APPENDIX D

CONSTRUCTION AND OPERATIONAL EMISSION CALCULATIONS

INTRODUCTION

Emissions that can adversely affect air quality originate from various activities. A project generates emissions both during the period of its construction and through ongoing daily operations. The current capacity in the SCAQMD's jurisdiction for refueling alternative clean-fueled locomotives is not sufficient if locomotives choose to use alternative fuels, such as liquefied natural gas (LNG), to comply with PR 3501 and 2502. Therefore, new alternative clean-fuel refueling capacity will need to be constructed, and emissions will be generated by the construction activities. Operation of the alternative clean-fueled vehicles may lead to increases in fuel delivery trips to the refueling terminals or stations because of differences in energy content of the alternative clean fuels compared with diesel fuel, which would lead to increased operational emissions from the delivery vehicles. While natural gas is transported through pipeline for a number of household applications, it would be unfeasible for the LNG to be transported via a pipeline over a mile to the locomotive fueling terminals so the LNG will be delivered via delivery truck. Some existing LNG-fueled locomotives are fueled straight from an LNG truck and others fuel at a remote terminal. While the LNG terminal might be constructed at its own separate location, it will be assumed the LNG terminal will constructed at the same location as the existing diesel fueling station as the fueling and delivery behavior of the locomotive is assumed to not change.

The following discussion provides the methodologies used by the SCAQMD to estimate the construction and operational air quality impacts from the implementation of the proposed railroad idling rules. The discussion first presents the methodologies for estimating unmitigated construction emissions and unmitigated operational emissions. Emissions were estimated for each year from 2006 through 2010 and compared with the emissions benefits (e.g., emissions reductions) from the proposed railroad idling rules and project alternatives. The remaining impacts were compared with CEQA significance levels to determine if significant air quality impacts would result.

CONSTRUCTION EMISSIONS (UNMITIGATED)

Construction emissions can be distinguished as either onsite or offsite. Onsite emission generated during construction principally consists of exhaust emissions (NOx, SOx, CO, VOC, and PM10) from mobile heavy-duty construction equipment and portable auxiliary equipment and fugitive dust (PM10) from disturbed soil. Offsite emissions during the construction phase normally consist of exhaust emissions from worker commute trips and material transport trips to and from the construction site.

Construction-Related Emissions

Alternative Clean-Fuel Refueling Station

To help quantify the environmental impacts associated with the construction of refueling stations needed to comply as an alternative to restricting railroad idling, the SCAQMD calculated emissions generated during construction of proposed LNG refueling terminal/station as an alternative to complying with the restricted idling time requirement. According to the California Energy Commission, LNG is "favored for heavy-duty applications, such as transit buses, train locomotives and long-haul semi-trucks." Compressed natural gas (CNG), on the other hand, is "used in light-duty passenger vehicles, pickup trucks, medium-duty delivery trucks and in transit and school buses." (as posted on the state of California's California Energy Commission website: http://www.consumerenergycenter.org/transportation/afv/naturalgas.html) According to Energy Conversions Inc, a manufacturer of alternative fuel systems for high output engines, "typically for freight locomotives, the preferred natural gas medium is LNG. Due to its density, five times more LNG can be stored in the same size container than CNG, saving space and making refueling less frequent." Accordingly, the locomotive fueled with LNG provides an 800-mile range which "far exceeds the 80-100 mile range that the same tender filled with CNG would provide." (http://www.energyconversions.com/tender.htm) Construction of the LNG terminal requires the installation of new equipment. Existing underground diesel fuel storage and dispensing tanks are expected to remain at the fueling locations for usage of those trains complying with the proposed rules by limiting idling time. Therefore, the construction activity to remove existing underground diesel fuel storage and dispensing tanks are not included in this analysis.

The SCAQMD then estimated the number of stations of each type that would be constructed each year to comply with the proposed railroad idling rules and the most likely number of each type that would be under construction at the same time. Finally, the maximum daily emissions from the construction of the LNG station were multiplied by the number anticipated to be constructed at the same time, and the results were added together to estimate total maximum daily emissions from station construction.

The SCAQMD assumed that construction of all of the new refueling stations would require an aboveground LNG storage tank to be added. The use of construction equipment to pour concrete slabs and install piping and hoses, as well as the construction worker trips to and from the construction site, will contribute to construction-related air quality impacts. During construction, combustion emissions and fugitive dust will be generated from the operation of heavy-duty equipment, material delivery trips, worker trips, portable equipment operation, concrete slab pouring, etc. Construction activities would also entail the use of portable equipment (e.g., generators) and hand held equipment by small construction crews to weld, cut, and grind metal structures.

Based upon the current requirements in the proposed railroad idling rules, construction activities could occur at each of the refueling stations. The SCAQMD estimated emissions for each of the construction activities on a daily basis to determine if the implementation of the proposed railroad idling rules would generate significant construction-related air quality impacts.

Number of Stations to be Constructed

The SCAQMD examined the number of current locations where locomotives fill up on diesel fuel. There are existing diesel fueling stations at each of the 19 known railyards in the district as well as smaller fueling stations scattered at various locations throughout the district. It would not be cost effective to build an LNG terminal at each of the smaller fueling stations but it might be reasonable to assume that an LNG terminal is constructed at each of the 19 railyards if the railroads choose this method of compliance. As noted above, it will be assumed the LNG terminal will constructed at the same location as the existing diesel fueling station as the fueling and delivery behavior of the locomotive is assumed to not change.

Compliance with the idling requirement in PR 3501 and 3502 takes effect six months from the date of adoption. The filing for an Emissions Equivalency Plan is required to take place 90 days before taking effect leaving the SCAQMD 90 days to approve or disapprove the Plan. The Plan should demonstrate equivalent emission reductions and the usage of an alternative fuel to operate a locomotive may provide compliance through the Plan. Therefore, the LNG station would need to be constructed in a "worst-case" timeframe of six months (compliance date to start reducing idling and anticipated time to apply for emission equivalency plan to by-pass idling reduction requirement), although it is not clear whether the applicant will be able to receive more time to construct. If operators of all 19 railyards chose to construct an LNG fueling station at their site, an average of three to four stations would need to be built each month before the idling requirement takes effect six months from the date of adoption of PR 3502. This is a "worst case" scenario since there is no deadline to applying for an emission equivalency plan. Since it could take three days to construct one LNG refueling station[1] and if three to four might be constructed 30 days (one month), the daily average number of stations being constructed on a given day is one.

[1] Final Program Environmental Assessment for Proposed Fleet Vehicle Rules and Related Rule Amendments (SCAQMD, June 5, 2000)

Onsite Refueling Station Construction Emissions

Number and Type of Construction Equipment

To estimate the peak daily emissions associated with the construction of the stations, the phases of construction (e.g., construction activities), the types of construction equipment, and the number of construction equipment must be determined. The SCAQMD relied on construction industry reference materials. Table D-1 lists the construction schedule and construction activities analyzed by the SCAQMD for constructing a single station of each type to determine the peak daily construction emissions.

TABLE D-1

Construction Equipment Needed for Each Phase of Activity to Construct LNG Station

LNG Refueling Station			
Construction Activity	**Type of Equipment**	**No. of Equip.**	**Work Crew**
Grading (Day 1)			4 Laborers
	Backhoe	1	1 Backhoe Op.
	Grader	1	1 Grader Op.
	Haul Truck	1	1 Truck Driver
Paving (Day 2)			3 Laborers
	Cement Truck	1	1 Truck Driver
	Paver	1	1 Paver Op.
	Paving Equipment	1	
LNG System Installation (Day 3)			4 Laborers
Pour Pad for LNG System	Cement Truck	1	2 Truck Drivers
All	Delivery/Haul Truck	1	1 Welder Op.
	Generator Set	1	
	Welder	1	

All = Miscellaneous activities performed by the designated type of equipment.
Op = Operators

For this air quality analysis, the SCAQMD assumed that each phase of construction would occur separately and sequentially. For example, slab pouring/paving would not commence until the grading was completed. The reason for this approach was to provide a worst case analysis of peak daily emissions.

Hours of Equipment Operation

The number of hours any piece of construction equipment operates in any one day is a component in estimating the daily mass emissions from construction activities. Hours of operation for various pieces of construction equipment during the various phases of construction were estimated from previous contractor experience with similar types of construction activities. If the total hours for a single piece of equipment exceeds eight hours, a default value of eight hours per day is used.

Once the SCAQMD used the aforementioned methodologies to estimate the number of pieces of construction equipment and the hours of operation of each piece of construction equipment, these values were used to determine the exhaust emissions and fugitive dust emissions generated from construction equipment associated with compliance equivalency as allowed in the proposed railroad idling rules. The following discussion provides the methodologies employed by the SCAQMD to determine the exhaust emissions and fugitive dust emissions generated from construction equipment.

Exhaust Emissions from Construction Equipment

The combustion of fuel, either gasoline or diesel, to provide power for the operation of various construction activities and equipment results in the generation of NOx, SOx, CO, VOC, and PM10 emissions. Heavy-duty off-road construction equipment required for grading, slab pouring/paving and tank installation generates exhaust emissions.

Composite off-road emission factors were developed for the SCAQMD by CARB from its Off-road Model and can be found on the SCAQMD website (http://www.aqmd.gov/ceqa/handbook/offroad/offroad.html). The composite off road emission factors were derived based on the equipment category (tractor, dozer, scraper, etc.), average fleet make-up for each year through 2020, vehicle population (number) in each equipment category by horsepower rating and load factor. Two types of composite emission factors have been developed - composite and horsepower-based composite factors. Composite emission factors have horsepower rating and load factors already built into the emission factors, so the user does not necessarily need to know these two parameters when calculating off-road mobile source emissions. Table D-2 outlines the composite emission factors for the specific off-road equipment used in calculating the emissions per construction equipment type based on year 2006 emission factors since the construction is expected to take place in year 2006 to comply with PR 3501 and 3502 deadlines.

TABLE D-2

Year 2006 Mobile Source Emission Factors for Specific Off-Road Construction Equipment

	Composite 2006 Emission Factors (pounds per hour)				
Off-road Construction Equipment	**CO**	**NOx**	**PM10**	**SOx**	**VOC**
Generator Sets	0.33	0.678	0.05	0.001	0.098
Graders	0.553	1.537	0.079	0.276	0.135
Pavers	0.442	0.849	0.062	0.165	0.109

Paving Equipment	0.414	0.934	0.067	0.144	0.11

TABLE D-2 (CONCLUDED)

Year 2006 Mobile Source Emission Factors for Specific Off-Road Construction Equipment

	Composite 2006 Emission Factors (pounds per hour)				
Off-road Construction Equipment	**CO**	**NOx**	**PM10**	**SOx**	**VOC**
Tractors/Loaders/Backhoes	0.421	0.834	0.084	0.115	0.128
Welders	0.234	0.326	0.034	0	0.081

To simplify calculating on-road mobile source emissions, the SCAQMD has derived mobile source emission factors using CARB's EMFAC 2002 (v2.2) BURDEN model which can be found on the SCAQMD website (http://www.aqmd.gov/ceqa/handbook/onroad/onroad.html). The emission factors were calculated by dividing the total daily district-wide emissions by total daily vehicle miles traveled to obtain emission factors in pounds per mile traveled. The emission factors have been derived by taking the weighted average of vehicle types and simplifying them into two categories – passenger/light-duty and medium-/heavy-duty vehicles (e.g., delivery trucks). These emission factors are used for typical land use projects where passenger/light-duty vehicles generate the majority of the vehicle trips. Some phases of the construction project, however, will require the need for a heavy-heavy-duty truck (HHDT) vehicle. HHDTs have a vehicle weight ranging between 33,001 to 60,000 pounds. Emission factors specifically for HHDTs have been extracted from CARB's Burden Model and developed by the SCAQMD to calculated truck emissions based on pounds per mile similarly to the mobile source emission factors discussed above. The specific HHDT emission factors can also be found on SCAQMD's website (http://www.aqmd.gov/ceqa/handbook/onroad/onroadHHDT05_25.xls). Since construction is expected to take place in year 2006, the emission factors for that year were used in the calculations. Passenger vehicle, delivery truck and heavy-heavy duty truck emission factors are listed in Table D-3 and are applied to the appropriate vehicle type used in the construction scenario to prepare the site as well as installing the LNG station.

TABLE D-3

Year 2006 Mobile Source Emission Factors for On-Road Construction Trucks and Employee Vehicles

	2006 Emission Factors (pounds per mile)				
On-Road Vehicles	**CO**	**NOx**	**PM10**	**SOx**	**VOC**
Employee Vehicle (light duty)	0.01393	0.00149	0.00008	0.00001	0.00150
Cement Truck (medium duty)	0.01914	0.02676	0.00048	0.00025	0.00278

Delivery/Haul Truck (with hoist) (heavy-heavy duty)	0.00593	0.03893	0.00073	0.00041	0.00132

Table D-4 provides the calculation for daily emissions from off-road and on-road equipment used in constructing one LNG station. The daily emissions for the off-road equipment are based on an eight hour work day and calculated using the following equation:

E = n x H x EF :where:

E = emission in pounds per day

n = number of pieces of equipment in a specified equipment category

H = hours per day of equipment operation

EF = the off-road mobile source emission factor by equipment category or horsepower-based equipment category in pounds per hour

The daily emissions for the on-road equipment are based on each employee traveling 20 miles each way to and from work. This approach assumes that each work crewmember drives his/her own vehicle to the construction site in the morning and back to his/her residence at the end of the day. No carpooling is assumed nor are other types of vehicle trips included (e.g., errands, lunch, etc.). The haul truck and the cement truck will each travel 50 miles per day (two trips at 25 miles each trip). The following equation is used to calculate exhaust emissions from on-road construction trucks and employee vehicles:

E = n x TL x EF :where:

E = emission in pounds per day

n = number of trips

TL = trip length (miles per day)

EF = emission factor (pounds per mile)

TABLE D-4

Construction Emissions from Off-Road Equipment and On-Road Vehicles to Construct One LNG Terminal

Schedule	Equipment Type	Number of Equipment	Operating Hours per Day	Total Miles Traveled per Day	CO	NOx	PM10	SOx	VOC
Day 1 - Grading	Backhoe	1	8	--	3.37	6.67	0.67	0.92	1.02
	Grader	1	8	--	4.42	12.30	0.63	2.21	1.08
	Haul Truck	1	--	50	0.30	1.95	0.04	0.02	0.07
	Employee Vehicles	4	--	160	2.23	0.24	0.01	0.00	0.24
TOTAL DAY 1 EMISSIONS					**10.32**	**21.15**	**1.35**	**3.15**	**2.41**
Day 2 – Paving	Cement Truck	1	--	50	0.96	1.34	0.02	0.01	0.14
	Paver	1	8	--	3.54	6.79	0.50	1.32	0.87
	Paving Equipment	1	8	--	3.31	7.47	0.54	1.15	0.88
	Employee Vehicles	3	--	120	1.67	0.18	0.01	0.00	0.18
TOTAL DAY 2 EMISSIONS					**9.48**	**15.78**	**1.07**	**2.49**	**2.07**
Day 3 - Installation	Cement Truck	1	--	50	0.96	1.34	0.02	0.01	0.14
	Delivery/Haul Truck	1	--	50	0.30	1.95	0.04	0.02	0.07
	Generator Set	1	8	--	2.64	1.79	0.09	0.00	0.00
	Welder	1	8	--	1.87	2.61	0.27	0.00	0.65
	Employee Vehicles	4	--	160	2.23	0.24	0.01	0.00	0.24
TOTAL DAY 3 EMISSIONS					**7.99**	**7.92**	**0.43**	**0.03**	**1.09**

Fugitive Dust (PM10) Emissions

Fugitive dust emissions generated during the construction phase can generally be classified into three major categories: demolition; site preparation (e.g., grading); and general construction. Demolition and site preparation include the use of heavy-duty construction equipment (e.g. backhoe) for excavation, concrete removal, backfill and grading, and slab pouring/paving. General construction activities entail the handling and transport of construction materials in conjunction with the actual physical installation of the equipment.

Although fugitive dust emissions from construction activities are temporary, they may have a significant impact on local air quality. Fugitive dust emissions often vary substantially from day to day, depending on the level of activity at the construction site, the specific operations, and the prevailing meteorological conditions. The following methodologies provide the predictive emission equations, emission factors, and default values used by the SCAQMD to calculate fugitive dust emissions for construction activities associated with the proposed railroad idling rules.

Emissions from Material Handling Activities

$$\text{Em} = \left(0.00112 \times (G/5)^{1.3} / (H/2)^{1.4}\right) \times (I/J)$$

Where :

$$\text{Em} = \text{Fugitive Dust Emissions}, \frac{\text{lbs}}{\text{day}}$$

$$\text{G} = \text{Mean Wind Speed, mph (See Table D-5)}$$

$$\text{H} = \text{Soil Moisture Content, \% (See Table D-5)}$$

$$\text{I} = \text{Dirt Handled or Stocked in Storage Pile, lbs (See Table D-5)}$$

$$\text{J} = \text{Conversion from pounds of dirt to tons of dirt, 2000}$$

Source: CEQA Handbook, Table A9-9-G, SCAQMD, 1993.

Emissions from Stock Pile Wind Erosion

$$Em = \left(0.85 \times \left(\frac{s}{1.5}\right) \times \left(\frac{365 - p}{235}\right) \times \left(\frac{UW}{15}\right)\right) \times A$$

Where :

Em = Fugitive Dust Emission, $\frac{lbs}{day}$

s = Material Silt Content, % (See Table D-5)

p = Number of Days with Rain $\geq$ 0.01 inches per year (See Table D-5)

UW = Percentage of Time That Unobstructed Wind Exceeds 12 mph (See Table D-5)

A = Area covered by Storage Pile, acre (See Table D-5)

Source: Fugitive Dust Background Document and Technical Information Document for Best Available Control Measures, EPA, September 1992.

Table D-5 provides the default values used by the SCAQMD in the above equations to estimate fugitive dust emissions generated during construction activities.

TABLE D-5

Default Values Used To Estimate Fugitive Dust Construction Emissions from the Installation of LNG Refueling Station

Variable	Value	Unit	Reference
Soil Silt Content, s	6.9	%	ASTM Test Method Default
Soil Moisture Content, M or H	15	%	SCAQMD 1993 CEQA Air Quality Hand Book
Soil Density, SD	2430	lbs/CY	Handbook of Solid Waste Management, Table 2.46
Mean Wind Speed, U or G	3.5	mph	A Climatological Air Quality Profile, Table XIII, SCAQMD, December 1981.
Mean Vehicle Speed, S	5	mph	SCAQMD Assumption
Mean Vehicle Weight (loaded), W			
Haul Truck	20	tons	CARB Vehicle Classifications
Cement Truck	15	tons	CARB Vehicle Classifications
Employee (light-duty trucks)	2.4	tons	CARB Vehicle Classifications
Mean Vehicle Wheels, w	4	per vehicle	SCAQMD Assumption
Silt Loading, SL	0.037	g/m^2	Final Report – Phase 1 PM10 Fugitive Dust Integration Project, Countess Environmental, July 1996.
Precipitation, p	34	inches/yr	SCAQMD Meteorological Records
Unobstructed Wind, UW	95	%	SCAQMD Assumption
Area Covered by Stockpile, A	0.018	acre	SCAQMD Assumption

Table D-6 provides that activity that will generate fugitive dust (PM) during the grading phase of the construction project.

TABLE D-6

Fugitive Dust Construction Emissions from the Installation of LNG Refueling Station

Activity	Equipment Type	Volume (cu.ft)/Area (acre)	Weight (tons/day)	Fugitive PM10 (lbs/day)	Source
Day 1 - Grading	Backhoe	--	180	0.00	SCAQMD CEQA Handbook, 1993, TableA9-9-G
	Stockpiling	0.018	--	0.01	Fugitive Dust Background and Technical Information Document for BACT, EPA, September 1992

The first phase of the construction activity, grading the site, will generate the highest daily exhaust emissions as demonstrated in Table D-4. The estimated fugitive dust emissions that will take place during the grading phase (as provided in Table D-6) are added to the exhaust emissions in Table D-7 to determine the peak daily emissions from the construction of one LNG station. These peak daily emissions are less than the SCAQMD's significance thresholds and, therefore, do not contribute to a significant adverse impact to air quality if LNG stations were installed at 19 locations over a six month period of time.

TABLE D-7

Peak Daily Construction Emissions (pounds per day) from the Installation of One LNG Refueling Station

	CO	NOx	PM10	SOx	VOC
Exhaust Emissions	10.32	21.15	1.35	3.15	2.41
Fugitive Dust	--	--	0.01	--	--
TOTAL	**10.32**	**21.15**	**1.36**	**3.15**	**2.41**
SCAQMD CEQA Significance Thresholds for Construction	550	100	150	150	75
Significant?	**No**	**No**	**No**	**No**	**No**

OPERATIONAL EMISSIONS (UNMITIGATED)

After construction is completed, the project becomes operational. Operational emissions are produced by the operation or occupancy of a facility or structure and by both stationary and mobile sources associated with its use. Stationary emissions may result from the use of equipment associated with manufacturing processes for example. Mobile source emissions result from motor vehicles.

Direct Operational Impacts

Potential operational-related air quality impacts could arise if off-site daily employee commuter and/or alternative clean fuel delivery trips associated with the implementation of the proposed railroad idling rules increase substantially. In the context of additional employee trips, long-term direct air quality impacts from the proposed railroad idling rules are not expected. It is envisioned that existing maintenance personnel will be properly trained in the operation, fueling, and maintenance of alternative clean-fueled locomotives (e.g., LNG) as well as fueling stations. Thus, the need for additional employees to perform these functions that would significantly increase the overall trips within the district is not expected to occur.

However, alternative clean fuel delivery trips will likely change for facilities that replace diesel switcher locomotives with LNG switcher locomotives due to the lower fuel value per gallon of LNG compared to diesel fuel.

The British thermal unit (Btu) per gallon of LNG is approximately 83,000 while the Btu per gallon of diesel is approximately 128,000. Thus, the fuel equivalents for LNG is approximately 1.54 (128,000/83,000). This means it would take 1.54 gallons of LNG to equal the energy content of one gallon of diesel. Thus, operators at affected railyards using LNG could require up to 54 percent more refilling trips than a facility currently using diesel. Similarly, the vehicles using these fuels may need to return to the fueling station up to 54 percent more often or will need to be equipped with larger fuel tanks. Diesel switcher locomotives currently consume approximately 50,000 gallons of diesel per year. Using the 1.54 equivalency to LNG, an LNG switcher locomotive would require 77,000 gallons of LNG fuel per year.

To estimate the number of intra-district locomotives that are equipped and are not equipped with anti-idling devices, the District staff used the ratio of intra-state locomotives that are equipped and are not equipped with anti-idling devices and applied the ratio to the total number of intra-district locomotives. Based on the data submitted to CARB by railroads (as part of the CARB 2005 Railroad MOU), the UP and BNSF had 238 and 176 intra-state locomotives in the state of California, respectively. Based on this data, the UP had 116 diesel locomotives with anti-idling and 122 locomotives without anti-idling device. The BNSF had four LNG locomotives, nine locomotives with anti-idling device and 163 without anti-idling device systems. Based on intrastate ratio of locomotives equipped and not equipped with anti-idling devices, of the 245 total intra-district locomotives, there is about 190 intra-district locomotives operation without anti-idling device systems. Out of the 190 locomotives, 97 belong to BNSF, 73 belong to UP, and the remaining 20 belong to PHL, respectively. Any locomotive which has already installed an anti-idling device would be in compliance with PR 3502 and, therefore, would not be replaced with an LNG switcher.

Assuming the unlikely occurrence that all 190 switcher locomotives in the Basin are replaced with LNG switchers, 14.6 million gallons of LNG would need to be transported annually. Assuming a typical truck transports 10,000 gallons of LNG fuel[2] per trip, the number of trucks needed to transport the LNG fuel is four per day (14.6 million gallons/10,000 gallons per truck/365 days per year = four trucks per day). These LNG trips will replace some of the existing diesel delivery trips as the diesel for the LNG locomotive would no longer be necessary. However, to provide a "worst case" scenario, a maximum increase of four LNG truck deliveries on a given day would result if LNG was used as an alternative fuel. Due to the fact that most LNG deliveries on the West Coast are transported by truck from Arizona, it is estimated that an LNG delivery truck could travel roundtrip up to 400 miles per day from the border of California to railyard.

The LNG will replace the need for diesel fuel and, thus, there would be a reduced number of diesel fuel delivery truck trips. Using the same assumptions as presented in the analysis of LNG delivery trucks, 50,000 gallons of diesel are used in a diesel switcher per year, 190 switcher locomotives would no longer use diesel fuel and the diesel delivery trips, which transport 10,000 gallon per trip, would be eliminated. Therefore, the number of trucks needed to transport the diesel fuel is three per day (50,000 gallons per year x 190 switchers/10,000 gallons per truck/365 days per year = 2.6 trucks per day). However, diesel fuel delivery trucks would not need to travel as far a distance as an LNG delivery truck. The assumption is that a diesel fuel delivery truck could travel roundtrip up to 100 miles per day. In order to account for the increase in delivery truck trips, the difference in the overall mileage traveled daily is calculated.

Three diesel deliver trucks each traveling 100 miles per day (300 miles/day) would be removed from the road if four LNG deliver trucks each traveling 400 miles per day (1,600 miles/day) will be added. Thus, the potential increased vehicle miles traveled is 1,300 miles per day. The operational emissions from LNG transport are calculated based on a heavy-heavy duty trucks delivering LNG fuel traveling a total of 1,300 miles per day. Using CARB's 2006 emission factors for heavy-heavy duty trucks will be a "worst-case" scenario since, due to state and federal requirements for ultra low sulfur diesel and future cleaner technology, the emission factors decrease over time as older vehicles are replaced by newer vehicles. Table D-8 outlines the exhaust emissions from the additional LNG delivery truck trips traveling 1,300 miles and takes into account the emission benefits from PR 3502 to provide the overall operational air quality impact from the proposed project. None of the daily emissions

[2] "Raley's LNG Truck Fleet: Final Results" (U.S. Department of Energy/National Renewable Energy Laboratory, March 2000)

exceed the SCAQMD operational significance thresholds and, thus, operational emissions from the proposed project are not significant.

TABLE D-8

Operational Emissions from an Increase of LNG Fuel Delivery Trips

	CO	**NOx**	**PM10**	**SOx**	**VOC**
2006 Heavy Heavy Duty Truck Emission Factors (pounds per mile)	0.0059	0.0389	0.0007	0.0004	0.0013
Increase Daily Exhaust Emissions due to Additional 1300 Miles Traveled (pounds per day)	**7.67**	**50.6**	**0.91**	**0.52**	**1.69**
SCAQMD CEQA Significance Thresholds for Operational (pounds per day)	550	55	150	150	75
Significant?	**No**	**No**	**No**	**No**	**No**

Example equation: 2006 emission factor (pounds per mile) x 1300 miles/day = daily exhaust emissions (pounds per day)