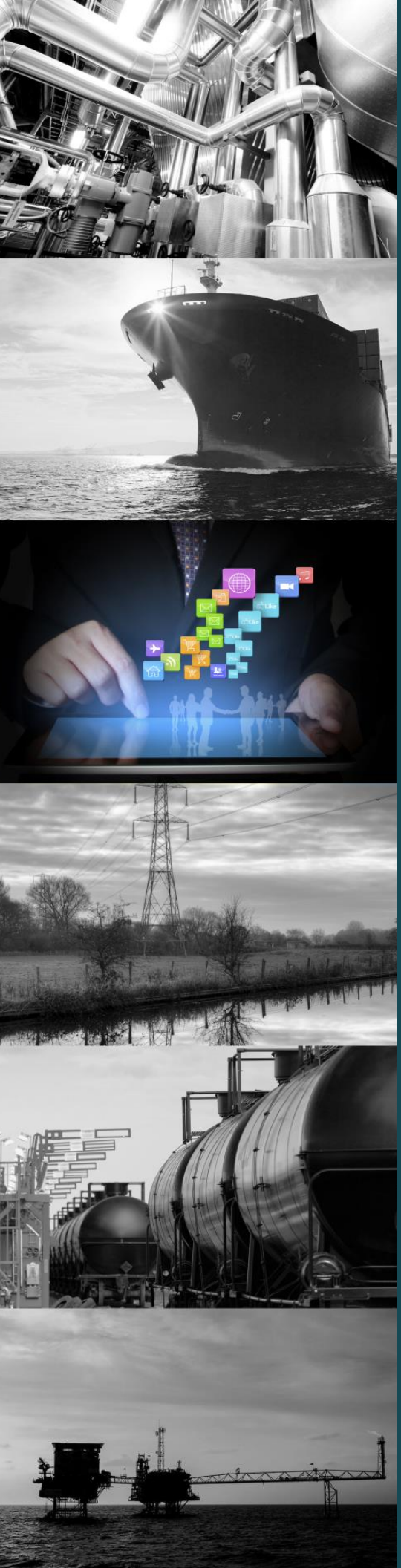

Argentine Yard Emission Inventory

PREPARED FOR:

BNSF Railway Company

E2MANAGETECH

COLLABORATE | INNOVATE | DELIVER

ARGENTINE YARD EMISSION INVENTORY

Prepared for:

BNSF Railway Company

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September 30, 2015

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APPENDICES

Executive Summary

E2 ManageTech, Inc. (E2) conducted an emission inventory for the BNSF Railway Company (BNSF) Argentine Facility (Facility) in Kansas City, Kansas. The purpose of this study was to identify and quantify on-site emissions generated from major source categories in 2008 and develop a comparison between estimated emissions currently generated at the Facility based on 2014 data.

The Facility operates as a hump yard and serves as a major hub where railcars are sorted and combined into destination specific trains. The Facility also operates as a maintenance yard servicing locomotives. In addition to locomotive emission sources, operational characteristics in 2008 included intermodal activities such as the trans-loading of containers to and from the yard. Therefore, the 2008 emission inventory is organized into the following major source categories:

- Emissions from on-site switching locomotives
- Line-haul locomotive emissions from the arrival and departure of trains at the Facility
- Locomotive emissions that occurred during maintenance activities
- Emissions generated from intermodal activity (truck trips and cargo handling equipment [CHE])

On-site operational activities within the Argentine Facility in 2014 served primarily as a locomotive transfer facility and maintenance yard. Intermodal activities ceased operation in 2013. Therefore, emission categories quantified for 2014 include the following major sources:

- Emissions from on-site switching locomotives
- Line-haul locomotive emissions from the arrival and departure of trains at the Facility
- Locomotive emissions that occurred during maintenance activities

This emission inventory provides an estimate for six pollutants, reported as tons per year (tpy). The pollutants are Nitrogen Oxides (NOx), Particulate Matter less than 10 microns (PM10), Particulate Matter less than 2.5 microns (PM2.5)[1], Hydrocarbons (HC), Carbon Monoxide (CO), and Sulfur Dioxide (SO2). A summary of results for 2008 and 2014 are provided in Table ES-1 and ES-2 respectively. Table ES-3 summarizes the 2014 percent reduction in emissions in comparison to the 2008 emission inventory

[1] It was assumed that 97 percent of PM10 fugitive dust emissions are comprised of PM2.5. *Source: Current Methodologies in Preparing Mobile Source Port-Related Emission Inventories (EPA, April 2009)*

Table ES-1: 2008 Emission Inventory

Emissions (2008)						
	Annual Emissions (tons/yr)					
On-Site Activity	**NOx**	**PM10**	**PM2.5**	**HC**	**CO**	**SO2**
Switching Locomotives	459.49	10.40	10.09	27.42	52.61	4.11
Line Haul Locomotives Idling	15.17	0.46	0.44	0.81	2.39	0.20
Maintenance Activity	94.46	2.13	2.07	2.88	9.78	0.12
Truck Activity	15.55	0.46	0.44	1.06	6.29	0.51
Cargo Handling Equipment Activity	53.28	5.77	5.60	7.97	159.75	1.65
Total	**637.95**	**19.21**	**18.64**	**40.14**	**230.81**	**6.58**

[a] It was assumed that 97 percent of PM10 fugitive dust emissions is comprised of PM2.5. Source: Current Methodologies in Preparing Mobile Source Port-Related Emission Inventories (April 2009)

Table ES-2: 2014 Emission Inventory

Emissions (2014)						
	Annual Emissions (tons/yr)					
On-Site Activity	**NOx**	**PM10**	**PM2.5**	**HC**	**CO**	**SO2**
Switching Locomotives	79.49	1.76	1.71	4.65	10.19	0.03
Line Haul Locomotives Idling	9.09	0.24	0.24	0.41	1.79	0.01
Maintenance Activity	70.55	1.91	1.85	2.35	3.97	0.01
Truck Activity	--	--	--	--	--	--
Cargo Handling Equipment Activity	--	--	--	--	--	--
Total	**159.13**	**3.91**	**3.79**	**7.42**	**15.95**	**0.05**

[a] It was assumed that 97 percent of PM10 fugitive dust emissions is comprised of PM2.5. Source: Current Methodologies in Preparing Mobile Source Port-Related Emission Inventories (April 2009)

Table ES-3: Percent Emissions Reduction in 2014 vs 2008

Emissions Reduction (2014 vs 2008)						
	Emissions Reduction Percentage					
On-Site Activity	**NOx**	**PM10**	**PM2.5**	**HC**	**CO**	**SO2**
Switching Locomotives	83%	83%	83%	83%	81%	99%
Line Haul Locomotives Idling	40%	47%	47%	49%	25%	97%
Maintenance Activity	25%	10%	10%	18%	59%	90%
Truck Activity	--	--	--	--	--	--
Cargo Handling Equipment Activity	--	--	--	--	--	--
Overall Reduction	75%	80%	80%	82%	93%	99%

As shown in Table ES-3, the 2014 emission inventory in comparison to the 2008 inventory shows a decline in on-site emissions with a 75 percent reduction in NOx, 80 percent reduction in PM10 and PM2.5, 82 percent reduction in HC, 93 percent reduction in CO, and a 99 percent reduction in SO2. This can be attributed to the penetration of cleaner engines into the fleet and the introduction of idle reduction technologies. Additionally, the changes in on-site operations to no longer include intermodal activities resulted in reduced emissions generated at the Facility. Lastly, vast reductions in SO2 can be attributed to the Facility's use of a low sulfur diesel fuel.

Section 1 Introduction

E2 conducted an emission inventory for the BNSF Argentine Facility (Facility) in Kansas City, Kansas. This emission inventory and the associated on-site operational activity were limited to information collected in calendar years 2008 and 2014. Emission estimates are not intended to represent emissions in other years or emissions outside the realm of the major source categories described in Section 2 - Methodology.

It should be noted that in May 2010, ENVIRON prepared an emission inventory/projection for calendar years 2008, 2014, and 2020 for the Kansas Department of Health and Environment (KDHE), detailing the emissions generated from primary railroad operations in the Kansas City metropolitan area (ENVIRON, 2010). The 2010 ENVIRON study was regional in nature. The purpose of this particular study is to provide a detailed emission inventory of railroad operations specific to the Facility. Many of the assumptions used in the 2010 study were used to inform these emission estimates.

Operations at the Facility in 2008 included off-road equipment and on-road vehicles associated with intermodal activities and the trans-loading of containers within the Facility. These intermodal activities were moved to BNSF's Logistics Park Kansas City facility and therefore are not included in the emission inventory for 2014.

Section 2 Methodology

2.1 Coordination of Information

E2 has prepared the emission inventory using site specific information provided by Matthew Brallier, General Foreman at the BNSF Argentine Facility. Input data from previous studies and/or technical memorandums were used when more precise inputs could not be estimated. E2 personnel performed a site walk at the Facility on Monday, August 24, 2015, in order to gather a comprehensive understanding of current operations. Additionally, in preparing this inventory, collaboration between E2 and BNSF was frequent and included numerous conference calls to discuss input factors and review the methodology.

2.2 Technical Approach

Emissions were estimated for five major source categories as described below.

Switching Locomotives. Switching locomotives or "switchers" play an integral role at the Argentine Facility and are required to help sort/assemble railcars within the yard. Switchers push freight cars up a small hill called a "hump" to a station where they are manually separated before they coast down and descend into a region known as the "bowl". On a cargo car's descent into the bowl, computers direct each car onto the appropriate track based on the car's destination. Additional switchers within the bowl are then utilized to assemble groups of cars and align them onto the appropriate departure track.

E2 estimated switching locomotives emissions using emission factors provided in the Technical Memorandum by the EPA titled, Emission Factors for Locomotives (EPA, 2009A). These emission factors include engine standards expected for normal fleet turnover and the penetration of cleaner engines, as well as the retrofit of existing engines. Emissions associated with switching locomotives were calculated using the formula below:

Emissions = (EF [g/gal]) x (Fuel Use [gal/hr]) x (Duration of Activity [hr/day]) x (Number of In-Service Locomotives)

The 2008 switching locomotive characteristics (fuel use, operating hours, and observed counts) at the BNSF Facility were obtained from a railroad survey detailed in the study prepared for KDHE titled, Development of Emission Estimates for Locomotives in the Kansas City Metropolitan Statistical Area (ENVIRON, 2010).

The 2014 switching locomotive characteristics were provided by BNSF Railway Company as shown in Appendix A, Table A-1. The information provided included a weekly, in-service switching locomotive schedule at the Facility for calendar year 2015. For analysis purposes, these counts were assumed to be consistent with in-service switching locomotive characteristic at the Facility for calendar year 2014.

Line-haul Locomotives. Line-haul locomotives arriving/departing the Facility for refueling or for shift changes in personnel, generate emissions associated with engine idling. Line-haul locomotives idle during periods just after arrival and prior to departure. These emissions have been captured within the 2008 and 2014 emission inventories. It should be noted that there are instances in which line-haul locomotives do not stop at the Facility for refueling or shift changes, and merely pass through the facility. For analysis purposes, emissions associated with line-haul locomotives passing through the Facility have not been included within this analysis. Other Class I and passenger rail utilize these tracks and therefore are not explicit to BNSF or its operations. These emissions are assumed to be independent to the emissions generated on-site by the Facility and will be captured in

regional estimates similar to the 2010 ENVIRON study. Emissions associated with idling line-haul locomotives were calculated using the following formula:

Emissions = (EF [g/gal]) x (Fuel Use [gal/hr]) x (Idling Time [hr/locomotive]) x (Number of Idling Locomotives)

E2 estimated line-haul emissions using emission factors provided in the Technical Memorandum by the EPA titled, Emission Factors for Locomotives (EPA, 2009A).

The number of on-site idling line-haul locomotives per year and assumed fuel consumption analyzed in the 2008 and 2014 emission inventories were estimated based on conversation with BNSF personnel. Idling durations were based on the assumption that line-haul locomotives would idle for 0.50 hours at the Facility for refueling and minor inspections. Idling emission controls in the 2014 emission inventory would reduce idling times by 25 percent.

Maintenance Activities. The Facility includes a maintenance building where locomotives undergo scheduled maintenance such as engine load and opacity testing which generate a quantifiable amount of emissions. E2's methodology for estimating maintenance emissions from locomotives utilizes notch specific emission rates (g/hr) multiplied by the average time in notch profile for the corresponding maintenance activity. Notch specific emission rates were gathered from the Port of Oakland Seaport Air Emissions Inventory (ENVIRON, 2008).

Emissions = (EF [g/hr per notch]) x (Time in Notch [hr/locomotive maintenance type]) x (Number of Locomotives [number of locomotives per maintenance type/yr)

The 2008 locomotive maintenance characteristics (test duration and observed counts) at the Facility were obtained from BNSF specific service data detailed in the Development of Emission Estimates for Locomotives in the Kansas City Metropolitan Statistical Area (ENVIRON, 2010). It is assumed that the average duration of full load tests occur for 45 minutes in notch 8. Opacity tests run through all 8 notches and idle profiles in approximately 40 minutes. Emission calculations associated with locomotive maintenance activities in the 2008 emission inventory utilized the average notch specific emission factors from the most popular line-haul engine models serviced.

In preparing the 2014 emission inventory, locomotive maintenance characteristics (test duration and observed counts) at the BNSF Facility were estimated based on a conversation with Matthew Brallier, the General Foreman at the Facility. It was assumed that full load tests occur for a duration of 30 minutes in notch 8. Opacity tests run through all notches with a test duration of approximately 3 minutes per notch. Emission calculations associated with locomotive maintenance activity in the 2014 emission inventory utilizes notch specific emission factors for the ES44 engine model, which was the most popular line-haul engine model serviced at the Facility in 2014.

Truck Activities. Truck emissions coincide with intermodal activity at the Argentine Facility and is thus characterized in the 2008 emission inventory only. Intermodal activity was not present at the Facility in 2014 and thus truck emissions have not been calculated in the 2014 inventory.

The most basic measure of truck activity is the number of truck trips that occur within the Facility, where a truck trip includes both an entrance and an exit by a truck. To estimate truck trips, BNSF provided 2008 lift counts for the Argentine intermodal yard as noted in the Development of Emission Estimates for Locomotives in the Kansas

City Metropolitan Statistical Area (ENVIRON, 2010). In order to calculate the number of two-way truck trips at the Facility in 2008, a ratio of 1.825 container lifts[2] to truck movements was utilized. This ratio determined the overall truck activity by creating a conversion which denotes the number of trucks that carried a container to and from the Facility as shown below:

Number Truck Trips = (Lift Counts [lifts]) x (Conversion Factor [1.825 truck trips/lift])

The general approach used to estimate truck emissions was to characterize the truck trips within the Facility by estimating the trip mileage per road link and the idle duration at each link as shown in Appendix A - Table A-1. Emission rates for 2008 in-use diesel-powered heavy-duty trucks were utilized (EPA, 2008). In-use truck activity emissions were calculated using the following formula:

Emissions = (EF [g/mile]) x (Trip Length [miles/truck trip]) x (Frequency [truck trips/yr])

Idle emission rates utilized in this analysis were based on national data representing the in-use fleet of heavy-duty trucks as of July 2008 (EPA, 2008A). Emissions associated with trucks idling at the entrance queue, within the yard, and at the exit queue are calculated as follows:

Emissions = (EF [g/hr]) x (Idling time [hr/truck trip]) x (Frequency [truck trips/yr])

Cargo Handling Equipment (CHE). Cargo handling equipment was associated with intermodal activities at the Argentine Facility in 2008. Intermodal activity was not present at the Facility in 2014 and thus CHE emissions have not been calculated in the 2014 emission inventory.

CHE is used to move cargo to and from railcars and on-road trucks. CHE activity estimates (equipment count, horsepower, model year, and average running hours) were provided by BNSF, as noted in the Development of Emission Estimates for Locomotives in the Kansas City Metropolitan Statistical Area (ENVIRON, 2010). Emissions associated with CHE were calculated using the following formula:

Emissions = (EF [g/hp-hr]) x (Equipment Count) x (Horsepower) x (Load Factor) x (Operational Activity [hr/year])

CHE emission factors are a function of the following formula:

EF = Zero Hour Emissions Rate + (Deterioration Rate x Cumulative Hours)

The zero hour emission rate (g/hp-hr) is the emission rate when an engine is new and without any component degradation for the equipment model year. Zero hour emission rates were sourced from the Development of Emission Estimates for Locomotives in the Kansas City Metropolitan Statistical Area (ENVIRON, 2010). The deterioration rate was used to calculate the change in emissions as a function of equipment age and reduced efficiency attributed to wear of various engine parts.

[2] Source: Development of Emission Estimates for Locomotives in the Kansas City Metropolitan Statistical Area (ENVIRON 2010)

For CHE equipment, E2 staff estimated the change in emissions over the useful life of the equipment's engine by using the equation for deterioration rate as shown below:

Deterioration Rate = (Deterioration Factor x Zero Hour Emission Rate) / Cumulative hours of useful life

Deterioration factors utilized in this analysis were sourced from the Exhaust and Crankcase Emission Factors for Nonroad Engine Modeling – Compression-Ignition (EPA, 2010). Cumulative hours of useful life were obtained from the emissions factors assessment analyzed in the Development of Emission Estimates for Locomotives in the Kansas City Metropolitan Statistical Area (ENVIRON, 2010).

Section 3 Calculations

Inventory of emissions generated by on-site major source categories within the Argentine Facility have been calculated for calendar years 2008 and 2014. The emissions analyzed are limited to the spatial domain of the Argentine facility as shown on Figure 1. Calculations for each major source category are described in Section 2.2 - Technical Approach. Additional detailed calculations are presented in Appendix B.

Section 4 Results and Comparisons

Emission inventories for 2008 and 2014 are presented in Tables 4-1 and 4-2.

Table 4-1: 2008 Emission Inventory

Emissions (2008)						
	Annual Emissions (tons/yr)					
On-Site Activity	NOx	PM10	PM2.5	HC	CO	SO2
Switching Locomotives	459.49	10.40	10.09	27.42	52.61	4.11
Line Haul Locomotives Idling	15.17	0.46	0.44	0.81	2.39	0.20
Maintenance Activity	94.46	2.13	2.07	2.88	9.78	0.12
Truck Activity	15.55	0.46	0.44	1.06	6.29	0.51
Cargo Handling Equipment Activity	53.28	5.77	5.60	7.97	159.75	1.65
Total	637.95	19.21	18.64	40.14	230.81	6.58

[a] It was assumed that 97 percent of PM10 fugitive dust emissions is comprised of PM2.5. Source: Current Methodologies in Preparing Mobile Source Port-Related Emission Inventories (April 2009)

Table 4-2: 2014 Emission Inventory

Emissions (2014)						
	Annual Emissions (tons/yr)					
On-Site Activity	NOx	PM10	PM2.5	HC	CO	SO2
Switching Locomotives	79.49	1.76	1.71	4.65	10.19	0.03
Line Haul Locomotives Idling	9.09	0.24	0.24	0.41	1.79	0.01
Maintenance Activity	70.55	1.91	1.85	2.35	3.97	0.01
Truck Activity	--	--	--	--	--	--
Cargo Handling Equipment Activity	--	--	--	--	--	--
Total	159.13	3.91	3.79	7.42	15.95	0.05

[a] It was assumed that 97 percent of PM10 fugitive dust emissions is comprised of PM2.5. Source: Current Methodologies in Preparing Mobile Source Port-Related Emission Inventories (April 2009)

It should be noted that on-site switching locomotive activity is an extensive emission source for both the 2008 and 2014 emission inventories. The 2008 inventory utilizes actual switching survey observations characteristic of the Facility in 2008 as provided within the Development of Emission Estimates for Locomotives in the Kansas City Metropolitan Area (ENVIRON, 2010). Survey results from the ENVIRON study indicated 28 on-site switching locomotives operating for 12 hours a day. To determine current switcher usage, E2 performed an on-site walk conducted in conjunction with discussion with BNSF staff at the Facility. This revealed that current operations include an average of 9 switching locomotives adapted with idle technology operating for 12 hours a day. Thus, differences in assumed on-site switching locomotive activity within the 2008 and 2014 inventories have resulted in further decreases in 2014 switching locomotive emissions in comparison to the 2008 emission inventory.

Notwithstanding, all major source categories within calendar year 2014 show a decrease in emissions when compared to emissions generated at the Facility in 2008. This can be attributed to the following reasons:

Introduction of Cleaner Burning Engines

When comparing the 2014 emission inventory to 2008 emissions, the reduction in emissions can be attributed to the introduction of regulatory requirements which involved adopting more stringent emission standards in locomotives and the penetration of cleaner engines into the fleet. Therefore, 2014 emission factors declined in comparison to those utilized in the 2008 inventory due to the introduction of newer, less polluting, higher tiered engines. Thus, natural fleet turnover and rebuilding of older engines to meet regulatory compliance requirements, resulted in less emissions generated in 2014.

Locomotive Idle Reduction Technologies

Locomotive engines may need to idle in order to maintain critical functions such as air pressure for the braking and starting systems and battery charge. Additionally, locomotives may idle to supply air-conditioning or heat to its crew, in order to comply with regulations and contractual requirements related to working conditions for the crew. The majority of locomotives at the Facility in 2014 include idle reduction technologies that reduce emissions by 25 percent. BNSF locomotives have installed Automatic Engine Start-Stop systems (AESS) which aid in helping reduce emissions associated with locomotives idling by shutting down the engine after a set idle time (15 minutes). AESS systems monitor critical functions and will start-up a shutdown engine if need be.

Change on Facility Operational Activity

A reduction in emissions within the 2014 emission inventory can also be attributed to a change in operational activity at the Facility. Intermodal activities at the Facility were eliminated in 2013, leading to a decrease in on-site emissions. Therefore, the elimination of 605,051 annual on-site truck trips and 146,740 cumulative annual cargo handling equipment running hours, have resulted in a decrease in Facility related emissions.

Use of Cleaner Fuels

SO2 emissions at the Facility in 2014 resulted in drastic reductions in SO2 in comparison to 2008 levels. This is attributed to the implementation schedule of locomotive fuel regulations requiring the switch to a low sulfur diesel fuel. Therefore, in calendar year 2014, more stringent fuel standards were in effect that were not required in 2008. With the use of cleaner burning fuels, sulfur levels were reduced from 351 ppm sulfur in 2008 to 15 ppm sulfur in 2014. This reduction in fuel sulfur content combined with cleaner burning engines resulted in the dramatic decrease in SO2 emissions.

Section 5 Conclusions

The 2014 emission inventory results in a reduction for all emissions when compared to the 2008 inventory. Table 4-3 details the percentage decrease in emissions based on activity type.

Table 4-3: Percent Emissions Reduction in 2014 vs 2008

Emissions Reduction (2014 vs 2008)						
	Emissions Reduction Percentage					
On-Site Activity	NOx	PM10	PM2.5	HC	CO	SO2
Switching Locomotives	83%	83%	83%	83%	81%	99%
Line Haul Locomotives Idling	40%	47%	47%	49%	25%	97%
Maintenance Activity	25%	10%	10%	18%	59%	90%
Truck Activity	--	--	--	--	--	--
Cargo Handling Equipment Activity	--	--	--	--	--	--
Overall Reduction	75%	80%	80%	82%	93%	99%

It should be noted that differences in on-site switching locomotive activity within the 2008 and 2014 inventories have resulted in decreased emissions associated with switching locomotives. Based on conversation with BNSF staff and site walk observations, E2 does not find the 2008 switching survey to be representative of 2014 switching locomotive operations at the Facility. Therefore, the 2014 emission inventory analyzed 9 switching locomotives adapted with idle technology operating at 12 hours a day as opposed to 28 locomotives operating at 12 hours a day. Differences in on-site switching locomotive activity within the 2008 and 2014 emission inventories have thus resulted in further reductions in 2014 on-site switching locomotive emissions.

Overall, the 2014 emission inventory in comparison to the 2008 emission inventory shows a decline in on-site emissions with a 75 percent reduction in NOx, 80 percent reduction in PM10 and PM2.5, 82 percent reduction in HC, 93 percent reduction in CO, and a 99 percent reduction in SO2. This can be attributed to the introduction of idle reduction technologies and the penetration of cleaner engines into the fleet. Additionally, the changes in on-site operations to no longer include intermodal activities resulted in reduced emissions generated at the Facility. Lastly, vast reductions in SO2 can be attributed to Facility's switch to using a low sulfur diesel fuel. Notwithstanding, it is expected that locomotive emission rates will decrease overtime due to the introduction of cleaner locomotives. Newer engines that meet more stringent standards will eventually replace the older engine fleet. Thus, a reduction in locomotive emissions per horsepower hour will occur with the penetration of higher tiered engines.

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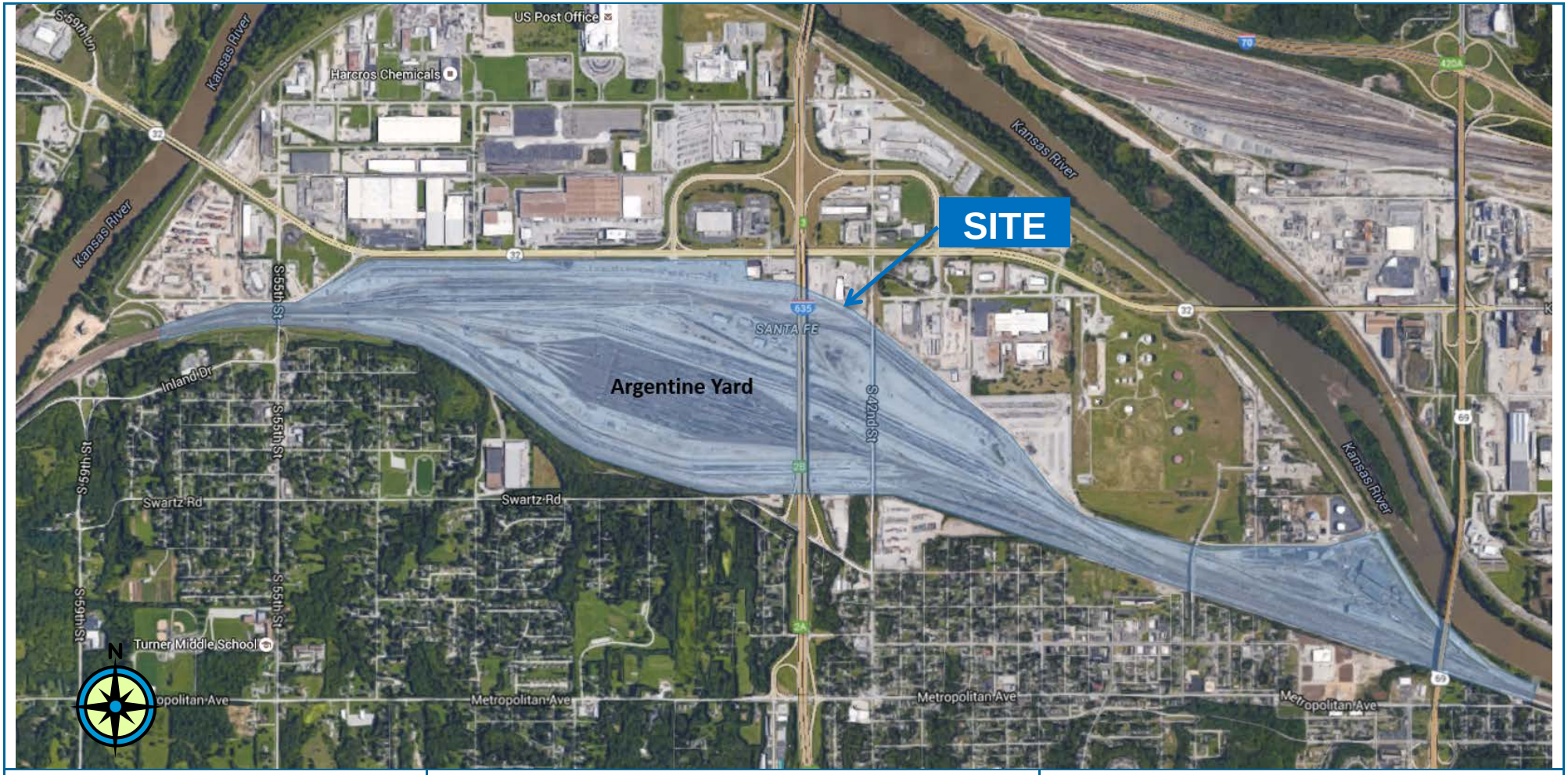
Figures



E2MANAGETECH COLLABORATE | INNOVATE | DELIVER	**BNSF Argentine Emission Inventory**	**Site Boundary**
	Project Number: **15-225-005**	Date: SEPTEMBER 2015	**Figure 1**

Appendix A

Data Input Tables

Table A-1: Argentine Emission Inventory 2008 and 2014 Inputs

BNSF Argentine Emissions Inventory 2008 Assumptions

On-site Emissions from Switching Locomotives		Comments
# of switching locomotives (locomotives/day)	28	Based on the switching survey results for the Argentine Facility obtained from the Development of Emission Estimates for Locomotives in the Kansas City Metropolitan Statistical Area (ENVIRON 2010)
Switcher activity frequency (days/year)	365	
Duration of activity (hrs/day)	12	Based on the switching survey results for the Argentine Facility obtained from the Development of Emission Estimates for Locomotives in the Kansas City Metropolitan Statistical Area (ENVIRON 2010)
Fuel consumption (gal/hr)	14	Based on the switching survey results for the Argentine Facility obtained from the Development of Emission Estimates for Locomotives in the Kansas City Metropolitan Statistical Area (ENVIRON 2010) The average of 14 gallons per hour (in-service and idling fuel consumption) was used in the KDHE study and represents the average fuel consumption of "locomotive engines rated at 2000 to 2500 hp more typical of those used in Kansas City". The average fuel consumption for the following engine models were used EMD 12-645E3B and EMD 16-645E.

Line-Haul Locomotive Idling Emissions		Comments
# of idling line-haul locomotives (locomotives/day)	112	Assumed that the number of trains stopping for refueling or inspection were 50% of the number of all locomotives passing through
Line-haul frequency (days/year)	365	
Idle time (hrs/locomotive)	0.5	30 minutes for fueling and minor inspection. Based on conversation with Matthew Brallier, General Foreman at the BNSF Argentine Facility.
Fuel usage while at idle (gal/hr)	4	Based on information from Matthew Brallier, General Foreman at the BNSF Argentine Facility

Maintenance Emissions		Comments
# of locomotives serviced for full load test (locomotives/yr)	1122	Based on the maintenance survey for the Argentine Facility obtained from the Development of Emission Estimates for Locomotives in the Kansas City Metropolitan Statistical Area (ENVIRON 2010)
# of locomotives serviced for opacity test (locomotives/yr)	1098	Based on the maintenance survey for the Argentine Facility obtained from the Development of Emission Estimates for Locomotives in the Kansas City Metropolitan Statistical Area (ENVIRON 2010)
Full Load Test Duration (hrs/test)	0.75	KDHE study (ENVIRON 2010)
Opacity Test Duration (hrs/test)	0.67	KDHE study (ENVIRON 2010)
Fuel usage (gal/hr)	29	Based on information from Matthew Brallier, General Foreman at the BNSF Argentine Facility

Truck Emissions		Comments
# of lifts/year	331,535	A lift is a movement of a container from or to a train. 2008 counts at BNSF Argentine Facility
# of truck trips/year	605,051	Estimated ratio of truck movement to lifts was estimated to be 1.825 by the Development of Emission Estimates for truck trips in the Kansas City Metropolitan Statistical Area (ENVIRON 2010)

Activity Description	Distance (mi)	Idle Duration (hr)
Entrance Queue	0.10	0.05
Argentine Yard	2.00	0.11
Exit Queue	0.10	0.01

BNSF Argentine Emissions Inventory 2008 Emission Factors

	Emission Factors[a] (g/gal)			
Locomotive Type	**NOx [b]**	**PM10 [b]**	**HC [b]**	**CO [c]**
Line Haul Locomotive	169	5.1	9	26.6
Switcher Locomotive	243	5.5	14.5	27.82

[a] The emission factors reflects the penetration of the various tiers of locomotives in the fleet over time as referenced in EPA-420-F-09-025, April 2009. % Turnover of new locomotives ranged from 3-5% yearly
[b] Source: Expected line-haul/switcher fleet average emission factors in 2014 (EPA-420-F-09-025, April 2009)
[c] Source: EPA-420-R-98-101, April 1998. Note: Emission rates were originally in g/hp-hr. Pursuant to guidance 20.8 bhp-hr/gal for line-haul locomotives and 15.2 bhp-hr/gal for switchers
CO emission rates were not expected to change with emission controls

Locomotive Fuel Type	Diesel
Fuel Sulfur Content (ppm) [a]	351
Fuel Density (g/gal)[b]	3167
Conversion Factor [c]	97.80%
SO2 Emission Factor (g/gal) [d]	2.17

[a] Suggested Nationwide Average Fuel Properties in 2008 (EPA-420-B-09-018, April 2009)
[b] Source: http://cta.ornl.gov/bedb/appendix_a/Lower_and_Higher_Heating_Values_of_Gas_Liquid_and_Solid_Fuels.pdf
[c] Fraction of sulfur fuel converted to SO2 (EPA-420-F-09-025, April 2009)
[d] SO2 (g/gal) = (fuel density) x (conversion factor) x (64 g SO2/32 g S) x (S content of Fuel)

Truck Activity [a]	**NOx**	**PM10**	**HC**	**CO**
In-Use (g/mile) [b]	8	0.219	0.453	2.311
Idle (g/hr) [c]	33.763	1.196	3.503	25.628

[a] Diesel heavy-duty truck emission factors are based on national average data representing the in-use fleet as of July 2008
[b] Average In-use Emission from Heavy-Duty Trucks (EPA420-F-08-027, October 2008)
[c] Idling Vehicle Emissions for Passenger Cars, Light-Duty Trucks, and Heavy-Duty Trucks (EPA420-F-08-025, October 2008)

Truck Fuel Type	Diesel
Fuel Sulfur Content (ppm) [a]	351
Fuel Density (g/gal)[b]	3167
Conversion Factor [c]	97.80%
SO2 Emission Factor (g/gal) [d]	2.17
Fuel Economy (mpg) [e]	6.3

[a] Suggested Nationwide Average Fuel Properties in 2008 (EPA-420-B-09-018, April 2009)
[b] Source: http://cta.ornl.gov/bedb/appendix_a/Lower_and_Higher_Heating_Values_of_Gas_Liquid_and_Solid_Fuels.pdf
[c] Fraction of sulfur fuel converted to SO2 (EPA-420-F-09-025, April 2009)
[d] SO2 (g/gal) = (fuel density) x (conversion factor) x (64 g SO2/32 g S) x (S content of Fuel)
[e] Source: EPA420-R-02-005

BNSF Argentine Emissions Inventory 2014 Assumptions

On-site Emissions from Switching Locomotives		Comments
# of switching locomotives (locomotives/day)	9	5 Bowl Power Locomotives; 4 Hump Unit
Switcher activity frequency (days/year)	365	
Duration of activity (hrs/day)	11.25	9 hours in service and 3 hours idling. Credit taken for a 25% reduction in idling emissions based on idling technology
Fuel consumption (gal/hr)	9	Based on conversation with Matthew Brallier, General Foreman at the BNSF Argentine Facility. Analyzed fuel consumption data for an on-site hump switcher which records its fuel consumption (in-service and idling).

Line-Haul Locomotive Idling Emissions		Comments
# of idling line-haul locomotives (locomotives/day)	112	Took a 7 day count of all locomotives entering the facility. Assumed that the number of trains stopping for refueling or inspection were 50% of the number of all locomotives passing through
Line-haul frequency (days/year)	365	
Idle time (hrs/locomotive)	0.375	30 minutes for fueling and minor inspection. Based on conversation with Matthew Brallier, General Foreman at the BNSF Argentine Facility. Credit taken for a 25% reduction in idling emissions based on idling technology
Fuel usage while at idle (gal/hr)	4	Based on information from Matthew Brallier, General Foreman at the BNSF Argentine Facility

Maintenance Emissions		Comments
# of locomotives serviced for full load test (locomotives/yr)	6420	Based on counts provided by Matt for locomotives coming in for unscheduled testing (6054) + all locomotives coming in for 92 day scheduled maintenance (366). It was noted that the majority of maintenance activity was for ES44 engine models
# of locomotives serviced for opacity test (locomotives/yr)	1189	Based on information from Matthew Brallier, General Foreman at the BNSF Argentine Facility. Took counts of the 368 day scheduled maintenance which requires opacity testing to be done. It was noted that the majority of maintenance activity was for ES44 engine models
Full Load Test Duration (hrs/test)	0.50	Based on conversation Matthew Brallier, General Foreman at the BNSF Argentine Facility
Opacity Test Duration (hrs/test)	0.50	8 notches ~3 minutes per notch
Fuel usage (gal/hr)	29	Based on information from Matthew Brallier, General Foreman at the BNSF Argentine Facility

BNSF Argentine Emissions Inventory 2014 Emission Factors

	Emission Factors[a] (g/gal)			
Locomotive Type	**NOx [b]**	**PM10 [b]**	**HC [b]**	**CO [c]**
Line Haul Locomotive	135	3.6	6.1	26.6
Switcher Locomotive	217	4.8	12.7	27.82

[a] The emission factors reflects the penetration of the various tiers of locomotives in the fleet over time as referenced in EPA-420-F-09-025, April 2009. % Turnover of new locomotives ranged from 3-5% yearly
[b] Source: Expected line-haul/switcher fleet average emission factors in 2014 (EPA-420-F-09-025, April 2009)
[c] Source: EPA-420-R-98-101, April 1998. Note: Emission rates were originally in g/hp-hr. Pursuant to guidance 20.8 bhp-hr/gal for line-haul locomotives and 15.2 bhp-hr/gal for switchers
CO emission rates were not expected to change with emission controls

Fuel Type [a]	Low Sulfur Diesel
Fuel Sulfur Content (ppm)	15
Fuel Density (g/gal)[b]	3206
Conversion Factor [c]	97.80%
SO2 Emission Factor (g/gal) [d]	0.09

[a] Pursuant to the Clean Air Nonroad Diesel Rule, locomotives are assumed to be fueled with low sulfur diesel in 2014
[b] Source: http://cta.ornl.gov/bedb/appendix_a/Lower_and_Higher_Heating_Values_of_Gas_Liquid_and_Solid_Fuels.pdf
[c] Fraction of sulfur fuel converted to SO2 (EPA-420-F-09-025, April 2009)
[d] SO2 (g/gal) = (fuel density) x (conversion factor) x (64 g SO2/32 g S) x (S content of Fuel)

Table A-2: Argentine Emission Inventory 2008 CHE Inputs

BNSF Argentine Emissions Inventory 2008 CHE Assumptions

Equipment Type [a]	Model Year [a]	Horsepower [a]	Running Hrs/ Year [a]	Load Factor [a]	Fuel Consumption (gal/year) [b]	Cumulative Hours [a]	Median Life [a]	Zero Hour Emission Rates (g/hp-hr) [a]				Deterioration Factors [c]				Deterioration Rate (g/hp-hr) [d]				EF (g/hp-hr)				EF (g/gal)
								NOx	PM10	HC	CO	NOx	PM10	HC	CO	NOx	PM10	HC	CO	Nox [e]	PM10 [e]	HC [e]	CO [e]	SO2 [f]
Hostler	2005	152	3180	0.59	11531	15900	4667	4.03	0.23	0.35	1.33	0.009	0.473	0.034	0.101	3.88579E-06	1.16552E-05	1.27491E-06	1.43915E-05	4.09	0.42	0.37	1.56	2.17
Hostler	2005	152	3180	0.59	11531	15900	4667	4.03	0.23	0.35	1.33	0.009	0.473	0.034	0.101	3.88579E-06	1.16552E-05	1.27491E-06	1.43915E-05	4.09	0.42	0.37	1.56	2.17
Hostler	2005	152	3180	0.59	11531	15900	4667	4.03	0.23	0.35	1.33	0.009	0.473	0.034	0.101	3.88579E-06	1.16552E-05	1.27491E-06	1.43915E-05	4.09	0.42	0.37	1.56	2.17
Hostler	2005	152	3180	0.59	11531	15900	4667	4.03	0.23	0.35	1.33	0.009	0.473	0.034	0.101	3.88579E-06	1.16552E-05	1.27491E-06	1.43915E-05	4.09	0.42	0.37	1.56	2.17
Hostler	2005	152	3180	0.59	11531	15900	4667	4.03	0.23	0.35	1.33	0.009	0.473	0.034	0.101	3.88579E-06	1.16552E-05	1.27491E-06	1.43915E-05	4.09	0.42	0.37	1.56	2.17
Hostler	2006	152	3180	0.59	11531	12720	4667	4.03	0.23	0.35	1.33	0.009	0.473	0.034	0.101	3.88579E-06	1.16552E-05	1.27491E-06	1.43915E-05	4.08	0.38	0.37	1.51	2.17
Hostler	2006	152	3180	0.59	11531	12720	4667	4.03	0.23	0.35	1.33	0.009	0.473	0.034	0.101	3.88579E-06	1.16552E-05	1.27491E-06	1.43915E-05	4.08	0.38	0.37	1.51	2.17
Hostler	2006	152	3180	0.59	11531	12720	4667	4.03	0.23	0.35	1.33	0.009	0.473	0.034	0.101	3.88579E-06	1.16552E-05	1.27491E-06	1.43915E-05	4.08	0.38	0.37	1.51	2.17
Hostler	2006	152	3180	0.59	11531	12720	4667	4.03	0.23	0.35	1.33	0.009	0.473	0.034	0.101	3.88579E-06	1.16552E-05	1.27491E-06	1.43915E-05	4.08	0.38	0.37	1.51	2.17
Hostler	2006	152	3180	0.59	11531	12720	4667	4.03	0.23	0.35	1.33	0.009	0.473	0.034	0.101	3.88579E-06	1.16552E-05	1.27491E-06	1.43915E-05	4.08	0.38	0.37	1.51	2.17
Hostler	2006	152	3180	0.59	11531	12720	4667	4.03	0.23	0.35	1.33	0.009	0.473	0.034	0.101	3.88579E-06	1.16552E-05	1.27491E-06	1.43915E-05	4.08	0.38	0.37	1.51	2.17
Hostler	2006	152	3180	0.59	11531	12720	4667	4.03	0.23	0.35	1.33	0.009	0.473	0.034	0.101	3.88579E-06	1.16552E-05	1.27491E-06	1.43915E-05	4.08	0.38	0.37	1.51	2.17
Hostler	2006	152	3180	0.59	11531	12720	4667	4.03	0.23	0.35	1.33	0.009	0.473	0.034	0.101	3.88579E-06	1.16552E-05	1.27491E-06	1.43915E-05	4.08	0.38	0.37	1.51	2.17
Hostler	2006	152	3180	0.59	11531	12720	4667	4.03	0.23	0.35	1.33	0.009	0.473	0.034	0.101	3.88579E-06	1.16552E-05	1.27491E-06	1.43915E-05	4.08	0.38	0.37	1.51	2.17
Hostler	2007	152	3180	0.59	11531	9540	4667	2.89	0.23	0.21	1.33	0.008	0.473	0.027	0.151	2.47697E-06	1.16552E-05	6.07457E-07	2.1516E-05	2.91	0.34	0.22	1.54	2.17
Hostler	2007	152	3180	0.59	11531	9540	4667	2.89	0.23	0.21	1.33	0.008	0.473	0.027	0.151	2.47697E-06	1.16552E-05	6.07457E-07	2.1516E-05	2.91	0.34	0.22	1.54	2.17
Hostler	2007	152	3180	0.59	11531	9540	4667	2.89	0.23	0.21	1.33	0.008	0.473	0.027	0.151	2.47697E-06	1.16552E-05	6.07457E-07	2.1516E-05	2.91	0.34	0.22	1.54	2.17
Hostler	2008	152	3180	0.59	11531	6360	4667	2.89	0.23	0.21	1.33	0.008	0.473	0.027	0.151	2.47697E-06	1.16552E-05	6.07457E-07	2.1516E-05	2.91	0.30	0.21	1.47	2.17
Hostler	2008	152	3180	0.59	11531	6360	4667	2.89	0.23	0.21	1.33	0.008	0.473	0.027	0.151	2.47697E-06	1.16552E-05	6.07457E-07	2.1516E-05	2.91	0.30	0.21	1.47	2.17
Hostler	2008	152	3180	0.59	11531	6360	4667	2.89	0.23	0.21	1.33	0.008	0.473	0.027	0.151	2.47697E-06	1.16552E-05	6.07457E-07	2.1516E-05	2.91	0.30	0.21	1.47	2.17
Hostler	2008	152	3180	0.59	11531	6360	4667	2.89	0.23	0.21	1.33	0.008	0.473	0.027	0.151	2.47697E-06	1.16552E-05	6.07457E-07	2.1516E-05	2.91	0.30	0.21	1.47	2.17
Hostler	2008	152	3180	0.59	11531	6360	4667	2.89	0.23	0.21	1.33	0.008	0.473	0.027	0.151	2.47697E-06	1.16552E-05	6.07457E-07	2.1516E-05	2.91	0.30	0.21	1.47	2.17
Hostler	2008	152	3180	0.59	11531	6360	4667	2.89	0.23	0.21	1.33	0.008	0.473	0.027	0.151	2.47697E-06	1.16552E-05	6.07457E-07	2.1516E-05	2.91	0.30	0.21	1.47	2.17
Hostler	2009	152	3180	0.59	11531	3180	4667	2.61	0.32	0.19	1.33	0.008	0.473	0.027	0.151	2.23698E-06	1.6216E-05	5.49604E-07	2.1516E-05	2.62	0.37	0.19	1.40	2.17
Hostler	2009	152	3180	0.59	11531	3180	4667	2.61	0.32	0.19	1.33	0.008	0.473	0.027	0.151	2.23698E-06	1.6216E-05	5.49604E-07	2.1516E-05	2.62	0.37	0.19	1.40	2.17
Hostler	2009	152	3180	0.59	11531	3180	4667	2.61	0.32	0.19	1.33	0.008	0.473	0.027	0.151	2.23698E-06	1.6216E-05	5.49604E-07	2.1516E-05	2.62	0.37	0.19	1.40	2.17
Hostler	2009	152	3180	0.59	11531	3180	4667	2.61	0.32	0.19	1.33	0.008	0.473	0.027	0.151	2.23698E-06	1.6216E-05	5.49604E-07	2.1516E-05	2.62	0.37	0.19	1.40	2.17
Hostler	2009	152	3180	0.59	11531	3180	4667	2.61	0.32	0.19	1.33	0.008	0.473	0.027	0.151	2.23698E-06	1.6216E-05	5.49604E-07	2.1516E-05	2.62	0.37	0.19	1.40	2.17
Hostler	2009	152	3180	0.59	11531	3180	4667	2.61	0.32	0.19	1.33	0.008	0.473	0.027	0.151	2.23698E-06	1.6216E-05	5.49604E-07	2.1516E-05	2.62	0.37	0.19	1.40	2.17
Hostler	2009	152	3180	0.59	11531	3180	4667	2.61	0.32	0.19	1.33	0.008	0.473	0.027	0.151	2.23698E-06	1.6216E-05	5.49604E-07	2.1516E-05	2.62	0.37	0.19	1.40	2.17
Hostler	2009	152	3180	0.59	11531	3180	4667	2.61	0.32	0.19	1.33	0.008	0.473	0.027	0.151	2.23698E-06	1.6216E-05	5.49604E-07	2.1516E-05	2.62	0.37	0.19	1.40	2.17
Hostler	2009	152	3180	0.59	11531	3180	4667	2.61	0.32	0.19	1.33	0.008	0.473	0.027	0.151	2.23698E-06	1.6216E-05	5.49604E-07	2.1516E-05	2.62	0.37	0.19	1.40	2.17
Hostler	2009	152	3180	0.59	11531	3180	4667	2.61	0.32	0.19	1.33	0.008	0.473	0.027	0.151	2.23698E-06	1.6216E-05	5.49604E-07	2.1516E-05	2.62	0.37	0.19	1.40	2.17
Mobile Repair Van	2004	225	1500	0.3	9924	9000	4500	2.11	0.06	1.00	50.76	0.009	0.473	0.034	0.101	0.00000211	3.15333E-06	3.77778E-06	0.00056964	2.13	0.09	1.03	55.89	2.17
Mobile Repair Van	1998	225	1500	0.3	9924	18000	4500	8.43	0.06	5.01	155.50	0.024	0.473	0.036	0.101	0.00002248	3.15333E-06	0.00002004	0.001745056	8.83	0.12	5.37	186.91	2.17
Mobile Repair Van	1998	225	1500	0.3	9924	18000	4500	8.43	0.06	5.01	155.50	0.024	0.473	0.036	0.101	0.00002248	3.15333E-06	0.00002004	0.001745056	8.83	0.12	5.37	186.91	2.17
Mobile Repair Van	1998	225	1500	0.3	9924	18000	4500	8.43	0.06	5.01	155.50	0.024	0.473	0.036	0.101	0.00002248	3.15333E-06	0.00002004	0.001745056	8.83	0.12	5.37	186.91	2.17
Mobile Repair Van	1998	225	1500	0.3	9924	18000	4500	8.43	0.06	5.01	155.50	0.024	0.473	0.036	0.101	0.00002248	3.15333E-06	0.00002004	0.001745056	8.83	0.12	5.37	186.91	2.17
Mobile Repair Van	1998	225	1500	0.3	9924	18000	4500	8.43	0.06	5.01	155.50	0.024	0.473	0.036	0.101	0.00002248	3.15333E-06	0.00002004	0.001745056	8.83	0.12	5.37	186.91	2.17
Mobile Repair Van	1998	225	1500	0.3	9924	18000	4500	8.43	0.06	5.01	155.50	0.024	0.473	0.036	0.101	0.00002248	3.15333E-06	0.00002004	0.001745056	8.83	0.12	5.37	186.91	2.17
Rubber Tire Gantry Crane	1998	220	3000	0.21	19848	36000	4667	6.15	0.50	0.71	1.92	0.024	0.473	0.036	0.101	1.58132E-05	2.53375E-05	2.73838E-06	2.07757E-05	6.72	1.41	0.81	2.67	2.17
Rubber Tire Gantry Crane	1991	220	3000	0.21	19848	57000	4667	9.25	0.79	1.56	6.94	0.024	0.473	0.047	0.185	2.3784E-05	4.00332E-05	7.85515E-06	0.000137551	10.61	3.07	2.01	14.78	2.17
Rubber Tire Gantry Crane	1993	220	3000	0.21	19848	51000	4667	9.25	0.79	1.56	6.94	0.024	0.473	0.047	0.185	2.3784E-05	4.00332E-05	7.85515E-06	0.000137551	10.46	2.83	1.96	13.96	2.17
Rubber Tire Gantry Crane	2000	315	3000	0.21	36111	30000	7000	6.64	0.40	0.46	3.36	0.024	0.473	0.036	0.101	1.13829E-05	1.35143E-05	1.18286E-06	0.00002424	6.98	0.81	0.50	4.09	2.17
Rubber Tire Gantry Crane	2004	315	3000	0.21	36111	18000	7000	4.97	0.27	0.39	2.29	0.009	0.473	0.034	0.101	0.000003195	9.12214E-06	9.47143E-07	1.65207E-05	5.03	0.43	0.41	2.59	2.17
Rubber Tire Gantry Crane	2008	315	3000	0.21	36111	6000	7000	3.03	0.36	0.38	2.17	0.008	0.473	0.027	0.151	1.73143E-06	1.21629E-05	7.32857E-07	0.000023405	3.04	0.43	0.38	2.31	2.17
Side Loader	2002	320	3000	0.43	36111	24000	7000	4.68	0.14	0.18	0.93	0.009	0.473	0.034	0.101	3.00857E-06	0.00000473	4.37143E-07	6.70929E-06	4.75	0.25	0.19	1.09	2.17
Forklift	2002	155	3000	0.43	10878	24000	4667	5.65	0.28	0.34	0.87	0.024	0.473	0.036	0.101	1.45275E-05	1.4189E-05	1.31133E-06	9.41397E-06	6.00	0.62	0.37	1.10	2.17
Side Loader	2008	175	3000	0.43	10878	6000	4667	2.82	0.23	0.20	0.87	0.008	0.473	0.027	0.151	2.41697E-06	1.16552E-05	5.7853E-07	1.40744E-05	2.83	0.30	0.20	0.95	2.17
Forklift	2008	155	3000	0.43	10878	6000	4667	2.82	0.23	0.20	0.87	0.008	0.473	0.027	0.151	2.41697E-06	1.16552E-05	5.7853E-07	1.40744E-05	2.83	0.30	0.20	0.95	2.17
Ariel Platform	1997	80	500	0.46	1236	6500	3000	8.43	0.06	5.01	155.50	0.024	0.473	0.047	0.185	0.00003372	0.00000473	0.000039245	0.004794583	8.65	0.09	5.27	186.66	2.17
Forklift	1998	85	500	0.59	1236	6000	4667	5.30	0.58	0.54	3.62	0.024	0.473	0.036	0.101	1.36276E-05	2.93915E-05	2.08271E-06	3.91708E-05	5.38	0.76	0.55	3.86	2.17
Forklift	1998	40	300	0.3	285	3600	4500	8.43	0.06	5.01	155.50	0.024	0.473	0.047	0.185	0.00002248	3.15333E-06	2.61633E-05	0.003196389	8.51	0.07	5.10	167.01	2.17

Notes:

[a] Obtained from the Development of Emission Estimates for Locomotives in the Kansas City Metropolitan Statistical Area (ENVIRON 2010). Appendix B, Table B-5

[b] Source: EPA-420-B-10-025. EPA rates are based on 1,000 hours of annual activity. Thus a fuel consumption ratio was created to be representative of the duration of activity at the Facility per equipment type

[c] Deterioration factor for tier 3 nonroad diesel engines. Source: Exhaust and Crankcase Emission Factors for Nonroad Engine Modeling - Compression-Ignition (EPA-420-R-10-018, 2010).

[d] Deterioration Rate = (Deterioration Factor x Zero Hour Emission Rate) / Cumulative hours at the end of useful life

[e] EF = Zero Hour Emissions Rate + (Deterioration Rate x Cumulative Hours)

[f] SO_2 (g/gal) = (fuel density) x (conversion factor) x (64 g SO_2/32 g S) x (S content of Fuel)

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Appendix B

Emission Calculation Tables

Table B-1: Argentine Emission Inventory 2008 and 2014 Switching Locomotive Calculations

BNSF Argentine Emissions Inventory (2008)
On-site Emissions from Switching Locomotives

# of switching locomotives	28
Switcher activity frequency (days/year)	365
Duration of activity (hrs/day)	12
Fuel consumption (gal/hr)	14

Switching Locomotives (2008)

Emission Factors[a] (g/gal)					Emissions[e] (lb/day)						Annual Emissions (lb/yr)						Annual Emissions (tons/yr)					
NOx[b]	PM10[b]	HC[b]	CO[c]	SO2[d]	NOx	PM10	PM2.5[f]	HC	CO	SO2	NOx	PM10	PM2.5[f]	HC	CO	SO2	NOx	PM10	PM2.5[f]	HC	CO	SO2
243	5.5	14.5	27.82	2.17	2517.78	56.99	55.28	150.24	288.25	22.53	918,989.60	20,800.18	20,176.17	54,836.83	105,211.07	8,222.96	459.49	10.40	10.09	27.42	52.61	4.11

Notes:

[a] The emission factors reflects the penetration of the various tiers of locomotives in the fleet over time as referenced in EPA-420-F-09-025, April 2009.

[b] Source: Expected switcher fleet average emission factors in 2008 (EPA-420-F-09-025, April 2009)

[c] Source: EPA-420-R-98-101, April 1998. Note: Emission rates were originally in g/hp-hr. Pursuant to guidance 15.2 bhp-hr/gal for switchers
CO emission rates were not expected to change with emission controls

[d] SO2 (g/gal) = (fuel density) x (conversion factor) x (64 g SO2/32 g S) x (S content of Fuel)

[e] Emissions [lb/day] = (Emission Factor [g/gal]) x (Fuel Use [gal/hr]) x (Duration of Activity [hr/day]) x (Frequency [# of in-service locomotives]) x (1/454 [lb/g])

[f] It was assumed that 97% of PM10 fugitive dust emissions are comprised of PM2.5. Source: Current Methodologies in Preparing Mobile Source Port-Related Emission Inventories (EPA, April 2009)

BNSF Argentine Emissions Inventory (2014)
On-site Emissions from Switching Locomotives

# of switching locomotives	9
Switcher activity frequency (days/year)	365
Duration of activity (hrs/day)	11.25
Fuel consumption (gal/hr)	9

Switching Locomotives (2014)

Emission Factors[a] (g/gal)					Emissions[e] (lb/day)						Annual Emissions (lb/yr)						Annual Emissions (tons/yr)					
NOx[b]	PM10[b]	HC[b]	CO[c]	SO2[d]	NOx	PM10	PM2.5[f]	HC	CO	SO2	NOx	PM10	PM2.5[f]	HC	CO	SO2	NOx	PM10	PM2.5[f]	HC	CO	SO2
217	4.8	12.7	27.82	0.09	435.55	9.63	9.35	25.49	55.84	0.19	158,977.00	3,516.54	3,411.05	9,304.18	20,381.29	68.91	79.49	1.76	1.71	4.65	10.19	0.03

Notes:

[a] The emission factors reflects the penetration of the various tiers of locomotives in the fleet over time as referenced in EPA-420-F-09-025, April 2009.

[b] Source: Expected switcher fleet average emission factors in 2014 (EPA-420-F-09-025, April 2009)

[c] Source: EPA-420-R-98-101, April 1998. Note: Emission rates were originally in g/hp-hr. Pursuant to guidance 15.2 bhp-hr/gal for switchers
CO emission rates were not expected to change with emission controls

[d] SO2 (g/gal) = (fuel density) x (conversion factor) x (64 g SO2/32 g S) x (S content of Fuel)

[e] Emissions [lb/day] = (Emission Factor [g/gal]) x (Fuel Use [gal/hr]) x (Duration of Activity [hr/day]) x (Frequency [# of in-service locomotives]) x (1/454 [lb/g])

[f] It was assumed that 97% of PM10 fugitive dust emissions are comprised of PM2.5. Source: Current Methodologies in Preparing Mobile Source Port-Related Emission Inventories (EPA, April 2009)

Table B-2: Argentine Emission Inventory 2008 and 2014 Line-Haul Idling Calculations

BNSF Argentine Emissions Inventory (2008)
Line-Hail Locomotives Idling Emissions

# of idling line-haul locomotives (locomotives/day)	112
Line-haul frequency (days/year)	365
Idle time (hrs/locomotive)	0.50
Fuel usage while at idle (gal/hr)	4

Line-Haul Locomotives Idling (2008)

Emission Factors[a] (g/gal)					Emissions[e] (lb/day)						Annual Emissions (lb/yr)						Annual Emissions (tons/yr)					
NOx [b]	PM10 [b]	HC [b]	CO [c]	SO2 [d]	NOx	PM10	PM2.5 [f]	HC	CO	SO2	NOx	PM10	PM2.5 [f]	HC	CO	SO2	NOx	PM10	PM2.5 [f]	HC	CO	SO2
169	5.1	9	26.6	2.17	83.12	2.51	2.43	4.43	13.08	1.07	30,337.84	915.52	888.05	1,615.62	4,775.07	390.32	15.17	0.46	0.44	0.81	2.39	0.20

Notes:

[a] The emission factors reflects the penetration of the various tiers of locomotives in the fleet over time as referenced in EPA-420-F-09-025, April 2009. % Turnover of new locomotives ranged from 3-5% yearly

[b] Source: Expected line-haul fleet average emission factors in 2008 (EPA-420-F-09-025, April 2009)

[c] Source: EPA-420-R-98-101, April 1998. Note: Emission rates were originally in g/hp-hr. Pursuant to guidance 20.8 bhp-hr/gal for line-haul locomotives
CO emission rates were not expected to change with emission controls

[d] SO2 (g/gal) = (fuel density) x (conversion factor) x (64 g SO2/32 g S) x (S content of Fuel)

[e] Emissions Idling [lb/day] = (Emission Factor [g/gal]) x (Fuel Use [gal/hr]) x (Idling Time [hr/locomotive]) x (Frequency [locomotives/day]) x (1/454 [lb/g])

[f] It was assumed that 97% of PM10 fugitive dust emissions are comprised of PM2.5. Source: Current Methodologies in Preparing Mobile Source Port-Related Emission Inventories (EPA, April 2009)

BNSF Argentine Emissions Inventory (2014)
Line-Hail Locomotives Idling Emissions

# of idling line-haul locomotives (locomotives/day)	112
Line-haul frequency (days/year)	365
Idle time (hrs/locomotive)	0.38
Fuel usage while at idle (gal/hr)	4

Line-Haul Locomotives Idling (2014)

Emission Factors[a] (g/gal)					Emissions[e] (lb/day)						Annual Emissions (lb/yr)						Annual Emissions (tons/yr)					
NOx [b]	PM10 [b]	HC [b]	CO [c]	SO2 [d]	NOx	PM10	PM2.5 [f]	HC	CO	SO2	NOx	PM10	PM2.5 [f]	HC	CO	SO2	NOx	PM10	PM2.5 [f]	HC	CO	SO2
135	3.6	6.1	26.6	0.09	49.80	1.33	1.29	2.25	9.81	0.03	18,175.78	484.69	470.15	821.28	3,581.30	12.66	9.09	0.24	0.24	0.41	1.79	0.01

Notes:

[a] The emission factors reflects the penetration of the various tiers of locomotives in the fleet over time as referenced in EPA-420-F-09-025, April 2009. % Turnover of new locomotives ranged from 3-5% yearly

[b] Source: Expected line-haul fleet average emission factors in 2014 (EPA-420-F-09-025, April 2009)

[c] Source: EPA-420-R-98-101, April 1998. Note: Emission rates were originally in g/hp-hr. Pursuant to guidance 20.8 bhp-hr/gal for line-haul locomotives
CO emission rates were not expected to change with emission controls

[d] SO2 (g/gal) = (fuel density) x (conversion factor) x (64 g SO2/32 g S) x (S content of Fuel)

[e] Emissions Idling [lb/day] = (Emission Factor [g/gal]) x (Fuel Use [gal/hr]) x (Idling Time [hr/locomotive]) x (Frequency [locomotives/day]) x (1/454 [lb/g])

[f] It was assumed that 97% of PM10 fugitive dust emissions are comprised of PM2.5. Source: Current Methodologies in Preparing Mobile Source Port-Related Emission Inventories (EPA, April 2009)

Table B-3: Argentine Emission Inventory 2008 and 2014 Maintenance Calculations

BNSF Argentine Emissions Inventory (2008)
On-site Emissions from Maintenance

Test Type	Number
Engine Full Load - Argentine (tests/year)	1122
Opacity Test - Argentine LMIT (tests/year)	391
Opacity Test - Argentine GE (tests/year)	707
Full Load Test Duration (hrs/test)	0.75
Opacity Test Duration (hrs/test)	0.67
Fuel usage (gal/hr)	29

Emission Factors

Engine Model	Notch	NOx (g/hr)	PM10 (g/hr)	HC (g/hr)	CO (g/hr)	SO2 (g/gal)
Dash 9 (Tier 0)	Idle	928	33.8	109	95	2.17
Dash 9 (Tier 0)	DB	1010	50.7	160	197	2.17
Dash 9 (Tier 0)	1	2511	56.1	141	139	2.17
Dash 9 (Tier 0)	2	4806	117.4	227	310	2.17
Dash 9 (Tier 0)	3	13851	205.7	584	831	2.17
Dash 9 (Tier 0)	4	18663	243.9	492	2136	2.17
Dash 9 (Tier 0)	5	13663	571.5	726	2801	2.17
Dash 9 (Tier 0)	6	21113	514.6	870	2502	2.17
Dash 9 (Tier 0)	7	25089	496.9	999	2932	2.17
Dash 9 (Tier 0)	8	31154	460.3	1239	3250	2.17

Emission Factors

Engine Model	Notch	NOx (g/hr)	PM10 (g/hr)	HC (g/hr)	CO (g/hr)	SO2 (g/gal)
Dash 9 (Tier 1)	Idle	376	16.9	55	49	2.17
Dash 9 (Tier 1)	DB	2036	88.4	309	461	2.17
Dash 9 (Tier 1)	1	1538	62.1	210	244	2.17
Dash 9 (Tier 1)	2	4672	140.2	298	368	2.17
Dash 9 (Tier 1)	3	14369	272.8	606	896	2.17
Dash 9 (Tier 1)	4	16071	354.5	714	1505	2.17
Dash 9 (Tier 1)	5	13855	393.4	789	1788	2.17
Dash 9 (Tier 1)	6	18020	466.4	931	2014	2.17
Dash 9 (Tier 1)	7	20886	445.1	978	2714	2.17
Dash 9 (Tier 1)	8	23913	632.1	109	3356	2.17

Emission Factors

Engine Model	Notch	NOx (g/hr)	PM10 (g/hr)	HC (g/hr)	CO (g/hr)	SO2 (g/gal)
ES44 (Tier 2)	Idle	329	7.7	24	30	2.17
ES44 (Tier 2)	DB	657	42	65	120	2.17
ES44 (Tier 2)	1	1135	69.3	62	142	2.17
ES44 (Tier 2)	2	2730	145.8	120	239	2.17
ES44 (Tier 2)	3	5310	273	220	607	2.17
ES44 (Tier 2)	4	7246	337.4	224	806	2.17
ES44 (Tier 2)	5	9612	376	311	479	2.17
ES44 (Tier 2)	6	13455	375.1	408	537	2.17
ES44 (Tier 2)	7	16005	419.6	488	790	2.17
ES44 (Tier 2)	8	18566	493.5	619	1034	2.17

Emission Factors

Engine Model	Notch	NOx (g/hr)	PM10 (g/hr)	HC (g/hr)	CO (g/hr)	SO2 (g/gal)
Average	Idle	1633	58.4	188	174	2.17
Average	DB	3703	181.1	534	778	2.17
Average	1	5184	187.5	413	525	2.17
Average	2	12208	403.4	645	917	2.17
Average	3	33530	751.5	1410	2334	2.17
Average	4	41980	935.8	1430	4447	2.17
Average	5	37130	1340.9	1826	5068	2.17
Average	6	52588	1356.1	2209	5053	2.17
Average	7	61980	1361.6	2465	6436	2.17
Average	8	73633	1585.9	1967	7640	2.17

Full Load Emissions (2008)

		Full Load Testing Emissions (lb/year)						Full Load Testing Emissions (tons/year)					
Engine Model	Notch	NOx	PM10	PM2.5 [a]	HC	CO	SO2	NOx	PM10	PM2.5 [a]	HC	CO	SO2
Average	8	136480.55	2939.50	2851.32	3645.88	14160.93	116.87	68.24	1.47	1.43	1.82	7.08	0.06

Opacity Testing Emissions (2008)

		Opacity Testing Emissions (lb/year)						Opacity Testing Emissions (tons/year)					
Engine Model	Notch	NOx	PM10	PM2.5 [a]	HC	CO	SO2	NOx	PM10	PM2.5 [a]	HC	CO	SO2
Average	Idle	264.61	9.46	9.18	30.46	28.19	11.44	0.13	0.005	0.005	0.02	0.01	0.01
Average	DB	600.03	29.35	28.47	86.53	126.07	11.44	0.30	0.015	0.014	0.04	0.06	0.01
Average	1	840.01	30.38	29.47	66.92	85.07	11.44	0.42	0.015	0.015	0.03	0.04	0.01
Average	2	1978.18	65.37	63.41	104.52	148.59	11.44	0.99	0.033	0.032	0.05	0.07	0.01
Average	3	5433.19	121.77	118.12	228.48	378.20	11.44	2.72	0.061	0.059	0.11	0.19	0.01
Average	4	6802.42	151.64	147.09	231.72	720.59	11.44	3.40	0.076	0.074	0.12	0.36	0.01
Average	5	8521.34	219.74	213.15	357.95	818.79	11.44	4.26	0.110	0.107	0.18	0.41	0.01
Average	6	10043.22	220.63	214.01	399.43	1042.89	11.44	5.02	0.110	0.107	0.20	0.52	0.01
Average	7	11931.47	256.98	249.27	318.73	1237.98	11.44	5.97	0.128	0.125	0.16	0.62	0.01
Average	8	52431.01	1322.60	1282.92	2120.61	5407.59	114.37	26.22	0.66	0.64	1.06	2.70	0.06

Full Load + Opacity Testing Emissions (tons/year)

NOx	PM10	PM2.5 [a]	HC	CO	SO2
94.46	2.13	2.07	2.88	9.78	0.12

Source: Port of Oakland 2005 Air Emissions Inventory (ENVIRON 2008)

[a] It was assumed that 97% of PM10 fugitive dust emissions are comprised of PM2.5. Source: Current Methodologies in Preparing Mobile Source Port-Related Emission Inventories (EPA, April 2009)

Emissions = (Notch Specific EF) x (Time in Notch [hr]) x (# of maintenance locomotive tests) x (1/454 [lb/g])

BNSF Argentine Emissions Inventory (2014)
On-site Emissions from Maintenance

Test Type	Number
Engine Full Load - Argentine (tests/year)	6420
Opacity Test - Argentine (tests/year)	1189
Full Load Test Duration (hrs/test)	0.50
Opacity Test Duration (hrs/test)	0.50
Fuel usage (gal/hr)	29

Emission Factors

Engine Model	Notch	NOx (g/hr)	PM10 (g/hr)	HC (g/hr)	CO (g/hr)	SO2 (g/gal)
ES44 (Tier 2)	Idle	329	7.7	24	30	0.09
ES44 (Tier 2)	DB	657	42	65	120	0.09
ES44 (Tier 2)	1	1135	69.3	62	142	0.09
ES44 (Tier 2)	2	2730	145.8	120	239	0.09
ES44 (Tier 2)	3	5310	273	220	607	0.09
ES44 (Tier 2)	4	7246	337.4	224	806	0.09
ES44 (Tier 2)	5	9612	376	311	479	0.09
ES44 (Tier 2)	6	13455	375.1	408	537	0.09
ES44 (Tier 2)	7	16005	419.6	488	790	0.09
ES44 (Tier 2)	8	18566	493.5	619	1034	0.09

Full Load Emissions (2014)

		Full Load Testing Emissions (lb/year)						Full Load Testing Emissions (tons/year)					
Engine Model	Notch	NOx	PM10	PM2.5 [a]	HC	CO	SO2	NOx	PM10	PM2.5 [a]	HC	CO	SO2
Average	8	131270.62	3489.28	3384.61	4376.63	7310.88	19.29	65.64	1.74	1.69	2.19	3.66	0.010

Opacity Testing Emissions (2014)

		Opacity Testing Emissions (lb/year)						Opacity Testing Emissions (tons/year)					
Engine Model	Notch	NOx	PM10	PM2.5 [a]	HC	CO	SO2	NOx	PM10	PM2.5 [a]	HC	CO	SO2
Average	Idle	43.08	1.01	0.98	3.14	3.93	0.36	0.022	0.001	0.0005	0.002	0.002	0.0002
Average	DB	86.03	5.50	5.33	8.51	15.71	0.36	0.043	0.003	0.0027	0.004	0.008	0.0002
Average	1	148.63	9.07	8.80	8.12	18.59	0.36	0.074	0.005	0.0044	0.004	0.009	0.0002
Average	2	357.49	19.09	18.52	15.71	31.30	0.36	0.179	0.010	0.0093	0.008	0.016	0.0002
Average	3	695.33	35.75	34.68	28.81	79.48	0.36	0.348	0.018	0.0173	0.014	0.040	0.0002
Average	4	948.84	44.18	42.86	29.33	105.54	0.36	0.474	0.022	0.0214	0.015	0.053	0.0002
Average	5	1258.66	49.24	47.76	40.72	62.72	0.36	0.629	0.025	0.0239	0.020	0.031	0.0002
Average	6	1761.89	49.12	47.64	53.43	70.32	0.36	0.881	0.025	0.0238	0.027	0.035	0.0002
Average	7	2095.81	54.95	53.30	63.90	103.45	0.36	1.048	0.027	0.0266	0.032	0.052	0.0002
Average	8	2431.16	64.62	62.68	81.06	135.40	0.36	1.216	0.032	0.0313	0.041	0.068	0.0002
	Total	9826.93	332.53	322.55	332.74	626.45	3.57	4.91	0.17	0.16	0.17	0.31	0.0018

Source: Port of Oakland 2005 Air Emissions Inventory (ENVIRON 2008)

[a] It was assumed that 97% of PM10 fugitive dust emissions are comprised of PM2.5. Source: Current Methodologies in Preparing Mobile Source Port-Related Emission Inventories (EPA, April 2009)

Emissions = (Notch Specific EF) x (Time in Notch [hr]) x (# of maintenance locomotive tests) x (1/454 [lb/g])

Full Load + Opacity Testing Emissions (tons/year)

NOx	PM10	PM2.5 [a]	HC	CO	SO2
70.55	1.91	1.85	2.35	3.97	0.01

Table B-4: Argentine Emission Inventory 2008 Truck Activity Calculations

BNSF Argentine Emissions Inventory (2008)
Truck Activity Emissions

Fuel Economy (mpg)	6.3
# of truck trips/year	605,051
Entrance Trip Length (mi/truck trip)	0.10
Entrance Queue Idling (hrs)	0.05
Argentine Yard Trip Length (mi/truck trip)	2.00
Argentine Yard Idling (hrs)	0.11
Exit Trip Length (mi/truck trip)	0.10
Exit Queue Idling (hrs)	0.01

In-Use Truck Activity (2008)

Emission Factors					Annual Emissions (lb/yr)						Annual Emissions (tons/yr)					
NOx (g/mile) [a]	PM10 (g/mile) [a]	HC (g/mile) [a]	CO (g/mile) [a]	SO2 (g/gal) [b]	NOx [c]	PM10 [c]	PM2.5 [c,d]	HC [c]	CO [c]	SO2 [e]	NOx	PM10	PM2.5 [d]	HC	CO	SO2
8	0.219	0.453	2.311	2.17	23,455.74	642.10	622.84	1,328.18	6,775.78	1,011.91	11.73	0.32	0.31	0.66	3.39	0.51

Notes:

[a] Average In-use Emission from Heavy-Duty Trucks (EPA420-F-08-027, October 2008)

[b] SO2 (g/gal) = (fuel density) x (conversion factor) x (64 g SO2/32 g S) x (S content of Fuel)

[c] Emissions [lb/yr] = (Emission Factor [g/mile]) x (Trip Length [miles/truck trip]) x (Frequency [truck trips/yr]) x (1/454 [lb/g])

[d] It was assumed that 97% of PM10 fugitive dust emissions are comprised of PM2.5. Source: Current Methodologies in Preparing Mobile Source Port-Related Emission Inventories (EPA, April 2009)

[e] SO2 Emissions [lb/yr] = (Emission Factor [g/gal]) x (1/Fuel Economy [mpg]) x (Distance [mi/trip]) x (Frequency [trips/year]) x (1/454 [lb/g])

Truck Idling (2008)

Emission Factors					Annual Emissions (lb/yr)						Annual Emissions (tons/yr)					
NOx (g/mile) [a]	PM10 (g/mile) [a]	HC (g/mile) [a]	CO (g/mile) [a]	SO2 (g/gal) [b]	NOx [c]	PM10 [c]	PM2.5 [c,d]	HC [c]	CO [c]	SO2 [e]	NOx	PM10	PM2.5 [d]	HC	CO	SO2
33.763	1.196	3.503	25.628	2.17	7,649.38	270.97	262.84	793.64	5,806.31	--	3.82	0.14	0.13	0.40	2.90	--

Notes:

[a] Idling Vehicle Emissions for Passenger Cars, Light-Duty Trucks, and Heavy-Duty Trucks (EPA420-F-08-025, October 2008)

[b] SO2 (g/gal) = (fuel density) x (conversion factor) x (64 g SO2/32 g S) x (S content of Fuel)

[c] Emissions [lb/yr] = (Emission Factor [g/hr]) x (Idling time [hr/truck trip]) x (Frequency [truck trips/yr]) x (1/454 [lb/g])

[d] It was assumed that 97% of PM10 fugitive dust emissions are comprised of PM2.5. Source: Current Methodologies in Preparing Mobile Source Port-Related Emission Inventories (EPA, April 2009)

[e] SO2 Emissions are nominal

Table B-5: Argentine Emission Inventory 2008 CHE Calculations

BNSF Argentine Emissions Inventory (2008)
CHE Emissions

Equipment	Counts	Horsepower	Load Factor	Activity (hrs/year)	Fuel Consumption (gal/year)
Hostler (2005)	5	152	0.59	3180	11531
Hostler (2006)	9	152	0.59	3180	11531
Hostler (2007)	3	152	0.59	3180	11531
Hostler (2008)	6	152	0.59	3180	11531
Hostler (2009)	10	152	0.59	3180	11531
Mobile Repair Van (2004)	1	225	0.30	1500	9924
Mobile Repair Van (1998)	6	225	0.30	1500	9924
Rubber Gantry Crane (1998)	1	220	0.21	3000	19848
Rubber Gantry Crane (1991)	1	220	0.21	3000	19848
Rubber Gantry Crane (1993)	1	220	0.21	3000	19848
Rubber Gantry Crane (2000)	1	315	0.21	3000	36111
Rubber Gantry Crane (2004)	1	315	0.21	3000	36111
Rubber Gantry Crane (2008)	1	315	0.21	3000	36111
Side Loader (2002)	1	320	0.43	3000	36111
Forklift (2002)	1	155	0.43	3000	10878
Side Loader (2008)	1	175	0.43	3000	10878
Forklift (2008)	1	155	0.43	3000	10878
Ariel Platform (1997)	1	80	0.46	500	1236
Forklift (1998)	1	85	0.59	500	1236
Forklift (1998)	1	40	0.59	300	285

Cargo Handling Equipment (2008)

Equipment	Emission Factors					Annual Emissions (lb/yr)						Annual Emissions (tons/yr)					
	NOx (g/hp-hr) [a]	PM10 (g/hp-hr) [a]	HC (g/hp-hr) [a]	CO (g/hp-hr) [a]	SO2 (g/gal) [b]	Nox [c]	PM10 [c]	PM2.5 [c,d]	HC [c]	CO [c]	SO2 [e]	NOx	PM10	PM2.5 [d]	HC	CO	SO2
Hostler (2005)	4.09	0.42	0.37	1.56	2.17	12,851.37	1,304.42	1,265.29	1,162.94	4,895.92	276.12	6.43	0.65	0.633	0.58	2.45	0.14
Hostler (2006)	4.08	0.38	0.37	1.51	2.17	23,062.62	2,138.42	2,074.27	2,070.37	8,553.92	497.01	11.53	1.07	1.037	1.04	4.28	0.25
Hostler (2007)	2.91	0.34	0.22	1.54	2.17	5,490.63	642.96	623.67	406.66	2,893.15	165.67	2.75	0.32	0.312	0.20	1.45	0.08
Hostler (2008)	2.91	0.30	0.21	1.47	2.17	10,951.58	1,146.23	1,111.85	806.04	5,528.42	331.34	5.48	0.57	0.556	0.40	2.76	0.17
Hostler (2009)	2.62	0.37	0.19	1.40	2.17	16,439.53	2,334.02	2,264.00	1,204.47	8,784.25	552.23	8.22	1.17	1.132	0.60	4.39	0.28
Mobile Repair Van (2004)	2.13	0.09	1.03	55.89	2.17	474.80	19.71	19.12	230.60	12,463.73	47.53	0.24	0.01	0.010	0.12	6.23	0.02
Mobile Repair Van (1998)	8.83	0.12	5.37	186.91	2.17	11,821.68	156.24	151.55	7,186.59	250,106.68	285.17	5.91	0.08	0.076	3.59	125.05	0.14
Rubber Gantry Crane (1998)	6.72	1.41	0.81	2.67	2.17	2,051.30	431.11	418.18	246.85	814.48	95.06	1.03	0.22	0.209	0.12	0.41	0.05
Rubber Gantry Crane (1991)	10.61	3.07	2.01	14.78	2.17	3,237.77	937.81	909.67	612.94	4,512.25	95.06	1.62	0.47	0.455	0.31	2.26	0.05
Rubber Gantry Crane (1993)	10.46	2.83	1.96	13.96	2.17	3,194.21	864.48	838.54	598.55	4,260.30	95.06	1.60	0.43	0.419	0.30	2.13	0.05
Rubber Gantry Crane (2000)	6.98	0.81	0.50	4.09	2.17	3,051.71	352.06	341.50	216.58	1,786.57	172.94	1.53	0.18	0.171	0.11	0.89	0.09
Rubber Gantry Crane (2004)	5.03	0.43	0.41	2.59	2.17	2,197.60	189.79	184.10	177.93	1,130.98	172.94	1.10	0.09	0.092	0.09	0.57	0.09
Rubber Gantry Crane (2008)	3.04	0.43	0.38	2.31	2.17	1,329.00	189.26	183.58	168.03	1,009.92	172.94	0.66	0.09	0.092	0.08	0.50	0.09
Side Loader (2002)	4.75	0.25	0.19	1.09	2.17	4,320.95	230.51	223.60	173.20	992.01	172.94	2.16	0.12	0.112	0.09	0.50	0.09
Forklift (2002)	6.00	0.62	0.37	1.10	2.17	2,641.92	273.30	265.10	163.60	482.67	52.10	1.32	0.14	0.133	0.08	0.24	0.03
Side Loader (2008)	2.83	0.30	0.20	0.95	2.17	1,409.45	149.14	144.67	101.18	474.60	52.10	0.70	0.07	0.072	0.05	0.24	0.03
Forklift (2008)	2.83	0.30	0.20	0.95	2.17	1,248.37	132.10	128.13	89.61	420.36	52.10	0.62	0.07	0.064	0.04	0.21	0.03
Ariel Platform (1997)	8.65	0.09	5.27	186.66	2.17	350.54	3.68	3.57	213.39	7,565.27	5.92	0.18	0.00	0.002	0.11	3.78	0.00
Forklift (1998)	5.38	0.76	0.55	3.86	2.17	297.24	41.77	40.52	30.52	212.92	5.92	0.15	0.02	0.020	0.02	0.11	0.00
Forklift (1998)	8.51	0.07	5.10	167.01	2.17	132.73	1.11	1.08	79.60	2,604.43	1.36	0.07	0.00	0.001	0.04	1.30	0.00
				Total		**106,555.00**	**11,538.13**	**11,191.98**	**15,939.63**	**319,492.83**	**3,301.51**	**53.28**	**5.77**	**5.60**	**7.97**	**159.75**	**1.65**

Notes:

[a] EF = Zero Hour Emissions Rate + (Deterioration Rate x Cumulative Hours) *See CHE Input Tab*

[b] SO2 (g/gal) = (fuel density) x (conversion factor) x (64 g SO2/32 g S) x (S content of Fuel)

[c] Emissions[lb/year] = (Emission Factor [g/hp-hr]) x (Equipment Count) x (Horsepower) x (Load Factor) x (Operational Activity [hr/year]) x (1/454 [lb/g])

[d] It was assumed that 97% of PM10 fugitive dust emissions are comprised of PM2.5. Source: Current Methodologies in Preparing Mobile Source Port-Related Emission Inventories (EPA, April 2009)

[e] SO2 Emissions [lb/yr] = (Emission Factor [g/gal]) x (Fuel Consumption [gal/yr]) x (Equipment Count) x (1/454 [lb/g])

Table B-6: Argentine Emission Inventory 2008 and 2014 Summary

BNSF Argentine Emissions Inventory (2008)
Summary (Total Emissions)

Emissions (2008)						
	Annual Emissions (tons/yr)					
On-Site Activity	NOx	PM10	PM2.5	HC	CO	SO2
Switching Locomotives	459.49	10.40	10.09	27.42	52.61	4.11
Line Haul Locomotives Idling	15.17	0.46	0.44	0.81	2.39	0.20
Maintenance Activity	94.46	2.13	2.07	2.88	9.78	0.12
Truck Activity	15.55	0.46	0.44	1.06	6.29	0.51
Cargo Handling Equipment Activity	53.28	5.77	5.60	7.97	159.75	1.65
Total	**637.95**	**19.21**	**18.64**	**40.14**	**230.81**	**6.58**

BNSF Argentine Emissions Inventory (2014)
Summary (Total Emissions)

Emissions (2014)						
	Annual Emissions (tons/yr)					
On-Site Activity	NOx	PM10	PM2.5	HC	CO	SO2
Switching Locomotives	79.49	1.76	1.71	4.65	10.19	0.03
Line Haul Locomotives Idling	9.09	0.24	0.24	0.41	1.79	0.01
Maintenance Activity	70.55	1.91	1.85	2.35	3.97	0.01
Truck Activity	--	--	--	--	--	--
Cargo Handling Equipment Activity	--	--	--	--	--	--
Total	**159.13**	**3.91**	**3.79**	**7.42**	**15.95**	**0.05**

BNSF Argentine Emissions Inventory
Percent Reduction in 2014 vs 2008

Emission Reductions (2014 vs 2008)						
	Emission Reduction Percentage					
On-Site Activity	NOx	PM10	PM2.5	HC	CO	SO2
Switching Locomotives	83%	83%	83%	83%	81%	99%
Line Haul Locomotives Idling	40%	47%	47%	49%	25%	97%
Maintenance Activity	25%	10%	10%	18%	59%	90%
Truck Activity	--	--	--	--	--	--
Cargo Handling Equipment Activity	--	--	--	--	--	--
Overall Reduction	75%	80%	80%	82%	93%	99%