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Draft Memorandum

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Date: May 24, 2016

Subject: Snelling Midway Air Quality Analysis Technical Memorandum

Introduction

This memorandum documents the traffic-related air quality evaluation completed for the proposed Snelling Midway AUAR area. This assessment was completed to evaluate the impacts of additional traffic generated by the proposed development on regional air quality levels and to identify whether this project would cause or contribute to a new localized exceedance of carbon monoxide (CO) ambient air quality standards. The analysis also evaluated the mobile source air toxic (MSAT) impacts of the project and potential air quality impacts during construction of the project. The scope and methods of these analyses were developed in collaboration with the City of Saint Paul, Minnesota Pollution Control Agency (MPCA), and the Minnesota Department of Transportation (MnDOT).

Motorized vehicles affect air quality by emitting airborne pollutants. Changes in traffic volumes, travel patterns, and roadway locations affect air quality by changing the number of vehicles and the congestion levels in a given area. The air quality impacts for this project were analyzed by addressing criteria pollutants, a group of six common air pollutants regulated by the U.S. Environmental Protection Agency (EPA). In addition to the criteria air pollutants, the EPA also regulates air toxics. These include seven compounds with significant contributions from mobile sources. A qualitative evaluation of Mobile Source Air Toxics (MSATs) has been performed for this project.

Criteria Pollutants

The air quality impacts from this project are analyzed by addressing criteria pollutants, as a group of common air pollutants regulated by the EPA on the basis of criteria (information on health and/or environmental effects of pollution). 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 the National Ambient Air Quality Standards (NAAQS).

Air quality is evaluated based on impacts to humans in the impacted environment. Humans experience air quality impacts by breathing unsafe concentrations of airborne pollutants. Exposure to air pollutants emitted from motor vehicles can occur in homes, businesses, and recreation facilities located adjacent to affected roadway segments or on pedestrian and bicycle facilities along project area roadways.

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 make people more susceptible to respiratory infection, result in lung inflammation, and aggravate preexisting respiratory diseases such as asthma. Ozone is not emitted directly from vehicles but is formed as 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 State of Minnesota is currently 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 VOCs. $PM_{2.5}$ 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:

- Premature death in people with heart or lung disease
- Nonfatal heart attacks
- Irregular heartbeat
- Aggravated asthma
- Decreased lung function
- Increased respiratory symptoms, such as irritation of the airways, coughing, or difficulty breathing
  Source: http://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 revised the annual $PM_{2.5}$ standard by lowering the level to 12.0 micrograms per cubic meter ($\mu g/m^3$), from the previous annual standard of 15.0 $\mu g/m^3$. The EPA has retained the 24-hour $PM_{2.5}$ standard at a level of 35 $\mu g/m^3$ (http://www.epa.gov/pm/actions.html). The agency also retained the existing standards for coarse particle pollution (PM_{10}). The NAAQS 24-hour standard for PM_{10} is 150 $\mu g/m^3$, which is not to be exceeded more than once per year on average over three years.

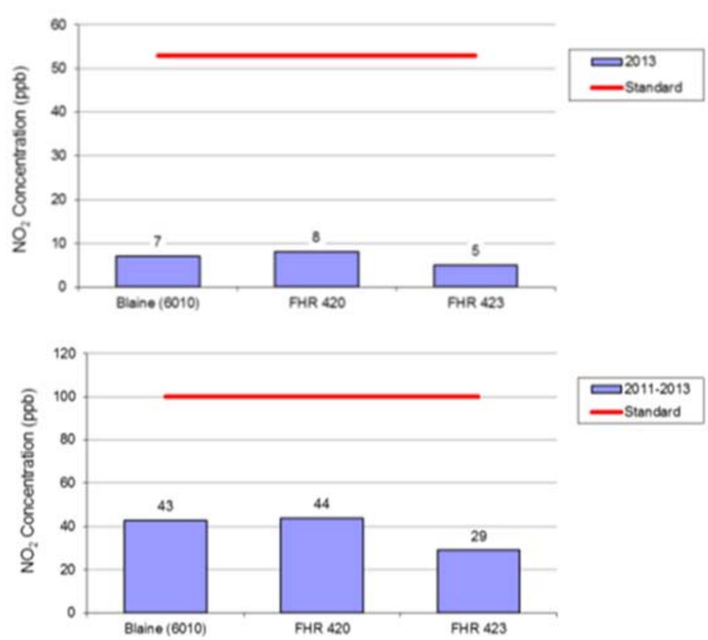
The Clean Air Act conformity requirements include the assessment of localized air quality impacts of transportation projects that are located within PM nonattainment and maintenance areas and deemed to be projects of air quality concern. This project is located in an unclassifiable/attainment area for PM, meaning that the project area has been identified as a geographic area that meets the national health-based standards for PM levels. Therefore, the project is exempt from detailed analysis and no quantitative evaluation of PM impacts was conducted for this project.

Nitrogen Dioxide (Nitrogen Oxides)

Nitrogen Dioxide (NO_2) is one compound in a group of highly reactive gases called Nitrogen oxides, or NO_x, which contain nitrogen and oxygen in varying amounts. Nitrogen oxides form when fuel is burned in a combustion process, primarily including motor vehicles, electric utilities, and other industrial, commercial, and residential sources that burn fuels.

Minnesota currently meets federal nitrogen dioxide standards, as shown in related figures from the *2015 Annual Air Monitoring Network Plan* (September 2014), which are shown in Figure 1. This document shows that for three monitoring sites in the Twin Cities Metropolitan Area, annual one-hour concentrations are substantially below the NAAQS limits of 53 parts per billion (ppb) and 100 ppb, respectively. Additionally, comparing these diagrams with similar diagrams from previous years, shows a steadily decreasing trend, which is in conformance with EPA's Tier 2 regulatory announcement.

Figure 1: Annual Average and 1-Hour NO_2 Concentrations Compared to the NAAQS



The EPA's Tier 2 regulatory standards announced in December 1999 "will significantly reduce emissions of nitrogen oxides from vehicles by about 74 percent by 2030" (EPA420-F-99-051, http://www.epa.gov/tier2/documents/f99051.pdf).

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 reductions of NO_x emissions. Thus, 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 at most risk when SO_2 levels increase. Once emitted into the atmosphere, SO_2 can be further oxidized to sulfuric acid, which is a component of acid rain.

MPCAs *2015 Annual Air Monitoring Network Plan for Minnesota* (September 2014) shows that eight sites were monitored for SO_2 in the Twin Cities Metropolitan Area during the period of 2011 to 2013. The NAAQS limit for SO_2 is met if the three-year average of the annual 99th percentile daily maximum one-hour SO_2 is less than 75 ppb. The maximum of the monitoring sites was found to be 14 ppb, which is well below the 75 ppb threshold.

MPCA also states that about 70 percent of SO_2 released into the air comes from electric power generation (*Air Quality in Minnesota: 2013 Report to the Legislature*, January 2013). Therefore, a much smaller proportion is 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.

Emissions of sulfur oxides from transportation sources are a small component of overall emissions and continue to decline due to the desulphurization 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. Therefore, 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, and no analysis is warranted.

Carbon Monoxide

Carbon Monoxide (CO) is a traffic-related pollutant that has been a concern in the Twin Cities Metropolitan area. In 1999, the EPA redesignated 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 found to be in attainment. Due to successful compliance as a maintenance area since 1999, the Twin Cities region was designated a limited maintenance area in 2010, further reducing the evaluation required for CO. Maintenance areas are required to undertake actions to demonstrate continuing compliance with CO standards. Since the AUAR area is located in Ramsey County, evaluation of CO for assessment of air quality impacts is required for approval in environmental documents.

Regional Conformity

The 1990 Clean Air Act Amendments (CAAA) require that the State Implementation Plans (SIPs) must demonstrate how states with nonattainment and maintenance areas will meet federal air quality standards. The EPA issued final rules on transportation conformity (40 CFR 93, Subpart A), which describe the methods required to demonstrate SIP compliance for transportation projects. It requires that regionally significant transportation projects must be a part of a conforming Long Range Transportation Policy Plan (LRTPP) and four-year Transportation Improvement Program (TIP). The proposed project is not a regionally significant transportation improvement and therefore conformity requirements do not apply. In concordance, no regional emissions modeling was completed as part of the evaluation of the current project.

Intersection CO Analysis

CO is also subject to detailed intersection-level evaluation to assess whether any localized impacts from increased traffic congestion may be expected to occur. Vehicles queued at congested intersections emit CO, which may contribute to elevated CO concentrations near the roadways where pedestrians may be present. The analysis completed for the AUAR area included three scenarios representing different conditions expected to occur. The scenarios include:

- 2018 Stadium Build Scenario – this condition reflects traffic patterns and volumes that would be expected to occur prior to an evening event at the proposed stadium. Increased traffic congestion would be expected as a result of additional event traffic along with normal p.m. peak period traffic. This scenario assumes year 2018 volumes and vehicle emission rates.

- 2035 Comprehensive Plan Full Buildout Scenario – this condition reflects traffic patterns and volumes that would be expected to occur once all of the proposed development in the AUAR area has been completed, including residential and commercial land uses. Increased traffic would be expected from the additional land uses proposed. This scenario assumes year 2035 traffic volumes, but uses year 2022 vehicle emission rates to represent a worst-case scenario should market conditions allow development to occur faster than anticipated.

- Construction Scenario – this condition reflects increased traffic congestion along roadways adjacent to the AUAR area that may occur due to temporary lane closures resulting from construction equipment. This scenario assumes existing traffic volumes and vehicle emission rates.

Air quality modeling was performed using current versions of EPA CO emission (MOVES2014) and dispersion modeling (CAL3QHC) software. All methods and procedures used in the air quality analyses are generally accepted by the EPA and MPCA as approved for industry-standard analytical methods. The modeling assumptions used in this analysis include the following:

Table 1: Modeling Assumptions

Category	Assumption
Speed Class	Arterial, posted speed limits
Traffic Mix	MOVES data for Ramsey County
Traffic Age Distribution	MPCA Data
Wind Speed	1 meter/second
Temperature	Meteorology information at county level
Wind Direction	36 directions at 10 degree increments
Surface Roughness	180 centimeters
Atmospheric Stability Class	D
8-Hour Persistence Factor	0.7
Fuel Program	Conventional Gasoline East
Fuel Reid Vapor Pressure	9.0 pounds/square inch
Oxygenated Fuels	Ethanol with 2.7 percent oxygen content

The CO emissions factors were produced by the MOVES2014 emission model at varying speeds for year 2018 and year 2022 conditions (see Appendix A).

Background CO concentrations are needed for air quality analysis purposes to represent conditions without the influence of nearby vehicles. The background concentrations are added to intersection-scale modeled results to yield predicted CO levels.

Background CO concentrations for the analysis documented in this study were obtained from MPCA for the monitoring station at Site 861 (near the intersection of University Avenue and Lexington Avenue) in Saint Paul. The maximum one-hour and eight-hour concentrations for the worst-case (winter) condition are shown in Table 2. Background concentrations were also adjusted for future year 2018 and year 2022 conditions to account for regional growth. The annual background growth rate was assumed to be 0.5 percent per year. To represent worst-case conditions, no background reduction was used to account for future emissions-control improvements. This likely overestimates the ambient background CO concentrations.

Table 2: Background Carbon Monoxide Concentrations

Site #861, Saint Paul, Minnesota	1-Hour	8-Hour
2013 Background CO Concentration (ppm)	2.4	1.1
Background Growth Factor – 2013 to 2018	1.28	1.28
Adjusted Background CO Concentration – 2018 (ppm)	3.1	1.4
Background Growth Factor – 2013 to 2022	1.41	1.41
Adjusted Background CO Concentration – 2022 (ppm)	3.4	1.55

The following intersections, and surrounding areas, were included in the evaluation of air quality impacts for carbon monoxide:

- Snelling Avenue & Concordia Avenue
- Snelling Avenue & St. Anthony Avenue
- Snelling Avenue & University Avenue
- Lexington Avenue & University Avenue

Analysis is required at the Snelling Avenue & University Avenue and Lexington Avenue & University Avenue intersections since these are included in the list of ten intersections in the Twin Cities as identified by MnDOT (http://dotapp7.dot.state.mn.us/edms/download?docId=644986). The Snelling Avenue & Concordia Avenue and Snelling Avenue & St. Anthony Avenue intersections were modeled due to their proximity to the project area and potential for traffic congestion.

Carbon monoxide concentrations near the intersections were estimated using forecast traffic volumes, proposed intersection geometrics, optimized signal timing, emission levels from MOVES2014, and dispersion modeling using the EPA model CAL3QHC. Schematics and peak-hour turning movements for each intersection model are provided in Appendix B.

The intersection CO modeling results are shown in Table 3 through Table 5. These results are the worst-case results from the CAL3QHC dispersion model. The results show the location of the highest expected concentration, the value of the highest one-hour and eight-hour concentrations, and the wind angle that produced these concentrations. The CO results provided represent background CO concentrations plus modeled intersection CO concentrations. The worst case was identified at the intersection of Snelling Avenue and Concordia Avenue, under the Year 2018 construction scenario.

Table 3: Year 2018 Stadium Build Scenario Carbon Monoxide Modeling Results (Shown in Parts per Million (ppm))

Highest CO Receptor Location	1-Hour Average Concentration	8-Hour Average Concentration	Wind Direction
I-94 Interchange Area			
NE Quadrant of Snelling Avenue and Concordia Avenue	5.2	2.5	200°
Snelling Avenue & University Avenue Station Area			
NE Quadrant of Intersection	5.0	2.4	180°
Stadium Site			
Shields Avenue East of Snelling Avenue	4.8	2.2	190°
Lexington Avenue & University Avenue Station Area			
NE Quadrant of Intersection	5.1	2.5	350°

Table 4: Year 2035 Comprehensive Plan Full Buildout Scenario Carbon Monoxide Modeling Results (Shown in Parts per Million (ppm))

Highest CO Receptor Location	1-Hour Average Concentration	8-Hour Average Concentration	Wind Direction
I-94 Interchange Area			
NE Quadrant of Snelling Avenue and Concordia Avenue	5.2	2.5	200°
Snelling Avenue & University Avenue Station Area			
SE Quadrant of Intersection	5.2	2.5	190°
Stadium Site			
Several Receptors Along Pedestrian Plaza	4.8	2.2	190°
Lexington Avenue & University Avenue Station Area			
University Avenue Median (West of Lexington Avenue)	5.1	2.5	170°

Table 5: Year 2018 Construction Scenario Carbon Monoxide Modeling Results (Shown in Parts per Million (ppm))

Highest CO Receptor Location	1-Hour Average Concentration	8-Hour Average Concentration	Wind Direction
I-94 Interchange Area			
NE Quadrant of Snelling Avenue and Concordia Avenue	5.3	2.6	200°
Snelling Avenue & University Avenue Station Area			
SE Quadrant of Intersection	5.1	2.5	190°
Stadium Site			
Shields Avenue East of Snelling Avenue	4.8	2.2	220°
Lexington Avenue & University Avenue Station Area			
University Avenue Median (West of Lexington Avenue)	5.1	2.5	170°

The highest predicted concentrations are expected to occur in the I-94 interchange area at the Snelling Avenue & Concordia Avenue intersection, with the one-hour and eight-hour concentrations of 5.3 and 2.6 ppm, respectively. Based on these results, concentrations of CO in the project area would be substantially below the federal one-hour standard of 35 ppm, the Minnesota one-hour standard of 30 ppm, and the federal eight-hour standard of 9 ppm. These CO modeling results show that the Snelling Midway project is not expected to cause CO concentrations exceeding state or federal standards.

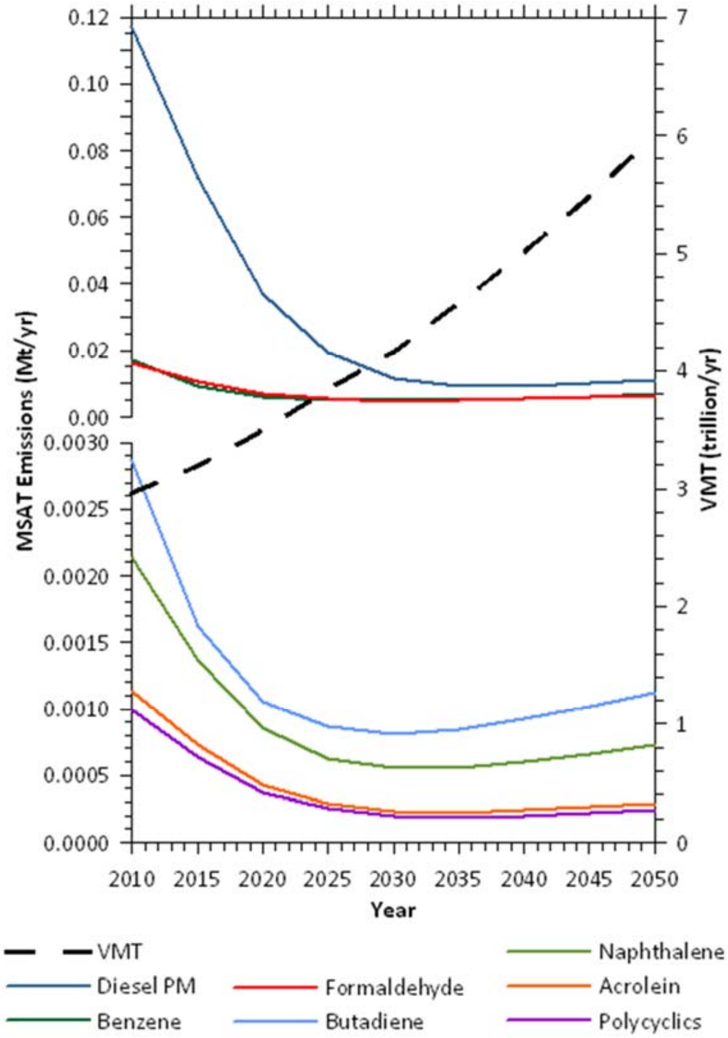
Mobile Source Air Toxics

Controlling air toxic emissions became a national priority with the passage of the CAAA of 1990, whereby Congress mandated that the EPA regulate 188 air toxics, also known as hazardous air pollutants. The EPA has assessed this expansive list in their latest rule on the Control of Hazardous Air Pollutants from Mobile Sources (Federal Register, Vol. 72, No. 37, page 8430, February 26, 2007), and identified a group of 93 compounds emitted from mobile sources that are listed in their Integrated Risk Information System (IRIS) (http://www.epa.gov/iris/).

In addition, EPA identified seven compounds with significant contributions from mobile sources that are among the national and regional-scale cancer risk drivers from their 1999 National Air Toxics Assessment (NATA) (http://www.epa.gov/ttn/atw/nata1999/). These are Acrolein, Benzene, 1,3-Butidiene, Diesel Particulate Matter plus diesel exhaust organic gases (Diesel PM), Formaldehyde, Naphthalene, and Polycyclic Organic Matter (POM). The 2007 EPA rule mentioned above requires controls that will dramatically decrease MSAT emissions through cleaner fuels and cleaner engines.

Based on an FHWA analysis using EPA's MOVES2010b model, as shown in Figure 2, even if vehicle-miles travelled (VMT) increases by 102 percent, as assumed from 2010 to 2050, a combined reduction of 83 percent in the total annual emissions for the priority MSAT is projected for the same time period. Local conditions may differ from these national projections in terms of fleet mix and turnover, VMT growth rates, and local control measures. However, the magnitude of the EPA-projected reductions is so great (even after accounting for VMT growth), that MSAT emissions in the project area are likely to be lower in the future in nearly all cases. On a regional basis, EPA's vehicle and fuel regulations will over time cause substantial reductions that, in almost all cases, will cause region-wide MSAT levels to be significantly lower than today.

Figure 2: National MSAT Emission Trends 2010-2050 for Vehicles Operating On Roadways Using EPA's MOVES2010b Model



Notes:

(1) Trends for specific locations may be different, depending on locally derived information on vehicle-miles travelled, vehicle speeds, vehicle mix, fuels, emission control programs, meteorology, and other factors.

Source: EPA MOVES2010b model runs conducted during May - June 2012 by FHWA. http://www.fhwa.dot.gov/environment/air_quality/air_toxics/policy_and_guidance/nmsatetrends.cfm

Air toxics analysis is a continuing area of research. While much work has been done to assess the overall health risk of air toxics, many questions remain unanswered. In particular, the tools and techniques for assessing project-specific health outcomes as a result of lifetime MSAT exposure remain limited. These limitations impede the ability to evaluate how potential public health risks posed by MSAT exposure should be factored into project-level decision-making within the context of NEPA.

Information is incomplete or unavailable to credibly predict the project-specific health impacts due to changes in MSAT emissions associated with a proposed set of development actions. The FHWA, EPA, the Health Effects Institute, and others have funded and conducted research studies to try to more clearly define potential risks from MSAT emissions associated with transportation projects. However, available technical tools do not enable us to predict the project-specific health impacts of MSAT emissions. The FHWA will continue to monitor the developing research in this field.

The methodologies for forecasting health impacts include emissions modeling, dispersion modeling, exposure modeling, and then final determination of health impacts – with each step in the process building on the model predictions obtained in the previous step. All are encumbered by technical shortcomings or uncertain science that prevent a more complete differentiation of the MSAT health impacts among a set of project alternatives. These difficulties are magnified for lifetime (i.e., 70 year) assessments, particularly because unsupportable assumptions would have to be made regarding changes in travel patterns and vehicle technology (which affects emissions rates) over that time frame, since such information is unavailable.

It is particularly difficult to reliably forecast 70-year lifetime MSAT concentrations and exposure near roadways; to determine the portion of time that people are actually exposed at a specific location; and to establish the extent attributable to a proposed action, especially given that some of the information needed is unavailable.

There are considerable uncertainties associated with the existing estimates of toxicity of the various MSATs, because of factors such as low-dose extrapolation and translation of occupational exposure data to the general population, a concern expressed by HEI (http://pubs.healtheffects.org/view.php?id=282). As a result, there is no national consensus on air dose-response values assumed to protect the public health and welfare for MSAT compounds, and in particular for diesel PM. The EPA (http://www.epa.gov/risk/basicinformation.htm#g) and the HEI (http://pubs.healtheffects.org/getfile.php?u=395) have not established a basis for quantitative risk assessment of diesel PM in ambient settings.

There is also a lack of a national consensus on an acceptable level of risk. The current context is the process used by the EPA as provided by the Clean Air Act to determine whether more stringent controls are required to 1) provide an ample margin of safety to protect public health, or, 2) prevent an adverse environmental effect.

Because of the limitations in the methodologies for forecasting health impacts described, any predicted difference in health impacts between scenarios is likely to be much smaller than the uncertainties associated with predicting the impacts. Consequently, the results of such assessments would not be useful to decision makers, who would need to weigh this information against project benefits, such as reducing traffic congestion, accident rates, and fatalities plus improved access for emergency response, that are better suited for quantitative analysis.

Qualitative MSAT Analysis

For each scenario in this AUAR, the amount of MSATs emitted would be proportional to the amount of VMT, assuming that other variables (such as travel not associated with the proposed development) are the same for each alternative. The VMT estimated for the comprehensive plan full buildout scenario is higher than that for the No Build condition, because of the additional activity associated with the proposed development. This increase in VMT associated with the Comprehensive Plan Full Buildout scenario would lead to higher MSAT emissions in the vicinity of the AUAR area. The higher emissions could be offset somewhat by a decrease in regional traffic due to increased use of transit. The extent to which these emissions decreases will offset VMT-related emissions increases is not known.

Regardless of which scenario is chosen, emissions will likely be lower than present levels in the design year as a result of EPA's national control programs that are projected to reduce annual MSAT emissions by over 80 percent from 2010 to 2050. Local conditions may differ from these national projections in terms of fleet mix and turnover, VMT growth rates, and local control measures. However, the EPA-projected reductions are so significant (even after accounting for VMT growth) that MSAT emissions in the study area are likely to be lower in the future as well.

The additional activity contemplated as part of the project scenarios could have the effect of increasing emissions in the vicinity of nearby homes and businesses; therefore, under the Comprehensive Plan Full Buildout scenario there may be localized areas where ambient concentrations of MSATs would be higher than under the No Build conditions. However, as discussed above, the magnitude and the duration of these potential differences cannot be reliably quantified due to incomplete or unavailable information in forecasting project-specific health impacts. Even though there may be differences among the scenarios, on a region-wide basis, EPA's vehicle and fuel regulations, coupled with fleet turnover, will cause substantial reductions over time that in almost all cases the MSAT levels in the future will be significantly lower than today.

In sum, the Stadium Build and Comprehensive Plan Full Buildout scenarios are expected to be associated with higher levels of MSAT emissions in the study area, relative to the No Build condition, along with some benefit from mode shifts to transit. There also could be slightly higher differences in MSAT levels in a few localized areas where activity occurs closer to homes, and businesses. Under all scenarios, MSAT levels are likely to decrease over time due to nationally mandated cleaner vehicles and fuels.

Avoidance, Minimization, and/or Mitigation Measures

The analysis presented in this document demonstrates there will be no anticipated exceedances of air pollutant concentrations resulting from the proposed project; therefore, no mitigation measures are necessary. The State of Minnesota does not require permits for traffic-related emissions for projects of this type.

This analysis also demonstrates that no exceedances are anticipated under the construction phase. However, a series of Best Management Practices (BMPs) would be implemented during construction to control dust. This may include the following preventive and mitigative measures:

- Minimization of land disturbance during site preparation
- Use of watering trucks to minimize dust
- Covering of trucks while hauling soil/debris off-site or transferring materials
- Stabilization of dirt piles if they are not removed immediately
- Use of dust suppressants on unpaved areas
- Minimization of unnecessary vehicle and machinery idling
- Revegetation of any disturbed land post-construction

APPENDIX A

CO Emissions Factors

Table A-1: Carbon Monoxide Emissions Factors from MOVES2014

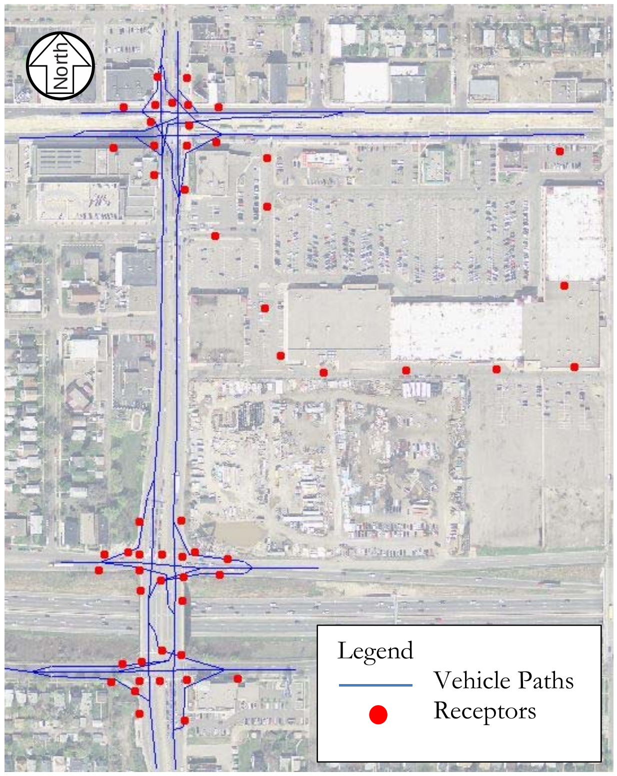
Speed	Emissions (g/veh-mi)	
	Year 2018	Year 2022
Idle*	10.8	5.0
2	15.7	11.8
5	10.1	7.8
10	7.3	5.7
15	6.4	5.1
20	5.7	4.5
25	4.8	3.7
30	4.5	3.6
35	4.2	3.3
40	3.8	3.1
45	3.6	2.9
50	3.5	2.8
55	3.6	2.9
60	3.7	3.0
65	3.9	3.2
70	4.5	3.7
75	5.9	4.9

* unit: g/veh-hour

APPENDIX B

CAL3QHC Schematics and Traffic Inputs

CAL3QHC Schematic for I-94 Interchange and Snelling Avenue & University Avenue Station Areas



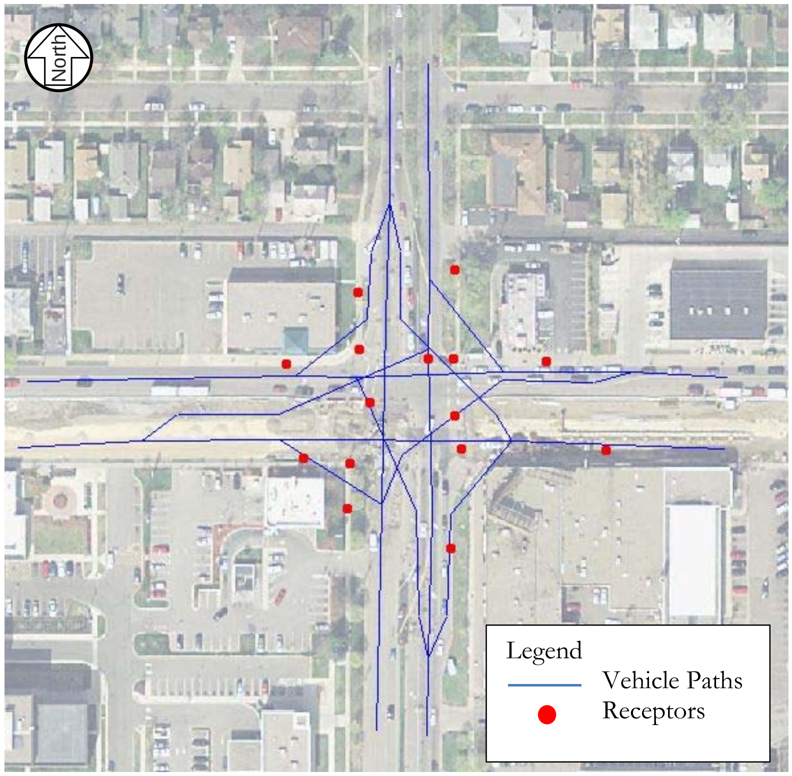
Year 2018 Stadium Build Scenario Peak Hour Turning Movements

Intersection	NBL	NBT	NBR	SBL	SBT	SBR	EBL	EBT	EBR	WBL	WBT	EBR
Snelling Avenue & Concordia Avenue	-	940	258	316	776	-	661	759	722	-	-	-
Snelling Avenue & St. Anthony Avenue	482	1,119	-	-	843	265	-	-	-	248	356	358
Snelling Avenue & University Avenue	94	564	76	182	747	31	86	276	118	146	191	101

Year 2035 Comprehensive Plan Full Buildout Scenario Peak Hour Turning Movements

Intersection	NBL	NBT	NBR	SBL	SBT	SBR	EBL	EBT	EBR	WBL	WBT	EBR
Snelling Avenue & Concordia Avenue	-	1,208	212	678	1,210	-	476	478	770	-	-	-
Snelling Avenue & St. Anthony Avenue	510	1,174	-	-	1,600	620	-	-	-	288	392	419
Snelling Avenue & University Avenue	205	1,066	121	243	910	107	111	446	136	118	391	83

CAL3QHC Schematic for Lexington Avenue & Snelling Avenue Station Area



Year 2018 Stadium Build Scenario Peak Hour Turning Movements

Intersection	NBL	NBT	NBR	SBL	SBT	SBR	EBL	EBT	EBR	WBL	WBT	EBR
Lexington Avenue & University Avenue	85	660	85	35	655	80	115	410	160	115	270	40

Year 2035 Comprehensive Plan Full Buildout Scenario Peak Hour Turning Movements

Intersection	NBL	NBT	NBR	SBL	SBT	SBR	EBL	EBT	EBR	WBL	WBT	EBR
Lexington Avenue & University Avenue	135	1,050	95	60	995	105	255	825	160	170	415	35