ENVIRON

STOCKTON RAILYARD TAC EMISSIONS INVENTORY

Submitted by: ENVIRON International Corporation

Contact: dsouten@environcorp.com; clindhjem@environcorp.com

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 Stockton 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.

Overview of the Stockton Yard

The Stockton yard sits along the east-west main line within Stockton but east of a significant north-south crossroad. The yard itself collects arrivals and prepares trains for departure. The site had supported an intermodal function prior to 2005, but was since shut down. Short line and other trains arrive and depart from this site, which is along side a busy mainline route.

Locomotive Facility Operations

The operations at the Stockton facility include engine-on locomotive activity within the service facility (heading A), the classification yard switching engines (D), train arrival and departure (E), passing freight (F), and passenger rail (G). Under each heading is a description of the operations. The locomotive operations through Stockton can be from the east or west arriving into or leaving the yard.

Because 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 Stockton 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.

A. Basic Locomotive Service

Refueling activity occurs at Stockton. Locomotives at Stockton were refueled with a total of 1,018,965 gallons of fuel, with an average of 1618 gallons per locomotive. Therefore, about 630 locomotives were refueled at Stockton in 2005. Based on studies at other facilities, 1.5 hours of idling is expected to occur with each refueling event.

B. Basic Engine Inspection

No such activity occurs within the Stockton facility.

C. Full Engine Service/Inspection

No such activity occurs within the Stockton facility.

D. Switching Engine Activity in the Yard

Switching engine fleet characteristics in the Stockton area were determined by a roster of engines made available by BNSF in early 2006. The data are shown in Table 1. Most engines are of similar power and type. This fleet was used to describe the switching engine activity assuming equivalent use of all nine engines in the fleet.

Table 1. Locomotive switching engine fleet characterization for service to the Stockton facility.

Locomotive Model	Certification Tier	HP	Engine Surrogate
GP35	Precontrolled	2500	GP-3x
GP35	Precontrolled	2500	GP-3x
GP38-2	Precontrolled	2000	GP-3x
GP39-2	Precontrolled	2300	GP-3x
GP39-2	Precontrolled	2300	GP-3x
GP39-2	Precontrolled	2300	GP-3x
GP39M	Precontrolled	2300	GP-3x
SW1500	Precontrolled	1500	Switcher

The time in mode for switching engine activity in Table 2 was determined from event recorder downloads of a sample of four engines operating in this yard. The four chosen engines include one 2,000 hp engine, one 3,800 hp engine, and two 2,500 hp engines. These four engines are representative of the switching engines dedicated to the Stockton 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 were 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. Switching engine (~2700 hp average) relative time in mode.

Throttle Notch	Time in Mode	Adjusted Time in Mode
DB	0.13%	**0.37%**
Idle	86.10%	**59.80%**
1	5.54%	**16.04%**
2	4.00%	**11.57%**
3	1.80%	**5.20%**
4	1.01%	**2.93%**
5	0.43%	**1.24%**
6	0.33%	**0.95%**
7	0.05%	**0.15%**
8	0.61%	**1.76%**

The total hours of switching engine operations were determined from daily schedules and typical number of engines available for use by shift. Three engines are available on the day shift, two on the afternoon, and a single engine on the night shift mainly for breaking and making long haul trains. Two engines are dedicated to handle local trains during any period of the day, but these appear in the Train Arrival and Train Departure database. Each of these engine/shifts demands on average 3.6 hours a day based on event recorder downloads indicating that engines operate in Notch 1-8 or DB mode about 15% of a 24 hour day. These 3.6 hours of operating time represent 40.2% of the duty not including engine idling time. So the operating period for each engine is estimated to be nearly 9 hours (3.6 divided by 0.402). With six engines dedicated to such duty, the end result is nearly 54 hours per day or 19,612 hours per year of switching engine operation.

E. Train Arrival and Departure (TA/TD)

Trains arrive and depart from the Stockton classification yard and have a distinct operating profile from other engines moving through or by the yard. BNSF provided engine counts for arriving and departing trains based on a designation from the yard. However, all trains/engines noted as arriving and departing do not necessarily have business in the yard and may be using the yard tracks as an alternative route to the adjacent mainline. Trains/engines that arrive and depart within eighteen minutes were subtracted from the total number of the arrivals and departures. The trains/engines that arrive and depart within eighteen minutes are considered to be passing locomotives and appear under activity category (F) because the minimum period for arrivals and departures was 18 minutes.

The number of engines listed as arriving and departing from the site was the larger of those labeled train arrival and train departure. A total number of engines that arrive and depart from the yard were estimated at 34,045 with 26,203 short-term (less than 18 minutes) stays that were those passing through the yard. Therefore 7,835 engines were used for this activity category. The fleet characteristics by model and emission tier level for arriving and departing trains is shown in Table 3.

Table 3. Fleet characteristics for arriving and departing engines

Tier	Model	Number	Fleet Fraction
x	Switchers	7	0.08%
x	SD-7x	3	0.04%
x	GP-60	76	0.97%
x	GP-50	53	0.68%
x	GP-4x	1418	18.10%
x	GP-3x	308	3.93%
x	Dash-9	448	5.72%
x	Dash-7	14	0.18%
0	SD-7x	3	0.04%
0	GP-60	208	2.66%
0	Dash-9	2645	33.76%
0	Dash-8	1027	13.10%
1	Dash-9	1190	15.19%
2	ES44/Dash-9	433	5.53%

BNSF provided throttle position for a sample of five engines that arrived and departed out of Stockton and were considered to be representative of the Stockton trains' activity. The average engine-on duty cycle from this five-engine cohort is shown in Table 4. The idle mode in the sample data could not distinguish between idle with the engine on and idle with the engine off. A separate data set with a time stamp of when the engine was cranked on provided when the engine was turned on but not when turned off. So for example, if an engine was cranked on twice it must have been shut off during some periods while in the yard. Therefore second-by-second event recorder data was searched for periods prior to each crank event to determine the length of time prior to crank when the engine was stopped, and those periods were subtracted from the total time at idle assuming that period of inactivity prior to the crank was time when the engine was off. This more in-depth study for Stockton showed that engines arriving and departing averaged 4.605 hours of idle time. However, 630 locomotive refueling events (covered under Basic Locomotive Service category A) at 1.5 hours idle per were assumed to occur within the 4.605 hours of idle noted here. When the entire fleet of 7,835 arriving/departing engines is adjusted for this activity, the average idle time is reduced to 4.48 hours. This adjustment is included in the Table 4 idle time.

Table 4. Activity by mode for arriving and departing trains

Throttle Position	Hours
Idle	4.484*
DB	0.014
T1	0.224
T2	0.200
T3	0.042
T4	0.012
T5	0.005
T6	0.000
T7	0.000
T8	0.001

* Modified from the original 5-engine cohort duty cycle average of 4.605 hours to subtract idle time while refueling.

F. Freight Movements on Adjacent Mainline

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 the traffic along its mainline. The radio tags are read east of the yard, so would count both the trains arriving and departing (TA/TD) from the Stockton yard as well as trains passing the yard without stopping. Therefore the engines arriving and departing from the yard were subtracted from the total engines counted at the reader to avoid double counting the activity in the yard.

BNSF Freight Movements

Data provided by BNSF showed a total of 34,045 locomotives passing the Stockton facility between May 1, 2005 and April 1, 2006 of which 7,835 were estimated to have arrived and departed from Stockton. The fleet characteristics for the remaining 26,210 were determined by subtracting the engine types for the 7,835 TA/TD engines from those for the full list of 34,045 engines. The fleet characterization results are shown in Table 5. The duty cycle was derived from event recorder downloads for six trains passing this yard. The summary profile is shown in Table 6.

Table 5. Fleet characterization for locomotive mainline activity past the Stockton facility.

Tier	Model	Number	Fleet Fraction
x	Switchers	58	0.22%
x	SD-7x	44	0.17%
x	GP-60	278	1.06%
x	GP-50	99	0.38%
x	GP-4x	3449	13.16%
x	GP-3x	504*	1.92%
x	Dash-9	2092	7.98%
x	Dash-7	0*	0.00%
0	SD-7x	20	0.08%
0	GP-60	416	1.59%
0	Dash-9	10646	40.62%
0	Dash-8	1736	6.62%
1	Dash-9	5086	19.41%
2	ES44/Dash-9	1780	6.79%

* Dash 7 engines came out as -10 engines when subtracting TA/TD from passing locomotives, so Dash 7 was reset to zero and 10 engines were removed from GP- 3x (similar power to Dash 7) to make the total 26,210.

Table 6. Locomotive time in mode passing the Stockton facility.

Throttle Position	Time in Mode (hrs)
DB	0.0000
Idle	0.015
T1	0.0000
T2	0.0000
T3	0.0000
T4	0.0000
T5	0.0008
T6	0.0008
T7	0.0000
T8	0.0097

Foreign (non-BNSF) Freight Movements

Data provided by BNSF showed only 646 foreign (non-BNSF and non-Commuter) locomotives passing the Stockton facility between May 1, 2005 and April 30, 2006. As with the BNSF freight, ENVIRON assumed one-half (323) were traveling Eastbound, and one-half (323) 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 5 and 6 show for the BNSF engines.

G. Commuter Rail Operations on Adjacent Mainline

BNSF data show that AMTRAK operates 4,175 trains per year in both directions throughout the week along this line. 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 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.

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." 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 Stockton facility are summarized in Tables 7a and 7b 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 7a.

Table 7a. 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

Locomotive Model Group	Cert Tier[a]	Emission Factors (g/hr) by Throttle Notch									
		Idle	DB[b]	1	2	3	4	5	6	7	8
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 7b 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 7b.

Table 7b. 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. The data and overall estimates are shown in Table 8.

Table 8. 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
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 (2005a) 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 9 were applied to the base emission rates to calculate the emission rates at the in-use fuel sulfur levels.

Table 9. 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%

Locomotive Diesel PM Emission Estimates

A. Basic Service

The engine idling during refueling events is shown in Table 10 below and represents 1.5 hours of idling for each engine event. The fleet was considered to have the same distribution as the train arrival and departure fleet.

Table 10. Emissions for refueling by engine type

Model Group Tier	Model Group	Number of Engines	Total (grams)
x	Switchers	1	**24**
x	GP-3x	25	**1,410**
x	GP-4x	114	**8,200**
x	GP-50	4	**168**
x	GP-60	6	**448**
x	SD-7x	0	**9**
x	Dash-7	1	**111**
x	Dash-9	36	**1,737**
0	GP-60	17	**530**
0	SD-7x	0	**6**
0	Dash-8	83	**4,575**
0	Dash-9	213	**10,796**
1	Dash-9	96	**2,426**
2	ES44/Dash-9	35	**402**
Total		**630**	**30,843**

B. Basic Engine Inspection

No such activity occurs within the Stockton facility.

C. Full Engine Service/Inspection

No such activity occurs within the Stockton facility.

D. Switching Engine Activity in the Yard

Estimated annual PM emissions for switching activities at the Stockton facility are presented in Table 11. ENVIRON calculated the composite emission factors for each engine type represented in the fleet using the engine-specific emission factors by notch in Table 7b, the fleet characteristics in Table 1, and the relative time in mode data from Table 2. The switching activity over 365 days per year was distributed equally across all 18 engines in the switching fleet. This category represents the switching engines activity that can occur any where in the yard. The switching engine activity is known only by the engine hours and selected downloads of the time in mode (notch) for the activity in the general area.

Table 11. Estimated annual PM emissions associated with movements of cars within the classification yard of the Stockton facility.

Locomotive Model Group	Cert Tier	# of Loco	PM Emissions (grams)
Switchers	Precntl	1	**136,975**
GP-3x	Precntl	7	**1,267,654**
Total		**8**	**1,404,629**

E. Train Arrival and Departures

Engines on trains that arrive and depart from the yard have a different activity profile than the switching engines or those that pass the yard. Emissions were derived based on the activity for an arriving and departing train and the emissions for all engines arriving and departing are shown in Table 12.

Table 12. Arriving/Departing trains' engine emissions for Stockton

Tier	Model Group	# of Engines	Engine Mode										Total
			Idle	DB	1	2	3	4	5	6	7	8	
x	Switchers	7	910	5	34	100	36	11	6	0	0	2	**1,104**
x	GP-3x	308	52,424	308	2,140	6,777	2,277	699	371	0	0	146	**65,143**
x	GP-4x	1418	304,886	1,577	11,364	38,146	12,778	3,930	2,152	0	0	911	**375,744**
x	GP-50	53	6,235	48	615	1,526	641	178	95	0	0	39	**9,377**
x	GP-60	76	16,643	104	835	2,014	865	245	129	0	0	56	**20,892**
x	SD-7x	3	353	0	30	43	20	9	5	0	0	2	**461**
X	Dash-7	14	4,131	36	345	344	191	50	22	0	0	4	**5,122**
X	Dash-9	448	64,565	336	5,457	9,708	3,686	1,398	771	0	0	214	**86,134**
0	GP-60	208	19,716	74	1,758	3,151	1,985	787	487	0	0	215	**28,173**
0	SD-7x	3	217	1	27	40	30	13	7	0	0	3	**338**
0	Dash-8	1027	170,108	2,103	19,824	27,369	11,184	3,246	1,561	0	0	428	**235,822**
0	Dash-9	2645	401,409	1,862	33,304	62,181	22,671	7,528	7,560	0	0	1,015	**537,530**
1	Dash-9	1190	90,200	1,461	16,589	33,419	13,527	4,923	2,341	0	0	627	**163,088**
2	ES44/Dash-9	433	14,955	253	6,736	12,647	4,927	1,705	814	0	0	178	**42,215**
Total		7,835	1,146,751	8,166	99,058	197,465	74,820	24,722	16,321	0	0	3,840	**1,571,143**

F. Freight Movements on Adjacent Mainline

The PM emission estimates for BNSF freight movements during the one-year period are presented in Table 13 and those for other railroad engines in Table 14.

Table 13. Estimated annual PM emissions associated with BNSF freight movements along the mainline adjacent to the Stockton facility.

Tier	Model Group	Number of Engines	Engine Mode										Total
			Idle	DB	1	2	3	4	5	6	7	8	
x	Switchers	58	0	50	0	0	0	0	9	14	0	238	**311**
x	GP-3x	504	0	554	0	0	0	0	101	161	0	2,796	**3,612**
x	GP-4x	3449	0	4,218	0	0	0	0	872	1,459	0	25,863	**32,412**
x	GP-50	99	0	97	0	0	0	0	29	50	0	840	**1,017**
x	GP-60	278	0	419	0	0	0	0	79	138	0	2,392	**3,027**
x	SD-7x	44	0	3	0	0	0	0	11	13	0	236	**263**
x	Dash-7	0	0	0	0	0	0	0	0	0	0	0	**0**
x	Dash-9	2092	0	1,723	0	0	0	0	600	684	0	11,662	**14,669**
0	GP-60	416	0	162	0	0	0	0	162	231	0	5,017	**5,572**
0	SD-7x	20	0	5	0	0	0	0	7	13	0	200	**224**
0	Dash-8	1736	0	3,913	0	0	0	0	440	484	0	8,435	**13,272**
0	Dash-9	10646	0	8,241	0	0	0	0	5,071	4,565	0	47,640	**65,517**
1	Dash-9	5086	0	6,869	0	0	0	0	1,667	1,977	0	31,256	**41,769**
2	ES44/Dash-9	1780	0	1,142	0	0	0	0	558	557	0	8,543	**10,800**
Total		26,210	0	27,395	0	0	0	0	9,605	10,345	0	145,118	**192,464**

Table 14. Estimated annual PM emissions associated with non-BNSF freight movements along the mainline adjacent to the Stockton facility.

Tier	Model Group	Number of Engines	Engine Mode										Total
			Idle	DB	1	2	3	4	5	6	7	8	
x	Switchers	0	0	0	0	0	0	0	0	0	0	0	**0**
x	GP-3x	4	0	4	0	0	0	0	1	1	0	22	**29**
x	GP-4x	29	0	35	0	0	0	0	7	12	0	217	**273**
x	GP-50	1	0	1	0	0	0	0	0	1	0	8	**10**
x	GP-60	2	0	3	0	0	0	0	1	1	0	17	**22**
x	SD-7x	0	0	0	0	0	0	0	0	0	0	0	**0**
x	Dash-7	0	0	0	0	0	0	0	0	0	0	0	**0**
x	Dash-9	18	0	15	0	0	0	0	5	6	0	100	**126**
0	GP-60	4	0	2	0	0	0	0	2	2	0	48	**54**
0	SD-7x	0	0	0	0	0	0	0	0	0	0	0	**0**
0	Dash-8	15	0	34	0	0	0	0	4	4	0	73	**115**
0	Dash-9	90	0	70	0	0	0	0	43	39	0	403	**554**
1	Dash-9	43	0	58	0	0	0	0	14	17	0	264	**353**
2	ES44/Dash-9	15	0	10	0	0	0	0	5	5	0	72	**91**
Total		646	0	231	0	0	0	0	81	87	0	1,226	**1,626**

G. Commuter Rail Operations on Adjacent Mainline

The annual PM emission estimates for passenger train movements on the adjacent mainline are presented in Table 15. Time in notch for these locomotives was assumed to be the same as was modeled for the freight locomotives. These represent AMTRAK trains along this line.

Table 15. Estimated annual PM emissions associated with Amtrak commuter movements along the mainline adjacent to the Stockton facility.

Tier	Model Group	Number of Engines	Engine Mode										Total
			Idle	DB	1	2	3	4	5	6	7	8	
x	EMD 12-710G3	4175	0	3,476	0	0	0	0	940	1,319	0	23,989	**29,724**

Non-Locomotive Facility Operations, Emission Factors and Emission Estimates

The operations at the Stockton facility also include non-locomotive activity within the yard (H through L). Under each heading is a description of the operations.

H. Cargo Handling Equipment Operations

There are no pieces of cargo handling equipment (CHE) used at this yard.

I. On-road Container Truck Operations

There are no regular trucks carrying containers to or from this site. A different site not selected for this study outside of Stockton is used for intermodal operations.

J. On-road Fleet Vehicle Operations

There are twenty fleet vehicles owned by BNSF based at Stockton shown in Table 16. The vehicles are parked near the Diamond St. entrance about 400 feet from the ingress amounting to the distance on site for each trip these vehicles make on site. The number of trips for each vehicle were derived from the average annual mileage (odometer/age) and the mileage per trip (5.07 for LDT2 and 0.98 for LHDT1 gasoline) from an EMFAC run for the San Joaquin region. The number of trips was multiplied by 400 feet per trip to derive the mileage on site for these vehicles.

Table 16. BNSF On-road fleet vehicle activity at the Stockton facility.

EMFAC Vehicle Type	Fuel	# of Vehicles	Estimated Average Annual Mileage per Vehicle	Estimated Average Annual Mileage on Site per Vehicle
LDT2	Gasoline	3	9,748	146
LHDT1	Gasoline	17	37,330	2,896

Annual PM and TOG emission factors from EMFAC and on-site emissions estimates for the fleet vehicles are presented in Table 17. 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.

Table 17. On-road fleet vehicle emissions at the Stockton facility

EMFAC Vehicle Type	Fuel	PM Emissions (grams)	TOG Exhaust Emissions (grams)	TOG Evap Emissions (grams)
LDT2/ LHDT1	Gasoline	782	118,008	87,268

K. Other Off-Road Equipment

K1. Transport Refrigeration Unit Operations

Transportation Refrigeration units (TRUs) are used to regulate temperatures during the transport of products with temperature requirements. In BNSF operations, temperatures are regulated by TRUs in shipping containers and in railcars when the material being shipped require such temperature regulation.

TRU emissions were estimated in accordance with the methodology presented by an early version of the OFFROAD model provided by ARB (2006c). TRU yearly activity was estimated using the time onsite by TRU configuration (either railcar or shipping container) and mode of transport was provided by BNSF. This activity data was used along with ARB default age, horsepower, and load factor input estimates in the OFFROAD model to estimate TRU emissions. All TRUs are assumed to use diesel fuel.

K1a. Boxcars

Stockton site boxcar TRU activity is shown in Table 18. As TRUs are not expected to be operating when a boxcar is not loaded, the TRU activity presented here represents loaded TRU shipping containers only. Stockton boxcar TRU emissions are presented in Table 19.

Table 18. Stockton site Boxcar TRU yearly activity.

Transport Mode	Yearly Visits	Average Time Onsite / Visit (hours)
Train Arrival – Train Departure	5	14[1]

[1] Average boxcar TRU time on site for other BNSF sites, since Stockton specific time was not available.

Table 19. Stockton site Boxcar TRU emissions (grams per year).

Mode	TOG	PM
Train Arrival – Train Departure	4,875	992

K1b. Containers

Stockton site container TRU activity and emissions are shown in Table 20. As TRUs are not expected to be operating when a shipping container is not loaded, the TRU activity presented here represents loaded TRU shipping containers only.

Table 20. Stockton site shipping container TRU yearly activity and emissions (grams per year).

Yearly Visits	Total Time Onsite (hours)	Average Time Onsite / Visit (hours)	TOG (gpy)	PM (gpy)
6	48	8[1]	3,343	680

[1] Average shipping container TRU time on site for other BNSF sites, since Stockton specific time was not available.

K2. 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 Stockton site has 16 miles of track within its boundaries compared with the California regional total of 3,779 miles. This represents 0.4% of the total California track mileage that is maintained.

Appendix A2 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 except two forklifts (equipment IDs TM1 and TM2) which were assumed to be powered by 4-stroke gasoline engines. Forklifts TM1 and TM2 could not be assumed to be diesel powered because diesel forklifts of 16 to 25 horsepower diesel forklifts were not included in the ARB OFFROAD model.

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. Load factors were assumed to be ARB OFFROAD model default (ARB, 2006b).

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 Stockton facility along with California totals are shown in Table 21.

Table 21. Track maintenance equipment emissions estimates (grams per year).

	Gasoline			Diesel	
Site	Evaporative TOG	Exhaust TOG	PM	TOG	PM
Stockton	91	516	15	52,096	19,072
California Totals	21,469	121,981	3,525	12,305,162	4,504,844

K3. Other Off-road Equipment (including Portable Engine) Operations

There is no other off-road equipment at the Stockton site.

L. Stationary Sources

There are no stationary sources at Stockton either permitted or otherwise.

Total TAC emissions from the Stockton facility

The estimated total annual diesel PM (DPM) emissions associated with the operations in the Stockton facility are summarized in Table 22.

Table 22. Estimated total annual DPM emissions associated with the operations in the Stockton facility.

Facility Operations	PM Emissions		Percentage
	Grams	Metric Tons	
Basic Services (A)	30,843	0.03	1%
Basic Engine Inspection (B)	0	0.00	0%
Full Engine Service/Inspection (C)	0	0.00	0%
Switching (D)	1,404,629	1.40	43%
Arriving and Departing Trains (E)	1,571,143	1.57	48%
Adjacent Freight Movements (F) BNSF	192,464	0.19	6%
Adjacent Freight Movements (F) Foreign	1,626	0.00	0%
Adjacent Commuter Rail Operations (G)	29,724	0.03	1%
Cargo Handling Equipment Operations (H)	0	0.00	0%
On-Road Container Truck Operations (I)	0	0.00	0%
On-Road Fleet Vehicle (J)	0	0.00	0%
Other Off-Road (K) TRU	1,672	0.00	0%
Other Off-Road (K) Track Maintenance	19,072	0.02	1%
Stationary Sources (L)	0	0.00	0%
Total	**3,251,173**	**3.25**	

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 Stockton facility are summarized in Table 23. Diesel TOG is not included in the tabulation.

Table 23. Estimated total annual TOG emissions from gasoline/LPG/NG fueled engines associated with the operations in Stockton facility.

Facility Operations	TOG Emissions		Percentage
	Grams	Metric Tons	
Basic Services (A)	0	0	0%
Basic Engine Inspection (B)	0	0	0%
Full Engine Service/Inspection (C)	0	0	0%
Switching (D)	0	0	0%
Arriving and Departing Trains (E)	0	0	0%
Adjacent Freight Movements (F)	0	0	0%
Adjacent Commuter Rail Operations (G)	0	0	0%
Cargo Handling Equipment Operations (H)	0	0	0%
On-Road Container Truck Operations (I)	0	0	0%
On-Road Fleet Vehicle (J) Exhaust	118,008	0.12	57%
On-Road Fleet Vehicle (J) Evaporative	87,268	0.09	42%
Other Off-Road (K) TRU	0	0	0%
Other Off-Road (K) Track Maintenance Exhaust	516	0.00	0%
Other Off-Road (K) Track Maintenance Evaporative	91	0.00	0%
Other Off-Road (K) Other Portable Engines	0	0	0%
Stationary Sources (L)	0	0	0%
Total	**205,883**	**0.21**	

REFERENCES

ARB. 2006a. Email from Dan Donohue of ARB to Chris Lindhjem of ENVIRON, May 9, 2006.

ARB. 2006b. E-mail communication from Sandee Kidd with Draft OFFROAD Model Emission Factors, ARB. April, 2006.

ARB. 2006c. Draft OFFROAD, and Draft EMFAC2005 models on disk. August, 2006. Cargo handling equipment emissions provided September 26, 2006.

ARB. 2005a. OFFROAD Modeling Change Technical Memo, "Changes to the Locomotive Inventory," prepared by Walter Wong, preliminary draft. March 16, 2005. Available online March 31, 2006: http://www.arb.ca.gov/msei/on-road/downloads/docs/Locomotive_Memo.pdf

ARB. 2005b. "Ports and Intermodal Rail Yards", California Air Resources Board, http://www.arb.ca.gov/regact/cargo2005/cargo2005.htm, October, 2005. and "Rulemaking to Consider to Consider the Adoption of a Proposed Regulation for Mobile Cargo Handling Equipment at Ports and Intermodal Rail Yards," December 8, 2005.

ARB. 2003. Staff Report: Initial Statement Of Reasons For Proposed Rulemaking: Airborne Toxic Control Measure For In-Use Diesel-Fueled Transport Refrigeration Units (TRU) and TRU Generator Sets, and Facilities Where TRUs Operate, California Air Resources Board, http://www.arb.ca.gov/regact/trude03/trude03.htm, October 2003.

ARB. 2000a. "EMFAC Technical Support Document: HC Conversions". California Air Resources Board, http://www.arb.ca.gov/msei/on-road/doctable_test.htm, February, 2000.

ARB. 2000b. "MSC #99-32: Public Meeting to Consider Approval of California's Emissions Inventory of Off-Road Large Compression-Ignited Engines (≥25hp) Using the New OFFROAD Emissions Model", Staff Report, California Air Resources Board, http://www.arb.ca.gov/msei/off-road/pubs.htm, January, 2000.

ARB. 1998. "MSC #98-27: Public Meeting to Consider Approval of the California Off-Road Large Spark-Ignited Engine Emissions Inventory", Staff Report, California Air Resources Board, http://www.arb.ca.gov/msei/off-road/pubs.htm, October, 1998.

EEA. 1997. "Documentation of Input Factors for the New Off-Road Mobile Source Emissions Inventory Model", Energy and Environmental Analysis, Inc., February, 1997.

EMFAC. 2003. EMFAC model version: Emfav2002 V2.2 Apr 23 2003. California Air Resources Board.

EPA. 2005. "Conversion Factors for Hydrocarbon Emission Components", U.S. Environmental Protection Agency, EPA420-R-05-015, December, 2005.

Port of Los Angeles (2005), “Port of Los Angeles Baseline Air Emission Inventory – 2001,” Prepared by Starcrest, July 2005.

SwRI. 2006. Personal communication between S. Fritz of SwRI and C. Lindhjem of ENVIRON, May 2006.

SwRI, 2005, "Exhaust Plume Study," correspondence with Steve Fritz at SwRI, September 2005 and May 2006.

SwRI, 2000 "Diesel Fuel Effects on Locomotive Exhaust Emissions." Prepared for California Air Resources Board, October 2000.

Wong, ARB, March 2005, http://www.arb.ca.gov/ei/areasrc/arbomobilsrctrains.htm

APPENDIX I

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/CRIB-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

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
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
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

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
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
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

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
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
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

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
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
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[Error! Bookmark not defined.] useful life.

[b] Horsepower estimated as ARB default[Error! Bookmark not defined.] for the most populous horsepower range for the associated equipment