Constant R (psia cuft / (lb-mol-deg R)):	10.731
Liquid Bulk Temperature (deg. R):	523.9983
Tank Paint Solar Absorptance (Shell):	0.1700
Daily Total Solar Insulation Factor (Btu/sqft day):	1,571.6498
Vapor Space Expansion Factor	
Vapor Space Expansion Factor:	0.1712
Daily Vapor Temperature Range (deg. R):	21.7491
Daily Vapor Pressure Range (psia):	1.2079
Breather Vent Press. Setting Range(psia):	0.0600
Vapor Pressure at Daily Average Liquid Surface Temperature (psia):	5.8655
Vapor Pressure at Daily Minimum Liquid Surface Temperature (psia):	5.2864
Vapor Pressure at Daily Maximum Liquid Surface Temperature (psia):	6.4943
Daily Avg. Liquid Surface Temp. (deg R):	526.1003
Daily Min. Liquid Surface Temp. (deg R):	520.6630
Daily Max. Liquid Surface Temp. (deg R):	531.5375
Daily Ambient Temp. Range (deg. R):	19.8167
Vented Vapor Saturation Factor	
Vented Vapor Saturation Factor:	0.4789
Vapor Pressure at Daily Average Liquid: Surface Temperature (psia):	5.8655
Vapor Space Outage (ft):	3.5000
Working Losses (lb):	800.1295
Vapor Molecular Weight (lb/lb-mole):	66.0000
Vapor Pressure at Daily Average Liquid Surface Temperature (psia):	5.8655
Annual Net Throughput (gal/yr.):	86,808.0000

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Annual Turnovers:	0.0000
Turnover Factor:	1.0000
Tank Diameter (ft):	7.0000
Working Loss Product Factor:	1.0000
Total Losses (lb):	1,403.8601

TANKS 4.0.9d
Emissions Report - Detail Format
Individual Tank Emission Totals

Emissions Report for: Annual

ICTF - TBA 2 - Horizontal Tank
Long Beach, California

	Losses(lbs)		
Components	Working Loss	Breathing Loss	Total Emissions
Gasoline (RVP 10)	800.13	603.73	1,403.86

TANKS 4.0.9d
Emissions Report - Detail Format
Tank Indentification and Physical Characteristics

Identification

User Identification:	ICTF - TBA-3	
City:	Long Beach	
State:	California	
Company:	UPRR	
Type of Tank:	Horizontal Tank	
Description:		

Tank Dimensions

Shell Length (ft):		6.00
Diameter (ft):		4.00
Volume (gallons):		500.00
Turnovers:		4.00
Net Throughput(gal/yr):		2,000.00
Is Tank Heated (y/n):	N	
Is Tank Underground (y/n):	N	

Paint Characteristics

Shell Color/Shade:	Gray/Medium	
Shell Condition	Good	

Breather Vent Settings

Vacuum Settings (psig):		-0.03
Pressure Settings (psig)		0.03

Meterological Data used in Emissions Calculations: Long Beach, California (Avg Atmospheric Pressure = 14.7 psia)

TANKS 4.0.9d
Emissions Report - Detail Format
Liquid Contents of Storage Tank

ICTF - TBA-3 - Horizontal Tank
Long Beach, California

Mixture/Component	Month	Daily Liquid Surf. Temperature (deg F) Avg.	Min.	Max.	Liquid Bulk Temp (deg F)	Vapor Pressure (psia) Avg.	Min.	Max.	Vapor Mol. Weight.	Liquid Mass Fract.	Vapor Mass Fract.	Mol. Weight	Basis for Vapor Pressure Calculations
Distillate fuel oil no. 2	All	74.48	63.43	85.52	67.39	0.0103	0.0074	0.0142	130.0000			188.00	Option 1: VP70 = .009 VP80 = .012

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TANKS 4.0.9d
Emissions Report - Detail Format
Detail Calculations (AP-42)

ICTF - TBA-3 - Horizontal Tank
Long Beach, California

Annual Emission Calcaulations

Standing Losses (lb):	0.3250
Vapor Space Volume (cu ft):	48.0243
Vapor Density (lb/cu ft):	0.0002
Vapor Space Expansion Factor:	0.0791
Vented Vapor Saturation Factor:	0.9989
Tank Vapor Space Volume:	
Vapor Space Volume (cu ft):	48.0243
Tank Diameter (ft):	4.0000
Effective Diameter (ft):	5.5293
Vapor Space Outage (ft):	2.0000
Tank Shell Length (ft):	6.0000
Vapor Density	
Vapor Density (lb/cu ft):	0.0002
Vapor Molecular Weight (lb/lb-mole):	130.0000
Vapor Pressure at Daily Average Liquid Surface Temperature (psia):	0.0103
Daily Avg. Liquid Surface Temp. (deg. R):	534.1460
Daily Average Ambient Temp. (deg. F):	64.3083
Ideal Gas Constant R (psia cuft / (lb-mol-deg R)):	10.731
Liquid Bulk Temperature (deg. R):	527.0583
Tank Paint Solar Absorptance (Shell):	0.6800
Daily Total Solar Insulation Factor (Btu/sqft day):	1,571.6498
Vapor Space Expansion Factor	
Vapor Space Expansion Factor:	0.0791
Daily Vapor Temperature Range (deg. R):	44.1922
Daily Vapor Pressure Range (psia):	0.0069
Breather Vent Press. Setting Range(psia):	0.0600
Vapor Pressure at Daily Average Liquid Surface Temperature (psia):	0.0103
Vapor Pressure at Daily Minimum Liquid Surface Temperature (psia):	0.0074
Vapor Pressure at Daily Maximum Liquid Surface Temperature (psia):	0.0142
Daily Avg. Liquid Surface Temp. (deg R):	534.1460
Daily Min. Liquid Surface Temp. (deg R):	523.0980
Daily Max. Liquid Surface Temp. (deg R):	545.1941
Daily Ambient Temp. Range (deg. R):	19.8167
Vented Vapor Saturation Factor	
Vented Vapor Saturation Factor:	0.9989
Vapor Pressure at Daily Average Liquid: Surface Temperature (psia):	0.0103
Vapor Space Outage (ft):	2.0000
Working Losses (lb):	0.0640
Vapor Molecular Weight (lb/lb-mole):	130.0000
Vapor Pressure at Daily Average Liquid Surface Temperature (psia):	0.0103
Annual Net Throughput (gal/yr.):	2,000.0000

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Annual Turnovers:	4.0000
Turnover Factor:	1.0000
Tank Diameter (ft):	4.0000
Working Loss Product Factor:	1.0000
Total Losses (lb):	0.3890

TANKS 4.0.9d
Emissions Report - Detail Format
Individual Tank Emission Totals

Emissions Report for: Annual

ICTF - TBA-3 - Horizontal Tank
Long Beach, California

	Losses(lbs)		
Components	Working Loss	Breathing Loss	Total Emissions
Distillate fuel oil no. 2	0.06	0.32	0.39

TANKS 4.0
Emissions Report - Detail Format
Tank Identification and Physical Characteristics

Identification

User Identification:	TNKD-0068
City:	Los Angeles C.O.
State:	California
Company:	UPRR
Type of Tank:	Vertical Fixed Roof Tank
Description:	Diesel Storage Tank - Dolores

Tank Dimensions

Shell Height (ft):	24.00
Diameter (ft):	34.00
Liquid Height (ft):	24.00
Avg. Liquid Height (ft):	12.00
Volume (gallons):	160,000.00
Turnovers:	65.63
Net Throughput (gal/yr):	10,500,000.00
Is Tank Heated (y/n):	N

Paint Characteristics

Shell Color/Shade:	White/White
Shell Condition:	Good
Roof Color/Shade:	White/White
Roof Condition:	Good

Roof Characteristics

Type:	Cone
Height (ft):	0.00
Slope (ft/ft) (Cone Roof):	0.00

Breather Vent Settings

Vacuum Settings (psig):	-0.03
Pressure Settings (psig):	0.03

Meteorological Data used in Emissions Calculations: Los Angeles C.O., California (Avg Atmospheric Pressure = 14.67 psia)

TANKS 4.0
Emissions Report - Detail Format
Liquid Contents of Storage Tank

Mixture/Component	Month	Daily Liquid Surf. Temperatures (deg F) Avg.	Min.	Max.	Liquid Bulk Temp. (deg F)	Vapor Pressures (psia) Avg.	Min.	Max.	Vapor Mol. Weight	Liquid Mass Fract.	Vapor Mass Fract.	Mol. Weight	Basis for Vapor Pressure Calculations
Distillate fuel oil no. 2	All	68.08	62.92	73.24	65.99	0.0084	0.0071	0.0099	130.0000			188.00	Option 5: A=12.101, B=8907

TANKS 4.0
Emissions Report - Detail Format
Detail Calculations (AP-42)

Annual Emission Calculations	
Standing Losses (lb):	26.9533
Vapor Space Volume (cu ft):	10,895.0433
Vapor Density (lb/cu ft):	0.0002
Vapor Space Expansion Factor:	0.0352
Vented Vapor Saturation Factor:	0.9947
Tank Vapor Space Volume	
Vapor Space Volume (cu ft):	10,895.0433
Tank Diameter (ft):	34.0000
Vapor Space Outage (ft):	12.0000
Tank Shell Height (ft):	24.0000
Average Liquid Height (ft):	12.0000
Roof Outage (ft):	0.0000
Roof Outage (Cone Roof)	
Roof Outage (ft):	0.0000
Roof Height (ft):	0.0000
Roof Slope (ft/ft):	0.0000
Shell Radius (ft):	17.0000
Vapor Density	
Vapor Density (lb/cu ft):	0.0002
Vapor Molecular Weight (lb/lb-mole):	130.0000
Vapor Pressure at Daily Average Liquid Surface Temperature (psia):	0.0084
Daily Avg. Liquid Surface Temp. (deg. R):	527.7526
Daily Average Ambient Temp. (deg. F):	65.9667
Ideal Gas Constant R (psia cuft / (lb-mol-deg R)):	10.731
Liquid Bulk Temperature (deg. R):	525.6567
Tank Paint Solar Absorptance (Shell):	0.1700
Tank Paint Solar Absorptance (Roof):	0.1700
Daily Total Solar Insulation Factor (Btu/sqft day):	1,567.1816
Vapor Space Expansion Factor	
Vapor Space Expansion Factor:	0.0352
Daily Vapor Temperature Range (deg. R):	20.6478
Daily Vapor Pressure Range (psia):	0.0028
Breather Vent Press. Setting Range(psia):	0.0600
Vapor Pressure at Daily Average Liquid Surface Temperature (psia):	0.0084
Vapor Pressure at Daily Minimum Liquid Surface Temperature (psia):	0.0071
Vapor Pressure at Daily Maximum Liquid Surface Temperature (psia):	0.0099
Daily Avg. Liquid Surface Temp. (deg R):	527.7526
Daily Min. Liquid Surface Temp. (deg R):	522.5906
Daily Max. Liquid Surface Temp. (deg R):	532.9145
Daily Ambient Temp. Range (deg. R):	18.3167
Vented Vapor Saturation Factor	
Vented Vapor Saturation Factor:	0.9947
Vapor Pressure at Daily Average Liquid Surface Temperature (psia):	0.0084
Vapor Space Outage (ft):	12.0000

TANKS 4.0
Emissions Report - Detail Format
Detail Calculations (AP-42)- (Continued)

Working Losses (lb):	170.8624
Vapor Molecular Weight (lb/lb-mole):	130.0000
Vapor Pressure at Daily Average Liquid Surface Temperature (psia):	0.0084
Annual Net Throughput (gal/yr.):	10,500,000.0000
Annual Turnovers:	65.6250
Turnover Factor:	0.6238
Maximum Liquid Volume (gal):	160,000.0000
Maximum Liquid Height (ft):	24.0000
Tank Diameter (ft):	34.0000
Working Loss Product Factor:	1.0000
Total Losses (lb):	197.8157

TANKS 4.0
Emissions Report - Detail Format
Individual Tank Emission Totals

Annual Emissions Report

	Losses(lbs)		
Components	Working Loss	Breathing Loss	Total Emissions
Distillate fuel oil no. 2	170.86	26.95	197.82

TANKS 4.0
Emissions Report - Detail Format
Tank Identification and Physical Characteristics

Identification

User Identification:	TNKD-0069
City:	Los Angeles C.O.
State:	California
Company:	UPRR
Type of Tank:	Vertical Fixed Roof Tank
Description:	Diesel Storage Tank - Dolores

Tank Dimensions

Shell Height (ft):	24.00
Diameter (ft):	34.00
Liquid Height (ft):	24.00
Avg. Liquid Height (ft):	12.00
Volume (gallons):	160,000.00
Turnovers:	65.63
Net Throughput (gal/yr):	10,500,000.00
Is Tank Heated (y/n):	N

Paint Characteristics

Shell Color/Shade:	White/White
Shell Condition:	Good
Roof Color/Shade:	White/White
Roof Condition:	Good

Roof Characteristics

Type:	Cone
Height (ft):	0.00
Slope (ft/ft) (Cone Roof):	0.00

Breather Vent Settings

Vacuum Settings (psig):	-0.03
Pressure Settings (psig):	0.03

Meteorological Data used in Emissions Calculations: Los Angeles C.O., California (Avg Atmospheric Pressure = 14.67 psia)

TANKS 4.0
Emissions Report - Detail Format
Liquid Contents of Storage Tank

Mixture/Component	Month	Daily Liquid Surf. Temperatures (deg F) Avg.	Min.	Max.	Liquid Bulk Temp. (deg F)	Vapor Pressures (psia) Avg.	Min.	Max.	Vapor Mol. Weight	Liquid Mass Fract.	Vapor Mass Fract.	Mol. Weight	Basis for Vapor Pressure Calculations
Distillate fuel oil no. 2	All	68.08	62.92	73.24	65.99	0.0084	0.0071	0.0099	130.0000			188.00	Option 5: A=12.101, B=8907

TANKS 4.0
Emissions Report - Detail Format
Detail Calculations (AP-42)

Annual Emission Calculations	
Standing Losses (lb):	26.9533
Vapor Space Volume (cu ft):	10,895.0433
Vapor Density (lb/cu ft):	0.0002
Vapor Space Expansion Factor:	0.0352
Vented Vapor Saturation Factor:	0.9947
Tank Vapor Space Volume	
Vapor Space Volume (cu ft):	10,895.0433
Tank Diameter (ft):	34.0000
Vapor Space Outage (ft):	12.0000
Tank Shell Height (ft):	24.0000
Average Liquid Height (ft):	12.0000
Roof Outage (ft):	0.0000
Roof Outage (Cone Roof)	
Roof Outage (ft):	0.0000
Roof Height (ft):	0.0000
Roof Slope (ft/ft):	0.0000
Shell Radius (ft):	17.0000
Vapor Density	
Vapor Density (lb/cu ft):	0.0002
Vapor Molecular Weight (lb/lb-mole):	130.0000
Vapor Pressure at Daily Average Liquid Surface Temperature (psia):	0.0084
Daily Avg. Liquid Surface Temp. (deg. R):	527.7526
Daily Average Ambient Temp. (deg. F):	65.9667
Ideal Gas Constant R (psia cuft / (lb-mol-deg R)):	10.731
Liquid Bulk Temperature (deg. R):	525.6567
Tank Paint Solar Absorptance (Shell):	0.1700
Tank Paint Solar Absorptance (Roof):	0.1700
Daily Total Solar Insulation Factor (Btu/sqft day):	1,567.1816
Vapor Space Expansion Factor	
Vapor Space Expansion Factor:	0.0352
Daily Vapor Temperature Range (deg. R):	20.6478
Daily Vapor Pressure Range (psia):	0.0028
Breather Vent Press. Setting Range(psia):	0.0600
Vapor Pressure at Daily Average Liquid Surface Temperature (psia):	0.0084
Vapor Pressure at Daily Minimum Liquid Surface Temperature (psia):	0.0071
Vapor Pressure at Daily Maximum Liquid Surface Temperature (psia):	0.0099
Daily Avg. Liquid Surface Temp. (deg R):	527.7526
Daily Min. Liquid Surface Temp. (deg R):	522.5906
Daily Max. Liquid Surface Temp. (deg R):	532.9145
Daily Ambient Temp. Range (deg. R):	18.3167
Vented Vapor Saturation Factor	
Vented Vapor Saturation Factor:	0.9947
Vapor Pressure at Daily Average Liquid Surface Temperature (psia):	0.0084
Vapor Space Outage (ft):	12.0000

TANKS 4.0
Emissions Report - Detail Format
Detail Calculations (AP-42)- (Continued)

Working Losses (lb):	170.8624
Vapor Molecular Weight (lb/lb-mole):	130.0000
Vapor Pressure at Daily Average Liquid Surface Temperature (psia):	0.0084
Annual Net Throughput (gal/yr.):	10,500,000.0000
Annual Turnovers:	65.6250
Turnover Factor:	0.6238
Maximum Liquid Volume (gal):	160,000.0000
Maximum Liquid Height (ft):	24.0000
Tank Diameter (ft):	34.0000
Working Loss Product Factor:	1.0000
Total Losses (lb):	197.8157

TANKS 4.0
Emissions Report - Detail Format
Individual Tank Emission Totals

Annual Emissions Report

	Losses(lbs)		
Components	Working Loss	Breathing Loss	Total Emissions
Distillate fuel oil no. 2	170.86	26.95	197.82

TANKS 4.0
Emissions Report - Detail Format
Total Emissions Summaries - All Tanks in Report

Annual Emissions Report

Tank Identification				Losses (lbs)
TNKD-0068	UPRR	Vertical Fixed Roof Tank	Los Angeles C.O., California	197.82
TNKD-0069	UPRR	Vertical Fixed Roof Tank	Los Angeles C.O., California	197.82
Total Emissions for all Tanks:				395.63

TANKS 4.0.9d
Emissions Report - Detail Format
Tank Indentification and Physical Characteristics

Identification

User Identification:	TNKO-0002
City:	Long Beach
State:	California
Company:	UPRR
Type of Tank:	Horizontal Tank
Description:	

Tank Dimensions

Shell Length (ft):		16.00
Diameter (ft):		10.00
Volume (gallons):		10,000.00
Turnovers:		4.00
Net Throughput(gal/yr):		40,000.00
Is Tank Heated (y/n):	N	
Is Tank Underground (y/n):	N	

Paint Characteristics

Shell Color/Shade:	White/White
Shell Condition	Good

Breather Vent Settings

Vacuum Settings (psig):	-0.03
Pressure Settings (psig)	0.03

Meterological Data used in Emissions Calculations: Long Beach, California (Avg Atmospheric Pressure = 14.7 psia)

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TANKS 4.0.9d
Emissions Report - Detail Format
Liquid Contents of Storage Tank

TNKO-0002 - Horizontal Tank
Long Beach, California

Mixture/Component	Month	Daily Liquid Surf. Temperature (deg F) Avg.	Min.	Max.	Liquid Bulk Temp (deg F)	Vapor Pressure (psia) Avg.	Min.	Max.	Vapor Mol. Weight.	Liquid Mass Fract.	Vapor Mass Fract.	Mol. Weight	Basis for Vapor Pressure Calculations
Distillate fuel oil no. 2	All	66.43	60.99	71.87	64.33	0.0081	0.0067	0.0096	130.0000			188.00	Option 1: VP60 = .0065 VP70 = .009

APP-504

TANKS 4.0.9d
Emissions Report - Detail Format
Detail Calculations (AP-42)

TNKO-0002 - Horizontal Tank
Long Beach, California

Annual Emission Calcaulations

Standing Losses (lb):	2.0381
Vapor Space Volume (cu ft):	800.4058
Vapor Density (lb/cu ft):	0.0002
Vapor Space Expansion Factor:	0.0374
Vented Vapor Saturation Factor:	0.9979
Tank Vapor Space Volume:	
Vapor Space Volume (cu ft):	800.4058
Tank Diameter (ft):	10.0000
Effective Diameter (ft):	14.2766
Vapor Space Outage (ft):	5.0000
Tank Shell Length (ft):	16.0000
Vapor Density	
Vapor Density (lb/cu ft):	0.0002
Vapor Molecular Weight (lb/lb-mole):	130.0000
Vapor Pressure at Daily Average Liquid Surface Temperature (psia):	0.0081
Daily Avg. Liquid Surface Temp. (deg. R):	526.1003
Daily Average Ambient Temp. (deg. F):	64.3083
Ideal Gas Constant R (psia cuft / (lb-mol-deg R)):	10.731
Liquid Bulk Temperature (deg. R):	523.9983
Tank Paint Solar Absorptance (Shell):	0.1700
Daily Total Solar Insulation Factor (Btu/sqft day):	1,571.6498
Vapor Space Expansion Factor	
Vapor Space Expansion Factor:	0.0374
Daily Vapor Temperature Range (deg. R):	21.7491
Daily Vapor Pressure Range (psia):	0.0028
Breather Vent Press. Setting Range(psia):	0.0600
Vapor Pressure at Daily Average Liquid Surface Temperature (psia):	0.0081
Vapor Pressure at Daily Minimum Liquid Surface Temperature (psia):	0.0067
Vapor Pressure at Daily Maximum Liquid Surface Temperature (psia):	0.0096
Daily Avg. Liquid Surface Temp. (deg R):	526.1003
Daily Min. Liquid Surface Temp. (deg R):	520.6630
Daily Max. Liquid Surface Temp. (deg R):	531.5375
Daily Ambient Temp. Range (deg. R):	19.8167
Vented Vapor Saturation Factor	
Vented Vapor Saturation Factor:	0.9979
Vapor Pressure at Daily Average Liquid: Surface Temperature (psia):	0.0081
Vapor Space Outage (ft):	5.0000
Working Losses (lb):	1.0038
Vapor Molecular Weight (lb/lb-mole):	130.0000
Vapor Pressure at Daily Average Liquid Surface Temperature (psia):	0.0081
Annual Net Throughput (gal/yr.):	40,000.0000

Annual Turnovers:	4.0000
Turnover Factor:	1.0000
Tank Diameter (ft):	10.0000
Working Loss Product Factor:	1.0000
Total Losses (lb):	3.0419

TANKS 4.0.9d
Emissions Report - Detail Format
Individual Tank Emission Totals

Emissions Report for: Annual

TNKO-0002 - Horizontal Tank
Long Beach, California

	Losses(lbs)		
Components	Working Loss	Breathing Loss	Total Emissions
Distillate fuel oil no. 2	1.00	2.04	3.04

TANKS 4.0.9d
Emissions Report - Detail Format
Tank Indentification and Physical Characteristics

Identification

User Identification:	TNKO-0003
City:	Long Beach
State:	California
Company:	UPRR
Type of Tank:	Horizontal Tank
Description:	

Tank Dimensions

Shell Length (ft):	20.50
Diameter (ft):	10.00
Volume (gallons):	12,000.00
Turnovers:	4.00
Net Throughput(gal/yr):	48,000.00
Is Tank Heated (y/n):	N
Is Tank Underground (y/n):	N

Paint Characteristics

Shell Color/Shade:	White/White
Shell Condition	Good

Breather Vent Settings

Vacuum Settings (psig):	-0.03
Pressure Settings (psig)	0.03

Meterological Data used in Emissions Calculations: Long Beach, California (Avg Atmospheric Pressure = 14.7 psia)

APP-508

TANKS 4.0.9d
Emissions Report - Detail Format
Liquid Contents of Storage Tank

TNKO-0003 - Horizontal Tank
Long Beach, California

Mixture/Component	Month	Daily Liquid Surf. Temperature (deg F) Avg.	Min.	Max.	Liquid Bulk Temp (deg F)	Vapor Pressure (psia) Avg.	Min.	Max.	Vapor Mol. Weight.	Liquid Mass Fract.	Vapor Mass Fract.	Mol. Weight	Basis for Vapor Pressure Calculations
Distillate fuel oil no. 2	All	66.43	60.99	71.87	64.33	0.0081	0.0067	0.0096	130.0000			188.00	Option 1: VP60 = .0065 VP70 = .009

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TANKS 4.0.9d
Emissions Report - Detail Format
Detail Calculations (AP-42)

TNKO-0003 - Horizontal Tank
Long Beach, California

Annual Emission Calcaulations

Standing Losses (lb):	2.6113
Vapor Space Volume (cu ft):	1,025.5199
Vapor Density (lb/cu ft):	0.0002
Vapor Space Expansion Factor:	0.0374
Vented Vapor Saturation Factor:	0.9979
Tank Vapor Space Volume:	
Vapor Space Volume (cu ft):	1,025.5199
Tank Diameter (ft):	10.0000
Effective Diameter (ft):	16.1600
Vapor Space Outage (ft):	5.0000
Tank Shell Length (ft):	20.5000
Vapor Density	
Vapor Density (lb/cu ft):	0.0002
Vapor Molecular Weight (lb/lb-mole):	130.0000
Vapor Pressure at Daily Average Liquid Surface Temperature (psia):	0.0081
Daily Avg. Liquid Surface Temp. (deg. R):	526.1003
Daily Average Ambient Temp. (deg. F):	64.3083
Ideal Gas Constant R (psia cuft / (lb-mol-deg R)):	10.731
Liquid Bulk Temperature (deg. R):	523.9983
Tank Paint Solar Absorptance (Shell):	0.1700
Daily Total Solar Insulation Factor (Btu/sqft day):	1,571.6498
Vapor Space Expansion Factor	
Vapor Space Expansion Factor:	0.0374
Daily Vapor Temperature Range (deg. R):	21.7491
Daily Vapor Pressure Range (psia):	0.0028
Breather Vent Press. Setting Range(psia):	0.0600
Vapor Pressure at Daily Average Liquid Surface Temperature (psia):	0.0081
Vapor Pressure at Daily Minimum Liquid Surface Temperature (psia):	0.0067
Vapor Pressure at Daily Maximum Liquid Surface Temperature (psia):	0.0096
Daily Avg. Liquid Surface Temp. (deg R):	526.1003
Daily Min. Liquid Surface Temp. (deg R):	520.6630
Daily Max. Liquid Surface Temp. (deg R):	531.5375
Daily Ambient Temp. Range (deg. R):	19.8167
Vented Vapor Saturation Factor	
Vented Vapor Saturation Factor:	0.9979
Vapor Pressure at Daily Average Liquid: Surface Temperature (psia):	0.0081
Vapor Space Outage (ft):	5.0000
Working Losses (lb):	1.2046
Vapor Molecular Weight (lb/lb-mole):	130.0000
Vapor Pressure at Daily Average Liquid Surface Temperature (psia):	0.0081
Annual Net Throughput (gal/yr.):	48,000.0000

Annual Turnovers:	4.0000
Turnover Factor:	1.0000
Tank Diameter (ft):	10.0000
Working Loss Product Factor:	1.0000
Total Losses (lb):	3.8159

TANKS 4.0.9d
Emissions Report - Detail Format
Individual Tank Emission Totals

Emissions Report for: Annual

TNKO-0003 - Horizontal Tank
Long Beach, California

	Losses(lbs)		
Components	Working Loss	Breathing Loss	Total Emissions
Distillate fuel oil no. 2	1.20	2.61	3.82

TANKS 4.0.9d
Emissions Report - Detail Format
Tank Indentification and Physical Characteristics

Identification

User Identification:	TNKO-0004
City:	Long Beach
State:	California
Company:	UPRR
Type of Tank:	Horizontal Tank
Description:	

Tank Dimensions

Shell Length (ft):		21.30
Diameter (ft):		8.00
Volume (gallons):		8,000.00
Turnovers:		4.00
Net Throughput(gal/yr):		32,000.00
Is Tank Heated (y/n):	N	
Is Tank Underground (y/n):	N	

Paint Characteristics

Shell Color/Shade:	White/White
Shell Condition	Good

Breather Vent Settings

Vacuum Settings (psig):	-0.03
Pressure Settings (psig)	0.03

Meterological Data used in Emissions Calculations: Long Beach, California (Avg Atmospheric Pressure = 14.7 psia)

TANKS 4.0.9d
Emissions Report - Detail Format
Liquid Contents of Storage Tank

TNKO-0004 - Horizontal Tank
Long Beach, California

Mixture/Component	Month	Daily Liquid Surf. Temperature (deg F) Avg.	Min.	Max.	Liquid Bulk Temp (deg F)	Vapor Pressure (psia) Avg.	Min.	Max.	Vapor Mol. Weight.	Liquid Mass Fract.	Vapor Mass Fract.	Mol. Weight	Basis for Vapor Pressure Calculations
Distillate fuel oil no. 2	All	66.43	60.99	71.87	64.33	0.0081	0.0067	0.0096	130.0000			188.00	Option 1: VP60 = .0065 VP70 = .009

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TANKS 4.0.9d
Emissions Report - Detail Format
Detail Calculations (AP-42)

TNKO-0004 - Horizontal Tank
Long Beach, California

Annual Emission Calcaulations

Standing Losses (lb):	1.7372
Vapor Space Volume (cu ft):	681.9457
Vapor Density (lb/cu ft):	0.0002
Vapor Space Expansion Factor:	0.0374
Vented Vapor Saturation Factor:	0.9983
Tank Vapor Space Volume:	
Vapor Space Volume (cu ft):	681.9457
Tank Diameter (ft):	8.0000
Effective Diameter (ft):	14.7333
Vapor Space Outage (ft):	4.0000
Tank Shell Length (ft):	21.3000
Vapor Density	
Vapor Density (lb/cu ft):	0.0002
Vapor Molecular Weight (lb/lb-mole):	130.0000
Vapor Pressure at Daily Average Liquid Surface Temperature (psia):	0.0081
Daily Avg. Liquid Surface Temp. (deg. R):	526.1003
Daily Average Ambient Temp. (deg. F):	64.3083
Ideal Gas Constant R (psia cuft / (lb-mol-deg R)):	10.731
Liquid Bulk Temperature (deg. R):	523.9983
Tank Paint Solar Absorptance (Shell):	0.1700
Daily Total Solar Insulation Factor (Btu/sqft day):	1,571.6498
Vapor Space Expansion Factor	
Vapor Space Expansion Factor:	0.0374
Daily Vapor Temperature Range (deg. R):	21.7491
Daily Vapor Pressure Range (psia):	0.0028
Breather Vent Press. Setting Range(psia):	0.0600
Vapor Pressure at Daily Average Liquid Surface Temperature (psia):	0.0081
Vapor Pressure at Daily Minimum Liquid Surface Temperature (psia):	0.0067
Vapor Pressure at Daily Maximum Liquid Surface Temperature (psia):	0.0096
Daily Avg. Liquid Surface Temp. (deg R):	526.1003
Daily Min. Liquid Surface Temp. (deg R):	520.6630
Daily Max. Liquid Surface Temp. (deg R):	531.5375
Daily Ambient Temp. Range (deg. R):	19.8167
Vented Vapor Saturation Factor	
Vented Vapor Saturation Factor:	0.9983
Vapor Pressure at Daily Average Liquid: Surface Temperature (psia):	0.0081
Vapor Space Outage (ft):	4.0000
Working Losses (lb):	0.8030
Vapor Molecular Weight (lb/lb-mole):	130.0000
Vapor Pressure at Daily Average Liquid Surface Temperature (psia):	0.0081
Annual Net Throughput (gal/yr.):	32,000.0000

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Annual Turnovers:	4.0000
Turnover Factor:	1.0000
Tank Diameter (ft):	8.0000
Working Loss Product Factor:	1.0000

Total Losses (lb):	2.5403

TANKS 4.0.9d
Emissions Report - Detail Format
Individual Tank Emission Totals

Emissions Report for: Annual

TNKO-0004 - Horizontal Tank
Long Beach, California

	Losses(lbs)		
Components	Working Loss	Breathing Loss	Total Emissions
Distillate fuel oil no. 2	0.80	1.74	2.54

TANKS 4.0.9d
Emissions Report - Detail Format
Tank Indentification and Physical Characteristics

Identification

User Identification:	TNKO-0184
City:	Long Beach
State:	California
Company:	UPRR
Type of Tank:	Horizontal Tank
Description:	

Tank Dimensions

Shell Length (ft):		20.50
Diameter (ft):		7.00
Volume (gallons):		6,000.00
Turnovers:		4.00
Net Throughput(gal/yr):		24,000.00
Is Tank Heated (y/n):	N	
Is Tank Underground (y/n):	N	

Paint Characteristics

Shell Color/Shade:	Gray/Light
Shell Condition	Good

Breather Vent Settings

Vacuum Settings (psig):	-0.03
Pressure Settings (psig)	0.03

Meterological Data used in Emissions Calculations: Long Beach, California (Avg Atmospheric Pressure = 14.7 psia)

TANKS 4.0.9d
Emissions Report - Detail Format
Liquid Contents of Storage Tank

TNKO-0184 - Horizontal Tank
Long Beach, California

Mixture/Component	Month	Daily Liquid Surf. Temperature (deg F) Avg.	Min.	Max.	Liquid Bulk Temp (deg F)	Vapor Pressure (psia) Avg.	Min.	Max.	Vapor Mol. Weight.	Liquid Mass Fract.	Vapor Mass Fract.	Mol. Weight	Basis for Vapor Pressure Calculations
Distillate fuel oil no. 2	All	72.27	62.76	81.78	66.55	0.0097	0.0072	0.0127	130.0000			188.00	Option 1: VP70 = .009 VP80 = .012

TANKS 4.0.9d
Emissions Report - Detail Format
Detail Calculations (AP-42)

TNKO-0184 - Horizontal Tank
Long Beach, California

Annual Emission Calcaulations

Standing Losses (lb):	2.7361
Vapor Space Volume (cu ft):	502.5047
Vapor Density (lb/cu ft):	0.0002
Vapor Space Expansion Factor:	0.0678
Vented Vapor Saturation Factor:	0.9982
Tank Vapor Space Volume:	
Vapor Space Volume (cu ft):	502.5047
Tank Diameter (ft):	7.0000
Effective Diameter (ft):	13.5204
Vapor Space Outage (ft):	3.5000
Tank Shell Length (ft):	20.5000
Vapor Density	
Vapor Density (lb/cu ft):	0.0002
Vapor Molecular Weight (lb/lb-mole):	130.0000
Vapor Pressure at Daily Average Liquid Surface Temperature (psia):	0.0097
Daily Avg. Liquid Surface Temp. (deg. R):	531.9374
Daily Average Ambient Temp. (deg. F):	64.3083
Ideal Gas Constant R (psia cuft / (lb-mol-deg R)):	10.731
Liquid Bulk Temperature (deg. R):	526.2183
Tank Paint Solar Absorptance (Shell):	0.5400
Daily Total Solar Insulation Factor (Btu/sqft day):	1,571.6498
Vapor Space Expansion Factor	
Vapor Space Expansion Factor:	0.0678
Daily Vapor Temperature Range (deg. R):	38.0313
Daily Vapor Pressure Range (psia):	0.0055
Breather Vent Press. Setting Range(psia):	0.0600
Vapor Pressure at Daily Average Liquid Surface Temperature (psia):	0.0097
Vapor Pressure at Daily Minimum Liquid Surface Temperature (psia):	0.0072
Vapor Pressure at Daily Maximum Liquid Surface Temperature (psia):	0.0127
Daily Avg. Liquid Surface Temp. (deg R):	531.9374
Daily Min. Liquid Surface Temp. (deg R):	522.4296
Daily Max. Liquid Surface Temp. (deg R):	541.4452
Daily Ambient Temp. Range (deg. R):	19.8167
Vented Vapor Saturation Factor	
Vented Vapor Saturation Factor:	0.9982
Vapor Pressure at Daily Average Liquid: Surface Temperature (psia):	0.0097
Vapor Space Outage (ft):	3.5000
Working Losses (lb):	0.7191
Vapor Molecular Weight (lb/lb-mole):	130.0000
Vapor Pressure at Daily Average Liquid Surface Temperature (psia):	0.0097
Annual Net Throughput (gal/yr.):	24,000.0000

Annual Turnovers:	4.0000
Turnover Factor:	1.0000
Tank Diameter (ft):	7.0000
Working Loss Product Factor:	1.0000
Total Losses (lb):	3.4552

TANKS 4.0.9d
Emissions Report - Detail Format
Individual Tank Emission Totals

Emissions Report for: Annual

TNKO-0184 - Horizontal Tank
Long Beach, California

	Losses(lbs)		
Components	Working Loss	Breathing Loss	Total Emissions
Distillate fuel oil no. 2	0.72	2.74	3.46

TANKS 4.0.9d
Emissions Report - Detail Format
Tank Indentification and Physical Characteristics

Identification

User Identification:	TNKO-0001
City:	Long Beach
State:	California
Company:	UPRR
Type of Tank:	Horizontal Tank
Description:	

Tank Dimensions

Shell Length (ft):		20.50
Diameter (ft):		10.00
Volume (gallons):		12,000.00
Turnovers:		4.00
Net Throughput(gal/yr):		48,000.00
Is Tank Heated (y/n):	N	
Is Tank Underground (y/n):	N	

Paint Characteristics

Shell Color/Shade:	Gray/Light
Shell Condition	Good

Breather Vent Settings

Vacuum Settings (psig):	-0.03
Pressure Settings (psig)	0.03

Meterological Data used in Emissions Calculations: Long Beach, California (Avg Atmospheric Pressure = 14.7 psia)

TANKS 4.0.9d
Emissions Report - Detail Format
Liquid Contents of Storage Tank

TNKO-0001 - Horizontal Tank
Long Beach, California

Mixture/Component	Month	Daily Liquid Surf. Temperature (deg F) Avg.	Min.	Max.	Liquid Bulk Temp (deg F)	Vapor Pressure (psia) Avg.	Min.	Max.	Vapor Mol. Weight.	Liquid Mass Fract.	Vapor Mass Fract.	Mol. Weight	Basis for Vapor Pressure Calculations
Distillate fuel oil no. 2	All	72.27	62.76	81.78	66.55	0.0097	0.0072	0.0127	130.0000			188.00	Option 1: VP70 = .009 VP80 = .012

TANKS 4.0.9d
Emissions Report - Detail Format
Detail Calculations (AP-42)

TNKO-0001 - Horizontal Tank
Long Beach, California

Annual Emission Calcaulations

Standing Losses (lb):	5.5796
Vapor Space Volume (cu ft):	1,025.5199
Vapor Density (lb/cu ft):	0.0002
Vapor Space Expansion Factor:	0.0678
Vented Vapor Saturation Factor:	0.9974
Tank Vapor Space Volume:	
Vapor Space Volume (cu ft):	1,025.5199
Tank Diameter (ft):	10.0000
Effective Diameter (ft):	16.1600
Vapor Space Outage (ft):	5.0000
Tank Shell Length (ft):	20.5000
Vapor Density	
Vapor Density (lb/cu ft):	0.0002
Vapor Molecular Weight (lb/lb-mole):	130.0000
Vapor Pressure at Daily Average Liquid Surface Temperature (psia):	0.0097
Daily Avg. Liquid Surface Temp. (deg. R):	531.9374
Daily Average Ambient Temp. (deg. F):	64.3083
Ideal Gas Constant R (psia cuft / (lb-mol-deg R)):	10.731
Liquid Bulk Temperature (deg. R):	526.2183
Tank Paint Solar Absorptance (Shell):	0.5400
Daily Total Solar Insulation Factor (Btu/sqft day):	1,571.6498
Vapor Space Expansion Factor	
Vapor Space Expansion Factor:	0.0678
Daily Vapor Temperature Range (deg. R):	38.0313
Daily Vapor Pressure Range (psia):	0.0055
Breather Vent Press. Setting Range(psia):	0.0600
Vapor Pressure at Daily Average Liquid Surface Temperature (psia):	0.0097
Vapor Pressure at Daily Minimum Liquid Surface Temperature (psia):	0.0072
Vapor Pressure at Daily Maximum Liquid Surface Temperature (psia):	0.0127
Daily Avg. Liquid Surface Temp. (deg R):	531.9374
Daily Min. Liquid Surface Temp. (deg R):	522.4296
Daily Max. Liquid Surface Temp. (deg R):	541.4452
Daily Ambient Temp. Range (deg. R):	19.8167
Vented Vapor Saturation Factor	
Vented Vapor Saturation Factor:	0.9974
Vapor Pressure at Daily Average Liquid: Surface Temperature (psia):	0.0097
Vapor Space Outage (ft):	5.0000
Working Losses (lb):	1.4382
Vapor Molecular Weight (lb/lb-mole):	130.0000
Vapor Pressure at Daily Average Liquid Surface Temperature (psia):	0.0097
Annual Net Throughput (gal/yr.):	48,000.0000

Annual Turnovers:	4.0000
Turnover Factor:	1.0000
Tank Diameter (ft):	10.0000
Working Loss Product Factor:	1.0000

Total Losses (lb):	7.0178

TANKS 4.0.9d
Emissions Report - Detail Format
Individual Tank Emission Totals

Emissions Report for: Annual

TNKO-0001 - Horizontal Tank
Long Beach, California

	Losses(lbs)		
Components	Working Loss	Breathing Loss	Total Emissions
Distillate fuel oil no. 2	1.44	5.58	7.02

TANKS 4.0.9d
Emissions Report - Detail Format
Tank Indentification and Physical Characteristics

Identification

User Identification:	ICTF - TBA 1 - CY 2010
City:	Long Beach
State:	California
Company:	UPRR
Type of Tank:	Horizontal Tank
Description:	

Tank Dimensions

Shell Length (ft):		7.00
Diameter (ft):		5.00
Volume (gallons):		1,000.00
Turnovers:		33.80
Net Throughput(gal/yr):		33,800.00
Is Tank Heated (y/n):	N	
Is Tank Underground (y/n):	N	

Paint Characteristics

Shell Color/Shade:	White/White
Shell Condition	Good

Breather Vent Settings

Vacuum Settings (psig):	-0.03
Pressure Settings (psig)	0.03

Meterological Data used in Emissions Calculations: Long Beach, California (Avg Atmospheric Pressure = 14.7 psia)

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TANKS 4.0.9d
Emissions Report - Detail Format
Liquid Contents of Storage Tank

ICTF - TBA 1 - CY 2010 - Horizontal Tank
Long Beach, California

Mixture/Component	Month	Daily Liquid Surf. Temperature (deg F) Avg.	Min.	Max.	Liquid Bulk Temp (deg F)	Vapor Pressure (psia) Avg.	Min.	Max.	Vapor Mol. Weight.	Liquid Mass Fract.	Vapor Mass Fract.	Mol. Weight	Basis for Vapor Pressure Calculations
Distillate fuel oil no. 2	All	66.43	60.99	71.87	64.33	0.0081	0.0067	0.0096	130.0000			188.00	Option 1: VP60 = .0065 VP70 = .009

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TANKS 4.0.9d
Emissions Report - Detail Format
Detail Calculations (AP-42)

ICTF - TBA 1 - CY 2010 - Horizontal Tank
Long Beach, California

Annual Emission Calcaulations

Standing Losses (lb):	0.2232
Vapor Space Volume (cu ft):	87.5444
Vapor Density (lb/cu ft):	0.0002
Vapor Space Expansion Factor:	0.0374
Vented Vapor Saturation Factor:	0.9989
Tank Vapor Space Volume:	
Vapor Space Volume (cu ft):	87.5444
Tank Diameter (ft):	5.0000
Effective Diameter (ft):	6.6773
Vapor Space Outage (ft):	2.5000
Tank Shell Length (ft):	7.0000
Vapor Density	
Vapor Density (lb/cu ft):	0.0002
Vapor Molecular Weight (lb/lb-mole):	130.0000
Vapor Pressure at Daily Average Liquid Surface Temperature (psia):	0.0081
Daily Avg. Liquid Surface Temp. (deg. R):	526.1003
Daily Average Ambient Temp. (deg. F):	64.3083
Ideal Gas Constant R (psia cuft / (lb-mol-deg R)):	10.731
Liquid Bulk Temperature (deg. R):	523.9983
Tank Paint Solar Absorptance (Shell):	0.1700
Daily Total Solar Insulation Factor (Btu/sqft day):	1,571.6498
Vapor Space Expansion Factor	
Vapor Space Expansion Factor:	0.0374
Daily Vapor Temperature Range (deg. R):	21.7491
Daily Vapor Pressure Range (psia):	0.0028
Breather Vent Press. Setting Range(psia):	0.0600
Vapor Pressure at Daily Average Liquid Surface Temperature (psia):	0.0081
Vapor Pressure at Daily Minimum Liquid Surface Temperature (psia):	0.0067
Vapor Pressure at Daily Maximum Liquid Surface Temperature (psia):	0.0096
Daily Avg. Liquid Surface Temp. (deg R):	526.1003
Daily Min. Liquid Surface Temp. (deg R):	520.6630
Daily Max. Liquid Surface Temp. (deg R):	531.5375
Daily Ambient Temp. Range (deg. R):	19.8167
Vented Vapor Saturation Factor	
Vented Vapor Saturation Factor:	0.9989
Vapor Pressure at Daily Average Liquid: Surface Temperature (psia):	0.0081
Vapor Space Outage (ft):	2.5000
Working Losses (lb):	0.8482
Vapor Molecular Weight (lb/lb-mole):	130.0000
Vapor Pressure at Daily Average Liquid Surface Temperature (psia):	0.0081
Annual Net Throughput (gal/yr.):	33,800.0000

Annual Turnovers:	33.8000
Turnover Factor:	1.0000
Tank Diameter (ft):	5.0000
Working Loss Product Factor:	1.0000
Total Losses (lb):	1.0714

TANKS 4.0.9d
Emissions Report - Detail Format
Individual Tank Emission Totals

Emissions Report for: Annual

ICTF - TBA 1 - CY 2010 - Horizontal Tank
Long Beach, California

	Losses(lbs)		
Components	Working Loss	Breathing Loss	Total Emissions
Distillate fuel oil no. 2	0.85	0.22	1.07

TANKS 4.0.9d
Emissions Report - Detail Format
Tank Indentification and Physical Characteristics

Identification

User Identification:	ICTF-TBA 2 - CY 2010
City:	Long Beach
State:	California
Company:	UPRR
Type of Tank:	Horizontal Tank
Description:	

Tank Dimensions

Shell Length (ft):		12.00
Diameter (ft):		7.00
Volume (gallons):		2,000.00
Turnovers:		0.00
Net Throughput(gal/yr):		56,425.00
Is Tank Heated (y/n):	N	
Is Tank Underground (y/n):	N	

Paint Characteristics

Shell Color/Shade:	White/White
Shell Condition	Good

Breather Vent Settings

Vacuum Settings (psig):	-0.03
Pressure Settings (psig)	0.03

Meterological Data used in Emissions Calculations: Long Beach, California (Avg Atmospheric Pressure = 14.7 psia)

TANKS 4.0.9d
Emissions Report - Detail Format
Liquid Contents of Storage Tank

ICTF-TBA 2 - CY 2010 - Horizontal Tank
Long Beach, California

Mixture/Component	Month	Daily Liquid Surf. Temperature (deg F) Avg.	Min.	Max.	Liquid Bulk Temp (deg F)	Vapor Pressure (psia) Avg.	Min.	Max.	Vapor Mol. Weight.	Liquid Mass Fract.	Vapor Mass Fract.	Mol. Weight	Basis for Vapor Pressure Calculations
Gasoline (RVP 10)	All	66.43	60.99	71.87	64.33	5.8655	5.2864	6.4943	66.0000			92.00	Option 4: RVP=10, ASTM Slope=3

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TANKS 4.0.9d
Emissions Report - Detail Format
Detail Calculations (AP-42)

ICTF-TBA 2 - CY 2010 - Horizontal Tank
Long Beach, California

Annual Emission Calcaulations

Standing Losses (lb):	603.7306
Vapor Space Volume (cu ft):	294.1491
Vapor Density (lb/cu ft):	0.0686
Vapor Space Expansion Factor:	0.1712
Vented Vapor Saturation Factor:	0.4789
Tank Vapor Space Volume:	
Vapor Space Volume (cu ft):	294.1491
Tank Diameter (ft):	7.0000
Effective Diameter (ft):	10.3444
Vapor Space Outage (ft):	3.5000
Tank Shell Length (ft):	12.0000
Vapor Density	
Vapor Density (lb/cu ft):	0.0686
Vapor Molecular Weight (lb/lb-mole):	66.0000
Vapor Pressure at Daily Average Liquid Surface Temperature (psia):	5.8655
Daily Avg. Liquid Surface Temp. (deg. R):	526.1003
Daily Average Ambient Temp. (deg. F):	64.3083
Ideal Gas Constant R (psia cuft / (lb-mol-deg R)):	10.731
Liquid Bulk Temperature (deg. R):	523.9983
Tank Paint Solar Absorptance (Shell):	0.1700
Daily Total Solar Insulation Factor (Btu/sqft day):	1,571.6498
Vapor Space Expansion Factor	
Vapor Space Expansion Factor:	0.1712
Daily Vapor Temperature Range (deg. R):	21.7491
Daily Vapor Pressure Range (psia):	1.2079
Breather Vent Press. Setting Range(psia):	0.0600
Vapor Pressure at Daily Average Liquid Surface Temperature (psia):	5.8655
Vapor Pressure at Daily Minimum Liquid Surface Temperature (psia):	5.2864
Vapor Pressure at Daily Maximum Liquid Surface Temperature (psia):	6.4943
Daily Avg. Liquid Surface Temp. (deg R):	526.1003
Daily Min. Liquid Surface Temp. (deg R):	520.6630
Daily Max. Liquid Surface Temp. (deg R):	531.5375
Daily Ambient Temp. Range (deg. R):	19.8167
Vented Vapor Saturation Factor	
Vented Vapor Saturation Factor:	0.4789
Vapor Pressure at Daily Average Liquid: Surface Temperature (psia):	5.8655
Vapor Space Outage (ft):	3.5000
Working Losses (lb):	520.0823
Vapor Molecular Weight (lb/lb-mole):	66.0000
Vapor Pressure at Daily Average Liquid Surface Temperature (psia):	5.8655
Annual Net Throughput (gal/yr.):	56,425.0000

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Annual Turnovers:	0.0000
Turnover Factor:	1.0000
Tank Diameter (ft):	7.0000
Working Loss Product Factor:	1.0000

Total Losses (lb):	1,123.8129

TANKS 4.0.9d
Emissions Report - Detail Format
Individual Tank Emission Totals

Emissions Report for: Annual

ICTF-TBA 2 - CY 2010 - Horizontal Tank
Long Beach, California

	Losses(lbs)		
Components	Working Loss	Breathing Loss	Total Emissions
Gasoline (RVP 10)	520.08	603.73	1,123.81

TANKS 4.0.9d
Emissions Report - Detail Format
Tank Indentification and Physical Characteristics

Identification

User Identification:	ICTF-TBA-3 - CY 2010
City:	Long Beach
State:	California
Company:	UPRR
Type of Tank:	Horizontal Tank
Description:	

Tank Dimensions

Shell Length (ft):		6.00
Diameter (ft):		4.00
Volume (gallons):		500.00
Turnovers:		2.60
Net Throughput(gal/yr):		1,300.00
Is Tank Heated (y/n):	N	
Is Tank Underground (y/n):	N	

Paint Characteristics

Shell Color/Shade:	Gray/Medium
Shell Condition	Good

Breather Vent Settings

Vacuum Settings (psig):	-0.03
Pressure Settings (psig)	0.03

Meterological Data used in Emissions Calculations: Long Beach, California (Avg Atmospheric Pressure = 14.7 psia)

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TANKS 4.0.9d
Emissions Report - Detail Format
Liquid Contents of Storage Tank

ICTF-TBA-3 - CY 2010 - Horizontal Tank
Long Beach, California

Mixture/Component	Month	Daily Liquid Surf. Temperature (deg F) Avg.	Min.	Max.	Liquid Bulk Temp (deg F)	Vapor Pressure (psia) Avg.	Min.	Max.	Vapor Mol. Weight.	Liquid Mass Fract.	Vapor Mass Fract.	Mol. Weight	Basis for Vapor Pressure Calculations
Distillate fuel oil no. 2	All	74.48	63.43	85.52	67.39	0.0103	0.0074	0.0142	130.0000			188.00	Option 1: VP70 = .009 VP80 = .012

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TANKS 4.0.9d
Emissions Report - Detail Format
Detail Calculations (AP-42)

ICTF-TBA-3 - CY 2010 - Horizontal Tank
Long Beach, California

Annual Emission Calcaulations

Standing Losses (lb):	0.3250
Vapor Space Volume (cu ft):	48.0243
Vapor Density (lb/cu ft):	0.0002
Vapor Space Expansion Factor:	0.0791
Vented Vapor Saturation Factor:	0.9989
Tank Vapor Space Volume:	
Vapor Space Volume (cu ft):	48.0243
Tank Diameter (ft):	4.0000
Effective Diameter (ft):	5.5293
Vapor Space Outage (ft):	2.0000
Tank Shell Length (ft):	6.0000
Vapor Density	
Vapor Density (lb/cu ft):	0.0002
Vapor Molecular Weight (lb/lb-mole):	130.0000
Vapor Pressure at Daily Average Liquid Surface Temperature (psia):	0.0103
Daily Avg. Liquid Surface Temp. (deg. R):	534.1460
Daily Average Ambient Temp. (deg. F):	64.3083
Ideal Gas Constant R (psia cuft / (lb-mol-deg R)):	10.731
Liquid Bulk Temperature (deg. R):	527.0583
Tank Paint Solar Absorptance (Shell):	0.6800
Daily Total Solar Insulation Factor (Btu/sqft day):	1,571.6498
Vapor Space Expansion Factor	
Vapor Space Expansion Factor:	0.0791
Daily Vapor Temperature Range (deg. R):	44.1922
Daily Vapor Pressure Range (psia):	0.0069
Breather Vent Press. Setting Range(psia):	0.0600
Vapor Pressure at Daily Average Liquid Surface Temperature (psia):	0.0103
Vapor Pressure at Daily Minimum Liquid Surface Temperature (psia):	0.0074
Vapor Pressure at Daily Maximum Liquid Surface Temperature (psia):	0.0142
Daily Avg. Liquid Surface Temp. (deg R):	534.1460
Daily Min. Liquid Surface Temp. (deg R):	523.0980
Daily Max. Liquid Surface Temp. (deg R):	545.1941
Daily Ambient Temp. Range (deg. R):	19.8167
Vented Vapor Saturation Factor	
Vented Vapor Saturation Factor:	0.9989
Vapor Pressure at Daily Average Liquid: Surface Temperature (psia):	0.0103
Vapor Space Outage (ft):	2.0000
Working Losses (lb):	0.0416
Vapor Molecular Weight (lb/lb-mole):	130.0000
Vapor Pressure at Daily Average Liquid Surface Temperature (psia):	0.0103
Annual Net Throughput (gal/yr.):	1,300.0000

Annual Turnovers:	2.6000
Turnover Factor:	1.0000
Tank Diameter (ft):	4.0000
Working Loss Product Factor:	1.0000
Total Losses (lb):	0.3666

TANKS 4.0.9d
Emissions Report - Detail Format
Individual Tank Emission Totals

Emissions Report for: Annual

ICTF-TBA-3 - CY 2010 - Horizontal Tank
Long Beach, California

	Losses(lbs)		
Components	Working Loss	Breathing Loss	Total Emissions
Distillate fuel oil no. 2	0.04	0.32	0.37

TANKS 4.0.9d
Emissions Report - Detail Format
Tank Indentification and Physical Characteristics

Identification

User Identification:	TNKD-9901 - CY 2010
City:	Long Beach
State:	California
Company:	UPRR
Type of Tank:	Horizontal Tank
Description:	

Tank Dimensions

Shell Length (ft):		34.50
Diameter (ft):		10.00
Volume (gallons):		20,000.00
Turnovers:		3.90
Net Throughput(gal/yr):		78,000.00
Is Tank Heated (y/n):	N	
Is Tank Underground (y/n):	N	

Paint Characteristics

Shell Color/Shade:	White/White
Shell Condition	Good

Breather Vent Settings

Vacuum Settings (psig):	-0.03
Pressure Settings (psig)	0.03

Meterological Data used in Emissions Calculations: Long Beach, California (Avg Atmospheric Pressure = 14.7 psia)

TANKS 4.0.9d
Emissions Report - Detail Format
Liquid Contents of Storage Tank

TNKD-9901 - CY 2010 - Horizontal Tank
Long Beach, California

Mixture/Component	Month	Daily Liquid Surf. Temperature (deg F) Avg.	Min.	Max.	Liquid Bulk Temp (deg F)	Vapor Pressure (psia) Avg.	Min.	Max.	Vapor Mol. Weight.	Liquid Mass Fract.	Vapor Mass Fract.	Mol. Weight	Basis for Vapor Pressure Calculations
Distillate fuel oil no. 2	All	66.43	60.99	71.87	64.33	0.0081	0.0067	0.0096	130.0000			188.00	Option 1: VP60 = .0065 VP70 = .009

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TANKS 4.0.9d
Emissions Report - Detail Format
Detail Calculations (AP-42)

TNKD-9901 - CY 2010 - Horizontal Tank
Long Beach, California

Annual Emission Calcaulations

Standing Losses (lb):	4.3947
Vapor Space Volume (cu ft):	1,725.8749
Vapor Density (lb/cu ft):	0.0002
Vapor Space Expansion Factor:	0.0374
Vented Vapor Saturation Factor:	0.9979
Tank Vapor Space Volume:	
Vapor Space Volume (cu ft):	1,725.8749
Tank Diameter (ft):	10.0000
Effective Diameter (ft):	20.9640
Vapor Space Outage (ft):	5.0000
Tank Shell Length (ft):	34.5000
Vapor Density	
Vapor Density (lb/cu ft):	0.0002
Vapor Molecular Weight (lb/lb-mole):	130.0000
Vapor Pressure at Daily Average Liquid Surface Temperature (psia):	0.0081
Daily Avg. Liquid Surface Temp. (deg. R):	526.1003
Daily Average Ambient Temp. (deg. F):	64.3083
Ideal Gas Constant R (psia cuft / (lb-mol-deg R)):	10.731
Liquid Bulk Temperature (deg. R):	523.9983
Tank Paint Solar Absorptance (Shell):	0.1700
Daily Total Solar Insulation Factor (Btu/sqft day):	1,571.6498
Vapor Space Expansion Factor	
Vapor Space Expansion Factor:	0.0374
Daily Vapor Temperature Range (deg. R):	21.7491
Daily Vapor Pressure Range (psia):	0.0028
Breather Vent Press. Setting Range(psia):	0.0600
Vapor Pressure at Daily Average Liquid Surface Temperature (psia):	0.0081
Vapor Pressure at Daily Minimum Liquid Surface Temperature (psia):	0.0067
Vapor Pressure at Daily Maximum Liquid Surface Temperature (psia):	0.0096
Daily Avg. Liquid Surface Temp. (deg R):	526.1003
Daily Min. Liquid Surface Temp. (deg R):	520.6630
Daily Max. Liquid Surface Temp. (deg R):	531.5375
Daily Ambient Temp. Range (deg. R):	19.8167
Vented Vapor Saturation Factor	
Vented Vapor Saturation Factor:	0.9979
Vapor Pressure at Daily Average Liquid: Surface Temperature (psia):	0.0081
Vapor Space Outage (ft):	5.0000
Working Losses (lb):	1.9574
Vapor Molecular Weight (lb/lb-mole):	130.0000
Vapor Pressure at Daily Average Liquid Surface Temperature (psia):	0.0081
Annual Net Throughput (gal/yr.):	78,000.0000

Annual Turnovers:	3.9000
Turnover Factor:	1.0000
Tank Diameter (ft):	10.0000
Working Loss Product Factor:	1.0000
Total Losses (lb):	6.3521

TANKS 4.0.9d
Emissions Report - Detail Format
Individual Tank Emission Totals

Emissions Report for: Annual

TNKD-9901 - CY 2010 - Horizontal Tank
Long Beach, California

	Losses(lbs)		
Components	Working Loss	Breathing Loss	Total Emissions
Distillate fuel oil no. 2	1.96	4.39	6.35

TANKS 4.0.9d
Emissions Report - Detail Format
Total Emissions Summaries - All Tanks in Report

Emissions Report for: Annual

Tank Identification				Losses (lbs)
ICTF - TBA 1 - CY 2010	UPRR	Horizontal Tank	Long Beach, California	1.07
ICTF-TBA 2 - CY 2010	UPRR	Horizontal Tank	Long Beach, California	1,123.81
ICTF-TBA-3 - CY 2010	UPRR	Horizontal Tank	Long Beach, California	0.37
TNKD-9901 - CY 2010	UPRR	Horizontal Tank	Long Beach, California	6.35
Total Emissions for all Tanks:				1,131.60

TANKS 4.0.9d
Emissions Report - Detail Format
Tank Indentification and Physical Characteristics

Identification

User Identification:	ICTG-New 1a
City:	Long Beach
State:	California
Company:	UPRR
Type of Tank:	Horizontal Tank
Description:	Proposed biodiesel tank

Tank Dimensions

Shell Length (ft):		5.50
Diameter (ft):		4.00
Volume (gallons):		500.00
Turnovers:		40.00
Net Throughput(gal/yr):		20,000.00
Is Tank Heated (y/n):	N	
Is Tank Underground (y/n):	N	

Paint Characteristics

Shell Color/Shade:	White/White
Shell Condition	Good

Breather Vent Settings

Vacuum Settings (psig):	-0.03
Pressure Settings (psig)	0.03

Meterological Data used in Emissions Calculations: Long Beach, California (Avg Atmospheric Pressure = 14.7 psia)

TANKS 4.0.9d
Emissions Report - Detail Format
Liquid Contents of Storage Tank

ICTG-New 1a - Horizontal Tank
Long Beach, California

Mixture/Component	Month	Daily Liquid Surf. Temperature (deg F) Avg.	Min.	Max.	Liquid Bulk Temp (deg F)	Vapor Pressure (psia) Avg.	Min.	Max.	Vapor Mol. Weight.	Liquid Mass Fract.	Vapor Mass Fract.	Mol. Weight	Basis for Vapor Pressure Calculations
Distillate fuel oil no. 2	All	66.43	60.99	71.87	64.33	0.0081	0.0067	0.0096	130.0000			188.00	Option 1: VP60 = .0065 VP70 = .009

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TANKS 4.0.9d
Emissions Report - Detail Format
Detail Calculations (AP-42)

ICTG-New 1a - Horizontal Tank
Long Beach, California

Annual Emission Calcaulations

Standing Losses (lb):	0.1122
Vapor Space Volume (cu ft):	44.0223
Vapor Density (lb/cu ft):	0.0002
Vapor Space Expansion Factor:	0.0374
Vented Vapor Saturation Factor:	0.9991
Tank Vapor Space Volume:	
Vapor Space Volume (cu ft):	44.0223
Tank Diameter (ft):	4.0000
Effective Diameter (ft):	5.2939
Vapor Space Outage (ft):	2.0000
Tank Shell Length (ft):	5.5000
Vapor Density	
Vapor Density (lb/cu ft):	0.0002
Vapor Molecular Weight (lb/lb-mole):	130.0000
Vapor Pressure at Daily Average Liquid Surface Temperature (psia):	0.0081
Daily Avg. Liquid Surface Temp. (deg. R):	526.1003
Daily Average Ambient Temp. (deg. F):	64.3083
Ideal Gas Constant R (psia cuft / (lb-mol-deg R)):	10.731
Liquid Bulk Temperature (deg. R):	523.9983
Tank Paint Solar Absorptance (Shell):	0.1700
Daily Total Solar Insulation Factor (Btu/sqft day):	1,571.6498
Vapor Space Expansion Factor	
Vapor Space Expansion Factor:	0.0374
Daily Vapor Temperature Range (deg. R):	21.7491
Daily Vapor Pressure Range (psia):	0.0028
Breather Vent Press. Setting Range(psia):	0.0600
Vapor Pressure at Daily Average Liquid Surface Temperature (psia):	0.0081
Vapor Pressure at Daily Minimum Liquid Surface Temperature (psia):	0.0067
Vapor Pressure at Daily Maximum Liquid Surface Temperature (psia):	0.0096
Daily Avg. Liquid Surface Temp. (deg R):	526.1003
Daily Min. Liquid Surface Temp. (deg R):	520.6630
Daily Max. Liquid Surface Temp. (deg R):	531.5375
Daily Ambient Temp. Range (deg. R):	19.8167
Vented Vapor Saturation Factor	
Vented Vapor Saturation Factor:	0.9991
Vapor Pressure at Daily Average Liquid: Surface Temperature (psia):	0.0081
Vapor Space Outage (ft):	2.0000
Working Losses (lb):	0.4601
Vapor Molecular Weight (lb/lb-mole):	130.0000
Vapor Pressure at Daily Average Liquid Surface Temperature (psia):	0.0081
Annual Net Throughput (gal/yr.):	20,000.0000

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Annual Turnovers:	40.0000
Turnover Factor:	0.9167
Tank Diameter (ft):	4.0000
Working Loss Product Factor:	1.0000
Total Losses (lb):	0.5723

TANKS 4.0.9d
Emissions Report - Detail Format
Individual Tank Emission Totals

Emissions Report for: Annual

ICTG-New 1a - Horizontal Tank
Long Beach, California

	Losses(lbs)		
Components	Working Loss	Breathing Loss	Total Emissions
Distillate fuel oil no. 2	0.46	0.11	0.57

APPENDIX J-2

SPECIATION PROFILE FOR GASOLINE STORAGE TANK

Toxic Air Contaminant Emissions from the Gasoline Storage Tank
Dolores and ICTF Rail Yards, Long Beach, CA

Profile[1]	CAS	Chemical Name	Organic Fraction	Tank TBA-2 2005 Emissions (tpy)
661	540841	2,2,4-trimethylpentane	0.0130	9.27E-03
661	71432	benzene	0.0036	2.58E-03
661	110827	cyclohexane	0.0103	7.36E-03
661	100414	ethylbenzene	0.0012	8.45E-04
661	78784	isopentane	0.3747	2.67E-01
661	98828	isopropylbenzene (cumene)	0.0001	7.88E-05
661	108383	m-xylene	0.0034	2.46E-03
661	110543	n-hexane	0.0155	1.10E-02
661	95476	o-xylene	0.0013	9.17E-04
661	106423	p-xylene	0.0011	7.66E-04
661	108883	toluene	0.0171	1.22E-02
Total				**3.15E-01**

Notes
1. Organic fraction from ARBs SPECIATE database. Data is from "Headspace vapors 1996 SSD etoh 2.0% (MTBE phaseout)" option.
2. Emissions were calculated for only chemicals that were in both the SPECIATE database and the AB2588 list.
3. Organic fraction reported on a ROG basis using ARB's Speciate ROG/TOG ratio (0.9963).

Toxic Air Contaminant Emissions from the Gasoline Storage Tank
Dolores and ICTF Rail Yards, Long Beach, CA

Profile[1]	CAS	Chemical Name	Organic Fraction	Tank TBA-2 2010 Emissions (tpy)
661	540841	2,2,4-trimethylpentane	0.0130	7.30E-03
661	71432	benzene	0.0036	2.03E-03
661	110827	cyclohexane	0.0103	5.80E-03
661	100414	ethylbenzene	0.0012	6.66E-04
661	78784	isopentane	0.3747	2.11E-01
661	98828	isopropylbenzene (cumene)	0.0001	6.20E-05
661	108383	m-xylene	0.0034	1.93E-03
661	110543	n-hexane	0.0155	8.69E-03
661	95476	o-xylene	0.0013	7.22E-04
661	106423	p-xylene	0.0011	6.03E-04
661	108883	toluene	0.0171	9.60E-03
Total				**2.48E-01**

Notes
1. Organic fraction from ARBs SPECIATE database. Data is from "Headspace vapors 1996 SSD etoh 2.0% (MTBE phaseout)" option.
2. Emissions were calculated for only chemicals that were in both the SPECIATE database and the AB2588 list.
3. Organic fraction reported on a ROG basis using ARB's Speciate ROG/TOG ratio (0.9963).

APPENDIX J-3

DEATILED EMISSION CALCULATIONS FOR THE
2005 BASELINE YEAR AND PROJECT YEARS 2010-2016

Summary of Emissions and Equipment Specifications for Storage Tanks
Dolores and ICTF Rail Yards, Long Beach, CA

Yard	Tank No.	Tank Location	Material Stored	Tank Capacity	Tank Dimensions			Shell Color	Shell Condition	Annual Throughput (gal/yr)	Emissions (tpy)	Permitted?	Exemption Citation
					Length	Height	Diameter						
ICTF	TNKD-9901	Crane Maintenance	Offroad Diesel	20,000	34.5		10	White	Good	120,000	0.004	Exempt	Rule 219(m)(4)
ICTF	TBA-1	Crane Maintenance	CARB Diesel	1,000	7		4	White	Good	52,000	0.001	Exempt	Rule 219(m)(4)
ICTF	TBA-2	Crane Maintenance	Gasoline	2,000	11.83	6.92	4.75	White	Good	86,808	0.71	Yes	NA
ICTF	TBA-3	Tractor Maintenance	SAE 15W-40 Motor	500	6		4	Dark Gray	Good	2000	0.0002	Exempt	Rule 219(m)(7)
ICTF	TBA-4	Crane Maintenance	Used Oil	300	4		4	Orange	Good	1800	neg.	Exempt	Rule 219(m)(7)
ICTF	TBA-5	Crane Maintenance	Motor Oil	243	2.5	3	4.3	White	Good	972	neg.	Exempt	Rule 219(m)(7)
ICTF	TBA-6	Crane Maintenance	Hydraulic Oil	300	6	2.5	3	White	Good	1200	neg.	Exempt	Rule 219(m)(7)
ICTF	TBA-7	Tractor Maintenance Area	Automatic Transmission Fluid	243	2.5	3	4.3	Black	Good	972	neg.	Exempt	Rule 219(m)(7)
ICTF	TBA-8	Tractor Maintenance	SAE 20W-50 Motor	202	3	3	3	White	Good	808	neg.	Exempt	Rule 219(m)(7)
ICTF	TBA-9	Tractor Maintenance	Used Motor Oil	300	4		2	Gray	Good	1200	neg.	Exempt	Rule 219(m)(7)
ICTF	TBA-10	Tractor Maintenance	Used Motor Oil	300	4		2	Gray	Good	1200	neg.	Exempt	Rule 219(m)(7)
ICTF	TBA-11	Tractor Maintenance	Hydraulic Oil	240	3	2.7	4.3	Dark Gray	Good	960	neg.	Exempt	Rule 219(m)(7)
Dolores	TNKD-0069	Tank Farm	Diesel	160,000		24.0	34.0	White	Good	10,500,000	0.10	Yes	NA
Dolores	TNKD-0068	Tank Farm	Diesel	160,000		24.0	34.0	White	Good	10,500,000	0.10	Yes	NA
Dolores	TNKO-0002	Tank Farm	Recovered Oil	10,000	16.0		10.0	White	Good	40000	0.002	Exempt	Rule 219(m)(7)
Dolores	TNKO-0003	Tank Farm	Drain Oil	12,000	20.5		10.0	White	Good	48000	0.002	Exempt	Rule 219(m)(7)
Dolores	TNKO-0004	Tank Farm	Journal Box Oil	8,000	21.3		8.0	White	Good	32000	0.001	Exempt	Rule 219(m)(7)
Dolores	TNKO-0001	Tank Farm	Lube Oil	12,000	20.5		10.0	Light Gray	Good	48000	0.004	Exempt	Rule 219(m)(7)
Dolores	TNKO-0184	Service Track	Recovered Oil	6,000	20.5		7.0	Light Gray	Good	24000	0.002	Exempt	Rule 219(m)(7)
Dolores	TNKS-0005	Tank Farm	Stormwater	25,000	30.0	12.0	12.0	White	Good	980,100	neg.	Yes	Part of WWTP
Dolores	TNKS-0006	Tank Farm	Stormwater	25,000	30.0	12.0	12.0	White	Good	980,100	neg.	Yes	Part of WWTP
Dolores	TNKS-0007	Tank Farm	Stormwater	25,000	30.0	12.0	12.0	White	Good	980,100	neg.	Yes	Part of WWTP
Dolores	TNKS-0008	Tank Farm	Stormwater	25,000	30.0	12.0	12.0	White	Good	980,100	neg.	Yes	Part of WWTP
Dolores	TNKS-0010	Tank Farm	Soap	8,000		8.0	8.0	White	Good	22,785	NA	Exempt	Rule 219(m)(6)
Dolores	NA	WWTP	Sludge	1,000	6.5	5.0	5.0	White	Good	NA	neg.	NA	Solids
Dolores	NA	WWTP	Nalco	380					Good	NA	neg.	NA	No Emissions
Total VOC											**0.93**		

Notes:
1. Annual throughput for non-exempt tanks provided by UPRR.
2. Annual throughput for exempt tanks based on the assumptions contained in the Trinity Reports.
3. Emissions calculations performed using the USEPA TANKS 4.0.9d program.
4. Emissions from small oil storage tanks, stormwater tanks, soap tank, sludge tanks and the Nalco tank were assumed to be negligible.
5. The VOC emissions for oil tanks were estimated by modeling the liquid conents as diesel fuel, resulting in conservative estimates.

Summary of Emissions and Equipment Specifications for Storage Tanks
Dolores and ICTF Rail Yards, Long Beach, CA

Yard	Tank No.	Tank Location	Material Stored	Tank Capacity	Tank Dimensions Length	Height	Diameter	Shell Color	Shell Condition	2010 Annual Throughput (gal/yr)[1,2]	Emissions (tpy)[3,4,5]	Permitted?	Exemption Citation
ICTF	TNKD-9901	Crane Maintenance	Offroad Diesel	20,000	34.5		10	White	Good	78,000	0.003	Exempt	Rule 219(m)(4)
ICTF	TBA-1	Crane Maintenance	CARB Diesel	1,000	7		4	White	Good	33,800	0.001	Exempt	Rule 219(m)(4)
ICTF	TBA-2	Crane Maintenance	Gasoline	2,000	11.83	6.92	4.75	White	Good	56,425	0.56	Yes	NA
ICTF	TBA-3	Tractor Maintenance	SAE 15W-40	500	6		4	Dark Gray	Good	1300	0.0002	Exempt	Rule 219(m)(7)
ICTF	TBA-4	Crane Maintenance	Used Oil	300	4		4	Orange	Good	1170	neg.	Exempt	Rule 219(m)(7)
ICTF	TBA-5	Crane Maintenance	Motor Oil	243	2.5	3	4.3	White	Good	631.8	neg.	Exempt	Rule 219(m)(7)
ICTF	TBA-6	Crane Maintenance	Hydraulic Oil	300	6	2.5	3	White	Good	780	neg.	Exempt	Rule 219(m)(7)
ICTF	TBA-7	Tractor Maintenance Area	Automatic Transmission Fluid	243	2.5	3	4.3	Black	Good	631.8	neg.	Exempt	Rule 219(m)(7)
ICTF	TBA-8	Tractor Maintenance	SAE 20W-50	202	3	3	3	White	Good	525.2	neg.	Exempt	Rule 219(m)(7)
ICTF	TBA-9	Tractor Maintenance	Used Motor Oil	300	4		2	Gray	Good	780	neg.	Exempt	Rule 219(m)(7)
ICTF	TBA-10	Tractor Maintenance	Used Motor Oil	300	4		2	Gray	Good	780	neg.	Exempt	Rule 219(m)(7)
ICTF	TBA-11	Tractor Maintenance	Hydraulic Oil	240	3	2.7	4.3	Dark Gray	Good	624	neg.	Exempt	Rule 219(m)(7)
Dolores	TNKD-0069	Tank Farm	Diesel	160,000		24.0	34.0	White	Good	10,500,000	0.10	Yes	NA
Dolores	TNKD-0068	Tank Farm	Diesel	160,000		24.0	34.0	White	Good	10,500,000	0.10	Yes	NA
Dolores	TNKO-0002	Tank Farm	Recovered Oil	10,000	16.0		10.0	White	Good	40000	0.002	Exempt	Rule 219(m)(7)
Dolores	TNKO-0003	Tank Farm	Drain Oil	12,000	20.5		10.0	White	Good	48000	0.002	Exempt	Rule 219(m)(7)
Dolores	TNKO-0004	Tank Farm	Journal Box Oil	8,000	21.3		8.0	White	Good	32000	0.001	Exempt	Rule 219(m)(7)
Dolores	TNKO-0001	Tank Farm	Lube Oil	12,000	20.5		10.0	Light Gray	Good	48000	0.004	Exempt	Rule 219(m)(7)
Dolores	TNKO-0184	Service Track	Recovered Oil	6,000	20.5		7.0	Light Gray	Good	24000	0.002	Exempt	Rule 219(m)(7)
Dolores	TNKS-0005	Tank Farm	Stormwater	25,000	30.0	12.0	12.0	White	Good	980,100	neg.	Yes	Part of WWTP
Dolores	TNKS-0006	Tank Farm	Stormwater	25,000	30.0	12.0	12.0	White	Good	980,100	neg.	Yes	Part of WWTP
Dolores	TNKS-0007	Tank Farm	Stormwater	25,000	30.0	12.0	12.0	White	Good	980,100	neg.	Yes	Part of WWTP
Dolores	TNKS-0008	Tank Farm	Stormwater	25,000	30.0	12.0	12.0	White	Good	980,100	neg.	Yes	Part of WWTP
Dolores	TNKS-0010	Tank Farm	Soap	8,000		8.0	8.0	White	Good	22,785	NA	Exempt	Rule 219(m)(6)
Dolores	NA	WWTP	Sludge	1,000	6.5	5.0	5.0	White	Good	NA	neg.	NA	Solids
Dolores	NA	WWTP	Nalco	380					Good	NA	neg.	NA	No Emissions
Total VOC											**0.77**		

Notes:
1. Annual throughput for ICTF tanks was equal to 65% of the 2005 throughput, based on the assumption that the diesel-fueled CHE will be operating at 65% of the 2005 rate due to the installation of the electric WSG Cranes.
2. Assumed no change from the 2005 throughput for the tanks at Dolores.
3. Emissions calculations performed using the USEPA TANKS 4.0.9d program.
4. Emissions from small oil storage tanks, stormwater tanks, soap tank, sludge tanks and the Nalco tank were assumed to be negligible.
5. The VOC emissions for oil tanks were estimated by modeling the liquid contents as diesel fuel, resulting in conservative estimates.

Summary of Emissions and Equipment Specifications for Storage Tanks
Dolores and ICTF Rail Yards, Long Beach, CA

Yard	Tank No.	Tank Location	Material Stored	Tank Capacity	Tank Dimensions Length	Height	Diameter	Shell Color	Shell Condition	2012 Annual Throughput (gal/yr)	Emissions (tpy)	Permitted?	Exemption Citation
ICTF	New-1a	Alt.Fuel - Hostlers (near Crane Maint.)	Biodiesel	500	5.5		4	White	Good	20,000	2.850E-04	Exempt	Rule 219(m)(4)
ICTF	New-1b	Alt.Fuel - Hostlers (near Crane Maint.)	LPG or LNG	1,000	15		3.5	White	Good	20,000	neg.	Exempt	
Dolores	TNKD-0069	Tank Farm	Diesel	160,000		24.0	34.0	White	Good	10,500,000	0.10	Yes	NA
Dolores	TNKD-0068	Tank Farm	Diesel	160,000		24.0	34.0	White	Good	10,500,000	0.10	Yes	NA
Dolores	TNKO-0002	Tank Farm	Recovered Oil	10,000	16.0		10.0	White	Good	40000	0.002	Exempt	Rule 219(m)(7)
Dolores	TNKO-0003	Tank Farm	Drain Oil	12,000	20.5		10.0	White	Good	48000	0.002	Exempt	Rule 219(m)(7)
Dolores	TNKO-0004	Tank Farm	Journal Box Oil	8,000	21.3		8.0	White	Good	32000	0.001	Exempt	Rule 219(m)(7)
Dolores	TNKO-0001	Tank Farm	Lube Oil	12,000	20.5		10.0	Light Gray	Good	48000	0.004	Exempt	Rule 219(m)(7)
Dolores	TNKO-0184	Service Track	Recovered Oil	6,000	20.5		7.0	Light Gray	Good	24000	0.002	Exempt	Rule 219(m)(7)
Dolores	TNKS-0005	Tank Farm	Stormwater	25,000	30.0	12.0	12.0	White	Good	980,100	neg.	Yes	Part of WWTP
Dolores	TNKS-0006	Tank Farm	Stormwater	25,000	30.0	12.0	12.0	White	Good	980,100	neg.	Yes	Part of WWTP
Dolores	TNKS-0007	Tank Farm	Stormwater	25,000	30.0	12.0	12.0	White	Good	980,100	neg.	Yes	Part of WWTP
Dolores	TNKS-0008	Tank Farm	Stormwater	25,000	30.0	12.0	12.0	White	Good	980,100	neg.	Yes	Part of WWTP
Dolores	TNKS-0010	Tank Farm	Soap	8,000		8.0	8.0	White	Good	22,785	NA	Exempt	Rule 219(m)(6)
Dolores	NA	WWTP	Sludge	1,000	6.5	5.0	5.0	White	Good	NA	neg.	NA	Solids
Dolores	NA	WWTP	Nalco	380					Good	NA	neg.	NA	No Emissions
Total VOC											**0.21**		

Notes:
1. Assumed all existing tanks at ICTF were removed by 2012. Assumed a new tank for storage of the alternative fuel (LNG, LPG, or biodiesel) was installed near the existing crane maintenance area.
2. Two tank options, a biodiesel tank or an LPG/LNG tanks, were considered for the emission calculations. Only one of these tanks will be installed at the facility.
3. Annual throughput for non-exempt tanks at Dolores provided by UPRR. Assumed no changes from the baseline year.
4. Annual throughput for exempt tanks based on the assumptions contained in the Trinity Reports.
5. Emissions calculations performed using the USEPA TANKS 4.0.9d program.
6. Emissions from small oil storage tanks, stormwater tanks, soap tank, sludge tanks and the Nalco tank were assumed to be negligible.
7. The VOC emissions for oil tanks were estimated by modeling the liquid contents as diesel fuel, resulting in conservative estimates.

Summary of Emissions and Equipment Specifications for Storage Tanks
Dolores and ICTF Rail Yards, Long Beach, CA

Yard	Tank No.	Tank Location	Material Stored	Tank Capacity	Tank Dimensions Length	Height	Diameter	Shell Color	Shell Condition	2014 Annual Throughput (gal/yr)	Emissions (tpy)	Permitted?	Exemption Citation
ICTF	New-1a	Alt.Fuel - Hostlers (near Crane Maint.)	Biodiesel	500	5.5		4	White	Good	20,000	2.850E-04	Exempt	Rule 219(m)(4)
ICTF	New-1b	Alt.Fuel - Hostlers (near Crane Maint.)	LPG or LNG	1,000	15		3.5	White	Good	20,000	neg.	Exempt	
Dolores	TNKD-0069	Tank Farm	Diesel	160,000		24.0	34.0	White	Good	10,500,000	0.10	Yes	NA
Dolores	TNKD-0068	Tank Farm	Diesel	160,000		24.0	34.0	White	Good	10,500,000	0.10	Yes	NA
Dolores	TNKO-0002	Tank Farm	Recovered Oil	10,000	16.0		10.0	White	Good	40000	0.002	Exempt	Rule 219(m)(7)
Dolores	TNKO-0003	Tank Farm	Drain Oil	12,000	20.5		10.0	White	Good	48000	0.002	Exempt	Rule 219(m)(7)
Dolores	TNKO-0004	Tank Farm	Journal Box Oil	8,000	21.3		8.0	White	Good	32000	0.001	Exempt	Rule 219(m)(7)
Dolores	TNKO-0001	Tank Farm	Lube Oil	12,000	20.5		10.0	Light Gray	Good	48000	0.004	Exempt	Rule 219(m)(7)
Dolores	TNKO-0184	Service Track	Recovered Oil	6,000	20.5		7.0	Light Gray	Good	24000	0.002	Exempt	Rule 219(m)(7)
Dolores	TNKS-0005	Tank Farm	Stormwater	25,000	30.0	12.0	12.0	White	Good	980,100	neg.	Yes	Part of WWTP
Dolores	TNKS-0006	Tank Farm	Stormwater	25,000	30.0	12.0	12.0	White	Good	980,100	neg.	Yes	Part of WWTP
Dolores	TNKS-0007	Tank Farm	Stormwater	25,000	30.0	12.0	12.0	White	Good	980,100	neg.	Yes	Part of WWTP
Dolores	TNKS-0008	Tank Farm	Stormwater	25,000	30.0	12.0	12.0	White	Good	980,100	neg.	Yes	Part of WWTP
Dolores	TNKS-0010	Tank Farm	Soap	8,000		8.0	8.0	White	Good	22,785	NA	Exempt	Rule 219(m)(6)
Dolores	NA	WWTP	Sludge	1,000	6.5	5.0	5.0	White	Good	NA	neg.	NA	Solids
Dolores	NA	WWTP	Nalco	380					Good	NA	neg.	NA	No Emissions
Total VOC											**0.21**		

Notes:
1. Assumed all existing tanks at ICTF were removed by 2012. Assumed a new tank for storage of the alternative fuel (LNG, LPG, or biodiesel) was installed near the existing crane maintenance area.
2. Two tank options, a biodiesel tank or an LPG/LNG tanks, were considered for the emission calculations. Only one of these tanks will be installed at the facility.
3. Annual throughput for non-exempt tanks at Dolores provided by UPRR. Assumed no changes from the baseline year.
4. Annual throughput for exempt tanks based on the assumptions contained in the Trinity Reports.
5. Emissions calculations performed using the USEPA TANKS 4.0.9d program.
6. Emissions from small oil storage tanks, stormwater tanks, soap tank, sludge tanks and the Nalco tank were assumed to be negligible.
7. The VOC emissions for oil tanks were estimated by modeling the liquid contents as diesel fuel, resulting in conservative estimates.

Summary of Emissions and Equipment Specifications for Storage Tanks
Dolores and ICTF Rail Yards, Long Beach, CA

Yard	Tank No.	Tank Location	Material Stored	Tank Capacity	Tank Dimensions			Shell Color	Shell Condition	2016 Annual Throughput (gal/yr)	Emissions (tpy)	Permitted?	Exemption Citation
					Length	Height	Diameter						
ICTF	New-1a	Alt.Fuel - Hostlers (near Crane Maint.)	Biodiesel	500	5.5		4	White	Good	20,000	2.850E-04	Exempt	Rule 219(m)(4)
ICTF	New-1b	Alt.Fuel - Hostlers (near Crane Maint.)	LPG or LNG	1,000	15		3.5	White	Good	20,000	neg.	Exempt	
Dolores	TNKD-0069	Tank Farm	Diesel	160,000		24.0	34.0	White	Good	10,500,000	0.10	Yes	NA
Dolores	TNKD-0068	Tank Farm	Diesel	160,000		24.0	34.0	White	Good	10,500,000	0.10	Yes	NA
Dolores	TNKO-0002	Tank Farm	Recovered Oil	10,000	16.0		10.0	White	Good	40000	0.002	Exempt	Rule 219(m)(7)
Dolores	TNKO-0003	Tank Farm	Drain Oil	12,000	20.5		10.0	White	Good	48000	0.002	Exempt	Rule 219(m)(7)
Dolores	TNKO-0004	Tank Farm	Journal Box Oil	8,000	21.3		8.0	White	Good	32000	0.001	Exempt	Rule 219(m)(7)
Dolores	TNKO-0001	Tank Farm	Lube Oil	12,000	20.5		10.0	Light Gray	Good	48000	0.004	Exempt	Rule 219(m)(7)
Dolores	TNKO-0184	Service Track	Recovered Oil	6,000	20.5		7.0	Light Gray	Good	24000	0.002	Exempt	Rule 219(m)(7)
Dolores	TNKS-0005	Tank Farm	Stormwater	25,000	30.0	12.0	12.0	White	Good	980,100	neg.	Yes	Part of WWTP
Dolores	TNKS-0006	Tank Farm	Stormwater	25,000	30.0	12.0	12.0	White	Good	980,100	neg.	Yes	Part of WWTP
Dolores	TNKS-0007	Tank Farm	Stormwater	25,000	30.0	12.0	12.0	White	Good	980,100	neg.	Yes	Part of WWTP
Dolores	TNKS-0008	Tank Farm	Stormwater	25,000	30.0	12.0	12.0	White	Good	980,100	neg.	Yes	Part of WWTP
Dolores	TNKS-0010	Tank Farm	Soap	8,000		8.0	8.0	White	Good	22,785	NA	Exempt	Rule 219(m)(6)
Dolores	NA	WWTP	Sludge	1,000	6.5	5.0	5.0	White	Good	NA	neg.	NA	Solids
Dolores	NA	WWTP	Nalco	380					Good	NA	neg.	NA	No Emissions
Total VOC											**0.21**		

Notes:
1. Assumed all existing tanks at ICTF were removed by 2012. Assumed a new tank for storage of the alternative fuel (LNG, LPG, or biodiesel) was installed near the existing crane maintenance area.
2. Two tank options, a biodiesel tank or an LPG/LNG tanks, were considered for the emission calculations. Only one of these tanks will be installed at the facility.
3. Annual throughput for non-exempt tanks at Dolores provided by UPRR. Assumed no changes from the baseline year.
4. Annual throughput for exempt tanks based on the assumptions contained in the Trinity Reports.
5. Emissions calculations performed using the USEPA TANKS 4.0.9d program.
6. Emissions from small oil storage tanks, stormwater tanks, soap tank, sludge tanks and the Nalco tank were assumed to be negligible.
7. The VOC emissions for oil tanks were estimated by modeling the liquid contents as diesel fuel, resulting in conservative estimates.

APPENDIX K

REFUELING OPERATIONS

APPENDIX K-1

SCAQMD EMISSION FACTOR DOCUMENT

APPENDIX K - VOC EMISSIONS CALCULATIONS FOR FUEL DISPENSING AND SMALL LIQUID ORGANIC STORAGE TANKS (<10,000 GALLONS)

Small liquid storage tank is defined as a tank with **a *storage capacity of less than 10,000 gallons and operated at ambient temperature and pressure***. VOC emissions can be calculated using the following equation:

$$E = EF * Q$$

where:
- E = VOC emissions (lb/year)
- Q = annual throughput (Mgal/year or 1,000 gallons/year)
- EF = emission factor (lb/Mgal)

Throughput is the amount of the liquid loaded in the tank during the reporting period.

A. Fuel Dispensing and Storage Tanks (including non-retail service stations)

Gasoline (use Activity Code 2A)**:** EF = 1.8 lb/Mgal (controlled)
Diesel (use Activity Code 2B)**:** EF = 0.028 lb/Mgal

NOTE: Report BENZENE emission from gasoline tank loss on Form TAC using a default factor of 1% or 0.018 lb/Mgal of throughput. Diesel tank benzene loss is negligible and does not have to be reported.

B. Small Fuel and Other Liquid Organic Storage Tanks (< 10,000 gallons) (use Activity Code 2D)

Under-Ground tank: EF (lb/Mgal) = loss factor ***f***

Above-Ground tank

$$EF(lb/Mgal) = \frac{a * (C/Q)}{[1 + (b * H)]} + f$$

where:
- C = tank size or capacity (Mgal or 1,000 gallons)
- Q = annual throughput (Mgal/year or 1,000 gallons/year)
- H = tank height (feet)
- a,b,f = loss factors ***a, b, f*** (see attached table "Loss Factors for Small Storage Tanks")

NOTE: If you need assistance with tank calculation, please contact Help Hotline at (714) 596-7456.

* Gasoline (RVP 6) is the most common type of gasoline in SCAQMD jurisdiction.

TOXIC AIR CONTAMINANT (TAC) CALCULATION

Toxic air contaminant emissions associated with storage tanks must be calculated and reported. In general, the emission factor and emission rate for each component can be estimated by:

$$EF_{TAC} = Z_{TAC} * EF \qquad and \qquad E_{TAC} = Z_{TAC} * E_T$$

where:
- EF_{TAC} = emission factor for TAC component, lbs/1,000 gallons
- EF = VOC emission factor, lbs/1,000 gallons
- Z_{TAC} = weight fraction of TAC component
- E_{TAC} = emission rate of TAC component, lbs/yr
- E_T = total tank VOC emissions, lbs/yr

Emissions for each TAC component must be calculated and reported individually on Form TAC.

APPENDIX K-2

DEATILED EMISSION CALCULATIONS FOR THE
2005 BASELINE YEAR AND PROJECT YEARS 2010-2016

Summary of Emissions from Refueling Operations
Dolores and ICTF Rail Yards, Long Beach, CA

Yard	Tank No.	Tank Location	Material Stored	2005 Throughput (gal/yr)	VOC Emission Factor (lb/1000 gal)[1]	2005 VOC Emissions (tpy)
ICTF	TNKD-9901	Crane Maintenance Area	Offroad Diesel	120,000	0.028	0.002
ICTF	TBA-1	Crane Maintenance Area	CARB Diesel	52,000	0.028	0.001
ICTF	TBA-2	Crane Maintenance Area	Gasoline	86,808	1.8	0.078
Dolores	TNKD-0069	Tank Farm	Diesel	10,500,000	0.028	0.147
Dolores	TNKD-0068	Tank Farm	Diesel	10,500,000	0.028	0.147
Total						**0.375**

Notes:
1. Emission factors from SCAQMD *General Instruction Book for the AQMD 2006-2007 Annual Emissions Reporting Program*, *Supplemental Instructions for Liquid Organic Storage Tanks and References.*

Summary of Emissions from Refueling Operations
Dolores and ICTF Rail Yards, Long Beach, CA

Yard	Tank No.	Tank Location	Material Stored	2010 Throughput (gal/yr)	VOC Emission Factor (lb/1000 gal)[1]	2010 VOC Emissions (tpy)
ICTF	TNKD-9901	Crane Maintenance Area	Offroad Diesel	78,000	0.028	0.001
ICTF	TBA-1	Crane Maintenance Area	CARB Diesel	33,800	0.028	0.000
ICTF	TBA-2	Crane Maintenance Area	Gasoline	56,425	1.8	0.051
Dolores	TNKD-0069	Tank Farm	Diesel	10,500,000	0.028	0.147
Dolores	TNKD-0068	Tank Farm	Diesel	10,500,000	0.028	0.147
Total						**0.346**

Notes:
1. Emission factors from SCAQMD *General Instruction Book for the AQMD 2006-2007 Annual Emissions Reporting Program* , Appendix K.

Summary of Emissions from Refueling Operations
Dolores and ICTF Rail Yards, Long Beach, CA

Yard	Tank No.	Tank Location	Material Stored	2012 Throughput (gal/yr)	VOC Emission Factor (lb/1000 gal)[1]	2012 VOC Emissions (tpy)
Dolores	TNKD-0069	Tank Farm	Diesel	10,500,000	0.028	0.147
Dolores	TNKD-0068	Tank Farm	Diesel	10,500,000	0.028	0.147
Total						**0.294**

Notes:
1. Emission factors from SCAQMD *General Instruction Book for the AQMD 2006-2007 Annual Emissions Reporting Program* , Appendix K.

Summary of Emissions from Refueling Operations
Dolores and ICTF Rail Yards, Long Beach, CA

Yard	Tank No.	Tank Location	Material Stored	2014 Throughput (gal/yr)	VOC Emission Factor (lb/1000 gal)[1]	2014 VOC Emissions (tpy)
Dolores	TNKD-0069	Tank Farm	Diesel	10,500,000	0.028	0.147
Dolores	TNKD-0068	Tank Farm	Diesel	10,500,000	0.028	0.147
Total						**0.294**

Notes:
1. Emission factors from SCAQMD *General Instruction Book for the AQMD 2006-2007 Annual Emissions Reporting Program* , Appendix K.

Summary of Emissions from Refueling Operations
Dolores and ICTF Rail Yards, Long Beach, CA

Yard	Tank No.	Tank Location	Material Stored	2016 Throughput (gal/yr)	VOC Emission Factor (lb/1000 gal)[1]	2016 VOC Emissions (tpy)
Dolores	TNKD-0069	Tank Farm	Diesel	10,500,000	0.028	0.147
Dolores	TNKD-0068	Tank Farm	Diesel	10,500,000	0.028	0.147
Total						**0.294**

Notes:
1. Emission factors from SCAQMD *General Instruction Book for the AQMD 2006-2007 Annual Emissions Reporting Program* , Appendix K.

APPENDIX K-3

SPECIATION PROFILE FOR GASOLINE REFUELING OPERATIONS

Toxic Air Contaminant Emissions from the Gasoline Refueling Operations
Dolores and ICTF Rail Yards, Long Beach, CA

Profile[1]	CAS	Chemical Name	Organic Fraction	Gasoline Refueling 2005 Emissions (tpy)
661	540841	2,2,4-trimethylpentane	0.0130	1.02E-03
661	71432	benzene	0.0036	2.82E-04
661	110827	cyclohexane	0.0103	8.06E-04
661	100414	ethylbenzene	0.0012	9.25E-05
661	78784	isopentane	0.3747	2.93E-02
661	98828	isopropylbenzene (cumene)	0.0001	8.63E-06
661	108383	m-xylene	0.0034	2.69E-04
661	110543	n-hexane	0.0155	1.21E-03
661	95476	o-xylene	0.0013	1.00E-04
661	106423	p-xylene	0.0011	8.39E-05
661	108883	toluene	0.0171	1.33E-03
Total				**3.45E-02**

Notes
1. Organic fraction from ARBs SPECIATE database. Data is from "Headspace vapors 1996 SSD etoh 2.0% (MTBE phaseout)" option.
2. Emissions were calculated for only chemicals that were in both the SPECIATE database and the AB2588 list.
3. Organic fraction reported on a ROG basis using ARB's Speciate ROG/TOG ratio (0.9963).

Toxic Air Contaminant Emissions from the Gasoline Refueling Operations
Dolores and ICTF Rail Yards, Long Beach, CA

Profile[1]	CAS	Chemical Name	Organic Fraction	Gasoline Refueling 2010 Emissions (tpy)
661	540841	2,2,4-trimethylpentane	0.0130	6.60E-04
661	71432	benzene	0.0036	1.83E-04
661	110827	cyclohexane	0.0103	5.24E-04
661	100414	ethylbenzene	0.0012	6.01E-05
661	78784	isopentane	0.3747	1.90E-02
661	98828	isopropylbenzene (cumene)	0.0001	5.61E-06
661	108383	m-xylene	0.0034	1.75E-04
661	110543	n-hexane	0.0155	7.85E-04
661	95476	o-xylene	0.0013	6.52E-05
661	106423	p-xylene	0.0011	5.45E-05
661	108883	toluene	0.0171	8.68E-04
Total				**2.24E-02**

Notes
1. Organic fraction from ARBs SPECIATE database. Data is from "Headspace vapors 1996 SSD etoh 2.0% (MTBE phaseout)" option.
2. Emissions were calculated for only chemicals that were in both the SPECIATE database and the AB2588 list.
3. Organic fraction reported on a ROG basis using ARB's Speciate ROG/TOG ratio (0.9963).

APPENDIX L

SAND TOWER

APPENDIX L-1

AP-42 SECTIONS 11.12

11.12 CONCRETE BATCHING

11.12-1 Process Description [1-5]

Concrete is composed essentially of water, cement, sand (fine aggregate) and coarse aggregate. Coarse aggregate may consist of gravel, crushed stone or iron blast furnace slag. Some specialty aggregate products could be either heavyweight aggregate (of barite, magnetite, limonite, ilmenite, iron or steel) or lightweight aggregate (with sintered clay, shale, slate, diatomaceous shale, perlite, vermiculite, slag pumice, cinders, or sintered fly ash). Supplementary cementitious materials, also called mineral admixtures or pozzolan minerals may be added to make the concrete mixtures more economical, reduce permeability, increase strength, or influence other concrete properties. Typical examples are natural pozzolans, fly ash, ground granulated blast-furnace slag, and silica fume, which can be used individually with portland or blended cement or in different combinations. Chemical admixtures are usually liquid ingredients that are added to concrete to entrain air, reduce the water required to reach a required slump, retard or accelerate the setting rate, to make the concrete more flowable or other more specialized functions.

Approximately 75 percent of the U.S. concrete manufactured is produced at plants that store, convey, measure and discharge these constituents into trucks for transport to a job site. At most of these plants, sand, aggregate, cement and water are all gravity fed from the weight hopper into the mixer trucks. The concrete is mixed on the way to the site where the concrete is to be poured. At some of these plants, the concrete may also be manufactured in a central mix drum and transferred to a transport truck. Most of the remaining concrete manufactured are products cast in a factory setting. Precast products range from concrete bricks and paving stones to bridge girders, structural components, and panels for cladding. Concrete masonry, another type of manufactured concrete, may be best known for its conventional 8 x 8 x 16-inch block. In a few cases concrete is dry batched or prepared at a building construction site. Figure 11.12-1 is a generalized process diagram for concrete batching.

The raw materials can be delivered to a plant by rail, truck or barge. The cement is transferred to elevated storage silos pneumatically or by bucket elevator. The sand and coarse aggregate are transferred to elevated bins by front end loader, clam shell crane, belt conveyor, or bucket elevator. From these elevated bins, the constituents are fed by gravity or screw conveyor to weigh hoppers, which combine the proper amounts of each material.

11.12-2 Emissions and Controls [6-8]

Particulate matter, consisting primarily of cement and pozzolan dust but including some aggregate and sand dust emissions, is the primary pollutant of concern. In addition, there are emissions of metals that are associated with this particulate matter. All but one of the emission points are fugitive in nature. The only point sources are the transfer of cement and pozzolan material to silos, and these are usually vented to a fabric filter or “sock”. Fugitive sources include the transfer of sand and aggregate, truck loading, mixer loading, vehicle traffic, and wind erosion from sand and aggregate storage piles. The amount of fugitive emissions generated during the transfer of sand and aggregate depends primarily on the surface moisture content of these materials. The extent of fugitive emission control varies widely from plant to plant. Particulate emission factors for concrete batching are give in Tables 11.12-1 and 11.12-2.

Types of controls used may include water sprays, enclosures, hoods, curtains, shrouds, movable and telescoping chutes, central duct collection systems, and the like. A major source of potential emissions, the movement of heavy trucks over unpaved or dusty surfaces in and around the plant, can be controlled by good maintenance and wetting of the road surface.

Predictive equations that allow for emission factor adjustment based on plant specific conditions are given in the Background Document for Chapter 11.12 and Chapter 13. Whenever plant specific data are available, they should be used with these predictive equations (e.g. Equations 11.12-1 through 11.12-3) in lieu of the general fugitive emission factors presented in Table 11.12-1 through11.12-5 in order to adjust to site specific conditions, such as moisture levels and localized wind speeds.

11.12-3 Updates since the 5^{th} Edition.

October 2001 – This major revision of the section replaced emissions factors based upon engineering judgment and poorly documented and performed source test reports with emissions tests conducted at modern operating truck mix and central mix facilities. Emissions factors for both total PM and total PM_{10} were developed from this test data.

June 2006 – This revision of the section supplemented the two source tests with several additional source tests of central mix and truck mix facilities. The measurement of the capture efficiency, local wind speed and fines material moisture level was improved over the previous two source tests. In addition to quantifying total PM and PM_{10}, $PM_{2.5}$ emissions were quantified at all of the facilities. Single value emissions factors for truck mix and central mix operations were revised using all of the data. Additionally, parameterized emissions factor equations using local wind speed and fines material moisture content were developed from the newer data.

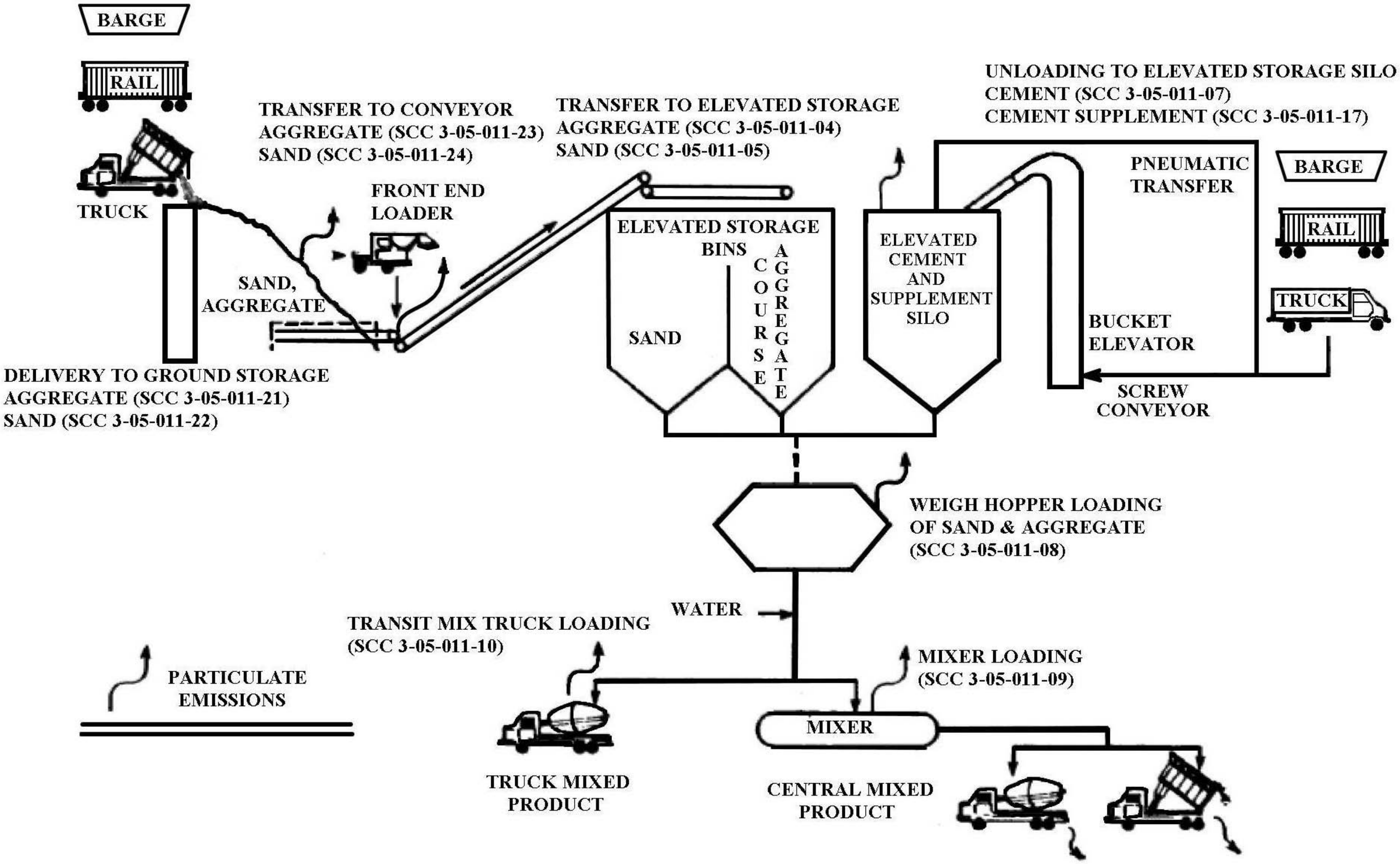

Figure 11.12-1. Typical Concrete Batching Process.

TABLE 11.12-1 (METRIC UNITS)
EMISSION FACTORS FOR CONCRETE BATCHING [a]

Source (SCC)	Uncontrolled				Controlled			
	Total PM	Emission Factor Rating	Total PM_{10}	Emission Factor Rating	Total PM	Emission Factor Rating	Total PM_{10}	Emission Factor Rating
Aggregate transfer [b] (3-05-011-04,-21,23)	0.0035	D	0.0017	D	ND		ND	
Sand transfer [b] (3-05-011-05,22,24)	0.0011	D	0.00051	D	ND		ND	
Cement unloading to elevated storage silo (pneumatic)[c] (3-05-011-07)	0.36	E	0.23	E	0.00050	D	0.00017	D
Cement supplement unloading to elevated storage silo (pneumatic)[d] (3-05-011-17)	1.57	E	0.65	E	0.0045	D	0.0024	E
Weigh hopper loading [e] (3-05-011-08)	0.0026	D	0.0013	D	ND		ND	
Mixer loading (central mix)[f] (3-05-011-09)	0.272 or Eqn. 11.12-1	B	0.067 or Eqn. 11.12-1	B	0.0087 or Eqn. 11.12-1	B	0.0024 or Eqn. 11.12-1	B
Truck loading (truck mix)[g] (3-05-011-10)	0.498	B	0.139	B	0.0280 or Eqn. 11.12-1	B	0.0080 or Eqn. 11.12-1	B
Vehicle traffic (paved roads)	See AP-42 Section 13.2.1							
Vehicle traffic (unpaved roads)	See AP-42 Section 13.2.2							
Wind erosion from aggregate and sand storage piles	See AP-42 Section 13.2.5							

ND = No data

[a] All emission factors are in kg of pollutant per Mg of material loaded unless noted otherwise. Loaded material includes course aggregate, sand, cement, cement supplement and the surface moisture associated with these materials. The average material composition of concrete batches presented in references 9 and 10 was 846 kg course aggregate, 648 kg sand, 223 kg cement and 33kg cement supplement. Approximately 75 liters of water was added to this solid material to produce 1826 kg of concrete.

[b] Reference 9 and 10. Emission factors are based upon an equation from AP-42, Section 13.2.2, with k_{PM-10} =.35, k_{PM} = .74, U = 10mph, $M_{aggregate}$ =1.77%, and M_{sand} = 4.17%. These moisture contents of the materials ($M_{aggregate}$ and M_{sand}) are the averages of the values obtained from Reference 9 and Reference 10.

[c] The uncontrolled PM & PM-10 emission factors were developed from Reference 9. The controlled emission factor for PM was developed from References 9, 10, 11, and 12. The controlled emission factor for PM-10 was developed from References 9 and 10.

[d] The controlled PM emission factor was developed from Reference 10 and Reference 12, whereas the controlled PM-10 emission factor was developed from only Reference 10.

[e] Emission factors were developed by using the Aggregate and Sand Transfer Emission Factors in conjunction with the ratio of aggregate and sand used in an average $yard^3$ of concrete. The unit for these emission factors is kg of pollutant per Mg of aggregate and sand.

[f] References 9, 10, and 14. The emission factor units are kg of pollutant per Mg of cement and cement supplement. The general factor is the arithmetic mean of all test data.

[g] Reference 9, 10, and 14. The emission factor units are kg of pollutant per Mg of cement and cement supplement. The general factor is the arithmetic mean of all test data.

TABLE 11.12-2 (ENGLISH UNITS)
EMISSION FACTORS FOR CONCRETE BATCHING [a]

Source (SCC)	Uncontrolled				Controlled			
	Total PM	Emission Factor Rating	Total PM_{10}	Emission Factor Rating	Total PM	Emission Factor Rating	Total PM_{10}	Emission Factor Rating
Aggregate transfer [b] (3-05-011-04,-21,23)	0.0069	D	0.0033	D	ND		ND	
Sand transfer [b] (3-05-011-05,22,24)	0.0021	D	0.00099	D	ND		ND	
Cement unloading to elevated storage silo (pneumatic)[c] (3-05-011-07)	0.72	E	0.46	E	0.00099	D	0.00034	D
Cement supplement unloading to elevated storage silo (pneumatic)[d] (3-05-011-17)	3.14	E	1.10	E	0.0089	D	0.0049	E
Weigh hopper loading [e] (3-05-011-08)	0.0051	D	0.0024	D	ND		ND	
Mixer loading (central mix)[f] (3-05-011-09)	0.544 or Eqn. 11.12-1	B	0.134 or Eqn. 11.12-1	B	0.0173 or Eqn. 11.12-1	B	0.0048 or Eqn. 11.12-1	B
Truck loading (truck mix)[g] (3-05-011-10)	0.995	B	0.278	B	0.0568 or Eqn. 11.12-1	B	0.0160 or Eqn. 11.12-1	B
Vehicle traffic (paved roads)	See AP-42 Section 13.2.1							
Vehicle traffic (unpaved roads)	See AP-42 Section 13.2.2							
Wind erosion from aggregate and sand storage piles	See AP-42 Section 13.2.5							

ND = No data

[a] All emission factors are in lb of pollutant per ton of material loaded unless noted otherwise. Loaded material includes course aggregate, sand, cement, cement supplement and the surface moisture associated with these materials. The average material composition of concrete batches presented in references 9 and 10 was 1865 lbs course aggregate, 1428 lbs sand, 491 lbs cement and 73 lbs cement supplement. Approximately 20 gallons of water was added to this solid material to produce 4024 lbs (one cubic yard) of concrete.

[b] Reference 9 and 10. Emission factors are based upon an equation from AP-42, Section 13.2.2, with k_{PM-10} =.35, k_{PM} = .74, U = 10mph, $M_{aggregate}$ =1.77%, and M_{sand} = 4.17%. These moisture contents of the materials ($M_{aggregate}$ and M_{sand}) are the averages of the values obtained from Reference 9 and Reference 10.

[c] The uncontrolled PM & PM-10 emission factors were developed from Reference 9. The controlled emission factor for PM was developed from References 9, 10, 11, and 12. The controlled emission factor for PM-10 was developed from References 9 and 10.

[d] The controlled PM emission factor was developed from Reference 10 and Reference 12, whereas the controlled PM-10 emission factor was developed from only Reference 10.

[e] Emission factors were developed by using the Aggregate and Sand Transfer Emission Factors in conjunction with the ratio of aggregate and sand used in an average $yard^3$ of concrete. The unit for these emission factors is lb of pollutant per ton of aggregate and sand.

[f] References 9, 10, and 14. The emission factor units are lb of pollutant per ton of cement and cement supplement. The general factor is the arithmetic mean of all test data.

[g] Reference 9, 10, and 14. The emission factor units are lb of pollutant per ton of cement and cement supplement. The general factor is the arithmetic mean of all test data.

The particulate matter emissions from truck mix and central mix loading operations are calculated in accordance with the values in Tables 11.12-1 or 11.12-2 or by Equation 11.12-1[14] when site specific data are available.

$$E = k\,(0.0032)\left[\frac{U^{a}}{M^{b}}\right] + c \qquad \text{Equation 11.12-1}$$

E	=	Emission factor in lbs./ton of cement and cement supplement
k	=	Particle size multiplier (dimensionless)
U	=	Wind speed at the material drop point, miles per hour (mph)
M	=	Minimum moisture (% by weight) of cement and cement supplement
a, b	=	Exponents
c	=	Constant

The parameters for Equation 11.12-1 are summarized in Tables 11.12-3 and 11.12-4.

Table 11.12-3. Equation Parameters for Truck Mix Operations

Condition	Parameter Category	k	a	b	c
Controlled[1]	Total PM	0.8	1.75	0.3	0.013
	PM_{10}	0.32	1.75	0.3	0.0052
	$PM_{10-2.5}$	0.288	1.75	0.3	0.00468
	$PM_{2.5}$	0.048	1.75	0.3	0.00078
Uncontrolled[1]	Total PM	0.995			
	PM_{10}	0.278			
	$PM_{10-2.5}$	0.228			
	$PM_{2.5}$	0.050			

Table 11.12-4. Equation Parameters for Central Mix Operations

Condition	Parameter Category	k	a	b	c
Controlled[1]	Total PM	0.19	0.95	0.9	0.0010
	PM_{10}	0.13	0.45	0.9	0.0010
	$PM_{10-2.5}$	0.12	0.45	0.9	0.0009
	$PM_{2.5}$	0.03	0.45	0.9	0.0002
Uncontrolled[1]	Total PM	5.90	0.6	1.3	0.120
	PM_{10}	1.92	0.4	1.3	0.040
	$PM_{10-2.5}$	1.71	0.4	1.3	0.036
	$PM_{2.5}$	0.38	0.4	1.3	0

1. Emission factors expressed in lbs/tons of cement and cement supplement

To convert from units of lbs/ton to units of kilograms per mega gram, the emissions calculated by Equation 11.12-1 should be divided by 2.0.

Particulate emission factors per yard of concrete for an average batch formulation at a typical facility are given in Tables 11.12-5 and 11.12-6. For truck mix loading and central mix loading, the emissions of PM, PM-10, PM-10-2.5, and PM-2.5 are calculated by multiplying the emission factor calculated using Equation 11.12-2 by a factor of 0.282 to convert from emissions per ton of cement and cement supplement to emissions per yard of concrete. This equation is based on a typical concrete formulation of 564 pounds of cement and cement supplement in a total of 4,024 pounds of material (including aggregate, sand, and water). This calculation is summarized in Equation 11.12-2.

$$\text{PM, PM10, PM10-2.5, PM2.5 emissions}\left(\frac{\text{pounds}}{\text{yd}^3\ \text{of concrete}}\right) = 0.282\,(\text{Equation } 11.12-1 \text{ factor or Table } 11.12\text{-}2 \text{ Factor})$$

Equation 11.12-2

Metals emission factors for concrete batching are given in Tables 11.12-6 and 11.12-7. Alternatively, the metals emissions from ready mix plants can be calculated based on (1) the weighted average concentration of the metal in the cement and the cement supplement (i.e. flyash) and (2) on the total particulate matter emission factors calculated in accordance with Equation 11.12-3. Emission factors calculated using Equation 11.12-3 are rated D.

$$\text{Metal}_{EF} = \text{PM}_{EF}\left(\frac{aC + bS}{C + S}\right)$$

Equation 11.12-3

Where:

Metal_{EF}	=	Metal Emissions, Lbs. As per Ton of Cement and Cement Supplement
PM_{EF}	=	Controlled Particulate Matter Emission Factor (PM, PM10, or PM2.5) Lbs. per Ton of Cement and Cement Supplement
a	=	ppm of Metal in Cement
C	=	Quantity of Cement Used, Lbs. per hour
b	=	ppm of Metal in Cement Supplement
S	=	Quantity of Cement Supplement Used, Lbs. per hour

This equation is based on the assumption that 100% of the particulate matter emissions are material entrained from the cement and cement supplement streams. Equation 11.12-3 over-estimates total metal emissions to the extent that sand and fines from aggregate contribute to the total particulate matter emissions.

TABLE 11.12-5 (ENGLISH UNITS)
PLANT WIDE EMISSION FACTORS PER YARD OF TRUCK MIX CONCRETE [a]

	Uncontrolled		Controlled	
	PM (lb/yd^3)	PM-10 (lb/yd^3)	PM (lb/yd^3)	PM-10 (lb/yd^3)
Aggregate delivery to ground storage (3-05-011-21)	0.0064	0.0031	0.0064	0.0031
Sand delivery to ground storage (3-05-011-22)	0.0015	0.0007	0.0015	0.0007
Aggregate transfer to conveyor (3-05-011-23)	0.0064	0.0031	0.0064	0.0031
Sand transfer to conveyor (3-05-011-24)	0.0015	0.0007	0.0015	0.0007
Aggregate transfer to elevated storage (3-05-011-04)	0.0064	0.0031	0.0064	0.0031
Sand transfer to elevated storage (3-05-011-05)	0.0015	0.0007	0.0015	0.0007
Cement delivery to Silo (3-05-011-07 controlled)	0.0002	0.0001	0.0002	0.0001
Cement supplement delivery to Silo (3-05-011-17 controlled)	0.0003	0.0002	0.0003	0.0002
Weigh hopper loading (3-05-011-08)	0.0079	0.0038	0.0079	0.0038
Truck mix loading (3-05-011-10)	See Equation 11.12-2			

TABLE 11.12-6 (ENGLISH UNITS)
PLANT WIDE EMISSION FACTORS PER YARD OF CENTRAL MIX CONCRETE [a]

	Uncontrolled		Controlled	
	PM (lb/yd^3)	PM-10 (lb/yd^3)	PM (lb/yd^3)	PM-10 (lb/yd^3)
Aggregate delivery to ground storage (3-05-011-21)	0.0064	0.0031	0.0064	0.0031
Sand delivery to ground storage (3-05-011-22)	0.0015	0.0007	0.0015	0.0007
Aggregate transfer to conveyor (3-05-011-23)	0.0064	0.0031	0.0064	0.0031
Sand transfer to conveyor (3-05-011-24)	0.0015	0.0007	0.0015	0.0007
Aggregate transfer to elevated storage (3-05-011-04)	0.0064	0.0031	0.0064	0.0031
Sand transfer to elevated storage (3-05-011-05)	0.0015	0.0007	0.0015	0.0007
Cement delivery to Silo (3-05-011-07 controlled)	0.0002	0.0001	0.0002	0.0001
Cement supplement delivery to Silo (3-05-011-17 controlled)	0.0003	0.0002	0.0003	0.0002
Weigh hopper loading (3-05-011-08)	0.0079	0.0038	0.0079	0.0038
Central mix loading (3-05-011-09)	See Equation 11.12-2			

[a] Total facility emissions are the sum of the emissions calculated in Tables 11.12-4 or 11.12-5. Total facility emissions do not include road dust and wind blown dust. The emission factors in Tables 11.12-4 and 11.12-5 are based upon the following composition of one yard of concrete.

Coarse Aggregate	1865. pounds
Sand	1428. pounds
Cement	491. pounds
Cement Supplement	73. pounds
Water	20. gallons (167 pounds)

TABLE 11.12-7 (METRIC UNITS)
CONCRETE BATCH PLANT METAL EMISSION FACTORS [a]

	Arsenic	Beryllium	Cadmium	Total Chromium	Lead	Manganese	Nickel	Total Phosphorus	Selenium	Emission Factor Rating
Cement Silo Filling [b] (SCC 3-05-011-07) w/ Fabric Filter	8.38e-07 2.12e-09	8.97e-09 2.43e-10	1.17e-07 2.43e-10	1.26e-07 1.45e-08	3.68e-07 5.46e-09	1.01e-04 5.87e-08	8.83e-06 2.09e-08	5.88e-05 ND	ND ND	E E
Cement Supplement Silo Filling [c] (SCC 3-05-011-17) w/ Fabric Filter	ND 5.02e-07	ND 4.52e-08	ND 9.92e-09	ND 6.10e-07	ND 2.60e-07	ND 1.28e-07	ND 1.14e-06	ND 1.77e-06	ND 3.62e-08	E E
Central Mix Batching [d] (SCC 3-05-011-09) w/ Fabric Filter	1.16e-07 9.35e-09	ND ND	5.92e-09 3.55e-10	7.11e-07 6.34e-08	1.91e-07 1.83e-08	3.06e-05 1.89e-06	1.64e-06 1.24e-07	1.01e-05 6.04e-07	ND ND	E E
Truck Loading [e] (SCC 3-05-011-10) w/ Fabric Filter	1.52e-06 5.80e-07	1.22e-07 5.18e-08	1.71e-08 4.53e-09	5.71e-06 2.05e-06	1.81e-06 7.67e-07	3.06e-05 1.04e-05	5.99e-06 2.39e-06	1.92e-05 6.16e-06	1.31e-06 5.64e-08	E E

ND=No data

[a] All emission factors are in kg of pollutant per Mg of material loaded unless noted otherwise. Loaded material includes course aggregate, sand, cement, cement supplement and the surface moisture associated with these materials. The average material composition of concrete batches presented in references 9 and 10 was 846 Kg course aggregate, 648 kg sand, 223 kg cement and 33kg cement supplement. Approximately 75 liters of water was added to this solid material to produce 1826 kg of concrete.

[b] The uncontrolled emission factors were developed from Reference 8. The controlled emission factors were developed form Reference 9 and 10. Although controlled emissions of phosphorous compounds were below detection, it is reasonable to assume that the effectiveness is comparable to the average effectiveness (98%) for the other metals.

[c] Reference 10.

[d] Reference 9. The emission factor units are kg of pollutant per Mg of cement and cement supplement. Emission factors were developed from a typical central mix operation. The average estimate of the percent of emissions captured during each run is 94%.

[e] Reference 9 and 10. The emission factor units are kg of pollutant per Mg of cement and cement supplement. Emission factors were developed from two typical truck mix loading operations. Based upon visual observations of every loading operation during the two test programs, the average capture efficiency during the testing was 71%.

TABLE 11.12-8 (ENGLISH UNITS)
CONCRETE BATCH PLANT METAL EMISSION FACTORS [a]

	Arsenic	Beryllium	Cadmium	Total Chromium	Lead	Manganese	Nickel	Total Phosphorus	Selenium	Emission Factor Rating
Cement Silo Filling [b] (SCC 3-05-011-07)	1.68e-06	1.79e-08	2.34e-07	2.52e-07	7.36e-07	2.02e-04	1.76e-05	1.18e-05	ND	E
w/ Fabric Filter	4.24e-09	4.86e-10	4.86e-10	2.90e-08	1.09e-08	1.17e-07	4.18e-08	ND	ND	E
Cement Supplement Silo Filling [c] (SCC 3-05-011-17)	ND	ND	ND	ND	ND	ND	ND	ND	ND	E
w/ Fabric Filter	1.00e-06	9.04e-08	1.98e-10	1.22e-06	5.20e-07	2.56e-07	2.28e-06	3.54e-06	7.24e-08	E
Central Mix Batching [d] (SCC 3-05-011-09)	2.32e-07	ND	1.18e-08	1.42e-06	3.82e-07	6.12e-05	3.28e-06	2.02e-05	ND	E
w/ Fabric Filter	1.87e-08	ND	7.10e-10	1.27e-07	3.66e-08	3.78e-06	2.48e-07	1.20e-06	ND	E
Truck Loading [e] (SCC 3-05-011-10)	3.04e-06	2.44e-07	3.42e-08	1.14e-05	3.62e-06	6.12e-05	1.19e-05	3.84e-05	2.62e-06	E
w/ Fabric Filter	1.16e-06	1.04e-07	9.06e-09	4.10e-06	1.53e-06	2.08e-05	4.78e-06	1.23e-05	1.13e-07	E

ND=No data

[a] All emission factors are in lb of pollutant per ton of material loaded unless noted otherwise. Loaded material includes course aggregate, sand, cement, cement supplement and the surface moisture associated with these materials. The average material composition of concrete batches presented in references 9 and 10 was 1865 lbs course aggregate, 1428 lbs sand, 491 lbs cement and 73 lbs cement supplement. Approximately 20 gallons of water was added to this solid material to produce 4024 lbs (one cubic yard) of concrete.

[b] The uncontrolled emission factors were developed from Reference 8. The controlled emission factors were developed form Reference 9 and 10. Although controlled emissions of phosphorous compounds were below detection, it is reasonable to assume that the effectiveness is comparable to the average effectiveness (98%) for the other metals.

[c] Reference 10.

[d] Reference 9. The emission factor units are lb of pollutant per ton of cement and cement supplement. Emission factors were developed from a typical central mix operation. The average estimate of the percent of emissions captured during each test run is 94%.

[e] Reference 9 and 10. The emission factor units are lb of pollutant per ton of cement and cement supplement. Emission factors were developed from two typical truck mix loading operations. Based upon visual observations of every loading operation during the two test programs, the average capture efficiency during the testing was 71%.

References for Section 11.12

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11. *Emission Test for Tiberi Engineering Company*, Alar Engineering Corporation, Burbank, IL, October, 1972.

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APPENDIX L-2

DEATILED EMISSION CALCULATIONS FOR THE
2005 BASELINE YEAR AND PROJECT YEARS 2010-2016

Summary of Emissions from Sand Tower Operations
Dolores and ICTF Rail Yards, Long Beach, CA

Pollutant	2005 Sand Throughput (ton/yr)	Pneumatic Transfer Emission Factor (lb/ton)	Gravity Transfer Emission Factor (lb/ton)	Process Emissions (tpy)		
				Pneumatic Transfer	Gravity Transfer	Total
PM10	3120.00	0.00034	0.00099	0.001	0.002	0.002

Notes:
1. Sand throughput provided by Union Pacific.
2. Pneumatic transfer emission factor from AP-42, Table 11.12-2, 6/06. Factor for controlled pneumatic cement unloading to elevated storage silo was used. The unit is equipped with a fabric filter.
3. Gravity transfer emission factor from AP-42, Table 11.12-2, 6/06. Factor for sand transfer was used.
4. There are no TAC emissions from this source.

Summary of Emissions from Sand Tower Operations
Dolores and ICTF Rail Yards, Long Beach, CA

Pollutant	2010 Sand Throughput (ton/yr)	Pneumatic Transfer Emission Factor (lb/ton)	Gravity Transfer Emission Factor (lb/ton)	2010 Emission Estimates (tpy)		
				Pneumatic Transfer	Gravity Transfer	Total
PM10	3120.00	0.00034	0.00099	0.001	0.002	0.002

Notes:
1. Sand throughput for the 2005 baseline year provided by UPRR. Assumed no increase in sand throughput for 2010.
2. Pneumatic transfer emission factor from AP-42, Table 11.12-2, 6/06. Factor for controlled pneumatic cement unloading to elevated storage silo was used. The unit is equipped with a fabric filter.
3. Gravity transfer emission factor from AP-42, Table 11.12-2, 6/06. Factor for sand transfer was used.

Summary of Emissions from Sand Tower Operations
Dolores and ICTF Rail Yards, Long Beach, CA

Pollutant	2012 Sand Throughput (ton/yr)	Pneumatic Transfer Emission Factor (lb/ton)	Gravity Transfer Emission Factor (lb/ton)	2012 Emission Estimates (tpy)		
				Pneumatic Transfer	Gravity Transfer	Total
PM10	3120.00	0.00034	0.00099	0.001	0.002	0.002

Notes:
1. Sand throughput for the 2005 baseline year provided by UPRR. Assumed no increase in sand throughput for 2012.
2. Pneumatic transfer emission factor from AP-42, Table 11.12-2, 6/06. Factor for controlled pneumatic cement unloading to elevated storage silo was used. The unit is equipped with a fabric filter.
3. Gravity transfer emission factor from AP-42, Table 11.12-2, 6/06. Factor for sand transfer was used.
4. There are no TAC emissions from this source.

Summary of Emissions from Sand Tower Operations
Dolores and ICTF Rail Yards, Long Beach, CA

Pollutant	2014 Sand Throughput (ton/yr)	Pneumatic Transfer Emission Factor (lb/ton)	Gravity Transfer Emission Factor (lb/ton)	2014 Emission Estimates (tpy)		
				Pneumatic Transfer	Gravity Transfer	Total
PM10	3120.00	0.00034	0.00099	0.001	0.002	0.002

Notes:
1. Sand throughput for the 2005 baseline year provided by UPRR. Assumed no increase in sand throughput for 2014.
2. Pneumatic transfer emission factor from AP-42, Table 11.12-2, 6/06. Factor for controlled pneumatic cement unloading to elevated storage silo was used. The unit is equipped with a fabric filter.
3. Gravity transfer emission factor from AP-42, Table 11.12-2, 6/06. Factor for sand transfer was used.
4. There are no TAC emissions from this source.

Summary of Emissions from Sand Tower Operations
Dolores and ICTF Rail Yards, Long Beach, CA

Pollutant	2016 Sand Throughput (ton/yr)	Pneumatic Transfer Emission Factor (lb/ton)	Gravity Transfer Emission Factor (lb/ton)	2016 Emission Estimates (tpy)		
				Pneumatic Transfer	Gravity Transfer	Total
PM10	3120.00	0.00034	0.00099	0.001	0.002	0.002

Notes:
1. Sand throughput for the 2005 baseline year provided by UPRR. Assumed no increase in sand throughput for 2016.
2. Pneumatic transfer emission factor from AP-42, Table 11.12-2, 6/06. Factor for controlled pneumatic cement unloading to elevated storage silo was used. The unit is equipped with a fabric filter.
3. Gravity transfer emission factor from AP-42, Table 11.12-2, 6/06. Factor for sand transfer was used.
4. There are no TAC emissions from this source.

APPENDIX M

WASTEWATER TREATMENT PLANT

DEATILED EMISSION CALCULATIONS FOR THE
2005 BASELINE YEAR AND PROJECT YEARS 2010-2016

Toxic Air Contaminant Emissions from DAF, Oil/Water Separator, and Basins at Wastewater Treatment Plant
Dolores and ICTF Rail Yards, Long Beach, CA

Pollutant	Emission Rate (grams/sec)	Emissions (tpy)
Benzene	5.10E-07	2.37E-05
Bis(2-ethylhexyl) Phthalate	1.83E-11	8.52E-10
Bromomethane	8.99E-07	4.18E-05
Chloroform	6.30E-07	2.93E-05
Ethylbenzene	3.04E-06	1.41E-04
Methylene Chloride	1.04E-05	4.84E-04
Toluene	3.50E-06	1.63E-04
Xylene	6.20E-06	2.89E-04
Total	**2.52E-05**	**1.17E-03**

1. Emission rates are from the Air Emissions Inventory and Regulatory Analysis Report for Dolores Yard, Trinity Conulstants, December 2005.
2. Emission rates from USEPA's Water8 Program and are based on the 1999 wastewater flow rate of 732,000 gallons per year.
3. Emissions (lb/yr) were calculated multipling the emission rate by the ratio of the 1999 wasterwater flow rate and the 2005 wastewater flow rate.

lb/yr = Emission Rate (g/sec) x (3600 sec/hr) x (8760 hr/yr) x (1 lb/ 453.59 g) x (980,100 gal/yr / 732,000 gal/yr)

4. The 2005 wastewater flow rate was provided by Mr. Brock Nelson of Union Pacific.

Toxic Air Contaminant Emissions from DAF, Oil/Water Separator, and Basins at Wastewater Treatment Plant
Dolores and ICTF Rail Yards, Long Beach, CA

Pollutant	Emission Rate (grams/sec)	2010 Emissions (lb/yr)	2010 Emissions (tpy)
Benzene	5.10E-07	4.75E-02	2.37E-05
Bis(2-ethylhexyl) Phthalate	1.83E-11	1.70E-06	8.52E-10
Bromomethane	8.99E-07	8.37E-02	4.18E-05
Chloroform	6.30E-07	5.86E-02	2.93E-05
Ethylbenzene	3.04E-06	2.83E-01	1.41E-04
Methylene Chloride	1.04E-05	9.68E-01	4.84E-04
Toluene	3.50E-06	3.26E-01	1.63E-04
Xylene	6.20E-06	5.77E-01	2.89E-04
Total	**2.52E-05**	**2.34E+00**	**1.17E-03**

Notes:
1. Emission rates are from the *Air Emissions Inventory and Regulatory Analysis Report for the Dolores Yard* , Trinity Consultants, December 2005.
2. Emission rates from USEPA's Water8 Program and are based on the 1999 wastewater flow rate of 732,000 gallons per year.
3. Emissions (lb/yr) were calculated multiplying the emission rate by the ratio of the 1999 wasterwater flow rate and the 2005 wastewater flow rate.

lb/yr = Emission Rate (g/sec) x (3600 sec/hr) x (8760 hr/yr) x (1 lb/ 453.59 g) x (980,100 gal/yr / 732,000 gal/yr)

4. The 2005 wastewater flow rate (980,100 gal/yr) was provided by Mr. Brock Nelson of Union Pacific. Assumed no increase in flow rate for 2010.

Toxic Air Contaminant Emissions from DAF, Oil/Water Separator, and Basins at Wastewater Treatment Plant
Dolores and ICTF Rail Yards, Long Beach, CA

Pollutant	Emission Rate (grams/sec)	2012 Emissions	
		(lb/yr)	(tpy)
Benzene	5.10E-07	4.75E-02	2.37E-05
Bis(2-ethylhexyl) Phthalate	1.83E-11	1.70E-06	8.52E-10
Bromomethane	8.99E-07	8.37E-02	4.18E-05
Chloroform	6.30E-07	5.86E-02	2.93E-05
Ethylbenzene	3.04E-06	2.83E-01	1.41E-04
Methylene Chloride	1.04E-05	9.68E-01	4.84E-04
Toluene	3.50E-06	3.26E-01	1.63E-04
Xylene	6.20E-06	5.77E-01	2.89E-04
Total	**2.52E-05**	**2.34E+00**	**1.17E-03**

1. Emission rates are from the *Air Emissions Inventory and Regulatory Analysis Report for Dolores Yard* , Trinity Consultants, December 2005.
2. Emission rates from USEPA's Water8 Program and are based on the 1999 wastewater flow rate of 732,000 gallons per year.
3. Emissions (lb/yr) were calculated multiplying the emission rate by the ratio of the 1999 wasterwater flow rate and the 2005 wastewater flow rate.

lb/yr = Emission Rate (g/sec) x (3600 sec/hr) x (8760 hr/yr) x (1 lb/ 453.59 g) x (980,100 gal/yr / 732,000 gal/yr)

4. The 2005 wastewater flow rate (980,100 gal/yr) was provided by Mr. Brock Nelson of Union Pacific. Assumed no increase in flow rate for 2012.

Toxic Air Contaminant Emissions from DAF, Oil/Water Separator, and Basins at Wastewater Treatment Plant
Dolores and ICTF Rail Yards, Long Beach, CA

Pollutant	Emission Rate (grams/sec)	2014 Emissions (lb/yr)	(tpy)
Benzene	5.10E-07	4.75E-02	2.37E-05
Bis(2-ethylhexyl) Phthalate	1.83E-11	1.70E-06	8.52E-10
Bromomethane	8.99E-07	8.37E-02	4.18E-05
Chloroform	6.30E-07	5.86E-02	2.93E-05
Ethylbenzene	3.04E-06	2.83E-01	1.41E-04
Methylene Chloride	1.04E-05	9.68E-01	4.84E-04
Toluene	3.50E-06	3.26E-01	1.63E-04
Xylene	6.20E-06	5.77E-01	2.89E-04
Total	**2.52E-05**	**2.34E+00**	**1.17E-03**

1. Emission rates are from the *Air Emissions Inventory and Regulatory Analysis Report for Dolores Yard* , Trinity Consultants, December 2005.
2. Emission rates from USEPA's Water8 Program and are based on the 1999 wastewater flow rate of 732,000 gallons per year.
3. Emissions (lb/yr) were calculated multiplying the emission rate by the ratio of the 1999 wasterwater flow rate and the 2005 wastewater flow rate.

lb/yr = Emission Rate (g/sec) x (3600 sec/hr) x (8760 hr/yr) x (1 lb/ 453.59 g) x (980,100 gal/yr / 732,000 gal/yr)

4. The 2005 wastewater flow rate (980,100 gal/yr) was provided by Mr. Brock Nelson of Union Pacific. Assumed no Assumed no increase in flow rate for 2014.

Toxic Air Contaminant Emissions from DAF, Oil/Water Separator, and Basins at Wastewater Treatment Plant
Dolores and ICTF Rail Yards, Long Beach, CA

Pollutant	Emission Rate (grams/sec)	2016 Emission Estimates (lb/yr)	(tpy)
Benzene	5.10E-07	4.75E-02	2.37E-05
Bis(2-ethylhexyl) Phthalate	1.83E-11	1.70E-06	8.52E-10
Bromomethane	8.99E-07	8.37E-02	4.18E-05
Chloroform	6.30E-07	5.86E-02	2.93E-05
Ethylbenzene	3.04E-06	2.83E-01	1.41E-04
Methylene Chloride	1.04E-05	9.68E-01	4.84E-04
Toluene	3.50E-06	3.26E-01	1.63E-04
Xylene	6.20E-06	5.77E-01	2.89E-04
Total	**2.52E-05**	**2.34E+00**	**1.17E-03**

1. Emission rates are from the *Air Emissions Inventory and Regulatory Analysis Report for Dolores Yard* , Trinity Consultants, December 2005.
2. Emission rates from USEPA's Water8 Program and are based on the 1999 wastewater flow rate of 732,000 gallons per year.
3. Emissions (lb/yr) were calculated multiplying the emission rate by the ratio of the 1999 wasterwater flow rate and the 2005 wastewater flow rate.

lb/yr = Emission Rate (g/sec) x (3600 sec/hr) x (8760 hr/yr) x (1 lb/ 453.59 g) x (980,100 gal/yr / 732,000 gal/yr)

4. The 2005 wastewater flow rate (980,100 gal/yr) was provided by Mr. Brock Nelson of Union Pacific. Assumed no increase in flow rate for 2016.

APPENDIX N

STEAM CLEANERS

APPENDIX N-1

AP-42 SECTIONS 1.5 AND 3.3

1.5 Liquefied Petroleum Gas Combustion

1.5.1 General[1]

Liquefied petroleum gas (LPG or LP-gas) consists of propane, propylene, butane, and butylenes; the product used for domestic heating is composed primarily of propane. This gas, obtained mostly from gas wells (but also, to a lesser extent, as a refinery by-product) is stored as a liquid under moderate pressures. There are three grades of LPG available as heating fuels: commercial-grade propane, engine fuel-grade propane (also known as HD-5 propane), and commercial-grade butane. In addition, there are high-purity grades of LPG available for laboratory work and for use as aerosol propellants. Specifications for the various LPG grades are available from the American Society for Testing and Materials and the Gas Processors Association. A typical heating value for commercial-grade propane and HD-5 propane is 90,500 British thermal units per gallon (Btu/gal), after vaporization; for commercial-grade butane, the value is 97,400 Btu/gal.

The largest market for LPG is the domestic/commercial market, followed by the chemical industry (where it is used as a petrochemical feedstock) and the agriculture industry. Propane is also used as an engine fuel as an alternative to gasoline and as a standby fuel for facilities that have interruptible natural gas service contracts.

1.5.2 Firing Practices[2]

The combustion processes that use LPG are very similar to those that use natural gas. Use of LPG in commercial and industrial applications may require a vaporizer to provide the burner with the proper mix of air and fuel. The burner itself will usually have different fuel injector tips as well as different fuel-to-air ratio controller settings than a natural gas burner since the LPG stoichiometric requirements are different than natural gas requirements. LPG is fired as a primary and backup fuel in small commercial and industrial boilers and space heating equipment and can be used to generate heat and process steam for industrial facilities and in most domestic appliances that typically use natural gas.

1.5.3 Emissions[1,3-5]

1.5.3.1 Criteria Pollutants -

LPG is considered a "clean" fuel because it does not produce visible emissions. However, gaseous pollutants such as nitrogen oxides (NO_x), carbon monoxide (CO), and organic compounds are produced as are small amounts of sulfur dioxide (SO_2) and particulate matter (PM). The most significant factors affecting NO_x, CO, and organic emissions are burner design, burner adjustment, boiler operating parameters, and flue gas venting. Improper design, blocking and clogging of the flue vent, and insufficient combustion air result in improper combustion and the emission of aldehydes, CO, hydrocarbons, and other organics. NO_x emissions are a function of a number of variables, including temperature, excess air, fuel and air mixing, and residence time in the combustion zone. The amount of SO_2 emitted is directly proportional to the amount of sulfur in the fuel. PM emissions are very low and result from soot, aerosols formed by condensable emitted species, or boiler scale dislodged during combustion. Emission factors for LPG combustion are presented in Table 1.5-1.

Table 1.5-1 presents emission factors on a volume basis ($lb/10^3gal$). To convert to an energy basis (lb/MMBtu), divide by a heating value of 91.5 $MMBtu/10^3gal$ for propane and 102 $MMBtu/10^3gal$ for butane.

1.5.3.2 Greenhouse Gases[6-11] -

Carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_2O) emissions are all produced during LPG combustion. Nearly all of the fuel carbon (99.5 percent) in LPG is converted to CO_2 during the combustion process. This conversion is relatively independent of firing configuration. Although the formation of CO acts to reduce CO_2 emissions, the amount of CO produced is insignificant compared to the amount of CO_2 produced. The majority of the 0.5 percent of fuel carbon not converted to CO_2 is due to incomplete combustion in the fuel stream.

Formation of N_2O during the combustion process is governed by a complex series of reactions and its formation is dependent upon many factors. Formation of N_2O is minimized when combustion temperatures are kept high (above 1475^{o}F) and excess air is kept to a minimum (less than 1 percent).

Methane emissions are highest during periods of low-temperature combustion or incomplete combustion, such as the start-up or shut-down cycle for boilers. Typically, conditions that favor formation of N_2O also favor emissions of CH_4.

1.5.4 Controls

The only controls developed for LPG combustion are to reduce NO_x emissions. NO_x controls have been developed for firetube and watertube boilers firing propane or butane. Vendors are now guaranteeing retrofit systems to levels as low as 30 to 40 ppm (based on 3 percent oxygen). These systems use a combination of low-NO_x burners and flue gas recirculation (FGR). Some burner vendors use water or steam injection into the flame zone for NO_x reduction. This is a trimming technique which may be necessary during backup fuel periods because LPG typically has a higher NO_x-forming potential than natural gas; conventional natural gas emission control systems may not be sufficient to reduce LPG emissions to mandated levels. Also, LPG burners are more prone to sooting under the modified combustion conditions required for low NO_x emissions. The extent of allowable combustion modifications for LPG may be more limited than for natural gas.

One NO_x control system that has been demonstrated on small commercial boilers is FGR. NO_x emissions from propane combustion can be reduced by as much as 50 percent by recirculating about 16 percent of the flue gas. NO_x emission reductions of over 60 percent have been achieved with FGR and low-NO_x burners used in combination.

1.5.5 Updates Since the Fifth Edition

The Fifth Edition was released in January 1995. Revisions to this section since that date are summarized below. For further detail, consult the memoranda describing each supplement or the background report for this section.

Supplement A, February 1996

No changes.

Supplement B, October 1996

- Text was added concerning firing practices.
- The CO_2 emission factor was updated.
- Emission factors were added for N_2O and CH_4.

Table 1.5-1. EMISSION FACTORS FOR LPG COMBUSTION[a]

EMISSION FACTOR RATING: E

Pollutant	Butane Emission Factor ($lb/10^3$ gal) Industrial Boilers[b] (SCC 1-02-010-01)	Butane Emission Factor ($lb/10^3$ gal) Commercial Boilers[c] (SCC 1-03-010-01)	Propane Emission Factor ($lb/10^3$ gal) Industrial Boilers[b] (SCC 1-02-010-02)	Propane Emission Factor ($lb/10^3$ gal) Commercial Boilers[c] (SCC 1-03-010-02)
PM[d]	0.6	0.5	0.6	0.4
SO_2[e]	0.09S	0.09S	0.10S	0.10S
NO_x[f]	21	15	19	14
N_2O[g]	0.9	0.9	0.9	0.9
CO_2[h,j]	14,300	14,300	12,500	12,500
CO	3.6	2.1	3.2	1.9
TOC	0.6	0.6	0.5	0.5
CH_4[k]	0.2	0.2	0.2	0.2

[a] Assumes emissions (except SO_x and NO_x) are the same, on a heat input basis, as for natural gas combustion. The NO_x emission factors have been multiplied by a correction factor of 1.5, which is the approximate ratio of propane/butane NO_x emissions to natural gas NO_x emissions. To convert from $lb/10^3$ gal to $kg/10^3$ L, multiply by 0.12. SCC = Source Classification Code.
[b] Heat input capacities generally between 10 and 100 million Btu/hour.
[c] Heat input capacities generally between 0.3 and 10 million Btu/hour.
[d] Filterable particulate matter (PM) is that PM collected on or prior to the filter of an EPA Method 5 (or equivalent) sampling train. For natural gas, a fuel with similar combustion characteristics, all PM is less than 10 µm in aerodynamic equivalent diameter (PM-10).
[e] S equals the sulfur content expressed in gr/100 ft^3 gas vapor. For example, if the butane sulfur content is 0.18 gr/100 ft^3, the emission factor would be (0.09 x 0.18) = 0.016 lb of $SO_2/10^3$ gal butane burned.
[f] Expressed as NO_2.
[g] Reference 12.
[h] Assuming 99.5% conversion of fuel carbon to CO_2.
[j] EMISSION FACTOR RATING = C.
[k] Reference 13.

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3.3 Gasoline And Diesel Industrial Engines

3.3.1 General

The engine category addressed by this section covers a wide variety of industrial applications of both gasoline and diesel internal combustion (IC) engines such as aerial lifts, fork lifts, mobile refrigeration units, generators, pumps, industrial sweepers/scrubbers, material handling equipment (such as conveyors), and portable well-drilling equipment. The three primary fuels for reciprocating IC engines are gasoline, diesel fuel oil (No.2), and natural gas. Gasoline is used primarily for mobile and portable engines. Diesel fuel oil is the most versatile fuel and is used in IC engines of all sizes. The rated power of these engines covers a rather substantial range, up to 250 horsepower (hp) for gasoline engines and up to 600 hp for diesel engines. (Diesel engines greater than 600 hp are covered in Section 3.4, "Large Stationary Diesel And All Stationary Dual-fuel Engines".) Understandably, substantial differences in engine duty cycles exist. It was necessary, therefore, to make reasonable assumptions concerning usage in order to formulate some of the emission factors.

3.3.2 Process Description

All reciprocating IC engines operate by the same basic process. A combustible mixture is first compressed in a small volume between the head of a piston and its surrounding cylinder. The mixture is then ignited, and the resulting high-pressure products of combustion push the piston through the cylinder. This movement is converted from linear to rotary motion by a crankshaft. The piston returns, pushing out exhaust gases, and the cycle is repeated.

There are 2 methods used for stationary reciprocating IC engines: compression ignition (CI) and spark ignition (SI). This section deals with both types of reciprocating IC engines. All diesel-fueled engines are compression ignited, and all gasoline-fueled engines are spark ignited.

In CI engines, combustion air is first compression heated in the cylinder, and diesel fuel oil is then injected into the hot air. Ignition is spontaneous because the air temperature is above the autoignition temperature of the fuel. SI engines initiate combustion by the spark of an electrical discharge. Usually the fuel is mixed with the air in a carburetor (for gasoline) or at the intake valve (for natural gas), but occasionally the fuel is injected into the compressed air in the cylinder.

CI engines usually operate at a higher compression ratio (ratio of cylinder volume when the piston is at the bottom of its stroke to the volume when it is at the top) than SI engines because fuel is not present during compression; hence there is no danger of premature autoignition. Since engine thermal efficiency rises with increasing pressure ratio (and pressure ratio varies directly with compression ratio), CI engines are more efficient than SI engines. This increased efficiency is gained at the expense of poorer response to load changes and a heavier structure to withstand the higher pressures.[1]

3.3.3 Emissions

Most of the pollutants from IC engines are emitted through the exhaust. However, some total organic compounds (TOC) escape from the crankcase as a result of blowby (gases that are vented from the oil pan after they have escaped from the cylinder past the piston rings) and from the fuel tank and carburetor because of evaporation. Nearly all of the TOCs from diesel CI engines enter the

atmosphere from the exhaust. Evaporative losses are insignificant in diesel engines due to the low volatility of diesel fuels.

The primary pollutants from internal combustion engines are oxides of nitrogen (NO_x), total organic compounds (TOC), carbon monoxide (CO), and particulates, which include both visible (smoke) and nonvisible emissions. Nitrogen oxide formation is directly related to high pressures and temperatures during the combustion process and to the nitrogen content, if any, of the fuel. The other pollutants, HC, CO, and smoke, are primarily the result of incomplete combustion. Ash and metallic additives in the fuel also contribute to the particulate content of the exhaust. Sulfur oxides (SO_x) also appear in the exhaust from IC engines. The sulfur compounds, mainly sulfur dioxide (SO_2), are directly related to the sulfur content of the fuel.[2]

3.3.3.1 Nitrogen Oxides -

Nitrogen oxide formation occurs by two fundamentally different mechanisms. The predominant mechanism with internal combustion engines is thermal NO_x which arises from the thermal dissociation and subsequent reaction of nitrogen (N_2) and oxygen (O_2) molecules in the combustion air. Most thermal NO_x is formed in the high-temperature region of the flame from dissociated molecular nitrogen in the combustion air. Some NO_x, called prompt NO_x, is formed in the early part of the flame from reaction of nitrogen intermediary species, and HC radicals in the flame. The second mechanism, fuel NO_x, stems from the evolution and reaction of fuel-bound nitrogen compounds with oxygen. Gasoline, and most distillate oils have no chemically-bound fuel N_2 and essentially all NO_x formed is thermal NO_x.

3.3.3.2 Total Organic Compounds -

The pollutants commonly classified as hydrocarbons are composed of a wide variety of organic compounds and are discharged into the atmosphere when some of the fuel remains unburned or is only partially burned during the combustion process. Most unburned hydrocarbon emissions result from fuel droplets that were transported or injected into the quench layer during combustion. This is the region immediately adjacent to the combustion chamber surfaces, where heat transfer outward through the cylinder walls causes the mixture temperatures to be too low to support combustion.

Partially burned hydrocarbons can occur because of poor air and fuel homogeneity due to incomplete mixing, before or during combustion; incorrect air/fuel ratios in the cylinder during combustion due to maladjustment of the engine fuel system; excessively large fuel droplets (diesel engines); and low cylinder temperature due to excessive cooling (quenching) through the walls or early cooling of the gases by expansion of the combustion volume caused by piston motion before combustion is completed.[2]

3.3.3.3 Carbon Monoxide -

Carbon monoxide is a colorless, odorless, relatively inert gas formed as an intermediate combustion product that appears in the exhaust when the reaction of CO to CO_2 cannot proceed to completion. This situation occurs if there is a lack of available oxygen near the hydrocarbon (fuel) molecule during combustion, if the gas temperature is too low, or if the residence time in the cylinder is too short. The oxidation rate of CO is limited by reaction kinetics and, as a consequence, can be accelerated only to a certain extent by improvements in air and fuel mixing during the combustion process.[2-3]

3.3.3.4 Smoke and Particulate Matter -

White, blue, and black smoke may be emitted from IC engines. Liquid particulates appear as white smoke in the exhaust during an engine cold start, idling, or low load operation. These are formed in the quench layer adjacent to the cylinder walls, where the temperature is not high enough to ignite the fuel. Blue smoke is emitted when lubricating oil leaks, often past worn piston rings, into the combustion chamber and is partially burned. Proper maintenance is the most effective method of preventing blue smoke emissions from all types of IC engines. The primary constituent of black smoke is agglomerated carbon particles (soot) formed in regions of the combustion mixtures that are oxygen deficient.[2]

3.3.3.5 Sulfur Oxides -

Sulfur oxides emissions are a function of only the sulfur content in the fuel rather than any combustion variables. In fact, during the combustion process, essentially all the sulfur in the fuel is oxidized to SO_2. The oxidation of SO_2 gives sulfur trioxide (SO_3), which reacts with water to give sulfuric acid (H_2SO_4), a contributor to acid precipitation. Sulfuric acid reacts with basic substances to give sulfates, which are fine particulates that contribute to PM-10 and visibility reduction. Sulfur oxide emissions also contribute to corrosion of the engine parts.[2-3]

3.3.4 Control Technologies

Control measures to date are primarily directed at limiting NO_x and CO emissions since they are the primary pollutants from these engines. From a NO_x control viewpoint, the most important distinction between different engine models and types of reciprocating engines is whether they are rich-burn or lean-burn. Rich-burn engines have an air-to-fuel ratio operating range that is near stoichiometric or fuel-rich of stoichiometric and as a result the exhaust gas has little or no excess oxygen. A lean-burn engine has an air-to-fuel operating range that is fuel-lean of stoichiometric; therefore, the exhaust from these engines is characterized by medium to high levels of O_2. The most common NO_x control technique for diesel and dual-fuel engines focuses on modifying the combustion process. However, selective catalytic reduction (SCR) and nonselective catalytic reduction (NSCR) which are post-combustion techniques are becoming available. Controls for CO have been partly adapted from mobile sources.[4]

Combustion modifications include injection timing retard (ITR), preignition chamber combustion (PCC), air-to-fuel ratio adjustments, and derating. Injection of fuel into the cylinder of a CI engine initiates the combustion process. Retarding the timing of the diesel fuel injection causes the combustion process to occur later in the power stroke when the piston is in the downward motion and combustion chamber volume is increasing. By increasing the volume, the combustion temperature and pressure are lowered, thereby lowering NO_x formation. ITR reduces NO_x from all diesel engines; however, the effectiveness is specific to each engine model. The amount of NO_x reduction with ITR diminishes with increasing levels of retard.[4]

Improved swirl patterns promote thorough air and fuel mixing and may include a precombustion chamber (PCC). A PCC is an antechamber that ignites a fuel-rich mixture that propagates to the main combustion chamber. The high exit velocity from the PCC results in improved mixing and complete combustion of the lean air/fuel mixture which lowers combustion temperature, thereby reducing NO_x emissions.[4]

The air-to-fuel ratio for each cylinder can be adjusted by controlling the amount of fuel that enters each cylinder. At air-to-fuel ratios less than stoichiometric (fuel-rich), combustion occurs under conditions of insufficient oxygen which causes NO_x to decrease because of lower oxygen and lower temperatures. Derating involves restricting the engine operation to lower than normal levels of power production for the given application. Derating reduces cylinder pressures and temperatures, thereby lowering NO_x formation rates.[4]

SCR is an add-on NO_x control placed in the exhaust stream following the engine and involves injecting ammonia (NH_3) into the flue gas. The NH_3 reacts with NO_x in the presence of a catalyst to form water and nitrogen. The effectiveness of SCR depends on fuel quality and engine duty cycle (load fluctuations). Contaminants in the fuel may poison or mask the catalyst surface causing a reduction or termination in catalyst activity. Load fluctuations can cause variations in exhaust temperature and NO_x concentration which can create problems with the effectiveness of the SCR system.[4]

NSCR is often referred to as a three-way conversion catalyst system because the catalyst reactor simultaneously reduces NO_x, CO, and HC and involves placing a catalyst in the exhaust stream of the engine. The reaction requires that the O_2 levels be kept low and that the engine be operated at fuel-rich air-to-fuel ratios.[4]

The most accurate method for calculating such emissions is on the basis of "brake-specific" emission factors (pounds per horsepower-hour [lb/hp-hr]). Emissions are the product of the brake-specific emission factor, the usage in hours, the rated power available, and the load factor (the power actually used divided by the power available). However, for emission inventory purposes, it is often easier to assess this activity on the basis of fuel used.

Once reasonable usage and duty cycles for this category were ascertained, emission values were aggregated to arrive at the factors for criteria and organic pollutants presented. Factors in Table 3.3-1 are in pounds per million British thermal unit (lb/MMBtu). Emission data for a specific design type were weighted according to estimated material share for industrial engines. The emission factors in these tables, because of their aggregate nature, are most appropriately applied to a population of industrial engines rather than to an individual power plant. Table 3.3-2 shows unweighted speciated organic compound and air toxic emission factors based upon only 2 engines. Their inclusion in this section is intended for rough order-of-magnitude estimates only.

Table 3.3-3 summarizes whether the various diesel emission reduction technologies (some of which may be applicable to gasoline engines) will generally increase or decrease the selected parameter. These technologies are categorized into fuel modifications, engine modifications, and exhaust after-treatments. Current data are insufficient to quantify the results of the modifications. Table 3.3-3 provides general information on the trends of changes on selected parameters.

3.3.5 Updates Since the Fifth Edition

The Fifth Edition was released in January 1995. Revisions to this section since that date are summarized below. For further detail, consult the memoranda describing each supplement or the background report for this section.

Supplement A, February 1996

No changes.

Supplement B, October 1996

- Text was revised concerning emissions and controls.
- The CO_2 emission factor was adjusted to reflect 98.5 percent conversion efficiency.

Table 3.3-1. EMISSION FACTORS FOR UNCONTROLLED GASOLINE AND DIESEL INDUSTRIAL ENGINES[a]

Pollutant	Gasoline Fuel (SCC 2-02-003-01, 2-03-003-01)		Diesel Fuel (SCC 2-02-001-02, 2-03-001-01)		EMISSION FACTOR RATING
	Emission Factor (lb/hp-hr) (power output)	Emission Factor (lb/MMBtu) (fuel input)	Emission Factor (lb/hp-hr) (power output)	Emission Factor (lb/MMBtu) (fuel input)	
NO_x	0.011	1.63	0.031	4.41	D
CO	0.439	62.7	6.68 E-03	0.95	D
SO_x	5.91 E-04	0.084	2.05 E-03	0.29	D
PM-10[b]	7.21 E-04	0.10	2.20 E-03	0.31	D
CO_2[c]	1.08	154	1.15	164	B
Aldehydes	4.85 E-04	0.07	4.63 E-04	0.07	D
TOC					
Exhaust	0.015	2.10	2.47 E-03	0.35	D
Evaporative	6.61 E-04	0.09	0.00	0.00	E
Crankcase	4.85 E-03	0.69	4.41 E-05	0.01	E
Refueling	1.08 E-03	0.15	0.00	0.00	E

[a] References 2,5-6,9-14. When necessary, an average brake-specific fuel consumption (BSFC) of 7,000 Btu/hp-hr was used to convert from lb/MMBtu to lb/hp-hr. To convert from lb/hp-hr to kg/kw-hr, multiply by 0.608. To convert from lb/MMBtu to ng/J, multiply by 430. SCC = Source Classification Code. TOC = total organic compounds.

[b] PM-10 = particulate matter less than or equal to 10 µm aerodynamic diameter. All particulate is assumed to be ≤ 1 µm in size.

[c] Assumes 99% conversion of carbon in fuel to CO_2 with 87 weight % carbon in diesel, 86 weight % carbon in gasoline, average BSFC of 7,000 Btu/hp-hr, diesel heating value of 19,300 Btu/lb, and gasoline heating value of 20,300 Btu/lb.

Table 3.3-2. SPECIATED ORGANIC COMPOUND EMISSION FACTORS FOR UNCONTROLLED DIESEL ENGINES[a]

EMISSION FACTOR RATING: E

Pollutant	Emission Factor (Fuel Input) (lb/MMBtu)
Benzene[b]	9.33 E-04
Toluene[b]	4.09 E-04
Xylenes[b]	2.85 E-04
Propylene	2.58 E-03
1,3-Butadiene[b,c]	<3.91 E-05
Formaldehyde[b]	1.18 E-03
Acetaldehyde[b]	7.67 E-04
Acrolein[b]	<9.25 E-05
Polycyclic aromatic hydrocarbons (PAH)	
Naphthalene[b]	8.48 E-05
Acenaphthylene	<5.06 E-06
Acenaphthene	<1.42 E-06
Fluorene	2.92 E-05
Phenanthrene	2.94 E-05
Anthracene	1.87 E-06
Fluoranthene	7.61 E-06
Pyrene	4.78 E-06
Benzo(a)anthracene	1.68 E-06
Chrysene	3.53 E-07
Benzo(b)fluoranthene	<9.91 E-08
Benzo(k)fluoranthene	<1.55 E-07
Benzo(a)pyrene	<1.88 E-07
Indeno(1,2,3-cd)pyrene	<3.75 E-07
Dibenz(a,h)anthracene	<5.83 E-07
Benzo(g,h,l)perylene	<4.89 E-07
TOTAL PAH	1.68 E-04

[a] Based on the uncontrolled levels of 2 diesel engines from References 6-7. Source Classification Codes 2-02-001-02, 2-03-001-01. To convert from lb/MMBtu to ng/J, multiply by 430.
[b] Hazardous air pollutant listed in the *Clean Air Act*.
[c] Based on data from 1 engine.

Table 3.3-3. EFFECT OF VARIOUS EMISSION CONTROL TECHNOLOGIES ON DIESEL ENGINES[a]

Technology	Affected Parameter	
	Increase	Decrease
Fuel modifications		
Sulfur content increase	PM, wear	
Aromatic content increase	PM, NO_x	
Cetane number		PM, NO_x
10% and 90% boiling point		PM
Fuel additives		PM, NO_x
Water/Fuel emulsions		NO_x
Engine modifications		
Injection timing retard	PM, BSFC	NO_x, power
Fuel injection pressure	PM, NO_x	
Injection rate control		NO_x, PM
Rapid spill nozzles		PM
Electronic timing & metering		NO_x, PM
Injector nozzle geometry		PM
Combustion chamber modifications		NO_x, PM
Turbocharging	PM, power	NO_x
Charge cooling		NO_x
Exhaust gas recirculation	PM, power, wear	NO_x
Oil consumption control		PM, wear
Exhaust after-treatment		
Particulate traps		PM
Selective catalytic reduction		NO_x
Oxidation catalysts		TOC, CO, PM

[a] Reference 8. PM = particulate matter. BSFC = brake-specific fuel consumption.

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APPENDIX N-2

DEATILED EMISSION CALCULATIONS FOR THE
2005 BASELINE YEAR AND PROJECT YEARS 2010-2016

Summary of Emissions from Steam Cleaners
Dolores and ICTF Rail Yards, Long Beach, CA

Emissions from Steam Cleaner Heaters

							Hours of		Carbon	2005 Emission Factors								2005 Emission Estimates							
				Emission	Fuel	Rating	Operation	Fuel Use	Oxidation	(lb/mgal)[4]					(kg/gal)[3]			(tons/yr)					(metric tons/yr)		
Yard	Location	Make	Model	Unit	Type	(MMBtu/hr)	(hr/yr)[1]	(gal/yr)[2]	Factor[3]	VOC	CO	NOx	PM10	SOx[5]	CO2	N2O[2]	CH4[2]	ROG	CO	NOx	PM10	SOx	CO2	N2O	CH4
Dolores	Service Track	Hydroblaster	M5-5	Heater	Propane	0.35	1000	3844.142	99.5%	0.5	1.9	14	0.4	0.002	5.7	8.29E-06	3.73E-05	9.61E-04	3.65E-03	2.69E-02	7.69E-04	2.88E-06	21.80	3.19E-05	1.44E-04
Dolores	Locomotive Shop	Hydroblaster	M5-5	Heater	Propane	0.35	1000	3844.142	99.5%	0.5	1.9	14	0.4	0.002	5.7	8.29E-06	3.73E-05	9.61E-04	3.65E-03	2.69E-02	7.69E-04	2.88E-06	21.80	3.19E-05	1.44E-04
Dolores	Locomotive Shop	Hydroblaster	M5-5	Heater	Propane	0.35	1000	3844.142	99.5%	0.5	1.9	14	0.4	0.002	5.7	8.29E-06	3.73E-05	9.61E-04	3.65E-03	2.69E-02	7.69E-04	2.88E-06	21.80	3.19E-05	1.44E-04
Dolores	Service Track	Hydroblaster	EH34	Heater	Propane	0.35	1000	3844.142	99.5%	0.5	1.9	14	0.4	0.002	5.7	8.29E-06	3.73E-05	9.61E-04	3.65E-03	2.69E-02	7.69E-04	2.88E-06	21.80	3.19E-05	1.44E-04
Total																		**0.004**	**0.015**	**0.108**	**0.003**	**0.000**	**87.21**	**1.27E-04**	**5.74E-04**

Emissions from Steam Cleaner Pumps

							Hours of		Carbon	2005 Emission Factors								2005 Emission Estimates							
				Emission		Rating	Operation	Fuel Use	Oxidation	(g/hp-hr)[7]					(kg/gal)[3]			(tons/yr)					(metric tons/yr)		
Yard	Location	Make	Model	Unit	Fuel Type	(hp)	(hr/yr)[1]	(gal/yr)[6]	Factor[3]	VOC	CO	NOx	PM10	SOx	CO2	N2O[2]	CH4[2]	ROG	CO	NOx	PM10	SOx	CO2	N2O	CH4
Dolores	Service Track	Hydroblaster	M5-5	Pump	Electric	NA	1000	0.00	99%	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dolores	Locomotive Shop	Hydroblaster	M5-5	Pump	Electric	NA	1000	0.00	99%	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dolores	Locomotive Shop	Hydroblaster	M5-5	Pump	Electric	NA	1000	0.00	99%	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dolores	Service Track	Hydroblaster	EH34	Pump	Gasoline	11	1000	627.56	99%	9.79	199.13	4.99	0.33	0.27	8.87	1.60E-04	1.23E-05	0.12	2.41	0.06	0.00	0.00	5.57	1.00E-04	7.70E-06
Total																		**0.12**	**2.41**	**0.06**	**0.00**	**0.00**	**5.57**	**1.00E-04**	**7.70E-06**

Notes:
1. Hours of operation are an engineering estimate.
2. Based on a propane HHV of 3.824 MMBtu/barrel (from ARB Draft Emission Factors for Mandatory Reporting Programs, August 10, 2007) and 42 gallons per barrel.
3. From the Air Resources Board's Draft *Emission Factors for Mandatory Reporting Programs*, August 10, 2007.
4. Emission factors, in lb/mgal, from AP-42, Table 1.5-1, 10/96.
5. Based on a propane sulfur content of 185 ppm and a density of 4.24 lb propane per gallon.
6. Based on a BSFC of 7,000 Btu/hp-hr (from AP-42) and a gasoline HHV of of 122,697 Btu/gal (from Transportation Energy Data Book, Edition 26, US DOE, 2007).
7. Emission factors in lb/hp-hr from AP-42, Table 3.3-1, 10/96.

Summary of Emissions from Steam Cleaners
Dolores and ICTF Rail Yards, Long Beach, CA

Emissions from Steam Cleaner Heaters

							Hours of		Carbon	2010 Emission Factors								2010 Emission Estimates							
				Emission	Fuel	Rating	Operation	Fuel Use	Oxidation	(lb/mgal)[4]					(kg/gal)[3]			(tons/yr)					(metric tons/yr)		
Yard	Location	Make	Model	Unit	Type	(MMBtu/hr)	(hr/yr)[1]	(gal/yr)[2]	Factor[3]	VOC	CO	NOx	PM10	SOx[5]	CO2	N2O[2]	CH4[2]	ROG	CO	NOx	PM10	SOx	CO2	N2O	CH4
Dolores	Service Track	Hydroblaster	M5-5	Heater	Propane	0.35	1000	3844.142	99.5%	0.5	1.9	14	0.4	0.002	5.7	8.29E-06	3.73E-05	9.61E-04	3.65E-03	2.69E-02	7.69E-04	2.88E-06	21.80	3.19E-05	1.44E-04
Dolores	Locomotive Shop	Hydroblaster	M5-5	Heater	Propane	0.35	1000	3844.142	99.5%	0.5	1.9	14	0.4	0.002	5.7	8.29E-06	3.73E-05	9.61E-04	3.65E-03	2.69E-02	7.69E-04	2.88E-06	21.80	3.19E-05	1.44E-04
Dolores	Locomotive Shop	Hydroblaster	M5-5	Heater	Propane	0.35	1000	3844.142	99.5%	0.5	1.9	14	0.4	0.002	5.7	8.29E-06	3.73E-05	9.61E-04	3.65E-03	2.69E-02	7.69E-04	2.88E-06	21.80	3.19E-05	1.44E-04
Dolores	Service Track	Hydroblaster	EH34	Heater	Propane	0.35	1000	3844.142	99.5%	0.5	1.9	14	0.4	0.002	5.7	8.29E-06	3.73E-05	9.61E-04	3.65E-03	2.69E-02	7.69E-04	2.88E-06	21.80	3.19E-05	1.44E-04
Total																		**0.004**	**0.015**	**0.108**	**0.003**	**0.000**	**87.21**	**1.27E-04**	**5.74E-04**

Emissions from Steam Cleaner Pumps

							Hours of		Carbon	2010 Emission Factors								2010 Emission Estimates							
				Emission		Rating	Operation	Fuel Use	Oxidation	(g/hp-hr)[7]					(kg/gal)[3]			(tons/yr)					(metric tons/yr)		
Yard	Location	Make	Model	Unit	Fuel Type	(hp)	(hr/yr)[1]	(gal/yr)[6]	Factor[3]	VOC	CO	NOx	PM10	SOx	CO2	N2O[2]	CH4[2]	ROG	CO	NOx	PM10	SOx	CO2	N2O	CH4
Dolores	Service Track	Hydroblaster	M5-5	Pump	Electric	NA	1000	0.00	99%	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dolores	Locomotive Shop	Hydroblaster	M5-5	Pump	Electric	NA	1000	0.00	99%	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dolores	Locomotive Shop	Hydroblaster	M5-5	Pump	Electric	NA	1000	0.00	99%	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dolores	Service Track	Hydroblaster	EH34	Pump	Gasoline	11	1000	627.56	99%	9.79	199.13	4.99	0.33	0.27	8.87	1.60E-04	1.23E-05	0.12	2.41	0.06	0.00	0.00	5.57	1.00E-04	7.70E-06
Total																		**0.12**	**2.41**	**0.06**	**0.00**	**0.00**	**5.57**	**1.00E-04**	**7.70E-06**

Notes:
1. Hours of operation are an engineering estimate. Assumed no change in the hours of operation from the baseline year.
2. Based on a propane HHV of 3.824 MMBtu/barrel (from ARB Draft Emission Factors for Mandatory Reporting Programs, August 10, 2007) and 42 gallons per barrel.
3. From the Air Resources Board's Draft *Emission Factors for Mandatory Reporting Programs*, August 10, 2007.
4. Emission factors, in lb/mgal, from AP-42, Table 1.5-1, 10/96.
5. Based on a propane sulfur content of 185 ppm and a density of 4.24 lb propane per gallon.
6. Based on a BSFC of 7,000 Btu/hp-hr (from AP-42) and a gasoline HHV of 122,697 Btu/gal (from Transportation Energy Data Book, Edition 26, US DOE, 2007).
7. Emission factors in lb/hp-hr from AP-42, Table 3.3-1, 10/96.

Summary of Emissions from Steam Cleaners
Dolores and ICTF Rail Yards, Long Beach, CA

Emissions from Steam Cleaner Heaters

							Hours of		Carbon	2012 Emission Factors								2012 Emission Estimates							
				Emission	Fuel	Rating	Operation	Fuel Use	Oxidation	(lb/mgal)[4]					(kg/gal)[3]			(tons/yr)					(metric tons/yr)		
Yard	Location	Make	Model	Unit	Type	(MMBtu/hr)	(hr/yr)[1]	(gal/yr)[2]	Factor[3]	VOC	CO	NOx	PM10	SOx[5]	CO2	N2O[2]	CH4[2]	ROG	CO	NOx	PM10	SOx	CO2	N2O	CH4
Dolores	Service Track	Hydroblaster	M5-5	Heater	Propane	0.35	1000	3844.142	99.5%	0.5	1.9	14	0.4	0.002	5.7	8.29E-06	3.73E-05	9.61E-04	3.65E-03	2.69E-02	7.69E-04	2.88E-06	21.80	3.19E-05	1.44E-04
Dolores	Locomotive Shop	Hydroblaster	M5-5	Heater	Propane	0.35	1000	3844.142	99.5%	0.5	1.9	14	0.4	0.002	5.7	8.29E-06	3.73E-05	9.61E-04	3.65E-03	2.69E-02	7.69E-04	2.88E-06	21.80	3.19E-05	1.44E-04
Dolores	Locomotive Shop	Hydroblaster	M5-5	Heater	Propane	0.35	1000	3844.142	99.5%	0.5	1.9	14	0.4	0.002	5.7	8.29E-06	3.73E-05	9.61E-04	3.65E-03	2.69E-02	7.69E-04	2.88E-06	21.80	3.19E-05	1.44E-04
Dolores	Service Track	Hydroblaster	EH34	Heater	Propane	0.35	1000	3844.142	99.5%	0.5	1.9	14	0.4	0.002	5.7	8.29E-06	3.73E-05	9.61E-04	3.65E-03	2.69E-02	7.69E-04	2.88E-06	21.80	3.19E-05	1.44E-04
Total																		**0.004**	**0.015**	**0.108**	**0.003**	**0.000**	**87.21**	**1.27E-04**	**5.74E-04**

Emissions from Steam Cleaner Pumps

							Hours of		Carbon	2012 Emission Factors								2012 Emission Estimates							
				Emission		Rating	Operation	Fuel Use	Oxidation	(g/hp-hr)[7]					(kg/gal)[3]			(tons/yr)					(metric tons/yr)		
Yard	Location	Make	Model	Unit	Fuel Type	(hp)	(hr/yr)[1]	(gal/yr)[6]	Factor[3]	VOC	CO	NOx	PM10	SOx	CO2	N2O[2]	CH4[2]	ROG	CO	NOx	PM10	SOx	CO2	N2O	CH4
Dolores	Service Track	Hydroblaster	M5-5	Pump	Electric	NA	1000	0.00	99%	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dolores	Locomotive Shop	Hydroblaster	M5-5	Pump	Electric	NA	1000	0.00	99%	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dolores	Locomotive Shop	Hydroblaster	M5-5	Pump	Electric	NA	1000	0.00	99%	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dolores	Service Track	Hydroblaster	EH34	Pump	Gasoline	11	1000	627.56	99%	9.79	199.13	4.99	0.33	0.27	8.87	1.60E-04	1.23E-05	0.12	2.41	0.06	0.00	0.00	5.57	1.00E-04	7.70E-06
Total																		**0.12**	**2.41**	**0.06**	**0.00**	**0.00**	**5.57**	**1.00E-04**	**7.70E-06**

Notes:
1. Hours of operation are an engineering estimate. Assumed no change in the hours of operation from the baseline year.
2. Based on a propane HHV of 3.824 MMBtu/barrel (from ARB Draft Emission Factors for Mandatory Reporting Programs, August 10, 2007) and 42 gallons per barrel.
3. From the Air Resources Board's Draft *Emission Factors for Mandatory Reporting Programs*, August 10, 2007.
4. Emission factors, in lb/mgal, from AP-42, Table 1.5-1, 10/96.
5. Based on a propane sulfur content of 185 ppm and a density of 4.24 lb propane per gallon.
6. Based on a BSFC of 7,000 Btu/hp-hr (from AP-42) and a gasoline HHV of 122,697 Btu/gal (from Transportation Energy Data Book, Edition 26, US DOE, 2007).
7. Emission factors in lb/hp-hr from AP-42, Table 3.3-1, 10/96.

Summary of Emissions from Steam Cleaners
Dolores and ICTF Rail Yards, Long Beach, CA

Emissions from Steam Cleaner Heaters

							Hours of		Carbon	2014 Emission Factors								2014 Emission Estimates							
				Emission	Fuel	Rating	Operation	Fuel Use	Oxidation	(lb/mgal)[4]					(kg/gal)[3]			(tons/yr)					(metric tons/yr)		
Yard	Location	Make	Model	Unit	Type	(MMBtu/hr)	(hr/yr)[1]	(gal/yr)[2]	Factor[3]	VOC	CO	NOx	PM10	SOx[5]	CO2	N2O[2]	CH4[2]	ROG	CO	NOx	PM10	SOx	CO2	N2O	CH4
Dolores	Service Track	Hydroblaster	M5-5	Heater	Propane	0.35	1000	3844.1423	99.5%	0.5	1.9	14	0.4	0.002	5.7	8.29E-06	3.73E-05	9.61E-04	3.65E-03	2.69E-02	7.69E-04	2.88E-06	21.80	3.19E-05	1.44E-04
Dolores	Locomotive Shop	Hydroblaster	M5-5	Heater	Propane	0.35	1000	3844.1423	99.5%	0.5	1.9	14	0.4	0.002	5.7	8.29E-06	3.73E-05	9.61E-04	3.65E-03	2.69E-02	7.69E-04	2.88E-06	21.80	3.19E-05	1.44E-04
Dolores	Locomotive Shop	Hydroblaster	M5-5	Heater	Propane	0.35	1000	3844.1423	99.5%	0.5	1.9	14	0.4	0.002	5.7	8.29E-06	3.73E-05	9.61E-04	3.65E-03	2.69E-02	7.69E-04	2.88E-06	21.80	3.19E-05	1.44E-04
Dolores	Service Track	Hydroblaster	EH34	Heater	Propane	0.35	1000	3844.1423	99.5%	0.5	1.9	14	0.4	0.002	5.7	8.29E-06	3.73E-05	9.61E-04	3.65E-03	2.69E-02	7.69E-04	2.88E-06	21.80	3.19E-05	1.44E-04
Total																		**0.004**	**0.015**	**0.108**	**0.003**	**0.000**	**87.21**	**1.27E-04**	**5.74E-04**

Emissions from Steam Cleaner Pumps

							Hours of		Carbon	2014 Emission Factors								2014 Emission Estimates							
				Emission		Rating	Operation	Fuel Use	Oxidation	(g/hp-hr)[7]					(kg/gal)[3]			(tons/yr)					(metric tons/yr)		
Yard	Location	Make	Model	Unit	Fuel Type	(hp)	(hr/yr)[1]	(gal/yr)[6]	Factor[3]	VOC	CO	NOx	PM10	SOx	CO2	N2O[2]	CH4[2]	ROG	CO	NOx	PM10	SOx	CO2	N2O	CH4
Dolores	Service Track	Hydroblaster	M5-5	Pump	Electric	NA	1000	0.00	99%	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dolores	Locomotive Shop	Hydroblaster	M5-5	Pump	Electric	NA	1000	0.00	99%	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dolores	Locomotive Shop	Hydroblaster	M5-5	Pump	Electric	NA	1000	0.00	99%	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dolores	Service Track	Hydroblaster	EH34	Pump	Gasoline	11	1000	627.56	99%	9.79	199.13	4.99	0.33	0.27	8.87	1.60E-04	1.23E-05	0.12	2.41	0.06	0.00	0.00	5.57	1.00E-04	7.70E-06
Total																		**0.12**	**2.41**	**0.06**	**0.00**	**0.00**	**5.57**	**1.00E-04**	**7.70E-06**

Notes:
1. Hours of operation are an engineering estimate. Assumed no change in the hours of operation from the baseline year.
2. Based on a propane HHV of 3.824 MMBtu/barrel (from ARB Draft Emission Factors for Mandatory Reporting Programs, August 10, 2007) and 42 gallons per barrel.
3. From the Air Resources Board's Draf *Emission Factors for Mandatory Reporting Programs*, August 10, 2007.
4. Emission factors, in lb/mgal, from AP-42, Table 1.5-1, 10/96.
5. Based on a propane sulfur content of 185 ppm and a density of 4.24 lb propane per gallon.
6. Based on a BSFC of 7,000 Btu/hp-hr (from AP-42) and a gasoline HHV of 122,697 Btu/gal (from Transportation Energy Data Book, Edition 26, US DOE, 2007).
7. Emission factors in lb/hp-hr from AP-42, Table 3.3-1, 10/96.

Summary of Emissions from Steam Cleaners
Dolores and ICTF Rail Yards, Long Beach, CA

Emissions from Steam Cleaner Heaters

							Hours of		Carbon	2016 Emission Factors								2016 Emission Estimates							
				Emission	Fuel	Rating	Operation	Fuel Use	Oxidation	(lb/mgal)[4]					(kg/gal)[3]			(tons/yr)					(metric tons/yr)		
Yard	Location	Make	Model	Unit	Type	(MMBtu/hr)	(hr/yr)[1]	(gal/yr)[2]	Factor[3]	VOC	CO	NOx	PM10	SOx[5]	CO2	N2O[2]	CH4[2]	ROG	CO	NOx	PM10	SOx	CO2	N2O	CH4
Dolores	Service Track	Hydroblaster	M5-5	Heater	Propane	0.35	1000	3844.1423	99.5%	0.5	1.9	14	0.4	0.002	5.7	8.29E-06	3.73E-05	9.61E-04	3.65E-03	2.69E-02	7.69E-04	2.88E-06	21.80	3.19E-05	1.44E-04
Dolores	Locomotive Shop	Hydroblaster	M5-5	Heater	Propane	0.35	1000	3844.1423	99.5%	0.5	1.9	14	0.4	0.002	5.7	8.29E-06	3.73E-05	9.61E-04	3.65E-03	2.69E-02	7.69E-04	2.88E-06	21.80	3.19E-05	1.44E-04
Dolores	Locomotive Shop	Hydroblaster	M5-5	Heater	Propane	0.35	1000	3844.1423	99.5%	0.5	1.9	14	0.4	0.002	5.7	8.29E-06	3.73E-05	9.61E-04	3.65E-03	2.69E-02	7.69E-04	2.88E-06	21.80	3.19E-05	1.44E-04
Dolores	Service Track	Hydroblaster	EH34	Heater	Propane	0.35	1000	3844.1423	99.5%	0.5	1.9	14	0.4	0.002	5.7	8.29E-06	3.73E-05	9.61E-04	3.65E-03	2.69E-02	7.69E-04	2.88E-06	21.80	3.19E-05	1.44E-04
Total																		**0.004**	**0.015**	**0.108**	**0.003**	**0.000**	**87.21**	**1.27E-04**	**5.74E-04**

Emissions from Steam Cleaner Pumps

							Hours of		Carbon	2016 Emission Factors								2016 Emission Estimates							
				Emission		Rating	Operation	Fuel Use	Oxidation	(g/hp-hr)[7]					(kg/gal)[3]			(tons/yr)					(metric tons/yr)		
Yard	Location	Make	Model	Unit	Fuel Type	(hp)	(hr/yr)[1]	(gal/yr)[6]	Factor[3]	VOC	CO	NOx	PM10	SOx	CO2	N2O[2]	CH4[2]	ROG	CO	NOx	PM10	SOx	CO2	N2O	CH4
Dolores	Service Track	Hydroblaster	M5-5	Pump	Electric	NA	1000	0.00	99%	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dolores	Locomotive Shop	Hydroblaster	M5-5	Pump	Electric	NA	1000	0.00	99%	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dolores	Locomotive Shop	Hydroblaster	M5-5	Pump	Electric	NA	1000	0.00	99%	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dolores	Service Track	Hydroblaster	EH34	Pump	Gasoline	11	1000	627.56	99%	9.79	199.13	4.99	0.33	0.27	8.87	1.60E-04	1.23E-05	0.12	2.41	0.06	0.00	0.00	5.57	1.00E-04	7.70E-06
Total																		**0.12**	**2.41**	**0.06**	**0.00**	**0.00**	**5.57**	**1.00E-04**	**7.70E-06**

Notes:
1. Hours of operation are an engineering estimate. Assumed no change in the hours of operation from the baseline year.
2. Based on a propane HHV of 3.824 MMBtu/barrel (from ARB Draft Emission Factors for Mandatory Reporting Programs, August 10, 2007) and 42 gallons per barrel.
3. From the Air Resources Board's Draf *Emission Factors for Mandatory Reporting Programs,* August 10, 2007.
4. Emission factors, in lb/mgal, from AP-42, Table 1.5-1, 10/96.
5. Based on a propane sulfur content of 185 ppm and a density of 4.24 lb propane per gallon.
6. Based on a BSFC of 7,000 Btu/hp-hr (from AP-42) and a gasoline HHV of 122,697 Btu/gal (from Transportation Energy Data Book, Edition 26, US DOE, 2007).
7. Emission factors in lb/hp-hr from AP-42, Table 3.3-1, 10/96.

APPENDIX N-3

SPECIATION PROFILES FOR STEAM CLEANERS

Toxic Air Contaminant Emissions from Steam Cleaners
Dolores and ICTF Rail Yards, Long Beach, CA

Propane Heaters

Profile[1]	CAS	Chemical Name	Organic Fraction	Emissions (tpy)
3	71432	benzene	0.0947	3.64E-04
3	110827	cyclohexane	0.0237	9.11E-05
3	50000	formaldehyde	0.1895	7.28E-04
3	108883	toluene	0.0474	1.82E-04
Total				**1.37E-03**

IC Engine

Profile[1]	CAS	Chemical Name	Organic Fraction	Emissions (tpy)
665	95636	1,2,4-trimethylbenzene	0.0140	1.67E-03
665	106990	1,3-butadiene	0.0091	1.08E-03
665	540841	2,2,4-trimethylpentane	0.0222	2.63E-03
665	75070	acetaldehyde	0.0106	1.26E-03
665	107028	acrolein (2-propenal)	0.0020	2.38E-04
665	71432	benzene	0.0368	4.37E-03
665	4170303	crotonaldehyde	0.0014	1.72E-04
665	110827	cyclohexane	0.0050	5.95E-04
665	100414	ethylbenzene	0.0167	1.98E-03
665	74851	ethylene	0.0996	1.18E-02
665	50000	formaldehyde	0.0327	3.88E-03
665	78795	isoprene	0.0016	1.85E-04
665	98828	isopropylbenzene (cumene)	0.0006	6.58E-05
665	67561	methyl alcohol	0.0038	4.53E-04
665	78933	methyl ethyl ketone (mek) (2-butanone)	0.0007	7.88E-05
665	108383	m-xylene	0.0496	5.89E-03
665	91203	naphthalene	0.0014	1.72E-04
665	110543	n-hexane	0.0146	1.73E-03
665	95476	o-xylene	0.0173	2.05E-03
665	115071	propylene	0.0546	6.48E-03
665	100425	styrene	0.0014	1.72E-04
665	108883	toluene	0.0756	8.98E-03
Total				**5.60E-02**

Notes:
1. Organic fraction from ARBs SPECIATE database.
2. Data for heaters is from "External combustion boiler - natural gas" option. SPECIATE database does not include an option for propane fueled boilers.
3. Data for the gasoline IC engine is from "Non-cat stabilized exhaust 1996 SSD 2.0% etoh (MTBE phaseout)" option
4. Emissions were calculated for only chemicals that were in both the SPECIATE database and the AB2588 list.
5. Organic fraction reported on a ROG basis using ARB's Speciate ROG/TOG ratio (Profile 3 ratio = 0.4222; Profile 665 ratio = 0.9198)

Toxic Air Contaminant Emissions from Steam Cleaners
Dolores and ICTF Rail Yards, Long Beach, CA

Propane Heaters

Profile[1]	CAS	Chemical Name	Organic Fraction	2010 Emissions (tpy)
3	71432	benzene	0.0947	3.64E-04
3	110827	cyclohexane	0.0237	9.11E-05
3	50000	formaldehyde	0.1895	7.28E-04
3	108883	toluene	0.0474	1.82E-04
Total				**1.37E-03**

IC Engine

Profile[1]	CAS	Chemical Name	Organic Fraction	2010 Emissions (tpy)
665	95636	1,2,4-trimethylbenzene	0.0140	1.67E-03
665	106990	1,3-butadiene	0.0091	1.08E-03
665	540841	2,2,4-trimethylpentane	0.0222	2.63E-03
665	75070	acetaldehyde	0.0106	1.26E-03
665	107028	acrolein (2-propenal)	0.0020	2.38E-04
665	71432	benzene	0.0368	4.37E-03
665	4170303	crotonaldehyde	0.0014	1.72E-04
665	110827	cyclohexane	0.0050	5.95E-04
665	100414	ethylbenzene	0.0167	1.98E-03
665	74851	ethylene	0.0996	1.18E-02
665	50000	formaldehyde	0.0327	3.88E-03
665	78795	isoprene	0.0016	1.85E-04
665	98828	isopropylbenzene (cumene)	0.0006	6.58E-05
665	67561	methyl alcohol	0.0038	4.53E-04
665	78933	methyl ethyl ketone (mek) (2-butanone)	0.0007	7.88E-05
665	108383	m-xylene	0.0496	5.89E-03
665	91203	naphthalene	0.0014	1.72E-04
665	110543	n-hexane	0.0146	1.73E-03
665	95476	o-xylene	0.0173	2.05E-03
665	115071	propylene	0.0546	6.48E-03
665	100425	styrene	0.0014	1.72E-04
665	108883	toluene	0.0756	8.98E-03
Total				**5.60E-02**

Notes:
1. Organic fraction from ARBs SPECIATE database.
2. Data for heaters is from "External combustion boiler - natural gas" option.
   SPECIATE database does not include an option for propane fueled boilers.
3. Data for the gasoline IC engine is from "Non-cat stabilized exhaust 1996
   SSD 2.0% etoh (MTBE phaseout)" option
4. Emissions were calculated for only chemicals that were in both the SPECIATE
   database and the AB2588 list.
5. Organic fraction reported on a ROG basis using ARB's Speciate ROG/TOG ratio
   (Profile 3 ratio = 0.4222; Profile 665 ratio = 0.9198)

Toxic Air Contaminant Emissions from Steam Cleaners
Dolores and ICTF Rail Yards, Long Beach, CA

Propane Heaters

Profile[1]	CAS	Chemical Name	Organic Fraction	2012 Emissions (tpy)
3	71432	benzene	0.0947	3.64E-04
3	110827	cyclohexane	0.0237	9.11E-05
3	50000	formaldehyde	0.1895	7.28E-04
3	108883	toluene	0.0474	1.82E-04
Total				**1.37E-03**

IC Engine

Profile[1]	CAS	Chemical Name	Organic Fraction	2012 Emissions (tpy)
665	95636	1,2,4-trimethylbenzene	0.0140	1.67E-03
665	106990	1,3-butadiene	0.0091	1.08E-03
665	540841	2,2,4-trimethylpentane	0.0222	2.63E-03
665	75070	acetaldehyde	0.0106	1.26E-03
665	107028	acrolein (2-propenal)	0.0020	2.38E-04
665	71432	benzene	0.0368	4.37E-03
665	4170303	crotonaldehyde	0.0014	1.72E-04
665	110827	cyclohexane	0.0050	5.95E-04
665	100414	ethylbenzene	0.0167	1.98E-03
665	74851	ethylene	0.0996	1.18E-02
665	50000	formaldehyde	0.0327	3.88E-03
665	78795	isoprene	0.0016	1.85E-04
665	98828	isopropylbenzene (cumene)	0.0006	6.58E-05
665	67561	methyl alcohol	0.0038	4.53E-04
665	78933	methyl ethyl ketone (mek) (2-butanone)	0.0007	7.88E-05
665	108383	m-xylene	0.0496	5.89E-03
665	91203	naphthalene	0.0014	1.72E-04
665	110543	n-hexane	0.0146	1.73E-03
665	95476	o-xylene	0.0173	2.05E-03
665	115071	propylene	0.0546	6.48E-03
665	100425	styrene	0.0014	1.72E-04
665	108883	toluene	0.0756	8.98E-03
Total				**5.60E-02**

Notes:
1. Organic fraction from ARBs SPECIATE database.
2. Data for heaters is from "External combustion boiler - natural gas" option. SPECIATE database does not include an option for propane fueled boilers.
3. Data for the gasoline IC engine is from "Non-cat stabilized exhaust 1996 SSD 2.0% etoh (MTBE phaseout)" option
4. Emissions were calculated for only chemicals that were in both the SPECIATE database and the AB2588 list.
5. Organic fraction reported on a ROG basis using ARB's Speciate ROG/TOG ratio (Profile 3 ratio = 0.4222; Profile 665 ratio = 0.9198)

Toxic Air Contaminant Emissions from Steam Cleaners
Dolores and ICTF Rail Yards, Long Beach, CA

Propane Heaters

Profile[1]	CAS	Chemical Name	Organic Fraction	2014 Emissions (tpy)
3	71432	benzene	0.0947	3.64E-04
3	110827	cyclohexane	0.0237	9.11E-05
3	50000	formaldehyde	0.1895	7.28E-04
3	108883	toluene	0.0474	1.82E-04
Total				**1.37E-03**

IC Engine

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665	110827	cyclohexane	0.0050	5.95E-04
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665	74851	ethylene	0.0996	1.18E-02
665	50000	formaldehyde	0.0327	3.88E-03
665	78795	isoprene	0.0016	1.85E-04
665	98828	isopropylbenzene (cumene)	0.0006	6.58E-05
665	67561	methyl alcohol	0.0038	4.53E-04
665	78933	methyl ethyl ketone (mek) (2-butanone)	0.0007	7.88E-05
665	108383	m-xylene	0.0496	5.89E-03
665	91203	naphthalene	0.0014	1.72E-04
665	110543	n-hexane	0.0146	1.73E-03
665	95476	o-xylene	0.0173	2.05E-03
665	115071	propylene	0.0546	6.48E-03
665	100425	styrene	0.0014	1.72E-04
665	108883	toluene	0.0756	8.98E-03
Total				**5.60E-02**

Notes:
1. Organic fraction from ARBs SPECIATE database.
2. Data for heaters is from "External combustion boiler - natural gas" option. SPECIATE database does not include an option for propane fueled boilers.
3. Data for the gasoline IC engine is from "Non-cat stabilized exhaust 1996 SSD 2.0% etoh (MTBE phaseout)" option
4. Emissions were calculated for only chemicals that were in both the SPECIATE database and the AB2588 list.
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665	98828	isopropylbenzene (cumene)	0.0006	6.58E-05
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Total				**5.60E-02**

Notes:
1. Organic fraction from ARBs SPECIATE database.
2. Data for heaters is from "External combustion boiler - natural gas" option. SPECIATE database does not include an option for propane fueled boilers.
3. Data for the gasoline IC engine is from "Non-cat stabilized exhaust 1996 SSD 2.0% etoh (MTBE phaseout)" option
4. Emissions were calculated for only chemicals that were in both the SPECIATE database and the AB2588 list.
5. Organic fraction reported on a ROG basis using ARB's Speciate ROG/TOG ratio (Profile 3 ratio = 0.4222; Profile 665 ratio = 0.9198)

APPENDIX O

NATURAL GAS-FIRED HEATER

APPENDIX O-1

AP-42 SECTION 1.4

1.4 Natural Gas Combustion

1.4.1 General[1-2]

Natural gas is one of the major combustion fuels used throughout the country. It is mainly used to generate industrial and utility electric power, produce industrial process steam and heat, and heat residential and commercial space. Natural gas consists of a high percentage of methane (generally above 85 percent) and varying amounts of ethane, propane, butane, and inerts (typically nitrogen, carbon dioxide, and helium). The average gross heating value of natural gas is approximately 1,020 British thermal units per standard cubic foot (Btu/scf), usually varying from 950 to 1,050 Btu/scf.

1.4.2 Firing Practices[3-5]

There are three major types of boilers used for natural gas combustion in commercial, industrial, and utility applications: watertube, firetube, and cast iron. Watertube boilers are designed to pass water through the inside of heat transfer tubes while the outside of the tubes is heated by direct contact with the hot combustion gases and through radiant heat transfer. The watertube design is the most common in utility and large industrial boilers. Watertube boilers are used for a variety of applications, ranging from providing large amounts of process steam, to providing hot water or steam for space heating, to generating high-temperature, high-pressure steam for producing electricity. Furthermore, watertube boilers can be distinguished either as field erected units or packaged units.

Field erected boilers are boilers that are constructed on site and comprise the larger sized watertube boilers. Generally, boilers with heat input levels greater than 100 MMBtu/hr, are field erected. Field erected units usually have multiple burners and, given the customized nature of their construction, also have greater operational flexibility and NO_x control options. Field erected units can also be further categorized as wall-fired or tangential-fired. Wall-fired units are characterized by multiple individual burners located on a single wall or on opposing walls of the furnace while tangential units have several rows of air and fuel nozzles located in each of the four corners of the boiler.

Package units are constructed off-site and shipped to the location where they are needed. While the heat input levels of packaged units may range up to 250 MMBtu/hr, the physical size of these units are constrained by shipping considerations and generally have heat input levels less than 100 MMBtu/hr. Packaged units are always wall-fired units with one or more individual burners. Given the size limitations imposed on packaged boilers, they have limited operational flexibility and cannot feasibly incorporate some NO_x control options.

Firetube boilers are designed such that the hot combustion gases flow through tubes, which heat the water circulating outside of the tubes. These boilers are used primarily for space heating systems, industrial process steam, and portable power boilers. Firetube boilers are almost exclusively packaged units. The two major types of firetube units are Scotch Marine boilers and the older firebox boilers. In cast iron boilers, as in firetube boilers, the hot gases are contained inside the tubes and the water being heated circulates outside the tubes. However, the units are constructed of cast iron rather than steel. Virtually all cast iron boilers are constructed as package boilers. These boilers are used to produce either low-pressure steam or hot water, and are most commonly used in small commercial applications.

Natural gas is also combusted in residential boilers and furnaces. Residential boilers and furnaces generally resemble firetube boilers with flue gas traveling through several channels or tubes with water or air circulated outside the channels or tubes.

1.4.3 Emissions[3-4]

The emissions from natural gas-fired boilers and furnaces include nitrogen oxides (NO_x), carbon monoxide (CO), and carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), volatile organic compounds (VOCs), trace amounts of sulfur dioxide (SO_2), and particulate matter (PM).

Nitrogen Oxides -

Nitrogen oxides formation occurs by three fundamentally different mechanisms. The principal mechanism of NO_x formation in natural gas combustion is thermal NO_x. The thermal NO_x mechanism occurs through the thermal dissociation and subsequent reaction of nitrogen (N_2) and oxygen (O_2) molecules in the combustion air. Most NO_x formed through the thermal NO_x mechanism occurs in the high temperature flame zone near the burners. The formation of thermal NO_x is affected by three furnace-zone factors: (1) oxygen concentration, (2) peak temperature, and (3) time of exposure at peak temperature. As these three factors increase, NO_x emission levels increase. The emission trends due to changes in these factors are fairly consistent for all types of natural gas-fired boilers and furnaces. Emission levels vary considerably with the type and size of combustor and with operating conditions (e.g., combustion air temperature, volumetric heat release rate, load, and excess oxygen level).

The second mechanism of NO_x formation, called prompt NO_x, occurs through early reactions of nitrogen molecules in the combustion air and hydrocarbon radicals from the fuel. Prompt NO_x reactions occur within the flame and are usually negligible when compared to the amount of NO_x formed through the thermal NO_x mechanism. However, prompt NO_x levels may become significant with ultra-low-NO_x burners.

The third mechanism of NO_x formation, called fuel NO_x, stems from the evolution and reaction of fuel-bound nitrogen compounds with oxygen. Due to the characteristically low fuel nitrogen content of natural gas, NO_x formation through the fuel NO_x mechanism is insignificant.

Carbon Monoxide -

The rate of CO emissions from boilers depends on the efficiency of natural gas combustion. Improperly tuned boilers and boilers operating at off-design levels decrease combustion efficiency resulting in increased CO emissions. In some cases, the addition of NO_x control systems such as low NO_x burners and flue gas recirculation (FGR) may also reduce combustion efficiency, resulting in higher CO emissions relative to uncontrolled boilers.

Volatile Organic Compounds -

The rate of VOC emissions from boilers and furnaces also depends on combustion efficiency. VOC emissions are minimized by combustion practices that promote high combustion temperatures, long residence times at those temperatures, and turbulent mixing of fuel and combustion air. Trace amounts of VOC species in the natural gas fuel (e.g., formaldehyde and benzene) may also contribute to VOC emissions if they are not completely combusted in the boiler.

Sulfur Oxides -

Emissions of SO_2 from natural gas-fired boilers are low because pipeline quality natural gas typically has sulfur levels of 2,000 grains per million cubic feet. However, sulfur-containing odorants are added to natural gas for detecting leaks, leading to small amounts of SO_2 emissions. Boilers combusting unprocessed natural gas may have higher SO_2 emissions due to higher levels of sulfur in the natural gas. For these units, a sulfur mass balance should be used to determine SO_2 emissions.

Particulate Matter -

Because natural gas is a gaseous fuel, filterable PM emissions are typically low. Particulate matter from natural gas combustion has been estimated to be less than 1 micrometer in size and has filterable and condensable fractions. Particulate matter in natural gas combustion are usually larger molecular weight hydrocarbons that are not fully combusted. Increased PM emissions may result from poor air/fuel mixing or maintenance problems.

Greenhouse Gases -[6-9]

CO_2, CH_4, and N_2O emissions are all produced during natural gas combustion. In properly tuned boilers, nearly all of the fuel carbon (99.9 percent) in natural gas is converted to CO_2 during the combustion process. This conversion is relatively independent of boiler or combustor type. Fuel carbon not converted to CO_2 results in CH_4, CO, and/or VOC emissions and is due to incomplete combustion. Even in boilers operating with poor combustion efficiency, the amount of CH_4, CO, and VOC produced is insignificant compared to CO_2 levels.

Formation of N_2O during the combustion process is affected by two furnace-zone factors. N_2O emissions are minimized when combustion temperatures are kept high (above 1475°F) and excess oxygen is kept to a minimum (less than 1 percent).

Methane emissions are highest during low-temperature combustion or incomplete combustion, such as the start-up or shut-down cycle for boilers. Typically, conditions that favor formation of N_2O also favor emissions of methane.

1.4.4 Controls[4,10]

NO_x Controls -

Currently, the two most prevalent combustion control techniques used to reduce NO_x emissions from natural gas-fired boilers are flue gas recirculation (FGR) and low NO_x burners. In an FGR system, a portion of the flue gas is recycled from the stack to the burner windbox. Upon entering the windbox, the recirculated gas is mixed with combustion air prior to being fed to the burner. The recycled flue gas consists of combustion products which act as inerts during combustion of the fuel/air mixture. The FGR system reduces NO_x emissions by two mechanisms. Primarily, the recirculated gas acts as a dilutent to reduce combustion temperatures, thus suppressing the thermal NO_x mechanism. To a lesser extent, FGR also reduces NO_x formation by lowering the oxygen concentration in the primary flame zone. The amount of recirculated flue gas is a key operating parameter influencing NO_x emission rates for these systems. An FGR system is normally used in combination with specially designed low NO_x burners capable of sustaining a stable flame with the increased inert gas flow resulting from the use of FGR. When low NO_x burners and FGR are used in combination, these techniques are capable of reducing NO_x emissions by 60 to 90 percent.

Low NO_x burners reduce NO_x by accomplishing the combustion process in stages. Staging partially delays the combustion process, resulting in a cooler flame which suppresses thermal NO_x formation. The two most common types of low NO_x burners being applied to natural gas-fired boilers are staged air burners and staged fuel burners. NO_x emission reductions of 40 to 85 percent (relative to uncontrolled emission levels) have been observed with low NO_x burners.

Other combustion control techniques used to reduce NO_x emissions include staged combustion and gas reburning. In staged combustion (e.g., burners-out-of-service and overfire air), the degree of staging is a key operating parameter influencing NO_x emission rates. Gas reburning is similar to the use of overfire in the use of combustion staging. However, gas reburning injects additional amounts of natural gas in the upper furnace, just before the overfire air ports, to provide increased reduction of NO_x to NO_2.

Two postcombustion technologies that may be applied to natural gas-fired boilers to reduce NO_x emissions are selective noncatalytic reduction (SNCR) and selective catalytic reduction (SCR). The SNCR system injects ammonia (NH_3) or urea into combustion flue gases (in a specific temperature zone) to reduce NO_x emission. The Alternative Control Techniques (ACT) document for NO_x emissions from utility boilers, maximum SNCR performance was estimated to range from 25 to 40 percent for natural gas-fired boilers.[12] Performance data available from several natural gas fired utility boilers with SNCR show a 24 percent reduction in NO_x for applications on wall-fired boilers and a 13 percent reduction in NO_x for applications on tangential-fired boilers.[11] In many situations, a boiler may have an SNCR system installed to trim NO_x emissions to meet permitted levels. In these cases, the SNCR system may not be operated to achieve maximum NO_x reduction. The SCR system involves injecting NH_3 into the flue gas in the presence of a catalyst to reduce NO_x emissions. No data were available on SCR performance on natural gas fired boilers at the time of this publication. However, the ACT Document for utility boilers estimates NO_x reduction efficiencies for SCR control ranging from 80 to 90 percent.[12]

Emission factors for natural gas combustion in boilers and furnaces are presented in Tables 1.4-1, 1.4-2, 1.4-3, and 1.4-4.[11] Tables in this section present emission factors on a volume basis (lb/10^6 scf). To convert to an energy basis (lb/MMBtu), divide by a heating value of 1,020 MMBtu/10^6 scf. For the purposes of developing emission factors, natural gas combustors have been organized into three general categories: large wall-fired boilers with greater than 100 MMBtu/hr of heat input, boilers and residential furnaces with less than 100 MMBtu/hr of heat input, and tangential-fired boilers. Boilers within these categories share the same general design and operating characteristics and hence have similar emission characteristics when combusting natural gas.

Emission factors are rated from A to E to provide the user with an indication of how “good” the factor is, with “A” being excellent and “E” being poor. The criteria that are used to determine a rating for an emission factor can be found in the Emission Factor Documentation for AP-42 Section 1.4 and in the introduction to the AP-42 document.

1.4.5 Updates Since the Fifth Edition

The Fifth Edition was released in January 1995. Revisions to this section are summarized below. For further detail, consult the Emission Factor Documentation for this section. These and other documents can be found on the Emission Factor and Inventory Group (EFIG) home page (http://www.epa.gov/ttn/chief).

Supplement D, March 1998

- Text was revised concerning Firing Practices, Emissions, and Controls.
- All emission factors were updated based on 482 data points taken from 151 source tests. Many new emission factors have been added for speciated organic compounds, including hazardous air pollutants.

July 1998 - minor changes

- Footnote D was added to table 1.4-3 to explain why the sum of individual HAP may exceed VOC or TOC, the web address was updated, and the references were reordered.

Table 1.4-1. EMISSION FACTORS FOR NITROGEN OXIDES (NO_x) AND CARBON MONOXIDE (CO) FROM NATURAL GAS COMBUSTION[a]

Combustor Type (MMBtu/hr Heat Input) [SCC]	NO_x[b]		CO	
	Emission Factor ($lb/10^6$ scf)	Emission Factor Rating	Emission Factor ($lb/10^6$ scf)	Emission Factor Rating
Large Wall-Fired Boilers (>100) [1-01-006-01, 1-02-006-01, 1-03-006-01]				
Uncontrolled (Pre-NSPS)[c]	280	A	84	B
Uncontrolled (Post-NSPS)[c]	190	A	84	B
Controlled - Low NO_x burners	140	A	84	B
Controlled - Flue gas recirculation	100	D	84	B
Small Boilers (<100) [1-01-006-02, 1-02-006-02, 1-03-006-02, 1-03-006-03]				
Uncontrolled	100	B	84	B
Controlled - Low NO_x burners	50	D	84	B
Controlled - Low NO_x burners/Flue gas recirculation	32	C	84	B
Tangential-Fired Boilers (All Sizes) [1-01-006-04]				
Uncontrolled	170	A	24	C
Controlled - Flue gas recirculation	76	D	98	D
Residential Furnaces (<0.3) [No SCC]				
Uncontrolled	94	B	40	B

[a] Reference 11. Units are in pounds of pollutant per million standard cubic feet of natural gas fired. To convert from $lb/10^6$ scf to $kg/10^6$ m^3, multiply by 16. Emission factors are based on an average natural gas higher heating value of 1,020 Btu/scf. To convert from $1b/10^6$ scf to lb/MMBtu, divide by 1,020. The emission factors in this table may be converted to other natural gas heating values by multiplying the given emission factor by the ratio of the specified heating value to this average heating value. SCC = Source Classification Code. ND = no data. NA = not applicable.

[b] Expressed as NO_2. For large and small wall fired boilers with SNCR control, apply a 24 percent reduction to the appropriate NO_X emission factor. For tangential-fired boilers with SNCR control, apply a 13 percent reduction to the appropriate NO_X emission factor.

[c] NSPS=New Source Performance Standard as defined in 40 CFR 60 Subparts D and Db. Post-NSPS units are boilers with greater than 250 MMBtu/hr of heat input that commenced construction modification, or reconstruction after August 17, 1971, and units with heat input capacities between 100 and 250 MMBtu/hr that commenced construction modification, or reconstruction after June 19, 1984.

TABLE 1.4-2. EMISSION FACTORS FOR CRITERIA POLLUTANTS AND GREENHOUSE GASES FROM NATURAL GAS COMBUSTION[a]

Pollutant	Emission Factor ($lb/10^6$ scf)	Emission Factor Rating
CO_2[b]	120,000	A
Lead	0.0005	D
N_2O (Uncontrolled)	2.2	E
N_2O (Controlled-low-NO_X burner)	0.64	E
PM (Total)[c]	7.6	D
PM (Condensable)[c]	5.7	D
PM (Filterable)[c]	1.9	B
SO_2[d]	0.6	A
TOC	11	B
Methane	2.3	B
VOC	5.5	C

[a] Reference 11. Units are in pounds of pollutant per million standard cubic feet of natural gas fired. Data are for all natural gas combustion sources. To convert from $lb/10^6$ scf to $kg/10^6$ m^3, multiply by 16. To convert from $lb/10^6$ scf to 1b/MMBtu, divide by 1,020. The emission factors in this table may be converted to other natural gas heating values by multiplying the given emission factor by the ratio of the specified heating value to this average heating value. TOC = Total Organic Compounds. VOC = Volatile Organic Compounds.

[b] Based on approximately 100% conversion of fuel carbon to CO_2. CO_2[$lb/10^6$ scf] = (3.67) (CON) (C)(D), where CON = fractional conversion of fuel carbon to CO_2, C = carbon content of fuel by weight (0.76), and D = density of fuel, $4.2x10^4$ $lb/10^6$ scf.

[c] All PM (total, condensible, and filterable) is assumed to be less than 1.0 micrometer in diameter. Therefore, the PM emission factors presented here may be used to estimate PM_{10}, $PM_{2.5}$ or PM_1 emissions. Total PM is the sum of the filterable PM and condensible PM. Condensible PM is the particulate matter collected using EPA Method 202 (or equivalent). Filterable PM is the particulate matter collected on, or prior to, the filter of an EPA Method 5 (or equivalent) sampling train.

[d] Based on 100% conversion of fuel sulfur to SO_2.
Assumes sulfur content is natural gas of 2,000 $grains/10^6$ scf. The SO_2 emission factor in this table can be converted to other natural gas sulfur contents by multiplying the SO_2 emission factor by the ratio of the site-specific sulfur content ($grains/10^6$ scf) to 2,000 $grains/10^6$ scf.

TABLE 1.4-3. EMISSION FACTORS FOR SPECIATED ORGANIC COMPOUNDS FROM NATURAL GAS COMBUSTION[a]

CAS No.	Pollutant	Emission Factor (lb/10^6 scf)	Emission Factor Rating
91-57-6	2-Methylnaphthalene[b, c]	2.4E-05	D
56-49-5	3-Methylchloranthrene[b, c]	<1.8E-06	E
	7,12-Dimethylbenz(a)anthracene[b,c]	<1.6E-05	E
83-32-9	Acenaphthene[b,c]	<1.8E-06	E
203-96-8	Acenaphthylene[b,c]	<1.8E-06	E
120-12-7	Anthracene[b,c]	<2.4E-06	E
56-55-3	Benz(a)anthracene[b,c]	<1.8E-06	E
71-43-2	Benzene[b]	2.1E-03	B
50-32-8	Benzo(a)pyrene[b,c]	<1.2E-06	E
205-99-2	Benzo(b)fluoranthene[b,c]	<1.8E-06	E
191-24-2	Benzo(g,h,i)perylene[b,c]	<1.2E-06	E
205-82-3	Benzo(k)fluoranthene[b,c]	<1.8E-06	E
106-97-8	Butane	2.1E+00	E
218-01-9	Chrysene[b,c]	<1.8E-06	E
53-70-3	Dibenzo(a,h)anthracene[b,c]	<1.2E-06	E
25321-22-6	Dichlorobenzene[b]	1.2E-03	E
74-84-0	Ethane	3.1E+00	E
206-44-0	Fluoranthene[b,c]	3.0E-06	E
86-73-7	Fluorene[b,c]	2.8E-06	E
50-00-0	Formaldehyde[b]	7.5E-02	B
110-54-3	Hexane[b]	1.8E+00	E
193-39-5	Indeno(1,2,3-cd)pyrene[b,c]	<1.8E-06	E
91-20-3	Naphthalene[b]	6.1E-04	E
109-66-0	Pentane	2.6E+00	E
85-01-8	Phenanathrene[b,c]	1.7E-05	D

TABLE 1.4-3. EMISSION FACTORS FOR SPECIATED ORGANIC COMPOUNDS FROM NATURAL GAS COMBUSTION (Continued)

CAS No.	Pollutant	Emission Factor ($lb/10^6$ scf)	Emission Factor Rating
74-98-6	Propane	1.6E+00	E
129-00-0	Pyrene[b, c]	5.0E-06	E
108-88-3	Toluene[b]	3.4E-03	C

[a] Reference 11. Units are in pounds of pollutant per million standard cubic feet of natural gas fired. Data are for all natural gas combustion sources. To convert from $lb/10^6$ scf to $kg/10^6$ m^3, multiply by 16. To convert from $1b/10^6$ scf to lb/MMBtu, divide by 1,020. Emission Factors preceeded with a less-than symbol are based on method detection limits.

[b] Hazardous Air Pollutant (HAP) as defined by Section 112(b) of the Clean Air Act.

[c] HAP because it is Polycyclic Organic Matter (POM). POM is a HAP as defined by Section 112(b) of the Clean Air Act.

[d] The sum of individual organic compounds may exceed the VOC and TOC emission factors due to differences in test methods and the availability of test data for each pollutant.

TABLE 1.4-4. EMISSION FACTORS FOR METALS FROM NATURAL GAS COMBUSTION[a]

CAS No.	Pollutant	Emission Factor ($lb/10^6$ scf)	Emission Factor Rating
7440-38-2	Arsenic[b]	2.0E-04	E
7440-39-3	Barium	4.4E-03	D
7440-41-7	Beryllium[b]	<1.2E-05	E
7440-43-9	Cadmium[b]	1.1E-03	D
7440-47-3	Chromium[b]	1.4E-03	D
7440-48-4	Cobalt[b]	8.4E-05	D
7440-50-8	Copper	8.5E-04	C
7439-96-5	Manganese[b]	3.8E-04	D
7439-97-6	Mercury[b]	2.6E-04	D
7439-98-7	Molybdenum	1.1E-03	D
7440-02-0	Nickel[b]	2.1E-03	C
7782-49-2	Selenium[b]	<2.4E-05	E
7440-62-2	Vanadium	2.3E-03	D
7440-66-6	Zinc	2.9E-02	E

[a] Reference 11. Units are in pounds of pollutant per million standard cubic feet of natural gas fired. Data are for all natural gas combustion sources. Emission factors preceeded by a less-than symbol are based on method detection limits. To convert from $lb/10^6$ scf to $kg/10^6$ m^3, multiply by l6. To convert from $lb/10^6$ scf to 1b/MMBtu, divide by 1,020.

[b] Hazardous Air Pollutant as defined by Section 112(b) of the Clean Air Act.

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APPENDIX O-2

DEATILED EMISSION CALCULATIONS FOR THE
2005 BASELINE YEAR AND PROJECT YEARS 2010-2016

Summary of Emissions from Natual Gas-Fired Heaters
Dolores and ICTF Rail Yards, Long Beach, CA

					Hours of			Carbon	2005 Emission Factors									2005 Emission Estimates								
				Rating	Operation	Fuel Use		Oxidation	(lb/mmcf)[4]						(kg/MMBtu)[3]			(tons/yr)						(metric tons/yr)		
Yard	Location	Equipment Type	Fuel Type	(MMBtu/hr)	(hr/yr)[1]	(MMBtu/yr)	(mmcf/yr)[2]	Factor[3]	VOC	CO	NOx	PM10	DPM	SOx	CO2	N2O	CH4	ROG	CO	NOx	PM10	DPM	SOx	CO2	N2O	CH4
ICTF	Administrative Building	Heater	Nat. Gas	0.76	2190	1664.40	1.66	99.5%	5.50	84.00	100.00	7.60	NA	0.60	53.05	5.90E-03	1.00E-04	0.00	0.07	0.08	0.01	NA	0.00	87.85	9.82E-03	1.66E-04

Notes:
1. Assumes operations equivalent to 3 months per year.
2. Annual fuel use based on a natural gas HHV of 1,000 Btu/scf.
3. From the Air Resources Board's Draft *Emission Factors for Mandatory Reporting Programs,* August 10, 2007.
4. Emission factors, in lb/mmcf, from AP-42, Table 1.4-1, 7/98.

Summary of Emissions from Natural Gas-Fired Heaters
Dolores and ICTF Rail Yards, Long Beach, CA

					Hours of			Carbon	2010 Emission Factors									2010 Emission Estimates								
				Rating	Operation	Fuel Use		Oxidation	(lb/mmcf)[4]						(kg/MMBtu)[3]			(tons/yr)						(metric tons/yr)		
Yard	Location	Equipment Type	Fuel Type	(MMBtu/hr)	(hr/yr)[1]	(MMBtu/yr)	(mmcf/yr)[2]	Factor[3]	VOC	CO	NOx	PM10	DPM	SOx	CO2	N2O	CH4	ROG	CO	NOx	PM10	DPM	SOx	CO2	N2O	CH4
ICTF	Administrative Building	Heater	Nat. Gas	0.76	2190	1664.40	1.66	99.5%	5.50	84.00	100.00	7.60	NA	0.60	53.05	5.90E-03	1.00E-04	0.00	0.07	0.08	0.01	NA	0.00	87.85	9.82E-03	1.66E-04

Notes:
1. Assumes operations equivalent to 3 months per year.
2. Annual fuel use based on a natural gas HHV of 1,000 Btu/scf.
3. From the Air Resources Board's Draft *Emission Factors for Mandatory Reporting Programs*, August 10, 2007.
4. Emission factors, in lb/mmcf, from AP-42, Table 1.4-1, 7/98.
5. Assumed no change in operation from the baseline year.

Summary of Emissions from Natural Gas-Fired Heaters
Dolores and ICTF Rail Yards, Long Beach, CA

					Hours of			Carbon	2012 Emission Factors									2012 Emission Estimates								
				Rating	Operation	Fuel Use		Oxidation	(lb/mmcf)[4]						(kg/MMBtu)[3]			(tons/yr)						(metric tons/yr)		
Yard	Location	Equipment Type	Fuel Type	(MMBtu/hr)	(hr/yr)[1]	(MMBtu/yr)	(mmcf/yr)[2]	Factor[3]	VOC	CO	NOx	PM10	DPM	SOx	CO2	N2O	CH4	ROG	CO	NOx	PM10	DPM	SOx	CO2	N2O	CH4
ICTF	Administrative Building	Heater	Nat. Gas	0.76	2190	1664.40	1.66	99.5%	5.50	84.00	100.00	7.60	NA	0.60	53.05	5.90E-03	1.00E-04	0.00	0.07	0.08	0.01	NA	0.00	87.85	9.82E-03	1.66E-04

Notes:
1. Assumes operations equivalent to 3 months per year.
2. Annual fuel use based on a natural gas HHV of 1,000 Btu/scf.
3. From the Air Resources Board's Draft *Emission Factors for Mandatory Reporting Programs*, August 10, 2007.
4. Emission factors, in lb/mmcf, from AP-42, Table 1.4-1, 7/98.
5. Assumed no change in operation from the baseline year.

Summary of Emissions from Natural Gas-Fired Heaters
Dolores and ICTF Rail Yards, Long Beach, CA

					Hours of			Carbon	2014 Emission Factors									2014 Emission Estimates								
				Rating	Operation	Fuel Use		Oxidation	(lb/mmcf)[4]						(kg/MMBtu)[3]			(tons/yr)						(metric tons/yr)		
Yard	Location	Equipment Type	Fuel Type	(MMBtu/hr)	(hr/yr)[1]	(MMBtu/yr)	(mmcf/yr)[2]	Factor[3]	VOC	CO	NOx	PM10	DPM	SOx	CO2	N2O	CH4	ROG	CO	NOx	PM10	DPM	SOx	CO2	N2O	CH4
ICTF	Administrative Building	Heater	Nat. Gas	0.76	2190	1664.40	1.66	99.5%	5.50	84.00	100.00	7.60	NA	0.60	53.05	5.90E-03	1.00E-04	0.00	0.07	0.08	0.01	NA	0.00	87.85	9.82E-03	1.66E-04

Notes:
1. Assumes operations equivalent to 3 months per year.
2. Annual fuel use based on a natural gas HHV of 1,000 Btu/scf.
3. From the Air Resources Board's Draft *Emission Factors for Mandatory Reporting Programs*, August 10, 2007.
4. Emission factors, in lb/mmcf, from AP-42, Table 1.4-1, 7/98.
5. Assumed no change in operation from the baseline year.

Summary of Emissions from Natural Gas-Fired Heaters
Dolores and ICTF Rail Yards, Long Beach, CA

					Hours of			Carbon	2016 Emission Factors									2016 Emission Estimates								
				Rating	Operation	Fuel Use		Oxidation	(lb/mmcf)[4]						(kg/MMBtu)[3]			(tons/yr)						(metric tons/yr)		
Yard	Location	Equipment Type	Fuel Type	(MMBtu/hr)	(hr/yr)[1]	(MMBtu/yr)	(mmcf/yr)[2]	Factor[3]	VOC	CO	NOx	PM10	DPM	SOx	CO2	N2O	CH4	ROG	CO	NOx	PM10	DPM	SOx	CO2	N2O	CH4
ICTF	Administrative Building	Heater	Nat. Gas	0.76	2190	1664.40	1.66	99.5%	5.50	84.00	100.00	7.60	NA	0.60	53.05	5.90E-03	1.00E-04	0.00	0.07	0.08	0.01	NA	0.00	87.85	9.82E-03	1.66E-04

Notes:
1. Assumes operations equivalent to 3 months per year.
2. Annual fuel use based on a natural gas HHV of 1,000 Btu/scf.
3. From the Air Resources Board's Draft *Emission Factors for Mandatory Reporting Programs*, August 10, 2007.
4. Emission factors, in lb/mmcf, from AP-42, Table 1.4-1, 7/98.
5. Assumed no change in operation from the baseline year.

APPENDIX O-3

SPECIATION PROFILE FOR HEATERS

Toxic Air Contaminant Emissions from the Natural Gas-Fired Heater
Dolores and ICTF Rail Yards, Long Beach, CA

Profile[1]	CAS	Chemical Name	Organic Fraction	2005 Emissions (tpy)
3	71432	benzene	0.0947	4.34E-04
3	110827	cyclohexane	0.0237	1.08E-04
3	50000	formaldehyde	0.1895	8.67E-04
3	108883	toluene	0.0474	2.17E-04
Total				**1.63E-03**

Notes:

1. Organic fraction from ARBs SPECIATE database. Data is from "External combustion boiler - natural gas" option.
2. Emissions were calculated for only chemicals that were in both the SPECIATE database and the AB2588 list.
3. Organic fraction reported on a ROG basis using ARB's Speciate ROG/TOG ratio (0.4222).

Toxic Air Contaminant Emissions from the Natural Gas-Fired Heater
Dolores and ICTF Rail Yards, Long Beach, CA

Profile[1]	CAS	Chemical Name	Organic Fraction	2010 Emissions (tpy)
3	71432	benzene	0.0947	4.34E-04
3	110827	cyclohexane	0.0237	1.08E-04
3	50000	formaldehyde	0.1895	8.67E-04
3	108883	toluene	0.0474	2.17E-04
Total				**1.63E-03**

Notes:
1. Organic fraction from ARBs SPECIATE database. Data is from "External combustion boiler - natural gas" option.
2. Emissions were calculated for only chemicals that were in both the SPECIATE database and the AB2588 list.
3. Organic fraction reported on a ROG basis using ARB's Speciate ROG/TOG ratio (0.4222).

Toxic Air Contaminant Emissions from the Natural Gas-Fired Heater
Dolores and ICTF Rail Yards, Long Beach, CA

Profile[1]	CAS	Chemical Name	Organic Fraction	2012 Emissions (tpy)
3	71432	benzene	0.095	4.34E-04
3	110827	cyclohexane	0.024	1.08E-04
3	50000	formaldehyde	0.189	8.67E-04
3	108883	toluene	0.047	2.17E-04
Total				**1.63E-03**

Notes:
1. Organic fraction from ARBs SPECIATE database. Data is from "External combustion boiler - natural gas" option.
2. Emissions were calculated for only chemicals that were in both the SPECIATE database and the AB2588 list.
3. Organic fraction reported on a ROG basis using ARB's Speciate ROG/TOG ratio (0.4222).

Toxic Air Contaminant Emissions from the Natural Gas-Fired Heater
Dolores and ICTF Rail Yards, Long Beach, CA

Profile[1]	CAS	Chemical Name	Organic Fraction	2014 Emissions (tpy)
3	71432	benzene	0.0947	4.34E-04
3	110827	cyclohexane	0.0237	1.08E-04
3	50000	formaldehyde	0.1895	8.67E-04
3	108883	toluene	0.0474	2.17E-04
Total				**1.63E-03**

Notes:
1. Organic fraction from ARBs SPECIATE database. Data is from "External combustion boiler - natural gas" option.
2. Emissions were calculated for only chemicals that were in both the SPECIATE database and the AB2588 list.
3. Organic fraction reported on a ROG basis using ARB's Speciate ROG/TOG ratio (0.4222).

Toxic Air Contaminant Emissions from the Natural Gas-Fired Heater
Dolores and ICTF Rail Yards, Long Beach, CA

Profile[1]	CAS	Chemical Name	Organic Fraction	2016 Emissions (tpy)
3	71432	benzene	0.0947	4.34E-04
3	110827	cyclohexane	0.0237	1.08E-04
3	50000	formaldehyde	0.1895	8.67E-04
3	108883	toluene	0.0474	2.17E-04
Total				**1.63E-03**

Notes:
1. Organic fraction from ARBs SPECIATE database. Data is from "External combustion boiler - natural gas" option.
2. Emissions were calculated for only chemicals that were in both the SPECIATE database and the AB2588 list.
3. Organic fraction reported on a ROG basis using ARB's Speciate ROG/TOG ratio (0.4222).

APPENDIX P

PROPANE-FUELED WELDER

APPENDIX P-1

AP-42 SECTION 3.2

3.2 Natural Gas-fired Reciprocating Engines

3.2.1 General[1-3]

Most natural gas-fired reciprocating engines are used in the natural gas industry at pipeline compressor and storage stations and at gas processing plants. These engines are used to provide mechanical shaft power for compressors and pumps. At pipeline compressor stations, engines are used to help move natural gas from station to station. At storage facilities, they are used to help inject the natural gas into high pressure natural gas storage fields. At processing plants, these engines are used to transmit fuel within a facility and for process compression needs (e.g., refrigeration cycles). The size of these engines ranges from 50 brake horsepower (bhp) to 11,000 bhp. In addition, some engines in service are 50 - 60 years old and consequently have significant differences in design compared to newer engines, resulting in differences in emissions and the ability to be retrofitted with new parts or controls.

At pipeline compressor stations, reciprocating engines are used to power reciprocating compressors that move compressed natural gas (500 - 2000 psig) in a pipeline. These stations are spaced approximately 50 to 100 miles apart along a pipeline that stretches from a gas supply area to the market area. The reciprocating compressors raise the discharge pressure of the gas in the pipeline to overcome the effect of frictional losses in the pipeline upstream of the station, in order to maintain the required suction pressure at the next station downstream or at various downstream delivery points. The volume of gas flowing and the amount of subsequent frictional losses in a pipeline are heavily dependent on the market conditions that vary with weather and industrial activity, causing wide pressure variations. The number of engines operating at a station, the speed of an individual engine, and the amount of individual engine horsepower (load) needed to compress the natural gas is dependent on the pressure of the compressed gas received by the station, the desired discharge pressure of the gas, and the amount of gas flowing in the pipeline. Reciprocating compressors have a wider operating bandwidth than centrifugal compressors, providing increased flexibility in varying flow conditions. Centrifugal compressors powered by natural gas turbines are also used in some stations and are discussed in another section of this document.

A compressor in storage service pumps gas from a low-pressure storage field (500 - 800 psig) to a higher pressure transmission pipeline (700 - 1000 psig) and/or pumps gas from a low-pressure transmission line (500 - 800 psig) to a higher pressure storage field (800 - 2000 psig).

Storage reciprocating compressors must be flexible enough to allow operation across a wide band of suction and discharge pressures and volume variations. The compressor must be able to compress at high compression ratios with low volumes and compress at low compression ratios with high volumes. These conditions require varying speeds and load (horsepower) conditions for the reciprocating engine powering the reciprocating compressor.

Reciprocating compressors are used at processing plants for process compression needs (e.g. refrigeration cycles). The volume of gas compressed varies, but the pressure needed for the process is more constant than the other two cases mentioned above.

3.2.2 Process Description[1-3]

Natural gas-fired reciprocating engines are separated into three design classes: 2-cycle (stroke) lean-burn, 4-stroke lean-burn, and 4-stroke rich-burn. Two-stroke engines complete the power cycle in a single crankshaft revolution as compared to the two crankshaft revolutions required for 4-stroke engines. All engines in these categories are spark-ignited.

In a 2-stroke engine, the air-to-fuel charge is injected with the piston near the bottom of the power stroke. The intake ports are then covered or closed, and the piston moves to the top of the cylinder, compressing the charge. Following ignition and combustion, the power stroke starts with the downward movement of the piston. As the piston reaches the bottom of the power stroke, exhaust ports or valves are opened to exhaust, or scavenge, the combustion products, and a new air-to-fuel charge is injected. Two-stroke engines may be turbocharged using an exhaust-powered turbine to pressurize the charge for injection into the cylinder and to increase cylinder scavenging. Non-turbocharged engines may be either blower scavenged or piston scavenged to improve removal of combustion products. Historically, 2-stroke designs have been widely used in pipeline applications. However, current industry practices reflect a decline in the usage of new 2-stroke engines for stationary applications.

Four-stroke engines use a separate engine revolution for the intake/compression cycle and the power/exhaust cycle. These engines may be either naturally aspirated, using the suction from the piston to entrain the air charge, or turbocharged, using an exhaust-driven turbine to pressurize the charge. Turbocharged units produce a higher power output for a given engine displacement, whereas naturally aspirated units have lower initial costs and require less maintenance.

Rich-burn engines operate near the stoichiometric air-to-fuel ratio (16:1) with exhaust excess oxygen levels less than 4 percent (typically closer to 1 percent). Additionally, it is likely that the emissions profile will be considerably different for a rich-burn engine at 4 percent oxygen than when operated closer to stoichiometric conditions. Considerations such as these can impact the quantitative value of the emission factor presented. It is also important to note that while rich-burn engines may operate, by definition, with exhaust oxygen levels as high as 4 percent, in reality, most will operate within plus or minus 1 air-to-fuel ratio of stoichiometry. Even across this narrow range, emissions will vary considerably, sometimes by more than an order of magnitude. Air-to-fuel ratios were not provided in the gathered emissions data used to develop the presented factors.

Lean-burn engines may operate up to the lean flame extinction limit, with exhaust oxygen levels of 12 percent or greater. The air to fuel ratios of lean-burn engines range from 20:1 to 50:1 and are typically higher than 24:1. The exhaust excess oxygen levels of lean-burn engines are typically around 8 percent, ranging from 4 to 17 percent. Some lean-burn engines are characterized as clean-burn engines. The term “clean-burn” technology is a registered trademark of Cooper Energy Systems and refers to engines designed to reduce NO_x by operating at high air-to-fuel ratios. Engines operating at high air-to-fuel ratios (greater than 30:1) may require combustion modification to promote stable combustion with the high excess air. These modifications may include a turbo charger or a precombustion chamber (PCC). A turbo charger is used to force more air into the combustion chamber, and a PCC is used to ignite a fuel-rich mixture that propagates into the main cylinder and ignites the very lean combustion charge. Lean-burn engines typically have lower oxides of nitrogen (NO_x) emissions than rich-burn engines.

3.2.3 Emissions

The primary criteria pollutants from natural gas-fired reciprocating engines are oxides of nitrogen (NO_x), carbon monoxide (CO), and volatile organic compounds (VOC). The formation of nitrogen oxides is exponentially related to combustion temperature in the engine cylinder. The other pollutants, CO and VOC species, are primarily the result of incomplete combustion. Particulate matter (PM) emissions include trace amounts of metals, non-combustible inorganic material, and condensible, semi-volatile organics which result from volatized lubricating oil, engine wear, or from products of incomplete combustion. Sulfur oxides are very low since sulfur compounds are removed from natural gas at processing plants. However, trace amounts of sulfur containing odorant are added to natural gas at city gates prior to distribution for the purpose of leak detection.

It should be emphasized that the actual emissions may vary considerably from the published emission factors due to variations in the engine operating conditions. This variation is due to engines operating at different conditions, including air-to-fuel ratio, ignition timing, torque, speed, ambient temperature, humidity, and other factors. It is not unusual to test emissions from two identical engines in the same plant, operated by the same personnel, using the same fuel, and have the test results show significantly different emissions. This variability in the test data is evidenced in the high relative standard deviation reported in the data set.

3.2.3.1 Nitrogen Oxides -

Nitrogen oxides are formed through three fundamentally different mechanisms. The principal mechanism of NO_x formation with gas-fired engines is thermal NO_x. The thermal NO_x mechanism occurs through the thermal dissociation and subsequent reaction of nitrogen (N_2) and oxygen (O_2) molecules in the combustion air. Most NO_x formed through the thermal NO_x mechanism occurs in high-temperature regions in the cylinder where combustion air has mixed sufficiently with the fuel to produce the peak temperature fuel/air interface. The second mechanism, called prompt NO_x, occurs through early reactions of nitrogen molecules in the combustion air and hydrocarbon radicals from the fuel. Prompt NO_x reactions occur within the flame and are usually negligible compared to the level of NO_x formed through the thermal NO_x mechanism. The third mechanism, fuel NO_x, stems from the evolution and reaction of fuel-bound nitrogen compounds with oxygen. Natural gas has negligible chemically bound fuel nitrogen (although some molecular nitrogen is present).

Essentially all NO_x formed in natural gas-fired reciprocating engines occurs through the thermal NO_x mechanism. The formation of NO_x through the prompt NO_x mechanism may be significant only under highly controlled situations in rich-burn engines when the thermal NO_x mechanism is suppressed. The rate of NO_x formation through the thermal NO_x mechanism is highly dependent upon the stoichiometric ratio, combustion temperature, and residence time at the combustion temperature. Maximum NO_x formation occurs through the thermal NO_x mechanism near the stoichiometric air-to-fuel mixture ratio since combustion temperatures are greatest at this air-to-fuel ratio.

3.2.3.2 Carbon Monoxide and Volatile Organic Compounds -

CO and VOC emissions are both products of incomplete combustion. CO results when there is insufficient residence time at high temperature to complete the final step in hydrocarbon oxidation. In reciprocating engines, CO emissions may indicate early quenching of combustion gases on cylinder walls or valve surfaces. The oxidation of CO to carbon dioxide (CO_2) is a slow reaction compared to most hydrocarbon oxidation reactions.

The pollutants commonly classified as VOC can encompass a wide spectrum of volatile organic compounds that are photoreactive in the atmosphere. VOC occur when some of the gas remains unburned or is only partially burned during the combustion process. With natural gas, some organics are carryover, unreacted, trace constituents of the gas, while others may be pyrolysis products of the heavier hydrocarbon constituents. Partially burned hydrocarbons result from poor air-to-fuel mixing prior to, or during, combustion, or incorrect air-to-fuel ratios in the cylinder during combustion due to maladjustment of the engine fuel system. Also, low cylinder temperature may yield partially burned hydrocarbons due to excessive cooling through the walls, or early cooling of the gases by expansion of the combustion volume caused by piston motion before combustion is completed.

3.2.3.3 Particulate Matter[4] -

PM emissions result from carryover of noncombustible trace constituents in the fuel and lubricating oil and from products of incomplete combustion. Emission of PM from natural gas-fired reciprocating engines are generally minimal and comprise fine filterable and condensible PM. Increased PM emissions may result from poor air-to-fuel mixing or maintenance problems.

3.2.3.4 Carbon Dioxide, Methane, and Nitrous Oxide[5] -

Carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_2O) are referred to as greenhouse gases. Such gases are largely transparent to incoming solar radiation; however, they absorb infrared radiation re-emitted by the Earth. Where available, emission factors for these pollutants are presented in the emission factors tables of this section.

3.2.4 Control Technologies

Three generic control techniques have been developed for reciprocating engines: parametric controls (timing and operating at a leaner air-to-fuel ratio); combustion modifications such as advanced engine design for new sources or major modification to existing sources (clean-burn cylinder head designs and prestratified charge combustion for rich-burn engines); and postcombustion catalytic controls installed on the engine exhaust system. Post-combustion catalytic technologies include selective catalytic reduction (SCR) for lean-burn engines, nonselective catalytic reduction (NSCR) for rich-burn engines, and CO oxidation catalysts for lean-burn engines.

3.2.4.1 Control Techniques for 4-Cycle Rich-burn Engines[4,6] -

Nonselective Catalytic Reduction (NSCR) -

This technique uses the residual hydrocarbons and CO in the rich-burn engine exhaust as a reducing agent for NO_x. In an NSCR, hydrocarbons and CO are oxidized by O_2 and NO_x. The excess hydrocarbons, CO, and NO_x pass over a catalyst (usually a noble metal such as platinum, rhodium, or palladium) that oxidizes the excess hydrocarbons and CO to H_2O and CO_2, while reducing NO_x to N_2. NO_x reduction efficiencies are usually greater than 90 percent, while CO reduction efficiencies are approximately 90 percent.

The NSCR technique is effectively limited to engines with normal exhaust oxygen levels of 4 percent or less. This includes 4-stroke rich-burn naturally aspirated engines and some 4-stroke rich-burn turbocharged engines. Engines operating with NSCR require tight air-to-fuel control to maintain high reduction effectiveness without high hydrocarbon emissions. To achieve effective NO_x reduction performance, the engine may need to be run with a richer fuel adjustment than normal. This exhaust excess oxygen level would probably be closer to 1 percent. Lean-burn engines could not be retrofitted with NSCR control because of the reduced exhaust temperatures.

Prestratified Charge -

Prestratified charge combustion is a retrofit system that is limited to 4-stroke carbureted natural gas engines. In this system, controlled amounts of air are introduced into the intake manifold in a specified sequence and quantity to create a fuel-rich and fuel-lean zone. This stratification provides both a fuel-rich ignition zone and rapid flame cooling in the fuel-lean zone, resulting in reduced formation of NO_x. A prestratified charge kit generally contains new intake manifolds, air hoses, filters, control valves, and a control system.

3.2.4.2 Control Techniques for Lean-burn Reciprocating Engines[4,6] -

Selective Catalytic Reduction[4,6] -

Selective catalytic reduction is a postcombustion technology that has been shown to be effective in reducing NO_x in exhaust from lean-burn engines. An SCR system consists of an ammonia storage, feed, and injection system, and a catalyst and catalyst housing. Selective catalytic reduction systems selectively reduce NO_x emissions by injecting ammonia (either in the form of liquid anhydrous ammonia or aqueous ammonium hydroxide) into the exhaust gas stream upstream of the catalyst. Nitrogen oxides, NH_3, and O_2 react on the surface of the catalyst to form N_2 and H_2O. For the SCR system to operate properly, the exhaust gas must be within a particular temperature range (typically between 450 and 850°F). The temperature range is dictated by the catalyst (typically made from noble metals, base metal oxides such as vanadium and titanium, and zeolite-based material). Exhaust gas temperatures greater than the upper limit (850°F) will pass the NO_x and ammonia unreacted through the catalyst. Ammonia emissions, called NH_3 slip, are a key consideration when specifying a SCR system. SCR is most suitable for lean-burn engines operated at constant loads, and can achieve efficiencies as high as 90 percent. For engines which typically operate at variable loads, such as engines on gas transmission pipelines, an SCR system may not function effectively, causing either periods of ammonia slip or insufficient ammonia to gain the reductions needed.

Catalytic Oxidation -

Catalytic oxidation is a postcombustion technology that has been applied, in limited cases, to oxidize CO in engine exhaust, typically from lean-burn engines. As previously mentioned, lean-burn technologies may cause increased CO emissions. The application of catalytic oxidation has been shown to be effective in reducing CO emissions from lean-burn engines. In a catalytic oxidation system, CO passes over a catalyst, usually a noble metal, which oxidizes the CO to CO_2 at efficiencies of approximately 70 percent for 2SLB engines and 90 percent for 4SLB engines.

3.2.5 Updates Since the Fifth Edition

The Fifth Edition was released in January 1995. Revisions to this section since that date are summarized below. For further detail, consult the memoranda describing each supplement or the background report for this section. These and other documents can be found on the Clearinghouse for Inventories/Emission Factors (CHIEF) electronic bulletin board (919-541-5742), or on the new Emission Factor and Inventory Group (EFIG) home page (http://www.epa.gov/ttn/chief).

Supplement A, February 1996

- In the table for uncontrolled natural gas prime movers, the Source Classification Code (SCC) for 4-cycle lean-burn was changed from 2-01-002-53 to 2-02-002-54. The SCC for 4-cycle rich-burn was changed from 2-02-002-54 to 2-02-02-002-53.

- An SCC (2-02-002-53) was provided for 4-cycle rich-burn engines, and the "less than" symbol (<) was restored to the appropriate factors.

Supplement B, October 1996

- The introduction section was revised.

- Text was added concerning process description of turbines.

- Text concerning emissions and controls was revised.

- References in various tables were editorially corrected.

- The inconsistency between a CO_2 factor in the table and an equation in the footnote was corrected.

Supplement F, July 2000

- Turbines used for natural gas compression were removed from this section and combined with utility turbines in Section 3.1. Section 3.2 now only contains information on natural gas-fired reciprocating engines.

- All emission factors were updated based on emissions data points taken from 70 emission reports containing over 400 source tests. Many new emission factors have been incorporated in this section for speciated organic compounds, including hazardous air pollutants.

TABLE 3.2-1 UNCONTROLLED EMISSION FACTORS FOR 2-STROKE LEAN-BURN ENGINES[a]
(SCC 2-02-002-52)

Pollutant	Emission Factor (lb/MMBtu)[b] (fuel input)	Emission Factor Rating
Criteria Pollutants and Greenhouse Gases		
NO_x[c] 90 - 105% Load	3.17 E+00	A
NO_x[c] <90% Load	1.94 E+00	A
CO[c] 90 - 105% Load	3.86 E-01	A
CO[c] <90% Load	3.53 E-01	A
CO_2[d]	1.10 E+02	A
SO_2[e]	5.88 E-04	A
TOC[f]	1.64 E+00	A
Methane[g]	1.45 E+00	C
VOC[h]	1.20 E-01	C
PM10 (filterable)[i]	3.84 E-02	C
PM2.5 (filterable)[i]	3.84 E-02	C
PM Condensable[j]	9.91 E-03	E
Trace Organic Compounds		
1,1,2,2-Tetrachloroethane[k]	6.63 E-05	C
1,1,2-Trichloroethane[k]	5.27 E-05	C
1,1-Dichloroethane	3.91 E-05	C
1,2,3-Trimethylbenzene	3.54 E-05	D
1,2,4-Trimethylbenzene	1.11 E-04	C
1,2-Dichloroethane	4.22 E-05	D
1,2-Dichloropropane	4.46 E-05	C
1,3,5-Trimethylbenzene	1.80 E-05	D
1,3-Butadiene[k]	8.20 E-04	D
1,3-Dichloropropene[k]	4.38 E-05	C
2,2,4-Trimethylpentane[k]	8.46 E-04	B
2-Methylnaphthalene[k]	2.14 E-05	C
Acenaphthene[k]	1.33 E-06	C

Table 3.2-1. UNCONTROLLED EMISSION FACTORS FOR 2-STROKE LEAN-BURN ENGINES

(Continued)

Pollutant	Emission Factor (lb/MMBtu)[b] (fuel input)	Emission Factor Rating
Acenaphthylene[k]	3.17 E-06	C
Acetaldehyde[k,l]	7.76 E-03	A
Acrolein[k,l]	7.78 E-03	A
Anthracene[k]	7.18 E-07	C
Benz(a)anthracene[k]	3.36 E-07	C
Benzene[k]	1.94 E-03	A
Benzo(a)pyrene[k]	5.68 E-09	D
Benzo(b)fluoranthene[k]	8.51 E-09	D
Benzo(e)pyrene[k]	2.34 E-08	D
Benzo(g,h,i)perylene[k]	2.48 E-08	D
Benzo(k)fluoranthene[k]	4.26 E-09	D
Biphenyl[k]	3.95 E-06	C
Butane	4.75 E-03	C
Butyr/Isobutyraldehyde	4.37 E-04	C
Carbon Tetrachloride[k]	6.07 E-05	C
Chlorobenzene[k]	4.44 E-05	C
Chloroform[k]	4.71 E-05	C
Chrysene[k]	6.72 E-07	C
Cyclohexane	3.08 E-04	C
Cyclopentane	9.47 E-05	C
Ethane	7.09 E-02	A
Ethylbenzene[k]	1.08 E-04	B
Ethylene Dibromide[k]	7.34 E-05	C
Fluoranthene[k]	3.61 E-07	C
Fluorene[k]	1.69 E-06	C
Formaldehyde[k,l]	5.52 E-02	A

Table 3.2-1. UNCONTROLLED EMISSION FACTORS FOR 2-STROKE LEAN-BURN ENGINES (Concluded)

Pollutant	Emission Factor (lb/MMBtu)[b] (fuel input)	Emission Factor Rating
Indeno(1,2,3-c,d)pyrene[k]	9.93 E-09	D
Isobutane	3.75 E-03	C
Methanol[k]	2.48 E-03	A
Methylcyclohexane	3.38 E-04	C
Methylene Chloride[k]	1.47 E-04	C
n-Hexane[k]	4.45 E-04	C
n-Nonane	3.08 E-05	C
n-Octane	7.44 E-05	C
n-Pentane	1.53 E-03	C
Naphthalene[k]	9.63 E-05	C
PAH[k]	1.34 E-04	D
Perylene[k]	4.97 E-09	D
Phenanthrene[k]	3.53 E-06	C
Phenol[k]	4.21 E-05	C
Propane	2.87 E-02	C
Pyrene[k]	5.84 E-07	C
Styrene[k]	5.48 E-05	A
Toluene[k]	9.63 E-04	A
Vinyl Chloride[k]	2.47 E-05	C
Xylene[k]	2.68 E-04	A

[a] Reference 7. Factors represent uncontrolled levels. For NO_x, CO, and PM10, “uncontrolled” means no combustion or add-on controls; however, the factor may include turbocharged units. For all other pollutants, “uncontrolled” means no oxidation control; the data set may include units with control techniques used for NOx control, such as PCC and SCR for lean burn engines, and PSC for rich burn engines. Factors are based on large population of engines. Factors are for engines at all loads, except as indicated. SCC = Source Classification Code. TOC = Total Organic Compounds. PM10 = Particulate Matter $\leq$ 10 microns (μm) aerodynamic diameter. A “<“ sign in front of a factor means that the corresponding emission factor is based on one-half of the method detection limit.

[b] Emission factors were calculated in units of (lb/MMBtu) based on procedures in EPA

Method 19. To convert from (lb/MMBtu) to (lb/10^6 scf), multiply by the heat content of the fuel. If the heat content is not available, use 1020 Btu/scf. To convert from (lb/MMBtu) to (lb/hp-hr) use the following equation:

$$\text{lb/hp-hr} = (\text{lb/MMBtu})\,(\text{heat input, MMBtu/hr})\,(\text{1/operating HP, 1/hp})$$

[c] Emission tests with unreported load conditions were not included in the data set.
[d] Based on 99.5% conversion of the fuel carbon to CO_2. CO_2 [lb/MMBtu] = (3.67)(%CON)(C)(D)(1/h), where %CON = percent conversion of fuel carbon to CO_2, C = carbon content of fuel by weight (0.75), D = density of fuel, 4.1 E+04 lb/10^6 scf, and h = heating value of natural gas (assume 1020 Btu/scf at 60°F).
[e] Based on 100% conversion of fuel sulfur to SO_2. Assumes sulfur content in natural gas of 2,000 gr/10^6 scf.
[f] Emission factor for TOC is based on measured emission levels of 43 tests.
[g] Emission factor for methane is determined by subtracting the VOC and ethane emission factors from the TOC emission factor. Measured emission factor for methane compares well with the calculated emission factor, 1.48 lb/MMBtu vs. 1.45 lb/MMBtu, respectively.
[h] VOC emission factor is based on the sum of the emission factors for all speciated organic compounds less ethane and methane.
[i] Considered $\leq 1\ \mu$m in aerodynamic diameter. Therefore, for filterable PM emissions, PM10(filterable) = PM2.5(filterable).
[j] No data were available for condensable PM emissions. The presented emission factor reflects emissions from 4SLB engines.
[k] Hazardous Air Pollutant as defined by Section 112(b) of the Clean Air Act.
[l] For lean burn engines, aldehyde emissions quantification using CARB 430 may reflect interference with the sampling compounds due to the nitrogen concentration in the stack. The presented emission factor is based on FTIR measurements. Emissions data based on CARB 430 are available in the background report.

Table 3.2-2. UNCONTROLLED EMISSION FACTORS FOR 4-STROKE LEAN-BURN ENGINES[a]
(SCC 2-02-002-54)

Pollutant	Emission Factor (lb/MMBtu)[b] (fuel input)	Emission Factor Rating
Criteria Pollutants and Greenhouse Gases		
NO_x[c] 90 - 105% Load	4.08 E+00	B
NO_x[c] <90% Load	8.47 E-01	B
CO[c] 90 - 105% Load	3.17 E-01	C
CO[c] <90% Load	5.57 E-01	B
CO_2[d]	1.10 E+02	A
SO_2[e]	5.88 E-04	A
TOC[f]	1.47 E+00	A
Methane[g]	1.25 E+00	C
VOC[h]	1.18 E-01	C
PM10 (filterable)[i]	7.71 E-05	D
PM2.5 (filterable)[i]	7.71 E-05	D
PM Condensable[j]	9.91 E-03	D
Trace Organic Compounds		
1,1,2,2-Tetrachloroethane[k]	<4.00 E-05	E
1,1,2-Trichloroethane[k]	<3.18 E-05	E
1,1-Dichloroethane	<2.36 E-05	E
1,2,3-Trimethylbenzene	2.30 E-05	D
1,2,4-Trimethylbenzene	1.43 E-05	C
1,2-Dichloroethane	<2.36 E-05	E
1,2-Dichloropropane	<2.69 E-05	E
1,3,5-Trimethylbenzene	3.38 E-05	D
1,3-Butadiene[k]	2.67E-04	D
1,3-Dichloropropene[k]	<2.64 E-05	E
2-Methylnaphthalene[k]	3.32 E-05	C
2,2,4-Trimethylpentane[k]	2.50 E-04	C
Acenaphthene[k]	1.25 E-06	C

Table 3.2-2. UNCONTROLLED EMISSION FACTORS FOR 4-STROKE LEAN-BURN ENGINES (Continued)

Pollutant	Emission Factor (lb/MMBtu)[b] (fuel input)	Emission Factor Rating
Acenaphthylene[k]	5.53 E-06	C
Acetaldehyde[k,l]	8.36 E-03	A
Acrolein[k,l]	5.14 E-03	A
Benzene[k]	4.40 E-04	A
Benzo(b)fluoranthene[k]	1.66 E-07	D
Benzo(e)pyrene[k]	4.15 E-07	D
Benzo(g,h,i)perylene[k]	4.14 E-07	D
Biphenyl[k]	2.12 E-04	D
Butane	5.41 E-04	D
Butyr/Isobutyraldehyde	1.01 E-04	C
Carbon Tetrachloride[k]	<3.67 E-05	E
Chlorobenzene[k]	<3.04 E-05	E
Chloroethane	1.87 E-06	D
Chloroform[k]	<2.85 E-05	E
Chrysene[k]	6.93 E-07	C
Cyclopentane	2.27 E-04	C
Ethane	1.05 E-01	C
Ethylbenzene[k]	3.97 E-05	B
Ethylene Dibromide[k]	<4.43 E-05	E
Fluoranthene[k]	1.11 E-06	C
Fluorene[k]	5.67 E-06	C
Formaldehyde[k,l]	5.28 E-02	A
Methanol[k]	2.50 E-03	B
Methylcyclohexane	1.23 E-03	C
Methylene Chloride[k]	2.00 E-05	C
n-Hexane[k]	1.11 E-03	C
n-Nonane	1.10 E-04	C

Table 3.2-2. UNCONTROLLED EMISSION FACTORS FOR 4-STROKE LEAN-BURN ENGINES
(Continued)

Pollutant	Emission Factor (lb/MMBtu)[b] (fuel input)	Emission Factor Rating
n-Octane	3.51 E-04	C
n-Pentane	2.60 E-03	C
Naphthalene[k]	7.44 E-05	C
PAH[k]	2.69 E-05	D
Phenanthrene[k]	1.04 E-05	D
Phenol[k]	2.40 E-05	D
Propane	4.19 E-02	C
Pyrene[k]	1.36 E-06	C
Styrene[k]	<2.36 E-05	E
Tetrachloroethane[k]	2.48 E-06	D
Toluene[k]	4.08 E-04	B
Vinyl Chloride[k]	1.49 E-05	C
Xylene[k]	1.84 E-04	B

[a] Reference 7. Factors represent uncontrolled levels. For NO_x, CO, and PM10, "uncontrolled" means no combustion or add-on controls; however, the factor may include turbocharged units. For all other pollutants, "uncontrolled" means no oxidation control; the data set may include units with control techniques used for NOx control, such as PCC and SCR for lean burn engines, and PSC for rich burn engines. Factors are based on large population of engines. Factors are for engines at all loads, except as indicated. SCC = Source Classification Code. TOC = Total Organic Compounds. PM-10 = Particulate Matter $\leq$ 10 microns (μm) aerodynamic diameter. A "<" sign in front of a factor means that the corresponding emission factor is based on one-half of the method detection limit.

[b] Emission factors were calculated in units of (lb/MMBtu) based on procedures in EPA Method 19. To convert from (lb/MMBtu) to (lb/10^6 scf), multiply by the heat content of the fuel. If the heat content is not available, use 1020 Btu/scf. To convert from (lb/MMBtu) to (lb/hp-hr) use the following equation:

$$\text{lb/hp-hr} = (\text{lb/MMBtu})\,(\text{heat input, MMBtu/hr})\,(1/\text{operating HP, 1/hp})$$

[c] Emission tests with unreported load conditions were not included in the data set.

[d] Based on 99.5% conversion of the fuel carbon to CO_2. CO_2 [lb/MMBtu] = (3.67)(%CON)(C)(D)(1/h), where %CON = percent conversion of fuel carbon to CO_2, C = carbon content of fuel by weight (0.75), D = density of fuel, 4.1 E+04 lb/10^6 scf, and

h = heating value of natural gas (assume 1020 Btu/scf at 60°F).

[e] Based on 100% conversion of fuel sulfur to SO_2. Assumes sulfur content in natural gas of 2,000 gr/10^6scf.

[f] Emission factor for TOC is based on measured emission levels from 22 source tests.

[g] Emission factor for methane is determined by subtracting the VOC and ethane emission factors from the TOC emission factor. Measured emission factor for methane compares well with the calculated emission factor, 1.31 lb/MMBtu vs. 1.25 lb/MMBtu, respectively.

[h] VOC emission factor is based on the sum of the emission factors for all speciated organic compounds less ethane and methane.

[i] Considered $\leq$ 1 μm in aerodynamic diameter. Therefore, for filterable PM emissions, PM10(filterable) = PM2.5(filterable).

[j] PM Condensable = PM Condensable Inorganic + PM-Condensable Organic

[k] Hazardous Air Pollutant as defined by Section 112(b) of the Clean Air Act.

[l] For lean burn engines, aldehyde emissions quantification using CARB 430 may reflect interference with the sampling compounds due to the nitrogen concentration in the stack. The presented emission factor is based on FTIR measurements. Emissions data based on CARB 430 are available in the background report.

Table 3.2-3. UNCONTROLLED EMISSION FACTORS FOR 4-STROKE RICH-BURN ENGINES[a]
(SCC 2-02-002-53)

Pollutant	Emission Factor (lb/MMBtu)[b] (fuel input)	Emission Factor Rating
Criteria Pollutants and Greenhouse Gases		
NO_x[c] 90 - 105% Load	2.21 E+00	A
NO_x[c] <90% Load	2.27 E+00	C
CO[c] 90 - 105% Load	3.72 E+00	A
CO[c] <90% Load	3.51 E+00	C
CO_2[d]	1.10 E+02	A
SO_2[e]	5.88 E-04	A
TOC[f]	3.58 E-01	C
Methane[g]	2.30 E-01	C
VOC[h]	2.96 E-02	C
PM10 (filterable)[i,j]	9.50 E-03	E
PM2.5 (filterable)[j]	9.50 E-03	E
PM Condensable[k]	9.91 E-03	E
Trace Organic Compounds		
1,1,2,2-Tetrachloroethane[l]	2.53 E-05	C
1,1,2-Trichloroethane[l]	<1.53 E-05	E
1,1-Dichloroethane	<1.13 E-05	E
1,2-Dichloroethane	<1.13 E-05	E
1,2-Dichloropropane	<1.30 E-05	E
1,3-Butadiene[l]	6.63 E-04	D
1,3-Dichloropropene[l]	<1.27 E-05	E
Acetaldehyde[l,m]	2.79 E-03	C
Acrolein[l,m]	2.63 E-03	C
Benzene[l]	1.58 E-03	B
Butyr/isobutyraldehyde	4.86 E-05	D
Carbon Tetrachloride[l]	<1.77 E-05	E

Table 3.2-3. UNCONTROLLED EMISSION FACTORS FOR 4-STROKE RICH-BURN ENGINES (Concluded)

Pollutant	Emission Factor (lb/MMBtu)[b] (fuel input)	Emission Factor Rating
Chlorobenzene[l]	<1.29 E-05	E
Chloroform[l]	<1.37 E-05	E
Ethane[n]	7.04 E-02	C
Ethylbenzene[l]	<2.48 E-05	E
Ethylene Dibromide[l]	<2.13 E-05	E
Formaldehyde[l,m]	2.05 E-02	A
Methanol[l]	3.06 E-03	D
Methylene Chloride[l]	4.12 E-05	C
Naphthalene[l]	<9.71 E-05	E
PAH[l]	1.41 E-04	D
Styrene[l]	<1.19 E-05	E
Toluene[l]	5.58 E-04	A
Vinyl Chloride[l]	<7.18 E-06	E
Xylene[l]	1.95 E-04	A

[a] Reference 7. Factors represent uncontrolled levels. For NO_x, CO, and PM-10, "uncontrolled" means no combustion or add-on controls; however, the factor may include turbocharged units. For all other pollutants, "uncontrolled" means no oxidation control; the data set may include units with control techniques used for NOx control, such as PCC and SCR for lean burn engines, and PSC for rich burn engines. Factors are based on large population of engines. Factors are for engines at all loads, except as indicated. SCC = Source Classification Code. TOC = Total Organic Compounds. PM10 = Particulate Matter $\leq$ 10 microns (μm) aerodynamic diameter. A "<" sign in front of a factor means that the corresponding emission factor is based on one-half of the method detection limit.

[b] Emission factors were calculated in units of (lb/MMBtu) based on procedures in EPA Method 19. To convert from (lb/MMBtu) to (lb/10^6 scf), multiply by the heat content of the fuel. If the heat content is not available, use 1020 Btu/scf. To convert from (lb/MMBtu) to (lb/hp-hr) use the following equation:

$$\text{lb/hp-hr} = (\text{lb/MMBtu})(\text{heat input, MMBtu/hr})(\text{1/operating HP, 1/hp})$$

[c] Emission tests with unreported load conditions were not included in the data set.

[d] Based on 99.5% conversion of the fuel carbon to CO_2. CO_2 [lb/MMBtu] = (3.67)(%CON)(C)(D)(1/h), where %CON = percent conversion of fuel carbon to CO_2,

C = carbon content of fuel by weight (0.75), D = density of fuel, 4.1 E+04 lb/10^6 scf, and h = heating value of natural gas (assume 1020 Btu/scf at 60°F).

[e] Based on 100% conversion of fuel sulfur to SO_2. Assumes sulfur content in natural gas of 2,000 gr/10^6scf.

[f] Emission factor for TOC is based on measured emission levels from 6 source tests.

[g] Emission factor for methane is determined by subtracting the VOC and ethane emission factors from the TOC emission factor.

[h] VOC emission factor is based on the sum of the emission factors for all speciated organic compounds. Methane and ethane emissions were not measured for this engine category.

[i] No data were available for uncontrolled engines. PM10 emissions are for engines equipped with a PCC.

[j] Considered $\leq$ 1 μm in aerodynamic diameter. Therefore, for filterable PM emissions, PM10(filterable) = PM2.5(filterable).

[k] No data were available for condensable emissions. The presented emission factor reflects emissions from 4SLB engines.

[l] Hazardous Air Pollutant as defined by Section 112(b) of the Clean Air Act.

[m] For rich-burn engines, no interference is suspected in quantifying aldehyde emissions. The presented emission factors are based on FTIR and CARB 430 emissions data measurements.

[n] Ethane emission factor is determined by subtracting the VOC emission factor from the NMHC emission factor.

References For Section 3.2

1. *Engines, Turbines, And Compressors Directory*, American Gas Association, Catalog #XF0488.

2. *Standards Support And Environmental Impact Statement, Volume I: Stationary Internal Combustion Engines*, EPA-450/2-78-125a, U. S. Environmental Protection Agency, Office of Air Quality Planning and Standards, Research Triangle Park, NC, July 1979.

3. *Alternative Control Techniques Document - NO_x Emissions From Stationary Reciprocating Engines*, EPA-453/R-93-032, July 1993.

4. *Handbook - Control Technologies For Hazardous Air Pollutants*, EPA-625/6-91-014, June 1991.

5. *Limiting Net Greenhouse Gas Emissions In The United States, Volume II: Energy Responses,* Report for the Office of Environmental Analysis, Office of Policy, Planning and Analysis, Department of Energy (DOE), DOE/PE-0101 Volume II, September 1991.

6. C. Castaldini, *NO_x Reduction Technologies For Natural Gas Industry Prime Movers*, GRI-90/0215, Gas Research Institute, Chicago, IL, August 1990.

7. *Emission Factor Documentation for AP-42 Section 3.2, Natural Gas-Fired Reciprocating Engines*, EPA Contract No. 68-D2-0160, Alpha-Gamma Technologies, Inc., Raleigh, North Carolina, July 2000.

APPENDIX P-2

DEATILED EMISSION CALCULATIONS FOR THE 2005 BASELINE YEAR AND PROJECT YEARS 2010-2016

Summary of Emissions from Propane-Fueled Welders
Dolores and ICTF Rail Yards, Long Beach, CA

						Hours of			Carbon	2005 Emission Factors								2005 Emission Estimates							
					Rating	Operation	Fuel Use		Oxidation	(lb/MMBtu)[5]					(kg/gal)[4]			(tons/yr)					(metric tons/yr)		
Yard	Location	Equipment Type	Make/Model	Fuel Type	(hp)	(hr/yr)[1]	(MMBtu/yr)[2]	(gal/yr)[3]	Factor[4]	VOC	CO	NOx	PM10	SOx	CO2	N2O[6]	CH4[6]	ROG	CO	NOx	PM10	SOx	CO2	N2O	CH4
Dolores	Service Track	Welder	Lincoln Ranger 9	Propane	18	1000	126	1,383.89	99.5%	2.96E-02	3.51	2.27	9.50E-03	5.88E-04	5.70	3.73E-05	8.29E-06	0.002	0.221	0.143	0.001	0.000	7.85	5.17E-05	1.15E-05

Notes:
1. Hours of operation are an engineering estimate.
2. Fuel use based on a BSFC of 7,000 Btu/hp-hr.
3. Fuel use based on a BSFC of 7,000 Btu/hp-hr, a propane HHV of 3.824 MMBtu/barrel (from ARB Draft Emission Factors for Mandatory Reporting Programs, August 10, 2007), and 42 gallons per barrel.
4. From the Air Resources Board's Draf *Emission Factors for Mandatory Reporting Programs,* August 10, 2007.
5. Emission factors, in lb/MMBtu, from AP-42, Table 3.2-3, 7/00.
6. Based on a propane HHV of 3.824 MMBtu/barrel (from ARB Draft Emission Factors for Mandatory Reporting Programs, August 10, 2007) and 42 gallons per barrel.

Summary of Emissions from Propane-Fueled Welders
Dolores and ICTF Rail Yards, Long Beach, CA

Yard	Location	Equipment Type	Make/Model	Fuel Type	Rating (hp)	Hours of Operation (hr/yr)[1]	Fuel Use (MMBtu/yr)[2]	Fuel Use (gal/yr)[3]	Carbon Oxidation Factor[4]	2010 Emission Factors (lb/MMBtu)[5] VOC	CO	NOx	PM10	SOx	2010 Emission Factors (kg/gal)[4] CO2	N2O[6]	CH4[6]	2010 Emission Estimates (tons/yr) ROG	CO	NOx	PM10	SOx	2010 Emission Estimates (metric tons/yr) CO2	N2O	CH4
Dolores	Service Track	Welder	Lincoln Ranger 9	Propane	18	1000	126	1,383.89	99.5%	2.96E-02	3.51	2.27	9.50E-03	5.88E-04	5.70	3.73E-05	8.29E-06	0.002	0.221	0.143	0.001	0.000	7.85	5.17E-05	1.15E-05

Notes:
1. Hours of operation are an engineering estimate.
2. Fuel use based on a BSFC of 7,000 Btu/hp-hr.
3. Fuel use based on a BSFC of 7,000 Btu/hp-hr, a propane HHV of 3.824 MMBtu/barrel (from ARB Draft Emission Factors for Mandatory Reporting Programs, August 10, 2007), and 42 gallons per barrel.
4. From the Air Resources Board's Draf *Emission Factors for Mandatory Reporting Programs,* August 10, 2007.
5. Emission factors, in lb/MMBtu, from AP-42, Table 3.2-3, 7/00.
6. Based on a propane HHV of 3.824 MMBtu/barrel (from ARB Draft Emission Factors for Mandatory Reporting Programs, August 10, 2007) and 42 gallons per barrel.

Summary of Emissions from Propane-Fueled Welders
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Yard	Location	Equipment Type	Make/Model	Fuel Type	Rating (hp)	Hours of Operation (hr/yr)[1]	Fuel Use (MMBtu/yr)[2]	Fuel Use (gal/yr)[3]	Carbon Oxidation Factor[4]	2012 Emission Factors (lb/MMBtu)[5] VOC	CO	NOx	PM10	SOx	2012 Emission Factors (kg/gal)[4] CO2	N2O[6]	CH4[6]	2012 Emission Estimates (tons/yr) ROG	CO	NOx	PM10	SOx	2012 Emission Estimates (metric tons/yr) CO2	N2O	CH4
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Notes:
1. Hours of operation are an engineering estimate. Assumed no change in the hours of operation from the baseline.
2. Fuel use based on a BSFC of 7,000 Btu/hp-hr.
3. Fuel use based on a BSFC of 7,000 Btu/hp-hr, a propane HHV of 3.824 MMBtu/barrel (from ARB Draft Emission Factors for Mandatory Reporting Programs, August 10, 2007), and 42 gallons per barrel.
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Summary of Emissions from Propane-Fueled Welders
Dolores and ICTF Rail Yards, Long Beach, CA

						Hours of			Carbon	2014 Emission Factors								2014 Emission Estimates							
					Rating	Operation	Fuel Use		Oxidation	(lb/MMBtu)[5]					(kg/gal)[4]			(tons/yr)					(metric tons/yr)		
Yard	Location	Equipment Type	Make/Model	Fuel Type	(hp)	(hr/yr)[1]	(MMBtu/yr)[2]	(gal/yr)[3]	Factor[4]	VOC	CO	NOx	PM10	SOx	CO2	N2O[6]	CH4[6]	ROG	CO	NOx	PM10	SOx	CO2	N2O	CH4
Dolores	Service Track	Welder	Lincoln Ranger 9	Propane	18	1000	126	1,383.89	99.5%	2.96E-02	3.51	2.27	9.50E-03	5.88E-04	5.70	3.73E-05	8.29E-06	0.002	0.221	0.143	0.001	0.000	7.85	5.17E-05	1.15E-05

Notes:
1. Hours of operation are an engineering estimate. Assumed no change in the hours of operation from the baseline.
2. Fuel use based on a BSFC of 7,000 Btu/hp-hr.
3. Fuel use based on a BSFC of 7,000 Btu/hp-hr, a propane HHV of 3.824 MMBtu/barrel (from ARB Draft Emission Factors for Mandatory Reporting Programs, August 10, 2007), and 42 gallons per barrel.
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Summary of Emissions from Propane-Fueled Welders
Dolores and ICTF Rail Yards, Long Beach, CA

Yard	Location	Equipment Type	Make/Model	Fuel Type	Rating (hp)	Hours of Operation (hr/yr)[1]	Fuel Use (MMBtu/yr)[2]	Fuel Use (gal/yr)[3]	Carbon Oxidation Factor[4]	2016 Emission Factors (lb/MMBtu)[5] VOC	CO	NOx	PM10	SOx	2016 Emission Factors (kg/gal)[4] CO2	N2O[6]	CH4[6]	2016 Emission Estimates (tons/yr) ROG	CO	NOx	PM10	SOx	2016 Emission Estimates (metric tons/yr) CO2	N2O	CH4
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Notes:
1. Hours of operation are an engineering estimate. Assumed no change in the hours of operation from the baseline.
2. Fuel use based on a BSFC of 7,000 Btu/hp-hr.
3. Fuel use based on a BSFC of 7,000 Btu/hp-hr, a propane HHV of 3.824 MMBtu/barrel (from ARB Draft Emission Factors for Mandatory Reporting Programs, August 10, 2007), and 42 gallons per barrel.
4. From the Air Resources Board's Draf *Emission Factors for Mandatory Reporting Programs,* August 10, 2007.
5. Emission factors, in lb/MMBtu, from AP-42, Table 3.2-3, 7/00.
6. Based on a propane HHV of 3.824 MMBtu/barrel (from ARB Draft Emission Factors for Mandatory Reporting Programs, August 10, 2007) and 42 gallons per barrel.

APPENDIX P-3

SPECIATION PROFILE FOR THE PROPANE-FUELED WELDER

Toxic Air Contaminant Emissions from Propane-Fueled Welders
Dolores and ICTF Rail Yards, Long Beach, CA

Profile[1]	CAS	Chemical Name	Organic Fraction	Emissions (tpy)
719	95636	1,2,4-trimethylbenzene	0.00001	1.70E-08
719	75070	acetaldehyde	0.00003	5.11E-08
719	71432	benzene	0.00010	1.87E-07
719	110827	cyclohexane	0.00001	1.70E-08
719	100414	ethylbenzene	0.00001	1.70E-08
719	74851	ethylene	0.00058	1.07E-06
719	50000	formaldehyde	0.00074	1.38E-06
719	108383	m-xylene	0.00001	1.70E-08
719	110543	n-hexane	0.00002	3.41E-08
719	95476	o-xylene	0.00001	1.70E-08
719	115071	propylene	0.00154	2.88E-06
719	108883	toluene	0.00004	6.82E-08
719	1330207	xylene	0.00002	3.41E-08
Total				**5.80E-06**

Notes:
1. Organic fraction from ARBs SPECIATE database. Data is from "ICE-reciprocating - natural gas" option. The SPECIATE database does not include a profile for propane-fueled engines.
2. Emissions were calculated for only chemicals that were in both the SPECIATE database and the AB2588 list.
3. Organic fraction reported on a ROG basis using ARB's Speciate ROG/TOG ratio (0.0914)

Toxic Air Contaminant Emissions from Propane-Fueled Welders
Dolores and ICTF Rail Yards, Long Beach, CA

Propane Welder

Profile[1]	CAS	Chemical Name	Organic Fraction	2010 Emissions (tpy)
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719	75070	acetaldehyde	0.00003	5.11E-08
719	71432	benzene	0.00010	1.87E-07
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719	1330207	xylene	0.00002	3.41E-08
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3. Organic fraction reported on a ROG basis using ARB's Speciate ROG/TOG ratio (0.0914).

Toxic Air Contaminant Emissions from Propane-Fueled Welders
Dolores and ICTF Rail Yards, Long Beach, CA

Propane Welder

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Dolores and ICTF Rail Yards, Long Beach, CA

Propane Welder

Profile[1]	CAS	Chemical Name	Organic Fraction	2016 Emissions (tpy)
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719	75070	acetaldehyde	0.00003	5.11E-08
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719	110827	cyclohexane	0.00001	1.70E-08
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719	74851	ethylene	0.00058	1.07E-06
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719	108383	m-xylene	0.00001	1.70E-08
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3. Organic fraction reported on a ROG basis using ARB's Speciate ROG/TOG ratio (0.0914)

APPENDIX Q

MISCELLANEOUS GASOLINE-FUELED EQUIPMENT

APPENDIX Q-1

AP-42 SECTION 3.3

3.3 Gasoline And Diesel Industrial Engines

3.3.1 General

The engine category addressed by this section covers a wide variety of industrial applications of both gasoline and diesel internal combustion (IC) engines such as aerial lifts, fork lifts, mobile refrigeration units, generators, pumps, industrial sweepers/scrubbers, material handling equipment (such as conveyors), and portable well-drilling equipment. The three primary fuels for reciprocating IC engines are gasoline, diesel fuel oil (No.2), and natural gas. Gasoline is used primarily for mobile and portable engines. Diesel fuel oil is the most versatile fuel and is used in IC engines of all sizes. The rated power of these engines covers a rather substantial range, up to 250 horsepower (hp) for gasoline engines and up to 600 hp for diesel engines. (Diesel engines greater than 600 hp are covered in Section 3.4, "Large Stationary Diesel And All Stationary Dual-fuel Engines".) Understandably, substantial differences in engine duty cycles exist. It was necessary, therefore, to make reasonable assumptions concerning usage in order to formulate some of the emission factors.

3.3.2 Process Description

All reciprocating IC engines operate by the same basic process. A combustible mixture is first compressed in a small volume between the head of a piston and its surrounding cylinder. The mixture is then ignited, and the resulting high-pressure products of combustion push the piston through the cylinder. This movement is converted from linear to rotary motion by a crankshaft. The piston returns, pushing out exhaust gases, and the cycle is repeated.

There are 2 methods used for stationary reciprocating IC engines: compression ignition (CI) and spark ignition (SI). This section deals with both types of reciprocating IC engines. All diesel-fueled engines are compression ignited, and all gasoline-fueled engines are spark ignited.

In CI engines, combustion air is first compression heated in the cylinder, and diesel fuel oil is then injected into the hot air. Ignition is spontaneous because the air temperature is above the autoignition temperature of the fuel. SI engines initiate combustion by the spark of an electrical discharge. Usually the fuel is mixed with the air in a carburetor (for gasoline) or at the intake valve (for natural gas), but occasionally the fuel is injected into the compressed air in the cylinder.

CI engines usually operate at a higher compression ratio (ratio of cylinder volume when the piston is at the bottom of its stroke to the volume when it is at the top) than SI engines because fuel is not present during compression; hence there is no danger of premature autoignition. Since engine thermal efficiency rises with increasing pressure ratio (and pressure ratio varies directly with compression ratio), CI engines are more efficient than SI engines. This increased efficiency is gained at the expense of poorer response to load changes and a heavier structure to withstand the higher pressures.[1]

3.3.3 Emissions

Most of the pollutants from IC engines are emitted through the exhaust. However, some total organic compounds (TOC) escape from the crankcase as a result of blowby (gases that are vented from the oil pan after they have escaped from the cylinder past the piston rings) and from the fuel tank and carburetor because of evaporation. Nearly all of the TOCs from diesel CI engines enter the

atmosphere from the exhaust. Evaporative losses are insignificant in diesel engines due to the low volatility of diesel fuels.

The primary pollutants from internal combustion engines are oxides of nitrogen (NO_x), total organic compounds (TOC), carbon monoxide (CO), and particulates, which include both visible (smoke) and nonvisible emissions. Nitrogen oxide formation is directly related to high pressures and temperatures during the combustion process and to the nitrogen content, if any, of the fuel. The other pollutants, HC, CO, and smoke, are primarily the result of incomplete combustion. Ash and metallic additives in the fuel also contribute to the particulate content of the exhaust. Sulfur oxides (SO_x) also appear in the exhaust from IC engines. The sulfur compounds, mainly sulfur dioxide (SO_2), are directly related to the sulfur content of the fuel.[2]

3.3.3.1 Nitrogen Oxides -

Nitrogen oxide formation occurs by two fundamentally different mechanisms. The predominant mechanism with internal combustion engines is thermal NO_x which arises from the thermal dissociation and subsequent reaction of nitrogen (N_2) and oxygen (O_2) molecules in the combustion air. Most thermal NO_x is formed in the high-temperature region of the flame from dissociated molecular nitrogen in the combustion air. Some NO_x, called prompt NO_x, is formed in the early part of the flame from reaction of nitrogen intermediary species, and HC radicals in the flame. The second mechanism, fuel NO_x, stems from the evolution and reaction of fuel-bound nitrogen compounds with oxygen. Gasoline, and most distillate oils have no chemically-bound fuel N_2 and essentially all NO_x formed is thermal NO_x.

3.3.3.2 Total Organic Compounds -

The pollutants commonly classified as hydrocarbons are composed of a wide variety of organic compounds and are discharged into the atmosphere when some of the fuel remains unburned or is only partially burned during the combustion process. Most unburned hydrocarbon emissions result from fuel droplets that were transported or injected into the quench layer during combustion. This is the region immediately adjacent to the combustion chamber surfaces, where heat transfer outward through the cylinder walls causes the mixture temperatures to be too low to support combustion.

Partially burned hydrocarbons can occur because of poor air and fuel homogeneity due to incomplete mixing, before or during combustion; incorrect air/fuel ratios in the cylinder during combustion due to maladjustment of the engine fuel system; excessively large fuel droplets (diesel engines); and low cylinder temperature due to excessive cooling (quenching) through the walls or early cooling of the gases by expansion of the combustion volume caused by piston motion before combustion is completed.[2]

3.3.3.3 Carbon Monoxide -

Carbon monoxide is a colorless, odorless, relatively inert gas formed as an intermediate combustion product that appears in the exhaust when the reaction of CO to CO_2 cannot proceed to completion. This situation occurs if there is a lack of available oxygen near the hydrocarbon (fuel) molecule during combustion, if the gas temperature is too low, or if the residence time in the cylinder is too short. The oxidation rate of CO is limited by reaction kinetics and, as a consequence, can be accelerated only to a certain extent by improvements in air and fuel mixing during the combustion process.[2-3]

3.3.3.4 Smoke and Particulate Matter -

White, blue, and black smoke may be emitted from IC engines. Liquid particulates appear as white smoke in the exhaust during an engine cold start, idling, or low load operation. These are formed in the quench layer adjacent to the cylinder walls, where the temperature is not high enough to ignite the fuel. Blue smoke is emitted when lubricating oil leaks, often past worn piston rings, into the combustion chamber and is partially burned. Proper maintenance is the most effective method of preventing blue smoke emissions from all types of IC engines. The primary constituent of black smoke is agglomerated carbon particles (soot) formed in regions of the combustion mixtures that are oxygen deficient.[2]

3.3.3.5 Sulfur Oxides -

Sulfur oxides emissions are a function of only the sulfur content in the fuel rather than any combustion variables. In fact, during the combustion process, essentially all the sulfur in the fuel is oxidized to SO_2. The oxidation of SO_2 gives sulfur trioxide (SO_3), which reacts with water to give sulfuric acid (H_2SO_4), a contributor to acid precipitation. Sulfuric acid reacts with basic substances to give sulfates, which are fine particulates that contribute to PM-10 and visibility reduction. Sulfur oxide emissions also contribute to corrosion of the engine parts.[2-3]

3.3.4 Control Technologies

Control measures to date are primarily directed at limiting NO_x and CO emissions since they are the primary pollutants from these engines. From a NO_x control viewpoint, the most important distinction between different engine models and types of reciprocating engines is whether they are rich-burn or lean-burn. Rich-burn engines have an air-to-fuel ratio operating range that is near stoichiometric or fuel-rich of stoichiometric and as a result the exhaust gas has little or no excess oxygen. A lean-burn engine has an air-to-fuel operating range that is fuel-lean of stoichiometric; therefore, the exhaust from these engines is characterized by medium to high levels of O_2. The most common NO_x control technique for diesel and dual-fuel engines focuses on modifying the combustion process. However, selective catalytic reduction (SCR) and nonselective catalytic reduction (NSCR) which are post-combustion techniques are becoming available. Controls for CO have been partly adapted from mobile sources.[4]

Combustion modifications include injection timing retard (ITR), preignition chamber combustion (PCC), air-to-fuel ratio adjustments, and derating. Injection of fuel into the cylinder of a CI engine initiates the combustion process. Retarding the timing of the diesel fuel injection causes the combustion process to occur later in the power stroke when the piston is in the downward motion and combustion chamber volume is increasing. By increasing the volume, the combustion temperature and pressure are lowered, thereby lowering NO_x formation. ITR reduces NO_x from all diesel engines; however, the effectiveness is specific to each engine model. The amount of NO_x reduction with ITR diminishes with increasing levels of retard.[4]

Improved swirl patterns promote thorough air and fuel mixing and may include a precombustion chamber (PCC). A PCC is an antechamber that ignites a fuel-rich mixture that propagates to the main combustion chamber. The high exit velocity from the PCC results in improved mixing and complete combustion of the lean air/fuel mixture which lowers combustion temperature, thereby reducing NO_x emissions.[4]

The air-to-fuel ratio for each cylinder can be adjusted by controlling the amount of fuel that enters each cylinder. At air-to-fuel ratios less than stoichiometric (fuel-rich), combustion occurs under conditions of insufficient oxygen which causes NO_x to decrease because of lower oxygen and lower temperatures. Derating involves restricting the engine operation to lower than normal levels of power production for the given application. Derating reduces cylinder pressures and temperatures, thereby lowering NO_x formation rates.[4]

SCR is an add-on NO_x control placed in the exhaust stream following the engine and involves injecting ammonia (NH_3) into the flue gas. The NH_3 reacts with NO_x in the presence of a catalyst to form water and nitrogen. The effectiveness of SCR depends on fuel quality and engine duty cycle (load fluctuations). Contaminants in the fuel may poison or mask the catalyst surface causing a reduction or termination in catalyst activity. Load fluctuations can cause variations in exhaust temperature and NO_x concentration which can create problems with the effectiveness of the SCR system.[4]

NSCR is often referred to as a three-way conversion catalyst system because the catalyst reactor simultaneously reduces NO_x, CO, and HC and involves placing a catalyst in the exhaust stream of the engine. The reaction requires that the O_2 levels be kept low and that the engine be operated at fuel-rich air-to-fuel ratios.[4]

The most accurate method for calculating such emissions is on the basis of "brake-specific" emission factors (pounds per horsepower-hour [lb/hp-hr]). Emissions are the product of the brake-specific emission factor, the usage in hours, the rated power available, and the load factor (the power actually used divided by the power available). However, for emission inventory purposes, it is often easier to assess this activity on the basis of fuel used.

Once reasonable usage and duty cycles for this category were ascertained, emission values were aggregated to arrive at the factors for criteria and organic pollutants presented. Factors in Table 3.3-1 are in pounds per million British thermal unit (lb/MMBtu). Emission data for a specific design type were weighted according to estimated material share for industrial engines. The emission factors in these tables, because of their aggregate nature, are most appropriately applied to a population of industrial engines rather than to an individual power plant. Table 3.3-2 shows unweighted speciated organic compound and air toxic emission factors based upon only 2 engines. Their inclusion in this section is intended for rough order-of-magnitude estimates only.

Table 3.3-3 summarizes whether the various diesel emission reduction technologies (some of which may be applicable to gasoline engines) will generally increase or decrease the selected parameter. These technologies are categorized into fuel modifications, engine modifications, and exhaust after-treatments. Current data are insufficient to quantify the results of the modifications. Table 3.3-3 provides general information on the trends of changes on selected parameters.

3.3.5 Updates Since the Fifth Edition

The Fifth Edition was released in January 1995. Revisions to this section since that date are summarized below. For further detail, consult the memoranda describing each supplement or the background report for this section.

Supplement A, February 1996

No changes.

Supplement B, October 1996

- Text was revised concerning emissions and controls.
- The CO_2 emission factor was adjusted to reflect 98.5 percent conversion efficiency.

Table 3.3-1. EMISSION FACTORS FOR UNCONTROLLED GASOLINE AND DIESEL INDUSTRIAL ENGINES[a]

Pollutant	Gasoline Fuel (SCC 2-02-003-01, 2-03-003-01)		Diesel Fuel (SCC 2-02-001-02, 2-03-001-01)		EMISSION FACTOR RATING
	Emission Factor (lb/hp-hr) (power output)	Emission Factor (lb/MMBtu) (fuel input)	Emission Factor (lb/hp-hr) (power output)	Emission Factor (lb/MMBtu) (fuel input)	
NO_x	0.011	1.63	0.031	4.41	D
CO	0.439	62.7	6.68 E-03	0.95	D
SO_x	5.91 E-04	0.084	2.05 E-03	0.29	D
PM-10[b]	7.21 E-04	0.10	2.20 E-03	0.31	D
CO_2[c]	1.08	154	1.15	164	B
Aldehydes	4.85 E-04	0.07	4.63 E-04	0.07	D
TOC					
Exhaust	0.015	2.10	2.47 E-03	0.35	D
Evaporative	6.61 E-04	0.09	0.00	0.00	E
Crankcase	4.85 E-03	0.69	4.41 E-05	0.01	E
Refueling	1.08 E-03	0.15	0.00	0.00	E

[a] References 2,5-6,9-14. When necessary, an average brake-specific fuel consumption (BSFC) of 7,000 Btu/hp-hr was used to convert from lb/MMBtu to lb/hp-hr. To convert from lb/hp-hr to kg/kw-hr, multiply by 0.608. To convert from lb/MMBtu to ng/J, multiply by 430. SCC = Source Classification Code. TOC = total organic compounds.

[b] PM-10 = particulate matter less than or equal to 10 µm aerodynamic diameter. All particulate is assumed to be ≤ 1 µm in size.

[c] Assumes 99% conversion of carbon in fuel to CO_2 with 87 weight % carbon in diesel, 86 weight % carbon in gasoline, average BSFC of 7,000 Btu/hp-hr, diesel heating value of 19,300 Btu/lb, and gasoline heating value of 20,300 Btu/lb.

Table 3.3-2. SPECIATED ORGANIC COMPOUND EMISSION FACTORS FOR UNCONTROLLED DIESEL ENGINES[a]

EMISSION FACTOR RATING: E

Pollutant	Emission Factor (Fuel Input) (lb/MMBtu)
Benzene[b]	9.33 E-04
Toluene[b]	4.09 E-04
Xylenes[b]	2.85 E-04
Propylene	2.58 E-03
1,3-Butadiene[b,c]	<3.91 E-05
Formaldehyde[b]	1.18 E-03
Acetaldehyde[b]	7.67 E-04
Acrolein[b]	<9.25 E-05
Polycyclic aromatic hydrocarbons (PAH)	
Naphthalene[b]	8.48 E-05
Acenaphthylene	<5.06 E-06
Acenaphthene	<1.42 E-06
Fluorene	2.92 E-05
Phenanthrene	2.94 E-05
Anthracene	1.87 E-06
Fluoranthene	7.61 E-06
Pyrene	4.78 E-06
Benzo(a)anthracene	1.68 E-06
Chrysene	3.53 E-07
Benzo(b)fluoranthene	<9.91 E-08
Benzo(k)fluoranthene	<1.55 E-07
Benzo(a)pyrene	<1.88 E-07
Indeno(1,2,3-cd)pyrene	<3.75 E-07
Dibenz(a,h)anthracene	<5.83 E-07
Benzo(g,h,l)perylene	<4.89 E-07
TOTAL PAH	1.68 E-04

[a] Based on the uncontrolled levels of 2 diesel engines from References 6-7. Source Classification Codes 2-02-001-02, 2-03-001-01. To convert from lb/MMBtu to ng/J, multiply by 430.
[b] Hazardous air pollutant listed in the *Clean Air Act*.
[c] Based on data from 1 engine.

Table 3.3-3. EFFECT OF VARIOUS EMISSION CONTROL TECHNOLOGIES ON DIESEL ENGINES[a]

Technology	Affected Parameter	
	Increase	Decrease
Fuel modifications		
Sulfur content increase	PM, wear	
Aromatic content increase	PM, NO_x	
Cetane number		PM, NO_x
10% and 90% boiling point		PM
Fuel additives		PM, NO_x
Water/Fuel emulsions		NO_x
Engine modifications		
Injection timing retard	PM, BSFC	NO_x, power
Fuel injection pressure	PM, NO_x	
Injection rate control		NO_x, PM
Rapid spill nozzles		PM
Electronic timing & metering		NO_x, PM
Injector nozzle geometry		PM
Combustion chamber modifications		NO_x, PM
Turbocharging	PM, power	NO_x
Charge cooling		NO_x
Exhaust gas recirculation	PM, power, wear	NO_x
Oil consumption control		PM, wear
Exhaust after-treatment		
Particulate traps		PM
Selective catalytic reduction		NO_x
Oxidation catalysts		TOC, CO, PM

[a] Reference 8. PM = particulate matter. BSFC = brake-specific fuel consumption.

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APPENDIX Q-2

DEATILED EMISSION CALCULATIONS FOR THE
2005 BASELINE YEAR AND PROJECT YEARS 2010-2016

Summary of Emissions from Miscellaneous Gasoline-Fueled Equipment
Dolores and ICTF Rail Yards, Long Beach, CA

Yard	Location	Equipment Type	Make/Model	Fuel Type	Rating (hp)	Hours of Operation (hr/yr)[1]	Fuel Use (gal/yr)[2]	Carbon Oxidation Factor[3]	2005 Emission Factors (g/hp-hr)[4] VOC	CO	NOx	PM10	SOx	(kg/gal)[3] CO2	N2O[5]	CH4[5]	2005 Emission Estimates (tons/yr) ROG	CO	NOx	PM10	SOx	(metric tons/yr) CO2	N2O	CH4
ICTF	WEBCO Area	Welder	Miller Power Arc 4000	Gasoline	8	1000	456.41	99%	9.79	199.13	4.99	0.33	0.27	8.87	1.60E-04	1.23E-05	0.09	1.76	0.04	0.00	0.00	4.01	7.28E-05	5.60E-06
ICTF	Mechanical Department	Welder	Miller Blue Stars 6000	Gasoline	13	1000	741.66	99%	9.79	199.13	4.99	0.33	0.27	8.87	1.60E-04	1.23E-05	0.14	2.85	0.07	0.00	0.00	6.51	1.18E-04	9.10E-06
ICTF	Mechanical Department	Welder	Miller Blue Stars 180	Gasoline	12.5	1000	713.14	99%	9.79	199.13	4.99	0.33	0.27	8.87	1.60E-04	1.23E-05	0.13	2.74	0.07	0.00	0.00	6.26	1.14E-04	8.75E-06
ICTF	Mechanical Department	Welder	Miller Bobcat	Gasoline	18	1000	1026.92	99%	9.79	199.13	4.99	0.33	0.27	8.87	1.60E-04	1.23E-05	0.19	3.95	0.10	0.01	0.01	9.02	1.64E-04	1.26E-05
ICTF	Crane Maintenance	Welder	Contractor Owned	Gasoline	20	1000	1141.02	99%	9.79	199.13	4.99	0.33	0.27	8.87	1.60E-04	1.23E-05	0.22	4.39	0.11	0.01	0.01	10.02	1.82E-04	1.40E-05
ICTF	Crane Maintenance Area	Pressure Washer	Vanguard Model 350447	Gasoline	18	1000	1026.92	99%	9.79	199.13	4.99	0.33	0.27	8.87	1.60E-04	1.23E-05	0.19	3.95	0.10	0.01	0.01	9.02	1.64E-04	1.26E-05
ICTF	WEBCO Area	Air Compressor	Honda	Gasoline	5.5	1000	313.78	99%	9.79	199.13	4.99	0.33	0.27	8.87	1.60E-04	1.23E-05	0.06	1.21	0.03	0.00	0.00	2.76	5.01E-05	3.85E-06
ICTF	Mechanical Department	Air Compressor	Ingersoll-Rand	Gasoline	30	1000	1711.53	99%	9.79	199.13	4.99	0.33	0.27	8.87	1.60E-04	1.23E-05	0.32	6.59	0.17	0.01	0.01	15.03	2.73E-04	2.10E-05
ICTF	Crane Maintenance Area	Generator		Gasoline	50	1000	2852.56	99%	9.79	199.13	4.99	0.33	0.27	8.87	1.60E-04	1.23E-05	0.54	10.98	0.28	0.02	0.01	25.05	4.55E-04	3.50E-05
Total																	**1.89**	**38.41**	**0.96**	**0.06**	**0.05**	**87.67**	**1.59E-03**	**1.23E-04**

Notes:
1. Hours of operation are an engineering estimate.
2. Based on a BSFC of 7,000 Btu/hp-hr (from AP-42) and a gasoline HHV of of 122,697 Btu/gal (from Transportation Energy Data Book, Edition 26, US DOE, 2007).
3. From the Air Resources Board's Draft *Emission Factors for Mandatory Reporting Programs*, August 10, 2007.
4. Emission factors, in lb/hp-hr, from AP-42, Table 3.3-1, 10/96.
5. Based on a gasoline HHV of 122,697 Btu/gal (from Transportation Energy Data Book, Edition 26, US DOE, 2007).

Summary of Emissions from Miscellaneous Gasoline-Fueled Equipment
Dolores and ICTF Rail Yards, Long Beach, CA

						Hours of		Carbon	2010 Emission Factors								2010 Emission Estimates							
		Equipment			Rating	Operation	Fuel Use	Oxidation	(g/hp-hr)[4]					(kg/gal)[3]			(tons/yr)					(metric tons/yr)		
Yard	Location	Type	Make/Model	Fuel Type	(hp)	(hr/yr)[1]	(gal/yr)[2]	Factor[3]	VOC	CO	NOx	PM10	SOx	CO2	N2O[5]	CH4[5]	ROG	CO	NOx	PM10	SOx	CO2	N2O	CH4
ICTF	WEBCO Area	Welder	Miller Power Arc 4000	Gasoline	8	1000	456.41	99%	9.79	199.13	4.99	0.33	0.27	8.87	1.60E-04	1.23E-05	0.09	1.76	0.04	0.00	0.00	4.01	7.28E-05	5.60E-06
ICTF	Mechanical Department	Welder	Miller Blue Stars 6000	Gasoline	13	1000	741.66	99%	9.79	199.13	4.99	0.33	0.27	8.87	1.60E-04	1.23E-05	0.14	2.85	0.07	0.00	0.00	6.51	1.18E-04	9.10E-06
ICTF	Mechanical Department	Welder	Miller Blue Stars 180	Gasoline	12.5	1000	713.14	99%	9.79	199.13	4.99	0.33	0.27	8.87	1.60E-04	1.23E-05	0.13	2.74	0.07	0.00	0.00	6.26	1.14E-04	8.75E-06
ICTF	Mechanical Department	Welder	Miller Bobcat	Gasoline	18	1000	1026.92	99%	9.79	199.13	4.99	0.33	0.27	8.87	1.60E-04	1.23E-05	0.19	3.95	0.10	0.01	0.01	9.02	1.64E-04	1.26E-05
ICTF	Crane Maintenance	Welder	Contractor Owned	Gasoline	20	1000	1141.02	99%	9.79	199.13	4.99	0.33	0.27	8.87	1.60E-04	1.23E-05	0.22	4.39	0.11	0.01	0.01	10.02	1.82E-04	1.40E-05
ICTF	Crane Maintenance Area	Pressure Washer	Vanguard Model 350447	Gasoline	18	1000	1026.92	99%	9.79	199.13	4.99	0.33	0.27	8.87	1.60E-04	1.23E-05	0.19	3.95	0.10	0.01	0.01	9.02	1.64E-04	1.26E-05
ICTF	WEBCO Area	Air Compressor	Honda	Gasoline	5.5	1000	313.78	99%	9.79	199.13	4.99	0.33	0.27	8.87	1.60E-04	1.23E-05	0.06	1.21	0.03	0.00	0.00	2.76	5.01E-05	3.85E-06
ICTF	Mechanical Department	Air Compressor	Ingersoll-Rand	Gasoline	30	1000	1711.53	99%	9.79	199.13	4.99	0.33	0.27	8.87	1.60E-04	1.23E-05	0.32	6.59	0.17	0.01	0.01	15.03	2.73E-04	2.10E-05
ICTF	Crane Maintenance Area	Generator		Gasoline	49	1000	2795.50	99%	9.79	199.13	4.99	0.33	0.27	8.87	1.60E-04	1.23E-05	0.53	10.76	0.27	0.02	0.01	24.55	4.46E-04	3.43E-05
Total																	**1.88**	**38.19**	**0.96**	**0.06**	**0.05**	**87.17**	**1.58E-03**	**1.22E-04**

Notes:
1. Hours of operation are an engineering estimate.
2. Based on a BSFC of 7,000 Btu/hp-hr (from AP-42) and a gasoline HHV of 122,697 Btu/gal (from Transportation Energy Data Book, Edition 26, US DOE, 2007).
3. From the Air Resources Board's Draf *Emission Factors for Mandatory Reporting Programs,* August 10, 2007.
4. Emission factors, in lb/hp-hr, from AP-42, Table 3.3-1, 10/96.
5. Based on a gasoline HHV of 122,697 Btu/gal (from Transportation Energy Data Book, Edition 26, US DOE, 2007).

Summary of Emissions from Miscellaneous Gasoline-Fueled Equipment
Dolores and ICTF Rail Yards, Long Beach, CA

									2012 Emission Factors								2012 Emission Estimates							
						Hours of		Carbon	(g/hp-hr)[4]					(kg/gal)[3]			(tons/yr)					(metric tons/yr)		
Yard	Location	Equipment Type	Make/Model	Fuel Type	Rating (hp)	Operation (hr/yr)[1]	Fuel Use (gal/yr)[2]	Oxidation Factor[3]	VOC	CO	NOx	PM10	SOx	CO2	N2O[5]	CH4[5]	ROG	CO	NOx	PM10	SOx	CO2	N2O	CH4
ICTF	WEBCO Area	Welder	Miller Power Arc 4000	Gasoline	8	1000	456.41	99%	9.79	199.13	4.99	0.33	0.27	8.87	1.60E-04	1.23E-05	0.09	1.76	0.04	0.00	0.00	4.01	7.28E-05	5.60E-06
ICTF	Mechanical Department	Welder	Miller Blue Stars 6000	Gasoline	13	1000	741.66	99%	9.79	199.13	4.99	0.33	0.27	8.87	1.60E-04	1.23E-05	0.14	2.85	0.07	0.00	0.00	6.51	1.18E-04	9.10E-06
ICTF	Mechanical Department	Welder	Miller Blue Stars 180	Gasoline	12.5	1000	713.14	99%	9.79	199.13	4.99	0.33	0.27	8.87	1.60E-04	1.23E-05	0.13	2.74	0.07	0.00	0.00	6.26	1.14E-04	8.75E-06
ICTF	Mechanical Department	Welder	Miller Bobcat	Gasoline	18	1000	1026.92	99%	9.79	199.13	4.99	0.33	0.27	8.87	1.60E-04	1.23E-05	0.19	3.95	0.10	0.01	0.01	9.02	1.64E-04	1.26E-05
ICTF	Crane Maintenance	Welder	Contractor Owned	Gasoline	20	1000	1141.02	99%	9.79	199.13	4.99	0.33	0.27	8.87	1.60E-04	1.23E-05	0.22	4.39	0.11	0.01	0.01	10.02	1.82E-04	1.40E-05
ICTF	Crane Maintenance Area	Pressure Washer	Vanguard Model 350447	Gasoline	18	1000	1026.92	99%	9.79	199.13	4.99	0.33	0.27	8.87	1.60E-04	1.23E-05	0.19	3.95	0.10	0.01	0.01	9.02	1.64E-04	1.26E-05
ICTF	WEBCO Area	Air Compressor	Honda	Gasoline	5.5	1000	313.78	99%	9.79	199.13	4.99	0.33	0.27	8.87	1.60E-04	1.23E-05	0.06	1.21	0.03	0.00	0.00	2.76	5.01E-05	3.85E-06
ICTF	Mechanical Department	Air Compressor	Ingersoll-Rand	Gasoline	30	1000	1711.53	99%	9.79	199.13	4.99	0.33	0.27	8.87	1.60E-04	1.23E-05	0.32	6.59	0.17	0.01	0.01	15.03	2.73E-04	2.10E-05
ICTF	Crane Maintenance Area	Generator		Gasoline	49	1000	2795.50	99%	9.79	199.13	4.99	0.33	0.27	8.87	1.60E-04	1.23E-05	0.53	10.76	0.27	0.02	0.01	24.55	4.46E-04	3.43E-05
Total																	**1.88**	**38.19**	**0.96**	**0.06**	**0.05**	**87.17**	**1.58E-03**	**1.22E-04**

Notes:
1. Hours of operation are an engineering estimate. Assumed no change from the baseline year.
2. Based on a BSFC of 7,000 Btu/hp-hr (from AP-42) and a gasoline HHV of 122,697 Btu/gal (from Transportation Energy Data Book, Edition 26, US DOE, 2007).
3. From the Air Resources Board's Draf *Emission Factors for Mandatory Reporting Programs*, August 10, 2007.
4. Emission factors, in lb/hp-hr, from AP-42, Table 3.3-1, 10/96.
5. Based on a gasoline HHV of 122,697 Btu/gal (from Transportation Energy Data Book, Edition 26, US DOE, 2007).

Summary of Emissions from Miscellaneous Gasoline-Fueled Equipment
Dolores and ICTF Rail Yards, Long Beach, CA

						Hours of		Carbon	2014 Emission Factors								2014 Emission Estimates							
		Equipment			Rating	Operation	Fuel Use	Oxidation	(g/hp-hr)[4]					(kg/gal)[3]			(tons/yr)					(metric tons/yr)		
Yard	Location	Type	Make/Model	Fuel Type	(hp)	(hr/yr)[1]	(gal/yr)[2]	Factor[3]	VOC	CO	NOx	PM10	SOx	CO2	N2O[5]	CH4[5]	ROG	CO	NOx	PM10	SOx	CO2	N2O	CH4
ICTF	WEBCO Area	Welder	Miller Power Arc 4000	Gasoline	8	1000	456.41	99%	9.79	199.13	4.99	0.33	0.27	8.87	1.60E-04	1.23E-05	0.09	1.76	0.04	0.00	0.00	4.01	7.28E-05	5.60E-06
ICTF	Mechanical Department	Welder	Miller Blue Stars 6000	Gasoline	13	1000	741.66	99%	9.79	199.13	4.99	0.33	0.27	8.87	1.60E-04	1.23E-05	0.14	2.85	0.07	0.00	0.00	6.51	1.18E-04	9.10E-06
ICTF	Mechanical Department	Welder	Miller Blue Stars 180	Gasoline	12.5	1000	713.14	99%	9.79	199.13	4.99	0.33	0.27	8.87	1.60E-04	1.23E-05	0.13	2.74	0.07	0.00	0.00	6.26	1.14E-04	8.75E-06
ICTF	Mechanical Department	Welder	Miller Bobcat	Gasoline	18	1000	1026.92	99%	9.79	199.13	4.99	0.33	0.27	8.87	1.60E-04	1.23E-05	0.19	3.95	0.10	0.01	0.01	9.02	1.64E-04	1.26E-05
ICTF	Crane Maintenance	Welder	Contractor Owned	Gasoline	20	1000	1141.02	99%	9.79	199.13	4.99	0.33	0.27	8.87	1.60E-04	1.23E-05	0.22	4.39	0.11	0.01	0.01	10.02	1.82E-04	1.40E-05
ICTF	Crane Maintenance Area	Pressure Washer	Vanguard Model 350447	Gasoline	18	1000	1026.92	99%	9.79	199.13	4.99	0.33	0.27	8.87	1.60E-04	1.23E-05	0.19	3.95	0.10	0.01	0.01	9.02	1.64E-04	1.26E-05
ICTF	WEBCO Area	Air Compressor	Honda	Gasoline	5.5	1000	313.78	99%	9.79	199.13	4.99	0.33	0.27	8.87	1.60E-04	1.23E-05	0.06	1.21	0.03	0.00	0.00	2.76	5.01E-05	3.85E-06
ICTF	Mechanical Department	Air Compressor	Ingersoll-Rand	Gasoline	30	1000	1711.53	99%	9.79	199.13	4.99	0.33	0.27	8.87	1.60E-04	1.23E-05	0.32	6.59	0.17	0.01	0.01	15.03	2.73E-04	2.10E-05
ICTF	Crane Maintenance Area	Generator		Gasoline	49	1000	2795.50	99%	9.79	199.13	4.99	0.33	0.27	8.87	1.60E-04	1.23E-05	0.53	10.76	0.27	0.02	0.01	24.55	4.46E-04	3.43E-05
Total																	**1.88**	**38.19**	**0.96**	**0.06**	**0.05**	**87.17**	**1.58E-03**	**1.22E-04**

Notes:
1. Hours of operation are an engineering estimate. Assumed no change from the baseline year.
2. Based on a BSFC of 7,000 Btu/hp-hr (from AP-42) and a gasoline HHV of 122,697 Btu/gal (from Transportation Energy Data Book, Edition 26, US DOE, 2007).
3. From the Air Resources Board's Draf *Emission Factors for Mandatory Reporting Programs,* August 10, 2007.
4. Emission factors, in lb/hp-hr, from AP-42, Table 3.3-1, 10/96.
5. Based on a gasoline HHV of 122,697 Btu/gal (from Transportation Energy Data Book, Edition 26, US DOE, 2007).

Summary of Emissions from Miscellaneous Gasoline-Fueled Equipment
Dolores and ICTF Rail Yards, Long Beach, CA

						Hours of		Carbon	2016 Emission Factors								2016 Emission Estimates							
		Equipment			Rating	Operation	Fuel Use	Oxidation	(g/hp-hr)[4]					(kg/gal)[3]			(tons/yr)					(metric tons/yr)		
Yard	Location	Type	Make/Model	Fuel Type	(hp)	(hr/yr)[1]	(gal/yr)[2]	Factor[3]	VOC	CO	NOx	PM10	SOx	CO2	N2O[5]	CH4[5]	ROG	CO	NOx	PM10	SOx	CO2	N2O	CH4
ICTF	WEBCO Area	Welder	Miller Power Arc 4000	Gasoline	8	1000	456.41	99%	9.79	199.13	4.99	0.33	0.27	8.87	1.60E-04	1.23E-05	0.09	1.76	0.04	0.00	0.00	4.01	7.28E-05	5.60E-06
ICTF	Mechanical Department	Welder	Miller Blue Stars 6000	Gasoline	13	1000	741.66	99%	9.79	199.13	4.99	0.33	0.27	8.87	1.60E-04	1.23E-05	0.14	2.85	0.07	0.00	0.00	6.51	1.18E-04	9.10E-06
ICTF	Mechanical Department	Welder	Miller Blue Stars 180	Gasoline	12.5	1000	713.14	99%	9.79	199.13	4.99	0.33	0.27	8.87	1.60E-04	1.23E-05	0.13	2.74	0.07	0.00	0.00	6.26	1.14E-04	8.75E-06
ICTF	Mechanical Department	Welder	Miller Bobcat	Gasoline	18	1000	1026.92	99%	9.79	199.13	4.99	0.33	0.27	8.87	1.60E-04	1.23E-05	0.19	3.95	0.10	0.01	0.01	9.02	1.64E-04	1.26E-05
ICTF	Crane Maintenance	Welder	Contractor Owned	Gasoline	20	1000	1141.02	99%	9.79	199.13	4.99	0.33	0.27	8.87	1.60E-04	1.23E-05	0.22	4.39	0.11	0.01	0.01	10.02	1.82E-04	1.40E-05
ICTF	Crane Maintenance Area	Pressure Washer	Vanguard Model 350447	Gasoline	18	1000	1026.92	99%	9.79	199.13	4.99	0.33	0.27	8.87	1.60E-04	1.23E-05	0.19	3.95	0.10	0.01	0.01	9.02	1.64E-04	1.26E-05
ICTF	WEBCO Area	Air Compressor	Honda	Gasoline	5.5	1000	313.78	99%	9.79	199.13	4.99	0.33	0.27	8.87	1.60E-04	1.23E-05	0.06	1.21	0.03	0.00	0.00	2.76	5.01E-05	3.85E-06
ICTF	Mechanical Department	Air Compressor	Ingersoll-Rand	Gasoline	30	1000	1711.53	99%	9.79	199.13	4.99	0.33	0.27	8.87	1.60E-04	1.23E-05	0.32	6.59	0.17	0.01	0.01	15.03	2.73E-04	2.10E-05
ICTF	Crane Maintenance Area	Generator		Gasoline	49	1000	2795.50	99%	9.79	199.13	4.99	0.33	0.27	8.87	1.60E-04	1.23E-05	0.53	10.76	0.27	0.02	0.01	24.55	4.46E-04	3.43E-05
Total																	**1.88**	**38.19**	**0.96**	**0.06**	**0.05**	**87.17**	**1.58E-03**	**1.22E-04**

Notes:
1. Hours of operation are an engineering estimate. Assumed no change from the baseline year.
2. Based on a BSFC of 7,000 Btu/hp-hr (from AP-42) and a gasoline HHV of 122,697 Btu/gal (from Transportation Energy Data Book, Edition 26, US DOE, 2007).
3. From the Air Resources Board's Draf *Emission Factors for Mandatory Reporting Programs,* August 10, 2007.
4. Emission factors, in lb/hp-hr, from AP-42, Table 3.3-1, 10/96.
5. Based on a gasoline HHV of 122,697 Btu/gal (from Transportation Energy Data Book, Edition 26, US DOE, 2007).

APPENDIX Q-3

SPECIATION PROFILE FOR GASOLINE-FUELED EQUIPMENT

Toxic Air Contaminant Emissions from Miscellaneous Gasoline-Fueled Equipment
Dolores and ICTF Rail Yards, Long Beach, CA

			Organic	2005 Emission Estimates (tpy)									
Profile[1]	CAS	Chemical Name	Fraction	Welder - WEBCO	Welder-Mech.	Welder-Mech.	Welder-Mech.	Welder-Cr. Maint.	Pressure Washer	Air Comp. - WEBCO	Air Comp - Mech.	Generator	Total
665	95636	1,2,4-trimethylbenzene	0.0140	1.21E-03	1.97E-03	1.89E-03	2.73E-03	3.03E-03	2.73E-03	8.33E-04	4.55E-03	7.58E-03	2.65E-02
665	106990	1,3-butadiene	0.0091	7.82E-04	1.27E-03	1.22E-03	1.76E-03	1.96E-03	1.76E-03	5.38E-04	2.93E-03	4.89E-03	1.71E-02
665	540841	2,2,4-trimethylpentane	0.0222	1.91E-03	3.11E-03	2.99E-03	4.31E-03	4.79E-03	4.31E-03	1.32E-03	7.18E-03	1.20E-02	4.19E-02
665	75070	acetaldehyde	0.0106	9.16E-04	1.49E-03	1.43E-03	2.06E-03	2.29E-03	2.06E-03	6.30E-04	3.44E-03	5.73E-03	2.00E-02
665	107028	acrolein (2-propenal)	0.0020	1.73E-04	2.81E-04	2.70E-04	3.89E-04	4.32E-04	3.89E-04	1.19E-04	6.48E-04	1.08E-03	3.78E-03
665	71432	benzene	0.0368	3.18E-03	5.16E-03	4.96E-03	7.15E-03	7.94E-03	7.15E-03	2.18E-03	1.19E-02	1.99E-02	6.95E-02
665	4170303	crotonaldehyde	0.0014	1.25E-04	2.03E-04	1.95E-04	2.81E-04	3.12E-04	2.81E-04	8.59E-05	4.68E-04	7.80E-04	2.73E-03
665	110827	cyclohexane	0.0050	4.33E-04	7.03E-04	6.76E-04	9.74E-04	1.08E-03	9.74E-04	2.98E-04	1.62E-03	2.71E-03	9.47E-03
665	100414	ethylbenzene	0.0167	1.44E-03	2.35E-03	2.25E-03	3.25E-03	3.61E-03	3.25E-03	9.92E-04	5.41E-03	9.02E-03	3.16E-02
665	74851	ethylene	0.0996	8.60E-03	1.40E-02	1.34E-02	1.94E-02	2.15E-02	1.94E-02	5.91E-03	3.23E-02	5.38E-02	1.88E-01
665	50000	formaldehyde	0.0327	2.82E-03	4.58E-03	4.41E-03	6.35E-03	7.05E-03	6.35E-03	1.94E-03	1.06E-02	1.76E-02	6.17E-02
665	78795	isoprene	0.0016	1.34E-04	2.18E-04	2.10E-04	3.02E-04	3.36E-04	3.02E-04	9.23E-05	5.04E-04	8.39E-04	2.94E-03
665	98828	isopropylbenzene (cumene)	0.0006	4.79E-05	7.78E-05	7.48E-05	1.08E-04	1.20E-04	1.08E-04	3.29E-05	1.80E-04	2.99E-04	1.05E-03
665	67561	methyl alcohol	0.0038	3.30E-04	5.36E-04	5.15E-04	7.42E-04	8.24E-04	7.42E-04	2.27E-04	1.24E-03	2.06E-03	7.21E-03
665	78933	methyl ethyl ketone (mek) (2-butanone)	0.0007	5.73E-05	9.31E-05	8.95E-05	1.29E-04	1.43E-04	1.29E-04	3.94E-05	2.15E-04	3.58E-04	1.25E-03
665	108383	m-xylene	0.0496	4.28E-03	6.96E-03	6.69E-03	9.63E-03	1.07E-02	9.63E-03	2.94E-03	1.61E-02	2.68E-02	9.37E-02
665	91203	naphthalene	0.0014	1.25E-04	2.03E-04	1.95E-04	2.81E-04	3.12E-04	2.81E-04	8.59E-05	4.68E-04	7.80E-04	2.73E-03
665	110543	n-hexane	0.0146	1.26E-03	2.05E-03	1.97E-03	2.84E-03	3.15E-03	2.84E-03	8.66E-04	4.73E-03	7.88E-03	2.76E-02
665	95476	o-xylene	0.0173	1.49E-03	2.42E-03	2.33E-03	3.35E-03	3.73E-03	3.35E-03	1.03E-03	5.59E-03	9.32E-03	3.26E-02
665	115071	propylene	0.0546	4.71E-03	7.66E-03	7.37E-03	1.06E-02	1.18E-02	1.06E-02	3.24E-03	1.77E-02	2.95E-02	1.03E-01
665	100425	styrene	0.0014	1.25E-04	2.03E-04	1.95E-04	2.81E-04	3.12E-04	2.81E-04	8.59E-05	4.68E-04	7.80E-04	2.73E-03
665	108883	toluene	0.0756	6.53E-03	1.06E-02	1.02E-02	1.47E-02	1.63E-02	1.47E-02	4.49E-03	2.45E-02	4.08E-02	1.43E-01
Total				**4.07E-02**	**6.61E-02**	**6.36E-02**	**9.16E-02**	**1.02E-01**	**9.16E-02**	**2.80E-02**	**1.53E-01**	**2.54E-01**	**8.90E-01**

Notes:

1. Organic fraction from ARBs SPECIATE database. Data is from "Non-cat stabilized exhaust 1996 SSD 2.0% etoh (MTBE phaseout)" option.
2. Emissions were calculated for only chemicals that were in both the SPECIATE database and the AB2588 list.
3. Organic fraction reported on a ROG basis using ARB's Speciate ROG/TOG ratio (0.9198).

Toxic Air Contaminant Emissions from Miscellaneous Gasoline-Fueled Equipment
Dolores and ICTF Rail Yards, Long Beach, CA

Profile[1]	CAS	Chemical Name	Organic Fraction	2010 Emission Estimates (tpy)									
				Welder - WEBCO	Welder-Mech.	Welder-Mech.	Welder-Mech.	Welder-Cr. Maint.	Pressure Washer	Air Comp. - WEBCO	Air Comp - Mech.	Generator	Total
665	95636	1,2,4-trimethylbenzene	0.0140	1.21E-03	1.97E-03	1.89E-03	2.73E-03	3.03E-03	2.73E-03	8.33E-04	4.55E-03	7.42E-03	**2.64E-02**
665	106990	1,3-butadiene	0.0091	7.82E-04	1.27E-03	1.22E-03	1.76E-03	1.96E-03	1.76E-03	5.38E-04	2.93E-03	4.79E-03	**1.70E-02**
665	540841	2,2,4-trimethylpentane	0.0222	1.91E-03	3.11E-03	2.99E-03	4.31E-03	4.79E-03	4.31E-03	1.32E-03	7.18E-03	1.17E-02	**4.16E-02**
665	75070	acetaldehyde	0.0106	9.16E-04	1.49E-03	1.43E-03	2.06E-03	2.29E-03	2.06E-03	6.30E-04	3.44E-03	5.61E-03	**1.99E-02**
665	107028	acrolein (2-propenal)	0.0020	1.73E-04	2.81E-04	2.70E-04	3.89E-04	4.32E-04	3.89E-04	1.19E-04	6.48E-04	1.06E-03	**3.76E-03**
665	71432	benzene	0.0368	3.18E-03	5.16E-03	4.96E-03	7.15E-03	7.94E-03	7.15E-03	2.18E-03	1.19E-02	1.95E-02	**6.91E-02**
665	4170303	crotonaldehyde	0.0014	1.25E-04	2.03E-04	1.95E-04	2.81E-04	3.12E-04	2.81E-04	8.59E-05	4.68E-04	7.65E-04	**2.72E-03**
665	110827	cyclohexane	0.0050	4.33E-04	7.03E-04	6.76E-04	9.74E-04	1.08E-03	9.74E-04	2.98E-04	1.62E-03	2.65E-03	**9.41E-03**
665	100414	ethylbenzene	0.0167	1.44E-03	2.35E-03	2.25E-03	3.25E-03	3.61E-03	3.25E-03	9.92E-04	5.41E-03	8.84E-03	**3.14E-02**
665	74851	ethylene	0.0996	8.60E-03	1.40E-02	1.34E-02	1.94E-02	2.15E-02	1.94E-02	5.91E-03	3.23E-02	5.27E-02	**1.87E-01**
665	50000	formaldehyde	0.0327	2.82E-03	4.58E-03	4.41E-03	6.35E-03	7.05E-03	6.35E-03	1.94E-03	1.06E-02	1.73E-02	**6.14E-02**
665	78795	isoprene	0.0016	1.34E-04	2.18E-04	2.10E-04	3.02E-04	3.36E-04	3.02E-04	9.23E-05	5.04E-04	8.22E-04	**2.92E-03**
665	98828	isopropylbenzene (cumene)	0.0006	4.79E-05	7.78E-05	7.48E-05	1.08E-04	1.20E-04	1.08E-04	3.29E-05	1.80E-04	2.93E-04	**1.04E-03**
665	67561	methyl alcohol	0.0038	3.30E-04	5.36E-04	5.15E-04	7.42E-04	8.24E-04	7.42E-04	2.27E-04	1.24E-03	2.02E-03	**7.17E-03**
665	78933	methyl ethyl ketone (mek) (2-butanone)	0.0007	5.73E-05	9.31E-05	8.95E-05	1.29E-04	1.43E-04	1.29E-04	3.94E-05	2.15E-04	3.51E-04	**1.25E-03**
665	108383	m-xylene	0.0496	4.28E-03	6.96E-03	6.69E-03	9.63E-03	1.07E-02	9.63E-03	2.94E-03	1.61E-02	2.62E-02	**9.31E-02**
665	91203	naphthalene	0.0014	1.25E-04	2.03E-04	1.95E-04	2.81E-04	3.12E-04	2.81E-04	8.59E-05	4.68E-04	7.65E-04	**2.72E-03**
665	110543	n-hexane	0.0146	1.26E-03	2.05E-03	1.97E-03	2.84E-03	3.15E-03	2.84E-03	8.66E-04	4.73E-03	7.72E-03	**2.74E-02**
665	95476	o-xylene	0.0173	1.49E-03	2.42E-03	2.33E-03	3.35E-03	3.73E-03	3.35E-03	1.03E-03	5.59E-03	9.13E-03	**3.24E-02**
665	115071	propylene	0.0546	4.71E-03	7.66E-03	7.37E-03	1.06E-02	1.18E-02	1.06E-02	3.24E-03	1.77E-02	2.89E-02	**1.03E-01**
665	100425	styrene	0.0014	1.25E-04	2.03E-04	1.95E-04	2.81E-04	3.12E-04	2.81E-04	8.59E-05	4.68E-04	7.65E-04	**2.72E-03**
665	108883	toluene	0.0756	6.53E-03	1.06E-02	1.02E-02	1.47E-02	1.63E-02	1.47E-02	4.49E-03	2.45E-02	4.00E-02	**1.42E-01**
Total				**4.07E-02**	**6.61E-02**	**6.36E-02**	**9.16E-02**	**1.02E-01**	**9.16E-02**	**2.80E-02**	**1.53E-01**	**2.49E-01**	**8.85E-01**

Notes:
1. Organic fraction from ARBs SPECIATE database. Data is from
"Non-cat stabilized exhaust 1996 SSD 2.0% etoh (MTBE phaseout)" option.
2. Emissions were calculated for only chemicals that were in both the SPECIATE
database and the AB2588 list.
3. Organic fraction reported on a ROG basis using ARB's Speciate ROG/TOG ratio (0.9198).

Toxic Air Contaminant Emissions from Miscellaneous Gasoline-Fueled Equipment
Dolores and ICTF Rail Yards, Long Beach, CA

			Organic	2012 Emissions (tpy)									
Profile[1]	CAS	Chemical Name	Fraction	Welder - WEBCO	Welder-Mech.	Welder-Mech.	Welder-Mech.	Welder-Cr. Maint.	Pressure Washer	Air Comp. - WEBCO	Air Comp - Mech.	Generator	Total
665	95636	1,2,4-trimethylbenzene	0.0140	1.21E-03	1.97E-03	1.89E-03	2.73E-03	3.03E-03	2.73E-03	8.33E-04	4.55E-03	7.42E-03	2.64E-02
665	106990	1,3-butadiene	0.0091	7.82E-04	1.27E-03	1.22E-03	1.76E-03	1.96E-03	1.76E-03	5.38E-04	2.93E-03	4.79E-03	1.70E-02
665	540841	2,2,4-trimethylpentane	0.0222	1.91E-03	3.11E-03	2.99E-03	4.31E-03	4.79E-03	4.31E-03	1.32E-03	7.18E-03	1.17E-02	4.16E-02
665	75070	acetaldehyde	0.0106	9.16E-04	1.49E-03	1.43E-03	2.06E-03	2.29E-03	2.06E-03	6.30E-04	3.44E-03	5.61E-03	1.99E-02
665	107028	acrolein (2-propenal)	0.0020	1.73E-04	2.81E-04	2.70E-04	3.89E-04	4.32E-04	3.89E-04	1.19E-04	6.48E-04	1.06E-03	3.76E-03
665	71432	benzene	0.0368	3.18E-03	5.16E-03	4.96E-03	7.15E-03	7.94E-03	7.15E-03	2.18E-03	1.19E-02	1.95E-02	6.91E-02
665	4170303	crotonaldehyde	0.0014	1.25E-04	2.03E-04	1.95E-04	2.81E-04	3.12E-04	2.81E-04	8.59E-05	4.68E-04	7.65E-04	2.72E-03
665	110827	cyclohexane	0.0050	4.33E-04	7.03E-04	6.76E-04	9.74E-04	1.08E-03	9.74E-04	2.98E-04	1.62E-03	2.65E-03	9.41E-03
665	100414	ethylbenzene	0.0167	1.44E-03	2.35E-03	2.25E-03	3.25E-03	3.61E-03	3.25E-03	9.92E-04	5.41E-03	8.84E-03	3.14E-02
665	74851	ethylene	0.0996	8.60E-03	1.40E-02	1.34E-02	1.94E-02	2.15E-02	1.94E-02	5.91E-03	3.23E-02	5.27E-02	1.87E-01
665	50000	formaldehyde	0.0327	2.82E-03	4.58E-03	4.41E-03	6.35E-03	7.05E-03	6.35E-03	1.94E-03	1.06E-02	1.73E-02	6.14E-02
665	78795	isoprene	0.0016	1.34E-04	2.18E-04	2.10E-04	3.02E-04	3.36E-04	3.02E-04	9.23E-05	5.04E-04	8.22E-04	2.92E-03
665	98828	isopropylbenzene (cumene)	0.0006	4.79E-05	7.78E-05	7.48E-05	1.08E-04	1.20E-04	1.08E-04	3.29E-05	1.80E-04	2.93E-04	1.04E-03
665	67561	methyl alcohol	0.0038	3.30E-04	5.36E-04	5.15E-04	7.42E-04	8.24E-04	7.42E-04	2.27E-04	1.24E-03	2.02E-03	7.17E-03
665	78933	methyl ethyl ketone (mek) (2-butanone)	0.0007	5.73E-05	9.31E-05	8.95E-05	1.29E-04	1.43E-04	1.29E-04	3.94E-05	2.15E-04	3.51E-04	1.25E-03
665	108383	m-xylene	0.0496	4.28E-03	6.96E-03	6.69E-03	9.63E-03	1.07E-02	9.63E-03	2.94E-03	1.61E-02	2.62E-02	9.31E-02
665	91203	naphthalene	0.0014	1.25E-04	2.03E-04	1.95E-04	2.81E-04	3.12E-04	2.81E-04	8.59E-05	4.68E-04	7.65E-04	2.72E-03
665	110543	n-hexane	0.0146	1.26E-03	2.05E-03	1.97E-03	2.84E-03	3.15E-03	2.84E-03	8.66E-04	4.73E-03	7.72E-03	2.74E-02
665	95476	o-xylene	0.0173	1.49E-03	2.42E-03	2.33E-03	3.35E-03	3.73E-03	3.35E-03	1.03E-03	5.59E-03	9.13E-03	3.24E-02
665	115071	propylene	0.0546	4.71E-03	7.66E-03	7.37E-03	1.06E-02	1.18E-02	1.06E-02	3.24E-03	1.77E-02	2.89E-02	1.03E-01
665	100425	styrene	0.0014	1.25E-04	2.03E-04	1.95E-04	2.81E-04	3.12E-04	2.81E-04	8.59E-05	4.68E-04	7.65E-04	2.72E-03
665	108883	toluene	0.0756	6.53E-03	1.06E-02	1.02E-02	1.47E-02	1.63E-02	1.47E-02	4.49E-03	2.45E-02	4.00E-02	1.42E-01
Total				**4.07E-02**	**6.61E-02**	**6.36E-02**	**9.16E-02**	**1.02E-01**	**9.16E-02**	**2.80E-02**	**1.53E-01**	**2.49E-01**	**8.85E-01**

Notes:
1. Organic fraction from ARBs SPECIATE database. Data is from "Non-cat stabilized exhaust 1996 SSD 2.0% etoh (MTBE phaseout)" option.
2. Emissions were calculated for only chemicals that were in both the SPECIATE database and the AB2588 list.
3. Organic fraction reported on a ROG basis using ARB's Speciate ROG/TOG ratio (0.9198).

Toxic Air Contaminant Emissions from Miscellaneous Gasoline-Fueled Equipment
Dolores and ICTF Rail Yards, Long Beach, CA

Profile[1]	CAS	Chemical Name	Organic Fraction	2014 Emission Estimates (tpy)									
				Welder - WEBCO	Welder-Mech.	Welder-Mech.	Welder-Mech.	Welder-Cr. Maint.	Pressure Washer	Air Comp. - WEBCO	Air Comp - Mech.	Generator	Total
665	95636	1,2,4-trimethylbenzene	0.0140	1.21E-03	1.97E-03	1.89E-03	2.73E-03	3.03E-03	2.73E-03	8.33E-04	4.55E-03	7.42E-03	**2.64E-02**
665	106990	1,3-butadiene	0.0091	7.82E-04	1.27E-03	1.22E-03	1.76E-03	1.96E-03	1.76E-03	5.38E-04	2.93E-03	4.79E-03	**1.70E-02**
665	540841	2,2,4-trimethylpentane	0.0222	1.91E-03	3.11E-03	2.99E-03	4.31E-03	4.79E-03	4.31E-03	1.32E-03	7.18E-03	1.17E-02	**4.16E-02**
665	75070	acetaldehyde	0.0106	9.16E-04	1.49E-03	1.43E-03	2.06E-03	2.29E-03	2.06E-03	6.30E-04	3.44E-03	5.61E-03	**1.99E-02**
665	107028	acrolein (2-propenal)	0.0020	1.73E-04	2.81E-04	2.70E-04	3.89E-04	4.32E-04	3.89E-04	1.19E-04	6.48E-04	1.06E-03	**3.76E-03**
665	71432	benzene	0.0368	3.18E-03	5.16E-03	4.96E-03	7.15E-03	7.94E-03	7.15E-03	2.18E-03	1.19E-02	1.95E-02	**6.91E-02**
665	4170303	crotonaldehyde	0.0014	1.25E-04	2.03E-04	1.95E-04	2.81E-04	3.12E-04	2.81E-04	8.59E-05	4.68E-04	7.65E-04	**2.72E-03**
665	110827	cyclohexane	0.0050	4.33E-04	7.03E-04	6.76E-04	9.74E-04	1.08E-03	9.74E-04	2.98E-04	1.62E-03	2.65E-03	**9.41E-03**
665	100414	ethylbenzene	0.0167	1.44E-03	2.35E-03	2.25E-03	3.25E-03	3.61E-03	3.25E-03	9.92E-04	5.41E-03	8.84E-03	**3.14E-02**
665	74851	ethylene	0.0996	8.60E-03	1.40E-02	1.34E-02	1.94E-02	2.15E-02	1.94E-02	5.91E-03	3.23E-02	5.27E-02	**1.87E-01**
665	50000	formaldehyde	0.0327	2.82E-03	4.58E-03	4.41E-03	6.35E-03	7.05E-03	6.35E-03	1.94E-03	1.06E-02	1.73E-02	**6.14E-02**
665	78795	isoprene	0.0016	1.34E-04	2.18E-04	2.10E-04	3.02E-04	3.36E-04	3.02E-04	9.23E-05	5.04E-04	8.22E-04	**2.92E-03**
665	98828	isopropylbenzene (cumene)	0.0006	4.79E-05	7.78E-05	7.48E-05	1.08E-04	1.20E-04	1.08E-04	3.29E-05	1.80E-04	2.93E-04	**1.04E-03**
665	67561	methyl alcohol	0.0038	3.30E-04	5.36E-04	5.15E-04	7.42E-04	8.24E-04	7.42E-04	2.27E-04	1.24E-03	2.02E-03	**7.17E-03**
665	78933	methyl ethyl ketone (mek) (2-butanone)	0.0007	5.73E-05	9.31E-05	8.95E-05	1.29E-04	1.43E-04	1.29E-04	3.94E-05	2.15E-04	3.51E-04	**1.25E-03**
665	108383	m-xylene	0.0496	4.28E-03	6.96E-03	6.69E-03	9.63E-03	1.07E-02	9.63E-03	2.94E-03	1.61E-02	2.62E-02	**9.31E-02**
665	91203	naphthalene	0.0014	1.25E-04	2.03E-04	1.95E-04	2.81E-04	3.12E-04	2.81E-04	8.59E-05	4.68E-04	7.65E-04	**2.72E-03**
665	110543	n-hexane	0.0146	1.26E-03	2.05E-03	1.97E-03	2.84E-03	3.15E-03	2.84E-03	8.66E-04	4.73E-03	7.72E-03	**2.74E-02**
665	95476	o-xylene	0.0173	1.49E-03	2.42E-03	2.33E-03	3.35E-03	3.73E-03	3.35E-03	1.03E-03	5.59E-03	9.13E-03	**3.24E-02**
665	115071	propylene	0.0546	4.71E-03	7.66E-03	7.37E-03	1.06E-02	1.18E-02	1.06E-02	3.24E-03	1.77E-02	2.89E-02	**1.03E-01**
665	100425	styrene	0.0014	1.25E-04	2.03E-04	1.95E-04	2.81E-04	3.12E-04	2.81E-04	8.59E-05	4.68E-04	7.65E-04	**2.72E-03**
665	108883	toluene	0.0756	6.53E-03	1.06E-02	1.02E-02	1.47E-02	1.63E-02	1.47E-02	4.49E-03	2.45E-02	4.00E-02	**1.42E-01**
Total				**4.07E-02**	**6.61E-02**	**6.36E-02**	**9.16E-02**	**1.02E-01**	**9.16E-02**	**2.80E-02**	**1.53E-01**	**2.49E-01**	**8.85E-01**

Notes:
1. Organic fraction from ARBs SPECIATE database. Data is from "Non-cat stabilized exhaust 1996 SSD 2.0% etoh (MTBE phaseout)" option.
2. Emissions were calculated for only chemicals that were in both the SPECIATE database and the AB2588 list.
3. Organic fraction reported on a ROG basis using ARB's Speciate ROG/TOG ratio (0.9198).

Toxic Air Contaminant Emissions from Miscellaneous Gasoline-Fueled Equipment
Dolores and ICTF Rail Yards, Long Beach, CA

			Organic	2016 Emission Estimates (tpy)									
Profile[1]	CAS	Chemical Name	Fraction	Welder - WEBCO	Welder-Mech.	Welder-Mech.	Welder-Mech.	Welder-Cr. Maint.	Pressure Washer	Air Comp. - WEBCO	Air Comp - Mech.	Generator	Total
665	95636	1,2,4-trimethylbenzene	0.0140	1.21E-03	1.97E-03	1.89E-03	2.73E-03	3.03E-03	2.73E-03	8.33E-04	4.55E-03	7.42E-03	**2.64E-02**
665	106990	1,3-butadiene	0.0091	7.82E-04	1.27E-03	1.22E-03	1.76E-03	1.96E-03	1.76E-03	5.38E-04	2.93E-03	4.79E-03	**1.70E-02**
665	540841	2,2,4-trimethylpentane	0.0222	1.91E-03	3.11E-03	2.99E-03	4.31E-03	4.79E-03	4.31E-03	1.32E-03	7.18E-03	1.17E-02	**4.16E-02**
665	75070	acetaldehyde	0.0106	9.16E-04	1.49E-03	1.43E-03	2.06E-03	2.29E-03	2.06E-03	6.30E-04	3.44E-03	5.61E-03	**1.99E-02**
665	107028	acrolein (2-propenal)	0.0020	1.73E-04	2.81E-04	2.70E-04	3.89E-04	4.32E-04	3.89E-04	1.19E-04	6.48E-04	1.06E-03	**3.76E-03**
665	71432	benzene	0.0368	3.18E-03	5.16E-03	4.96E-03	7.15E-03	7.94E-03	7.15E-03	2.18E-03	1.19E-02	1.95E-02	**6.91E-02**
665	4170303	crotonaldehyde	0.0014	1.25E-04	2.03E-04	1.95E-04	2.81E-04	3.12E-04	2.81E-04	8.59E-05	4.68E-04	7.65E-04	**2.72E-03**
665	110827	cyclohexane	0.0050	4.33E-04	7.03E-04	6.76E-04	9.74E-04	1.08E-03	9.74E-04	2.98E-04	1.62E-03	2.65E-03	**9.41E-03**
665	100414	ethylbenzene	0.0167	1.44E-03	2.35E-03	2.25E-03	3.25E-03	3.61E-03	3.25E-03	9.92E-04	5.41E-03	8.84E-03	**3.14E-02**
665	74851	ethylene	0.0996	8.60E-03	1.40E-02	1.34E-02	1.94E-02	2.15E-02	1.94E-02	5.91E-03	3.23E-02	5.27E-02	**1.87E-01**
665	50000	formaldehyde	0.0327	2.82E-03	4.58E-03	4.41E-03	6.35E-03	7.05E-03	6.35E-03	1.94E-03	1.06E-02	1.73E-02	**6.14E-02**
665	78795	isoprene	0.0016	1.34E-04	2.18E-04	2.10E-04	3.02E-04	3.36E-04	3.02E-04	9.23E-05	5.04E-04	8.22E-04	**2.92E-03**
665	98828	isopropylbenzene (cumene)	0.0006	4.79E-05	7.78E-05	7.48E-05	1.08E-04	1.20E-04	1.08E-04	3.29E-05	1.80E-04	2.93E-04	**1.04E-03**
665	67561	methyl alcohol	0.0038	3.30E-04	5.36E-04	5.15E-04	7.42E-04	8.24E-04	7.42E-04	2.27E-04	1.24E-03	2.02E-03	**7.17E-03**
665	78933	methyl ethyl ketone (mek) (2-butanone)	0.0007	5.73E-05	9.31E-05	8.95E-05	1.29E-04	1.43E-04	1.29E-04	3.94E-05	2.15E-04	3.51E-04	**1.25E-03**
665	108383	m-xylene	0.0496	4.28E-03	6.96E-03	6.69E-03	9.63E-03	1.07E-02	9.63E-03	2.94E-03	1.61E-02	2.62E-02	**9.31E-02**
665	91203	naphthalene	0.0014	1.25E-04	2.03E-04	1.95E-04	2.81E-04	3.12E-04	2.81E-04	8.59E-05	4.68E-04	7.65E-04	**2.72E-03**
665	110543	n-hexane	0.0146	1.26E-03	2.05E-03	1.97E-03	2.84E-03	3.15E-03	2.84E-03	8.66E-04	4.73E-03	7.72E-03	**2.74E-02**
665	95476	o-xylene	0.0173	1.49E-03	2.42E-03	2.33E-03	3.35E-03	3.73E-03	3.35E-03	1.03E-03	5.59E-03	9.13E-03	**3.24E-02**
665	115071	propylene	0.0546	4.71E-03	7.66E-03	7.37E-03	1.06E-02	1.18E-02	1.06E-02	3.24E-03	1.77E-02	2.89E-02	**1.03E-01**
665	100425	styrene	0.0014	1.25E-04	2.03E-04	1.95E-04	2.81E-04	3.12E-04	2.81E-04	8.59E-05	4.68E-04	7.65E-04	**2.72E-03**
665	108883	toluene	0.0756	6.53E-03	1.06E-02	1.02E-02	1.47E-02	1.63E-02	1.47E-02	4.49E-03	2.45E-02	4.00E-02	**1.42E-01**
Total				**4.07E-02**	**6.61E-02**	**6.36E-02**	**9.16E-02**	**1.02E-01**	**9.16E-02**	**2.80E-02**	**1.53E-01**	**2.49E-01**	**8.85E-01**

Notes:
1. Organic fraction from ARBs SPECIATE database. Data is from "Non-cat stabilized exhaust 1996 SSD 2.0% etoh (MTBE phaseout)" option.
2. Emissions were calculated for only chemicals that were in both the SPECIATE database and the AB2588 list.
3. Organic fraction reported on a ROG basis using ARB's Speciate ROG/TOG ratio (0.9198).

APPENDIX R

WORKER VEHICLES

APPENDIX R-1

DEATILED EMISSION CALCULATIONS, EMISSION FACTOR DERIVATION, EMFAC2007 OUTPUT, AND SPECIATION PROFILE FOR THE 2005 BASELINE YEAR

Summary of Emissions from Worker Vehicles
Dolores and ICTF Rail Yards, Long Beach, CA

Yard	Number of Trips (trips/yr)[1,2]	VMT per Trip[3]	VMT per Year	Fuel Use (gal/yr)[4]	Carbon Oxidation Factor[5]	2005 Emission Factors (g/mi)[6] ROG	CO	NOx	PM10	SOx	(kg/gal)[5] CO2	N2O[7]	CH4[7]	2005 Emissions (tpy) ROG	CO	NOx	PM10	SOx	(metric tons/yr) CO2	N2O	CH4
Dolores-Onsite	32,850	0.5	16,425.00	857.74	99%	0.36	0.63	0.59	0.04	0.00	8.87	1.23E-05	1.60E-04	0.01	0.01	0.01	0.00	0.00	7.53	0.00	0.00
ICTF - Onsite	152,935	2.5	382,337.50	19,966.37	99%	0.36	0.63	0.59	0.04	0.00	8.87	1.23E-05	1.60E-04	0.15	0.27	0.25	0.02	0.00	175.33	0.00	0.00
Total	**185,785**		**398,762.50**											**0.16**	**0.28**	**0.26**	**0.02**	**0.00**	**182.86**	**0.00**	**0.00**

Notes:
1. Number of trips for Dolores from personal communication with M.J. Germer on August 24, 2007. Based on employee force counts, assumes no ride sharing, and assumes 365 days per year.
2. Number of trips for ICTF from personal communication with M.J. Germer on August 24, 2007. Based on employee force counts, assumes no ride sharing, and assumes 365 days per year.
3. VMT per truck trip from Trinity reports.
4. Fuel use calculated from VMT and from fuel economy based on the EMFAC 2007 model with the BURDEN output option.
5. From the Air Resources Board's Draft *Emission Factors for Mandatory Reporting Programs,* August 10, 2007.
6. Running exhaust emission factors (g/mi) from EMFAC 2007 using the BURDEN output option. The EMFAC default model year distribution for L.A. County was used.
7. Based on a gasoline HHV of 122,697 BTU/gal, assuming ethanol content of 5.7 volume % (Source: TRANSPORTATION ENERGY DATA BOOK: EDITION 26, U.S. Department of Energy, 2007).
8. Assumed no idling for worker vehicles.

Emission Factors Worker Vehicles
Dolores and ICTF Rail Yards, Long Beach, CA

2005 MY Vehicle Class Population Distribution (<5151 LBS GVWR)			
	PC	LDT1	LDT2
Population counts	3,603,550	451,168	1,420,700
Fraction of LD/MD total	0.6581	0.0824	0.2595

Vehicle Class Weighted Average Emission Factors					
Emission Category	**Units**	**PC**	**LDT1**	**LDT2**	**AVERAGE**
ROG Exhaust	g/mi	0.346	0.539	0.329	0.358
CO Exhaust	g/mi	0.633	0.862	0.562	0.634
NOX Exhaust	g/mi	0.490	0.694	0.816	0.592
PM10 Total	g/mi	0.034	0.036	0.046	0.037
SOX	g/mi	0.004	0.006	0.005	0.005
Fuel Economy	mi/gal	20.356	16.796	16.834	19.149

Notes:
1. Emission factors calculated using EMFAC 2007.

Toxic Air Contaminant Emissions from Gasoline-Fueled Worker Vehicles
Dolores and ICTF Rail Yards, Long Beach, CA

Profile[1]	CAS	Chemical Name	Organic Fraction	2005 Emissions (tpy)		
				Dolores	ICTF	Total
2105	95636	1,2,4-trimethylbenzene	0.0120	7.79E-05	1.81E-03	1.89E-03
2105	106990	1,3-butadiene	0.0068	4.41E-05	1.03E-03	1.07E-03
2105	540841	2,2,4-trimethylpentane	0.0288	1.87E-04	4.34E-03	4.53E-03
2105	75070	acetaldehyde	0.0035	2.26E-05	5.25E-04	5.48E-04
2105	107028	acrolein (2-propenal)	0.0017	1.07E-05	2.49E-04	2.60E-04
2105	71432	benzene	0.0309	2.00E-04	4.65E-03	4.85E-03
2105	4170303	crotonaldehyde	0.0004	2.34E-06	5.44E-05	5.67E-05
2105	110827	cyclohexane	0.0077	4.96E-05	1.16E-03	1.21E-03
2105	100414	ethylbenzene	0.0131	8.48E-05	1.97E-03	2.06E-03
2105	74851	ethylene	0.0794	5.14E-04	1.20E-02	1.25E-02
2105	50000	formaldehyde	0.0197	1.28E-04	2.97E-03	3.10E-03
2105	78795	isoprene	0.0018	1.14E-05	2.67E-04	2.78E-04
2105	98828	isopropylbenzene (cumene)	0.0001	7.78E-07	1.81E-05	1.89E-05
2105	67561	methyl alcohol	0.0015	9.88E-06	2.30E-04	2.40E-04
2105	78933	methyl ethyl ketone (mek) (2-butanone)	0.0002	1.48E-06	3.44E-05	3.58E-05
2105	108383	m-xylene	0.0445	2.88E-04	6.70E-03	6.99E-03
2105	91203	naphthalene	0.0006	3.81E-06	8.87E-05	9.25E-05
2105	110543	n-hexane	0.0200	1.29E-04	3.01E-03	3.14E-03
2105	95476	o-xylene	0.0155	1.00E-04	2.33E-03	2.43E-03
2105	115071	propylene	0.0382	2.47E-04	5.76E-03	6.01E-03
2105	100425	styrene	0.0015	9.93E-06	2.31E-04	2.41E-04
2105	108883	toluene	0.0718	4.65E-04	1.08E-02	1.13E-02
Total				**2.59E-03**	**6.02E-02**	**6.28E-02**

Notes:
1. Organic fraction from ARBs SPECIATE database. Data is from "Cat stabilzed exhaust 2005 SSD etoh 2% O (MTBE phaseout)" option.
2. Emissions were calculated for only chemicals that were in both the SPECIATE database and the AB2588 list.
3. Organic fraction reported on a ROG basis using ARB's Speciate ROG/TOG ratio (0.8012).

Title : Los Angeles County Avg Annual CYr 2005 Default Title
Version : Emfac2007 V2.3 Nov 1 2006
Run Date : 2007/08/20 15:18:38
Scen Year: 2005 -- All model years in the range 1965 to 2005 selected
Season : Annual
Area : Los Angeles County Average
I/M Stat : Enhanced Interim (2005) -- Using I/M schedule for area 59 Los Angeles (SC)
Emissions: Tons Per Day
****

	LDA-TOT	LDT1-TOT	LDT2-TOT
Vehicles	3603550	451168	1420700
VMT/1000	123280	16519	53929
Trips	22617700	2805710	9013310
Reactive Organic Gas Emissions			
Run Exh	27.06	7.35	11.54
Idle Exh	0	0	0
Start Ex	19.97	2.47	8.04
	-------	-------	-------
Total Ex	47.02	9.82	19.58
Diurnal	4.38	0.54	1.4
Hot Soak	6.2	0.87	1.89
Running	25.79	4.11	9.7
Resting	2.63	0.36	0.85
	-------	-------	-------
Total	86.03	15.69	33.43
Carbon Monoxide Emissions			
Run Exh	589.16	132.38	294.02
Idle Exh	0	0	0
Start Ex	201.07	26.93	90.19
	-------	-------	-------
Total Ex	790.22	159.31	384.21
Oxides of Nitrogen Emissions			
Run Exh	54.15	11.1	40.42
Idle Exh	0	0	0
Start Ex	12.5	1.52	8.1
	-------	-------	-------
Total Ex	66.65	12.63	48.52
Carbon Dioxide Emissions (000)			
Run Exh	55.87	9.06	29.72
Idle Exh	0	0	0
Start Ex	1.9	0.29	0.9
	-------	-------	-------
Total Ex	57.77	9.35	30.63
PM10 Emissions			
Run Exh	1.62	0.26	1.42
Idle Exh	0	0	0
Start Ex	0.15	0.02	0.12
	-------	-------	-------
Total Ex	1.77	0.28	1.54
TireWear	1.09	0.15	0.48
BrakeWr	1.7	0.23	0.75
	-------	-------	-------
Total	4.56	0.66	2.76
Lead	0	0	0
SOx	0.58	0.11	0.3
Fuel Consumption (000 gallons)			
Gasoline	6042.18	965.82	3199.62
Diesel	13.88	17.67	4.01

APPENDIX R-2

DEATILED EMISSION CALCULATIONS, EMISSION FACTOR DERIVATION, EMFAC2007 OUTPUT, AND SPECIATION PROFILE FOR PROJECT YEAR 2010

Summary of Emissions from Worker Vehicles
Dolores and ICTF Rail Yards, Long Beach, CA

Yard	Number of Trips (trips/yr)[1,2]	VMT per Trip[3]	VMT per Year	Fuel Use (gal/yr)[5]	Carbon Oxidation Factor[6]	2010 Emission Factors (g/mi)[7] ROG	CO	NOx	PM10	SOx	(kg/gal)[6] CO2	N2O[8]	CH4[8]	2010 Emission Estimates (tpy) ROG	CO	NOx	PM10	SOx	(metric tons/yr) CO2	N2O	CH4
Dolores-Onsite	32,850	0.5	16,425.00	832.41	99%	0.18	0.37	0.35	0.04	0.00	8.87	1.23E-05	1.60E-04	0.00	0.01	0.01	0.00	0.00	7.31	1.02E-05	1.33E-04
ICTF - Onsite	152,935	2.5	382,337.50	19,376.63	99%	0.18	0.37	0.35	0.04	0.00	8.87	1.23E-05	1.60E-04	0.08	0.16	0.15	0.02	0.00	170.15	2.38E-04	3.09E-03
Total			**398,762.50**											**0.08**	**0.16**	**0.15**	**0.02**	**0.00**	**177.46**	**2.48E-04**	**3.22E-03**

Notes:
1. Number of trips for Dolores from personal communication with M.J. Germer on August 24, 2007. Based on employee force counts, assumes no ride sharing, and assumes 365 days per year.
2. Number of trips for ICTF from personal communication with M.J. Germer on August 24, 2007. Based on employee force counts, assumes no ride sharing, and assumes 365 days per year.
3. VMT per truck trip from Trinity reports.
4. Assumed no change from the baseline year in the number of employees or trip length for 2010.
5. Fuel use calculated from VMT and from fuel economy based on the EMFAC 2007 model with the BURDEN output option.
6. From the Air Resources Board's Draft *Emission Factors for Mandatory Reporting Programs,* August 10, 2007.
7. Running exhaust emission factors (g/mi) from EMFAC 2007 using the BURDEN output option. The EMFAC default model year distribution for L.A. County was used.
8. Based on a gasoline HHV of 122,697 BTU/gal, assuming ethanol content of 5.7 volume % (Source: TRANSPORTATION ENERGY DATA BOOK: EDITION 26, U.S. Department of Energy, 2007).
9. Assumed no idling for worker vehicles.

Emission Factors Worker Vehicles
Dolores and ICTF Rail Yards, Long Beach, CA

2010 CY Vehicle Class Population Distribution (<5151 LBS GVWR)			
	PC	LDT1	LDT2
Population counts	3,466,660	430,233	1,354,820
Fraction of LD/MD total	0.6601	0.0819	0.2580

Vehicle Class Weighted Average Emission Factors					
Emission Category	**Units**	**PC**	**LDT1**	**LDT2**	**AVERAGE**
ROG Exhaust	g/mi	0.170	0.280	0.191	0.184
CO Exhaust	g/mi	0.344	0.519	0.386	0.369
NOX Exhaust	g/mi	0.273	0.431	0.502	0.345
PM10 Total	g/mi	0.034	0.037	0.050	0.038
SOX	g/mi	0.004	0.005	0.005	0.004
Fuel Economy	mi/gal	21.119	17.101	17.018	19.732

Notes:
1. Emission factors calculated using EMFAC 2007.

Toxic Air Contaminant Emissions from Gasoline-Fueled Worker Vehicles
Dolores and ICTF Rail Yards, Long Beach, CA

Profile[1]	CAS	Chemical Name	Organic Fraction	2010 Emissions (tpy) Dolores	ICTF	Total
2105	95636	1,2,4-trimethylbenzene	0.0120	4.02E-05	9.35E-04	9.75E-04
2105	106990	1,3-butadiene	0.0068	2.27E-05	5.29E-04	5.52E-04
2105	540841	2,2,4-trimethylpentane	0.0288	9.62E-05	2.24E-03	2.34E-03
2105	75070	acetaldehyde	0.0035	1.16E-05	2.71E-04	2.82E-04
2105	107028	acrolein (2-propenal)	0.0017	5.52E-06	1.28E-04	1.34E-04
2105	71432	benzene	0.0309	1.03E-04	2.40E-03	2.50E-03
2105	4170303	crotonaldehyde	0.0004	1.20E-06	2.80E-05	2.92E-05
2105	110827	cyclohexane	0.0077	2.56E-05	5.96E-04	6.21E-04
2105	100414	ethylbenzene	0.0131	4.37E-05	1.02E-03	1.06E-03
2105	74851	ethylene	0.0794	2.65E-04	6.17E-03	6.44E-03
2105	50000	formaldehyde	0.0197	6.58E-05	1.53E-03	1.60E-03
2105	78795	isoprene	0.0018	5.90E-06	1.37E-04	1.43E-04
2105	98828	isopropylbenzene (cumene)	0.0001	4.01E-07	9.34E-06	9.75E-06
2105	67561	methyl alcohol	0.0015	5.09E-06	1.19E-04	1.24E-04
2105	78933	methyl ethyl ketone (mek) (2-butanone)	0.0002	7.61E-07	1.77E-05	1.85E-05
2105	108383	m-xylene	0.0445	1.48E-04	3.46E-03	3.60E-03
2105	91203	naphthalene	0.0006	1.97E-06	4.57E-05	4.77E-05
2105	110543	n-hexane	0.0200	6.66E-05	1.55E-03	1.62E-03
2105	95476	o-xylene	0.0155	5.16E-05	1.20E-03	1.25E-03
2105	115071	propylene	0.0382	1.28E-04	2.97E-03	3.10E-03
2105	100425	styrene	0.0015	5.12E-06	1.19E-04	1.24E-04
2105	108883	toluene	0.0718	2.40E-04	5.58E-03	5.82E-03
Total				**1.33E-03**	**3.11E-02**	**3.24E-02**

Notes:
1. Organic fraction from ARBs SPECIATE database. Data is from "Cat stabilzed exhaust 2005 SSD etoh 2% O (MTBE phaseout)" option.
2. Emissions were calculated for only chemicals that were in both the SPECIATE database and the AB2588 list.
3. Organic fraction reported on a ROG basis using ARB's Speciate ROG/TOG ratio (0.8012).

Title : Los Angeles County Avg Annual CYr 2010 Default Title
Version : Emfac2007 V2.3 Nov 1 2006
Run Date : 2007/09/08 12:23:28
Scen Year: 2010 -- All model years in the range 1966 to 2010 selected
Season : Annual
Area : Los Angeles County Average
I/M Stat : Enhanced Interim (2005) -- Using I/M schedule for area 59 Los Angeles (SC)
Emissions: Tons Per Day
****

	LDA-TOT	LDT1-TOT	LDT2-TOT
Vehicles	3466660	430233	1354820
VMT/1000	116525	15208	49797
Trips	21796700	2679850	8556440
Reactive Organic Gas Emissions			
Run Exh	11.18	3.22	5.76
Idle Exh	0	0	0
Start Ex	10.66	1.47	4.72
	-------	-------	-------
Total Ex	21.84	4.69	10.48
Diurnal	2.75	0.37	0.99
Hot Soak	4.35	0.62	1.54
Running	13.45	2.76	7.51
Resting	1.82	0.27	0.67
	-------	-------	-------
Total	44.21	8.7	21.19
Carbon Monoxide Emissions			
Run Exh	308.39	71	173.78
Idle Exh	0	0	0
Start Ex	119.33	18.26	57.81
	-------	-------	-------
Total Ex	427.73	89.27	231.59
Oxides of Nitrogen Emissions			
Run Exh	27.2	6.12	22.19
Idle Exh	0	0	0
Start Ex	7.89	1.1	5.38
	-------	-------	-------
Total Ex	35.08	7.22	27.58
Carbon Dioxide Emissions (000)			
Run Exh	51.4	8.28	27.33
Idle Exh	0	0	0
Start Ex	1.76	0.27	0.85
	-------	-------	-------
Total Ex	53.15	8.55	28.18
PM10 Emissions			
Run Exh	1.54	0.26	1.47
Idle Exh	0	0	0
Start Ex	0.14	0.02	0.12
	-------	-------	-------
Total Ex	1.67	0.27	1.59
TireWear	1.03	0.13	0.44
BrakeWr	1.61	0.21	0.69
	-------	-------	-------
Total	4.31	0.62	2.72
Lead	0	0	0
SOx	0.52	0.08	0.27
Fuel Consumption (000 gallons)			
Gasoline	5511.48	878.25	2924.19
Diesel	6.06	11.06	1.94

APPENDIX R-3

DEATILED EMISSION CALCULATIONS, EMISSION FACTOR DERIVATION, EMFAC2007 OUTPUT, AND SPECIATION PROFILE FOR PROJECT YEAR 2012

Summary of Emissions from Worker Vehicles
Dolores and ICTF Rail Yards, Long Beach, CA

Yard	Number of Trips (trips/yr)[1,2]	VMT per Trip[3]	VMT per Year	Fuel Use (gal/yr)[5]	Carbon Oxidation Factor[6]	2012 Emission Factors (g/mi)[7] ROG	CO	NOx	PM10	SOx	(kg/gal)[6] CO2	N2O[8]	CH4[8]	2012 Emission Estimates (tpy) ROG	CO	NOx	PM10	SOx	(metric tons/yr) CO2	N2O	CH4
Dolores-Onsite	32,850	0.5	16,425.00	834.30	99%	0.15	0.31	0.29	0.04	0.00	8.87	1.23E-05	1.60E-04	0.00	0.01	0.01	0.00	0.00	7.33	0.00	0.00
ICTF - Onsite	152,935	2.5	382,337.50	19,420.55	99%	0.15	0.31	0.29	0.04	0.00	8.87	1.23E-05	1.60E-04	0.06	0.13	0.12	0.02	0.00	170.54	0.00	0.00
Total			**398,762.50**	**20,254.85**										**0.06**	**0.14**	**0.13**	**0.02**	**0.00**	**177.86**	**0.00**	**0.00**

Notes:
1. Number of trips for Dolores from personal communication with M.J. Germer on August 24, 2007. Based on employee force counts, assumes no ride sharing, and assumes 365 days per year.
2. Number of trips for ICTF from personal communication with M.J. Germer on August 24, 2007. Based on employee force counts, assumes no ride sharing, and assumes 365 days per year.
3. VMT per truck trip from Trinity reports.
4. Assumed no change from the baseline year in the number of employees or trip length.
5. Fuel use calculated from VMT and from fuel economy based on the EMFAC 2007 model with the BURDEN output option.
6. From the Air Resources Board's Draft *Emission Factors for Mandatory Reporting Programs,* August 10, 2007.
7. Running exhaust emission factors (g/mi) from EMFAC 2007 using the BURDEN output option. The EMFAC default model year distribution for L.A. County was used.
8. Based on a gasoline HHV of 122,697 BTU/gal, assuming ethanol content of 5.7 volume % (Source: TRANSPORTATION ENERGY DATA BOOK: EDITION 26, U.S. Department of Energy, 2007).
9. Assumed no idling for worker vehicles.

Emission Factors Worker Vehicles
Dolores and ICTF Rail Yards, Long Beach, CA

2012 CY Vehicle Class Population Distribution (<5151 LBS GVWR)			
	PC	LDT1	LDT2
Population counts	3,564,370	441,633	1,403,290
Fraction of LD/MD total	0.6589	0.0816	0.2594

Vehicle Class Weighted Average Emission Factors					
Emission Category	**Units**	**PC**	**LDT1**	**LDT2**	**AVERAGE**
ROG Exhaust	g/mi	0.131	0.217	0.163	0.146
CO Exhaust	g/mi	0.283	0.436	0.355	0.314
NOX Exhaust	g/mi	0.222	0.356	0.435	0.288
PM10 Total	g/mi	0.034	0.037	0.052	0.039
SOX	g/mi	0.004	0.005	0.005	0.004
Fuel Economy	mi/gal	21.113	17.031	16.901	19.687

Notes:
1. Emission factors calculated using EMFAC 2007.

Toxic Air Contaminant Emissions from Gasoline-Fueled Worker Vehicles
Dolores and ICTF Rail Yards, Long Beach, CA

Profile[1]	CAS	Chemical Name	Organic Fraction	2012 Emissions (tpy)		
				Dolores	ICTF	Total
2105	95636	1,2,4-trimethylbenzene	0.0120	3.19E-05	7.42E-04	7.74E-04
2105	106990	1,3-butadiene	0.0068	1.80E-05	4.20E-04	4.38E-04
2105	540841	2,2,4-trimethylpentane	0.0288	7.64E-05	1.78E-03	1.85E-03
2105	75070	acetaldehyde	0.0035	9.24E-06	2.15E-04	2.24E-04
2105	107028	acrolein (2-propenal)	0.0017	4.38E-06	1.02E-04	1.06E-04
2105	71432	benzene	0.0309	8.18E-05	1.90E-03	1.99E-03
2105	4170303	crotonaldehyde	0.0004	9.56E-07	2.23E-05	2.32E-05
2105	110827	cyclohexane	0.0077	2.03E-05	4.73E-04	4.94E-04
2105	100414	ethylbenzene	0.0131	3.47E-05	8.08E-04	8.43E-04
2105	74851	ethylene	0.0794	2.10E-04	4.90E-03	5.11E-03
2105	50000	formaldehyde	0.0197	5.23E-05	1.22E-03	1.27E-03
2105	78795	isoprene	0.0018	4.69E-06	1.09E-04	1.14E-04
2105	98828	isopropylbenzene (cumene)	0.0001	3.19E-07	7.42E-06	7.74E-06
2105	67561	methyl alcohol	0.0015	4.04E-06	9.41E-05	9.82E-05
2105	78933	methyl ethyl ketone (mek) (2-butanone)	0.0002	6.04E-07	1.41E-05	1.47E-05
2105	108383	m-xylene	0.0445	1.18E-04	2.74E-03	2.86E-03
2105	91203	naphthalene	0.0006	1.56E-06	3.63E-05	3.79E-05
2105	110543	n-hexane	0.0200	5.29E-05	1.23E-03	1.28E-03
2105	95476	o-xylene	0.0155	4.10E-05	9.54E-04	9.95E-04
2105	115071	propylene	0.0382	1.01E-04	2.36E-03	2.46E-03
2105	100425	styrene	0.0015	4.06E-06	9.46E-05	9.87E-05
2105	108883	toluene	0.0718	1.90E-04	4.43E-03	4.62E-03
Total				**1.06E-03**	**2.47E-02**	**2.57E-02**

Notes:
1. Organic fraction from ARBs SPECIATE database. Data is from
"Cat stabilzed exhaust 2005 SSD etoh 2% O (MTBE phaseout)" option.
2. Emissions were calculated for only chemicals that were in both the SPECIATE database and the AB2588 list.
3. Organic fraction reported on a ROG basis using ARB's Speciate ROG/TOG ratio (0.8012).

Title : Los Angeles County Avg Annual CYr 2012 Default Title
Version : Emfac2007 V2.3 Nov 1 2006
Run Date : 2007/09/10 08:17:54
Scen Year: 2012 -- All model years in the range 1968 to 2012 selected
Season : Annual
Area : Los Angeles County Average
I/M Stat : Enhanced Interim (2005) -- Using I/M schedule for area 59 Los Angeles (SC)
Emissions: Tons Per Day
****

	LDA-TOT	LDT1-TOT	LDT2-TOT
Vehicles	3564370	441633	1403290
VMT/1000	118147	15509	50521
Trips	22381600	2745760	8828530
Reactive Organic Gas Emissions			
Run Exh	8.38	2.47	4.89
Idle Exh	0	0	0
Start Ex	8.71	1.25	4.18
	-------	-------	-------
Total Ex	17.09	3.71	9.07
Diurnal	2.45	0.35	0.97
Hot Soak	4.18	0.6	1.61
Running	11.35	2.54	7.41
Resting	1.74	0.26	0.71
	-------	-------	-------
Total	36.81	7.45	19.76
Carbon Monoxide Emissions			
Run Exh	257.22	59.18	156.84
Idle Exh	0	0	0
Start Ex	102.71	16.17	52.81
	-------	-------	-------
Total Ex	359.92	75.35	209.65
Oxides of Nitrogen Emissions			
Run Exh	22.22	5.11	19.34
Idle Exh	0	0	0
Start Ex	6.75	0.97	4.87
	-------	-------	-------
Total Ex	28.97	6.08	24.22
Carbon Dioxide Emissions (000)			
Run Exh	52.25	8.51	27.96
Idle Exh	0	0	0
Start Ex	1.79	0.27	0.88
	-------	-------	-------
Total Ex	54.04	8.78	28.84
PM10 Emissions			
Run Exh	1.63	0.27	1.64
Idle Exh	0	0	0
Start Ex	0.15	0.02	0.13
	-------	-------	-------
Total Ex	1.78	0.29	1.77
TireWear	1.04	0.14	0.45
BrakeWr	1.63	0.21	0.7
	-------	-------	-------
Total	4.45	0.64	2.91
Lead	0	0	0
SOx	0.52	0.09	0.28
Fuel Consumption (000 gallons)			
Gasoline	5591.24	901.2	2987.66
Diesel	4.57	9.45	1.62

APPENDIX R-4

DEATILED EMISSION CALCULATIONS, EMISSION FACTOR DERIVATION, EMFAC2007 OUTPUT, AND SPECIATION PROFILE FOR PROJECT YEAR 2014

Summary of Emissions from Worker Vehicles
Dolores and ICTF Rail Yards, Long Beach, CA

Yard	Number of Trips (trips/yr)[1,2]	VMT per Trip[3]	VMT per Year	Fuel Use (gal/yr)[5]	Carbon Oxidation Factor[6]	2014 Emission Factors (g/mi)[7]					2014 Emission Factors (kg/gal)[6]			2014 Emission Estimates (tpy)					2014 Emission Estimates (metric tons/yr)		
						ROG	CO	NOx	PM10	SOx	CO2	N2O[8]	CH4[8]	ROG	CO	NOx	PM10	SOx	CO2	N2O	CH4
Dolores-Onsite	32,850	0.5	16,425.00	832.54	99%	0.12	0.27	0.24	0.04	0.00	8.87	1.23E-05	1.60E-04	0.00	0.00	0.00	0.00	0.00	7.31	0.00	0.00
ICTF - Onsite	152,935	2.5	382,337.50	19,379.57	99%	0.12	0.27	0.24	0.04	0.00	8.87	1.23E-05	1.60E-04	0.05	0.11	0.10	0.02	0.00	170.18	0.00	0.00
Total			**398,762.50**											**0.05**	**0.12**	**0.11**	**0.02**	**0.00**	**177.49**	**0.00**	**0.00**

Notes:
1. Number of trips for Dolores from personal communication with M.J. Germer on August 24, 2007. Based on employee force counts, assumes no ride sharing, and assumes 365 days per year.
2. Number of trips for ICTF from personal communication with M.J. Germer on August 24, 2007. Based on employee force counts, assumes no ride sharing, and assumes 365 days per year.
3. VMT per truck trip from Trinity reports.
4. Assumed no change from the baseline year in the number of employees or trip length.
5. Fuel use calculated from VMT and from fuel economy based on the EMFAC 2007 model with the BURDEN output option.
6. From the Air Resources Board's Draft *Emission Factors for Mandatory Reporting Programs,* August 10, 2007.
7. Running exhaust emission factors (g/mi) from EMFAC 2007 using the BURDEN output option. The EMFAC default model year distribution for L.A. County was used.
8. Based on a gasoline HHV of 122,697 BTU/gal, assuming ethanol content of 5.7 volume % (Source: TRANSPORTATION ENERGY DATA BOOK: EDITION 26, U.S. Department of Energy, 2007).
9. Assumed no idling for worker vehicles.

Emission Factors Worker Vehicles
Dolores and ICTF Rail Yards, Long Beach, CA

2014 CY Vehicle Class Population Distribution (<5151 LBS GVWR)			
	PC	LDT1	LDT2
Population counts	3,654,180	451,930	1,446,880
Fraction of LD/MD total	0.6581	0.0814	0.2606

Vehicle Class Weighted Average Emission Factors					
Emission Category	**Units**	**PC**	**LDT1**	**LDT2**	**AVERAGE**
ROG Exhaust	g/mi	0.102	0.164	0.138	0.116
CO Exhaust	g/mi	0.237	0.365	0.328	0.271
NOX Exhaust	g/mi	0.182	0.293	0.376	0.242
PM10 Total	g/mi	0.035	0.038	0.055	0.040
SOX	g/mi	0.004	0.005	0.005	0.004
Fuel Economy	mi/gal	21.191	17.046	16.875	19.729

Notes:
1. Emission factors calculated using EMFAC 2007.

Toxic Air Contaminant Emissions from Gasoline-Fueled Worker Vehicles
Dolores and ICTF Rail Yards, Long Beach, CA

			Organic	2014 Emissions (tpy)		
Profile[1]	CAS	Chemical Name	Fraction	Dolores	ICTF	Total
2105	95636	1,2,4-trimethylbenzene	0.0120	2.54E-05	5.90E-04	6.15E-04
2105	106990	1,3-butadiene	0.0068	1.43E-05	3.34E-04	3.48E-04
2105	540841	2,2,4-trimethylpentane	0.0288	6.07E-05	1.41E-03	1.47E-03
2105	75070	acetaldehyde	0.0035	7.34E-06	1.71E-04	1.78E-04
2105	107028	acrolein (2-propenal)	0.0017	3.48E-06	8.11E-05	8.46E-05
2105	71432	benzene	0.0309	6.50E-05	1.51E-03	1.58E-03
2105	4170303	crotonaldehyde	0.0004	7.60E-07	1.77E-05	1.85E-05
2105	110827	cyclohexane	0.0077	1.62E-05	3.76E-04	3.92E-04
2105	100414	ethylbenzene	0.0131	2.76E-05	6.42E-04	6.70E-04
2105	74851	ethylene	0.0794	1.67E-04	3.89E-03	4.06E-03
2105	50000	formaldehyde	0.0197	4.15E-05	9.67E-04	1.01E-03
2105	78795	isoprene	0.0018	3.73E-06	8.67E-05	9.05E-05
2105	98828	isopropylbenzene (cumene)	0.0001	2.53E-07	5.90E-06	6.15E-06
2105	67561	methyl alcohol	0.0015	3.21E-06	7.48E-05	7.80E-05
2105	78933	methyl ethyl ketone (mek) (2-butanone)	0.0002	4.80E-07	1.12E-05	1.17E-05
2105	108383	m-xylene	0.0445	9.37E-05	2.18E-03	2.27E-03
2105	91203	naphthalene	0.0006	1.24E-06	2.89E-05	3.01E-05
2105	110543	n-hexane	0.0200	4.21E-05	9.79E-04	1.02E-03
2105	95476	o-xylene	0.0155	3.26E-05	7.58E-04	7.90E-04
2105	115071	propylene	0.0382	8.05E-05	1.87E-03	1.96E-03
2105	100425	styrene	0.0015	3.23E-06	7.52E-05	7.84E-05
2105	108883	toluene	0.0718	1.51E-04	3.52E-03	3.68E-03
Total				**8.42E-04**	**1.96E-02**	**2.04E-02**

Notes:
1. Organic fraction from ARBs SPECIATE database. Data is from "Cat stabilzed exhaust 2005 SSD etoh 2% O (MTBE phaseout)" option.
2. Emissions were calculated for only chemicals that were in both the SPECIATE database and the AB2588 list.
3. Organic fraction reported on a ROG basis using ARB's Speciate ROG/TOG ratio (0.8012).

Title : Los Angeles County Avg Annual CYr 2014 Default Title
Version : Emfac2007 V2.3 Nov 1 2006
Run Date : 2007/09/10 08:18:50
Scen Year: 2014 -- All model years in the range 1970 to 2014 selected
Season : Annual
Area : Los Angeles County Average
I/M Stat : Enhanced Interim (2005) -- Using I/M schedule for area 59 Los Angeles (SC)
Emissions: Tons Per Day
****

	LDA-TOT	LDT1-TOT	LDT2-TOT
Vehicles	3654180	451930	1446880
VMT/1000	119777	15792	51239
Trips	22896700	2804090	9062520
Reactive Organic Gas Emissions			
Run Exh	6.35	1.82	4.12
Idle Exh	0	0	0
Start Ex	7.09	1.04	3.69
	-------	-------	-------
Total Ex	13.44	2.86	7.81
Diurnal	2.21	0.32	0.96
Hot Soak	4.04	0.58	1.69
Running	9.91	2.33	7.32
Resting	1.67	0.25	0.75
	-------	-------	-------
Total	31.28	6.35	18.54
Carbon Monoxide Emissions			
Run Exh	216.2	48.76	141.56
Idle Exh	0	0	0
Start Ex	87.97	14.14	48.1
	-------	-------	-------
Total Ex	304.17	62.9	189.66
Oxides of Nitrogen Emissions			
Run Exh	18.33	4.24	16.9
Idle Exh	0	0	0
Start Ex	5.68	0.85	4.36
	-------	-------	-------
Total Ex	24.01	5.1	21.26
Carbon Dioxide Emissions (000)			
Run Exh	52.88	8.68	28.43
Idle Exh	0	0	0
Start Ex	1.81	0.27	0.9
	-------	-------	-------
Total Ex	54.69	8.95	29.33
PM10 Emissions			
Run Exh	1.71	0.28	1.78
Idle Exh	0	0	0
Start Ex	0.15	0.02	0.14
	-------	-------	-------
Total Ex	1.86	0.3	1.92
TireWear	1.06	0.14	0.45
BrakeWr	1.66	0.22	0.71
	-------	-------	-------
Total	4.57	0.66	3.08
Lead	0	0	0
SOx	0.53	0.09	0.28
Fuel Consumption (000 gallons)			
Gasoline	5648.94	918.45	3035.11
Diesel	3.39	7.98	1.29

APPENDIX R-5

DEATILED EMISSION CALCULATIONS, EMISSION FACTOR DERIVATION, EMFAC2007 OUTPUT, AND SPECIATION PROFILE FOR PROJECT YEAR 2016

Summary of Emissions from Worker Vehicles
Dolores and ICTF Rail Yards, Long Beach, CA

Yard	Number of Trips (trips/yr)[1,2]	VMT per Trip[3]	VMT per Year	Fuel Use (gal/yr)[5]	Carbon Oxidation Factor[6]	2016 Emission Factors (g/mi)[7] ROG	CO	NOx	PM10	SOx	(kg/gal)[6] CO2	N2O[8]	CH4[8]	2016 Emission Estimates (tpy) ROG	CO	NOx	PM10	SOx	(metric tons/yr) CO2	N2O	CH4
Dolores-Onsite	32,850	0.5	16,425.00	834.50	99%	0.09	0.24	0.20	0.04	0.00	8.87	1.23E-05	1.60E-04	0.00	0.00	0.00	0.00	0.00	7.33	0.00	0.00
ICTF - Onsite	152,935	2.5	382,337.50	19,425.20	99%	0.09	0.24	0.20	0.04	0.00	8.87	1.23E-05	1.60E-04	0.04	0.10	0.09	0.02	0.00	170.58	0.00	0.00
Total			**398,762.50**	**20,260**										**0.04**	**0.11**	**0.09**	**0.02**	**0.00**	**177.91**	**0.00**	**0.00**

Notes:
1. Number of trips for Dolores from personal communication with M.J. Germer on August 24, 2007. Based on employee force counts, assumes no ride sharing, and assumes 365 days per year.
2. Number of trips for ICTF from personal communication with M.J. Germer on August 24, 2007. Based on employee force counts, assumes no ride sharing, and assumes 365 days per year.
3. VMT per truck trip from Trinity reports.
4. Assumed no change from the baseline year in the number of employees or trip length.
5. Fuel use calculated from VMT and from fuel economy based on the EMFAC 2007 model with the BURDEN output option.
6. From the Air Resources Board's Draft *Emission Factors for Mandatory Reporting Programs*, August 10, 2007.
7. Running exhaust emission factors (g/mi) from EMFAC 2007 using the BURDEN output option. The EMFAC default model year distribution for L.A. County was used.
8. Based on a gasoline HHV of 122,697 BTU/gal, assuming ethanol content of 5.7 volume % (Source: TRANSPORTATION ENERGY DATA BOOK: EDITION 26, U.S. Department of Energy, 2007).
9. Assumed no idling for worker vehicles.

Emission Factors Worker Vehicles
Dolores and ICTF Rail Yards, Long Beach, CA

2016 CY Vehicle Class Population Distribution (<5151 LBS GVWR)			
	PC	LDT1	LDT2
Population counts	3,722,460	459,471	1,479,400
Fraction of LD/MD total	0.6575	0.0812	0.2613

Vehicle Class Weighted Average Emission Factors					
Emission Category	**Units**	**PC**	**LDT1**	**LDT2**	**AVERAGE**
ROG Exhaust	g/mi	0.081	0.122	0.119	0.094
CO Exhaust	g/mi	0.205	0.309	0.308	0.240
NOX Exhaust	g/mi	0.151	0.241	0.327	0.204
PM10 Total	g/mi	0.035	0.039	0.057	0.041
SOX	g/mi	0.004	0.005	0.005	0.004
Fuel Economy	mi/gal	21.168	16.994	16.781	19.683

Notes:
1. Emission factors calculated using EMFAC 2007.

Toxic Air Contaminant Emissions from Gasoline-Fueled Worker Vehicles
Dolores and ICTF Rail Yards, Long Beach, CA

Profile[1]	CAS	Chemical Name	Organic Fraction	2016 Emissions (tpy)		
				Dolores	ICTF	Total
2105	95636	1,2,4-trimethylbenzene	0.0120	2.05E-05	4.77E-04	4.98E-04
2105	106990	1,3-butadiene	0.0068	1.16E-05	2.70E-04	2.82E-04
2105	540841	2,2,4-trimethylpentane	0.0288	4.91E-05	1.14E-03	1.19E-03
2105	75070	acetaldehyde	0.0035	5.94E-06	1.38E-04	1.44E-04
2105	107028	acrolein (2-propenal)	0.0017	2.82E-06	6.56E-05	6.84E-05
2105	71432	benzene	0.0309	5.26E-05	1.22E-03	1.28E-03
2105	4170303	crotonaldehyde	0.0004	6.15E-07	1.43E-05	1.49E-05
2105	110827	cyclohexane	0.0077	1.31E-05	3.04E-04	3.17E-04
2105	100414	ethylbenzene	0.0131	2.23E-05	5.19E-04	5.42E-04
2105	74851	ethylene	0.0794	1.35E-04	3.15E-03	3.29E-03
2105	50000	formaldehyde	0.0197	3.36E-05	7.82E-04	8.16E-04
2105	78795	isoprene	0.0018	3.01E-06	7.02E-05	7.32E-05
2105	98828	isopropylbenzene (cumene)	0.0001	2.05E-07	4.77E-06	4.98E-06
2105	67561	methyl alcohol	0.0015	2.60E-06	6.05E-05	6.31E-05
2105	78933	methyl ethyl ketone (mek) (2-butanone)	0.0002	3.89E-07	9.04E-06	9.43E-06
2105	108383	m-xylene	0.0445	7.58E-05	1.76E-03	1.84E-03
2105	91203	naphthalene	0.0006	1.00E-06	2.34E-05	2.44E-05
2105	110543	n-hexane	0.0200	3.40E-05	7.92E-04	8.26E-04
2105	95476	o-xylene	0.0155	2.63E-05	6.13E-04	6.39E-04
2105	115071	propylene	0.0382	6.52E-05	1.52E-03	1.58E-03
2105	100425	styrene	0.0015	2.61E-06	6.08E-05	6.34E-05
2105	108883	toluene	0.0718	1.22E-04	2.85E-03	2.97E-03
Total				**6.81E-04**	**1.59E-02**	**1.65E-02**

Notes:
1. Organic fraction from ARBs SPECIATE database. Data is from "Cat stabilzed exhaust 2005 SSD etoh 2% O (MTBE phaseout)" option.
2. Emissions were calculated for only chemicals that were in both the SPECIATE database and the AB2588 list.
3. Organic fraction reported on a ROG basis using ARB's Speciate ROG/TOG ratio (0.8012).

Title : Los Angeles County Avg Annual CYr 2016 Default Title
Version : Emfac2007 V2.3 Nov 1 2006
Run Date : 2007/09/10 08:19:34
Scen Year: 2016 -- All model years in the range 1972 to 2016 selected
Season : Annual
Area : Los Angeles County Average
I/M Stat : Enhanced Interim (2005) -- Using I/M schedule for area 59 Los Angeles (SC)
Emissions: Tons Per Day
****

	LDA-TOT	LDT1-TOT	LDT2-TOT
Vehicles	3722460	459471	1479400
VMT/1000	120746	15976	51715
Trips	23258000	2844690	9221080
Reactive Organic Gas Emissions			
Run Exh	4.98	1.28	3.52
Idle Exh	0	0	0
Start Ex	5.8	0.86	3.24
	-------	-------	-------
Total Ex	10.78	2.15	6.76
Diurnal	2.01	0.29	0.96
Hot Soak	3.91	0.56	1.76
Running	8.92	2.2	7.26
Resting	1.62	0.24	0.8
	-------	-------	-------
Total	27.24	5.44	17.53
Carbon Monoxide Emissions			
Run Exh	184.38	39.95	128.21
Idle Exh	0	0	0
Start Ex	75.1	12.24	43.46
	-------	-------	-------
Total Ex	259.48	52.2	171.67
Oxides of Nitrogen Emissions			
Run Exh	15.35	3.51	14.78
Idle Exh	0	0	0
Start Ex	4.72	0.73	3.85
	-------	-------	-------
Total Ex	20.07	4.25	18.63
Carbon Dioxide Emissions (000)			
Run Exh	53.44	8.82	28.89
Idle Exh	0	0	0
Start Ex	1.83	0.28	0.92
	-------	-------	-------
Total Ex	55.28	9.1	29.81
PM10 Emissions			
Run Exh	1.78	0.29	1.92
Idle Exh	0	0	0
Start Ex	0.16	0.02	0.15
	-------	-------	-------
Total Ex	1.94	0.31	2.07
TireWear	1.06	0.14	0.46
BrakeWr	1.67	0.22	0.72
	-------	-------	-------
Total	4.68	0.68	3.24
Lead	0	0	0
SOx	0.53	0.09	0.29
Fuel Consumption (000 gallons)			
Gasoline	5701.79	933.45	3080.78
Diesel	2.48	6.63	1.04

APPENDIX S

ROADWAY DUST

APPENDIX S-1

AP-42 SECTION 13.2 AND EXERPT FROM THE
SCAQMD STAFF REPORT FOR RULE 1186

13.2.1 Paved Roads

13.2.1.1 General

Particulate emissions occur whenever vehicles travel over a paved surface such as a road or parking lot. Particulate emissions from paved roads are due to direct emissions from vehicles in the form of exhaust, brake wear and tire wear emissions and resuspension of loose material on the road surface. In general terms, resuspended particulate emissions from paved roads originate from, and result in the depletion of, the loose material present on the surface (i.e., the surface loading). In turn, that surface loading is continuously replenished by other sources. At industrial sites, surface loading is replenished by spillage of material and trackout from unpaved roads and staging areas. Figure 13.2.1-1 illustrates several transfer processes occurring on public streets.

Various field studies have found that public streets and highways, as well as roadways at industrial facilities, can be major sources of the atmospheric particulate matter within an area.[1-9] Of particular interest in many parts of the United States are the increased levels of emissions from public paved roads when the equilibrium between deposition and removal processes is upset. This situation can occur for various reasons, including application of granular materials for snow and ice control, mud/dirt carryout from construction activities in the area, and deposition from wind and/or water erosion of surrounding unstabilized areas. In the absence of continuous addition of fresh material (through localized trackout or application of antiskid material), paved road surface loading should reach an equilibrium value in which the amount of material resuspended matches the amount replenished. The equilibrium surface loading value depends upon numerous factors. It is believed that the most important factors are: mean speed of vehicles traveling the road; the average daily traffic (ADT); the number of lanes and ADT per lane; the fraction of heavy vehicles (buses and trucks); and the presence/absence of curbs, storm sewers and parking lanes.[10]

The particulate emission factors presented in the previous version of this section of AP-42, dated October 2002, implicitly included the emissions from vehicles in the form of exhaust, brake wear, and tire wear as well as resuspended road surface material. EPA included these sources in the emission factor equation for paved roads since the field testing data used to develop the equation included both the direct emissions from vehicles and emissions from resuspension of road dust.

This version of the paved road emission factor equation only estimates particulate emissions from resuspended road surface material [28]. The particulate emissions from vehicle exhaust, brake wear, and tire wear are now estimated separately using EPA's MOBILE6.2 [27]. This approach eliminates the possibility of double counting emissions. Double counting results when employing the previous version of the emission factor equation in this section and MOBILE6.2 to estimate particulate emissions from vehicle traffic on paved roads. It also incorporates the decrease in exhaust emissions that has occurred since the paved road emission factor equation was developed. The previous version of the paved road emission factor equation includes estimates of emissions from exhaust, brake wear, and tire wear based on emission rates for vehicles in the 1980 calendar year fleet. The amount of PM released from vehicle exhaust has decreased since 1980 due to lower new vehicle emission standards and changes in fuel characteristics.

13.2.1.2 Emissions And Correction Parameters

Dust emissions from paved roads have been found to vary with what is termed the "silt loading" present on the road surface as well as the average weight of vehicles traveling the road. The term silt loading (sL) refers to the mass of silt-size material (equal to or less than 75 micrometers [μm] in physical diameter) per unit area of the travel surface. The total road surface dust loading consists of loose material that can be collected by broom sweeping and vacuuming of the traveled portion of the paved road. The silt fraction is determined by measuring the proportion of the loose dry surface dust that passes through a 200-mesh screen, using the ASTM-C-136 method. Silt loading is the product of the silt fraction and the total loading, and is abbreviated "sL". Additional details on the sampling and analysis of such material are provided in AP-42 Appendices C.1 and C.2.

The surface sL provides a reasonable means of characterizing seasonal variability in a paved road emission inventory. In many areas of the country, road surface loadings [11-21] are heaviest during the late winter and early spring months when the residual loading from snow/ice controls is greatest. As noted earlier, once replenishment of fresh material is eliminated, the road surface loading can be expected to reach an equilibrium value, which is substantially lower than the late winter/early spring values.

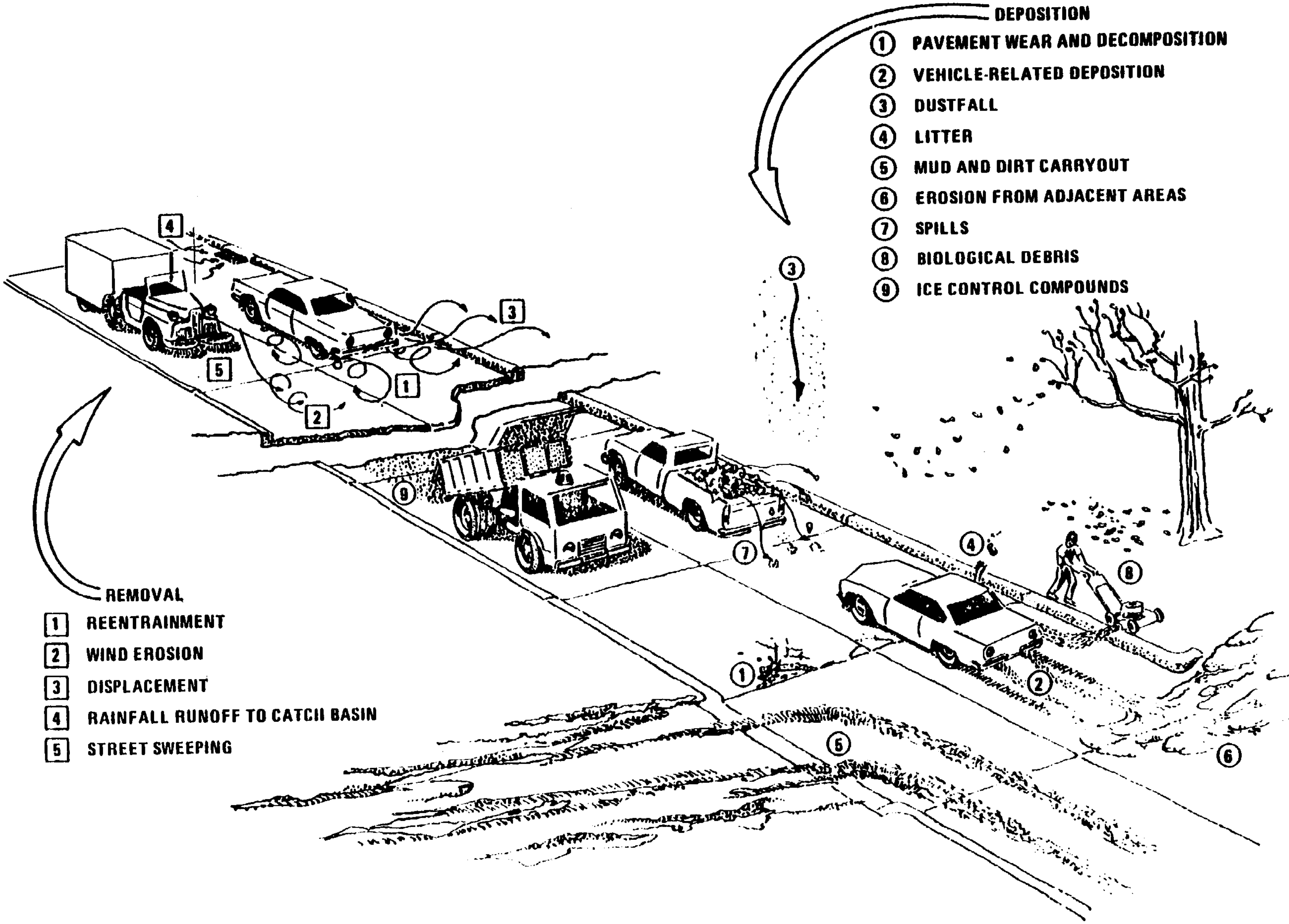

Figure 13.2.1-1. Deposition and removal processes.

13.2.1.3 Predictive Emission Factor Equations[10]

The quantity of particulate emissions from resuspension of loose material on the road surface due to vehicle travel on a dry paved road may be estimated using the following empirical expression:

$$E = k \left(\frac{sL}{2} \right)^{0.65} \times \left(\frac{W}{3} \right)^{1.5} - C \qquad (1)$$

where:

- E = particulate emission factor (having units matching the units of k),
- k = particle size multiplier for particle size range and units of interest (see below),
- sL = road surface silt loading (grams per square meter) (g/m^2),
- W = average weight (tons) of the vehicles traveling the road, and
- C = emission factor for 1980's vehicle fleet exhaust, brake wear and tire wear.

It is important to note that Equation 1 calls for the average weight of all vehicles traveling the road. For example, if 99 percent of traffic on the road are 2 ton cars/trucks while the remaining 1 percent consists of 20 ton trucks, then the mean weight "W" is 2.2 tons. More specifically, Equation 1 is *not* intended to be used to calculate a separate emission factor for each vehicle weight class. Instead, only one emission factor should be calculated to represent the "fleet" average weight of all vehicles traveling the road.

The particle size multiplier (*k*) above varies with aerodynamic size range as shown in Table 13.2.1-1. To determine particulate emissions for a specific particle size range, use the appropriate value of k shown in Table 13.2.1-1.

The emission factors for the exhaust, brake wear and tire wear of a 1980's vehicle fleet (*C*) was obtained from EPA's MOBILE6.2 model [28]. The emission factor also varies with aerodynamic size range as shown in Table 13.2.1-2.

Table 13.2-1.1. PARTICLE SIZE MULTIPLIERS FOR PAVED ROAD EQUATION

Size range[a]	Particle Size Multiplier k[b]		
	g/VKT	g/VMT	lb/VMT
PM-2.5[c]	0.66	1.1	0.0024
PM-10	4.6	7.3	0.016
PM-15	5.5	9.0	0.020
PM-30[d]	24	38	0.082

[a] Refers to airborne particulate matter (PM-x) with an aerodynamic diameter equal to or less than x micrometers.

[b] Units shown are grams per vehicle kilometer traveled (g/VKT), grams per vehicle mile traveled (g/VMT), and pounds per vehicle mile traveled (lb/VMT). The multiplier k includes unit conversions to produce emission factors in the units shown for the indicated size range from the mixed units required in Equation 1.

[c] The revised k-factors were based on the ratio of $PM_{2.5}$:PM_{10} in Table 1 of Reference 22 and are found in Table 2 of Reference 22. However, this ratio may not be used directly to estimate $PM_{2.5}$ from PM_{10} emissions. Equation (1) must be be computed separately for each size fraction because the relationship between $PM_{2.5}$ and PM_{10} emissions is not a simple ratio (i.e., the constant "C" in Equation (1) is not multiplied by the k-factor).

[d] PM-30 is sometimes termed "suspendable particulate" (SP) and is often used as a surrogate for TSP.

Table 13.2.1-2. EMISSION FACTOR FOR 1980'S VEHICLE FLEET EXHAUST, BRAKE WEAR AND TIRE WEAR

Particle Size Range[a]	*C*, Emission Factor for Exhaust, Brake Wear and Tire Wear[b]		
	g/VMT	g/VKT	lb/VMT
$PM_{2.5}$	0.1617	0.1005	0.00036
PM_{10}	0.2119	0.1317	0.00047
PM_{15}	0.2119	0.1317	0.00047
PM_{30}[c]	0.2119	0.1317	0.00047

[a] Refers to airborne particulate matter (PM-x) with an aerodynamic diameter equal to or less than x micrometers.
[b] Units shown are grams per vehicle kilometer traveled (g/VKT), grams per vehicle mile traveled (g/VMT), and pounds per vehicle mile traveled (lb/VMT).
[c] PM-30 is sometimes termed "suspendable particulate" (SP) and is often used as a surrogate for TSP.

Equation 1 is based on a regression analysis of numerous emission tests, including 65 tests for PM-10.[10] Sources tested include public paved roads, as well as controlled and uncontrolled industrial paved roads. All sources tested were of freely flowing vehicles traveling at constant speed on relatively level roads. No tests of "stop-and-go" traffic or vehicles under load were available for inclusion in the data base. The equations retain the quality rating of A (B for PM-2.5), if applied within the range of source conditions that were tested in developing the equation as follows:

Silt loading:	0.03 - 400 g/m^2 0.04 - 570 grains/square foot (ft^2)
Mean vehicle weight:	1.8 - 38 megagrams (Mg) 2.0 - 42 tons
Mean vehicle speed:	16 - 88 kilometers per hour (kph) 10 - 55 miles per hour (mph)

Note: There may be situations where low silt loading and/or low average weight will yield calculated negative emissions from equation 1. If this occurs, the emissions calculated from equation 1 should be set to zero.

Users are cautioned that application of equation 1 outside of the range of variables and operating conditions specified above, e.g., application to roadways or road networks with speeds below 10 mph and with stop-and-go traffic, will result in emission estimates with a higher level of uncertainty. In these situations, users are encouraged to consider alternative methods that are equally or more plausible in light of local emissions data and/or ambient concentration or compositional data.

To retain the quality rating for the emission factor equation when it is applied to a specific paved road, it is necessary that reliable correction parameter values for the specific road in question be determined. With the exception of limited access roadways, which are difficult to sample, the collection and use of site-specific silt loading (sL) data for public paved road emission inventories are strongly recommended. The field and laboratory procedures for determining surface material silt content and surface dust loading are summarized in Appendices C.1 and C.2. In the event that site-specific values cannot be obtained, an appropriate value for a paved public road may be selected from the values in Table 13.2.1-3, but the quality rating of the equation should be reduced by 2 levels. Also, recall that Equation 1 refers to emissions due to freely flowing (not stop-and-go) traffic at constant speed on level roads.

Equation 1 may be extrapolated to average uncontrolled conditions (but including natural mitigation) under the simplifying assumption that annual (or other long-term) average emissions are inversely proportional to the frequency of measurable (> 0.254 mm [0.01 inch]) precipitation by application of a precipitation correction term. The precipitation correction term can be applied on a daily or an hourly basis [26].

For the daily basis, Equation 1 becomes:

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

where *k*, *sL*, *W*, *and C* are as defined in Equation 1 and

E_{ext} = annual or other long-term average emission factor in the same units as *k*,
P = number of "wet" days with at least 0.254 mm (0.01 in) of precipitation during the averaging period, and
N = number of days in the averaging period (e.g., 365 for annual, 91 for seasonal, 30 for monthly).

Note that the assumption leading to Equation 2 is based on analogy with the approach used to develop long-term average unpaved road emission factors in Section 13.2.2. However, Equation 2 above incorporates an additional factor of "4" in the denominator to account for the fact that paved roads dry more quickly than unpaved roads and that the precipitation may not occur over the complete 24-hour day.

For the hourly basis, equation 1 becomes:

$$E_{ext} = \left[k \left(\frac{sL}{2} \right)^{0.65} \left(\frac{W}{3} \right)^{1.5} - C \right] \left(1 - \frac{1.2P}{N} \right) \qquad (3)$$

where k, sL, and W, and *C* are as defined in Equation 1 and

E_{ext} = annual or other long-term average emission factor in the same units as *k*,
P = number of hours with at least 0.254 mm (0.01 in) of precipitation during the averaging period, and
N = number of hours in the averaging period (e.g., 8760 for annual, 2124 for season 720 for monthly).

Note: In the hourly moisture correction term (1-1.2P/N) for equation 3, the 1.2 multiplier is applied to account for the residual mitigative effect of moisture. For most applications, this equation will produce satisfactory results. However, if the time interval for which the equation is applied is short, e.g., for one hour or one day, the application of this multiplier makes it possible for the moisture correction term to become negative. This will result in calculated negative emissions which is not realistic. Users should expand the time interval to include sufficient "dry" hours such that negative emissions are not calculated. For the special case where this equation is used to calculate emissions on an hour by hour basis, such as would be done in some emissions modeling situations, the moisture correction term should be modified so that the moisture correction "credit" is applied to the first hours following cessation of precipitation. In this special case, it is suggested that this 20% "credit" be applied on a basis of one hour credit for each hour of precipitation up to a maximum of 12 hours.

Note that the assumption leading to Equation 3 is based on analogy with the approach used to develop long-term average unpaved road emission factors in Section 13.2.2.

Figure 13.2.1-2 presents the geographical distribution of "wet" days on an annual basis for the United States. Maps showing this information on a monthly basis are available in the *Climatic Atlas of the United States*[23] . Alternative sources include other Department of Commerce publications (such as local climatological data summaries). The National Climatic Data Center (NCDC) offers several products that provide hourly precipitation data. In particular, NCDC offers *Solar and Meteorological Surface Observation Network 1961-1990* (SAMSON) CD-ROM, which contains 30 years worth of hourly meteorological data for first-order National Weather Service locations. Whatever meteorological data are used, the source of that data and the averaging period should be clearly specified.

It is emphasized that the simple assumption underlying Equations 2 and 3 has not been verified in any rigorous manner. For that reason, the quality ratings for Equations 2 and 3 should be downgraded one letter from the rating that would be applied to Equation 1.

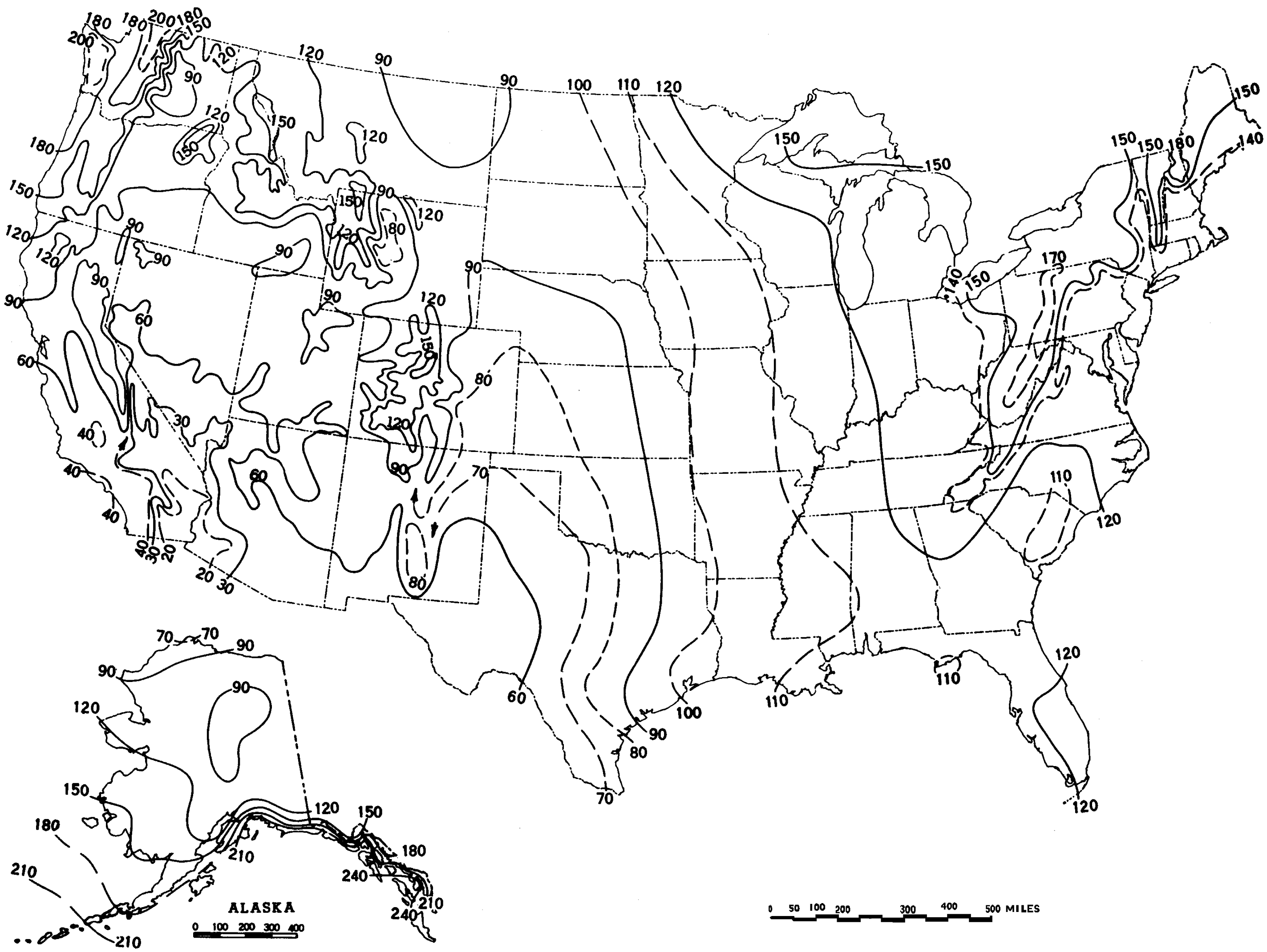

Figure 13.2.1-2. Mean number of days with 0.01 inch or more of precipitation in the United States.

Table 13.2.1-3 presents recommended default silt loadings for normal baseline conditions and for wintertime baseline conditions in areas that experience frozen precipitation with periodic application of antiskid material[24]. The winter baseline is represented as a multiple of the non-winter baseline, depending on the ADT value for the road in question. As shown, a multiplier of 4 is applied for low volume roads (< 500 ADT) to obtain a wintertime baseline silt loading of 4 X 0.6 = 2.4 g/m^2.

Table 13.2.1-3. Ubiquitous Silt Loading Default Values with Hot Spot Contributions from Anti-Skid Abrasives (g/m^2)

ADT Category	< 500	500-5,000	5,000-10,000	> 10,000
Ubiquitous Baseline g/m^2	0.6	0.2	0.06	0.03 0.015 limited access
Ubiquitous Winter Baseline Multiplier during months with frozen precipitation	X4	X3	X2	X1
Initial peak additive contribution from application of antiskid abrasive (g/m^2)	2	2	2	2
Days to return to baseline conditions (assume linear decay)	7	3	1	0.5

It is suggested that an additional (but temporary) silt loading contribution of 2 g/m^2 occurs with each application of antiskid abrasive for snow/ice control. This was determined based on a typical application rate of 500 lb per lane mile and an initial silt content of 1 % silt content. Ordinary rock salt and other chemical deicers add little to the silt loading, because most of the chemical dissolves during the snow/ice melting process.

To adjust the baseline silt loadings for mud/dirt trackout, the number of trackout points is required. It is recommended that in calculating PM-10 emissions, six additional miles of road be added for each active trackout point from an active construction site, to the paved road mileage of the specified category within the county. In calculating PM-2.5 emissions, it is recommended that three additional miles of road be added for each trackout point from an active construction site.

It is suggested the number of trackout points for activities other than road and building construction areas be related to land use. For example, in rural farming areas, each mile of paved road would have a specified number of trackout points at intersections with unpaved roads. This value could be estimated from the unpaved road density (mi/sq. mi.).

The use of a default value from Table 13.2.1-3 should be expected to yield only an order-of-magnitude estimate of the emission factor. Public paved road silt loadings are dependent upon: traffic characteristics (speed, ADT, and fraction of heavy vehicles); road characteristics (curbs, number of lanes, parking lanes); local land use (agriculture, new residential construction) and regional/seasonal factors (snow/ice controls, wind blown dust). As a result, the collection and use of site-specific silt loading data is highly recommended. In the event that default silt loading values are used, the quality ratings for the equation should be downgraded 2 levels.

Limited access roadways pose severe logistical difficulties in terms of surface sampling, and few silt loading data are available for such roads. Nevertheless, the available data do not suggest great variation in silt loading for limited access roadways from one part of the country to another. For annual conditions, a default value of 0.015 g/m^2 is recommended for limited access roadways.[9,22] Even fewer of the available data correspond to worst-case situations, and elevated loadings are observed to be quickly depleted because of high traffic speeds and high ADT rates. A default value of 0.2 g/m^2 is recommended for short periods of time following application of snow/ice controls to limited access roads.[22]

The limited data on silt loading values for industrial roads have shown as much variability as public roads. Because of the variations of traffic conditions and the use of preventive mitigative controls, the data probably do not reflect the full extent of the potential variation in silt loading on industrial roads. However, the collection of site specific silt loading data from industrial roads is easier and safer than for public roads. Therefore, the collection and use of site-specific silt loading data is preferred and is highly recommended. In the event that site-specific values cannot be obtained, an appropriate value for an industrial road may be selected from the mean values given in Table 13.2.1-4, but the quality rating of the equation should be reduced by 2 levels.

Table 13.2.1-4 (Metric And English Units). TYPICAL SILT CONTENT AND LOADING VALUES FOR PAVED ROADS AT INDUSTRIAL FACILITIES[a]

Industry	No. Of Sites	No. Of Samples	Silt Content (%)		No. Of Travel Lanes	Total Loading x 10^{-3}			Silt Loading (g/m^2)	
			Range	Mean		Range	Mean	Units[b]	Range	Mean
Copper smelting	1	3	15.4-21.7	19.0	2	12.9-19.5 45.8-69.2	15.9 55.4	kg/km lb/mi	188-400	292
Iron and steel production	9	48	1.1-35.7	12.5	2	0.006-4.77 0.020-16.9	0.495 1.75	kg/km lb/mi	0.09-79	9.7
Asphalt batching	1	3	2.6-4.6	3.3	1	12.1-18.0 43.0-64.0	14.9 52.8	kg/km lb/mi	76-193	120
Concrete batching	1	3	5.2-6.0	5.5	2	1.4-1.8 5.0-6.4	1.7 5.9	kg/km lb/mi	11-12	12
Sand and gravel processing	1	3	6.4-7.9	7.1	1	2.8-5.5 9.9-19.4	3.8 13.3	kg/km lb/mi	53-95	70
Municipal solid waste landfill	2	7	—	—	2	—	—	—	1.1-32.0	7.4
Quarry	1	6	—	—	2	—	—	—	2.4-14	8.2

[a] References 1-2,5-6,11-13. Values represent samples collected from *industrial* roads. Public road silt loading values are presented in Table-13.2.1-2. Dashes indicate information not available.

[b] Multiply entries by 1000 to obtain stated units; kilograms per kilometer (kg/km) and pounds per mile (lb/mi).

13.2.1.4 Controls[6,25]

Because of the importance of the silt loading, control techniques for paved roads attempt either to prevent material from being deposited onto the surface (preventive controls) or to remove from the travel lanes any material that has been deposited (mitigative controls). Covering of loads in trucks, and the paving of access areas to unpaved lots or construction sites, are examples of preventive measures. Examples of mitigative controls include vacuum sweeping, water flushing, and broom sweeping and flushing. Actual control efficiencies for any of these techniques can be highly variable. Locally measured silt loadings before and after the application of controls is the preferred method to evaluate controls. It is particularly important to note that street sweeping of gutters and curb areas may actually increase the silt loading on the traveled portion of the road. Redistribution of loose material onto the travel lanes will actually produce a short-term increase in the emissions.

In general, preventive controls are usually more cost effective than mitigative controls. The cost-effectiveness of mitigative controls falls off dramatically as the size of an area to be treated increases. The cost-effectiveness of mitigative measures is also unfavorable if only a short period of time is required for the road to return to equilibrium silt loading condition. That is to say, the number and length of public roads within most areas of interest preclude any widespread and routine use of mitigative controls. On the other hand, because of the more limited scope of roads at an industrial site, mitigative measures may be used quite successfully (especially in situations where truck spillage occurs). Note, however, that public agencies could make effective use of mitigative controls to remove sand/salt from roads after the winter ends.

Because available controls will affect the silt loading, controlled emission factors may be obtained by substituting controlled silt loading values into the equation. (Emission factors from controlled industrial roads were used in the development of the equation.) The collection of surface loading samples from treated, as well as baseline (untreated), roads provides a means to track effectiveness of the controls over time.

13.2.1.5 Changes since Fifth Edition

The following changes were made since the publication of the Fifth Edition of AP-42:

1) The particle size multiplier was reduced by approximately 55% as a result of emission testing specifically to evaluate the PM-2.5 component of the emissions.

2) Default silt loading values were included in Table 13.2.1-2 replacing the Tables and Figures containing silt loading statistical information.

3) Editorial changes within the text were made indicating the possible causes of variations in the silt loading between roads within and among different locations. The uncertainty of using the default silt loading value was discussed.

4) Section 13.2.1.1 was revised to clarify the role of dust loading in resuspension. Additional minor text changes were made.

5) Equations 2 and 3, Figure 13.2.1-2, and text were added to incorporate natural mitigation into annual or other long-term average emission factors.

6) The emission factor equation was adjusted to remove the component of particulate emissions from exhaust, brake wear, and tire wear. The parameter *C* in the new equation varies with aerodynamic size range of the particulate matter. Table 13.2.1-2 was added to present the new coefficients.

7) The default silt loading values in Table 13.2.1-3 were revised to incorporate the results from a recent analysis of silt loading data.

8) The PM-2.5 particle size multiplier was reduced by 40% as the result of wind tunnel studies of a variety of dust emitting surface materials.

9) References were rearranged and renumbered.

References For Section 13.2.1

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2. R. Bohn, *et al.*, *Fugitive Emissions From Integrated Iron And Steel Plants*, EPA-600/2-78-050, U. S. Environmental Protection Agency, Cincinnati, OH, March 1978.

3. C. Cowherd, Jr., *et al.*, *Iron And Steel Plant Open Dust Source Fugitive Emission Evaluation*, EPA-600/2-79-103, U. S. Environmental Protection Agency, Cincinnati, OH, May 1979.

4. C. Cowherd, Jr., *et al.*, *Quantification Of Dust Entrainment From Paved Roadways*, EPA-450/3-77-027, U. S. Environmental Protection Agency, Research Triangle Park, NC, July 1977.

5. *Size Specific Particulate Emission Factors For Uncontrolled Industrial And Rural Roads*, EPA Contract No. 68-02-3158, Midwest Research Institute, Kansas City, MO, September 1983.

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7. J. P. Reider, *Size-specific Particulate Emission Factors For Uncontrolled Industrial And Rural Roads*, EPA Contract 68-02-3158, Midwest Research Institute, Kansas City, MO, September 1983.

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14. *Montana Street Sampling Data*, Montana Department Of Health And Environmental Sciences, Helena, MT, July 1992.

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18. *Post-storm Measurement Results — Salt Lake County Road Dust Silt Loading Winter 1991/92 Measurement Program*, Aerovironment, Inc., Monrovia, CA, June 1992.

19. Written communication from Harold Glasser, Department of Health, Clark County (NV).

20. *PM-10 Emissions Inventory Data For The Maricopa And Pima Planning Areas*, EPA Contract No. 68-02-3888, Engineering-Science, Pasadena, CA, January 1987.

21. *Characterization Of PM-10 Emissions From Antiskid Materials Applied To Ice- And Snow-Covered Roadways*, EPA Contract No. 68-D0-0137, Midwest Research Institute, Kansas City, MO, October 1992.

22. C. Cowherd, *Background Document for Revisions to Fine Fraction Ratios &sed for AP-42 Fugitive Dust Emission Factors*. Prepared by Midwest Research Institute for Western Governors Association, Western Regional Air Partnership, Denver, CO, February 1, 2006.

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27. EPA, 2002b. MOBILE6 User Guide, United States Environmental Protection Agency, Office of Transportation and Air Quality. EPA420-R-02-028, October 2002.

28. Written communication (Technical Memorandum) from P. Hemmer, E.H. Pechan & Associates, Inc., Durham, NC to B. Kuykendal, U. S. Environmental Protection Agency, Research Triangle Park, NC, August, 21, 2003.

South Coast
Air Quality Management District
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BOARD MEETING DATE: January 10, 1997 AGENDA NO. 31

PROPOSAL: Amend Rule 403 - Fugitive Dust and Adopt Rule 1186 - PM_{10} Emissions from Paved and Unpaved Roads and Livestock Operations

SYNOPSIS: The 1994 PM_{10} SIP identified candidate Best Available Control Measures (BACM) for fugitive dust sources and established technical and cost feasibility criteria for their adoption by February 8, 1997, as required by the federal Clean Air Act. AQMD staff have completed the BACM feasibility analysis and have incorporated the BACM that meet the feasibility criteria into proposed amendments to Rule 403 and proposed Rule 1186.

COMMITTEE: Stationary Source, December 5, 1996, reviewed.

RECOMMENDED ACTION:
Amend Rule 403 - Fugitive Dust and Adopt Rule 1186 - PM_{10} Emissions from Paved and Unpaved Roads and Livestock Operations.

James M. Lents, Ph.D.
Executive Officer

BRW:MDZ:LTT:JCL:ML

Background

The South Coast Air Basin (Basin) exceeds state and federal air quality standards for PM_{10} (defined as particulate matter with an aerodynamic diameter of 10 microns or less). As a result of these exceedances, the Basin has been designated by the U.S. Environmental Protection Agency (U.S. EPA) as a "serious nonattainment area" for PM_{10}. Under the federal Clean Air Act (CAA), the South Coast Air Quality Management District (District) is required to implement best available control measures (BACM) for fugitive dust sources by February 8, 1997. The District also is required to adopt contingency measures in regulatory form by February 8, 1997 to be implemented if the area does not achieve sufficient progress towards attainment. In 1994, the District prepared and adopted a "serious nonattainment area" PM_{10} SIP revision (1994 BACM SIP, Appendix I-D of 1994 AQMP) that identified candidate BACM for fugitive dust sources. The 1994 BACM SIP committed the District to

Relevancy Factor

Not all portions of construction sites lend themselves to increased watering. For example, steep slopes, building foundations, and landscaped areas will not be subject to watering. Presuming that 20 percent of active construction sites contain areas where watering is not feasible, the relevancy factor is estimated at 80.

Usage Factor

For construction activities, the usage factor is 100 because increased watering is the only available control action.

PR 1186[2]

BCM 1b: Routine Street Cleaning (d)(2)

Control Effectiveness

Previous studies have documented that routine street sweeping is not effective in reducing ambient PM_{10} concentrations and, in fact, broom sweepers resuspend as many particles as they remove (Chow, et al., 1989). A recent study, however, documented that vacuum-based, PM_{10}-efficient street sweepers represented an 80-percent reduction in resuspended PM_{10} emissions compared with mechanical broom sweepers. The study also documented that these PM_{10}-efficient street sweepers removed 99 percent of street surface silt loading (CE-CERT, 1995). Together, the reduction in resuspended emissions and improved collection efficiency of PM_{10}-efficient street sweepers is estimated to result in a control effectiveness of 79 percent on the day of street sweeping (.99 x .80 = 79%). Presuming that street silt loading returns to equilibrium 3 days after they are cleaned, the control effectiveness for days 2 and 3 is estimated at 53 and 26 percent, respectively (based on a linear interpolation). If street sweeping occurs an average of twice per month (24 days/year) the overall control effectiveness of the measure is estimated at 10 [(.79 x 24 + .53 x 24 + .26 x 24)/365 = .10]. A low control effectiveness value of 5 and a high value of 15 are also included in this analysis.

Relevancy Factor

Street sweeping is not routinely conducted on freeways due to safety considerations. Accordingly, the relevancy factor for routine street sweeping is estimated as the percentage of PM_{10} emissions generated from non-freeway roadways within the District. Based on 1993 data, an average of 70 percent of the District's entrained road dust PM_{10} emissions are from local, collector, and major streets. Unlike the requirements for

[2] Refers to sections of PR 1186

minimal track-out, the relevancy factor does not need to be adjusted because the measure attempts to reduce silt loadings regardless of their origin. The resulting relevancy factor is 70.

Usage Factor

For routine street sweeping requirements, the usage factor is 100 because routine street cleaning is the only available option.

BCM 1c: Post-Event Cleaning (d)(1)

Control Effectiveness

Based on the information presented for the routine street cleaning measure, the control effectiveness of the post-event cleaning measure is estimated at 79 percent. This is based on use of a PM_{10}-efficient street sweeper for final street cleaning (presumes that heavy equipment is presently used for larger accumulations and not as a result of this control measure). A high control-effectiveness value of 85 and a low value of 70 have also been included in this analysis.

Relevancy Factor

U.S. EPA guidance indicates that 9 percent of paved road deposition is attributable to erosion from adjacent areas (U.S. EPA, 1988). In the absence of other information regarding post-event street loadings, the relevancy factor for this control measure is estimated at 9.

Usage Factor

The usage factor is 100 because street cleaning is the only option available to comply with the intent of the control measure.

BCM 1d/e: Curb and Gutter/Chemical Stabilization (e)(1)

Control Effectiveness

Limited research has been conducted regarding the effectiveness of curb and gutter or road shoulder improvements (e.g., chemical stabilization/asphaltic road base) in reducing paved road silt loading. Dust loadings for streets with uncurbed shoulders were, however, estimated to be four times greater than that observed for curbed streets (U.S. EPA, 1992). Accordingly, the control effectiveness of these measures is estimated at 75. A high value of 80 and a low value of 70 have also been included in this analysis.

APPENDIX S-2

DEATILED EMISSION CALCULATIONS FOR THE
2005 BASELINE YEAR AND PROJECT YEARS 2010-2016

Summary of Particulate Matter Emissions from Paved Roadways
Dolores and ICTF Rail Yards, Long Beach, CA

Yard	Vehicle Type	Annual VMT (mi/yr)[1]	PM10 Emission Factor (g/VMT)[2]	Control Efficiency (%)[3]	2005 PM10 Emission Estimates (tpy)[3]
Dolores	Delivery Trucks	502.31	12.11	45%	0.00
Dolores	Yard Truck	118,007.00	12.11	45%	0.87
Dolores	Worker Vehicles	16,425.00	12.11	45%	0.12
ICTF	Intermodal Trucks	1,641,629.38	12.11	45%	12.06
ICTF	Delivery Trucks	17.18	12.11	45%	0.00
ICTF	Yard Truck	365,000.00	12.11	45%	2.68
ICTF	Worker Vehicles	382,337.50	12.11	45%	2.81
Total		**2,523,918.37**			**18.54**

Notes:

1. See intermodal truck, delivery truck, and worker vehicle subsheets for VMT calculations.
2. PM10 emission factor calculated using Equation 2 of AP-42 Section 13.2.1 (11/06) and the variables listed in the following table.

Variable	Unit	Annual PM10	Reference
k	g/VMT	7.3	AP-42, Table 13.2-1.1, 11/06
sL	g/m2	0.015	AP-42, Table 13.2.1-3, 11/06
W	tons	36.1	Trinity Report, Table 19-1
C	g/VMT	0.2119	AP-42, Table 13.2.1-2, 11/06
P	days	40	AP-42, Fig 13.2.1-2, 11/06
N	days	365	
$(sL/2)^{0.65}$		0.0416	AP-42, Equation 2, Section13.2.1, 11/6
$(W/3)^{1.5}$		41.7425	AP-42, Equation 2, Section13.2.1, 11/7
(P/4N)		0.0274	AP-42, Equation 2, Section13.2.1, 11/8
E	**g/VMT**	**12.11**	AP-42, Equation 2, Section13.2.1, 11/9

3. The control efficiency is calculated based on the equation in Attachment 1 of the SCAQMD staff report for Rule 1186 (1/97) and assumes street sweeping twice per week.

Summary of Particulate Matter Emissions from Paved Roadways
Dolores and ICTF Rail Yards, Long Beach, CA

Yard	Vehicle Type	2010 VMT (mi/yr)[1]	PM10 Emission Factor (g/VMT)[2]	Control Efficiency (%)[3]	2010 PM10 Emission Estimates (tpy)[3]
Dolores	Delivery Trucks	502.32	12.11	45%	0.00
Dolores	Worker Vehicles	16,425.00	12.11	45%	0.12
Dolores	Yard Truck	118,007.00	12.11	45%	0.87
ICTF	Drayage Trucks	2,381,400.00	12.11	45%	17.49
ICTF	Delivery Trucks	11.50	12.11	45%	0.00
ICTF	Yard Truck	365,000.00	12.11	45%	2.68
ICTF	Worker Vehicles	382,337.50	12.11	45%	2.81
Total		**3,263,683.32**			**23.97**

Notes:
1. See intermodal truck, delivery truck, and worker vehicle subsheets for VMT calculations.
2. PM10 emission factor calculated using Equation 2 of AP-42 Section 13.2.1 (11/06) and the variables listed in the following table.

Variable	Unit	Annual PM10	Reference
k	g/VMT	7.3	AP-42, Table 13.2-1.1, 11/06
sL	g/m2	0.015	AP-42, Table 13.2.1-3, 11/06
W	tons	36.1	Trinity Report, Table 19-1
C	g/VMT	0.2119	AP-42, Table 13.2.1-2, 11/06
P	days	40	AP-42, Fig 13.2.1-2, 11/06
N	days	365	
$(sL/2)^{0.65}$		0.0416	AP-42, Equation 2, Section13.2.1, 11/6
$(W/3)^{1.5}$		41.7425	AP-42, Equation 2, Section13.2.1, 11/7
(P/4N)		0.0274	AP-42, Equation 2, Section13.2.1, 11/8
E	**g/VMT**	**12.11**	AP-42, Equation 2, Section13.2.1, 11/9

3. The control efficiency is calculated based on the equation in Attachment 1 of the SCAQMD staff report for Rule 1186 (1/97) and assumes street sweeping twice per week.

Summary of Particulate Matter Emissions from Paved Roadways
Dolores and ICTF Rail Yards, Long Beach, CA

Yard	Vehicle Type	Annual VMT (mi/yr)[1]	PM10 Emission Factor (g/VMT)[2]	Control Efficiency (%)[3]	2012 PM10 Emission Estimates (tpy)[3]
Dolores	Delivery Trucks	502.31	12.11	45%	0.00
Dolores	Worker Vehicles	16,425.00	12.11	45%	0.12
Dolores	Yard Truck	118,007.00	12.11	45%	0.87
ICTF	Drayage Trucks	2,910,600.00	12.11	45%	21.38
ICTF	Delivery Trucks	1.25	12.11	45%	0.00
ICTF	Yard Truck	365,000.00	12.11	45%	2.68
ICTF	Worker Vehicles	382,337.50	12.11	45%	2.81
Total		**3,792,873.06**			**27.86**

Notes:
1. See intermodal truck, delivery truck, and worker vehicle subsheets for VMT calculations.
2. PM10 emission factor calculated using Equation 2 of AP-42 Section 13.2.1 (11/06) and the variables listed in the following table.

Variable	Unit	Annual PM10	Reference
k	g/VMT	7.3	AP-42, Table 13.2-1.1, 11/06
sL	g/m2	0.015	AP-42, Table 13.2.1-3, 11/06
W	tons	36.1	Trinity Report, Table 19-1
C	g/VMT	0.2119	AP-42, Table 13.2.1-2, 11/06
P	days	40	AP-42, Fig 13.2.1-2, 11/06
N	days	365	
$(sL/2)^{0.65}$		0.0416	AP-42, Equation 2, Section13.2.1, 11/6
$(W/3)^{1.5}$		41.7425	AP-42, Equation 2, Section13.2.1, 11/7
(P/4N)		0.0274	AP-42, Equation 2, Section13.2.1, 11/8
E	**g/VMT**	**12.11**	AP-42, Equation 2, Section13.2.1, 11/9

3. The control efficiency is calculated based on the equation in Attachment 1 of the SCAQMD staff report for Rule 1186 (1/97) and assumes street sweeping twice per week.

Summary of Particulate Matter Emissions from Paved Roadways
Dolores and ICTF Rail Yards, Long Beach, CA

Yard	Vehicle Type	Annual VMT (mi/yr)[1]	PM10 Emission Factor (g/VMT)[2]	Control Efficiency (%)[3]	2014 PM10 Emission Estimates (tpy)[3]
Dolores	Delivery Trucks	502.31	12.11	45%	0.00
Dolores	Worker Vehicles	16,425.00	12.11	45%	0.12
Dolores	Yard Truck	118,007.00	12.11	45%	0.87
ICTF	Drayage Trucks	2,653,560.00	12.11	45%	19.49
ICTF	Delivery Trucks	1.25	12.11	45%	0.00
ICTF	Yard Truck	365,000.00	12.11	45%	2.68
ICTF	Worker Vehicles	382,337.50	12.11	45%	2.81
Total		**3,535,833.06**			**25.97**

Notes:
1. See intermodal truck, delivery truck, and worker vehicle subsheets for VMT calculations.
2. PM10 emission factor calculated using Equation 2 of AP-42 Section 13.2.1 (11/06) and the variables listed in the following table.

Variable	Unit	Annual PM10	Reference
k	g/VMT	7.3	AP-42, Table 13.2-1.1, 11/06
sL	g/m2	0.015	AP-42, Table 13.2.1-3, 11/06
W	tons	36.1	Trinity Report, Table 19-1
C	g/VMT	0.2119	AP-42, Table 13.2.1-2, 11/06
P	days	40	AP-42, Fig 13.2.1-2, 11/06
N	days	365	
$(sL/2)^{0.65}$		0.0416	AP-42, Equation 2, Section13.2.1, 11/6
$(W/3)^{1.5}$		41.7425	AP-42, Equation 2, Section13.2.1, 11/7
(P/4N)		0.0274	AP-42, Equation 2, Section13.2.1, 11/8
E	**g/VMT**	**12.11**	AP-42, Equation 2, Section13.2.1, 11/9

3. The control efficiency is calculated based on the equation in Attachment 1 of the SCAQMD staff report for Rule 1186 (1/97) and assumes street sweeping twice per week.

Summary of Particulate Matter Emissions from Paved Roadways
Dolores and ICTF Rail Yards, Long Beach, CA

Yard	Vehicle Type	Annual VMT (mi/yr)[1]	PM10 Emission Factor (g/VMT)[2]	Control Efficiency (%)[3]	2016 PM10 Emission Estimates (tpy)[3]
Dolores	Delivery Trucks	502.31	12.11	45%	0.00
Dolores	Worker Vehicles	16,425.00	12.11	45%	0.12
Dolores	Yard Truck	118,007.00	12.11	45%	0.87
ICTF	Drayage Trucks	3,061,800.00	12.11	45%	22.49
ICTF	Delivery Trucks	1.25	12.11	45%	0.00
ICTF	Yard Truck	365,000.00	12.11	45%	2.68
ICTF	Worker Vehicles	382,337.50	12.11	45%	2.81
Total		**3,944,073.06**			**28.97**

Notes:
1. See intermodal truck, delivery truck, and worker vehicle subsheets for VMT calculations.
2. PM10 emission factor calculated using Equation 2 of AP-42 Section 13.2.1 (11/06) and the variables listed in the following table.

Variable	Unit	Annual PM10	Reference
k	g/VMT	7.3	AP-42, Table 13.2-1.1, 11/06
sL	g/m2	0.015	AP-42, Table 13.2.1-3, 11/06
W	tons	36.1	Trinity Report, Table 19-1
C	g/VMT	0.2119	AP-42, Table 13.2.1-2, 11/06
P	days	40	AP-42, Fig 13.2.1-2, 11/06
N	days	365	
$(sL/2)^{0.65}$		0.0416	AP-42, Equation 2, Section13.2.1, 11/6
$(W/3)^{1.5}$		41.7425	AP-42, Equation 2, Section13.2.1, 11/7
(P/4N)		0.0274	AP-42, Equation 2, Section13.2.1, 11/8
E	**g/VMT**	**12.11**	AP-42, Equation 2, Section13.2.1, 11/9

3. The control efficiency is calculated based on the equation in Attachment 1 of the SCAQMD staff report for Rule 1186 (1/97) and assumes street sweeping twice per week.

APPENDIX T

70-YEAR AVERAGE EMISSION RATES

Summary of Locomotive Emissions for UPRR Dolores and ICTF
HC TPY

	Activity	2005	2010	2012	2014	2016	2020	2030	2040	2080
ICTF	Train Activity	1.00	1.06	1.26	1.28	1.25	0.89	0.45	0.24	0.24
	Yard Operations	5.78	8.32	10.15	12.00	13.84	13.84	13.84	13.84	13.84
	Load Testing	0.42	0.31	0.37	0.37	0.36	0.26	0.13	0.07	0.07
	Service Idling	1.35	0.97	1.14	1.17	1.13	0.81	0.41	0.22	0.22
	Subtotal ICTF-related	*8.54*	*10.65*	*12.92*	*14.82*	*16.58*	*15.80*	*14.84*	*14.38*	*14.38*
Dolores (Total)	Train Activity	2.32	1.05	0.86	0.56	0.32	0.23	0.11	0.06	0.06
	Yard Operations	5.66	6.11	4.99	3.79	2.55	2.55	2.55	2.55	2.55
	Load Testing	0.56	0.31	0.24	0.16	0.09	0.06	0.03	0.02	0.02
	Service Idling	1.78	0.97	0.76	0.50	0.28	0.20	0.10	0.06	0.06
	Subtotal Dolores-All	*10.31*	*8.45*	*6.86*	*5.02*	*3.24*	*3.05*	*2.80*	*2.69*	*2.69*
Total In-Yard	Train Activity	3.32	2.12	2.11	1.84	1.56	1.12	0.57	0.31	0.31
	Yard Operations	11.44	14.43	15.15	15.79	16.40	16.40	16.40	16.40	16.40
	Load Testing	0.97	0.61	0.61	0.53	0.45	0.32	0.16	0.09	0.09
	Service Idling	3.13	1.94	1.90	1.67	1.41	1.01	0.51	0.28	0.28
	Total In-Yard	**18.86**	**19.10**	**19.78**	**19.84**	**19.83**	**18.85**	**17.64**	**17.07**	**17.07**

70 year average calculation (integrating trapezoids between years)		Yr-wted emissions:		38.87	39.61	39.67	77.36	182.45	173.56	682.88
		70 year average:		**17.63**	**TPY**					

Summary of Locomotive Emissions for UPRR Dolores and ICTF

CO TPY

	Activity	2005	2010	2012	2014	2016	2020	2030	2040	2080
ICTF	Train Activity	1.49	1.97	2.38	2.81	3.24	3.24	3.24	3.24	3.24
	Yard Operations	13.51	19.43	23.72	28.03	32.35	32.35	32.35	32.35	32.35
	Load Testing	1.17	0.85	1.02	1.20	1.38	1.38	1.38	1.38	1.38
	Service Idling	1.97	1.85	2.22	2.62	3.02	3.02	3.02	3.02	3.02
	Subtotal ICTF-related	*18.14*	*24.10*	*29.33*	*34.66*	*39.99*	*39.99*	*39.99*	*39.99*	*39.99*
Dolores (Total)	Train Activity	4.03	1.96	1.61	1.23	0.83	0.83	0.83	0.83	0.83
	Yard Operations	13.21	14.29	11.67	8.87	5.97	5.97	5.97	5.97	5.97
	Load Testing	1.55	0.85	0.68	0.51	0.35	0.35	0.35	0.35	0.35
	Service Idling	2.61	1.85	1.48	1.12	0.76	0.76	0.76	0.76	0.76
	Subtotal Dolores-All	*21.41*	*18.94*	*15.44*	*11.73*	*7.90*	*7.90*	*7.90*	*7.90*	*7.90*
Total In-Yard	Train Activity	5.52	3.93	3.99	4.03	4.06	4.06	4.06	4.06	4.06
	Yard Operations	26.72	33.71	35.39	36.90	38.31	38.31	38.31	38.31	38.31
	Load Testing	2.73	1.70	1.69	1.71	1.73	1.73	1.73	1.73	1.73
	Service Idling	4.58	3.69	3.70	3.74	3.78	3.78	3.78	3.78	3.78
	Total In-Yard	**39.55**	**43.04**	**44.77**	**46.39**	**47.89**	**47.89**	**47.89**	**47.89**	**47.89**

70 year average calculation (integrating trapezoids between years)	Yr-wted emissions:	87.81	91.16	94.28	191.56	478.89	478.89	1915.56
	70 year average:	**47.69**	**TPY**					

Summary of Locomotive Emissions for UPRR Dolores and ICTF
NOx TPY

	Activity	2005	2010	2012	2014	2016	2020	2030	2040	2080
ICTF	Train Activity	13.09	16.63	19.75	22.00	24.04	19.49	9.84	5.21	5.21
	Yard Operations	129.46	27.93	34.10	40.30	46.50	46.50	46.50	46.50	46.50
	Load Testing	10.81	9.75	11.70	13.03	14.24	11.55	5.83	3.09	3.09
	Service Idling	8.37	7.26	8.55	9.53	10.41	8.44	4.26	2.25	2.25
	Subtotal ICTF-related	*161.72*	*61.58*	*74.10*	*84.86*	*95.20*	*85.98*	*66.44*	*57.05*	*57.05*
Dolores	Train Activity	36.99	16.85	13.83	9.91	6.32	5.12	2.59	1.37	1.37
(Total)	Yard Operations	126.65	20.54	16.78	12.75	8.58	8.58	8.58	8.58	8.58
	Load Testing	14.32	9.75	7.80	5.59	3.56	2.89	1.46	0.77	0.77
	Service Idling	11.09	7.26	5.70	4.08	2.60	2.11	1.07	0.56	0.56
	Subtotal Dolores-All	*189.05*	*54.40*	*44.11*	*32.32*	*21.06*	*18.69*	*13.69*	*11.28*	*11.28*
Total In-Yard	Train Activity	50.08	33.48	33.58	31.90	30.36	24.61	12.43	6.57	6.57
	Yard Operations	256.11	48.47	50.88	53.05	55.08	55.08	55.08	55.08	55.08
	Load Testing	25.13	19.50	19.50	18.62	17.81	14.43	7.29	3.86	3.86
	Service Idling	19.46	14.52	14.25	13.61	13.01	10.55	5.33	2.82	2.82
	Total In-Yard	**350.77**	**115.98**	**118.21**	**117.18**	**116.26**	**104.67**	**80.13**	**68.33**	**68.33**

70 year average calculation (integrating trapezoids between years)	Yr-wted emissions:	234.19	235.38	233.44	441.87	924.03	742.33	2733.34
	70 year average:	**79.21**	**TPY**					

Summary of Locomotive Emissions for UPRR Dolores and ICTF

DPM TPY

	Activity	**2005**	**2010**	**2012**	**2014**	**2016**	**2020**	**2030**	**2040**	**2080**
ICTF	Train Activity	0.32	0.51	0.61	0.63	0.62	0.46	0.24	0.13	0.13
	Yard Operations	2.82	0.60	0.74	0.87	1.01	1.01	1.01	1.01	1.01
	Load Testing	0.25	0.22	0.27	0.28	0.28	0.21	0.10	0.06	0.06
	Service Idling	0.28	0.23	0.27	0.28	0.27	0.20	0.10	0.06	0.06
	Subtotal ICTF-related	*3.67*	*1.56*	*1.88*	*2.06*	*2.18*	*1.88*	*1.45*	*1.25*	*1.25*
Dolores (Total)	Train Activity	0.91	0.51	0.43	0.29	0.16	0.12	0.06	0.03	0.03
	Yard Operations	2.75	0.44	0.36	0.28	0.19	0.19	0.19	0.19	0.19
	Load Testing	0.33	0.22	0.18	0.12	0.07	0.05	0.03	0.01	0.01
	Service Idling	0.37	0.23	0.18	0.12	0.07	0.05	0.03	0.01	0.01
	Subtotal Dolores-All	*4.37*	*1.41*	*1.15*	*0.80*	*0.49*	*0.41*	*0.30*	*0.25*	*0.25*
Total In-Yard	Train Activity	1.23	1.02	1.04	0.91	0.79	0.59	0.30	0.16	0.16
	Yard Operations	5.57	1.05	1.10	1.15	1.19	1.19	1.19	1.19	1.19
	Load Testing	0.59	0.44	0.45	0.40	0.34	0.26	0.13	0.07	0.07
	Service Idling	0.65	0.45	0.44	0.39	0.34	0.25	0.13	0.07	0.07
	Total In-Yard	**8.04**	**2.96**	**3.03**	**2.85**	**2.67**	**2.29**	**1.75**	**1.50**	**1.50**
70 year average calculation (integrating trapezoids between years)		Yr-wted emissions:		5.99	5.88	5.52	9.92	20.22	16.24	59.84
		70 year average:		**1.77**	**TPY**					

Summary of Locomotive Emissions for UPRR Dolores and ICTF

SOx TPY

	Activity	2005	2010	2012	2014	2016	2020	2030	2040	2080
ICTF	Train Activity	0.84	0.15	0.08	0.05	0.05	0.05	0.05	0.05	0.05
	Yard Operations	0.91	0.09	0.11	0.13	0.15	0.15	0.15	0.15	0.15
	Load Testing	0.20	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01
	Service Idling	1.30	0.11	0.05	0.03	0.04	0.04	0.04	0.04	0.04
	Subtotal ICTF-related	*3.24*	*0.38*	*0.26*	*0.22*	*0.25*	*0.25*	*0.25*	*0.25*	*0.25*
Dolores (Total)	Train Activity	2.10	0.15	0.05	0.02	0.01	0.01	0.01	0.01	0.01
	Yard Operations	0.89	0.07	0.05	0.04	0.03	0.03	0.03	0.03	0.03
	Load Testing	0.26	0.02	0.01	0.00	0.00	0.00	0.00	0.00	0.00
	Service Idling	1.73	0.11	0.04	0.01	0.01	0.01	0.01	0.01	0.01
	Subtotal Dolores-All	*4.97*	*0.35*	*0.15*	*0.08*	*0.05*	*0.05*	*0.05*	*0.05*	*0.05*
Total In-Yard	Train Activity	2.93	0.30	0.13	0.07	0.07	0.07	0.07	0.07	0.07
	Yard Operations	1.79	0.15	0.16	0.17	0.17	0.17	0.17	0.17	0.17
	Load Testing	0.46	0.05	0.03	0.01	0.01	0.01	0.01	0.01	0.01
	Service Idling	3.03	0.23	0.09	0.05	0.05	0.05	0.05	0.05	0.05
	Total In-Yard	**8.21**	**0.73**	**0.41**	**0.29**	**0.30**	**0.30**	**0.30**	**0.30**	**0.30**

70 year average calculation (integrating trapezoids between years)	Yr-wted emissions:	1.14	0.70	0.60	1.21	3.02	3.02	12.08
	70 year average:	**0.31**	**TPY**					

Summary of Locomotive Emissions for UPRR Dolores and ICTF
CO_2 MTPY

	Activity	2005	2010	2012	2014	2016	2020	2030	2040	2080
ICTF	Train Activity	840	1213	1452	1715	1979	1979	1979	1979	1979
	Yard Operations	6075	8738	10669	12608	14548	14548	14548	14548	14548
	Load Testing	632	759	924	1091	1259	1259	1259	1259	1259
	Service Idling	777	586	685	810	934	934	934	934	934
	Subtotal ICTF-related	*8325*	*11295*	*13729*	*16225*	*18721*	*18721*	*18721*	*18721*	*18721*
Dolores (Total)	Train Activity	2390	1230	1021	776	522	522	522	522	522
	Yard Operations	5943	6425	5248	3987	2684	2684	2684	2684	2684
	Load Testing	838	759	616	468	315	315	315	315	315
	Service Idling	1030	586	457	347	234	234	234	234	234
	Subtotal Dolores-All	*10201*	*9000*	*7342*	*5578*	*3755*	*3755*	*3755*	*3755*	*3755*
Total In-Yard	Train Activity	3231	2443	2473	2491	2502	2502	2502	2502	2502
	Yard Operations	12018	15163	15917	16596	17232	17232	17232	17232	17232
	Load Testing	1470	1518	1539	1559	1574	1574	1574	1574	1574
	Service Idling	1807	1171	1142	1157	1168	1168	1168	1168	1168
	Total In-Yard	**18526**	**20296**	**21071**	**21803**	**22476**	**22476**	**22476**	**22476**	**22476**

70 year average calculation (integrating trapezoids between years)	Yr-wted emissions:	41367	42875	44279	89904	224759	224759	899035
	70 year average:	**22385**	**MTPY**					

Summary of Locomotive Emissions for UPRR Dolores and ICTF
N2O MTPY

	Activity	2005	2010	2012	2014	2016	2020	2030	2040	2080
ICTF	Train Activity	0.021	0.031	0.037	0.043	0.050	0.050	0.050	0.050	0.050
	Yard Operations	0.153	0.220	0.268	0.317	0.366	0.366	0.366	0.366	0.366
	Load Testing	0.016	0.019	0.023	0.027	0.032	0.032	0.032	0.032	0.032
	Service Idling	0.020	0.015	0.017	0.020	0.024	0.024	0.024	0.024	0.024
	Subtotal ICTF-related	*0.209*	*0.284*	*0.345*	*0.408*	*0.471*	*0.471*	*0.471*	*0.471*	*0.471*
Dolores (Total)	Train Activity	0.060	0.031	0.026	0.020	0.013	0.013	0.013	0.013	0.013
	Yard Operations	0.149	0.162	0.132	0.100	0.068	0.068	0.068	0.068	0.068
	Load Testing	0.021	0.019	0.015	0.012	0.008	0.008	0.008	0.008	0.008
	Service Idling	0.026	0.015	0.011	0.009	0.006	0.006	0.006	0.006	0.006
	Subtotal Dolores-All	*0.257*	*0.226*	*0.185*	*0.140*	*0.094*	*0.094*	*0.094*	*0.094*	*0.094*
Total In-Yard	Train Activity	0.081	0.061	0.062	0.063	0.063	0.063	0.063	0.063	0.063
	Yard Operations	0.302	0.381	0.400	0.417	0.433	0.433	0.433	0.433	0.433
	Load Testing	0.037	0.038	0.039	0.039	0.040	0.040	0.040	0.040	0.040
	Service Idling	0.045	0.029	0.029	0.029	0.029	0.029	0.029	0.029	0.029
	Total In-Yard	**0.466**	**0.511**	**0.530**	**0.548**	**0.565**	**0.565**	**0.565**	**0.565**	**0.565**

70 year average calculation (integrating trapezoids between years)		Yr-wted emissions:		1.041	1.079	1.114	2.262	5.654	5.654	22.616
		70 year average:		**0.563**	**MTPY**					

Summary of Locomotive Emissions for UPRR Dolores and ICTF

CH4 MTPY

	Activity	**2005**	**2010**	**2012**	**2014**	**2016**	**2020**	**2030**	**2040**	**2080**
ICTF	Train Activity	0.066	0.095	0.114	0.135	0.156	0.156	0.156	0.156	0.156
	Yard Operations	0.478	0.687	0.839	0.991	1.144	1.144	1.144	1.144	1.144
	Load Testing	0.050	0.060	0.073	0.086	0.099	0.099	0.099	0.099	0.099
	Service Idling	0.061	0.046	0.054	0.064	0.073	0.073	0.073	0.073	0.073
	Subtotal ICTF-related	*0.654*	*0.888*	*1.079*	*1.275*	*1.472*	*1.472*	*1.472*	*1.472*	*1.472*
Dolores (Total)	Train Activity	0.188	0.097	0.080	0.061	0.041	0.041	0.041	0.041	0.041
	Yard Operations	0.467	0.505	0.413	0.313	0.211	0.211	0.211	0.211	0.211
	Load Testing	0.066	0.060	0.048	0.037	0.025	0.025	0.025	0.025	0.025
	Service Idling	0.081	0.046	0.036	0.027	0.018	0.018	0.018	0.018	0.018
	Subtotal Dolores-All	*0.802*	*0.708*	*0.577*	*0.439*	*0.295*	*0.295*	*0.295*	*0.295*	*0.295*
Total In-Yard	Train Activity	0.254	0.192	0.194	0.196	0.197	0.197	0.197	0.197	0.197
	Yard Operations	0.945	1.192	1.251	1.305	1.355	1.355	1.355	1.355	1.355
	Load Testing	0.116	0.119	0.121	0.123	0.124	0.124	0.124	0.124	0.124
	Service Idling	0.142	0.092	0.090	0.091	0.092	0.092	0.092	0.092	0.092
	Total In-Yard	**1.456**	**1.595**	**1.656**	**1.714**	**1.767**	**1.767**	**1.767**	**1.767**	**1.767**

70 year average calculation (integrating trapezoids between years)	Yr-wted emissions:	3.252	3.370	3.481	7.067	17.669	17.669	70.674
	70 year average:	**1.760**	**MTPY**					

Summary of Emissions from HHD Diesel-Fueled Drayage Trucks
Dolores and ICTF Rail Yards, Long Beach, CA

Running Exhaust Emissions

Yard	Number of Truck Trips[1]	VMT per Trip[2]	VMT per Year	Fuel Use (gal/yr)[3]	Carbon Oxidation Factor[4]	70 Yr Avg. Emission Factors (g/mi)[5,6] ROG	CO	NOx	PM10[7]	DPM[7]	SOx	(kg/gal)[4] CO2	N2O[8]	CH4[8]	70 Year Avg. Emission Rates (tpy) ROG	CO	NOx	PM10	DPM	SOx	(metric tons/yr) CO2	N2O	CH4
ICTF - Onsite	2,216,890	1.35	2,992,801.69	846,979.39	99%	1.34	3.15	6.23	0.25	0.25	0.03	10.15	1.39E-05	4.16E-05	4.43	10.39	20.56	0.81	0.81	0.09	8,510.87	0.01	0.04

Idling Exhaust Emissions

Yard	Number of Truck Trips	Idling[9] (mins/trip)	Idling[9] (hr/yr)	Fuel Use (gal/yr)[3]	Carbon Oxidation Factor[4]	70 Yr Avg. Emission Factors (g/hr)[10] ROG	CO	NOx	PM10	DPM	SOx	(kg/gal)[4] CO2	N2O[8]	CH4[8]	70 Year Avg. Emission Rates (tpy) ROG	CO	NOx	PM10	DPM	SOx	(metric tons/yr) CO2	N2O	CH4
ICTF - Onsite	2,216,890	15	554,222.54	158,884	99%	8.03	41.98	122.49	0.26	0.26	0.06	10.15	1.39E-05	4.16E-05	4.90	25.65	74.83	0.16	0.16	0.04	1,596.55	0.00	0.01

Notes:
1. Number of truck trips is the average number of trips from 2010-2016. Assumed no growth after 2016, when Yard reaches its maximum capacity.
2. Average trip length estimated from aerial photos. Assumes trucks will enter through the new Alameda St gate, travel through the facility and exit the existing Sepulveda Blvd. gate.
3. Fuel use calculated using the EMFAC 2007 model with the BURDEN output option.
4. From the Air Resources Board's Draft *Emission Factors for Mandatory Reporting Programs,* August 10, 2007.
5. Running exhaust emission factors (g/mi) from EMFAC 2007 using the BURDEN output option. The EMFAC default model year distribution for L.A. County was used.
6. Emission factor calculations assumed an average speed of 15 mph.
7. The PM10 emission factor includes engine exhaust emissions along with brake and tire wear. The DPM emission factor includes engine exhaust emissions only.
8. Based on a diesel fuel HHV of 5.825 MMBtu/barrel (from ARB Draft Emission Factors for Mandatory Reporting Programs, August 10, 2007) and 42 gallons per barrel.
9. Idiling time per trip is based on the ICTF Modernization Plan.
10. Idling exhaust emission factors from EMFAC 2007 using the EMFAC output option. The EMFAC default model year distribution for L.A. County was used.

Calculation of 70 Year Average ROG Emission Rates
Dolores and ICTF Rail Yards, Long Beach, CA

Year	ROG Emission Rates (tpy)		
	CHE	Heavy Equipment	TRU
2010	3.14	0.67	4.25
2011	3.14	0.67	4.25
2012	0.08	0.12	3.46
2013	0.08	0.12	3.46
2014	0.08	0.13	2.85
2015	0.08	0.13	2.85
2016	0.09	0.14	2.68
2017	0.09	0.14	2.68
2018	0.09	0.14	2.68
2019	0.09	0.14	2.68
2020	0.09	0.14	2.68
2021	0.09	0.14	2.68
2022	0.09	0.14	2.68
2023	0.09	0.14	2.68
2024	0.09	0.14	2.68
2025	0.09	0.14	2.68
2026	0.09	0.14	2.68
2027	0.09	0.14	2.68
2028	0.09	0.14	2.68
2029	0.09	0.14	2.68
2030	0.09	0.14	2.68
2031	0.09	0.14	2.68
2032	0.09	0.14	2.68
2033	0.09	0.14	2.68
2034	0.09	0.14	2.68
2035	0.09	0.14	2.68
2036	0.09	0.14	2.68
2037	0.09	0.14	2.68
2038	0.09	0.14	2.68
2039	0.09	0.14	2.68
2040	0.09	0.14	2.68
2041	0.09	0.14	2.68
2042	0.09	0.14	2.68
2043	0.09	0.14	2.68
2044	0.09	0.14	2.68
2045	0.09	0.14	2.68
2046	0.09	0.14	2.68
2047	0.09	0.14	2.68

Year	ROG Emission Rates (tpy)		
	CHE	Heavy Equipment	TRU
2048	0.09	0.14	2.68
2049	0.09	0.14	2.68
2050	0.09	0.14	2.68
2051	0.09	0.14	2.68
2052	0.09	0.14	2.68
2053	0.09	0.14	2.68
2054	0.09	0.14	2.68
2055	0.09	0.14	2.68
2056	0.09	0.14	2.68
2057	0.09	0.14	2.68
2058	0.09	0.14	2.68
2059	0.09	0.14	2.68
2060	0.09	0.14	2.68
2061	0.09	0.14	2.68
2062	0.09	0.14	2.68
2063	0.09	0.14	2.68
2064	0.09	0.14	2.68
2065	0.09	0.14	2.68
2066	0.09	0.14	2.68
2067	0.09	0.14	2.68
2068	0.09	0.14	2.68
2069	0.09	0.14	2.68
2070	0.09	0.14	2.68
2071	0.09	0.14	2.68
2072	0.09	0.14	2.68
2073	0.09	0.14	2.68
2074	0.09	0.14	2.68
2075	0.09	0.14	2.68
2076	0.09	0.14	2.68
2077	0.09	0.14	2.68
2078	0.09	0.14	2.68
2079	0.09	0.14	2.68
2080	0.09	0.14	2.68
Average	**0.18**	**0.15**	**2.75**

Calculation of 70 Year Average CO Emission Rates
Dolores and ICTF Rail Yards, Long Beach, CA

Year	CO Emission Rates (tpy)		
	CHE	Heavy Equipment	TRU
2010	40.78	12.19	16.71
2011	40.78	12.19	16.71
2012	1.18	10.67	18.88
2013	1.18	10.67	18.88
2014	1.22	12.54	21.25
2015	1.22	12.54	21.25
2016	1.25	12.17	24.02
2017	1.25	12.17	24.02
2018	1.25	12.17	24.02
2019	1.25	12.17	24.02
2020	1.25	12.17	24.02
2021	1.25	12.17	24.02
2022	1.25	12.17	24.02
2023	1.25	12.17	24.02
2024	1.25	12.17	24.02
2025	1.25	12.17	24.02
2026	1.25	12.17	24.02
2027	1.25	12.17	24.02
2028	1.25	12.17	24.02
2029	1.25	12.17	24.02
2030	1.25	12.17	24.02
2031	1.25	12.17	24.02
2032	1.25	12.17	24.02
2033	1.25	12.17	24.02
2034	1.25	12.17	24.02
2035	1.25	12.17	24.02
2036	1.25	12.17	24.02
2037	1.25	12.17	24.02
2038	1.25	12.17	24.02
2039	1.25	12.17	24.02
2040	1.25	12.17	24.02
2041	1.25	12.17	24.02
2042	1.25	12.17	24.02
2043	1.25	12.17	24.02
2044	1.25	12.17	24.02
2045	1.25	12.17	24.02
2046	1.25	12.17	24.02
2047	1.25	12.17	24.02

Year	CO Emission Rates (tpy)		
	CHE	Heavy Equipment	TRU
2048	1.25	12.17	24.02
2049	1.25	12.17	24.02
2050	1.25	12.17	24.02
2051	1.25	12.17	24.02
2052	1.25	12.17	24.02
2053	1.25	12.17	24.02
2054	1.25	12.17	24.02
2055	1.25	12.17	24.02
2056	1.25	12.17	24.02
2057	1.25	12.17	24.02
2058	1.25	12.17	24.02
2059	1.25	12.17	24.02
2060	1.25	12.17	24.02
2061	1.25	12.17	24.02
2062	1.25	12.17	24.02
2063	1.25	12.17	24.02
2064	1.25	12.17	24.02
2065	1.25	12.17	24.02
2066	1.25	12.17	24.02
2067	1.25	12.17	24.02
2068	1.25	12.17	24.02
2069	1.25	12.17	24.02
2070	1.25	12.17	24.02
2071	1.25	12.17	24.02
2072	1.25	12.17	24.02
2073	1.25	12.17	24.02
2074	1.25	12.17	24.02
2075	1.25	12.17	24.02
2076	1.25	12.17	24.02
2077	1.25	12.17	24.02
2078	1.25	12.17	24.02
2079	1.25	12.17	24.02
2080	1.25	12.17	24.02
Average	**2.36**	**12.14**	**23.59**

Calculation of 70 Year Average NOx Emission Rates
Dolores and ICTF Rail Yards, Long Beach, CA

Year	NOx Emission Rates (tpy)		
	CHE	Heavy Equipment	TRU
2010	75.87	6.98	17.45
2011	75.87	6.98	17.45
2012	0.86	2.80	20.84
2013	0.86	2.80	20.84
2014	0.87	3.02	21.86
2015	0.87	3.02	21.86
2016	0.88	3.01	22.58
2017	0.88	3.01	22.58
2018	0.88	3.01	22.58
2019	0.88	3.01	22.58
2020	0.88	3.01	22.58
2021	0.88	3.01	22.58
2022	0.88	3.01	22.58
2023	0.88	3.01	22.58
2024	0.88	3.01	22.58
2025	0.88	3.01	22.58
2026	0.88	3.01	22.58
2027	0.88	3.01	22.58
2028	0.88	3.01	22.58
2029	0.88	3.01	22.58
2030	0.88	3.01	22.58
2031	0.88	3.01	22.58
2032	0.88	3.01	22.58
2033	0.88	3.01	22.58
2034	0.88	3.01	22.58
2035	0.88	3.01	22.58
2036	0.88	3.01	22.58
2037	0.88	3.01	22.58
2038	0.88	3.01	22.58
2039	0.88	3.01	22.58
2040	0.88	3.01	22.58
2041	0.88	3.01	22.58
2042	0.88	3.01	22.58
2043	0.88	3.01	22.58
2044	0.88	3.01	22.58
2045	0.88	3.01	22.58
2046	0.88	3.01	22.58
2047	0.88	3.01	22.58

Year	NOx Emission Rates (tpy)		
	CHE	Heavy Equipment	TRU
2048	0.88	3.01	22.58
2049	0.88	3.01	22.58
2050	0.88	3.01	22.58
2051	0.88	3.01	22.58
2052	0.88	3.01	22.58
2053	0.88	3.01	22.58
2054	0.88	3.01	22.58
2055	0.88	3.01	22.58
2056	0.88	3.01	22.58
2057	0.88	3.01	22.58
2058	0.88	3.01	22.58
2059	0.88	3.01	22.58
2060	0.88	3.01	22.58
2061	0.88	3.01	22.58
2062	0.88	3.01	22.58
2063	0.88	3.01	22.58
2064	0.88	3.01	22.58
2065	0.88	3.01	22.58
2066	0.88	3.01	22.58
2067	0.88	3.01	22.58
2068	0.88	3.01	22.58
2069	0.88	3.01	22.58
2070	0.88	3.01	22.58
2071	0.88	3.01	22.58
2072	0.88	3.01	22.58
2073	0.88	3.01	22.58
2074	0.88	3.01	22.58
2075	0.88	3.01	22.58
2076	0.88	3.01	22.58
2077	0.88	3.01	22.58
2078	0.88	3.01	22.58
2079	0.88	3.01	22.58
2080	0.88	3.01	22.58
Average	**2.99**	**3.12**	**22.37**

Calculation of 70 Year Average DPM Emission Rates
Dolores and ICTF Rail Yards, Long Beach, CA

Year	DPM Emission Rates (tpy)		
	CHE	Heavy Equipment	TRU
2010	2.45	0.27	0.66
2011	2.45	0.27	0.66
2012	0.01	0.004	0.44
2013	0.01	0.004	0.44
2014	0.01	0.004	0.52
2015	0.01	0.004	0.52
2016	0.01	0.004	0.10
2017	0.01	0.004	0.10
2018	0.01	0.004	0.10
2019	0.01	0.004	0.10
2020	0.01	0.004	0.10
2021	0.01	0.004	0.10
2022	0.01	0.004	0.10
2023	0.01	0.004	0.10
2024	0.01	0.004	0.10
2025	0.01	0.004	0.10
2026	0.01	0.004	0.10
2027	0.01	0.004	0.10
2028	0.01	0.004	0.10
2029	0.01	0.004	0.10
2030	0.01	0.004	0.10
2031	0.01	0.004	0.10
2032	0.01	0.004	0.10
2033	0.01	0.004	0.10
2034	0.01	0.004	0.10
2035	0.01	0.004	0.10
2036	0.01	0.004	0.10
2037	0.01	0.004	0.10
2038	0.01	0.004	0.10
2039	0.01	0.004	0.10
2040	0.01	0.004	0.10
2041	0.01	0.004	0.10
2042	0.01	0.004	0.10
2043	0.01	0.004	0.10
2044	0.01	0.004	0.10
2045	0.01	0.004	0.10
2046	0.01	0.004	0.10
2047	0.01	0.004	0.10

Year	DPM Emission Rates (tpy)		
	CHE	Heavy Equipment	TRU
2048	0.01	0.004	0.10
2049	0.01	0.004	0.10
2050	0.01	0.004	0.10
2051	0.01	0.004	0.10
2052	0.01	0.004	0.10
2053	0.01	0.004	0.10
2054	0.01	0.004	0.10
2055	0.01	0.004	0.10
2056	0.01	0.004	0.10
2057	0.01	0.004	0.10
2058	0.01	0.004	0.10
2059	0.01	0.004	0.10
2060	0.01	0.004	0.10
2061	0.01	0.004	0.10
2062	0.01	0.004	0.10
2063	0.01	0.004	0.10
2064	0.01	0.004	0.10
2065	0.01	0.004	0.10
2066	0.01	0.004	0.10
2067	0.01	0.004	0.10
2068	0.01	0.004	0.10
2069	0.01	0.004	0.10
2070	0.01	0.004	0.10
2071	0.01	0.004	0.10
2072	0.01	0.004	0.10
2073	0.01	0.004	0.10
2074	0.01	0.004	0.10
2075	0.01	0.004	0.10
2076	0.01	0.004	0.10
2077	0.01	0.004	0.10
2078	0.01	0.004	0.10
2079	0.01	0.004	0.10
2080	0.01	0.004	0.10
Average	**0.08**	**0.01**	**0.14**

Calculation of 70 Year Average SOx Emission Rates
Dolores and ICTF Rail Yards, Long Beach, CA

Year	SOx Emission Rates (tpy)		
	CHE	Heavy Equipment	TRU
2010	0.96	0.01	0.02
2011	0.96	0.01	0.02
2012	0	0	0.03
2013	0	0	0.03
2014	0	0	0.04
2015	0	0	0.04
2016	0	0	0.04
2017	0	0	0.04
2018	0	0	0.04
2019	0	0	0.04
2020	0	0	0.04
2021	0	0	0.04
2022	0	0	0.04
2023	0	0	0.04
2024	0	0	0.04
2025	0	0	0.04
2026	0	0	0.04
2027	0	0	0.04
2028	0	0	0.04
2029	0	0	0.04
2030	0	0	0.04
2031	0	0	0.04
2032	0	0	0.04
2033	0	0	0.04
2034	0	0	0.04
2035	0	0	0.04
2036	0	0	0.04
2037	0	0	0.04
2038	0	0	0.04
2039	0	0	0.04
2040	0	0	0.04
2041	0	0	0.04
2042	0	0	0.04
2043	0	0	0.04
2044	0	0	0.04
2045	0	0	0.04
2046	0	0	0.04
2047	0	0	0.04

Year	SOx Emission Rates (tpy)		
	CHE	Heavy Equipment	TRU
2048	0	0	0.04
2049	0	0	0.04
2050	0	0	0.04
2051	0	0	0.04
2052	0	0	0.04
2053	0	0	0.04
2054	0	0	0.04
2055	0	0	0.04
2056	0	0	0.04
2057	0	0	0.04
2058	0	0	0.04
2059	0	0	0.04
2060	0	0	0.04
2061	0	0	0.04
2062	0	0	0.04
2063	0	0	0.04
2064	0	0	0.04
2065	0	0	0.04
2066	0	0	0.04
2067	0	0	0.04
2068	0	0	0.04
2069	0	0	0.04
2070	0	0	0.04
2071	0	0	0.04
2072	0	0	0.04
2073	0	0	0.04
2074	0	0	0.04
2075	0	0	0.04
2076	0	0	0.04
2077	0	0	0.04
2078	0	0	0.04
2079	0	0	0.04
2080	0	0	0.04
Average	**0.03**	**0.00**	**0.04**

Calculation of 70 Year Average CO_2 Emission Rates
Dolores and ICTF Rail Yards, Long Beach, CA

Year	CO_2 Emission Rates (Mtpy)		
	CHE	Heavy Equipment	TRU
2010	9,595.00	752.61	2037.47
2011	9,595.00	752.61	2037.47
2012	91.58	313.25	2490.25
2013	91.58	313.25	2490.25
2014	91.58	336.01	2943.02
2015	91.58	336.01	2943.02
2016	91.58	313.25	3395.79
2017	91.58	313.25	3395.79
2018	91.58	313.25	3395.79
2019	91.58	313.25	3395.79
2020	91.58	313.25	3395.79
2021	91.58	313.25	3395.79
2022	91.58	313.25	3395.79
2023	91.58	313.25	3395.79
2024	91.58	313.25	3395.79
2025	91.58	313.25	3395.79
2026	91.58	313.25	3395.79
2027	91.58	313.25	3395.79
2028	91.58	313.25	3395.79
2029	91.58	313.25	3395.79
2030	91.58	313.25	3395.79
2031	91.58	313.25	3395.79
2032	91.58	313.25	3395.79
2033	91.58	313.25	3395.79
2034	91.58	313.25	3395.79
2035	91.58	313.25	3395.79
2036	91.58	313.25	3395.79
2037	91.58	313.25	3395.79
2038	91.58	313.25	3395.79
2039	91.58	313.25	3395.79
2040	91.58	313.25	3395.79
2041	91.58	313.25	3395.79
2042	91.58	313.25	3395.79
2043	91.58	313.25	3395.79
2044	91.58	313.25	3395.79
2045	91.58	313.25	3395.79
2046	91.58	313.25	3395.79
2047	91.58	313.25	3395.79

Year	CO_2 Emission Rates (Mtpy)		
	CHE	Heavy Equipment	TRU
2048	91.58	313.25	3395.79
2049	91.58	313.25	3395.79
2050	91.58	313.25	3395.79
2051	91.58	313.25	3395.79
2052	91.58	313.25	3395.79
2053	91.58	313.25	3395.79
2054	91.58	313.25	3395.79
2055	91.58	313.25	3395.79
2056	91.58	313.25	3395.79
2057	91.58	313.25	3395.79
2058	91.58	313.25	3395.79
2059	91.58	313.25	3395.79
2060	91.58	313.25	3395.79
2061	91.58	313.25	3395.79
2062	91.58	313.25	3395.79
2063	91.58	313.25	3395.79
2064	91.58	313.25	3395.79
2065	91.58	313.25	3395.79
2066	91.58	313.25	3395.79
2067	91.58	313.25	3395.79
2068	91.58	313.25	3395.79
2069	91.58	313.25	3395.79
2070	91.58	313.25	3395.79
2071	91.58	313.25	3395.79
2072	91.58	313.25	3395.79
2073	91.58	313.25	3395.79
2074	91.58	313.25	3395.79
2075	91.58	313.25	3395.79
2076	91.58	313.25	3395.79
2077	91.58	313.25	3395.79
2078	91.58	313.25	3395.79
2079	91.58	313.25	3395.79
2080	91.58	313.25	3395.79
Average	**359.28**	**326.27**	**3,319.27**

Calculation of 70 Year Average N_2O Emission Rates
Dolores and ICTF Rail Yards, Long Beach, CA

Year	N_2O Emission Rates (Mtpy)		
	CHE	Heavy Equipment	TRU
2010	0.00	0	0
2011	0.00	0	0
2012	0	0	0
2013	0	0	0
2014	0	0	0
2015	0	0	0
2016	0	0	0
2017	0	0	0
2018	0	0	0
2019	0	0	0
2020	0	0	0
2021	0	0	0
2022	0	0	0
2023	0	0	0
2024	0	0	0
2025	0	0	0
2026	0	0	0
2027	0	0	0
2028	0	0	0
2029	0	0	0
2030	0	0	0
2031	0	0	0
2032	0	0	0
2033	0	0	0
2034	0	0	0
2035	0	0	0
2036	0	0	0
2037	0	0	0
2038	0	0	0
2039	0	0	0
2040	0	0	0
2041	0	0	0
2042	0	0	0
2043	0	0	0
2044	0	0	0
2045	0	0	0
2046	0	0	0
2047	0	0	0

Year	N_2O Emission Rates (Mtpy)		
	CHE	Heavy Equipment	TRU
2048	0	0	0
2049	0	0	0
2050	0	0	0
2051	0	0	0
2052	0	0	0
2053	0	0	0
2054	0	0	0
2055	0	0	0
2056	0	0	0
2057	0	0	0
2058	0	0	0
2059	0	0	0
2060	0	0	0
2061	0	0	0
2062	0	0	0
2063	0	0	0
2064	0	0	0
2065	0	0	0
2066	0	0	0
2067	0	0	0
2068	0	0	0
2069	0	0	0
2070	0	0	0
2071	0	0	0
2072	0	0	0
2073	0	0	0
2074	0	0	0
2075	0	0	0
2076	0	0	0
2077	0	0	0
2078	0	0	0
2079	0	0	0
2080	0	0	0
Average	0.00	0.00	0.00

Calculation of 70 Year Average CH_4 Emission Rates
Dolores and ICTF Rail Yards, Long Beach, CA

Year	CH_4 Emission Rates (Mtpy)		
	CHE	Heavy Equipment	TRU
2010	0.03	0.00	0.01
2011	0.03	0.00	0.01
2012	0.00	0.00	0.01
2013	0.00	0.00	0.01
2014	0.00	0.00	0.01
2015	0.00	0.00	0.01
2016	0.00	0.00	0.01
2017	0.00	0.00	0.01
2018	0.00	0.00	0.01
2019	0.00	0.00	0.01
2020	0.00	0.00	0.01
2021	0.00	0.00	0.01
2022	0.00	0.00	0.01
2023	0.00	0.00	0.01
2024	0.00	0.00	0.01
2025	0.00	0.00	0.01
2026	0.00	0.00	0.01
2027	0.00	0.00	0.01
2028	0.00	0.00	0.01
2029	0.00	0.00	0.01
2030	0.00	0.00	0.01
2031	0.00	0.00	0.01
2032	0.00	0.00	0.01
2033	0.00	0.00	0.01
2034	0.00	0.00	0.01
2035	0.00	0.00	0.01
2036	0.00	0.00	0.01
2037	0.00	0.00	0.01
2038	0.00	0.00	0.01
2039	0.00	0.00	0.01
2040	0.00	0.00	0.01
2041	0.00	0.00	0.01
2042	0.00	0.00	0.01
2043	0.00	0.00	0.01
2044	0.00	0.00	0.01
2045	0.00	0.00	0.01
2046	0.00	0.00	0.01
2047	0.00	0.00	0.01

2048	0.00	0.00	0.01
2049	0.00	0.00	0.01
2050	0.00	0.00	0.01
2051	0.00	0.00	0.01
2052	0.00	0.00	0.01
2053	0.00	0.00	0.01
2054	0.00	0.00	0.01
2055	0.00	0.00	0.01
2056	0.00	0.00	0.01
2057	0.00	0.00	0.01
2058	0.00	0.00	0.01
2059	0.00	0.00	0.01
2060	0.00	0.00	0.01
2061	0.00	0.00	0.01
2062	0.00	0.00	0.01
2063	0.00	0.00	0.01
2064	0.00	0.00	0.01
2065	0.00	0.00	0.01
2066	0.00	0.00	0.01
2067	0.00	0.00	0.01
2068	0.00	0.00	0.01
2069	0.00	0.00	0.01
2070	0.00	0.00	0.01
2071	0.00	0.00	0.01
2072	0.00	0.00	0.01
2073	0.00	0.00	0.01
2074	0.00	0.00	0.01
2075	0.00	0.00	0.01
2076	0.00	0.00	0.01
2077	0.00	0.00	0.01
2078	0.00	0.00	0.01
2079	0.00	0.00	0.01
2080	0.00	0.00	0.01
Average	**0.00**	**0.00**	**0.01**

APPENDIX U

SOURCE TREATMENT AND ASSUMPTIONS FOR AIR DISPERSION MODELING FOR NON-LOCOMOTIVE SOURCES

Appendix U

Source Treatment and Assumptions for Air Dispersion Modeling for Non-Locomotive Sources

As shown in Figures 4-8, emissions were allocated spatially throughout the Yard in the areas where each source type operates or is most likely to operate. Emissions from mobile sources, low-level cargo handling equipment, heavy equipment, and moving locomotives were simulated as a series of volume sources along their corresponding travel routes and work areas. Yard hostlers, heavy-duty trucks, and other low-level emission sources were first allocated to the areas of the yard where their activity occurs, and were then allocated uniformly to a series of sources within the defined areas. Depending on their magnitude and proximity to yard boundaries, idling emissions for heavy-duty trucks may be treated as point sources rather than being included in the non-idling volume sources used to characterize moving vehicles. Idling of locomotives and elevated cargo handling equipment (cranes) were simulated as a series of point sources within the areas where these events occur. Large sources such as RTGs and cranes that are stationary or slow moving were treated as point sources with appropriate stack parameters.

Emissions from stationary sources, such as fuel tanks, were simulated as a point source corresponding to the actual equipment location within the Yard. Assumptions used spatially to allocate emissions for each source group are shown in the Table below. See Figures 2 and 3 for the source locations. See Appendix A-4 for assumptions regarding the spatial allocation of locomotive emissions.

Source Treatment and Assumptions for Air Dispersion Modeling for Non-Locomotive Sources ICTF and Dolores Rail Yards 2005 Baseline Year		
Source	Source Treatment	Assumptions for Spatial Allocation of Emissions
HHD Diesel-Fueled Drayage Trucks	Point (idling) Volume (traveling)	Onsite - Assumed 10% of the traveling emissions and 1/3 of the idling occurred at the intermodal gate. The remaining emissions (traveling and idling) were modeled in the trailer parking area. Offsite – emissions were placed along the various truck travel routes.
HHD Diesel-Fueled Delivery Trucks	Volume	Emissions from delivery trucks were allocated to the areas near the storage tanks served by the trucks. Due to the relatively small emission rates, emissions from idling and traveling were not separated.
Cargo Handling Equipment (low level)	Volume	Top Picks – all emissions were modeled in the chassis stacking area. Yard Hostlers – assumed 10% of the total emissions from yard hostlers occurred at the tractor maintenance area and the remaining emissions occurred in the trailer parking area.
Cargo Handling Equipment (RTGs)	Point	Assumed 10% of the total emissions from RTGs occurred at the crane maintenance area and the remaining emissions occurred in the areas around the unloading tracks.
Heavy Equipment (idling and traveling)	Point or Volume	Taylor Forklifts – assumed all operation occurred in the RTG maintenance area. Man Lift – assumed all operation occurred in the RTG maintenance area. Grove Crane and Forklift – were modeled as yard-wide sources.
TRUs and Reefer Cars	Volume	Assumed all emissions from TRUs and reefer cars occurred in the trailer parking area
Gasoline-Fueled Yard Trucks	Volume	Yard trucks were modeled as yard-wide sources.

Source Treatment and Assumptions for Air Dispersion Modeling for Non-Locomotive Sources ICTF and Dolores Rail Yards 2005 Baseline Year		
Source	Source Treatment	Assumptions for Spatial Allocation of Emissions
I.C. Engines	Point (Emer. Gen.) Volume (Air Comp.)	Emergency Generator – emissions from the emergency generator were modeled at the ICTF Administration Building Area. Air Compressor – was treated as a yard-wide source.
Storage Tanks	Point	Emissions from storage tanks were modeled at the actual tank locations.
Refueling Operations	Point	Emissions from refueling operations were modeled at the associated tank locations.
WWTP	Point	Emissions from the WWTP were modeled at the actual WWTP location.
Steam Cleaners	Volume	Emissions from steam cleaners were modeled in the area around the Dolores locomotive shop.
Natural Gas-Fired Heater	Point	Emissions from the heater were modeling at the ICTF Administration Building.
Propane Fueled Welder	Volume	Emissions from the propane-fueled welder were modeled at the Dolores locomotive shop.
Misc. Gasoline-Fueled Equipment	Volume	Emissions from one welder, the pressure washer, and the generator were modeled at the Crane Maintenance area. Emissions from the remaining 4 welders and 2 air compressors were modeled as ICTF yard-wide sources.
Worker Vehicles	Volume	Emissions from worker vehicles were modeled as yard-wide sources.

APPENDIX V

SEASONAL AND DIURNAL ACTIVITY PROFILES

Appendix V

Development of Temporal Activity Profiles for the UPRR ICTF and Dolores Yards

Locomotive activity can vary by time of day and season. For each yard, the number of trains arriving and departing from the yard in each month and each hour of the day was tabulated and used to develop temporal activity profiles for modeling. The number of locomotives released from service facilities in each month was also tabulated. The AERMOD EMISFACT SEASHR option was used to adjust emission rates by season and hour of the day, and the EMISFACT SEASON option was used where only seasonal adjustments were applied. Where hour of day adjustments (but not seasonal) were applied, the EMISFACT HROFDY option was used.

Time of day profiles for train idling activity were developed assuming that departure events involved locomotive idling during the hour of departure and the preceding hour, and that arrival events involved locomotive idling during the hour of arrival. Thus, the hourly activity adjustment factor for hour *i* is given by

$$\frac{NA(j) + \sum_{j=i-1}^{i} ND(j)}{\sum_{j=1}^{24} (NA(j) + 2 \cdot ND(j))} ,$$

where *NA(j)* and *ND(j)* are respectively the number of arriving and departing trains in hour *j*. These factors were applied to both idling on arriving and departing trains and idling in the service area (if applicable).

Similarly, time of day profiles for road power movements in the yard (arrivals, departures, and power moves) were developed without including arrivals in preceding hours and departures in subsequent hours. In this case, the hourly activity adjustment factor for hour *i* is given by

$$\frac{NA(i) + ND(i)}{\sum_{j=1}^{24} (NA(j) + ND(j))} .$$

Seasonal adjustment factors are calculated as the sum of trains arriving and departing in each three month season, divided by the total number of arrivals and departures for the year. The hourly adjustment factors for each season are simply the product of the seasonal adjustment factor and the 24 hourly adjustment factors.

For yards with heavy duty truck and cargo handling activities related to rail traffic, seasonal train activity adjustments were applied, but not hour of day adjustments. Temporal profiles for yard switching operations were based on hourly (but not seasonal) factors developed from the operating shifts for the individual yard switching jobs. In some cases, locomotive load testing diurnal profiles were developed based on the specific times of day when load testing is conducted.

Table V-1 lists the hourly activity factors derived for train movements, train and service idling, and yard switching at the UPRR ICTF and Dolores Yards. Separate temporal profiles are listed for day and night moving emissions as different volume source parameters are used for day and night. Table V-2 lists the seasonal activity factors for train and service activity.

Table V-1. Hourly Activity Factors for Train Activity at the UPRR Dolores/ICTF

Hour	Train Idling	Train Movements (Daytime)	Train Movements (Nighttime)	Yard Switching (Daytime)	Yard Switching (Nighttime)
1	1.233	0.000	1.340	0.000	1.000
2	1.224	0.000	1.414	0.000	1.000
3	0.716	0.000	0.684	0.000	1.000
4	0.794	0.000	0.790	0.000	1.000
5	0.870	0.000	0.849	0.000	1.000
6	1.009	0.000	1.100	0.000	1.000
7	0.936	0.971	0.000	1.000	0.000
8	0.912	0.971	0.000	1.000	0.000
9	1.091	1.034	0.000	1.000	0.000
10	1.264	0.962	0.000	1.000	0.000
11	1.251	1.359	0.000	1.000	0.000
12	0.841	0.983	0.000	1.000	0.000
13	0.602	0.603	0.000	1.000	0.000
14	0.796	0.775	0.000	1.000	0.000
15	1.049	1.000	0.000	1.000	0.000
16	1.006	1.117	0.000	1.000	0.000
17	0.880	0.890	0.000	1.000	0.000
18	1.305	1.085	0.000	1.000	0.000
19	1.395	0.000	1.302	0.000	1.000
20	1.140	0.000	1.289	0.000	1.000
21	0.851	0.000	0.818	0.000	1.000
22	0.860	0.000	0.886	0.000	1.000
23	0.832	0.000	0.896	0.000	1.000
24	1.143	0.000	0.881	0.000	1.000

Table V-2. Seasonal Activity Factors for the UPRR Dolores/ICTF

Activity Type	Winter	Spring	Summer	Fall
Trains	0.943	1.020	1.042	0.994
Service	0.836	1.060	1.097	1.007

APPENDIX W

SELECTION OF POPULATION FOR THE URBAN OPTION INPUT
IN AERMOD AIR DISPERSION MODELING ANALYSIS

Appendix W

Selection of Population for the Urban Option Input in AERMOD Air Dispersion Modeling Analysis

Urban heat islands and the thermal domes generated by them extend over an entire urbanized area[1]. Hot spots within the urban heat island are associated with roads and roofs, which surround each Union Pacific (UP) rail yard in high density. Following guidance cited by the ARB ("*For urban areas adjacent to or near other urban areas, or part of urban corridors, the user should attempt to identify that part of the urban area that will contribute to the urban heat island plume affecting the source.*"), it is the entire metropolitan area that contributes to the urban heat island plume affecting the rail yard. For metropolitan areas containing substantial amounts of open water, the area of water should not be included.

To simulate the effect of the urban heat island on turbulence in the boundary layer, especially at night, when the effect is substantial, AERMOD adjusts the height of the nighttime urban boundary layer for the heat flux emitted into the boundary layer by the urban surface, which is warmer than surrounding rural areas[2,3]. The difference between the urban and rural boundary layer temperatures is proportional to the maximum temperature difference of 12 Celsius degrees observed in a study of several Canadian cities, and directly related to the logarithm of the ratio of the urban population to a reference population of 2,000,000 (i.e., Montreal, the Canadian city with the maximum urban-rural temperature difference)[4].

The adjusted height of the nocturnal urban boundary layer is proportional to the one-fourth power of the ratio of the population of the city of interest to the reference population, based on the observation that the convective boundary layer depth is proportional to the square root of the city size, and city size is roughly proportional to the square root of its population, assuming constant population density[5]. Regardless of wind direction during any specific hour used by AERMOD, it is the entire metropolitan area, minus bodies of water, which moves additional heat flux into the atmosphere and affects its dispersive properties, not just the 400 km^2 area of the air dispersion modeling domain that surrounds the each rail yard, which was chosen purely for modeling convenience.

Continuing to follow the guidance cited by the ARB ("*If this approach results in the identification of clearly defined MSAs, then census data may be used as above to determine the appropriate population for input to AERMOD"),* the population of each Metropolitan Statistical Area is being used in the modeling run for each rail yard.

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[1] USEPA. *Thermally-Sensed Image of Houston*, http://www.epa.gov/heatisland/pilot/houston_thermal.htm, included in Heat Island Effect website, http://www.epa.gov/heatisland/about/index.html, accessed November 8, 2006.

[2] USEPA. *AERMOD: Description of Model Formulation,* Section 5.8 – Adjustments for the Urban Boundary Layer, pages 66-67, EPA-454/R-03-004, September 2004, accessed at http://www.epa.gov/scram001/7thconf/aermod/aermod_mfd.pdf on November 9,

[3] Oke, T.R. *City Size and the Urban Heat Island,* Atmospheric Environment, Volume 7, pp. 769-779, 1973.

[4] Ibid for References 3 and 4.

[5] Ibid.