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Toxic Air Contaminant Emissions Inventory and Dispersion Modeling Report for the City of Industry Rail Yard, City of Industry, California

prepared for:

Union Pacific Railroad Company

November 2007

prepared by:

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SUMMARY

In accordance with the 2005 California Air Resources Board (CARB)/Railroad Statewide Agreement (MOU), Union Pacific Railroad Company (UPRR) has prepared a facility-wide emission inventory for the City of Industry Rail Yard (Yard) in City of Industry, California. The inventory quantifies emissions of specified toxic air contaminants (TACs) (including Diesel particulate matter [DPM]) from stationary, mobile, and portable sources at the Yard. The inventory was prepared in accordance with CARB's *Rail Yard Emission Inventory Methodology* guidelines (July 2006) and UPRR's *Emission Inventory Protocol* (May 2006).

The City of Industry Yard is both an intermodal container handling facility and classification yard for manifest (mixed freight) trains. Incoming trains terminate on various tracks within the Yard. Yard switcher locomotives then move sections of railcars as needed.

The City of Industry Yard proper includes several distinct areas. The area west of South Azusa Ave. includes a set of tracks for arriving and departing trains (known as the "A" Yard), the Bowl (used for some arriving and departing trains as well as classification), and the intermodal tracks for unloading and loading containers. The Marne Yard, east of South Azusa Ave., contains several parallel sets of tracks for originating trains, and for classification (train building). In addition, two main rail lines are connected to the Yard: the Alhambra Subdivision mainline, which runs along the north side of the Yard; and the Los Angeles Subdivision main line, approximately ½ mile to the south of the Yard.

In addition to the City of Industry Yard itself, there is another small yard, known as the Azusa Yard, located adjacent to the Los Angeles Subdivision main line east of South Azusa Ave. Activities in the Azusa Yard are limited to local trains operating out of the main City of Industry Yard, which serve customers to the east and west along the Los Angeles Subdivision.

There is no locomotive servicing facility at City of Industry. However, a limited amount of locomotive servicing does occur in the Marne Yard. This activity consists primarily of

refueling of locomotives from trucks (known as "direct to locomotive" or DTL fueling), along with some minor maintenance and repairs.

Facilities within the Yard include classification tracks, a gate complex for inbound and outbound intermodal truck traffic, intermodal loading and unloading tracks, a crane maintenance shop, and various buildings and facilities supporting railroad and contractor operations.

Emission sources at the Yard include, but are not limited to, locomotives, heavy-heavy-duty (HHD) Diesel-fueled trucks, cargo handling equipment (CHE), heavy equipment, transport refrigeration units (TRUs), refrigerated rail cars (reefer cars), an emergency generator, and a wastewater treatment plant (WWTP). Emissions were calculated on a source-specific and facility-wide basis for the 2005 calendar year.

An air dispersion modeling analysis was also conducted for the Yard. 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 Yard. Emission sources included in the modeling analysis were locomotives, HHD Diesel-fueled trucks, Diesel-fueled cargo handling equipment (CHE), Diesel-fueled heavy equipment, and the wastewater treatment plant (WWTP). The air dispersion modeling was conducted using the AERMOD Gaussian plume dispersion model and meteorological data (wind speed, wind direction, temperature, and cloud cover) from the Ontario International Airport. 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) and UPRR's *Modeling Protocol* (August 2006).

Toxic Air Contaminant Emission Inventory and Air Dispersion Modeling Report for the City of Industry Rail Yard City of Industry, California

TABLE OF CONTENTS

Page

SUMMARY i
PART I. INTRODUCTION 1
PART II. FACILITY DESCRIPTION 2
A. Facility Name and Address 2
B. Facility Contact Information 2
C. Main Purpose of the Facility 2
D. Types of Operations Performed at the Facility 3
E. Facility Operating Schedule 4
F. General Land Use Surrounding the Facility 4
PART III. MAP AND FACILITIES PLOT PLAN 6
PART IV. COVERED SOURCES 8
PART V. SITE-SPECIFIC EQUIPMENT INVENTORIES 9
A. Locomotives 9
B. Diesel-Fueled Trucks (Yard Trucks) 11
C. HHD Diesel-Fueled Trucks 12
D. Cargo Handling Equipment (CHE) 12
E. Heavy Equipment 13
F. Tanks 14
G. Wastewater Treatment Plant 14
H. Emergency Generator 15
I. Air Compressor 15
J. TRUs and Reefer Cars 15
K. Portable Equipment 15
PART VI. ACTIVITY DATA 17
A. Locomotives 17
B. Diesel-Fueled Trucks (Yard Trucks) 20
C. HHD Diesel-Fueled Trucks 22
D. Cargo Handling Equipment 24
E. Heavy Equipment 25

F. Wastewater Treatment Plant 25
G. Emergency Generator 25
H. Air Compressor 26
I. TRUs and Reefer Cars 26
PART VII. EMISSIONS 27
A. Calculation Methodology and Emission Factors 27
1. Locomotives 27
2. Diesel-Fueled Trucks (Yard Trucks) 33
3. HHD Diesel-Fueled Trucks 35
4. Cargo Handling Equipment (CHE) 35
5. Heavy Equipment 36
6. Wastewater Treatment Plant 37
7. Emergency Generator 37
8. Air Compressor 38
9. TRUs and Reefer Cars 38
B. TAC Emissions by Source Type 39
1. Locomotives 39
2. Diesel-Fueled Trucks (Yard Trucks) 40
3. HHD Diesel-Fueled Trucks 41
4. Cargo Handling Equipment 41
5. Heavy Equipment 42
6. Wastewater Treatment Plant 43
7. Emergency Generator and Air Compressor 44
8. TRUs and Reefer Cars 44
C. Facility Total Emissions 45
PART VIII. RISK SCREENING CALCULATIONS 46
PART IX. AIR DISPERSION MODELING 48
A. Model Selection and Preparation 48
1. Modeled Sources and Source Treatment 48
2. Model Selection 49
3. Modeling Inputs 56
4. Meteorological Data Selection 60
5. Model Domain and Receptor Grids 61
6. Dispersion Coefficients 67
7. Building Downwash 68
B. Modeling Results 68
C. Demographic Data 68
PART X. REFERENCES 69

LIST OF APPENDICES

Appendix A – Locomotive Data
Appendix B – Emission Factor Derivation and EMFAC2007 Output for Diesel-Fueled Yard Trucks
Appendix C – Emission Factor Derivation and EMFAC2007 Output for HHD Diesel-Fueled Trucks
Appendix D – Emission Factor Derivation and CARB's Spreadsheet Model Output for Cargo Handling Equipment
Appendix E – Emission Factor Derivation and OFFROAD2007 Output for Heavy Equipment
Appendix F – Emission Factor Derivation and OFFROAD2007 Output for the Air Compressor
Appendix G – Emission Factor Derivation and OFFROAD2007 Output for TRUs and Reefer Cars
Appendix H – Detailed Emission Calculations
Appendix I – Detailed Risk Screening Calculations
Appendix J – Source Treatment and Assumptions for Air Dispersion Modeling for Non-Locomotive Sources
Appendix K – Seasonal and Diurnal Activity Profiles
Appendix L – Selection of Population for the Urban Option Input in AERMOD Air Dispersion Modeling Analysis
Appendix M – Demographic Data

LIST OF TABLES

Page

Table 1 Locomotive Models (Road Power) Identified at the City of Industry Rail Yard[a] 11
Table 2 Equipment Specifications for Diesel-Fueled Yard Trucks[a] City of Industry Rail Yard 12
Table 3 Equipment Specifications for Cargo Handling Equipment City of Industry Rail Yard 13
Table 4 Equipment Specifications for Heavy Equipment City of Industry Rail Yard 13
Table 5 Storage Tank Specifications City of Industry Rail Yard 14
Table 6 Portable Equipment Specifications City of Industry Rail Yard 16
Table 7 Summary of Train Activity Data City of Industry Rail Yard[a] 18
Table 8 Locomotive Service, Maintenance and Load Test Events City of Industry Rail Yard 20
Table 9 Activity Data for Diesel-Fueled Yard Trucks City of Industry Rail Yard 21
Table 10 Summary of Gate Count Data City of Industry Rail Yard 22
Table 11 Summary of HHD Intermodal Truck Activity Data City of Industry Rail Yard 23

Table 12 Summary of HHD Delivery Truck Activity Data City of Industry Rail Yard.....24
Table 13 Activity Data for Cargo Handling Equipment City of Industry Rail Yard.....24
Table 14 Activity Data for Heavy Equipment City of Industry Rail Yard.....25
Table 15 Activity Data for TRUs and Reefer Cars City of Industry Rail Yard.....26
Table 16 Locomotive Diesel Particulate Matter Emission Factors (g/hr) Adjusted for Fuel Sulfur Content of 221 PPM City of Industry Rail Yard.....31
Table 17 Locomotive Diesel Particulate Matter Emission Factors (g/hr) Adjusted for Fuel Sulfur Content of 2,639 PPM City of Industry Rail Yard.....32
Table 18 Emission Factors for Diesel-Fueled Yard Trucks City of Industry Rail Yard.....34
Table 19 Emission Factors for HHD Diesel-Fueled Drayage and Delivery Trucks[a] City of Industry Rail Yard.....35
Table 20 Emission Factors for Cargo Handling Equipment City of Industry Rail Yard.....36
Table 21 Emission Factors for Heavy Equipment City of Industry Rail Yard.....36
Table 22 Emission Factors for the Wastewater Treatment Plant City of Industry Rail Yard.....37
Table 23 Emission Factors for the Diesel-Fueled Emergency Generator City of Industry Rail Yard.....37
Table 24 Emission Factors for the Diesel-Fueled Air Compressor City of Industry Rail Yard.....38
Table 25 Emission Factors for TRUs and Reefer Cars City of Industry Rail Yard.....38
Table 26 Locomotive Duty Cycles City of Industry Rail Yard.....39
Table 27 DPM Emissions from Locomotives City of Industry Rail Yard.....40
Table 28 DPM Emissions from Diesel-Fueled Yard Trucks City of Industry Rail Yard.....40
Table 29 DPM Emissions from HHD Diesel-Fueled Trucks City of Industry Rail Yard.....41
Table 30 DPM Emissions from Cargo Handling Equipment City of Industry Rail Yard.....42
Table 31 DPM Emissions from Heavy Equipment City of Industry Rail Yard.....43
Table 32 TAC Emissions from the Wastewater Treatment Plant City of Industry Rail Yard.....43
Table 33 DPM Emissions from the Emergency Generator and Air Compressor City of Industry Rail Yard.....44
Table 34 DPM Emissions from TRUs and Reefer Cars City of Industry Rail Yard.....44
Table 35 Facility-Wide Diesel Particulate Emissions City of Industry Rail Yard.....45
Table 36 Summary of Weighted Risk by Source Category City of Industry Rail Yard.....46
Table 37 Summary of De Minimis Sources City of Industry Rail Yard.....47
Table 38 Source Treatment for Air Dispersion Modeling City of Industry Rail Yard.....49
Table 39 Locomotive Modeling Inputs City of Industry Rail Yard.....58
Table 40 Non-Locomotive Modeling Inputs City of Industry Rail Yard.....59
Table 41 Sensitive Receptor Locations City of Industry Rail Yard.....62

LIST OF FIGURES

Page

Figure 1 Location Map..... 6
Figure 2 City of Industry Rail Yard Layout..... 7
Figure 3 Intermodal Truck and Yard Hostlers..... 50
Figure 4 Locomotive Service & Load Testing & Waste Water Treatment Plant..... 51
Figure 5 Train Movement and Idling..... 52
Figure 6 Locomotive Yard Switching..... 53
Figure 7 Heavy Equipment and Cargo Handling Equipment..... 54
Figure 8 Coarse Modeling Grid City of Industry Rail Yard..... 64
Figure 9 Fine Modeling Grid City of Industry Rail Yard..... 65
Figure 10 Sensitive Receptors City of Industry Rail Yard..... 66

Toxic Air Contaminant Emission Inventory and Air Dispersion Modeling Report for the City of Industry Rail Yard City of Industry, California

PART I. INTRODUCTION

In accordance with the 2005 California Air Resources Board (CARB)/Railroad Statewide Agreement (MOU), Union Pacific Railroad Company (UPRR) has prepared a facility-wide emission inventory for the City of Industry Rail Yard (Yard) in City of Industry, California. The inventory quantifies emissions of specified toxic air contaminants (TACs) (including Diesel particulate matter [DPM]) from stationary, mobile, and portable sources at the Yard. The inventory was prepared in accordance with CARB's *Rail Yard Emission Inventory Methodology* guidelines (July 2006) and UPRR's *Emission Inventory Protocol* (May 2006).

An air dispersion modeling analysis was also conducted for the Yard. 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 Yard. Emission sources included in the modeling analysis were locomotives, heavy-heavy duty (HHD) Diesel-fueled trucks, Diesel-fueled cargo handling equipment (CHE), Diesel-fueled heavy equipment, and the wastewater treatment plant (WWTP). The air dispersion modeling was conducted using the AERMOD Gaussian plume dispersion model and meteorological data (wind speed, wind direction, temperature, and cloud cover) from the Ontario International Airport. 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) and UPRR's *Modeling Protocol* (August 2006).

PART II. FACILITY DESCRIPTION

A. Facility Name and Address

Union Pacific Railroad Company
City of Industry Rail Yard
17225 East Arenth Avenue
City of Industry, CA 91748

B. Facility Contact Information

Brock Nelson
Director of Environmental Operations – West
Union Pacific Railroad Company
10031 Foothills Boulevard
Roseville, CA 95747
Phone: (916) 789-6370
Fax: (402) 233-3162
banelson@up.com

C. Main Purpose of the Facility

The City of Industry Yard is both an intermodal container handling facility and a classification[1] yard for manifest (mixed freight) trains. Incoming trains terminate on various tracks within the yard. Yard switchers then move sections of cars to various locations within the Yard, as needed. Sections of manifest train cars are moved and reconnected to others to build new outbound trains. Intermodal cars are moved to the intermodal loading/unloading tracks where containers are removed from and placed on the cars.

The City of Industry Yard proper includes several distinct areas. The area west of South Azusa Ave. includes a set of tracks for arriving and departing trains (known as the "A" Yard), the Bowl[2] (used for some arriving and departing trains as well as classification),

[1] A classification yard receives trains, breaks them into sections, and reconnects them to make new trains for the rail cars ultimate destinations.
[2] A "bowl" is traditionally a large number of parallel tracks used for classification. Railcars are pushed over a "hump" (a raised section of track), separated from one another, and allowed to roll by gravity into the appropriate track within the bowl. The City of Industry Yard no longer uses the Bowl in this manner. All train breaking and building activities are handled by flat switching (moving sections of cars using yard switcher engines).

and the intermodal tracks for unloading and loading of containers. The Marne Yard, east of South Azusa Ave., contains several parallel sets of tracks for originating trains, and classification (train building). In addition, two main lines are connected to the Yard: the Alhambra Subdivision mainline, which runs along the north side of the Yard; and the Los Angeles Subdivision main line, approximately ½ mile to the south of the Yard.

In addition to the City of Industry Yard itself, there is another small yard known as the Azusa Yard, which is located adjacent to the Los Angeles Subdivision main line east of South Azusa Ave. Activities in the Azusa Yard are limited to local trains operating out of the main City of Industry Yard, which serve customers to the east and west along the Los Angeles Subdivision.

There is no locomotive servicing facility at City of Industry. However, a limited amount of locomotive servicing does occur in the Marne Yard. This activity consists primarily of refueling of locomotives from trucks (known as "direct to locomotive" or DTL fueling), with some minor maintenance and repairs

Facilities within the Yard include classification tracks, a gate complex for inbound and outbound intermodal truck traffic, intermodal loading and unloading tracks, a crane maintenance shop, and various buildings and facilities supporting railroad and contractor operations.

D. Types of Operations Performed at the Facility

Activities at the Yard include receiving inbound trains, switching cars, loading and unloading intermodal trains, storing intermodal containers and chassis, building and departing outbound trains, and repairing freight cars and intermodal containers/chassis. UPRR operates yard switcher locomotives within City of Industry to support many of these activities. In addition, locomotive refueling directly from fuel trucks (DTL fueling) and limited other locomotive servicing is conducted. The Yard also includes a bypassing main line with freight and passenger train traffic that is not handled in the Yard.
The railroad track layout for City of Industry is primarily linear along a roughly east-west axis. The Alhambra Subdivision main line runs adjacent to the north side of the Yard,

and the Los Angeles Subdivision main line is approximately ½ mile south of the Yard. There are leads into and out of the Yard at each end along the Alhambra Subdivision and a single lead from the southwest end of the Yard to the Los Angeles Subdivision.

The length of the City of Industry Yard itself is relatively short, approximately 2.8 miles. However, there are tracks parallel to the Azusa Subdivision extending from both ends of the Yard which are used in the course of bringing terminating trains into the Yard and building and departing originating trains. These extend to approximately Glendora Ave. to the west and Fullerton Rd. to the east. The A yard (the primary area for terminating and originating intermodal trains) is on the north side of the yard adjacent to the main line between Hofgaarden St. and Wickford Ave. The Bowl tracks are immediately south of the A yard. The intermodal loading/unloading tracks lie to the south of the Bowl and are serviced by rubber tired gantry (RTG) cranes and other types of cargo handling equipment. The Marne Yard is adjacent to the main line between S. Azusa Ave. and S. Hambledon Ave., with some of the tracks extending to Fullerton Rd. The Azusa Yard is adjacent to the Los Angeles Subdivision about ½ mile south of the Marne Yard, running for approximately ½ mile east from S. Azusa Ave.

E. Facility Operating Schedule

The City of Industry Yard operates 24 hours per day, 365 days per year.

F. General Land Use Surrounding the Facility

The City of Industry Yard covers a narrow area approximately 2.8 miles in length (tracks and train push back areas extend both east and west of the main Yard) and approximately one-quarter of a mile wide. The Yard is bisected by South Azusa Ave. (SR-39). The main area of the Yard is west of SR-39. A smaller portion of the Yard, which is used for overflow container and chassis storage, is located east of SR-39. The Yard is located approximately one-half mile north of SR-60 (Pomona Freeway).

Land use on the north side of the Yard is mostly residential. The nearest residences are approximately 55 feet north of the Yard boundary. There are a number of truck

distribution centers and other commercial/industrial facilities located to the west, south, and east of the Yard. There is a residential area, including an elementary school, approximately one-third mile southwest of the Yard. The location of specific receptors is further discussed in Part IX.

PART III. MAP AND FACILITIES PLOT PLAN

Figure 1
Location Map

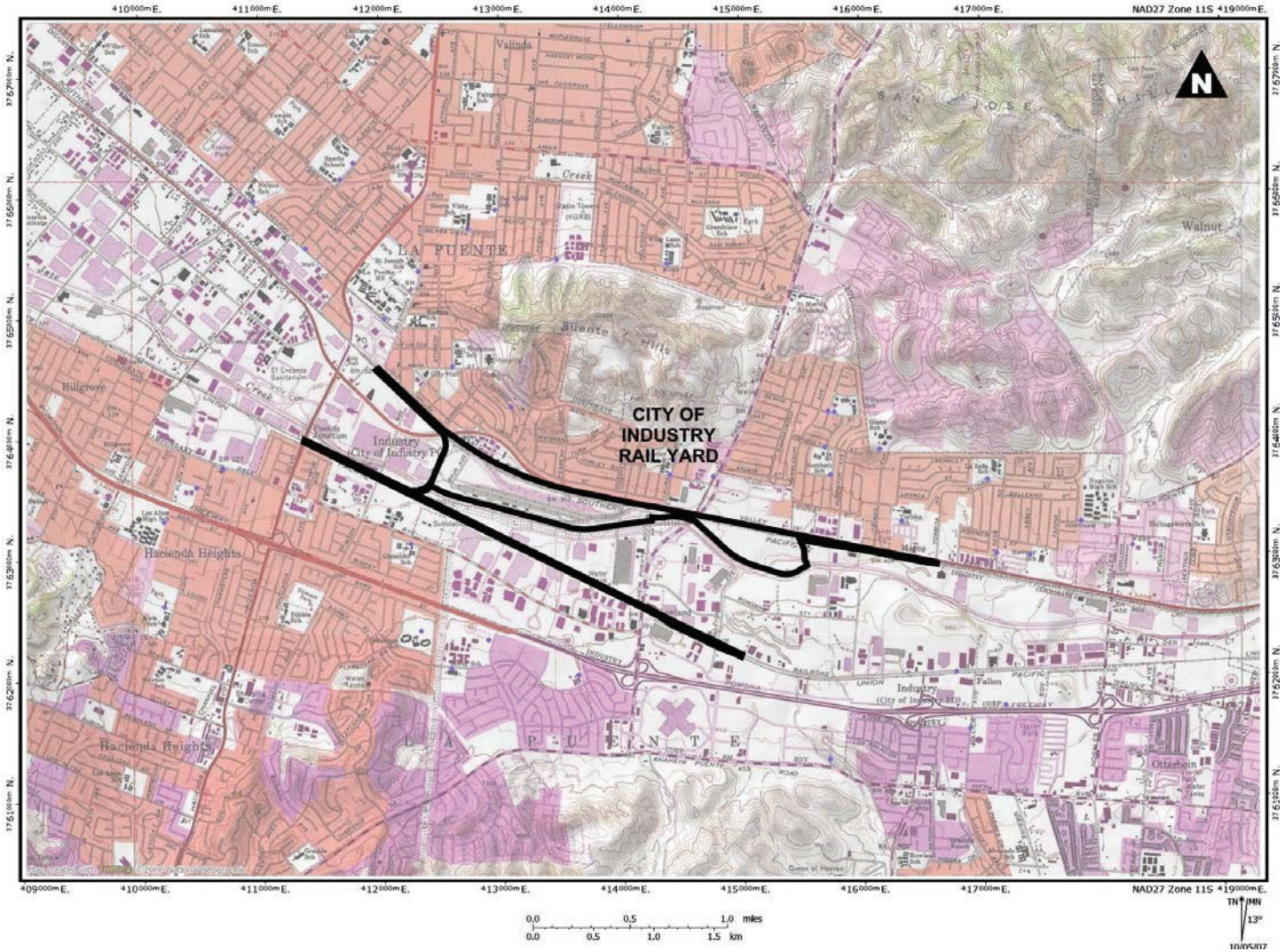
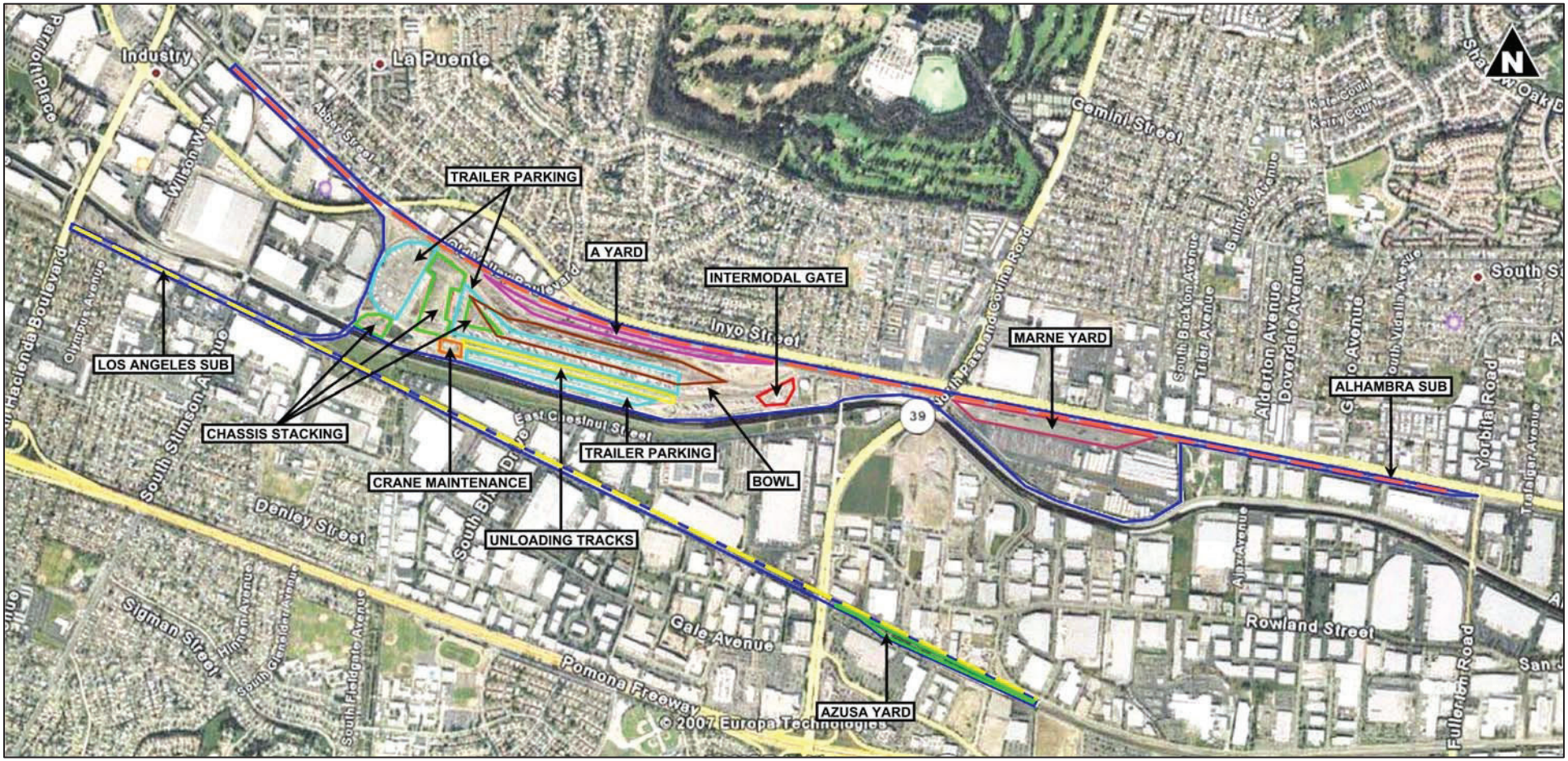


Figure 2
City of Industry Rail Yard Layout



PART IV. COVERED SOURCES

This emission inventory quantifies toxic air contaminant (TAC) emissions from the stationary, mobile, and portable sources located or operating at the Yard. 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), an emergency generator, and a WWTP. Site-specific equipment inventories are included in Part V below.

Per the UPRR *Emission Inventory Protocol*, stationary point sources that are exempt from local air district rules have been identified, but not included in the detailed emission inventory. Also, de minimis sources, based on weighted risk, have been identified in the inventory, but have not been further discussed or included in the modeling analysis. De minimis sources are the individual sources that represent less than 3% of the facility-total weighted-average site health risk (determined separately for cancer risk and non-cancer chronic health hazard). Total exclusions for all de minimis sources did not exceed 10% of the facility-total weighted average site cancer risk or chronic health hazard. De minimis sources are further discussed in Part VIII of this report.

PART V. SITE-SPECIFIC EQUIPMENT INVENTORIES

As discussed in Part IV above, there are a number of mobile, stationary, and portable emissions sources operating at the City of Industry Yard. The mobile sources include locomotives, heavy-heavy duty (HHD) Diesel-fueled trucks, cargo handling equipment (CHE), and other heavy equipment. The stationary emission sources include storage tanks, a WWTP, and an emergency generator. Portable equipment operating at the Yard includes transport refrigeration units (TRUs), refrigerated railcars (reefer cars), welders, air compressors, and a hydraulic lift. Each source group is further discussed below.

A. Locomotives

Locomotive activities at the Yard 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 lower 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, and pulling departing trains out of the Yard. Road power is also used for final building of trains prior to departure.

The Yard handles both manifest freight trains and intermodal trains. All arriving trains enter the A Yard, with the exception of manifest freight trains arriving from UPRR's West Colton Yard. Trains arriving from the West Colton Yard use both the A Yard and the Bowl. Due to limited track length, arriving trains must be "doubled over" by pulling through the arrival yard, uncoupling the rear section of the train, pulling back out of the yard, and then pushing the remaining section of the train onto another track. The locomotive consists[3] are then detached and move to the Marne Yard for refueling and other minor service, if needed.

[3] "Consist" is the term used to describe the one or more locomotives connected together to pull a train.

Most originating trains are built and depart from either the A Yard or the Marne Yard. The exceptions to this are West Colton manifest freight trains, which use the A Yard and the Bowl, and local trains operating on the Los Angeles Subdivision, which use the Bowl tracks exclusively. Consists are built and brought to the trains from the Marne Yard, and are used to do final train building (connecting already built major train segments) 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 crew.

Through trains are trains that nominally bypass the Yard on the Alhambra and Los Angeles Subdivision main lines. Data show some nominally through trains enter and leave the City of Industry Yard and the Azusa Yard, stopping to add or drop rail cars or locomotives. In these cases, the locomotive consist is not disconnected or moved to service, but does stop and idle for some period of time. These so-called "set-out" events are counted separately from main line through trains 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).[4]

Table 1 shows the number of road power locomotives in operation (arrivals, departures, and through traffic) at City of Industry during the 2005 calendar year by locomotive model group and type of train, including both working and non-working units (i.e., units that are shut-down).

[4] 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 1 Locomotive Models (Road Power) Identified at the City of Industry Rail Yard[a]						
Locomotive Model Group	Through Trains and Power Moves	Intermodal Trains	Manifest Trains other than West Colton	West Colton Manifest Trains	Local Trains	Power Moves in Yard
Switch[b]	35	0	4	2	34	12
GP3x	688	10	4	17	3,809	835
GP4x	1,698	390	56	185	1,333	415
GP50	160	31	2	2	4	8
GP60	3,229	249	119	644	973	227
SD7x	4,498	2,181	217	16	9	254
SD90	22	13	2	0	0	2
Dash7	7	4	0	0	0	0
Dash8	1,052	371	50	6	2	43
Dash9	2,022	1,087	194	17	10	168
C60A	14	4	2	0	0	2
Unknown	132	49	7	3	34	16
Total	**13,557**	**4,389**	**657**	**892**	**6,208**	**1,982**

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.

B. Diesel-Fueled Trucks (Yard Trucks)

UPRR operates a variety of on-road Diesel-fueled trucks (yard trucks) that are used for various activities in and around the Yard. Table 2 shows the equipment specifications for the Diesel-fueled yard trucks.

Table 2 Equipment Specifications for Diesel-Fueled Yard Trucks[a] City of Industry Rail Yard				
Equipment Type	Equipment ID	Make/Model	Model Year	Vehicle Class
Boom Truck	UP 65629	International 4900	1992	HHD
Welder Truck	UP 65984	Ford F-800	1992	MHD
Boom Truck	UP 68842	Ford F-Series	1997	HHD
Gang Truck	UP 60099	Freightliner	1999	HHD
Flat Bed Truck	TTX	Isuzu NPR HD	2000	HHD
Flat Bed Truck	TTX	Chevy W-4500	2001	HHD
Flat Bed Truck	TTX	Isuzu NPR HD	2001	HHD
Truck	TTX	Ford F-350	2001	LHDT1
Truck	TTX	Ford F-250	2001	MHD
Flat Bed Truck	TTX	Chevy W-4500	2003	HHD

Notes:
a. Vehicle specifications provided by UPRR personnel.

C. HHD Diesel-Fueled Trucks

A variety of HHD Diesel-fueled trucks operate at the Yard each day. The HHD 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 default fleet distribution for HHD Diesel-fueled trucks operating in Los Angeles County was used.

In addition to the drayage trucks, HHD trucks deliver Diesel fuel and various oils to the Yard. 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 operating in Los Angeles County was used.

D. Cargo Handling Equipment (CHE)

A variety of heavy equipment is used to load, unload, and move cargo containers within the Yard. Table 3 provides the equipment specifications for cargo handling equipment (CHE) operating at the Yard.

Table 3 Equipment Specifications for Cargo Handling Equipment City of Industry Rail Yard				
Equipment Type	Make/Model	Model Year	Rating (hp)	No. of Units
Chassis Stacker	Taylor GT210	1999	154	1
RTG[a]	Mi Jack 1000R	1984	300	1
RTG[a]	Mi Jack 1000R	1991	300	2
RTG[a]	Taylor 6040	2004	300	1
Top Pick	Caterpillar V250	1977	250	1
Top Pick	Taylor TEC-950	1995	350	1
Yard Hostler	Ottawa Commando	2003	150	2
Yard Hostler	Ottawa Commando	2004	150	3
Yard Hostler	Ottawa Commando	2005	150	9
Total				**21**

Notes:
a. Rubber Tire Gantry Crane

E. Heavy Equipment

In addition to the CHE discussed above, Diesel-fueled heavy equipment is used at City of Industry. The heavy equipment is used for non-cargo-related activities at the Yard, such as locomotive maintenance, handling of parts and Company material, derailments, etc. Table 4 provides detailed information for the heavy equipment used at the Yard.

Table 4 Equipment Specifications for Heavy Equipment City of Industry Rail Yard				
Equipment Type	Make/Model	Model Year	Rating (hp)	No. of Units
Forklift	Taylor T300M "Big Red"	2005	160	1
Forklift (12,000 lb)	Caterpillar DP70	1997	92.5	2
Backhoe[a]	John Deere S-310	ALL	108	1
Forklift (8,000 lb)	Caterpillar DP-40D	1999	84	1
Forklift (6,000 lb)	Caterpillar R-80	1989	56.5	1
Total				**6**

Notes:
a. Equipment specifications for the John Deere backhoe could not be found. Therefore, a fleet average model year and engine horsepower were assumed for this unit.

F. Tanks

There are a number of tanks at the City of Industry Yard that are used to store liquid petroleum and other products such as Diesel fuel, lubricating oils, and recovered oil. Table 5 provides detailed information for all storage tanks located at each facility.

Table 5
Storage Tank Specifications
City of Industry Rail Yard

Tank No.	Tank Location	Material Stored	Tank Capacity (gallons)
1	Crane Maintenance - PARSEC	Diesel	1,000
TNKO-0178	Crest Area	Lube Oil	1,000
R-oil	Oil/Water Separator (WWTP)	Recovered Oil	550
2	Crane Maintenance - PARSEC	Hydraulic Oil	241
3	Crane Maintenance - PARSEC	Motor Oil	241
4	Crane Maintenance - PARSEC	Used Oil	241
5	Crane Maintenance - PARSEC	Motor Oil	103
6	Crane Maintenance - PARSEC	Used Oil	168
7	Crane Maintenance - PARSEC	Hydraulic Oil	353

Notes:
a. All tanks listed are exempt from permitting requirements per SCAQMD Rule 219(m).

As shown in Table 5, all of the storage tanks at the facility are exempt from South Coast Air Quality Management District (SCAQMD) permitting requirements per Rule 219(m). Since these storage tanks are exempt from local air district rules, the emissions from these tanks are not included in the inventory or the dispersion modeling analysis, consistent with the UPRR inventory protocol.

G. Wastewater Treatment Plant

The City of Industry Yard also has a wastewater treatment plant (WWTP). Equipment at the WWTP includes two oil/water separators, various pumps, and storage tanks. Operation of the oil/water separators results in fugitive emissions of VOC.

H. Emergency Generator

An emergency generator is located at the Yard office building to provide emergency power when electrical service from the local power provider is disrupted. The generator is a 134 horsepower, Diesel-fueled unit manufactured by John Deere.

I. Air Compressor

A portable air compressor is used for various tasks throughout the Yard. The air compressor is a 150 horsepower, Diesel-fueled unit manufactured by Ingersoll Rand.

J. 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 in and out of and are temporarily stored at the Yard. The TRUs are owned by a variety of independent shipping companies and equipment-specific data are not available. Therefore, the default 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.

K. Portable Equipment

A variety of portable equipment is used at the Yard. Equipment specifications for the welders and other miscellaneous portable equipment are shown in Table 6.

Table 6 Portable Equipment Specifications City of Industry Rail Yard				
Equipment Location	Equipment Type	Fuel Type	Rated Capacity (hp)	No of Units
TTX Operations	Welder[a]	Gasoline	18	1
TTX Operations	Welder[a]	Gasoline	20	3
Crane Maintenance	Welder[a,b]	Gasoline	<50	1
Crane Maintenance	Air Compressor[a]	Gasoline	13	1
TTX Operations	Air Compressor[a]	Diesel	49	1
TTX Operations	Hydraulic Lift[a]	Gasoline	11	1

Notes:
a. Exempt from permitting requirements per SCAQMD Rule 219(b)(1).
b. The exact rating of this unit could not be determined.

Internal combustion engines with a rated capacity of 50 brake horsepower or less are exempt from permitting requirements by SCAQMD Rule 219(b)(1). As shown in Table 6, all of the welders and miscellaneous portable equipment operated at the Yard have a rated capacity of less than 50 hp, and therefore are exempt from permitting requirements. Since these units are exempt from local air district rules, the emissions from these units are not included in this inventory or in the dispersion modeling analysis, consistent with the UPRR inventory protocol.

PART VI. ACTIVITY DATA

Emissions from mobile sources are based on the number and type of equipment, equipment size, load factor, and operation during the baseline year of 2005. Since fuel consumption data were not available, the default load factors from the OFFROAD2007 model and operating data were used for emission calculations. Emissions from stationary and portable sources were based on the number and type of equipment, equipment size, and operation during the baseline year of 2005. For sources where operating data weren't available, an average operating mode (AOM) was developed based on employee interviews.

A. Locomotives

Road Power – Locomotive emissions were based on the number, model distribution, and operating conditions (idling, throttle notch, and speeds of movements, etc). Table 7 summarizes the activity data for locomotives operating on trains at the Yard during the 2005 calendar year. Power moves into and out of rail yards occur under train symbols if the regular train crew is still on board the locomotive(s) following termination of a train. In addition, some power moves occur without train symbols if the power is being ferried between yards by "hostlers" (Mechanical Department employees) instead of regular train crews. Since they do not have train symbols assigned, these power moves do not appear in the train database. To ensure the emissions calculations were 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 equal.

Table 7
Summary of Train Activity Data
City of Industry Rail Yard[a]

Train Type	Eastbound			Westbound			Speed (mph)	Idle per Train (hours)	Work 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				
Thru Trains (Alhambra Sub)	850	3.021	513	3,475	2.992	1,087	50	0	0	0.5
Thru Trains (Los Angeles Sub)	17	3.412	12	21	2.524	2	50	0	0	0.5
Intermodal Trains Terminating	45	2.356	--	53	1.925	--	10	1	0	--
Intermodal Trains Originating	710	2.985	--	826	2.496	--	10	0	3[b]	--
Manifest Trains Other than West Colton Terminating	2	2.000	--	99	3.081	--	10	1	0	--
Manifest Trains Other than West Colton Originating	107	2.290	--	40	2.575	--	10	0	3[b]	--
West Colton Manifest Trains Terminating	0	--	--	98	3.286	--	10	1	0	--
West Colton Manifest Trains Originating	166	2.892	--	27	3.333	--	10	0	3[b]	--
Local Trains Terminating (Alhambra Sub)	565	2.012	--	240	1.729	--	10	0	0	--
Local Trains Originating (Alhambra Sub)	542	2.052	--	496	2.270	--	10	0	2[b]	--
Local Trains Terminating (Los Angeles Sub)	79	1.975	--	343	1.974	--	10	0	0	--
Local Trains Originating (Los Angeles Sub)	245	1.931	--	565	1.968	--	10	0	2-3[c]	--
Power Moves Through (Alhambra Sub)	40	4.750	6	72	4.014	--	50	0	0	--
Power Moves Through (Los Angeles Sub)	1	1.000	--	1	2.000	--	50	0	0	--
Power Moves Terminating	395	2.119	--	317	2.019	--	10	0	0	--
Power Moves Originating	81	2.741	--	125	2.264	--	10	0	0	--

Notes:
a. In addition to the activities described above, four GP-4x switchers operate in the Yard.
b. Intermodal, manifest, and Alhambra Sub local trains' consists do final train building in the main Yard prior to departure.
c. Los Angeles Sub local trains' consists do final train building in the main Yard and Azusa Yard prior to departure (2 hours for eastbound trains, 3 hours for westbound trains).

Yard Switching – Yard operations include movements of intermodal and manifest freight cars within the Yard. At the City of Industry Yard, the yard operations are performed by two sets of two GP-40 switchers. These sets work within the full length of the City of Industry Yard, with one set working approximately 23 hours per day in the Yard, and the other approximately 20 hours per day within the Yard and approximately 4 hours per day working outside the Yard.

Service and Maintenance – A limited amount of locomotive servicing and maintenance activities, involving both road power and yard locomotives, is performed at the Marne Yard. Service activities include limited idling associated with some of the refueling events. A very small number of load test events are shown in the data, which include additional periods of idling and higher throttle settings following specific maintenance tasks. Following service, locomotives are taken as consists to departing trains.

A separate database provided information on each locomotive serviced at City of Industry. These data show service events for all locomotives that occurred within the Yard. 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 during refueling in the Marne Yard prior to their being grouped into consists for outbound trains. Some refueling events occur with 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 8.

Table 8 Locomotive Service, Maintenance and Load Test Events City of Industry Rail Yard					
Activity	Number of Events	Extra Non-ZTR Idling[a] (min)	ZTR and Non-ZTR Idling[b] (min)	N1 time (min)	N8 time (min)
Locomotive Service Events	121	0	60	0	0
Locomotive Maintenance Events	96	0	0	0	0
Unscheduled Maintenance Post-Test	28	0	5	0	10

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

B. Diesel-Fueled Trucks (Yard Trucks)

Emissions from the on-road Diesel-fueled trucks operating at the Yard are based on the engine model year, annual vehicle miles traveled (VMT), and the amount of time spent idling. Table 9 summarizes the activity data for the on-road Diesel-fueled trucks operating at the Yard.

Table 9
Activity Data for Diesel-Fueled Yard Trucks
City of Industry Rail Yard

Equipment Type	Equipment ID	Make/Model	Model Year	Vehicle Class	Annual VMT[a]	Idling Time[b] (min/day)	Idling Time[b] (hr/yr)
Boom Truck	UP 65629	International 4900	1992	HHD	10,584	15	91
Welder Truck	UP 65984	Ford F-800	1992	MHD	17,065	15	91
Boom Truck	UP 68842	Ford F-Series	1997	HHD	13,767	15	91
Gang Truck	UP 60099	Freightliner	1999	HHD	13,556	15	91
Flat Bed Truck	TTX	Isuzu NPR HD	2000	HHD	8,973	15	91
Flat Bed Truck	TTX	Chevy W-4500	2001	HHD	6,714	15	91
Flat Bed Truck	TTX	Isuzu NPR HD	2001	HHD	5,795	15	91
Truck	TTX	Ford F-350	2001	LHDT1	9,282	15	91
Truck	TTX	Ford F-250	2001	MHD	21,556	15	91
Flat Bed Truck	TTX	Chevy W-4500	2003	HHD	10,065	15	91

Notes:
a. Annual VMT based on the current odometer reading and the age of the vehicle.
b. Idling time (min/day) is an engineering estimate based on personal observation.

C. HHD Diesel-Fueled Trucks

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. Gate count data were used to determine the number of HHD intermodal trucks operating at the Yard during the 2005 calendar year. UPRR personnel count the number of cargo containers processed through both the "in" and "out" gates of the Yard. Since each HHD truck holds only one cargo container, the gate counts were used to determine the number of HHD truck trips for 2005. Trucks that enter or exit the facility without a chassis and/or a cargo container are referred to as "bobtails." Based on personal communication with the Intermodal Operations Manager at the Yard, the monthly gate counts were increased by 25% to account for bobtails. The monthly gate count data for 2005, including the estimated number of bobtails, are summarized in Table 10.

Table 10
Summary of Gate Count Data
City of Industry Rail Yard

Month	In-Gate Total[a]	Out-Gate Total[a]	Bobtails[b]	Total
January	5,835	6,678	3,128	15,641
February	8,212	7,289	3,875	19,376
March	11,012	10,117	5,282	26,411
April	12,063	10,025	5,522	27,610
May	11,499	10,401	5,475	27,375
June	12,571	10,926	5,874	29,371
July	10,856	9,175	5,008	25,039
August	11,799	11,652	5,863	29,314
September	12,153	9,869	5,506	27,528
October	10,591	8,357	4,737	23,685
November	10,254	8,787	4,760	23,801
December	10,214	8,872	4,772	23,858
Totals	**127,059**	**112,148**	**59,802**	**299,009**

Notes:
a. Provided by UPRR.
b. Bobtails are trucks without a chassis and/or container. Based on personal communication with the Intermodal Operations Manager, it was assumed bobtail counts are equal to 25% of the container count.

Table 11 summarizes the remaining activity data, such as annual VMT and idling time, for HHD Diesel-fueled drayage trucks operating at City of Industry. 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/or unloading. Based on discussions with the Intermodal Operations Manager, the average queuing time at the gate 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/disconnected from the truck cab. An additional 5 minutes of idle per trip was included to account for any other delays.

Table 11
Summary of HHD Intermodal Truck Activity Data
City of Industry Rail Yard

Number of HHD Truck Trips[a]	VMT per HHD Truck Trip (mi/trip)[b]	Annual VMT (mi/yr)	Idling Time	
			(min/trip)[b]	(hr/yr)
299,009	1.6	478,414	30	149,504

Notes:
a. Provided by UPRR. See Table 10.
b. Engineering estimate based on personal communication with the Intermodal Operations Manager for the Yard.

In addition to the intermodal trucks, HHD trucks deliver Diesel fuel and various oils to the Yard. The annual number of delivery truck trips was calculated based on the facility material throughput and a tanker truck capacity of 8,000 gallons per truck. The VMT per trip was estimated from aerial photos of the Yard. Activity data for the HHD delivery trucks are summarized in Table 12.

Table 12 Summary of HHD Delivery Truck Activity Data City of Industry Rail Yard					
Delivery Type	Number of HHD Truck Trips[a]	VMT per HHD Truck Trip (mi/trip)[b]	Annual VMT (mi/yr)	Idling Time	
				(min/trip)[c]	(hr/yr)
Diesel Fuel	7	0.92	6.44	10	1.17
Various Oils	1	0.92	0.92	10	0.17

Notes:
a. Number of truck trips based on the material throughput and a tanker truck volume of 8,000 gallons per truck.
b. VMT per trip estimated from aerial photos of each Yard.
c. Engineering estimate based on personal communication with UPRR staff.

D. Cargo Handling Equipment

Emissions from CHE operating at the Yard are based on the number and type of equipment, equipment model year, equipment size, and the annual hours of operation. Activity data for CHE are summarized in Table 13.

Table 13 Activity Data for Cargo Handling Equipment City of Industry Rail Yard					
Equipment Type	Make/Model	Model Year	Rating (hp)	No. of Units	Hours of Operation (hr/yr per unit)[a]
Chassis Stacker	Taylor GT210	1999	154	1	4,380
RTG	Mi Jack 1000R	1984	300	1	0
RTG	Mi Jack 1000R	1991	300	1	6,570
RTG	Mi Jack 1000R	1991	300	1	3,285
RTG	Taylor 6040	2004	300	1	6,570
Top Pick	Caterpillar V250	1977	250	1	1,095
Top Pick	Taylor TEC-950	1995	350	1	1,095
Yard Hostler	Ottawa Commando	2003	150	2	6,570
Yard Hostler	Ottawa Commando	2004	150	3	6,570
Yard Hostler	Ottawa Commando	2005	150	9	6,570

Notes:
a. Hours of operation provided by UPRR staff.

E. Heavy Equipment

Emissions from heavy equipment operating at the City of Industry Yard are based on the number and type of equipment, equipment model year, equipment size, and the annual hours of operation. Activity data for heavy equipment are summarized in Table 14.

Table 14
Activity Data for Heavy Equipment
City of Industry Rail Yard

Equipment Type	Make/Model	Model Year	Rating (hp)	No. of Units	Hours of Operation (hr/yr per unit)[a]
Forklift	Taylor T300M	2005	160	1	1,000
Forklift (12,000 lb)	Caterpillar DP70	1997	92.5	2	730
Backhoe[b]	John Deere S-310	ALL	108	1	1,825
Forklift (8,000 lb)	Caterpillar DP-40D	1999	84	1	730
Forklift (6,000 lb)	Caterpillar R-80	1989	56.5	1	365

Notes:
a. Hours of operation provided by equipment operators.
b. Equipment specifications for the John Deere backhoe could not be found. Therefore, a fleet average model year and engine horsepower were assumed for this unit.

F. Wastewater Treatment Plant

Emissions from the WWTP are based on the annual wastewater flow rate. Per UPRR staff, the annual flow rate for the WWTP is not measured at this Yard. Therefore, the annual flow rate contained in the *Air Emission Inventory and Regulatory Analysis Report for the City of Industry Yard* (Trinity Consultants, December 2005) was used for emission calculations. Per the Trinity Report, the annual WWTP flow rate is 4,717,389 gallons per year.

G. Emergency Generator

Emissions from the emergency generator at the Yard are based on the rated capacity of the unit and the annual hours of operation. In 2005, the generator was operated 20 hours.

H. Air Compressor

Emissions from the air compressor at the Yard are based on the rated capacity of the unit and the annual hours of operation. In 2005, the air compressor was operated 104 hours.

I. TRUs and Reefer Cars

Emissions from TRUs and reefer cars are based on the average size of the units, the average number of units in the Yard, and the hours of operation for each unit. Activity data for TRUs and reefer cars are summarized in Table 15.

Table 15
Activity Data for TRUs and Reefer Cars
City of Industry Rail Yard

Equipment Type	Average Rating (hp)[a]	Average No. of Units in Yard[b]	Hours of Operation	
			(hr/day)[c]	(hr/yr)[d]
Container	28.56	10	4	1,460
Railcar	34	4	4	1,460

Notes:
a. Based on the average horsepower distribution in the OFFROAD2007 model.
b. UPRR staff estimates and car data reports indicate that there are 3-5 TRUs and 0-2 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.

PART VII. EMISSIONS

A. Calculation Methodology and Emission Factors

Emission calculations were based on the site-specific equipment inventory, equipment activity data, and the source-specific emission factors. The calculation methodology and emission factors for each specific source type are further discussed below. Emissions were calculated in accordance with CARB Guidelines (July 2006) and the UPRR *Emission Inventory Protocol* (May 2006).

1. Locomotives

Emissions were calculated for both UPRR-owned and -operated locomotives, as well as "foreign" locomotives[5] 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).[6] 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, with model groups defined by manufacturer and engine type.[7] 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 City of Industry Yard for different types of activities. Movement durations were calculated from distance traveled and speed.

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[5] 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.

[6] 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.

[7] 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

Detailed counts of locomotive by model, U. S. EPA technology tier, and train type are shown in Appendices A-1 and A-2. Maps detailing the principal locomotive routes at the Yard are contained in Appendix A-5.

For line haul operations, a yard-specific average consist composition (number of units, number of units operating, model distribution, locomotive tier distribution, fraction equipped with auto start/stop technology[8]) was developed from UPRR data for different train types. The data showed that intermodal trains used predominately newer, high-horsepower SD-70 and Dash 9 locomotives. Progressively lower fractions of these locomotives and higher fractions of older, lower horsepower units were found on through trains and power moves; manifest freight trains other than those to and from UPRR's West Colton Yard; West Colton manifest trains; and local trains. In-yard power moves showed a more uniform mix of all model types. Therefore, locomotive model distributions were developed for each of these six separate groups for use in the emission calculations.

Movement speed, duration, and notch estimates were developed for arriving trains, departing trains, through trains, and in-yard movements. Through trains were assumed to operate on the main lines in notch 6 at 50 mph. Through trains were assumed to reduce throttle on approach to the yard through notch 3 at 30 mph and notch 2 at 20 mph before entering the Yard proper. All road power movements within the Yard (including terminating and originating trains, through trains doing setouts, and power moves) were assumed to be at 10 mph in throttle notches 1 and 2 (50% each). Idle duration was based on UPRR operator estimates for units not equipped with auto start/stop. Units that were equipped with AESS or 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 trains on each main line; originating and

[8] 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.

terminating intermodal trains; originating and terminating manifest freight trains other than trains from UPRR's West Colton Yard; West Colton manifest trains; local trains; and power moves through, originating, and terminating.

Fuel sulfur content affects the emission rates for DPM from locomotives. 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 rail yards (with the exception of local trains) use fuel produced outside of California, and arrive with approximately 10% remaining fuel in their tanks.
- 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.[9] 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).

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 16 and 17. 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.

[9] Personal communication from Theron Hinckley of Chevron Products Company to Jon Germer of UPRR and Rob Ireson, December 13, 2006.

Table 16
Locomotive Diesel Particulate Matter Emission Factors (g/hr)
Adjusted for Fuel Sulfur Content of 221 PPM
City of Industry Rail Yard

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	CARB and ENVIRON
GP-3x	N	38.0	72.0	31.0	110.0	174.1	187.5	230.2	369.1	423.5	555.1	CARB and ENVIRON
GP-4x	N	47.9	80.0	35.7	134.3	211.9	228.6	289.7	488.5	584.2	749.9	CARB and ENVIRON
GP-50	N	26.0	64.1	51.3	142.5	282.3	275.2	339.6	587.7	663.5	847.2	CARB and ENVIRON
GP-60	N	48.6	98.5	48.7	131.7	266.3	264.8	323.5	571.6	680.2	859.8	CARB and ENVIRON
GP-60	0	21.1	25.4	37.6	75.5	224.1	311.5	446.4	641.6	1029.9	1205.1	KCS7332
SD-7x	N	24.0	4.8	41.0	65.7	146.8	215.0	276.8	331.8	434.7	538.0	CARB and ENVIRON
SD-7x	0	14.8	15.1	36.8	61.1	215.7	335.9	388.6	766.8	932.1	1009.6	CARB and ENVIRON
SD-7x	1	29.2	31.8	37.1	66.2	205.3	261.7	376.5	631.4	716.4	774.0	NS2630[c]
SD-7x	2	55.4	59.5	38.3	134.2	254.4	265.7	289.0	488.2	614.7	643.0	UP8353[c]
SD-90	0	61.1	108.5	50.1	99.1	239.5	374.7	484.1	291.5	236.1	852.4	EMD 16V265H
Dash 7	N	65.0	180.5	108.2	121.2	306.9	292.4	297.5	255.3	249.0	307.7	CARB and ENVIRON
Dash 8	0	37.0	147.5	86.0	133.1	248.7	261.6	294.1	318.5	347.1	450.7	CARB and ENVIRON
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 CARB & CN2508[a]
Dash 9	1	16.9	88.4	62.1	140.2	259.5	342.2	380.4	443.5	402.7	570.0	CSXT595[b]
Dash 9	2	7.7	42.0	69.3	145.8	259.8	325.7	363.6	356.7	379.7	445.1	BNSF 7736[b]
C60-A	0	71.0	83.9	68.6	78.6	237.2	208.9	247.7	265.5	168.6	265.7	CARB and ENVIRON

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

Table 17
Locomotive Diesel Particulate Matter Emission Factors (g/hr)
Adjusted for Fuel Sulfur Content of 2,639 PPM
City of Industry Rail Yard

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	CARB and ENVIRON
GP-3x	N	38.0	72.0	31.0	110.0	184.5	208.8	262.2	410.8	457.9	601.1	CARB and ENVIRON
GP-4x	N	47.9	80.0	35.7	134.3	224.5	254.6	330.0	543.7	631.6	812.1	CARB and ENVIRON
GP-50	N	26.0	64.1	51.3	142.5	299.0	306.5	386.9	653.9	717.3	917.4	CARB and ENVIRON
GP-60	N	48.6	98.5	48.7	131.7	282.1	294.9	368.5	636.1	735.4	931.0	CARB and ENVIRON
GP-60	0	21.1	25.4	37.6	75.5	237.4	346.9	508.5	714.0	1113.4	1304.9	KCS7332
SD-7x	N	24.0	4.8	41.0	65.7	155.5	239.4	315.4	369.2	469.9	582.6	CARB and ENVIRON
SD-7x	0	14.8	15.1	36.8	61.1	228.5	374.1	442.7	853.3	1007.8	1093.2	CARB and ENVIRON
SD-7x	1	29.2	31.8	37.1	66.2	217.5	291.5	428.9	702.6	774.5	838.1	NS2630[c]
SD-7x	2	55.4	59.5	38.3	134.2	269.4	295.9	329.2	543.3	664.6	696.2	UP8353[c]
SD-90	0	61.1	108.5	50.1	99.1	253.7	417.3	551.5	324.4	255.3	923.1	EMD 16V265H
Dash 7	N	65.0	180.5	108.2	121.2	352.7	323.1	327.1	293.7	325.3	405.4	CARB and ENVIRON
Dash 8	0	37.0	147.5	86.0	133.1	285.9	289.1	323.3	366.4	453.5	593.8	CARB and ENVIRON
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 CARB & CN2508[a]
Dash 9	1	16.9	88.4	62.1	140.2	298.2	378.1	418.3	510.2	526.2	751.1	CSXT595[b]
Dash 9	2	7.7	42.0	69.3	145.8	298.5	359.9	399.8	410.4	496.1	586.4	BNSF 7736[b]
C60-A	0	71.0	83.9	68.6	78.6	272.6	230.8	272.3	305.4	220.3	350.1	CARB and ENVIRON

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

2. Diesel-Fueled Trucks (Yard Trucks)

Emission estimates for the Diesel-fueled yard trucks are based on the vehicle class, vehicle model year, annual VMT within the Yard, and amount of time the vehicles spend idling. Vehicle-specific emission factors, calculated using the EMFAC2007 model, are shown in Table 18. Per CARB guidelines, 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. Detailed emission factor derivation calculations and EMFAC2007 output are contained in Appendix B.

Table 18
Emission Factors for Diesel-Fueled Yard Trucks
City of Industry Rail Yard

Equipment Type	Equipment ID	Make/Model	Model Year	Vehicle Class	Traveling Emission Factors (g/mi)[a]					Idling Emissions Factors (g/hr)[a,b]				
					ROG	CO	NOx	DPM	SOx	ROG	CO	NOx	DPM	SOx
Boom Truck	UP 65629	International 4900	1992	HHD	8.25	20.27	32.16	3.78	0.27	15.52	53.81	101.42	2.57	0.55
Welder Truck	UP 65984	Ford F-800	1992	MHD	0.94	9.70	18.46	1.25	0.16	3.17	26.30	75.05	1.40	0.34
Boom Truck	UP 68842	Ford F-Series	1997	HHD	6.92	16.99	31.05	2.26	0.24	12.41	49.53	110.27	1.93	0.55
Gang Truck	UP 60099	Freightliner	1999	HHD	5.84	14.32	30.22	1.94	0.25	9.31	44.51	119.08	1.33	0.55
Flat Bed Truck	TTX	Isuzu NPR HD	2000	HHD	5.24	12.87	29.54	1.81	0.23	9.31	44.51	119.08	1.33	0.55
Flat Bed Truck	TTX	Chevy W-4500	2001	HHD	4.60	11.29	28.80	1.66	0.24	9.31	44.51	119.08	1.33	0.55
Flat Bed Truck	TTX	Isuzu NPR HD	2001	HHD	4.60	11.29	28.80	1.66	0.24	9.31	44.51	119.08	1.33	0.55
Truck	TTX	Ford F-350	2001	LHDT1	0.39	1.58	8.68	0.13	0.00	3.17	26.30	75.05	0.75	0.05
Truck	TTX	Ford F-250	2001	MHD	0.37	3.16	12.93	0.43	0.13	3.17	26.30	75.05	0.75	0.34
Flat Bed Truck	TTX	Chevy W-4500	2003	HHD	1.50	3.48	18.89	0.46	0.23	7.65	41.43	123.52	1.03	0.55

Notes:
a. Emission factors calculated using the EMFAC2007 model with the BURDEN output options.
b. Idling emission factors calculated using the EMFAC2007 model with the EMFAC output option.
c. See Table 2 for vehicle specifications.
d. Diesel PM_{10} (DPM) is a TAC.

3. HHD Diesel-Fueled Trucks

Emission factors for the HHD Diesel-fueled drayage and delivery trucks were obtained from CARB's EMFAC2007 model. Per CARB guidelines, 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 trucks are shown in Table 19. Detailed emission factor derivation calculations and the EMFAC2007 output are contained in Appendix C.

Table 19
Emission Factors for HHD Diesel-Fueled Drayage and Delivery Trucks[a]
City of Industry Rail Yard

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

Notes:
a. See Part V for vehicle specifications.
b. Emission factors calculated using the EMFAC2007 model with the BURDEN output option. The default fleet distribution for Los Angeles County was used.
c. Emission factors calculated using the EMFAC2007 model with the EMFAC output option. The default fleet distribution for Los Angeles County was used.
d. Diesel PM_{10} (DPM) is a TAC.

4. Cargo Handling Equipment (CHE)

Emission factors for CHE were calculated using a spreadsheet provided by CARB staff and are based on the OFFROAD2007 model. The emission factors for the CHE are shown in Table 20. Detailed emission factor derivation calculations and the CARB spreadsheet are contained in Appendix D.

Table 20 Emission Factors for Cargo Handling Equipment City of Industry Rail Yard							
Equipment Type	Make/Model	Model Year	Emission Factors (g/hp-hr)[a]				
			VOC	CO	NOx	DPM	SOx
Chassis Stacker	Taylor GT210	1999	0.54	2.85	6.86	0.36	0.06
RTG	Mi Jack 1000R	1984	NA	NA	NA	NA	NA
RTG	Mi Jack 1000R	1991	0.67	3.26	8.93	0.44	0.05
RTG	Taylor 6040	2004	0.09	0.95	4.16	0.10	0.05
Top Pick	Caterpillar V250	1977	1.23	6.17	14.94	0.86	0.06
Top Pick	Taylor TEC-950	1995	0.62	3.11	8.57	0.40	0.06
Yard Hostler	Ottawa Commando	2003	0.26	2.86	5.25	0.23	0.06
Yard Hostler	Ottawa Commando	2004	0.17	2.81	4.61	0.17	0.06
Yard Hostler	Ottawa Commando	2005	0.12	2.75	4.28	0.14	0.60

Notes:
a. Emission factors calculated using a spreadsheet provided by CARB staff and are based on the OFFROAD2007 model.

5. Heavy Equipment

Emission factors for heavy equipment were calculated using OFFROAD2007 model and are shown in Table 21. Detailed emission factor derivation calculations and OFFROAD2007 output are contained in Appendix E.

Table 21 Emission Factors for Heavy Equipment City of Industry Rail Yard							
Equipment Type	Make/Model	Model Year	Emission Factors (g/hp-hr)[a]				
			ROG[b]	CO	NOx	DPM	SOx
Forklift	Taylor T300M	2005	0.25	2.83	4.32	0.15	0.06
Forklift (12,000 lb)	Caterpillar DP70	1997	1.85	4.60	10.39	0.97	0.06
Backhoe	John Deere S-310	ALL[c]	1.14	3.26	6.82	0.56	0.05
Forklift (8,000 lb)	Caterpillar DP-40D	1999	1.85	4.60	8.36	1.06	0.06
Forklift (6,000 lb)	Caterpillar R-80	1989	1.85	4.60	10.39	0.97	0.06

Notes:
a. Emission factors from the OFFROAD2007 model.
b. Evaporative emissions for these sources are negligible.
c. Equipment specifications for the John Deere backhoe could not be found. Therefore, a fleet average model year and engine horsepower were assumed for this unit.

6. Wastewater Treatment Plant

Emission factors for the WWTP are from the *Air Emission Inventory and Regulatory Analysis Report for the City of Industry Yard* (Trinity Consultants, December 2005). Emission rates were calculated by Trinity Consultants using EPA's WATER9 program. The emission rates are shown in Table 22.

Table 22
Emission Factors for the Wastewater Treatment Plant
City of Industry Rail Yard

Pollutant	Emission Rate (grams/sec)
Benzene	2.36×10^{-6}
Bis (2-ethylhexyl) Phthalate	1.76×10^{-8}
Bromomethane	5.31×10^{-6}
Chloroform	3.10×10^{-6}
Ethylbenzene	1.44×10^{-5}
Methylene Chloride	3.29×10^{-5}
Toluene	1.56×10^{-5}
Xylene	2.70×10^{-5}
Total	**1.01×10^{-4}**

Notes:
a. Emission rates from *Air Emission Inventory and Regulatory Analysis for City of Industry Yard*, Trinity Consultants, December 2005.

7. Emergency Generator

Emission factors for the emergency generator at the Yard are from AP-42, Table 3.3.-1 (10/96). The emission factors are shown in Table 23.

Table 23
Emission Factors for the Diesel-Fueled Emergency Generator
City of Industry Rail Yard

Emission Factors (g/hp-hr)[a]				
ROG	CO	NOx	DPM[b]	SOx
1.14	3.03	14.06	1.00	0.93

Notes:
a. Emission factors from AP-42, Table 3.3-1, 10/96.
b. Diesel PM_{10} (DPM) is a TAC.

8. Air Compressor

Emission factors for the air compressor were calculated using OFFROAD2007 model and are shown in Table 24. Detailed emission factor derivation calculations and OFFROAD2007 output are contained in Appendix F.

Table 24
Emission Factors for the Diesel-Fueled Air Compressor
City of Industry Rail Yard

Emission Factors (g/hp-hr)[a]				
ROG	CO	NOx	DPM[b]	SOx
1.27	3.56	9.72	0.06	0.53

Notes:
a. Emission factors from OFFROAD2007 model.
b. Diesel PM_{10} (DPM) is a TAC.

9. TRUs and Reefer Cars

Emission factors for the Diesel-fueled TRUs and reefer cars are from the OFFROAD2007 model and are shown in Table 25. Detailed emission factor derivation calculations and the OFFROAD2007 output are contained in Appendix G.

Table 25
Emission Factors for TRUs and Reefer Cars
City of Industry Rail Yard

Equipment Type	Emissions (g/hp-hr-unit)[a]				
	HC[b]	CO	NOx	DPM	SOx[c]
TRU	2.85	6.78	6.43	0.71	0.07
Reefer Car	3.23	7.49	6.71	0.79	0.07

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.

B. TAC Emissions by Source Type

TAC emission calculations for each source type were based on the site-specific equipment inventory (shown in Part V of this report), equipment activity data (shown in Part VI of this report), and the source-specific emission factors shown in Part VII.A above. Detailed emission calculations for each source group are contained in Appendix H.

1. Locomotives

Emissions from locomotive operations were based on the emission factors shown in Tables 16 and 17, the number of events, the number of locomotives per consist, duration, and duty cycle of different types of activity. Table 26 shows the duty cycles assumed for different types of activities.

Table 26
Locomotive Duty Cycles
City of Industry Rail Yard

Activity	Duty Cycle
Through Train Movement	EB: N4 – 100%; WB: N3- 100%
Movements within the Yard	N1 – 50%, N2- 50%
Yard Operations	EPA Switch Duty Cycle[a]

Notes:
a. EPA (1998) Regulatory Support Document

For locomotive models and tiers for which specific emission factors were not available, the emissions for the next lower tier were used, or the next higher tier if no lower tier data were available. Emission factors for the "average locomotive" for different types of activity were developed from the emission factors and the actual locomotive model and technology distributions for that activity. Separate distributions were developed for eight types of activity: through trains (including through power moves); intermodal arrival; intermodal departures; other trains; arriving power moves; departing power moves; east end Yard operations; and west end Yard operations. Table 27 shows the DPM emission estimates for the different types of activities.

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Table 27 DPM Emissions from Locomotives City of Industry Rail Yard	
Activity	DPM Emissions (tpy)
Through Trains	0.51
Trains in Yard	2.06
Yard Operations	3.29
Service and Load Testing	0.01
Total	**5.87**

Notes:
a. See Table 1 for equipment specifications.
b. See Tables 7 and 8 for activity data.
c. See Table 16 and 17 for emission factors.
d. Emissions from Yard operations are based on two sets of switcher locomotives (one set operating 20 hours per day and the other operating 23 hours per day), the EPA Switch Duty Cycle, and the emission factors shown in Table 16.
e. See Appendices A-3 and A-4 for detailed emission calculations. The calculations of sulfur adjustments are shown in Appendix A-7.

2. Diesel-Fueled Trucks (Yard Trucks)

Emission estimates for Diesel-fueled yard trucks are based on vehicle class, vehicle model year, annual VMT within the Yard, and amount of time the vehicles spend idling. Table 28 shows the DPM emission estimates for Diesel-fueled yard trucks operating at City of Industry in 2005.

Table 28 DPM Emissions from Diesel-Fueled Yard Trucks City of Industry Rail Yard			
Pollutant	Emissions (tpy)		
	Traveling Mode	Idling Mode	Total
DPM	0.19	0.00	0.19

Notes:
a. See Table 2 for equipment specifications.
b. See Table 9 for activity data.
c. See Table 18 for emission factors.

3. HHD Diesel-Fueled Trucks

DPM emission estimates for the HHD Diesel-fueled drayage and delivery trucks are based on the number of truck trips, the annual VMT within the Yard, and the amount of idling time. Table 29 shows the DPM emission estimates for the Diesel-fueled HHD trucks operating at the Yard in 2005.

Table 29
DPM Emissions from HHD Diesel-Fueled Trucks
City of Industry Rail Yard

Source	DPM Emissions (tpy)		
	Traveling Mode	Idling Mode	Total
Drayage Trucks	1.30	0.47	1.77
Delivery Trucks[4]	0.00	0.00	0.00
Total	**1.30**	**0.47**	**1.77**

Notes:
a. See Part V for equipment specifications.
b. See Tables 10-12 for activity data.
c. See Table 19 for emission factors.
d. Due to the small number of deliveries and limited VMT, emissions from HHD Diesel-fueled delivery trucks are negligible.

4. Cargo Handling Equipment

DPM emission estimates for the CHE are based on the number and type of equipment, the equipment model, and the hours of operation. Table 30 shows the DPM emission estimates for the Diesel-fueled cargo handling equipment operating at the City of Industry Yard in 2005.

Table 30 DPM Emissions from Cargo Handling Equipment City of Industry Rail Yard				
Equipment Type	Make/Model	Model Year	No of Units	DPM Emissions (tpy)
Chassis Stacker	Taylor GT210	1999	1	0.08
RTG	Mi Jack 1000R	1984	1	0.00
RTG	Mi Jack 1000R	1991	1	0.42
RTG	Mi Jack 1000R	1991	1	0.21
RTG	Taylor 6040	2004	1	0.09
Top Pick	Caterpillar V250	1977	1	0.15
Top Pick	Taylor TEC-950	1995	1	0.10
Yard Hostler	Ottawa Commando	2003	2	0.32
Yard Hostler	Ottawa Commando	2004	3	0.37
Yard Hostler	Ottawa Commando	2005	9	0.88
Total			**21**	**2.62**

Notes:
a. See Table 3 for equipment specifications.
b. See Table 13 for activity data.
c. See Table 20 for emission factors.

5. Heavy Equipment

Emission estimates for the heavy equipment are based on the number and type of equipment, the equipment model, and the hours of operation. Table 31 shows the DPM emission estimates for the Diesel-fueled heavy equipment operating at the Yard in 2005.

Table 31 DPM Emissions from Heavy Equipment City of Industry Rail Yard				
Equipment Type	Make/Model	Model Year	No of Units	DPM Emissions (tpy)
Forklift	Taylor T300M	2005	1	0.01
Forklift (12,000 lb)	Caterpillar DP70	1997	2	0.04
Backhoe	John Deere S-310	ALL[d]	1	0.07
Forklift (8,000 lb)	Caterpillar DP-40D	1999	1	0.02
Forklift (6,000 lb)	Caterpillar R-80	1989	1	0.01
Total			**6**	**0.15**

Notes:
a. See Table 4 for equipment specifications.
b. See Table 14 for activity data.
c. See Table 21 for emission factors.
d. Equipment specifications for the John Deere backhoe could not be found. Therefore, a fleet average model year and engine horsepower were assumed for this unit.

6. Wastewater Treatment Plant

TAC emission estimates for the WWTP are based on emission rates from the *Air Emission Inventory and Regulatory Analysis Report for City of Industry Yard* (Trinity Consultants, December 2005) and the annual wastewater flow rate. Table 32 shows the TAC emissions from City of Industry WWTP during 2005.

Table 32 TAC Emissions from the Wastewater Treatment Plant City of Industry Rail Yard	
Pollutant	Emissions (tpy)
Benzene	8.20×10^{-5}
Bis (2-ethylhexyl) Phthalate	6.12×10^{-7}
Bromomethane	1.85×10^{-4}
Chloroform	1.08×10^{-4}
Ethylbenzene	5.01×10^{-4}
Methylene Chloride	1.14×10^{-3}
Toluene	5.42×10^{-4}
Xylene	9.39×10^{-4}
Total	**3.50×10^{-3}**

Notes:
a. See Part V for equipment description.
b. See Part VI for activity data.
c. See Table 22 for emission factors.

7. Emergency Generator and Air Compressor

Emission estimates for the emergency generator and the air compressor are based on the size of the unit and the hours of operation. Table 33 shows the DPM emission estimates for the Diesel-fueled emergency generator and air compressor operating at the Yard in 2005.

Table 33
DPM Emissions from the Emergency Generator and Air Compressor
City of Industry Rail Yard

Equipment Type	DPM Emissions (tpy)
Emergency Generator	0.003
Air Compressor	0.000
Total	**0.003**

Notes:
a. See Part V for equipment specifications.
b. See Part VI for activity data.
c. See Tables 23 and 24 for emission factors.

8. TRUs and Reefer Cars

Emission estimates for the Diesel-fueled TRUs and reefer cars were based on the average number of units in the Yard and the hours of operation. Table 34 shows the DPM emission estimates from TRUs and reefer cars operating at City of Industry in 2005.

Table 34
DPM Emissions from TRUs and Reefer Cars
City of Industry Rail Yard

Equipment Type	DPM Emissions (tpy)
TRU	0.18
Railcar	0.09
Total	**0.27**

Notes:
a. See Part V for equipment specifications.
b. See Table 15 for activity data.
c. See Table 25 for emission factors.

C. Facility Total Emissions

Facility-wide DPM emissions are shown in Table 35. The WWTP is the only source of other TACs at the City of Industry Yard; therefore, Table 32 summarizes facility-wide emissions of TACs other than DPM.

Table 35
Facility-Wide Diesel Particulate Emissions
City of Industry Rail Yard

Source	Emissions (tpy)
Locomotives[a]	5.870
Diesel-Fueled Yard Trucks[b]	0.190
HHD Diesel-Fueled Trucks[c]	1.770
Cargo Handling Equipment[d]	2.620
Heavy Equipment[e]	0.150
Emergency Generator[f]	0.003
Air Compressor[f]	0.000
TRUs and Reefer Cars[g]	0.270
Total	**10.870**

Notes:
a. See Table 27.
b. See Table 28.
c. See Table 29.
d. See Table 30.
e. See Table 31.
f. See Table 33.
g. See Table 34.

PART VIII. RISK SCREENING CALCULATIONS

As discussed in Part IV of this report and agreed upon with the CARB, de minimis sources, based on weighted health risk, were identified in the inventory, but were not included in the modeling analysis. De minimis sources are the individual source categories that represent less than 3% of the facility-total weighted-average site health impacts (determined separately for cancer risk and non-cancer chronic health hazard). Total exclusions for all de minimis sources did not exceed 10% of the facility-total weighted-average site health impacts.

The OEHHA unit risk factor for each pollutant was multiplied by the annual emissions of that pollutant to generate a risk index value for each source. Each source-specific risk index was divided by the facility total risk index to get the fractional contribution to the total risk for each source. The cancer risk, the non-cancer health hazard index, and the fractional contribution to the cancer risk and non-cancer chronic health hazard for each source are summarized in Table 36. Detailed cancer risk and non-cancer health hazard index calculations are in Appendix I.

Table 36
Summary of Weighted Risk by Source Category
City of Industry Rail Yard

Source	Cancer Risk		Non-Cancer Chronic Health Hazard	
	Risk Index Value	Percent of Total Risk	Health Hazard Index Value	Percent of Total Hazard
Locomotives	1.76×10^{-3}	54.01	2.94×10^{1}	51.81
Diesel-Fueled Yard Trucks	5.69×10^{-5}	1.75	9.49×10^{-1}	1.67
HHD Diesel-Fueled Drayage Trucks	5.31×10^{-4}	16.26	8.84	15.60
HHD Diesel-Fueled Delivery Trucks	7.25×10^{-9}	0.00	1.21×10^{-4}	0.00
Cargo Handling Equipment	7.86×10^{-5}	24.09	1.31×10^{1}	23.10
Heavy Equipment	4.38×10^{-5}	1.34	7.30×10^{-1}	1.29
WWTP	8.21×10^{-5}	2.52	1.37	2.41
Emergency Generator	4.09×10^{-9}	0.00	2.32	4.08
Air Compressor	8.84×10^{-7}	0.03	1.47×10^{-2}	0.03
TRUs and Reefer Cars	1.37×10^{-7}	0.00	2.29×10^{-3}	0.00
	3.26×10^{-3}	**100**	**5.67×10^{1}**	**100**

Sources that represent less than 3% each of the facility-total weighted-average cancer risk and non-cancer chronic health hazard, as shown in Table 36, are de minimis. Table 37 lists the de minimis sources for the City of Industry Yard.

Table 37
Summary of De Minimis Sources
City of Industry Rail Yard

De Minimis Sources for Cancer Risk	De Minimis Sources for Non-Cancer Chronic Health Hazard
Diesel-fueled Yard Trucks	Diesel-fueled Yard Trucks
Diesel-fueled Delivery Trucks	Diesel-fueled Delivery Trucks
Heavy Equipment	Heavy Equipment
TRUs and Reefer Cars	TRUs and Reefer Cars
WWTP	Emergency Generator
Emergency Generator	Air Compressor
Air Compressor	

Sources that are de minimis for both cancer risk and non-cancer chronic health hazard (i.e., yard trucks, TRUs and reefer cars, emergency generator, and air compressor) are not included in the dispersion modeling analysis. At the request of CARB, heavy equipment was included in the dispersion modeling analysis, notwithstanding its de minimis risk contribution.

PART IX. AIR DISPERSION MODELING

An air dispersion modeling analysis was conducted for the City of Industry Yard. 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 Yard. 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

As discussed in Part VIII, only sources that represent more than 3% of the facility-total weighted-average site health impacts (determined separately for cancer risk and non-cancer chronic health hazard) were included in the dispersion modeling analysis. At the request of CARB, heavy equipment and HHD Diesel-fueled delivery trucks were included as well, notwithstanding their de minimis risk contribution. 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 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 38 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 J. Figures 3 through 7 shows the location of each source.

Table 38 Source Treatment for Air Dispersion Modeling City of Industry Rail Yard	
Source	Source Treatment
HHD Diesel-Fueled Trucks (idling)	Volume
HHD Diesel-Fueled Trucks (traveling)	Volume
Locomotives (idling)	Point
Locomotives (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
WWTP	Volume

Notes:
a. See Figures 3 through 7 for source locations.

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 the CARB's *Health Risk Assessment Guidance for Rail Yard and Intermodal Facilities* (July 2006).

AERMOD is a steady-state,[10] 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).[11] AERMOD was used with meteorological data (wind speed, wind direction, temperature, and cloud cover) from the Ontario International Airport. AERMOD used these parameters to select the appropriate dispersion coefficients.

[10] The term "steady-state" means that the model assumes no variability in meteorological parameters over a one-hour time period.
[11] Federal Register, November 9, 2005; Volume 70, Number 216, Pages 68218-68261.

Figure 3
Intermodal Truck and Yard Hostlers

Figure 4
Locomotive Service & Load Testing & Waste Water Treatment Plant

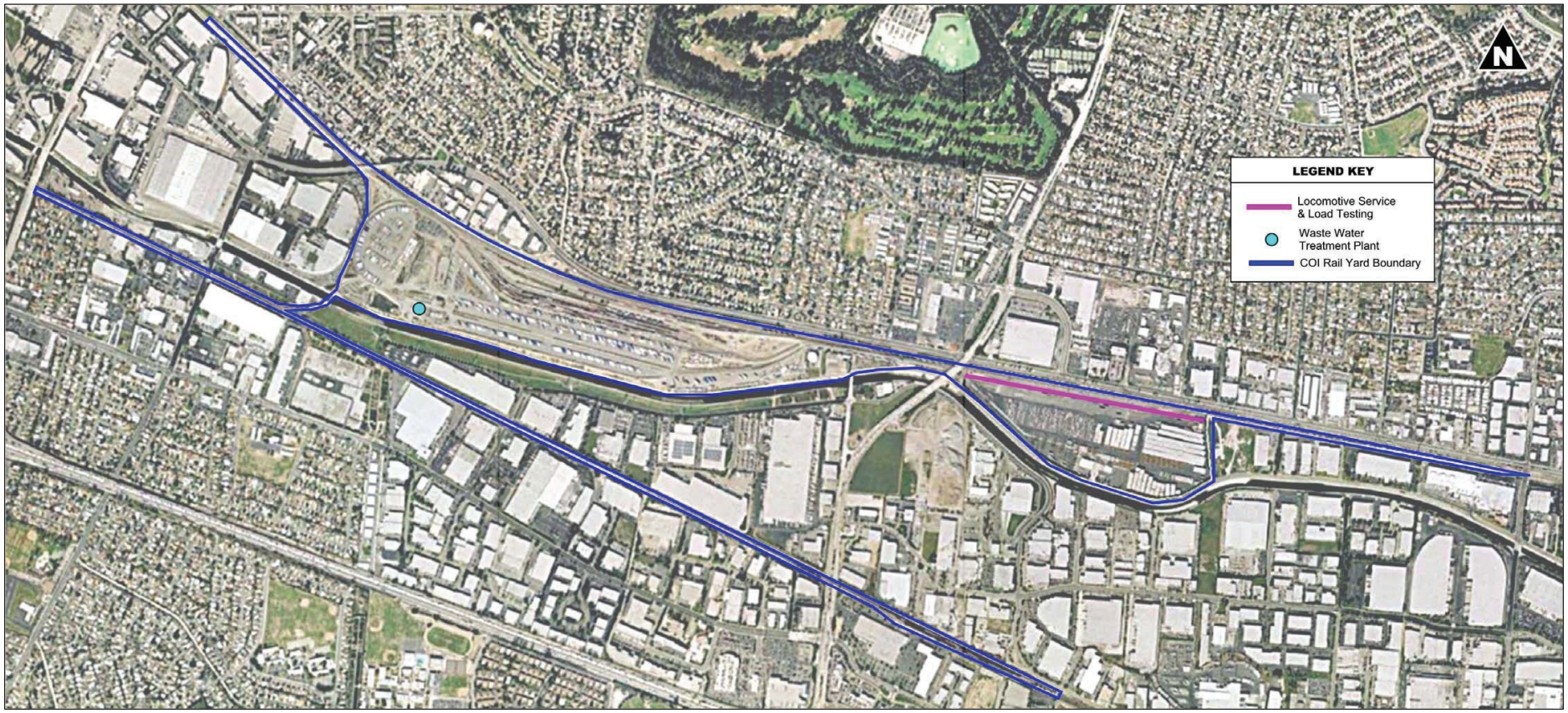


Figure 5
Train Movement and Idling

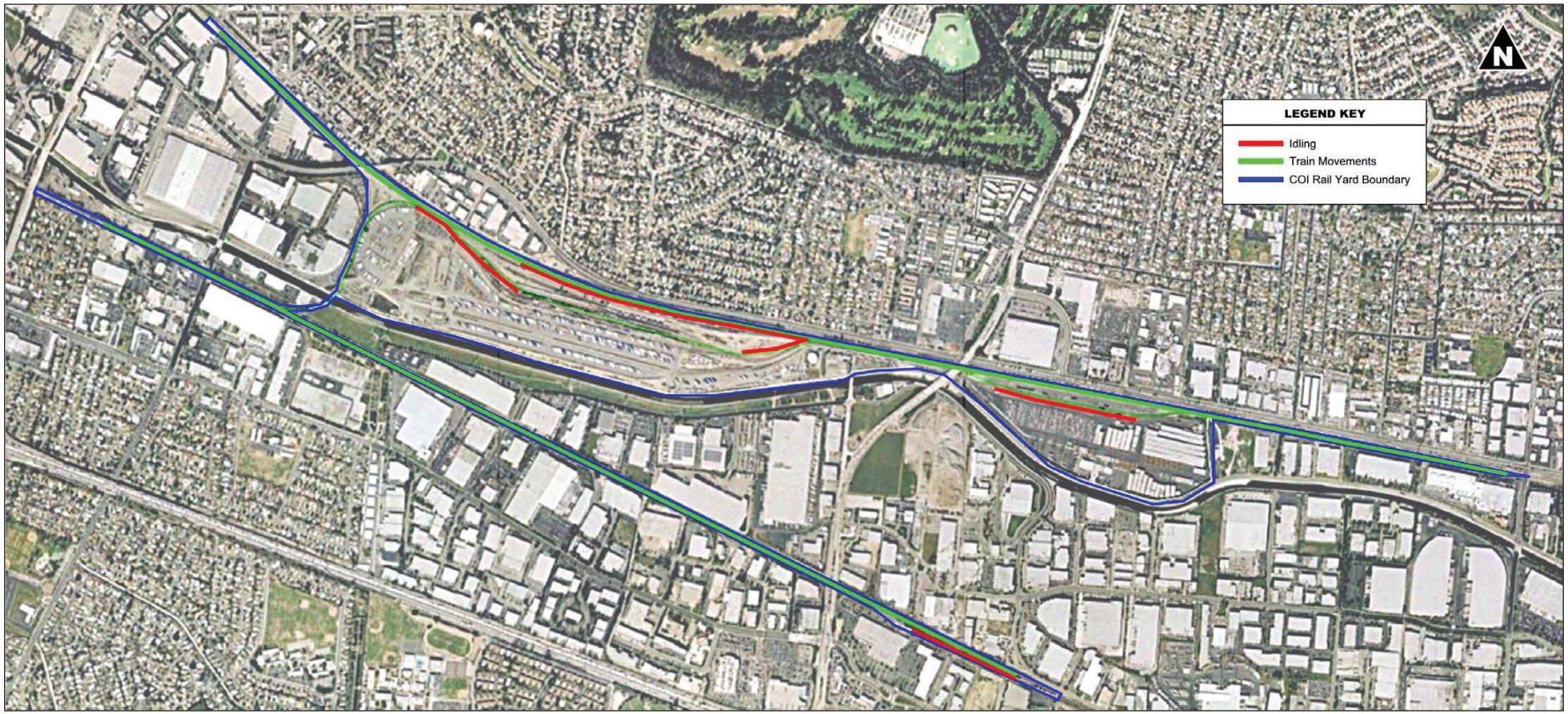


Figure 6
Locomotive Yard Switching

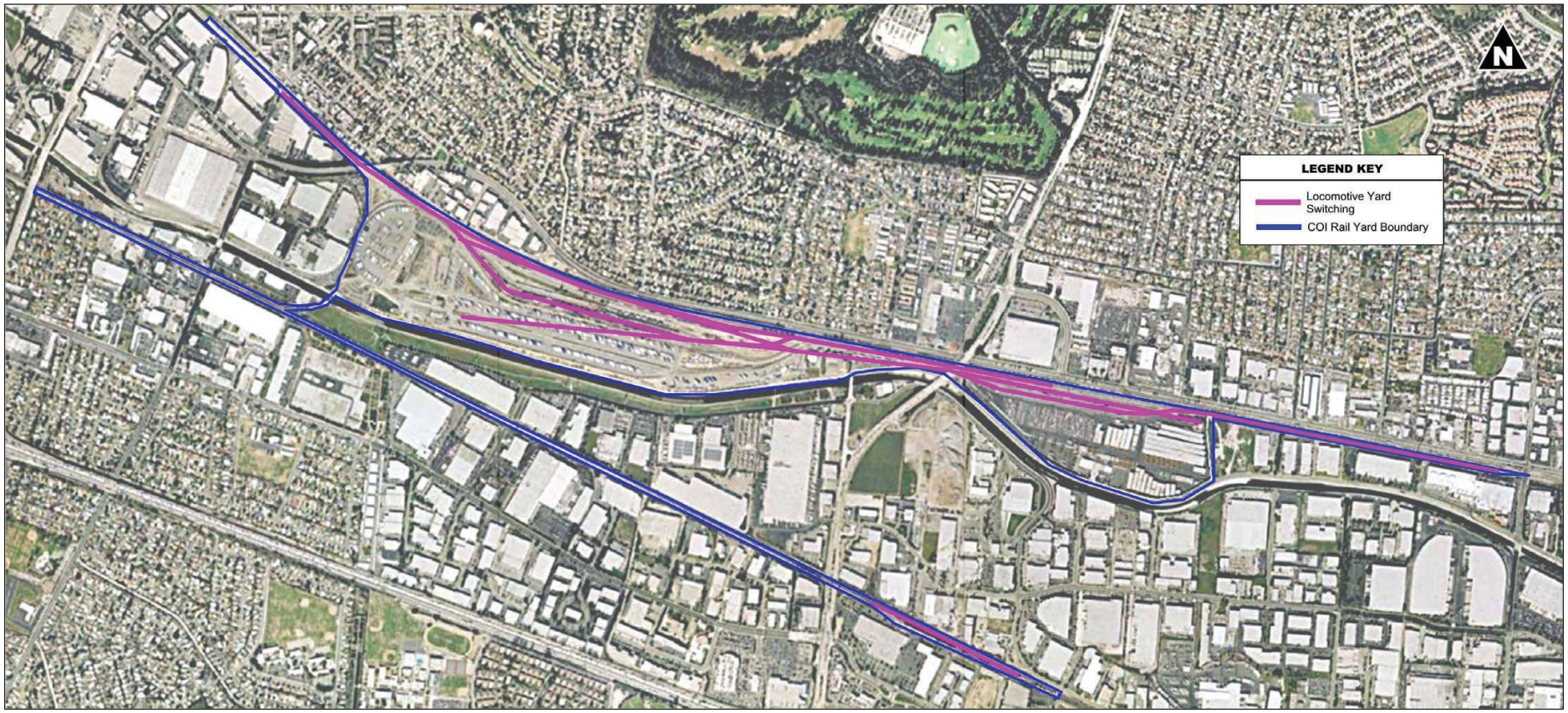
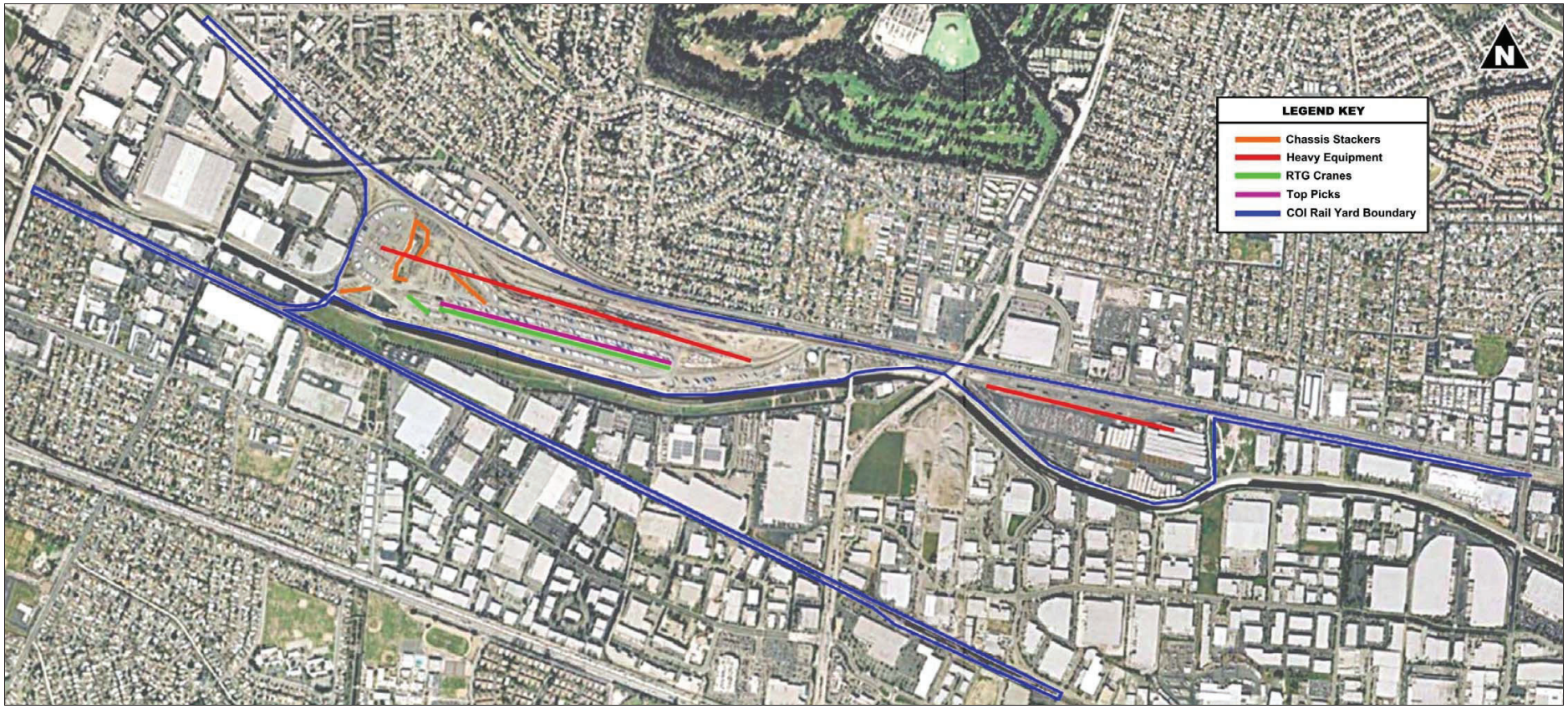


Figure 7
Heavy Equipment and Cargo Handling Equipment



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 to prepare meteorological data for use in AERMOD. Albedo and Bowen ratio[12] were estimated in multiple wind direction sectors surrounding the Yard, while surface roughness from separate sectors around the meteorological monitoring site was used in the model. This separation was based on the fact that atmospheric turbulence induced by surface roughness around the meteorological monitoring tower affects the resulting wind speed profile used by AERMOD to represent conditions at the Yard, while the albedo and Bowen ratio around the Yard are more appropriate to characterize land use conditions surrounding the area being modeled.

As suggested by USEPA (2000), for purposes of determining albedo and Bowen ratio the surface characteristics were specified in sectors no smaller than a 30-degree arc. Specifying surface characteristics in narrower sectors becomes less meaningful because of expected wind direction variability during an hour, as well as the encroachment of characteristics from the adjacent sectors with a one-hour travel time. Use of weighted-average[13] characteristics by surface area within a 30-degree (or wider) sector made it possible to have a unique portion of the surface significantly influence the properties of the sector that it occupies. The length of the upwind fetch for defining the nature of the turbulent characteristics of the atmosphere in each sector surrounding the source location

[12] 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.

[13] Weighting was based on wind direction frequency, as determined from a wind rose.

was 3 kilometers as recommended by Irwin (1978) and USEPA's *Guideline on Air Quality Models*.[14]

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 activities. The following profiles were used in the modeling. See Appendix A-4 for the profiles used and Appendix K 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 number of departures in 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 used for locomotive service and load test emissions based the same seasonal profile developed for train activity.

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

[14] USEPA (1986), and published as Appendix W to 40 CFR Part 51 (as revised).

modeling. Stack parameters used to create the AERMOD input file for locomotive operations are shown in Table 39. Table 40 summarizes the modeling inputs used to create the AERMOD input file for each non-locomotive source at the Yard.

Table 39
Locomotive Modeling Inputs
City of Industry Rail Yard

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[e] (m)	Release Height (m)
Locomotives (idling and load tests)[a]							
Road power idling – 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 locomotive idling – GP40	4.6	0.666	3.7	352	-	-	-
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 40
Non-Locomotive Modeling Inputs
City of Industry Rail Yard

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	-	-	-	-	1.39	20-50	4.15
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
Backhoe[b]					1.39	20-50	4.15
Yard Hostlers[b]	-	-	-	-	1.39	20-50	4.15
WWTP					2.60	11.68	5.60

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. Wind speed, wind direction, temperature, and cloud cover data from the Ontario International Airport were used for this project. Although the Ontario airport is approximately 18 miles east of the City of Industry Yard, the dominant effect of the elevated terrain to the north was judged to be sufficiently important for airflow patterns that Ontario surface winds would be most representative of conditions at the Yard.

Because rail yards, especially 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.

The selection of Ontario International Airport for surface winds data was largely dependent on the limited availability of data from other stations for the same years for which upper air data were available. There are several SCAQMD surface stations in the general vicinity of the Yard for which historical (1981) data are available, but only in a form useable in AERMOD's predecessor, ISCST3.

AERMET, the meteorological preprocessor for AERMOD, required at a minimum data from one surface National Weather Service (NWS) station, Ontario International Airport, for the Yard, and one upper air NWS station, Miramar Marine Corps Air Station in San Diego. Missing hourly surface data from Ontario International Airport were replaced by the last previous values available in the same dataset.

Eleven years worth of meteorological data from Ontario, for years 1990 through 2000, were processed with AERMET to assure that an adequate number of years of acceptable data completeness and quality would be available for AERMOD modeling. It is expected that year-to-year variability would not cause significant differences in the modeled health

impacts, and hence would justify needing to subject the full set of receptors to only one year of meteorological data. The meteorological data from 1999 were selected for the rail yard dispersion modeling because it was one of the two years recorded after the anemometer height was adjusted, and it was the year with the most conservative (i.e., largest) distances of impact from a specified source. 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 the City of Industry.

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 8 and 9 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 41 lists the address, elevations, and UTM coordinates for each sensitive receptor. Figure 10shows the outline of the Yard and the location of each sensitive receptor identified in Table 41.

Table 41
Sensitive Receptor Locations
City of Industry Rail Yard

Receptor	Address	Elevation (m)	UTM-E (m)	UTM-N (m)
Bixby Elementary School	16446 Wedgeworth Dr., Hacienda Heights, CA 91745	132.9	412464	3762272
Cedarlane Middle School	16333 Cedarlane Dr., Hacienda Heights, CA 91745	124.4	412211	3762590
Del Valle Elementary School	801 N. Del Valle St., La Puente, CA 91744	104.5	412863	3766109
Giano Intermediate School	3223 S. Giano St., La Puente, CA 91744	135.0	416086	3764078
Glen A. Wilson High School	16455 Wedgeworth Dr., Hacienda Heights, CA 91745	126.2	412779	3762504
Glenelder Elementary School	16234 Folger St., Hacienda Heights, CA 91745	110.0	412130	3763319
Hacienda Christian	15518 E. Gale Ave., Hacienda Heights, CA 91745	100.6	410555	3763959
Hurley Elementary School	535 S. Laura Ave., La Puente, CA 91744	120.4	414315	3763877
Jellick Elementary School	1400 S. Jellick Ave., Rowland Heights, CA 91748	136.2	416829	3761734
Kwis Elementary School	1925 S. Kwis Ave., Hacienda Heights, CA 91745	118.0	410053	3762803
La Puente High School	15615 E. Nelson Ave., La Puente, CA 91744	104.2	411920	3765203
La Seda Elementary School	341 S. La Seda Rd., La Puente, CA 91744	132.0	416991	3763820
Los Altos High School	15325 E. Los Robles Ave., Hacienda Heights, CA 91745	107.6	410053	3763517
Nelson Elementary School	330 N. California Ave., La Puente, CA 91744	94.5	410825	3766199
New Montesorri School	15243 E. Nelson Ave, La Puente, CA 91744	96.9	411264	3765796
Nogales High School	401 S. Nogales St., La Puente, CA 91744	139.9	417778	3763467
Northam Elementary School	17800 E. Renault St., La Puente, CA 91744	124.7	415671	3763867
Rincon Intermediate School	2800 E. Hollingworth St., West Covina, CA 91792	142.6	418209	3763262
Rorimer Elementary School	18750 E. Rorimer St., La Puente, CA 91744	132.9	417348	3763185
Shadybend Elementary School	15430 Shadybend Dr., Hacienda Heights, CA 91745	102.4	410327	3763803
Sierra Vista Middle School	15801 Sierra Vista Ct., La Puente, CA 91744	107.9	412633	3765952
Sparks Elementary School	15151 E. Temple Ave., La Puente, CA 91744	95.4	411558	3766375
Sparks Middle School	15100 Giordano St., La Puente, CA 91744	96.6	411672	3766512
St. Joseph Elementary School	15650 E. Temple Avenue, La Puente, CA 91744	107.3	412214	3765600

Table 41
Sensitive Receptor Locations
City of Industry Rail Yard

Receptor	Address	Elevation (m)	UTM-E (m)	UTM-N (m)
Villacorta Elementary School	17840 Villa Corta St, La Puente, CA 91744	135.0	415706	3764391
Wedgeworth Elementary	16949 Wedgeworth Dr, Hacienda Heights, CA 91745	125.0	413537	3762207
William Workman High School	16303 Temple Ave., City of Industry, CA 91744	126.5	413381	3765688
Wing Lane Elementary School	16605 Wing Lane, Valinda, CA 91744	116.1	414311	3765645
Workman Elementary School	16000 Workman St., La Puente, CA 91744	112.8	412495	3764803
Yorbita Elementary School	502 S. Vidalia St., La Puente, CA 91744	124.1	416268	3763476
Argudo Day Care	16335 Bamboo St., La Puente,CA 91744	122.5	412981	3764456
Kinder Care Learning Center	1650 Stoner Creek Rd, City of Industry, CA 91748	139.0	415646	3761484
Options: Early Learning Center-Hurley	535 Laura Ave, La Puente, CA 91744	123.1	414348	3764002
Options: Headstart	17721 Gemini St, La Puente, CA 91744	134.1	415651	3764400
Options: State Pre-School	18455 Railroad St, City of Industry, CA 91748	131.4	416721	3762211
Tatman Family Daycare	650 La Seda Rd #5A, La Puente, CA 91744	130.8	417065	3763199
Pacific Clinic	18623 Gale Ave., City of Industry, CA 91748	134.4	417133	3761929
The Childrens Clinic	17800 Renault St., La Puente, CA 91744	128.6	415624	3764097
Whittier Womens Health Center	565 S Azusa Way La Puente, CA 91744	119.8	414679	3763856

Notes:
a. UTM Coordinates are in Zone 11, NAD 83.

Figure 8
Coarse Modeling Grid
City of Industry Rail Yard

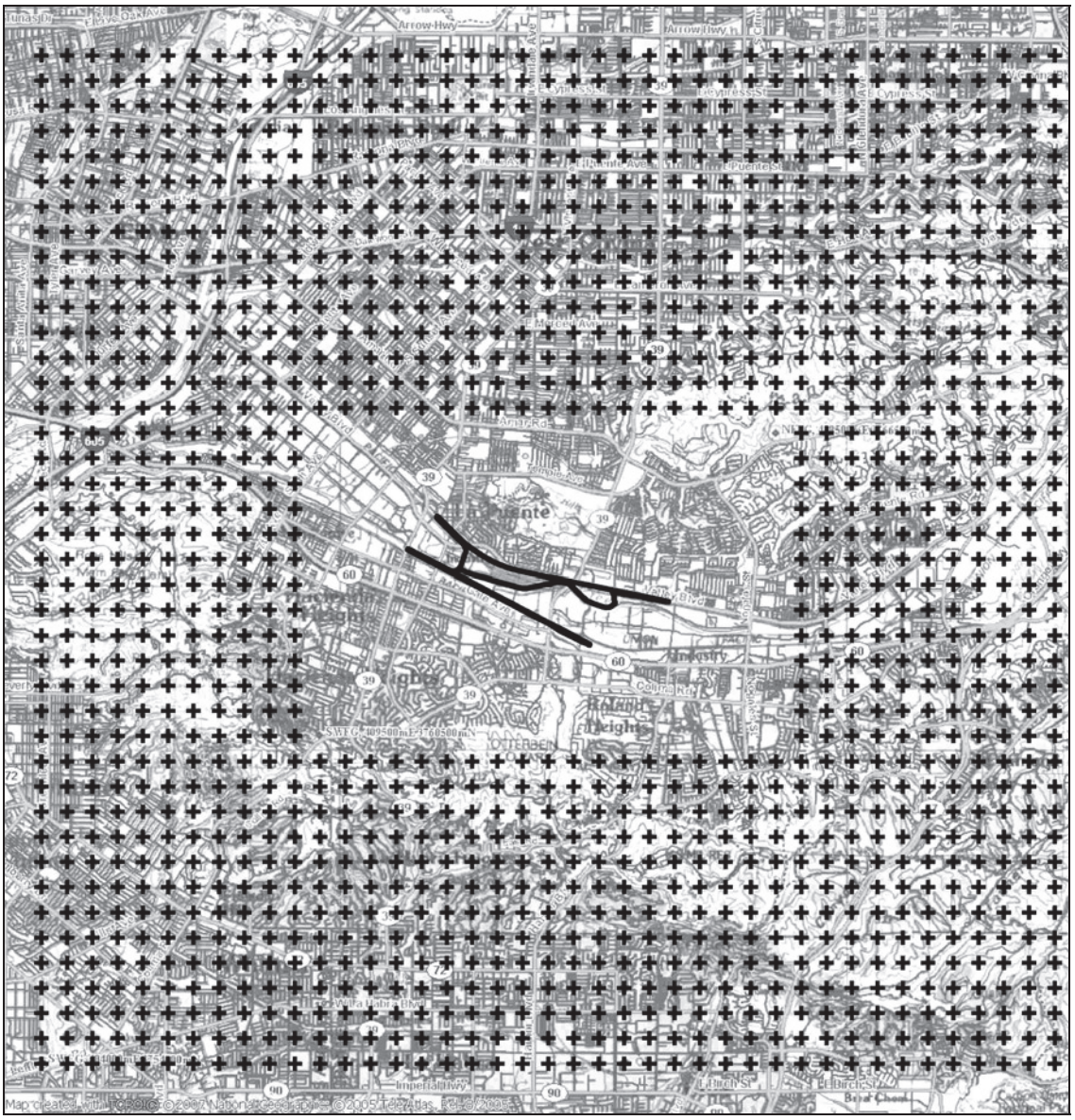


Figure 9
Fine Modeling Grid
City of Industry Rail Yard

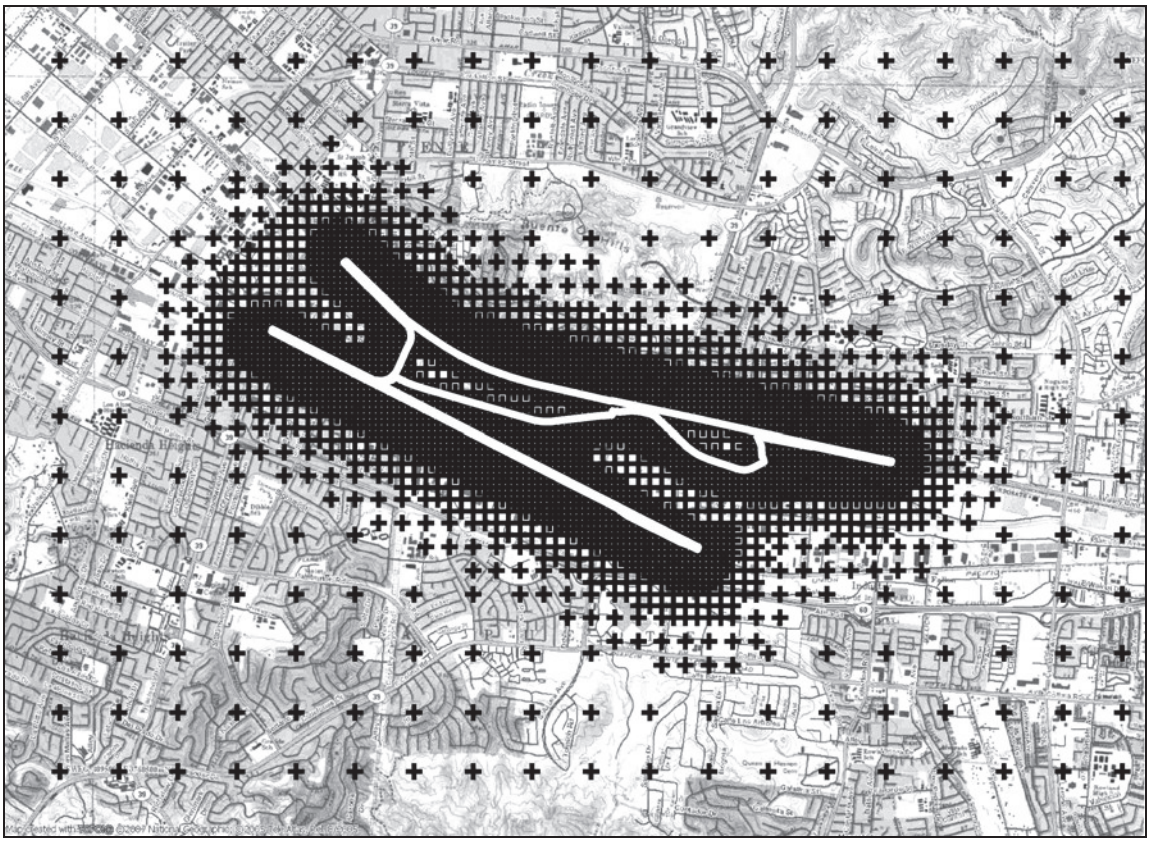
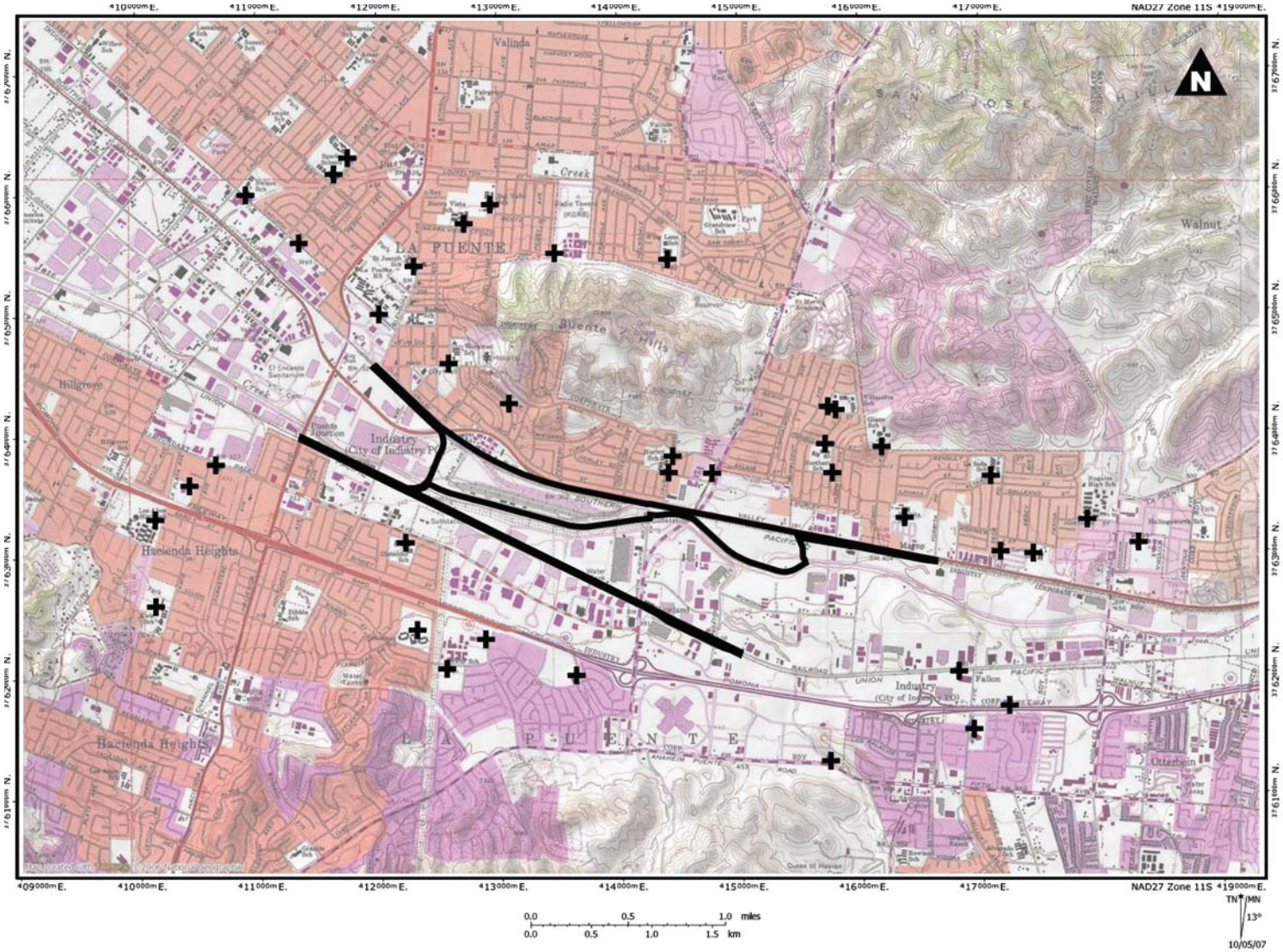


Figure 10
Sensitive Receptors
City of Industry Rail Yard



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 Yard was divided into sectors to characterize the albedo and Bowen ratio. The area surrounding the Ontario International Airport meteorological monitoring station was similarly divided into sectors to characterize surface roughness. These parameters were provided along with the meteorological data (wind speed, wind direction, temperature, and cloud cover) to the AERMET software. The resulting meteorological input file allows 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 the City of Industry Yard, AERMOD was run with the urban option. Based on CARB and USEPA guidance,[15] 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 area encompassed by the surrounding Los Angeles Standard Metropolitan Statistical Area (SMSA) was considered to determine the urban heat island effect on the nocturnal convective boundary layer height. The population of this SMSA is approximately 13,000,000,[16] and the surface roughness that characterizes this metropolitan area was set to the URBANOPT default of 1 m. See Appendix L for additional discussion of this issue.

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[15] AERMOD Implementation Guide**,** September 27, 2005, *http://www.epa.gov/scram001/7thconf/aermod/aermod_implmtn_guide.pdf*

[16] U.S. Census Bureau, Statistical Abstract of the United States: 2006 (*http://www.census.gov/compendia/statab/population/pop.pdf*) -- Table 26 (p. 30) gives 2004 Los Angeles-Long Beach-Santa Ana MSA population of 12,925,000.

7. Building Downwash

Building downwash effects were considered for the Yard. 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 Yard 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 have been provided to CARB in an electronic format.

C. Demographic Data

Demographic data files have been provided to CARB in an electronic format. See Appendix M for a description of the data.

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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

Thru Trains (Alhambra Sub)

EB arr 850

Technology	ZTR/AESS	Switch	GP3x	GP4x	GP50	GP60	SD7x	SD90	Dash7	Dash8	Dash9	C60A	Unknown
Pre Tier 0	**No**	3	316	382	70	875	3	1	0	81	36	0	12
Pre Tier 0	**Yes**	0	289	0	0	3	0	0	0	0	3	0	0
Tier 0	**No**	0	0	12	0	224	90	0	0	5	18	0	0
Tier 0	**Yes**	0	20	0	0	0	0	0	0	0	6	0	0
Tier 1	**No**	0	0	0	0	0	19	0	0	0	0	0	0
Tier 1	**Yes**	0	0	0	0	0	81	0	0	0	8	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	4	0	0	0	7	0	0

EB dep 850

Technology	ZTR/AESS	Switch	GP3x	GP4x	GP50	GP60	SD7x	SD90	Dash7	Dash8	Dash9	C60A	Unknown
Pre Tier 0	**No**	3	316	382	70	875	3	1	0	81	36	0	12
Pre Tier 0	**Yes**	0	289	0	0	3	0	0	0	0	3	0	0
Tier 0	**No**	0	0	12	0	224	90	0	0	5	18	0	0
Tier 0	**Yes**	0	20	0	0	0	0	0	0	0	6	0	0
Tier 1	**No**	0	0	0	0	0	19	0	0	0	0	0	0
Tier 1	**Yes**	0	0	0	0	0	81	0	0	0	8	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	4	0	0	0	7	0	0

WB arr 3475

Technology	ZTR/AESS	Switch	GP3x	GP4x	GP50	GP60	SD7x	SD90	Dash7	Dash8	Dash9	C60A	Unknown
Pre Tier 0	**No**	13	35	1160	75	1559	43	16	6	792	690	6	106
Pre Tier 0	**Yes**	10	13	0	0	3	0	0	0	0	51	0	0
Tier 0	**No**	1	1	33	2	395	1943	3	0	134	267	7	0
Tier 0	**Yes**	3	3	0	0	9	10	0	0	0	63	0	0
Tier 1	**No**	0	0	0	0	0	372	0	0	0	5	0	0
Tier 1	**Yes**	0	0	0	0	0	1557	0	0	0	188	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	237	0	0	0	585	0	0

Appendix A-1
Locomotive Model, Tier, and Auto Start/Stop Technology Frequency by Train Type

WB dep 3475

Technology	ZTR/AESS	Switch	GP3x	GP4x	GP50	GP60	SD7x	SD90	Dash7	Dash8	Dash9	C60A	Unknown
Pre Tier 0	**No**	13	35	1160	75	1559	43	16	6	792	690	6	106
Pre Tier 0	**Yes**	10	13	0	0	3	0	0	0	0	51	0	0
Tier 0	**No**	1	1	33	2	395	1943	3	0	134	267	7	0
Tier 0	**Yes**	3	3	0	0	9	10	0	0	0	63	0	0
Tier 1	**No**	0	0	0	0	0	372	0	0	0	5	0	0
Tier 1	**Yes**	0	0	0	0	0	1557	0	0	0	188	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	237	0	0	0	585	0	0

Thru Trains (LA Sub)

EB arr 17

Technology	ZTR/AESS	Switch	GP3x	GP4x	GP50	GP60	SD7x	SD90	Dash7	Dash8	Dash9	C60A	Unknown
Pre Tier 0	**No**	0	1	11	1	10	0	0	0	4	2	0	0
Pre Tier 0	**Yes**	0	0	0	0	0	0	0	0	0	0	0	0
Tier 0	**No**	0	1	0	0	2	9	0	0	0	1	0	0
Tier 0	**Yes**	0	0	0	0	0	1	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	10	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	1	0	0	0	4	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	1	11	1	10	0	0	0	4	2	0	0
Pre Tier 0	**Yes**	0	0	0	0	0	0	0	0	0	0	0	0
Tier 0	**No**	0	1	0	0	2	9	0	0	0	1	0	0
Tier 0	**Yes**	0	0	0	0	0	1	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	10	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	1	0	0	0	4	0	0

Appendix A-1
Locomotive Model, Tier, and Auto Start/Stop Technology Frequency by Train Type

WB arr 21

Technology	ZTR/AESS	Switch	GP3x	GP4x	GP50	GP60	SD7x	SD90	Dash7	Dash8	Dash9	C60A	Unknown
Pre Tier 0	**No**	0	0	7	1	4	0	0	0	3	3	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	9	0	0	2	1	0	0
Tier 0	**Yes**	0	0	0	0	0	0	0	0	0	4	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	11	0	0	0	6	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 21

Technology	ZTR/AESS	Switch	GP3x	GP4x	GP50	GP60	SD7x	SD90	Dash7	Dash8	Dash9	C60A	Unknown
Pre Tier 0	**No**	0	0	7	1	4	0	0	0	3	3	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	9	0	0	2	1	0	0
Tier 0	**Yes**	0	0	0	0	0	0	0	0	0	4	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	11	0	0	0	6	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

Intermodal Trains

EB arr 45

Technology	ZTR/AESS	Switch	GP3x	GP4x	GP50	GP60	SD7x	SD90	Dash7	Dash8	Dash9	C60A	Unknown
Pre Tier 0	**No**	0	1	30	0	26	1	0	0	0	7	0	6
Pre Tier 0	**Yes**	0	1	0	0	0	0	0	0	0	1	0	0
Tier 0	**No**	0	0	0	0	5	11	0	0	0	2	0	0
Tier 0	**Yes**	0	0	0	0	0	0	0	0	0	1	0	0
Tier 1	**No**	0	0	0	0	0	4	0	0	0	0	0	0
Tier 1	**Yes**	0	0	0	0	0	10	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 710

Technology	ZTR/AESS	Switch	GP3x	GP4x	GP50	GP60	SD7x	SD90	Dash7	Dash8	Dash9	C60A	Unknown
Pre Tier 0	**No**	0	2	163	17	48	20	3	1	165	184	1	18
Pre Tier 0	**Yes**	0	2	0	0	0	0	0	0	0	13	0	0
Tier 0	**No**	0	0	3	0	19	487	2	0	24	51	1	0
Tier 0	**Yes**	0	0	0	0	0	1	0	0	0	3	0	0
Tier 1	**No**	0	0	0	0	0	101	0	0	0	0	0	0
Tier 1	**Yes**	0	0	0	0	0	379	0	0	0	8	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	131	0	0	0	272	0	0

WB arr 53

Technology	ZTR/AESS	Switch	GP3x	GP4x	GP50	GP60	SD7x	SD90	Dash7	Dash8	Dash9	C60A	Unknown
Pre Tier 0	**No**	0	0	9	0	7	1	0	0	7	6	0	3
Pre Tier 0	**Yes**	0	1	0	0	0	0	0	0	0	0	0	0
Tier 0	**No**	0	0	0	0	2	26	1	0	2	3	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	2	0	0	0	0	0	0
Tier 1	**Yes**	0	0	0	0	0	24	0	0	0	2	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	1	0	0	0	5	0	0

WB dep 826

Technology	ZTR/AESS	Switch	GP3x	GP4x	GP50	GP60	SD7x	SD90	Dash7	Dash8	Dash9	C60A	Unknown
Pre Tier 0	**No**	0	3	182	14	116	23	5	3	154	176	1	22
Pre Tier 0	**Yes**	0	0	0	0	0	0	0	0	0	11	0	0
Tier 0	**No**	0	0	3	0	25	420	2	0	19	45	1	0
Tier 0	**Yes**	0	0	0	0	1	2	0	0	0	1	0	0
Tier 1	**No**	0	0	0	0	0	84	0	0	0	0	0	0
Tier 1	**Yes**	0	0	0	0	0	329	0	0	0	13	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	124	0	0	0	283	0	0

Appendix A-1
Locomotive Model, Tier, and Auto Start/Stop Technology Frequency by Train Type

Manifest Trains Other than West Colton

EB arr 2

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	2	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	0	0	0

EB dep 107

Technology	ZTR/AESS	Switch	GP3x	GP4x	GP50	GP60	SD7x	SD90	Dash7	Dash8	Dash9	C60A	Unknown
Pre Tier 0	**No**	0	0	18	1	45	0	0	0	13	6	0	1
Pre Tier 0	**Yes**	0	0	0	0	0	0	0	0	0	3	0	0
Tier 0	**No**	0	0	0	0	15	36	0	0	2	11	0	0
Tier 0	**Yes**	0	0	0	0	1	0	0	0	0	13	0	0
Tier 1	**No**	0	0	0	0	0	7	0	0	0	1	0	0
Tier 1	**Yes**	0	0	0	0	0	32	0	0	0	38	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

WB arr 99

Technology	ZTR/AESS	Switch	GP3x	GP4x	GP50	GP60	SD7x	SD90	Dash7	Dash8	Dash9	C60A	Unknown
Pre Tier 0	**No**	0	3	20	0	32	0	1	0	23	11	0	2
Pre Tier 0	**Yes**	0	1	0	0	0	0	0	0	0	1	0	0
Tier 0	**No**	0	0	2	0	7	49	0	0	3	17	2	0
Tier 0	**Yes**	0	0	0	0	0	0	0	0	0	17	0	0
Tier 1	**No**	0	0	0	0	0	14	0	0	0	0	0	0
Tier 1	**Yes**	0	0	0	0	0	45	0	0	0	47	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	6	0	0

Appendix A-1
Locomotive Model, Tier, and Auto Start/Stop Technology Frequency by Train Type

WB dep 40

Technology	ZTR/AESS	Switch	GP3x	GP4x	GP50	GP60	SD7x	SD90	Dash7	Dash8	Dash9	C60A	Unknown
Pre Tier 0	**No**	0	0	16	1	15	0	1	0	9	3	0	4
Pre Tier 0	**Yes**	4	0	0	0	0	0	0	0	0	1	0	0
Tier 0	**No**	0	0	0	0	4	8	0	0	0	3	0	0
Tier 0	**Yes**	0	0	0	0	0	0	0	0	0	5	0	0
Tier 1	**No**	0	0	0	0	0	6	0	0	0	0	0	0
Tier 1	**Yes**	0	0	0	0	0	13	0	0	0	9	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	1	0	0	0	0	0	0

West Colton Manifest 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 166

Technology	ZTR/AESS	Switch	GP3x	GP4x	GP50	GP60	SD7x	SD90	Dash7	Dash8	Dash9	C60A	Unknown
Pre Tier 0	**No**	1	8	99	2	262	0	0	0	3	4	0	2
Pre Tier 0	**Yes**	1	2	0	0	0	0	0	0	0	0	0	0
Tier 0	**No**	0	0	2	0	61	8	0	0	1	5	0	0
Tier 0	**Yes**	0	0	0	0	3	0	0	0	0	1	0	0
Tier 1	**No**	0	0	0	0	0	2	0	0	0	0	0	0
Tier 1	**Yes**	0	0	0	0	0	6	0	0	0	6	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	1	0	0

Appendix A-1
Locomotive Model, Tier, and Auto Start/Stop Technology Frequency by Train Type

WB arr 98

Technology	ZTR/AESS	Switch	GP3x	GP4x	GP50	GP60	SD7x	SD90	Dash7	Dash8	Dash9	C60A	Unknown
Pre Tier 0	**No**	0	3	58	0	200	0	0	0	2	0	0	1
Pre Tier 0	**Yes**	0	2	0	0	0	0	0	0	0	0	0	0
Tier 0	**No**	0	0	2	0	50	0	0	0	0	0	0	0
Tier 0	**Yes**	0	1	0	0	3	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 27

Technology	ZTR/AESS	Switch	GP3x	GP4x	GP50	GP60	SD7x	SD90	Dash7	Dash8	Dash9	C60A	Unknown
Pre Tier 0	**No**	0	1	24	0	55	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	10	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

Local Trains (Alhambra Sub)

EB arr 565

Technology	ZTR/AESS	Switch	GP3x	GP4x	GP50	GP60	SD7x	SD90	Dash7	Dash8	Dash9	C60A	Unknown
Pre Tier 0	**No**	6	254	219	1	202	0	0	0	0	0	0	10
Pre Tier 0	**Yes**	1	352	1	0	0	0	0	0	0	0	0	0
Tier 0	**No**	0	33	9	0	41	1	0	0	0	0	0	0
Tier 0	**Yes**	0	6	0	0	1	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 542

Technology	ZTR/AESS	Switch	GP3x	GP4x	GP50	GP60	SD7x	SD90	Dash7	Dash8	Dash9	C60A	Unknown
Pre Tier 0	**No**	2	302	214	1	62	0	0	0	1	2	0	5
Pre Tier 0	**Yes**	0	451	0	0	0	0	0	0	0	1	0	0
Tier 0	**No**	0	42	5	0	6	4	0	0	0	1	0	0
Tier 0	**Yes**	0	7	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	2	0	0

WB arr 240

Technology	ZTR/AESS	Switch	GP3x	GP4x	GP50	GP60	SD7x	SD90	Dash7	Dash8	Dash9	C60A	Unknown
Pre Tier 0	**No**	0	122	83	0	9	0	0	0	0	0	0	0
Pre Tier 0	**Yes**	0	175	0	0	0	0	0	0	0	0	0	0
Tier 0	**No**	0	14	2	0	2	0	0	0	0	0	0	0
Tier 0	**Yes**	0	8	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 496

Technology	ZTR/AESS	Switch	GP3x	GP4x	GP50	GP60	SD7x	SD90	Dash7	Dash8	Dash9	C60A	Unknown
Pre Tier 0	**No**	12	140	212	2	420	0	0	0	0	1	0	19
Pre Tier 0	**Yes**	9	176	0	0	0	0	0	0	0	0	0	0
Tier 0	**No**	0	14	6	0	102	0	0	0	0	2	0	0
Tier 0	**Yes**	0	9	0	0	2	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

Local Trains (LA Sub)

EB arr 79

Technology	ZTR/AESS	Switch	GP3x	GP4x	GP50	GP60	SD7x	SD90	Dash7	Dash8	Dash9	C60A	Unknown
Pre Tier 0	**No**	0	41	38	0	13	0	0	0	0	0	0	0
Pre Tier 0	**Yes**	0	61	0	0	0	0	0	0	0	0	0	0
Tier 0	**No**	0	2	1	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 245

Technology	ZTR/AESS	Switch	GP3x	GP4x	GP50	GP60	SD7x	SD90	Dash7	Dash8	Dash9	C60A	Unknown
Pre Tier 0	**No**	0	129	114	0	36	0	0	0	0	0	0	0
Pre Tier 0	**Yes**	0	180	0	0	0	0	0	0	0	0	0	0
Tier 0	**No**	0	11	2	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	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	0	0	0

WB arr 343

Technology	ZTR/AESS	Switch	GP3x	GP4x	GP50	GP60	SD7x	SD90	Dash7	Dash8	Dash9	C60A	Unknown
Pre Tier 0	**No**	2	188	147	0	22	0	0	0	0	0	0	0
Pre Tier 0	**Yes**	0	284	0	0	0	0	0	0	0	0	0	0
Tier 0	**No**	0	20	5	0	0	0	0	0	0	0	0	0
Tier 0	**Yes**	0	9	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 dep 565

Technology	ZTR/AESS	Switch	GP3x	GP4x	GP50	GP60	SD7x	SD90	Dash7	Dash8	Dash9	C60A	Unknown
Pre Tier 0	**No**	2	293	266	0	54	0	0	0	1	0	0	0
Pre Tier 0	**Yes**	0	441	0	0	0	0	0	0	0	0	0	0
Tier 0	**No**	0	35	9	0	1	0	0	0	0	0	0	0
Tier 0	**Yes**	0	10	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 Thru (Alahambra Sub)

EB arr 40

Technology	ZTR/AESS	Switch	GP3x	GP4x	GP50	GP60	SD7x	SD90	Dash7	Dash8	Dash9	C60A	Unknown
Pre Tier 0	**No**	0	3	47	4	74	0	1	1	3	3	0	4
Pre Tier 0	**Yes**	1	1	0	0	0	0	0	0	0	0	0	0
Tier 0	**No**	0	0	0	0	12	3	0	0	0	7	1	0
Tier 0	**Yes**	0	1	0	0	0	0	0	0	0	5	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	13	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 40

Technology	ZTR/AESS	Switch	GP3x	GP4x	GP50	GP60	SD7x	SD90	Dash7	Dash8	Dash9	C60A	Unknown
Pre Tier 0	**No**	0	3	47	4	74	0	1	1	3	3	0	4
Pre Tier 0	**Yes**	1	1	0	0	0	0	0	0	0	0	0	0
Tier 0	**No**	0	0	0	0	12	3	0	0	0	7	1	0
Tier 0	**Yes**	0	1	0	0	0	0	0	0	0	5	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	13	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

Appendix A-1
Locomotive Model, Tier, and Auto Start/Stop Technology Frequency by Train Type

WB arr 72

Technology	ZTR/AESS	Switch	GP3x	GP4x	GP50	GP60	SD7x	SD90	Dash7	Dash8	Dash9	C60A	Unknown
Pre Tier 0	**No**	1	0	45	7	48	0	1	0	24	19	0	10
Pre Tier 0	**Yes**	0	4	0	0	0	0	0	0	0	2	0	0
Tier 0	**No**	0	0	1	0	7	37	0	0	4	7	0	0
Tier 0	**Yes**	3	0	0	0	0	0	0	0	0	2	0	0
Tier 1	**No**	0	0	0	0	0	6	0	0	0	0	0	0
Tier 1	**Yes**	0	0	0	0	0	44	0	0	0	6	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	4	0	0	0	7	0	0

WB dep 72

Technology	ZTR/AESS	Switch	GP3x	GP4x	GP50	GP60	SD7x	SD90	Dash7	Dash8	Dash9	C60A	Unknown
Pre Tier 0	**No**	1	0	45	7	48	0	1	0	24	19	0	10
Pre Tier 0	**Yes**	0	4	0	0	0	0	0	0	0	2	0	0
Tier 0	**No**	0	0	1	0	7	37	0	0	4	7	0	0
Tier 0	**Yes**	3	0	0	0	0	0	0	0	0	2	0	0
Tier 1	**No**	0	0	0	0	0	6	0	0	0	0	0	0
Tier 1	**Yes**	0	0	0	0	0	44	0	0	0	6	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	4	0	0	0	7	0	0

Power Moves Thru (LA Sub)

EB arr 1

Technology	ZTR/AESS	Switch	GP3x	GP4x	GP50	GP60	SD7x	SD90	Dash7	Dash8	Dash9	C60A	Unknown
Pre Tier 0	**No**	0	0	0	0	1	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 1

Technology	ZTR/AESS	Switch	GP3x	GP4x	GP50	GP60	SD7x	SD90	Dash7	Dash8	Dash9	C60A	Unknown
Pre Tier 0	No	0	0	0	0	1	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 arr 1

Technology	ZTR/AESS	Switch	GP3x	GP4x	GP50	GP60	SD7x	SD90	Dash7	Dash8	Dash9	C60A	Unknown
Pre Tier 0	No	0	0	0	0	2	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 1

Technology	ZTR/AESS	Switch	GP3x	GP4x	GP50	GP60	SD7x	SD90	Dash7	Dash8	Dash9	C60A	Unknown
Pre Tier 0	No	0	0	0	0	2	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

Power Moves In Yard

EB arr 395

Technology	ZTR/AESS	Switch	GP3x	GP4x	GP50	GP60	SD7x	SD90	Dash7	Dash8	Dash9	C60A	Unknown
Pre Tier 0	**No**	3	153	149	3	77	0	0	0	14	18	0	5
Pre Tier 0	**Yes**	2	219	0	0	0	0	0	0	0	5	0	0
Tier 0	**No**	0	17	2	0	10	53	0	0	6	5	0	0
Tier 0	**Yes**	0	1	0	0	0	0	0	0	0	3	0	0
Tier 1	**No**	0	0	0	0	0	10	0	0	0	1	0	0
Tier 1	**Yes**	0	0	0	0	0	48	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	6	0	0	0	22	0	0

EB dep 81

Technology	ZTR/AESS	Switch	GP3x	GP4x	GP50	GP60	SD7x	SD90	Dash7	Dash8	Dash9	C60A	Unknown
Pre Tier 0	**No**	0	22	50	2	44	0	1	0	3	5	0	1
Pre Tier 0	**Yes**	0	27	1	0	0	0	0	0	0	4	0	0
Tier 0	**No**	0	0	2	0	7	7	0	0	0	8	2	0
Tier 0	**Yes**	0	0	0	0	0	0	0	0	0	5	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	13	0	0	0	15	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	1	0	0	0	1	0	0

WB arr 317

Technology	ZTR/AESS	Switch	GP3x	GP4x	GP50	GP60	SD7x	SD90	Dash7	Dash8	Dash9	C60A	Unknown
Pre Tier 0	**No**	0	129	149	0	50	0	0	0	8	16	0	4
Pre Tier 0	**Yes**	4	184	0	0	0	0	0	0	0	4	0	0
Tier 0	**No**	0	15	4	0	7	23	0	0	0	5	0	0
Tier 0	**Yes**	0	2	0	0	0	0	0	0	0	3	0	0
Tier 1	**No**	0	0	0	0	0	5	0	0	0	0	0	0
Tier 1	**Yes**	0	0	0	0	0	17	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	3	0	0	0	3	0	0

Appendix A-1
Locomotive Model, Tier, and Auto Start/Stop Technology Frequency by Train Type

WB dep 125

Technology	ZTR/AESS	Switch	GP3x	GP4x	GP50	GP60	SD7x	SD90	Dash7	Dash8	Dash9	C60A	Unknown
Pre Tier 0	**No**	3	22	57	3	26	1	1	0	9	17	0	6
Pre Tier 0	**Yes**	0	40	0	0	0	0	0	0	0	1	0	0
Tier 0	**No**	0	1	1	0	6	29	0	0	3	3	0	0
Tier 0	**Yes**	0	3	0	0	0	0	0	0	0	0	0	0
Tier 1	**No**	0	0	0	0	0	5	0	0	0	0	0	0
Tier 1	**Yes**	0	0	0	0	0	25	0	0	0	4	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	7	0	0	0	10	0	0

APPENDIX A-2

LOCOMOTIVE MODEL DISTRIBUTION BY TRAIN TYPE GROUPS

Appendix A2
Locomotive Model Distribution by Train Type Groups

Through 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	0.00127	0.02644	0.12305	0.01177	0.19166	0.00343	0.00142	0.00052	0.06756	0.05609	0.00045
Pre Tier 0	Yes	0.00082	0.02287	0.00000	0.00000	0.00045	0.00000	0.00000	0.00000	0.00000	0.00417	0.00000
Tier 0	No	0.00007	0.00015	0.00343	0.00015	0.04775	0.15575	0.00022	0.00000	0.01080	0.02242	0.00060
Tier 0	Yes	0.00045	0.00179	0.00000	0.00000	0.00067	0.00082	0.00000	0.00000	0.00000	0.00596	0.00000
Tier 1	No	0.00000	0.00000	0.00000	0.00000	0.00000	0.02965	0.00000	0.00000	0.00000	0.00037	0.00000
Tier 1	Yes	0.00000	0.00000	0.00000	0.00000	0.00000	0.12708	0.00000	0.00000	0.00000	0.01646	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	0.01832	0.00000	0.00000	0.00000	0.04514	0.00000

Intermodal 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	0.00000	0.00138	0.08848	0.00714	0.04539	0.01037	0.00184	0.00092	0.07512	0.08594	0.00046
Pre Tier 0	Yes	0.00000	0.00092	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00576	0.00000
Tier 0	No	0.00000	0.00000	0.00138	0.00000	0.01175	0.21751	0.00115	0.00000	0.01037	0.02327	0.00046
Tier 0	Yes	0.00000	0.00000	0.00000	0.00000	0.00023	0.00069	0.00000	0.00000	0.00000	0.00115	0.00000
Tier 1	No	0.00000	0.00000	0.00000	0.00000	0.00000	0.04401	0.00000	0.00000	0.00000	0.00000	0.00000
Tier 1	Yes	0.00000	0.00000	0.00000	0.00000	0.00000	0.17097	0.00000	0.00000	0.00000	0.00530	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	0.05899	0.00000	0.00000	0.00000	0.12903	0.00000

Manifest Trains Other Than West Colton

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	0.00462	0.08308	0.00308	0.14154	0.00000	0.00308	0.00000	0.06923	0.03077	0.00000
Pre Tier 0	Yes	0.00615	0.00154	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00769	0.00000
Tier 0	No	0.00000	0.00000	0.00308	0.00000	0.04000	0.14615	0.00000	0.00000	0.00769	0.04769	0.00308
Tier 0	Yes	0.00000	0.00000	0.00000	0.00000	0.00154	0.00000	0.00000	0.00000	0.00000	0.05385	0.00000
Tier 1	No	0.00000	0.00000	0.00000	0.00000	0.00000	0.04154	0.00000	0.00000	0.00000	0.00154	0.00000
Tier 1	Yes	0.00000	0.00000	0.00000	0.00000	0.00000	0.14154	0.00000	0.00000	0.00000	0.14462	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	0.00462	0.00000	0.00000	0.00000	0.01231	0.00000

Appendix A2
Locomotive Model Distribution by Train Type Groups

West Colton Manifest 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	0.00112	0.01350	0.20360	0.00225	0.58155	0.00000	0.00000	0.00000	0.00562	0.00450	0.00000
Pre Tier 0	Yes	0.00112	0.00450	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
Tier 0	No	0.00000	0.00000	0.00450	0.00000	0.13611	0.00900	0.00000	0.00000	0.00112	0.00562	0.00000
Tier 0	Yes	0.00000	0.00112	0.00000	0.00000	0.00675	0.00000	0.00000	0.00000	0.00000	0.00112	0.00000
Tier 1	No	0.00000	0.00000	0.00000	0.00000	0.00000	0.00225	0.00000	0.00000	0.00000	0.00000	0.00000
Tier 1	Yes	0.00000	0.00000	0.00000	0.00000	0.00000	0.00675	0.00000	0.00000	0.00000	0.00675	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	0.00000	0.00000	0.00000	0.00000	0.00112	0.00000

Local 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	0.00389	0.23793	0.20943	0.00065	0.13249	0.00000	0.00000	0.00000	0.00032	0.00049	0.00000
Pre Tier 0	Yes	0.00162	0.34338	0.00016	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00016	0.00000
Tier 0	No	0.00000	0.02770	0.00632	0.00000	0.02462	0.00081	0.00000	0.00000	0.00000	0.00049	0.00000
Tier 0	Yes	0.00000	0.00794	0.00000	0.00000	0.00049	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
Tier 1	No	0.00000	0.00000	0.00000	0.00000	0.00000	0.00016	0.00000	0.00000	0.00000	0.00000	0.00000
Tier 1	Yes	0.00000	0.00000	0.00000	0.00000	0.00000	0.00049	0.00000	0.00000	0.00000	0.00016	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	0.00000	0.00000	0.00000	0.00000	0.00032	0.00000

In-Yard 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	0.00305	0.16582	0.20600	0.00407	0.10020	0.00051	0.00102	0.00000	0.01729	0.02848	0.00000
Pre Tier 0	Yes	0.00305	0.23906	0.00051	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00712	0.00000
Tier 0	No	0.00000	0.01679	0.00458	0.00000	0.01526	0.05697	0.00000	0.00000	0.00458	0.01068	0.00102
Tier 0	Yes	0.00000	0.00305	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00560	0.00000
Tier 1	No	0.00000	0.00000	0.00000	0.00000	0.00000	0.01068	0.00000	0.00000	0.00000	0.00051	0.00000
Tier 1	Yes	0.00000	0.00000	0.00000	0.00000	0.00000	0.05239	0.00000	0.00000	0.00000	0.01475	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	0.00865	0.00000	0.00000	0.00000	0.01831	0.00000

Appendix A2
Locomotive Model Distribution by Train Type Groups

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	0.00000	0.00000	1.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
Pre Tier 0	Yes	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
Tier 0	No	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
Tier 0	Yes	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
Tier 1	No	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
Tier 1	Yes	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	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	0.00000	0.00000	0.00000	0.00000	0.00000	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 Through (Alhambra Sub) without Setouts	1	337	3.021	513	1	3.021	0.5
EB Through (Alhambra Sub) with Setouts	2	513	3.021	513	1	3.021	0.5
WB Through (Alhambra Sub) without Setouts	3	2388	2.992	1087	1	2.992	0.5
WB Through (Alhambra Sub) with Setouts	4	1087	2.992	1087	1	2.992	0.5
EB Through (Los Angeles Sub) without Setouts	5	5	3.412	12	1	3.412	0.5
EB Through (Los Angeles Sub) with Setouts	6	12	3.412	12	1	3.412	0.5
WB Through (Los Angeles Sub) without Setouts	7	19	2.524	2	1	2.524	0.5
WB Through (Los Angeles Sub) with Setouts	8	2	2.524	2	1	2.524	0.5
EB Intermodal Terminating	9	45	2.356	0	2	2.356	0.0
EB Intermodal Originating	10	710	2.985	0	2	2.985	0.9
WB Intermodal Terminating	11	53	1.925	0	2	1.925	0.0
WB Intermodal Originating	12	826	2.496	0	2	2.496	0.9
EB Manifest Terminating	13	2	2.000	0	3	2.000	0.0
EB Manifest Originating	14	107	2.290	0	3	2.290	0.9
WB Manifest Terminating	15	99	3.081	0	3	3.081	0.0
WB Manifest Originating	16	40	2.575	0	3	2.575	0.9
EB West Colton Manifest Terminating	17	0	0.000	0	4	1.000	0.9
EB West Colton Manifest Originating	18	166	2.892	0	4	2.892	0.9
WB West Colton Manifest Terminating	19	98	3.286	0	4	3.286	0.9
WB West Colton Manifest Originating	20	27	3.333	0	4	3.333	0.9
EB Local Terminating (Alhambra Sub)	21	565	2.012	0	5	2.012	1.0
EB Local Originating (Alhambra Sub)	22	542	2.052	0	5	2.052	1.0
WB Local Terminating (Alhambra Sub)	23	240	1.729	0	5	1.729	1.0
WB Local Originating (Alhambra Sub)	24	496	2.270	0	5	2.270	1.0
EB Local Terminating (Los Angeles Sub)	25	79	1.975	0	5	1.975	1.0
EB Local Originating (Los Angeles Sub)	26	245	1.931	0	5	1.931	1.0
WB Local Terminating (Los Angeles Sub)	27	343	1.974	0	5	1.974	1.0
WB Local Originating (Los Angeles Sub)	28	565	1.968	0	5	1.968	1.0
EB Power Moves Through (Alhambra Sub) without Setouts	29	34	4.750	6	1	1.500	0.5
EB Power Moves Through (Alhambra Sub) with Setouts	30	6	4.750	6	1	1.500	0.5
WB Power Moves Through (Alhambra Sub) without Setouts	31	68	4.014	4	1	1.500	0.5
WB Power Moves Through (Alhambra Sub) with Setouts	32	4	4.014	4	1	1.500	0.5
EB Power Moves Through (Los Angeles Sub)	33	1	1.000	0	1	1.000	0.5
WB Power Moves Through (Los Angeles Sub)	35	1	2.000	0	1	1.500	0.5
EB Power Moves Terminating	37	1659	2.119	0	6	1.500	0.0
EB Power Moves Originating	38	81	2.741	0	6	1.500	0.9
WB Power Moves Terminating	39	1331	2.019	0	6	1.500	0.0
WB Power Moves Originating	40	125	2.264	0	6	1.500	0.9
Yard Operations (Hours)	41	15695	2.000	0	7	2.000	1.0

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)												
Through Trains and Power Moves	1	26.67	33.38	63.32	46.36	105.63	225.81	271.51	345.58	544.18	642.08	760.77
Intermodal Trains	2	18.76	28.38	51.53	48.28	100.58	223.32	283.34	354.67	540.99	625.43	717.97
Manifest Trains	3	21.36	30.64	63.78	49.07	105.75	227.10	280.99	373.73	544.79	617.18	726.07
West Colton Manifest Trains	4	42.50	43.25	81.83	44.26	122.35	244.93	263.15	334.81	557.82	699.52	870.21
Local Trains	5	27.59	41.04	75.90	34.57	117.05	195.73	209.85	261.11	428.75	507.53	653.63
In-Yard Power Moves	6	25.82	37.96	70.00	38.36	112.97	202.76	229.72	289.57	461.01	536.73	669.75
Yard Switching	7	47.94	47.94	80.04	35.70	134.30	211.93	228.61	289.68	488.55	584.17	749.94
47-State Fuel (2639 ppm S)												
Through Trains and Power Moves	1	26.67	33.38	63.32	46.36	105.63	243.96	301.84	390.43	608.77	713.51	849.23
Intermodal Trains	2	18.76	28.38	51.53	48.28	100.58	243.64	314.73	399.33	606.61	704.37	814.31
Manifest Trains	3	21.36	30.64	63.78	49.07	105.75	248.49	312.00	419.71	612.21	701.11	829.96
West Colton Manifest Trains	4	42.50	43.25	81.83	44.26	122.35	259.99	293.02	381.01	621.14	758.56	945.24
Local Trains	5	27.59	41.04	75.90	34.57	117.05	207.38	233.73	297.44	477.14	548.88	707.99
In-Yard Power Moves	6	25.82	37.96	70.00	38.36	112.97	216.97	255.59	328.30	514.58	589.51	737.46
Yard Switching	7	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
Through 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**	0.0013	0.0264	0.1231	0.0118	0.1917	0.0034	0.0014	0.0005	0.0676	0.0561	0.0005
Pre Tier 0	**Yes**	0.0008	0.0229	0.0000	0.0000	0.0005	0.0000	0.0000	0.0000	0.0000	0.0042	0.0000
Tier 0	**No**	0.0001	0.0002	0.0034	0.0002	0.0478	0.1558	0.0002	0.0000	0.0108	0.0224	0.0006
Tier 0	**Yes**	0.0005	0.0018	0.0000	0.0000	0.0007	0.0008	0.0000	0.0000	0.0000	0.0060	0.0000
Tier 1	**No**	0.0000	0.0000	0.0000	0.0000	0.0000	0.0297	0.0000	0.0000	0.0000	0.0004	0.0000
Tier 1	**Yes**	0.0000	0.0000	0.0000	0.0000	0.0000	0.1271	0.0000	0.0000	0.0000	0.0165	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	0.0183	0.0000	0.0000	0.0000	0.0451	0.0000

Appendix A-3
Sample Calculations

Intermodal 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	0.0000	0.0014	0.0885	0.0071	0.0454	0.0104	0.0018	0.0009	0.0751	0.0859	0.0005
Pre Tier 0	Yes	0.0000	0.0009	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0058	0.0000
Tier 0	No	0.0000	0.0000	0.0014	0.0000	0.0118	0.2175	0.0012	0.0000	0.0104	0.0233	0.0005
Tier 0	Yes	0.0000	0.0000	0.0000	0.0000	0.0002	0.0007	0.0000	0.0000	0.0000	0.0012	0.0000
Tier 1	No	0.0000	0.0000	0.0000	0.0000	0.0000	0.0440	0.0000	0.0000	0.0000	0.0000	0.0000
Tier 1	Yes	0.0000	0.0000	0.0000	0.0000	0.0000	0.1710	0.0000	0.0000	0.0000	0.0053	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	0.0590	0.0000	0.0000	0.0000	0.1290	0.0000

Manifest 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	0.0000	0.0046	0.0831	0.0031	0.1415	0.0000	0.0031	0.0000	0.0692	0.0308	0.0000
Pre Tier 0	Yes	0.0062	0.0015	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0077	0.0000
Tier 0	No	0.0000	0.0000	0.0031	0.0000	0.0400	0.1462	0.0000	0.0000	0.0077	0.0477	0.0031
Tier 0	Yes	0.0000	0.0000	0.0000	0.0000	0.0015	0.0000	0.0000	0.0000	0.0000	0.0539	0.0000
Tier 1	No	0.0000	0.0000	0.0000	0.0000	0.0000	0.0415	0.0000	0.0000	0.0000	0.0015	0.0000
Tier 1	Yes	0.0000	0.0000	0.0000	0.0000	0.0000	0.1415	0.0000	0.0000	0.0000	0.1446	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	0.0046	0.0000	0.0000	0.0000	0.0123	0.0000

West Colton Manifest 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	0.0011	0.0135	0.2036	0.0023	0.5816	0.0000	0.0000	0.0000	0.0056	0.0045	0.0000
Pre Tier 0	Yes	0.0011	0.0045	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	0.0045	0.0000	0.1361	0.0090	0.0000	0.0000	0.0011	0.0056	0.0000
Tier 0	Yes	0.0000	0.0011	0.0000	0.0000	0.0068	0.0000	0.0000	0.0000	0.0000	0.0011	0.0000
Tier 1	No	0.0000	0.0000	0.0000	0.0000	0.0000	0.0023	0.0000	0.0000	0.0000	0.0000	0.0000
Tier 1	Yes	0.0000	0.0000	0.0000	0.0000	0.0000	0.0068	0.0000	0.0000	0.0000	0.0068	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	0.0011	0.0000

Local 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	0.0039	0.2379	0.2094	0.0007	0.1325	0.0000	0.0000	0.0000	0.0003	0.0005	0.0000
Pre Tier 0	Yes	0.0016	0.3434	0.0002	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0002	0.0000
Tier 0	No	0.0000	0.0277	0.0063	0.0000	0.0246	0.0008	0.0000	0.0000	0.0000	0.0005	0.0000
Tier 0	Yes	0.0000	0.0079	0.0000	0.0000	0.0005	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	0.0002	0.0000	0.0000	0.0000	0.0000	0.0000
Tier 1	Yes	0.0000	0.0000	0.0000	0.0000	0.0000	0.0005	0.0000	0.0000	0.0000	0.0002	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	0.0003	0.0000

In-Yard 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**	0.0031	0.1658	0.2060	0.0041	0.1002	0.0005	0.0010	0.0000	0.0173	0.0285	0.0000
Pre Tier 0	**Yes**	0.0031	0.2391	0.0005	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0071	0.0000
Tier 0	**No**	0.0000	0.0168	0.0046	0.0000	0.0153	0.0570	0.0000	0.0000	0.0046	0.0107	0.0010
Tier 0	**Yes**	0.0000	0.0031	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0056	0.0000
Tier 1	**No**	0.0000	0.0000	0.0000	0.0000	0.0000	0.0107	0.0000	0.0000	0.0000	0.0005	0.0000
Tier 1	**Yes**	0.0000	0.0000	0.0000	0.0000	0.0000	0.0524	0.0000	0.0000	0.0000	0.0148	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	0.0087	0.0000	0.0000	0.0000	0.0183	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**	0.0031	0.1658	0.2060	0.0041	0.1002	0.0005	0.0010	0.0000	0.0173	0.0285	0.0000
Pre Tier 0	**Yes**	0.0031	0.2391	0.0005	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0071	0.0000
Tier 0	**No**	0.0000	0.0168	0.0046	0.0000	0.0153	0.0570	0.0000	0.0000	0.0046	0.0107	0.0010
Tier 0	**Yes**	0.0000	0.0031	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0056	0.0000
Tier 1	**No**	0.0000	0.0000	0.0000	0.0000	0.0000	0.0107	0.0000	0.0000	0.0000	0.0005	0.0000
Tier 1	**Yes**	0.0000	0.0000	0.0000	0.0000	0.0000	0.0524	0.0000	0.0000	0.0000	0.0148	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	0.0087	0.0000	0.0000	0.0000	0.0183	0.0000

Appendix A-3
Sample Calculations

Track Segment	Segment Number	Length (mi)
Los Angeles Sub West End	1	0.2651
Los Angeles Sub #2	2	0.1754
Los Angeles Sub Lead #1	3	0.0537
Los Angeles Sub Lead #2	4	0.0436
Los Angeles Sub Lead #3	5	0.0248
Los Angeles Sub Lead #4	6	0.0329
East Bowl to Mid Yard	13	0.2799
Mid Yard to West Marne	14	0.2851
Marne North Track	15	0.2851
East Marne to Fullerton	16	0.6980
West Marne to Marne South Track	17	0.1554
Marne South Track	18	0.2811
Marne South Track to East Marne	19	0.1401
Alhambra Sub West End	20	0.1863
Alhambra Sub #2	21	0.1863
Alhambra Sub #3	22	0.2530
Alhambra Sub #4	23	0.2207
Alhambra Sub #5	24	0.2702
Alhambra Sub #6	25	0.7284
Alhambra Sub #7	26	0.5547
Alhambra Sub #8	27	0.6778
Alhambra Sub Lead #1	28	0.1977
Alhambra Sub Lead #2	29	0.1164
A Yard West End	30	0.1584
A Yard West Middle	31	0.3410
A Yard East Middle	32	0.3275
Bowl West End	33	0.1715
Bowl Middle	34	0.4917
Bowl East End	35	0.2016
Los Angeles Sub Lead #7	40	0.0639
Los Angeles Sub Lead #8	41	0.0617
Los Angeles Sub Lead #9	42	0.0552
Los Angeles Sub Lead #5	43	0.0286
Los Angeles Sub Lead #6	44	0.0581
Los Angeles Sub #3	45	1.4558
Azusa Yard	46	0.3568
A Yard Switching	47	0.7644
Intermodal Track and Bowl Yard Switching	48	0.7446
Switching between A Yard/Bowl and Marne	49	0.3618
Marne Yard Switching	50	0.5270

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)	Working Time - Final Train Building (hrs)	Fraction of Segment or Time Moving
EB Through (Alhambra Sub) without Setouts	1	20	50	1	0.000	0.000	0.000	1.000
"	1	21	50	1	0.000	0.000	0.000	1.000
"	1	22	50	1	0.000	0.000	0.000	1.000
"	1	23	50	1	0.000	0.000	0.000	1.000
"	1	24	50	1	0.000	0.000	0.000	1.000
"	1	25	50	1	0.000	0.000	0.000	1.000
"	1	26	50	1	0.000	0.000	0.000	1.000
"	1	27	50	1	0.000	0.000	0.000	1.000
EB Through (Alhambra Sub) with Setouts	2	20	30	2	0.000	0.000	0.000	1.000
"	2	21	20	3	0.000	0.000	0.000	1.000
"	2	28	10	4	0.000	0.000	0.000	1.000
"	2	29	10	4	0.000	0.000	0.000	1.000
"	2	30	10	4	0.000	0.000	0.000	1.000
"	2	31	10	4	0.500	0.000	0.000	1.000
"	2	32	10	4	0.000	0.000	0.000	1.000
"	2	13	10	4	0.000	0.000	0.000	1.000
"	2	14	10	4	0.000	0.000	0.000	1.000
"	2	15	10	4	0.000	0.000	0.000	1.000
"	2	16	10	4	0.000	0.000	0.000	1.000
WB Through (Alhambra Sub) without Setouts	3	20	50	1	0.000	0.000	0.000	1.000
"	3	21	50	1	0.000	0.000	0.000	1.000
"	3	22	50	1	0.000	0.000	0.000	1.000
"	3	23	50	1	0.000	0.000	0.000	1.000
"	3	24	50	1	0.000	0.000	0.000	1.000
"	3	25	50	1	0.000	0.000	0.000	1.000
"	3	26	50	1	0.000	0.000	0.000	1.000
"	3	27	50	1	0.000	0.000	0.000	1.000
WB Through (Alhambra Sub) with Setouts	4	20	30	2	0.000	0.000	0.000	1.000
"	4	21	20	3	0.000	0.000	0.000	1.000
"	4	28	10	4	0.000	0.000	0.000	1.000
"	4	29	10	4	0.000	0.000	0.000	1.000
"	4	30	10	4	0.000	0.000	0.000	1.000
"	4	31	10	4	0.500	0.000	0.000	1.000
"	4	32	10	4	0.000	0.000	0.000	1.000
"	4	13	10	4	0.000	0.000	0.000	1.000
"	4	14	10	4	0.000	0.000	0.000	1.000
"	4	15	10	4	0.000	0.000	0.000	1.000
"	4	16	10	4	0.000	0.000	0.000	1.000
EB Through (Los Angeles Sub) without Setouts	5	1	50	1	0.000	0.000	0.000	1.000
"	5	2	50	1	0.000	0.000	0.000	1.000
"	5	45	50	1	0.000	0.000	0.000	1.000
"	5	46	50	1	0.000	0.000	0.000	1.000
EB Through (Los Angeles Sub) with Setouts	6	1	50	1	0.000	0.000	0.000	1.000
"	6	2	30	2	0.000	0.000	0.000	1.000
"	6	45	20	3	0.000	0.000	0.000	1.000
"	6	46	10	4	0.000	0.500	0.000	1.000
WB Through (Los Angeles Sub) without Setouts	7	1	50	1	0.000	0.000	0.000	1.000
"	7	2	50	1	0.000	0.000	0.000	1.000
"	7	45	50	1	0.000	0.000	0.000	1.000
"	7	46	50	1	0.000	0.000	0.000	1.000
WB Through (Los Angeles Sub) with Setouts	8	1	50	1	0.000	0.000	0.000	1.000
"	8	2	30	2	0.000	0.000	0.000	1.000
"	8	45	20	3	0.000	0.000	0.000	1.000
"	8	46	10	4	0.000	0.500	0.000	1.000
EB Intermodal Terminating	9	20	30	2	0.000	0.000	0.000	1.000
"	9	21	20	3	0.000	0.000	0.000	1.000
"	9	28	10	4	0.000	0.000	0.000	1.000
"	9	29	10	4	0.000	0.000	0.000	1.000
"	9	30	10	4	0.000	0.000	0.000	1.000
"	9	31	10	4	0.000	0.000	0.000	1.000
"	9	32	10	4	0.000	0.000	0.000	1.000
"	9	13	10	4	0.000	0.000	0.000	1.000
"	9	14	10	4	0.000	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)	Working Time - Final Train Building (hrs)	Fraction of Segment or Time Moving
"	9	14	10	4	0.000	0.000	0.000	1.000
"	9	13	10	4	0.000	0.000	0.000	1.000
"	9	32	10	4	0.500	0.500	0.000	0.500
"	9	-32	10	4	0.000	0.000	0.000	0.500
"	9	-13	10	4	0.000	0.000	0.000	1.000
"	9	-17	10	4	0.000	0.000	0.000	1.000
"	9	-18	10	4	0.000	0.000	0.000	0.500
EB Intermodal Originating	10	18	10	5	0.000	0.000	1.500	0.000
"	10	-17	10	4	0.000	0.000	0.000	0.500
"	10	-13	10	4	0.000	0.000	0.000	0.500
"	10	-32	10	4	0.000	0.000	0.000	0.250
"	10	32	10	5	0.000	0.000	0.250	0.000
"	10	13	10	5	0.000	0.000	0.250	0.000
"	10	14	10	5	0.000	0.000	0.250	0.000
"	10	15	10	4	0.000	0.000	0.000	0.500
"	10	16	10	4	0.000	0.000	0.000	0.500
"	10	-19	10	4	0.000	0.000	0.000	0.500
"	10	-19	10	4	0.000	0.000	0.000	0.250
"	10	19	10	5	0.000	0.000	0.100	0.000
"	10	16	10	5	0.000	0.000	0.650	0.000
WB Intermodal Terminating	11	16	10	4	0.000	0.000	0.000	1.000
"	11	15	10	4	0.000	0.000	0.000	1.000
"	11	14	10	4	0.000	0.000	0.000	1.000
"	11	13	10	4	0.000	0.000	0.000	1.000
"	11	32	10	4	0.000	0.000	0.000	1.000
"	11	31	10	4	0.000	0.000	0.000	1.000
"	11	30	10	4	0.000	0.000	0.000	1.000
"	11	29	10	4	0.000	0.000	0.000	1.000
"	11	28	10	4	0.000	0.000	0.000	1.000
"	11	21	10	4	0.000	0.000	0.000	1.000
"	11	21	10	4	0.000	0.000	0.000	1.000
"	11	28	10	4	0.000	0.000	0.000	1.000
"	11	29	10	4	0.000	0.000	0.000	1.000
"	11	33	10	4	0.500	0.500	0.000	0.500
"	11	-33	10	4	0.000	0.000	0.000	0.500
"	11	-29	10	4	0.000	0.000	0.000	1.000
"	11	-30	10	4	0.000	0.000	0.000	1.000
"	11	-31	10	4	0.000	0.000	0.000	1.000
"	11	-32	10	4	0.000	0.000	0.000	1.000
"	11	-13	10	4	0.000	0.000	0.000	1.000
"	11	-17	10	4	0.000	0.000	0.000	1.000
"	11	-18	10	4	0.000	0.000	0.000	0.500
WB Intermodal Originating	12	18	10	5	0.000	0.000	1.500	0.000
"	12	-17	10	4	0.000	0.000	0.000	0.500
"	12	-13	10	4	0.000	0.000	0.000	0.500
"	12	-32	10	4	0.000	0.000	0.000	0.500
"	12	-31	10	4	0.000	0.000	0.000	0.500
"	12	-30	10	4	0.000	0.000	0.000	0.500
"	12	30	10	5	0.000	0.000	0.150	0.000
"	12	29	10	5	0.000	0.000	0.200	0.000
"	12	28	10	5	0.000	0.000	0.200	0.000
"	12	21	10	5	0.000	0.000	0.200	0.000
"	12	20	10	4	0.000	0.000	0.000	0.500
"	12	-17	10	4	0.000	0.000	0.000	0.500
"	12	17	10	5	0.000	0.000	0.150	0.000
"	12	13	10	5	0.000	0.000	0.200	0.000
"	12	32	10	5	0.000	0.000	0.200	0.000
"	12	31	10	5	0.000	0.000	0.200	0.000
"	12	30	10	4	0.000	0.000	0.000	0.500
"	12	29	10	4	0.000	0.000	0.000	0.500
"	12	28	10	4	0.000	0.000	0.000	0.500
"	12	21	10	4	0.000	0.000	0.000	0.500
"	12	20	10	4	0.000	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)	Working Time - Final Train Building (hrs)	Fraction of Segment or Time Moving
EB Manifest Terminating	13	20	30	2	0.000	0.000	0.000	1.000
"	13	21	20	3	0.000	0.000	0.000	1.000
"	13	28	10	4	0.000	0.000	0.000	1.000
"	13	29	10	4	0.000	0.000	0.000	1.000
"	13	30	10	4	0.000	0.000	0.000	1.000
"	13	31	10	4	0.000	0.000	0.000	1.000
"	13	32	10	4	0.000	0.000	0.000	1.000
"	13	13	10	4	0.000	0.000	0.000	1.000
"	13	14	10	4	0.000	0.000	0.000	1.000
"	13	14	10	4	0.000	0.000	0.000	1.000
"	13	13	10	4	0.000	0.000	0.000	1.000
"	13	32	10	4	0.500	0.500	0.000	0.500
"	13	-32	10	4	0.000	0.000	0.000	0.500
"	13	-13	10	4	0.000	0.000	0.000	1.000
"	13	-17	10	4	0.000	0.000	0.000	1.000
"	13	-18	10	4	0.000	0.000	0.000	0.500
EB Manifest Originating	14	18	10	5	0.000	0.000	1.500	0.000
"	14	-17	10	4	0.000	0.000	0.000	0.500
"	14	-13	10	4	0.000	0.000	0.000	0.500
"	14	-32	10	4	0.000	0.000	0.000	0.250
"	14	32	10	5	0.000	0.000	0.250	0.000
"	14	13	10	5	0.000	0.000	0.250	0.000
"	14	14	10	5	0.000	0.000	0.250	0.000
"	14	15	10	4	0.000	0.000	0.000	0.500
"	14	16	10	4	0.000	0.000	0.000	0.500
"	14	-19	10	4	0.000	0.000	0.000	0.500
"	14	-19	10	4	0.000	0.000	0.000	0.250
"	14	19	10	5	0.000	0.000	0.100	0.000
"	14	16	10	5	0.000	0.000	0.650	0.000
WB Manifest Terminating	15	16	10	4	0.000	0.000	0.000	1.000
"	15	15	10	4	0.000	0.000	0.000	1.000
"	15	14	10	4	0.000	0.000	0.000	1.000
"	15	13	10	4	0.000	0.000	0.000	1.000
"	15	32	10	4	0.000	0.000	0.000	1.000
"	15	31	10	4	0.000	0.000	0.000	1.000
"	15	30	10	4	0.000	0.000	0.000	1.000
"	15	29	10	4	0.000	0.000	0.000	1.000
"	15	28	10	4	0.000	0.000	0.000	1.000
"	15	21	10	4	0.000	0.000	0.000	1.000
"	15	21	10	4	0.000	0.000	0.000	1.000
"	15	28	10	4	0.000	0.000	0.000	1.000
"	15	29	10	4	0.000	0.000	0.000	1.000
"	15	33	10	4	0.500	0.500	0.000	0.500
"	15	-33	10	4	0.000	0.000	0.000	0.500
"	15	-29	10	4	0.000	0.000	0.000	1.000
"	15	-30	10	4	0.000	0.000	0.000	1.000
"	15	-31	10	4	0.000	0.000	0.000	1.000
"	15	-32	10	4	0.000	0.000	0.000	1.000
"	15	-13	10	4	0.000	0.000	0.000	1.000
"	15	-17	10	4	0.000	0.000	0.000	1.000
"	15	-18	10	4	0.000	0.000	0.000	0.500
WB Manifest Originating	16	18	10	5	0.000	0.000	1.500	0.000
"	16	-17	10	4	0.000	0.000	0.000	0.500
"	16	-13	10	4	0.000	0.000	0.000	0.500
"	16	-32	10	4	0.000	0.000	0.000	0.500
"	16	-31	10	4	0.000	0.000	0.000	0.500
"	16	-30	10	4	0.000	0.000	0.000	0.500
"	16	30	10	5	0.000	0.000	0.150	0.000
"	16	29	10	5	0.000	0.000	0.200	0.000
"	16	28	10	5	0.000	0.000	0.200	0.000
"	16	21	10	5	0.000	0.000	0.200	0.000
"	16	20	10	4	0.000	0.000	0.000	0.500
"	16	-17	10	4	0.000	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)	Working Time - Final Train Building (hrs)	Fraction of Segment or Time Moving
"	16	17	10	5	0.000	0.000	0.150	0.000
"	16	13	10	5	0.000	0.000	0.200	0.000
"	16	32	10	5	0.000	0.000	0.200	0.000
"	16	31	10	5	0.000	0.000	0.200	0.000
"	16	30	10	4	0.000	0.000	0.000	0.500
"	16	29	10	4	0.000	0.000	0.000	0.500
"	16	28	10	4	0.000	0.000	0.000	0.500
"	16	21	10	4	0.000	0.000	0.000	0.500
"	16	20	10	4	0.000	0.000	0.000	0.500
EB West Colton Manifest Terminating	17	20	30	2	0.000	0.000	0.000	1.000
"	17	21	20	3	0.000	0.000	0.000	1.000
"	17	28	10	4	0.000	0.000	0.000	1.000
"	17	29	10	4	0.000	0.000	0.000	1.000
"	17	30	10	4	0.000	0.000	0.000	0.500
"	17	31	10	4	0.000	0.000	0.000	0.500
"	17	32	10	4	0.000	0.000	0.000	0.500
"	17	13	10	4	0.000	0.000	0.000	0.250
"	17	14	10	4	0.000	0.000	0.000	0.250
"	17	14	10	4	0.000	0.000	0.000	0.250
"	17	13	10	4	0.000	0.000	0.000	0.250
"	17	32	10	4	0.250	0.250	0.000	0.250
"	17	-32	10	4	0.000	0.000	0.000	0.250
"	17	-13	10	4	0.000	0.000	0.000	0.500
"	17	-17	10	4	0.000	0.000	0.000	0.500
"	17	-18	10	4	0.000	0.000	0.000	0.250
"	17	33	10	4	0.000	0.000	0.000	0.500
"	17	34	10	4	0.000	0.000	0.000	0.500
"	17	35	10	4	0.000	0.000	0.000	0.500
"	17	13	10	4	0.000	0.000	0.000	0.250
"	17	14	10	4	0.000	0.000	0.000	0.250
"	17	14	10	4	0.000	0.000	0.000	0.250
"	17	13	10	4	0.000	0.000	0.000	0.250
"	17	35	10	4	0.250	0.250	0.000	0.250
"	17	-35	10	4	0.000	0.000	0.000	0.250
"	17	-13	10	4	0.000	0.000	0.000	0.500
"	17	-17	10	4	0.000	0.000	0.000	0.500
"	17	-18	10	4	0.000	0.000	0.000	0.250
EB West Colton Manifest Originating	18	18	10	5	0.000	0.000	1.500	0.000
"	18	-17	10	4	0.000	0.000	0.000	0.500
"	18	-13	10	4	0.000	0.000	0.000	0.500
"	18	-32	10	4	0.000	0.000	0.000	0.250
"	18	32	10	5	0.000	0.000	0.250	0.000
"	18	13	10	5	0.000	0.000	0.250	0.000
"	18	14	10	5	0.000	0.000	0.250	0.000
"	18	15	10	4	0.000	0.000	0.000	0.500
"	18	16	10	4	0.000	0.000	0.000	0.500
"	18	-17	10	4	0.000	0.000	0.000	0.500
"	18	-13	10	4	0.000	0.000	0.000	0.500
"	18	-35	10	4	0.000	0.000	0.000	0.250
"	18	35	10	5	0.000	0.000	0.250	0.000
"	18	13	10	5	0.000	0.000	0.250	0.000
"	18	14	10	5	0.000	0.000	0.250	0.000
"	18	15	10	4	0.000	0.000	0.000	0.500
"	18	16	10	4	0.000	0.000	0.000	0.500
WB West Colton Manifest Terminating	19	16	10	4	0.000	0.000	0.000	1.000
"	19	15	10	4	0.000	0.000	0.000	1.000
"	19	14	10	4	0.000	0.000	0.000	1.000
"	19	13	10	4	0.000	0.000	0.000	1.000
"	19	32	10	4	0.000	0.000	0.000	0.500
"	19	31	10	4	0.000	0.000	0.000	0.500
"	19	30	10	4	0.000	0.000	0.000	0.500
"	19	29	10	4	0.000	0.000	0.000	0.250
"	19	28	10	4	0.000	0.000	0.000	0.250

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)	Working Time - Final Train Building (hrs)	Fraction of Segment or Time Moving
"	19	21	10	4	0.000	0.000	0.000	0.250
"	19	28	10	4	0.000	0.000	0.000	0.250
"	19	29	10	4	0.250	0.250	0.000	0.250
"	19	-30	10	4	0.000	0.000	0.000	0.250
"	19	-31	10	4	0.000	0.000	0.000	0.500
"	19	-32	10	4	0.000	0.000	0.000	0.500
"	19	-13	10	4	0.000	0.000	0.000	0.500
"	19	-17	10	4	0.000	0.000	0.000	0.500
"	19	-18	10	4	0.000	0.000	0.000	0.250
"	19	35	10	4	0.000	0.000	0.000	0.500
"	19	34	10	4	0.000	0.000	0.000	0.500
"	19	33	10	4	0.000	0.000	0.000	0.500
"	19	29	10	4	0.000	0.000	0.000	0.250
"	19	28	10	4	0.000	0.000	0.000	0.250
"	19	21	10	4	0.000	0.000	0.000	0.250
"	19	28	10	4	0.000	0.000	0.000	0.250
"	19	29	10	4	0.250	0.250	0.000	0.250
"	19	-33	10	4	0.000	0.000	0.000	0.250
"	19	-34	10	4	0.000	0.000	0.000	0.500
"	19	-35	10	4	0.000	0.000	0.000	0.500
"	19	-13	10	4	0.000	0.000	0.000	0.500
"	19	-17	10	4	0.000	0.000	0.000	0.500
"	19	-18	10	4	0.000	0.000	0.000	0.250
WB West Colton Manifest Originating	20	18	10	5	0.000	0.000	1.500	0.000
"	20	-17	10	4	0.000	0.000	0.000	0.500
"	20	-13	10	4	0.000	0.000	0.000	0.500
"	20	-32	10	4	0.000	0.000	0.000	0.500
"	20	-31	10	4	0.000	0.000	0.000	0.500
"	20	-30	10	4	0.000	0.000	0.000	0.250
"	20	30	10	5	0.000	0.000	0.150	0.000
"	20	29	10	5	0.000	0.000	0.200	0.000
"	20	28	10	5	0.000	0.000	0.200	0.000
"	20	21	10	5	0.000	0.000	0.200	0.000
"	20	20	10	4	0.000	0.000	0.000	0.500
"	20	-17	10	4	0.000	0.000	0.000	0.500
"	20	-13	10	4	0.000	0.000	0.000	0.500
"	20	-35	10	4	0.000	0.000	0.000	0.500
"	20	-34	10	4	0.000	0.000	0.000	0.500
"	20	-33	10	4	0.000	0.000	0.000	0.250
"	20	33	10	5	0.000	0.000	0.150	0.000
"	20	29	10	5	0.000	0.000	0.200	0.000
"	20	28	10	5	0.000	0.000	0.200	0.000
"	20	21	10	5	0.000	0.000	0.200	0.000
"	20	20	10	4	0.000	0.000	0.000	0.500
EB Local Terminating (Alhambra Sub)	21	20	30	2	0.000	0.000	0.000	1.000
"	21	21	20	3	0.000	0.000	0.000	1.000
"	21	28	10	4	0.000	0.000	0.000	1.000
"	21	29	10	4	0.000	0.000	0.000	1.000
"	21	33	10	4	0.000	0.000	0.000	1.000
"	21	34	10	4	0.000	0.000	0.000	1.000
"	21	35	10	4	0.500	0.500	0.000	1.000
"	21	-13	10	4	0.000	0.000	0.000	1.000
"	21	-17	10	4	0.000	0.000	0.000	1.000
"	21	-18	10	4	0.000	0.000	0.000	0.500
EB Local Originating (Alhambra Sub)	22	18	10	5	0.000	0.000	1.000	0.000
"	22	-17	10	4	0.000	0.000	0.000	1.000
"	22	-13	10	4	0.000	0.000	0.000	1.000
"	22	35	10	5	0.000	0.000	0.500	0.000
"	22	13	10	4	0.000	0.000	0.000	1.000
"	22	14	10	4	0.000	0.000	0.000	1.000
"	22	15	10	4	0.000	0.000	0.000	1.000
"	22	16	10	4	0.000	0.000	0.000	1.000
WB Local Terminating (Alhambra Sub)	23	16	10	4	0.000	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)	Working Time - Final Train Building (hrs)	Fraction of Segment or Time Moving
"	23	15	10	4	0.000	0.000	0.000	1.000
"	23	14	10	4	0.000	0.000	0.000	1.000
"	23	13	10	4	0.000	0.000	0.000	1.000
"	23	35	10	4	0.000	0.000	0.000	1.000
"	23	34	10	4	0.000	0.000	0.000	1.000
"	23	33	10	4	0.500	0.500	0.000	1.000
"	23	-33	10	4	0.000	0.000	0.000	1.000
"	23	-34	10	4	0.000	0.000	0.000	1.000
"	23	-35	10	4	0.000	0.000	0.000	1.000
"	23	-13	10	4	0.000	0.000	0.000	1.000
"	23	-17	10	4	0.000	0.000	0.000	1.000
"	23	-18	10	4	0.000	0.000	0.000	0.500
WB Local Originating (Alhambra Sub)	24	18	10	5	0.000	0.000	1.000	0.000
"	24	-17	10	4	0.000	0.000	0.000	1.000
"	24	-13	10	4	0.000	0.000	0.000	1.000
"	24	-35	10	4	0.000	0.000	0.000	1.000
"	24	-34	10	4	0.000	0.000	0.000	1.000
"	24	33	10	5	0.000	0.000	0.500	1.000
"	24	29	10	4	0.000	0.000	0.000	1.000
"	24	28	10	4	0.000	0.000	0.000	1.000
"	24	21	10	4	0.000	0.000	0.000	1.000
"	24	20	10	4	0.000	0.000	0.000	1.000
EB Local Terminating (Los Angeles Sub)	25	1	30	2	0.000	0.000	0.000	1.000
"	25	2	20	3	0.000	0.000	0.000	1.000
"	25	3	10	4	0.000	0.000	0.000	1.000
"	25	4	10	4	0.000	0.000	0.000	1.000
"	25	5	10	4	0.000	0.000	0.000	1.000
"	25	6	10	4	0.000	0.000	0.000	1.000
"	25	43	10	4	0.000	0.000	0.000	1.000
"	25	44	10	4	0.000	0.000	0.000	1.000
"	25	40	10	4	0.000	0.000	0.000	1.000
"	25	41	10	4	0.000	0.000	0.000	1.000
"	25	42	10	4	0.000	0.000	0.000	1.000
"	25	29	10	4	0.000	0.000	0.000	1.000
"	25	33	10	4	0.000	0.000	0.000	1.000
"	25	34	10	4	0.000	0.000	0.000	1.000
"	25	35	10	4	0.000	0.000	0.000	1.000
"	25	-13	10	4	0.000	0.000	0.000	1.000
"	25	-17	10	4	0.000	0.000	0.000	1.000
"	25	-18	10	4	0.000	0.000	0.000	0.500
EB Local Originating (Los Angeles Sub)	26	18	10	5	0.000	0.000	1.000	0.000
"	26	-17	10	4	0.000	0.000	0.000	1.000
"	26	-13	10	4	0.000	0.000	0.000	1.000
"	26	-35	10	4	0.000	0.000	0.000	1.000
"	26	34	10	5	0.000	0.000	1.000	0.000
"	26	33	10	4	0.000	0.000	0.000	1.000
"	26	29	10	4	0.000	0.000	0.000	1.000
"	26	42	10	4	0.000	0.000	0.000	1.000
"	26	41	10	4	0.000	0.000	0.000	1.000
"	26	40	10	4	0.000	0.000	0.000	1.000
"	26	44	10	4	0.000	0.000	0.000	1.000
"	26	43	10	4	0.000	0.000	0.000	1.000
"	26	6	10	4	0.000	0.000	0.000	1.000
"	26	5	10	4	0.000	0.000	0.000	1.000
"	26	4	10	4	0.000	0.000	0.000	1.000
"	26	3	10	4	0.000	0.000	0.000	1.000
"	26	2	10	4	0.000	0.000	0.000	1.000
"	26	45	20	3	0.000	0.000	0.000	1.000
"	26	46	30	2	0.000	0.000	0.000	1.000
WB Local Terminating (Los Angeles Sub)	27	46	30	2	0.000	0.000	0.000	1.000
"	27	45	20	3	0.000	0.000	0.000	1.000
"	27	2	10	4	0.000	0.000	0.000	1.000
"	27	3	10	4	0.000	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)	Working Time - Final Train Building (hrs)	Fraction of Segment or Time Moving
"	27	4	10	4	0.000	0.000	0.000	1.000
"	27	5	10	4	0.000	0.000	0.000	1.000
"	27	6	10	4	0.000	0.000	0.000	1.000
"	27	43	10	4	0.000	0.000	0.000	1.000
"	27	44	10	4	0.000	0.000	0.000	1.000
"	27	40	10	4	0.000	0.000	0.000	1.000
"	27	41	10	4	0.000	0.000	0.000	1.000
"	27	42	10	4	0.000	0.000	0.000	1.000
"	27	29	10	4	0.000	0.000	0.000	1.000
"	27	33	10	4	0.000	0.000	0.000	1.000
"	27	34	10	4	0.000	0.000	0.000	1.000
"	27	35	10	4	0.000	0.000	0.000	1.000
"	27	-13	10	4	0.000	0.000	0.000	1.000
"	27	-17	10	4	0.000	0.000	0.000	1.000
"	27	-18	10	4	0.000	0.000	0.000	0.500
WB Local Originating (Los Angeles Sub)	28	18	10	5	0.000	0.000	1.000	0.000
"	28	-17	10	4	0.000	0.000	0.000	1.000
"	28	-13	10	4	0.000	0.000	0.000	1.000
"	28	-35	10	4	0.000	0.000	0.000	1.000
"	28	34	10	5	0.000	0.000	1.000	0.000
"	28	33	10	4	0.000	0.000	0.000	1.000
"	28	29	10	4	0.000	0.000	0.000	1.000
"	28	42	10	4	0.000	0.000	0.000	1.000
"	28	41	10	4	0.000	0.000	0.000	1.000
"	28	40	10	4	0.000	0.000	0.000	1.000
"	28	44	10	4	0.000	0.000	0.000	1.000
"	28	43	10	4	0.000	0.000	0.000	1.000
"	28	6	10	4	0.000	0.000	0.000	1.000
"	28	5	10	4	0.000	0.000	0.000	1.000
"	28	4	10	4	0.000	0.000	0.000	1.000
"	28	3	10	4	0.000	0.000	0.000	1.000
"	28	2	10	4	0.000	0.000	0.000	1.000
"	28	45	10	4	0.000	0.000	0.000	1.000
"	28	46	10	5	0.000	0.000	1.000	0.000
"	28	45	10	4	0.000	0.000	0.000	1.000
"	28	2	20	3	0.000	0.000	0.000	1.000
"	28	1	30	2	0.000	0.000	0.000	1.000
EB Power Moves Through (Alhambra Sub) without Setou	29	-20	50	1	0.000	0.000	0.000	1.000
"	29	-21	50	1	0.000	0.000	0.000	1.000
"	29	-22	50	1	0.000	0.000	0.000	1.000
"	29	-23	50	1	0.000	0.000	0.000	1.000
"	29	-24	50	1	0.000	0.000	0.000	1.000
"	29	-25	50	1	0.000	0.000	0.000	1.000
"	29	-26	50	1	0.000	0.000	0.000	1.000
"	29	-27	50	1	0.000	0.000	0.000	1.000
EB Power Moves Through (Alhambra Sub) with Setouts	30	-20	30	2	0.000	0.000	0.000	1.000
"	30	-21	20	3	0.000	0.000	0.000	1.000
"	30	-28	10	4	0.000	0.000	0.000	1.000
"	30	-29	10	4	0.000	0.000	0.000	1.000
"	30	-30	10	4	0.000	0.000	0.000	1.000
"	30	-31	10	4	0.000	0.000	0.000	1.000
"	30	-32	10	4	0.000	0.000	0.000	1.000
"	30	-13	10	4	0.000	0.000	0.000	1.000
"	30	-17	10	4	0.000	0.000	0.000	1.000
"	30	-18	10	4	0.000	0.500	0.000	1.000
"	30	-19	10	4	0.000	0.000	0.000	1.000
"	30	-16	10	4	0.000	0.000	0.000	1.000
WB Power Moves Through (Alhambra Sub) without Seto	31	-20	50	1	0.000	0.000	0.000	1.000
"	31	-21	50	1	0.000	0.000	0.000	1.000
"	31	-22	50	1	0.000	0.000	0.000	1.000
"	31	-23	50	1	0.000	0.000	0.000	1.000
"	31	-24	50	1	0.000	0.000	0.000	1.000
"	31	-25	50	1	0.000	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)	Working Time - Final Train Building (hrs)	Fraction of Segment or Time Moving
"	31	-26	50	1	0.000	0.000	0.000	1.000
"	31	-27	50	1	0.000	0.000	0.000	1.000
WB Power Moves Through (Alhambra Sub) with Setouts	32	-20	30	2	0.000	0.000	0.000	1.000
"	32	-21	20	3	0.000	0.000	0.000	1.000
"	32	-28	10	4	0.000	0.000	0.000	1.000
"	32	-29	10	4	0.000	0.000	0.000	1.000
"	32	-30	10	4	0.000	0.000	0.000	1.000
"	32	-31	10	4	0.000	0.000	0.000	1.000
"	32	-32	10	4	0.000	0.000	0.000	1.000
"	32	-13	10	4	0.000	0.000	0.000	1.000
"	32	-17	10	4	0.000	0.000	0.000	1.000
"	32	-18	10	4	0.000	0.500	0.000	1.000
"	32	-19	10	4	0.000	0.000	0.000	1.000
"	32	-16	10	4	0.000	0.000	0.000	1.000
EB Power Moves Through (Los Angeles Sub)	33	-1	50	1	0.000	0.000	0.000	1.000
"	33	-2	50	1	0.000	0.000	0.000	1.000
"	33	-45	50	1	0.000	0.000	0.000	1.000
"	33	-46	50	1	0.000	0.000	0.000	1.000
WB Power Moves Through (Los Angeles Sub)	35	-1	50	1	0.000	0.000	0.000	1.000
"	35	-2	50	1	0.000	0.000	0.000	1.000
"	35	-45	50	1	0.000	0.000	0.000	1.000
"	35	-46	50	1	0.000	0.000	0.000	1.000
EB Power Moves Terminating	37	-20	30	2	0.000	0.000	0.000	1.000
"	37	-21	20	3	0.000	0.000	0.000	1.000
"	37	-28	10	4	0.000	0.000	0.000	1.000
"	37	-29	10	4	0.000	0.000	0.000	1.000
"	37	-30	10	4	0.000	0.000	0.000	1.000
"	37	-31	10	4	0.000	0.000	0.000	1.000
"	37	-32	10	4	0.000	0.000	0.000	1.000
"	37	-13	10	4	0.000	0.000	0.000	1.000
"	37	-17	10	4	0.000	0.000	0.000	1.000
"	37	-18	10	4	0.000	0.000	0.000	0.500
EB Power Moves Originating	38	-16	10	4	0.000	0.000	0.000	1.000
"	38	-19	10	4	0.000	0.000	0.000	1.000
"	38	-18	10	4	0.000	0.000	0.000	0.500
WB Power Moves Terminating	39	-16	10	4	0.000	0.000	0.000	1.000
"	39	-19	10	4	0.000	0.000	0.000	1.000
"	39	-18	10	4	0.000	0.000	0.000	0.500
WB Power Moves Originating	40	-20	30	2	0.000	0.000	0.000	1.000
"	40	-21	20	3	0.000	0.000	0.000	1.000
"	40	-28	10	4	0.000	0.000	0.000	1.000
"	40	-29	10	4	0.000	0.000	0.000	1.000
"	40	-30	10	4	0.000	0.000	0.000	1.000
"	40	-31	10	4	0.000	0.000	0.000	1.000
"	40	-32	10	4	0.000	0.000	0.000	1.000
"	40	-13	10	4	0.000	0.000	0.000	1.000
"	40	-17	10	4	0.000	0.000	0.000	1.000
"	40	-18	10	4	0.000	0.000	0.000	0.500

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) Negative activity code values indicate an activity and segment where setout idling occurs

Appendix A-3
Sample Calculations

Yard Operations	Activity Code	Segment Number	Duty Cycle Number	Non-Z Idle Ti (hrs	TR Idle Time (hrs)	Fraction of Working Time
A Yard Switching	41	47	6	0	0	0.3
Intermodal Track and Bowl Yard Switching	41	48	6	0	0	0.25
Switching between A Yard/Bowl and Marne	41	49	6	0	0	0.1
Marne Yard Switching	41	50	6	0	0	0.25
East Marne to Fullerton Switching	41	16	6	0	0	0.1

Duty Cycles (Percent of Time by Notch)	Duty Cycle Number	Idle	DB	N1	N2	N3	N4	N5	N6	N7	N8
Through Trains	1	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%	0.0%	0.0%
Setouts Approach #1	2	0.0%	0.0%	0.0%	0.0%	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Setouts Approach #2	3	0.0%	0.0%	0.0%	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
In Yard	4	0.0%	0.0%	50.0%	50.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Road Power Train Building	5	20.0%	0.0%	40.0%	40.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Yard Switching	6	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	24.56	32.64	64.83	47.92	114.13	222.99	267.81	330.25	495.16	575.7	694.67
LoadTest	2	23.38	30.08	67.95	52.47	112.55	226.46	272.3	340.63	492.45	570.28	680.16
47-State Fuel (2639 ppm S)												
Service	1	24.56	32.64	64.83	47.92	114.13	242.82	297.5	371.87	555.24	648.61	786.23
LoadTest	2	23.38	30.08	67.95	52.47	112.55	248.74	302.26	382.38	553.52	650.92	780.88

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 Events	121	0.00	0	60	0	0	0	0	0	0	0	0	0
Unscheduled Mtc Post Test	28	0.90	0	5	0	0	0	0	0	0	0	0	10

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	0.0083	0.2066	0.0331	0.0661	0.0083	0.0000	0.0000	0.0826	0.0744	0.0000
Pre Tier 0	Yes	0.0000	0.0579	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	0.0165	0.1570	0.0083	0.0000	0.0165	0.0248	0.0000
Tier 0	Yes	0.0000	0.0331	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	0.0496	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	0.0413	0.0000	0.0000	0.0000	0.1157	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	0.0000	0.1379	0.0345	0.0690	0.0000	0.0000	0.0000	0.1724	0.0690	0.0000
Pre Tier 0	Yes	0.0000	0.0345	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	0.0345	0.1379	0.0000	0.0000	0.0000	0.0345	0.0000
Tier 0	Yes	0.0000	0.0345	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	0.1035	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	0.1379	0.0000

Appendix A-3
Sample Calculations

Example 1 -- EB Departing Intermodal Trains

Parameter	**Value**
Activity Code	10
Number of Events	710
Locomotives per Consist on Train	2.985
Number of Setouts	0
Locomotives per Consist Working During Power Moves	1.5
Emission Factor Group	2
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)**	**Working Time - Final Train Building (hrs)**	**Fraction of Segment Moving**	**Locomotive Hours Moving (Duty Cycle 4)**	**Locomotive Hours Working (Duty Cycle 5)**	**Locomotive Hours NonZTR Idle**	**Locomotive Hours ZTR Idle**
Consist Preparation:														
Marne South Track	10	18	0.2811	10	5	N	0	0	1.5	0	0.00	3179.03	0.00	0.00
A Yard Departures:														
West Marne to Marne South Track	10	-17	0.1554	10	4	Y	0	0	0	0.5	8.27	0.00	0.00	0.00
East Bowl to Mid Yard	10	-13	0.2799	10	4	Y	0	0	0	0.5	14.90	0.00	0.00	0.00
A Yard East Middle	10	-32	0.3275	10	4	Y	0	0	0	0.25	8.72	0.00	0.00	0.00
A Yard East Middle	10	32	0.3275	10	5	N	0	0	0.25	0	0.00	529.84	0.00	0.00
East Bowl to Mid Yard	10	13	0.2799	10	5	N	0	0	0.25	0	0.00	529.84	0.00	0.00
Mid Yard to West Marne	10	14	0.2851	10	5	N	0	0	0.25	0	0.00	529.84	0.00	0.00
Marne North Track	10	15	0.2851	10	4	N	0	0	0	0.5	30.21	0.00	0.00	0.00
East Marne to Fullerton	10	16	0.6980	10	4	N	0	0	0	0.5	73.97	0.00	0.00	0.00
Marne Yard Departures:														
Marne South Track to East Marne	10	-19	0.1401	10	4	Y	0	0	0	0.5	7.46	0.00	0.00	0.00
Marne South Track to East Marne	10	-19	0.1401	10	4	Y	0	0	0	0.25	3.73	0.00	0.00	0.00
Marne South Track to East Marne	10	19	0.1401	10	5	N	0	0	0.1	0	0.00	211.94	0.00	0.00
East Marne to Fullerton	10	16	0.6980	10	5	N	0	0	0.65	0	0.00	1377.58	0.00	0.00

Note: EB intermodal departures are from both the A Yard (50%) and the Marne Yard (50%)

Total											*147.27*	*6358.05*	*0.00*	*0.00*

Emission Factors	**Group ID**	**Idle-NonZTR**	**Idle-All**	**DB**	**N1**	**N2**	**N3**	**N4**	**N5**	**N6**	**N7**	**N8**
Departing IM Trains - CA Fuel	2	18.8	28.4	51.5	48.3	100.6	223.3	283.3	354.7	541.0	625.4	718.0
Departing IM Trains - 47-State Fuel	2	18.8	28.4	51.5	48.3	100.6	243.6	314.7	399.3	606.6	704.4	814.3
CA Fuel Fraction Adjusted Rates		*18.8*	*28.4*	*51.5*	*48.3*	*100.6*	*225.4*	*286.5*	*359.1*	*547.6*	*633.3*	*727.6*
	Duty Cycle											
Duty Cycle Moving	4	0.00	0.00	0.00	0.50	0.50	0.00	0.00	0.00	0.00	0.00	0.00
Duty Cycle Working	5	0.20	0.20	0.00	0.40	0.40	0.00	0.00	0.00	0.00	0.00	0.00
Weighted g/hr emissions	4	0.00	0.00	0.00	24.14	50.29	0.00	0.00	0.00	0.00	0.00	0.00
	5	3.75	5.68	0.00	19.31	40.23	0.00	0.00	0.00	0.00	0.00	0.00

	Moving (Duty Cycle 4)	**Working (Duty Cycle 5)**	**Idle-NonZTR**	**Idle-All**
Emission Rate (g/hr)	74.43	68.97	18.76	28.38
Locomotive Hours	147.27	6358.05	0.00	0.00
Total Emissions (g/yr)	**10961**	**438527**	**0**	**0**

Appendix A-3
Sample Calculations

Example 2 -- Unscheduled Maintenance Load Testing

Number of Unscheduled Maintenance Load Tests	28											
Fraction of Calif. Fuel	0.90											
Emission Factors (g/hr)	**Group ID**	**Idle-NonZTR**	**Idle-All**	**DB**	**N1**	**N2**	**N3**	**N4**	**N5**	**N6**	**N7**	**N8**
Load Test - CA Fuel	2	23.38	30.08	67.95	52.47	112.55	226.46	272.30	340.63	492.45	570.28	680.16
Load Test - 47-State Fuel	2	23.38	30.08	67.95	52.47	112.55	248.74	302.26	382.38	553.52	650.92	780.88
CA Fuel Fraction Adjusted Rates		*23.38*	*30.08*	*67.95*	*52.47*	*112.55*	*228.69*	*275.30*	*344.81*	*498.56*	*578.34*	*690.23*

Duration (minutes)

Activity	**Number of Locomotives**	**Idle-NonZTR**	**Idle-All**	**DB**	**N1**	**N2**	**N3**	**N4**	**N5**	**N6**	**N7**	**N8**
Unscheduled Mtc Post Test	28	0	5	0	0	0	0	0	0	0	0	10
Emissions (g)												
Notch-Specific		0.0	70.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3221.1

Total Emissions (g/yr)	**3291**

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 $\boldsymbol{D}(i)$ (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.

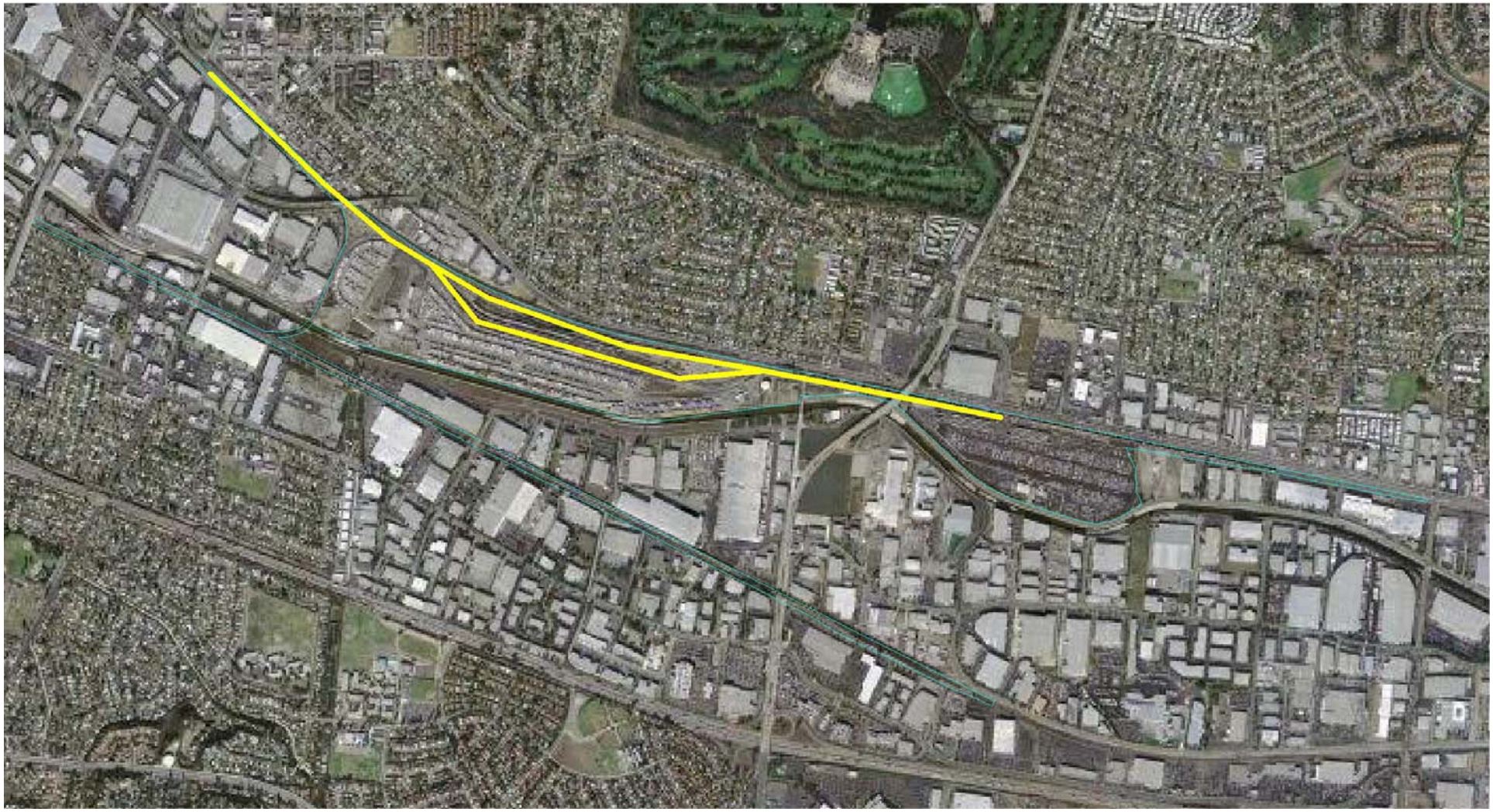
Yard Switcher Operations

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.

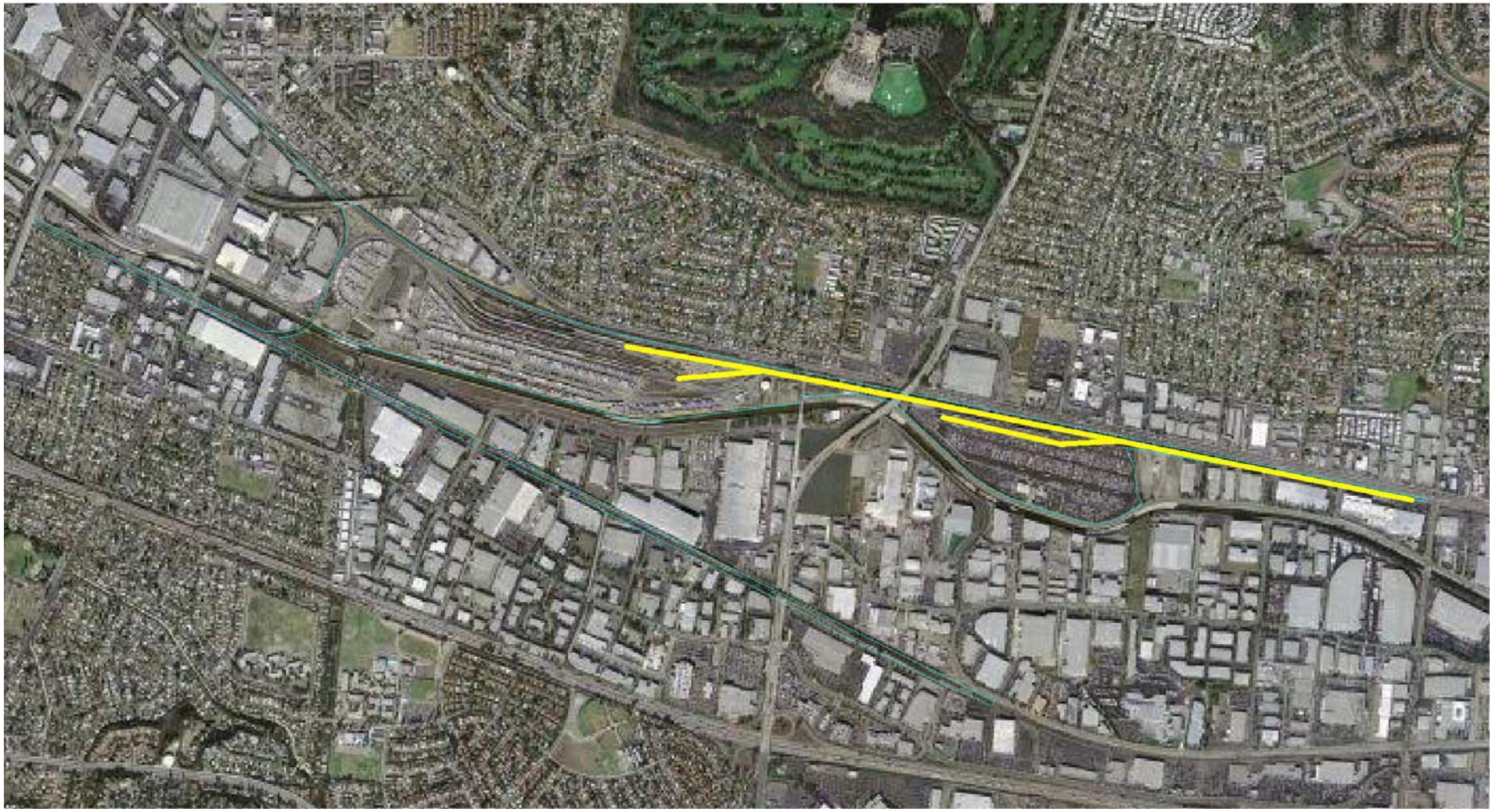
APPENDIX A-5

PRINCIPLE LOCOMOTIVE ROUTES

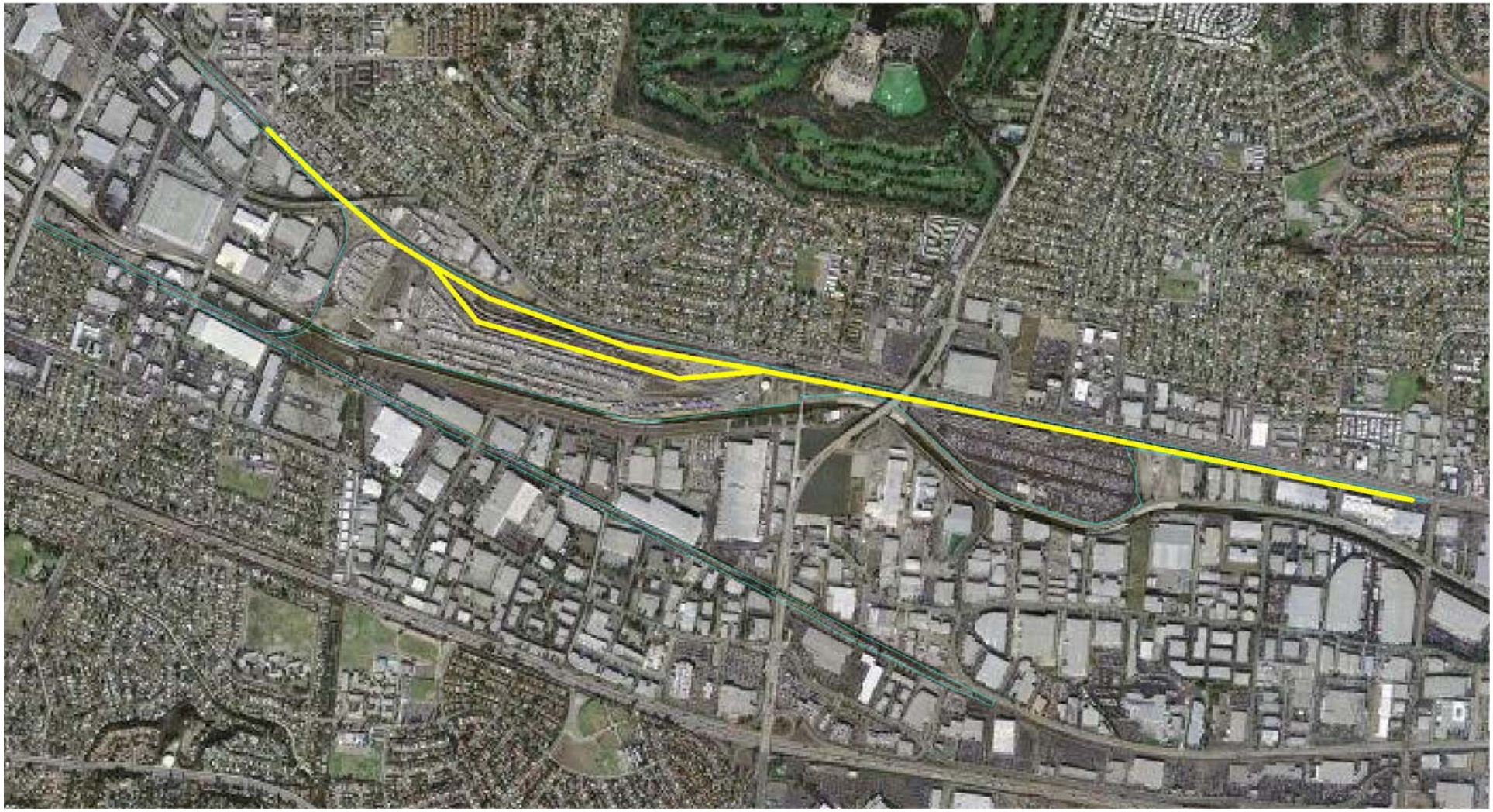
Appendix A-5
East Bound Arriving Freight Trains



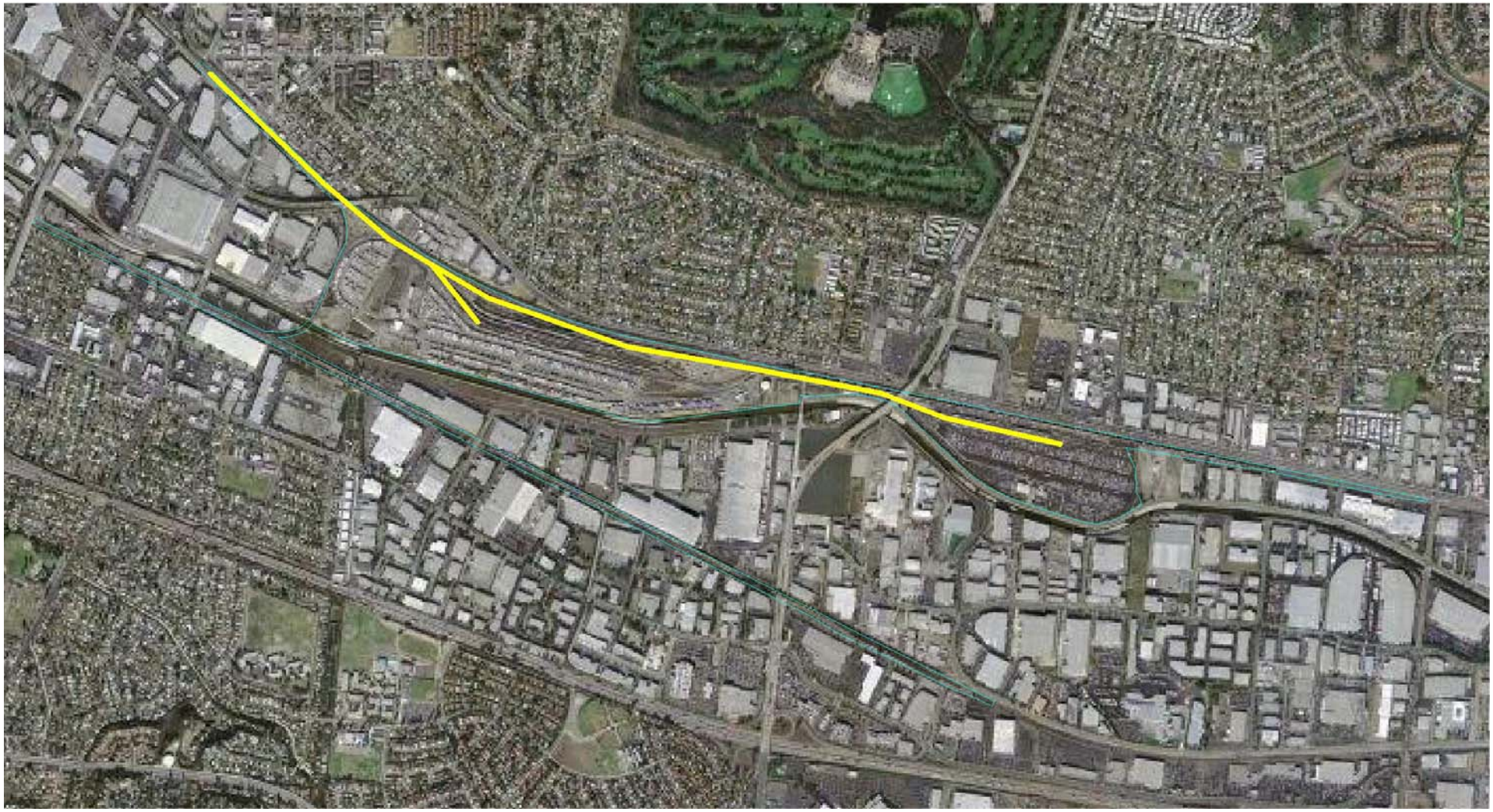
Appendix A-5
East Bound Departing Freight Trains



Appendix A-5
West Bound Arriving Freight Trains

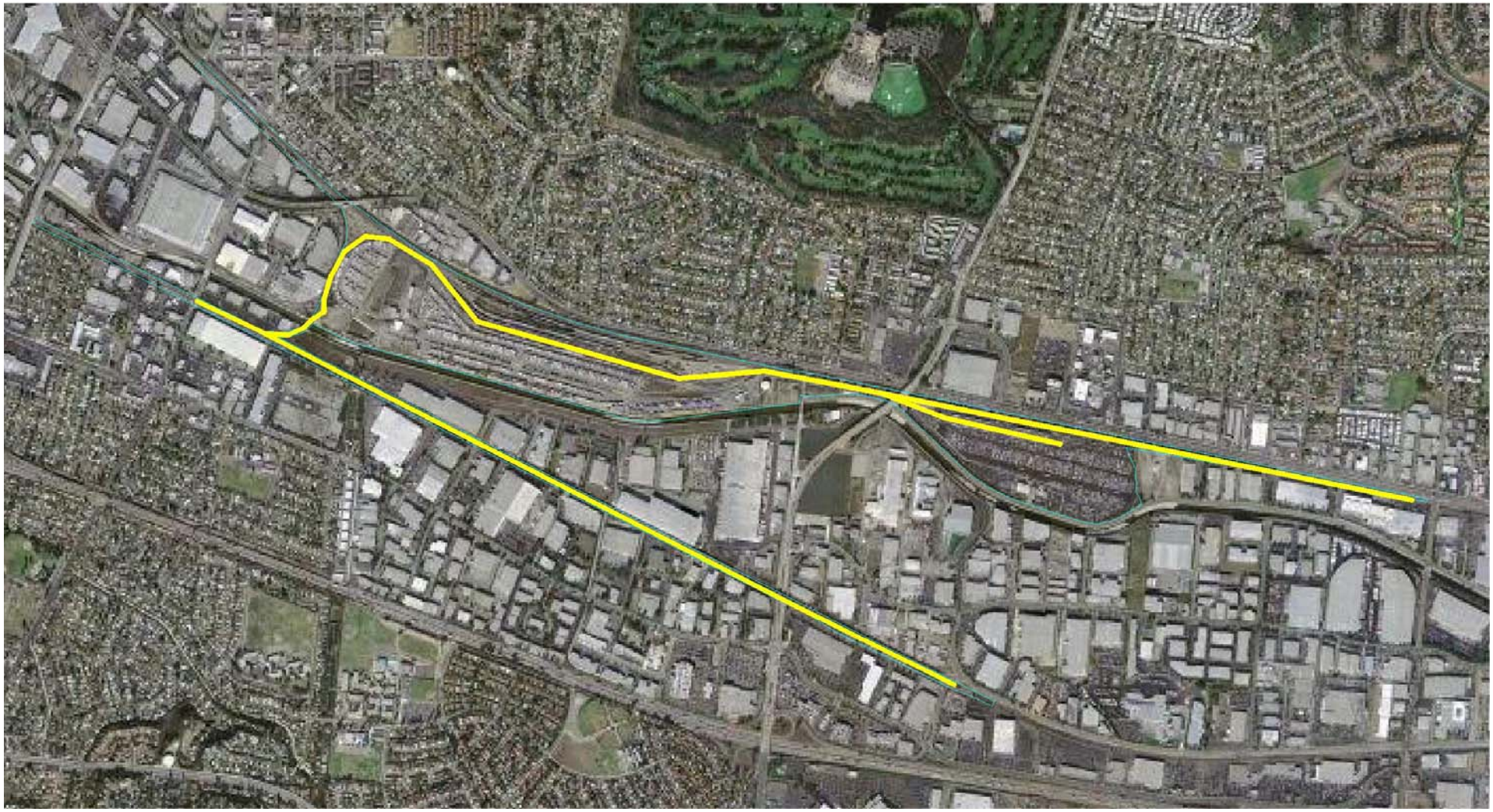


Appendix A-5
West Bound Departing Freight Trains



Appendix A-5
East Bound Arriving Local Trains

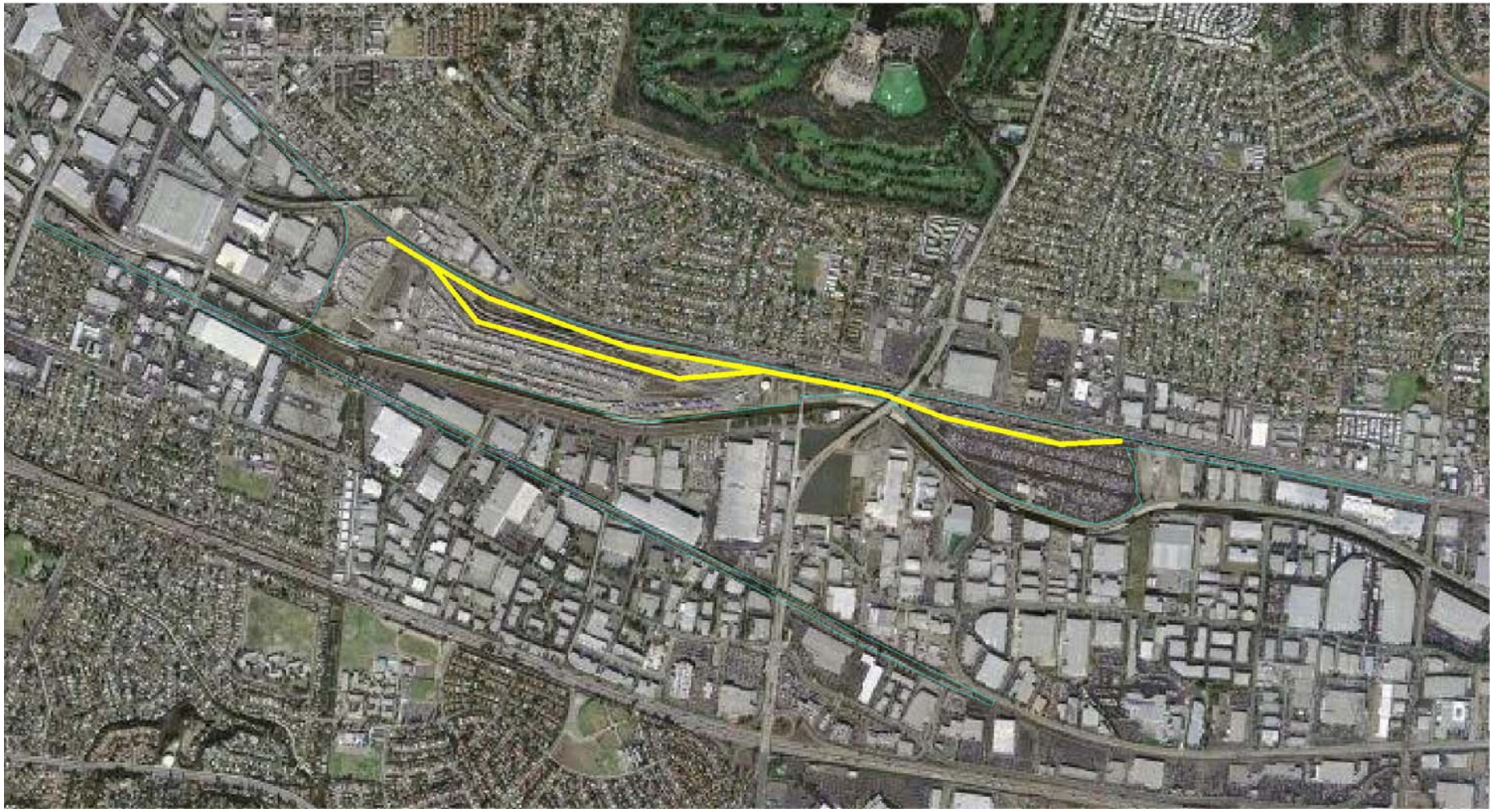
Appendix A-5
East Bound Departing Local Trains



Appendix A-5
West Bound Arriving Local Trains

Appendix A-5
West Bound Departing Local Trains

Appendix A-5
Power Moves



Appendix A-5
Through Trains

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		

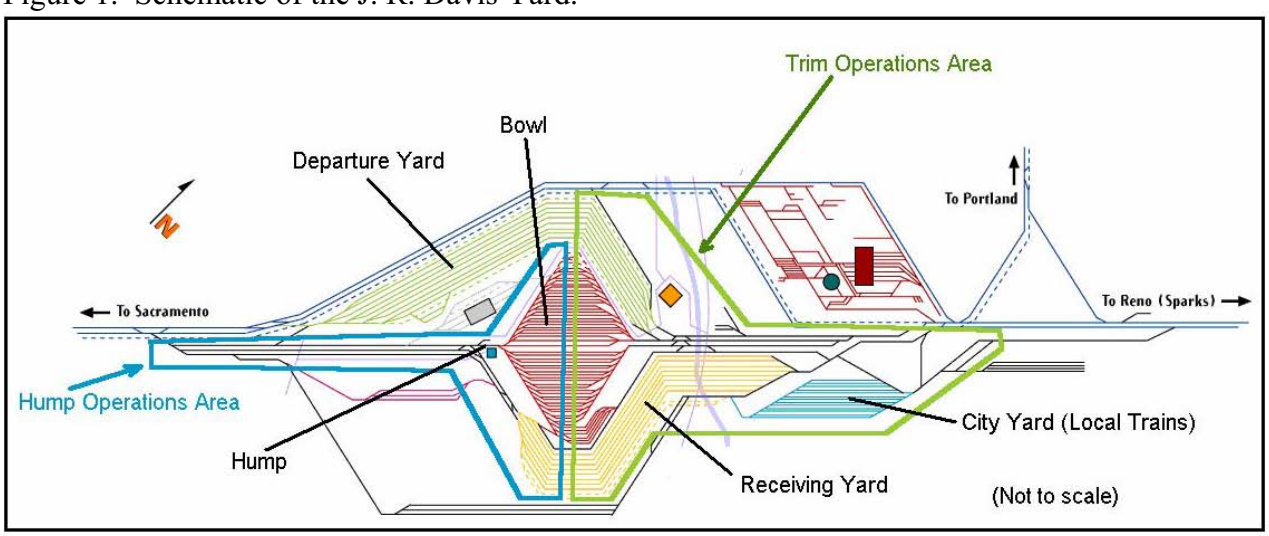
The parameters listed in Table 2 were used to calculate the number of trains by time of day arriving or departing from each area of the yard, as well as average composition of their consists (number of locomotives and distribution of locomotive models). The combination of train symbol, train segment, 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.

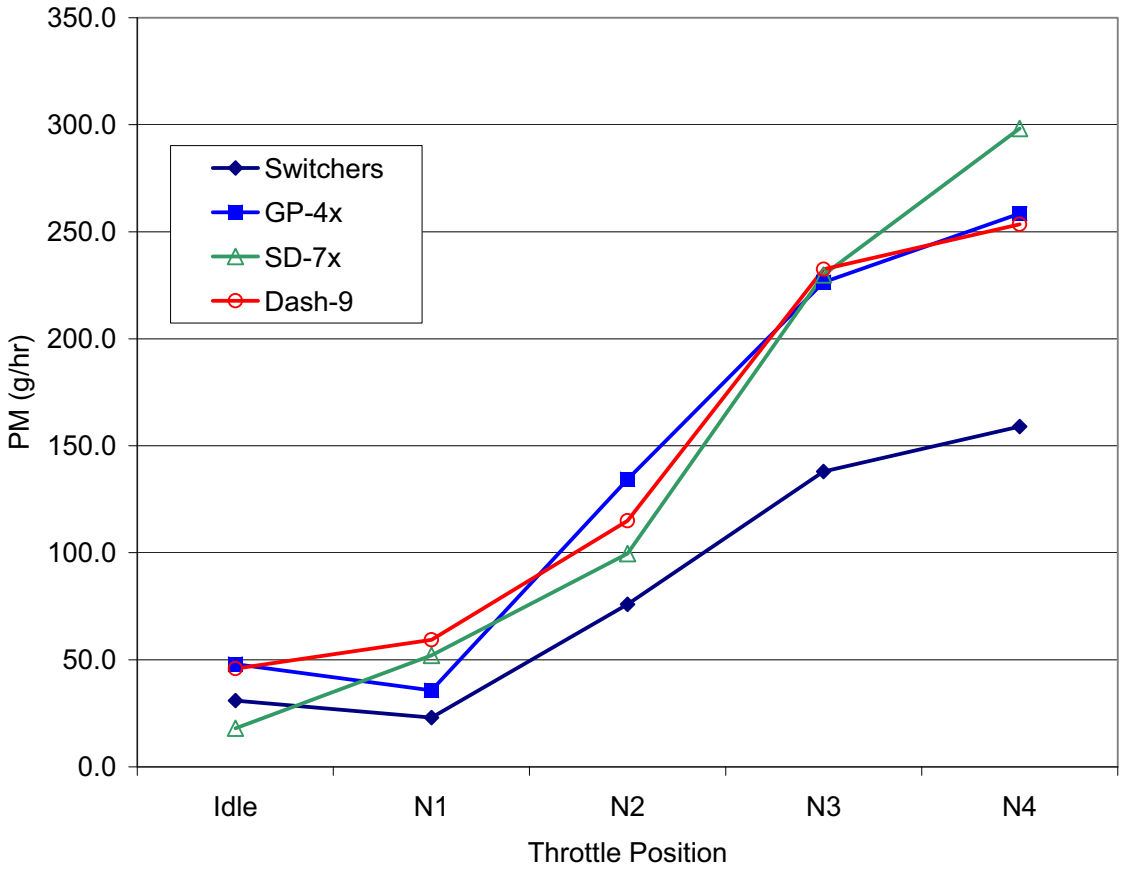
Table 3. Locomotive Model Groups

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).



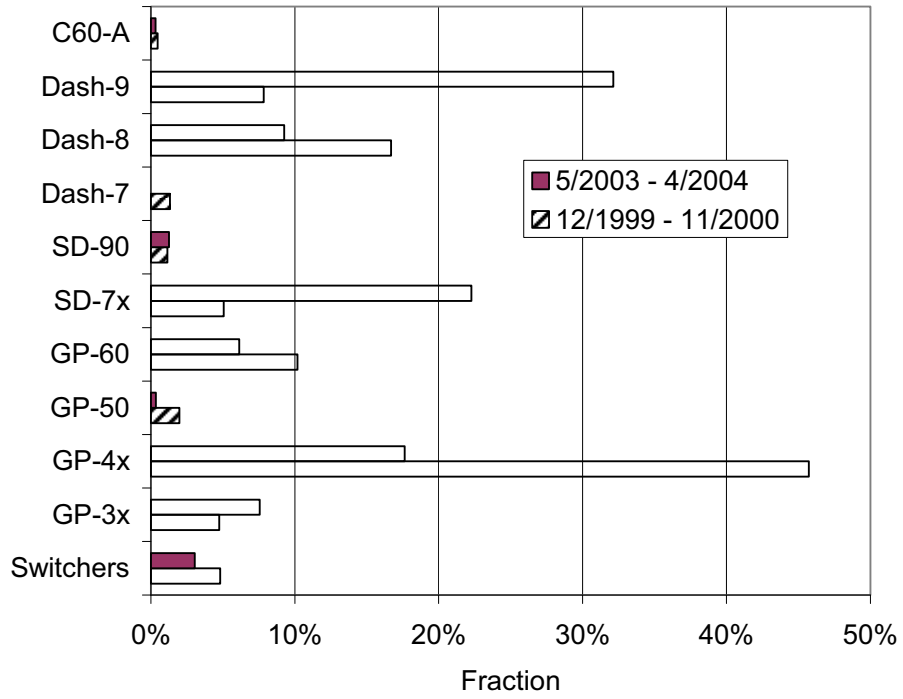
The emission factors used were based on tests using fuel typical of national off-road diesel. Initial emission estimates were derived by multiplying model-specific g/hr emission rates by the total hours of operation and locomotive model fraction for each activity within the yard. At the Davis Yard, over 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.

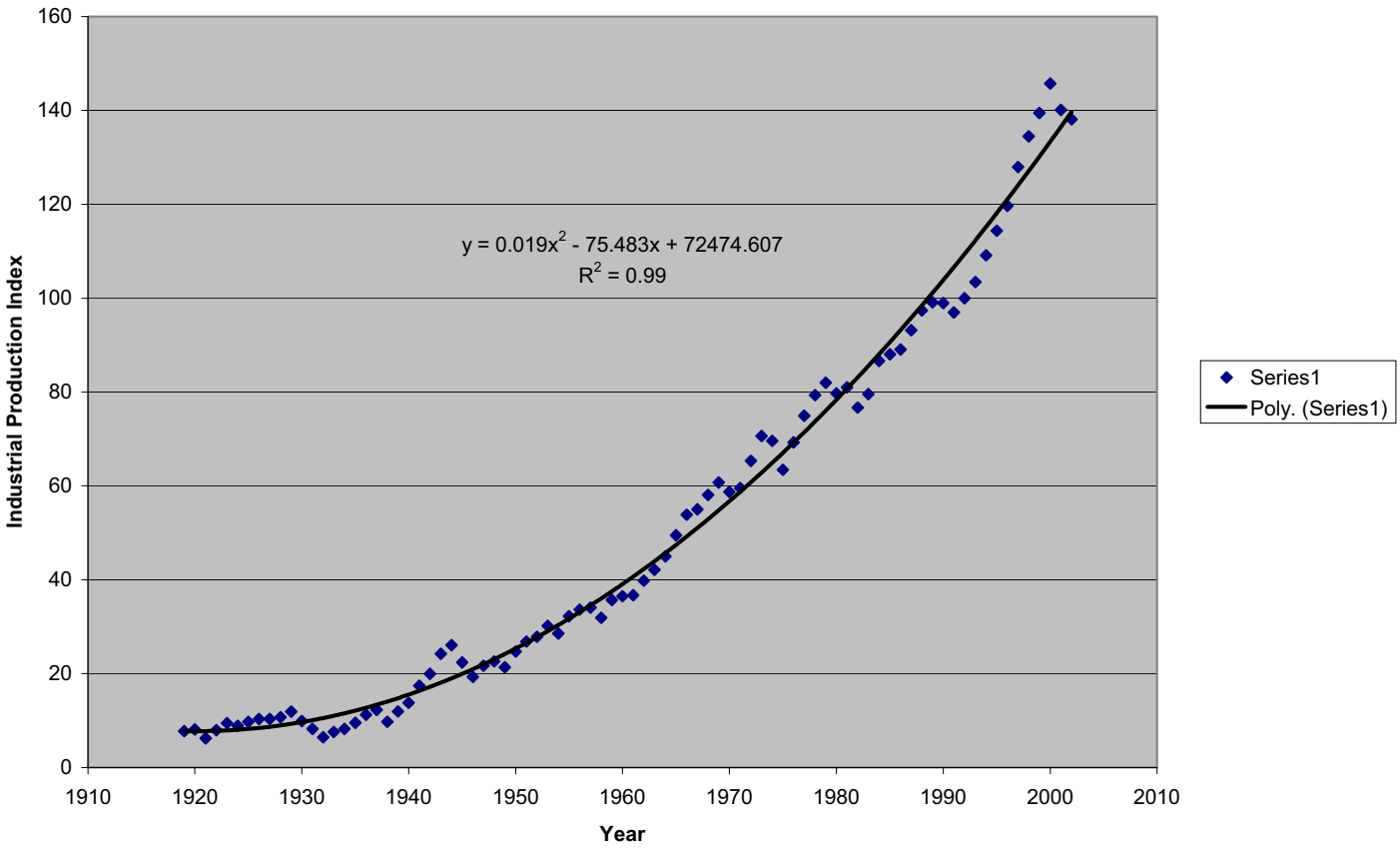
Revised Growth in Emissions

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



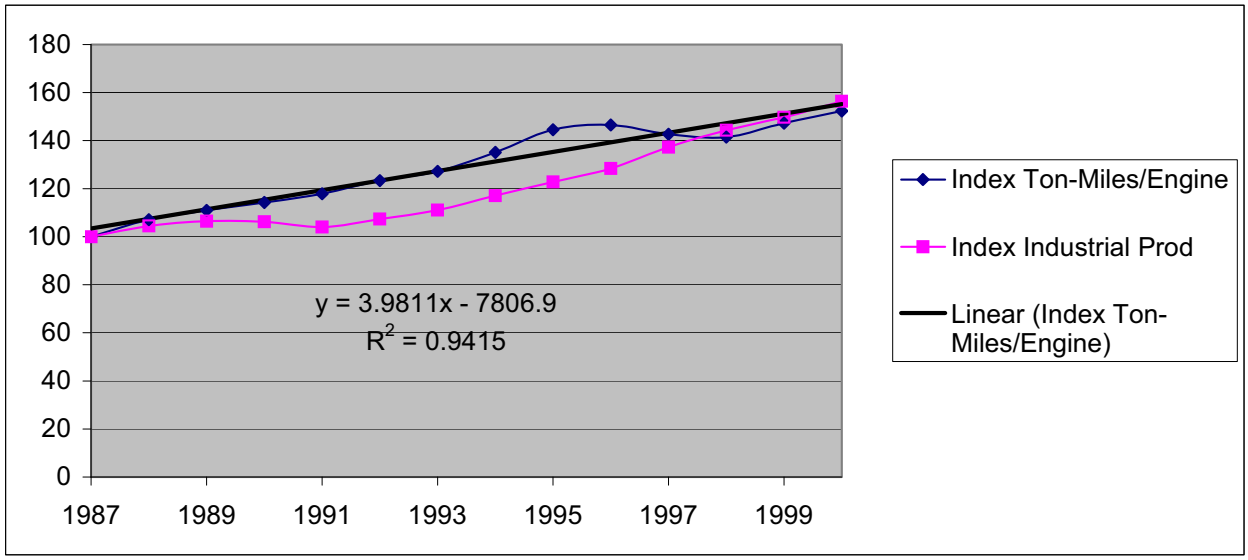
Another surrogate for growth is net ton-miles per engine. Consequently, staff analyzed railroad data from the AAR's Railroad Facts booklet (2001 edition). The booklet contains line-haul railroad statistics including financial status, operation and employment data, and usage profiles. Revenue ton-mile 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	EPA Aromatic	Nonroad Aromatic	Weighted Aromatic	PM Emission Reduction
		Volume Percent	Volume Percent	Volume Percent	Volume Percent	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:

Equations to correct for PM for GE (4-Stroke) engines

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:

Equations to correct for PM for EMD (2-Stroke) engines

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	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

PRELIMINARY DRAFT – DO NOT CITE OR QUOTE

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

PRELIMINARY DRAFT – DO NOT CITE OR QUOTE

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 B

EMISSION FACTOR DERIVATION AND EMFAC2007 OUTPUT FOR DIESEL-FUELED YARD TRUCKS

Summary of Emission Factors for Diesel-Fueled Yard Trucks
City of Industry Rail Yard, City of Industry, CA

Running Exhaust Emissions

Equipment Type	Equipment ID/Owner	Make	Model	Year	Vehicle Class	2005 Emission Factors (g/mi)[1,2]					
						ROG	CO	NOx	PM10[3]	DPM[3]	SOx
Boom Truck	UP65629	International	4900	1992	HHD	8.25	20.27	32.16	3.92	3.78	0.27
Welder Truck	65984	Ford	F-800	1992	MHD	0.94	9.70	18.46	1.25	1.25	0.16
Boom Truck	UP 68842	Ford	F-Series	1997	HHD	6.92	16.99	31.05	2.34	2.26	0.24
Gang Truck	60099	Freightliner	Unknown	1999	HHD	5.84	14.32	30.22	2.02	1.94	0.25
Flat Bed Truck	TTX	Isuzu	NPR HD	2000	HHD	5.24	12.87	29.54	1.88	1.81	0.23
Flat Bed Truck	TTX	Chevy	W-4500	2001	HHD	4.60	11.29	28.80	1.73	1.66	0.24
Flat Bed Truck	TTX	Isuzu	NPR HD	2001	HHD	4.60	11.29	28.80	1.73	1.66	0.24
Truck	TTX	Ford	F350	2001	LHDT1	0.39	1.58	8.68	0.13	0.13	0.00
Truck	TTX	Ford	F250	2001	MHD	0.37	3.16	12.93	0.43	0.43	0.13
Flat Bed Truck	TTX	Chevy	W-4500	2003	HHD	1.50	3.48	18.89	0.52	0.46	0.23

Idling Exhaust Emissions

Equipment Type	Equip. ID	Make	Model	Model Year	Vehicle Class	2005 Emission Factors (g/hr)[4]					
						ROG	CO	NOx	PM10	DPM	SOx
Boom Truck	UP65629	International	4900	1992	HHD	15.52	53.81	101.42	2.57	2.57	0.55
Welder Truck	65984	Ford	F-800	1992	MHD	3.17	26.30	75.05	1.40	1.40	0.34
Boom Truck	UP 68842	Ford	F-Series	1997	HHD	12.41	49.53	110.27	1.93	1.93	0.55
Gang Truck	60099	Freightliner	Unknown	1999	HHD	9.31	44.51	119.08	1.33	1.33	0.55
Flat Bed Truck	TTX	Isuzu	NPR HD	2000	HHD	9.31	44.51	119.08	1.33	1.33	0.55
Flat Bed Truck	TTX	Chevy	W-4500	2001	HHD	9.31	44.51	119.08	1.33	1.33	0.55
Flat Bed Truck	TTX	Isuzu	NPR HD	2001	HHD	9.31	44.51	119.08	1.33	1.33	0.55
Truck	TTX	Ford	F350	2001	LHDT1	3.17	26.30	75.05	0.75	0.75	0.05
Truck	TTX	Ford	F250	2001	MHD	3.17	26.30	75.05	0.75	0.75	0.34
Flat Bed Truck	TTX	Chevy	W-4500	2003	HHD	7.65	41.43	123.52	1.03	1.03	0.55

Notes:
1. Running exhaust emissions calculated using the EMFAC2007 model with the BURDEN output option.
2. Running exhaust emission factor calculations assumed an average speed of 15 mph.
3. The PM10 emission factor includes engine exhaust emissions along with brake and tire wear. The DPM emission factor includes engine exhaust emissions only.
4. Idling exhaust emissions factors calculated using the EMFAC2007 model with the EMFAC output option.

Title : Los Angeles County Avg Annual CYr 2005 Default Title
Version : Emfac2007 V2.3 Nov 1 2006 ** WIS Enabled **
Run Date : 2007/08/31 12:05:08
Scen Year: 2005 -- Model year 1992 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-DSL	HHDT-DSL
Vehicles	1059	840
VMT/1000	58	132
Trips	29682	4249
Reactive Organic Gas Emissions		
Run Exh	0.06	1.2
Idle Exh	0	0.02
Start Ex	0	0
	---	---
Total Ex	0.06	1.23
Diurnal	0	0
Hot Soak	0	0
Running	0	0
Resting	0	0
	---	---
Total	0.06	1.23
Carbon Monoxide Emissions		
Run Exh	0.62	2.95
Idle Exh	0	0.08
Start Ex	0	0
	---	---
Total Ex	0.62	3.03
Oxides of Nitrogen Emissions		
Run Exh	1.18	4.68
Idle Exh	0.01	0.16
Start Ex	0	0
	---	---
Total Ex	1.19	4.84
Carbon Dioxide Emissions (000)		
Run Exh	0.1	0.42
Idle Exh	0	0.01
Start Ex	0	0
	---	---
Total Ex	0.1	0.43
PM10 Emissions		
Run Exh	0.08	0.55
Idle Exh	0	0
Start Ex	0	0
	---	---
Total Ex	0.08	0.56
TireWear	0	0.01
BrakeWr	0	0
	---	---
Total	0.08	0.57
Lead	0	0
SOx	0.01	0.04
Fuel Consumption (000 gallons)		
Gasoline	0	0
Diesel	8.66	38.33

Title : Los Angeles County Avg Annual CYr 2005 Default Title
Version : Emfac2007 V2.3 Nov 1 2006 ** WIS Enabled **
Run Date : 2007/08/31 12:11:08
Scen Year: 2005 -- Model year 1992 selected
Season : Annual
Area : Los Angeles
****
Year: 2005 -- Model Years 1992 to 1992 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	MHD NCAT	MHD CAT	MHD DSL	MHD ALL	HHD NCAT	HHD CAT	HHD DSL	HHD ALL
0	0	23.103	3.173	6.815	0	0	15.519	14.78

Pollutant Name: Carbon Monoxide Temperature: 65F Relative Humidity: 60%

Speed MPH	MHD NCAT	MHD CAT	MHD DSL	MHD ALL	HHD NCAT	HHD CAT	HHD DSL	HHD ALL
0	0	141.992	26.3	47.438	0	0	53.81	51.248

Pollutant Name: Oxides of Nitrogen Temperature: 65F Relative Humidity: 60%

Speed MPH	MHD NCAT	MHD CAT	MHD DSL	MHD ALL	HHD NCAT	HHD CAT	HHD DSL	HHD ALL
0	0	1.561	75.051	61.623	0	0	101.415	96.586

Pollutant Name: Carbon Dioxide Temperature: 65F Relative Humidity: 60%

Speed MPH	MHD NCAT	MHD CAT	MHD DSL	MHD ALL	HHD NCAT	HHD CAT	HHD DSL	HHD ALL
0	0	4776.9	4098	4222.044	0	0	6617.134	6302.033

Pollutant Name: Sulfur Dioxide Temperature: 65F Relative Humidity: 60%

Speed MPH	MHD NCAT	MHD CAT	MHD DSL	MHD ALL	HHD NCAT	HHD CAT	HHD DSL	HHD ALL
0	0	0.049	0.341	0.287	0	0	0.55	0.524

Pollutant Name: PM10 Temperature: 65F Relative Humidity: 60%

Speed MPH	MHD NCAT	MHD CAT	MHD DSL	MHD ALL	HHD NCAT	HHD CAT	HHD DSL	HHD ALL
0	0	0	1.395	1.14	0	0	2.568	2.445

Title : Los Angeles County Avg Annual CYr 2005 Default Title
Version : Emfac2007 V2.3 Nov 1 2006 ** WIS Enabled **
Run Date : 2007/08/31 12:11:08
Scen Year: 2005 -- Model year 1992 selected
Season : Annual
Area : Los Angeles
****
Year: 2005 -- Model Years 1992 to 1992 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: PM10 - Tire Wear Temperature: 65F Relative Humidity: 60%

Speed MPH	MHD NCAT	MHD CAT	MHD DSL	MHD ALL	HHD NCAT	HHD CAT	HHD DSL	HHD ALL
0	0	0	0	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	HHD NCAT	HHD CAT	HHD DSL	HHD ALL
0	0	0	0	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	HHD NCAT	HHD CAT	HHD DSL	HHD ALL
0	0	0	0	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	HHD NCAT	HHD CAT	HHD DSL	HHD ALL
0	0	0	0	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 : 2007/08/31 12:06:12
Scen Year: 2005 -- Model year 1997 selected
Season : Annual
Area : Los Angeles County Average
I/M Stat : Enhanced Interim (2005) -- Using I/M schedule for area 59 Los An
Emissions: Tons Per Day
****

	HHDT-DSL
Vehicles	1395
VMT/1000	345
Trips	7058
Reactive Organic Gas Emissions	
Run Exh	2.63
Idle Exh	0.03
Start Ex	0

Total Ex	2.66
Diurnal	0
Hot Soak	0
Running	0
Resting	0

Total	2.66
Carbon Monoxide Emissions	
Run Exh	6.46
Idle Exh	0.13
Start Ex	0

Total Ex	6.59
Oxides of Nitrogen Emissions	
Run Exh	11.81
Idle Exh	0.29
Start Ex	0

Total Ex	12.1
Carbon Dioxide Emissions (000)	
Run Exh	1.09
Idle Exh	0.02
Start Ex	0

Total Ex	1.11
PM10 Emissions	
Run Exh	0.86
Idle Exh	0
Start Ex	0

Total Ex	0.86
TireWear	0.01
BrakeWr	0.01

Total	0.89
Lead	0
SOx	0.09
Fuel Consumption (000 gallons)	
Gasoline	0
Diesel	99.81

Title : Los Angeles County Avg Annual CYr 2005 Default Title
Version : Emfac2007 V2.3 Nov 1 2006 ** WIS Enabled **
Run Date : 2007/08/31 12:12:00
Scen Year: 2005 -- Model year 1997 selected
Season : Annual
Area : Los Angeles
****
Year: 2005 -- Model Years 1997 to 1997 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	12.413	11.839

Pollutant Name: Carbon Monoxide Temperature: 65F Relative Humidity: 60%

Speed MPH	HHD NCAT	HHD CAT	HHD DSL	HHD ALL
0	0	0	49.525	47.237

Pollutant Name: Oxides of Nitrogen Temperature: 65F Relative Humidity: 60%

Speed MPH	HHD NCAT	HHD CAT	HHD DSL	HHD ALL
0	0	0	110.267	105.171

Pollutant Name: Carbon Dioxide Temperature: 65F Relative Humidity: 60%

Speed MPH	HHD NCAT	HHD CAT	HHD DSL	HHD ALL
0	0	0	6617.135	6311.32

Pollutant Name: Sulfur Dioxide Temperature: 65F Relative Humidity: 60%

Speed MPH	HHD NCAT	HHD CAT	HHD DSL	HHD ALL
0	0	0	0.55	0.525

Pollutant Name: PM10 Temperature: 65F Relative Humidity: 60%

Speed MPH	HHD NCAT	HHD CAT	HHD DSL	HHD ALL
0	0	0	1.928	1.839

Title : Los Angeles County Avg Annual CYr 2005 Default Title
Version : Emfac2007 V2.3 Nov 1 2006 ** WIS Enabled **
Run Date : 2007/08/31 12:12:00
Scen Year: 2005 -- Model year 1997 selected
Season : Annual
Area : Los Angeles
****
Year: 2005 -- Model Years 1997 to 1997 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: 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

Pollutant Name: Gasoline - mi/gal Temperature: 65F Relative Humidity: 60%

Speed MPH	HHD NCAT	HHD CAT	HHD DSL	HHD ALL
0	0	0	0	0

Pollutant Name: Diesel - mi/gal Temperature: 65F Relative Humidity: 60%

Speed MPH	HHD NCAT	HHD CAT	HHD DSL	HHD 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 : 2007/08/31 12:06:56
Scen Year: 2005 -- Model year 1999 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	1652
VMT/1000	477
Trips	8358
Reactive Organic Gas Emissions	
Run Exh	3.07
Idle Exh	0.03
Start Ex	0

Total Ex	3.1
Diurnal	0
Hot Soak	0
Running	0
Resting	0

Total	3.1
Carbon Monoxide Emissions	
Run Exh	7.53
Idle Exh	0.14
Start Ex	0

Total Ex	7.67
Oxides of Nitrogen Emissions	
Run Exh	15.89
Idle Exh	0.37
Start Ex	0

Total Ex	16.26
Carbon Dioxide Emissions (000)	
Run Exh	1.51
Idle Exh	0.02
Start Ex	0

Total Ex	1.53
PM10 Emissions	
Run Exh	1.02
Idle Exh	0
Start Ex	0

Total Ex	1.03
TireWear	0.02
BrakeWr	0.01

Total	1.06
Lead	0
SOx	0.13
Fuel Consumption (000 gallons)	
Gasoline	0
Diesel	137.62

Title : Los Angeles County Avg Annual CYr 2005 Default Title
Version : Emfac2007 V2.3 Nov 1 2006 ** WIS Enabled **
Run Date : 2007/08/31 12:12:33
Scen Year: 2005 -- Model year 1999 selected
Season : Annual
Area : Los Angeles
****
Year: 2005 -- Model Years 1999 to 1999 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	9.314	8.921

Pollutant Name: Carbon Monoxide Temperature: 65F Relative Humidity: 60%

Speed MPH	HHD NCAT	HHD CAT	HHD DSL	HHD ALL
0	0	0	44.514	42.637

Pollutant Name: Oxides of Nitrogen Temperature: 65F Relative Humidity: 60%

Speed MPH	HHD NCAT	HHD CAT	HHD DSL	HHD ALL
0	0	0	119.076	114.054

Pollutant Name: Carbon Dioxide Temperature: 65F Relative Humidity: 60%

Speed MPH	HHD NCAT	HHD CAT	HHD DSL	HHD ALL
0	0	0	6617.134	6338.052

Pollutant Name: Sulfur Dioxide Temperature: 65F Relative Humidity: 60%

Speed MPH	HHD NCAT	HHD CAT	HHD DSL	HHD ALL
0	0	0	0.55	0.527

Title : Los Angeles County Avg Annual CYr 2005 Default Title
Version : Emfac2007 V2.3 Nov 1 2006 ** WIS Enabled **
Run Date : 2007/08/31 12:12:33
Scen Year: 2005 -- Model year 1999 selected
Season : Annual
Area : Los Angeles
****
Year: 2005 -- Model Years 1999 to 1999 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: PM10 Temperature: 65F Relative Humidity: 60%

Speed MPH	HHD NCAT	HHD CAT	HHD DSL	HHD ALL
0	0	0	1.334	1.277

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

Pollutant Name: Gasoline - mi/gal Temperature: 65F Relative Humidity: 60%

Speed MPH	HHD NCAT	HHD CAT	HHD DSL	HHD ALL
0	0	0	0	0

Pollutant Name: Diesel - mi/gal Temperature: 65F Relative Humidity: 60%

Speed MPH	HHD NCAT	HHD CAT	HHD DSL	HHD 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 : 2007/08/31 12:08:07
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 Ang
Emissions: Tons Per Day
****

	HHDT-DSL
Vehicles	1648
VMT/1000	507
Trips	8338
Reactive Organic Gas Emissions	
Run Exh	2.93
Idle Exh	0.03
Start Ex	0

Total Ex	2.96
Diurnal	0
Hot Soak	0
Running	0
Resting	0

Total	2.96
Carbon Monoxide Emissions	
Run Exh	7.19
Idle Exh	0.14
Start Ex	0

Total Ex	7.33
Oxides of Nitrogen Emissions	
Run Exh	16.51
Idle Exh	0.36
Start Ex	0

Total Ex	16.88
Carbon Dioxide Emissions (000)	
Run Exh	1.6
Idle Exh	0.02
Start Ex	0

Total Ex	1.62
PM10 Emissions	
Run Exh	1.01
Idle Exh	0
Start Ex	0

Total Ex	1.01
TireWear	0.02
BrakeWr	0.02

Total	1.05
Lead	0
SOx	0.13
Fuel Consumption (000 gallons)	
Gasoline	0
Diesel	146.1

Title : Los Angeles County Avg Annual CYr 2005 Default Title
Version : Emfac2007 V2.3 Nov 1 2006 ** WIS Enabled **
Run Date : 2007/08/31 12:14:01
Scen Year: 2005 -- Model year 2000 selected
Season : Annual
Area : Los Angeles
****
Year: 2005 -- Model Years 2000 to 2000 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	9.314	8.739

Pollutant Name: Carbon Monoxide Temperature: 65F Relative Humidity: 60%

Speed MPH	HHD NCAT	HHD CAT	HHD DSL	HHD ALL
0	0	0	44.514	41.766

Pollutant Name: Oxides of Nitrogen Temperature: 65F Relative Humidity: 60%

Speed MPH	HHD NCAT	HHD CAT	HHD DSL	HHD ALL
0	0	0	119.076	111.726

Pollutant Name: Carbon Dioxide Temperature: 65F Relative Humidity: 60%

Speed MPH	HHD NCAT	HHD CAT	HHD DSL	HHD ALL
0	0	0	6617.135	6208.685

Pollutant Name: Sulfur Dioxide Temperature: 65F Relative Humidity: 60%

Speed MPH	HHD NCAT	HHD CAT	HHD DSL	HHD ALL
0	0	0	0.55	0.516

Pollutant Name: PM10 Temperature: 65F Relative Humidity: 60%

Speed MPH	HHD NCAT	HHD CAT	HHD DSL	HHD ALL
0	0	0	1.334	1.251

Title : Los Angeles County Avg Annual CYr 2005 Default Title
Version : Emfac2007 V2.3 Nov 1 2006 ** WIS Enabled **
Run Date : 2007/08/31 12:14:01
Scen Year: 2005 -- Model year 2000 selected
Season : Annual
Area : Los Angeles
****
Year: 2005 -- Model Years 2000 to 2000 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: 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

Pollutant Name: Gasoline - mi/gal Temperature: 65F Relative Humidity: 60%

Speed MPH	HHD NCAT	HHD CAT	HHD DSL	HHD ALL
0	0	0	0	0

Pollutant Name: Diesel - mi/gal Temperature: 65F Relative Humidity: 60%

Speed MPH	HHD NCAT	HHD CAT	HHD DSL	HHD ALL
0	0	0	0	0

Title : Statewide totals Avg Annual CYr 2005 Default Title
Version : Emfac2007 V2.3 Nov 1 2006 ** WIS Enabled **
Run Date : 2007/08/31 13:02:52
Scen Year: 2005 -- Model year 2001 selected
Season : Annual
Area : Statewide totals Average
I/M Stat : Enhanced Interim (2005) -- Using I/M schedule for area 59 Los Angeles (SC)
Emissions: Tons Per Day
****

	LHDT1-DSL
Vehicles	1490
VMT/1000	69
Trips	18743
Reactive Organic Gas Emissions	
Run Exh	0.03
Idle Exh	0
Start Ex	0

Total Ex	0.03
Diurnal	0
Hot Soak	0
Running	0
Resting	0

Total	0.03
Carbon Monoxide Emissions	
Run Exh	0.12
Idle Exh	0
Start Ex	0

Total Ex	0.13
Oxides of Nitrogen Emissions	
Run Exh	0.66
Idle Exh	0
Start Ex	0

Total Ex	0.67
Carbon Dioxide Emissions (000)	
Run Exh	0.04
Idle Exh	0
Start Ex	0

Total Ex	0.04
PM10 Emissions	
Run Exh	0.01
Idle Exh	0
Start Ex	0

Total Ex	0.01
TireWear	0
BrakeWr	0

Total	0.01
Lead	0
SOx	0
Fuel Consumption (000 gallons)	
Gasoline	0
Diesel	3.59

Title : Los Angeles County Avg Annual CYr 2005 Default Title
Version : Emfac2007 V2.3 Nov 1 2006 ** WIS Enabled **
Run Date : 2007/08/31 12:10:05
Scen Year: 2005 -- Model year 2001 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-DSL	HHDT-DSL
Vehicles	3201	1164
VMT/1000	273	377
Trips	89760	5889
Reactive Organic Gas Emissions		
Run Exh	0.11	1.91
Idle Exh	0	0.02
Start Ex	0	0
	---	---
Total Ex	0.11	1.93
Diurnal	0	0
Hot Soak	0	0
Running	0	0
Resting	0	0
	---	---
Total	0.11	1.93
Carbon Monoxide Emissions		
Run Exh	0.95	4.69
Idle Exh	0.01	0.1
Start Ex	0	0
	---	---
Total Ex	0.96	4.79
Oxides of Nitrogen Emissions		
Run Exh	3.89	11.97
Idle Exh	0.03	0.26
Start Ex	0	0
	---	---
Total Ex	3.91	12.22
Carbon Dioxide Emissions (000)		
Run Exh	0.45	1.19
Idle Exh	0	0.01
Start Ex	0	0
	---	---
Total Ex	0.45	1.2
PM10 Emissions		
Run Exh	0.13	0.69
Idle Exh	0	0
Start Ex	0	0
	---	---
Total Ex	0.13	0.69
TireWear	0	0.01
BrakeWr	0	0.01
	---	---
Total	0.13	0.72
Lead	0	0
SOx	0.04	0.1
Fuel Consumption (000 gallons)		
Gasoline	0	0
Diesel	40.9	108.41

Title : Los Angeles County Avg Annual CYr 2005 Default Title
Version : Emfac2007 V2.3 Nov 1 2006 ** WIS Enabled **
Run Date : 2007/08/31 12:15:55
Scen Year: 2005 -- Model year 2001 selected
Season : Annual
Area : Los Angeles
****
Year: 2005 -- Model Years 2001 to 2001 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	LHD1 NCAT	LHD1 CAT	LHD1 DSL	LHD1 ALL	MHD NCAT	MHD CAT	MHD DSL	MHD ALL	HHD NCAT	HHD CAT	HHD DSL	HHD ALL
0	0	23.103	3.173	22.139	0	23.103	3.173	6.84	0	0	9.314	8.146

Pollutant Name: Carbon Monoxide Temperature: 65F Relative Humidity: 60%

Speed MPH	LHD1 NCAT	LHD1 CAT	LHD1 DSL	LHD1 ALL	MHD NCAT	MHD CAT	MHD DSL	MHD ALL	HHD NCAT	HHD CAT	HHD DSL	HHD ALL
0	0	141.992	26.3	136.392	0	141.992	26.3	47.584	0	0	44.514	38.931

Pollutant Name: Oxides of Nitrogen Temperature: 65F Relative Humidity: 60%

Speed MPH	LHD1 NCAT	LHD1 CAT	LHD1 DSL	LHD1 ALL	MHD NCAT	MHD CAT	MHD DSL	MHD ALL	HHD NCAT	HHD CAT	HHD DSL	HHD ALL
0	0	1.561	75.051	5.117	0	1.561	75.051	61.531	0	0	119.076	104.142

Pollutant Name: Carbon Dioxide Temperature: 65F Relative Humidity: 60%

Speed MPH	LHD1 NCAT	LHD1 CAT	LHD1 DSL	LHD1 ALL	MHD NCAT	MHD CAT	MHD DSL	MHD ALL	HHD NCAT	HHD CAT	HHD DSL	HHD ALL
0	0	4776.899	4098	4744.043	0	4776.9	4098	4222.897	0	0	6617.134	5787.272

Pollutant Name: Sulfur Dioxide Temperature: 65F Relative Humidity: 60%

Speed MPH	LHD1 NCAT	LHD1 CAT	LHD1 DSL	LHD1 ALL	MHD NCAT	MHD CAT	MHD DSL	MHD ALL	HHD NCAT	HHD CAT	HHD DSL	HHD ALL
0	0	0.049	0.341	0.063	0	0.049	0.341	0.287	0	0	0.55	0.481

Pollutant Name: PM10 Temperature: 65F Relative Humidity: 60%

Speed MPH	LHD1 NCAT	LHD1 CAT	LHD1 DSL	LHD1 ALL	MHD NCAT	MHD CAT	MHD DSL	MHD ALL	HHD NCAT	HHD CAT	HHD DSL	HHD ALL
0	0	0	0.753	0.036	0	0	0.753	0.614	0	0	1.334	1.166

Pollutant Name: PM10 - Tire Wear Temperature: 65F Relative Humidity: 60%

Speed MPH	LHD1 NCAT	LHD1 CAT	LHD1 DSL	LHD1 ALL	MHD NCAT	MHD CAT	MHD DSL	MHD ALL	HHD NCAT	HHD CAT	HHD DSL	HHD ALL
0	0	0	0	0	0	0	0	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 : 2007/08/31 12:15:55
Scen Year: 2005 -- Model year 2001 selected
Season : Annual
Area : Los Angeles
****
Year: 2005 -- Model Years 2001 to 2001 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: PM10 - Brake Wear Temperature: 65F Relative Humidity: 60%

Speed MPH	LHD1 NCAT	LHD1 CAT	LHD1 DSL	LHD1 ALL	MHD NCAT	MHD CAT	MHD DSL	MHD ALL	HHD NCAT	HHD CAT	HHD DSL	HHD ALL
0	0	0	0	0	0	0	0	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	MHD NCAT	MHD CAT	MHD DSL	MHD ALL	HHD NCAT	HHD CAT	HHD DSL	HHD ALL
0	0	0	0	0	0	0	0	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	MHD NCAT	MHD CAT	MHD DSL	MHD ALL	HHD NCAT	HHD CAT	HHD DSL	HHD ALL
0	0	0	0	0	0	0	0	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 : 2007/08/31 12:08:46
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
****

	HHDT-DSL
Vehicles	931
VMT/1000	315
Trips	4709
Reactive Organic Gas Emissions	
Run Exh	0.52
Idle Exh	0.01
Start Ex	0

Total Ex	0.53
Diurnal	0
Hot Soak	0
Running	0
Resting	0

Total	0.53
Carbon Monoxide Emissions	
Run Exh	1.21
Idle Exh	0.07
Start Ex	0

Total Ex	1.28
Oxides of Nitrogen Emissions	
Run Exh	6.56
Idle Exh	0.21
Start Ex	0

Total Ex	6.78
Carbon Dioxide Emissions (000)	
Run Exh	1
Idle Exh	0.01
Start Ex	0

Total Ex	1.01
PM10 Emissions	
Run Exh	0.16
Idle Exh	0
Start Ex	0

Total Ex	0.16
TireWear	0.01
BrakeWr	0.01

Total	0.18
Lead	0
SOx	0.08
Fuel Consumption (000 gallons)	
Gasoline	0
Diesel	90.72

Title : Los Angeles County Avg Annual CYr 2005 Default Title
Version : Emfac2007 V2.3 Nov 1 2006 ** WIS Enabled **
Run Date : 2007/08/31 12:14:30
Scen Year: 2005 -- Model year 2003 selected
Season : Annual
Area : Los Angeles
****
Year: 2005 -- Model Years 2003 to 2003 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	7.652	7.176

Pollutant Name: Carbon Monoxide Temperature: 65F Relative Humidity: 60%

Speed MPH	HHD NCAT	HHD CAT	HHD DSL	HHD ALL
	0	0	0	41.429	38.854

Pollutant Name: Oxides of Nitrogen Temperature: 65F Relative Humidity: 60%

Speed MPH	HHD NCAT	HHD CAT	HHD DSL	HHD ALL
	0	0	0	123.519	115.843

Pollutant Name: Carbon Dioxide Temperature: 65F Relative Humidity: 60%

Speed MPH	HHD NCAT	HHD CAT	HHD DSL	HHD ALL
	0	0	0	6617.134	6205.931

Pollutant Name: Sulfur Dioxide Temperature: 65F Relative Humidity: 60%

Speed MPH	HHD NCAT	HHD CAT	HHD DSL	HHD ALL
	0	0	0	0.55	0.516

Pollutant Name: PM10 Temperature: 65F Relative Humidity: 60%

Speed MPH	HHD NCAT	HHD CAT	HHD DSL	HHD ALL

Title : Los Angeles County Avg Annual CYr 2005 Default Title
Version : Emfac2007 V2.3 Nov 1 2006 ** WIS Enabled **
Run Date : 2007/08/31 12:14:30
Scen Year: 2005 -- Model year 2003 selected
Season : Annual
Area : Los Angeles
****

Year: 2005 -- Model Years 2003 to 2003 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)

0	0	0	1.034	0.97

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

Pollutant Name: Gasoline - mi/gal Temperature: 65F Relative Humidity: 60%

Speed MPH	HHD NCAT	HHD CAT	HHD DSL	HHD ALL
0	0	0	0	0

Pollutant Name: Diesel - mi/gal Temperature: 65F Relative Humidity: 60%

Speed MPH	HHD NCAT	HHD CAT	HHD DSL	HHD ALL
0	0	0	0	0

APPENDIX C

EMISSION FACTOR DERIVATION AND EMFAC2007 OUTPUT FOR HHD DIESEL-FUELED DELIVERY TRUCKS

Emission Factors for HHD Diesel-Fueled Trucks
City of Industry Rail Yard, City of Industry, CA

Running Exhaust Emissions

2005 Emission Factors (g/mi)[1,2]					
ROG	CO	NOx	PM10[3]	DPM[3]	SOx
6.40	17.23	28.68	2.53	2.47	0.24

Idling Exhaust Emissions

2005 Emission Factors (g/hr)[4]					
ROG	CO	NOx	PM10	DPM	SOx
16.163	52.988	100.382	2.845	2.845	0.550

Notes:
1. 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.
2. Emission factor calculations assumed an average speed of 15 mph.
3. The PM10 emission factor includes engine exhaust emissions along with brake and tire wear. The DPM emission factor includes engine exhaust emissions only.
4. 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

Summary of Intermodal Gate Count Data
City of Industry Rail Yard, City of Industry, CA

Month	In-Gate Total [1]	Out-Gate Total [1]	In & Out Bobtails [2]	In & Out Total
Jan	5,835	6,678	3,128	15,641
Feb	8,212	7,289	3,875	19,376
Mar	11,012	10,117	5,282	26,411
Apr	12,063	10,025	5,522	27,610
May	11,499	10,401	5,475	27,375
June	12,571	10,926	5,874	29,371
July	10,856	9,175	5,008	25,039
Aug	11,799	11,652	5,863	29,314
Sept	12,153	9,869	5,506	27,528
Oct	10,591	8,357	4,737	23,685
Nov	10,254	8,787	4,760	23,801
Dec	10,214	8,872	4,772	23,858
Totals	127,059	112,148	59,802	**299,009**

Notes:
1. Provided by UPRR. (In&Out Gate Box Balance.pdf Reports).
2. Personal communication with UPRR personnel.

APPENDIX D

EMISSION FACTOR DERIVATION AND CARB SPREADSHEET MODEL OUTPUT FOR CARGO HANDLING EQUIPMENT

Emission Factors for Cargo Handling Equipment
City of Industry Rail Yard, City of Industry, CA

Equipment Type	Equipment ID	Make	Model	Year	Load Factor[1]	2005 Emission Factors (g/bhp-hr)[2]					
						HC	CO	NOx	PM10	DPM	SOx
Chassie Stacker	69588	Taylor	GT210	1999	0.30	0.538	2.851	6.862	0.360	0.360	0.060
RTG	98451	Mi Jack	1000R	1984	0.43	NA	NA	NA	NA	NA	NA
RTG	99152	Mi Jack	1000R	1991	0.43	0.669	3.263	8.928	0.444	0.444	0.052
RTG	99153	Mi Jack	1000R	1991	0.43	0.669	3.263	8.928	0.444	0.444	0.052
RTG	90405	Taylor	6040	2004	0.43	0.091	0.946	4.162	0.097	0.097	0.052
Top Pick	87764	Cat	V250	1977	0.59	1.230	6.172	14.936	0.858	0.858	0.060
Top Pick	89583	Taylor	TEC-950	1995	0.59	0.621	3.113	8.573	0.402	0.402	0.060
Yard Hostlers	32006	Ottawa	Commando	2003	0.55	0.263	2.862	5.248	0.230	0.230	0.060
Yard Hostlers	42160	Ottawa	Commando	2004	0.55	0.169	2.808	4.631	0.173	0.173	0.060
Yard Hostlers	52002	Ottawa	Commando	2005	0.55	0.119	2.754	4.283	0.139	0.139	0.060

Notes:
1. Default load factors from OFFROAD 2007 model.
2. Emission factors from CARB's Cargo Handling Equipment Emission Calculation Spreadsheet (CHE_Model_UP_CityIndustry_YTcorrected091207.xls).

CONFIDENTIAL BUSINESS INFORMATION/TRADE SECRET

Cal Year	Yard	Equipment Type	Code	Useful Life (hours)	Model Year	Age (years)	Population	HP	HP Bin	Yearly Operational Hrs	Cummulative Hours	Emission Control Factor? (y/n)	If no emission control leave blank Emission Control	Load Factor	HPMY	HC EF	Emission Control HC EF
2005	***(Example Calculation)***	***Yard Tractor onroad engine***	***9***	***8800***	***1985***	***21***	***2***	***500***	***500***	***1100***	***23100***	***n***		***0.65***	***5001985***	***1.30E+00***	***0.00E+00***
2005	City of Industry	Forklift	3	87600	1999	7	1	154	175	4380	30660	n		0.30	1751999	6.80E-01	0.00E+00
2005	City of Industry	Crane	1	0	1984	22	1	300	500	0	0	n		0.43	5001984	9.00E-01	0.00E+00
2005	City of Industry	Crane	1	118260	1991	15	1	300	500	6570	98550	n		0.43	5001991	6.80E-01	0.00E+00
2005	City of Industry	Crane	1	59130	1991	15	1	300	500	3285	49275	n		0.43	5001991	6.80E-01	0.00E+00
2005	City of Industry	Crane	1	118260	2004	2	1	300	500	6570	13140	n		0.43	5002004	1.20E-01	0.00E+00
2005	City of Industry	Material Handling Equip	4	19710	1977	29	1	250	250	1095	31755	n		0.59	2501977	1.00E+00	0.00E+00
2005	City of Industry	Material Handling Equip	4	19710	1995	11	1	350	500	1095	12045	n		0.59	5001995	6.80E-01	0.00E+00
2005	City of Industry	Yard Tractor offroad engine	8	52560	2003	3	2	150	175	6570	19710	n		0.65	1752003	3.30E-01	0.00E+00
2005	City of Industry	Yard Tractor offroad engine	8	52560	2004	2	3	150	175	6570	13140	n		0.65	1752004	2.20E-01	0.00E+00
2005	City of Industry	Yard Tractor offroad engine	8	52560	2005	1	9	150	175	6570	6570	n		0.65	1752005	1.60E-01	0.00E+00

HC dr	FCF HC	CO EF	Emission Control CO EF	CO dr	NOX EF	Emission Control NOX EF	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
0.000065	*0.720000*	*1.55E+01*	*0.00E+00*	*0.000440*	*6.00E+00*	*0.00E+00*	*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*
0.000002	0.720000	2.70E+00	0.00E+00	0.000005	6.90E+00	0.00E+00	0.000011	0.948000	3.80E-01	0.00E+00	0.000002	0.822000	5.97E-02	5.38E-01	2.85E+00	6.86E+00	5.97E-02	3.60E-01	1.73E-01
#DIV/0!	0.720000	4.20E+00	0.00E+00	#DIV/0!	1.10E+01	0.00E+00	#DIV/0!	0.930000	5.30E-01	0.00E+00	#DIV/0!	0.750000	5.21E-02	#DIV/0!	#DIV/0!	#DIV/0!	5.21E-02	#DIV/0!	0.00E+00
0.000003	0.720000	2.70E+00	0.00E+00	0.000006	8.17E+00	0.00E+00	0.000015	0.930000	3.80E-01	0.00E+00	0.000002	0.750000	5.21E-02	6.69E-01	3.26E+00	8.93E+00	5.21E-02	4.44E-01	8.99E-01
0.000005	0.720000	2.70E+00	0.00E+00	0.000011	8.17E+00	0.00E+00	0.000029	0.930000	3.80E-01	0.00E+00	0.000004	0.750000	5.21E-02	6.69E-01	3.26E+00	8.93E+00	5.21E-02	4.44E-01	4.50E-01
0.000000	0.720000	9.20E-01	0.00E+00	0.000002	4.29E+00	0.00E+00	0.000008	0.948000	1.10E-01	0.00E+00	0.000001	0.822000	5.21E-02	9.06E-02	9.46E-01	4.16E+00	5.21E-02	9.72E-02	1.22E-01
0.000022	0.720000	4.40E+00	0.00E+00	0.000056	1.20E+01	0.00E+00	0.000128	0.930000	5.50E-01	0.00E+00	0.000019	0.750000	5.97E-02	1.23E+00	6.17E+00	1.49E+01	5.97E-02	8.58E-01	3.15E-01
0.000015	0.720000	2.70E+00	0.00E+00	0.000034	8.17E+00	0.00E+00	0.000087	0.930000	3.80E-01	0.00E+00	0.000013	0.750000	5.97E-02	6.21E-01	3.11E+00	8.57E+00	5.97E-02	4.02E-01	2.23E-01
0.000002	0.720000	2.70E+00	0.00E+00	0.000008	5.26E+00	0.00E+00	0.000014	0.948000	2.40E-01	0.00E+00	0.000002	0.822000	5.97E-02	2.63E-01	2.86E+00	5.25E+00	5.97E-02	2.30E-01	5.33E-01
0.000001	0.720000	2.70E+00	0.00E+00	0.000008	4.72E+00	0.00E+00	0.000013	0.948000	1.90E-01	0.00E+00	0.000002	0.822000	5.97E-02	1.69E-01	2.81E+00	4.63E+00	5.97E-02	1.73E-01	5.17E-01
0.000001	0.720000	2.70E+00	0.00E+00	0.000008	4.44E+00	0.00E+00	0.000012	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	1.09E+00

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***
1.52E-01	6.35E-01	1.53E+00	1.33E-02	8.03E-02	8.03E-02	7.39E-02	4.73E-04	4.15E-04	1.74E-03	4.19E-03	3.65E-05	2.20E-04	2.20E-04	2.02E-04
0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
7.90E-01	3.05E+00	8.33E+00	4.86E-02	4.15E-01	4.15E-01	3.81E-01	2.46E-03	2.16E-03	8.34E-03	2.28E-02	1.33E-04	1.14E-03	1.14E-03	1.04E-03
3.95E-01	1.52E+00	4.17E+00	2.43E-02	2.07E-01	2.07E-01	1.91E-01	1.23E-03	1.08E-03	4.17E-03	1.14E-02	6.66E-05	5.68E-04	5.68E-04	5.22E-04
1.07E-01	8.83E-01	3.88E+00	4.86E-02	9.07E-02	9.07E-02	8.34E-02	3.34E-04	2.93E-04	2.42E-03	1.06E-02	1.33E-04	2.48E-04	2.48E-04	2.29E-04
2.77E-01	1.10E+00	2.66E+00	1.06E-02	1.53E-01	1.53E-01	1.40E-01	8.63E-04	7.59E-04	3.01E-03	7.28E-03	2.91E-05	4.18E-04	4.18E-04	3.85E-04
1.96E-01	7.75E-01	2.13E+00	1.49E-02	1.00E-01	1.00E-01	9.20E-02	6.10E-04	5.36E-04	2.12E-03	5.85E-03	4.08E-05	2.74E-04	2.74E-04	2.52E-04
4.69E-01	4.04E+00	7.41E+00	8.43E-02	3.24E-01	3.24E-01	2.98E-01	1.46E-03	1.28E-03	1.11E-02	2.03E-02	2.31E-04	8.88E-04	8.88E-04	8.17E-04
4.54E-01	5.94E+00	9.80E+00	1.26E-01	3.67E-01	3.67E-01	3.38E-01	1.42E-03	1.24E-03	1.63E-02	2.69E-02	3.46E-04	1.01E-03	1.01E-03	9.25E-04
9.58E-01	1.75E+01	2.72E+01	3.79E-01	8.81E-01	8.81E-01	8.11E-01	2.99E-03	2.62E-03	4.79E-02	7.45E-02	1.04E-03	2.41E-03	2.41E-03	2.22E-03

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 E

EMISSION FACTOR DERIVATION AND OFFROAD2007 OUTPUT FOR HEAVY EQUIPMENT

Emission Factorss for Diesel-Fueled Heavy Equipment
City of Industry Rail Yard, City of Industry, CA

Equipment Owner	Equipment Type	Make	Model	Model Year[3]	Rating (hp)[3]	Load Factor[1]	2005 Emission Factors (g/hp-hr)[2]					
							VOC	CO	NOx	PM10	DPM	SOx
UP	Forklift	Taylor	T300M "Big Red"	2005	160	0.30	0.25	2.83	4.32	0.15	0.15	0.06
TTX	Forklift (12,000 lb)	Caterpillar	DP70	1997	92.5	0.30	1.85	4.60	10.39	0.97	0.97	0.06
MoW	Backhoe	John Deere	S-310	Fleet Avg	108	0.55	1.14	3.26	6.82	0.56	0.56	0.05
TTX	Forklift (8,000 lb)	Caterpillar	DP-40D	1999	84	0.30	1.85	4.60	8.36	1.06	1.06	0.06
TTX	Forklift (6,000 lb)	Caterpillar	R-80	1989	56.5	0.30	1.85	4.60	10.39	0.97	0.97	0.06
Total												

Notes
1. Default load factors from OFFROAD2007 model.
2. Emission factors from OFFROAD2007 model.
3. Information for the John Deere backhoe could not be found. Therefore, a fleet average model year and engine horsepower were assumed for this unit.

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Offroad Output for Heavy Equipment

Cnty	SubR	SCC	HP	TechType	MYr	Population	ROG-Exhaust	CO-Exhaust	NOx-Exhaust	CO2-Exhaust	SO2-Exhaust
Los Angele	SC	2270002066	ALL		ALL		1.323364302	3.775530694	7.909326688	574.3873002	0.057816075
Los Angele	SC	2270003020	120		1999		0.01060821	0.02633769	0.04789867	3.255549	0.000330974
Los Angele	SC	2270003020	120		1997		0.009905544	0.02459314	0.05558715	3.039908	0.000309051
Los Angele	SC	2270003020	120		1989		0.001426223	0.003540978	0.008003566	0.437693	4.44978E-05
Los Angele	SC	2270003020	175		2005		0.002079355	0.02370748	0.03620302	4.763254	0.000464488

Offroad Output for Heavy Equipment

PM-Exhaust	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)
0.647311083		17704	0.55	108	1	1.141862443	3.257709683	6.824547919	0.049886493	0.558531172
0.006085767		208.71	0.3	83	1	1.851805476	4.597597385	8.361355911	0.057775885	1.062352334
0.005184907		194.89	0.3	83	1	1.851762519	4.597491554	10.39157475	0.057774547	0.969277048
0.000746535		28.06	0.3	83	1	1.851809393	4.597609436	10.39183823	0.057776015	0.969301803
0.001248682		170.1	0.3	149	1	0.248091946	2.828586191	4.31945371	0.055418991	0.148982712

OFFROAD Output for Heavy Equipment

CY	Season	AvgDays	Code	Equipment	Fuel	MaxHP	Class	C/R	Pre	Hand	Port	County	Air Basin	Air Dist.	MY	Population	Activity	Consumption	ROG Exhaust	CO Exhaust	NOX Exhaust	CO2 Exhaust	SO2 Exhaust	PM Exhaust	N2O Exhaust	CH4 Exhaust
2005	Annual	Mon-Sun	2270002066	Tractors/Loaders/Backhoes	D	25	Construction and Mining Equipment	U	P	NHH	NP	Los Angeles	SC	SC	2005	9.43	24.37	17.59	2.33E-04	7.95E-04	1.47E-03	1.93E-01	2.12E-05	1.06E-04	0.00E+00	2.10E-05
2005	Annual	Mon-Sun	2270002066	Tractors/Loaders/Backhoes	D	25	Construction and Mining Equipment	U	P	NHH	NP	Los Angeles	SC	SC	2004	9.1	23.49	16.97	2.52E-04	7.67E-04	1.80E-03	1.86E-01	2.05E-05	1.02E-04	0.00E+00	2.28E-05
2005	Annual	Mon-Sun	2270002066	Tractors/Loaders/Backhoes	D	25	Construction and Mining Equipment	U	P	NHH	NP	Los Angeles	SC	SC	2003	8.46	21.85	15.78	2.35E-04	7.13E-04	1.67E-03	1.73E-01	1.90E-05	9.52E-05	0.00E+00	2.12E-05
2005	Annual	Mon-Sun	2270002066	Tractors/Loaders/Backhoes	D	25	Construction and Mining Equipment	U	P	NHH	NP	Los Angeles	SC	SC	2002	7.76	20.03	14.47	2.15E-04	6.54E-04	1.53E-03	1.59E-01	1.75E-05	8.73E-05	0.00E+00	1.94E-05
2005	Annual	Mon-Sun	2270002066	Tractors/Loaders/Backhoes	D	25	Construction and Mining Equipment	U	P	NHH	NP	Los Angeles	SC	SC	2001	6.37	16.46	11.89	1.77E-04	5.37E-04	1.26E-03	1.30E-01	1.43E-05	7.17E-05	0.00E+00	1.59E-05
2005	Annual	Mon-Sun	2270002066	Tractors/Loaders/Backhoes	D	25	Construction and Mining Equipment	U	P	NHH	NP	Los Angeles	SC	SC	2000	6.69	17.28	12.48	1.86E-04	5.64E-04	1.32E-03	1.37E-01	1.51E-05	7.53E-05	0.00E+00	1.67E-05
2005	Annual	Mon-Sun	2270002066	Tractors/Loaders/Backhoes	D	25	Construction and Mining Equipment	U	P	NHH	NP	Los Angeles	SC	SC	1999	6.46	16.68	12.26	5.15E-04	1.16E-03	1.53E-03	1.32E-01	1.45E-05	1.45E-04	0.00E+00	4.64E-05
2005	Annual	Mon-Sun	2270002066	Tractors/Loaders/Backhoes	D	25	Construction and Mining Equipment	U	P	NHH	NP	Los Angeles	SC	SC	1998	6.2	16.02	11.77	4.94E-04	1.12E-03	1.47E-03	1.27E-01	1.40E-05	1.40E-04	0.00E+00	4.46E-05
2005	Annual	Mon-Sun	2270002066	Tractors/Loaders/Backhoes	D	25	Construction and Mining Equipment	U	P	NHH	NP	Los Angeles	SC	SC	1997	2.64	6.82	5.01	2.10E-04	4.75E-04	6.24E-04	5.40E-02	5.94E-06	5.94E-05	0.00E+00	1.90E-05
2005	Annual	Mon-Sun	2270002066	Tractors/Loaders/Backhoes	D	25	Construction and Mining Equipment	U	P	NHH	NP	Los Angeles	SC	SC	1996	1.9	4.92	3.61	1.52E-04	3.43E-04	4.50E-04	3.90E-02	4.28E-06	4.28E-05	0.00E+00	1.37E-05
2005	Annual	Mon-Sun	2270002066	Tractors/Loaders/Backhoes	D	25	Construction and Mining Equipment	U	P	NHH	NP	Los Angeles	SC	SC	1995	1.4	3.62	2.66	1.12E-04	2.52E-04	3.31E-04	2.87E-02	3.15E-06	3.15E-05	0.00E+00	1.01E-05
2005	Annual	Mon-Sun	2270002066	Tractors/Loaders/Backhoes	D	25	Construction and Mining Equipment	U	P	NHH	NP	Los Angeles	SC	SC	1994	0.96	2.49	1.83	7.68E-05	1.74E-04	2.23E-04	1.97E-02	2.17E-06	1.98E-05	0.00E+00	6.93E-06
2005	Annual	Mon-Sun	2270002066	Tractors/Loaders/Backhoes	D	25	Construction and Mining Equipment	U	P	NHH	NP	Los Angeles	SC	SC	1993	0.53	1.37	1	4.22E-05	9.52E-05	1.23E-04	1.08E-02	1.19E-06	1.09E-05	0.00E+00	3.80E-06
2005	Annual	Mon-Sun	2270002066	Tractors/Loaders/Backhoes	D	25	Construction and Mining Equipment	U	P	NHH	NP	Los Angeles	SC	SC	1992	0.35	0.9	0.66	2.78E-05	6.28E-05	8.08E-05	7.14E-03	7.85E-07	7.16E-06	0.00E+00	2.51E-06
2005	Annual	Mon-Sun	2270002066	Tractors/Loaders/Backhoes	D	25	Construction and Mining Equipment	U	P	NHH	NP	Los Angeles	SC	SC	1991	0.19	0.5	0.37	1.53E-05	3.46E-05	4.46E-05	3.94E-03	4.33E-07	3.95E-06	0.00E+00	1.38E-06
2005	Annual	Mon-Sun	2270002066	Tractors/Loaders/Backhoes	D	25	Construction and Mining Equipment	U	P	NHH	NP	Los Angeles	SC	SC	1990	0.08	0.19	0.14	5.98E-06	1.35E-05	1.74E-05	1.54E-03	1.69E-07	1.54E-06	0.00E+00	5.40E-07
2005	Annual	Mon-Sun	2270002066	Tractors/Loaders/Backhoes	D	50	Construction and Mining Equipment	U	P	NHH	NP	Los Angeles	SC	SC	2005	26.42	114.27	158.15	1.76E-03	1.06E-02	1.47E-02	1.73E+00	1.94E-04	1.07E-03	0.00E+00	1.58E-04
2005	Annual	Mon-Sun	2270002066	Tractors/Loaders/Backhoes	D	50	Construction and Mining Equipment	U	P	NHH	NP	Los Angeles	SC	SC	2004	25.58	105.7	147.22	3.20E-03	1.21E-02	1.44E-02	1.60E+00	1.80E-04	1.24E-03	0.00E+00	2.88E-04
2005	Annual	Mon-Sun	2270002066	Tractors/Loaders/Backhoes	D	50	Construction and Mining Equipment	U	P	NHH	NP	Los Angeles	SC	SC	2003	24.87	97.93	138.61	7.18E-03	1.57E-02	1.49E-02	1.48E+00	1.66E-04	1.74E-03	0.00E+00	6.48E-04
2005	Annual	Mon-Sun	2270002066	Tractors/Loaders/Backhoes	D	50	Construction and Mining Equipment	U	P	NHH	NP	Los Angeles	SC	SC	2002	24.49	91.7	130.27	7.47E-03	1.61E-02	1.43E-02	1.39E+00	1.56E-04	1.76E-03	0.00E+00	6.74E-04
2005	Annual	Mon-Sun	2270002066	Tractors/Loaders/Backhoes	D	50	Construction and Mining Equipment	U	P	NHH	NP	Los Angeles	SC	SC	2001	21.44	76.12	108.52	6.79E-03	1.45E-02	1.21E-02	1.15E+00	1.29E-04	1.56E-03	0.00E+00	6.12E-04
2005	Annual	Mon-Sun	2270002066	Tractors/Loaders/Backhoes	D	50	Construction and Mining Equipment	U	P	NHH	NP	Los Angeles	SC	SC	2000	23.05	77.38	110.68	7.46E-03	1.58E-02	1.26E-02	1.17E+00	1.31E-04	1.68E-03	0.00E+00	6.73E-04
2005	Annual	Mon-Sun	2270002066	Tractors/Loaders/Backhoes	D	50	Construction and Mining Equipment	U	P	NHH	NP	Los Angeles	SC	SC	1999	22.36	70.74	101.49	7.30E-03	1.53E-02	1.17E-02	1.07E+00	1.20E-04	1.62E-03	0.00E+00	6.59E-04
2005	Annual	Mon-Sun	2270002066	Tractors/Loaders/Backhoes	D	50	Construction and Mining Equipment	U	P	NHH	NP	Los Angeles	SC	SC	1998	21.58	64.1	93.32	8.74E-03	1.79E-02	1.27E-02	9.72E-01	1.09E-04	1.78E-03	0.00E+00	7.88E-04
2005	Annual	Mon-Sun	2270002066	Tractors/Loaders/Backhoes	D	50	Construction and Mining Equipment	U	P	NHH	NP	Los Angeles	SC	SC	1997	20.67	57.4	83.85	8.25E-03	1.68E-02	1.16E-02	8.70E-01	9.75E-05	1.66E-03	0.00E+00	7.45E-04
2005	Annual	Mon-Sun	2270002066	Tractors/Loaders/Backhoes	D	50	Construction and Mining Equipment	U	P	NHH	NP	Los Angeles	SC	SC	1996	19.77	51.05	74.66	7.47E-03	1.52E-02	1.03E-02	7.74E-01	8.67E-05	1.50E-03	0.00E+00	6.74E-04
2005	Annual	Mon-Sun	2270002066	Tractors/Loaders/Backhoes	D	50	Construction and Mining Equipment	U	P	NHH	NP	Los Angeles	SC	SC	1995	18.87	45.08	65.92	6.60E-03	1.34E-02	9.11E-03	6.83E-01	7.66E-05	1.32E-03	0.00E+00	5.95E-04
2005	Annual	Mon-Sun	2270002066	Tractors/Loaders/Backhoes	D	50	Construction and Mining Equipment	U	P	NHH	NP	Los Angeles	SC	SC	1994	18.32	40.24	58.84	5.89E-03	1.20E-02	8.13E-03	6.10E-01	6.83E-05	1.18E-03	0.00E+00	5.31E-04
2005	Annual	Mon-Sun	2270002066	Tractors/Loaders/Backhoes	D	50	Construction and Mining Equipment	U	P	NHH	NP	Los Angeles	SC	SC	1993	17.91	35.86	52.44	5.25E-03	1.07E-02	7.25E-03	5.44E-01	6.09E-05	1.05E-03	0.00E+00	4.73E-04
2005	Annual	Mon-Sun	2270002066	Tractors/Loaders/Backhoes	D	50	Construction and Mining Equipment	U	P	NHH	NP	Los Angeles	SC	SC	1992	17.7	32.02	46.83	4.68E-03	9.53E-03	6.47E-03	4.85E-01	5.44E-05	9.40E-04	0.00E+00	4.23E-04
2005	Annual	Mon-Sun	2270002066	Tractors/Loaders/Backhoes	D	50	Construction and Mining Equipment	U	P	NHH	NP	Los Angeles	SC	SC	1991	17.41	28.12	41.12	4.11E-03	8.37E-03	5.68E-03	4.26E-01	4.78E-05	8.25E-04	0.00E+00	3.71E-04
2005	Annual	Mon-Sun	2270002066	Tractors/Loaders/Backhoes	D	50	Construction and Mining Equipment	U	P	NHH	NP	Los Angeles	SC	SC	1990	16.86	23.97	35.05	3.51E-03	7.13E-03	4.85E-03	3.63E-01	4.07E-05	7.03E-04	0.00E+00	3.16E-04
2005	Annual	Mon-Sun	2270002066	Tractors/Loaders/Backhoes	D	50	Construction and Mining Equipment	U	P	NHH	NP	Los Angeles	SC	SC	1989	14.75	18.11	26.49	2.65E-03	5.39E-03	3.66E-03	2.75E-01	3.08E-05	5.32E-04	0.00E+00	2.39E-04
2005	Annual	Mon-Sun	2270002066	Tractors/Loaders/Backhoes	D	50	Construction and Mining Equipment	U	P	NHH	NP	Los Angeles	SC	SC	1988	11.81	12.22	17.86	1.79E-03	3.64E-03	2.47E-03	1.85E-01	2.07E-05	3.59E-04	0.00E+00	1.61E-04
2005	Annual	Mon-Sun	2270002066	Tractors/Loaders/Backhoes	D	50	Construction and Mining Equipment	U	P	NHH	NP	Los Angeles	SC	SC	1987	8.42	7.08	10.37	1.06E-03	2.11E-03	1.45E-03	1.07E-01	1.20E-05	2.08E-04	0.00E+00	9.56E-05
2005	Annual	Mon-Sun	2270002066	Tractors/Loaders/Backhoes	D	50	Construction and Mining Equipment	U	P	NHH	NP	Los Angeles	SC	SC	1986	5.67	4.77	6.97	7.12E-04	1.42E-03	9.76E-04	7.22E-02	8.09E-06	1.40E-04	0.00E+00	6.43E-05
2005	Annual	Mon-Sun	2270002066	Tractors/Loaders/Backhoes	D	50	Construction and Mining Equipment	U	P	NHH	NP	Los Angeles	SC	SC	1985	4.04	3.4	4.97	5.08E-04	1.01E-03	6.96E-04	5.15E-02	5.77E-06	9.97E-05	0.00E+00	4.58E-05
2005	Annual	Mon-Sun	2270002066	Tractors/Loaders/Backhoes	D	50	Construction and Mining Equipment	U	P	NHH	NP	Los Angeles	SC	SC	1984	3.51	2.95	4.32	4.41E-04	8.79E-04	6.05E-04	4.48E-02	5.01E-06	8.66E-05	0.00E+00	3.98E-05
2005	Annual	Mon-Sun	2270002066	Tractors/Loaders/Backhoes	D	50	Construction and Mining Equipment	U	P	NHH	NP	Los Angeles	SC	SC	1983	3.33	2.8	4.1	4.19E-04	8.34E-04	5.74E-04	4.25E-02	4.76E-06	8.22E-05	0.00E+00	3.78E-05
2005	Annual	Mon-Sun	2270002066	Tractors/Loaders/Backhoes	D	50	Construction and Mining Equipment	U	P	NHH	NP	Los Angeles	SC	SC	1982	3.41	2.87	4.2	4.29E-04	8.54E-04	5.88E-04	4.35E-02	4.87E-06	8.42E-05	0.00E+00	3.87E-05
2005	Annual	Mon-Sun	2270002066	Tractors/Loaders/Backhoes	D	50	Construction and Mining Equipment	U	P	NHH	NP	Los Angeles	SC	SC	1981	3.47	2.92	4.28	4.37E-04	8.69E-04	5.99E-04	4.43E-02	4.96E-06	8.57E-05	0.00E+00	3.94E-05
2005	Annual	Mon-Sun	2270002066	Tractors/Loaders/Backhoes	D	50	Construction and Mining Equipment	U	P	NHH	NP	Los Angeles	SC	SC	1980	3.31	2.79	4.08	4.17E-04	8.29E-04	5.71E-04	4.23E-02	4.73E-06	8.18E-05	0.00E+00	3.76E-05
2005	Annual	Mon-Sun	2270002066	Tractors/Loaders/Backhoes	D	50	Construction and Mining Equipment	U	P	NHH	NP	Los Angeles	SC	SC	1979	2.65	2.22	3.26	3.33E-04	6.62E-04	4.56E-04	3.37E-02	3.78E-06	6.53E-05	0.00E+00	3.00E-05
2005	Annual	Mon-Sun	2270002066	Tractors/Loaders/Backhoes	D	50	Construction and Mining Equipment	U	P	NHH	NP	Los Angeles	SC	SC	1978	2.03	1.71	2.5	2.55E-04	5.07E-04	3.49E-04	2.58E-02	2.90E-06	5.00E-05	0.00E+00	2.30E-05
2005	Annual	Mon-Sun	2270002066	Tractors/Loaders/Backhoes	D	50	Construction and Mining Equipment	U	P	NHH	NP	Los Angeles	SC	SC	1977	1.58	1.33	1.94	1.98E-04	3.95E-04	2.72E-04	2.01E-02	2.25E-06	3.89E-05	0.00E+00	1.79E-05
2005	Annual	Mon-Sun	2270002066	Tractors/Loaders/Backhoes	D	50	Construction and Mining Equipment	U	P	NHH	NP	Los Angeles	SC	SC	1976	1.27	1.06	1.56	1.59E-04	3.17E-04	2.18E-04	1.61E-02	1.81E-06	3.12E-05	0.00E+00	1.44E-05
2005	Annual	Mon-Sun	2270002066	Tractors/Loaders/Backhoes	D	50	Construction and Mining Equipment	U	P	NHH	NP	Los Angeles	SC	SC	1975	0.99	0.83	1.22	1.25E-04	2.48E-04	1.71E-04	1.26E-02	1.42E-06	2.45E-05	0.00E+00	1.12E-05
2005	Annual	Mon-Sun	2270002066	Tractors/Loaders/Backhoes	D	50	Construction and Mining Equipment	U	P	NHH	NP	Los Angeles	SC	SC	1974	0.71	0.6	0.88	8.97E-05	1.78E-04	1.23E-04	9.09E-03	1.02E-06	1.76E-05	0.00E+00	8.09E-06
2005	Annual	Mon-Sun	2270002066	Tractors/Loaders/Backhoes	D	50	Construction and Mining Equipment	U	P	NHH	NP	Los Angeles	SC	SC	1973	0.53	0.45	0.66	6.72E-05	1.34E-04	9.21E-05	6.81E-03	7.63E-07	1.32E-05	0.00E+00	6.06E-06
2005	Annual	Mon-Sun	2270002066	Tractors/Loaders/Backhoes	D	50	Construction and Mining Equipment	U	P	NHH	NP	Los Angeles	SC	SC	1972	0.36	0.3	0.44	4.51E-05	8.97E-05	6.18E-05	4.57E-03	5.12E-07	8.85E-06	0.00E+00	4.07E-06
2005	Annual	Mon-Sun	2270002066	Tractors/Loaders/Backhoes	D	50	Construction and Mining Equipment	U	P	NHH	NP	Los Angeles	SC	SC	1971	0.19	0.16	0.23	2.38E-05	4.74E-05	3.27E-05	2.42E-03	2.71E-07	4.68E-06	0.00E+00	2.15E-06
2005	Annual	Mon-Sun	2270002066	Tractors/Loaders/Backhoes	D	50	Construction and Mining Equipment	U	P	NHH	NP	Los Angeles	SC	SC	1970	0.07	0.06	0.08	8.32E-06	1.66E-05	1.14E-05	8.44E-04	9.45E-08	1.63E-06	0.00E+00	7.51E-07
2005	Annual	Mon-Sun	2270002066	Tractors/Loaders/Backhoes	D	120	Construction and Mining Equipment	U	P	NHH	NP	Los Angeles	SC	SC	2005	353.38	1528.43	3598.97	2.73E-02	2.27E-01	3.53E-01	3.95E+01	4.02E-03	1.85E-02	0.00E+00	2.46E-03
2005	Annual	Mon-Sun	2270002066	Tractors/Loaders/Backhoes	D	120	Construction and Mining Equipment	U	P	NHH	NP	Los Angeles	SC	SC	2004	342.21	1413.87	3338.13	4.35E-02	2.25E-01	3.63E-01	3.65E+01	3.71E-03	2.53E-02	0.00E+00	3.93E-03
2005	Annual	Mon-Sun	2270002066	Tractors/Loaders/Backhoes	D	120	Construction and Mining Equipment	U	P	NHH	NP	Los Angeles	SC	SC	2003	332.63	1309.92	3113.32	8.58E-02	2.33E-01	4.30E-01	3.38E+01	3.44E-03	4.49E-02	0.00E+00	7.74E-03
2005	Annual	Mon-Sun	2270002066	Tractors/Loaders/Backhoes	D	120	Construction and Mining Equipment	U	P	NHH	NP	Los Angeles	SC	SC	2002	327.57	1226.59	2917.82	8.45E-02	2.25E-01	4.15E-01	3.17E+01	3.22E-03	4.52E-02	0.00E+00	7.62E-03
2005	Annual	Mon-Sun	2270002066	Tractors/Loaders/Backhoes	D	120	Construction and Mining Equipment	U	P	NHH	NP	Los Angeles	SC	SC	2001	286.75	1018.21	2424.16	7.34E-02	1.92E-01	3.53E-01	2.63E+01	2.67E-03	4.00E-02	0.00E+00	6.63E-03
2005	Annual	Mon-Sun	2270002066	Tractors/Loaders/Backhoes	D	120	Construction and Mining Equipment	U	P	NHH	NP	Los Angeles	SC	SC	2000	308.3	1035.07	2466.26	7.78E-02	2.01E-01	3.68E-01	2.67E+01	2.72E-03	4.30E-02	0.00E+00	7.02E-03
2005	Annual	Mon-Sun	2270002066	Tractors/Loaders/Backhoes	D	120	Construction and Mining Equipment	U	P	NHH	NP	Los Angeles	SC	SC	1999	299.07	946.19	2256.16	7.39E-02	1.88E-01	3.44E-01	2.45E+01	2.49E-03	4.14E-02	0.00E+00	6.67E-03
2005	Annual	Mon-Sun	2270002066	Tractors/Loaders/Backhoes	D	120	Construction and Mining Equipment	U	P	NHH	NP	Los Angeles	SC	SC	1998	288.66	857.38	2045.82	6.93E-02	1.74E-01	3.18E-01	2.22E+01	2.25E-03	3.92E-02	0.00E+00	6.25E-03
2005	Annual	Mon-Sun	2270002066	Tractors/Loaders/Backhoes	D	120	Construction and Mining Equipment	U	P	NHH	NP	Los Angeles	SC	SC	1997	276.52	767.8	1833.25	6.40E-02	1.59E-01	3.61E-01	1.98E+01	2.02E-03	3.34E-02	0.00E+00	5.77E-03
2005	Annual	Mon-Sun	2270002066	Tractors/Loaders/Backhoes	D	120	Construction and Mining Equipment	U	P	NHH	NP	Los Angeles	SC	SC	1996	264.37	682.89	1630.89	5.75E-02	1.43E-01	3.23E-01	1.76E+01	1.79E-03	3.01E-02	0.00E+00	5.19E-03
2005	Annual	Mon-Sun	2270002066	Tractors/Loaders/Backhoes	D	120	Construction and Mining Equipment	U	P	NHH	NP	Los Angeles	SC	SC	1995	252.34	602.96	1440	5.08E-02	1.26E-01	2.85E-01	1.56E+01	1.58E-03	2.66E-02	0.00E+00	4.58E-03
2005	Annual	Mon-Sun	2270002066	Tractors/Loaders/Backhoes	D	120	Construction and Mining Equipment	U	P	NHH	NP	Los Angeles	SC	SC	1994	245.09	538.2	1285.33	4.53E-02	1.13E-01	2.54E-01	1.39E+01	1.41E-03	2.37E-02	0.00E+00	4.09E-03
2005	Annual	Mon-Sun	2270002066	Tractors/Loaders/Backhoes	D	120	Construction and Mining Equipment	U	P	NHH	NP	Los Angeles	SC	SC	1993	239.53	479.62	1145.44	4.04E-02	1.00E-01	2.27E-01	1.24E+01	1.26E-03	2.11E-02	0.00E+00	3.64E-03
2005	Annual	Mon-Sun	2270002066	Tractors/Loaders/Backhoes	D	120	Construction and Mining Equipment	U	P	NHH	NP	Los Angeles	SC	SC	1992	236.79	428.3	1022.88	3.61E-02	8.95E-02	2.02E-01	1.11E+01	1.13E-03	1.89E-02	0.00E+00	3.25E-03
2005	Annual	Mon-Sun	2270002066	Tractors/Loaders/Backhoes	D	120	Construction and Mining Equipment	U	P	NHH	NP	Los Angeles	SC	SC	1991	232.86	376.11	898.23	3.17E-02	7.86E-02	1.78E-01	9.72E+00	9.88E-04	1.66E-02	0.00E+00	2.86E-03
2005	Annual	Mon-Sun	2270002066	Tractors/Loaders/Backhoes	D	120	Construction and Mining Equipment	U	P	NHH	NP	Los Angeles	SC	SC	1990	225.51	320.6	765.66	2.70E-02	6.70E-02	1.51E-01	8.28E+00	8.42E-04	1.41E-02	0.00E+00	2.44E-03
2005	Annual	Mon-Sun	2270002066	Tractors/Loaders/Backhoes	D	120	Construction and Mining Equipment	U	P	NHH	NP	Los Angeles	SC	SC	1989	197.27	242.27	578.59	2.04E-02	5.06E-02	1.14E-01	6.26E+00	6.36E-04	1.07E-02	0.00E+00	1.84E-03
2005	Annual	Mon-Sun	2270002066	Tractors/Loaders/Backhoes	D	120	Construction and Mining Equipment	U	P	NHH	NP	Los Angeles	SC	SC	1988	157.95	163.4	390.24	1.38E-02	3.42E-02	7.72E-02	4.22E+00	4.29E-04	7.20E-03	0.00E+00	1.24E-03
2005	Annual	Mon-Sun	2270002066	Tractors/Loaders/Backhoes	D	120	Construction and Mining Equipment	U	P	NHH	NP	Los Angeles	SC	SC	1987	112.66	94.74	228.67	1.16E-02	2.72E-02	6.66E-02	2.45E+00	2.49E-04	5.08E-03	0.00E+00	1.05E-03
2005	Annual	Mon-Sun	2270002066	Tractors/Loaders/Backhoes	D	120	Construction and Mining Equipment	U	P	NHH	NP	Los Angeles	SC	SC	1986	75.79	63.74	153.85	7.81E-03	1.83E-02	4.48E-02	1.65E+00	1.67E-04	3.42E-03	0.00E+00	7.04E-04
2005	Annual	Mon-Sun	2270002066	Tractors/Loaders/Backhoes	D	120	Construction and Mining Equipment	U	P	NHH	NP	Los Angeles	SC	SC	1985	54.04	45.45	109.7	5.57E-03	1.31E-02	3.19E-02	1.17E+00	1.19E-04	2.44E-03	0.00E+00	5.02E-04

OFFROAD Output for Heavy Equipment

CY	Season	AvgDays	Code	Equipment	Fuel	MaxHP	Class	C/R	Pre	Hand	Port	County	Air Basin	Air Dist.	MY	Population	Activity	Consumption	ROG Exhaust	CO Exhaust	NOX Exhaust	CO2 Exhaust	SO2 Exhaust	PM Exhaust	N2O Exhaust	CH4 Exhaust
2005	Annual	Mon-Sun	2270002066	Tractors/Loaders/Backhoes	D	120	Construction and Mining Equipment	U	P	NHH	NP	Los Angeles	SC	SC	1984	46.95	39.49	95.31	4.84E-03	1.14E-02	2.77E-02	1.02E+00	1.04E-04	2.12E-03	0.00E+00	4.36E-04
2005	Annual	Mon-Sun	2270002066	Tractors/Loaders/Backhoes	D	120	Construction and Mining Equipment	U	P	NHH	NP	Los Angeles	SC	SC	1983	44.56	37.47	90.45	4.59E-03	1.08E-02	2.63E-02	9.68E-01	9.84E-05	2.01E-03	0.00E+00	4.14E-04
2005	Annual	Mon-Sun	2270002066	Tractors/Loaders/Backhoes	D	120	Construction and Mining Equipment	U	P	NHH	NP	Los Angeles	SC	SC	1982	45.63	38.37	92.61	4.70E-03	1.10E-02	2.70E-02	9.91E-01	1.01E-04	2.06E-03	0.00E+00	4.24E-04
2005	Annual	Mon-Sun	2270002066	Tractors/Loaders/Backhoes	D	120	Construction and Mining Equipment	U	P	NHH	NP	Los Angeles	SC	SC	1981	46.47	39.08	94.33	4.79E-03	1.12E-02	2.75E-02	1.01E+00	1.03E-04	2.10E-03	0.00E+00	4.32E-04
2005	Annual	Mon-Sun	2270002066	Tractors/Loaders/Backhoes	D	120	Construction and Mining Equipment	U	P	NHH	NP	Los Angeles	SC	SC	1980	44.33	37.28	89.98	4.57E-03	1.07E-02	2.62E-02	9.63E-01	9.79E-05	2.00E-03	0.00E+00	4.12E-04
2005	Annual	Mon-Sun	2270002066	Tractors/Loaders/Backhoes	D	120	Construction and Mining Equipment	U	P	NHH	NP	Los Angeles	SC	SC	1979	35.39	29.76	71.83	3.64E-03	8.56E-03	2.09E-02	7.69E-01	7.82E-05	1.60E-03	0.00E+00	3.29E-04
2005	Annual	Mon-Sun	2270002066	Tractors/Loaders/Backhoes	D	120	Construction and Mining Equipment	U	P	NHH	NP	Los Angeles	SC	SC	1978	27.12	22.81	55.05	2.79E-03	6.56E-03	1.60E-02	5.89E-01	5.99E-05	1.22E-03	0.00E+00	2.52E-04
2005	Annual	Mon-Sun	2270002066	Tractors/Loaders/Backhoes	D	120	Construction and Mining Equipment	U	P	NHH	NP	Los Angeles	SC	SC	1977	21.09	17.74	42.81	2.17E-03	5.10E-03	1.25E-02	4.58E-01	4.66E-05	9.52E-04	0.00E+00	1.96E-04
2005	Annual	Mon-Sun	2270002066	Tractors/Loaders/Backhoes	D	120	Construction and Mining Equipment	U	P	NHH	NP	Los Angeles	SC	SC	1976	16.93	14.23	34.36	1.74E-03	4.09E-03	1.00E-02	3.68E-01	3.74E-05	7.64E-04	0.00E+00	1.57E-04
2005	Annual	Mon-Sun	2270002066	Tractors/Loaders/Backhoes	D	120	Construction and Mining Equipment	U	P	NHH	NP	Los Angeles	SC	SC	1975	13.25	11.15	26.9	1.36E-03	3.21E-03	7.83E-03	2.88E-01	2.93E-05	5.98E-04	0.00E+00	1.23E-04
2005	Annual	Mon-Sun	2270002066	Tractors/Loaders/Backhoes	D	120	Construction and Mining Equipment	U	P	NHH	NP	Los Angeles	SC	SC	1974	9.54	8.02	19.36	9.82E-04	2.31E-03	5.63E-03	2.07E-01	2.11E-05	4.30E-04	0.00E+00	8.86E-05
2005	Annual	Mon-Sun	2270002066	Tractors/Loaders/Backhoes	D	120	Construction and Mining Equipment	U	P	NHH	NP	Los Angeles	SC	SC	1973	7.14	6.01	14.5	7.36E-04	1.73E-03	4.22E-03	1.55E-01	1.58E-05	3.22E-04	0.00E+00	6.64E-05
2005	Annual	Mon-Sun	2270002066	Tractors/Loaders/Backhoes	D	120	Construction and Mining Equipment	U	P	NHH	NP	Los Angeles	SC	SC	1972	4.8	4.03	9.73	4.94E-04	1.16E-03	2.83E-03	1.04E-01	1.06E-05	2.16E-04	0.00E+00	4.46E-05
2005	Annual	Mon-Sun	2270002066	Tractors/Loaders/Backhoes	D	120	Construction and Mining Equipment	U	P	NHH	NP	Los Angeles	SC	SC	1971	2.53	2.13	5.14	2.61E-04	6.13E-04	1.50E-03	5.51E-02	5.60E-06	1.14E-04	0.00E+00	2.36E-05
2005	Annual	Mon-Sun	2270002066	Tractors/Loaders/Backhoes	D	120	Construction and Mining Equipment	U	P	NHH	NP	Los Angeles	SC	SC	1970	0.89	0.74	1.8	9.12E-05	2.14E-04	5.23E-04	1.92E-02	1.96E-06	3.99E-05	0.00E+00	8.23E-06
2005	Annual	Mon-Sun	2270002066	Tractors/Loaders/Backhoes	D	175	Construction and Mining Equipment	U	P	NHH	NP	Los Angeles	SC	SC	2005	26.37	114.07	525.2	2.45E-03	2.86E-02	4.38E-02	5.78E+00	5.63E-04	1.49E-03	0.00E+00	2.21E-04
2005	Annual	Mon-Sun	2270002066	Tractors/Loaders/Backhoes	D	175	Construction and Mining Equipment	U	P	NHH	NP	Los Angeles	SC	SC	2004	25.54	105.52	486.4	3.41E-03	2.75E-02	4.41E-02	5.34E+00	5.21E-04	1.79E-03	0.00E+00	3.07E-04
2005	Annual	Mon-Sun	2270002066	Tractors/Loaders/Backhoes	D	175	Construction and Mining Equipment	U	P	NHH	NP	Los Angeles	SC	SC	2003	24.82	97.76	451.38	4.78E-03	2.63E-02	4.70E-02	4.95E+00	4.83E-04	2.27E-03	0.00E+00	4.31E-04
2005	Annual	Mon-Sun	2270002066	Tractors/Loaders/Backhoes	D	175	Construction and Mining Equipment	U	P	NHH	NP	Los Angeles	SC	SC	2002	24.45	91.54	424.29	8.49E-03	2.55E-02	6.06E-02	4.64E+00	4.52E-04	3.64E-03	0.00E+00	7.66E-04
2005	Annual	Mon-Sun	2270002066	Tractors/Loaders/Backhoes	D	175	Construction and Mining Equipment	U	P	NHH	NP	Los Angeles	SC	SC	2001	21.4	75.99	352.42	7.38E-03	2.18E-02	5.17E-02	3.85E+00	3.75E-04	3.22E-03	0.00E+00	6.66E-04
2005	Annual	Mon-Sun	2270002066	Tractors/Loaders/Backhoes	D	175	Construction and Mining Equipment	U	P	NHH	NP	Los Angeles	SC	SC	2000	23.01	77.25	358.47	7.82E-03	2.27E-02	5.38E-02	3.91E+00	3.82E-04	3.46E-03	0.00E+00	7.06E-04
2005	Annual	Mon-Sun	2270002066	Tractors/Loaders/Backhoes	D	175	Construction and Mining Equipment	U	P	NHH	NP	Los Angeles	SC	SC	1999	22.32	70.61	327.86	7.43E-03	2.13E-02	5.03E-02	3.58E+00	3.49E-04	3.33E-03	0.00E+00	6.70E-04
2005	Annual	Mon-Sun	2270002066	Tractors/Loaders/Backhoes	D	175	Construction and Mining Equipment	U	P	NHH	NP	Los Angeles	SC	SC	1998	21.54	63.99	297.24	6.96E-03	1.97E-02	4.65E-02	3.24E+00	3.16E-04	3.16E-03	0.00E+00	6.28E-04
2005	Annual	Mon-Sun	2270002066	Tractors/Loaders/Backhoes	D	175	Construction and Mining Equipment	U	P	NHH	NP	Los Angeles	SC	SC	1997	20.64	57.3	266.31	6.43E-03	1.80E-02	4.24E-02	2.90E+00	2.83E-04	2.95E-03	0.00E+00	5.80E-04
2005	Annual	Mon-Sun	2270002066	Tractors/Loaders/Backhoes	D	175	Construction and Mining Equipment	U	P	NHH	NP	Los Angeles	SC	SC	1996	19.73	50.96	236.9	5.78E-03	1.62E-02	4.41E-02	2.58E+00	2.52E-04	2.42E-03	0.00E+00	5.22E-04
2005	Annual	Mon-Sun	2270002066	Tractors/Loaders/Backhoes	D	175	Construction and Mining Equipment	U	P	NHH	NP	Los Angeles	SC	SC	1995	18.83	45	209.17	5.10E-03	1.43E-02	3.89E-02	2.28E+00	2.22E-04	2.14E-03	0.00E+00	4.60E-04
2005	Annual	Mon-Sun	2270002066	Tractors/Loaders/Backhoes	D	175	Construction and Mining Equipment	U	P	NHH	NP	Los Angeles	SC	SC	1994	18.29	40.17	186.7	4.56E-03	1.27E-02	3.47E-02	2.03E+00	1.98E-04	1.91E-03	0.00E+00	4.11E-04
2005	Annual	Mon-Sun	2270002066	Tractors/Loaders/Backhoes	D	175	Construction and Mining Equipment	U	P	NHH	NP	Los Angeles	SC	SC	1993	17.88	35.79	166.38	4.06E-03	1.13E-02	3.10E-02	1.81E+00	1.77E-04	1.70E-03	0.00E+00	3.66E-04
2005	Annual	Mon-Sun	2270002066	Tractors/Loaders/Backhoes	D	175	Construction and Mining Equipment	U	P	NHH	NP	Los Angeles	SC	SC	1992	17.67	31.96	148.58	3.63E-03	1.01E-02	2.77E-02	1.62E+00	1.58E-04	1.52E-03	0.00E+00	3.27E-04
2005	Annual	Mon-Sun	2270002066	Tractors/Loaders/Backhoes	D	175	Construction and Mining Equipment	U	P	NHH	NP	Los Angeles	SC	SC	1991	17.38	28.07	130.47	3.18E-03	8.90E-03	2.43E-02	1.42E+00	1.39E-04	1.33E-03	0.00E+00	2.87E-04
2005	Annual	Mon-Sun	2270002066	Tractors/Loaders/Backhoes	D	175	Construction and Mining Equipment	U	P	NHH	NP	Los Angeles	SC	SC	1990	16.83	23.93	111.22	2.71E-03	7.58E-03	2.07E-02	1.21E+00	1.18E-04	1.14E-03	0.00E+00	2.45E-04
2005	Annual	Mon-Sun	2270002066	Tractors/Loaders/Backhoes	D	175	Construction and Mining Equipment	U	P	NHH	NP	Los Angeles	SC	SC	1989	14.72	18.08	84.04	2.05E-03	5.73E-03	1.56E-02	9.16E-01	8.93E-05	8.59E-04	0.00E+00	1.85E-04
2005	Annual	Mon-Sun	2270002066	Tractors/Loaders/Backhoes	D	175	Construction and Mining Equipment	U	P	NHH	NP	Los Angeles	SC	SC	1988	11.79	12.19	56.68	1.38E-03	3.87E-03	1.06E-02	6.18E-01	6.02E-05	5.80E-04	0.00E+00	1.25E-04
2005	Annual	Mon-Sun	2270002066	Tractors/Loaders/Backhoes	D	175	Construction and Mining Equipment	U	P	NHH	NP	Los Angeles	SC	SC	1987	8.41	7.07	33.13	1.04E-03	3.49E-03	8.23E-03	3.58E-01	3.49E-05	4.87E-04	0.00E+00	9.36E-05
2005	Annual	Mon-Sun	2270002066	Tractors/Loaders/Backhoes	D	175	Construction and Mining Equipment	U	P	NHH	NP	Los Angeles	SC	SC	1986	5.66	4.76	22.29	6.98E-04	2.35E-03	5.54E-03	2.41E-01	2.35E-05	3.27E-04	0.00E+00	6.30E-05
2005	Annual	Mon-Sun	2270002066	Tractors/Loaders/Backhoes	D	175	Construction and Mining Equipment	U	P	NHH	NP	Los Angeles	SC	SC	1985	4.03	3.39	15.89	4.98E-04	1.67E-03	3.95E-03	1.72E-01	1.68E-05	2.34E-04	0.00E+00	4.49E-05
2005	Annual	Mon-Sun	2270002066	Tractors/Loaders/Backhoes	D	175	Construction and Mining Equipment	U	P	NHH	NP	Los Angeles	SC	SC	1984	3.5	2.95	13.82	4.62E-04	1.49E-03	3.43E-03	1.49E-01	1.46E-05	2.03E-04	0.00E+00	4.17E-05
2005	Annual	Mon-Sun	2270002066	Tractors/Loaders/Backhoes	D	175	Construction and Mining Equipment	U	P	NHH	NP	Los Angeles	SC	SC	1983	3.33	2.8	13.12	4.38E-04	1.41E-03	3.26E-03	1.42E-01	1.38E-05	1.93E-04	0.00E+00	3.95E-05
2005	Annual	Mon-Sun	2270002066	Tractors/Loaders/Backhoes	D	175	Construction and Mining Equipment	U	P	NHH	NP	Los Angeles	SC	SC	1982	3.41	2.86	13.43	4.49E-04	1.45E-03	3.33E-03	1.45E-01	1.41E-05	1.97E-04	0.00E+00	4.05E-05
2005	Annual	Mon-Sun	2270002066	Tractors/Loaders/Backhoes	D	175	Construction and Mining Equipment	U	P	NHH	NP	Los Angeles	SC	SC	1981	3.47	2.92	13.68	4.57E-04	1.47E-03	3.40E-03	1.48E-01	1.44E-05	2.01E-04	0.00E+00	4.12E-05
2005	Annual	Mon-Sun	2270002066	Tractors/Loaders/Backhoes	D	175	Construction and Mining Equipment	U	P	NHH	NP	Los Angeles	SC	SC	1980	3.31	2.78	13.05	4.36E-04	1.41E-03	3.24E-03	1.41E-01	1.37E-05	1.92E-04	0.00E+00	3.93E-05
2005	Annual	Mon-Sun	2270002066	Tractors/Loaders/Backhoes	D	175	Construction and Mining Equipment	U	P	NHH	NP	Los Angeles	SC	SC	1979	2.64	2.22	10.43	3.70E-04	1.15E-03	2.82E-03	1.12E-01	1.10E-05	1.53E-04	0.00E+00	3.34E-05
2005	Annual	Mon-Sun	2270002066	Tractors/Loaders/Backhoes	D	175	Construction and Mining Equipment	U	P	NHH	NP	Los Angeles	SC	SC	1978	2.02	1.7	7.99	2.84E-04	8.79E-04	2.16E-03	8.62E-02	8.41E-06	1.17E-04	0.00E+00	2.56E-05
2005	Annual	Mon-Sun	2270002066	Tractors/Loaders/Backhoes	D	175	Construction and Mining Equipment	U	P	NHH	NP	Los Angeles	SC	SC	1977	1.57	1.32	6.22	2.21E-04	6.83E-04	1.68E-03	6.70E-02	6.54E-06	9.11E-05	0.00E+00	1.99E-05
2005	Annual	Mon-Sun	2270002066	Tractors/Loaders/Backhoes	D	175	Construction and Mining Equipment	U	P	NHH	NP	Los Angeles	SC	SC	1976	1.26	1.06	4.99	1.77E-04	5.48E-04	1.35E-03	5.38E-02	5.25E-06	7.31E-05	0.00E+00	1.60E-05
2005	Annual	Mon-Sun	2270002066	Tractors/Loaders/Backhoes	D	175	Construction and Mining Equipment	U	P	NHH	NP	Los Angeles	SC	SC	1975	0.99	0.83	3.91	1.39E-04	4.29E-04	1.06E-03	4.21E-02	4.11E-06	5.73E-05	0.00E+00	1.25E-05
2005	Annual	Mon-Sun	2270002066	Tractors/Loaders/Backhoes	D	175	Construction and Mining Equipment	U	P	NHH	NP	Los Angeles	SC	SC	1974	0.71	0.6	2.81	9.98E-05	3.09E-04	7.61E-04	3.03E-02	2.96E-06	4.12E-05	0.00E+00	9.01E-06
2005	Annual	Mon-Sun	2270002066	Tractors/Loaders/Backhoes	D	175	Construction and Mining Equipment	U	P	NHH	NP	Los Angeles	SC	SC	1973	0.53	0.45	2.11	7.48E-05	2.31E-04	5.70E-04	2.27E-02	2.21E-06	3.09E-05	0.00E+00	6.75E-06
2005	Annual	Mon-Sun	2270002066	Tractors/Loaders/Backhoes	D	175	Construction and Mining Equipment	U	P	NHH	NP	Los Angeles	SC	SC	1972	0.36	0.3	1.41	5.02E-05	1.55E-04	3.83E-04	1.52E-02	1.49E-06	2.07E-05	0.00E+00	4.53E-06
2005	Annual	Mon-Sun	2270002066	Tractors/Loaders/Backhoes	D	175	Construction and Mining Equipment	U	P	NHH	NP	Los Angeles	SC	SC	1971	0.19	0.16	0.75	2.92E-05	8.21E-05	2.19E-04	8.06E-03	7.86E-07	1.31E-05	0.00E+00	2.63E-06
2005	Annual	Mon-Sun	2270002066	Tractors/Loaders/Backhoes	D	175	Construction and Mining Equipment	U	P	NHH	NP	Los Angeles	SC	SC	1970	0.07	0.06	0.26	1.02E-05	2.87E-05	7.65E-05	2.81E-03	2.74E-07	4.59E-06	0.00E+00	9.19E-07
2005	Annual	Mon-Sun	2270002066	Tractors/Loaders/Backhoes	D	250	Construction and Mining Equipment	U	N	NHH	NP	Los Angeles	SC	SC	2005	8.53	36.89	286.16	1.06E-03	5.34E-03	2.37E-02	3.16E+00	3.09E-04	5.45E-04	0.00E+00	9.54E-05
2005	Annual	Mon-Sun	2270002066	Tractors/Loaders/Backhoes	D	250	Construction and Mining Equipment	U	N	NHH	NP	Los Angeles	SC	SC	2004	8.26	34.13	264.86	1.31E-03	5.13E-03	2.35E-02	2.93E+00	2.86E-04	5.45E-04	0.00E+00	1.18E-04
2005	Annual	Mon-Sun	2270002066	Tractors/Loaders/Backhoes	D	250	Construction and Mining Equipment	U	N	NHH	NP	Los Angeles	SC	SC	2003	8.03	31.62	245.57	1.63E-03	4.92E-03	2.45E-02	2.71E+00	2.65E-04	5.86E-04	0.00E+00	1.47E-04
2005	Annual	Mon-Sun	2270002066	Tractors/Loaders/Backhoes	D	250	Construction and Mining Equipment	U	N	NHH	NP	Los Angeles	SC	SC	2002	7.91	29.61	230.22	2.19E-03	4.75E-03	3.01E-02	2.54E+00	2.48E-04	7.23E-04	0.00E+00	1.97E-04
2005	Annual	Mon-Sun	2270002066	Tractors/Loaders/Backhoes	D	250	Construction and Mining Equipment	U	N	NHH	NP	Los Angeles	SC	SC	2001	6.92	24.58	191.15	1.90E-03	4.06E-03	2.56E-02	2.11E+00	2.06E-04	6.32E-04	0.00E+00	1.72E-04
2005	Annual	Mon-Sun	2270002066	Tractors/Loaders/Backhoes	D	250	Construction and Mining Equipment	U	N	NHH	NP	Los Angeles	SC	SC	2000	7.44	24.98	194.37	2.02E-03	4.24E-03	2.67E-02	2.14E+00	2.09E-04	6.72E-04	0.00E+00	1.82E-04
2005	Annual	Mon-Sun	2270002066	Tractors/Loaders/Backhoes	D	250	Construction and Mining Equipment	U	N	NHH	NP	Los Angeles	SC	SC	1999	7.22	22.84	177.72	1.91E-03	3.97E-03	2.50E-02	1.96E+00	1.91E-04	6.41E-04	0.00E+00	1.73E-04
2005	Annual	Mon-Sun	2270002066	Tractors/Loaders/Backhoes	D	250	Construction and Mining Equipment	U	N	NHH	NP	Los Angeles	SC	SC	1998	6.97	20.69	161.07	1.79E-03	3.68E-03	2.31E-02	1.78E+00	1.73E-04	6.03E-04	0.00E+00	1.62E-04
2005	Annual	Mon-Sun	2270002066	Tractors/Loaders/Backhoes	D	250	Construction and Mining Equipment	U	N	NHH	NP	Los Angeles	SC	SC	1997	6.67	18.53	144.27	1.66E-03	3.37E-03	2.11E-02	1.59E+00	1.55E-04	5.58E-04	0.00E+00	1.50E-04
2005	Annual	Mon-Sun	2270002066	Tractors/Loaders/Backhoes	D	250	Construction and Mining Equipment	U	N	NHH	NP	Los Angeles	SC	SC	1996	6.38	16.48	128.32	1.49E-03	3.01E-03	1.88E-02	1.41E+00	1.38E-04	5.02E-04	0.00E+00	1.34E-04
2005	Annual	Mon-Sun	2270002066	Tractors/Loaders/Backhoes	D	250	Construction and Mining Equipment	U	N	NHH	NP	Los Angeles	SC	SC	1995	6.09	14.55	114.59	2.80E-03	7.81E-03	2.13E-02	1.25E+00	1.22E-04	1.17E-03	0.00E+00	2.52E-04
2005	Annual	Mon-Sun	2270002066	Tractors/Loaders/Backhoes	D	250	Construction and Mining Equipment	U	N	NHH	NP	Los Angeles	SC	SC	1994	5.92	12.99	102.28	2.50E-03	6.98E-03	1.90E-02	1.11E+00	1.09E-04	1.05E-03	0.00E+00	2.25E-04
2005	Annual	Mon-Sun	2270002066	Tractors/Loaders/Backhoes	D	250	Construction and Mining Equipment	U	N	NHH	NP	Los Angeles	SC	SC	1993	5.78	11.58	91.15	2.22E-03	6.22E-03	1.70E-02	9.93E-01	9.68E-05	9.32E-04	0.00E+00	2.01E-04
2005	Annual	Mon-Sun	2270002066	Tractors/Loaders/Backhoes	D	250	Construction and Mining Equipment	U	N	NHH	NP	Los Angeles	SC	SC	1992	5.72	10.34	81.4	1.99E-03	5.55E-03	1.51E-02	8.87E-01	8.65E-05	8.32E-04	0.00E+00	1.79E-04
2005	Annual	Mon-Sun	2270002066	Tractors/Loaders/Backhoes	D	250	Construction and Mining Equipment	U	N	NHH	NP	Los Angeles	SC	SC	1991	5.62	9.08	71.48	1.74E-03	4.87E-03	1.33E-02	7.79E-01	7.59E-05	7.31E-04	0.00E+00	1.57E-04
2005	Annual	Mon-Sun	2270002066	Tractors/Loaders/Backhoes	D	250	Construction and Mining Equipment	U	N	NHH	NP	Los Angeles	SC	SC	1990	5.44	7.74	60.93	1.49E-03	4.15E-03	1.13E-02	6.64E-01	6.47E-05	6.23E-04	0.00E+00	1.34E-04
2005	Annual	Mon-Sun	2270002066	Tractors/Loaders/Backhoes	D	250	Construction and Mining Equipment	U	N	NHH	NP	Los Angeles	SC	SC	1989	4.76	5.85	46.04	1.12E-03	3.14E-03	8.57E-03	5.02E-01	4.89E-05	4.71E-04	0.00E+00	1.01E-04
2005	Annual	Mon-Sun	2270002066	Tractors/Loaders/Backhoes	D	250	Construction and Mining Equipment	U	N	NHH	NP	Los Angeles	SC	SC	1988	3.81	3.94	31.05	7.58E-04	2.12E-03	5.78E-03	3.38E-01	3.30E-05	3.18E-04	0.00E+00	6.84E-05
2005	Annual	Mon-Sun	2270002066	Tractors/Loaders/Backhoes	D	250	Construction and Mining Equipment	U	N	NHH	NP	Los Angeles	SC	SC	1987	2.72	2.29	18.15	5.68E-04	1.91E-03	4.51E-03	1.96E-01	1.91E-05	2.67E-04	0.00E+00	5.13E-05
2005	Annual	Mon-Sun	2270002066	Tractors/Loaders/Backhoes	D	250	Construction and Mining Equipment	U	N	NHH	NP	Los Angeles	SC	SC	1986	1.83	1.54	12.21	3.82E-04	1.28E-03	3.03E-03	1.32E-01	1.29E-05	1.79E-04	0.00E+00	3.45E-05
2005	Annual	Mon-Sun	2270002066	Tractors/Loaders/Backhoes	D	250	Construction and Mining Equipment	U	N	NHH	NP	Los Angeles	SC	SC	1985	1.3	1.1	8.71	2.73E-04	9.16E-04	2.16E-03	9.41E-02	9.18E-06	1.28E-04	0.00E+00	2.46E-05
2005	Annual	Mon-Sun	2270002066	Tractors/Loaders/Backhoes	D	250	Construction and Mining Equipment	U	N	NHH	NP	Los Angeles	SC	SC	1984	1.13	0.95	7.57	2.53E-04	8.15E-04	1.88E-03	8.18E-02	7.97E-06	1.11E-04	0.00E+00	2.28E-05

OFFROAD Output for Heavy Equipment

CY	Season	AvgDays	Code	Equipment	Fuel	MaxHP	Class	C/R	Pre	Hand	Port	County	Air Basin	Air Dist.	MY	Population	Activity	Consumption	ROG Exhaust	CO Exhaust	NOX Exhaust	CO2 Exhaust	SO2 Exhaust	PM Exhaust	N2O Exhaust	CH4 Exhaust
2005	Annual	Mon-Sun	2270002066	Tractors/Loaders/Backhoes	D	250	Construction and Mining Equipment	U	N	NHH	NP	Los Angeles	SC	SC	1983	1.08	0.9	7.19	2.40E-04	7.74E-04	1.78E-03	7.76E-02	7.57E-06	1.05E-04	0.00E+00	2.17E-05
2005	Annual	Mon-Sun	2270002066	Tractors/Loaders/Backhoes	D	250	Construction and Mining Equipment	U	N	NHH	NP	Los Angeles	SC	SC	1982	1.1	0.93	7.36	2.46E-04	7.92E-04	1.83E-03	7.95E-02	7.75E-06	1.08E-04	0.00E+00	2.22E-05
2005	Annual	Mon-Sun	2270002066	Tractors/Loaders/Backhoes	D	250	Construction and Mining Equipment	U	N	NHH	NP	Los Angeles	SC	SC	1981	1.12	0.94	7.5	2.50E-04	8.07E-04	1.86E-03	8.09E-02	7.89E-06	1.10E-04	0.00E+00	2.26E-05
2005	Annual	Mon-Sun	2270002066	Tractors/Loaders/Backhoes	D	250	Construction and Mining Equipment	U	N	NHH	NP	Los Angeles	SC	SC	1980	1.07	0.9	7.15	2.39E-04	7.70E-04	1.77E-03	7.72E-02	7.53E-06	1.05E-04	0.00E+00	2.16E-05
2005	Annual	Mon-Sun	2270002066	Tractors/Loaders/Backhoes	D	250	Construction and Mining Equipment	U	N	NHH	NP	Los Angeles	SC	SC	1979	0.85	0.72	5.71	2.03E-04	6.28E-04	1.55E-03	6.16E-02	6.01E-06	8.38E-05	0.00E+00	1.83E-05
2005	Annual	Mon-Sun	2270002066	Tractors/Loaders/Backhoes	D	250	Construction and Mining Equipment	U	N	NHH	NP	Los Angeles	SC	SC	1978	0.65	0.55	4.38	1.55E-04	4.81E-04	1.19E-03	4.72E-02	4.61E-06	6.42E-05	0.00E+00	1.40E-05
2005	Annual	Mon-Sun	2270002066	Tractors/Loaders/Backhoes	D	250	Construction and Mining Equipment	U	N	NHH	NP	Los Angeles	SC	SC	1977	0.51	0.43	3.41	1.21E-04	3.74E-04	9.22E-04	3.67E-02	3.58E-06	4.99E-05	0.00E+00	1.09E-05
2005	Annual	Mon-Sun	2270002066	Tractors/Loaders/Backhoes	D	250	Construction and Mining Equipment	U	N	NHH	NP	Los Angeles	SC	SC	1976	0.41	0.34	2.73	9.70E-05	3.00E-04	7.40E-04	2.95E-02	2.87E-06	4.01E-05	0.00E+00	8.76E-06
2005	Annual	Mon-Sun	2270002066	Tractors/Loaders/Backhoes	D	250	Construction and Mining Equipment	U	N	NHH	NP	Los Angeles	SC	SC	1975	0.32	0.27	2.14	7.60E-05	2.35E-04	5.79E-04	2.31E-02	2.25E-06	3.14E-05	0.00E+00	6.86E-06
2005	Annual	Mon-Sun	2270002066	Tractors/Loaders/Backhoes	D	250	Construction and Mining Equipment	U	N	NHH	NP	Los Angeles	SC	SC	1974	0.23	0.19	1.54	5.47E-05	1.69E-04	4.17E-04	1.66E-02	1.62E-06	2.26E-05	0.00E+00	4.93E-06
2005	Annual	Mon-Sun	2270002066	Tractors/Loaders/Backhoes	D	250	Construction and Mining Equipment	U	N	NHH	NP	Los Angeles	SC	SC	1973	0.17	0.15	1.15	4.10E-05	1.27E-04	3.12E-04	1.24E-02	1.21E-06	1.69E-05	0.00E+00	3.70E-06
2005	Annual	Mon-Sun	2270002066	Tractors/Loaders/Backhoes	D	250	Construction and Mining Equipment	U	N	NHH	NP	Los Angeles	SC	SC	1972	0.12	0.1	0.77	2.75E-05	8.51E-05	2.10E-04	8.35E-03	8.14E-07	1.14E-05	0.00E+00	2.48E-06
2005	Annual	Mon-Sun	2270002066	Tractors/Loaders/Backhoes	D	250	Construction and Mining Equipment	U	N	NHH	NP	Los Angeles	SC	SC	1971	0.06	0.05	0.41	1.60E-05	4.50E-05	1.20E-04	4.41E-03	4.30E-07	7.20E-06	0.00E+00	1.44E-06
2005	Annual	Mon-Sun	2270002066	Tractors/Loaders/Backhoes	D	250	Construction and Mining Equipment	U	N	NHH	NP	Los Angeles	SC	SC	1970	0.02	0.02	0.14	5.58E-06	1.57E-05	4.19E-05	1.54E-03	1.50E-07	2.51E-06	0.00E+00	5.04E-07
2005	Annual	Mon-Sun	2270002066	Tractors/Loaders/Backhoes	D	500	Construction and Mining Equipment	U	N	NHH	NP	Los Angeles	SC	SC	2005	13.77	59.54	927.23	3.03E-03	1.71E-02	6.99E-02	1.03E+01	1.00E-03	1.76E-03	0.00E+00	2.73E-04
2005	Annual	Mon-Sun	2270002066	Tractors/Loaders/Backhoes	D	500	Construction and Mining Equipment	U	N	NHH	NP	Los Angeles	SC	SC	2004	13.33	55.08	858.2	3.87E-03	1.63E-02	7.07E-02	9.49E+00	9.25E-04	1.75E-03	0.00E+00	3.49E-04
2005	Annual	Mon-Sun	2270002066	Tractors/Loaders/Backhoes	D	500	Construction and Mining Equipment	U	N	NHH	NP	Los Angeles	SC	SC	2003	12.96	51.03	795.4	4.22E-03	1.55E-02	6.68E-02	8.79E+00	8.57E-04	1.73E-03	0.00E+00	3.81E-04
2005	Annual	Mon-Sun	2270002066	Tractors/Loaders/Backhoes	D	500	Construction and Mining Equipment	U	N	NHH	NP	Los Angeles	SC	SC	2002	12.76	47.78	745.14	4.72E-03	1.49E-02	6.70E-02	8.23E+00	8.03E-04	1.73E-03	0.00E+00	4.25E-04
2005	Annual	Mon-Sun	2270002066	Tractors/Loaders/Backhoes	D	500	Construction and Mining Equipment	U	N	NHH	NP	Los Angeles	SC	SC	2001	11.17	39.67	618.91	4.77E-03	1.26E-02	6.24E-02	6.83E+00	6.66E-04	1.65E-03	0.00E+00	4.31E-04
2005	Annual	Mon-Sun	2270002066	Tractors/Loaders/Backhoes	D	500	Construction and Mining Equipment	U	N	NHH	NP	Los Angeles	SC	SC	2000	12.01	40.32	629.67	6.09E-03	1.31E-02	8.26E-02	6.95E+00	6.77E-04	2.18E-03	0.00E+00	5.49E-04
2005	Annual	Mon-Sun	2270002066	Tractors/Loaders/Backhoes	D	500	Construction and Mining Equipment	U	N	NHH	NP	Los Angeles	SC	SC	1999	11.65	36.86	575.7	5.74E-03	1.22E-02	7.67E-02	6.35E+00	6.19E-04	2.08E-03	0.00E+00	5.18E-04
2005	Annual	Mon-Sun	2270002066	Tractors/Loaders/Backhoes	D	500	Construction and Mining Equipment	U	N	NHH	NP	Los Angeles	SC	SC	1998	11.25	33.4	521.75	5.35E-03	1.13E-02	7.06E-02	5.75E+00	5.61E-04	1.95E-03	0.00E+00	4.83E-04
2005	Annual	Mon-Sun	2270002066	Tractors/Loaders/Backhoes	D	500	Construction and Mining Equipment	U	N	NHH	NP	Los Angeles	SC	SC	1997	10.77	29.91	467.3	4.91E-03	1.03E-02	6.41E-02	5.15E+00	5.02E-04	1.81E-03	0.00E+00	4.43E-04
2005	Annual	Mon-Sun	2270002066	Tractors/Loaders/Backhoes	D	500	Construction and Mining Equipment	U	N	NHH	NP	Los Angeles	SC	SC	1996	10.3	26.6	415.65	4.41E-03	9.18E-03	5.73E-02	4.58E+00	4.47E-04	1.63E-03	0.00E+00	3.98E-04
2005	Annual	Mon-Sun	2270002066	Tractors/Loaders/Backhoes	D	500	Construction and Mining Equipment	U	N	NHH	NP	Los Angeles	SC	SC	1995	9.83	23.49	370.86	8.26E-03	2.38E-02	6.49E-02	4.05E+00	3.95E-04	3.32E-03	0.00E+00	7.45E-04
2005	Annual	Mon-Sun	2270002066	Tractors/Loaders/Backhoes	D	500	Construction and Mining Equipment	U	N	NHH	NP	Los Angeles	SC	SC	1994	9.55	20.97	331.03	7.37E-03	2.12E-02	5.79E-02	3.61E+00	3.52E-04	2.97E-03	0.00E+00	6.65E-04
2005	Annual	Mon-Sun	2270002066	Tractors/Loaders/Backhoes	D	500	Construction and Mining Equipment	U	N	NHH	NP	Los Angeles	SC	SC	1993	9.33	18.68	295	6.57E-03	1.89E-02	5.16E-02	3.22E+00	3.14E-04	2.64E-03	0.00E+00	5.93E-04
2005	Annual	Mon-Sun	2270002066	Tractors/Loaders/Backhoes	D	500	Construction and Mining Equipment	U	N	NHH	NP	Los Angeles	SC	SC	1992	9.22	16.69	263.43	5.87E-03	1.69E-02	4.61E-02	2.87E+00	2.80E-04	2.36E-03	0.00E+00	5.29E-04
2005	Annual	Mon-Sun	2270002066	Tractors/Loaders/Backhoes	D	500	Construction and Mining Equipment	U	N	NHH	NP	Los Angeles	SC	SC	1991	9.07	14.65	231.33	5.15E-03	1.48E-02	4.05E-02	2.52E+00	2.46E-04	2.07E-03	0.00E+00	4.65E-04
2005	Annual	Mon-Sun	2270002066	Tractors/Loaders/Backhoes	D	500	Construction and Mining Equipment	U	N	NHH	NP	Los Angeles	SC	SC	1990	8.79	12.49	197.19	4.39E-03	1.27E-02	3.45E-02	2.15E+00	2.10E-04	1.77E-03	0.00E+00	3.96E-04
2005	Annual	Mon-Sun	2270002066	Tractors/Loaders/Backhoes	D	500	Construction and Mining Equipment	U	N	NHH	NP	Los Angeles	SC	SC	1989	7.69	9.44	149.01	3.32E-03	9.56E-03	2.61E-02	1.63E+00	1.59E-04	1.34E-03	0.00E+00	2.99E-04
2005	Annual	Mon-Sun	2270002066	Tractors/Loaders/Backhoes	D	500	Construction and Mining Equipment	U	N	NHH	NP	Los Angeles	SC	SC	1988	6.15	6.37	100.5	2.24E-03	6.45E-03	1.76E-02	1.10E+00	1.07E-04	9.01E-04	0.00E+00	2.02E-04
2005	Annual	Mon-Sun	2270002066	Tractors/Loaders/Backhoes	D	500	Construction and Mining Equipment	U	N	NHH	NP	Los Angeles	SC	SC	1987	4.39	3.69	60.05	1.60E-03	1.55E-02	1.37E-02	6.36E-01	6.20E-05	7.28E-04	0.00E+00	1.45E-04
2005	Annual	Mon-Sun	2270002066	Tractors/Loaders/Backhoes	D	500	Construction and Mining Equipment	U	N	NHH	NP	Los Angeles	SC	SC	1986	2.95	2.48	40.4	1.08E-03	1.04E-02	9.24E-03	4.28E-01	4.17E-05	4.90E-04	0.00E+00	9.73E-05
2005	Annual	Mon-Sun	2270002066	Tractors/Loaders/Backhoes	D	500	Construction and Mining Equipment	U	N	NHH	NP	Los Angeles	SC	SC	1985	2.11	1.77	28.81	7.69E-04	7.43E-03	6.59E-03	3.05E-01	2.97E-05	3.49E-04	0.00E+00	6.94E-05
2005	Annual	Mon-Sun	2270002066	Tractors/Loaders/Backhoes	D	500	Construction and Mining Equipment	U	N	NHH	NP	Los Angeles	SC	SC	1984	1.83	1.54	25.07	7.16E-04	6.61E-03	5.72E-03	2.65E-01	2.58E-05	3.03E-04	0.00E+00	6.46E-05
2005	Annual	Mon-Sun	2270002066	Tractors/Loaders/Backhoes	D	500	Construction and Mining Equipment	U	N	NHH	NP	Los Angeles	SC	SC	1983	1.74	1.46	23.79	6.80E-04	6.28E-03	5.43E-03	2.51E-01	2.45E-05	2.88E-04	0.00E+00	6.13E-05
2005	Annual	Mon-Sun	2270002066	Tractors/Loaders/Backhoes	D	500	Construction and Mining Equipment	U	N	NHH	NP	Los Angeles	SC	SC	1982	1.78	1.49	24.36	6.96E-04	6.43E-03	5.56E-03	2.57E-01	2.51E-05	2.95E-04	0.00E+00	6.28E-05
2005	Annual	Mon-Sun	2270002066	Tractors/Loaders/Backhoes	D	500	Construction and Mining Equipment	U	N	NHH	NP	Los Angeles	SC	SC	1981	1.81	1.52	24.81	7.09E-04	6.55E-03	5.66E-03	2.62E-01	2.56E-05	3.00E-04	0.00E+00	6.39E-05
2005	Annual	Mon-Sun	2270002066	Tractors/Loaders/Backhoes	D	500	Construction and Mining Equipment	U	N	NHH	NP	Los Angeles	SC	SC	1980	1.73	1.45	23.67	6.76E-04	6.24E-03	5.40E-03	2.50E-01	2.44E-05	2.86E-04	0.00E+00	6.10E-05
2005	Annual	Mon-Sun	2270002066	Tractors/Loaders/Backhoes	D	500	Construction and Mining Equipment	U	N	NHH	NP	Los Angeles	SC	SC	1979	1.38	1.16	18.9	5.69E-04	4.98E-03	4.71E-03	2.00E-01	1.95E-05	2.29E-04	0.00E+00	5.14E-05
2005	Annual	Mon-Sun	2270002066	Tractors/Loaders/Backhoes	D	500	Construction and Mining Equipment	U	N	NHH	NP	Los Angeles	SC	SC	1978	1.06	0.89	14.49	4.36E-04	3.82E-03	3.61E-03	1.53E-01	1.49E-05	1.75E-04	0.00E+00	3.94E-05
2005	Annual	Mon-Sun	2270002066	Tractors/Loaders/Backhoes	D	500	Construction and Mining Equipment	U	N	NHH	NP	Los Angeles	SC	SC	1977	0.82	0.69	11.27	3.39E-04	2.97E-03	2.81E-03	1.19E-01	1.16E-05	1.36E-04	0.00E+00	3.06E-05
2005	Annual	Mon-Sun	2270002066	Tractors/Loaders/Backhoes	D	500	Construction and Mining Equipment	U	N	NHH	NP	Los Angeles	SC	SC	1976	0.66	0.55	9.04	2.72E-04	2.38E-03	2.25E-03	9.55E-02	9.32E-06	1.09E-04	0.00E+00	2.46E-05
2005	Annual	Mon-Sun	2270002066	Tractors/Loaders/Backhoes	D	500	Construction and Mining Equipment	U	N	NHH	NP	Los Angeles	SC	SC	1975	0.52	0.43	7.08	2.13E-04	1.87E-03	1.76E-03	7.48E-02	7.29E-06	8.56E-05	0.00E+00	1.92E-05
2005	Annual	Mon-Sun	2270002066	Tractors/Loaders/Backhoes	D	500	Construction and Mining Equipment	U	N	NHH	NP	Los Angeles	SC	SC	1974	0.37	0.31	5.09	1.53E-04	1.34E-03	1.27E-03	5.38E-02	5.25E-06	6.16E-05	0.00E+00	1.38E-05
2005	Annual	Mon-Sun	2270002066	Tractors/Loaders/Backhoes	D	500	Construction and Mining Equipment	U	N	NHH	NP	Los Angeles	SC	SC	1973	0.28	0.23	3.82	1.15E-04	1.01E-03	9.50E-04	4.03E-02	3.93E-06	4.61E-05	0.00E+00	1.04E-05
2005	Annual	Mon-Sun	2270002066	Tractors/Loaders/Backhoes	D	500	Construction and Mining Equipment	U	N	NHH	NP	Los Angeles	SC	SC	1972	0.19	0.16	2.56	7.72E-05	6.75E-04	6.38E-04	2.71E-02	2.64E-06	3.10E-05	0.00E+00	6.96E-06
2005	Annual	Mon-Sun	2270002066	Tractors/Loaders/Backhoes	D	500	Construction and Mining Equipment	U	N	NHH	NP	Los Angeles	SC	SC	1971	0.1	0.08	1.36	4.51E-05	3.57E-04	3.65E-04	1.43E-02	1.39E-06	1.95E-05	0.00E+00	4.07E-06
2005	Annual	Mon-Sun	2270002066	Tractors/Loaders/Backhoes	D	500	Construction and Mining Equipment	U	N	NHH	NP	Los Angeles	SC	SC	1970	0.03	0.03	0.47	1.57E-05	1.25E-04	1.27E-04	5.00E-03	4.87E-07	6.80E-06	0.00E+00	1.42E-06
2005	Annual	Mon-Sun	2270002066	Tractors/Loaders/Backhoes	D	750	Construction and Mining Equipment	U	N	NHH	NP	Los Angeles	SC	SC	2005	0.16	0.69	16.16	5.95E-05	2.98E-04	1.31E-03	1.79E-01	1.74E-05	3.08E-05	0.00E+00	5.37E-06
2005	Annual	Mon-Sun	2270002066	Tractors/Loaders/Backhoes	D	750	Construction and Mining Equipment	U	N	NHH	NP	Los Angeles	SC	SC	2004	0.15	0.64	14.95	6.75E-05	2.84E-04	1.23E-03	1.65E-01	1.61E-05	3.06E-05	0.00E+00	6.09E-06
2005	Annual	Mon-Sun	2270002066	Tractors/Loaders/Backhoes	D	750	Construction and Mining Equipment	U	N	NHH	NP	Los Angeles	SC	SC	2003	0.15	0.59	13.86	7.79E-05	2.70E-04	1.23E-03	1.53E-01	1.49E-05	3.04E-05	0.00E+00	7.03E-06
2005	Annual	Mon-Sun	2270002066	Tractors/Loaders/Backhoes	D	750	Construction and Mining Equipment	U	N	NHH	NP	Los Angeles	SC	SC	2002	0.15	0.56	12.99	9.25E-05	2.59E-04	1.29E-03	1.43E-01	1.40E-05	3.28E-05	0.00E+00	8.35E-06
2005	Annual	Mon-Sun	2270002066	Tractors/Loaders/Backhoes	D	750	Construction and Mining Equipment	U	N	NHH	NP	Los Angeles	SC	SC	2001	0.13	0.46	10.79	1.01E-04	2.20E-04	1.39E-03	1.19E-01	1.16E-05	3.57E-05	0.00E+00	9.10E-06
2005	Annual	Mon-Sun	2270002066	Tractors/Loaders/Backhoes	D	750	Construction and Mining Equipment	U	N	NHH	NP	Los Angeles	SC	SC	2000	0.14	0.47	10.97	1.06E-04	2.29E-04	1.44E-03	1.21E-01	1.18E-05	3.80E-05	0.00E+00	9.57E-06
2005	Annual	Mon-Sun	2270002066	Tractors/Loaders/Backhoes	D	750	Construction and Mining Equipment	U	N	NHH	NP	Los Angeles	SC	SC	1999	0.14	0.43	10.03	1.00E-04	2.13E-04	1.34E-03	1.11E-01	1.08E-05	3.62E-05	0.00E+00	9.02E-06
2005	Annual	Mon-Sun	2270002066	Tractors/Loaders/Backhoes	D	750	Construction and Mining Equipment	U	N	NHH	NP	Los Angeles	SC	SC	1998	0.13	0.39	9.09	9.32E-05	1.96E-04	1.23E-03	1.00E-01	9.78E-06	3.40E-05	0.00E+00	8.41E-06
2005	Annual	Mon-Sun	2270002066	Tractors/Loaders/Backhoes	D	750	Construction and Mining Equipment	U	N	NHH	NP	Los Angeles	SC	SC	1997	0.13	0.35	8.14	8.56E-05	1.79E-04	1.12E-03	8.98E-02	8.76E-06	3.15E-05	0.00E+00	7.72E-06
2005	Annual	Mon-Sun	2270002066	Tractors/Loaders/Backhoes	D	750	Construction and Mining Equipment	U	N	NHH	NP	Los Angeles	SC	SC	1996	0.12	0.31	7.24	7.68E-05	1.60E-04	9.99E-04	7.99E-02	7.79E-06	2.84E-05	0.00E+00	6.93E-06
2005	Annual	Mon-Sun	2270002066	Tractors/Loaders/Backhoes	D	750	Construction and Mining Equipment	U	N	NHH	NP	Los Angeles	SC	SC	1995	0.11	0.27	6.46	1.44E-04	4.15E-04	1.13E-03	7.05E-02	6.88E-06	5.79E-05	0.00E+00	1.30E-05
2005	Annual	Mon-Sun	2270002066	Tractors/Loaders/Backhoes	D	750	Construction and Mining Equipment	U	N	NHH	NP	Los Angeles	SC	SC	1994	0.11	0.24	5.77	1.28E-04	3.70E-04	1.01E-03	6.29E-02	6.14E-06	5.17E-05	0.00E+00	1.16E-05
2005	Annual	Mon-Sun	2270002066	Tractors/Loaders/Backhoes	D	750	Construction and Mining Equipment	U	N	NHH	NP	Los Angeles	SC	SC	1993	0.11	0.22	5.14	1.14E-04	3.30E-04	9.00E-04	5.61E-02	5.47E-06	4.61E-05	0.00E+00	1.03E-05
2005	Annual	Mon-Sun	2270002066	Tractors/Loaders/Backhoes	D	750	Construction and Mining Equipment	U	N	NHH	NP	Los Angeles	SC	SC	1992	0.11	0.19	4.59	1.02E-04	2.95E-04	8.03E-04	5.01E-02	4.88E-06	4.11E-05	0.00E+00	9.22E-06
2005	Annual	Mon-Sun	2270002066	Tractors/Loaders/Backhoes	D	750	Construction and Mining Equipment	U	N	NHH	NP	Los Angeles	SC	SC	1991	0.11	0.17	4.03	8.98E-05	2.59E-04	7.06E-04	4.40E-02	4.29E-06	3.61E-05	0.00E+00	8.10E-06
2005	Annual	Mon-Sun	2270002066	Tractors/Loaders/Backhoes	D	750	Construction and Mining Equipment	U	N	NHH	NP	Los Angeles	SC	SC	1990	0.1	0.15	3.44	7.65E-05	2.20E-04	6.01E-04	3.75E-02	3.66E-06	3.08E-05	0.00E+00	6.90E-06
2005	Annual	Mon-Sun	2270002066	Tractors/Loaders/Backhoes	D	750	Construction and Mining Equipment	U	N	NHH	NP	Los Angeles	SC	SC	1989	0.09	0.11	2.6	5.78E-05	1.67E-04	4.54E-04	2.83E-02	2.76E-06	2.33E-05	0.00E+00	5.22E-06
2005	Annual	Mon-Sun	2270002066	Tractors/Loaders/Backhoes	D	750	Construction and Mining Equipment	U	N	NHH	NP	Los Angeles	SC	SC	1988	0.07	0.07	1.75	3.90E-05	1.12E-04	3.07E-04	1.91E-02	1.86E-06	1.57E-05	0.00E+00	3.52E-06
2005	Annual	Mon-Sun	2270002066	Tractors/Loaders/Backhoes	D	750	Construction and Mining Equipment	U	N	NHH	NP	Los Angeles	SC	SC	1987	0.05	0.04	1.05	2.79E-05	2.70E-04	2.39E-04	1.11E-02	1.08E-06	1.27E-05	0.00E+00	2.52E-06
2005	Annual	Mon-Sun	2270002066	Tractors/Loaders/Backhoes	D	750	Construction and Mining Equipment	U	N	NHH	NP	Los Angeles	SC	SC	1986	0.03	0.03	0.7	1.88E-05	1.82E-04	1.61E-04	7.45E-03	7.27E-07	8.53E-06	0.00E+00	1.70E-06
2005	Annual	Mon-Sun	2270002066	Tractors/Loaders/Backhoes	D	750	Construction and Mining Equipment	U	N	NHH	NP	Los Angeles	SC	SC	1985	0.02	0.02	0.5	1.34E-05	1.29E-04	1.15E-04	5.31E-03	5.18E-07	6.08E-06	0.00E+00	1.21E-06
2005	Annual	Mon-Sun	2270002066	Tractors/Loaders/Backhoes	D	750	Construction and Mining Equipment	U	N	NHH	NP	Los Angeles	SC	SC	1984	0.02	0.02	0.44	1.25E-05	1.15E-04	9.97E-05	4.62E-03	4.50E-07	5.28E-06	0.00E+00	1.13E-06
2005	Annual	Mon-Sun	2270002066	Tractors/Loaders/Backhoes	D	750	Construction and Mining Equipment	U	N	NHH	NP	Los Angeles	SC	SC	1983	0.02	0.02	0.41	1.18E-05	1.09E-04	9.46E-05	4.38E-03	4.27E-07	5.02E-06	0.00E+00	1.07E-06

OFFROAD Output for Heavy Equipment

CY	Season	AvgDays	Code	Equipment	Fuel	MaxHP	Class	C/R	Pre	Hand	Port	County	Air Basin	Air Dist.	MY	Population	Activity	Consumption	ROG Exhaust	CO Exhaust	NOX Exhaust	CO2 Exhaust	SO2 Exhaust	PM Exhaust	N2O Exhaust	CH4 Exhaust
2005	Annual	Mon-Sun	2270002066	Tractors/Loaders/Backhoes	D	750	Construction and Mining Equipment	U	N	NHH	NP	Los Angeles	SC	SC	1982	0.02	0.02	0.42	1.21E-05	1.12E-04	9.69E-05	4.49E-03	4.38E-07	5.14E-06	0.00E+00	1.09E-06
2005	Annual	Mon-Sun	2270002066	Tractors/Loaders/Backhoes	D	750	Construction and Mining Equipment	U	N	NHH	NP	Los Angeles	SC	SC	1981	0.02	0.02	0.43	1.23E-05	1.14E-04	9.87E-05	4.57E-03	4.46E-07	5.23E-06	0.00E+00	1.11E-06
2005	Annual	Mon-Sun	2270002066	Tractors/Loaders/Backhoes	D	750	Construction and Mining Equipment	U	N	NHH	NP	Los Angeles	SC	SC	1980	0.02	0.02	0.41	1.18E-05	1.09E-04	9.41E-05	4.36E-03	4.25E-07	4.99E-06	0.00E+00	1.06E-06
2005	Annual	Mon-Sun	2270002066	Tractors/Loaders/Backhoes	D	750	Construction and Mining Equipment	U	N	NHH	NP	Los Angeles	SC	SC	1979	0.02	0.01	0.33	9.92E-06	8.69E-05	8.20E-05	3.48E-03	3.39E-07	3.98E-06	0.00E+00	8.95E-07
2005	Annual	Mon-Sun	2270002066	Tractors/Loaders/Backhoes	D	750	Construction and Mining Equipment	U	N	NHH	NP	Los Angeles	SC	SC	1978	0.01	0.01	0.25	7.60E-06	6.66E-05	6.28E-05	2.67E-03	2.60E-07	3.05E-06	0.00E+00	6.86E-07
2005	Annual	Mon-Sun	2270002066	Tractors/Loaders/Backhoes	D	750	Construction and Mining Equipment	U	N	NHH	NP	Los Angeles	SC	SC	1977	0.01	0.01	0.2	5.91E-06	5.18E-05	4.89E-05	2.07E-03	2.02E-07	2.37E-06	0.00E+00	5.34E-07
2005	Annual	Mon-Sun	2270002066	Tractors/Loaders/Backhoes	D	750	Construction and Mining Equipment	U	N	NHH	NP	Los Angeles	SC	SC	1976	0.01	0.01	0.16	4.75E-06	4.15E-05	3.92E-05	1.66E-03	1.62E-07	1.91E-06	0.00E+00	4.28E-07
2005	Annual	Mon-Sun	2270002066	Tractors/Loaders/Backhoes	D	750	Construction and Mining Equipment	U	N	NHH	NP	Los Angeles	SC	SC	1975	0.01	0.01	0.12	3.72E-06	3.25E-05	3.07E-05	1.30E-03	1.27E-07	1.49E-06	0.00E+00	3.35E-07
2005	Annual	Mon-Sun	2270002066	Tractors/Loaders/Backhoes	D	750	Construction and Mining Equipment	U	N	NHH	NP	Los Angeles	SC	SC	1974	0	0	0.09	2.67E-06	2.34E-05	2.21E-05	9.38E-04	9.15E-08	1.07E-06	0.00E+00	2.41E-07
2005	Annual	Mon-Sun	2270002066	Tractors/Loaders/Backhoes	D	750	Construction and Mining Equipment	U	N	NHH	NP	Los Angeles	SC	SC	1973	0	0	0.07	2.00E-06	1.75E-05	1.66E-05	7.03E-04	6.85E-08	8.04E-07	0.00E+00	1.81E-07
2005	Annual	Mon-Sun	2270002066	Tractors/Loaders/Backhoes	D	750	Construction and Mining Equipment	U	N	NHH	NP	Los Angeles	SC	SC	1972	0	0	0.04	1.34E-06	1.18E-05	1.11E-05	4.72E-04	4.60E-08	5.40E-07	0.00E+00	1.21E-07
2005	Annual	Mon-Sun	2270002066	Tractors/Loaders/Backhoes	D	750	Construction and Mining Equipment	U	N	NHH	NP	Los Angeles	SC	SC	1971	0	0	0.02	7.86E-07	6.22E-06	6.36E-06	2.49E-04	2.43E-08	3.39E-07	0.00E+00	7.09E-08
2005	Annual	Mon-Sun	2270002066	Tractors/Loaders/Backhoes	D	750	Construction and Mining Equipment	U	N	NHH	NP	Los Angeles	SC	SC	1970	0	0	0.01	2.74E-07	2.17E-06	2.22E-06	8.70E-05	8.49E-09	1.18E-07	0.00E+00	2.48E-08
																	17704		1.323364302	3.77553069	7.909326688	574.3873002	0.057816075	0.64731108		
2005	Annual	Mon-Sun	2270003020	Forklifts	D	120	Industrial Equipment	U	P	NHH	NP	Los Angeles	SC	SC	1999	42.29	208.71	300.88	1.06E-02	2.63E-02	4.79E-02	3.26E+00	3.31E-04	6.09E-03	0.00E+00	9.57E-04
2005	Annual	Mon-Sun	2270003020	Forklifts	D	120	Industrial Equipment	U	P	NHH	NP	Los Angeles	SC	SC	1997	39.48	194.89	280.95	9.91E-03	2.46E-02	5.56E-02	3.04E+00	3.09E-04	5.18E-03	0.00E+00	8.94E-04
2005	Annual	Mon-Sun	2270003020	Forklifts	D	120	Industrial Equipment	U	P	NHH	NP	Los Angeles	SC	SC	1989	5.69	28.06	40.45	1.43E-03	3.54E-03	8.00E-03	4.38E-01	4.45E-05	7.47E-04	0.00E+00	1.29E-04
2005	Annual	Mon-Sun	2270003020	Forklifts	D	175	Industrial Equipment	U	P	NHH	NP	Los Angeles	SC	SC	2005	34.46	170.1	433.06	2.08E-03	2.37E-02	3.62E-02	4.76E+00	4.64E-04	1.25E-03	0.00E+00	1.88E-04

Fleet Average Rating Calculation for Backhoe

ASC	DESC	FUEL	' CAT		CA POP	HP RATING
2270002066	Tractors/Loaders/Backhoes	D	25 U	8	282	23
2270002066	Tractors/Loaders/Backhoes	D	50 U	18	1685	44
2270002066	Tractors/Loaders/Backhoes	D	120 U	18	22538	75
2270002066	Tractors/Loaders/Backhoes	D	175 U	18	1682	147
2270002066	Tractors/Loaders/Backhoes	D	250 U	18	544	249
2270002066	Tractors/Loaders/Backhoes	D	500 U	18	878	500
2270002066	Tractors/Loaders/Backhoes	D	750 U	18	605	750
			Statewide Total		***28214***	***108***

APPENDIX F

EMISSION FACTOR DERIVATION AND OFFROAD2007 OUTPUT FOR THE AIR COMPRESSOR

Emission Factors for the Diesel-Fueled Air Compressor
City of Industry Rail Yard, City of Industry, CA

Location	Equipment Type	Make	Model Year	Rating (hp)	Load Factor[1]	2005 Emission Factors (g/hp-hr)[2]					
						ROG	CO	NOx	PM10	DPM	SOx
TTX Operations	Air Compressor	Ingersoll Rand	1988	150	0.48	1.27	3.56	9.72	0.06	0.06	0.53
Total											

Notes:
1. Load factor ffrom the OFFROAD2007 model.
2. Emission factors from OFFROAD2007 model. Evaporative emissions were negligible.

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Cnty	SubR	SCC	HP	TechType	MYr	Population	ROG-Exhaust	CO-Exhaus	NOx-Exhau	CO2-Exhau	SO2-Exhau
Los Angeles		2270006015	175		1988		0.000236866	0.000662	0.001807	0.105781	1.03E-05

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PM-Exhaus	Crankcase	FuelCons.	Activity	LF	HPAvg	ROG/ROG	ROG (lb/hp	CO (lb/hp-h	NOx (lb/hp	SOx (lb/hp	PM (lb/hp-hr)
9.93E-05			2.39	0.48	147	1	0.002809	0.007852	0.021429	0.000122	0.001177

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CY	Season	AvgDays	Code	Equipment	Fuel	MaxHP	Class	C/R	Pre	Hand	Port	County	Air Basin	Air Dist.	MY
2005	Annual	Mon-Sun	2270006015	Air Compres	D	175	Light Commercial Equipment	U	P	NHH	P	Los Angeles	SC	SC	1988

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Population	Activity	Consumption	ROG Exhaust	CO Exhaust	NOX Exhaust	CO2 Exhaust	SO2 Exhaust	PM Exhaust	N2O Exhaust	CH4 Exhaust
1.07	2.39	9.71	2.37E-04	6.62E-04	1.81E-03	1.06E-01	1.03E-05	9.93E-05	0.00E+00	2.14E-05

APPENDIX G

EMISSION FACTOR DERIVATION AND OFFROAD2007 OUTPUT FOR TRUs AND REEFER CARS

Emission Factors for Transport Refrigeration Units and Refrigerated Railcars
City of Industry Rail Yard, City of Industry, CA

TRU Equip Type	Average Rating (hp)[1]	Fuel Type	Load Factor[2]	2005 Emission Factors (g/hp-hr)[3]					VOC Evaporative Emission Factors[4]	
				HC	CO	NOx	DPM	SOx	Part 1 (lb/hr)	Part 2 (lb/yr)
Container	28.56	Diesel	0.56	2.85	6.78	6.43	0.71	0.07	-	-
Railcar	34	Diesel	0.53	3.23	7.49	6.71	0.79	0.07	-	-
Total										

Notes:
1. Based on the average horsepower distribution in the OFFROAD 2006 model.
2. Load factors are the default factors from the OFFROAD 2007 model.
3. Emission factors from OFFROAD 2007 model.
4. Evaporative emissions are negligible.

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

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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 H

DETAILED EMISSION CALCULATIONS

Summary of Diesel Particulate Matter Emissions
City of Industry Rail Yard, City of Industry, CA

Source	DPM Emissions (tpy)
Locomotive	5.875
Diesel-Fueled Yard Trucks	0.190
HHD Diesel-Fueled Drayage Trucks	1.769
HHD Diesel-Fueled Delivery Trucks	0.000
Cargo Handling Equipment (CHE)	2.620
Heavy Equipment	0.146
Transport Refrigeration Units (TRUs)	0.274
Emergency Generator	0.003
Air Compressor	0.000
Total	**10.88**

Summary of Emissions from Locomotives
City of Industry Rail Yard, City of Industry, CA

Activity	DPM Emissions (tpy)
Thru Trains	0.51
Trains In Yard	2.06
Yard Operations	3.29
Service and Load Testing	0.01
Total	**5.88**

Summary of Emissions from Diesel-Fueled Yard Trucks
City of Industry Rail Yard, City of Industry, CA

Running Exhaust Emissions

Equipment Type	Equipment ID/Owner	Make	Model	Year	Vehicle Class	VMT (mi/yr)[1]	2005 Emission Factors (g/mi)[2,3]						2005 Emissions Estimates (tpy)					
							ROG	CO	NOx	PM10[4]	DPM[4]	SOx	ROG	CO	NOx	PM10	DPM	SOx
Boom Truck	UP65629	International	4900	1992	HHD	10,584	8.25	20.27	32.16	3.92	3.78	0.27	0.10	0.24	0.38	0.05	0.04	0.00
Welder Truck	65984	Ford	F-800	1992	MHD	17,065	0.94	9.70	18.46	1.25	1.25	0.16	0.02	0.18	0.35	0.02	0.02	0.00
Boom Truck	UP 68842	Ford	F-Series	1997	HHD	13,767	6.92	16.99	31.05	2.34	2.26	0.24	0.10	0.26	0.47	0.04	0.03	0.00
Gang Truck	60099	Freightliner	Unknown	1999	HHD	13,556	5.84	14.32	30.22	2.02	1.94	0.25	0.09	0.21	0.45	0.03	0.03	0.00
Flat Bed Truck	TTX	Isuzu	NPR HD	2000	HHD	8,973	5.24	12.87	29.54	1.88	1.81	0.23	0.05	0.13	0.29	0.02	0.02	0.00
Flat Bed Truck	TTX	Chevy	W-4500	2001	HHD	6,714	4.60	11.29	28.80	1.73	1.66	0.24	0.03	0.08	0.21	0.01	0.01	0.00
Flat Bed Truck	TTX	Isuzu	NPR HD	2001	HHD	5,795	4.60	11.29	28.80	1.73	1.66	0.24	0.03	0.07	0.18	0.01	0.01	0.00
Truck	TTX	Ford	F350	2001	LHDT1	9,282	0.39	1.58	8.68	0.13	0.13	0.00	0.00	0.02	0.09	0.00	0.00	0.00
Truck	TTX	Ford	F250	2001	MHD	21,556	0.37	3.16	12.93	0.43	0.43	0.13	0.01	0.08	0.31	0.01	0.01	0.00
Flat Bed Truck	TTX	Chevy	W-4500	2003	HHD	10,065	1.50	3.48	18.89	0.52	0.46	0.23	0.02	0.04	0.21	0.01	0.01	0.00
Total													**0.45**	**1.30**	**2.94**	**0.19**	**0.19**	**0.02**

Idling Exhaust Emissions

Equipment Type	Equip. ID	Make	Model	Model Year	Vehicle Class	Idling[5] (min/day)	Idling[5] (hr/yr)	2005 Emission Factors (g/hr)[6]						2005 Emissions Estimates (tpy)					
								ROG	CO	NOx	PM10	DPM	SOx	ROG	CO	NOx	PM10	DPM	SOx
Boom Truck	UP65629	International	4900	1992	HHD	15	91	15.52	53.81	101.42	2.57	2.57	0.55	0.00	0.01	0.01	0.00	0.00	0.00
Welder Truck	65984	Ford	F-800	1992	MHD	15	91	3.17	26.30	75.05	1.40	1.40	0.34	0.00	0.00	0.01	0.00	0.00	0.00
Boom Truck	UP 68842	Ford	F-Series	1997	HHD	15	91	12.41	49.53	110.27	1.93	1.93	0.55	0.00	0.00	0.01	0.00	0.00	0.00
Gang Truck	60099	Freightliner	Unknown	1999	HHD	15	91	9.31	44.51	119.08	1.33	1.33	0.55	0.00	0.00	0.01	0.00	0.00	0.00
Flat Bed Truck	TTX	Isuzu	NPR HD	2000	HHD	15	91	9.31	44.51	119.08	1.33	1.33	0.55	0.00	0.00	0.01	0.00	0.00	0.00
Flat Bed Truck	TTX	Chevy	W-4500	2001	HHD	15	91	9.31	44.51	119.08	1.33	1.33	0.55	0.00	0.00	0.01	0.00	0.00	0.00
Flat Bed Truck	TTX	Isuzu	NPR HD	2001	HHD	15	91	9.31	44.51	119.08	1.33	1.33	0.55	0.00	0.00	0.01	0.00	0.00	0.00
Truck	TTX	Ford	F350	2001	LHDT1	15	91	3.17	26.30	75.05	0.75	0.75	0.05	0.00	0.00	0.01	0.00	0.00	0.00
Truck	TTX	Ford	F250	2001	MHD	15	91	3.17	26.30	75.05	0.75	0.75	0.34	0.00	0.00	0.01	0.00	0.00	0.00
Flat Bed Truck	TTX	Chevy	W-4500	2003	HHD	15	91	7.65	41.43	123.52	1.03	1.03	0.55	0.00	0.00	0.01	0.00	0.00	0.00
Total														**0.01**	**0.04**	**0.10**	**0.00**	**0.00**	**0.00**

Notes:
1. Annual VMT estimated based on the vehicle age and odometer reading.
2. Running exhaust emissions calculated using the EMFAC2007 model with the BURDEN output option.
3. Running exhaust emission factor calculations assumed an average speed of 15 mph.
4. The PM10 emission factor includes engine exhaust emissions along with brake and tire wear. The DPM emission factor includes engine exhaust emissions only.
5. Idling time (hr/yr) is an engineering estimate based on discussions with UPRR staff.
6. Idling exhaust emissions factors calculated using the EMFAC2007 model with the EMFAC output option.

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Summary of Emissions from HHD Diesel-Fueled Drayage Truck Traffic
City of Industry Rail Yard, City of Industry, CA

Running Exhaust Emissions

Number of Truck Trips[1]	VMT per Trip[2]	VMT per Year	2005 Emission Factors (g/mi)[3,4]						2005 Emission Estimates (tpy)					
			ROG	CO	NOx	PM10[5]	DPM[5]	SOx	ROG	CO	NOx	PM10	DPM	SOx
299,009	1.6	478,414.00	6.40	17.23	28.68	2.53	2.47	0.24	3.38	9.09	15.13	1.33	1.30	0.13

Idling Exhaust Emissions

Number of Truck Trips[1]	Idling[6]		2005 Emission Factors (g/hr)[7]						2005 Emission Estimates (tpy)					
	(mins/trip)	(hr/yr)	ROG	CO	NOx	PM10	DPM	SOx	ROG	CO	NOx	PM10	DPM	SOx
299,009	30	149,504.38	16.163	52.988	100.382	2.845	2.845	0.550	2.66	8.73	16.54	0.47	0.47	0.09

Notes:
1. Number of truck trips calculated from UPRR provided gate counts. The total gate counts were increased by 25% to account for bobtail trucks (trucks without a chassie or trailer and trucks with an empty chassie).
2. VMT per trip engineering estimate from site visit.
3. 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.
4. Emission factor calculations assumed an average speed of 15 mph.
5. The PM10 emission factor includes engine exhaust emissions along with brake and tire wear. The DPM emission factor includes engine exhaust emissions only.
6. Engineering estimate based on personal observation.
7. Idling exhaust emission factors from EMFAC 2007 using the EMFAC output option. The EMFAC default model year distribution for L.A. County was used.

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Summary of Emissions from Intermodal HHD Diesel-Fueled Delivery Trucks
City of Industry Rail Yard, City of Industry, CA

Running Exhaust Emissions

Delivery Type	Truck Trips (trips/yr)[1]	VMT per Trip (mi/trip)[2]	VMT per Year	2005 Emission Factors (g/mi)[3,4]						2005 Emission Estimates (tons/yr)					
				ROG	CO	NOx	PM10[5]	DPM[5]	SOx	ROG	CO	NOx	PM10	DPM	SOx
Diesel Fuel	7	0.92	6.44	6.40	17.23	28.68	2.53	2.47	0.24	0.00	0.00	0.00	0.00	0.00	0.00
Various Oils	1	0.92	0.92	6.40	17.23	28.68	2.53	2.47	0.24	0.00	0.00	0.00	0.00	0.00	0.00
Total	**8**									**5.19E-05**	**1.40E-04**	**2.33E-04**	**2.05E-05**	**2.00E-05**	**1.97E-06**

Idling Exhaust Emissions

Delivery Type	Number of Truck Trips	Idling		2005 Emission Factors (g/hr)[7]						2005 Emission Estimates (tons/yr)					
		(mins/trip)[6]	(hr/yr)	ROG	CO	NOx	PM10	DPM	SOx	ROG	CO	NOx	PM10	DPM	SOx
Diesel Fuel	7	10	1.17	16.16	52.99	100.38	2.85	2.85	0.55	0.00	0.00	0.00	0.00	0.00	0.00
Various Oils	1	10	0.17	16.16	52.99	100.38	2.85	2.85	0.55	0.00	0.00	0.00	0.00	0.00	0.00
Total	**8**									**2.38E-05**	**7.79E-05**	**1.48E-04**	**4.18E-06**	**4.18E-06**	**8.08E-07**

Notes:
1. Annual truck trips based on annual product deliveries and a tanker truck volume of 8,000 gallons.
2. VMT per truck trip estimated from Google Earth, for onsite travel only.
3. 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.
4. Emission factor calculations assumed an average speed of 15 mph.
5. The PM10 emission factor includes engine exhaust emissions along with brake and tire wear. The DPM emission factor includes engine exhaust emissions only.
6. Engineering estimate based on personal observation.
7. Idling exhaust emission factors from EMFAC 2007 using the EMFAC output option. The EMFAC default model year distribution for L.A. County was used.

Summary of Emissions from Cargo Handling Equipment
City of Industry Rail Yard, City of Industry, CA

Equipment	Equipment			Engine	Engine		Rating	No. of	Annual Hours	Load	2005 Emission Factors (g/bhp-hr)[3]						2005 Emission Estimates (tpy)					
Type	ID	Make	Model	Make	Model	Year	(hp)	Units	of Operation[1]	Factor[2]	HC	CO	NOx	PM10	DPM	SOx	HC	CO	NOx	PM10	DPM	SOx
Chassie Stacker	69588	Taylor	GT210	Perkins	10006-6t	1999	154	1	*4380*	0.30	0.538	2.851	6.862	0.360	0.360	0.060	0.120	0.636	1.531	0.080	0.080	0.013
RTG	98451	Mi Jack	1000R	Detroit	671NA	1984	300	1	0	0.43	NA	NA	NA	NA	NA	NA	0.000	0.000	0.000	0.000	0.000	0.000
RTG	99152	Mi Jack	1000R	Detroit	671NA	1991	300	1	6570	0.43	0.669	3.263	8.928	0.444	0.444	0.052	0.625	3.048	8.341	0.415	0.415	0.049
RTG	99153	Mi Jack	1000R	Detroit	671NA	1991	300	1	3285	0.43	0.669	3.263	8.928	0.444	0.444	0.052	0.313	1.524	4.170	0.207	0.207	0.024
RTG	90405	Taylor	6040	Detroit	DDEC	2004	300	1	6570	0.43	0.091	0.946	4.162	0.097	0.097	0.052	0.085	0.883	3.888	0.091	0.091	0.049
Top Pick	87764	Cat	V250	Cat	3218	1977	250	1	1095	0.59	1.230	6.172	14.936	0.858	0.858	0.060	0.219	1.099	2.659	0.153	0.153	0.011
Top Pick	89583	Taylor	TEC-950	Cummins	L-10	1995	350	1	1095	0.59	0.621	3.113	8.573	0.402	0.402	0.060	0.155	0.776	2.137	0.100	0.100	0.015
Yard Hostlers	32006	Ottawa	Commando	Cummins	6BT	2003	150	2	6570	0.65	0.263	2.862	5.248	0.230	0.230	0.060	0.371	4.042	7.412	0.325	0.325	0.084
Yard Hostlers	42160	Ottawa	Commando	Cummins	6BT	2004	150	3	6570	0.65	0.169	2.808	4.631	0.173	0.173	0.060	0.359	5.948	9.810	0.367	0.367	0.127
Yard Hostlers	52002	Ottawa	Commando	Cummins	6BT	2005	150	9	6570	0.65	0.119	2.754	4.283	0.139	0.139	0.060	0.758	17.502	27.217	0.882	0.882	0.380
Total								**21**									**3.004**	**35.458**	**67.165**	**2.620**	**2.620**	**0.751**

Notes:
1. Hours of operation provided by UPRR staff.

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Summary of Emissions from Diesel-Fueled Heavy Equipment
City of Industry Rail Yard, City of Industry, CA

Equipment Owner	Equipment Type	Fuel Type	Make	Model	Engine Make	Engine Model	Model Year[4]	Rating (hp)[4]	No of Units	Annual Hours of Operation[1]	Load Factor[2]	2005 Emission Factors (g/hp-hr)[3]						2005 Emission Estimates(tpy)					
												ROG	CO	NOx	PM10	DPM	SOx	VOC	CO	NOx	PM10	DPM	SOx
UP	Forklift	Diesel	Taylor	T300M "Big Red"	Cummins	5.9BT	2005	160	1	1000	0.30	0.25	2.83	4.32	0.15	0.15	0.06	0.01	0.15	0.23	0.01	0.01	0.00
TTX	Forklift (12,000 lb)	Diesel	Caterpillar	DP70	Mitsubishi	S-6-S	1997	92.5	2	730	0.30	1.85	4.60	10.39	0.97	0.97	0.06	0.08	0.21	0.46	0.04	0.04	0.00
MoW	Backhoe	Diesel	John Deere	S-310	Unknown	Unknown	Fleet Avg	*108*	1	1825	0.55	1.14	3.26	6.82	0.56	0.56	0.05	0.14	0.39	0.82	0.07	0.07	0.01
TTX	Forklift (8,000 lb)	Diesel	Caterpillar	DP-40D	Caterpillar	Unknown	1999	84	1	730	0.30	1.85	4.60	8.36	1.06	1.06	0.06	0.04	0.09	0.17	0.02	0.02	0.00
TTX	Forklift (6,000 lb)	Diesel	Caterpillar	R-80	Caterpillar	Unknown	1989	56.5	1	365	0.30	1.85	4.60	10.39	0.97	0.97	0.06	0.01	0.03	0.07	0.01	0.01	0.00
Total									**6**									**0.28**	**0.87**	**1.75**	**0.15**	**0.15**	**0.01**

Notes
1. Hours of operation estimated by UPRR staff.
2. Default load factors from OFFROAD2007 model.
3. Emission factors from OFFROAD2007 model.
4. Information for the John Deere backhoe could not be found. Therefore, a fleet average model year and engine horsepower were assumed for this unit.

Toxic Air Contaminant Emissions from the Wastewater Treatment Plant
City of Industry Rail Yard, City of Industry, CA

Pollutant	Emission Rate (grams/sec)	2005 Emission Estimates (lb/yr)	(tpy)
Benzene	2.36E-06	1.64E-01	8.20E-05
Bis(2-ethylhexyl) Phthalate	1.76E-08	1.22E-03	6.12E-07
Bromomethane	5.31E-06	3.69E-01	1.85E-04
Chloroform	3.10E-06	2.16E-01	1.08E-04
Ethylbenzene	1.44E-05	1.00E+00	5.01E-04
Methylene Chloride	3.29E-05	2.29E+00	1.14E-03
Toluene	1.56E-05	1.08E+00	5.42E-04
Xylene	2.70E-05	1.88E+00	9.39E-04
Total	**1.01E-04**	**7.00**	**3.50E-03**

1. Emission rates are from the *Air Emissions Inventory and Regulatory Analysis Report for City of Industry Yard* , Trinity Consultants, December 2005.
2. Emission rates from USEPA's Water8 Program and are based on the 2003-2004 wastewater flow rate of 4,717,389 gallons per year, per the Trinity Report.
3. Per UPRR staff, the flowrate for the clarifier is not measured, therefore, the annual flow rate in the Trinity Report was used for the emission calculations.

Summary of Emissions from Diesel-Fueled Internal Combustion Engines
City of Industry Rail Yard, City of Industry, CA

Location	Equipment Type	Make	Model Year	Fuel Type	Rating (hp)	Annual of Operation (hr/yr)[1,2]	Load Factor[3]	2005 Emission Factors (g/hp-hr)[4,5]						2005 Emission Estimates (tpy)					
								ROG	CO	NOx	PM10	DPM	SOx	ROG	CO	NOx	PM10	DPM	SOx
Yard Office	Emergency Generator	John Deere	Unknown	Diesel	134	20	NA	1.14	3.03	14.06	1.00	1.00	0.93	0.003	0.009	0.042	0.003	0.003	0.003
TTX Operations	Air Compressor	Ingersoll Rand	1988	Diesel	150	104	0.48	1.27	3.56	9.72	0.06	0.06	0.53	0.011	0.029	0.080	0.000	0.000	0.004
Total														**0.014**	**0.038**	**0.122**	**0.003**	**0.003**	**0.007**

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. Annual hours of operation for the air compressor were provided by TTX staff.
3. Load factor for the air compressor from the OFFROAD2007 model.
4. Emission factors for emergency generator from AP-42, Table 3.3-1.
5. Emission factors for the air compressor from OFFROAD2007 model. Evaporative emissions were negligible.

Summary of Emissions from Transport Refrigeration Units and Refrigerated Railcars
City of Industry Rail Yard, City of Industry, CA

TRU Equip Type	Average Rating (hp)[1]	Fuel Type	Average No. Units in Yard[2]	Hours of Operation (hr/day)[3]	Hours of Operation (hr/yr)[4]	Load Factor[5]	2005 Emission Factors (g/hp-hr)[6] HC	CO	NOx	DPM	SOx	VOC Evaporative Emission Factors[6] Part 1 (lb/hr)	Part 2 (lb/yr)	2005 Emission Estimates (tpy) HC	CO	NOx	DPM	SOx
Container	28.56	Diesel	10	4	1,460	0.56	2.85	6.78	6.43	0.71	0.07	-	-	0.73	1.74	1.65	0.18	0.02
Railcar	34	Diesel	4	4	1,460	0.53	3.23	7.49	6.71	0.79	0.07	-	-	0.38	0.87	0.78	0.09	0.01
Total			**14**		**2,920**									**1.11**	**2.61**	**2.43**	**0.27**	**0.03**

Notes:
1. Based on the average horsepower distribution in the OFFROAD 2006 model.
2. UPRR staff estimate that there are 3-5 TRUs and 0-2 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. Load factors are the default factors from the OFFROAD 2007 model.
6. Emission factors from OFFROAD 2007 model.
7. Evaporative emissions are negligible.

Summary of Emissions and Equipment Specifications for Storage Tanks
City of Industry Rail Yard, City of Industry, CA

Tank No.	Tank Location	Material Stored	Tank Capacity	Shell Color	Shell Condition	Potential Throughput (gal/yr)	Permitted?	Citation
1	Crane Maint. - PARSEC	Diesel	1,000	White	Good	52,000	Exempt	Rule 219(n)(4)
TNKO-0178	Crest Area	Lube Oil	1,000	Light Gray	Good	8,000	Exempt	Rule 219(n)(7)
Roil	Oil/Water Separator (WWTP)	Recovered Oil	550	Light Gray	Good	4,400	Exempt	Rule 219(n)(4)
2	Crane Maint. - PARSEC	Hydraulic Oil	241	Black	Good	1,928	Exempt	Rule 219(n)(4)
3	Crane Maint. - PARSEC	Motor Oil	241	Black	Good	1,928	Exempt	Rule 219(n)(4)
4	Crane Maint. - PARSEC	Used Oil	241	Black	Good	1,928	Exempt	Rule 219(n)(4)
5	Crane Maint. - PARSEC	Motor Oil	103	Silver	Good	824	Exempt	Rule 219(n)(4)
6	Crane Maint. - PARSEC	Used Oil	168	White	Good	1,344	Exempt	Rule 219(n)(4)
7	Crane Maint. - PARSEC	Hydraulic Oil	353	Light Gray	Good	2,824	Exempt	Rule 219(n)(4)
Total						**75,176**		

Notes:
1. Total potential throughput from 2005 Trinity Report. Actual throughput is estimated at approximately 50% of the potential.

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Equipment Specifications for Welders
City of Industry Rail Yard, City of Industry, CA

Location	Make	Model	Fuel Type	Rating (hp)
TTX Operations	Lincoln	Ranger 9	Gasoline	18
TTX Operations	Miller	Trailblazer	Gasoline	20
TTX Operations	Miller	Trailblazer	Gasoline	20
TTX Operations	Miller	Trailblazer	Gasoline	20
PARSEC			Gasoline	<50

Notes:
1. Welding equipment is exempt from SCAQMD permitting requirements per Rule 219(f)(8).
2. IC Engines meet the exempt requirements of SCAQMD Rule 219(b)(1).

Equipment Specifications for Miscellanous Combustion Sources
City of Industry Rail Yard, City of Industry, CA

Location	Equipment Type	Make	Fuel Type	Rating (hp)
TTX Operations	Hydraulic Lift	Honda GXV340	Gasoline	11
Crane Maintenance - PARSEC	Air Compressor	Honda GXV340	Gasoline	13
TTX Operations	Air Compressor	Atlas	Diesel	49

Notes:
1. These units are exempt from SCAQMD permitting requirements per Rule 219(b)(1).

APPENDIX I

DETAILED RISK SCREENING CALCULATIONS

Summary of Risk Index Values
City of Industry Rail Yard, City of Industry, CA

Source	Risk Index Value Cancer	% of Total Cancer Risk	Risk Index Value Chronic	% of Total Chronic Risk
Locomotive	1.76E-03	54.01	2.94E+01	51.81
Diesel-Fueled Yard Trucks	5.69E-05	1.75	9.49E-01	1.67
HHD Diesel-Fueled Drayage Trucks	5.31E-04	16.26	8.84E+00	15.60
HHD Diesel-Fueled Delivery Trucks	7.25E-09	0.00	1.21E-04	0.00
Cargo Handling Equipment (CHE)	7.86E-04	24.09	1.31E+01	23.10
Heavy Equipment	4.38E-05	1.34	7.30E-01	1.29
Transport Refrigeration Units (TRUs)	8.21E-05	2.52	1.37E+00	2.41
WWTP	4.09E-09	0.00	2.32E+00	4.08
Emergency Generator	8.84E-07	0.03	1.47E-02	0.03
Air Compressor	1.37E-07	0.00	2.29E-03	0.00
Total	3.26E-03	100.00	5.67E+01	100.00

Calculation of Risk Index Values for Diesel-Fueled Sources
City of Industry Rail Yard, City of Industry, CA

Source	DPM Emissions (tpy)	Unit Risk Factor Cancer	Cancer Risk Index Value	Unit Risk Factor Chronic	Chronic Risk Index Value
Locomotive	5.88	3.00E-04	1.76E-03	5.00E+00	2.94E+01
Diesel-Fueled Yard Trucks	0.19	3.00E-04	5.69E-05	5.00E+00	9.49E-01
HHD Diesel-Fueled Drayage Trucks	1.77	3.00E-04	5.31E-04	5.00E+00	8.84E+00
HHD Diesel-Fueled Delivery Trucks	0.00	3.00E-04	7.25E-09	5.00E+00	1.21E-04
Cargo Handling Equipment (CHE)	2.62	3.00E-04	7.86E-04	5.00E+00	1.31E+01
Heavy Equipment	0.15	3.00E-04	4.38E-05	5.00E+00	7.30E-01
Transport Refrigeration Units (TRUs)	0.27	3.00E-04	8.21E-05	5.00E+00	1.37E+00
Emergency Generator	0.00	3.00E-04	8.84E-07	5.00E+00	1.47E-02
Air Compressor	0.00	3.00E-04	1.37E-07	5.00E+00	2.29E-03
Total	**10.88**		**3.26E-03**		**5.44E+01**

Notes:
1. Unit risk factor from Consolidated Table of OEHHA/ARB Approved Risk Assessment Health Values, April 25, 2005. Cancer inhalation risk used.

Calculation of Risk Index Values for WWTP
City of Industry Rail Yard, City of Industry, CA

CAS	Chemical Name	Emissions (tpy)	Unit Risk Factor Cancer	Cancer Risk Index Value	Unit Risk Factor Chronic	Chronic Risk Index Value
71432	Benzene	8.20E-05	2.90E-05	2.38E-09	6.00E+01	4.92E-03
	Bis(2-ethylhexyl) Phthalate	6.12E-07				
	Bromomethane	1.85E-04				
67663	Chloroform	1.08E-04	5.30E-06	5.71E-10	3.00E+02	3.23E-02
100414	Ethylbenzene	5.01E-04			2.00E+03	1.00E+00
75092	Methylene Chloride	1.14E-03	1.00E-06	1.14E-09	4.00E+02	4.57E-01
108883	Toluene	5.42E-04			3.00E+02	1.63E-01
1330207	Xylene	9.39E-04			7.00E+02	6.57E-01
Total		**3.50E-03**		**4.09E-09**		**2.32E+00**

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APPENDIX J

SOURCE TREATMENT AND ASSUMPTIONS FOR AIR DISPERSION MODELING FOR NON-LOCOMOTIVE SOURCES

Appendix J

Source Treatment and Assumptions for Air Dispersion Modeling for Non-Locomotive Sources

As shown in Figures 3 through 7, 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 (RTGs) 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.

Assumptions used spatially to allocate emissions for each source group are shown in the Table below. See Figures 3 through 7 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 City of Industry Rail Yard		
Source	Source Treatment	Assumptions for Spatial Allocation of Emissions
Wastewater Treatment Plant	Volume	Assumed all emissions occurred at the WWTP location.
HHD Diesel-Fueled Intermodal Trucks (idling)	Volume	Assumed 1/3 of the total HHD truck idling occurred at the intermodal gate. The remaining 66% was allocated to the 3 trailer parking areas as follows: Area #1 – 25%, Area #2 – 25%, Area #3 – 50%.
HHD Diesel-Fueled Intermodal Trucks (traveling)	Volume	Assumed 30% of the traveling emissions occurred between Arenth Ave. and the intermodal gate and 15% occurred as trucks traveled through the intermodal gate. The remaining 55% of the emissions were allocated to the trailer parking areas as follows: Area #1 – 25%, Area #2 – 25%, and Area #3 – 50%.
Cargo Handling Equipment (low level)	Volume	Chassis Stackers – emissions were evenly allocated into the 3 chassis stacking areas. Top Picks – assumed all emissions occurred in the area around the unloading tracks. Yard Hostlers – emissions were allocated to the 3 trailer parking areas as follows: Area #1 – 25%, Area #2 – 25%, Area #3 – 50%.
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	Emissions from the backhoe and the forklift were allocated throughout the Yard.

APPENDIX K

SEASONAL AND DIURNAL ACTIVITY PROFILES

Appendix K

Development of Temporal Activity Profiles for the UPRR City of Industry Yard

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 K-1 lists the hourly activity factors derived for train movements, train and service idling, and yard switching at the UPRR City of Industry Yard. Separate temporal profiles are listed for day and night moving emissions as different volume source parameters are used for day and night. Table K-2 lists the seasonal activity factors for train and service activity.

Table K-1. Hourly Activity Factors for Train Activity at the UPRR City of Industry

Hour	Train Idling	Train Movements (Daytime)	Train Movements (Nighttime)	Yard Switching (Daytime(	Yard Switching (Nighttime)
1	1.158	0.000	1.303	0.000	1.000
2	0.971	0.000	1.262	0.000	1.000
3	0.736	0.000	0.883	0.000	1.000
4	0.714	0.000	0.791	0.000	1.000
5	0.634	0.000	0.695	0.000	1.000
6	0.623	0.000	0.732	0.000	1.000
7	0.613	0.585	0.000	1.000	0.000
8	0.853	0.736	0.000	1.000	0.000
9	0.950	0.869	0.000	1.000	0.000
10	1.305	0.846	0.000	1.000	0.000
11	1.316	1.427	0.000	1.000	0.000
12	0.789	0.869	0.000	1.000	0.000
13	1.172	0.553	0.000	1.000	0.000
14	1.148	1.623	0.000	1.000	0.000
15	0.690	0.851	0.000	1.000	0.000
16	0.661	0.777	0.000	1.000	0.000
17	0.760	0.787	0.000	1.000	0.000
18	0.770	0.892	0.000	1.000	0.000
19	1.260	0.000	0.814	0.000	1.000
20	1.351	0.000	1.825	0.000	1.000
21	1.201	0.000	0.709	0.000	1.000
22	1.145	0.000	1.482	0.000	1.000
23	1.399	0.000	0.627	0.000	1.000
24	1.782	0.000	2.063	0.000	1.000

Table K-2. Seasonal Activity Factors for the UPRR City of Industry Yard

Activity Type	Winter	Spring	Summer	Fall
Trains and Service	0.801	0.972	1.259	0.968

APPENDIX L

SELECTION OF POPULATION FOR THE URBAN OPTION INPUT FOR AERMOD AIR DISPERSION MODELING ANALYSIS

Appendix L

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.

APPENDIX M

DEMOGRAPHIC DATA

Appendix M

Population Shape Files for UPRR Rail Yards

The accompanying shape files include census boundaries as polygons and the corresponding residential populations from the 2000 U.S. Census. Separate shape files are included at the tract, block group, and block levels. The primary ID for each polygon begins with *ssccctttttt*, where *ss* is the FIPS state code (06 for California), *cc* is the county code, and *tttttt* is the tract code. The primary IDs for block groups have a single additional digit which is the block group number within each tract. Those for blocks have four additional digits identifying the block number. The population for each polygon are included as both the secondary ID and as attribute 1. Polygon coordinates are UTM zone 10 (Oakland and Stockton) or 11 (southern California yards), NAD83, in meters. The files contain entire tracts, block groups, or blocks that are completely contained within a specified area. For all yards except Stockton, the area included extends 10 kilometers beyond the 20 x 20 kilometer modeling domains. For Stockton, this area was extended to 20 kilometers beyond the modeling domain boundaries to avoid excluding some very large blocks.

In merging the population data[1] with the corresponding boundaries[2], it was noted that at all locations, there are defined census areas (primarily blocks, but in some cases block groups and tracts) for which there are no population records listed in the population files. Overlaying these boundaries on georeferenced aerial photos indicates that these are areas that likely have no residential populations (e.g., industrial areas and parks). The defined areas without population data have been excluded from these files. Areas with an identified population of zero have been included. It was also observed that some blocks, block groups and tracts with residential populations cover both residential areas and significant portions of the rail yards themselves. For this reason, any analysis of population exposures based on dispersion modeling should exclude receptors that are within the yard boundaries or within 20 meters of any modeled emission source locations.

To facilitate the exclusion of non-representative receptors, separate shape files have been generated that define the area within 20 meters of the yard boundaries for each yard. These files are also included with the accompanying population files. It should also be noted that the spatial extent of individual polygons can vary widely, even within the same type. For example, single blocks may be as small as 20 meters or as large as 10,000 meters or more in length. To estimate populations contained within specific areas, it may prove most useful to generate populations on a regular grid (e.g., 250 x 250 m cells) rather than attempting to process irregularly shaped polygons.

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[1] Population data were extracted from the *Census 2000 Summary File 1* DVD, issued by the U.S. Department of Commerce, September 2001.

[2] Boundaries were extracted from ESRI shapefiles (*.shp) created from the U.S. Census TIGER Line Files downloaded from ESRI (*http://arcdata.esri.com/data/tiger2000/tiger_download.cfm*).