Appendix U
Air Quality Technical Memorandum

Chicago Red Line Extension Project

Air Quality
Technical Memorandum

June 21, 2013
Updated July 27, 2015

Prepared for:
Chicago Transit Authority
567 W. Lake Street
Chicago, IL 60661

Prepared by:
CWC Transit Group
125 S. Wacker Drive
Suite 600
Chicago, IL 60606

Table of Contents

Appendix

Figures

Tables

Abbreviations

BRT	Bus Rapid Transit
CAA	Clean Air Act
CFR	Code of Federal Regulations
CH4	methane
CMAP	Chicago Metropolitan Agency for Planning
CO	carbon monoxide
CO2	carbon dioxide
CO2e	carbon dioxide equivalent
CTA	Chicago Transit Authority
EIS	Environmental Impact Statement
FMVECP	Federal Motor Vehicle Emissions Control Program
FTA	Federal Transit Administration
FHWA	Federal Highway Administration
GHG	greenhouse gas
GWP	Global Warming Potential
IAAQS	Illinois Ambient Air Quality Standards
IDOT	Illinois Department of Transportation
IEPA	Illinois Environmental Protection Agency
LOS	level of service
MSAT	mobile source air toxics
NAAQS	National Ambient Air Quality Standards
NEPA	National Environmental Policy Act
N2O	nitrous oxide
NO2	nitrogen dioxide
NOx	oxides of nitrogen
PM10	particulate matter with an aerodynamic diameter of 10 micrometers and less
PM2.5	particulate matter with an aerodynamic diameter of 2.5 micrometers and less
ppb	parts per billion
ppm	parts per million
RLE	Red Line Extension
ROW	right-of-way
RPM	Red and Purple Modernization
RTP	Regional Transportation Plan
SIP	State Implementation Plan
TIP	Transportation Improvement Program
tpy	tons per year

UPRR	Union Pacific Railroad
USC	United States Code
USEPA	U.S. Environmental Protection Agency
VMT	vehicle-miles traveled
VOCs	volatile organic compounds
μg/m3	micrograms per cubic meter

Section 1
Summary

This technical memorandum analyzes the potential impacts of the Red Line Extension (RLE) Project on carbon monoxide (CO) hot spots, project-related greenhouse gas (GHG) emissions, fine particulate matter (particulate matter with an aerodynamic diameter of 2.5 micrometers and less [$PM_{2.5}$]) hot spots, mobile source air toxics (MSAT), impacts of construction, possible mitigation measures, and cumulative impacts.

The project area is in Cook County, Illinois, which has been designated as a nonattainment area with respect to the ozone national ambient air quality standard (NAAQS). The U.S. Environmental Protection Agency (USEPA) has also designated it as a nonattainment area with respect to the $PM_{2.5}$ NAAQS. The Illinois Environmental Protection Agency (IEPA) is seeking a redesignation from USEPA to attainment for $PM_{2.5}$. Because the RLE Project is in a "Moderate" ozone nonattainment area, it is the Federal Transit Administration's (FTA's) responsibility, as the federal funding agency, to ensure that the proposed project conforms to the Illinois State Implementation Plan (SIP).

Conformity can be demonstrated by showing that the proposed project is included in a conforming Regional Transportation Plan (RTP). The RLE Project is included in the Chicago Metropolitan Agency for Planning's (CMAP's) *GO TO 2040,* which is a conforming RTP published in 2010. Therefore, this project conforms to the objectives of the SIP, and further demonstration of the project compliance with the transportation conformity rule is not required. However, for the purpose of National Environmental Policy Act (NEPA) disclosure, an evaluation of project impacts was conducted.

Based on the results of the air quality analysis presented here, all build alternatives of the RLE Project would provide a regional net air quality benefit.

Based on the results of the CO modeling analysis at selected traffic intersections in the project area, implementation of any of the RLE Project build alternatives would not lead to exceedances of the Illinois Ambient Air Quality Standards (IAAQS) and NAAQS and no adverse air quality impacts are expected to occur with any of the build alternatives. Based on the CO hot spot analysis, no air quality mitigation measures would be required for any of the traffic intersections analyzed for any of the build alternatives.

The FMVECP (Federal Motor Vehicle Emission Control Program) (40 United States Code [USC] § 7521), which has been very effective in controlling emissions of all of the criteria pollutants, has little or no impact on GHG emissions from motor vehicles. The same technology that leads to more efficient fuel use also leads to lower carbon dioxide (CO_2) emissions. Because estimated changes in vehicle-miles traveled (VMT) would be quite small, the changes in GHG emissions in the project area would also be quite small. Compared to the No Build Alternative, the total carbon dioxide equivalent (CO_2e) emissions from any of the alternatives would be about 0.02 percent lower. Indirect emissions from the fossil-fueled power plants would increase because of increased electrical energy demand for the project.

The $PM_{2.5}$ emissions factors for motor vehicles in the Chicago area are expected to decline by over 38 percent between 2012 and 2030. In addition, VMT in the project area under all of the build alternatives (including VMT generated by additional bus operations) would be slightly lower than under the No Build Alternative VMT, by about 0.02 percent, due to passenger diversions to the RLE Project. When taken together, the regional $PM_{2.5}$ emissions with implementation of the build alternatives would be slightly lower than with the No Build Alternative. In addition to the federal exhaust emissions control programs and fuel reformulation programs, statewide efforts to reduce congestion and vehicle idling are also expected to have a direct benefit by reducing $PM_{2.5}$ concentrations at the local level.

The USEPA's FMVECP is expected to reduce MSAT emissions by 54 percent in the project area between 2012 and 2030. In addition, VMT in the project area for all build alternatives are expected to be slightly lower than under the No Build Alternative, by about 0.02 percent, due to passenger diversions to the Red Line. When taken together, regional MSAT emissions under any of the build alternatives in 2030 would be slightly lower than with the No Build Alternative.

The potential air quality impacts during construction would primarily be associated with dust and vehicle exhaust emissions. The IEPA has strict guidelines for controlling fugitive dust, diesel soot emissions, and GHG emissions. Impacts on local traffic movements could also result from trucks and construction equipment entering and leaving the construction sites and staging areas. There would be no adverse air quality impacts due to construction activities because mitigation measures would be incorporated into the project construction plan.

To minimize air quality impacts during construction, CTA would direct the contractor to prepare and implement a Dust Control Plan; retrofit diesel-powered equipment and vehicles to have emission control devices and use ultra-low sulfur diesel to control diesel particulate emissions; and develop a plan to allow construction trucks to access and egress the construction sites and staging area without adverse impacts on the local traffic. These plans would follow the guidelines from Illinois Department of Transportation (IDOT). The GHG emissions during construction could also be minimized by limiting truck and equipment idling times, maintaining equipment in proper working order, using alternative fuels for generators, reducing electricity consumption at the construction sites, and substituting single occupancy vehicle use with carpooling, shuttle vans, and transit passes for construction workers.

Updated July 27, 2015. In August 2014, based on the technical analysis and public input until then, CTA announced the NEPA Preferred Alternative—the UPRR Rail Alternative. CTA is considering two alignment (route) options of this alternative: the East Option and the West Option. At this time, CTA is also considering only the South Station Option of the 130th Street Station. In late 2014 and early 2015, CTA conducted additional engineering on the East and West Options to refine the East and West Option alignments. Appendix A of this technical memorandum summarizes the refined alignments and any additional or different impacts that would result. The information in Appendix A supersedes information presented in other chapters of this technical memorandum.

Section 2
Project Description

The Chicago Transit Authority (CTA) is proposing to extend the Red Line from the existing 95th Street Terminal to the vicinity of 130th Street, subject to the availability of funding. The proposed RLE would include four stations. Each station would include bus transfer and parking facilities. This project is one part of the Red Ahead Program to extend and enhance the entire Red Line. The CTA is also planning 95th Street Terminal improvements that are anticipated to be completed prior to the proposed RLE construction.

The project area is 11 miles south of the Chicago central business district (commonly referred to as the Loop) and encompasses approximately 20 square miles. The boundaries of the project area are 95th Street on the north, Ashland Avenue on the west, Stony Island Avenue on the east, and the Calumet-Sag Channel/Little Calumet River and 134th Street on the south. The I-57 Expressway and I-94 Bishop Ford Freeway cross the western and eastern edges of the project area, respectively. Lake Calumet is in the eastern portion of the project area. The project area encompasses parts of nine community areas in the City of Chicago and the eastern section of the Village of Calumet Park. Chicago community areas include Beverly, Washington Heights, Roseland, Morgan Park, Pullman, West Pullman, Riverdale, Hegewisch, and South Deering. The project area comprises residential (primarily single family), industrial (both existing and vacant), transportation (including freight), and commercial development.

The Draft Environmental Impact Statement (EIS) focuses on the following alternatives (shown in Figure 2-1), which emerged from the Alternatives Analysis and the NEPA scoping process:

- No Build Alternative
- Bus Rapid Transit (BRT) Alternative
- Union Pacific Railroad (UPRR) Rail Alternative
  - Right-of-Way (ROW) Option
  - East Option
  - West Option
- Halsted Rail Alternative

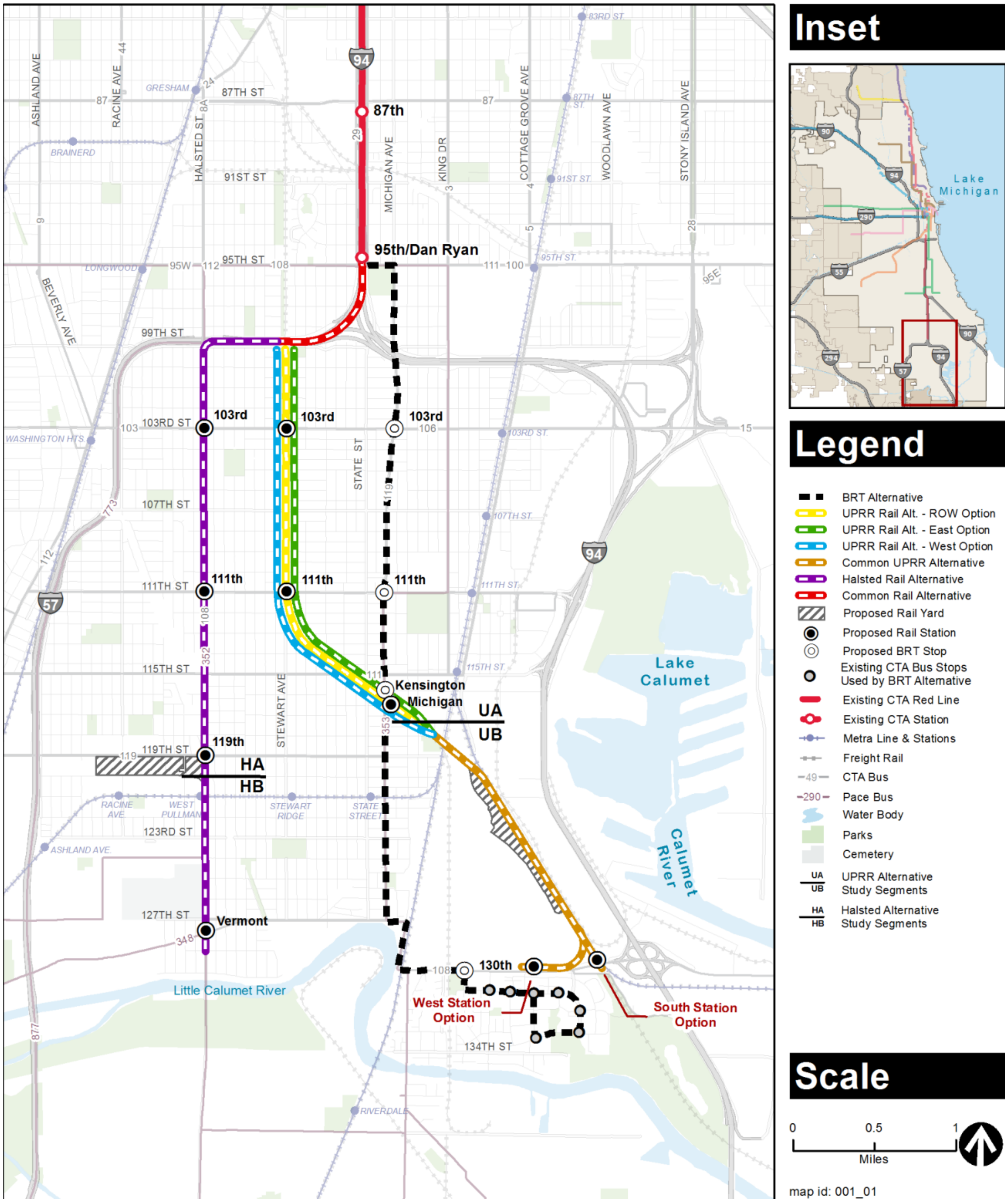

Figure 2-1: Red Line Extension Project Alternatives

The No Build Alternative is a required alternative as part of the NEPA environmental analysis and is used for comparison purposes to assess the relative benefits and impacts of extending the Red Line. The No Build Alternative is carried into the Draft EIS phase of the project development regardless of its performance versus the build alternatives under consideration. No new infrastructure would be constructed as part of the No Build Alternative other than committed transportation improvements that are already in the CMAP Fiscal Year 2010–2015 Transportation Improvement Program (TIP) and the improvements to 95th Street Terminal. The TIP projects within the project area consist of four bridge reconstructions, several road improvement projects including resurfacing and coordination of signal timing on 95th Street, work on Metra's facilities, construction of a bicycle/pedestrian multi-use trail, and preservation of historic facilities. The No Build Alternative includes regular maintenance of existing track and structures, and bus transit service would be focused on the preservation of existing services and projects. All elements of the No Build Alternative are included in each of the other alternatives. Under this alternative, travel times would not improve from existing conditions.

The BRT Alternative (formerly referred to as the Transportation Systems Management Alternative) is a 5.0-mile, limited-stop, enhanced BRT route, which is assumed to operate 24 hours per day between the existing 95th Street Terminal and the intersection of 130th Street and Eberhart Avenue. No dedicated bus lanes would be provided for the BRT Alternative; however, parking lanes would be removed for some portions of the alignment and four stops with improved bus shelters and park & ride facilities would be created at 103rd Street and Michigan Avenue, 111th Street and Michigan Avenue, Kensington Avenue and Michigan Avenue, and 130th Street and Eberhart Avenue. Although BRT service elements would not continue south of the 130th Street stop, the bus route would continue through Altgeld Gardens along the existing route with six stops. The BRT Alternative would be consistent with bus routing changes that may occur as part of improvements to the 95th Street Terminal. Under this alternative, travel times between 130th Street and the Loop would improve over existing conditions.

The UPRR Rail Alternative is a 5.3-mile extension of the heavy rail transit Red Line from its existing 95th Street Terminal to 130th Street, just west of I-94. The Chicago Transit Board designated the UPRR Rail Alternative as the Locally Preferred Alternative at its August 12, 2009 board meeting. This alternative includes construction and operation of new heavy rail transit tracks, mostly in existing transportation corridors. The UPRR Rail Alternative has three options for alignment (ROW, East, and West), all of which would include operation on elevated structure from 95th Street to just past the Canadian National/Metra Electric District tracks near 119th Street. The alignment would then transition to at-grade through an industrial area with no public through streets, terminating at 130th Street in the vicinity of Altgeld Gardens. Four new stations would be constructed at 103rd Street, 111th Street, Michigan Avenue, and 130th Street. The 130th Street station would be the terminal station, with two options under evaluation: the South Station Option and the West Station Option. A new yard and shop facility would be sited near 120th Street and Cottage Grove Avenue. The bus routes in the vicinity of the UPRR Rail Alternative would be modified to enhance connectivity between the Red Line and the bus network. The hours of operation and service frequency for the UPRR Rail Alternative are assumed to be the same as for the current Red Line. Under this alternative, travel times between 130th Street and the Loop would improve substantially over existing conditions.

The Halsted Rail Alternative is a 5.0-mile heavy rail transit extension of the existing Red Line. In this alternative, the Red Line would operate on an elevated structure running south from 95th Street along I-57 until Halsted Street. The alignment would then turn south and continue along Halsted Street to the intersection of Halsted Street and Vermont Avenue near 127th Street. This alternative would include four new stations at 103rd Street, 111th Street, 119th Street, and Vermont Avenue. The Vermont Avenue station would be the terminal station. A new yard and shop would be sited west of Halsted Street and between the 119th Street and Vermont Avenue stations. The bus routes in the vicinity of the Halsted Rail Alternative would be modified to enhance connectivity to the Red Line. The hours of operation and service frequency for the Halsted Rail Alternative are assumed to be the same as for the current Red Line. Under this alternative, travel times between 127th Street and the Loop would improve substantially over existing conditions. This alternative would not extend rail to Altgeld Gardens, which would be served by bus connecting to the Vermont terminal station.

Section 3
Methods for Impact Evaluation

3.1 Regulatory Framework

3.1.1 Federal

Under authority of the Clean Air Act (CAA) and its amendments, the USEPA has established NAAQS for criteria pollutants to protect the public health and welfare (U.S. Congress 1970, 1977, 1990). The criteria pollutants that are of greatest significance to the transportation sector include CO, nitrogen dioxide (NO_2), ozone, particulate matter with an aerodynamic diameter of 10 micrometers and less (PM_{10}) and particulate matter with an aerodynamic diameter of 2.5 micrometers and less ($PM_{2.5}$). The NAAQS are summarized in Table 3-1. Although not shown in this table, the IAAQS are identical to the NAAQS.

3.1.2 State

The RLE Project and its associated stations would be in Cook County, Illinois. This county has been designated by the USEPA as a moderate nonattainment area with respect to the 8-hour ozone NAAQS. Cook County is also a nonattainment area for $PM_{2.5}$ and for lead. Illinois, through its SIP, specifies target dates for achieving compliance with the NAAQS, and identifies specific emission reduction goals for nonattainment or maintenance areas.

The RLE Project is included in a conforming RTP. Therefore, a regional analysis of project emissions would not be required for purposes of demonstrating compliance with the transportation conformity rules.

3.1.3 Local

There are no local ordinances that address transportation projects such as the RLE Project. There are also no local regulations that pertain to emissions of CAA criteria pollutants. Emissions of CO from parking facilities are not, for example, covered by local regulations.

Table 3-1: National Ambient Air Quality Standards for Criteria Pollutants

Pollutant	Standard Type	Averaging Period	National	Form
Carbon Monoxide	Primary	1-hour	40 mg/m^3 (35 ppm)$^{(1)}$	Not to be exceeded more than once per year
		8-hour	10 mg/m^3 (9 ppm)	
Lead	Primary and Secondary	Rolling 3-Month	0.15 µg/m$^{3\ (2)}$	Not to be exceeded
Nitrogen Dioxide	Primary	1-hour	100 ppb	98th percentile, averaged over 3 years
	Primary and Secondary	Annual	53 ppb$^{(3)}$ (100 µg/m^3)	Annual arithmetic mean
Ozone	Primary and Secondary	8-hour	0.075 ppm$^{(5)}$	Annual fourth-highest daily maximum 8-hr concentration, averaged over 3 years
PM_{10}	Primary and Secondary	24-hour	150 µg/m^3	Not to be exceeded more than once per year on average over 3 years
$PM_{2.5}$	Primary and Secondary	Annual	15 µg/m$^{3\ (6)}$	Annual arithmetic mean, averaged over 3 years
	Primary and Secondary	24-hour	35 µg/m$^{3\ (6)}$	98th percentile, averaged over 3 years
Sulfur Dioxide	Primary	1-hour	75 ppb $^{(7)}$	99th percentile of 1-hour daily maximum concentrations, averaged over 3 years
	Secondary	3-hour	0.5 ppm	Not to be exceeded more than once per year

Source: USEPA, National Primary and Secondary Ambient Air Quality Standards (40 Code of Federal Regulations 50)

(1) The units of pollutant concentrations are in milligrams per cubic meter (mg/m^3), micrograms per cubic meter (µg/m^3), parts per million by volume (ppm), or parts per billion by volume (ppb).

2) Final rule signed October 15, 2008. The 1978 lead standard (1.5 µg/m^3 as a calendar quarterly average) remains in effect until 1 year after an area is designated for the 2008 standard, except that in designated nonattainment areas for the 1978 standard, the 1978 standard remains in effect until implementation plans to attain or maintain the 2008 standard are approved. The metropolitan Chicago area is no longer subject to the 1978 lead standard.

(3) The official level of the annual NO_2 standard is 0.053 ppm, equal to 53 ppb, which is shown here for the purpose of clearer comparison to the 1-hour NO_2 standard.

(4) USEPA revoked the 1-hour ozone standard in most areas of the United States.

(5) Final rule signed March 12, 2008. The 1997 ozone standard (0.08 ppm, annual fourth-highest daily maximum 8-hour concentration, averaged over 3 years) and related implementation rules remain in place. EPA revoked the 1-hour ozone standard (0.12 ppm, not to be exceeded more than once per year) in most areas of the United States as of June 15, 2005, although some areas have continued obligations under that standard (“anti-backsliding”). The 1-hour ozone standard is attained when the expected number of days per calendar year with maximum hourly average concentrations above 0.12 ppm is less than or equal to 1.

(6) The $PM_{2.5}$ standards are referenced to local conditions of temperature and pressure rather than standard conditions (760 mm and 25 degrees C).

(7) Final rule signed June 2, 2010. The 1971 annual and 24-hour sulfur dioxide standards were revoked in that same rulemaking. However, these standards remain in effect until 1 year after an area is designated for the 2010 standard, except in designated nonattainment areas for the 1971 standards, where the 1971 standards remain in effect until implementation plans to attain or maintain the 2010 standard are approved. The metropolitan Chicago area is no longer subject to the 1971 annual and 24-hour sulfur dioxide standards.

3.2 Impact Analysis Thresholds

3.2.1 During Construction

There is no quantitative basis for impact thresholds during construction, with the exception of the NAAQS for such pollutants as particulate matter (PM_{10} and $PM_{2.5}$) and CO. Most state transportation and environmental review agencies expect to see dust control and traffic management addressed and mitigated. The IDOT, for instance, has formal requirements for the contractor to prepare a Dust Control Plan, a Traffic Management Plan, and emission controls and low sulfur fuels for diesel-powered equipment.

3.2.2 During Operation

The impact thresholds during operation are the NAAQS. The thresholds for criteria pollutants during project operation are limited to controlling emissions that affect the nonattainment or maintenance status of the pollutants. For ozone nonattainment, the controls are focused on the precursors; namely, oxides of nitrogen (NOx) and volatile organic compounds (VOCs).

The SIP provides the emissions control strategy and implementation schedules for achieving and maintaining the NAAQS, such as the 8-hour ozone standard. If a proposed transportation project is in the RTP, and the RTP conforms to the SIP, then a separate conformity analysis of the specific project is not warranted because its impacts on region-wide emissions have already been taken into account.

Some states have impact thresholds for MSAT that are either related to emissions or exposure levels. But neither IEPA nor the FTA has any such requirements. Likewise, there are no quantitative impact thresholds for GHG emissions. Many states, including Illinois, have policies or guidance that encourage project proponents to minimize GHG emissions through conservation (using less energy) and use of alternative fuels (using less fossil fuel and more renewable energy such as solar or wind).

3.3 Area of Potential Impact

For an air quality assessment, impacts could be regional or localized; thus, the area of potential impact has both a regional and a local component. The regional component follows the analysis area adopted by the traffic analysis, which is a corridor bounded on the south by a varying boundary that includes 134th Street, on the north by 91st Street, on the west by a varying boundary that includes Halsted Street, and on the east by a varying boundary that includes I-94. The local component would be limited to the individual stations, their associated parking facilities, and nearby intersections affected by traffic entering and exiting the stations.

3.4 Methods

3.4.1 Air Quality Effects

The overall air quality effects from project operations are normally evaluated by quantifying the selected criteria pollutant emissions on a regional basis, and at local hot spots where motor vehicle congestion can take place. The RLE Project is included in a conforming RTP, and a corridor-wide emissions inventory analysis is therefore not necessary to demonstrate transportation conformity. The IEPA is trying to seek a re-designation of its $PM_{2.5}$ nonattainment status from USEPA. The RLE Project is not considered to be a project of local air quality concern (for example, a project that involves a significant increase in diesel buses or trucks). Under these circumstances, therefore, a qualitative hot spot analysis of $PM_{2.5}$ was prepared for the existing conditions, and the No Build Alternative, the BRT Alternative, the UPRR Rail Alternative (with its three options), and the Halsted Rail Alternative for the year 2030.

3.4.2 CO Hot Spot Analysis

A project-level CO hot spot analysis is performed as part of the NEPA process, for purposes of identifying and disclosing substantial impacts, and to evaluate possible mitigation measures. CO concentrations caused by local traffic at critical intersections must be estimated for comparison with the federal and state 1-hour and 8-hour CO standards. Concentrations must be estimated using the current, state-of-the-art approved emission factor programs and a dispersion model approved by USEPA to determine whether sensitive receptors would experience new or worsened violations of the federal CO standards.

Local CO dispersion modeling analysis was conducted at three "worst case" selected intersections for each project alternative. The "worst case" intersections for each alternative were selected based on level of service and total traffic volumes during the peak hour, as described in the USEPA's (1992) *Guideline for Modeling Carbon Monoxide from Roadway Intersections*. Table 3-2 presents the list of intersections selected for detailed analysis by project alternative. The listed ID numbers correspond to ID numbers in the *Transportation Technical Memorandum*. Figure 3-1 shows the location of each of the intersections analyzed.

The CO emission factors were developed using the USEPA's MOBILE6.2 program (USEPA 2004) and guidance from IEPA. Intersections were evaluated using EPA's CAL3QHC program (USEPA 1993). The estimated maximum 1-hour CO concentrations at each intersection were used to determine the 8-hour CO concentrations by multiplying the 1-hour concentration by a persistence factor approved by the IEPA of 0.7 (IEPA Personal communication 2012).

Total CO concentrations were derived by adding the modeled maximum concentrations to a background level to account for CO sources other than the traffic at the intersection being modeled. The background values represent worst-case, ambient CO levels that are assumed to occur independently of the vehicle traffic being analyzed. The nearest representative monitoring site to the project area is at 321 S. Franklin Street in Chicago. In consultation with IEPA (IEPA Personal communication 2012), background levels of 3.0 parts per million (ppm) for the 1-hour concentration and 1.7 ppm for 8-hour concentration were used based on the highest second-highest measured concentrations from the most recent 3 full years of monitoring data (2009–2011). These background levels are intended to represent worst-case urban conditions. The background concentrations were conservatively held constant for all analysis years and project alternatives. The maximum 1-hour and 8-hour CO concentrations (including an appropriate background concentration) were compared to the NAAQS for CO to determine impacts.

Table 3-2: Intersections Selected for the Detailed Air Quality Analysis by Alternative

Alternative	ID No.	Intersection Name	LOS	Total Volume
Existing	5	98th Place and Halsted Street	F	3,506
	14	103rd Street and Vincennes Avenue and Beverly Avenue	F	3,023
	59	119th Street and Ashland Avenue	F	1,922
No Build	5	98th Place and Halsted Street	F	3,742
	14	103rd Street and Vincennes Avenue and Beverly Avenue	F	3,598
	59	119th Street and Ashland Avenue	F	3,511
Bus Rapid Transit	5	98th Place and Halsted Street	F	3,688
	59	119th Street and Ashland Avenue	F	2,267
	73	130th Street and Indiana Avenue	F	2,602
Union Pacific Railroad Rail*	5	98th Place and Halsted Street	F	3,770
	62	119th Street and State Street	F	1,713
	73	130th Street and Indiana Avenue	F	3,479
Halsted Rail	5	98th Place and Halsted Street	F	3,771
	68	127th Street and Halsted Street	F	3,543
	70	127th Street and Vermont Avenue and Wallace Street	F	3,054

Source: KM Chng Environmental Inc., November 2012.
Notes:
LOS (level of service) and total volume data are for the peak hour.
Total volume is the number of vehicles entering an intersection from all approaches in the peak hour.
* = Results are the same for all UPRR Options.

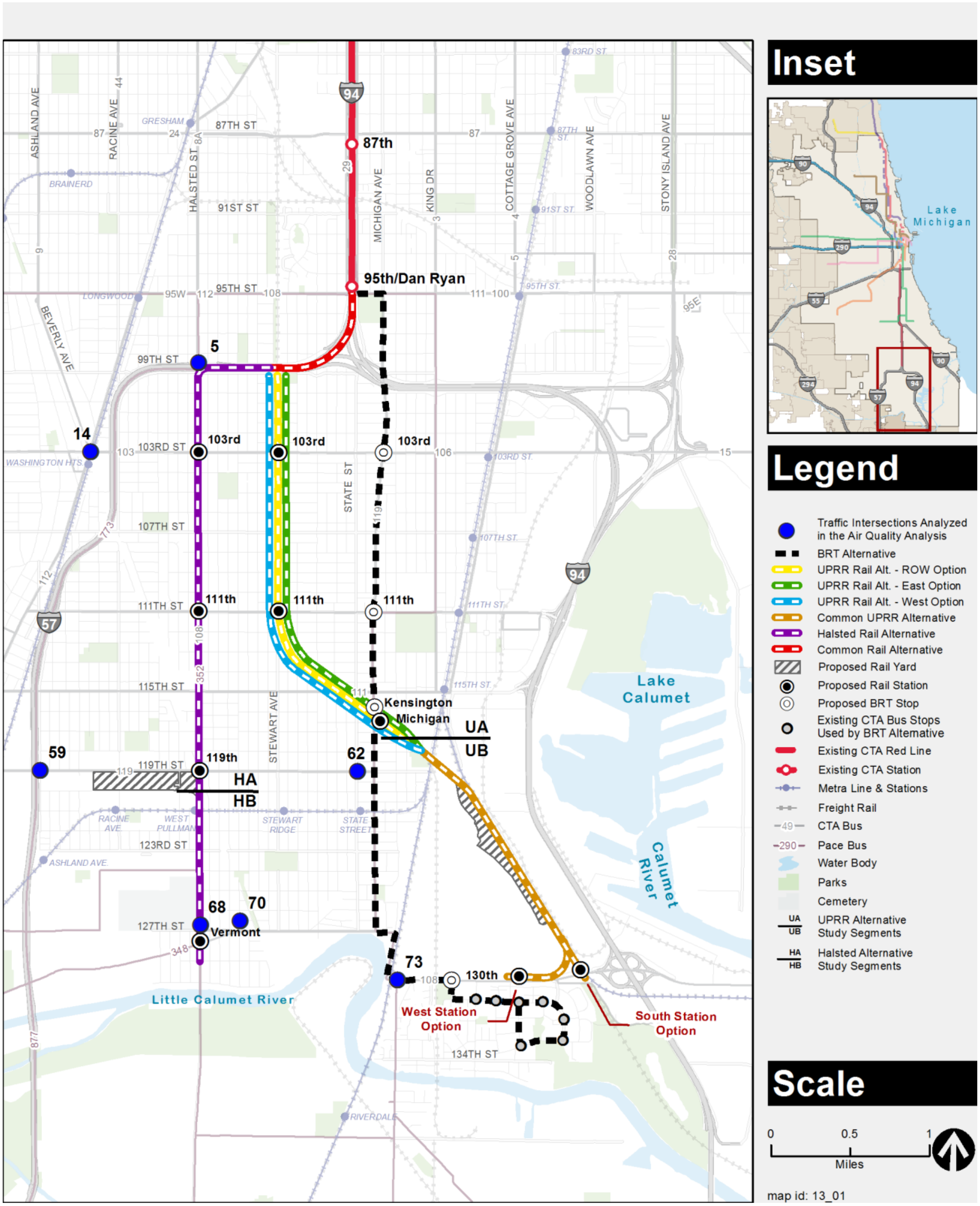

Figure 3-1: Traffic Intersections Analyzed in the Air Quality Analysis

3.4.3 Greenhouse Gases

A GHG is a gas in the atmosphere that absorbs and emits radiation within the thermal infrared range. Some GHGs are emitted by natural sources, such as respiration of plants and living organisms. GHGs can also be man-made, with sources such as the combustion of fossil fuels in transportation, residential space heating and utility power plants. Greenhouse gases act like a blanket around Earth, trapping energy in the atmosphere and causing it to warm. This phenomenon is called the greenhouse effect and is natural and necessary to support life on Earth. However, the buildup of GHG can change Earth's climate and result in dangerous effects on human health and welfare and on ecosystems. The primary GHG in the Earth's atmosphere are water vapor, carbon dioxide, methane, nitrous oxide, and ozone. In addition, sulfur hexafluoride (SF6) is also a known GHG and is used in transformers and electrical equipment. Water vapor is not regulated in any way and ozone is regulated under the CAA; therefore, these two compounds will not be addressed further in this technical memorandum.

Of the GHGs that are implicated in global climate change, CO_2 is the most dominant GHG in the atmosphere, by far. The GHGs differ in their ability to trap heat. For example, 1 ton of emissions of CO_2 has a different effect than 1 ton of emissions of methane. To compare emissions of different GHGs, emissions were computed using a weighting factor called a Global Warming Potential (GWP). To use a GWP, the heat-trapping ability of 1 metric ton (1,000 kilograms) of CO_2 is taken as the standard, and emissions are expressed in terms of CO_2e. Therefore, the GWP of CO_2 is 1. The GWP of methane is 21, while the GWP of nitrous oxide is 310. Total GHG emissions were determined by converting CO_2, methane (CH_4), and N_2O emissions from each of the major source categories into total CO_2e emissions by multiplying each compound by its respective GWP and summing the results.

The CO_2e emissions were estimated for the existing conditions and each of the project alternatives in 2030. The USEPA's MOBILE6.2 program was used to determine CO_2 emission factors from motor vehicles (cars, trucks, and buses). Emission factors for CH_4 and nitrous oxide N_2O were taken from Table 13.4 of *The Climate Registry - General Reporting Protocol* (TCR 2012). Vehicle fuel economy was assumed to be the national average of 23.8 miles per gallon (taken from Table 4-23 of the *National Transportation Statistics Report*, [Bureau of Transportation Statistics 2011]). Emission factors were combined with motor vehicle-generated VMT to estimate GHG emissions.

The quantitative assessment of project-related GHG benefits and/or impacts on climate change was conducted in accordance with the *Illinois Climate Change Advisory Group's Final Recommendations to the Governor (ICCAG 2007)*. These changes in GHG emissions reflect differences in VMT, travel speed, fuel consumption, and delay along the project corridor. This comparison of GHG emissions was supplemented by a qualitative assessment of project-related GHG benefits and/or impacts on global climate change. If any of the project alternatives were to lead to increased electricity use, this increase could lead to increased GHG emissions from local power plants supplying electricity to the grid.

The FTA issued new New Starts Guidance in January 2013 (Federal Transit Administration, *Proposed New Starts and Small Starts Policy Guidance*, January 9, 2013), which provides rates for converting VMT to CO, NOx, $PM_{2.5}$, VOCs, and GHG (CO_2e). The guidance was not available at the time this analysis was prepared; it was released long after the GHG analysis for this project was completed and the analysis has not been redone. The GHG emission factors used in this analysis are conservative (about 20 percent higher than the new FTA values). Thus, while the magnitude of the GHG impacts (actually improvements) would be smaller when using the FTA values, the overall conclusions would not change.

3.4.4 $PM_{2.5}$ Hot Spot Analysis

A hot spot analysis is defined in 40 Code of Federal Regulations (CFR) 93.101 as an estimation of likely future localized $PM_{2.5}$ pollutant concentrations and a comparison of those concentrations to the relevant air quality standards. A hot spot analysis assesses the air quality impacts on a scale smaller than an entire nonattainment or maintenance area. Such an analysis is a means of demonstrating that a transportation project meets CAA conformity requirements to support state and local air quality goals with respect to potential localized air quality impacts.

The qualitative $PM_{2.5}$ hot spot analysis followed USEPA's latest guidance (USEPA 2006). The analysis was based on direct emissions only. No precursor or secondary reaction products were taken into account. Based on the USEPA guidance, construction phase impacts were not required to be addressed in the $PM_{2.5}$ hot spot analysis. The method chosen to complete the $PM_{2.5}$ analysis is a combination of (1) performing and evaluating air quality studies for the proposed project location, and (2) using results of other studies for the general project location, including the Illinois SIP for $PM_{2.5}$ (CMAP 2008, 2010a, 2010b, 2010c). Various federal regulations requiring lower particulate emissions and fuel reformulations, including low-sulfur diesel fuels, have a significant role in reducing $PM_{2.5}$ emissions from mobile sources.

3.4.5 Mobile Source Air Toxics

Mobile source air toxics (MSAT) are compounds emitted from highway vehicles and non-road equipment and that are known or suspected to cause cancer or other serious health and environmental effects. Mobile sources are responsible for direct emissions of air toxics and contribute to precursor emissions that react to form secondary pollutants. The NEPA process requires the examination and avoidance of potential impacts on the natural and human environment when considering approval of proposed transportation projects.

The RLE Project would not have a high potential of MSAT effects, because direct emissions of MSAT from motor vehicles on the roadways are expected to decrease substantially with time. Project impacts on air toxics were assessed qualitatively, following the Federal Highway Administration's (FHWA's) 2009 guidelines (FHWA 2009). A qualitative analysis provides a basis for identifying and comparing the potential differences among MSAT emissions, if any, from the various alternatives. The qualitative assessment presented here is derived in part from a study conducted by the FHWA titled *A Methodology for Evaluating Mobile Source Air Toxic Emissions Among Transportation Project Alternatives* (FHWA 2011).

This assessment includes a description and discussion of national trend data projecting substantial overall reductions in emissions due to stricter engine and fuel regulations issued by USEPA, a discussion of information that is incomplete or unavailable for a project-specific assessment of MSAT impacts in compliance with the Council on Environmental Quality regulations (40 CFR 1502.22(b)), and a summary of current studies regarding the health impacts of MSAT, in compliance with 40 CFR 150.22(b). A qualitative comparison of MSAT from the various project alternatives was developed from the estimates of VMT, which were used as a surrogate for indicating trends in MSAT emissions.

3.4.6 Construction Impacts

Potential air quality impacts during construction were addressed qualitatively for construction vehicle emissions, including particulate matter (PM_{10} and $PM_{2.5}$) emissions and fugitive dust emissions. The focus of the assessment was to identify various mitigation measures to minimize or avoid these potential impacts.

3.4.7 Mitigation Measures

Mitigation of emissions during construction activities was addressed in Section 3.4.6. Following construction, operation of the project would result in no direct emissions. There could be an overall decrease in motor vehicle emissions due to diversion of passengers from motor vehicles to transit. During operation, none of the build alternatives would be likely to lead to any of the following:

- Emissions causing or contributing to a new violation of the NAAQS in the project area.
- An increase in the frequency or severity of an existing violation of the NAAQS.
- A delay of timely attainment of the NAAQS or other emissions reduction milestones in the project area.

Therefore, no mitigation measures would be needed for operation of the project.

Section 4
Affected Environment

As described in Section 3.1.2, Cook County, Illinois has been designated as a moderate nonattainment area with respect to the 8-hour ozone NAAQS. The IEPA, through the SIP, specifies target dates for achieving compliance with the ozone standard, and identifies specific emission reduction goals for NO_2 and non-methane hydrocarbons, which are precursors of ozone. The USEPA has designated Cook County a nonattainment area for $PM_{2.5}$, but current air quality data show that Cook County is meeting the $PM_{2.5}$ NAAQS. The IEPA has requested a redesignation, but to date, the USEPA has not acted on this request. The USEPA has designated a portion of Cook County a nonattainment area for lead, but that nonattainment area is not in the project area.

Because the project would occur in a “moderate” ozone nonattainment area, it is the FTA's responsibility, as the federal lead agency, to ensure that the proposed project conforms to the Illinois SIP. A "conforming" project is defined as one that meets the SIP's objectives of eliminating or reducing the severity and number of violations of the NAAQS and achieving expeditious attainment of those standards.

Federally funded transit projects are subject to the USEPA transportation conformity rule (40 CFR Part 93 Subpart A). Conformity is demonstrated by showing that the proposed project is included in a conforming RTP and also meets the project-level requirements contained in the transportation conformity rule. The Long-Range RTP for the region is the *2030 Regional Transportation Plan for Northeastern Illinois* ([2030 RTP] CMAP 2008). The Board of the CMAP and the Metropolitan Planning Organization Policy Committee approved an update to the 2030 RTP on October 8 and October 9, 2008, respectively. The region’s TIP, *Federal Fiscal Year 2010–2015 Transportation Improvement Program* (CMAP 2010) was accepted by the U.S. Department of Transportation on October 25, 2010, following approvals by the CMAP Metropolitan Planning Organization Policy Committee, IDOT, IEPA, and USEPA. All of the projects in the TIP are included in the conforming 2030 RTP. The 2030 RTP was replaced by the *GO TO 2040* comprehensive regional plan (CMAP 2010) in January 2012. The updated RTP (*GO TO 2040)* continues to carry the RLE Project. Because the RLE Project is in a conforming RTP, a regional analysis of project emissions is not required to demonstrate compliance with the transportation conformity rule.

4.1 Measured Ambient Air Quality Concentrations

This section summarizes measured ambient air quality data for the region including the project area. The IEPA maintains a statewide network of monitoring stations that continuously measure pollutant concentrations in the ambient air. These stations provide data to assess compliance with the NAAQS and the IAAQS and to evaluate the effectiveness of pollution control strategies. The pollutants of concern are CO, NOx, Ozone, PM_{10}, $PM_{2.5}$, and sulfur dioxide. Table 4-1 presents the maximum ambient concentrations for these pollutants measured at representative monitoring stations nearest to the project corridor for the most recently available full year of data, calendar year 2011. As shown in Table 4-1, except for one exceedance of the 8-hour ozone at the Lawndale Street Station, there were no exceedances in the project area of any of the NAAQS or IAAQS in 2011.

Table 4-1: Measured Ambient Air Quality in the Project Area for 2011

Pollutant	Monitor Location	Averaging Period	Monitored Value	Standard
Carbon Monoxide	321 S. Franklin (Chicago, IL)	1-hour	3.3 ppm	35.0 ppm
Carbon Monoxide	321 S. Franklin (Chicago, IL)	8-hour	1.5 ppm	9.0 ppm
Nitrogen Dioxide	321 S. Franklin (Chicago, IL)	1-hour	89 ppb	100 ppb
Ozone	7801 Lawndale (Chicago, IL)	8-hour	**0.082 ppm**	0.075 ppm
PM_{10}	750 Dundee Rd. (Northbrook, IL)	24-hour	38 µg/m^3	150 µg/m^3
$PM_{2.5}$	3535 E.114th St. (Chicago, IL)	24-hour	28.5 µg/m^3	35 µg/m^3
$PM_{2.5}$	3535 E.114th St. (Chicago, IL)	Annual	12.6 µg/m^3	15.0 µg/m^3
Sulfur Dioxide	7801 Lawndale (Chicago, IL)	1-hour	29 ppb	75 ppb
Sulfur Dioxide	7801 Lawndale (Chicago, IL)	24-hour	7 ppb	140 ppb

Source: EPA, Airdata website (http://www.epa.gov/airdata), Monitor Values Report accessed October 15, 2012.
Units of measure are parts per million (ppm) or parts per billion (ppb) by volume, and micrograms per cubic meter of air (µg/m3).
Values in **bold** exceed the applicable standard, but do not constitute a violation.

4.2 CO Hot Spot Analysis

Following the methods described in Section 3.4.2, a CO hot spot analysis was conducted for the existing conditions using EPA's MOBILE6.2 emission factors program and EPA's CAL3QHC dispersion model. A summary of the modeled maximum 1-hour CO concentrations at each of the street intersections selected for analysis (98th Place and Halsted Street, 103rd Street and Vincennes Avenue and Beverly Avenue, and 119th Street and Ashland Avenue) is presented in Table 4-2. These concentrations include a background level of 3.0 parts per million (ppm), which was determined to remain constant with time. The 8-hour CO concentrations were estimated by multiplying the modeled 1-hour results (without the background) by a persistence factor of 0.7 and adding a background of 1.7 ppm (also assumed to remain constant with time). A summary of the modeled maximum 8-hour CO concentrations for the selected intersections for the existing conditions is also presented in Table 4-2.

Table 4-2: Estimated Maximum 1-Hour and 8-Hour Carbon Monoxide Concentrations for the Existing Conditions

ID No.	Intersection Description	Maximum 1-hour* (ppm)	Maximum 8-hour** (ppm)
5	98th Place and Halsted Street	5.7	3.6
14	103rd Street and Vincennes Avenue and Beverly Avenue	5.1	3.2
59	119th Street and Ashland Avenue	5.0	3.1

Source: KM Chng Environmental Inc., 2012.
* Values include a background 1-hour CO concentration of 3.0 ppm.
** Values include a background 8-hour CO concentration of 1.7 ppm.
ppm = parts per million

As shown in Table 4-2, the maximum modeled 1-hour CO concentration at any of the three intersections analyzed for the existing conditions was estimated to be 5.7 ppm, including a background concentration of 3.0 ppm, for the intersection of 98th Place and Halsted Street. This maximum 1-hour CO concentration occurred at a receptor located along the southbound approach of Halsted Street about 3 meters from the intersection with 98th Place. All of the modeled 1-hour CO concentrations for the existing conditions were well below the 1-hour CO National and Illinois standard of 35 ppm.

The maximum 8-hour CO concentration for the existing conditions occurred at the same receptor at the same intersection as the 1-hour concentration and was estimated to be 3.6 ppm, including a background CO concentration of 1.7 ppm. All of the modeled 8-hour CO concentrations for the existing conditions were also well below the corresponding 8-hour CO National and Illinois standards of 9 ppm.

4.3 Greenhouse Gas Analysis

A GHG is a gas in the atmosphere that absorbs and emits radiation within the thermal infrared range. The quantitative assessment of project-related GHG benefits and/or impacts on climate change presented here was conducted to reflect the changes in GHG emissions based on differences in VMT, travel speed, fuel consumption, and delay along the project corridor.

The six-county Chicago metropolitan area, including Cook County, was estimated to have emissions of about 105 million metric tons of CO_2e in calendar year 2000. The transportation sector was responsible for up to 31 percent of the CO_2 emissions, and on-road vehicles generated approximately 90 percent of the CO_2e emissions from transportation sources (McGraw et al. 2010).

The GHG emissions in the project area for the existing conditions in 2012 were estimated to be about 53,048,993 tons per year (tpy) of CO_2, about 1,704 tpy of CH4, and about 2,613 tpy of N_2O.

When converted to total CO_2e using the GWP conversion factors, the total GHG is 53,894,714 tpy of CO_2e.

4.4 $PM_{2.5}$ Hot Spot Analysis

The method chosen to complete the qualitative $PM_{2.5}$ analysis is a combination of (1) performing and evaluating air quality studies for the proposed project location, and (2) using results of other studies for the general project location (including the Illinois SIP for $PM_{2.5}$).

Diesel particulate matter is part of a complex mixture that makes up diesel exhaust. Diesel exhaust is commonly found throughout the environment and is estimated by EPA to contribute to the human health risk. Diesel exhaust is composed of two phases, either gas or particle and both phases contribute to the risk. The gas phase is composed of many of the urban hazardous air pollutants, such as acetaldehyde, acrolein, benzene, 1,3-butadiene, formaldehyde and polycyclic aromatic hydrocarbons. The particle phase also has many different types of particles that can be classified by size or composition. The sizes of diesel particulates that are of greatest health concern are those that are in the categories of fine and ultra-fine particles. The composition of these fine and ultra-fine particles may be composed of elemental carbon with adsorbed compounds such as organic compounds, sulfate, nitrate, metals and other trace elements. Diesel exhaust is emitted from a broad range of diesel engines; the on road diesel engines of trucks, buses and cars and the off road diesel engines that include locomotives, marine vessels, and heavy duty equipment.

Diesel exhaust causes health effects from both short-term or acute exposures and also long-term chronic exposures, such as repeated occupational exposures. The type and severity of health effects depends upon several factors including the amount of chemical one is exposed to and the length of time one is exposed. Individuals also react differently to different levels of exposure. There is limited information on exposure to just diesel particulate matter but there is enough evidence to indicate that inhalation exposure to diesel exhaust causes acute and chronic health effects. Acute exposure to diesel exhaust may cause irritation to the eyes, nose, throat and lungs, and some neurological effects such as lightheadedness. Acute exposure may also elicit a cough or nausea as well as exacerbate asthma. Based upon human and laboratory studies, there is considerable evidence that diesel exhaust is a likely carcinogen. Human epidemiological studies demonstrate an association between exposure to diesel exhaust and increased lung cancer rates in occupational settings.

The USEPA has designated Cook County as a nonattainment area for $PM_{2.5}$, but current air quality data show that Cook County is meeting the $PM_{2.5}$ NAAQS. As noted above, the IEPA has also requested a redesignation to attainment status, but to date, the USEPA has not acted on this request. Following joint guidance issued by EPA and FHWA (USEPA 2006), the following qualitative assessment of $PM_{2.5}$ hot spot analysis was conducted. Air quality monitoring of $PM_{2.5}$ in Cook County and across the state shows a decrease in $PM_{2.5}$ concentrations of 24 percent over the past decade (2001–2010). For the existing conditions, monitored ambient $PM_{2.5}$ concentrations in the vicinity of the RLE Project show no exceedances of the $PM_{2.5}$ standard in 2011 (the most recent year for which complete data is available).

4.5 Mobile Source Air Toxics Analysis

Mobile source air toxics are emitted from motor vehicles and non-road construction equipment. The MSAT can be present in the fuels, formed from incomplete combustion of fossil fuels, or formed as secondary reaction products from the combustion emissions in the atmosphere. A qualitative comparison of MSAT from the various project alternatives was developed from the estimates of VMT, which were used as a surrogate for indicating trends in MSAT, and the comparisons are provided below. Although a qualitative analysis cannot identify and measure health impacts from MSAT, it provides a basis for comparing and contrasting the various alternatives with respect to MSAT emissions. The qualitative analysis of MSAT for this project assumes the change in the amount of MSAT emitted between the No Build and the RLE Project Alternatives will be proportional to the change in the project-related VMT.

Mobile source air toxics are a subset of the 188 air toxics defined by the CAA. Most air toxics originate from human-made sources, including on-road mobile sources, non-road mobile sources (e.g., airplanes), and stationary sources (e.g., factories or refineries). Metal air toxics also result from engine wear or from impurities in oil or gasoline. The USEPA has assessed the list of 188 air toxics in its latest rule on the Control of Hazardous Air Pollutants from Mobile Sources and identified a group of 93 compounds emitted from mobile sources that are listed in its Integrated Risk Information System. There currently are no established ambient air quality standards for MSAT. In accordance with the FHWA's guidance regarding air toxic analysis (FHWA 2009), a qualitative assessment of MSAT is also included in the air quality analysis.

Of the many MSAT that are regulated by the USEPA, six are judged to be significant for transportation sources partly because of their suspected carcinogenicity and their relative abundance in vehicle exhaust. According to USEPA's *Control of Emissions of Hazardous Air Pollutants from Mobile Sources Final Rule* (USEPA 2007), these six priority MSAT include benzene, acrolein, formaldehyde, 1,3-butadiene, acetaldehyde, and diesel particulate matter. As a result of the FMVECP (40 USC § 7521), the FHWA estimates that even with an assumed 64 percent increase in VMT from 2000 to 2020, emissions of the various non-diesel MSAT would decrease by 57 to 65 percent. For diesel particulates and diesel organic gases, the reduction was estimated at 87 percent. A qualitative comparison of MSAT from the various project alternatives was developed from the estimates of VMT, which were used as a surrogate for indicating trends in MSAT emissions.

Section 5
Impacts and Mitigations

This section describes the analyses performed and assesses the results in comparison to the No Build Alternative.

5.1 No Build Alternative

The No Build Alternative in 2030 is defined as the existing transportation system plus any committed transportation improvements that are already in the CMAP Fiscal Year 2010–2015 TIP. The TIP projects within the project area include four bridge reconstructions, several road improvement projects including resurfacing and coordination of signal timing, work on Metra's facilities, construction of a bicycle/pedestrian multi-use trail, and preservation of historic facilities. No new infrastructure would be constructed as part of the No Build Alternative.

5.1.1 Permanent Impacts and Mitigations – No Build Alternative

With the No Build Alternative, there would be no changes in ridership due to the proposed RLE Project; therefore, there would be no changes in direct emissions due to the proposed project. The Red Line trains run on electricity; therefore, they cause no direct emissions. Their electricity comes from the electric utility grid, which may include local, fossil-fueled power plants. No increase in electrical power consumption would be expected under the No Build Alternative; therefore, no change in indirect emissions would be expected with the No Build Alternative.

5.1.1.1 CO Hot Spot Analysis

A summary of the modeled maximum 1-hour CO concentrations at all of the street intersections selected for analysis is presented in Table 5-1. A summary of the modeled maximum 8-hour CO concentrations for the selected intersections is presented in Table 5-2. For comparison purposes, the results for all project alternatives are presented in these tables. The three "worst case" intersections for each alternative were selected based on level of service (LOS) and total traffic volumes during the peak hour, as required by USEPA guidance (USEPA 1992). These intersections may not be the same for each alternative based on the traffic analysis LOS results.

As shown in Table 5-1, the maximum modeled 1-hour CO concentration at any of the three intersections analyzed for the No Build Alternative (98th Place and Halsted Street, 103rd Street and Vincennes Avenue and Beverly Avenue, and 119th Street and Ashland Avenue) was estimated to be 5.1 ppm, including a background concentration of 3.0 ppm, and occurred at the intersection of 98th Place and Halsted Street. This maximum 1-hour CO concentration occurred at a receptor located along the eastbound departure of 98th Place about 3 meters from the intersection with Halsted Street. All of the modeled 1-hour CO concentrations for the No Build Alternative were well below the 1-hour CO National and Illinois standards of 35 ppm.

Table 5-1: Summary of Estimated Maximum 1-hour Carbon Monoxide Concentrations* by Project Alternative

ID No.	Intersection Description	Existing (ppm)	No Build (ppm)	BRT (ppm)	UPRR (ppm)	Halsted (ppm)
5	98th Place and Halsted Street	5.7	5.1	5.1	5.1	5.1
14	103rd Street and Vincennes Avenue and Beverly Avenue	5.1	4.9	na	na	na
59	119th Street and Ashland Avenue	5.0	4.6	4.7	na	na
62	119th Street and State Street	na	na	na	3.9	na
68	127th Street and Halsted Street	na	na	na	na	4.6
70	127th Street and Wallace Street and Vermont Avenue	na	na	na	na	4.7
73	130th Street and Indiana Avenue	na	na	4.4	4.8	na

Source: KM Chng Environmental Inc., 2012.
* Values include a background 1-hour CO concentration of 3.0 ppm.
na means this intersection was not analyzed for this alternative.
ppm = parts per million, BRT = Bus Rapid Transit, UPRR = Union Pacific Railroad

As shown in Table 5-2, the maximum 8-hour CO concentration for the No Build Alternative was for the same receptor at the same intersection as the 1-hour concentration and was estimated to be 3.2 ppm, including a background CO concentration of 1.7 ppm. All of the modeled 8-hour CO concentrations for the No Build Alternative were also well below the corresponding 8-hour CO National and Illinois standards of 9 ppm.

Table 5-2: Summary of Estimated Maximum 8-Hour Carbon Monoxide Concentrations* by Project Alternative

ID No.	Intersection Description	Existing (ppm)	No Build (ppm)	BRT (ppm)	UPRR (ppm)	Halsted (ppm)
5	98th Place and Halsted Street	3.6	3.2	3.2	3.2	3.2
14	103rd Street and Vincennes Avenue and Beverly Avenue	3.2	3.0	na	na	na
59	119th Street and Ashland Avenue	3.1	2.8	2.9	na	na
62	119th Street and State Street	na	na	na	2.3	na
68	127th Street and Halsted Street	na	na	na	na	2.8
70	127th Street and Vermont Avenue and Wallace Street	na	na	na	na	2.9
73	130th Street and Indiana Avenue	na	na	2.7	3.0	na

Source: KM Chng Environmental Inc., 2012.
* Values include a background 8-hour CO concentration of 1.7 ppm.
na means this intersection was not analyzed for this alternative.
ppm = parts per million, BRT = Bus Rapid Transit, UPRR = Union Pacific Railroad

5.1.1.2 Greenhouse Gas Analysis

A quantitative assessment of project-related GHG benefits and/or impacts on climate change was conducted to reflect the changes in GHG emissions based on differences in VMT, travel speed, fuel consumption, and delay along the project corridor. There would be no growth in VMTs or delay due to the RLE Project in the No Build Alternative. Following the methods described in Section 3.4.3, emissions of GHG were estimated for each of the project alternatives.

A summary of the results of that analysis is presented in Table 5-3 by alternative for comparison purposes. The No Build Alternative would not be expected to change the ridership or to result in changes in diversion from motor vehicles to trains. However, some growth in VMT for the project corridor that would be unrelated to the proposed project would still take place. The increases in regional VMT would lead to increases in GHG (CO_2e) emissions under the No Build Alternative.

Table 5-3: Project-Related Greenhouse Gas Emissions by Project Alternative

Alternative	CO_2 (tpy)	CH_4 (tpy)	N_20 (tpy)	Total GHG (tpy)	GWP* (tons CO2e/year)
Existing Conditions	53,048,993	1,704	2,613	53,053,310	53,894,714
No Build Alternative	62,539,690	1,980	3,036	62,544,707	63,522,530
BRT Alternative	62,532,636	1,980	3,036	62,537,652	63,515,365
UPRR Rail Alternative	62,527,538	1,979	3,036	62,532,553	63,510,186
Halsted Rail Alternative	62,528,056	1,979	3,036	62,533,071	63,510,713

Source: KM Chng Environmental Inc., 2012.
Notes:
CO_2 = carbon dioxide, CH_4 = methane, N_2O = nitrous oxide, GHG = greenhouse gas, tpy = tons per year, GWP = Global Warming Potential in units of tons of carbon dioxide equivalents per year (CO_2e/year), BRT = Bus Rapid Transit, UPRR = Union Pacific Railroad

With the No Build Alternative, estimated project-related GHG emissions would be about 62,539,690 tpy of CO_2, about 1,980 tpy of CH4, and about 3,036 tpy of N_2O. These emissions would be an increase of 17.9, 16.1, and 16.2 percent, respectively when compared to the existing conditions GHG emissions. The sum of project-related GHG emissions for the No Build Alternative is 62,544,707 tpy or about 18 percent more than the 53,053,310 tpy of total project-related GHG emissions for the existing conditions.

When converted to total CO_2e emissions using the GWP conversion factors, the total emissions of project-related CO_2e for the No Build Alternative would be 63,522,530 tpy of CO_2e. Compared to the existing conditions CO_2e emissions of 53,894,714 tpy, this would be an increase of about 18 percent.

5.1.1.3 $PM_{2.5}$ Hot Spot Analysis

For the No Build Alternative in 2030, project-related $PM_{2.5}$ emissions in the Northeastern Illinois Nonattainment Area (CMAP 2008) were estimated to be 1,981 tpy. Specifically, $PM_{2.5}$ emissions factors for motor vehicles in the Chicago area are expected to decline by over 38 percent between 2012 and 2030. However, VMT in the project area in the No Build Alternative are expected to increase compared to the existing conditions VMT by about 14 percent. When taken together, these two factors would result in a reduction in regional $PM_{2.5}$ emissions by 2030. In addition to the federal exhaust emissions control programs and fuel reformulation programs, statewide efforts to reduce congestion and vehicle idling are also expected to have a direct benefit by reducing $PM_{2.5}$ concentrations at the local level.

In its conformity analysis, CMAP concluded that the *GO TO 2040* plan and the TIP meet all applicable requirements for conformity for the annual $PM_{2.5}$ standard; *GO TO 2040* and the TIP have also been recommended for approval by USDOT.

5.1.1.4 MSAT Analysis

A qualitative comparison of MSAT from the various project alternatives was developed from the estimates of VMT, which were used as a surrogate for indicating trends in MSAT emissions, and the comparisons are provided below.

The No Build Alternative would not be expected to change the ridership or result in substantial diversion from motor vehicles to trains. The EPA's FMVECP is expected to reduce MSAT emissions by about 54 percent in the project area between 2012 and 2030. However, VMT in the project area in the No Build Alternative are expected to increase compared to the existing conditions VMT by about 14 percent. When taken together, these two factors would result in a reduction in regional MSAT emissions for the No Build Alternative compared to the existing conditions.

5.1.2 Construction Impacts and Mitigations – No Build Alternative

Under the No Build Alternative, no new infrastructure would be constructed. However, it is assumed that necessary repairs to keep the Red Line running would take place. Therefore, there would be no new emissions due to construction, except for projects that were already planned. Potential impacts on air quality due to the No Build Alternative would be minimal and no mitigation is proposed for the No Build Alternative.

5.1.3 Cumulative Impacts and Mitigations – No Build Alternative

The only project that might be related to the No Build Alternative with respect to air quality impacts is CTA's Red and Purple Modernization (RPM) Project. Without improvements to the existing Red Line, the RLE might not be able to achieve its full potential. The impact on air quality would not be adverse.

5.2 Bus Rapid Transit Alternative

The proposed Bus Rapid Transit Alternative (BRT Alternative) is a BRT route that would operate between the existing 95th Street Terminal and the intersection of 130th Street and Eberhart Avenue via 95th Street, Michigan Avenue, 127th Street, Indiana Avenue, and 130th Street. Four stops with improved bus shelters would be created at 103rd Street and Michigan Avenue, 111th Street and Michigan Avenue, Kensington Avenue and Michigan Avenue, and 130th Street and Eberhart Avenue. The bus route would continue through Altgeld Gardens with stops at 131st Street and Langley Avenue, 131st Street and Corliss Avenue, 131st Street and Ingleside Avenue, 132nd Street and Ellis Avenue, 133rd Street and Ellis Avenue, and 133rd Place and Corliss Avenue. The BRT Alternative would be consistent with bus routing changes that may occur as part of improvements to the 95th Street Terminal.

5.2.1 Permanent Impacts and Mitigations – Bus Rapid Transit Alternative

The Red Line trains run on electricity; therefore, they cause no direct emissions. Their electricity comes from the electric utility grid, which may include local, fossil-fueled power plants. No increase in direct project-related emissions from Red Line Trains would be expected under the BRT Alternative. However, with the increase in bus miles travelled, a slight change in direct emissions would be expected with the BRT Alternative.

5.2.1.1 CO Hot Spot Analysis

A summary of the modeled maximum 1-hour CO concentrations at each of the street intersections selected for analysis (98th Place and Halsted Street, 103rd Street and Vincennes Avenue and Beverly Avenue, and 119th Street and Ashland Avenue) is presented in Table 5-1. A summary of the modeled maximum 8-hour CO concentrations for the selected intersections is also presented in Table 5-2. The three "worst case" intersections for each alternative were selected based on LOS and total traffic volumes during the peak hour, as required by USEPA guidance (USEPA 1992). These intersections may not be the same for each alternative based on the traffic analysis LOS results.

As shown in Table 5-1, the maximum modeled 1-hour CO concentration at any of the three intersections analyzed for the BRT Alternative was estimated to be 5.1 ppm, including a background concentration of 3.0 ppm, and occurred at the intersection of 98th Place and Halsted Street. This maximum 1-hour CO concentration occurred at a receptor located along the eastbound departure of 98th Place about 3 meters from the intersection with Halsted Street. All of the modeled 1-hour CO concentrations for the BRT Alternative were well below the 1-hour CO National and Illinois standards of 35 ppm.

As also shown in Table 5-2, the maximum 8-hour CO concentration for the BRT Alternative occurred at the same receptor at the same intersection as the 1-hour concentration and was estimated to be 3.2 ppm, including a background CO concentration of 1.7 ppm. All of the modeled 8-hour CO concentrations for the BRT Alternative were also well below the corresponding 8-hour CO National and Illinois standards of 9 ppm.

Based on the above analysis, no mitigation measures would be required for any of the traffic intersections analyzed for the BRT Alternative. Also, no adverse air quality impacts from CO emissions are expected to occur with this alternative.

5.2.1.2 Greenhouse Gas Analysis

This quantitative assessment of project-related GHG benefits and/or impacts on climate change presented here was conducted based on the methods described in Section 3.4.3. The BRT Alternative is expected to cause a small change in ridership to divert from motor vehicles to transit, and to also cause a very small increase in additional BRT Alternative bus VMT. This would lead to a small decrease in VMT of 31,182. Thus, this decrease in VMT would lead to a small decrease in GHG emissions under the BRT Alternative.

As shown in Table 5-3, the estimated BRT Alternative project-related GHG emissions would be about 62,532,636 tpy of CO_2, about 1,980 tpy of CH4, and about 3,036 tpy of N_2O. When compared to the existing conditions, project-related GHG emissions for the BRT Alternative would represent an increase of over 16 percent for each pollutant. However, when the BRT Alternative GHG emissions are compared to the No Build Alternative GHG emissions, they would be smaller by about 0.01 percent for each pollutant.

The sum of project-related GHG emissions for the BRT Alternative is 62,537,652 tpy or about 15 percent higher than the 53,053,310 tpy of total project-related GHG emissions for the existing conditions. However, the sum of project-related GHG emissions for the BRT Alternative is about 0.01 percent less than the 62,544,707 tpy of total project-related GHG emissions for the No Build Alternative.

When converted to total CO_2e emissions using the GWP conversion factors, the total project-related GHG emissions for the BRT Alternative would be 63,515,365 tpy of CO_2 equivalents. Total project-related CO_2e emissions for the BRT Alternative would be about 15 percent higher than the 53,894,714 tpy of total project-related CO_2e emissions for the existing conditions. However, compared to the No Build Alternative, the CO_2e emissions for the BRT Alternative would be about 0.01 percent lower in total CO_2e emissions. Therefore, no adverse air quality impacts from GHG emissions are anticipated due to this alternative.

5.2.1.3 $PM_{2.5}$ Hot Spot Analysis

The $PM_{2.5}$ emissions factors for motor vehicles in the Chicago area are expected to decline by over 38 percent between 2012 and 2030. In addition, VMT in the project area in the BRT Alternative (including VMT generated by additional bus operations) are expected to be slightly lower than in the No Build Alternative VMT, by about 0.01 percent, due to passenger diversions. When taken together, these two factors would result in the BRT Alternative having slightly lower regional $PM_{2.5}$ emissions than the No Build Alternative. In addition to the federal exhaust emissions control programs and fuel reformulation programs, statewide efforts to reduce congestion and vehicle idling are also expected to have a direct benefit by reducing $PM_{2.5}$ concentrations at the local level.

In its conformity analysis, CMAP concluded that the *GO TO 2040* plan and the TIP meet all applicable requirements for conformity for the annual $PM_{2.5}$ standard; *GO TO 2040* and the TIP have also been recommended for approval by USDOT. Therefore, no adverse air quality impacts from $PM_{2.5}$ emissions are anticipated due to this alternative.

5.2.1.4 MSAT Analysis

The EPA's FMVECP is expected to reduce MSAT emissions by about 54 percent in the project area between 2012 and 2030. In addition, VMT in the project area with the BRT Alternative (including VMT generated by additional bus operations) are expected to be slightly lower than in the No Build Alternative VMT, by about 0.01 percent, due to passenger diversions. When taken together, these factors would result in the regional MSAT emissions with the BRT Alternative being slightly lower than with the No Build Alternative. Therefore, no adverse air quality impacts from MSAT emissions are anticipated due to this alternative.

5.2.2 Construction Impacts and Mitigations – Bus Rapid Transit Alternative

Construction activities for the BRT Alternative would be grouped by type of work and location. Overall schedule and coordination would be phased and scheduled to maintain CTA operations at the 95th Street Terminal and 98th Street Yard and Shop, and to maintain vehicular traffic on affected expressways and roadways. Construction for the BRT corridor could be sequenced to coordinate with CTA operations at the 95th Street Terminal.

Emissions from construction equipment would occur during site preparation activities such as grading, installing curbs, or grubbing and removal of vegetation to prepare a site for construction. Impacts during construction would be primarily associated with fugitive dust and emissions from on-road and non-road vehicles. The equipment producing these emissions could include haul trucks, concrete trucks, front-end loaders, excavators, cranes, drill rigs, compressors, flatbed trucks, and generators. Most state air quality agencies, including IEPA, have strict guidelines for controlling fugitive dust (usually by good housekeeping practices), diesel particulate emissions (by exhaust emission controls and use of low sulfur fuels), and GHG emissions (by limiting equipment operations such as excessive idling and by using alternative fuels).

Construction activities can also result in traffic disruption, rerouting, and temporary shutdown of traffic. Traffic disruption, such as decreased roadway capacity or detouring, can lead to increased traffic congestion, thereby increasing motor vehicle exhaust emissions on nearby roadways, and resulting in elevated localized pollutant concentrations. Temporary shutdown of traffic would occur at nighttime and during low traffic volume intervals per IDOT approval. Work would be sequenced to minimize impacts on adjacent roadways and commercial and residential buildings. Existing utilities would be protected during construction of the BRT stations, park & ride facilities, and traffic signal improvements.

Proper traffic management during the construction period would mitigate any potential adverse effects. This would include finding less congested routes for construction-related truck traffic, creating temporary detours for regular roadways where capacities have been diminished, providing traffic control, routing trucks away from residential neighborhoods, and restricting construction activities during hours of high traffic volumes on the existing roadways. Staging areas and worker parking areas would be established away from sensitive receptors.

Many state agencies such as IDOT require the contractor to develop a Dust Control Plan that would address in detail how dust would be controlled at all times at the construction site, the staging areas, and the access and egress routes. The agencies also require all diesel-powered equipment and vehicles to be retrofitted with emissions control devices and to use ultra-low sulfur diesel to control diesel particulate emissions.

CTA would require the contractor to develop a plan and schedule to allow construction trucks to access and egress the construction sites and staging areas without excessive disruption and impacts on residences and commercial establishments.

Compared with the other two build alternatives, construction activities for the BRT Alternative would be noticeably fewer and smaller in scale. With the use of appropriate mitigation measures as described above, no violations of any of the IAAQS are anticipated for this alternative. Therefore, with appropriate mitigation measures in place, no adverse air quality impacts due to construction activities are anticipated due to this alternative.

5.2.3 Cumulative Impacts and Mitigations – Bus Rapid Transit Alternative

The only project that might be related to the BRT Alternative with respect to air quality impacts is CTA's RPM Project. Without improvements to the existing Red Line, the RLE might not be able to achieve its full potential. The impact on air quality with or without the RPM Project would not be adverse.

5.3 Union Pacific Railroad Rail Alternative

The UPRR Alternative would extend the heavy rail transit Red Line from the existing 95th Street Terminal to 130th Street, just west of I-94. The UPRR Rail Alternative would be an extension of the existing Red Line. Three UPRR Rail Alternative options for the segment between I-57 and the CN/Metra Electric tracks are assessed here:

- ROW Option: CTA tracks placed in the UPRR ROW.
- East Option: CTA tracks placed immediately adjacent to and east of the UPRR ROW.
- West Option: CTA tracks placed immediately adjacent to and west of the UPRR ROW.

The air quality analysis presented here applies to the project area as a whole. Because nearly all of the project-related air pollutant emissions would come from motor vehicles and because the project-related motor vehicles would move throughout the entire project area, the results of the air quality analysis apply equally to all of the UPRR options mentioned above, as well as to the 120th Street yard and shop. That is, it makes no difference in the analysis whether the Red Line Trains would be on the UPRR ROW, on the east side, or on the west side of the ROW; the pollutant emissions would be the same in each case. In addition, the air pollutant emissions associated with the 120th Street yard and shop would be quite unsubstantial. Further separate analysis of the 120th Street yard and shop was not conducted. Therefore, the UPRR Rail Alternative and all of its options are discussed as only one alternative.

5.3.1 Permanent Impacts and Mitigations – Union Pacific Railroad Rail Alternative

The Red Line trains run on electricity; therefore, they cause no direct emissions. Their electricity comes from the electric utility grid, which may include local, fossil-fueled power plants. An increase in indirect emissions due to electrical power consumption by the Red Line trains would be expected under the UPRR Rail Alternative.

5.3.1.1 CO Hot Spot Analysis

A summary of the modeled maximum 1-hour CO concentrations at each of the street intersections selected for analysis (98th Place and Halsted Street, 119th Street and State Street, and 130th Street and Indiana Avenue) is presented in Table 5-1. A summary of the modeled maximum 8-hour CO concentrations for the selected intersections is also presented in Table 5-2. The three "worst case" intersections for each alternative were selected based on LOS and total traffic volumes during the peak hour, as required by USEPA guidance (USEPA 1992). These intersections may not be the same for each alternative based on the traffic analysis LOS results.

As shown in Table 5-1, the maximum modeled 1-hour CO concentration at any of the three intersections analyzed for the UPRR Rail Alternative was estimated to be 5.1 ppm, including a background concentration of 3.0 ppm, and occurred at the intersection of 98th Place and Halsted Street. This maximum 1-hour CO concentration occurred at a receptor located along the eastbound departure of 98th Place about 3 meters from the intersection with Halsted Street. All of the modeled 1-hour CO concentrations for the UPRR Rail Alternative were well below the 1-hour CO National and Illinois standards of 35 ppm.

As also shown in Table 5-2, the maximum 8-hour CO concentration for the UPRR Rail Alternative occurred at the same receptor at the same intersection as the 1-hour concentration and was estimated to be 3.2 ppm, including a background CO concentration of 1.7 ppm. All of the modeled 8-hour CO concentrations for the UPRR Rail Alternative were also well below the corresponding 8-hour CO National and Illinois standards of 9 ppm.

Based on the above analysis, no mitigation measures would be required for any of the traffic intersections analyzed for the UPRR Rail Alternative. Also, no adverse air quality impacts from CO emissions are expected to occur with this alternative.

5.3.1.2 Greenhouse Gas Analysis

This quantitative assessment of project-related GHG benefits and/or impacts on climate change presented here was conducted based on the methods described in Section 3.4.3. The UPRR Rail Alternative is expected to cause a small change in ridership to divert from motor vehicles to trains leading to a small decrease in VMT of 53,718. Thus, this decrease in VMT would lead to a small decrease in GHG emissions under the UPRR Rail Alternative.

As shown in Table 5-3, the UPRR Rail Alternative project-related GHG emissions would be about 62,527,538 tpy of CO_2, about 1,979 tpy of CH4, and about 3,036 tpy of N_2O. When compared to the existing conditions, project-related GHG emissions for the UPRR Rail Alternative would be an increase of over 16 percent for each pollutant. However, when compared to the No Build Alternative GHG emissions, these results would be 0.02 percent lower for each pollutant.

When converted to total CO_2e using the GWP conversion factors, the total of GHG emissions for the UPRR Rail Alternative would be 63,510,186 tpy of CO_2 equivalents. Total project-related CO_2e emissions for the UPRR Rail Alternative would be about 17.9 percent higher than the 53,894,714 tpy of total project-related CO_2e emissions for the existing conditions. However, compared to the No Build Alternative, GHG emissions for the UPRR Rail Alternative would be about 0.02 percent lower in total CO_2e emissions. Therefore, no adverse air quality impacts from GHG emissions are anticipated due to this alternative.

5.3.1.3 $PM_{2.5}$ Hot Spot Analysis

The $PM_{2.5}$ emissions factors for motor vehicles in the Chicago area are expected to decline by over 38 percent between 2012 and 2030. In addition, VMT in the project area in the UPRR Rail Alternative would be slightly lower than the No Build Alternative VMT, by about 0.02 percent, due to passenger diversions to the Red Line. When taken together, these two parameters would result in reduction in existing regional $PM_{2.5}$ emissions with the UPRR Rail Alternative. In addition to the federal exhaust emissions control programs and fuel reformulation programs, statewide efforts to reduce congestion and vehicle idling are also expected to have a direct benefit by reducing $PM_{2.5}$ concentrations at the local level.

In its conformity analysis, CMAP concluded that the *GO TO 2040* plan and the TIP meet all applicable requirements for conformity for the annual $PM_{2.5}$ standard; *GO TO 2040* and the TIP have also been recommended for approval by USDOT. Therefore, no adverse air quality impacts from $PM_{2.5}$ emissions are anticipated due to this alternative.

5.3.1.4 MSAT Analysis

The EPA's FMVECP is expected to reduce MSAT emissions by 54 percent in the project area between 2012 and 2030. In addition, VMT in the project area in the UPRR Rail Alternative would be slightly lower than the No Build Alternative VMT, by about 0.02 percent, due to passenger diversions. When taken together, this would result in MSAT emissions with the UPRR Rail Alternative being lower than under the No Build Alternative. Therefore, no adverse air quality impacts from MSAT emissions are anticipated due to this alternative.

5.3.2 Construction Impacts and Mitigations - Union Pacific Railroad Rail Alternative

Construction activities for all of the UPRR Rail Alternative options would be grouped by type of work and location. Overall schedule and coordination would be phased and scheduled to maintain CTA operations at the 95th Street Terminal and 98th Street Yard and Shop, and to maintain vehicular traffic on affected expressways and roadways. Special or temporary track work might be required between the 95th Street Terminal and the 98th Street Yard and Shop. Because construction would occur in the middle of the expressway, road closures and traffic diversions would occur. The corridor is divided into seven segments for the purposes of describing construction activities; construction for individual segments or groups of adjacent segments could be sequenced to coordinate with CTA operations at the 95th Street Terminal. See Section 5.2.2 for a discussion of emissions, construction sequencing, traffic management, dust control, and construction truck access that would also apply to the UPRR Rail Alternative.

Compared with the other two build alternatives, construction activities for the UPRR Rail Alternative would be the most extensive of any of the three build alternatives being analyzed. However, with the use of appropriate mitigation measures as described above, no violations of any of the IAAQS or NAAQS are anticipated due to this alternative. Therefore, with appropriate mitigation measures in place, no adverse air quality impacts due to construction activities are anticipated due to this alternative.

5.3.3 Cumulative Impacts and Mitigations – Union Pacific Railroad Rail Alternative

The only project that might be related to the UPRR Rail Alternative with respect to air quality impacts is CTA's RPM Project. Without improvements to the existing Red Line, the RLE might not be able to achieve its full potential. The impact on air quality with or without the RPM Project would not be adverse.

5.4 Halsted Rail Alternative

The Halsted Rail Alternative would include a 5-mile extension of the existing Red Line. It would operate on an elevated structure running south from 95th Street along I-57 until Halsted Street. It would then turn south and continue along Halsted Street to the intersection of Halsted Street and Vermont Avenue near 127th Street. Four stations would be at 103rd Street, 111th Street, 119th Street, and Vermont Avenue.

The air quality analysis presented here applies to the project area as a whole. Because nearly all of the project-related air pollutant emissions would come from motor vehicles and because the project-related motor vehicles would move throughout the entire project area, the air quality analysis applies equally to each part of the Halsted Rail Alternative. In addition, the air pollutant emissions associated with the 119th Street yard and shop would be quite unsubstantial. Therefore, the Halsted Rail Alternative is discussed here in its entirety, rather than by segment or feature.

5.4.1 Permanent Impacts and Mitigations – Halsted Rail Alternative

The Red Line trains run on electricity; therefore, they cause no direct emissions. Their electricity comes from the electric utility grid, which may include local, fossil-fueled power plants. An increase in indirect emissions due to electrical power consumption by the Red Line trains would be expected under the Halsted Rail Alternative.

5.4.1.1 CO Hot Spot Analysis

A summary of the modeled maximum 1-hour CO concentrations at each of the street intersections selected for analysis (98th Place and Halsted Street, 127th Street and Halsted Street, and 127th Street and Wallace Street and Vermont Avenue) is presented in Table 5-1. A summary of the modeled maximum 8-hour CO concentrations for the selected intersections is also presented in Table 5-2.

As shown in Table 5-1, the maximum modeled 1-hour CO concentration at any of the three intersections analyzed for the Halsted Rail Alternative was estimated to be 5.1 ppm, including a background concentration of 3.0 ppm, and occurred at the intersection of 98th Place and Halsted Street. This maximum 1-hour CO concentration occurred at a receptor located along the eastbound departure of 98th Place about 3 meters from the intersection with Halsted Street. All of the modeled 1-hour CO concentrations for the Halsted Rail Alternative were well below the 1-hour CO National and Illinois standards of 35 ppm.

As also shown in Table 5-2, the maximum 8-hour CO concentration for the Halsted Rail Alternative occurred at the same receptor at the same intersection as for the 1-hour concentration and was estimated to be 3.2 ppm, including a background CO concentration of 1.7 ppm. All of the modeled 8-hour CO concentrations for the Halsted Rail Alternative were also well below the corresponding 8-hour CO National and Illinois standards of 9 ppm.

Based on the above analysis, no mitigation measures would be required for any of the traffic intersections analyzed for the Halsted Rail Alternative. Also, no adverse air quality impacts from CO emissions are expected to occur with this alternative.

5.4.1.2 Greenhouse Gas Analysis

This quantitative assessment of project-related GHG benefits and/or impacts on climate change presented here was conducted based on the methods described in Section 3.4.3. The Halsted Rail Alternative is expected to cause a small change in ridership to divert from motor vehicles to trains leading to a small decrease in VMT of 51,427. Thus, this decrease in VMT would lead to a slightly lower amount of GHG emissions under the Halsted Rail Alternative compared to the No Build Alternative.

As shown in Table 5-3, the Halsted Rail Alternative project-related GHG emissions would be about 62,528,056 tpy of CO_2, about 1,979 tpy of CH4, and about 3,036 tpy of N_2O. These results would be an increase of over 16 percent for each pollutant when compared to the existing conditions GHG emissions. When compared to the No Build Alternative GHG emissions, GHG emissions for the Halsted Rail Alternative would be 0.02 percent lower.

When converted to total CO_2e using the GWP conversion factors, the total emissions of GHGs for the Halsted Rail Alternative would be 63,510,713 tpy of CO_2 equivalents. Total project-related CO_2e emissions for the Halsted Rail Alternative would be about 18 percent higher than the 53,894,714 tpy of total project-related CO_2e emissions for the existing conditions. However, compared to the No Build Alternative, the CO_2e emissions for the Halsted Rail Alternative would be lower by about 0.02 percent. Therefore, no adverse air quality impacts from GHG emissions are anticipated due to this alternative.

5.4.1.3 $PM_{2.5}$ Hot Spot Analysis

The $PM_{2.5}$ emissions factors for motor vehicles in the Chicago area are expected to decline by over 38 percent between 2012 and 2030. In addition, VMT in the project area in the Halsted Rail Alternative would be slightly lower than the No Build Alternative VMT, by about 0.02 percent, due to passenger diversions. When taken together, these two parameters would result in a small reduction in existing regional $PM_{2.5}$ emissions with the Halsted Rail Alternative. In addition to the federal exhaust emissions control programs and fuel reformulation programs, statewide efforts to reduce congestion and vehicle idling are also expected to have a direct benefit by reducing $PM_{2.5}$ concentrations at the local level.

In its conformity analysis, CMAP concluded that the *GO TO 2040* plan and the TIP meet all applicable requirements for conformity for the annual $PM_{2.5}$ standard; *GO TO 2040* and the TIP have also been recommended for approval by USDOT. Therefore, no adverse air quality impacts from $PM_{2.5}$ emissions are anticipated due to this alternative.

5.4.1.4 MSAT Analysis

The EPA's FMVECP is expected to reduce MSAT emissions by 54 percent in the project area between 2012 and 2030. In addition, VMT in the project area in the Halsted Rail Alternative would be slightly lower than the No Build Alternative VMT, by about 0.02, percent due to passenger diversions. When taken together, these results would result in regional MSAT emissions with the Halsted Rail Alternative being lower than the No Build Alternative. Therefore, no adverse air quality impacts from MSAT emissions are anticipated due to this alternative.

5.4.2 Construction Impacts and Mitigations – Halsted Rail Alternative

Construction activities for the Halsted Rail Alternatives would be grouped by type of work and location. Overall schedule and coordination of all construction segments would be phased and scheduled to maintain CTA operations at the 95th Street Terminal and 98th Street Yard and Shop, and vehicular traffic on affected expressways and roadways. Special or temporary track work might be required between the 95th Street Terminal and the 98th Street Yard and Shop. Because construction would occur in the middle of the expressway, road closures and traffic diversions would occur. The corridor is divided into five segments for the purposes of describing construction activities; construction for individual segments or groups of adjacent segments could be sequenced to coordinate with CTA operations at the 95th Street Terminal. See Section 5.2.2 for a discussion of emissions, construction sequencing, traffic management, dust control, and construction truck access that would also apply to the UPRR Rail Alternative.

Compared with the other two build alternatives, construction activities for the Halsted Rail Alternative would be less than the UPRR Rail Alternative and somewhat more than the BRT Alternative. However, with the use of appropriate mitigation measures as described above, no violations of any of the IAAQS or NAAQS are anticipated due to this alternative. Therefore, with appropriate mitigation measures in place, no adverse air quality impacts due to construction activities are anticipated due to this alternative.

5.4.3 Cumulative Impacts and Mitigations – Halsted Rail Alternative

The only project that might be related to the Halsted Rail Alternative with respect to air quality impacts is CTA's RPM Project. Without improvements to the existing Red Line, the RLE might not be able to achieve its full potential. The impact on air quality with or without the RPM Project would not be adverse. However, the basis for the regional plan and the TIP would have changed, possibly triggering a need to update the SIP.

Section 6
Impacts Remaining After Mitigation

Based on the results of the air quality analysis presented here, all build alternatives of the RLE Project would provide a regional net air quality benefit when compared to existing conditions or the No Build Alternative.

6.1 Bus Rapid Transit Alternative

With the BRT Alternative, no adverse air quality impacts were identified in any the air quality analyses performed for this alternative. The CO hot spot analysis demonstrated compliance with the IAAQS and NAAQS for CO; the GHG analysis showed fewer GHG emissions compared to the No Build Alternative; the $PM_{2.5}$ assessment demonstrated that lower $PM_{2.5}$ emissions are likely compared to the No Build Alternative; and the assessment of MSAT also demonstrated that lower emissions of MSAT are likely compared to the No Build Alternative.

6.2 Union Pacific Railroad Rail Alternative

As described previously, the air quality analysis presented here applies equally to all of the UPRR Rail Alternative options, as well as to the 120th Street yard and shop. With the UPRR Rail Alternative, no adverse air quality impacts were identified in any the air quality analyses performed for this alternative. The CO hot spot analysis demonstrated compliance with the IAAQS and NAAQS for CO; the GHG analysis showed lower GHG emissions compared to the No Build Alternative; the $PM_{2.5}$ assessment demonstrated that lower $PM_{2.5}$ emissions than with the No Build Alternative would be likely; and the assessment of MSAT also demonstrated that lower emissions of MSAT than with the No Build Alternative would be likely.

6.3 Halsted Rail Alternative

No adverse air quality impacts were identified for the Halsted Rail Alternative. The CO hot spot analysis demonstrated compliance with the IAAQS and NAAQS for CO; the GHG analysis showed lower GHG emissions compared to the No Build Alternative; the $PM_{2.5}$ assessment demonstrated that lower $PM_{2.5}$ emissions than with the No Build Alternative would be likely; and the assessment of MSAT also demonstrated that lower emissions of MSAT than with the No Build Alternative would be likely.

Based on the results of the air quality analysis presented here, all build alternatives of the RLE Project would provide a regional net air quality benefit when compared to existing conditions or the No Build Alternative.

Section 7
References Cited

Bureau of Transportation Statistics (BTS). 2011. Bureau of Transportation Statistics, National Transportation Statistics, Table 4-23. Available from the Bureau of Transportation Statistics web site: http://www.bts.gov/publications/national_transportation_statistics/html/table_04_23.html. December 2011.

Chicago Metropolitan Agency for Planning (CMAP). 2008. 2030 Regional Transportation Plan for Northeastern Illinois, available at: http://www.cmap.illinois.gov/2030-regional-transportation-plan.

CMAP. 2010a. CMAP Transportation Improvement Program (TIP), Federal Fiscal Year 2010–2015, October 2010a.

CMAP. 2010b. Chicago Metropolitan Agency for Planning (CMAP). 2010b. GO TO 2040 Regional Plan. Accessed at: http://www.cmap.illinois.gov/2040/main.

CMAP. 2010c. FY 2010-2015 Transportation Improvement Program (TIP) and Conformity Analysis, available at http://www.cmap.illinois.gov/tip/fy-2010-2015-draft-tip.

Federal Highway Administration (FHWA). 2009. Federal Highway Administration, Interim Guidance Update on Mobile Source Air Toxic Analysis in NEPA. Office of Natural and Human Environment. September 2009.

FHWA. 2011. A Methodology for Evaluating Mobile Source Air Toxic Emissions Among Transportation Project Alternatives. Accessed at EPA's website: http://www.fhwa.dot.gov/environment/air_quality/air_toxics/research_and_analysis/mobile_source_air_toxics/msatemissions.cfm.

Illinois Climate Change Advisory Group (ICCAG). 2007. Illinois Climate Change Advisory Group's Final Recommendations to the Governor. September 2007. Accessed at http://www.epa.state.il.us/air/climatechange/documents/final-recommendations.html.

McGraw, Jennifer, Peter Haas, Linda Young, and Anne Evens. 2010. Greenhouse Gas Emissions in Chicago: Emissions Inventories and Reduction Strategies for Chicago and its Metropolitan Region.

Sprague, J. 2012. Personal communication. IEPA. November 28, 2012.

The Climate Registry (TCR). 2012. The Climate Registry – General Reporting Protocol. Available from the Climate Registry web site: http://theclimateregistry.org/downloads/GRP.pdf. May 2012.

U.S. Congress. 1970, 1977, 1990. The Clean Air Act of 1970, Public Law 91-604; The 1977 Clean Air Act Amendments, Public Law 95-95; The 1990 Clean Air Act Amendments, Public Law 101-549.

U.S. Environmental Protection Agency (USEPA). 1992. Guideline for Modeling Carbon Monoxide from Roadway Intersections. USEPA, Office of Air Quality Planning and Standards. Research Triangle Park, NC. Report Number EPA-454/R-92-005. November 1992.

USEPA. 1994. User's Guide to CAL3QHC Version 2.0: A Modeling Methodology for Predicting Pollutant Concentrations Near Roadway Intersections. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, NC. Report number EPA-454/R-92-006. November 1992. Revised September 1995.

USEPA. 2004. Approved final version of MOBILE6.2 computer program released by memorandum Policy Guidance on the Use of MOBILE6.2 and the December 2003 AP-42 Method for Re-entrained Road Dust for SIP Development and Transportation Conformity. Margo Tsirigotis Oge, Director, Office of Transportation and Air Quality, and Steve Page, Director, Office of Air Quality Planning and Standards. U.S. Environmental Protection Agency. Washington, DC. February 24, 2004.

USEPA. 2006. Transportation Conformity Guidance for Qualitative Hot-spot Analyses in $PM_{2.5}$ and PM_{10} Nonattainment and Maintenance Areas. Office of Transportation and Air Quality, U.S. Environmental Protection Agency. Office of Natural and Human Environment, Federal Highway Administration. March 2006.

USEPA. 2007. Control of Hazardous Air Pollutants from Mobile Sources: Final Rule to Reduce Mobile Source Air Toxics. 2007.

USEPA. 2012. EPA Airdata website. Monitor Values Report. Accessed October 15, 2012. Accessed at http://www.epa.gov/airdata.

Appendix A
2014–2015 Red Line Extension Project Update

2014–2015 Red Line Extension Project Update

From 2012-2014, CTA evaluated benefits and impacts of four alternatives: the No Build Alternative, the Bus Rapid Transit Alternative (along Michigan Avenue), the Union Pacific Railroad (UPRR) Rail Alternative, and the Halsted Alternative. CTA evaluated three options of the UPRR Rail Alternative: Right-of-Way Option, East Option, and West Option. CTA also evaluated two options of the UPRR Rail Alternative 130th Street station: a South Station Option and a West Station Option. Based on the project description provided in Section 2 of this technical memorandum, CTA analyzed the impacts of these alternatives and station options. The benefits and impacts are included in the technical memoranda prepared in 2012-2014.

In August 2014, based on the technical analysis and public input, CTA announced the NEPA Preferred Alternative—the UPRR Rail Alternative. Additional conceptual engineering was conducted on the UPRR Rail Alternative to refine the East and West Option alignments. In addition, CTA is considering only the South Station Option of the 130th Street Station.

In late 2014 and early 2015, CTA conducted additional engineering and revised assumptions on the East and West Options to refine the alignments. The refinement of the East and West Options consisted of the following items:

- For the segment of the alignment along I-57, CTA shifted the proposed alignment from the median of I-57 to the north side of I-57 within the existing expressway right-of-way. The construction would be less complex, safer for construction workers, and have a shorter duration. The shift would also allow for fewer impacts to Wendell Smith Park for the East Option, and would allow for no permanent impacts to Wendell Smith Park for the West Option.
- CTA modified the curve speeds as the alignment heads south from I-57 along the UPRR tracks. The curve speed for both the East and West Options would be 35 mph.
- CTA shifted the East Option alignment near 103rd Street station to minimize impacts to Block Park and the Roseland Pumping Station.
- CTA modified the curves south of 103rd Street for both the East and West Options to 55 mph to maximize the train speed.
- CTA refined the layout of the 120th Street yard and shop to optimize yard operations. The refined layout of the yard would accommodate 340 train cars.

The refinement of the East and West Option alignments minimizes potential impacts to parks while providing flexibility for future design phases. The Draft Environmental Impact Statement contains the benefits and impacts of the refined East and West Option alignments and supersedes information presented in other chapters of this technical memorandum.

The refined East and West Option alignments would have no additional or different impacts from those described in the technical memoranda for the following resource areas: construction, transportation, land use and economic development, historic and cultural resources, safety and security, hazardous materials, indirect and cumulative, air quality, floodplains, vegetation and wildlife habitat, threatened and endangered species, and geology and soils.