Basis for Proposed Commitments to Reduce Diesel Particulate Matter at the BNSF HOBART RAILYARD

This document explains the Air Resources Board (ARB or Board) staff's basis and rationale for the commitments we propose to request from BNSF Railway (Railroad) to further reduce emissions of diesel particulate matter (PM) at the Hobart Railyard. The purpose is to decrease the health risk from exposure to diesel PM at this high priority railyard to protect nearby communities, consistent with the Board's direction.

ARB staff independently assessed the potential for feasible emission reductions through the use of cleaner, cost-effective technology that is currently available or that we expect will become available over the next decade. The proposed commitments are based on the level of emission reductions likely to be achievable with the accelerated introduction of this technology. We also present ARB's estimate of the health risk reduction that would result from the Railroad's acceptance and implementation of the commitments.

1. What would the proposed commitments accomplish?

These commitments would require that the Railroad achieve the expected emission reductions from existing regulations and agreements, and that the Railroad take any additional actions needed to meet the diesel PM emission levels, regardless of any increases in activity or growth at the BNSF Hobart Railyard.

With these commitments, the remaining diesel PM emissions and health risk in 2020 would be 37 percent lower than under the existing regulations and agreements alone.

The commitments would establish enforceable requirements, tracking mechanisms, and deadlines for BNSF Railroad to reduce diesel PM emissions at the railyard 55 percent by 2011, increasing to a reduction of 85 percent by 2020 (relative to calendar year 2005 levels). In each benchmark year, the remaining emissions could not be exceeded despite any growth or increase in activity at the railyard, including growth in the number of containers moved. The higher the growth, the more actions the Railroad would need to take to reduce emissions.

In most cases, there is a high correlation between reducing diesel PM emissions and reducing health risk. Our analysis links the two to estimate the expected change in health risk in proportion to the change in emissions. This relationship can vary based on the location of the emission sources in relation to the people exposed.

The commitments would provide transparency and require regular public updates on: the equipment operating in the yard, the Railroad's plans to upgrade each type of equipment, and the resulting changes in emissions and health risk.

- The Railroad would develop and submit emission inventories, air dispersion modeling, and emission reduction plans to ARB on a defined schedule.
- ARB staff would use these submittals to periodically update the health risk assessment for the railyard to reflect the new emission reductions and any changes in the location of the emission sources within the facility.
- ARB would publish all of these documents for public review and comment on a defined schedule.
- The Railroad and ARB would hold community meetings to seek public input on the draft emission reduction plans and the updated health risk assessment.
- ARB would prepare periodic estimates of future health risks, through 2020, concurrent with BNSF's submittal of final emission reduction plans

The commitments would provide independent ARB verification of locomotives operating in the railyard to determine the number of units at each emission control level and compare those counts to data submitted by the Railroad.

The commitments would require the Railroad to evaluate the emission reductions associated with operational changes (for example, moving truck gates and equipment operations to alternate locations within the facility). ARB staff would assess the impact of such changes on health risk.

The commitments would also add a new ambient air quality monitor for PM near the railyard to measure air quality trends.

If the Railroad did not deliver the required emission reductions on schedule, the commitments would require ARB staff to bring regulatory proposal(s) to the Board within four months of a final finding of non-compliance.

2. How did ARB staff develop the percent reduction in diesel PM emissions for the proposed commitments? What actions are reflected in the numbers?

Railyard-Specific Data on Emission Sources. We began by evaluating the number, activity, and control level of the specific emission sources operating at the BNSF Hobart Railyard, including:

- The interstate line haul locomotive fleet that serves the South Coast Air Basin and the railyard.
- The individual switch locomotives in the railyard.
- The individual cargo handling equipment in the railyard.
- The fleet of drayage trucks serving the railyard.
- The transport refrigeration units operated with drayage trucks or railcars in the railyard.

To project railyard emissions in future years, we used the equipment activity and controls, together with anticipated growth. ARB staff relied on a 1.5 percent per year increase in fuel use, which equates to a roughly 3 percent per year increase in containers, based on historic growth rates over the last 12 years.

Projected Emissions with Existing Program. We then evaluated how the existing program of regulations and agreements affects the kinds of equipment that will be operating and the emissions from that equipment.

We refer to different levels of emissions from locomotives based on emission standards set by the U.S. Environmental Protection Agency (U.S. EPA). The oldest locomotives (Pre-Tier 0) don't have emission controls. Tier 0 locomotives have modest NOx controls, while Tier 1 locomotives have additional NOx and PM controls. All new locomotive engines today meet at least Tier 2 emission standards to cut both pollutants. New Tier 3 locomotives will be available in the future with further PM controls, while advanced technology Tier 4 locomotives will significantly reduce NOx and PM emissions.

The existing program numbers in this document reflect the benefits of the following rules and agreements to reduce diesel PM emissions and health risk from railyard operations:

- Adopted ARB regulations for drayage trucks, cargo equipment, transport refrigeration units, and cleaner fuel for intrastate locomotives.
- The 1998 ARB/Railroads Agreement to reduce fleet average emissions of nitrogen oxides (NOx) from locomotives in the South Coast Air Basin to Tier 2 levels by 2010.
- The 2005 ARB/Railroads Agreement to reduce diesel PM emissions, (which has an associated reduction in health risk) near railyards, through the use of idle reduction devices and cleaner fuels, as well as prevention of excess smoke from locomotives.
- Under the 2008 U.S. EPA rulemaking, when railroads remanufacture locomotives, these locomotives must meet a PM emission standard that is 50 percent lower than the previous level.

Table 1 shows the railyard emissions in 2005, and the declining emissions in 2010, 2015, and 2020 due to the benefits of the existing program.

Possible Paths to Further Reduce Emissions. Locomotives account for the majority of the remaining emissions after implementation of the existing program. In response, we focused our evaluation of the additional actions to further reduce emissions on locomotives. We believe the following accelerated upgrades and other actions could be implemented to achieve additional emission reductions:

a. Between 2010 and 2015, replace switch and medium horsepower locomotives operating primarily within the railyard with cleaner Tier 3/generator-set (gen-set) technology or equivalent. BNSF has lined up federal and State co-funding for seven of these upgrades, with the units being introduced over the next two years.

b. Between 2013 and 2020, upgrade the fleet of line-haul locomotives to Tier 3 emission levels on average (based on a combination of increasingly cleaner locomotives).

c. Between 2015 and 2020, retrofit Tier 3 switch and medium-horsepower locomotives with diesel PM filters or equivalent technology, or replace them with Tier 4 locomotives.

d. By 2020, accelerate Tier 4 line haul locomotives into the fleet serving the Railyard, install electric infrastructure to support rail mounted gantry cranes and stationary transport refrigeration units. Also, relocate the truck gate, and/or install an automated gate system, and/or install a bridge to provide access for trucks to the Railyard.

ARB recognizes that there are other pathways than those noted above for the railroad to further reduce emissions.

Establishing the Performance Standard for Emission Reductions. We quantified the additional benefits of implementing the path described above, as shown in Table 2, and used the results to set the performance standards for the proposed commitments. As shown in Table 3, the performance standards are expressed as the percent emission reduction from 2005 levels to be achieved by each compliance deadline.

The Railroad would have to meet the emission reduction levels in Table 3, but would have the discretion to select the most efficient combination of actions and path to do so. The Railroad would define its detailed strategy to upgrade equipment and implement any operational changes in each emission reduction plan.

In Table 1 below, the estimated emission reductions for various technologies are preliminary and are subject to revision upon confirmation of actual emissions performance.

Table 1
BNSF Hobart Railyard:
Diesel PM Emission Reductions by Equipment Type
(tons per year)

Equipment Type	2005	2010	2015	2020
Emissions With Existing Program				
Freight Locomotives				
- Line Haul	3.2	2.4	2.2	2.1
- Switch	2.2	2.2	1.7	1.6
- Service/Testing	0	0	0	0
Subtotal for Locomotives	*5.4*	*4.6*	*3.9*	*3.7*
Cargo Equipment	5.9	2.5	1.2	0.6
Drayage Trucks	10.7	2.1	1.6	1.1
Transport Refrigeration Units	2.1	1.0	0.6	0.2
Maintenance/Stationary	0.1	0.1	0.1	0.1
Subtotal for Other Equipment	*18.8*	*5.7*	*3.5*	*2.0*
Total Tons	**24.2**	**10.3**	**7.4**	**5.7**
Reduction (%) from 2005	N/A	57%	70%	76%
Emissions with Existing Program Plus Proposed Commitments (Table 2 shows additional emission reductions to achieve the emissions noted below)				
Total Tons	**24.2**	**10.3**	**6.1**	**3.6**
Reduction (%) from 2005	N/A	57%	75%	85%

Note: BNSF recently shifted all operations at BNSF Commerce Eastern Railyard, which was closed 2008, to the BNSF Hobart Railyard which resulted in a diesel PM emission increase at the Hobart Railyard. BNSF would absorb all incremental diesel PM emission increases resulting from the Commerce Eastern Railyard operational shift.

Table 2
BNSF Hobart Railyard:
Diesel PM Emission Reductions from Potential Actions Identified by ARB Staff
(tons per year)

Potential Actions*	2015	2020
(a) Replace switch or medium horsepower locomotives with cleaner Tier 3/gen-set technology	-1.1	-1.0
(b) Upgrade line-haul locomotives to Tier 3 emission levels on average (included in existing program)	N/A	N/A
(c) Retrofit or replace Tier 3 switch and medium-horsepower locomotives with diesel PM filters or equivalent technology	0	-0.4
(d) Accelerate Tier 4 line haul locomotives, and electrify cranes and transport refrigeration units, and implement operational changes	-0.2	-0.7
Total Reductions	-1.3	-2.1

* Specific actions to be detailed by BNSF in the Railyard Emission Reduction Plan.

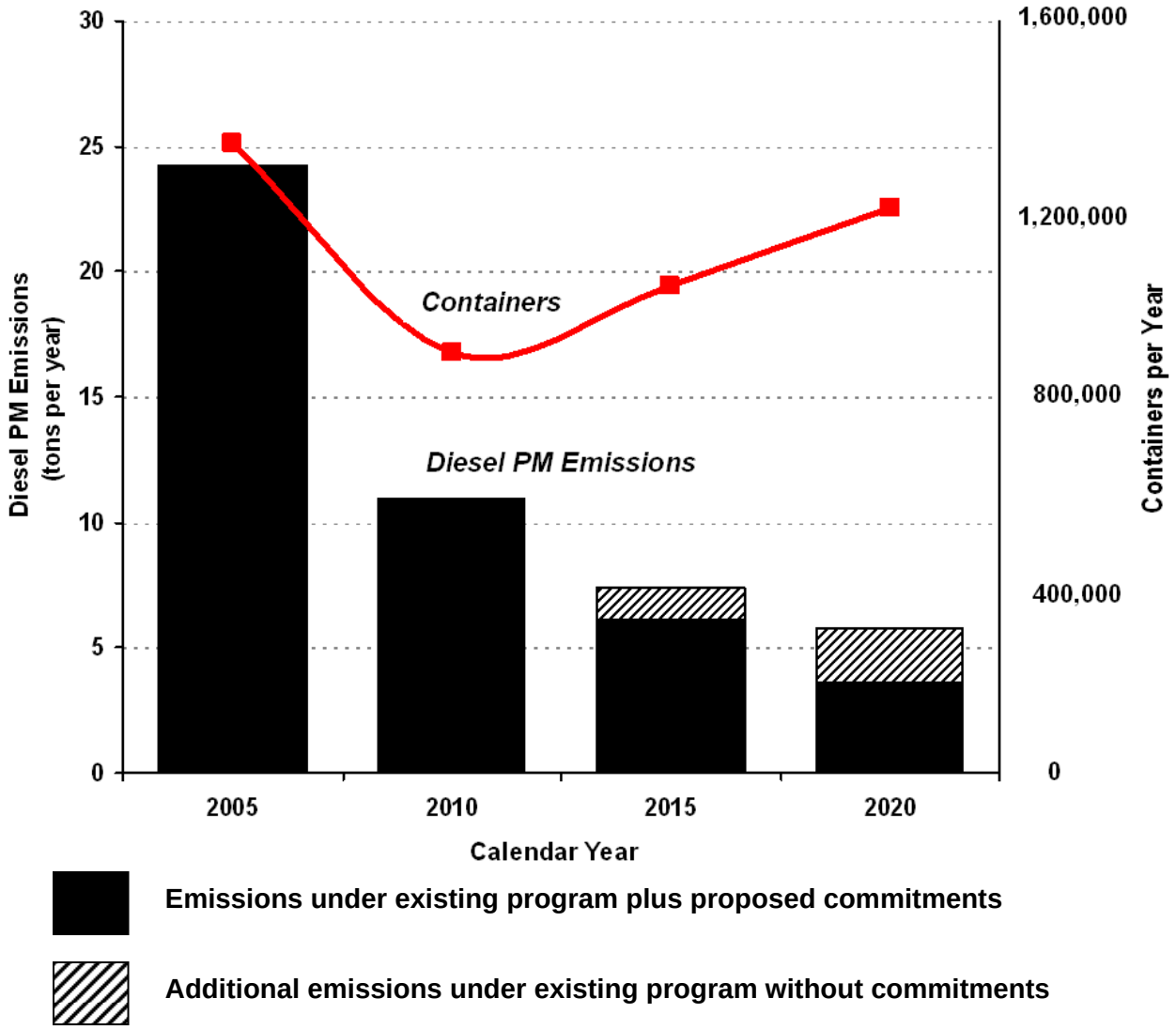
Table 3
BNSF Hobart Railyard:
Proposed Commitments to Reduce Diesel PM Emissions

Diesel PM Reductions from 2005 Baseline	Compliance Deadline
55 percent	December 31, 2011
65 percent	December 31, 2013
75 percent	December 31, 2015
75-80 percent	December 31, 2017
85 percent	December 31, 2020

3. How would growth affect the emissions levels to be achieved under the commitments?

The commitments would require that emissions be reduced to specific levels, regardless of growth. The greater the growth, the greater the reductions that the Railroad must achieve to meet those fixed levels. Figure 1 illustrates the decline in diesel PM emissions that would result under the existing program plus the commitments, while cargo grows up to the railyard's capacity of nearly 1.2 million container lifts by 2020.

Figure 1
BNSF Hobart Railyard:
Projected Cargo Growth and Diesel PM Emissions
with Existing Program Plus Proposed Commitments



This cargo forecast is based on historical container lift volumes at the railyard, correlated with UP and BNSF national locomotive diesel fuel consumption. The container projections after 2010 rely on a three percent per year container growth rate for this yard, and the emissions estimates assume a corresponding 1.5 percent per year growth in fuel use.

4. How much would the proposed commitments reduce the potential diesel PM health risks near the railyard?

Compared to 2005 numbers, ARB staff estimates that the emission reductions required under the commitments would cut the maximum individual cancer risk 57 percent by 2010, rising to 85 percent by 2020, as shown in Table 4. The reductions would also significantly decrease the number of people exposed to an excess cancer risk above 10 in a million in 2010, as shown in Table 5.

Table 4
BNSF Hobart Railyard:
Estimated Maximum Individual Cancer Risk
(Excess Cancer Risk in a Million)

	Excess Cancer Risk			
	2005	**2010**	**2015**	**2020**
Existing Program	500	215	150	120
Existing Program + Commitments	N/A	215	125	75
Total % Reduction from 2005 Due to Existing Program + Commitments	N/A	57%	75%	85%

Table 5
BNSF Hobart Railyard:
Estimated Population Exposure to
Excess Cancer Risk Greater than 10 in a Million

	Number of People Exposed			
	2005	**2010**	**2015**	**2020**
Existing Program	848,000	315,000	246,000	190,000
Existing Program + Commitments	N/A	315,000	203,000	96,000
Total % Reduction from 2005 Due to Existing Program + Commitments	N/A	63%	76%	89%

5. How would ARB staff verify that the Railroad is achieving the diesel PM emission reductions required under the commitments?

To monitor compliance, ARB staff would thoroughly review the comprehensive inventories of equipment, activity, and emissions provided by the Railroad. We will also independently develop our own information sources to verify the data provided by the Railroad. ARB staff plans to: (1) conduct semi-annual railyard emission source inspections through 2015, (2) track locomotive activity through photographic databases, and (3) conduct unannounced field surveys outside the railyard to count the number, type, and emissions level of operating locomotives.

We will also cross-check the Railroad's inventory with data submitted to comply with ARB regulations for cargo equipment, drayage trucks, and transport refrigeration units; as well as the 1998 Locomotive NOx Fleet Average Agreement.

6. What alternatives to the proposed commitments did ARB staff evaluate?

Staff evaluated two primary alternatives to the proposed commitments — ARB regulations for non-preempted locomotives and electrification of cargo equipment at the railyard. We are convinced that the proposed commitments would ensure significantly greater reductions in diesel PM emissions and health risk than the regulatory alternatives described below.

<u>ARB Regulation of Non-Preempted Locomotives</u>

To evaluate the effectiveness of this approach in reducing emissions from locomotives at the BNSF Hobart Railyard, we considered the number of units that could be regulated. For the reasons described below, there are virtually no non-preempted locomotives that currently operate on a continuous basis at the Hobart Railyard or in the South Coast Air Basin. Thus, a regulation to reduce diesel PM emissions from non-preempted locomotives would yield little to no air quality benefits in this region.

Under the Federal Clean Air Act and U.S. EPA regulation, states are expressly preempted from regulating the emissions of newly built or remanufactured locomotives. U.S. EPA did suggest (Preamble to 2008 rulemaking) that states may have the authority to regulate locomotives that have exceeded their "useful lives," defined as 133 percent of the time to the first remanufacture. This would make line haul locomotives eligible for state regulation when they are roughly ten years old. Switch and medium horsepower locomotives typically last longer until the first full remanufacture (defined by U.S. EPA), making them eligible for state regulation when they are about 15 years old.

In response to the requirements of the 1998 Locomotive NOx Fleet Average Agreement in the South Coast Air Basin, BNSF has replaced all non-preempted switch locomotives within the railyard with Tier 0 or better switch or medium horsepower locomotives. To comply, BNSF is also using nearly all Tier 0, 1, and 2 interstate line haul locomotives (rather than preempted locomotives) for operations in the South Coast Air Basin.

ARB Regulation to Require Electrification of Cargo Handling Equipment

A second alternative would be an ARB regulation to require railroads to install the electrification infrastructure needed to reduce railyard cargo handling equipment diesel PM emissions to near zero. As discussed below, these emission reductions are technically feasible for several railyard applications, but not cost-effective in comparison with reductions from locomotives.

At this time, staff believes it is more effective to focus limited resources on providing reductions of locomotive emissions, rather than diverting significant resources to the smaller remaining cargo handling equipment emissions. However, an investment in electrification infrastructure could provide cleaner power for transport refrigeration units operating at the railyard.

An existing ARB regulation for diesel cargo handling equipment used at ports and intermodal railyards requires this equipment to achieve the most stringent Tier 4 PM emissions standards by about 2015. Based on staff's analysis, the existing regulation will require railyard equipment to be about 90 percent cleaner than the equipment used in 2005.

By 2020, the diesel PM emissions from cargo handling equipment at the BNSF Hobart Railyard will be reduced to about 0.6 tons per year. The capital costs to install 54 electrified rail mounted gantry cranes would be $5 million or more per unit (about $270 million for all), plus electrification infrastructure costs ($180 million), for a total cost of about $450 million. The total electrification capital costs, divided by the remaining diesel crane and yard hostler NOx and diesel PM emissions within the railyard, would result in a cost-effectiveness of about $438 per pound of emissions reduced.

The capital costs to replace 129 diesel yard tractors (or hostlers) with electric yard tractors is about $200,000 per unit (about $26 million for all). The total electric yard tractor capital costs, divided by the remaining diesel yard tractor NOx and diesel PM emissions within the railyard, would result in a cost-effectiveness of about $213 per pound of emissions reduced.

Locomotives are the largest remaining diesel PM emissions source within the railyard after 2015, representing up to 85 percent of remaining railyard diesel PM emissions. Locomotive NOx and PM emission reductions have a cost-effectiveness range of $1 to $10 per pound of NOx and PM emissions reduced.