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MEMORANDUM

TO: Jim Grube, Hennepin County
Scott Pedersen, MnDOT

FROM: Samuel Turrentine, AICP

DATE: March 1, 2016

RE: Air Quality Analysis for Support of NEPA Documentation
SEH No. HENNC 113114 14.00

The purpose of this memorandum is to provide a complete response to Question 16.b (Air – Vehicle Emissions) of the project's State Environmental Assessment Worksheet.

National Ambient Air Quality Standards (NAAQS) – Criteria Pollutants

Motorized vehicles affect air quality by directly emitting (via exhaust, brake wear, tire wear, crankcase) or causing emission (via dust resuspension) of airborne pollutants. Changes in traffic volumes, travel patterns, and roadway locations affect air quality by changing the number of vehicles in an area and the congestion levels. The air quality impacts from the project are analyzed by addressing criteria pollutants, a group of common air pollutants regulated by U.S. Environmental Protection Agency (EPA) on the basis of health and environmental impact criteria. The criteria pollutants identified by the EPA are ozone, particulate matter, carbon monoxide, nitrogen dioxide, lead, and sulfur dioxide. Potential impacts resulting from these pollutants are assessed by comparing projected concentrations to NAAQS.

In addition to the criteria air pollutants, the EPA also regulates "air toxics," which are non-criteria pollutants that can also impact human health and the environment. The Federal Highway Administration (FHWA) provides guidance for the assessment of Mobile Source Air Toxic (MSAT) effects for transportation projects in the National Environmental Policy Act (NEPA) process. A quantitative evaluation of MSATs has been performed for this project. The scope and methods of the analysis performed were developed in collaboration with the Minnesota Department of Transportation (MnDOT) and the Minnesota Pollution Control Agency (MPCA).

Ozone

Ground-level ozone is a primary constituent of smog and is a pollution problem throughout many areas of the United States. Exposures to ozone can cause people to be more susceptible to respiratory infection, resulting in lung inflammation, and aggravating respiratory diseases, such as asthma. Ozone is not emitted directly from vehicles but is formed when volatile organic compounds (VOCs) and nitrogen oxides (NO_x) react in the presence of sunlight. Transportation sources emit NO_x and VOCs and can, therefore, affect ozone concentrations. However, due to the phenomenon of atmospheric formation of ozone from chemical precursors, concentrations are not expected to be elevated near a particular roadway.

The MPCA, in cooperation with various other agencies, industries, and groups, has encouraged voluntary control measures for ozone and has begun developing a regional ozone modeling effort. Ozone concentrations in the lower atmosphere are influenced by a complex relationship of precursor

concentrations, meteorological conditions, and regional influences on background concentrations. MPCA states in *Air Quality in Minnesota: 2015 Report to the Legislature* (January 2015) that:

> *On November 24, 2014, the EPA announced proposed changes to the National Ambient Air Quality Standard for ozone. The proposal seeks to strengthen the ozone standard by lowering the standard from 75 ppb to a value between 65 ppb and 70 ppb. The proposal is based on scientific evidence that strongly indicates ozone impacts human health at levels below the existing standard of 75 ppb.*
>
> *Based on 2013 ozone monitoring results, all areas of Minnesota will meet the revised ozone standard if it is set at 70 ppb. If the ozone standard is set at 66 ppb or lower, the Twin Cities metropolitan area will not meet the standard. The EPA is expected to finalize the revised ozone standard in October 2015. EPA plans to use monitoring data from 2014-2016 to determine compliance. The MPCA will closely monitor ozone levels over the summer of 2015 and 2016 to assess the likelihood of violating the revised ozone standard.*

Additionally, the State of Minnesota is classified by the EPA as an "ozone attainment area," which means that Minnesota has been identified as a geographic area that meets the national health-based standards for ozone levels. Because of these factors, a quantitative ozone analysis was not conducted for this project.

Particulate Matter

Particulate matter (PM) is the term for particles and liquid droplets suspended in the air. Particles come in a wide variety of sizes and have been historically assessed based on size, typically measured by the diameter of the particle in micrometers. $PM_{2.5}$, or fine particulate matter, refers to particles that are 2.5 micrometers or less in diameter. PM_{10} refers to particulate matter that is 10 micrometers or less in diameter.

Motor vehicles (i.e., cars, trucks, and buses) emit direct PM from their tailpipes, as well as from normal brake and tire wear. Vehicle dust from paved and unpaved roads may be re-entrained, or re-suspended, in the atmosphere. In addition, $PM_{2.5}$ can be formed in the atmosphere from gases such as sulfur dioxide, nitrogen oxides, and volatile organic compounds. $PM_{2.5}$ can penetrate the human respiratory system's natural defenses and damage the respiratory tract when inhaled. Numerous scientific studies have linked particle pollution exposure to a variety of problems, including:

- Increased respiratory symptoms, such as irritation of the airways, coughing, or difficulty breathing;
- Decreased lung function;
- Aggravated asthma;
- Development of chronic bronchitis;
- Irregular heartbeat;
- Heart attacks; and
- Premature death in people with heart or lung disease.

(Source: www.epa.gov/air/particlepollution/health.html)

On December 14, 2012, the EPA issued a final rule revising the annual health NAAQS for fine particles ($PM_{2.5}$). The EPA website states:

> *With regard to primary (health-based) standards for fine particles (generally referring to particles less than or equal to 2.5 micrometers (mm) in diameter, $PM_{2.5}$), the EPA is strengthening the annual $PM_{2.5}$ standard by lowering the level to 12.0 micrograms per cubic meter ($\mu g/m^3$). The existing annual standard, 15.0$\mu g/m^3$, was set in 1997. The EPA is revising the annual $PM_{2.5}$ standard to 12.0$\mu g/m^3$ so as to provide increased protection against health effects associated with long- and short-term exposures (including premature mortality, increased hospital admissions and emergency department*

> *visits, and development of chronic respiratory disease), and to retain the 24-hour $PM_{2.5}$ standard at a level of 35µg/m^3 (the EPA issued the 24-hour standard in 2006). The EPA is revising the Air Quality Index (AQI) for $PM_{2.5}$ to be consistent with the revised primary $PM_{2.5}$ standards.*
> (Source: www.epa.gov/pm/actions.html)

The EPA also retained the existing standards for coarse particle pollution (PM_{10}). The NAAQS 24-hour standard for PM_{10} is 150 µg/m^3 which is not to be exceeded more than once per year on average over three years.

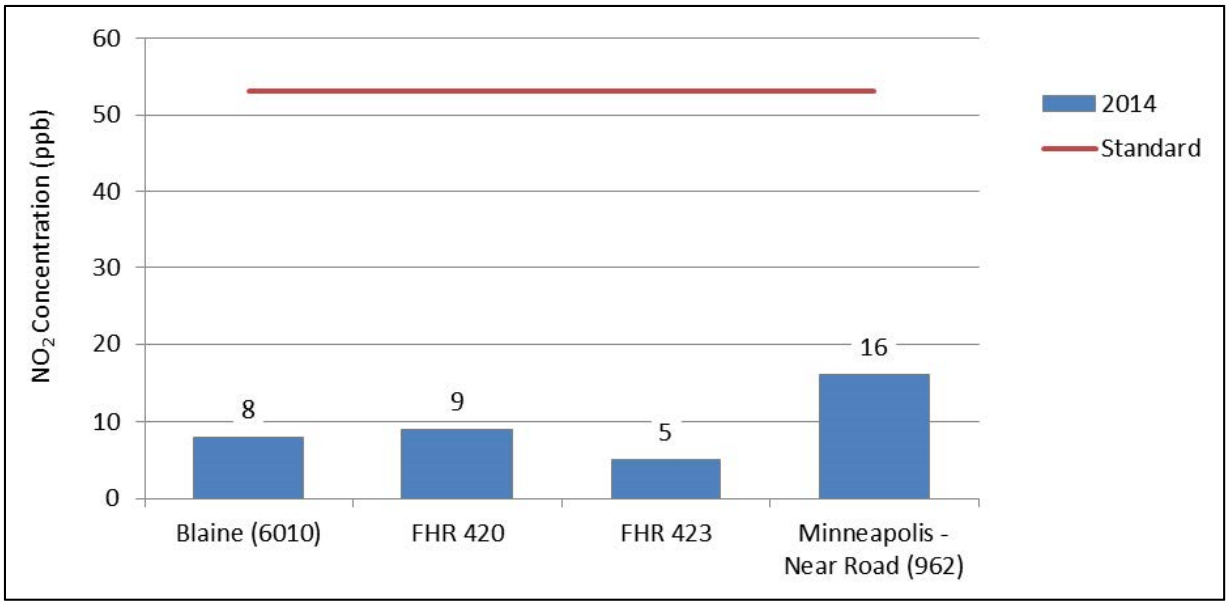
The Clean Air Act conformity requirements include the assessment of localized air quality impacts of federally-funded or federally-approved transportation projects that are located within $PM_{2.5}$ nonattainment and maintenance areas and deemed to be projects of air quality concern. The project is located in an area that has been designated as an unclassifiable/attainment area for PM. This means that the project area has been identified as a geographic area that meets the national health- based standards for PM levels, and therefore is exempt from performing PM analyses.

Nitrogen Dioxide (Nitrogen Oxides)
Nitrogen oxides, or NO_x, are the generic term for a group of highly reactive gases, all of which contain nitrogen and oxygen in varying amounts. Nitrogen oxides form when fuel is burned at high temperatures, as in a combustion process. The primary sources of NO_x are motor vehicles, electric utilities, and other industrial, commercial, and residential sources that burn fuels. In addition to being precursors to ozone and fine particle, NOx can worsen bronchitis, emphysema and asthma, and increase risk of premature death from heart or lung disease (*2015 Report to the Legislature*, MPCA, January 2015).

Nitrogen dioxide (NO_2), which is a form of nitrogen oxide (NO_x), is regularly monitored. Minnesota currently meets the federal nitrogen dioxide (NO_2) annual standard, as shown in Exhibit 1 from *2016 Annual Air Monitoring Network Plan*. This document states:

> *A monitoring site meets the annual NAAQS for NO_2 if the annual average is less than or equal to 53 ppb. The 2014 Minnesota averages ranged from 5 ppb at FHR 423 to 16 ppb at the Minneapolis Near Road (962) site; therefore, Minnesota currently meets the annual NAAQS for NO_2.*

Exhibit 1 – Annual NO_2 Concentrations Compared to the NAAQs



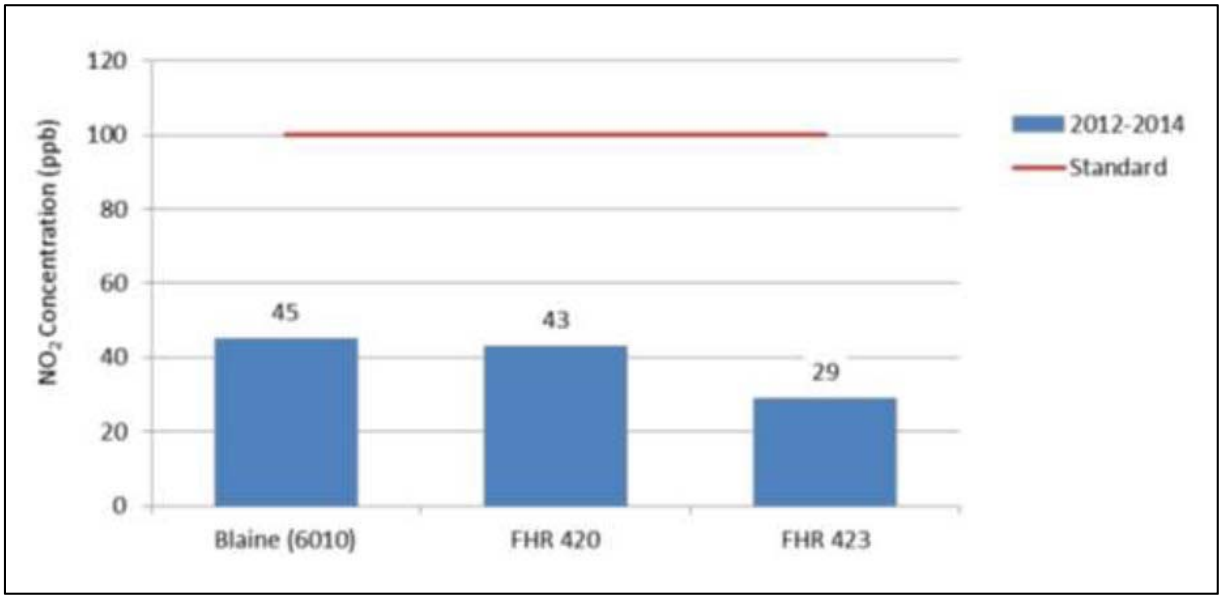
In the *2016 Annual Air Monitoring Network Plan for Minnesota (October 2015)*, it states the following with regard to the 1-hr NO_2 Standard:

> *On January 22, 2010 the EPA finalized revisions to the NO_2 NAAQS. As part of the standard review process, the EPA retained the existing annual NO_2 NAAQS, but also created a new 1-hour standard. This new 1-hour NAAQS will protect against adverse health effects associated with short term exposures to elevated NO_2. To meet this standard, the three-year average of the annual 98th percentile daily maximum 1-hour NO_2 concentration must not exceed 100 ppb. Figure 22 [Exhibit 2] shows the 2012-2014 average of the annual 98th percentile daily maximum 1-hour NO_2 concentrations at Minnesota sites and compares them to the 1-hour standard. Minnesota averages ranged from 29 ppb at FHR 423 to 45 ppb at Blaine (6010); therefore, all Minnesota sites currently meet the1-hour NAAQS for NO_2.*

The EPA's regulatory announcement, EPA420-F-99-051 (December 1999), describes the Tier 2 standards for tailpipe emissions, and states:

> *The new tailpipe standards are set at an average standard of 0.07 grams per mile for nitrogen oxides for all classes of passenger vehicles beginning in 2004. This includes all light-duty trucks, as well as the largest SUVs. Vehicles weighing less than 6000 pounds will be phased-in to this standard between 2004 and 2007.*
>
> *As newer, cleaner cars enter the national fleet, the new tailpipe standards will significantly reduce emissions of nitrogen oxides from vehicles by about 74 percent by 2030. The standards also will reduce emissions by more than 2 million tons per year by 2020 and nearly 3 million tons annually by 2030.*

Exhibit 2 – 1-Hour NO_2 Concentrations Compared to the NAAQs



Within the project area, it is unlikely that NO_2 standards will be approached or exceeded based on the relatively low ambient concentrations of NO_2 in Minnesota and on the long-term trend toward reduction of NO_x emissions. Because of these factors, a specific analysis of NO_2 was not conducted for this project.

Sulfur Dioxide

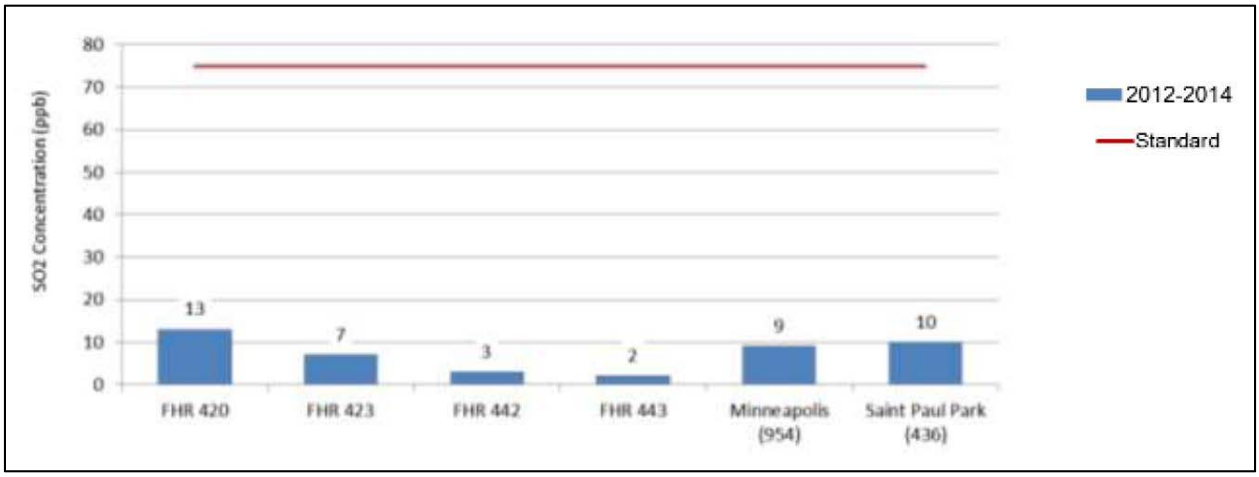
Sulfur dioxide (SO_2) and other sulfur oxide gases (SO_x) are formed when fuel containing sulfur, such as coal, oil, and diesel fuel is burned. Sulfur dioxide is a heavy, pungent, colorless gas. Elevated levels can impair breathing, lead to other respiratory symptoms, and at very high levels aggravate heart disease. People with asthma are most at risk when SO_2 levels increase. Once emitted into the atmosphere, SO_2 can be further oxidized to sulfuric acid, a component of acid rain.

MPCA monitoring shows that ambient SO_2 concentrations were at less than 20 percent of the federal standards over the 3-year period from 2012 through 2014, as shown in Exhibit 3 below. (Source: *2016 Annual Air Monitoring Network Plan for Minnesota, October 2015*) MPCA also states that a 67 percent decrease in SO_2 emissions from point sources (i.e., sources with MPCA air permits) occurred in Minnesota between 2002 and 2012 (*2015 Report to the Legislature, MPCA, January 2015*). Compared to point sources, a much smaller proportion of ambient SO_2 concentrations are attributable to on-road mobile sources. The MPCA has concluded that long-term trends in both ambient air concentrations and total SO_2 emissions in Minnesota indicate steady improvement.

In the *2016 Annual Air Monitoring Network Plan for Minnesota (October 2015)*, it states the following with regard to SO_2:

> *On June 2, 2010, the EPA finalized revisions to the primary SO_2 NAAQS. EPA established a new 1-hour standard which is met if the three-year average of the annual 99th percentile daily maximum 1-hour SO_2 concentration is less than 75 ppb. In addition to creating the new 1-hour standard, the EPA revoked the existing 24-hour and annual standards. Figure 24 [Exhibit 3] describes the 2012-2014 average 99th percentile 1-hour SO_2 concentration and compares them to the 1-hour standard. Minnesota averages ranged from 2 ppb at FHR 443 to 13 ppb at FHR 420; therefore, all Minnesota sites currently meet the1-hour NAAQS for SO_2.*

Exhibit 3 – One-Hour SO_2 Concentrations Compared to the NAAQs



Emissions of sulfur oxides from transportation sources are a small component of overall emissions and continue to decline due to the desulfurization of fuels. Additionally, the project area is classified by the EPA as a "sulfur dioxide attainment area," which means that the project area has been identified as a geographic area that meets the national health-based standards for sulfur dioxide levels. Because of these factors, a quantitative analysis for sulfur dioxide was not conducted for this project.

Lead
Due to the phase out of leaded gasoline, lead is no longer a pollutant associated with vehicular emissions.

Carbon Monoxide
Carbon monoxide (CO) is the traffic-related pollutant that has been of concern in the Twin Cities Metropolitan area. In 1999, the EPA re-designated all of Hennepin, Ramsey, Anoka, and portions of Carver, Scott, Dakota, Washington, and Wright counties as a maintenance area for CO. This means the area was previously classified as a nonattainment area but was subsequently determined to be in attainment. This area includes the project area, which is located in Hennepin County. Evaluation of CO for assessment of air quality impacts is required for environmental approval of NEPA documents.

Air Quality Conformity
The EPA issued final rules on transportation conformity (40 CFR 93, Subpart A) which describe the methods required to demonstrate State Implementation Plan (SIP) compliance for transportation projects. The metropolitan planning organization (MPO) with responsibility for transportation planning in the Twin Cities area is the Metropolitan Council. For transportation projects within the Metropolitan Council's jurisdiction, transportation conformity requires that such projects must be part of the Metropolitan Council's Long Range Transportation Policy Plan (LRTPP) and the four-year Transportation Improvement Program (TIP). Accordingly, this project is consistent with the Metropolitan Council's 2040 LRTPP, approved January 2015, and in the current 2016-2019 TIP, as amended. This project is also included in the transportation conformity section of the TIP. On November 8, 2010, the EPA approved a limited maintenance plan request for the Twin Cities maintenance area. Under a limited maintenance plan, the EPA has determined that there is no requirement to project emissions over the maintenance period and that "an emission budget may be treated as essentially not constraining for the length of the maintenance period. The reason is that it is unreasonable to expect that our maintenance area will experience so much growth within this period that a violation of CO NAAQS would result." (USEPA Limited Maintenance Plan Option for Nonclassifiable CO Nonattainment Areas, October 6, 1995) Therefore, no regional modeling analysis is required, however federally funded projects are still subject to "hot spot" analysis requirements. The limited maintenance plan adopted in 2010 determines that the level of CO emissions and resulting ambient concentrations will continue to demonstrate attainment of the CO NAAQS.

This project does not interfere with implementation of any transportation control measure included in the SIP. The current LRTPP (adopted January 2015) was determined to conform to the requirements of the 1990 CAAA (per 40 CFR 51 and 93). A TIP conformity determination was also made by those agencies. The current LRTPP was submitted to MnDOT for transmittal to USDOT for a conformity determination. The project's design concept and scope are not significantly different from that used in the TIP conformity analysis.

As demonstrated by the above information, this project conforms to the requirements of the CAAA, the Conformity Rules, 40 CFR 93, and to the applicable sections of Minnesota State Implementation Plan for air quality.

Carbon Monoxide Hot-Spot Analysis
Although this project is located in an area where conformity requirements apply, the scope of the project does not indicate that adverse air quality impacts would be expected. Furthermore, the EPA has approved a screening method to determine which intersections need hot-spot analysis. The screening procedure includes a flowchart that asks two questions to determine if a CO hot-spot analysis is required:

- Is the project ADT greater than the Benchmark (Average Annual Daily Traffic) AADT?
- Does the project involve/affect the Top 10 Intersections?

The Benchmark AADT identified in the screening procedure is equal to that at the intersection with the highest AADT (2007) in the Twin Cities. The benchmark AADT of 79,400 is not exceeded by any intersection in the project, as shown in Table 1.

Table 1 – Project Area Intersection Volumes

Intersection	Traffic Control	2038 Build
Lake Street at Blaisdell Avenue	Signal	37,400
Lake Street at Nicollet Avenue	Signal	31,950
Lake Street at 1st Avenue	Signal	30,200
Lake Street at Stevens Avenue	Signal	33,300
Lake Street at 2nd Avenue	Signal	29,950
Lake Street at 3rd Avenue	Signal	26,150
Lake Street at Clinton Avenue	Stop	26,000
Lake Street at 4th Avenue	Signal	28,900
Lake Street at 5th Avenue	Stop	25,900
31st Street at Stevens Avenue	Signal	29,400
31st Street at 2nd Avenue	Signal	24,250
28th Street at Stevens Avenue	Signal	19,400
28th Street at NB I-35W Exit Ramp	Signal	25,300
28th Street at 2nd/Clinton Avenue	Signal	25,800
28th Street at 4th Avenue	Signal	19,650
26th Street at Clinton Avenue	Stop	16,850
26th Street at 5th Avenue	Signal	23,500

Source: SEH CORSIM Modeling.

The Top 10 Intersections identified in the screening procedure include the seven intersections with the highest AADT and three locations which are monitored by the MPCA. These intersections are U.S. Highway 169 at County Highway 81; Highway 7 at County Highway 101; Highway 252 at 85th Avenue; University Avenue at Snelling Avenue; Highway 252 at Brookdale Drive; Cedar Avenue at County Road 42; Highway 7 at Williston Road; University Avenue at Lexington Avenue; Highway 252 at 66th Avenue, and; ***Hennepin Avenue at Lake Street (emphasis added)***. As shown in Table 2, the project does not substantially affect the Hennepin Avenue intersections with Lake Street and Lagoon Avenue (or any of the remaining Top 10 Intersections).

Table 2 – Hennepin Avenue at Lake Street/Lagoon Avenue Intersection Volumes

Intersection	Traffic Control	2038 Build
Hennepin Avenue at Lagoon Avenue	Signalized	42,400
Hennepin Avenue at Lake Street	Signalized	38,400
Combined as One Intersection	**Signalized**	**57,800**
Combined as Two Intersections	**Signalized**	**80,800**

Source: SEH CORSIM Modeling.

The results of the screening procedure demonstrate that there are no signalized intersections included in this project area that require hot-spot analysis. Therefore, no further CO air quality analysis is necessary.

Improvements in vehicle technology and in motor fuel regulations continue to result in reductions in vehicle emission rates. The EPA MOVES 2010b emissions model estimates that emission rates will continue to fall from existing rates through year 2030. Consequently, year 2030 vehicle-related CO concentrations in the study area are likely to be lower than existing concentrations even considering the increase in development-related and background traffic.

Mobile Source Air Toxics (MSATs)
A quantitative air quality analysis of MSATs was performed on the proposed project following FHWA guidance because the project will create new or add significant capacity to an urban highway where the AADT is projected to be greater than 140,000 to 150,000 by the design year. Results of the air toxics analysis show a reduction in long-term emissions for air toxics related to the project in the traffic study area; the full report is included on the CD-ROM provided with this Environmental Assessment.

Construction can have a short term effect on MSAT and lessening the effects of MSAT should be considered for projects with substantial construction related MSAT emissions that are likely to occur over an extended building period. In an effort to mitigate for Construction MSAT emissions, project-related construction equipment and vehicles that show excessive emissions of exhaust gases or visible smoke/particulate matter due to poor engine adjustments, or other inefficient operating conditions (such as long-term idling), should be shut down until repairs or adjustments have been made.

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