4.9 Air Quality and Climate

The air quality analysis presented here was completed to assess air pollutant emissions and impacts associated with the Proposed Action. SEA also considered the potential for the Proposed Action to impact local climate conditions through local land use changes, or to impact global climate through greenhouse gas (GHG) emissions. SEA met and consulted with EPA Region 5 staff in Chicago on several occasions to receive their input on the scope of the air quality analysis. Some elements of the following analysis, in particular the carbon monoxide (CO) and air toxics analyses for vehicles delayed near at-grade crossings, were prepared in response to EPA's concerns. The emissions analysis provided here accounts for the effects of EPA's locomotive emissions standards, first issued in 1998, and then tightened in 2008 (Federal Register, May 6, 2008). These emissions standards will dramatically reduce the emissions of air pollutants from diesel-powered freight and passenger locomotives, even after accounting for projected growth in rail freight and passenger movement.

Many Federal projects and actions are potentially subject to Conformity Rules, which were established to ensure that Federal actions do not impede states' efforts to attain or maintain compliance with national ambient air quality standards (NAAQS). The Transportation Conformity Rule (40 CFR 93, Subpart A) applies to certain federally-funded or federally-approved highway and mass transit projects. The General Conformity Rule potentially applies to all other types federally-funded or federally-approved projects (those not subject to Transportation Conformity Rules). The purpose of the General Conformity Rule is to ensure that federal activities do not interfere with emission budgets established by states, ensure that actions do not cause or contribute to new violations of the NAAQS (40 CFR 50), and ensure the attainment and maintenance of NAAQS (EPA 2008h).

The air quality analysis compares the total estimated annual changes in these operational emissions of each pollutant with the General Conformity *de minimis* emissions thresholds provided under 40 CFR 93, Subpart B. SEA used the General Conformity emissions thresholds (100 tons/year for all affected pollutants, given the existing attainment status and classification of each pollutant) as a measure to determine whether mitigation should be considered to minimize the subject emissions. The air quality analysis also included a hot-spot analysis for CO and mobile source air toxics (MSATs) to evaluate whether emissions due to motor vehicles idling at railroad crossings under the Proposed Action would exceed NAAQS or air toxics guidelines established by the EPA.

The analyses described above used emission factors taken from EPA-approved models or used federally-established emissions standards to estimate emissions for comparison to General Conformity *de minimis* thresholds, or to estimate concentrations for comparison to NAAQS.

The following is a summary of the findings presented in this section:

- SEA analyzed the extent to which air pollutant emissions in the greater Chicago metropolitan area could change as a result of the Proposed Action and associated construction activities. Emissions would increase because of an increase in fuel use due to the longer routes taken under the Proposed Action, although the gross-ton-mile efficiency of the system would be greatly improved because of more free-flowing operations, larger trains, and less train idling time. Emission changes for nitrogen oxides (NO_x) and volatile organic compounds (VOC), the pollutants of greatest concern for Chicago's ozone nonattainment area, would increase by approximately 19 tons and two tons per year, respectively, in 2010, due to construction activities expected as a result of the Proposed Action. In 2015, when operational changes are expected to be fully implemented, emission changes for NO_x and VOC would increase by approximately 374 tons and 26 tons, respectively, based on the Applicants' initial fuel use analysis accounting for only the projected changes in travel routes for CN trains. However, the Applicants' refined fuel use analysis, which accounts for reduced idling of CN trains, plus fuel savings by other carriers, means that net changes in NO_x and VOC emissions would be only 96 and 8 tons per year in 2015. Thus, estimated net increases in emissions for 2010 construction activities and 2015 operations, based on the revised fuel use analysis, are expected to be less than the General Conformity *de minimus* threshold of 100 tons per year, and are not expected to adversely affect the Chicago area's ability to bring the area into attainment with the NAAQS for ozone. [Section 4.9.3] The relocation of rail yard activity under the Proposed Action is not expected to have an adverse impact on the Illinois or Indiana State Implementation Plans for the attainment of NAAQS.

- SEA also conducted "hot spot" analyses for CO and mobile source air toxics (MSATs) to evaluate the air quality impacts of highway vehicles delayed at highway/rail at-grade rail crossings that would be affected by the Proposed Action. On the basis of that analysis, SEA concluded that no receptor sites would be expected to experience concentrations in excess of the current 1-hour or 8-hour NAAQS as a result of CO emissions. In addition, SEA concluded that the increase in MSATs represented a negligible cancer risk in the context of other cancer risks, and a negligible health risk for non-cancer effects. [Section 4.9.5]
- With respect to global climate change, SEA recognized that the Proposed Action's main potential contribution to global climate change would be through the emissions of greenhouse gases, primarily carbon dioxide. However, the net annual change in carbon dioxide emissions (0.0069 million metric tons of carbon dioxide) would be a minor fraction of the total carbon dioxide emissions in the U.S. and the world, equivalent to the annual carbon dioxide emissions output by 1,000 U.S. passenger vehicles annually.

4.9.1 Air Quality Methodology

The Board's environmental regulations at 49 CFR 1105.7(e)(5) address the factors to consider relating to air quality, and the criteria for determining when air analyses should be completed. Section 1105.79(e)(5)(i)(A) states that if a proposed action will result in "an increase in rail traffic of at least 100 percent (measured in gross ton miles annually) or an increase of at least eight trains a day on any segment of rail line affected by the proposal," the effect on air emissions must be quantified. Additionally, Section 1105.7(e)(5)(ii)(A) states that if a proposed action would affect a nonattainment area under the Clean Air Act, and would result in "an increase in rail traffic of at least 50 percent (measured in gross ton miles annually) or an increase of at least three trains a day on any segment of rail line," SEA will assess whether any expected increased emissions are within the parameters established by the State Implementation Plan under the Clean Air Act. Multiple track segments involved in the Proposed Action meet both of these criteria for a nonattainment area because all or parts of the ten counties in the Study Area are designated nonattainment for one or more pollutants of concern (refer to Section 3.9.1).

SEA's air quality analysis evaluated the direct impacts from locomotive and vehicular emissions within the region that would result from the No-Action Alternative, in comparison to emissions associated with the Proposed Action, for the following criteria pollutants: volatile organic compounds (VOC); carbon monoxide (CO); nitrogen oxides (NO_x); sulfur dioxide (SO_2); and two sizes of particulate matter (PM_{10} and $PM_{2.5}$). These pollutants were analyzed because they are EPA's primary indicators of air quality. The region-wide emissions changes are especially relevant to some pollutants, such as ozone, that are affected mostly by regional emissions as opposed to localized emissions. Ozone is affected by emissions of precursor pollutants, especially NO_x and VOC, over a large area. The term "precursor pollutants" refers to pollutants which react with sunlight and other chemicals to form ozone.

This section also includes a discussion of other operations-related air quality issues, including (stratospheric) ozone-depleting materials, which are transported on rail lines that would be affected by the Proposed Action, and hot-spot analyses for carbon monoxide and air toxics.

The air quality analysis also considers the emissions due to construction activities that would potentially occur as a result of the Proposed Action.

4.9.1.1 Operational Air Emissions Methodology

The operational air quality analysis is provided for 2015, consistent with the timeframe in the traffic analysis. In general, this year is expected to provide a maximum impact scenario for analysis of all emissions related to the Proposed Action for all pollutants of concern. This is primarily because of the rapid decreases in projected emissions from locomotives and other nonroad emissions resulting from EPA emission standards. EPA has promulgated emissions standards for new and rebuilt locomotives which result in progressively reduced emissions over time. Locomotive emissions, which make up the majority of emissions related to the Proposed Action, are expected to decrease in coming decades for the U.S. locomotive fleet (EPA 2008i). This analysis assumes that emissions from the Applicants' locomotive fleet will decrease at the same general rate as the overall U.S. fleet as projected by EPA.

Fuel Use Data - Original and Revised Figures

The specific method of calculating the operational air emissions is described in the next subsection. First, however, it is important for the reader to understand the overall operational fuel use data that are used in this analysis, because original, published information was later supplemented and revised by the Applicants.

For some aspects of the air quality analysis, two sets of emissions estimates were made to reflect data originally supplied by the Applicants, as well as to reflect revised data provided at SEA's request which considered fuel-savings benefits to foreign carriers as a result of improved connections and fuel-savings benefits due to less locomotive idling time. SEA initially requested that the Applicants provide fuel use changes based on its Operating Plan (Board 2008c). On March 26, 2008, the Applicants provided the requested fuel use information based on the Applicants' Operating Plan (Applicants 2008b). This is referred to as the "Original CN Fuel Use Estimates." The Applicants calculated the fuel use for the No-Action Alternative and the Proposed Action using the Train Performance Calculator (TPC). As part of SEA's review of the Operating Plan as described in Section 4.1, SEA confirmed and validated the fuel use information from the Applicants.

> **What is TPC?**
> A Train Performance Calculator (TPC) is an industry standard model that looks at the performance characteristics of a single train, such as trip duration, speed, fuel use, and fuel efficiency.

However, SEA then determined that the approaches used by the Applicants might not have factored in certain fuel use savings. Specifically, SEA was aware that the TPC did not calculate the reduction in locomotive idle time that would result from implementation of the Operating Plan, and that the Applicants did not estimate fuel savings for other carriers based on the change in the interchange location that would result under the Proposed Action. On April 14, 2008, SEA requested that the Applicants provide a best estimate of the fuel savings attributable to reduced locomotive idle time and foreign carrier savings (Board 2008d). On May 23, 2008, the Applicants provided SEA with the estimates referred to in this analysis as "Revised CN Fuel Use Estimates" (Applicants 2008l).

In addition to providing the fuel savings information, the "Revised CN Fuel Use Estimates" also reflect a change in the original number of active CN trains for the analysis year (2015). The "Original

CN Fuel Use Estimates" reflected the Operating Plan submitted by the Applicants with the application, which assumed that CN's Class I partners would negotiate changes in existing routing arrangements. However, one of CN's Class I partners (CSXT) has since informed CN that it is unwilling to change the current arrangement it has with CN regarding the routing of CSXT trains on CN's line in the Chicago area; therefore, the "Revised CN Fuel Use Estimates" reflect an adjustment in fuel consumption because two CSXT trains are now expected to remain on their current route (on segment CN-2) instead of moving on to the EJ&E line.

The emissions due to vehicular traffic delay affected by this change were not calculated in this air quality analysis because the analysis reflecting the Operating Plan is conservative for all public at-grade crossings along the EJ&E line. There are no public at-grade crossings along segment CN-2; therefore, allowing two CSXT trains to remain on this segment would not change the delay emissions analysis of the existing line on which these trains travel, and would slightly reduce the vehicle delay emissions for the EJ&E line.

Throughout this discussion of air quality impacts, where two sets of emissions estimates were made, to reflect both the Original and the Revised CN Fuel Use Estimates, tables are titled "Original Estimates" (for example, Table 4.9-1), and "Revised Estimates" (for example, Table 4.9-2). For some emissions and fuel-use components (i.e., idling fuel-use savings and other carrier fuel savings), there are no "Original" versions of the tables, because these components were not addressed in the original CN fuel use information transmittal.

Locomotive Emissions Calculations

SEA developed quantitative estimates of operation-related emissions changes associated with the Proposed Action for VOCs, CO, NO_x, SO_2, PM_{10}, and $PM_{2.5}$, which are criteria pollutants. SEA estimated emissions based on annual fuel use changes between CN and EJ&E rail line segments projected to occur as a result of the Proposed Action. Additionally, fuel use changes for other carriers operating on CN and EJ&E rail line segments were also considered. Finally, the reduction in fuel use resulting from reduced idling time by CN trains was also considered in the estimate of emissions changes (Applicants 2008j). For these fuel use changes, emission factors were calculated for 2015 based on EPA's nationwide rail emissions inventory (developed in the Regulatory Impact Analysis (RIA) for the 2008 locomotive emissions standards), coupled with Table 9 of a technical highlight document for the 1999 locomotive rule, which provides the expected fleet average emission factors for all locomotives (EPA 2008i and 1997). To update the Table 9 emission factors to fit the 2008 locomotive emission standards, SEA multiplied the emission factors listed in the referenced Table 9 by the yearly emissions from the RIA for the 2008 rule (the control case) and divided by the yearly emissions listed in the RIA for the 1997 rule (the baseline). This process of multiplying by the ratio of control case to baseline emissions, by pollutant, results in an estimate of the year-by-year emission factors in grams per gallon for the entire fleet of locomotives under the 2008 rule (EPA 2008i).

SEA used No-Action and Proposed Action fuel use quantities to estimate emissions, using estimated gram/gallon emission factors calculated as described above. SEA used the following equation to estimate emissions from line-haul operations:

Annual Emissions (ER) = E x FC

where:

ER	=	Annual emissions by pollutant, in grams/year, which was then converted to tons/year.
E	=	Estimated fleet-average emission factor, in grams/gallon.

FC = Estimated annual fuel consumption for line-haul locomotives during operation, in gallons/year.

Vehicle Idling Emissions Calculations

As part of the air quality analysis, SEA developed a quantitative estimate of emissions associated with the combustion of fuel by vehicles delayed at highway/rail at-grade crossings. SEA estimated emissions caused by delayed highway vehicles at all public at-grade crossings potentially affected by the Proposed Action for all criteria pollutants. SEA used the estimated vehicle delay time in combination with the number of days per year, annual average daily traffic volume (AADT), and fleet average emission factors to estimate the increase in air emissions from delayed idling vehicles. The vehicle delay time was estimated as shown in Section 4.3.1 of this document.

The 2015 fleet-average emission factors in grams/vehicle-hour were obtained for this analysis from EPA's MOBILE6.2 emission factor (EF) model (EPA 2003b). SEA used the MOBILE6.2 model to obtain emissions factors in units of grams per vehicle-mile at a speed of 2.5 mph, and then multiplied those numbers by 2.5 mph to produce an emissions factor representative of an idling vehicle in units of grams of pollutant per vehicle-hour of operation. As input to MOBILE6.2, SEA used local average temperatures based on climate data, and local data on Reid Vapor Pressure. For all other MOBILE6.2 inputs, SEA used national default values that have been developed by EPA and which are already incorporated in the MOBILE6.2 input files.

SEA converted values of grams/year (shown as "E" in the following equation) to tons/year as appropriate.

$$E \text{ (grams/yr)} = D_{an} \text{ (vehicle-hours/yr)} \times EF \text{ (grams/vehicle-hour)}$$

4.9.1.2 Construction-Related Air Emissions Calculations

For its analysis, SEA assumed that construction-related emissions would occur over a three-year period between 2009 and 2011 and would occur evenly across the three-year time frame. SEA developed a quantitative estimate of the emissions associated with the construction phase of the Proposed Action for all criteria pollutants. Information on the duration of the construction activities, hours of use of construction and support equipment, and the surface area that would be disturbed was compiled for use in the estimate of construction emissions. The duration of construction activities was taken from data provided by the Applicants, indicating that construction would occur over multiple construction seasons, which for the purposes of this analysis SEA has assumed would take place between 2009 and 2011. This analysis assumed that the hours of construction would be evenly distributed across all three years. The type, size (horsepower), and hours of equipment operation for SEA's analysis were developed using engineering estimates based on industry experience for the type of construction being proposed. Appendix K shows the total hours of operation for each piece of equipment expected to be used for construction activities. The surface area to be disturbed was estimated using geographic information systems (GIS) mapping of the potential construction areas.

SEA estimated construction-related emissions from off-road equipment and a switch locomotive that would be used for handling construction materials. Off-road diesel equipment was assumed to include ballast compactors, ballast regulators, ballast tampers, portable rail drills, portable rail saws (gasoline), self-propelled anchor applicators, track crane (i.e., speed swing), backhoes/loaders, bulldozers, compactors, excavators, generators, graders, rollers/compactors, construction trucks, and haul trucks.

SEA used emission factors produced by the EPA's NONROAD2005 model (Version 2005.1.0) and graphical user interface. NONROAD2005, which links to information in the NONROAD emission inventory model, is a software tool for predicting emissions from small and large nonroad vehicles, equipment, and engines (EPA 2006a). The various option settings for temperature, Reid Vapor Pressure (RVP), and gasoline and diesel sulfur content within NONROAD2005 can be found in Appendix K. For fugitive particulate emissions (that is, for dust emissions not coming from a fixed exhaust point), SEA used emission factors taken from documents prepared for the Western Regional Air Partnership (WRAP) (Countess Environmental 2004; Midwest Research Institute 2005).

For activities associated with construction, SEA estimated the annual emissions for all pollutants using the following equation:

Annual Emissions (ER) = H x B x EF

where:

ER	=	Annual emissions by pollutant, in grams/year, which was then converted to tons/year.
H	=	Total annual unit hours of equipment use. Load factors, a fraction of load based on the estimate of hours of usage per year, fuel consumption per year, and fuel consumption rate at rated power for each engine in the field that was surveyed, are included within NONROAD2005. In-use adjustment factors, which represent operational behavior of nonroad equipment unlike the steady-state testing procedures used in emissions testing, are also included.
B	=	Brake horsepower rating, or bhp. The rating is determined by nonroad equipment type.
EF	=	Exhaust emission factor by pollutant, as appropriate, in grams per bhp-hour (g/bhp-hr). For VOCs, the emission factor includes contributions from emissions other than exhaust, including crankcase, diurnal loss, hot soak, running loss, tank and hose permeation, vapor displacement, and spillage emissions. These types of emissions do not exist for other pollutants analyzed.

For fugitive particulate emissions associated with construction, SEA estimated the annual emissions using the following equation:

Annual Emissions (ER) = SA x SF x EF x 12/M

where:

ER	=	Annual emissions by pollutant, in tons/year.
SA	=	Surface area of a given area of anticipated construction, in acres.
SF	=	Scaling factor for each location, in months. This is calculated by dividing SA by the total sum of all SA values to determine a percentage of total construction time required for each location, and multiplied by M.
EF	=	Exhaust emission factor by pollutant, as appropriate, in tons/acre/month.
M	=	Total months estimated to complete construction at all locations. For this project, M is assumed to be 36 months.

4.9.2 No-Action Alternative

The air emissions analysis focuses on the net change in emissions between the No-Action and Proposed Action alternatives. The net change represents the emissions attributable to the Proposed Action. Therefore, the meaningful presentation of analysis results requires that the No-Action and the Proposed Action emissions be displayed together for direct comparison. For this reason, all analysis results, for both the No-Action Alternative and the Proposed Action, are discussed together in the Proposed Action section below (Section 4.9.3).

The No-Action Alternative would not result in any construction activities. Therefore, construction-related emissions described in Section 4.9.3.2 for the Proposed Action would not occur under the No-Action scenario.

4.9.3 Proposed Action

4.9.3.1 Proposed Changes in Rail Line Operations

Air Emissions from Locomotives

Table 4.9-1, Table 4.9-2,Table 4.9-3, and Table 4.9-4, below, summarize the estimates for emissions related to No-Action and the Proposed Action operations of CN trains, operations of other carriers on CN and EJ&E lines, and locomotive idling times. As described previously in Section 4.9.1.1, the tables titled "Original Estimates" represent data based on the Original CN Fuel Use Estimates, while the tables titled "Revised Estimates" represent data based on the Revised CN Fuel Use Estimates (refer to Fuel Use Data under Section 4.9.1.1). For some emissions and fuel use components (i.e., idling fuel-use savings and foreign carrier fuel savings), there are no "Original" versions of the tables, because these components were not addressed in the Original CN fuel use information transmittal (for example, Table 4.9-3 and Table 4.9-4 below).

Emissions for 2015 would increase under the Proposed Action compared with the No-Action Alternative, because of an increase in fuel use due to the longer routes taken under the Proposed Action. The longer routes would be a result of the Proposed Action moving trains from a more direct route through the Chicago metropolitan area to a route which goes around the Chicago metropolitan area, traveling more miles and using more fuel. However, the gross-ton-mile efficiency of the CN system would be greatly improved under the Proposed Action, due to more free-flowing operations, longer trains, and less idling time. Section 4.8, Energy discusses this concept in greater detail.

Table 4.9-1. Emissions Caused By Active Operations Of CN Trains – Original Estimates

Pollutant	No-Action Fuel Use[a] (gal)	Proposed Action Fuel Use[a] (gal)	2015 E.F. (g/gal)	2015 No-Action Emissions (tons/yr)	2015 Proposed Action Emissions (tons/yr)
VOC	5,121,203	7,598,663	8.95	50.5	75.0
CO			27.40	154.7	229.5
NO_x			136.73	771.8	1145.2
SO_2			0.10	0.56	0.84
PM_{10}			4.38	24.7	36.7
$PM_{2.5}$			4.25	24.0	35.6

Notes:

[a] Fuel use is total projected use, in gallons, under expected No-Action and Proposed Action operation alternatives, with full implementation of the Applicants' Operating Plan in 2015 under the Proposed Action scenario.

Table 4.9-2. Emissions Caused by Active Operations of CN Trains – Revised Estimates					
Pollutant	No-Action Fuel Use[a] (gal)	Proposed Action Fuel Use[a] (gal)	2015 E.F. (g/gal)	2015 No-Action Emissions (tons/yr)	2015 Proposed Action Emissions (tons/yr)
VOC	5,121,418	7,026,553	8.95	50.5	69.3
CO			27.40	154.7	212.2
NO_x			136.73	771.9	1059.0
SO_2			0.10	0.56	0.77
PM_{10}			4.38	24.7	33.9
$PM_{2.5}$			4.25	24.0	32.9

Notes:
[a] Fuel use is total projected use, in gallons, under expected No-Action and Proposed Action operation alternatives, with full implementation of the Applicants' Operating Plan in 2015 under the Proposed Action scenario.

Table 4.9-3. Emissions Caused by Active and Idling Operations of Other Carriers – Revised Estimates					
Pollutant	No-Action Fuel Use[a] (gal)	Proposed Action Fuel Use[a] (gal)	2015 E.F. (g/gal)	2015 No-Action Emissions (tons/yr)	2015 Proposed Action Emissions (tons/yr)
VOC	1,345,781	434,420	8.95	13.3	4.3
CO			27.40	40.6	13.1
NO_x			136.73	202.8	65.5
SO_2			0.10	0.15	0.05
PM_{10}			4.38	6.5	2.1
$PM_{2.5}$			4.25	6.3	2.0

Notes:
[a] Fuel use is total projected use, in gallons, under expected No-Action and Proposed Action operation alternatives, with full implementation of the Applicants' Operating Plan in 2015 under the Proposed Action scenario.

Table 4.9-4. Emissions Caused by Idling of CN Trains – Revised Estimates					
Pollutant	No-Action Fuel Use[a] (gal)	Proposed Action Fuel Use[a] (gal)	2015 E.F. (g/gal)	2015 No-Action Emissions (tons/yr)	2015 Proposed Action Emissions (tons/yr)
VOC	577,327	214,799	8.95	5.7	2.1
CO			27.40	17.4	6.5
NO_x			136.73	87.0	32.4
SO_2			0.10	0.06	0.02
PM_{10}			4.38	2.8	1.0
$PM_{2.5}$			4.25	2.7	1.0

Notes:

[a] Fuel use is total projected use, in gallons, under expected No-Action and Proposed Action operation alternatives, with full implementation of the Applicants' Operating Plan in 2015 under the Proposed Action scenario.

Air Emissions from Vehicle Idling at Highway/Rail At-Grade Crossings

Table 4.9-5 shows a summary of the calculation of No-Action and Proposed Action hours of idling along intersections crossing both CN and EJ&E lines, and the net increase of idling hours under the Proposed Action. Table 4.9-6 summarizes the estimates for emissions related to No-Action and Proposed Action idling traffic. These results are based on the Original CN train numbers and lengths, and do not address the slightly lower vehicle idling emissions that would occur if the two CSXT trains discussed earlier (Section 4.9.1.1) remain on their existing route. Vehicle delay emissions for 2015 would increase under the Proposed Action compared with No-Action, because of the re-routing of longer CN trains to a longer route, which has more public at-grade intersections than the current CN lines.

Emissions of SO_2 from vehicles delayed near at-grade crossings are extremely low because of the ultra-low sulfur content mandated for on-road gasoline and diesel-fueled vehicles.

Table 4.9-5. Traffic Delay 2015 Idling Hours			
Scenario	Hours of Vehicle Idling on EJ&E Lines	Hours of Vehicle Idling on CN Lines	Total Hours of Vehicle Idling on All Lines
No-Action 2015	102,103	582,706	684,809
Proposed Action 2015	752,843	116,823	869,666
Net change 2015	650,740	(465,882)	184,857

Table 4.9-6. Traffic Delay 2015 Exhaust Emissions							
Pollutant	No-Action Total Idling Hours (2015)	Proposed Action Total Idling Hours (2015)	Net Change in Total Idling Hours (2015)	2015 E.F. (g/hr)	2015 No-Action Emissions (tons/yr)	2015 Proposed Action Emissions (tons/yr)	2015 Change in Emissions (tons/yr)
VOC	684,809	869,666	184,857	8.46	6.4	8.1	1.7
CO				66.73	50.4	64.0	13.6
NO_x				3.29	2.5	3.2	0.7
SO_2				0.023	0.017	0.022	0.005
PM_{10}				0.028	0.021	0.027	0.006
$PM_{2.5}$				0.026	0.020	0.025	0.005

Air Emissions from Truck-to-Rail Diversions

There is no expected growth in rail-related freight transport attributed to the Proposed Action, and therefore, there would be no resulting diversion to rail of freight that would otherwise be carried by over-the-road trucks.

Net Change in Operational Emissions from Proposed Action Compared with No-Action Alternative

SEA totaled the annual net changes in locomotive and vehicle idling emissions, positive and negative, for the Proposed Action and No-Action Alternative, to provide estimates, pollutant by pollutant, of net changes in regional emissions associated with the Proposed Action. For the Proposed Action, the net change in emissions was evaluated over a region to include the greater Chicago metropolitan area, including those counties that are designated as nonattainment with respect to the ozone and $PM_{2.5}$ National Ambient Air Quality Standards (NAAQS). The Chicago regional ozone nonattainment area was selected as the air-quality study area because the pollutant of greatest concern based on emission levels from the above activities, together with potential for adverse impact on air quality, is $NO_{x,}$ which is an ozone precursor. It is therefore the criteria pollutant of greatest concern with respect to the Proposed Action.

SEA compared the total estimated annual changes in these operational emissions of each pollutant with the General Conformity *de minimis* emissions thresholds provided under 40 CFR 93, Subpart B. While General Conformity rules are not applicable to the operational emissions that may result from the Board's possible approval of this action (because they do not have authority over the operation of the rail line), SEA used the General Conformity emissions thresholds (100 tons/year for all affected pollutants, given the existing attainment status and classification of each pollutant) as a measure to determine whether mitigation should be considered to minimize the subject emissions. Tables 4.9-6a through 4.9-11b, below summarize the total operational emissions changes attributable to the Proposed Action for each pollutant.

As shown on Table 4.9-11, operational emissions changes exceed the General Conformity emissions thresholds for NO_x when calculated using the Original CN Fuel Use Estimates. However, after accounting for fuel and emissions reductions due to reduced idling, and fuel and emissions reductions due to improvements in movement of other carriers' freight trains (Table 4.9-12), changes in NO_x

emissions would be below the thresholds. Changes in operational emissions of all other affected pollutants would also be below the General Conformity thresholds.

Table 4.9-7. Net 2015 VOC Operational Emissions (tons/yr) – Original Estimates				
Category	Source	No-Action Emissions (2015)	Proposed Action Emissions (2015)	Net Change in Emissions (2015)
Operations	CN active trains	50.5	75.0	24.5
	Other active and idling trains	no data	no data	no data
	CN idling trains	no data	no data	no data
Intersection delay	Vehicle idling	6.4	8.1	1.7
Total		**56.9**	**83.1**	**26.2**

Table 4.9-8. Net 2015 VOC Operational Emissions (tons/yr) – Revised Estimates				
Category	Source	No-Action Emissions (2015)	Proposed Action Emissions (2015)	Net Change in Emissions (2015)
Operations	CN active trains	50.5	69.3	18.8
	Other active and idling trains	13.3	4.3	(9.0)
	CN idling trains	5.7	2.1	(3.6)
Intersection delay	Vehicle idling	6.4	8.1	1.7
Total		**75.9**	**83.8**	**7.9**

Table 4.9-9. Net 2015 CO Operational Emissions (tons/yr) – Original Estimates				
Category	Source	No-Action Emissions (2015)	Proposed Action Emissions (2015)	Net Change in Emissions (2015)
Operations	CN active trains	154.7	229.5	74.8
	Other active and idling trains	no data	no data	no data
	CN idling trains	no data	no data	no data
Intersection delay	Vehicle idling	50.4	64.0	13.6
Total		**205.1**	**293.5**	**88.4**

Table 4.9-10. Net 2015 CO Operational Emissions (tons/yr) – Revised Estimates				
Category	Source	No-Action Emissions (2015)	Proposed Action Emissions (2015)	Net Change in Emissions (2015)
Operations	CN active trains	154.7	212.2	57.5
	Other active and idling trains	40.6	13.1	(27.5)
	CN idling trains	17.4	6.5	(10.9)
Intersection delay	Vehicle idling	50.4	64.0	13.6
Total		263.1	295.8	32.7

Table 4.9-11. Net 2015 NO_x Operational Emissions (tons/yr) – Original Estimates				
Category	Source	No-Action Emissions (2015)	Proposed Action Emissions (2015)	Net Change in Emissions (2015)
Operations	CN active trains	771.8	1145.2	373.4
	Other active and idling trains	no data	no data	no data
	CN idling trains	no data	no data	no data
Intersection delay	Vehicle idling	2.5	3.2	0.7
Total		774.3	1148.4	374.1

Table 4.9-12. Net 2015 NO_x Operational Emissions (tons/yr) – Revised Estimates				
Category	Source	No-Action Emissions (2015)	Proposed Action Emissions (2015)	Net Change in Emissions (2015)
Operations	CN active trains	771.9	1059.0	287.1
	Other active and idling trains	202.8	65.5	(137.4)
	CN idling trains	87.0	32.4	(54.6)
Intersection delay	Vehicle idling	2.5	3.2	0.7
Total		1064.2	1160.1	95.8

Table 4.9-13. Net 2015 SO_2 Operational Emissions (tons/yr) – Original Estimates				
Category	**Source**	**No-Action Emissions (2015)**	**Proposed Action Emissions (2015)**	**Net Change in Emissions (2015)**
Operations	CN active trains	0.56	0.84	0.28
	Other active and idling trains	no data	no data	no data
	CN idling trains	no data	no data	no data
Intersection delay	Vehicle idling	0.017	0.022	0.005
Total		**0.058**	**0.86**	**0.29**

Table 4.9-14. Net 2015 SO_2 Operational Emissions (tons/yr) – Revised Estimates				
Category	**Source**	**No-Action Emissions (2015)**	**Proposed Action Emissions (2015)**	**Net Change in Emissions (2015)**
Operations	CN active trains	0.56	0.77	0.21
	Other active and idling trains	0.15	0.05	(0.10)
	CN idling trains	0.06	0.02	(0.04)
Intersection delay	Vehicle idling	0.017	0.022	0.005
Total		**0.79**	**0.86**	**0.08**

Table 4.9-15. Net 2015 PM_{10} Operational Emissions (tons/yr) – Original Estimates				
Category	**Source**	**No-Action Emissions (2015)**	**Proposed Action Emissions (2015)**	**Net Change in Emissions (2015)**
Operations	CN active trains	24.7	36.7	12.0
	Other active and idling trains	no data	no data	no data
	CN idling trains	no data	no data	no data
Intersection delay	Vehicle idling	0.021	0.027	0.006
Total		**24.7**	**36.7**	**12.0**

Table 4.9-16. Net 2015 PM_{10} Operational Emissions (tons/yr) – Revised Estimates				
Category	**Source**	**No-Action Emissions (2015)**	**Proposed Action Emissions (2015)**	**Net Change in Emissions (2015)**
Operations	CN active trains	24.7	33.9	9.20
	Other active and idling trains	6.5	2.1	(4.4)
	CN idling trains	2.8	1.0	(1.8)
Intersection delay	Vehicle idling	0.021	0.027	0.006
Total		**34.0**	**37.0**	**3.0**

Table 4.9-17. Net 2015 $PM_{2.5}$ Operational Emissions (tons/yr) – Original Estimates				
Category	**Source**	**No-Action Emissions (2015)**	**Proposed Action Emissions (2015)**	**Net Change in Emissions (2015)**
Operations	CN active trains	24.0	35.6	11.6
	Other active and idling trains	no data	no data	no data
	CN idling trains	no data	no data	no data
Intersection delay	Vehicle idling	0.020	0.025	0.005
Total		**24.0**	**35.6**	**11.6**

Table 4.9-18. Net 2015 $PM_{2.5}$ Operational Emissions (tons/yr) – Revised Estimates				
Category	**Source**	**No-Action Emissions (2015)**	**Proposed Action Emissions (2015)**	**Net Change in Emissions (2015)**
Operations	CN active trains	24.0	32.9	8.9
	Other active and idling trains	6.3	2.0	(4.3)
	CN idling trains	2.7	1.0	(1.7)
Intersection delay	Vehicle idling	0.020	0.025	0.005
Total		**33.0**	**35.9**	**2.9**

Conclusions

SEA's evaluation of emissions changes arising from the transaction encompasses CN train emission increases from the longer distances traveled by CN trains which would travel on the EJ&E around the periphery of Chicago rather than through the central part of the city and vehicle related emissions increases from additional delay vehicles may experience due to increased frequency of blocked crossings on the EJ&E due to increased train traffic. In addition SEA's evaluation also included changes due to reduced congestion of train traffic in central Chicago such as reduced idling time for trains in Central Chicago and reduced train travel distances for interchanging trains with other railroads. Information provided by CN in their revised submittal of fuel use information, from which emissions changes are derived, also included reduced fuel use for two less trains which would travel on the EJ&E, than CN's operating plan reflects, due to CN's inability to negotiate a new interchange point with CSX. Therefore, those two trains will continue to go through central Chicago.

Table 4.9-19 presents emissions changes estimated from Applicant's original operating plan train traffic redistribution and from their revised information submittal which accounts for fuel use reductions due to decreased congestion in Central Chicago and other fuel savings described above. Emissions estimates for vehicle idling at highway /rail at-grade crossings are also included.

Table 4.9-19. Transaction-Related Emissions Changes.

	Original Operating Plan & Vehicles - 2015 (Tons Per Year)			Revised Fuel Use Including Fuel Savings - 2015 (Tons Per Year)		
	Trains	Vehicles	Total	Trains	Vehicles	Total
VOC	24.5	1.7	26.2	6.2	1.7	7.9
CO	74.8	13.6	88.4	19.1	13.6	32.7
NO_x	373.4	0.7	374.1	95.1	0.7	95.8
SO_2	0.28	0.005	0.291	0.07	0.005	0.08
PM_{10}	12.0	0.006	12.0	3.0	0.006	3.0
$PM_{2.5}$	11.6	0.005	11.6	2.9	0.005	2.9

Therefore, while transaction related emissions changes do result in a net increase in emissions of criteria pollutants, emissions increases for SO_2, PM_{10} and $PM_{2.5}$ are fairly minimal. Emissions increases for carbon dioxide are quite modest. And emissions increases for VOC's and NOx are under air quality general conformity *de minimus* thresholds.

Ozone-Depleting Materials

Two chemicals classified as stratospheric ozone-depleting materials by EPA are transported on rail segments that would be affected by the Proposed Action. Table 4.9-20 shows the chemicals, quantities shipped, and segments affected. Section 4.2, Rail Safety, and Section 4.3, Hazardous Materials, give information on safety practices (including speed restrictions), the Applicants' safety record on derailments, accidents and spills, and contingency plans to deal with accidental spills. Section 4.3 also includes a table of statistics on train accidents and calculates the likelihood of an accident involving hazardous materials and the accidental releases of those materials caused by collision or derailment. These calculations can be conservatively used to express the likelihood of an accidental release of ozone-depleting materials in the event of a collision or derailment.

The Proposed Action would not change the amounts of ozone-depleting materials transported, but would change their route through the Chicago area.

Table 4.9-20. Ozone-Depleting Materials Transported on Rail Segments That Would Be Affected by the Proposed Action

Chemical Formula	Chemical Name	HazMat Code[a]	Segments	Quantity Shipped (trains/day)	EPA Category[b]
CCl_4	Carbon Tetrachloride	4921831	CN-19, CN-20, CN-21, CN-22	0.0027	Group I, Class IV

C_3H_6FBr	Bromofluoropropane	4905419	CN-16, CN-19, CN-20, CN-21, CN-22, CN-23A, CN-23B, CN-24, CN-25, CN-26	0.0137, 0.0356, 0.0082, 0.0274	Group I, Class VII
C_3H_6FBr	Bromofluoropropane	4905421	CN-10, CN-16, CN-19, CN-21, CN-22, CN-23A, CN-23B, CN-24, CN-25	0.5068, 0.1507, 0.3589, 0.0027	Group I, Class VII
C_3H_6FBr	Bromofluoropropane	4905781	CN-2, CN-21, CN-22, CN-23A, CN-23B, CN-24, CN-25	0.0027, 0.0055	Group I, Class VII
C_3H_6FBr	Bromofluoropropane	4905791	CN-3, CN-4, CN-5, CN-6, CN-7, CN-8, CN-23A, CN-23B, CN-24	0.0027	Group I, Class VII

Notes:

[a] Hazardous material codes differ for the same chemical, depending on its intended use, so bromofluoropropane is shown under four separate codes based on different uses for chemicals shipped.

[b] As shown in EPA (2008j), "Ozone-depleting Substances," *Ozone Layer Depletion - Science*, retrieved on June 26, 2008, http://www.epa.gov/ozone/science/ods/index.html.

Hot-Spot Analyses

At the request of EPA Region V, SEA conducted a hot-spot analysis as part of the air quality evaluation of the Proposed Action. The purpose of this analysis was to evaluate the air quality impacts of highway vehicles delayed at highway/rail at-grade crossings affected by the Proposed Action. SEA conducted the hot-spot analysis for both carbon monoxide (CO) and mobile source air toxics (MSATs).

The hot-spot modeling analysis used an EPA dispersion model for roadways known as CAL3QHC, which estimates the combined impacts of both moving and stopped (idling) traffic. This model is publicly available through EPA's Support Center for Regulatory Atmospheric Modeling website (EPA 2008k). The Proposed Action would not increase the total daily vehicle volumes on the subject roadways. Therefore, the impacts from the moving traffic are part of the existing environment. Also, because there is already some rail traffic through the subject highway/rail at-grade crossings, a portion of the idling emissions analyzed in this assessment are part of the existing environment. Thus, this analysis provides estimated air quality impacts that are the sum of impacts from existing moving traffic, existing idling traffic, and new/added idling traffic attributable to the Proposed Action.

Carbon Monoxide

The carbon monoxide (CO) analysis evaluates impacts of motor vehicle traffic delayed by trains at public at-grade crossings on the ambient air surrounding the crossing. Prior to the analysis of CO impacts, at-grade crossings affected by the Proposed Action were reviewed to determine which crossings should undergo a hot-spot analysis. Intersections were reviewed based on Level of Service (LOS) to identify the most congested crossings for analysis. Three crossings on the existing EJ&E line (Washington in Joliet, Will County, IL, Woodruff in Joliet, Will County, IL, and North Rowell in Joliet, Will County, IL) that would be affected by the Proposed Action are expected to have LOS D or worse for the year of analysis (2015). These are the same criteria used to identify intersections of analysis for projects subject to Transportation Conformity requirements (40 CFR 93, Subpart A). The North Rowell crossing was removed from consideration because the number of trains in the Proposed Action was equal to the number of trains at the Washington crossing, while the volume of traffic and blocked crossing time was less than at the Washington crossing. Less blocked crossing time and less traffic means less emissions compared to the Washington crossing, which means if the Washington crossing complies with air quality standards, the North Rowell crossing will also comply with air quality standards. Therefore, the Washington crossing is a more conservative crossing from an air quality perspective. Additionally, because crossings and intersections with high average daily traffic (ADT) counts often have greater impact than a crossing with LOS D, E, or F or worse and a low ADT, all crossings on the existing EJ&E line were sorted to identify the crossing with the greatest average daily traffic (ADT). Ogden Avenue (near Aurora, DuPage County, IL) was the crossing identified as having the greatest ADT of all crossings on the existing EJ&E line. The Ogden Avenue crossing was added to the analysis as a conservative measure because the criteria used to identify intersections for analysis does not always capture the intersection with the greatest impact

The analysis of CO impacts used two EPA-approved air quality models for modeling traffic impacts in 2015. The MOBILE6.2 vehicle emissions model was used to estimate year 2015 average vehicle CO emissions on roadways at each crossing. The output from MOBILE6.2 was then input into the CAL3QHC atmospheric dispersion model, which was used to predict the maximum CO concentrations at the studied crossings. The CAL3QHC dispersion modeling analysis of the projected 2015 Proposed Action conditions was completed for each crossing identified. The projected 2015 traffic levels input to the CAL3QHC dispersion model were defined in Section 4.3.1. Roadway geometrics, including number of lanes present at each crossing and the physical layout of the lanes, were determined using CALRoads View, a Windows-based front-end software package for the CAL3QHC dispersion model, and publicly available aerial photography for each crossing (Lakes Environmental Software 2007).

MOBILE6.2 Emissions Modeling. A MOBILE6.2 model run was performed to estimate fleet-average CO emission rates for the roadway segments at the analyzed intersections under both free flow and queuing conditions. MOBILE6.2 model results were obtained for the analysis year (2015), for each of the vehicle speeds necessary (2.5 mph for queuing, 30 mph for free flow traffic at the Washington and Woodruff crossings, 45 mph for free flow traffic at the Ogden crossing). MOBILE6.2 model inputs used national default data for vehicle fleet mix, and temperature and RVP data which reflect local conditions.

The MOBILE6.2 model results for CO emissions are summarized in Table 4.9-21. The idling emission factors shown were converted to grams/per-vehicle hour by multiplying the equivalent idling speed (2.5 mph) by the MOBILE5b output value, which is presented in grams/per-vehicle mile. Converting the queuing emissions factor to grams/vehicle-hour was necessary for input into the CAL3QHC model.

Table 4.9-21. MOBILE6.2 CO Emission Rates

Year Analyzed	Vehicle Speed (MPH)	CO Emission Rate
2015	Idle	66.75 g/Veh-Hr
2015	30	9.7 g/Veh-Mi
2015	45	10.3 g/Veh-Mi

CAL3QHC Dispersion Modeling. CAL3QHC is an EPA model used to predict CO pollutant concentrations from motor vehicles on roadways. This model is publicly available through EPA's Support Center for Regulatory Atmospheric Modeling website (EPA 2008k). Inputs to CAL3QHC included traffic volumes provided by traffic engineers for the 2015 year peak hour of traffic. The selected cases were modeled using a conservative-case hour of meteorology. In this case, the meteorology consisted of a wind speed of 1.0 meter per second (m/s) and a stability class of "E," appropriate for "rural" areas. This approach simulates weather conditions in which the air is relatively stagnant, so the emissions from motor vehicles are not quickly dispersed. The CAL3QHC model uses an assumed snapshot of meteorological conditions and applies it to static levels of traffic to predict CO concentrations at locations near the modeled highway/rail at-grade crossings. The model's output is in one-hour concentrations. To convert these concentrations to other periods of length, EPA recommends of the one-hour concentrations by a persistence factor to determine an 8-hour concentration for comparison to NAAQS. In real world conditions, the weather doesn't stay the same for eight hours, nor does the traffic in a given location. The persistence factor accounts for variations in both meteorology and traffic over an 8-hour period as compared to a one-hour period.

Because the Proposed Action would have no impact on the physical roadway layout, the crossings' roadway and receptor geometry used aerial photography of the existing roadways for future conditions. Receptors were placed in each quadrant of the crossing at the nearest point of public access, and also at 25, 50, 100, 150, 200, and 250 meters from the crossing, along the roadway in each direction. The CAL3QHC model calculates a concentration at each of the receptors input. Receptors were placed one foot outside the mixing zone, which is an area defined as the roadway width plus three meters on either side of the roadway (EPA 1992a). A "mixing zone" is an area along a roadway where the movement of vehicles causes movement of the air. CAL3QHC model runs for CO were completed for each of the chosen crossings for the 2015 Proposed Action. The CAL3QHC output was summarized and compared against NAAQS to determine if any of the crossings would exceed NAAQS.

Roadway and Receptor Geometry. For each of the crossings analyzed, 28 receptors were placed in the vicinity of the crossings, as described above. For the Washington and Woodruff crossings in Joliet, Will County, IL, one lane approaches the crossing from each direction. For the Ogden crossing near Aurora, DuPage County, IL, two lanes approach the crossing from each direction.

All dispersion models have limitations that keep it from perfectly simulating the real world. One of CAL3QHC's limitations is that it assumes traffic which is idling (in this case, because of a train blocking the crossing), extends in a straight line back away from the crossing, even if the actual roadway has curves. Therefore, after the initial modeling, the CAL3QHC output was reviewed to determine situations where the "model predicted queue length" was calculated by CAL3QHC to be larger than the physical roadway configuration, resulting in projected impacts that would not be a result of the actual roadway, and instead would be a result of a model limitation. For example, a roadway approaching a crossing may curve at some distance from the crossing. In some cases, the initial CAL3QHC estimated queue length at the crossing may be longer than the length of the roadway before the curve. In these situations, the dispersion model would assume the queue of vehicles would extend in a straight line back along the path of the initial stretch of roadway. For situations where the initial run output showed this occurred, guidance from Section 4.2 (Limitations and Recommendations) of the CAL3QHC User's Guide was followed to readjust queue length to the available physical queue lengths, which simulated idling vehicles as moving vehicles and worked around the model's limitation. The model then was rerun with the adjusted queue lengths and geometries (EPA 1995).

Traffic Parameters. Traffic volume data and traffic signal information were developed for year 2015 peak hour traffic data obtained from the Traffic section of this Draft EIS, using ADT as a base. Identifying peak hour traffic is intended to capture the hour with the most traffic on a given day at a given location. To convert to peak hour, the ADT was multiplied by 10 percent to estimate a 1-hour peak, and this value was multiplied by 60 percent to approximate traffic in each direction. Thus, the total traffic is somewhat overestimated by this methodology, as being 120 percent (60 percent each direction) of actual ADT.

The following assumptions were input to the CAL3QHC model for each of the intersections:

- The signals would be actuated (by the arrival of the train).
- The arrival type of motor vehicles would be average progression, which assumes vehicles arrive to an intersection at random intervals.
- Clearance lost time would be 4 seconds (the time it takes for traffic to begin moving after the crossing is cleared).

Background CO Concentrations. The background 1- and 8-hour CO concentrations for 2015 levels were very conservatively set at 6.2 and 3.7 ppm, respectively. Background concentrations are the concentrations of a pollutant in the air which already exist due to natural or manmade sources. These background concentrations are the maximum 1- and 8-hour values measured in the Study Area from 2004 to 2006, as discussed in Section 3.9.1.3. Given the downward trend of background CO concentrations, it is conservative to use measured 2004 to 2006 data as background concentrations for 2015.

CAL3QHC Results. The results at the highest modeled receptor for each crossing model run are documented in Table 4.9-22, as follows. The table shows the one-hour CO concentration and the eight-hour CO concentration for each highest modeled receptor including the background concentration assumed for the Study Area. Total maximum predicted concentrations are below the NAAQS for all crossings analyzed.

Table 4.9-22. Modeled Hot Spot CO Results

Crossing	1-Hour CO Results (ppm)				8-Hour CO Results (ppm)[a]			
	Modeled	Background	Total	NAAQS	Modeled	Background	Total	NAAQS
Ogden	4.0	6.2	10.2	35	2.8	3.7	6.5	9
Washington	1.6		7.8		1.1		4.8	
Woodruff	1.5		7.7		1.1		4.8	

Notes:
[a] Eight-hour predicted concentrations are estimated based on a persistence factor of 0.7.

Conclusions. A hot-spot air quality analysis for CO has been conducted for the Proposed Action and no receptor sites are forecast to experience concentrations in excess of the current one-hour or eight-hour NAAQS. Based on this analysis, SEA concluded that the Proposed Action will have no adverse impact on air quality as a result of CO emissions from motor vehicles delayed at public at-grade crossings as a result of the Proposed Action.

Air Toxics, Reference Concentrations and Cancer Risk Factors

Air toxics are pollutants, which are known or suspected to cause cancer or other serious health effects, or adverse environmental effects, and for which no NAAQS exist. To assess the potential for adverse impacts from such substances, the predicted concentrations of these substances are typically compared to state or federal guidelines that have been established to provide a margin of safety for protection of public health. For this EIS, Federal guidelines established by EPA were used for comparison with predicted air toxics concentrations.

The five air toxics compounds evaluated in this study are acetaldehyde, acrolein, benzene, 1,3-butadiene, and formaldehyde. These, along with methyl tertiary butyl ether (MTBE), are the primary mobile source air toxics (MSATs) of concern for projects involving motor vehicle engine emissions. However, MTBE is not considered in this analysis. MTBE is a gasoline additive, but is becoming less common because of groundwater contamination concerns, and was banned in Illinois, effective 2004 (415 ILCS 122).

Table 4.9-23, below, summarizes the inhalation reference concentrations (RfCs) for non-cancer effects and the estimated concentration that would equate to a one-in-a-million lifetime cancer risk if exposed to the listed concentration continuously. A reference concentration is an estimate of a continuous inhalation exposure threshold for a given duration to the human population (including susceptible subgroups) that is likely to be without an appreciable risk of adverse health effects over a lifetime (EPA 2008l). The RfC and cancer risk data in Table 4.9-23 are taken from EPA's Integrated Risk Information System (IRIS) online database (EPA 2008m).

Any cancer effect at a one-in-a-million level is far too low to be measurable in comparison to the cancer risk from all causes, meaning that the one-in-a-million level represents essentially negligible cancer risk. In setting hazardous air pollutant emission standards (Maximum Achievable Control Technology or MACT standards) under the Clean Air Act, EPA has stated that its goal is to minimize the number of people exposed to lifetime cancer risk greater than one in a million. EPA also considers a 100 per million cancer risk as a maximum acceptable individual exposure in setting such MACT standards (EPA 1999). That is to say, when setting MACT standards which apply to various sources of air emissions, EPA attempts to set the standard which would result in a maximum risk of one hundred people getting cancer out of one million people exposed.

The non-cancer exposure levels listed in Table 4.9-23, below, are the levels to which various mammals (usually rodents) were exposed in experimental studies. The Adjustment Factor (AF) is a divisor applied by EPA that represents a downward adjustment from the experimental exposure level to account for differences in exposure lengths, protection of potentially more sensitive human individuals, and greater sensitivity in humans compared to animal species tested. According to the IRIS website, "the RfC is an estimate (with uncertainty spanning perhaps an order of magnitude) of a daily inhalation exposure of the human population (including sensitive subgroups) that is likely to be without an appreciable risk of deleterious effects during a lifetime."

Table 4.9-23. IRIS Non-Cancer Reference Concentrations (RfC) and One-in-a-Million Cancer Risk Concentrations for MSATs Studied

Pollutant (MSAT)	Non-Cancer Inhalation Thresholds				Concentration for 1/million Cancer Risk (µg/m^3)
	Exposure Descriptor[a]	Exposure Level (µg/m^3)	AF	RfC (µg/m^3)	
Acetaldehyde	NOAEL	8,700	1,000	9	0.5
Acrolein	LOAEL	20	1,000	0.02	N/A
Benzene	BMCL	8,200	300	30	0.45
1,3-Butadiene	BMCL10	1,980	1,000	2	0.03
Formaldehyde	N/A	N/A	N/A	N/A	0.08

Notes:

[a] NOAEL: no observed adverse effects level.
LOAEL: lowest observed adverse effects level.
BMCL: benchmark concentration 95 percent lower confidence level.
BMCL10: benchmark concentration 95 percent lower confidence level for 10 percent of subjects affected.
N/A: not applicable, because EPA has found insufficient data to establish either a non-cancer inhalation threshold or a cancer risk.

Methodology. The air toxics analysis performed by SEA evaluates impacts of motor vehicle traffic delayed by trains at public at-grade crossings on the ambient air surrounding the crossing. The dispersion model and meteorological data for this analysis are the same as used for the CO hot-spot analysis described above with a few exceptions. Receptor locations were placed at the corners of structures nearest the roadway and rail crossing in each of the four quadrants surrounding the crossing and at the nearest edges of structures adjacent to the roadway. Structures were chosen to conservatively estimate locations where persons might be present over a 70-year period. The "pollutant type" parameter was set to PM (particulate matter), to give results in units of micrograms per cubic meter ($\mu g/m^3$) for ease of comparison with IRIS thresholds.

The CAL3QHC dispersion model produces results for a 1-hour averaging period. To convert from 1-hour concentrations to 24-hour concentrations, the results were multiplied by 0.6 in accordance with EPA guidance. To convert from 1-hour concentrations to annual concentrations, the results were multiplied by 0.1 (EPA 1992).[1] These factors assumed the more conservative values for each averaging period's factor, to account for the low height of the emission source.

Emission estimates of the five MSATs analyzed were based on emission factors output by EPA's MOBILE6.2 emissions model for on-road sources. Table 4.9-24, below, lists the MSAT queue (2.5 mph) and free-flow (30 and 45 mph) emission factors for 2015 used in this analysis for the Proposed Action. The free-flow traffic at the Ogden crossing was assumed to travel at 45 mph, and the free-flow traffic at the Washington and Woodruff crossings was assumed to travel at 30 mph. Because MOBILE6.2 emission factors for MSATs are output in milligrams per vehicle-mile, and because of limitations in the number of significant figures calculated by the CAL3QHC model, results from CAL3QHC were divided by 1,000 to determine concentrations in $\mu g/m^3$, because CAL3QHC expects emission rates to be in units of grams per vehicle-mile.

Table 4.9-24. MOBILE 6.2 MSAT Emission Factors for Air Toxics Analysis – Proposed Action

Year Analyzed	Vehicle Speed (MPH)	Acetaldehyde Emission Rate	Acrolein Emission Rate	Benzene Emission Rate[a]	1,3-Butadiene Emission Rate	Formaldehyde Emission Rate[a]
2015	Idle	19.91 mg/Veh-Hr	2.71 mg/Veh-Hr	240.25 mg/Veh-Hr	20.52 mg/Veh-Hr	53.60 mg/Veh-Hr
2015	30	2.431 mg/Veh-Mi	0.319mg/Veh-Mi	22.765 mg/Veh-Mi	2.47 mg/Veh-Mi	6.489 mg/Veh-Mi
2015	45	2.106 mg/Veh-Mi	0.277 mg/Veh-Mi	21.208 mg/Veh-Mi	2.287 mg/Veh-Mi	5.601 mg/Veh-Mi

Notes:
[a] Benzene and formaldehyde emission rates were input to CAL3QHC in centigrams per vehicle hour (for queue links) and centigrams per vehicle mile (for free flow links) to avoid a modeling error which results from the appearance of too many significant digits during the modeling run. As such, results for these runs were divided by 100 to determine concentrations in $\mu g/m^3$.

Results – Non-Cancer MSATs. Based on the dispersion modeling methodology described above, the maximum modeled concentrations of the MSATs at identified receptors are summarized in Table 4.9-25, below, for the MSATs with an applicable IRIS Reference Concentration (RfC).

[1] EPA, *Screening Procedures for Estimating the Air Quality Impact of Stationary Sources, Revised*, EPA0454/R-92-019, October 1992.

Table 4.9-25. Maximum Modeled 24-Hour MSAT Concentrations in Comparison to RfC Values.				
Pollutant	Maximum Modeled Concentration (µg/m^3)			Reference Concentration (µg/m^3)
	Ogden	Washington	Woodruff	
Acetaldehyde	0.37	0.17	0.16	9
Acrolein	0.049	0.023	0.021	0.02
Benzene	3.8	1.2	1.7	30
1,3-Butadiene	0.40	0.17	0.17	2

The maximum concentrations of acetaldehyde, benzene, and 1,3-butadiene are all below the EPA's RfCs listed in the IRIS database. However, maximum modeled acrolein concentrations are above the RfC of 0.02 µg/m^3 for all three modeled crossings. The maximum acrolein concentration of 0.049 µg/m^3 is approximately two and one half times the RfC value. Acrolein concentrations at receptors near the Washington and Woodruff crossings (in Joliet, Will County, IL) are approximately equal to the reference concentration.

As shown earlier in Table 4.9-23, EPA was very conservative in setting the RfCs to ensure safety of human populations. For acrolein, the Lowest Observed Adverse Effects Level was for rats exposed to 20 µg/m^3; a concentration at which nasal lesions were reported. EPA divided this value by 1000 to create a significant safety factor with respect to human exposure. Therefore, for acrolein, the RfC with respect to human exposure is 1000 times lower than the Lowest Observed Adverse Effect Level for rats.

A recent review by the Health Effects Institute (HEI) provides a summary of measured acrolein concentrations in various settings, including motor vehicles, open air, and residences (HEI 2007). HEI summarized several studies and listed the average concentrations for each study and type of setting. All of the measured average concentrations of acrolein summarized by HEI were above the 0.02 µg/m^3 RfC, and the majority were far above this concentration. One recent study summarized by HEI involved the collection of hundreds of samples of "personal exposures" of adults and children over two-day periods. That study found average concentrations over the two-day period ranging from 10.9 to 12.9 µg/m^3.

Given the measurement data summarized by HEI, it would appear that people are generally exposed to acrolein concentration levels at two to three orders of magnitude greater than the EPA RfC and the maximum modeled acrolein concentration in Table 4.9-25, above, with no apparent ill effects. Based on the data from the HEI study, and the fact that EPA was very conservative in setting the RfC to ensure safety of human populations, it is apparent that the modeled acrolein concentrations present negligible risk to public health, at least in comparison to any risks to which they are already exposed.

Results - Carcinogenic MSATs. Table 4.9-26, below, shows the modeled concentrations of the modeled MSATs along with 1/million cancer risk thresholds in the IRIS database. For acetaldehyde, the maximum modeled annual concentration (for a conservative meteorological scenario) is below the 1 per million cancer risk at all modeled crossings. Benzene, 1,3-butadiene, and formaldehyde all have maximum modeled annual concentrations which are higher than the 1 per million cancer risk at the Ogden Avenue crossing (near Aurora, DuPage County, IL).The pollutant with the highest concentration relative to theist cancer risk threshold is 1,3-butadiene threshold. The maximum 1,3-butadiene concentration that would result from motor vehicle delay due to trains affected by the Proposed Action equates to a lifetime cancer risk of approximately 2.2 per million. This is far below

EPA's stated maximum acceptable cancer risk of 100 per million for setting risk-based emissions standards.

Table 4.9-26. Maximum Modeled Annual MSAT Concentrations in Comparison to 1/106 Cancer Risk

Pollutant	Maximum Modeled Concentration ($\mu g/m^3$)			Concentration for 1/million Cancer Risk ($\mu g/m^3$)
	Ogden	Washington	Woodruff	
Acetaldehyde	0.061	0.028	0.027	0.5
Benzene	0.63	0.20	0.28	0.45
1,3-Butadiene	0.066	0.029	0.028	0.03
Formaldehyde	0.16	0.056	0.072	0.08

The predicted cancer risk values at the receptor locations SEA studied essentially assume that one million people would be breathing air at the specified location for an entire 70-year lifetime. Because the actual population would spend the vast majority to their time away from the roadway, not in any fixed location, the real risk is far lower than even the minimal risk represented by the maximum receptor values presented in Table 4.9-26, above. However, even the receptor maximum values are considered to represent a negligible cancer risk on their own.

Risk – Conservatism and Context. The modeled concentrations presented for the above MSATs are conservative, upper estimates of impact, for a number of reasons, detailed below:

- There are currently trains operating at the modeled crossings that cause motor vehicles to be delayed. The results shown in Table 4.9-26, above, do not account for the vehicle delay that already exists, or the times of day when traffic flows unimpeded and which would continue to exist in a No-Action scenario. That is to say, the results only show risk in a Proposed Action scenario. Under a No-Action scenario, there would still be risk because of the delay that already exists.
- The CAL3QHC model was intended for short-term (1-hour) analyses, and as such, peak hour traffic was modeled by assuming 10 percent of the ADT to estimate a conservative peak hour value. However, for 24-hour and annual analyses, average traffic levels would be substantially less than assumed for the peak 1-hour period measured by the CAL3QHC model. In other words, the analysis produced by running the model assumes that emission rates from traffic are constantly occurring at the peak level. The 24-hour average hourly traffic level would be approximately 4 percent of an ADT value (total for 24 hours equals 100 percent; 100 divided by 24 equals 4.2 percent per hour), or a 58 percent decrease from the 1-hour traffic (10 percent of the ADT) input to CAL3QHC (10 percent minus 4.2 percent equals 5.8 percent; 5.8 from 10 equals a 58 percent decrease). While the model results are not quite linear, it could reasonably be expected that concentrations would be approximately half of those shown in Table 4.9-26, above, if the peak hour traffic value measured by the model was replaced by a 24-hour average traffic value.
- To conservatively capture the maximum traffic in each direction at a given crossing, it was assumed that 60 percent of the peak hour traffic traveled in each direction, thus double counting some of the emissions. In other words, the analysis essentially simulated 120 percent of the projected peak hour two-way traffic level.
- The averaging time adjustments convert from 1- to 24-hour concentrations, or to convert from 1-hour to annual concentrations are the most conservative of the range of possible

factors recommended by EPA. These factors are intended to account for variation in meteorological conditions which occur over longer averaging periods compared to the one-hour averaging period.

- The 70-year (lifetime) average concentrations in Table 4.9-26, above, would be lower than one-year (annual) average concentrations due to variability in meteorology over a 70-year period.

To better understand the relative risk implied by the concentrations shown in Table 4.9-26, above, it is useful to compare the predicted cancer risks with the estimated risks from other factors. Table 4.9-27, below, presents estimated lifetime cancer risks for various groups and living situations (EPA 2007c). The EPA study states that the Air Toxics risks listed in Table 4.9-27 are for individuals breathing *outdoor* air at 1999 concentration levels for a lifetime. Indoor air often has higher toxics levels than outdoor air, due to cooking, off-gassing from carpet and furniture, etc.

In EPA's National-Scale Air Toxics Assessment, the agency cites benzene as the air toxic contributing the most to outdoor air cancer risk, being responsible on average for about 25 percent of the cancer risk (EPA 2007c). Most of this benzene-related risk is from gasoline-powered on-road vehicles. Because of EPA's locomotive emissions standards, which were adopted in 2008 and are now being applied to new engines, EPA estimates that the cancer risk from benzene alone will drop by 60 percent between 1999 and 2020, due to increasingly stringent EPA emissions and fuel standards that are affecting nearly all sectors of engines for nonroad and on-road vehicles (EPA 2008i). Also, VOCs in general, including other MSATs, will be similarly reduced by these emission control programs (EPA 2008i).

Table 4.9-27. Comparative Lifetime Cancer Risks

Risk Basis	Cases per Million People
All Causes, U.S. Average	330,000
Radon (indoor), U.S. Average	2,000
Air Toxics in Urban Areas	25 to >50
Air Toxics in Rural Areas	1 to 25
Ogden Avenue Crossing Traffic @ Maximum Receptor, for 1,3-Butadiene	2.2[a]

Source: EPA (2007c), "National-Scale Air Toxics Assessment for 1999: Estimated Emissions, Concentrations, and Risk. Technical Fact Sheet," Technology Transfer Network, 1999 National-Scale Air Toxics Assessment. Retrieved on June 26, 2008. http://www.epa.gov/ttn/atw/nata1999/natafinalfact.html. November 6, 2007.

Notes:

[a] Includes existing impacts of moving and idling highway vehicles near Ogden Avenue crossing, plus incremental impact of idling traffic due to the Proposed Action. Thus, incremental risk from the Proposed Action is a fraction of this value.

Conclusions: SEA conducted a hot-spot air quality analysis for air toxics for the effects of traffic delays due to trains affected by the Proposed Action. Based on the data summarized in Table 4.9-27, above, SEA concluded that the localized cancer risks of the assessed MSAT emissions from the Proposed Action would be negligible in comparison to total cancer risk that exists from all causes. Non-cancer risks to public health were also found to be negligible. SEA also concluded, based on the data in Table 4.9-26, that risk at local receptors would also be quite low in comparison to air pollutant risks from other air pollutant sources, both indoor and outdoor. The negligible risks from the Proposed Action will drop even further in coming decades, as a result of EPA emissions standards for new on-road and nonroad (locomotive and other nonroad equipment) engines, which are decreasing engine emissions fast enough to more than offset the increased emissions that would result from expected population growth.

Rail Yard Impacts

Under the Proposed Action there would be a transfer of rail carload handling activity from existing rail yards within the Chicago-Gary metropolitan nonattainment area (NAA) to other yards in the NAA, including Kirk Yard and East Joliet Yard. With the Proposed Action, Kirk Yard and East Joliet Yard are expected to see an increase in carload activity greater than the Board's air quality analysis threshold for rail yards that will experience an increase in carload activity of at least 20 percent, as provided in 49 CFR 1105.7 However, because these increases would be due to a transfer of rail yard activity from other yards within the Chicago-Gary ozone and $PM_{2.5}$ nonattainment area (NAA), total emissions from rail yard activity in the NAA are not expected to change as a result of the Proposed Action. Therefore, SEA determined that the relocation of rail yard activity should have no adverse impact on the Illinois or Indiana State Implementation Plans (SIPs) for attainment of the NAAQS.

4.9.3.2 Proposed New Construction

Construction-Related Emissions

Construction-related emissions related to the proposed 6 new connections are anticipated to occur over a three-year period between 2009 and 2011 and were calculated evenly across the three years. SEA compiled information on the duration of the construction activities, hours of use of construction and support equipment, and the surface area disturbed for use in the estimate of construction emissions. Appendix K provides details on the factors and assumptions used for the construction-related analyses.

Table 4.9-28 and Table 4.9-29, below, summarize the estimates for emissions related to construction equipment exhaust and for emissions of fugitive particulates resulting from construction activities, respectively. Under the Proposed Action, construction exhaust emissions for each pollutant would likely decline gradually (for everything but SO_2) for each year given reductions in locomotive emissions and implementation of more stringent government-required fuel standards. The levels of SO_2, are expected to drop off rapidly in 2010, because of a required sulfur reduction (from 500 to 15 parts per million) for land-based nonroad diesel fuel. This is relevant because construction would be expected to occur between 2009 and 2011, and the required sulfur reduction would also occur at that time.

The fugitive emissions, shown in Table 4.9-29, below, are based on the estimated surface disturbance areas for all proposed construction sites, which were developed using GIS mapping. As described in Chapter 2, there are alternative construction locations for several of the proposed connections. Appendix K shows these alternative locations and their anticipated surface disturbance areas. However, the emissions shown in Table 4.9-29 for the proposed construction locations are representative of anticipated impacts, regardless of the connection location; use of any or all of the alternative sites would not result in any substantive change in the fugitive emissions shown here.

Table 4.9-28. Construction Exhaust Emissions (tons/year)

Year[a]	VOC	CO	NO_X	SO_2	PM_{10}	$PM_{2.5}$
2009	2.08	10.8	20.0	0.75	1.62	1.58
2010	1.97	10.4	18.9	0.022	1.51	1.47
2011	1.84	9.42	17.3	0.022	1.39	1.34
TOTAL	5.89	30.6	56.2	0.79	4.52	4.39

Notes:

[a] Construction activities are assumed to occur equally over a three-year period which, for the purpose of this analysis, SEA has assumed to be 2009-2011.

Table 4.9-29. Construction Fugitive Emissions								
Location	Surface Area[a]	Scaling Factor	E.F. PM_{10}	E.F. $PM_{2.5}$	3-Year Emissions PM_{10}[b]	3-Year Emissions $PM_{2.5}$[b]	1-Year (2010) Emissions PM_{10}	1-Year (2010) Emissions $PM_{2.5}$
	(acres)	(months)	(tons/acre/month)		(tons/location)		(tons/location)	
Leithton	7.4	1.24	0.11	0.01	1.00	0.10	0.33	0.03
Diamond Lake to Gilmer	44.2	7.42			36.1	3.61	12.0	1.20
Munger	3.7	0.63			0.26	0.03	0.09	0.01
East Siding	36.5	6.13			24.6	2.46	8.21	0.82
Walker Siding	16.5	2.77			5.02	0.50	1.67	0.17
Joliet	5.4	0.90			0.54	0.05	0.18	0.02
East Joliet to Frankfort	62.7	10.5			72.7	7.27	24.2	2.42
Matteson	22.0	3.68			8.90	0.89	2.97	0.30
Griffith	5.6	0.95			0.59	0.06	0.20	0.02
Ivanhoe	5.8	0.97			0.62	0.06	0.21	0.02
Kirk Yard	4.6	0.77			0.39	0.04	0.13	0.01
TOTAL	**214**	**36**			**151**	**15.1**	**50.2**	**5.02**

Source: Surface area estimates via GIS

Notes:

[a] Estimates of acreage per location were determined using GIS mapping.

[b] Construction activities are assumed to occur equally over a three-year period which, for the purpose of this analysis, SEA has assumed to be 2009-2011.

Conclusions

SEA's analysis of construction related emissions indicates that construction of new connections and double tracking will result in emissions of various pollutants, however the quantities are quite small in relation to other sources of such emissions and the effect would be minimal.

4.9.3.3 Total Net Change in Emissions Compared with State Implementation Plans

Emission Comparison

All ten counties in the Study Area are, in whole or in part, classified as nonattainment for ozone and $PM_{2.5}$ (refer to Section 3.9.1). They are a part of the Chicago-Gary-Lake County, Illinois-Indiana, nonattainment area (NAA). SEA compared the total annual changes in emissions attributable to the Proposed Action (that is, operational and construction-related emissions changes) to the applicable State Implementation Plans (SIPs).

As Table 4.9-30 and Table 4.9-31, below, show, the calculated net emissions increases related to the Proposed Action are expected to meet all parameters established by applicable State Implementation Plans for ozone. For VOC and NO_x, the total emissions (existing emissions plus Proposed Action increase) are well below the current Illinois margins between projected emissions in 2010 or 2020, and the allowable 2010 or 2020 emissions budgets. Most of the Proposed Action emissions increase will be in Illinois, with only a small proportion in Indiana. While Indiana's Maintenance Plan does not provide estimates of actual emissions in comparison to the Indiana budget, the portion of the Proposed Action emissions in Indiana will be small. Based on the revised estimates in Table 4.9-30, and the available budget in Illinois in comparison to the Proposed Action emissions, it is apparent that the additional emissions will be negligible in comparison to the available emissions budgets.

In addition, the emissions connected to the Proposed Action will continue to fall in years beyond 2015, due to EPA emissions standards for locomotives and motor vehicles. Therefore, the Proposed Action is not expected to adversely affect attainment of the ozone NAAQS.

Table 4.9-30. VOC & NO_x Total Emissions for O_3 Compared with SIP (Tons/Summer Day) – Original Estimates

Year	VOCs				NO_x			
	Illinois Emissions	Illinois SIP Budget	Indiana SIP Budget[a]	Net Change due to Proposed Action[b]	Illinois Emissions	Illinois SIP Budget	Indiana SIP Budget	Net Change due to Proposed Action[b]
2007	121.69	151.11	- -	- -	279.84	280.40	- -	- -
2010	91.93	127.42	11.5	0.0054	205.33	280.40	40.6	0.052
2015	- -	- -	- -	0.07	- -	- -	- -	1.02
2020	51.29	127.42	6.00	- -	67.67	280.40	12.60	- -
2030	51.98	127.42	- -	- -	48.17	280.40	- -	- -
2040	- -	- -	7.16	- -	- -	- -	7.96	- -

Sources: Indiana Department of Environmental Management (IDEM) (2006a), Request for Redesignation and Maintenance Plan for Ozone Attainment in the 8-Hour Ozone Nonattainment Area--Lake and Porter Counties, Indiana, retrieved on May 8, 2008, http://www.in.gov/idem/programs/air/redesignations/lakeporter/lakeporterfinal.pdf, September 2006. Chicago Metropolitan Agency for Planning (CMAP) (2006c), Transportation Conformity Analysis for the PM2.5 and 8-Hour Ozone National Ambient Air Quality Standards, retrieved on June 26, 2008, http://www.cmap.illinois.gov/uploadedFiles/publications/other_publications/pm25_conformity_analysis.pdf, October 12, 2006.

Notes:

[a] Indiana's Maintenance Plan does not provide estimates of actual emissions in comparison to the Indiana budget.

[b] Net change of emissions in tons per summer day resulting from the Proposed Action was calculated by taking the previously calculated tons per year values and dividing by 365 days per year. Values for 2010 are Proposed Action-related construction emissions, and values for 2015 are Proposed Action-related operations emissions, including vehicle idling emissions at crossings.

Table 4.9-31. VOC & NO_x Total Emissions for O_3 Compared with SIP (Tons/Summer Day) – Revised Estimates

Year	VOCs				NO_x			
	Illinois Emissions	Illinois SIP Budget	Indiana SIP Budget[a]	Net Change due to Proposed Action[b]	Illinois Emissions	Illinois SIP Budget	Indiana SIP Budget	Net Change due to Proposed Action[b]
2007	121.69	151.11	- -	- -	279.84	280.40	- -	- -

Table 4.9-31. VOC & NO_x Total Emissions for O_3 Compared with SIP (Tons/Summer Day) – Revised Estimates								
Year	VOCs				NO_x			
	Illinois Emissions	Illinois SIP Budget	Indiana SIP Budget[a]	Net Change due to Proposed Action[b]	Illinois Emissions	Illinois SIP Budget	Indiana SIP Budget	Net Change due to Proposed Action[b]
2010	91.93	127.42	11.5	0.0054	205.33	280.40	40.6	0.052
2015	- -	- -	- -	0.021	- -	- -	- -	0.26
2020	51.29	127.42	6.00	- -	67.67	280.40	12.60	- -
2030	51.98	127.42	- -	- -	48.17	280.40	- -	- -
2040	- -	- -	7.16	- -	- -	- -	7.96	- -

Sources: IDEM (2006a), *Request for Redesignation and Maintenance Plan for Ozone Attainment in the 8-Hour Ozone Nonattainment Area--Lake and Porter Counties, Indiana*, retrieved on May 8, 2008, http://www.in.gov/idem/programs/air/redesignations/lakeporter/lakeporterfinal.pdf, September 2006.
CMAP (2006c), *Transportation Conformity Analysis for the $PM_{2.5}$ and 8-Hour Ozone National Ambient Air Quality Standards*, retrieved on June 26, 2008, http://www.cmap.illinois.gov/uploadedFiles/publications/other_publications/pm25_conformity_analysis.pdf, October 12, 2006.

Notes:

[a] Indiana's Maintenance Plan does not provide estimates of actual emissions in comparison to the Indiana budget.

[b] Net change of emissions in tons per summer day resulting from the Proposed Action was calculated by taking the previously calculated tons per year values and dividing by 365 days per year. Values for 2010 are Proposed Action-related construction emissions, and values for 2015 are Proposed Action-related operations emissions, including vehicle idling emissions at crossings.

With respect to the Chicago area's $PM_{2.5}$ nonattainment status, no emissions budgets are yet available for the pollutants that primarily contribute to $PM_{2.5}$, either directly (as direct $PM_{2.5}$ emissions), or secondarily, as NO_x or SO_2 emissions, which are chemically converted in the atmosphere to $PM_{2.5}$. The net SO_2 emissions increase that would be caused by the Proposed Action is clearly negligible. As shown in Table 4.9-32, below, the 2015 $PM_{2.5}$ and NO_x emissions increases that would result from the Proposed Action represent a small portion of the total existing emissions, representing approximately 1 percent or less of the total 2010 or 2020 emissions of these pollutants in the Study Area, based on CN's Original fuel estimates. With CN's revised fuel estimates, as shown in Table 4.9-33, that follows, the projected net emissions increases are an even smaller fraction of total Study Area emissions. The emissions increases of these pollutants due to the Proposed Action will decline over time, because of implementation of EPA emissions standards for engines and fuel sulfur restrictions.

Table 4.9-32. $PM_{2.5}$ and NO_x Total Emissions for $PM_{2.5}$ Compared with SIP (Tons/Year) – Original Estimates								
Year	Northeastern Illinois		Northwestern Indiana		Nonattainment Area Total		Net Change Due to Proposed Action	
	Direct $PM_{2.5}$	NO_x	Direct $PM_{2.5}$	NO_x	Direct $PM_{2.5}$	NO_x	$PM_{2.5}$	NO_x
2007	3,071	167,631	563	30,398	3,633	198,029	- -	- -
2010[a]	1,635	78,496	305	14,919	1,940	93,415	6.5	18.9
2015[a]	- -	- -	- -	- -	- -	- -	11.6	374.1
2020	1,042	26,036	172	4,572	1,214	30,608	- -	- -
2030	1,029	18,853	167	2,548	1,196	21,401	- -	- -

Source: CMAP (2006c), Transportation Conformity Analysis for the $PM_{2.5}$ and 8-Hour Ozone National Ambient Air Quality Standards, retrieved on June 26, 2008, http://www.cmap.illinois.gov/uploadedFiles/publications/other_publications/pm25_conformity_analysis.pdf, October 12, 2006.

Notes:

[a] Values for 2010 are Proposed Action-related construction emissions, and values for 2015 are Proposed Action-related operations emissions, including vehicle idling emissions at crossings.

Table 4.9-33. $PM_{2.5}$ and NO_x Total Emissions for $PM_{2.5}$ Compared with SIP (Tons/Year) – Revised Estimates								
Year	Northeastern Illinois		Northwestern Indiana		Nonattainment Area Total		Net Change Due to Proposed Action	
	Direct $PM_{2.5}$	NO_x	Direct $PM_{2.5}$	NO_x	Direct $PM_{2.5}$	NO_x	$PM_{2.5}$	NO_x
2007	3,071	167,631	563	30,398	3,633	198,029	- -	- -
2010[a]	1,635	78,496	305	14,919	1,940	93,415	6.5	18.9
2015[a]	- -	- -	- -	- -	- -	- -	2.9	95.8
2020	1,042	26,036	172	4,572	1,214	30,608	- -	- -
2030	1,029	18,853	167	2,548	1,196	21,401	- -	- -

Source: CMAP (2006c), Transportation Conformity Analysis for the $PM_{2.5}$ and 8-Hour Ozone National Ambient Air Quality Standards, retrieved on June 26, 2008, http://www.cmap.illinois.gov/uploadedFiles/publications/other_publications/pm25_conformity_analysis.pdf, October 12, 2006.

Notes:

[a] Values for 2010 are Proposed Action-related construction emissions, and values for 2015 are Proposed Action-related operations emissions, including vehicle idling emissions at crossings.

Conclusions

SEA's evaluation of transaction related emissions changes indicates that while modest increases will occur they are well within emissions budgets established for achieving attainment with ambient air quality standards and therefore, should not affect air quality attainment.

4.9.4 Climate

4.9.4.1 Urban Heat Island

Larger metropolitan areas experience a recognized urban heat island (UHI) effect, which occurs when cities replace natural land cover with pavement, buildings, and other infrastructure. The Proposed Action would affect approximately 214 acres of land as a result of construction of new double track and connections associated with the Proposed Action. The total acreage of the study area is approximately 3.5 million acres. Given that UHI effects are a result of changes in land use, and that the area impacted by the Proposed Action is approximately 0.006 percent of the total study area, it is not anticipated that the Proposed Action will have any discernable impact on the local UHI.

4.9.4.2 Global Climate Change

Global climate can be affected by many factors, including changes in atmospheric composition due to greenhouse gas emissions. Other factors include solar variation, volcanic activity, ocean current cycles, variations in Earth orbit, and orientation of its rotational axis. The Little Ice Age, for example, is widely believed to have been caused by a reduction in solar activity, given the observation that during the core of the Little Ice Age there was almost no sunspot activity. Concerns expressed in recent years are that mankind's emissions of greenhouse gases may warm the climate, possibly affecting precipitation patterns as well.

The Proposed Action's main potential contribution to global climate change would be through the emissions of greenhouse gases (GHGs), primarily carbon dioxide (CO_2). As shown below in Table 4.9-34 and Table 4.9-35, the net annual change in CO_2 emissions due to the Proposed Action would be a minor fraction of the total CO_2 emissions in the world. Based on the Revised estimates in 4.9-24b, the CO_2 emissions increase associated with the Proposed Action would be of the same order of magnitude as the annual CO_2 emissions output by 1,000 passenger vehicles. The Proposed Action would contribute between 0.00009 percent and 0.00002 percent (Original and Revised estimates, respectively) to the global CO_2 emissions in 2015, assuming no increases in total world GHG emissions between 2005 and 2015. Over time periods of a year or longer, it can be assumed that CO_2 is essentially evenly distributed throughout the atmosphere across the globe. Because CO_2 is a minor contributor to the greenhouse effect in comparison to water vapor and clouds, and because mankind's emissions of CO_2 are a minor fraction of total CO_2 in the atmosphere, the project's possible contribution to manmade global climate effects would be much smaller than even the very small percentages stated above.

Table 4.9-34. Annual Million Metric Tons of CO_2 – Original Estimates

Category	Emissions
World Total [a, b]	28,193
U.S. Total [a, b]	5,957
U.S. Power Plants Total [a, c]	2,514
1,000 Passenger Vehicles [a, d]	0.0053
Net Change 2015 – Original Estimates [e]	0.025

Sources:

Energy Information Administration, 2008, "Converting Energy Units 101," *Energy Information Administration*, retrieved on June 25, 2008, http://www.eia.doe.gov/basics/conversion_basics.html.

EPA (2008n), "Passenger vehicles per year," *Calculations and References*, retrieved on June 26, 2008, http://www.epa.gov/cleanenergy/energy-resources/refs.html#vehicles, April 9, 2008.

EPA (2008o), "Gallons of gasoline consumed," *Calculations and References*, retrieved on June 26, 2008, http://www.epa.gov/cleanenergy/energy-resources/refs.html#gasoline, April 9, 2008.

Notes:

[a] Emissions data are for year 2005.

[b] From Energy Information Administration (2008). Includes CO_2 emissions from the consumption and flaring of fossil fuels. Data for most recent year (2005) are preliminary.

[c] From Energy Information Administration (2008). Includes CO_2 emissions from energy consumption at conventional power plants and combined heat and power plants.

[d] From EPA (2008n). The weighted average fuel economy for cars, vans, trucks, and SUVs was 19.7 miles per gallon, and the average vehicle miles traveled were 11,856 miles per year.

[e] From EPA (2008o). Net change mmBtu/yr energy usage calculated in Chapter 3.9 was converted to gasoline, assuming 124,000 Btu/gal of gasoline. Carbon dioxide emissions per gallon of gasoline were calculated using 8.81×10^{-3} metric tons of CO_2 per gallon of gasoline.

Table 4.9-35. Annual Million Metric Tons of CO_2 – Revised Estimates

Category	Emissions
World Total [a, b]	28,193
U.S. Total [a, b]	5,957
U.S. Power Plants Total [a, c]	2,514
1,000 Passenger Vehicles [a, d]	0.0053
Net Change 2015 – Revised Estimates [e]	0.0069

Sources:

Energy Information Administration, 2008, "Converting Energy Units 101," *Energy Information Administration*, retrieved on June 25, 2008, http://www.eia.doe.gov/basics/conversion_basics.html.

EPA (2008n), "Passenger vehicles per year," *Calculations and References*, retrieved on June 26, 2008, http://www.epa.gov/cleanenergy/energy-resources/refs.html#vehicles, April 9, 2008.

EPA (2008o), "Gallons of gasoline consumed," *Calculations and References*, retrieved on June 26, 2008, http://www.epa.gov/cleanenergy/energy-resources/refs.html#gasoline, April 9, 2008.

Notes:

[a] Emissions data are for year 2005.

[b] From Energy Information Administration (2008). Includes CO_2 emissions from the consumption and flaring of fossil fuels. Data for most recent year (2005) are preliminary.

[c] From Energy Information Administration (2008). Includes CO_2 emissions from energy consumption at conventional power plants and combined heat and power plants.

[d] From EPA (2008n). The weighted average fuel economy for cars, vans, trucks, and SUVs was 19.7 miles per gallon, and the average vehicle miles traveled were 11,856 miles per year.

[e] From EPA (2008o). Net change mmBtu/yr energy usage calculated in Chapter 3.9 was converted to gasoline, assuming 124,000 Btu/gal of gasoline. Carbon dioxide emissions per gallon of gasoline were calculated using 8.81×10^{-3} metric tons of CO_2 per gallon of gasoline.

4.9.4.2 Conclusions

As discussed in Section 4.9.4.1, the Proposed Action would not have any discernable impact on the local UHI because of the relatively small size of land that would be disturbed in relation to the size of the Study Area. Additionally, as shown in Table 4.9-34 and Table 4.9-35, the increased amount of CO_2 emissions for the Proposed Action is a minor fraction of the total CO_2 emissions in the world, and therefore, it is concluded that the direct contribution to that portion of climate change caused by CO_2 emissions would not be discernable. A brief discussion of climate change effects from related projects is included in Section 5.5.1 (Indirect and Cumulative Effects – Air Quality and Climate).

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