Draft Report

DIESEL PARTICULATE MATTER MITIGATION PLAN FOR THE BNSF RAILROAD RICHMOND RAIL YARD

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1. INTRODUCTION

In accordance with the 2005 California Air Resources Board (CARB)/Railroad Statewide Agreement (MOU), BNSF has prepared this Mitigation Plan for the Richmond Rail Yard. The purpose of this Plan is to outline the potential mitigation measures that can be used reduce Diesel particulate matter (DPM) emissions from the Richmond Rail Yard. The Plan also contains sections detailing how the baseline and projected emissions were calculated and mechanisms that will be used to track progress. The baseline emissions were described in great detail in a series of reports that are publicly available (http://www.arb.ca.gov/railyard/hra/hra.htm).

As discussed below, the proposed Mitigation Measures, when fully implemented, will reduce the DPM emissions from the Richmond Yard by 72% from 2005 baseline. These emission reductions will concurrently lower any existing predicted health risk associated with the facility operations. Other federal, state, and local air pollution control measures and plans, and existing railroad voluntary agreement measures will supplement the current and future emission reduction discussed in this Plan.

2. SUMMARY OF RAIL YARD OPERATIONS

BNSF has been reconsidering the use of the Richmond yard, and as shown in this report, the activity at this site has been steadily decreasing. In previous years, the site had handled cargo from the Port of Oakland, but since the opening of the Oakland near dock facility in 2002, less traffic has moved through Richmond in each successive year. The Richmond yard in 2005 continued limited intermodal operations, but has trains of many types arriving and originating from the yard.

The site runs generally northeast and southwest with no through traffic immediately adjacent to the yard. There is a yard to the north of the site, but BNSF has no control over it and no traffic moves between the Richmond site and those operations to the north. Nearly all engines at the Richmond yard arrive from and leave toward the northeast. A small line runs south of the Richmond yard for only about one mile. Since only a small number of cars move into the Richmond yard from the southern direction we do not consider a through track in this assessment.

3. EMISSIONS SUMMARY

Tables 3-1 and 3-2 below, shows the DPM emissions from the Richmond Yard, by equipment category, for the 2005 baseline year, and for future years as the mitigation measures proposed in this Plan are implemented over time. As shown in Table 3-1, when the proposed mitigation measures are implemented DPM emissions will be reduced by approximately 72 percent. These emission reductions will concurrently lower any existing predicted health risk related to facility operations. A detailed discussion of each mitigation measure is provided in Section 6.

The projected emission reduction calculations shown in Tables 3-1 and 3-2 do not assume a change in freight handled at the Richmond Yard, but estimates with activity forecasts are provided in Section 4. The assumptions and methodologies used to predict the activity are discussed in Section 5. In addition, the analysis takes into account certain other future regulatory measures and voluntary agreements, which will be implemented and effective by 2020.

In summary the emission totals for all rail yards were compiled using the adjustments to the emission inventory projecting fleet turnover and future year emission rates. The totals, by source category, are provided in Tables 3-1 and 3-2 for Richmond.

Table 3-1. Estimated total annual DPM emissions associated with the operations at the Richmond facility with 2005 activity levels. (metric tonnes)

Richmond	**PM Emissions (metric tonnes)**				
Facility Operations	**2005**	**2005 Revised**	**2010**	**2015**	**2020**
Basic Services[1]	0.50	0.52	0.45	0.26	0.16
Switching	1.06	1.06	0.39	0.34	0.33
Arriving and Departing Trains	1.40	1.40	1.26	0.78	0.51
Cargo Handling Equipment[2]	0.25	0.17	0.10	N/A	N/A
Drayage Trucks[3]	0.46	0.48	0.04	0.01	0.01
On-Road Fleet Vehicle	0.00	0.00	0.00	0.00	0.00
Other Off-Road TRU[4]	0.39	0.24	0.03	0.02	0.00
Other Off-Road Track Maintenance	0.02	0.02	0.02	0.01	0.01
Other Off-Road	0.10	0.10	0.10	0.10	0.10
Stationary Source	0.00	0.00	0.00	0.00	0.00
Total	**4.19**	**3.99**	**2.39**	**1.52**	**1.12**

[1] – Basic number of locomotives serviced adjusted
[2] – Cargo handling activity (hours per year) and load factor adjusted
[3] – Truck emission factors update to EMFAC v2.3
[4] – TRU relative engine on time incorporated in the calculations

Table 3-2. Estimated total annual DPM emissions associated with the operations at the Richmond facility with 2005 activity levels. (short tons)

Richmond	**PM Emissions (short tons)**				
Facility Operations	**2005**	**2005 Revised**	**2010**	**2015**	**2020**
Basic Services	0.55	0.57	0.50	0.29	0.18
Switching	1.17	1.17	0.43	0.37	0.36
Arriving and Departing Trains	1.54	1.54	1.39	0.86	0.56
Cargo Handling Equipment	0.28	0.19	0.11	0.00	0.00
Drayage Trucks	0.51	0.53	0.04	0.01	0.02
On-Road Fleet Vehicle	0.00	0.00	0.00	0.00	0.00
Other Off-Road TRU	0.43	0.26	0.03	0.02	0.00
Other Off-Road Track Maintenance	0.02	0.02	0.02	0.01	0.01
Other Off-Road	0.11	0.11	0.11	0.11	0.11
Stationary Source	0.00	0.00	0.00	0.00	0.00
Total	**4.62**	**4.40**	**2.63**	**1.68**	**1.25**

4. EMISSION INVENTORY METHODOLOGY

In forecasting emissions at rail yards, ENVIRON projected the impact of several rulemakings and voluntary initiatives. These rulemakings and initiatives include emission reductions expected to result from Federal, State, and voluntary emission reduction strategies from all sources. The emission reductions will primarily result from normal and accelerated fleet turnover to engines meeting more stringent new engine emission standards. Normal fleet turnover is the fleet replacement expected due to retirement of older equipment for mechanical or other business reasons. Accelerated turnover of equipment is the centerpiece of many California rulemakings and some voluntary initiatives and is expected to result in emission reductions in years immediately after a change in the new engine emission standards. Retrofit of older equipment is often available as an alternative element to comply with accelerated turnover.

The emission sources affected include the following source categories:

- Locomotives (Line-Haul & Switching)
- Heavy Equipment (truck and off-road equipment)
- Cargo Handling Equipment
- Drayage Trucks
- Transport Refrigeration Units (TRU) and Refrigerated Railcars
- Other Miscellaneous Diesel-Fueled Equipment

For the emissions evaluation, ENVIRON considered a constant 2005 level of activity and applied activity changes after the fact. Overall ENVIRON expected emissions from rail yards to have significant reductions in the years 2005 through 2020 as a result of Federal, State, and local initiatives affecting new engines and of replacement or retrofit of older equipment with engines and equipment using low emission technology. The projected emission reductions range from 58% to 72% for the years 2010 through 2020. A scenario was run to determine the emission reduction due to fleet turnover or other measures prior to applying any activity forecasts. The scenarios with 2005 activity and forecasted activity are shown in Table 4-1 and in Figures 4-1 and 4-2 for Richmond rail yard.

Table 4-1. DPM emission (short tons per year) forecast summary for BNSF Richmond.

Yard (condition)	2005	2010	2015	2020
2005 Activity	4.40	2.63	1.68	1.24
Forecast Activity	4.40	1.86	1.44	1.23

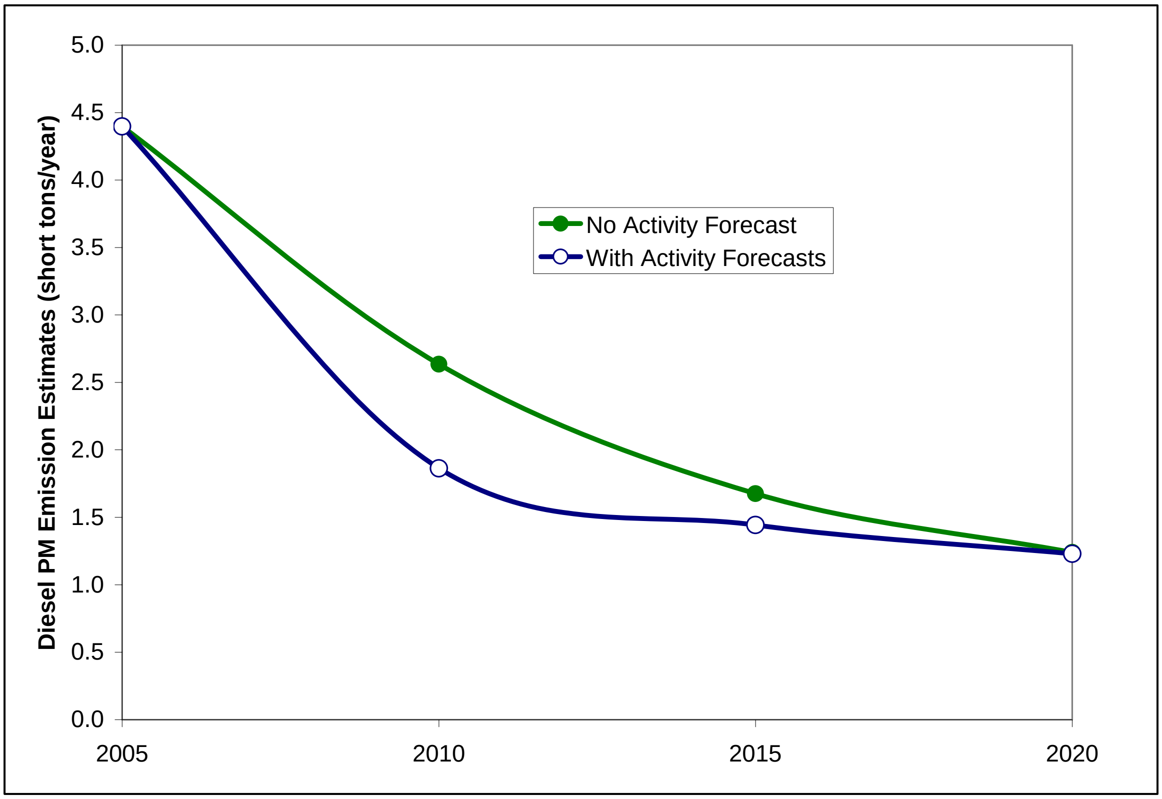

Figure 4-1. BNSF Richmond emission summary (with and without activity forecasts) in short tons.

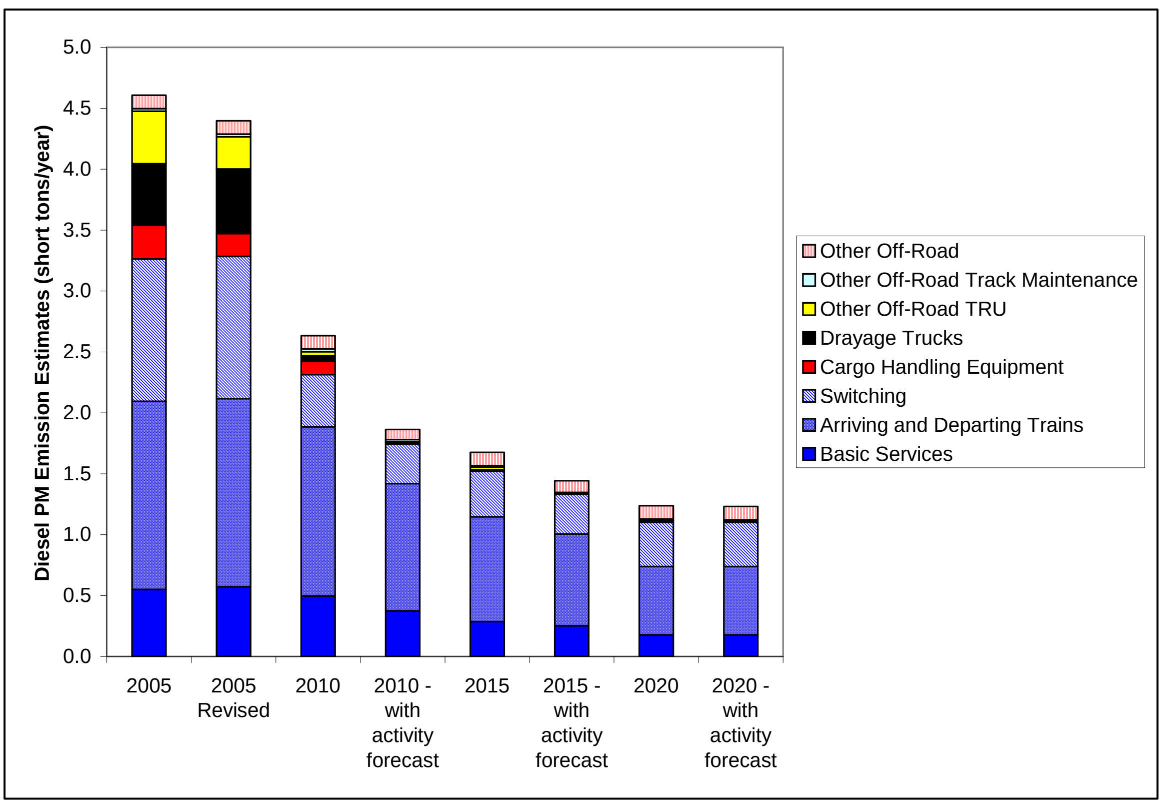

Figure 4-2. BNSF Richmond emission summary (with and without activity forecasts) in short tons by source category.

A general discussion of the analytical methodology and assumptions used to calculate the 2005 baseline emissions and to forecast emissions for calendar years 2010 through 2020, for each equipment category is provided below. Detailed emission calculations for the 2005 baseline year can be found in the Richmond Toxic Air Contaminants Emissions Inventory with modifications for the revised emission inventory methods described in this report.

4.1 Locomotives

In addition, BNSF has agreed in the MOU (ARB/Railroad Statewide Agreement, "Particulate Emission Reduction Program at California Rail Yards," June 2005) to reduce idling and to use lower sulfur fuels for locomotives based and refueled in California.

The reduced idling agreement calls for locomotives based in California to be refit with idle shut-off devices, limiting each idle event to no more than 15 minutes. This will affect all switching locomotives at California yards and many line-haul locomotives. ENVIRON assumed that all BNSF new locomotives are fitted with idle shutoff; so at least all Tier 2 locomotives were expected to use these devices.

BNSF agreed to accelerate the use of low sulfur fuel in California ahead of the Federal standard for 15 ppm sulfur starting in 2012. By agreement, BNSF will use 15 ppm sulfur in 80% of the California refueling gallons with the remaining assumed to be at the 2007 Federal standard of 500 ppm. Based on an assessment of the in-bound locomotives using Federal fuel and out-bound locomotives using California fuel along with refueling rates at locations inside and outside of California, ENVIRON calculated the average sulfur level to be no higher than 0.034% in 2007-2011 time frame compared with 0.105% in 2005 due to the agreement.

EPA announced final emission standards (EPA, 2008) that include an analysis of the expected benefit of normal fleet turnover and the additional benefit of the EPA rule. The emission standards include a retrofit of existing equipment as well as new locomotive emission standards. Existing Tier 0, 1, and 2 locomotives will be subject to retrofit at the time of rebuild; so the locomotives will be rebuilt gradually throughout their remaining useful life.

The emissions standards and projected EPA emission factors are shown in Tables 4-2 and 4-3, depending on the duty cycle chosen to certify the locomotives - either line-haul or switching locomotive duty cycles. The duty cycle for line-haul locomotives typically leads to lower emission on a gram per horsepower-hour (hp-hr) basis because the switching locomotive duty cycle has a considerable idling time (no hp-hr generated). In some cases the uncontrolled emissions are much lower than some of the emission standards, so no emission reduction would be expected from those standards especially for HC and CO emissions. The relative emission factors provided by EPA were used to adjust the locomotive emission rates. For instance, for the Tier 2 remanufactured locomotives the PM emissions were reduced by 55.6% that reflect the expected emission reduction from 0.08 g/hp-hr for remanufactured locomotives compared to 0.18 g/hp-hr for the baseline Tier 2 locomotives in Table 4-2b.

Table 4-2a. Locomotive – Emission standards (g/hp-hr) for line-haul (duty cycle) locomotives.

Emission Standard	Applicable Year	HC (g/hp-hr)	CO (g/hp-hr)	NOx (g/hp-hr)	PM (g/hp-hr)
Uncontrolled Emissions	**Pre-1973**	**0.48**	**1.28**	**13.0**	**0.32**
Tier 0 – original	1973 – 2001	1.00	5.0	9.5	0.60
Tier 0 – final[1]	2008 / 2010	1.00	5.0	8.0	0.22
Tier 1 – original	2002 – 2004	0.55	2.2	7.4	0.45
Tier 1 – final[1]	2008 / 2010	0.55	5.0	7.4	0.22
Tier 2 – original	2005	0.30	1.5	5.5	0.20
Tier 2 – final[1]	2013	0.30	1.5	5.5	0.10
Tier 3	2012 – 2014	0.30	1.5	5.5	0.10
Tier 4 [2]	2015	0.14	1.5	1.3	0.03

1 These are retrofit standards at the time of rebuild and phased in as retrofit kit availability.
2 The Tier 4 NOx standard can be a 1.4 NOx + HC standard.

Table 4-2b. Locomotive – EPA projected emissions factors (g/hp-hr) for line-haul locomotives.

Locomotive Type	Applicable Year	HC (g/hp-hr)	CO (g/hp-hr)	NOx (g/hp-hr)	PM (g/hp-hr)
Uncontrolled Emissions	**Pre-1973**	**0.48**	**1.28**	**13.0**	**0.32**
Tier 0 – original	1973 – 2001	0.48	1.28	8.60	0.32
Tier 0 – final[1]	2008 / 2010	0.30	1.28	7.20	0.20
Tier 1 – original	2002 – 2004	0.47	1.28	6.70	0.32
Tier 1 – final[1]	2008 / 2010	0.29	1.28	6.70	0.20
Tier 2 – original	2005	0.26	1.28	4.95	0.18
Tier 2 – final[1]	2008 / 2013	0.13	1.28	4.95	0.08
Tier 3	2012 – 2014	0.13	1.28	4.95	0.08
Tier 4 [2]	2015	0.04	1.28	1.00	0.015

1 These are estimated emissions with retrofit with some exceptions for older Tier 0 locomotives.
2 The Tier 4 NOx standard would not apply until 2017, while the other standards would apply starting in 2015. The Tier 4 NOx standard would apply, however, at remanufacture for model year 2015 and 2016 locomotives.

Table 4-3a. Locomotive – Emission standards for switching (duty cycle) locomotives.

Emission Standard	Applicable Year	HC (g/hp-hr)	CO (g/hp-hr)	NOx (g/hp-hr)	PM (g/hp-hr)
Uncontrolled Emissions	**Pre-1973**	**1.01**	**1.83**	**17.4**	**0.44**
Tier 0 – original	1973 – 2001	2.10	8.0	14.00	0.72
Tier 0 – final[1]	2008 / 2010	2.10	8.0	11.80	0.26
Tier 1 – original	2002 – 2004	1.20	2.5	11.00	0.54
Tier 1 – final[1]	2008 / 2010	1.20	2.5	11.00	0.26
Tier 2 – original	2005	0.60	2.4	8.10	0.24
Tier 2 – final[1]	2008 / 2013	0.60	2.4	8.10	0.13
Tier 3	2011 - 2015	0.60	2.4	5.00	0.10
Tier 4 [2]	2015	0.14	2.4	1.30	0.03

1 These are retrofit standards at the time of rebuild and phased in as retrofit kit availability allows.
2 The Tier 4 NOx standard can be a 1.3 NOx + HC standard.

Table 4-3b. Locomotive – EPA projected emission factors for switching (duty cycle) locomotives.

Locomotive Type	Applicable Year	HC (g/hp-hr)	CO (g/hp-hr)	NOx (g/hp-hr)	PM (g/hp-hr)
Uncontrolled Emissions	**Pre-1973**	**1.01**	**1.83**	**17.4**	**0.44**
Tier 0 – original	1973 – 2001	1.01	1.83	14.0	0.44
Tier 0 – final[1]	2008 / 2010	0.57	1.83	10.62	0.23
Tier 1 – original	2002 – 2004	1.01	1.83	9.9	0.43
Tier 1 – final[1]	2008 / 2010	0.57	1.83	9.9	0.23
Tier 2 – original	2005	0.51	1.83	7.3	0.19
Tier 2 – final[1]	2008 / 2013	0.26	1.83	7.3	0.11
Tier 3	2011 - 2015	0.26	1.83	5.4	0.08
Tier 4 [2]	2015	0.08	1.83	1.00	0.015

1 These are estimated emissions with retrofit with some exceptions for older Tier 0 locomotives.
2 The Tier 4 NOx standard would not apply until 2017, while the other standards would apply starting in 2015. The Tier 4 NOx standard would apply, however, at remanufacture for model year 2015 and 2016 locomotives.

4.1.1 Line-haul Locomotives

Line-haul locomotives are responsible for long-haul trips that pass rail yards on the mainline tracks and also enter classification and intermodal yard pulling arriving and departing trains (TA/TD). The two types of activities, passing and TA/TD, were treated uniquely in the assessment of the rail yards because the spatial allocation of the activity and the locomotive duty cycles are unique to each type of train.

The fleet composition is an important consideration in the forecasted emissions. For 2010, 2015 and 2020, ENVIRON estimated the fleet turnover to Tier 2 (through 2011), Tier 3 (through 2014) and Tier 4 locomotives to be 3% per year with the equivalent fleet replacement of Tier 0, Tier 1, and Tier 2 locomotives by the Tier 3 and Tier 4 locomotives. ENVIRON assumed that the Tier 3 and 4 locomotives percentage emissions reductions would occur equivalently for all modes (idle and notches) from the Tier 2 locomotives. The Tier 3 PM emission standard is essentially the same as the rebuilt Tier 2, but the locomotives meeting Tier 4 standards have a lower PM emission standard.

This assumption of the fleet make-up somewhat overstates future year emissions because Dash 9 and the ES44 Tier 2 locomotives have higher rated power than some of the locomotives used in 2005. Therefore either fewer locomotives or lower power notch settings would be used to perform the same work with these higher-powered locomotives.

BNSF estimated that the remaining Tier 0 and Tier 1 locomotives would undergo locomotive rebuilds every 6 years or 17% of the fleet per year. Likewise because Tier 2 locomotives would be rebuilt every 8 years, 12.5% of the Tier 2 fleet would be rebuilt per year. The final rebuild kits would be available for all locomotives starting in 2010 for Tier 0 and Tier 1, and 2013 for Tier 2. Some emission reductions could occur earlier, but ENVIRON chose to ignore the phase-in period for rebuild kits assuming no kits would be available prior to the mandated date. The emission reduction was calculated to be 37.5% for Tier 0 and 1 rebuilds (0.20 g/hp-hr compared to the baseline PM emission rate of 0.32 g/hp-hr) and 50% for Tier 2 rebuilds from Tier 2 base emissions (0.20 to 0.10 g/hp-hr PM emission rate reduction).

Table 4-4 provides expected fleet composition for the arriving and departing trains and Table 4-5 for passing trains with introduction of the Tier 3 and Tier 4 locomotives replacing the in-use fleet. ENVIRON assumes that the introduction of Tier 3 and 4 locomotives could replace the fleet of Tier 0 / 1 / 2 locomotives in equal proportion and so the fleet fraction of remaining Tier 0, 1, and 2 locomotives were proportionally reduced.

Table 4-4. Fleet composition estimate of locomotives at Richmond in future years.

Locomotive Model	Tier Level	2005	2010	2015	2020
Switchers	Precontrolled	0.26%			
GP-3x	precontrolled	14.62%			
GP-4x	precontrolled	8.48%	9.33%		
GP-50	precontrolled	0.16%			
GP-60	precontrolled	0.64%			
SD-7x	precontrolled	0.03%			
Dash-7	precontrolled	0.14%			
Dash-9	precontrolled	7.12%			
GP-60	0	1.82%	1.82%		
SD-7x	0	0.06%	0.06%		
Dash-8	0	7.87%	7.87%	4.07%	
Dash-9	0	35.39%	42.51%	7.10%	
Dash-9	0 – rebuild			35.41%	31.58%
Dash-9	1	17.18%	17.18%	2.86%	
Dash-9	1 – rebuild			14.32%	17.18%
ES44	2	6.23%	21.23%	18.18%	3.03%
ES44	2 – rebuild			6.06%	21.21%
ES44	3			9.00%	9.00%
ES44	4			3.00%	18.00%
		100.00%	100.00%	100.00%	100.00%

Idle emission reductions are difficult to predict. Past locomotive idle times were found to be short and result from main line congestion and speed limits forcing engineers to back off power, but no idle emission reductions are expected for this activity category. The TA/TD locomotives however do spend more time in the yard where locomotives can idle a significant amount of time. ENVIRON assumed that the idle shut-off devices would reduce TA/TD locomotives idle time to 1 hour (15 minutes for each event; arrival and train cut out, move to refueling area, arrival at ready track awaiting assignment, and prior to leaving with a new train) per arrival of new Tier 2 locomotives with factory installed idle limiting timers.

4.1.2 Switching Locomotives

Based on conversation with BNSF, the switching locomotives would have continued to be Tier 0 compliant and remanufactured according to the schedule that EPA has finalized. However, BNSF has placed 5 generator set switching engines at the Richmond Yard, which comprise the bulk of the switching activity. For this analysis, because of potential scheduling issues with the cleaner generator set locomotives, one of the six switching engines was assumed to remain a Tier 0 locomotive.

The emissions for switching locomotives will be affected by the MOU idle reduction measure in addition to the remanufacturing emissions reductions. The generator-set switching locomotives are designed with idle shutoff device and therefore would be expected to have better than average compliance with the idle reduction measure. It will take a study to determine the idle reduction due to idle shut off devices installed on these locomotives. Because some emission reduction will be realized with these devices, ENVIRON assumed 30% reduction of the time in idle mode.

4.1.3 Locomotive Service

Nearly all locomotives (primarily line-haul) arriving at Richmond are refueled and receive basic service on site. In 2005, 10,002 locomotives were serviced, and this figure reflects an upward revision from 9,630 in the original evaluation. ENVIRON assumed the service activity to be affected by the idle reduction devices on Tier 2 and later locomotives reducing the idle time from 1.5 hours to 0.5 hours accounting for up to two moves of the locomotive at the service site.

4.2 Cargo Handling Equipment

BNSF cargo handling equipment (CHE) emissions were projected to 2010, 2015, and 2020 based on 2005 annual emission estimates generated by ARB and control factors by equipment type to account for decreases in emissions due to fleet turnover. The ARB CHE Regulation requires that in addition to natural fleet turnover, an accelerated turnover of older engines to newer cleaner engines and/or Verified Diesel Emission Control Systems (VDECS) be implemented in CHE fleets. The control factor estimates used to generate future year emission estimates incorporate emissions reductions due to natural and accelerated-regulation driven fleet turnovers. Note that BNSF CHE activity and population were assumed equivalent to 2005 levels in all future years for the initial analysis, and the activity forecast was applied to this estimate.

Fleet turnover reductions were estimated based on data included in the ARB Proposed Regulation For Mobile Cargo Handling Equipment At Ports And Intermodal Rail Yards, Initial Statement of Reasons (ISOR) (Data source: CHE ISOR, http://www.arb.ca.gov/regact/cargo2005/isor.pdf, 10/2005: Table VI-1: Projected Annual Emissions for Cargo Handling Equipment Used in Ports and Intermodal Rail Yard Applications with Implementation of the Proposed Regulation For Mobile Cargo Handling Equipment At Ports And Intermodal Rail Yards). These data include: 1) statewide emissions reductions by equipment type, 2) ARB regulation population and activity growth estimates, and 3) ARB regulation port and rail yard population fractions by equipment type. Fleet turnover control factors were assumed to be equivalent for Port and Rail equipment and were estimated according to the methodology outlined in the example below, where yard truck control factors are estimated for the period from 2004 to 2010:

$$FC_{04\text{-}10,yt} = E_{2010,yt} / (AF_{,yt} * PF_{,yt} * E_{2004,yt})$$

Where:

$FC_{04\text{-}10,yt}$=Fleet turnover control factor from 2004 to 2010 for yard trucks

E_{2004} = CA statewide 2004 annual yard truck emissions

E_{2010} = CA statewide 2010 annual yard truck emissions

AF = Average activity growth factor by equipment type weighted by Port and Rail population:

$$AF_{,yt}=A_{port,yt}*FP_{port,yt}+A_{rail,yt}*FP_{rail,yt}$$

A = Rail or port activity growth factor

FP = Rail or port Population Fraction

PF = Average population growth factor by equipment type weighted by Port and Rail population: $PF_{,yt}=P_{port,yt}*FP_{port,yt}+P_{rail,yt}*FP_{rail,yt}$

P = Rail or port population growth factor

FP = Rail or port Population Fraction

The control factor above was assumed to be linear, and future year emissions were estimated according to the fleet turnover correction factor, scaled to the number of years between the base year and future year. 2010 to 2020 control factors were calculated in similar fashion to the 2004 to 2010 control factors and all control factors are shown in Table 4-5.

Table 4-5. CHE emission reduction with ARB rulemaking.

Equipment Type	Emission Reduction	
	2004 to 2010	2010 to 2020
Crane	71%	67%
Forklift	75%	72%
Material Handling Equip	68%	73%
Yard Tractor offroad	77%	77%

Since the CARB HRA reports were released in November of 2007, additional information has become available, and the 2005 baseline emission inventory, as shown in Table 1, has been adjusted accordingly. Specifically, the default engine load factor for yard hostlers has been adjusted based on new data. The default load factor (65%) for yard hostlers contained in the OFFROAD model is based on data collected for equipment operating at various facilities and not specifically at an intermodal rail yard. Additional data have been collected by both UPRR and BNSF Railway to determine an appropriate engine load factor for yard hostlers operating at intermodal rail yards. The data collected by both railroads show that the default load factor from the OFFROAD model and the load factor from the Ports study are too high for yard hostlers operating at intermodal rail yards. Based on the UPRR and BNSF data, a more appropriate load factor for yard hostlers operating at intermodal rail yards is between 15 and 20%. Therefore, the 2005 baseline emission estimates for yard hostlers that were presented in the CARB HRA report have been recalculated using a load factor of 19%.

4.3 Drayage Trucks

BNSF has little control over private owner/operators who carry most of the containers to and from the site. The vehicle types are the heaviest trucks on the road and often are not the most modern or recent model years. However, there is a California rule making (http://www.arb.ca.gov/regact/2007/drayage07/modtext.pdf) mandating complete fleet turnover for container trucks that meet or exceed 2007 model year California or federal emission standards by December 31, 2013 with an interim control scenario implemented by December 31, 2009.

At the BNSF Richmond site, ENVIRON used the default truck age distribution for the county. Significant emission reductions are expected from port and intermodal trucks due to the 2007 new engine emission standards (that result in very low PM emission rates) and to the California "Regulation to Control Emissions from In-Use On-Road Diesel-Fueled Heavy Duty Drayage Trucks." Trucks arriving at the Richmond yard would be responsible for fleet turnover to 2007 and later model years by December 31, 2013.

Since the CARB HRA report was released in November of 2007, the EMFAC2007 v2.3 has become the standard model to estimate emissions from on-road vehicles. The base was revised using this version of EMFAC instead of a prerelease version of EMFAC used in the CARB HRA.

In order to estimate the impact of the rule on emissions from trucks arriving at Richmond, the age distribution was modified to reflect the implementation of the rule and 85% PM control from VDECS devices applied to the EMFAC emission factors for the 2010 average fleet complying with the rule. Otherwise the fleet composition was adjusted to reflect the rule by allowing only those model years allowed under the rule to comprise the fleet.

The general activity indicators in terms of idling and mileage at the site followed the original estimates provided in the 2005 emission estimate report found at the web site detailing the result of the Richmond study (http://www.arb.ca.gov/railyard/hra/hra.htm). No reconfiguration of the site was included in the forecasted activity per truck trip.

4.4 On-road Vehicles

There were 22 fleet vehicles based at the Richmond facility according to records from BNSF. Eighteen of these vehicles were associated with the Mechanical department at the Richmond site, and four with the intermodal or other administrative department. Activity parameters included gross vehicle weight rating (GVWR), fuel type and annual mileage are known for each vehicle.

On-road vehicle fleets based at the site are used by BNSF and contractor staff for crew changes, errands, and other general uses. The vehicle types are largely gasoline-fueled vehicles. The vehicle mileage on site for these vehicles is a very small portion of the vehicle's annual mileage and therefore results in little emissions in 2005. To estimate the emission reduction in future years, the EMFAC model was run to determine the expected emission reduction percentage using the default age distribution and fleet turnover in the county. For light-heavy duty diesel trucks, the minimum emission reduction that occurs from normal fleet turnover is 11% for 2005 to 2010, about 21% to 2015, and 24% to 2020.

4.5 Transport Refrigeration Units (TRUs) and Refrigerated Railcars (Reefers)

Transport refrigeration units (TRU) use small diesel generators to run refrigeration compressors on containers and refrigerated boxcars. By far more emissions are derived from containers than from boxcars in general. BNSF submitted emission estimates for its sites using the time on site of loaded containers and boxcar, however later it was realized that the engines running the refrigeration compressors only run 60% of the time on average. BNSF and ENVIRON conducted a survey of several dozen TRU units and compared the hours the TRU was working to the engine hours, both read from individual hour meters on each unit. Because ENVIRON overestimated the on-site TRU diesel generator engine emissions, the total emissions were adjusted downward for this analysis prior to assessing future year emissions.

ARB has written a rulemaking to address TRU emissions (2003). From this rulemaking, ARB estimated TRU emission reductions. 2005 BNSF TRU PM emission estimates were projected to 2010, 2015, 2020 based on emission factor reduction estimates that were drawn from the 2003 TRU ATCM ISOR, Figure VII-2 (ARB, ATCM ISOR, Figure VII-2, October 2003 http://www.arb.ca.gov/regact/trude03/trude03.htm). The emission reduction control factors are shown in Table 4-6.

Table 4-6. ENVIRON estimated ARB PM emission reductions for TRU.

Year	<25 HP	25-50HP	Combined
2000 to 2010	-18%	-70%	-66%
2010 to 2020	-28%	-91%	-79%

For each site, future year activity and population were assumed to be equivalent to 2005 activity and population. ENVIRON estimated the emission reduction for TRU for the years 2010, 2015 (through interpolation), and 2020.

4.6 Other Miscellaneous Diesel-Fueled Equipment

Other offroad equipment primarily consists of track maintenance equipment with portable engines occasionally used for general industrial purposes. Track maintenance equipment is comprised of any number of various equipment types from small pumps and generators to larger, specially designed equipment for rail line maintenance. However, equipment based at each site is used over the entire rail network, so a low fraction of this equipment activity and emissions occur on site.

To estimate emission reductions from this equipment, an OFFROAD model run using construction and industrial equipment was made to determine the relative emission reduction. The emission reduction equipment with rated power of 50 – 500 hp (the breadth of the equipment found at rail yards) are typically similar even though the standards and phase-in schedules for new emission standards vary by engine power. ENVIRON estimated the average emission reduction for 2010 at 14%, 2015 at 36%, and 2020 at 59%.

5. PROJECTED ACTIVITY FORECASTS

Historic activity data from calendar years 1999 through 2008 were reviewed to determine the expected activity forecast for the Richmond Yard. Table 5-1 summarized the historic activity data for the Richmond Yard.

Table 5-1. Historic Activity Data for Diesel-Fueled Equipment Richmond Rail Yard.

Activity	Historic Actual Data							Growth Rate (%)
	2002	2003	2004	2005	2006	2007	2008	
Locomotives Serviced				10,002	8,820	9,048	7,533	Recover to 2005 Levels by 2020
Container Lifts	128,356	85,778	77,788	54,601	32,863	7,176	5,873	Eventually eliminated

As shown in Table 5-1, based on historic actual data activity at the Richmond Yard has decreased to levels 75% for locomotives and 11% for container lifts through 2008. BNSF expects the locomotive activity to recover to 2005 levels as the Richmond Yard is reconfigured for other uses. However, container activity is expected to continue at 2008 levels to serve local customers until sometime after 2010 when container traffic will be eliminated. Drayage truck traffic is expected at levels higher than those for containers because of a potential reuse for the

Richmond Yard may demand truck traffic at 53% of the 2005 level. An overall summary of the activity indicators used in this forecast is presented in Table 5-2.

Table 5-2. Estimates of Richmond Rail Yard Activity Forecasts.

Activity	Activity Forecast for this Study				
	2005	2008	2010	2015	2020
Locomotives Serviced	10,002	7,533	7,533	8,768	10,002
Container Lifts	54,601	5,873	5,873	0	0
Truck Traffic	55,950	6,018	6,018	17,709	29,400

6. MITIGATION MEASURES

6.1 Current Mitigation Measures

BNSF has implemented all measures in the MOU with the state and works to comply with all rules as quickly as possible. BNSF is already using the lowest emitting switching locomotives for the majority of that activity at Richmond.

6.2 Proposed Future Mitigation Measures

BNSF will work with local and state authorities to investigate additional mitigation measures.

7. EVALUATION OF ADDITIONAL MITIGATION MEASURES

The evaluation of the current and proposed mitigation measures will be conducted once the mitigation measures have been specifically defined.

8. MECHANISMS FOR TRACKING PROGRESS

BNSF will work with state officials to determine a method for tracking the emissions reductions achieved through the implementation of the Mitigation Measures.

9. CONCLUSIONS

The emissions at the Richmond yard will be reduced by at least 70% by 2020 without considering any additional mitigation measures.