APPENDIX G

Air Quality Analysis Report

Greenhouse Gas Analysis

A. Introduction to the Transportation Air Quality Analysis

Motorized vehicles affect air quality by emitting airborne pollutants. Changes in traffic volumes, travel patterns, and roadway locations affect air quality as the number of vehicles and the congestion levels in a given area change. The adverse impacts this project could have on air quality have been analyzed by addressing criteria air pollutants, a group of common air pollutants that are regulated by the U.S. Environmental Protection Agency (EPA) on the basis of specific criteria that reflect the effects of pollution on public health and the environment. The criteria air 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 the project's projected concentrations to National Ambient Air Quality Standards (NAAQS).

In addition to the criteria air pollutants, the EPA also regulates a category of pollutants known as air toxics, which are generated by emissions from mobile sources. 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.

B. NAAQS Criteria Pollutants

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, resulting 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 (NOx) that react in the presence of sunlight. Transportation sources emit NOx 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.

In 2012, the MPCA enrolled in EPA's voluntary Advance Programs for ozone. This program helps the states achieve voluntary emission reductions to lower concentrations of this pollutant. The program aims at helping state and local governments reduce air pollution in areas that currently meet federal standards for ozone. As researchers better understand the health impacts of air pollutants, EPA reviews and strengthens national air quality standards. These programs help the states stay ahead of changes to the national standards. Without continued improvements in air quality, Minnesota is at risk for violating air quality standards in the future. Partners in the Clean Air Minnesota program, including MnDOT, have committed to reducing ozone precursor emissions by 10% from 2011 levels.

According to the MPCA, ozone levels in Minnesota have been improving since 2003. However, progress in reducing both pollutants has been affected by year-to-year variability in the weather. Moreover, climate change may cause future challenges, both from increased local temperatures causing more ozone to form, and from longer and more frequent droughts resulting in more fine-particle pollution from wildfires.[1]

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 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[2]:

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

[1] Source: *The Air We Breathe: The State of Minnesota's Air Quality 2019*, MPCA, January 2019

[2] Source**:** Health and Environmental Effects of Particulate Matter (PM)

In January 2013, the EPA issued a final rule revising the annual health NAAQS for fine particles ($PM_{2.5}$) to be 12.0 micrograms per cubic meter ($\mu g/m^3$) as the annual $PM_{2.5}$ standard. The EPA retained the 24-hour $PM_{2.5}$ standard at a level of 35 $\mu g/m^3$ (the EPA issued the 24-hour standard in 2006). 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. [3]

In 2012, the MPCA enrolled in EPA's voluntary Advance Programs for particulate matter. This program helps the states achieve voluntary emission reductions to lower concentrations of this pollutant. The program aims at helping state and local governments reduce air pollution in areas that currently meet federal standards for fine particles. As researchers better understand the health impacts of air pollutants, EPA reviews and strengthens national air quality standards. These programs help the states stay ahead of changes to the national standards. Without continued improvements in air quality, Minnesota is at risk for violating air quality standards in the future. Partners in the Clean Air Minnesota Program, including MnDOT, have committed to reducing man-made fine particulate matter (PM2.5) by 10% from 2011 levels.

The Clean Air Act conformity requirements include the assessment of localized air quality impacts of federally-funded or federally-approved transportation projects that are deemed to be projects of air quality concern located within $PM_{2.5}$ nonattainment and maintenance areas. This project is not considered one of air quality concern. This is supported, in part, by the designation of the State of Minnesota as an unclassifiable/ attainment area for PM. This means that Minnesota has been identified as a geographic area that meets or exceeds the national standards for the reduction of PM levels, and therefore is exempt from performing PM analyses.

Nitrogen Dioxide (Nitrogen Oxides)

Nitrogen oxides, or NOx, 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 NOx are motor vehicles, electric utilities, and other industrial, commercial, and residential sources that burn fuels. In addition to being a precursor to ozone, NOx can worsen bronchitis, emphysema and asthma and increase risk of premature death from heart or lung disease.

Minnesota currently meets federal nitrogen dioxide standards, as shown in **Exhibit 1** from *Annual Air Monitoring Network Plan for Minnesota 2018* (July 2017)[4]. This document states:

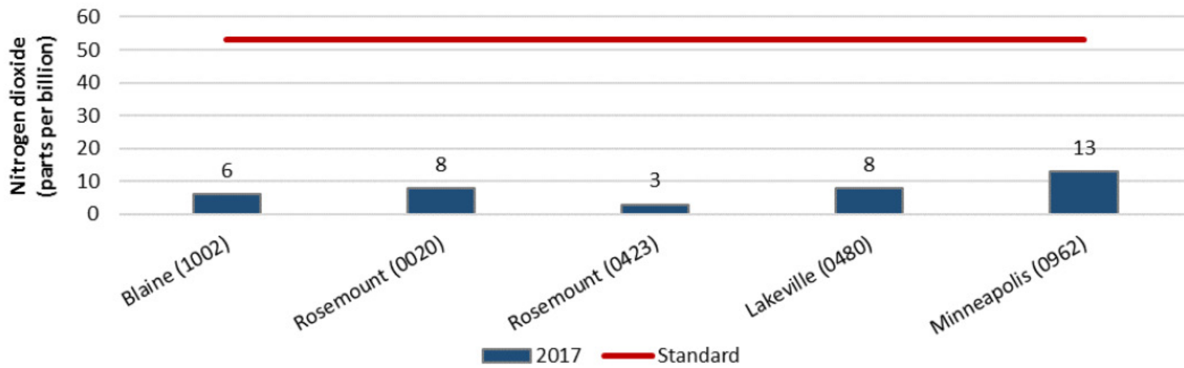
> *A monitoring site meets the annual NAAQS for NO2 if the annual average is less than or equal to 53 ppb. Minnesota averages ranged from 5 ppb at Flint*

[3] Source: 2012 National Ambient Air Quality Standards (NAAQS) for Particulate Matter (PM)

[4] Source: *Annual Air Monitoring Network Plan for Minnesota 2018*, MPCA, July 2017.

Hills Refinery 423 to 13 ppb at the Near Road I-35/I-94 site (962); therefore, Minnesota currently meets the annual NAAQS for NO2 (Figure 21).

Exhibit 1. Average Annual NO_2 Concentrations Compared to the NAAQS



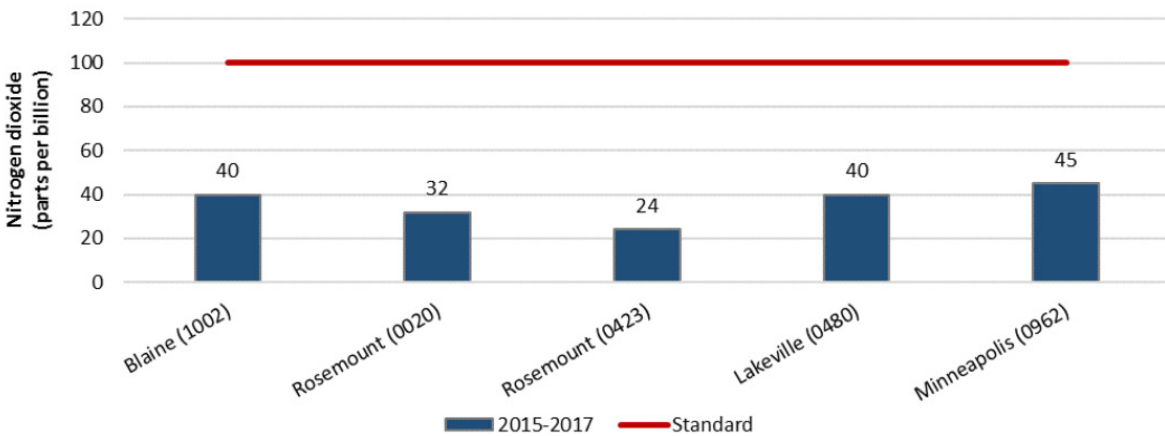
In the *Annual Air Monitoring Network Plan for Minnesota 2019* (July 2018), it states the following with regard to the 1-hour NO_2 standard:

> *On January 22, 2010 the EPA finalized revisions to the NO2 NAAQS. As part of the standard review process, the EPA retained the existing annual NO2 NAAQS, but also created an additional one-hour standard. The new one-hour NAAQS is intended to protect against adverse health effects associated with short-term exposures to elevated NO2. To meet this standard, the three-year average of the annual 98th percentile daily maximum one-hour NO2 concentration must not exceed 100 ppb. Minnesota averages ranged from 26 ppb at Flint Hills Refinery 423 to 46 ppb at Blaine (6010); therefore, all Minnesota sites currently meet the one-hour NAAQS for NO2 (Figure 22).*

Exhibit 2 depicts the 2015-2017 1-hour NO_2 concentrations at Minnesota sites compared to the 1-hour NO_2 NAAQS.[5]

[5] Source: *Annual Air Monitoring Network Plan for Minnesota 2019*, MPCA, July 2018.

Exhibit 2. One-hour NO2 Concentrations Compared to the NAAQS



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 6,000 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.*

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.

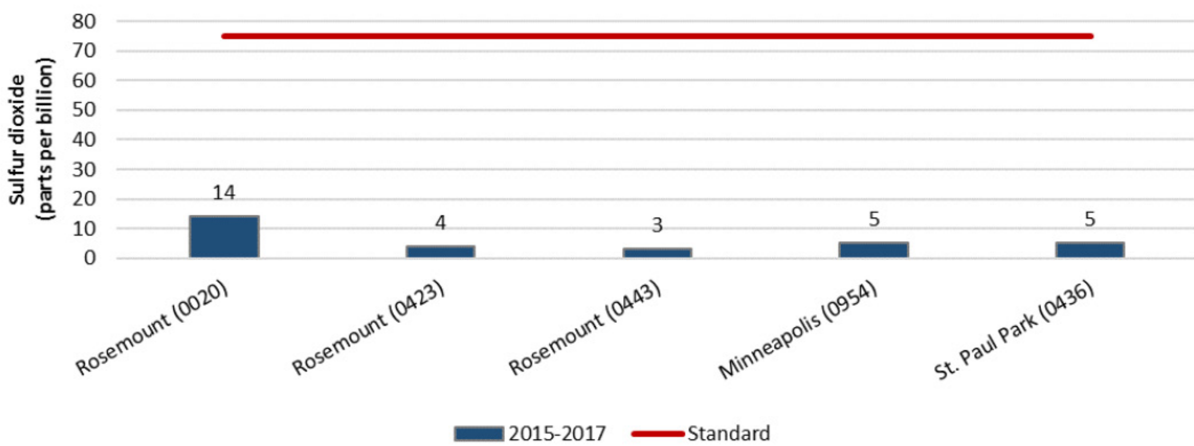
Sulfur Dioxide

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, can lead to other respiratory symptoms, and at very high levels, can 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 15 percent of the federal standards over the 3-year period from 2013 through 2015, as shown in **Exhibit 3** below.[6] In the *Annual Air Monitoring Network Plan for Minnesota 2018*, it states the following with regard to SO_2:

> *On June 2, 2010, the EPA finalized revisions to the primary SO2 NAAQS. EPA established a new one-hour standard, which is met if the three-year average of the annual 99th percentile daily maximum one-hour SO2 concentration is less than 75 ppb. Previous standards were revoked under the new rule. Minnesota averages from 2014-2016 ranged from 2 ppb at Rochester (5008) to 12 ppb at Flint Hills Refinery (420); therefore, all Minnesota sites currently meet the one-hour NAAQS for SO2 (Figure 24).*

Exhibit 3. One-hour SO_2 Concentration 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 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. 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.

[6] Source: *Annual Air Monitoring Network Plan for Minnesota 2019*, MPCA, July 2018.

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 has now been found to be in attainment. This Project is located in Goodhue County and therefore no Carbon Monoxide analysis was required.

Air Quality Conformity

The project is not located in an area in which conformity requirements apply, and the scope of the project does not indicate that air quality impacts would be expected. Therefore, no further air quality analysis is necessary.

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8/1/2020

Greenhouse Gas Analysis

TH 52 Southbound Reconstruction
SP 2506-83 (TH 52)

Greenhouse Gases (GHGs)

Minnesota's position near the center of North America subjects us to an exceptional variety of extreme weather. During the course of a single year, most Minnesotans will experience both blizzards and heatwaves, windstorms, strong thunderstorms, and heavy rains.

The conditions, however, have changed rapidly, and an overwhelming base of scientific evidence projects that Minnesota's climate will see additional significant changes through the end of the 21st century[1]. Over the last several decades, the state has experienced substantial warming during winter and at night, with increased precipitation throughout the year, often from larger and more frequent heavy rainfall events. These changes alone have damaged buildings and infrastructure, limited recreational opportunities, altered our growing seasons, impacted natural resources, and affected the conditions of lakes, rivers, wetlands, and our groundwater aquifers that provide water for drinking and irrigation. The years and decades ahead in Minnesota will bring even warmer winters and nights, and even larger rainfalls, in addition to other climatic changes not yet experienced in the state.

In the years and decades ahead, winter warming and increased extreme rainfall will continue to be Minnesota's two leading symptoms of climate change. Climate models used in the 2017 National Climate Assessment also project that Minnesota will have a greater tendency toward extreme heat, especially by the middle of the 21st century[2]. The future drought situation in Minnesota is less clear and appears to depend on how much greenhouse gas emissions increase by mid-century.

GHG's are gases that warm the atmosphere and surface of the planet. Human activity has been increasing the amount of GHG's in the atmosphere, leading to changes in the earth's climate. The primary GHG's are carbon dioxide (CO2), nitrous oxide (N2O), methane (CH4), sulfur hexafluoride (SF6), and two classes of compounds called hydrofluorocarbons (HFCs) and perfluorocarbons (PFCs).

The most recent greenhouse gas (GHG) emissions inventory from the Minnesota Pollution Control Agency (MPCA) showed that transportation overtook the electricity generation sector to become the number one source of GHG emissions in Minnesota starting in 2016[3]. This is consistent with trends in other states, and

[1] https://www.pca.state.mn.us/sites/default/files/p-gen4-07c.pdf
[2] https://nca2018.globalchange.gov/downloads/NCA4_Ch21_Midwest_Full.pdf
[3] http://www.dot.state.mn.us/sustainability/docs/2018-sustainability-report.pdf

chan es in both sectors and trends (electricity decreasin , transportation increasin) are expected to continue in the future.

Table   . Analysis Results

Operational Emissions (Base Year and Design Year)	CO2e, Metric Tons Per Year
Base Year (2020)	78,760
No Action Alternative (2040)	68,508
Build Alternative (2040)	68,508
Difference Build vs No-Build	0
Cumulative Difference over project lifetime (20 years)	**$CO2_e$, Metric Tons (total)**
	0

The GHG analysis above illustrates that the project will result in a decrease in GHG emissions compared to the Base Year. The analysis also shows that the project will have no affect on GHG emissions compared to the No Action Alternative.

Summary of Greenhouse Gases (GHGs)

This document summarizes the GHG emissions associated with construction of the proposed project. It does not include an assessment of the potential climate *effects*of those emissions. In the case of GHGs and climate chan e, climate is driven by *global* cumulative chan es of GHG concentrations in the atmosphere; the chan es in emissions from one individual project are simply too small to justify calculation of resultin   chan es in temperature, sea level, precipitation, and other significant cumulative climate effects. However, estimation of emissions is still useful to the public and decisionmakers so that they can understand whether projects are contributin   to pro ress in mitigatin   climate chan e.

Assessin   GHG emissions from transportation projects is one of several strate ies that MnDOT is pursuin   to address the issue of climate chan e. Other strate ies that MnDOT is pursuin   include intermodal transportation, electric vehicle incentives and infrastructure, clean vehicle standards, and alternative fuels. The agency is also developin   a process for evaluatin   flood risk to MnDOT brid es, lar e culverts, and pipes. Studyin   the performance of infrastructure under predicted extreme events will help MnDOT   ain knowled e and better assess the impacts of climate chan es to plan, design, build, and maintain assets for resilience. More information re ardin   MnDOT’s efforts to address climate chan e can be found at http://www.dot.state.mn.us/sustainability/.