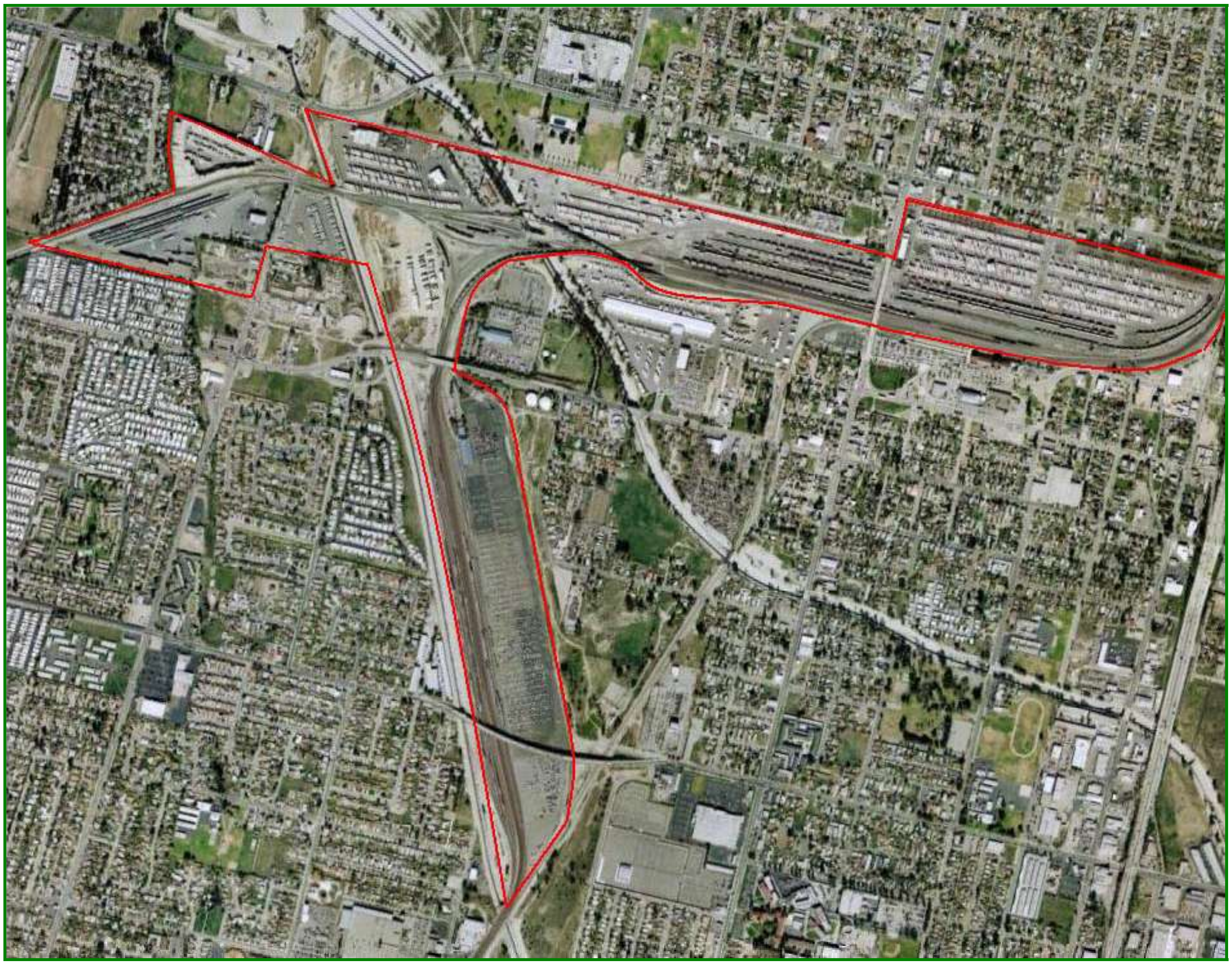
SAN BERNARDINO TAC EMISSIONS INVENTORY



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1.0 INTRODUCTION

This document describes the data and methods used in estimating toxic air contaminant (TAC) emissions, in particular diesel particulate matter and total organic gases, resulting from facility operations and other activities at BNSF's San Bernardino facility as well as rail-related activities in its direct vicinity. The data describe activities grouped by emission sources and by spatial activity.

The emission sources include:

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

Emission factors for diesel particulate matter (PM) and total organic gases (TOG - which are then speciated into other relevant toxic air contaminants) for each source are provided in the document. Emission estimates are based on specific activity data.

2.0 OVERVIEW OF THE SAN BERNARDINO YARD

The San Bernardino yard is a rail yard that is split into two distinct sections – an East-West aligned intermodal rail yard ("A" yard) and a roughly North-South aligned automotive yard ("B" yard). The majority of activity occurs in the intermodal "A" yard. The freight activities in the "B" yard are miniscule for the years 2005 and after, due to the termination of an exclusive contract with General Motors. Besides the activities on those two yards, a number of trains pass through or by the yard.

The main purpose of the San Bernardino intermodal yard is the make-up of trains. In order to make-up trains, containers or truck chassis are hauled into the yard, temporarily stored and then loaded onto a rail car. The intermodal cargo is carried in either containers or trailers. Both are loaded onto flatbed railcars. Containers may be carried in double stack configuration.

The railcars are moved within the yard by switching locomotive. Most ready trains will leave eastward. About 3 trains per day await clearance before exiting the yard near 4th Street. The average wait time for those engines is 20 minutes. Furthermore, some passing trains may undergo a crew change and observe idle periods as well.

Container and trailers are brought into the yard from surrounding industrial areas. Trucks usually enter the yard through the main ingress on West 4th Street. Once in the yard, containers and trailers are parked in the eastern section of the intermodal yard, East of Mt. Vermont Avenue. However, irregularly, during peak times in the year, containers and trailers may be stored in one of the satellite yards west of the main yard.

The transfer of containers within the yard as well as the loading of the containers and trailers onto trains uses off-road heavy equipment (yard tractors, lift machines, gantry cranes etc.). However, BNSF operates several on-road licensed yard tractors that can transfer containers and trailers from the satellite yards to the main yard if needed.

The loading activity on the "B" yard is currently at a very low level. Furthermore, the predominant unloading of auto rail cars utilizes the power of the self propelled gasoline vehicles and thus does not contribute to the particulate emissions. The largest contributor to diesel PM emissions in the "B" yard, despite the passing of trains, are the on-road trucks that pick-up autos for delivery.

In addition to BNSF operations there are some limited non-BNSF freight trains as well as passenger trains that use BNSF or adjacent tracks. The non-BNSF freight trains are described in the sections below as 'foreign trains'. The two passenger services on adjacent tracks are operated by AMTRAK and Metrolink. Just south of the east portion of the intermodal rail yard is a commuter rail station, served by both AMTRAK and Metrolink. AMTRAK trains arrive and leave from West using the fly-over tracks that cross the BNSF yard. Metrolink also uses a line southward that routes directly through the residential areas. Thus only portions of those tracks are adjacent to the BNSF yard. Metrolink also parks locomotives overnight, parallel to 3rd Street, from North J Street to North I Street, in addition to its passenger services.

3.0 LOCOMOTIVE FACILITY OPERATIONS

The make-up of trains and their departure as well as the passing of complete trains are the most significant locomotive activities at the San Bernardino site. The engine-on locomotive operations include switching activities (Section 3.4) and maneuvering activities in the classification yard (Section 3.5), as well as passing trains on operating tracks (Section 3.6 and Section 3.7). Service activities are limited to a small amount of locomotive refueling (Section 3.1). There are no locomotive inspections at the San Bernardino yard (Section 3.2 and 3.3). A subcontracted firm undertakes some maintenance on railcars. However, those services do not require locomotive activities.

Because different locomotive and engine models have different emissions characteristics, it is important to characterize the types and models of the locomotives that work, arrive and depart, or pass the San Bernardino 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 and activity profiles.

3.1 Basic Locomotive Service

A limited number of locomotives are refueled at the San Bernardino yard. The locomotive refueling area is located in the Y that connects the "A" with the "B" yard. Locomotives are fueled from trucks directly. (DTL) The DTL services utilize on-road trucks to deliver the locomotive fuels. A total number of approximately 7,952 locomotives refuel in 2005 with an average of 1.5 hours of idling. Refueling resulted in 11,928 hours of engine idling while refueling.

3.2 Basic Engine Inspection

No such activity occurs within the BNSF's San Bernardino facility.

3.3 Full Engine Service/Inspection

No such activity occurs within the BNSF's San Bernardino facility.

3.4 Switching Engine Activity

Switching engine fleet characteristics in the San Bernardino yard were determined by a roster of engines made available by BNSF in 2007. A total of 14 switching locomotives operate in San Bernardino. The snapshot of the switching engine fleet characterization used for this evaluation is shown in Table 3-1.

Table 3-1. Locomotive switching engine fleet characterization for service to the San Bernardino facility.

Locomotive Model	Certification Tier	HP	Number of Engines	Engine Surrogate
GP25	Precontrolled	2500	2	Switcher
GP30	Precontrolled	2500	2	Switcher
GP35	Precontrolled	2500	4	Switcher
GP38	Precontrolled	2000	1	GP-3x
GP38-2	Precontrolled	2000	1	GP-3x
GP39-2	Precontrolled	2300	2	GP-3x
SD39-2	Precontrolled	2300	2	Switcher

The switching engine activity is based on the hours of operation, the engine activity and the engine-specific emission factors.

The San Bernardino "A" yard operates 24 hours, 7 days a week on three shifts. A total number of 8 switching engines are supported by 4 line-haul engines on average. A set of 8 engines operates 24 hours, seven days per week. Four of those switching engines are dedicated to the yard west of Mt. Vermont Street. However, the four other engines operate east of Mt. Vermont Street. The switching engines are dedicated to specific jobs that assemble local trains but may provide other services as well. In the San Bernardino "B" yard, three engines operate on two jobs per day. This results in an estimate of 70,064 hours of switching activity per year.

The time in mode for switching engine activity in Table 3-2 was determined from event recorder downloads of a sample of eight engines operating in the San Bernardino yard. The eight engines range from 2,300 – 3,000 hp, and are representative of the switching engines dedicated to the services in San Bernardino. Emission factors are based on the engine roster in Table 3-1.

Table 3-2. Switching engine relative time in mode.

Throttle Notch	Time in Mode
Engine shut off	20.0%
DB	1.3%
Idle	69.7%
1	2.8%
2	2.3%
3	1.3%
4	0.8%
5	0.4%
6	0.2%
7	0.3%
8	0.7%

3.5 Train Arrival and Departures in and from the Yard

Trains arrive and depart from the San Bernardino yard and have an operating profile distinct from other engines moving through or by the yard. Trains arrive and depart, compared to passing through or by the yard, under certain circumstances. Those include the pick-up or delivery of trains to the yard, re-fueling, crew change or the awaiting for track clearance at the yard exit.

BNSF provided engine counts for arriving and departing trains as well as automatic train reader counts from readers near the yard.

However, all 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 that stayed longer than one hour in the yard were considered true arriving and departing trains. All others were considered passing trains and appear under activity category as described in section 3.6.

Between May 1, 2005 and April 31, 2006, the total number of BNSF engines that passed north of the San Bernardino yard counted 85,450 engines, corresponding to approximately 23,000 to 28,000 trains per year or 62 to 78 per day. In addition, 19,641 foreign engines per day passed by the yard. A number of 14,428 of the BNSF engines or approximately 10 to 13 trains per day arrived in or departed from the yard, using a minimum residence time of one-hour as a cut-off value to avoid counting locomotives pulling trains that may have been counted as entering the yard only to pass through. Of those 14,428 engines, approximately 4,500 stop in San Bernardino to only undergo a crew change. Thus, about 8 trains or 27 engines arrive in San Bernardino for cargo operations and about 3.5 or 12 engines in order to undergo a crew change. This corresponds well with the BNSF interview data of 7 – 8 trains made-up per day. Other arriving trains stop in San Bernardino to be refueled or to receive other services. The fleet characteristics by model and emission tier level for arriving and departing trains is shown in Table 3-3.

Table 3-3. Fleet characteristics for arriving and departing engines.

Tier	Model	Number	Fleet Fraction
Precntrl	Switchers	1	0%
Precntrl	GP-3x	165	1%
Precntrl	GP-4x	1,217	8%
Precntrl	GP-50	21	0%
Precntrl	GP-60	39	0%
Precntrl	SD-7x		0%
Precntrl	Dash-7	5	0%
0	GP-60	447	3%
0	SD-7x	23	0%
0	Dash-8	1,274	9%
0	Dash-9	7,346	51%
1	Dash-9	2,809	19%
2	ES44/Dash-9	1,081	7%

BNSF provided throttle position for a sample engine that arrived and departed out of the San Bernardino yard and spend a long period of time (~24 hours) within the yard. This information, is representative for trains originating and terminating at San Bernardino, is shown in Table 3-4. Other trains that arrive and depart used a time in mode profile typical of crew change trains taken from Barstow where crew change trains were identified. The activity patterns represented arrival and departures trains. In addition trains idle during the refueling, which is calculated for under the basic service section A and that idle time subtracted from that shown in Table 3-4 for originating/departing trains. Furthermore, engines usually stay longer at the yard than the idle time indicates. During longer periods of inactivity, engines may be switched off.

Table 3-4. Combined locomotive activity by mode for arriving and departing trains, for cargo operations as well as for crew changes.

Throttle Position	Hours in mode	
	Cargo Operations	Crew Change
DB	0.162	0.069
Idle	4.003	0.232
T1	0.601	0.015
T2	0.389	0.029
T3	0.256	0.025
T4	0.082	0.017
T5	0.037	0.007
T6	0.004	0.004
T7	0.001	0.005
T8	0.003	0.007

3.6 Freight Movements on Mainline

The main line in San Bernardino runs centrally through the "B" yard and on the South side of the "A" yard. Its length is approximately 2.8 miles. Most trains go to or come from the ports in Southern California and arrive from or leave towards East for continental destinations. Some trains wait for track clearance on the North-East exit of the yard.

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 automatic readers capture traffic to and from west as well as to and from east of the yard, going to and leaving from the San Bernardino yard. One reader location captures trains coming from and leaving to the ports of southern California, and one captures trains coming from and leaving to the inland destinations.

The total number of freight trains passing includes trains arriving and departing in San Bernardino as well as trains passing through the yard without significant stops. As stated above, 85,540 BNSF engines passed the automatic readers between May 1, 2005 and April 30, 2006. An additional 19,641 foreign engines passed the readers. Of those, 1,917 were Amtrak passenger trains and thus are not considered as freight movements. Thus a total of 103,174 locomotive engines pulling or pushing freight trains pass by the yard or have their destination in the San Bernardino yard. 14,428 of these locomotives were estimated to have both arrived and departed from San Bernardino. From the total of 103,174, the number of arriving and departing engines was subtracted from the total number of locomotives passing readers north of the yard because those train/engine activity were counted and provided under Heading E. The number of freight train locomotives that passed the yard was therefore estimated as 88,746.

3.6.1 BNSF Freight Movements

The fleet characteristic for the BNSF engines is shown in Table 3-5.

Table 3-5. Fleet characterization for locomotives for the San Bernardino facility.

Tier	Model	Number	Fleet Fraction
Precntrl	Switchers	3	0%
Precntrl	GP-3x	814	1%
Precntrl	GP-4x	5,992	8%
Precntrl	GP-50	104	0%
Precntrl	GP-60	192	3%
Precntrl	Dash-7	26	0%
0	GP-60	2,198	11%
0	SD-7x	111	0%
0	Dash-8	6,272	13%
0	Dash-9	36,161	16%
1	Dash-9	13,829	9%
2	ES44/Dash-9	5,320	2%

Table 3-6. Average time in mode for locomotives passing the San Bernardino facility.

Throttle Position	Time in Mode (hrs)
DB	0.017
Idle	0.007
T1	0.005
T2	0.010
T3	0.008
T4	0.007
T5	0.008
T6	0.022
T7	0.003
T8	0.000

Some trains are held to wait for track clearance not accounted in samples used to determine the time in mode of most other passing trains. This additional wait time occurs with approximately 3 trains per day that travel eastward. The trains wait for clearance near the furthermost east exit of the yard, close to the West 5th Street overpass. Those emissions are calculated separately as they present emissions at a distinct location.

ENVIRON used the overall BNSF fleet roster to estimate the emissions from waiting trains because no specific list of engines that stopped for clearance was available. The sum of all wait time was divided by all passing trains to estimate an average wait time per engine.

3.6.2 Foreign (non-BNSF) Freight Movements

19,641 foreign (non-BNSF) locomotives passed the San Bernardino facility between May 1, 2005 and April 30, 2006. Of those 1,917 were Amtrak commuter trains and subtracted from the foreign freight train counts. Thus 17,724 foreign engines passed the yard pulling or pushing freight trains. ENVIRON made the assumption that the fleet mix and time in mode for these engines would be the same as what Tables 3-5 and 3-6 show for the BNSF engines.

3.7 Commuter Rail Operations on Adjacent Mainline

A separate set of adjacent tracks from those used for freight and AMTRAK trains is used by Metrolink commuter trains. Those trains, operated by Metrolink, use the fly-over rail over the "A" yard and terminate at the commuter rail station on 3rd Street to the South-East of the yard. A total of 14,456 trains, pulled by one locomotive, account for activity on those adjacent tracks. 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.

4.0 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." 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, 2006b). 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 San Bernardino facility are summarized in Tables 4-1a and 4-1b 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 4-1a.

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

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

Table 4-1b 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 4-1b.

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

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

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 4-2.

Table 4-2. 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
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 (2005b) 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 4-3 were applied to the base emission rates to calculate the emission rates at the in-use fuel sulfur levels.

Table 4-3. 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%

5.0 LOCOMOTIVE DIESEL PM EMISSION ESTIMATES

5.1 Basic Service

Estimated annual PM emissions for refueling activities at BNSF's San Bernardino yard are presented in Table 5-1. ENVIRON calculated these emissions using the San Bernardino characteristic fleet mix and an engine idling for approximately 1.5 hours, which was confirmed during yard inspections. Refueling occurs year round mostly during day time hours between 8 a.m. and 8 p.m.

Table 5-1. Estimated annual PM emissions associated with refueling of locomotive engines.

Locomotive Model Group	Cert Tier	# of Loco	PM Emissions (grams)
Switchers	Precntl	0	15
GP-3x	Precntl	91	5,198
GP-4x	Precntl	671	48,244
GP-50	Precntl	12	453
GP-60	Precntl	21	1,565
Dash-7	Precntl	3	283
GP-60	0	246	7,790
SD-7x	0	12	276
Dash-8	0	702	38,922
Dash-9	0	4049	205,492
Dash-9	1	1548	39,251
ES44/Dash-9	2	596	6,880
Total		**7,952**	**354,369**

5.2 Basic Engine Inspection

No such activity occurs at the San Bernardino facility.

5.3 Full Engine Service/Inspection

No such activity occurs at the San Bernardino facility.

5.4 Switching Engine Activity

Estimated annual PM emissions for switching activities at the San Bernardino facility are presented in Table 5-2. Due to the dedicated areas at the San Bernardino facility, the emissions are split into "A" yard east of Mt. Vernon Street, "A" yard west of Mt. Vernon Street and "B" yard area. All switchers are of GP-3x model. ENVIRON calculated these emissions using the engine-specific emission factors by notch in Table 4-1b, the fleet characteristics in Table 3-1, and the relative time in mode data from Table 3-2. The switching activity over 365 days per year was distributed equally across all 14 engines in the switching fleet. 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 5-2. Estimated annual PM emissions associated with switch locomotives within the yards of the San Bernardino facility.

Areas in the San Bernardino yard	PM Emissions (grams)
"A" yard east of Mt. Vernon Street	1,472,524
"A" yard west of Mt. Vernon Street	1,472,524
"B" yard	736,262
Total	**3,681,311**

5.5 Train Arrival and Departures in and from the Yard

Trains arriving and departing in San Bernardino have a similar fleet mix then passing BNSF trains. The fleet characteristics of Table 3-3 were used to estimate the emissions. Emissions were derived based on the activity, shown in table 3-4, for an arriving and departing train. The emissions for all engines arriving and departing are shown in Table 5-3.

Table 5-3. Emissions from locomotives arriving to and departing from San Bernardino, both for cargo operations and for crew changes. (grams/year)

Model Group	Cert. Tier	PM Emissions (grams)	
		Cargo Operations	Crew Change
Switchers	Precntl	**93**	**5**
GP-3x	Precntl	**34,074**	**1,781**
GP-4x	Precntl	**309,609**	**16,375**
GP-50	Precntl	**4,597**	**275**
GP-60	Precntl	**10,759**	**588**
Dash-7	Precntl	**1,896**	**87**
GP-60	0	**76952**	**5,619**
SD-7x	0	**3,335**	**254**
Dash-8	0	**332,298**	**17,433**
Dash-9	0	**1,622,140**	**84,035**
Dash-9	1	**563,641**	**34,242**
ES44/Dash-9	2	**186,642**	**10,851**
Sub-Total		**3,146,037**	**171,485**
Total		**3,317,522**	

5.6 Freight Movements on Adjacent Mainline

The PM emission estimates for BNSF freight movements during the one-year period are presented in Table 5-4. The emissions include those from the passing trains as well as those from trains waiting for clearance at the east exit of the yard. Emissions for other railroad engines are presented in Table 5-5.

Table 5-4. Estimated annual PM emissions associated with BNSF locomotives passing along the mainline through the San Bernardino facility. (grams/year)

		PM Emissions (grams)	
Model Group	**Cert Tier**	**Total passing trains**	**Trains waiting for clearance**
Switchers	Precntl	38	2
GP-3x	Precntl	14,369	636
GP-4x	Precntl	135,562	5,905
GP-50	Precntl	2,727	55
GP-60	Precntl	5,035	192
Dash-7	Precntl	150	35
GP-60	0	61,752	953
SD-7x	0	3,309	34
Dash-8	0	125,436	4,764
Dash-9	0	865,977	25,152
Dash-9	1	322,614	4,804
ES44/Dash-9	2	107,380	842
Total		1,644,376	43,375
Total with clearance idling			**1,687,751**

The PM emission estimates for BNSF trains that wait for track clearance near the east exit of the yard resulted in additional 43,375 grams PM per year (2005). Thus while only roughly 3% of the total PM emissions (1,687,751 grams) it is recognized separately because of its distinct location.

Table 5-5. Estimated annual PM emissions associated with non-BNSF locomotives passing along the mainline through the San Bernardino facility.

Model Group	Cert Tier	Total
Switchers	Precntl	**9**
GP-3x	Precntl	**3,593**
GP-4x	Precntl	**33,830**
GP-50	Precntl	**681**
GP-60	Precntl	**1,256**
Dash-7	Precntl	**128**
GP-60	0	**15,411**
SD-7x	0	**826**
Dash-8	0	**31,303**
Dash-9	0	**216,110**
Dash-9	1	**80,510**
ES44/Dash-9	2	**26,797**
Total		**410,455**

5.7 Commuter Rail Operations on Adjacent Mainline

The annual PM emission estimates for commuter movements on the adjacent mainline are presented in Table 5-6. 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 5-6. Estimated annual PM emissions associated with commuter movements in or next to the San Bernardino facility.

Model Group	Locomotive **Model Group**	Cert Tier	# of Loco	Total
AMTRAK	EMD 12 710G3	Precntl	728	**5,041**
Metrolink	EMD 12 710G3	Precntl	13,728	**139,346**
Total				**144,360**

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

The operations at the San Bernardino facility also include non-locomotive activity within the yard. A description of the operations is included in Sections 6.1 - 6.5.

6.1. Cargo Handling Equipment Operations

Cargo handling equipment (CHE) is used to handle intermodal freight at the San Bernardino site and includes yard hostlers, cranes and container lifting equipment. Based on the equipment population and activity, ARB provided the emission estimates using latest emissions model.

BNSF provided the input on CHE characteristics for all of their California sites. Table 6-1 shows San Bernardino site CHE characteristics and activity. Annual use hours represent the average use hours per year. Usually, newer pieces of equipment are used more than older equipment, indicated by the relatively high annual use numbers of recent equipment. Average ARB figures for the respective equipment category were used if no specific activity data was available.

Table 6-1. San Bernardino CHE characteristics and activity.

ID	Equipment Type	Number	Model Year	Fuel Type	Engine Rated HP	Annual Use (hrs)
SB-1	Crane	1	1995	D	315	2639
SB-2	Crane	1	1996	D	315	3176
SB-3	Crane	1	1997	D	315	3132
SB-4	Crane	1	1997	D	315	1821
SB-5	Crane	1	1998	D	315	2953
SB-6	Crane	1	2000	D	315	4384
SB-7	Crane	1	2001	D	315	4078
SB-8	Crane	1	1997	D	315	1750
SB-9	Crane	1	2004	D	315	4729
SB-10	Crane	1	2005	D	315	2669
SB-11	Crane	1	2004	D	315	5721
SB-12	Crane	1	2005	D	315	2651
SB-13	Crane	1	1995	D	315	1632*
SB-14	Container Handling Equipment	1	1994	D	250	506
SB-15	Container Handling Equipment	1	1990	D	160	300
SB-16	Container Handling Equipment	1	1994	D	160	480
SB-17	Container Handling Equipment	1	1994	D	160	33
SB-18	Container Handling Equipment	1	1987	D	260	2388*
SB-19	Container Handling Equipment	1	1991	D	160	2388*
SB-20	Container Handling Equipment	1	1994	D	160	2388*
SB-21	Container Handling Equipment	1	2005	D	160	2388*
SB-22	Forklift	1	1999	D	154	803*
SB-23 – SB-74	Yard Tractors, off-road	52	1997	D	203	1289*

*ARB, 2005a Average annual use for diesel fueled intermodal equipment

The activity profiles for the San Bernardino yard in Table 6-1 have been used by ARB for estimating the emissions. Table 6-2 shows the DPM emissions for each piece of CHE at the San Bernardino yard. ARB had indicated that the use of fuel consumption as the activity indicator for cargo handling equipment was not consistent with its approach for estimating emissions.

Table 6-2. CHE DPM Emissions Estimates (grams per year - 2005).

ID	Equipment Type	Fuel Type	Number	PM (gpy)
SB-1	Crane	D	1	143,457
SB-2	Crane	D	1	72,721
SB-3	Crane	D	1	68,768
SB-4	Crane	D	1	40,564
SB-5	Crane	D	1	63,946
SB-6	Crane	D	1	89,489
SB-7	Crane	D	1	64,568
SB-8	Crane	D	1	38,983
SB-9	Crane	D	1	62,174
SB-10	Crane	D	1	33,875
SB-11	Crane	D	1	75,216
SB-12	Crane	D	1	33,646
SB-13	Crane	D	1	88,716
SB-14	Container Handling Equipment	D	1	30,744
SB-15	Container Handling Equipment	D	1	11,218
SB-16	Container Handling Equipment	D	1	16,687
SB-17	Container Handling Equipment	D	1	1,147
SB-18	Container Handling Equipment	D	1	248,369
SB-19	Container Handling Equipment	D	1	87,725
SB-20	Container Handling Equipment	D	1	83,018
SB-21	Container Handling Equipment	D	1	30,346
SB-22	Forklift	D	1	13,361
SB-23 – SB-74	Yard Tractors, off-road	D	52	1,910,761
Diesel Equipment Total				**3,310,496**

6.2. On-road Truck Operations

The San Bernardino site includes an intermodal yard, where tractor-trailers receive or deliver primarily containers to the container yard and by trailer on rail services, where the entire truck trailer is delivered or shipped on a rail car. Furthermore, some truck traffic relates to empty containers that are moved between the main yard and the satellite storage areas.

A second portion of the yard is dedicated to automotive cargo. Most of the cars arrive in dedicated rail cars to be then distributed to dealers with on-road trucks. Unloading of the rail cars and loading of the trucks uses the self propulsion of the autos.

To address truck traffic, BNSF conducted truck counts at their entrance and exit gates. However, truck counts are conducted in such a manner that only tractor-trailer combination trucks are counted. Therefore summing the total truck entrances and exits will overestimate the total truck trips by the number of trips that trucks both enter and leave as a tractor-trailer combination. During the analysis for the Hobart yard, ENVIRON had matched the truck entering and leaving the gates in order to develop a truck trip description. The resulting pattern, shown in Table 6-3 was used to correct the truck counts in San Bernardino, assuming a similar pattern at this site. The truck trip pattern in Hobart resulted in a factor of 0.93 truck trips per each gate count. Thus the 663,758 gate counts in 2005 at the San Bernardino site correspond with approximately 618,215 truck trips, as in Table 18.

Table 6-3. San Bernardino gate counts, Hobart pattern and resulting yearly truck trips.

	Count pattern		Trip pattern	
Truck trip pattern	**Gate counts**	**% distribution**	**Real trips**	**Weighted pattern**
Total Trucks Logging In & Out Gates (Trailer-Truck In, Trailer-Truck Out) (Matches)	2 count	13.7 %	1 trip	6.9 %
Trucks Logging In Without Logging Out (Trailer-Truck In, Bobtail Out)	1 count	44.7 %	1 trip	44.7 %
Trucks Logging Out Without Logging In (Bobtail In, Trailer-Truck Out)	1 count	41.6 %	1 trip	41.6 %
Totals	**4 counts**	**100 %**	**3 trips**	**93.1 %**
San Bernardino gate counts per year	**663,758**	**100 %**		
San Bernardino truck trips per year			**618,215**	**93.1 %**

A sample chase truck study was conducted to determine entrance queuing time, average speed and distance on site, time on site (engine on or off noted), and exit queuing time. The results for 41 trucks chased were used to estimate the typical operation characteristics for the San Bernardino yard. The average results for the fleet are shown in Table 6-4. However because the chase truck study was conducted from the entrance gate to the exit gate, it ignored travel within the site boundary but outside the gates. Since the ingress runs about 600 feet and the egress about 1000 feet parallel to West 4th Street, but outside the gates, those lengths were added to each truck trip.

Table 6-4. Average activity for truck trips using chase truck surveys.

Mode	Time (min)	Speed (mph)	Distance (miles)	Outside Gates – Inside Site Boundary Distance (miles)
Entrance Queue (Inside or Outside of Site Boundary)	5.8	--	--	0.1
Travel on site	8.3	16.7	2.3	--
Idle on Site	18.1	--	--	--
Exit Queue	3.9	--	--	0.2

The age distribution at the San Bernardino site differs from other BNSF sites because of its inland location and the specific customer base. The trucks that deliver containers and flat beds to the San Bernardino yard are much younger then trucks providing comparable services to and from the marine ports. In the sample of the truck chase, 76% of the trucks were younger than 8 years and 51% younger than 5 years. This is a significant difference to the trucks in, for example, Hobart – Los Angeles, which in the majority are ten years and older. Due to the limited number of samples, the average age distribution created through EMFAC model was used. Due to the highest accuracy, the vehicle mile normalized age distribution for the South Coast Air Basin was used for the calculation. According to the VMT adjusted age distribution, 55% were younger than 8 years and 41% were younger than 5 years. Although different from the sample, the

EMFAC figures likely reflect the age distribution more accurately. The HHDDV emission rates were calculated for each aged engine by interpolating between 15 and 20 mph to determine the emission rates at an average speed of 16.7 mph. These estimates are shown in Table 6-5 with summary emissions estimates in Table 6-6.

Table 6-5. Emission rate calculations for San Bernardino.

Age	EMFAC truck age distribution	Idle PM EF (g/min)	PM EF 16.71 mph (g/min)
1	3.98%	0.017237	0.013533
2	2.88%	0.017237	0.010979
3	3.40%	0.017237	0.014333
4	2.76%	0.022227	0.024649
5	4.25%	0.022227	0.041413
6	6.02%	0.022227	0.063364
7	6.03%	0.022227	0.067899
8	5.01%	0.022227	0.059871
9	5.10%	0.03213	0.065141
10	5.89%	0.03213	0.078997
11	6.70%	0.03213	0.093803
12	5.35%	0.03213	0.07782
13	4.24%	0.042794	0.088429
14	3.06%	0.042794	0.06561
15	3.43%	0.042794	0.075471
16	4.46%	0.057225	0.169465
17	4.51%	0.057225	0.174671
18	3.37%	0.057225	0.132515
19	2.98%	0.071373	0.119972
20	2.53%	0.114734	0.106433
21	2.45%	0.114734	0.104584
22	2.09%	0.114734	0.090415
23	0.91%	0.114734	0.039572
24	1.00%	0.114734	0.043913
25	1.25%	0.114734	0.055643
26	0.95%	0.114734	0.042681
27	1.02%	0.114734	0.046015
28	0.75%	0.114734	0.034123
29	0.50%	0.114734	0.023084
30	0.42%	0.114734	0.019295
31	0.46%	0.114734	0.021226
32	0.44%	0.114734	0.020263
33	0.39%	0.114734	0.018245
34	0.40%	0.114734	0.0187
35	0.24%	0.114734	0.011033
36	0.26%	0.114734	0.012097
37	0.24%	0.114734	0.011075
38	0.13%	0.114734	0.006281
39	0.10%	0.114734	0.004824
40	0.05%	0.114734	0.002312
41	0.00%	0.114734	0
	Weighted average	**0.047 g/min**	**2.17 g/mile**

Table 6-6. Emissions estimates for the truck trips to and from the San Bernardino yard.

Mode or location	Per trip emissions (PM10 g/trip)	Total Emissions (618,215 trips) (PM10 g/yr)
On-site travel	4.99	3,085,150
Idle – on-site	0.86	529,129
Idle - entrance	0.28	170,390
Idle – exit	0.18	113,692
Sum (g/yr)		**3,898,361**

A second on-road truck activity is the refueling of locomotives at the San Bernardino yard. There were 7,952 refueling events. A 33,000 lbs refueling truck without trailer has a capacity of 2,800 gallons of liquid fuel. Considering an approximate average fuel amount of 1,250 gallons per refueling activity, one truck trip may refuel two locomotives. All background data, including age distribution, speed on site, was assumed to be similar to the other on-road trucks.

The fueling trucks enter the yard south from West Rialto Avenue and travel approximately 0.225 miles to the DTL site in the Y of the yard. Fueling takes about 30 minutes with a total of 60 minutes idling assumed per one fueling activity. Idling at the entrance and exit were assumed similar to the other on-road trucks. Table 6-7 sums the emissions from the fueling trucks at San Bernardino.

Table 6-7. Emissions estimates for fueling truck trips at the San Bernardino site.

Mode or Location	Container Trucks	
	Per trip emissions (PM10 g/trip)	Total Emissions (3,976 trips) (PM10 g/yr)
On-site travel	0.98	3,882
Idle – on-site	5.68	22,581
Idle – entrance	0.28	1,096
Idle – exit	0.18	731
Sum (g/yr)		**28,290**

6.3 On-road Fleet Vehicle Operations

There are two types of fleet vehicles; those owned by BNSF and those owned by BNSF's contractors (Eagle International, Progress Rail Service, CBRE and TEMCO). The BNSF parking lot is located west of Mt. Vernon Street adjacent to West 4th Street. Its distance to the public street, including distances inside and outside the BNSF yard, is approximately 3600 feet. The parking lot for the contractors is east of Mt. Vernon Street, approximately 4200 feet from the public street area.

There are 82 SF-owned fleet vehicles based at the San Bernardino facility according to records from BNSF. The EMFAC model provides an average trip distance by vehicle type for the South Coast in 2005. The trip distance was used to determine the number of trips for each vehicle by dividing it into the annual mileage accumulation. The annual mileage was determined from the odometer reading divided by the age of the vehicle, which likely overestimates the annual mileage because vehicles tend to be used less as they age. BNSF fleet vehicles (primarily parked next to West 4th Street) run an about 3600 feet along West 4th Street to get into or out of the lot. This distance was used as the distance traveled within the site for each trip. Table 6-8 provides the overall activity estimates for this fleet.

Table 6-8. BNSF On-road fleet vehicle activity at the San Bernardino facility.

EMFAC Vehicle Type	Fuel	Number of Vehicles	Estimated Average Annual Mileage per Vehicle	Estimated Average Annual Mileage on Site per Vehicle
LDA	Gasoline	5	84,793	12,703
LDT2	Gasoline	48	999,655	131,117
LHDT1	Gasoline	14	306,122	166,255
MHDT	Gasoline	1	7,272	6,768
LHD1	Diesel	1	19,348	2,905
MHDT	Diesel	13	156,086	52,608

For the contractor vehicles, a similar approach was used except that no annual mileage accumulation figures were available for this fleet. Typical fleet mileage accumulation from the BNSF vehicles or from EMFAC2005 defaults were used where appropriate. The BNSF contractor fleet vehicles were assumed to use the ingress and egress on West 4th street and proceed to the lots east of Mt. Vernon Street or about 4200 ft on site. Table 6-9 provides the overall activity estimates for this fleet.

Table 6-9. Contractor On-road fleet vehicle activity at the San Bernardino facility.

EMFAC Vehicle Type	Fuel	Number of Vehicles	Estimated Average Annual Mileage per Vehicle	Estimated Average Annual Mileage on Site per Vehicle
LDT2	Gasoline	52	528,131	80816
LHDT1	Gasoline	1	15,152	9,601
MHDT1	Gasoline	1	13,259	13,259
LHD1	Diesel	14	291,935	51,130

Annual PM and TOG emission factors from EMFAC and on-site emissions estimates for the fleet vehicles are presented in Table 6-10. 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.

Table 6-10. BNSF and Contractor on-road fleet vehicle emissions at San Bernardino.

EMFAC Vehicle Type	Fuel	PM Emissions (grams)	TOG Exhaust Emissions (grams)	TOG Evaporative Emissions (grams)
LDA/LDT1/LDT2/LHDT1/MDV BNSF fleet vehicles	Gasoline	5,187	387,950	214,213
LDA/LDT1/LDT2/LHDT1/MDV Contractor vehicles	Gasoline	2,486	135,865	67,092
LHDT1/HHDT BNSF fleet vehicles	Diesel	14,834	13,020	--
LHDT1/HHDT Contractor vehicles	Diesel	2,153	7,712	--

6.4. Other Off-Road Equipment

6.4.1. Transport Refrigeration Unit Operations

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

TRU emissions were estimated in accordance with the methodology presented by an early version of the OFFROAD model provided by ARB (2006a). 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. An additional factor of 0.6 was used to account for the only temporary use of TRU units. All TRUs are assumed to use diesel fuel.

Boxcars

San Bernardino site boxcar TRU activity is shown in Table 6-11. 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. San Bernardino container TRU emissions are presented in Table 6-12.

Table 6-11. San Bernardino site Boxcar TRU yearly activity.

Transport Mode	Yearly Visits	Average Time Onsite / Visit (hours)
Train Arrival – Train Departure	25	13

Table 6-12. San Bernardino site Boxcar TRU emissions (grams/year).

Mode	TOG	PM
Train Arrival – Train Departure	13,580	2,763

Containers

San Bernardino site container TRU activity and associated emissions are shown in Table 6-137. 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 6-13. San Bernardino site shipping container TRU yearly activity and emissions (grams/year).

Yearly Visits	Total Time Onsite (hours)	Average Time Onsite / Visit (hours)	TOG (gpy)	PM (gpy)
27,153	352,989	13	14,749,595	3,000,932

6.4.2 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 develop the on-site emissions as a portion of the estimated emissions from all track maintenance equipment throughout California. The relative track mileage (including all tracks, main line and other tracks) at the San Bernardino yard compared to the California total track mileage was used to establish the apportion factor.

The San Bernardino yard has 31.8 miles of track within its boundaries compared with the California regional total of 3,779 miles. This represents 0.84% 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 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 the ARB default (ARB, 2006a) for the most populous horsepower range for the assigned ARB equipment category and type. Load factors were assumed to be ARB OFFROAD model default factors (ARB, 2006a).

Emissions

Exhaust emissions from track maintenance equipment were estimated using the draft version of the OFFROAD model (ARB, 2006a). Emissions from track maintenance equipment at the San Bernardino facility along with California totals are shown in Table 6-14.

Table 6-14. Track maintenance equipment emissions estimates (grams per year).

Site	Gasoline			Diesel	
	Evaporative TOG	Exhaust TOG	PM	TOG	PM
San Bernardino	181	1,389	40	104,811	38,632
California Totals	21,469	121,981	3,525	12,305,162	4.504,844

6.5 Stationary Sources

Air quality permits for the San Bernardino facility show several types of stationary sources for potential evaluation.

Source types:
1) Gasoline storage and dispensing unit [1 on site]
2) Diesel-fueled internal combustion engine (ICEs) [1 on site]
3) SVE with well and ducts [2 on site]

The gasoline storage and dispensing unit is comprised of a 2000 gallon tank with a hose and nozzle. Although the exact throughput was not available from the SCAQMD permit application (i.e., application # 332267), ENVIRON assumed the throughput was approximately equal to the throughput for the Los-Angeles –Hobart Yard based on the sizes of the gasoline tanks and the relative activity at the two Yards. 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 6-15.

Table 6-15. TOG emissions for the gasoline dispensing and storage facility at the San Bernardino 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 I and II Vapor Recovery)	14,945	31,669	85,708	132,322

The relevant parameters for the diesel ICE, as well as its estimated annual PM emissions are presented in Table 6-16. To estimate emissions from the the diesel ICE at the San Bernardino site, maximum permitted operating hours and maximum state- or district-permitted PM certification levels contained in the SCAQMD permit application # 199239 for the Caterpillar Model 3508 internal combustion engine was used.

Table 6-16. Parameters and PM emissions estimates for the diesel-fueled ICE at the San Bernardino facility.

Specifications	Brake horsepower (hp)	Maximum Est. Operation Time (hr/yr)	PM Emissions (grams)
Caterpillar Model 3508	1337	200	84,903
Total			**84,903**

Two soil vapor extraction systems (SVESs) are used at the San Bernardino Yard to extract and treat vapors from soils contaminated with gasoline, diesel, perchloroethylene, trichloroethylene, 1,1-dichloroethane, and 1,2-dichloroethane, and vinyl chloride. The SVESs each consist of an extraction well and ducts, water knockout drum, extraction blower, and a thermal oxidizer. Because the primary pollutant of concern from the SVESs is nitrogen oxides (NOx) and sufficient information was not available from the SCAQMD permit applications (i.e., permit application #s 421488 and 421489) or Facility personnel to estimate TOG emissions from the SVESs, ENVIRON assumed that TOG emissions from the SVESs were negligible.

7.0 TOTAL TAC EMISSIONS FROM BNSF'S SAN BERNARDINO FACILITY

The estimated total annual diesel PM (DPM) emissions associated with the operations in the San Bernardino facility are summarized in Table 7-1.

Table 7-1. Estimated total annual DPM emissions associated with the operations in the San Bernardino facility.

Facility Operations	PM Emissions		Percentage
	Grams	Metric Tons	
Basic Services	354,369	0.35	2 %
Basic Engine Inspection	N/A	N/A	N/A
Full Engine Service/Inspection	N/A	N/A	N/A
Switching	3,681,311	3,68	19%
Arriving and Departing Trains	3,317,522	3.32	17%
Adjacent Freight Movements	2,098,205	2.10	11%
Adjacent Commuter Rail Operations	144,360	0.14	1%
Cargo Handling Equipment Operations	3,310,496	3.31	17%
On-Road Container Truck Operations	3,898,361	3.90	20%
On-Road Container Truck Operations Contractors	28,290	0.03	0%
On-Road Fleet Vehicle	16,987	0.02	0%
Other Off-Road TRU	3,003,695	3.00	15%
Other Off-Road Track Maintenance	37,906	0.04	0%
Other Off-Road Portable Engines			
Stationary Sources (L)	84,903	0.08	0
Total	**19,976,404**	**19.98**	**100%**

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 San Bernardino facility are summarized in Table 7-2. The three LPG-fueled forklifts account for a large majority of the emissions. Diesel TOG is not included in the tabulation.

Table 7-2. Estimated total annual TOG emissions from gasoline/LPG/NG fueled engines associated with the operations in the San Bernardino facility.

	TOG Emissions		
Facility Operations	**Grams**	**Metric Tons**	**Percentage**
Basic Services	0	0	0%
Basic Engine Inspection	0	0	0%
Full Engine Service/Inspection	0	0	0%
Switching	0	0	0%
Arriving and Departing Trains	0	0	0%
Adjacent Freight Movements	0	0	0%
Adjacent Commuter Rail Operations	0	0	0%
Cargo Handling Equipment Operations	0	0	0%
On-Road Container Truck Operations	0	0	0%
On-Road Fleet Vehicle Exhaust	523,455	0.52	56%
On-Road Fleet Vehicle Evaporative	281,305	0.28	30%
Other Off-Road TRU			0
Other Off-Road Track Maintenance Exhaust	1,026	0.00	0%
Other Off-Road Track Maintenance Evaporative	181	0.00	0%
Other Off-Road Other Portable Engines Exhaust			
Other Off-Road Other Portable Engines Evaporative			
Stationary Sources	132,322	0.13	14%
Total	**938,290**	**0.94**	**100%**

8.0 REFERENCES

ARB. 2006a. *Draft OFFROAD, and Draft EMFAC2005 models* [CD-ROM]. August. Cargo handling equipment emissions provided September.

ARB. 2006b. Personal communication between D. Donohue, California Air Resources Board, and C. Lindhjem, ENVIRON International Corporation, May.

ARB. 2006c. Personal communication with S. Kidd, Air Resources Board, "Draft OFFROAD Model Emission Factors", April.

ARB. 2005a. Initial Statement of Reasons for Proposed Rulemaking: Public hearing to consider adoption of the proposed regulation for mobile cargo handling equipment at ports and intermodal rail yards. Appendix B: Emission Inventory Methodology, California Air Resources Board, December 2005, http://www.arb.ca.gov/regact/cargo2005/cargo2005.htm

ARB. 2005b. OFFROAD Modeling Change Technical Memo, Changes to the Locomotive Inventory, prepared by Walter Wong, preliminary draft, March 2005, http://www.arb.ca.gov/msei/on-road/downloads/docs/Locomotive_Memo.pdf (accessed March 2006)

ARB. 2003a. 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, October 2003, http://www.arb.ca.gov/regact/trude03/trude03.htm.

ARB. 2003b. OFFROAD Modeling Change Technical Memo, October.

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

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", California Air Resources Board, January 2000, http://www.arb.ca.gov/msei/off-road/pubs.htm

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

CAPCOA. 1997. Gasoline Service Station Industry-wide Risk Assessment Guidelines, California Association of Air Pollution Control Officers, November.

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

EMFAC. 2003. EMFAC model version: Emfac2002 V2.2, California Air Resources Board, April.

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

POLA. 2005. "Port of Los Angeles Baseline Air Emission Inventory – 2001." Prepared by Starcrest, July.

SwRI. 2006. Personal communication between S. Fritz, Southwest Research Institute, and C. Lindhjem, ENVIRON International Corporation, May.

SwRI. 2005. Personal communication with S. Fritz, Southwest Research Institute, Exhaust Plume Study, September 2005 and May 2006.

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

Wong, California Air Resources Board, March 2005, http://www.arb.ca.gov/ei/areasrc/arbomobilsrctrains.htm

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/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
TM32	RUBBER TIRED CRANE	Construction	Cranes	1982	175	N	0	0
TM33	RUBBER TIRED CRANE	Construction	Cranes	1999	175	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
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
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

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
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
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

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
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
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

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
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 useful life.

[b] Horsepower estimated as ARB default for the most populous horsepower range for the associated equipment type.

APPENDIX B

Description Of Locations And Activities

San Bernardino

"A" yard	The "A" yard in San Bernardino is the intermodal rail yard in West-East configuration between North Rancho Avenue and I-215.
"B" yard	The "B" yard in San Bernardino is the automotive yard more or less North-South exposed between West Rialto Avenue and Johnston Street. The "B" yard is the location of the rail track whereas the autos are parked on the General Motors yard.
BNSF administrative building	The BNSF yard administration is located on the West-end of the yard near the flood channel. Access to the facility is from West 4th Street. It also is the location of employee parking.
Commuter Rail Station	A commuter rail terminates at a station south of the East portion of the intermodal yard. The rail station is used by Amtrak and Metrolink trains.
Eagle equipment fueling	A diesel fueling station as well as the employee parking is located across the street from the equipment repair facility next to Mt. Vernon Avenue.
Eagle equipment repair	The eagle fleet is a subcontracted cargo handling equipment fleet. The location of the Eagle fleet, maintenance and office facilities is in the North-West corner of the East portion of the intermodal yard. On-road access to the facility is on North Mt. Vernon Avenue near 4th Street.
Eagle tractor repair	The repair facility for off-road tractors from Eagle is located at the far West end of the intermodal yard, near the BNSF administrative building. The facility can be reached through road-way within the yard as well as from 4th Street.
East intermodal yard	The East portion of the intermodal or "A" yard between North Mt. Vernon Avenue andI-215. The bulk part of intermodal freight switching activity occurs in the eastern portion of the intermodal yard.
General Motors (GM) Yard	The GM yard is adjacent to the "B" yard. It is the parking area for imported autos. Autos mostly arrive by rail and are being further transported by truck. Autos are being loaded and unloaded using their own propulsion.

Ingress and egress	Ingress and egress for the intermodal yard is located towards the West end of the yard. On-road access is West 4th Street at Nunez Park. Ingress and egress for the automotive yard is located on the North end of the automotive yard. On-road access is from West Rialto Avenue between South Muscott Street and the flood channel. It arches North and underpasses West Rialto Avenue near the rail tracks.
Locomotive refueling area	The locomotive refueling area is located in the Y that connects the "A" with the "B" yard. Locomotives are fueled from trucks directly. (DTL)
Metrolink locomotive parking	Metrolink parks some of its locomotives over night near the North exit of the intermodal yard. The locomotives are roughly parked parallel to 3rd Street, from North J Street to North I Street.
Satellite yards	Satellite yards are yards that have not direct connection with the main intermodal or automotive rail yard. Satellite yards are used for storage and services and can only be reached with on-road licensed vehicles.
West intermodal yard	The West portion of the intermodal or "A" yard between North Rancho Avenue and North Mt. Vernon Avenue.

APPENDIX C

Glossary / Definition Of Terms

Boxcar	Boxcars are closed rail cars that can be loaded with consumer goods and packed bulk cargo. Box cars may be refrigerated for temperature sensitive cargo.
Can storage	Empty truck trailers and empty containers on trailers are called cans. Can storage areas are those areas where the trailers are parked for dispatching.
Chassis storage	Chassis are the trailer chassis that can take standard containers.
Classification yard	A classification yard is a rail yard used to separate and sort rail cars. Classification yards characteristics are a tree-like multiplying of rail tracks. Rail cars may be pushed by switcher locomotives directly or pushed over a hump (see hump yard) for sorting with kinetic energy.
Containers	Standard ocean shipping containers are boxes, usually made out of steel, to carry consumer goods, product cargo and bulk cargo. Ocean containers most common lengths are 20’, 40’, 45’, 48’ and 53’ feet. Their capacity is measured in twenty-foot equivalent units (TEU). Maximum gross weight of a 20’ container is 24 metric tonnes, with a maximum payload of 21.5 metric tonnes. 40’ containers have a maximum gross weight of 30.5 tonnes. Containers can be refrigerated units or designed to carry liquids and other specialty cargo.
Diesel Particulate Matter (DPM)	DPM refers to the particulate matter emitted from self igniting internal combustion engines (diesel engines). DPM has been added to the list of TAC by the State of California
DTL	Stands for direct to locomotive and refers to the fueling of locomotives from mobile fueling trucks. See locomotive fueling location.
Engines	Refer to the diesel engines of the locomotives
Fly-over rail	A fly-over rail is an elevated structure to avoid the intersection of a passing line with tracks in the rail yard.
Foreign freight movement	Foreign freight movement is trains operated by other carriers than BNSF that pass through or by the yard or that get handled in the yard. Foreign traffic also may include passenger rail services.
Hump yard	A sorting yard that utilizes the energy of gravity to passively roll rail cars down a slope into an array of tracks. Rail cars are usually pushed over a hump, which creates the down slope, by a switcher locomotive.

Intermodal freight transport	Activities of freight transport that utilizes multiple modes of transport, including ship, rail and truck, without handling the freight itself.
Job, Barstow yard	A job on the Barstow rail yard consists of two locomotives or a mother and slough engine configuration. This engine works rail cars in the hump yard or on the make-up tracks.
Job, San Bernardino	A job at the San Bernardino rail yard refers to one switching action. This switching action usually utilizes 4 switching locomotives and 2 – 4 road locomotives.
Line haul locomotive	Line haul is the long distance hauling with dedicated destinations. Locomotives that pull or push those long distance line haul trains are either referred to as line haul or road locomotives.
Load testing	Load testings are conducted after annual inspections (GE engines also before the annual inspections). Load testing refers to the power testing of the locomotive engine in each of the notch settings under load conditions. Each notch setting load test runs for 60 minutes (45 minutes for pre-testing respectively).
Locomotives	Refer to the single propulsion unit on rail. Locomotives can be diesel powered, diesel electric or a diesel generator set with a separate electric motor on rails.
Mode and time in mode	Mode and time in mode here are the engine power settings of locomotive engines. Locomotive diesel engines have 8 power modes, or notch settings, plus one setting for idle. (note: mode can also refer to the mode of transport, which means the different types of freight transport equipment like ship, train, truck etc.)
Notch setting	Locomotive diesel engines have 8 power modes, called notch settings, plus one setting for idle. The time spend in each notch setting determines energy output and emissions and is also called time in mode. (see mode)
Opacity testing	Opacity test measures the smoke and particulate emissions from the engine using an optical methodology. Opacity testing is conducted once a year concurrently with the load testing. Opacity testing is a 60 minute test including warm-up etc. The opacity test itself requires 28 minutes.
Passing trains	Trains that pass the yard on an adjacent track. Passing trains can be freight or passenger trains and can be BNSF or foreign trains.

Power testing	A shortened version of the load testing. Power testing occurs at the M184 inspections. Power testing is a 20 pre-load, # and 30 post-load test.
Road locomotives	See line haul locomotives.
Roster	Refers to a location specific mix of locomotives and engines that determines the combined emission factors for that location. Locations can be entire yards or functional sections of rail yards.
Run through trains	Trains that drive through the yard without uncoupling or adding railcars.
Switcher locomotive or engine	Switcher locomotives are locomotives operating exclusively on and around rail yards to maneuver the rail cars for arriving, sorting and departure. Switcher engines have sometime less power than line-haul locomotives. However, switcher engines are often retired line-haul locomotives and thus of the same configuration and power.
Toxic Air Contaminants (TAC)	TACs refer to a set of chemicals determined by the …
Train make up	The build up of complete trains from individual rail cars to depart for a specific destination.
Trains	Trains are full length locomotives with rail cars. Line haul trains are usually pulled by locomotive contests of 3 – 5 units. Thus 100 trains equates to 300 – 500 locomotive units.