COMMERCE-MECHANICAL FACILITY
TAC EMISSIONS INVENTORY

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APPENDICES

TABLES

1.0 INTRODUCTION

This document describes the data and methods used in estimating toxic air contaminant (TAC) emissions resulting from facility operations and other activities in and around the Commerce-Mechanical facility. The data describe activities grouped by like emission source and by spatial activity. The emission sources include:

- Locomotives
- Cargo Handling equipment
- On-road vehicles
- Off-road equipment
- Stationary sources

Emissions factors for diesel PM and organic gases (which are then speciated into other relevant toxic air contaminants) for each source are included, and emissions estimates provided.

2.0 LOCOMOTIVE FACILITY OPERATIONS

The operations at the Commerce-Mechanical facility include engine-on locomotive activity within the service facility (Sections 2.1 - 2 4), classification yard (Section 2.5), and operating tracks (Sections 2.6 and 2.7). Under each heading is a description of the operations.

Since different locomotive and engine models have different emissions characteristics, it is important to characterize the types and models of the locomotives that are being serviced in the Commerce-Mechanical facility. ENVIRON estimated the locomotive fleet fractions for different locomotive types and models using data provided by BNSF. The operation descriptions below each include a uniquely applicable fleet characterization.

2.1 Basic Locomotive Service

14,577 locomotives were serviced over the period from April 1, 2005 through March 31, 2006. All locomotives entering the facility have sand, fuel, and lubricant service regardless of other service provided at the facility.

Number Served: 14,577 over one year.

Operations

(1) Movement into yard at about 5 mph in Notch 1 (single locomotive) or Notch 2 (with 4 locomotives) - 100% on Notch 1 is assumed in the study.
(2) Idle time while refueling is estimated to be 1 hour.
(3) In-Consist (4 locomotives on average) is estimated to be 30 minutes at Idle.
(4) Lead engine only is load tested at Notch 8 for 15 minutes.
(5) Movement out of yard at about 5 mph in Notch 2 (4-locomotive consist).

Idle shutdown sometimes occurs after 30 minutes and two 30-minute idle periods are typical during service BNSF indicated that this operation occurs throughout a 24-hour period. The activities (duration and modes of operations) for the Basic Services are summarized in Table 2-1.

Table 2-1. Activities for the Basic Services in the Commerce-Mechanical facility.

Activities	Est. Speed (mph)	Est. Distance (mile)	Est. Time (hour)	Operation Mode
A1: Movement into Yard	5	0.17	0.03	Notch 1
A2: Idling while Refueling	0	0	1.0	Idle
A3: In-consist	0	0	0.5	Idle
A4: Lead Engine Load Test	0	0	0.25	Notch 8
A5: Movement out of Yard	5	0.17	0.03	Notch 2

Since Basic Services are performed on all locomotives passing through the facility, ENVIRON assumed the fleet characteristics for this activity group are equivalent to typical fleet characteristics of the mainline locomotive activity. Data provided by BNSF detailed the fleet of locomotives passing the Commerce-Mechanical facility between May 1, 2005 and April 30, 2006. ENVIRON classified the annual locomotive counts by unique engine model description for all BNSF owned and operated engines. Eleven percent of BNSF engine model types could

not be identified because some engines originally owned by other railroads (such as CSX or Norfolk Southern) were leased by BNSF. This fraction of unidentified engines was reallocated proportionally across the rest of the fleet. The final fleet characterization is shown in Table 2-2. Engine surrogates were assigned for use with emission factor data, though approximately 96% of the fleet had matching emission data for the same model type and certification tier.

Table 2-2. Fleet characterization for locomotive mainline activity past the Commerce-Mechanical facility, as well as for Basic Services in the Commerce-Mechanical facility.

Locomotive Model	Certification Tier	HP	Fleet Fraction	Engine Surrogate
C44-9W	0	4400	39.6%	Dash-9
C44-9W	1	4400	18.1%	Dash-9
C44-9W	Precontrolled	4400	7.7%	Dash-9
SD40-2	Precontrolled	2997	6.7%	GP-4x
ES44DC	2	4400	6.0%	ES44/Dash-9
C40-8W	0	4135	5.5%	Dash-8
GP35	Precontrolled	2500	2.2%	GP-3x
GP60M	0	3800	1.9%	GP-60
B40-8W	Precontrolled	4000	1.7%	Dash-8 Tier 0
SD40-2	0	3000	1.2%	GP-4x Precontrolled
GP39-2	Precontrolled	2300	1.1%	GP-3x
GP30	Precontrolled	2500	1.1%	GP-3x
B40-8	Precontrolled	4000	0.9%	Dash-8 Tier 0
GP60	0	3800	0.9%	GP-60
GP60B	0	3800	0.8%	GP-60
B40-8W	0	4000	0.8%	Dash-8
GP60	Precontrolled	3800	0.8%	GP-60
SD60M	Precontrolled	3800	0.5%	GP-60
SD60	Precontrolled	3800	0.3%	GP-60
SD45-2	Precontrolled	3345	0.3%	GP-4x
SD50	Precontrolled	3385	0.3%	GP-50
GP38-2	Precontrolled	2000	0.3%	GP-3x
SD39	Precontrolled	2300	0.2%	GP-3x
GP25	Precontrolled	2500	0.2%	GP-3x
GP38	Precontrolled	2000	0.1%	GP-3x
GP39M	Precontrolled	2300	0.1%	GP-3x
GP40M	Precontrolled	3000	0.1%	GP-4x
SD40	Precontrolled	2930	0.1%	GP-4x
SD45	Precontrolled	3480	0.1%	GP-4x
B23-7	Precontrolled	2250	0.1%	Dash-7
SD40-2T	Precontrolled	3000	0.1%	GP-4x
SD75M	0	4300	0.04%	SD-7x
SW1500	Precontrolled	1500	0.04%	Switcher
SD60M	0	3800	0.03%	GP-60
AC4400CW	1	4400	0.03%	Dash-9
SD40-2B	Precontrolled	3000	0.03%	GP-4x
SD40-2S	0	3000	0.02%	GP-4x Precontrolled
SD70MAC	Precontrolled	4000	0.02%	SD-7x
SD70MAC	0	4000	0.02%	SD-7x
GP39E	Precontrolled	2300	0.02%	GP-3x
GP50	Precontrolled	3300	0.02%	GP-50
GP9	Precontrolled	1750	0.02%	Switcher
SD45-2T	Precontrolled	3400	0.02%	GP-4x
SW1000N	Precontrolled	1000	0.02%	Switcher
SD45-2B	Precontrolled	3400	0.01%	GP-4x
ES44AC	2	4400	0.01%	ES44/Dash-9

Locomotive Model	Certification Tier	HP	Fleet Fraction	Engine Surrogate
SD40-3	Precontrolled	3000	0.01%	GP-4x
SD9	Precontrolled	1750	0.01%	Switcher
SD45-2BF	Precontrolled	3600	0.01%	GP-4x
GG-20B	Precontrolled	2000	0.003%	GP-3x
GP40E	Precontrolled	3000	0.003%	GP-4x
GP40X	Precontrolled	3600	0.003%	GP-4x
SD38-2	Precontrolled	2300	0.003%	GP-3x
SD60	0	3800	0.003%	GP-60

2.2 Basic Engine Inspection

At 3 and 6 months or 122 and 184 days (M03, M06, M122, M184) locomotives undergo a basic engine inspection.

Number Inspected: 476 locomotives over one year.

Operations

(1) Movement to Engine Shop (2 minutes at Notch 1 for each locomotive). Notch 2 towing 4 locomotives could be used but not assumed here to simplify the modeling.
(2) Preload tested 20 minutes at Notch 8 immediately southeast of engine shop.
(3) After service, 35 to 45 minutes load tested at Notch 8 occurs immediately northeast of engine shop.
(4) Movement back into service (2 minutes at Notch 1).

Opacity testing is only performed annually and is assumed not to take place during these basic service inspections. BNSF indicated that the basic inspection operation occurs throughout a 24-hour period. The activities (duration and modes of operations) for the Basic Engine Inspection are summarized in Table 2-3.

Table 2-3. Activities for the Basic Engine Inspection in the Commerce-Mechanical facility.

Activities	Est. Speed (mph)	Est. Distance (mile)	Est. Time (hour)	Operation Mode
B1: Movement into Engine Shop	5	0.17	0.03	Notch 1
B2: Preloaded Test	0	0	0.33	Notch 8
B3: After Service Load Test	0	0	0.67	Notch 8
B4: Movement out to Service	5	0.17	0.03	Notch 1

BNSF provided service data from April 1, 2005 to March 31, 2006 to ENVIRON. Based on these service data, the locomotive fleet fractions for different locomotive types and models undergoing basic engine inspection in the Commerce-Mechanical facility are shown in Table 2-4

Table 2-4. Fleet characterization for the Basic Engine Inspection in the Commerce-Mechanical facility.

Locomotive Model	Certification Tier	HP	Fleet Fraction	Engine Surrogate
C44-9W	0	4400	45.7%	Dash-9
C44-9W	1	4400	23.8%	Dash-9
C44-9W	Precontrolled	4400	8.0%	Dash-9
ES44DC	2	4400	6.5%	ES44/Dash-9
C40-8W	0	4135	6.3%	Dash-8
GP35	Precontrolled	2500	2.3%	GP-3x
SD40-2	Precontrolled	2900	1.5%	GP-4x
B40-8W	Precontrolled	4000	1.1%	Dash-8 Tier 0
GP30	Precontrolled	2500	1.1%	GP-3x
GP39-2	Precontrolled	2300	1.1%	GP-3x
B40-8	Precontrolled	4000	0.4%	Dash-8 Tier 0
B40-8W	0	4000	0.4%	Dash-8
GP25	Precontrolled	2500	0.4%	GP-3x
GP38-2	Precontrolled	2000	0.4%	GP-3x
SD39	Precontrolled	2300	0.4%	GP-3x
GG-20B	Precontrolled	2000	0.2%	GP-3x
GP38	Precontrolled	2000	0.2%	GP-3x
GP9	Precontrolled	1750	0.2%	Switcher

2.3 Full Engine Service/Inspection

After engine repairs (unscheduled inspections for reported problems) or at scheduled inspections/service at 12 months, 244 days, or 368 days (M12, M244, M368), the engine is preloaded for diagnostic, and a loaded test of 35 to 45 minutes is typically performed concurrently with an opacity test at steady-state for at least 150 seconds at each notch setting and idle followed by a final loaded test of about 20 minutes before sent back into operation. The opacity testing is being phased-in. While it is not fully implemented at the present time, it will be assumed to be fully implemented for the purpose of this study BNSF indicated that this operation occurs throughout a 24-hour period.

Total with opacity testing - 231 locomotives over one year
Total without opacity testing - 305 locomotives over one year
Total Number Served: 536 locomotives over one year

Operations

(1) Movement to Engine Shop (2 minutes at Notch 1)
(2) Preload test - 20 minutes at Notch 8 prior to repair/service southeast of the engine shop
(3) Opacity Test - 150 seconds testing occurs at each setting/mode (8 Notches and idle) setting But overall time for testing estimated to be 35 to 45 minutes, which figures out to be 300 seconds at each mode including 8 notches and idle So, we assumed 117 seconds for stabilizing and 150 seconds for testing at each engine setting for this work for a total of 40 minutes
(4) Final Load Test - 40 minutes at Notch 8 (opacity and final load testing occur northwest of engine shop)
(5) Returned to service (2 minutes at Notch 1)

The activities (duration and modes of operations) for the Full Engine Service/Inspection are summarized in Table 2-5. The fleet characterization based on the service data is provided in Table 2-6.

Table 2-5. Activities for the Full Engine Service/Inspection in the Commerce-Mechanical facility.

Activities	Est. Speed (mph)	Est. Distance (mile)	Est. Time (hour)	Operation Mode
C1: Movement into Engine Shop	5	0.003	0.03	Notch 1
C2: Preloaded Test	0	0	0.33	Notch 8
C3: Opacity Test	0	0	0.67	Idle and Notches 1 to 8
C4: Final Load Test	0	0	0.67	Notch 8
C5: Movement out to Service	5	0.003	0.03	Notch 1

Table 2-6. Fleet characterization for the Full Engine Service/Inspection in the Commerce-Mechanical facility.

Locomotive Model	Certification Tier	HP	Fleet Fraction	Engine Surrogate
C44-9W	0	4400	46.8%	Dash-9
C44-9W	1	4400	29.3%	Dash-9
C44-9W	Precontrolled	4400	10.3%	Dash-9
C40-8W	0	4135	6.2%	Dash-8
ES44DC	2	4400	4.5%	ES44/Dash-9
B40-8	Precontrolled	4000	0.7%	Dash-8 Tier 0
SD40-2	Precontrolled	3000	0.7%	GP-4x
B40-8W	Precontrolled	4000	0.6%	Dash-8 Tier 0
B40-8W	0	4000	0.4%	Dash-8
B23-7	Precontrolled	2250	0.2%	Dash-7
SD39	Precontrolled	2300	0.2%	GP-3x
SD40-2	0	3000	0.2%	GP-4x Precontrolled

2.4. Movements of Cars to Car Repair Yard

Switching engine fleet characteristics in the Commerce-Mechanical area were determined by a roster of engines made available by BNSF in early 2006. The data are shown in Table 2-7. Most engines are of similar power and type. This fleet was used to describe the switching engine activity assuming equivalent use of all 18 engines in the fleet.

Table 2-7. Locomotive switching engine fleet characterization for service to the Commerce-Mechanical facility.

Locomotive Model	Certification Tier	HP	Number of Engines	Engine Surrogate
GP-25	Precontrolled	2500	1	GP-3x
GP-30	Precontrolled	2500	3	GP-3x
GP-35	Precontrolled	2500	4	GP-3x
GP39-2	Precontrolled	2300	6	GP-3x
GP39E	Precontrolled	2300	1	GP-3x
SD39	Precontrolled	2300	1	GP-3x
MK1200G	Precontrolled	1200	2	Switcher

The time in mode for switching engine activity in Table 2-8 was determined from event recorder downloads of a sample of three engines operating in this yard. The three engines chosen range from 2,300 - 2,500 hp, and are representative of the switching engines dedicated to the area. The time in mode from the event recorder downloads could not distinguish engine idling and engine off periods, so the idle mode was fixed at the EPA switching engine cycle estimate of 59.8% and the remaining notch settings renormalized so that the full cycle sums to 100% of the time. This adjustment has the effect of increasing the emissions estimate by placing more of the activity into the higher notch settings.

Table 2-8. Switching engine (~2,500 hp) relative time in mode.

Throttle Notch	Time in Mode
DB	0.03%
Idle	59.80%
1	12.66%
2	14.92%
3	7.14%
4	3.86%
5	0.85%
6	0.31%
7	0.18%
8	0.25%

The total switching engine activity consists of engines performing two switches a day with one hour of engine on-site time per switch (i.e. two hours of switching engine use per day).

2.5. Movements in Adjacent Classification Yard

The activity in this area of the yard was lumped together with the activity in Area D because the activity description applies to both areas. Switching engines move cars in and out of the car repair yard lot and into and out of the classification yard. Cars repaired or waiting to be repaired is a large portion of the activity within this area, so the switching engine activity is indistinguishable from the Car Repair Yard.

2.6. Freight Movements on Adjacent Mainline

The adjacent main line along the (primarily) south-southwest edge of the facility runs approximately a half mile, which likely corresponds with the same distance from milepost 148 to the Commerce-Mechanical Station at milepost 148.459. The Commerce-Eastern Avenue site is listed as milepost 147.3, and the track distance from Eastern Avenue to the southwest edge of the Commerce-Eastern Facility is 0.7 miles. So it was concluded that the length from the southwest edge to the southeast edge of the facility represents the activity along milepost 148 to 148.459.

Two subcategories of freight movements occur on the mainline BNSF and non-BNSF (foreign). All operations for both subcategories are assumed to occur throughout a 24-hour period BNSF reads radio tags for most of the traffic along its mainline, cataloging every locomotive except most of the Metrolink engines operating commuter trains during weekdays.

2.6.1 BNSF Freight Movements

Data provided by BNSF showed a total of 56,920 locomotives passing the Commerce-Mechanical facility between May 1, 2005 and April 30, 2006. Since only the total number of locomotives was available, ENVIRON assumed one-half (28,460) were traveling Eastbound, and one-half (28460) were traveling Westbound. ENVIRON determined the time in mode distributions for Eastbound and Westbound mainline activity using computer simulation data provided by BNSF for a hypothetical locomotive traveling at approximately 30 mph past the Commerce-Mechanical facility (milepost 148-148.5). These data are summarized in Table 2-9. Note that the total time to pass the Commerce-Mechanical facility traveling eastbound amounts to 63 seconds, while the total time in the Westbound direction is only 57 seconds on average.

Table 2-9. Locomotive time in mode passing the Commerce-Mechanical facility.

Direction	Throttle Notch	Est. Distance (mile)	Est. Time (hour)
Westbound	DB	0.50	0.0160
Eastbound	DB	0.14	0.0021
Eastbound	1	0.08	0.0028
Eastbound	2	0.15	0.0056
Eastbound	3	0.13	0.0071

The fleet characterization for locomotives along the mainline was provided in Table 2-2, and derived from all engines passing the site on the adjacent mainlines.

2.6.2 Foreign (non-BNSF) Freight Movements

Data provided by BNSF showed only 222 foreign (non-BNSF and non-Commuter) locomotives passing the Commerce-Mechanical facility between May 1, 2005 and April 30, 2006. As with the BNSF freight, ENVIRON assumed one-half (111) were traveling Eastbound, and one-half (111) were traveling Westbound. Without engine model descriptions for these locomotives, ENVIRON made the assumption that the fleet mix and time in mode for these engines would be the same as what Tables 2 and 9 show for the BNSF engines.

2.7. Commuter Rail Operations on Adjacent Mainline

BNSF data show that AMTRAK operates 10,391 trains per year in both directions throughout the week along this line BNSF also confirmed that Metrolink operates 7,280 trains per year along this line, with activity occurring only during weekdays. Although it does not occur throughout a 24-hour period, this operation is assumed to occur throughout a 24-hour period for modeling simplicity in this study.

Exact fleet characteristics are not known for the AMTRAK and Metrolink locomotives. However, both ARB and BNSF have indicated the predominance of F59PHI (EMD 710E3, 3000 hp) engines in the AMTRAK and Metrolink fleets, which for purposes of emissions estimates in this study are modeled using the average emission levels from the EPA (1997) study for the two 12 cylinder EMD 710G3 engines based on similarities in engine design, size, and power rating.

3.0 LOCOMOTIVE EMISSION FACTORS FOR DIESEL PARTICULATE MATTER

Emission factors used in this study were based primarily on the emission factors used in the California Air Resources Board (ARB)'s Risk Assessment Study for the Union Pacific Roseville facility, and the Southwest Research Institute (SwRI, 2000) study sponsored by ARB, entitled "Diesel Fuel Effects on Locomotive Exhaust Emissions" and supplemented with one model of engine from the EPA (1997) data summary to specifically address the commuter and passenger rail engines. Since the publication date of the Roseville report, ARB provided ENVIRON with additional emission factors for criteria pollutants, and made some adjustments to the original Roseville data (ARB, 2006a). ENVIRON also received permission from the engine owners to obtain additional emission factor data from the Exhaust Plume Study performed by SwRI (2005). The PM emission factors relevant to all locomotives in the Commerce-Mechanical facility are summarized in Tables 10a and 10b for several different locomotive model groups and certification tiers. Specific locomotives and engines in each locomotive model group can be inferred from the fleet characterization tables provided above.

Based on conversation with the principal researcher on all the locomotive studies (SwRI, 2006), ENVIRON learned that a default fuel sulfur content of 0.3% was used on all test results and certification data produced with locomotives to date (the emission rates in SwRI, 2000 were those with 0.3% sulfur fuel). The emission rates using this fuel are reflected in Table 3-1a.

Table 3-1a. PM emission factors for locomotives used in the study, assuming default fuel sulfur content (0.3%).

Locomotive Model Group	Cert Tier[a]	Emission Factors (g/hr) by Throttle Notch									
		Idle	DB[b]	1	2	3	4	5	6	7	8
Switchers [1]	Precntl	31.0	56.0	23.0	76.0	138.0	159.0	201.0	308.0	345.0	448.0
GP-3x [1]	Precntl	38.0	72.0	31.0	110.0	186.0	212.0	267.0	417.0	463.0	608.0
GP-4x [1]	Precntl	47.9	80.0	35.7	134.3	226.4	258.5	336.0	551.9	638.6	821.3
GP-50 [1]	Precntl	26.0	64.1	51.3	142.5	301.5	311.2	394.0	663.8	725.3	927.8
GP-60 [1]	Precntl	48.6	98.5	48.7	131.7	284.5	299.4	375.3	645.7	743.6	941.6
SD-7x [1]	Precntl	24.0	4.8	41.0	65.7	156.8	243.1	321.1	374.8	475.2	589.2
Dash-7 [1]	Precntl	65.0	180.5	108.2	121.2	359.5	327.7	331.5	299.4	336.7	420.0
Dash-9 [2]	Precntl	32.1	53.9	54.2	108.1	219.9	289.1	370.6	437.7	486.1	705.7
EMD 12-710G3 [3]	Precntl	27.5	54.5	34.0	112.5	208.0	234.5	291.0	423.0	545.0	727.5
GP-60 [4]	0	21.1	25.4	37.6	75.5	239.4	352.2	517.8	724.8	1125.9	1319.8
SD-7x [1]	0	14.8	15.1	36.8	61.1	230.4	379.8	450.8	866.2	1019.1	1105.7
Dash-8 [1]	0	37.0	147.5	86.0	133.1	291.4	293.2	327.7	373.5	469.4	615.2
Dash-9 [5]	0	33.8	50.7	56.1	117.4	229.2	263.8	615.9	573.9	608.0	566.6
Dash-9 [4]	1	16.9	88.4	62.1	140.2	304.0	383.5	423.9	520.2	544.6	778.1
ES44/Dash-9 [4]	2	7.7	42.0	69.3	145.8	304.3	365.0	405.2	418.4	513.5	607.5

[1] Final locomotive emission factors (an update to the Roseville study emission factors Table B-1) received via email from Dan Donohue of ARB, May 9, 2006.

[2] "Diesel Fuel Effects on Locomotive Exhaust Emissions," Southwest Research Institute, October 2000.

[3] EPA, 1997.

[4] Confidential data from SwRI, 2006.

[5] Average of ARB and SwRI, 2006.

[a] Precntl: Precontrolled

[b] DB: Dynamic Braking

Table 3-1b provides emission factors adjusted for fuel sulfur content of 0.105%. This adjustment was performed according to documented ARB procedures from the OFFROAD Modeling

Change Technical Memo (Wong, 2005). All locomotive emissions presented in this document utilized the emission factors from Table 3-1b.

Table 3-1b. Emission Factors for locomotives used in the study, adjusted for reduced fuel sulfur content (0.105%).

Locomotive Model Group	Cert Tier[a]	Emission Factors (g/hr) by Throttle Notch									
		Idle	DB[b]	1	2	3	4	5	6	7	8
Switchers [1]	Precntl	31.0	56.0	23.0	76.0	131.8	146.1	181.5	283.2	324.4	420.7
GP-3x [1]	Precntl	38.0	72.0	31.0	110.0	177.7	194.8	241.2	383.4	435.3	570.9
GP-4x [1]	Precntl	47.9	80.0	35.7	134.3	216.2	237.5	303.5	507.4	600.4	771.2
GP-50 [1]	Precntl	26.0	64.1	51.3	142.5	288.0	285.9	355.8	610.4	681.9	871.2
GP-60 [1]	Precntl	48.6	98.5	48.7	131.7	271.7	275.1	338.9	593.7	699.1	884.2
SD-7x [1]	Precntl	24.0	4.8	41.0	65.7	149.8	223.4	290.0	344.6	446.8	553.3
Dash-7 [1]	Precntl	65.0	180.5	108.2	121.2	322.6	302.9	307.7	268.4	275.2	341.2
Dash-9 [2]	Precntl	32.1	53.9	54.2	108.1	197.3	267.3	343.9	392.4	397.3	573.3
EMD 12-710G3 [3]	Precntl	27.5	54.5	34.0	112.5	186.6	216.8	270.1	379.3	445.4	591.0
GP-60 [4]	0	21.1	25.4	37.6	75.5	228.7	323.6	467.7	666.4	1058.5	1239.3
SD-7x [1]	0	14.8	15.1	36.8	61.1	220.1	349.0	407.1	796.5	958.1	1038.3
Dash-8 [1]	0	37.0	147.5	86.0	133.1	261.5	271.0	304.1	334.9	383.6	499.7
Dash-9 [5]	0	33.8	50.7	56.1	117.4	205.7	243.9	571.5	514.6	496.9	460.3
Dash-9 [4]	1	16.9	88.4	62.1	140.2	272.8	354.5	393.4	466.4	445.1	632.1
ES44/Dash-9 [4]	2	7.7	42.0	69.3	145.8	273.0	337.4	376.0	375.1	419.6	493.5

[1] Final locomotive emission factors (an update to the Roseville study emission factors Table B-1) received via email from Dan Donohue of ARB, May 9, 2006.

[2] "Diesel Fuel Effects on Locomotive Exhaust Emissions," Southwest Research Institute, October 2000.
[3] EPA, 1997.
[4] Confidential data from SwRI, 2006.
[5] Average of ARB and SwRI, 2006.
[a] Precntl: Precontrolled
[b] DB: Dynamic Braking

The sulfur content value of 0.105% used for the adjustment was obtained by averaging data provided by BNSF for diesel fuel dispensed and corresponding sulfur level at all California sites and those near California. For sites outside of California, ENVIRON assumed that half of the fuel dispensed would be used in California, because trains moving in either direction may be fueled there. In reality, it is likely that less than half of the out-of-state fuel dispense will be used in California, because many of those sites are a significant distance from the state border.

Table 3-2. Fuel sulfur and total annual fueling at various locomotive fueling locations.

Location	State	Total Gallons	% Sulfur
Holbrook	AZ	21,935	0.192
Phoenix	AZ	3,542,292	0.034
Flagstaff	AZ	2,019	0.192
Kingman	AZ	334,309	0.034
Vacaville	CA	33,074	0.034
Redding	CA	1,004	0.192
Summit	CA	1,750	0.192
San Diego	CA	530	0.192
Bakersfield	CA	240,976	0.034
Barstow	CA	1,946,092	0.015
Oakland	CA	1,762,993	0.034
Needles	CA	770,667	0.192
Bakersfield	CA	131,075	0.034
Bakersfield	CA	11,070	0.034

Location	State	Total Gallons	% Sulfur
Corona	CA	103,982	0.034
Fresno	CA	2,669,884	0.034
Kaiser	CA	460,390	0.034
Kings Park	CA	61,900	0.034
Pittsburg	CA	12,695	0.034
Riverbank	CA	2,070,244	0.034
San Bernardino	CA	9,940,295	0.034
San Diego	CA	111,369	0.192
Stockton	CA	1,018,965	0.034
Stuart Mesa	CA	41,509	0.192
Terminal Island	CA	14,816,643	0.192
Victorville	CA	66,042	0.034
Watson	CA	1,152,454	0.192
Bakersfield	CA	11,236	0.192
Winslow	AZ	3,496,072	0.170
Belen	NM	202,462,278	0.192
Barstow	CA	52,439,321	0.015
Commerce	CA	31,573,289	0.015
Richmond	CA	22,255,177	0.034
Klamath Falls	OR	3,070,865	0.381

The fuel sulfur correction methodology described by ARB (2005) was used to adjust PM emission rates from an average fuel sulfur level of 0.3% to 0.105% using the fuel sulfur - PM relationship equation, A + B * (fuel sulfur, ppm). The emission reductions calculated for GE and EMD engines shown in Table 3-3 were applied to the base emission rates to calculate the emission rates at the in-use fuel sulfur levels.

Table 3-3. Fuel sulfur emission reductions by notch and engine type.

Notch	B	A	Fuel Sulfur 0.3% EF (g/hp-hr)	Fuel Sulfur 0.105% EF (g/hp-hr)	Reduction
GE 4-stroke Engine					
8	0.00001308	0.0967	0.13594	0.110434	18.76%
7	0.00001102	0.0845	0.11756	0.096071	18.28%
6	0.00000654	0.1037	0.12332	0.110567	10.34%
5	0.00000548	0.132	0.14844	0.137754	7.20%
4	0.00000663	0.1513	0.17119	0.1582615	7.55%
3	0.00000979	0.1565	0.18587	0.1667795	10.27%
EMD 2-stroke engine					
8	0.0000123	0.3563	0.3932	0.369215	6.10%
7	0.0000096	0.284	0.3128	0.29408	5.98%
6	0.0000134	0.2843	0.3245	0.29837	8.05%
5	0.000015	0.2572	0.3022	0.27295	9.68%
4	0.0000125	0.2629	0.3004	0.276025	8.11%
3	0.0000065	0.2635	0.283	0.270325	4.48%

4.0 LOCOMOTIVE DIESEL PM EMISSION ESTIMATES

4.1. Basic Service

The annual PM emissions for Basic Service by individual activities are presented in Table 4-1. Most of the PM emissions were estimated to originate from the idling activities (A2+A3, 60%) and load testing (A4, 35%) in this facility.

Table 4-1. Estimated annual PM emissions associated with the Basic Services in the Commerce-Mechanical facility.

Locomotive Model Group	Cert Tier	# of Loco	PM Emissions by Operation Activity (grams)					Annual Total (grams)
			A1	A2	A3	A4	A5	
Switchers	Precntl	12	8	371	185	314	27	**906**
GP-3x	Precntl	778	724	29,579	14,790	27,775	2,569	**75,437**
GP-4x	Precntl	1257	1,346	60,249	30,124	60,578	5,063	**157,361**
GP-50	Precntl	43	67	1,127	563	2,359	185	**4,302**
GP-60	Precntl	225	329	10,952	5,476	12,453	890	**30,101**
SD-7x	Precntl	3	4	78	39	112	6	**239**
Dash-7	Precntl	12	38	760	380	250	43	**1,470**
Dash-9	Precntl	1128	1,834	36,206	18,103	40,398	3,657	**100,197**
GP-60	0	528	596	11,144	5,572	40,908	1,196	**59,416**
SD-7x	0	9	10	136	68	598	17	**829**
Dash-8	0	1299	3,353	48,004	24,002	40,574	5,188	**121,121**
Dash-9	0	5766	9,702	195,092	97,546	165,867	20,300	**488,507**
Dash-9	1	2647	4,932	44,738	22,369	104,583	11,134	**187,756**
ES44/Dash-9	2	869	1,807	6,694	3,347	26,813	3,802	**42,463**
Total		**14,577**	**24,750**	**445,128**	**222,564**	**523,583**	**54,079**	**1,270,104**

4.2. Basic Engine Inspection

The PM emission estimates for Basic Engine Inspection by individual activities over the one-year period for each activity in the Commerce-Mechanical facility are presented in Table 4-2. Most of the PM emissions were estimated to originate from the pre-service (B2, 33%) and post-service (B3, 67%) load tests in this facility.

Table 4-2. Estimated annual PM emissions associated with the Basic Engine Inspection in the Commerce-Mechanical facility.

Locomotive Model Group	Cert Tier	# of Loco	PM Emissions by Operation Activity (grams)				Annual Total (grams)
			B1	B2	B3	B4	
Switchers	Precntl	1	1	139	282	1	**422**
GP-3x	Precntl	29	27	5,464	11,093	27	**16,610**
GP-4x	Precntl	7	7	1,782	3,617	7	**5,414**
Dash-9	Precntl	38	62	7,189	14,595	62	**21,908**
Dash-8	0	39	101	6,432	13,058	101	**19,691**
Dash-9	0	218	365	32,960	66,920	365	**100,610**
Dash-9	1	113	211	23,571	47,857	211	**71,849**
ES44/Dash-9	2	31	64	5,049	10,250	64	**15,428**
Total		**476**	**838**	**82,585**	**167,672**	**838**	**251,932**

4.3. Full Engine Service/Inspection

The PM emission estimates for Full Engine Service/Inspection by individual activities over the one-year period are presented in Table 4-3. Similar to the Basic Engine Service, most of the PM emissions were estimated to originate from the pre service (C2, 28%), opacity test (C3, 14%) and post service (C4, 57%) load tests in this facility.

Table 4-3. Estimated annual PM emissions associated with the Full Engine Service/ Inspection in the Commerce facility.

Locomotive Model Group	Cert Tier	# of Loco	PM Emissions by Operation Activity (grams)					Annual Total (grams)
			C1	C2	C3	C4	C5	
GP-3x	Precntl	1	1	188	70	383	1	**643**
GP-4x	Precntl	5	5	1,273	458	2,584	5	**4,325**
Dash-7	Precntl	1	3	113	68	229	3	**415**
Dash-9	Precntl	55	89	10,405	4,175	21,125	89	**35,883**
Dash-8	0	42	108	6,926	3,114	14,062	108	**24,320**
Dash-9	0	251	422	38,125	21,744	77,405	422	**138,118**
Dash-9	1	157	292	32,749	14,021	66,491	292	**113,846**
ES44/Dash-9	2	24	50	3,909	1,923	7,936	50	**13,867**
Total		**536**	**972**	**93,687**	**45,572**	**190,214**	**972**	**331,417**

4.4. Movements of Cars to Car Repair Yard and in Adjacent Classification Yard

Estimated annual PM emissions for switching activities at the Commerce-Mechanical facility are presented in Table 4-4. ENVIRON calculated these emissions using the engine-specific emission factors by notch in Table 3-1b and the relative time in mode data from Table 2-8. Two hours per day of switching activity over 365 days per year were assumed to be divided equally between all 18 engines in the switching fleet.

Table 4-4. Estimated annual PM emissions associated with movements of cars to car repair yard and in the adjacent classification yard of the Commerce-Mechanical facility.

Locomotive Model Group	Cert Tier	# of Loco	PM Emissions (grams)
Switchers	Precntl	2	**4,211**
GP-3x	Precntl	16	**44,607**
Total		**18**	**48,819**

4.5. Freight Movements on Adjacent Mainline

The PM emission estimates for BNSF and foreign freight movements during the one-year period are presented in Tables 4-5 and 4-6, respectively. Note that eastbound emissions are more than two times higher than westbound emissions.

Table 4-5. Estimated annual PM emissions associated with BNSF freight movements along the mainline adjacent to the Commerce-Mechanical facility.

Locomotive Model Group	Cert Tier	# of Loco	PM Emissions by Direction (grams)		Total
			Westbound	Eastbound	
Switchers	Precntl	47	21	36	**57**
GP-3x	Precntl	3040	1,735	3,197	**4,932**
GP-4x	Precntl	4907	3,114	6,236	**9,350**
GP-50	Precntl	169	86	263	**349**
GP-60	Precntl	880	687	1,317	**2,004**
SD-7x	Precntl	13	0	10	**10**
Dash-7	Precntl	46	65	83	**148**
Dash-9	Precntl	4403	1,881	4,972	**6,853**
GP-60	0	2062	415	2,262	**2,677**
SD-7x	0	36	4	36	**41**
Dash-8	0	5073	5,933	7,946	**13,879**
Dash-9	0	22514	9,046	26,657	**35,703**
Dash-9	1	10337	7,245	15,836	**23,082**
ES44/Dash-9	2	3394	1,130	5,128	**6,258**
Total		56,921	31,365	73,979	**105,344**

Table 4-6. Estimated annual PM missions associated with non-BNSF freight movements along the mainline adjacent to the Commerce-Mechanical facility.

Locomotive Model Group	Cert Tier	# of Loco	PM Emissions by Direction (grams)		Total
			Westbound	Eastbound	
Switchers	Precntl	0	0.0	0	**0.0**
GP-3x	Precntl	12	6.9	13	**19.5**
GP-4x	Precntl	19	12.1	24	**36.2**
GP-50	Precntl	1	0.5	2	**2.1**
GP-60	Precntl	3	2.3	4	**6.8**
SD-7x	Precntl	0	0.0	0	**0.0**
Dash-7	Precntl	0	0.0	0	**0.0**
Dash-9	Precntl	17	7.3	19	**26.5**
GP-60	0	8	1.6	9	**10.4**
SD-7x	0	0	0.0	0	**0.0**
Dash-8	0	20	23.4	31	**54.7**
Dash-9	0	89	35.8	105	**141.1**
Dash-9	1	40	28.0	61	**89.3**
ES44/Dash-9	2	13	4.3	20	**24.0**
Total		**222**	**122**	**288**	**411**

4.6. Commuter Rail Operations on Adjacent Mainline

The annual PM emission estimates for commuter movements on the adjacent mainline are presented in Table 4-7. Time in notch for these locomotives was assumed to be the same as was modeled for the freight locomotives. AMTRAK and Metrolink estimates are kept separate, since Metrolink only operates on weekdays.

Table 4-7. Estimated annual PM missions associated with commuter movements along the mainline adjacent to the Commerce-Mechanical facility.

Agency	Locomotive Model Group	Cert Tier	# of Loco	PM Emissions by Direction (grams)		Total
				Westbound	Eastbound	
AMTRAK	EMD 12 710G3	Precntl	10391	4,490	11,187	**15,677**
Metrolink	EMD 12 710G3	Precntl	7280	3,146	7,838	**10,984**
Total				7,636	19,024	**26,661**

5.0 NON-LOCOMOTIVE FACILITY OPERATIONS, EMISSION FACTORS AND EMISSION ESTIMATES

The operations at the Commerce-Mechanical facility also include non-locomotive activity within the yard (Sections 5.1 through 5.5). Under each heading is a description of the operations.

5.1 Cargo Handling Equipment Operations

No such activity occurs within the Commerce-Mechanical facility.

5.2 On-road Container Truck Operations

No such activity occurs within the Commerce-Mechanical facility.

5.3. On-road Fleet Vehicle Operations

There are 29 fleet vehicles based at the Commerce-Mechanical facility according to records from BNSF Parameters including gross vehicle weight rating (GVWR), fuel type and annual mileage are known for each vehicle. The draft EMFAC2005 model (ARB, 2006c) provides an average trip distance for each vehicle type in 2005. With this estimate of miles per trip, total annual mileage for each vehicle can be converted to an estimated number of trips. A conservative assumption that all trips either start or end on site can be combined with an approximate distance of 750 feet from the facility parking lot to the gate in order to estimate the amount of on-site driving for each vehicle.

Using this procedure, the distance driven on site each year by the 29 fleet vehicles is estimated. Each vehicle's GVWR can be used to assign the appropriate vehicle type and emission factor to calculate the emissions associated with driving on site throughout the year. Table 5-1 provides a summary of relevant parameters for emissions modeling.

Table 5-1. On-road fleet vehicle activity at the Commerce-Mechanical facility.

EMFAC Vehicle Type	Fuel	# of Vehicles	Average Annual Mileage	Est. Annual Mileage on Site
LDA	Gasoline	1	20,161	629
LDT2	Gasoline	3	62,444	1,706
LHDT1	Gasoline	18	291,715	33,006
MHDT	Diesel	5	44,087	3,096
HHDT	Diesel	2	25,669	114
Total		**29**	**444,076**	**38,552**

Annual PM and TOG emission factors from the draft version EMFAC provided by ARB and on-site emissions estimates for the fleet vehicles are presented in Table 5-2. Note that gasoline and diesel vehicle estimates were kept separate, so that gasoline TOG exhaust and evaporative emissions could be speciated into TACs differently. ARB Speciate Profile #2105 will be used for the gasoline TOG exhaust emissions, and Profile #422 will be used for the gasoline TOG

evaporative emissions. The gasoline PM speciation profile is #400, and ARB made a recommendation in August of 5% for the Cr+6 fraction.

Table 5-2. On-road fleet vehicle emissions at the Commerce-Mechanical facility.

EMFAC Vehicle Type	PM Emissions (grams)	TOG Exhaust Emissions (grams)	TOG Evap Emissions (grams)
Gasoline Total	436	58,082	31,046
Diesel Total	996	951	0

5.4. Other Off-Road Equipment

5.4.1. Transport Refrigeration Unit Operations

No containers are handled at Commerce-Mechanical, and so no TRU were handled at this site.

5.4.1.1. Boxcars

No such activity occurs within the Commerce-Mechanical facility.

5.4.1.2. Containers/Trailer TRU

No such activity occurs within the Commerce-Mechanical facility.

5.4.2. Track Maintenance Equipment Operations

Track maintenance equipment includes equipment used to service tracks anywhere in California though it may be housed at any given facility. This equipment category includes large and small engines and equipment.

Activity

BNSF California track maintenance equipment can be used on any or all tracks within California to maintain the network. Therefore, the approach used to determine the activity and emissions for a given facility was to estimate emissions from all track maintenance equipment and apportion those emissions by site using the relative track mileage (including all tracks, main line and other tracks) at the site to the California total track mileage.

The Commerce-Mechanical site has 12 miles of track within its boundaries compared with the California regional total of 3,779 miles. This represents 0.3% of the total California track mileage that is maintained.

Appendix I shows a list of all BNSF track maintenance equipment located in California with horsepower and operational parameters. Based on BNSF staff knowledge of equipment characteristics, it was assumed that all track maintenance equipment was diesel powered.

If the equipment model year was not available, the ARB default (ARB, 2006c) useful life was assumed as the equipment age. If rated horsepower was not available, horsepower was assumed to be ARB default (ARB, 2006c) for the most populous horsepower range for the assigned ARB equipment category and type.

Emissions

Exhaust emissions from track maintenance equipment were estimated using the draft version of the OFFROAD model (ARB, 2006c) Emissions from track maintenance equipment at the Commerce-Mechanical facility along with California totals are shown in Table 5-3. The diesel TOG from this equipment will be speciated using ARB Speciate Profile #818.

Table 5-3. Track Maintenance Equipment Emissions Estimates (grams per year).

Site	Gasoline			Diesel	
	Evaporative TOG	Exhaust TOG	PM	TOG	PM
Commerce-Mechanical	68	387	11	39,072	14,304
California Totals	21,469	121,981	3,525	12,305,162	4,504,844

5.4.3. Other Off-road Equipment (including Portable Engine) Operations

There are other types of off-road equipment dedicated to the Commerce-Mechanical site including forklifts and other equipment.

Activity

Surveys were returned by equipment operators with relevant equipment characteristics and operational information Table 5-4 shows Commerce-Mechanical site portable engine characteristics and activity.

Table 5-4. Portable Engine Equipment Characteristics and operation.

ARB Equipment Type	Model Year	Fuel Type	Rated Horsepower	Activity (hrs/yr)
Forklifts	1998	D	57	2080
Forklifts	2000	D	83[b]	2080
Forklifts	1998	D	83 [b]	2080
Forklifts	1998	D	83 [b]	2080
Cranes	1997	D	149 [b]	2080
Forklifts	1976	LPG	70 [b]	2080
Pressure Washers	1993[a]	NG	7.5	1248
Forklifts	1997	LPG	70 [b]	2080[c]
Forklifts	1997	LPG	70 [b]	2080 [c]
Leaf Blowers/Vacuums	1999	G	5	208
Welders	2000	G	70 [b]	104
Other General Industrial	2002	G	7	312
Other General Industrial	2002	G	7	312
Forklifts	1993[a]	D	83 [b]	1560
Other Lawn & Garden Equipment	1999	G	42	104

[a] Model year assumed to be equivalent to ARB default (ARB, 2006c) useful life.
[b] Rated horsepower assumed to be ARB default (ARB, 2006c) average horsepower for the most populous horsepower group in the assigned ARB Equipment Type category.
[c] Assumed equivalent activity to the activity of other comparable Forklifts at the site.

Emissions

Emissions were calculated using the draft OFFROAD model provided by ARB (2006c). Emissions from portable engine offroad equipment at the Commerce-Mechanical facility are shown in Table 5-5.

Table 5-5. Portable Engine Equipment Emissions Estimates (grams per year).

Fuel Type	ARB equipment type	Evaporative TOG (grams)	Exhaust TOG (grams)	PM (grams)
D	Cranes	0	795,778	366,025
	Forklifts			
LPG	Forklifts	0	664,635	7,862
NG	Pressure Washers			
G	Other Gen. Industrial Equip.	37,850	191,757	3,544
	Welders			
	Leaf Blowers/Vacuums			
	Other Lawn/Garden Equip.			

5.5. Stationary Sources

Air quality permits for the Commerce-Mechanical facility show several types of stationary sources for potential evaluation.

Source types:
(1) Diesel fuel storage tanks [3 on site]
(2) Wastewater treatment plant [1 on site]
(3) Gasoline storage and dispensing unit [1 on site]
(4) Diesel-fueled internal combustion engines (ICEs) [2 on site]

The three diesel fuel storage tanks and wastewater treatment plant are assumed to have negligible emissions.

The gasoline storage and dispensing unit is comprised of a 2000 gallon tank and 10 foot hose with nozzle Phase I and II vapor recovery systems are in place. The estimated TAC emissions associated with gasoline storage and dispensing operations are mainly from 1) filling/working loss, 2) dispensing and spillage loss, and 3) breathing loss. The emissions were estimated using the South Coast Air Quality Management District (SCAQMD) methodology, which contained emission factors and followed guidance from the Gasoline Service Station Industry-Wide Risk Assessment Guidelines (CAPCOA, 1997) prepared by the Toxics Committee of the California Air Pollution Control Officers Association (CAPCOA). The estimated annual TOG emissions are shown in Table 5-6.

Table 5-6. TOG emissions for the gasoline dispensing and storage facility at the Commerce-Mechanical facility.

Specifications	Filling/ Working Emissions (grams)	Dispensing and Spillage Emissions (grams)	Breathing Emissions (grams)	Total TOG Emissions (grams)
Gasoline Dispensing and Storage Facility with Aboveground Storage Tank (Phase and Vapor Recovery)	12,763	13,193	49,761	75,718

The relevant parameters for the two diesel ICEs, as well as their estimated annual PM emissions are presented in Table 5-7. Emissions were calculated based on the actual hours of operations and emission factors contained in the permit applications (# 400454) for the Generac internal combustion engine and (# 327431) for the Detroit Diesel emergency fire pump driver.

Table 5-7. Parameters and PM emissions estimates for the diesel-fueled ICEs at the Commerce-Mechanical facility.

Specifications	Brake horsepower (hp)	Actual Operation Time (hr/yr)	PM Emissions (grams)
Generac 12 cyl. turbo	1135	29	1,275
Detroit Diesel 6 cyl. turbo	412	29	1,950
Total			**3,225**

6.0 TOTAL TAC EMISSIONS FROM THE COMMERCE - MECHANICAL FACILITY

The estimated total annual diesel PM (DPM) emissions associated with the operations in the Commerce-Mechanical facility are summarized in Table 6-1.

Table 6-1. Estimated total annual OPM emissions associated with the operations in the Commerce-Mechanical facility.

Facility Operations	PM Emissions		Percentage
	Grams	Metric Tons	
Basic Services	1,270,104	1.27	51%
Basic Engine Inspection	251,932	0.25	10%
Full Engine Service/Inspection	331,417	0.33	13%
Switching	48,819	0.05	2%
Adjacent Freight Movements	105,755	0.11	4%
Adjacent Commuter Rail Operations)	26,661	0.03	1%
Cargo Handling Equipment	0	0	0%
On-Road Container Trucks	0	0	0%
On-Road Fleet Vehicle	996	0.00	0%
Other Off-Road TRU	0	0	0%
Other Off-Road Track Maintenance	14,304	0.01	1%
Other Off-Road Portable Engines	366,025	0.37	15%
Stationary Sources	3,225	0.00	0%
Total	**2,419,238**	**2.42**	

The estimated total annual emissions of total organic gases (TOG) (for speciation into the other TACs) associated with gasoline, LPG, and CNG operations in the Commerce-Mechanical facility are summarized in Table 6-2. Diesel TOG is not included in the tabulation.

Table 6-2. Estimated total annual TOG emissions associated with the operations in the Commerce-Mechanical facility.

Facility Operations	TOG Emissions		Percentage
	Grams	Metric Tons	
Basic Services	0	0	0%
Basic Engine Inspection	0	0	0%
Full Engine Service/Inspection	0	0	0%
Switching	0	0	0%
Adjacent Freight Movements	0	0	0%
Adjacent Commuter Rail Operations)	0	0	0%
Cargo Handling Equipment	0	0	0%
On-Road Container Trucks	0	0	0%
On-Road Fleet Vehicle Exhaust	58,082	0 06	5%
On-Road Fleet Vehicle Evaporative	31,046	0.03	3%
Other Off-Road TRU	0	0	0%
Other Off-Road Track Maintenance Exhaust	387	0 00	0%
Other Off-Road Track Maintenance Evap	68	0 00	0%
Other Off-Road Portable Engines Exhuast	856,392	0 86	81%
Other Off-Road Portable Engines Evaporative	37,850	0 04	4%
Stationary Sources Evaporative	75,718	0 07	7%
Total	**1,059,543**	**1.06**	

7.0 REFERENCES

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APPENDIX A

TRACK MAINTENANCE EQUIPMENT

Equipment ID	Equipment Type	ARB Category	ARB Equipment type	Engine Model Year	Engine Horsepower	Dual Engine (Y/N)	Operating Hours Per week	Average Operating Hours Per Year
TM1	FORKLIFT	Industrial	Forklifts	1998	17	N	30	1440
TM2	FORKLIFT	Industrial	Forklifts	1985	17	N	30	1440
TM3	ANCHOR APPLICATOR	Industrial	Other General Industrial	1988	50	N	25	1200
TM4	ANCH REMVR	Industrial	Other General Industrial	1994	90	N	15	720
TM5	ANCHOR BOXER	Industrial	Other General Industrial	1987	76	N	25	1200
TM6	ANCHOR BOXER	Industrial	Other General Industrial	1987	76	N	25	1200
TM7	ANCHOR REMOVER	Industrial	Other General Industrial	1995	50	N	20	960
TM8	ANCHOR APP/REM	Industrial	Other General Industrial	2004	50	N	25	1200
TM9	ANCHOR APP/REM	Industrial	Other General Industrial	2004	50	N	25	1200
TM10	ANCHOR APP/REM	Industrial	Other General Industrial	2004	50	N	25	1200
TM11	AIR COMPRESSOR	Commercial	Air Compressors	1989	35	N	12	576
TM12	AIR COMPRESSOR	Commercial	Air Compressors	1989[a]	35	N	15	720
TM13	AIR COMPRESSOR	Commercial	Air Compressors	1989[a]	35	N	10	480
TM14	AIR COMPRESSOR	Commercial	Air Compressors	1989[a]	35	N	10	480
TM15	ADZ/CR B-DCF	Industrial	Other General Industrial	2002	90	N	15	720
TM16	DBL BRM	Industrial	Other General Industrial	1983	100	N	0	0
TM17	DBL BRM	Industrial	Other General Industrial	1985	100	N	0	0
TM18	DBL BRM TRLR	Industrial	Other General Industrial	2000	100	N	25	1200
TM19	BALLAST REGULATOR	Industrial	Other General Industrial	1981	64	N	17.29	829.92
TM20	BALLAST REGULATOR	Industrial	Other General Industrial	1991	64	N	0	0
TM21	BALLAST REGULATOR	Industrial	Other General Industrial	1986	64	N	0	0
TM22	BALLAST REGULATOR	Industrial	Other General Industrial	1979	64	N	45	2160
TM23	BALLAST REGULATOR	Industrial	Other General Industrial	1984	175	N	45	2160
TM24	BALLAST REGULATOR	Industrial	Other General Industrial	1983	175	N	0	0
TM25	BALLAST REGULATOR	Industrial	Other General Industrial	1985	175	N	0	0
TM26	BALLAST REGULATOR	Industrial	Other General Industrial	1996	175	N	10.2	489.6
TM27	BALLAST REGULATOR	Industrial	Other General Industrial	1996	175	N	31.33	1503.84
TM28	BALLAST REGULATOR	Industrial	Other General Industrial	1996	175	N	0	0
TM29	BALLAST REGULATOR	Industrial	Other General Industrial	2003	175	N	15	720
TM30	LOCOMOTIVE CRANE	Construction	Cranes	1979	250	N	0	0
TM31	TRUCK CRANE	Construction	Cranes	1986	175	Y	0	0
TM32	RUBBER TIRED CRANE	Construction	Cranes	1982	175	N	0	0
TM33	RUBBER TIRED CRANE	Construction	Cranes	1999	175	N	0	0
TM34	RUBBER TIRED CRANE	Construction	Cranes	2001	175	N	0	0
TM35	WHL LDR	Construction	Rubber Tired Loaders	1974	300	N	3.06	146.88
TM36	CRN/LDR HR	Construction	Cranes	1974	100	N	0	0

Equipment ID	Equipment Type	ARB Category	ARB Equipment type	Engine Model Year	Engine Horsepower	Dual Engine (Y/N)	Operating Hours Per week	Average Operating Hours Per Year
TM37	CRN/LDR HR	Construction	Cranes	1984	100	N	0	0
TM38	CRN/LDR HR	Construction	Cranes	1984	100	N	3.36	161.28
TM39	CRN/LDR HR	Construction	Cranes	1984	100	N	28.8	1382.4
TM40	WHL LDR*GP	Construction	Rubber Tired Loaders	1995	120	N	0	0
TM41	SKID-LDR FBHTAH	Construction	Skid Steer Loaders	2003	74	N	0	0
TM42	CRN/LDR HR	Construction	Cranes	2004	100	N	26.56	1274.88
TM43	BK-HO/LDR	Construction	Tractors/Loaders/Backhoes	1992	75.5	N	2	96
TM44	BK-HO/LDR	Construction	Tractors/Loaders/Backhoes	1992	75.5	N	0	0
TM45	BK-HO/LDR EH	Construction	Tractors/Loaders/Backhoes	1995	69	N	12.37	593.76
TM46	BK-HO/LDR EH	Construction	Tractors/Loaders/Backhoes	1995	69	N	46.38	2226.24
TM47	BK-HO/LDR EF	Construction	Tractors/Loaders/Backhoes	1998	78	N	0	0
TM48	BK-HO/LDR EF	Construction	Tractors/Loaders/Backhoes	1999	78	N	0	0
TM49	BK-HO/LDR EF	Construction	Tractors/Loaders/Backhoes	1999	78	N	12.88	618.24
TM50	BK-HO/LDR EF	Construction	Tractors/Loaders/Backhoes	1999	78	N	7.31	350.88
TM51	BK-HO/LDR EF	Construction	Tractors/Loaders/Backhoes	1999	78	N	8.91	427.68
TM52	BK-HO/LDR EF	Construction	Tractors/Loaders/Backhoes	2000	78	N	0	0
TM53	BK-HO/LDR EF	Construction	Tractors/Loaders/Backhoes	2003	88	N	0	0
TM54	BK-HO/LDR EF	Construction	Tractors/Loaders/Backhoes	2004	88	N	1.65	79.2
TM55	BK-HO/LDR EF	Construction	Tractors/Loaders/Backhoes	2004	88	N	9.93	476.64
TM56	BK-HO/LDR EF	Construction	Tractors/Loaders/Backhoes	2004	88	N	6.13	294.24
TM57	BK-HO/LFR EF	Construction	Tractors/Loaders/Backhoes	1989[a]	119	N	15	720
TM58	BK-HO/LFR EF	Construction	Tractors/Loaders/Backhoes	1989[a]	85	N	15	720
TM59	BK-HO/LFR EF	Construction	Tractors/Loaders/Backhoes	1989[a]	74	N	15	720
TM60	BK-HO/LFR EF	Construction	Tractors/Loaders/Backhoes	1989[a]	74	N	15	720
TM61	BK-HO/LFR EF	Construction	Tractors/Loaders/Backhoes	1989[a]	74	N	15	720
TM62	BK-HO/LFR EF	Construction	Tractors/Loaders/Backhoes	1989[a]	74	N	15	720
TM63	BK-HO/LFR EF	Construction	Tractors/Loaders/Backhoes	1989[a]	74	N	15	720
TM64	BK-HO/LFR EF	Construction	Tractors/Loaders/Backhoes	1989[a]	74	N	15	720
TM65	BK-HO/LFR EF	Construction	Tractors/Loaders/Backhoes	1989[a]	74	N	15	720
TM66	BK-HO/LFR EF	Construction	Tractors/Loaders/Backhoes	1989[a]	85	N	15	720
TM67	BK-HO/LFR EF	Construction	Tractors/Loaders/Backhoes	1989[a]	99	N	15	720
TM68	BK-HO/LFR EF	Construction	Tractors/Loaders/Backhoes	1989[a]	74	N	15	720
TM69	BK-HO/LFR EF	Construction	Tractors/Loaders/Backhoes	1989[a]	74	N	15	720
TM70	BK-HO/LFR EF	Construction	Tractors/Loaders/Backhoes	1989[a]	85	N	15	720
TM71	Directional Boring Machine	Construction	Bore/Drill Rigs	2002[a]	82[b]	N	15	720
TM72	Manlift	Industrial	Aerial Lifts	1989[a]	34[b]	N	15	720

Equipment ID	Equipment Type	ARB Category	ARB Equipment type	Engine Model Year	Engine Horsepower	Dual Engine (Y/N)	Operating Hours Per week	Average Operating Hours Per Year
TM73	Trencher	Construction	Trenchers	1998[a]	39	N	15	720
TM74	Trencher	Construction	Trenchers	1998[a]	39	N	15	720
TM75	Trencher	Construction	Trenchers	1998[a]	39	N	15	720
TM76	Trencher Rider	Construction	Trenchers	1998[a]	79	N	15	720
TM77	RAIL LIFTER	Industrial	Other General Industrial	1997	19	N	20	960
TM78	TIE SPIKER	Industrial	Other General Industrial	1986	19	N	0	0
TM79	TIE SPIKER	Industrial	Other General Industrial	1986	19	N	0	0
TM80	TIE SPIKER	Industrial	Other General Industrial	1991	19	N	3.1	148.8
TM81	TIE SPIKER	Industrial	Other General Industrial	2002	90	N	10	480
TM82	TIE SPIKER	Industrial	Other General Industrial	2002	90	N	10	480
TM83	TIE SPIKER	Industrial	Other General Industrial	2002	90	N	10	480
TM84	SPIKE PULLER	Industrial	Other General Industrial	1984	35	N	10	480
TM85	SPIKE PULLER	Industrial	Other General Industrial	1995	35	N	10	480
TM86	SPIKE PULLER	Industrial	Other General Industrial	1995	35	N	10	480
TM87	SPIKE PULLER	Industrial	Other General Industrial	1986	35	N	0	0
TM88	DITCHER/SPREADER	Industrial	Other General Industrial	1980	97[b]	N	15	720
TM89	TIE TAMPER	Industrial	Other General Industrial	1985	175	N	20	960
TM90	TIE TAMPER	Industrial	Other General Industrial	1985	175	N	3.74	179.52
TM91	TIE TAMPER	Industrial	Other General Industrial	1989	250	N	22.4	1075.2
TM92	TIE TAMPER	Industrial	Other General Industrial	1995	250	N	40	1920
TM93	TIE TAMPER	Industrial	Other General Industrial	1996	250	N	40	1920
TM94	TIE TAMPER	Industrial	Other General Industrial	1996	250	N	90	4320
TM95	TIE TAMPER	Industrial	Other General Industrial	1996	250	N	40	1920
TM96	TIE TAMPER	Industrial	Other General Industrial	1997	250	N	0.92	44.16
TM97	TIE TAMPER	Industrial	Other General Industrial	2000	250	N	35	1680
TM98	TIE TAMPER	Industrial	Other General Industrial	2000	300	N	40	1920
TM99	TIE TAMPER	Industrial	Other General Industrial	2001	250	N	31	1488
TM100	TIE TAMPER	Industrial	Other General Industrial	2002	300	N	35	1680
TM101	TIE TAMPER	Industrial	Other General Industrial	2003	250	N	0	0
TM102	TIE TAMPER	Industrial	Other General Industrial	1995	175	N	0	0
TM103	TIE TAMPER	Industrial	Other General Industrial	1987	175	N	0	0
TM104	TIE TAMPER	Industrial	Other General Industrial	1985	150	N	15	720
TM105	TIE CRANE	Construction	Cranes	1982	64	N	15	720
TM106	TIE CRANE	Construction	Cranes	1982	64	N	0	0
TM107	TIE CRANE	Construction	Cranes	1985	64	N	0	0
TM108	TIE CRANE	Construction	Cranes	1986	64	N	0	0

Equipment ID	Equipment Type	ARB Category	ARB Equipment type	Engine Model Year	Engine Horsepower	Dual Engine (Y/N)	Operating Hours Per week	Average Operating Hours Per Year
TM109	TIE PLUGGER	Industrial	Other General Industrial	2000	90	N	20	960
TM110	TIE PLUGGER	Industrial	Other General Industrial	2002	90	N	20	960
TM111	TIE PLUGGER	Industrial	Other General Industrial	2003	90	N	20	960
TM112	TIE INSERT/EXTRACT	Industrial	Other General Industrial	1985	175	N	0	0
TM113	TIE INSERT/EXTRACT	Industrial	Other General Industrial	1985	175	N	0	0
TM114	TIE INSERT/EXTRACT	Industrial	Other General Industrial	1987	175	N	41.58	1995.84
TM115	DOZER	Construction	Crawler Tractors	1985	145	N	0	0
TM116	WELDER	Commercial	Welders	1984	64	N	25	1200
TM117	WELDER	Commercial	Welders	1984	64	N	25	1200
TM118	WELDER	Commercial	Welders	1986	64	N	25	1200
TM119	WELDER	Commercial	Welders	1987	64	N	25	1200
TM120	WELDER	Commercial	Welders	1988	40	N	25	1200
TM121	WELDER	Commercial	Welders	1988	64	N	25	1200
TM122	WELDER	Commercial	Welders	1988	64	N	25	1200
TM123	WELDER	Commercial	Welders	1998	64	N	25	1200
TM124	WELDER	Commercial	Welders	1999	64	N	25	1200
TM125	WELDER	Commercial	Welders	1999	64	N	25	1200
TM126	WELDER	Commercial	Welders	1999	64	N	25	1200
TM127	WELDER	Commercial	Welders	2000	64	N	25	1200
TM128	WELDER	Commercial	Welders	2000	64	N	25	1200
TM129	WELDER	Commercial	Welders	2000	40	N	25	1200
TM130	WELDER	Commercial	Welders	2000	40	N	25	1200
TM131	WELDER	Commercial	Welders	2001	64	N	25	1200
TM132	WELDER	Commercial	Welders	2003	40	N	25	1200
TM133	WELDER	Commercial	Welders	2003	64	N	25	1200
TM134	WELDER	Commercial	Welders	2003	40	N	25	1200
TM135	WELDER	Commercial	Welders	2004	64	N	25	1200
TM136	WELDER	Commercial	Welders	2004	64	N	25	1200
TM137	WELDER	Commercial	Welders	2004	64	N	25	1200
TM138	WELDER	Commercial	Welders	2004	40	N	25	1200
TM139	WELDER	Commercial	Welders	2005	40	N	25	1200
TM140	WELDER	Commercial	Welders	2005	40	N	25	1200
TM141	WELDER	Commercial	Welders	2005	40	N	25	1200
TM142	WELDER	Commercial	Welders	2005	40	N	25	1200
TM143	RAIL HEATER	Industrial	Other General Industrial	1982	90	N	25	1200
TM144	RAIL HEATER	Industrial	Other General Industrial	1995	90	N	25	1200

Equipment ID	Equipment Type	ARB Category	ARB Equipment type	Engine Model Year	Engine Horsepower	Dual Engine (Y/N)	Operating Hours Per week	Average Operating Hours Per Year
TM145	SPIKE RECLAIMER	Industrial	Other General Industrial	1992	90	N	25	1200
TM146	TIE PLATE RETRIEVER	Industrial	Other General Industrial	2003	25	N	25	1200
TM147	TRACK STABILIZER	Industrial	Other General Industrial	1989	300	N	9.26	444.48
TM148	TRACK STABILIZER	Industrial	Other General Industrial	2000	300	N	45	2160
TM149	TRACK STABILIZER	Industrial	Other General Industrial	2001	300	N	45	2160

[a] Model year estimated as 2005 minus ARB default useful life.
[b] Horsepower estimated as ARB default for the most populous horsepower range for the associated equipment type[a]