I-270 Corridor Improvements

# Air Quality Technical Report - I-270 Corridor Improvements Environmental Impact Statement

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# Contents

**Air Quality Technical Report - I-270 Corridor Improvements Environmental Impact Statement** ........ **1**

**Contents** ........ **1**

**Acronyms and Abbreviations** ........ **1**

**1.0 Introduction** ........ **1**

**2.0 Resources Considered** ........ **3**

2.1 Criteria Pollutants ........ 4
2.2 Mobile Source Air Toxics ........ 6
2.3 Construction Fugitive Dust ........ 8

**3.0 Regulatory Context** ........ **8**

3.1 NEPA ........ 8
3.2 Clean Air Act and National Ambient Air Quality Standards ........ 8
3.3 Transportation Conformity Rule ........ 9
3.3.1 Regional Conformity ........ 9
3.3.2 Project-Level Conformity ........ 9
3.4 Mobile Source Air Toxics ........ 10

**4.0 Affected Environment** ........ **11**

4.1 Climate and Topography ........ 11
4.2 Existing Air Quality ........ 11

**5.0 Project Scoping and Interagency Consultation** ........ **12**

5.1 Project Scoping ........ 12
5.2 Interagency Consultation ........ 13

**6.0 Methods Overview** ........ **13**

6.1 Study Area ........ 13
6.2 Description of Alternatives ........ 15
6.3 No Action Alternative ........ 15
6.4 Build Alternatives ........ 17
6.4.1 Three General-Purpose Lanes Alternative ........ 17
6.4.2 Two General-Purpose Lanes and One Express Lane that Accommodates Transit Alternative ........ 20
6.5 Applicable Guidance ........ 20

**7.0 Environmental Consequences** ........ **21**

7.1 Conformity Determinations ........ 21
7.2 Project-level Conformity ........ 21
7.3 Regional Conformity ........ 22
7.4 Quantitative Criteria Pollutant Emissions Inventories ........ 22

7.5 Quantitative MSAT Analysis ........ 24
7.6 Qualitative Analysis of Construction Emissions ........ 26

**8.0 Mitigation Measures ........ 26**

**9.0 References ........ 33**

# Acronyms and Abbreviations

| Acronym | Definition |
|---|---|
| 2GPL+1EL | Two General-Purpose Lanes and One Express Lane That Accommodates Transit Alternative |
| 3GPL | Three General-Purpose Lanes Alternative |
| °F | degree(s) Fahrenheit |
| $\mu g/m^3$ | microgram(s) per cubic meter |
| AADT | average annual daily traffic |
| APCD | Air Pollution Control Division |
| APEN | Air Pollutant Emission Notice |
| AQ-PLAG | *Air Quality Project-Level Analysis Guidance* |
| AQCC | Air Quality Control Commission |
| AQS | Air Quality System |
| C.R.S. | Colorado Revised Statutes |
| CAA | Clean Air Act |
| CCR | Code of Colorado Regulations |
| CDOT | Colorado Department of Transportation |
| CDPHE | Colorado Department of Public Health and Environment |
| CFR | *Code of Federal Regulations* |
| CO | carbon monoxide |
| CRS | Colorado Revised Statutes |
| DEIS | Draft Environmental Impact Statement |
| Diesel PM | Diesel Particulate Matter |
| DRCOG | Denver Regional Council of Governments |
| EA | Environmental Assessment |
| EIS | Environmental Impact Statement |
| EPA | U.S. Environmental Protection Agency |
| FHWA | Federal Highway Administration |
| FR | *Federal Register* |
| GP | general-purpose |
| HAP | hazardous air pollutants |
| I-25 | Interstate 25 |
| I-270 | Interstate 270 |
| I-70 | Interstate 70 |
| I-76 | Interstate 76 |
| IRIS | Integrated Risk Information System |
| mph | mile(s) per hour |
| MOVES | Mobile Source Vehicle Emissions Simulator |

| Acronym | Definition |
| --- | --- |
| MPO | metropolitan planning organization |
| MSAT | mobile source air toxic |
| MVRTP | Metro Vision Regional Transportation Plan |
| NAAQS | National Ambient Air Quality Standards |
| NEPA | National Environmental Policy Act |
| $NO_2$ | nitrogen dioxide |
| $NO_x$ | nitrogen oxides |
| $O_3$ | ozone |
| PAH | polycyclic aromatic hydrocarbons |
| Pb | lead |
| PM | particulate matter |
| $PM_{10}$ | particulate matter less than 10 microns in aerodynamic diameter |
| $PM_{2.5}$ | particulate matter less than 2.5 microns in aerodynamic diameter |
| POM | polycyclic organic matter |
| ppb | part(s) per billion (by volume) |
| ppm | part(s) per million (by volume) |
| ROW | Right-of-way |
| RTD | Regional Transportation District |
| RTP | Regional Transportation Plan |
| SIP | State Implementation Plan |
| $SO_2$ | sulfur dioxide |
| TIP | Transportation Improvement Program |
| USC | United States Code |
| VMT | vehicle miles traveled |
| VOC | volatile organic compound |

# 1.0 Introduction

CDOT is dedicated to providing an accessible experience for everyone. While we are continuously improving our standards, some complex items in this document, such as certain figures and images, are difficult to create with fully accessible parameters to all users. If you need help understanding any part of this document, we are here to assist and have resources to provide additional accessibility assistance to any requests. Please email us at CDOT_Accessibility@state.co.us to request an accommodation, and a member of our I-270 Engineering Program will schedule a time to review the content with you. To learn more about accessibility at CDOT, please visit the Accessibility at CDOT webpage on the CDOT Website.

The Federal Highway Administration (FHWA) and Colorado Department of Transportation (CDOT) are preparing an Environmental Impact Statement (EIS) to evaluate potential improvements to the Interstate 270 (I-270) corridor. FHWA and CDOT are the lead agencies for this National Environmental Policy Act (NEPA) process, which was initiated in 2020, initially anticipating an Environmental Assessment. Moving into 2023, CDOT determined a more detailed environmental review was needed and requested that an EIS be prepared. A Notice of Intent was published in August 2024 (89 *Federal Register* [FR] 67510, FHWA 2024).

I-270 in Colorado is a controlled-access interstate highway with two through lanes in each direction between Interstate 25 (I-25) and Interstate 70 (I-70) in central Denver and Commerce City (Figure 1). It has a posted speed limit of 55 miles per hour (mph). The project limits include the I-270 interchanges with Interstate 76 (I-76), York Street, Vasquez Boulevard, and Quebec Street. The project will tie into the I-25 and I-70 system interchanges but improvements to these interchanges are part of projects on I-25 and I-70 and will be designed and approved separately.

The purpose of the I-270 Corridor Improvements Project is to implement transportation solutions that modernize the I-270 Corridor to accommodate existing and forecasted transportation demands. The project needs are:

- Traveler safety on the corridor,
- Travel time and reliability on the corridor,
- Transit on the corridor,
- Bicycle and pedestrian connectivity across I-270, and
- Freight operations on the corridor.

In addition to addressing project needs, CDOT, FHWA, and Cooperating and Participating Agencies have established a key project goal: to minimize environmental and community impacts resulting from the project.

This Air Quality Technical Report documents the transportation project-level air quality assessment that was conducted in support of the EIS and is prepared in accordance with the CDOT *Air Quality Project-Level Analysis Guidance* (AQ-PLAG) (CDOT 2019). The purpose of the air quality analysis is to analyze potential impacts associated with the Project in accordance with NEPA and applicable federal air quality requirements, including the U.S. Environmental

Protection Agency (EPA) transportation conformity rule. Air quality at the state level follows CRS 43-1-128, *Environmental Impacts of Capacity Projects*. Two additional air quality-related reports have been completed to document state level analyses and are available on the I-270 website (https://www.codot.gov/projects/studies/i270study).

The resources considered in this analysis are described in Section 2.0 of this report, and the applicable federal regulations are described in Section 3.0. The affected environment and existing air quality conditions are described in Section 4.0. This report supports the analysis and conclusions in the EIS.

**Figure 1. I-270 Corridor Improvements Project Limits**

The air quality analysis documented in this report includes two major elements:

- A quantitative emissions inventory for comparative analysis of criteria air pollutants and mobile source air toxics (MSATs).[1]
- A qualitative discussion of potential emissions and air quality effects from construction activities.

The NEPA scoping and interagency consultation activities described in Section 5.0 culminated in the development of the Work Plan for this analysis. The Work Plan is provided in this report as Appendix A and is referenced where appropriate. Section 6.0 provides an overview of the air quality analysis methods that are described in detail in Appendix B.

The air quality analysis considered three project alternatives (see Section 6.2):

- **No Action Alternative**, which maintains the existing I-270 highway configuration of two general-purpose travel lanes in each direction.
- **Three General-Purpose Lanes Alternative** (3GPL), which would add one general-purpose travel lane in each direction of I-270.
- **Two General-Purpose Lanes and One Express Lane That Accommodates Transit Alternative** (2GPL+1EL), which would add one new travel lane, operated as an Express Lane, in each direction through the I-270 corridor.

The comparative quantitative emissions analysis considers existing conditions in the year 2023 (for the No Action Alternative) and future conditions from the No Action Alternative, 3GPL, and 2GPL+1EL Alternatives in the design year 2050. The air quality analysis results and environmental consequences are described in Section 7.0. Finally, air quality mitigation measures that are applicable to the project are described in Section 8.0.

# 2.0 Resources Considered

The primary air quality concerns for the I-270 Corridor Improvements project focus on the exposure of local populations to:

- Criteria pollutants that are regulated at the federal level through the Clean Air Act (CAA) (Title 42 United States Code [USC] Chapter 85) to achieve and maintain National Ambient Air Quality Standards (NAAQS) (40 Code of Federal Regulations [CFR] Part 50).
- MSAT pollutants defined by FHWA as priority MSAT pollutants of concern that arise from transportation activities.
- Fugitive dust emissions associated with project construction activities.

[1] Three categories for analysis of MSAT in NEPA documents are described in the FHWA Updated Interim Guidance on Mobile Source Air Toxic Analysis in NEPA Documents (FHWA 2023a). The project team determined that the I-270 Corridor Improvements project meets the criteria for projects with higher potential MSAT effects based on the annual average daily traffic (AADT) projected for the design year of the project and the addition of substantial new capacity and FHWA concurred. The project is also located in proximity to populated areas. The analysis of MSAT emissions for projects meeting these criteria must be quantitative.

## 2.1 Criteria Pollutants

The CAA of 1970, as amended, identifies six criteria pollutants that are harmful to human health and the environment. Ground-level ozone ($O_3$), carbon monoxide (CO), nitrogen dioxide ($NO_2$), coarse particulate matter (PM), and fine PM are considered transportation-related criteria pollutants. Nitrogen oxides ($NO_x$) and volatile organic compounds (VOC) are important transportation-related pollutant precursors.

**Ground-level ozone.** $O_3$ is a colorless gas that is formed when $NO_x$ chemically reacts with VOCs in the presence of sunlight. Warm temperatures, strong sunlight, and low wind speeds provide optimum conditions for $O_3$ formation. $O_3$ concentrations often peak downwind of the $NO_x$ and VOC emission sources. As a result, $O_3$ is of regional concern and $O_3$ pollution issues are addressed through regulation of $NO_x$ and VOC emissions. $O_3$ is evaluated using VOC and $NO_x$ emission precursors in an emission inventory burden analysis. VOCs are highly reactive hydrocarbons that contribute to $O_3$ formation. Motor vehicles produce $NO_x$ and VOC emissions through combustion and also produce VOC emissions through fuel evaporative processes (known as running losses). $O_3$ can irritate and damage the respiratory system. Health effects associated with $O_3$ include breathing problems, reduced lung function, asthma, and other respiratory ailments. $O_3$ also damages plants, trees, rubber products, fabrics, and other materials.

**Particulate matter.** PM is a complex mixture of small particles and liquid droplets classified as $PM_{10}$ (particles with diameter of 10 micrometers or less) or $PM_{2.5}$ (particles with diameter of 2.5 micrometers or less). PM from motor vehicles is emitted directly from the tailpipe from fuel combustion (exhaust emissions) and is also produced from non-exhaust processes including brake wear, tire wear, road wear, and resuspended road dust. Construction activities also produce PM emissions through tailpipe exhaust and by disturbing dust (fugitive emissions). Diesel PM, an important MSAT of concern, is also a component of diesel vehicle exhaust. $PM_{2.5}$ penetrates deep into the lungs and can cause respiratory ailments and contribute to cardiovascular disease and increased mortality. $PM_{10}$ does not penetrate as deep into the lungs but can irritate the nose and throat and cause respiratory distress.

**Carbon monoxide.** CO is a colorless, odorless gas emitted directly from vehicle tailpipes as a product of combustion. CO tends to concentrate at intersections with large traffic volumes, high vehicle delays, and poor level of service (high congestion). CO reduces the oxygen carrying capacity of blood in the body. High concentrations of CO can cause headaches, dizziness, and confusion, and can be hazardous to those with heart and respiratory issues. At very high concentrations, CO poisoning can cause unconsciousness and death.

**Nitrogen dioxide.** $NO_2$ is a highly reactive gas that is emitted during the combustion process. $NO_2$ can sometimes be seen as a reddish-brown haze layer over an urban area. Health effects include lung damage and respiratory illness. $NO_2$ is regulated through the NAAQS, but motor vehicles produce a variety of highly reactive nitrogen oxide pollutants, known collectively as $NO_x$, which cause health effects and also contribute to the secondary formation of $O_3$ and $PM_{2.5}$ in the atmosphere.

**Sulfur dioxide.** Sulfur dioxide ($SO_2$) is a highly reactive gas emitted during the combustion process. $SO_2$ also contributes to the secondary formation of $PM_{2.5}$ in the atmosphere. Motor vehicles emit very small amounts of $SO_2$ and related pollutants (known collectively as sulfur oxides, or $SO_x$) because diesel fuel contains sulfur, a natural component of crude oil. The EPA implements stringent regulations on the sulfur content in diesel fuel. Therefore, sulfur dioxide is not considered a transportation-related criteria pollutant. $SO_2$ causes breathing problems and lung damage.

**Lead.** Lead (Pb) is a metal found naturally in the environment. It is used in manufacturing and historically was added to gasoline to reduce engine knocking, boost octane ratings, and decrease wear and tear on engine components. Pb poisoning causes serious health effects, including seizures, high blood pressure, learning disabilities, behavioral disorders, and central nervous system problems. Pb has been phased out of paint and automotive fuels and is no longer considered a transportation-related criteria pollutant.

The current NAAQS are shown in Table 1. The NAAQS include primary standards that protect public health and secondary standards that protect public welfare. Each NAAQS has a specific concentration level, averaging time, and statistical form.

Table 1. National Ambient Air Quality Standards

| Pollutant | Primary/Secondary | Averaging Time | Level[2] | Form |
|---|---|---|---|---|
| CO | Primary | 8 hours | 9 ppm | Not to be exceeded more than once per year |
| CO | Primary | 1 hour | 35 ppm | Not to be exceeded more than once per year |
| Pb | Primary and Secondary | Rolling 3-month average | 0.15 $\mu g/m^3$ | Not to be exceeded |
| $NO_2$ | Primary | 1 hour | 100 ppb | 98th percentile of 1-hour daily maximum concentrations, averaged over 3 years |
| $NO_2$ | Primary and Secondary | 1 year | 53 ppb | Annual mean |
| $O_3$ | Primary and Secondary | 8 hours | 0.070 ppm | Annual fourth-highest daily maximum 8-hour concentration, averaged over 3 years |
| $PM_{2.5}$ | Primary | 1 year | 9 $\mu g/m^3$ | Annual mean, averaged over 3 years |
| $PM_{2.5}$ | Secondary | 1 year | 15 $\mu g/m^3$ | Annual mean, averaged over 3 years |
| $PM_{2.5}$ | Primary and Secondary | 24 hours | 35 $\mu g/m^3$ | 98th percentile, averaged over 3 years |
| $PM_{10}$ | Primary and Secondary | 24 hours | 150 $\mu g/m^3$ | Not to be exceeded more than once per year on average over 3 years |
| $SO_2$ | Primary | 1 hour | 75 ppb | 99th percentile of 1-hour daily maximum concentrations, averaged over 3 years |
| $SO_2$ | Secondary | 1 year | 10 ppb | Annual mean, averaged over 3 years |

## 2.2 Mobile Source Air Toxics

MSATs are hazardous air pollutants (HAP) emitted from motor vehicles and equipment that are known or suspected to cause cancer or other serious health and environmental effects. EPA has identified nine compounds with significant contributions from mobile sources that are among the key drivers of national and regional-scale cancer risk and noncancer hazards.

[2] ppm: parts per million; $\mu g/m^3$: microgram(s) per cubic meter; ppb: parts per billion

FHWA has labeled these as priority MSAT pollutants for NEPA studies. These priority MSAT pollutants are described below.[3]

**1,3 Butadiene.** 1,3 butadiene is a component of motor vehicle exhaust that breaks down quickly in the atmosphere but nonetheless is found in the ambient air at low levels in urban and suburban areas. Acute exposure causes irritation of the eyes, nasal passages, throat, and lungs. Chronic exposure may result in cardiovascular diseases, leukemia, and other cancers.

**Acetaldehyde.** Acetaldehyde is a component of motor vehicle exhaust. Acute exposure can result in irritation of the eyes, skin, and respiratory tract. Symptoms of chronic intoxication of acetaldehyde resemble those of alcoholism. Acetaldehyde is considered a probable human carcinogen.

**Acrolein.** Acrolein is a component of motor vehicle exhaust. Acute and chronic exposure may result in upper respiratory tract irritation and congestion, as well as irritation to the eyes. It is unclear from the scientific evidence if acrolein poses a reproductive or cancer risk to humans.

**Benzene.** Benzene is a component of gasoline vapors and motor vehicle exhaust. Acute (short-term) exposure can cause eye, skin, and respiratory tract irritation, while chronic (long-term) exposure can cause blood disorders, reproductive effects, and cancer.

**Diesel Particulate Matter (Diesel PM).** Diesel PM is a component of diesel exhaust that includes soot particles made up primarily of carbon, ash, metallic abrasion particles, sulfates, and silicates. More than 90 percent of diesel PM is less than 1 micrometer in diameter. Diesel PM can increase the risk of cardiovascular, cardiopulmonary, and respiratory diseases, and lung cancer.

**Ethylbenzene.** Ethylbenzene is a component of gasoline vapors and motor vehicle exhaust. Acute exposure can result in respiratory effects, such as throat irritation and chest constriction, irritation of the eyes, and neurological effects such as dizziness. Chronic exposure has shown conflicting results regarding its effects on the blood.

**Formaldehyde.** Formaldehyde is a component of motor vehicle exhaust. Both acute and chronic exposure can result in respiratory symptoms, as well as eye, nose, and throat irritation. The EPA considers formaldehyde a probable human carcinogen.

**Naphthalene.** Naphthalene is a component of motor vehicle exhaust. Acute and chronic exposure can lead to anemia and cataracts, as well as liver and neurological damage. The EPA considers naphthalene a possible human carcinogen.

**Polycyclic Organic Matter (POM).** POM defines a broad class of compounds, including polycyclic aromatic hydrocarbons (PAH), which are formed by the incomplete burning of oil

[3] These descriptions are informed by EPA's Health Effects Notebook for Hazardous Air Pollutants (https://www.epa.gov/haps/health-effects-notebook-hazardous-air-pollutants).

and gas and are present in the atmosphere in particulate form. POM compounds have various acute effects, but the principal concern is that chronic exposure can increase the risk of cancer in humans.

## 2.3 Construction Fugitive Dust

Project construction activities result in short-term, temporary emissions of fugitive dust, including $PM_{2.5}$ and $PM_{10}$. The term "fugitive" refers to the widespread or open area sources of the dust as compared to a single point source, such as a smokestack. Sources of fugitive dust during project construction include disturbed surface areas at the construction site and trucks transporting soil and debris from the construction site. Fugitive dust emissions vary from day to day at a construction site, depending on the nature and magnitude of construction activity and local weather conditions. Fugitive dust emissions depend on conditions, such as soil moisture, silt content of soil, wind speed, and the number of construction vehicles operating. Track-out of dust from the construction site can increase the amount of re-suspended road dust from nearby paved roads. Fugitive dust has been linked to respiratory and cardiovascular health effects. It is also a component of haze, which can reduce visibility.

# 3.0 Regulatory Context

As described in this section, several federal laws and regulations must be considered for air quality assessments of transportation projects.

## 3.1 NEPA

NEPA (Title 42 USC Chapter 55) was passed by Congress in 1969 and signed into law by President Richard Nixon on January 1, 1970, following a period of increased concern for human impacts on the natural and human environments. NEPA requires environmental review for any federal action that has the potential to affect the environment. Transportation projects that have a federal nexus (e.g., projects that use federal funds and/or require FHWA approval) must be evaluated for potential impacts on the natural and human environments. Air quality is one of several elements considered in a NEPA evaluation. NEPA also requires that agencies making these decisions consult with other agencies, involve the public, disclose information, investigate the environmental effects of a reasonable range of alternatives, and prepare a detailed statement of the environmental effects of the alternatives. NEPA applies to projects irrespective of the federal NAAQS attainment status of the project location. CDOT's Policy Directive 1904.0 establishes the CDOT NEPA Manual (CDOT 2024) for maintaining compliance with NEPA standards on CDOT projects.

## 3.2 Clean Air Act and National Ambient Air Quality Standards

Air quality at the federal level is regulated under the CAA (Title 42 USC Chapter 85 and amended in 1977 and 1990). The purpose of the CAA is to protect and enhance air quality to promote public health, welfare, and the productive capacity of the nation. Six criteria air pollutants and a group of HAPs are regulated under the CAA. A subset of HAPs is referred to as MSATs.

The EPA establishes primary (health) and secondary (environment and property) NAAQS for criteria pollutants (see Table 1 in Section 2.1). Areas that violate the NAAQS are designated by the EPA as nonattainment areas based on ambient air quality monitoring data. State Implementation Plans (SIP) developed for these areas may include control requirements on emissions from the transportation sector and other sources. A nonattainment area that receives a Clean Air Determination from EPA can be redesignated as a maintenance area. Transportation planning is subject to specific requirements in NAAQS nonattainment and maintenance areas.

## 3.3 Transportation Conformity Rule

Transportation projects in federal nonattainment and maintenance areas are subject to transportation conformity requirements (CAA Section 176(c)), implemented in the Conformity Rule (40 CFR 93), to ensure that federally supported transportation activities in NAAQS nonattainment and maintenance areas are consistent with air quality goals in any applicable SIP. Transportation conformity includes both regional and project-level components.

### 3.3.1 Regional Conformity

Regional conformity for a transportation project is satisfied if the project's design concept, scope, and "open-to-traffic" schedule are consistent with those included in a currently conforming, fiscally constrained Regional Transportation Plan (RTP) and Transportation Improvement Program (TIP) (40 CFR 93.114). Projects that are part of a region's conforming RTP and TIP meet the regional conformity requirement through a broad assessment of emissions involving the entire transportation network to ensure they are consistent with the emissions goals contained in the region's SIP. The Denver Regional Council of Governments (DRCOG) is the federally designated metropolitan planning organization (MPO) responsible for transportation planning for the Denver metropolitan region, where the project is located. The DRCOG 2050 Metro Vision RTP (MVRTP) (DRCOG 2024) and the 2024-2027 TIP (DRCOG 2025) are the latest federally approved and fiscally constrained conforming plan and program for the DRCOG planning area. The project is listed in the 2050 MVRTP, which was adopted by DRCOG in April 2021 and FHWA in June 2021 and amended in May 2024. FHWA issued the conformity determination for the DRCOG 2024 Amended 2050 MVRTP and the amended Fiscal Year 2024-2027 DRCOG TIP on July 29, 2024.[4] The project is included in the fiscally constrained 2024-2027 TIP and specifically referenced by TIP number 2020-068.

### 3.3.2 Project-Level Conformity

Project-level conformity is an additional requirement that applies to criteria pollutant emissions that may cause localized air quality impacts to ensure the project does not: (1)

[4] The conformity determination is published in Appendix R of the DRCOG 2024 Amended 2050 MVRTP.

cause or contribute to any new violations of the NAAQS; (2) worsen existing NAAQS violations; and (3) delay timely attainment of any NAAQS or required interim milestones. Project-level conformity requirements only apply to projects of air quality concern in NAAQS nonattainment or maintenance areas.

Unless otherwise stated in a SIP, transportation conformity requirements for maintenance areas no longer apply after an area has remained in maintenance for 20 years. The project is in an area that has completed 20 years of maintenance of applicable CO and $PM_{10}$ NAAQS, and it is no longer considered a maintenance area for those pollutants for the purposes of transportation conformity.[5] Therefore, project-level hot-spot analyses for CO and $PM_{10}$ are not required under the Conformity Rule.

Denver is in attainment for the 1997, 2006, and 2012 $PM_{2.5}$ standard, so project-level hot-spot analyses are not required under the Conformity Rule. EPA has not yet designated nonattainment areas for the 2024 annual $PM_{2.5}$ standard of 9.0 micrograms per cubic meter (μg/m$^3$). However, in their January 2025 submittal to EPA, the Colorado Department of Health and Environment (CDPHE) recommended all areas of Colorado be designated in attainment for the $PM_{2.5}$ annual standard based on monitoring data between 2021 and 2023. Although project-level hot-spot analysis is not required for these pollutants under the Conformity Rule, emissions are still quantified for the NEPA comparison. Section 7.2 presents the quantitative criteria pollutant emissions inventory for the NEPA comparative assessment.

## 3.4 Mobile Source Air Toxics

Toxic air pollutants, also known as HAPs, are those known to cause cancer or other serious health effects. The CAA Section 112 requires the EPA to regulate emissions of 188 HAPs. EPA assessed this expansive list in its rule on the C*ontrol of Hazardous Air Pollutants From Mobile Sources* (72 FR, 8430, February 26, 2007), and identified a group of 93 compounds emitted from mobile sources that are part of EPA's Integrated Risk Information System (IRIS) (EPA 2021). The EPA also identified a subset of this list that is now considered the nine priority MSATs: 1,3-butadiene, acetaldehyde, acrolein, benzene, diesel PM, ethylbenzene, formaldehyde, naphthalene, and POM (see Section 2.2). FHWA considers these to be the priority MSATs for NEPA studies. This list is subject to change and may be adjusted in consideration of future EPA rules.

FHWA provides *Updated Interim Guidance on Mobile Source Air Toxic Analysis in NEPA Documents* (FHWA 2023a). FHWA guidance presents a tiered approach with three categories for analyzing MSAT in NEPA documents, depending on specific project circumstances for evaluating potential MSAT effects. Potential MSAT effects from the project were evaluated following this guidance and are discussed further in Section 7.3 and Appendix C.

[5] The 20-year periods of maintenance with the CO and $PM_{10}$ NAAQS for the Denver-Boulder area ended on January 14, 2022, and October 16, 2022, respectively.

# 4.0 Affected Environment

This section describes the atmospheric conditions of the study area, including the climate and topography, NAAQS attainment status, and monitored ambient pollutant concentrations.

## 4.1 Climate and Topography

The I-270 Corridor Improvements project is located in the Denver metropolitan area northeast of downtown Denver. The project resides in the South Platte River Valley, in the High Plains (elevation 5,150 ft above mean sea level) east of the Rocky Mountains. The region has a semi-arid, continental climate with hot summers and cold winters. The nearby mountains and surrounding hills produce microclimates that affect local wind and temperature patterns. The difference between the daily high and low temperatures in the project area can be extreme due to the high elevation and low relative humidity in the region. Summers are hot with high temperatures frequently exceeding 90 degrees Fahrenheit (°F). Winters are relatively cold with an average low temperature in December of 17.7°F (NWS 2021). The annual average precipitation in the Denver area is 14.5 inches, with 70 percent of the precipitation occurring during the summer months. The annual average snowfall is 54.8 inches, with most snow occurring from October to April. Downslope (Chinook) winds periodically bring warm and dry conditions, and in some cases, severe windstorms, to the region. Thunderstorms can occur within the study area during spring and summer.

## 4.2 Existing Air Quality

As of March 2025, all areas in Colorado were in attainment of all NAAQS criteria pollutants except ground-level $O_3$. Eight counties in the Denver metropolitan area (Adams, Arapahoe, Boulder, Broomfield, Denver, Douglas, Jefferson, and Weld) and a portion of one county in the Colorado North Front Range (Larimer) are currently designated as nonattainment for exceeding the 2015 8-hour $O_3$ standard (70 ppb). Seven counties in the Denver metropolitan area (Adams, Arapahoe, Boulder, Broomfield, Denver, Douglas, and Jefferson) and portions of two counties in the Colorado North Front Range (Larimer and Weld) are currently designated as nonattainment for exceeding the 2008 8-hour $O_3$ standard (75 ppb). The Denver Metro/Northern Front Range area was originally designated as nonattainment under the 1-hour $O_3$ standard, which was replaced with an 8-hour $O_3$ standard in 2008. Annual fourth-highest daily maximum 8-hour $O_3$ design values have fluctuated above and below the NAAQS since 2008 (APCD 2024).

The Denver region was previously designated nonattainment for CO and $PM_{10}$. The region was redesignated to attainment/maintenance status for CO by the EPA on December 14, 2001 (EPA 2001), and for $PM_{10}$ by the EPA on September 16, 2002 (EPA 2002). Denver is in attainment for the 1997, 2006, and 2012 $PM_{2.5}$ standards. EPA has not yet designated nonattainment areas for the 2024 annual $PM_{2.5}$ standard of 9.0 μg/m$^3$. However, in their January 2025 submittal to EPA, CDPHE recommended all areas of Colorado be designated in attainment for the $PM_{2.5}$ annual standard based on monitoring data between 2021 and 2023.

Ambient air quality monitoring data from nearby stations that best represent the study area are provided for the years 2020 through 2023 in Table 2. CDPHE Air Pollution Control Division (APCD) operates several air pollutant monitoring stations that are approved by the EPA in Adams County and the City and County of Denver. The closest monitor is located at 7275 Birch St. in Commerce City (Commerce, Air Quality System [AQS] 080010010)[6], approximately 1.2 miles east of the study area, and is considered to be most representative of the air quality conditions of the study area. The Commerce City monitor measures only $PM_{10}$ and $PM_{2.5}$ concentrations. Air quality data for other pollutants were obtained from a nearby station located at 3174 East 78th Avenue in Welby (Welby, AQS 080013001), approximately 1.3 miles northeast of the study area.

**Table 2. Pollutant Concentrations Measured at Air Quality Monitoring Sites Near the Project Site**

| Site | Pollutant | Parameter | 2020 | 2021 | 2022 | 2023 |
|---|---|---|---|---|---|---|
| Commerce City | $PM_{10}$ | Maximum 24-hour average (µg/m$^3$) | 139 | 104 | 114 | 98 |
| Commerce City | $PM_{2.5}$ | 98th percentile 24-hour average (µg/m$^3$) | 27.8 | 29.8 | 16.4 | 23.7 |
| Commerce City | $PM_{2.5}$ | Annual average (µg/m$^3$) | 9.8 | 10.3 | 6.9 | 8.3 |
| Welby | $PM_{10}$ | Maximum 24-hour average (µg/m$^3$) | 111 | 96 | 100 | 95 |
| Welby | CO | Maximum 1-hour average (ppm) | 1.9 | 2.0 | 2.0 | 1.8 |
| Welby | CO | Maximum 8-hour average (ppm) | 1.2 | 1.5 | 1.1 | 1.3 |
| Welby | $O_3$ | 3-year average of fourth max. 8-hour (ppm) | 0.069 | 0.072 | 0.077 | 0.074 |
| Welby | $NO_2$ | 3-year average of 98th percentile 1-hour (ppb) | 60 | 58 | 56 | 56 |
| Welby | $NO_2$ | Annual average | 15.5 | 15.4 | 16.7 | 15.9 |

Data sources: APCD 2021, 2022, 2023, and 2024.

# 5.0 Project Scoping and Interagency Consultation

## 5.1 Project Scoping

An environmental scoping meeting was held for the project on September 20, 2023. FHWA, CDOT resource specialists and project staff, and consultant team members were invited to the meeting. The meeting included the topics of project overview and status; roles, responsibilities, and expectations; agency coordination; and a review of the environmental

[6] The Commerce City monitor was located at 4201 72nd Avenue through 2020 and was then switched to the current location on Birch Street. During the switch, no data were collected between November 2020 and the first half of March 2021. Therefore, calendar years 2020 and 2021 do not have complete data at the Commerce City monitor.

resources and scoping form. It was not determined that additional air quality scoping meetings were necessary at the meeting.

## 5.2 Interagency Consultation

Air Quality Working Group meetings were held throughout the project to discuss analysis needs for the project, development of the Work Plan, and analysis results. Numerous Working Group meetings were held and included invitees from FHWA, EPA, CDOT, and the consultant team. During the beginning of the air quality coordination, meetings were held weekly and then were held as needed once the air quality analysis began.

The Air Quality Work Plan was reviewed by FHWA, EPA, and CDOT, and consensus was reached to complete the final approved Work Plan, dated July 11, 2024.

Input data for the air quality analysis were sent to the Working Group for review, and comments were discussed in Working Group meetings. Inputs were revised as necessary based on decisions made by the Working Group. The key inputs included emissions factors and traffic information.

Once the analysis results were available and quality checked, they were shown to and discussed with the Working Group participants. Questions about and comments on the results by the participants were verified and the analysis was updated as necessary. As an example of that process, the Working Group questioned traffic volumes used in the quantitative emissions analysis that seemed higher than expected. The traffic consultant team reviewed those data and determined that traffic volumes in one time period had been double counted in another. This resulted in the need to recalculate the emissions with revised traffic inputs.

# 6.0 Methods Overview

The air quality analysis was completed based on the requirements of NEPA, the conformity provisions of the CAA Amendments, FHWA's MSAT Guidance (FHWA 2023a, 2023b), and CDOT's AQ-PLAG, Version 1 (CDOT 2019). The quantitative emissions inventories were developed by modeling operational emissions from motor vehicles using the most recent version of EPA's Motor Vehicle Emissions Simulator (MOVES) model (MOVES4.0.1) when the analysis was conducted. The analysis methodology included use of a lookup table of emission factors based on the results of the MOVES runs and $PM_{10}$ road dust emission factors provided by CDPHE in combination with traffic data[7] to calculate operational emissions for the 2023 Existing Conditions and each project alternative in the design year (2050). Appendix B provides a detailed description of the MOVES model setup and input data. Additional details of the overall analysis methodology are also provided in the Work Plan (Appendix A).

## 6.1 Study Area

The air quality analysis for the I-270 Corridor Improvements project encompasses a comprehensive study area that includes the entire approximately 6.5-mile stretch of I-270 between I-25 and I-70, as well as other roadways and intersections that are either part of or

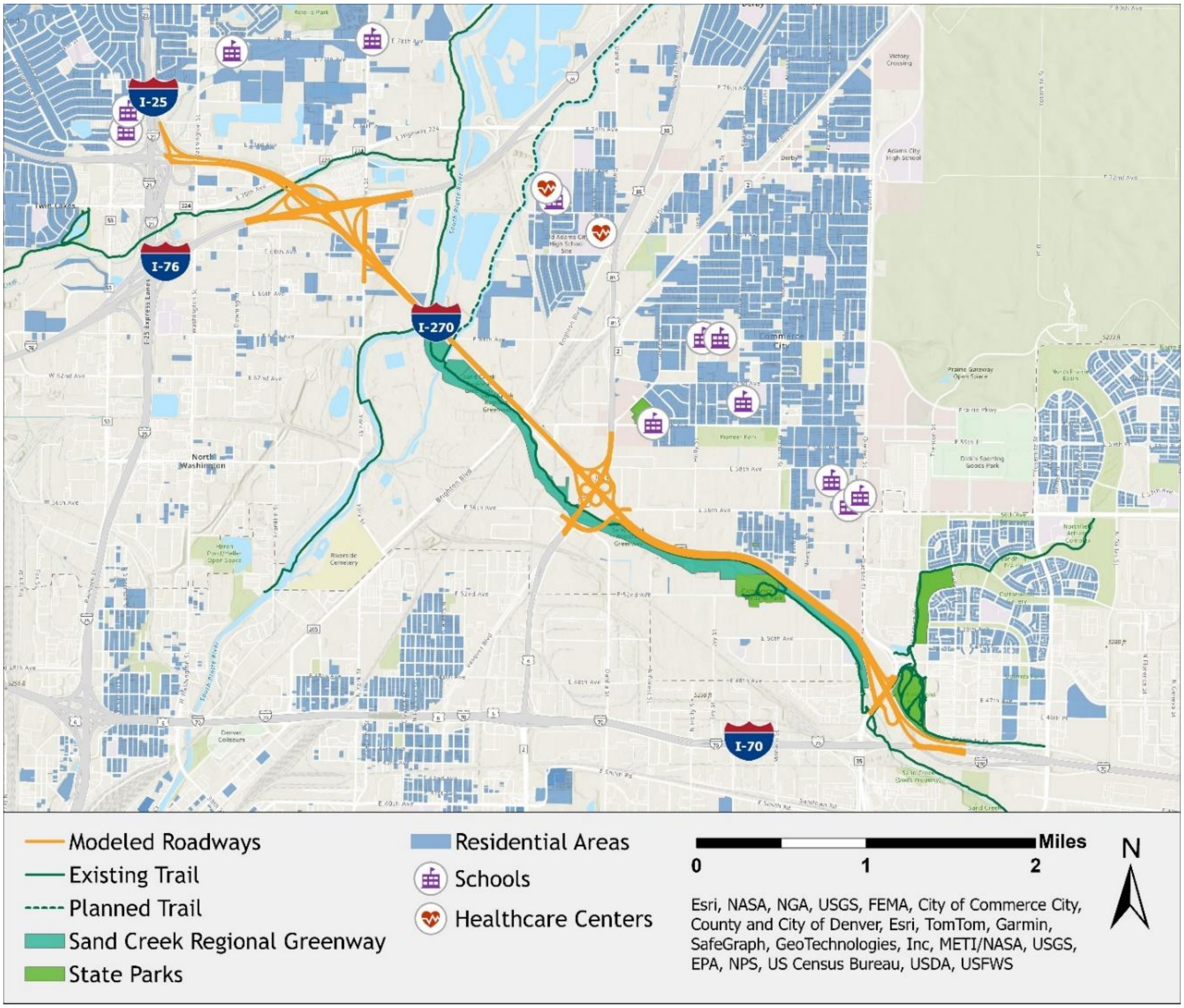
[7] See the Traffic Technical Report for more details on development of the activity data.

impacted by the project.[8] The project limits include the I-270 interchanges with I-76, York Street, Vasquez Boulevard, and Quebec Street. The study area spans portions of Adams County and Denver County and is shown in Figure 2. The air quality analysis focuses on the roadways highlighted in orange in Figure 2.[9]

The I-270 project is located in an urban area with land uses consisting mostly of industrial uses, along with areas of commercial and residential land uses. Children, the elderly, and those with health conditions who are most susceptible to the adverse effects of exposure to air pollution are generally considered to be sensitive to air pollutants compared with other individuals. Sensitive air quality receptors generally include residences, schools, day care centers, parks and playgrounds, elder care facilities, and hospitals. There are sensitive receptors throughout the study area that include residences, schools, health care centers, parks, and trails.

[8] Impact of the project build alternatives refers to changes in AADT on traffic links that connect with a project roadway and are within 100 meters of the project. Relevant changes in AADT are based on thresholds defined in FHWA guidance (FHWA 2023b).
[9] The roadways and roadway segments included in the air quality analysis as shown in Figure 2 explicitly represent those in the No Action Alternative. For the project build alternatives, the analysis includes roadways corresponding to the additional lanes on I-270 and reconfigured ramps and intersections.

Figure 2. Air Quality Study Area




## 6.2 Description of Alternatives

The air quality analysis considered two project build alternatives for full evaluation, as well as the No Action Alternative, which is fully evaluated as a baseline for comparison. Additional information on the development of project alternatives and evaluation process for the build alternatives are included in the Alternatives Development Technical Report.

## 6.3 No Action Alternative

The No Action Alternative evaluates operations of I-270 if a build alternative would not occur along the corridor. It does not address the project purpose and needs but is carried forward as a baseline for comparison. This alternative would maintain the existing highway configuration of two general-purpose travel lanes in each direction. Under the No Action Alternative, the corridor would require substantial ongoing maintenance and continuous repairs to bridges and pavement. While these frequent maintenance activities would be necessary to keep the roadway operational, they would lead to recurring lane closures, traffic disruptions, and temporary impacts on travel time and reliability. Furthermore, the underlying infrastructure deficiencies would persist, necessitating increasingly complex and potentially impactful repairs over time.

The No Action Alternative would include the rehabilitation of 19 existing structures, including at 7 locations that have structures that are or will be reaching the end of their useful life. The age of the structure, recent bridge inspections, and current ongoing maintenance costs, both planned and emergency maintenance, determine if a structure is or will be reaching the end of its useful life. The seven structure locations along the I-270 corridor that are or will be reaching the end of their useful life are as follows:

- Vasquez Bridge over Sand Creek (E-17-AT)
- York Street Bridge over I-270 (E-17-IC)
- I-270 over South Platte River Eastbound and Westbound Bridges (E-17-IE & E-17-ID)
- I-270 over Burlington Ditch Eastbound and Westbound Bridges (E-17-IG & I-17-IF)
- I-270 over Brighton Boulevard, Union Pacific Railroad (UPRR) and BNSF Railway (BNSF) Eastbound and Westbound Bridges (E-17-II & E-17-IH)
- I-270 over 60th Avenue and BNSF Eastbound and Westbound Bridges (E-17-IK & E-17-IJ)
- I-270 over East 56th Avenue Eastbound and Westbound (E-17-IO & E-17-IN)

The cross section would remain unchanged along I-270 under the No Action Alternative. Figure 3 shows the No Action Alternative cross section west of Vasquez Boulevard, and Figure 4 show the cross section east of Vasquez Boulevard.

**Figure 3. No Action Alternative (west of Vasquez Boulevard)**

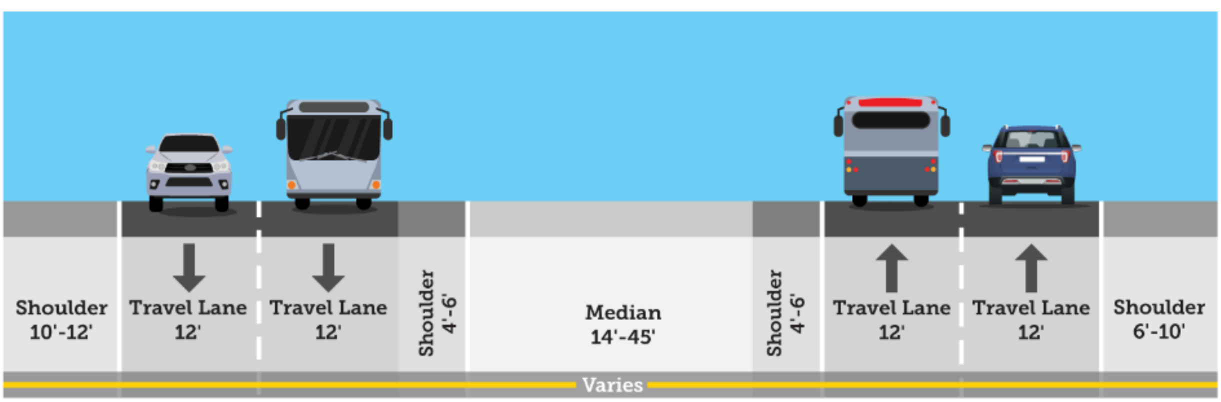
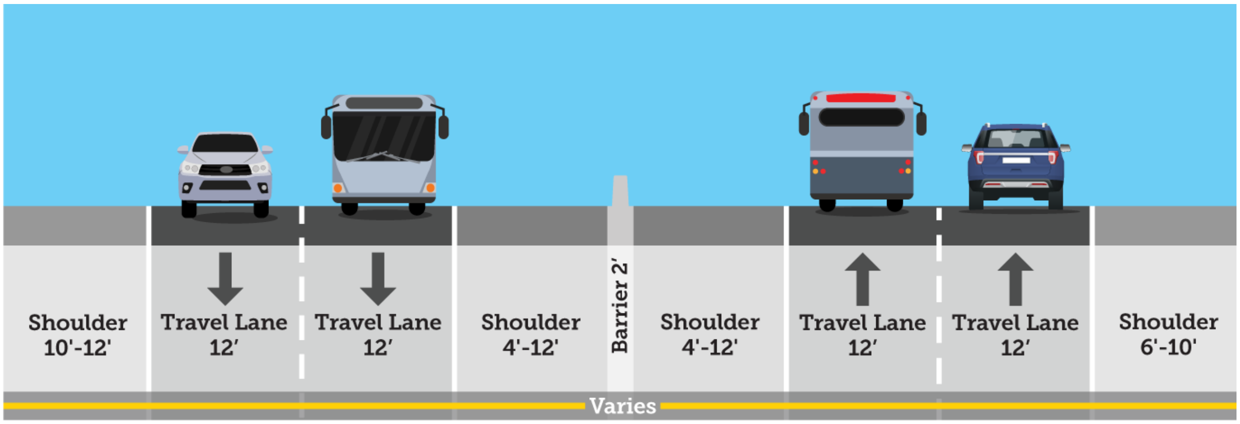


**Figure 4. No Action Alternative (east of Vasquez Boulevard)**



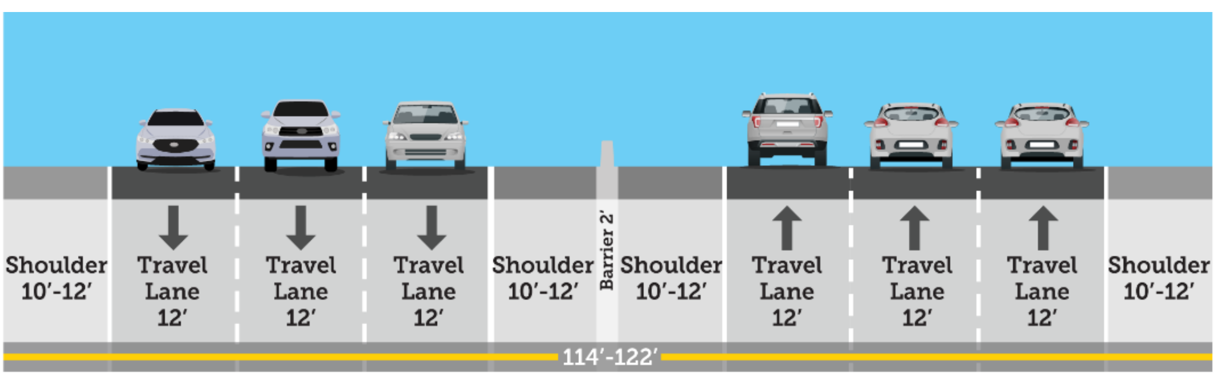

## 6.4 Build Alternatives

The build alternatives include improving the operational and physical conditions of the I-270 highway; reconfiguring interchanges and ramps; enhancing transit on the corridor; improving bicycle and pedestrian access across I-270; replacing deficient bridges and other infrastructure; and providing modern drainage, water quality, intelligent transportation systems (ITS), and other supporting infrastructure. Both add one new travel lane in each direction and have similar footprints, and varying primarily in how the additional travel operates.

### 6.4.1 Three General-Purpose Lanes Alternative

This alternative would reconstruct I-270 to provide three general-purpose lanes in each direction, as shown in Figure 5.

**Figure 5. Three General-Purpose Lanes Alternative**



This alternative includes:

#### 6.4.1.1 Mainline Improvements

- Providing three general-purpose lanes in each direction
- Widening shoulders to meet current standards
- Restriping of the westbound I-270 to northbound I-25 off-ramp to provide dual-exit lane capacity
- Adding emergency turnouts and turnaround.
- Adding one continuous auxiliary lane in each direction between the I-76 and Vasquez Boulevard on-ramps and off-ramps

#### 6.4.1.2 Interchange Improvements

- Adding an eastbound collector ramp to consolidate incoming movements from the I-76 on-ramps
- Separating the westbound I-270 York Street and I-76 off-ramps
- Improving the Vasquez Boulevard interchange design with improved westbound on-ramp acceleration lanes and the eastbound off-ramp deceleration lanes
- Improving the Quebec Street interchange ramp acceleration and deceleration lengths

#### 6.4.1.3 Bridge Improvements

- Reconstructing bridges that are at, or will be reaching, the end of their useful life. Bridges carrying travel lanes on I-270 include widening to accommodate additional lanes
    - Replacing the existing York Street bridge over I-270 to meet current bridge standards, accommodate an additional travel lane in each direction on York Street, include a 10-foot multi-use path and a 5-foot sidewalk, and enhance lighting
    - Replacing the existing I-270 bridges over the South Platte River Trail to meet current bridge standards, accommodate this project's bicycle and pedestrian improvements on the South Platte River Trail, and enhance lighting
    - Replacing the existing I-270 bridges over the Burlington Ditch to meet current bridge standards, accommodate future bicycle and pedestrian improvements, and enhance lighting
    - Replacing the existing I-270 bridges over Brighton Boulevard to meet current bridge standards, accommodate this project's bicycle and pedestrian improvements on Brighton Boulevard and future bicycle and pedestrian improvements by others, and enhance lighting
    - Replacing the existing I-270 bridges over East 60th Avenue and the BNSF crossing to meet current bridge standards, accommodate future bicycle and pedestrian improvements, and enhance lighting
    - Replacing the existing I-270 bridges over East 56th Avenue to meet current bridge standards, accommodate this project's bicycle and pedestrian improvements, and enhance lighting
    - Replacing the existing Vasquez Boulevard bridge over Sand Creek to meet current bridge standards and accommodate this project's bicycle and pedestrian improvements

#### 6.4.1.4 Bicycle and Pedestrian Improvements

- Improving the York Street I-270 ramp terminal intersections with crosswalks, curb ramps, and pedestrian indicators at the ramp terminal traffic signals
- Adding a new 5-foot sidewalk on the west side and reconstructing a 6-foot sidewalk on the east side of Brighton Boulevard under I-270
- Reconstructing East 56th Avenue under I-270 and adding an on-street bicycle lane, a 10-foot multi-use path, and 6-foot sidewalk connecting to existing sidewalks
- Improving the intersection at East 56th Avenue and South Sandcreek Drive to include curb ramps, crosswalks, and lighting that meet current standards
- Improving the intersection at East 56th Avenue and Eudora Street to include curb ramps, crosswalks, and lighting that meet current standards
- Adding attached sidewalks on the west side of South Sandcreek Drive. The new sidewalks would be 8 feet wide from Quebec Street to East 47th Avenue Drive and 6 feet wide from East 47th Avenue Drive to East 49th Avenue, with a pedestrian crosswalk across East 47th Avenue Drive connecting the two segments
- Improving wayfinding at key locations, guiding bicyclists and pedestrians to the nearest RTD bus stops, major road connections, or distances to the next trailhead to avoid out-of-direction travel

#### 6.4.1.5 Trail Improvements

- Reconfiguring the South Platte River Trail crossing under I-270 to improve bicycle and pedestrian visibility around tight curves and increase vertical clearance from the I-270 overpass
- Improving bicycle and pedestrian visibility on the Sand Creek Trail by straightening out tight curves, adding a center stripe, and enhancing lighting at the Vasquez Boulevard bridge over the Sand Creek Trail
- Adding a multi-use path with bicycle and pedestrian underpasses crossing under two free-flow interchange ramps on the east side of Vasquez Boulevard through the interchange with enhanced lighting
- Adding a multi-use path on the east and west sides of the Vasquez Boulevard bridge over Sand Creek, connecting users from the East 56th Avenue and Vasquez Boulevard intersection to a new connection to the Sand Creek Trail
- Adding a multi-use trail spur, connecting the proposed north-south Vasquez Boulevard multi-use trail to the East 56th Avenue and South Sandcreek Drive intersection
- Adding a multi-use path in the southeast corner of East 56th Avenue and South Sandcreek Drive
- Adding a 10-foot-wide bicycle and pedestrian overpass over I-270 and South Sandcreek Drive approximately halfway between East 56th Avenue and Quebec Street

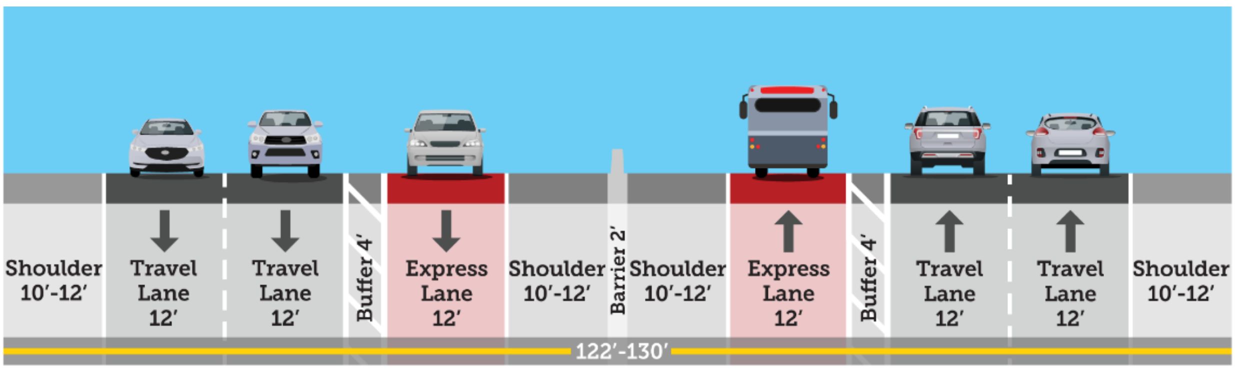
#### 6.4.1.6 Transit Improvements

- Adding four new bus stops with connecting sidewalks and curb ramps on Quebec Street and South Sandcreek Drive near the I-270/Quebec Street interchange to improve access to RTD routes 88 and 37

### 6.4.2 Two General-Purpose Lanes and One Express Lane that Accommodates Transit Alternative

This alternative would reconstruct I-270 with two general-purpose lanes and one Express Lane in each direction, as shown in Figure 6. Transit vehicles and high-occupancy vehicles (three or more people) could travel in the Express Lane free of charge. Other travelers, including freight trucks, who choose to pay a fee could also use the new Express Lane.

**Figure 6. Two General-Purpose Lanes and One Express Lane that Accommodates Transit Alternative**




This alternative includes:

#### 6.4.2.1 Mainline Improvements

- Providing two general-purpose lanes and one Express Lane that accommodates transit in each direction
- Remainder of mainline improvements identified in the Three General-Purpose Lanes Alternative

#### 6.4.2.2 Interchange Improvements

This alternative includes the same interchange improvements identified in the Three General-Purpose Lanes Alternative.

#### 6.4.2.3 Bridge Improvements

This alternative includes the same bridge improvements identified in the Three General-Purpose Lanes Alternative.

#### 6.4.2.4 Bicycle, Pedestrian, Trail, and Transit Improvements

This alternative includes the same bicycle, pedestrian, trail, and transit enhancements identified in the Three General-Purpose Lanes Alternative.

## 6.5 Applicable Guidance

The methodology for the air quality analysis is in accordance with all applicable federal and state regulations, and is based upon guidance from EPA, FHWA, and CDOT. The following relevant guidance was applied in the analysis methodology as described at the beginning of this section (Section 6.0).

- NEPA Manual, Version 7 (CDOT 2024)
- Air Quality Project-Level Analysis Guidance (AQ-PLAG), Version 1 (CDOT 2019)
- Updated Interim Guidance on Mobile Source Air Toxic Analysis in NEPA Documents (FHWA 2023a)
- Frequently Asked Questions (FAQs): Conducting Quantitative Mobile Source Air Toxics (MSAT) Analysis for FHWA NEPA Documents (FHWA 2023b)
- MOVES4 Technical Guidance: Using MOVES to Prepare Emission Inventories for State Implementation Plans and Transportation Conformity (EPA 2023)

# 7.0 Environmental Consequences

This section documents how the I-270 Corridor Improvements Project meets federal conformity requirements and presents results of the quantitative emissions inventories and NEPA comparative analysis for criteria air pollutants and MSAT pollutants. Section 7.1 demonstrates how the Project meets applicable transportation conformity requirements for CO, $PM_{2.5}$, $PM_{10}$, and $O_3$ under 40 CFR 93. Section 7.2 presents the quantitative criteria pollutant emissions inventory for the NEPA comparative assessment. Section 7.3 summarizes the quantitative MSAT emissions analysis.

## 7.1 Conformity Determinations

This project is in the Denver Metro/North Front Range $O_3$ nonattainment area for the 2008 and 2015 8-hour $O_3$ NAAQS. Because the project is in at least one nonattainment or maintenance area, transportation conformity requirements apply per 40 CFR 93.

## 7.2 Project-level Conformity

The Project is in an area that has completed 20 years of maintenance of applicable CO and $PM_{10}$ NAAQS, and the study area is no longer considered a maintenance area for those pollutants for the purposes of transportation conformity. The 20-year periods of maintenance with the CO and $PM_{10}$ NAAQS for the Denver-Boulder area ended on January 14, 2022, and October 16, 2022, respectively.

Denver is in attainment for the 1997, 2006, and 2012 $PM_{2.5}$ standard, so project-level hot-spot analyses are not required under the Conformity Rule. EPA has not yet designated nonattainment areas for the 2024 annual $PM_{2.5}$ standard of 9.0 micrograms per cubic meter ($\mu g/m^3$). However, in their January 2025 submittal to EPA, CDPHE recommended all areas of Colorado be designated in attainment for the $PM_{2.5}$ annual standard based on monitoring data between 2021 and 2023.

Therefore, project-level hot-spot analyses for CO, $PM_{10}$, and $PM_{2.5}$ are not required to demonstrate conformity with the CAA. $O_3$ is modeled on a regional basis and is not modeled at the project level.

## 7.3 Regional Conformity

Project-level conformity analyses, also known as hot-spot analyses, are not applicable to $O_3$ according to 40 CFR 93. This is because $O_3$ is not directly emitted from sources but rather forms through complex chemical reactions involving its precursor pollutants, VOCs and $NO_X$. These reactions often result in $O_3$ exceedances at locations distant from the emission sources. Consequently, $O_3$ conformity is determined at the regional level using a regional emissions analysis based on models with the latest planning assumptions.

Regional conformity for transportation projects is satisfied by the project's inclusion in a federally approved RTP and regional TIP. DRCOG is the federally designated transportation planning agency for the Denver region, where the study area is located. The DRCOG's 2050 MVRTP (DRCOG 2024) and the 2024-2027 TIP (DRCOG 2025) are the latest federally approved and fiscally constrained conforming plan and program for the DRCOG planning area. The project is listed in the 2050 MVRTP, which was adopted by DRCOG in April 2021 and FHWA in June 2021 and amended in May 2024. FHWA issued the conformity determination for the DRCOG 2024 Amended 2050 MVRTP and the amended Fiscal Year 2024-2027 DRCOG TIP on July 29, 2024.[10] The Project is included in the fiscally constrained 2024-2027 TIP and specifically referenced by TIP number 2020-068.

$O_3$ is modeled on a regional basis for the RTP and TIP. The design concept and scope of the Project is consistent with the project description in the RTP and TIP, and the "open-to-traffic" assumptions in DRCOG's regional emissions analysis. Inclusion in the conforming RTP and TIP demonstrates that the project was evaluated for regional impacts, meets the planning and regional requirements for demonstration of federal conformity, and is consistent with local air quality planning efforts.

## 7.4 Quantitative Criteria Pollutant Emissions Inventories

The emission inventories for the criteria pollutants were developed to provide a NEPA comparative analysis based on applicable guidance noted in Section 6.3 and methods described in Appendix A and Appendix B of this document. The emissions inventories are based on vehicle traffic for the roadway segments included in DRCOG's Compass model and within the air quality study area (see Figure 2 in Section 6.1). This includes all roadway segments affected by the project.[11]

The emissions reported in this section should be interpreted as representing motor vehicle emissions resulting from the project; the differences in emissions between alternatives are solely due to the project. Variations in the general emission inventory trends for the following criteria pollutants and $O_3$ precursor pollutants are described in this section:

[10] The conformity determination is published in Appendix R of the DRCOG 2024 Amended 2050 MVRTP.
[11] Roadways that are not part of the project build alternatives are included in the analysis based on criteria in Frequently Asked Questions (FAQs): FHWA Recommendations for Conducting Quantitative Mobile Source Air Toxics (MSAT) Analysis for FHWA NEPA Documents (FHWA 2023b).

- $PM_{10}$
- $PM_{2.5}$
- CO
- $SO_2$
- $NO_2$
- $NO_x$
- VOC

Because $O_3$ formation requires a complex chemical reaction of other pollutants to occur, $O_3$ emissions are not explicitly quantified in the emissions inventories. Rather, the primary precursor pollutants for $O_3$ formation, $NO_x$ and VOCs, are quantified.

Table 3 shows estimated daily Vehicle Miles Traveled (VMT) for the Project alternatives. As shown in the table, VMT increases in future years. The future year alternatives, 3GPL and 2GPL+1EL, are expected to have higher traffic volumes and increased daily VMT for I-270 due to the addition of a lane in both directions, while the No Action Alternative maintains two lanes. The VMT in the 3GPL alternative is slightly higher compared to the 2GPL+1EL alternative.

**Table 3. Daily Vehicle Miles Traveled (VMT)**

| 2023 Existing | 2050 No Action | 2050 3GPL | 2050 2GPL+1EL |
|---|---|---|---|
| 926,995 | 1,443,023 | 1,692,053 | 1,591,552 |

Table 4 and Table 5 summarize the modeled criteria pollutant emissions for a typical weekday in representative winter and summer months for the existing conditions year (2023) and the design year (2050). Emissions were inventoried in the winter (January) and summer (July) to addresses seasonal differences in weather patterns (such as temperature inversions that occur as a result of the complex topography of the region). Emissions of most criteria pollutants decrease from existing conditions to the design year for all three project alternatives, which is attributed to the implementation of stringent emission standards, improved fuel efficiency, and vehicle fleet turnover. $PM_{10}$ emissions show a slight increase from the existing conditions to the design year, with approximately 65 to 85 percent of total $PM_{10}$ emissions attributed to re-entrained road dust. Both of the project build alternatives exhibit slightly higher emissions than the No Action alternative due to increased traffic volumes in the design year.

Table 4. NEPA Comparative Analysis of Criteria Air Pollutant and Ozone Precursor Emissions (in U.S. tons per day) in January (Typical Weekday)

| Pollutant | 2023 Existing | 2050 No Action | 2050 3GPL | 2050 2GPL+1EL |
|---|---|---|---|---|
| $PM_{10}$ | 0.327 | 0.456 | 0.518 | 0.488 |
| $PM_{2.5}$ | 0.033 | 0.011 | 0.011 | 0.010 |
| CO | 2.945 | 0.614 | 0.679 | 0.634 |
| $SO_2$ | 0.002 | 0.001 | 0.001 | 0.001 |
| $NO_2$ | 0.070 | 0.030 | 0.031 | 0.028 |
| $NO_x$ | 0.906 | 0.160 | 0.167 | 0.153 |
| VOCs | 0.172 | 0.061 | 0.069 | 0.065 |

Table 5. NEPA Comparative Analysis of Criteria Air Pollutant and Ozone Precursor Emissions (in U.S. tons per day) in July (Typical Weekday)

| Pollutant | 2023 Existing | 2050 No Action | 2050 3GPL | 2050 2GPL+1EL |
|---|---|---|---|---|
| $PM_{10}$ | 0.275 | 0.374 | 0.422 | 0.397 |
| $PM_{2.5}$ | 0.033 | 0.011 | 0.011 | 0.010 |
| CO | 3.411 | 0.699 | 0.777 | 0.726 |
| $SO_2$ | 0.002 | 0.001 | 0.001 | 0.001 |
| $NO_2$ | 0.061 | 0.023 | 0.024 | 0.022 |
| $NO_x$ | 0.790 | 0.122 | 0.127 | 0.117 |
| VOCs | 0.215 | 0.066 | 0.075 | 0.071 |

## 7.5 Quantitative MSAT Analysis

MSAT emissions were analyzed in accordance with FHWA guidance (FHWA 2023a), which provides a tiered approach with three categories of analysis, depending on specific project circumstances: (1) no analysis for projects with no potential for meaningful MSAT effects; (2) qualitative analysis for projects with low potential MSAT effects; or (3) quantitative analysis to differentiate alternatives for projects with higher potential MSAT effects. Compared with the No Action Alternative, the 3GPL and 2GPL+1EL alternatives are expected to have higher traffic volumes and increased daily VMT due to the addition of a lane on I-270. FHWA determined that the I-270 Corridor Improvements Project meets the criteria for projects with higher potential MSAT effects based on the AADT projected for the design year of the project and the addition of substantial new capacity. The project is also located in proximity to populated areas. Therefore, this project would have higher potential MSAT effects, and a quantitative analysis of the MSAT emissions was conducted in accordance with FHWA's MSAT guidance to provide a basis for identifying and comparing the potential differences among MSAT emissions from the No Action, 3GPL, and 2GPL+1EL alternatives.

The emission inventories for the nine FHWA priority MSAT pollutants were developed based on applicable guidance in Section 6.3 and methods described in Appendix B. Table 6 and Table 7 summarize the modeled MSAT emissions (in units of pounds per day) for a typical weekday in representative winter and summer months for the existing conditions year (2023) and the design year (2050).

**Table 6. NEPA Comparative Analysis of MSAT Air Pollutant Emissions (pounds per day) in January (Typical Weekday)**

| Pollutant | 2023 Existing | 2050 No Action | 2050 3GPL | 2050 2GPL+1EL |
|---|---|---|---|---|
| 1,3-butadiene | 0.549 | 0.000 | 0.000 | 0.000 |
| Acetaldehyde | 3.274 | 0.352 | 0.369 | 0.340 |
| Acrolein | 0.438 | 0.022 | 0.023 | 0.022 |
| Benzene | 4.898 | 0.832 | 0.939 | 0.882 |
| Diesel PM | 53.093 | 0.819 | 0.876 | 0.800 |
| Ethylbenzene | 5.058 | 2.037 | 2.317 | 2.177 |
| Formaldehyde | 5.941 | 0.388 | 0.414 | 0.383 |
| Naphthalene | 0.699 | 0.020 | 0.022 | 0.021 |
| Polycyclic Organic Matter | 0.360 | 0.009 | 0.010 | 0.009 |

**Table 7. NEPA Comparative Analysis of MSAT Air Pollutant Emissions (pounds per day) in July (Typical Weekday)**

| Pollutant | 2023 Existing | 2050 No Action | 2050 3GPL | 2050 2GPL+1EL |
|---|---|---|---|---|
| 1,3-butadiene | 0.616 | 0.000 | 0.000 | 0.000 |
| Acetaldehyde | 3.317 | 0.358 | 0.376 | 0.346 |
| Acrolein | 0.445 | 0.024 | 0.025 | 0.023 |
| Benzene | 6.662 | 1.206 | 1.367 | 1.285 |
| Diesel PM | 53.093 | 0.819 | 0.876 | 0.800 |
| Ethylbenzene | 5.331 | 2.110 | 2.403 | 2.258 |
| Formaldehyde | 6.107 | 0.407 | 0.436 | 0.404 |
| Naphthalene | 0.717 | 0.023 | 0.026 | 0.024 |
| Polycyclic Organic Matter | 0.367 | 0.010 | 0.011 | 0.011 |

The modeled MSAT emissions decrease between the 2023 existing conditions and the design year (2050) for all three project alternatives. This is consistent with EPA's national emissions control programs that are projected to reduce annual MSAT emissions by 90 percent from 2010 to 2050 (FHWA 2023a). The much larger decrease in estimated emissions of diesel PM between 2023 and 2050 compared to the other MSAT is most likely a result of Colorado's adoption of the Advanced Clean Trucks rule and the corresponding increase of electric vehicles in the medium- and heavy-duty truck fleets by 2050. Despite the decrease in MSAT emissions between the 2023 existing conditions and the design year, slightly higher emissions are estimated for the project build alternatives (3GPL and 2GPL+1EL Alternatives) than the No Action Alternative in 2050. This difference is due to the higher estimates of traffic volumes and daily VMT that result from the addition of a lane in both directions of I-270 in the project build alternatives.

### 7.6 Qualitative Analysis of Construction Emissions

Project construction would result in short-term, temporary emissions of fugitive dust and equipment-related exhaust emissions such as $NO_x$, CO, VOCs, and PM ($PM_{10}$ and $PM_{2.5}$) in the study area. Construction of the project is not expected to last longer than 5 years. Therefore, construction emissions would not need to be accounted for in any hot-spot analysis per 40 CFR 93.123(c)(5). Since hot-spot analysis is not required for this project under 40 CFR 93.123(c)(5) (see Section 7.1.1), it is also not necessary for NEPA purposes.

Sources of fugitive dust ($PM_{10}$ and $PM_{2.5}$) during project construction would include disturbed surface areas at the construction site and trucks carrying uncovered loads of soil and debris. Fugitive dust emissions would vary from day to day, depending on the nature and magnitude of construction activity and local weather conditions. Dust emissions would depend on conditions such as soil moisture, the silt content of soil, wind speed, and the number of operating construction vehicles.

Exhaust emissions during construction would be generated by fuel combustion in motor vehicles and construction equipment. Construction vehicles and the disruption of normal traffic flow could result in increased motor vehicle emissions in certain areas. These emissions would be temporary and limited to the immediate area surrounding the construction site. Measures to control emissions are discussed in Section 1.1.

## 8.0 Mitigation Measures

Based on the analysis results summarized in Section 7.0, the project is not expected to cause substantial adverse effects on air quality, and the project meets transportation conformity requirements.

Although the analysis projects an increase in some pollutant emissions (associated with increases in VMT) for the project build alternatives compared with the No Action Alternative, several strategies have been and continue to be implemented in the Denver Metro/North Front Range $O_3$ nonattainment area to reduce emissions of the $O_3$ precursors $NO_x$ and VOCs. The strategies include multimodal transportation options, rideshare programs, reformulated summer season fuels, and vehicle inspection and maintenance programs. Several strategies have also been and continue to be implemented to maintain attainment of the CO and $PM_{10}$ NAAQS, including oxygenated fuels and vehicle inspection and maintenance programs for CO, and diesel smoke inspections and road dust control measures for $PM_{10}$.

Temporary effects to the local air quality are anticipated during construction because the proposed project would likely have localized diesel-emitting sources from construction equipment and vehicles traveling to and from the construction site. Therefore, the project will comply with CDOT's *Standard Specifications for Road and Bridge Construction* (CDOT

2023b) and the Air Quality Control Commission's (AQCC) Regulations 1 (5 CCR 1001-3, Emission Control for Particulate Matter, Smoke, Carbon Monoxide, and Sulfur Oxides) and 3 (5 CCR 1001-5, Stationary Source Permitting and Air Pollutant Emission Notice (APEN) Requirements) to ensure that appropriate control measures are implemented during construction to reduce emissions of most pollutants and control fugitive dust.

Examples of typical emission and dust control measures include but are not limited to the following:

- Conduct ambient air quality monitoring for PM near the project area to assess air quality conditions and trigger additional mitigation measures when elevated PM readings occur during construction.
- Cover, wet, compact, or use a chemical stabilization binding agent to control dust and excavated materials at construction sites.
- Use wind barriers and wind screens to prevent spreading of dust from the site.
- Have a wheel wash station and/or crushed stone apron at egress/ingress areas to prevent dirt from being tracked onto public streets.
- Use vacuum-powered street sweepers to remove dirt tracked onto public streets.
- Cover all dump trucks that are hauling material leaving the sites to prevent dirt from spilling onto public streets.
- Locate construction diesel engines as far away as possible from residential areas.
- Locate staging areas as far away as possible from residential areas.

The contractor will be required to obtain an APEN and follow its requirements for the project. APENs are submitted to CDPHE and used to report predicted emissions, apply for a permit, and modify an existing permit. The project may need to obtain a permit if predicted emissions are greater than permit thresholds as defined by CDPHE. Preparation of a fugitive dust control plan will also be required to specify measures to reduce dust emissions during construction. The contractor will also be required to obtain any air quality permits for stationary sources unless exempt.

Table 8 lists the emission control measure commitments for the project.

**Table 8. Emission Control Measure Commitments**

| Activity Triggering Mitigation | Location of Activity | Impact | Emission Control Measure Commitment | Responsible Branch | Timing/Phase That Mitigation Will Be Implemented |
|---|---|---|---|---|---|
| General construction activities | Study Area | Release of fugitive dust from construction activities | Obtain any required air quality permits prior to the start of construction, including a Colorado Department of Public Health and Environment (CDPHE) Air Pollutant Emission Notice, also known as an APEN, which requires a Fugitive Dust Control Plan to address how dust will be kept, at a minimum, during construction. | CDOT Engineering and Contractor | Pre-Construction |
| General construction activities | Study Area | Release of fugitive dust from construction activities | Conduct ambient air quality monitoring for particulate matter (PM) near the project area to assess air quality conditions and trigger additional mitigation measures when elevated PM readings occur during construction. | CDOT Engineering and Contractor | Construction |
| General construction activities | Study Area | Release of fugitive dust from construction activities | Cover, wet, compact, or use a chemical stabilization binding agent to control dust and excavated materials at construction sites during windy conditions and as specified by the Fugitive Dust Control Plan. | CDOT Engineering and Contractor | Construction |
| General construction activities | Study Area | Release of fugitive dust from construction activities | Use wind barriers and wind screens to prevent the spreading of dust from the site during windy conditions and as specified by the Fugitive Dust Control Plan. | CDOT Engineering and Contractor | Construction |

| Activity Triggering Mitigation | Location of Activity | Impact | Emission Control Measure Commitment | Responsible Branch | Timing/Phase That Mitigation Will Be Implemented |
|---|---|---|---|---|---|
| General construction activities | Study Area | Release of fugitive dust from construction activities | Have a wheel wash station and/or crushed stone apron at egress/ingress areas to prevent dirt from being tracked onto public streets. | CDOT Engineering and Contractor | Construction |
| General construction activities | Study Area | Release of fugitive dust from construction activities | Use vacuum-powered street sweepers to remove dirt tracked onto public streets. | CDOT Engineering and Contractor | Construction |
| General construction activities | Study Area | Release of fugitive dust from construction activities | Cover all dump trucks that are hauling material, leaving the sites to prevent dirt from spilling onto public streets. | CDOT Engineering and Contractor | Construction |
| General construction activities | Study Area | Release of fugitive dust from construction activities | Minimize disturbed areas, particularly in winter. | CDOT Engineering and Contractor | Construction |

| Activity Triggering Mitigation | Location of Activity | Impact | Emission Control Measure Commitment | Responsible Branch | Timing/Phase That Mitigation Will Be Implemented |
|---|---|---|---|---|---|
| General construction activities | Study Area | Release of diesel emissions from construction equipment | Prohibit unnecessary idling of construction equipment. | CDOT Engineering and Contractor | Construction |
| General construction activities | Study Area | Release of diesel emissions from construction equipment | Locate diesel engines as far away as possible from residential areas. | CDOT Engineering and Contractor | Construction |
| General construction activities | Study Area | Release of diesel emissions from construction equipment | Locate staging areas as far away as possible from residential areas. | CDOT Engineering and Contractor | Construction |
| General construction activities | Study Area | Release of diesel emissions from construction equipment | To the extent practical, use heavy construction equipment that has the cleanest available engines or that can be retrofitted with diesel particulate-control technology. | CDOT Engineering and Contractor | Pre-Construction and Construction |

| Activity Triggering Mitigation | Location of Activity | Impact | Emission Control Measure Commitment | Responsible Branch | Timing/Phase That Mitigation Will Be Implemented |
|---|---|---|---|---|---|
| General construction activities | Study Area | Release of diesel emissions from construction equipment | To the extent practical, use alternatives to diesel engines and/or diesel fuels, such as biodiesel, liquefied natural gas, or compressed natural gas, fuel cells, and electric engines. | CDOT Engineering and Contractor | Construction |
| General construction activities | Study Area | Release of diesel emissions from construction equipment | Install engine pre-heater devices to eliminate unnecessary idling for wintertime construction. | CDOT Engineering and Contractor | Pre-Construction |
| General construction activities | Study Area | Release of diesel emissions from construction equipment | Prohibit tampering with equipment to increase horsepower or to defeat an emission control device's effectiveness. | CDOT Engineering and Contractor | Construction |
| General construction activities | Study Area | Release of diesel emissions from construction equipment | Require construction vehicle engines to be properly tuned and maintained. | CDOT Engineering and Contractor | Construction |

| Activity Triggering Mitigation | Location of Activity | Impact | Emission Control Measure Commitment | Responsible Branch | Timing/Phase That Mitigation Will Be Implemented |
|---|---|---|---|---|---|
| General construction activities | Study Area | Release of diesel emissions from construction equipment | Use construction vehicles and equipment with the minimum practical engine size for the intended job. | CDOT Engineering and Contractor | Construction |

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# Appendix A. I-270 Air Quality Analysis Work Plan

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# I-270 Air Quality Analysis: Work Plan

July 11, 2024

**Federal Project No.**
STU 2706-046

**CDOT Project Code**
25611

# Acronyms and Abbreviations

| Acronym | Definition |
|---|---|
| APCD | Air Pollution Control Division |
| AQ-PLAG | Air Quality Project-Level Analysis Guidance |
| ATR | Automated Traffic Recorder |
| AVFT | Alternate Vehicle Fuel and Technology |
| CAA | Clean Air Act |
| CAP | criteria air pollutant |
| CDOT | Colorado Department of Transportation |
| CDPHE | Colorado Department of Public Health and Environment |
| CO | carbon monoxide |
| C.R.S | Colorado Revised Statutes |
| DEIS | Draft Environmental Impact Statement |
| Diesel PM | diesel particulate matter |
| DRCOG | Denver Regional Council of Governments |
| EF | emission factor |
| EPA | U.S. Environmental Protection Agency |
| FAQ | frequently asked question |
| FHWA | Federal Highway Administration |
| HPMS | Highway Performance Monitoring System |
| I-270 | Interstate 270 |
| I/M | inspection and maintenance |
| MOVES | Mobile Source Vehicle Emissions Simulator |
| mph | miles per hour |
| MPO | metropolitan planning organization |
| MSAT | mobile source air toxic |
| NAAQS | National Ambient Air Quality Standards |
| NEPA | National Environmental Policy Act |
| $NO_2$ | nitrogen dioxide |
| $NO_x$ | nitrogen oxides |
| $O_3$ | ozone |
| PM | particulate matter |
| $PM_{10}$ | PM with diameter equal to or less than 10 micrometers |
| $PM_{2.5}$ | PM with diameter equal to or less than 2.5 micrometers |
| POM | polycyclic organic matter |
| RTD | Regional Transportation District |
| RTP | Regional Transportation Plan |
| RunSpecs | run specifications |
| SIP | State Implementation Plan |

| | |
|---|---|
| $SO_2$ | sulfur dioxide |
| TDM | travel demand model |
| TIP | Transportation Improvement Program |
| TP | time period |
| USDOT | U.S. Department of Transportation |
| VMT | vehicle miles traveled |
| VOC | volatile organic compound |
| ZEV | zero emission vehicle |

# 1.0 Introduction

The Colorado Department of Transportation (CDOT) and Federal Highway Administration (FHWA) are preparing an Environmental Impact Statement (EIS) for the Interstate 270 (I-270) Corridor Improvements project. This document provides a brief overview of the regulatory context for the air quality analysis (Section 2.0); describes the proposed methodology for the air quality analysis (Section 3.0); and discusses plans for technical reporting of the analysis (Section 4.0).

The proposed air quality analysis includes:

- **A quantitative emissions inventory** will be developed for comparative analysis of criteria air pollutants (CAPs), and mobile source air toxics (MSATs) from the Project across the (1) Existing Conditions in 2023 (base year), (2) No Action Alternative in 2050 (horizon year), and (3) selected Build Alternatives in 2050. The selection of Build Alternatives for this detailed analysis will be based on comparative screening. The emissions inventory will be based on travel demand model (TDM) results for the traffic activity data, as developed in the traffic analysis (see the traffic report for more details on development of the activity data).[12]
- **A qualitative discussion of potential emissions and air quality effects from construction** of the project Build Alternatives selected for detailed analysis will be provided, along with potential emissions avoidance, minimization, and control measures.

# 2.0 Regulatory Context for the Air Quality Analysis

The purpose of the air quality analysis is to analyze potential impacts associated with the Project for the DEIS in accordance with the National Environmental Policy Act (NEPA) and applicable federal and state air quality requirements, including the U.S. Environmental Protection Agency (EPA) transportation conformity rule and requirements of Colorado Revised Statutes (C.R.S.) 43-1-128.

## 2.1 Transportation Conformity

The transportation conformity requirement is based on Section 176(c) of the Clean Air Act (CAA) (Title 42 *United States Code* Chapter 85), which prohibits the U.S. Department of Transportation (USDOT) and other federal agencies from funding, authorizing, or approving plans, programs, or projects that do not conform to a State Implementation Plan (SIP) for attaining the National Ambient Air Quality Standards (NAAQS) for carbon monoxide (CO), nitrogen dioxide ($NO_2$), sulfur dioxide ($SO_2$), ozone ($O_3$), particulate matter (PM) with diameter equal to or less than 10 micrometers ($PM_{10}$), and PM with diameter equal to or less than 2.5 micrometers ($PM_{2.5}$). Conformity requirements apply only in NAAQS nonattainment

[12] The TDM data for the air quality analyses do not include the direct connects for I-270 with I-25 at the west end of the corridor and with I-70 at the east end of the corridor, which presents a worst-case scenario in terms of modeling emissions from vehicles in the TDM that are connecting with those other interstates or impacting other traffic links in the project.

and maintenance areas. Demonstration of project-level conformity for a transportation project requires that the project comes from a currently conforming Regional Transportation Plan (RTP) and federal Transportation Improvement Program (TIP), follows other requirements of an SIP, and will not

- Cause or contribute to any new violation of the NAAQS;
- Increase the frequency or severity of any existing NAAQS violation;
- Delay timely attainment of any NAAQS or any required interim emission reductions, or other milestones.

The project is in an area of $O_3$ nonattainment (Denver-Boulder-Greeley-Ft. Collins-Loveland nonattainment area for the 2008 $O_3$ NAAQS, and the Denver Metro/North Front Range for the 2015 $O_3$ NAAQS). The project is in an area that has completed 20 years of maintenance of applicable CO and $PM_{10}$ NAAQS, and the area is no longer considered a maintenance area for those pollutants for the purposes of transportation conformity.[13] The area is in attainment of the $PM_{2.5}$ NAAQS. Therefore, project-level quantitative hot-spot analyses for CO, $PM_{10}$, and $PM_{2.5}$, and consideration of quantitative construction-related emissions in a hot-spot analysis, are not required in the air quality analysis to demonstrate conformity of the project with the CAA. To meet federal requirements for regional transportation conformity, the proposed air quality analysis will include confirmation by CDOT of whether the Denver Regional Council of Governments (DRCOG)[14] has demonstrated that the Project conforms to the relevant RTP and TIP. Confirmation that the design concept, scope, and "open-to-traffic" schedule of the project Build Alternatives analyzed for the EIS are consistent with the descriptions in the conforming RTP and TIP will serve to demonstrate that the Project meets this transportation conformity requirement.

## 2.2 National Environmental Policy Act

The quantitative air quality analysis will be conducted to support the EIS and decision-making under NEPA (Title 42 United States Code Chapter 55). An emissions inventory analysis will be conducted to provide a quantitative comparison of project-level emissions across existing conditions of the I-270 corridor, the No Action Alternative, and the Build Alternatives. Emissions inventories for all analyzed scenarios will be developed for the CAPs and MSATs summarized below.

### 2.2.1 Criteria Air Pollutants

The following transportation-related CAPs will be included in the inventories: CO, $NO_2$, $SO_2$, $PM_{10}$, and $PM_{2.5}$, as well as the $O_3$ precursors nitrogen oxides ($NO_x$) and volatile organic compounds (VOCs).

[13] The 20-year periods of maintenance with the CO and $PM_{10}$ NAAQS for the Denver-Boulder area ended on January 14, 2022, and October 16, 2022, respectively.
[14] DRCOG is the federally designated metropolitan planning organization (MPO) responsible for transportation planning for the Denver metropolitan region, where the project is located.

### 2.2.2 Mobile Source Air Toxics

The emissions inventories will include the nine MSATs identified by the EPA to be among the national and regional-scale cancer risk drivers or contributors and noncancer hazard contributors (EPA 2014) and currently considered as priority MSAT by FHWA: 1,3-butadiene, acetaldehyde, acrolein, benzene, diesel PM, ethylbenzene, formaldehyde, naphthalene, and polycyclic organic matter (POM).

# 3.0 Analysis Methods

The methodology for the air quality analysis will be conducted in accordance with all applicable federal regulations, and it will be based upon guidance from EPA, FHWA, and CDOT. The following relevant guidance will be applied to the methodology for the proposed analysis, where appropriate, as described in this section and agreed upon by CDOT, FHWA, and EPA:

- *CDOT NEPA Manual* (CDOT 2024)
- *Air Quality Project-Level Analysis Guidance (AQ-PLAG), Version 1* (CDOT 2019)
- *Updated Interim Guidance on Mobile Source Air Toxic Analysis in NEPA Documents* (FHWA 2023a)
- *Frequently Asked Questions (FAQs): Conducting Quantitative Mobile Source Air Toxics (MSAT) Analysis for FHWA NEPA Documents* (FHWA 2023b)
- *MOVES4 Technical Guidance: Using MOVES to Prepare Emission Inventories for State Implementation Plans and Transportation Conformity* (EPA 2023)

## 3.1 Quantitative Emissions Analysis for Comparison of Alternatives

For the proposed quantitative project-level emissions analysis, a lookup table of emission factors for all CAPs and MSAT listed in Section 2.2 will be generated by running the most recent version of EPA's Motor Vehicle Emissions Simulator (MOVES) available when this work plan was prepared (i.e., MOVES4.0.1) for each analysis year and incorporating re-entrained road dust/sanding emission factors provided by the Colorado Department of Public Health and Environment (CDPHE) Air Pollution Control Division (APCD).[15] Before its subsequent use in calculating project-level emissions for the analysis, CDOT and FHWA will review the lookup table, along with the underlying MOVES input/output files. EPA will be provided the run specifications (RunSpecs) and input/output databases for the MOVES modeling to review. For each analysis scenario (i.e., Existing Conditions in 2023, No Action Alternative in 2050, and the Build Alternatives in 2050), emission factors from the lookup table will be combined with link-level travel activity (traffic) and roadway type data to calculate the link-level emissions, which will be aggregated to the Project level for each pollutant. The methodology details for this process are described below.

[15] Note that using MOVES to generate a project-scale lookup table of emission factors eliminates the need to use project-specific traffic data as part of the MOVES inputs and adds flexibility to the analysis. If traffic data change or new links are later added to the analysis, updated emissions can be calculated without needing to revise MOVES inputs and re-run the MOVES model.

### 3.1.1 MOVES Runs – Overview of Approach

MOVES will be run with the Project Scale setting to estimate running exhaust and crankcase running exhaust emissions for all pollutants, as well as brake wear and tire wear $PM_{10}$ and $PM_{2.5}$ emissions. The MOVES runs will produce emission factors for the lookup table. Data for Links input for MOVES will be developed based on hypothetical link-level traffic and roadway data that will cover the range of actual link-level traffic for all analysis scenarios. Link Source Types input for MOVES will be provided by APCD or CDOT.

Mainline and ramp roadway segments will be modeled as urban restricted roadways. Other non-freeway roadways (i.e., arterials and collectors) will be modeled as urban unrestricted roadways. Only on-road links will be modeled (no "off-network" links will be modeled). For each of the two road types, a series of hypothetical links with traffic volume of 1 vehicle per hour traveling one mile will be created, with average vehicle speed ranging from 0 to 75 miles per hour (mph) in 1 mph speed bins.[16] Emission factors will be developed for both passenger ("non-truck") vehicle and truck vehicle categories, with appropriate mapping of MOVES source types to non-truck and truck categories.

For the analysis, the winter and summer seasons, represented by the months of January and July, respectively, will be modeled using appropriate fuels inputs for each season. This approach allows modeling of typical "worst-case" wintertime air quality in Denver, as well as the peak summertime period when warm-weather conditions can adversely influence air quality.

Emission factors from the lookup table will be applied (outside of MOVES) to project-specific link-level traffic data in order to calculate link-level emissions, which will be aggregated to the project level for each analysis scenario. The emission factors in the lookup table by vehicle type and speed (from the MOVES runs and incorporated road dust/sanding emission factors) will be applied to the link-level traffic data to calculate the emissions for each link by traffic time period. The traffic data are anticipated to vary across four time periods during the day (AM Peak, Midday, PM Peak, and Evening).

### 3.1.2 MOVES Run Specification Inputs

MOVES RunSpecs will be created to specify the parameter options for the MOVES model. Table 1 summarizes the MOVES inputs for the RunSpecs as defined in the navigation panel of the MOVES interface. The following subsections describe input options needed for the RunSpecs.

[16] Note that only a single road grade (equal to 0 percent) will be modeled in MOVES for the quantitative emissions inventory analysis, consistent with normal practices for emissions inventory development using the MOVES model. Section 3.1 discusses the methodology for a set of comparative inventories of project-level emissions.

**Table 1. MOVES RunSpec options**

| Navigation Panel | Model Selection |
|---|---|
| Scale | Project scale; inventory calculation type |
| Time Spans | Hour; weekdays; January/July; calendar years 2023 and 2050 |
| Geographic Bounds | Adams County |
| Vehicles | All MOVES4 vehicle and fuel type combinations |
| Road Types | Urban restricted access, urban unrestricted access |
| Pollutants and Processes | CAPs and MSAT listed in Section 2.2; running exhaust and crankcase running exhaust (all pollutants), and brake wear and tire wear (only $PM_{10}$ and $PM_{2.5}$) |
| General Output | Units of grams and miles |
| Output Emissions Detail | Road type |

### 3.1.3 MOVES Project Data Manager Inputs

After the RunSpecs are created, an input database table must be created before running MOVES. This is done using the Project Data Manager to enter project-specific data. **Table** summarizes the MOVES Project Data Manager inputs, and they are discussed in more detail below.

**Table 2. MOVES Project Data Manager inputs**

| Project Data Manager Tab | Data Source |
|---|---|
| Meteorology Data | Provided by APCD |
| Age Distribution | Provided by APCD |
| Fuel | MOVES defaults; and AVFT[a] data provided by CDOT |
| Retrofit | No inputs (not applicable) |
| Inspection and Maintenance (I/M) Program | Provided by APCD |
| Link Source Type | Generated by the Air Quality Consultant using traffic count data provided by APCD[b] |
| Links | Generated by the Air Quality Consultant |

[a] AVFT = Alternate Vehicle Fuel and Technology

[b] Note that the data provided by APCD are based on local Highway Performance Monitoring System (HPMS) traffic counts and reflect a statewide average for urban freeways and are only used to define the vehicle type mix for separate "car" and "truck" input files for MOVES. The project-specific fleet mix will be represented in the emissions analysis by the DRCOG TDM results for “car” and “truck” traffic volumes.

#### Meteorology Data

The meteorology data for this analysis will be consistent with those used in the regional emissions analysis for transportation conformity and provided by APCD. The relevant data provided by APCD for each modeled season will be used to calculate average temperature and humidity for each traffic time period in the two seasons. Note that MOVES PM running exhaust, brake wear, and tire wear emissions are not affected by the meteorological inputs.

### Vehicle Age Distribution

The vehicle age distribution input for the modeling, which will be provided by APCD, is expected to be based on their latest available composite of vehicle registration data from seven Denver area counties (Adams, Arapaho, Boulder, Broomfield, Denver, Douglas, and Jefferson). These data will be used to represent the vehicle age distribution in the analysis years (2023 and 2050).

### Fuel

Consistent with APCD's standard practice, the default parameters in MOVES for fuel inputs will be used with the addition of AVFT data from CDOT to reflect the future zero emission vehicle (ZEV) fleet resulting from the state's adoption of the Colorado Clean Cars and Advanced Clean Trucks rules that can be accommodated in MOVES4.

### Inspection and Maintenance Parameters

Existing and anticipated future vehicle inspection and maintenance (I/M) program parameters for the Denver metropolitan area will be provided by APCD.

### Link Source Type

Link source type inputs are used to define the fraction of travel on each link by vehicle type. Two separate sets of MOVES runs will be conducted, one for light-duty vehicles and one for (heavy-duty) trucks, such that two sets of link source type inputs will be needed: one set with fractions for the four types of MOVES light-duty vehicles (MOVES sourcetypes 11, 21, 31, and 32), and one set with fractions for the nine types of heavy-duty vehicles, including buses (MOVES sourcetypes 41, 42, 43, 51, 52, 53, 54, 61, and 62).

For the Express Lanes in the project Build Alternatives that will only permit usage by light-duty vehicles and buses, a third set of link source type fractions representing the Express Lane vehicle mix could be developed. However, including buses in the "truck" group, and not modeling emissions for any buses in the Express Lanes, is planned for two reasons:

- Only one Regional Transportation District (RTD) bus route currently uses the corridor, and buses are a very small fraction of total travel.
- The travel activity data provided for this analysis only includes traffic volumes for light-duty vehicles and trucks, and not separate traffic volumes for buses.

Automated Traffic Recorder (ATR) data by HPMS class (if available) for representative freeway and arterial segments will be provided by APCD and will be used, along with MOVES default estimates by vehicle miles traveled (VMT) by source type, to develop link source type inputs for the two groups of vehicles.

### Links

A links input table will be created that represents all possible combinations of road type (urban restricted and unrestricted access) and speed to generate the lookup table of emission factors applicable to any traffic link in the analysis scenarios.

### 3.1.4 Road Dust Emission Factors

The analysis includes re-entrained $PM_{10}$ road dust emissions based on emission factors developed and provided by APCD for the Denver region (an alternative local method developed for local-specific conditions, as discussed in the guidance). These factors were developed based on monitoring studies conducted in 1989 and 1990, and they are applied in SIP development and regional transportation conformity analyses. They account for both ongoing re-entrained road dust and emissions due, historically, to road sanding (now, deicing) in the winter months. If enforceable commitments for road dust emissions reductions are made as part of the project Build Alternatives, an alternative set of reduced factors provided by APCD will be used in the analysis. The appropriate set of re-entrained road dust emission factors will be added to the lookup table and used for calculating $PM_{10}$ emissions for each traffic link and season in this analysis. Since deicing materials are only needed in the winter months, those factors will only be applied to the emissions analysis for the winter season (the month of January); emissions factors for normal re-entrained dust will be applied in the analyses for the winter and summer seasons (the months of January and July). $PM_{2.5}$ road dust will not be modeled in the analysis because the Denver area is in attainment of the $PM_{2.5}$ NAAQS, and neither APCD nor EPA have made a finding that road dust is a significant contributor to $PM_{2.5}$ concentrations.

### 3.1.5 Calculation of Project-Level Emissions

The project-level emissions for each pollutant and season in all four analysis scenarios will be calculated from the link-level traffic data for each scenario, each appropriate emission factors from the lookup table developed using MOVES, and each of the road dust emission factors provided by APCD. The calculation will be performed as follows. First, the link-level emissions will be calculated for each traffic time period as the product (multiplication) of VMT by all vehicles, number of hours, and applicable fleet-average total emission factor based on the fleet mix (i.e., fraction of passenger and truck vehicles) and average speed in each traffic time period:

$$\mathrm{E}_{link}^{TP} = \mathrm{VMT}_{link}^{TP} \times \mathrm{hrs} \times \left( f_t^{TP} \times EF_t(v^{TP}) + (1 - f_t^{TP}) \times EF_{\mathrm{pass}}(v^{TP}) \right) \qquad \textbf{Equation 1}$$

Where

$$\mathrm{E}_{link}^{TP} = \text{link-level emissions for a single time period (TP)}$$

$$\mathrm{VMT}_{link}^{TP} = \mathrm{L}_{link} \times V_{tot}^{TP}$$

$$L_{link} = \text{link length (miles)}$$

$$V_{tot}^{TP} = V_{pass}^{TP} + V_t^{TP} = \text{total vehicle volume in the TP}$$

$$V_{pass}^{TP} = \text{passenger vehicle volume in the TP}$$

$$V_t^{TP} = \text{truck vehicle volume in the TP}$$

$$hrs = \text{number of hours in the TP}$$

$$f_t^{TP} = \frac{V_t^{TP}}{V_{tot}^{TP}} = \text{truck fraction of } V_{tot}^{TP}$$

$$EF_t(v^{TP}) = \text{emission factor for truck vehicles as a function of average speed, v, for the TP (g/mile)}$$

$$EF_{pass}(v^{TP}) = \text{emission factor for passenger vehicles as a function of speed, v, for the TP (g/mile)}$$

Note that the emission factors (*EF*) by vehicle type and speed in Equation 1 represent the sum over the emission processes modeled in MOVES (i.e., running exhaust and crankcase running exhaust for all pollutants, plus brake wear and tire wear for $PM_{10}$ and $PM_{2.5}$), as well as the $PM_{10}$ road dust EF based on the analysis season. For each traffic link, the average speed for each TP and the road type will be used as keys to identify the applicable emission factors for passenger and truck vehicles in the lookup table. As the Project traffic volumes represent annual average volumes, CDOT monthly ATR summary data will be used to develop seasonal traffic adjustments.

After the link-level emissions by TP for each link have been calculated, the total link-level emissions will be calculated as the summation of Equation 1 over all TPs. Finally, the project-level emissions will be calculated by summing the total link-level emission for each link over all links in the traffic data. The project-level emissions inventories for the different categories of pollutants (i.e., CAPs and MSATs) will be reported in appropriate mass units per day.

### 3.2 Qualitative Analysis of Construction Emissions

As described in Section 2.0, a project-level quantitative analysis is not required for this project to demonstrate conformity with the CAA. Air quality impacts resulting from roadway construction activities are typically not a concern when contractors utilize appropriate control measures, and analyses of construction emissions tend to be qualitative rather than quantitative. Therefore, fugitive dust and other pollutant emissions from construction of this project will be considered qualitatively for NEPA purposes only. The proposed air quality analysis will include a brief discussion of construction emissions, air quality impacts, and potential avoidance, minimization, and control measures for construction of the project.

## 4.0 Reporting

After completion of the proposed air quality analysis described in this work plan, an air quality technical report for the EIS will be prepared to document the results, along with the analysis methodology, input data, and key assumptions used for the analysis. The report will include a discussion of the relevant regulations, air pollutants, and air quality concerns, as well as potential avoidance, minimization, and control strategies. Some aspects of the report, such as any control strategy commitments for the project, will require contributions from CDOT or other consultants for the EIS.

# 5.0 References

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# Appendix B. Air Quality Analysis Methods

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This appendix describes the approach for modeling operational emissions from motor vehicles using the Mobile Source Vehicle Emissions Simulator (MOVES) model and development of the quantitative emissions inventory for the Project. This process involves setting up a run specification for the MOVES model, entering project data using a MOVES tool called the Project Data Manager, running MOVES, exporting the results as an emissions lookup table, and then using project traffic data combined with the lookup table to calculate project operating emissions for each year and project alternative. These steps are described in more detail below.

# 1.0 Traffic Data

As described in the Traffic Technical Report in the I-270 Corridor Improvements Environmental Impact Statement, the project team selected the Denver Regional Council of Governments (DRCOG) Focus version 2.3.2 Travel Demand Model and TransModeler 6.1 microsimulation software as the primary tools for the I-270 traffic analysis. These tools provide accurate traffic forecasts and detailed simulations and meet the technical requirements established by the Colorado Department of Transportation (CDOT) and the Federal Highway Administration (FHWA). The analysis uses the 2023 base year and 2050 horizon year travel demand models from Focus version 2.3.2 for the existing and future traffic condition analyses.

The emissions inventories were developed using lookup tables of emissions rates by vehicle type, road type, and speed (described below), and estimates of vehicle miles traveled (VMT) and speeds by vehicle type from the traffic data. The traffic data provide estimates of traffic volume and speed for each modeled roadway segment (link); the traffic volume was combined with the length of each link in miles to estimate VMT. These calculations were performed separately for cars and trucks, as data for these two vehicle types are included in the summary traffic data.

The emissions inventory includes all roadway links involved in the project, as well as adjacent roadway links where traffic is affected by the project (see **Figure** in Section 6.1 in the main body of this Air Quality Technical Report). These "non-project" links were identified using the criteria contained in FHWA's *Mobile Source Air Toxics Frequently Asked Questions*,[17] which provide the only available recommendations for identifying links affected by a highway project. These criteria are:

1. a 5 percent or more change in annual average daily traffic (AADT) on congested highway links of level of service (LOS) D or worse;
2. a 10 percent or more change in AADT on uncongested highway links of LOS C or better;
3. a 10 percent or more change in travel time; or
4. a 10 percent or more change in intersection delay.

These criteria were applied to all modeled roadway links to arrive at a final set of project and non-project links to include in the emissions inventory analysis.

Note that because the DRCOG travel demand model and the Traffic Technical Report findings are based on different modeling approaches (travel demand modeling versus microsimulation modeling) and slightly different roadway networks (the Traffic Technical Report includes the entire project area, while the emissions analysis includes specific links selected using the criteria above), the two analyses reach different conclusions regarding the changes in VMT under the project alternatives. The analysis documented in this report relies on the DRCOG travel demand model results for the identified emissions analysis network, which project

[17] Frequently Asked Questions (FAQs): FHWA Recommendations for Conducting Quantitative Mobile Source Air Toxics (MSAT) Analysis for FHWA NEPA Documents, https://www.fhwa.dot.gov/environMent/air_quality/air_toxics/policy_and_guidance/msat/fhwa_nepa_msat_faq_moves3_.pdf

higher VMT for the No Action and 3GPL alternatives, and slightly lower VMT for the 2GPL+1EL Alternative relative to the values in the traffic report.

# 2.0 MOVES Runs – Overview of Approach

MOVES was run with the Project Scale setting to estimate running exhaust and crankcase running exhaust emissions for all pollutants. The MOVES runs produce emission factors for a lookup table, with emissions by road type, speed, and vehicle type (car or truck). Data for Links input for MOVES were developed based on hypothetical link-level traffic and roadway data that cover the range of actual link-level traffic for all analysis scenarios, as described below. Link Source Type inputs for MOVES, which describe the mix of vehicle types on each link, were developed using data provided by the Colorado Air Pollution Control Division (APCD).

Mainline and ramp roadway segments were modeled as urban restricted roadways. Other non-freeway roadways (i.e., arterials and collectors) were modeled as urban unrestricted roadways. Only on-road links were modeled; no "off-network" links were modeled. "Off-network" links reflect parking facilities, such as park-and-ride lots or truck stops, and no facilities of this type are affected by the project. For each of the two road types, a series of hypothetical links with a traffic volume of one vehicle per hour traveling one mile were created, with average vehicle speed ranging from 0 to 75 miles per hour (mph) in 1 mph speed bins.[18] Emission factors were developed for both passenger ("non-truck") vehicle and truck vehicle categories, with appropriate mapping of MOVES source types to non-truck and truck categories.

Modeling was performed for a 2023 base year and a 2050 project design year. For the analysis, the winter and summer seasons, represented by the months of January and July, respectively, were modeled using appropriate fuels inputs for each season. This approach allows the modeling to capture wintertime conditions in Denver as well as the peak summertime period when warm-weather conditions impact vehicle air conditioning use.

Emission factors from the lookup table were applied (outside of MOVES) to project-specific link-level traffic data in order to calculate link-level emissions, which were aggregated to the project level for each analysis scenario. The emission factors in the lookup table by vehicle type and speed (from the MOVES runs) were applied to the link-level traffic data to calculate the emissions for each link by traffic time period. The traffic data vary across three time periods during the day (AM Peak, PM Peak, and Evening).

[18] Note that only a single road grade (equal to 0 percent) was modeled in MOVES for the quantitative emissions inventory analysis, consistent with normal practices for emissions inventory development using the MOVES model.

## 2.1 Run Specification Inputs

MOVES run specifications (RunSpecs) were created to specify the parameter options for the MOVES model. Table 1 summarizes the MOVES inputs for the RunSpecs, as defined in the navigation panel of the MOVES interface.

**Table 1. MOVES Run Specification Selections**

| Navigation Panel | Model Selection |
|---|---|
| Scale | Project scale; inventory calculation type |
| Time Spans | Hour; weekdays; January/July; calendar years 2023 and 2050 |
| Geographic Bounds | Adams County |
| Vehicles | All MOVES4 vehicle and fuel type combinations |
| Road Types | Urban restricted access, urban unrestricted access |
| Pollutants and Processes | Running exhaust and crankcase running exhaust (all pollutants) |
| General Output | Units of grams and miles |
| Output Emissions Detail | Road type |

## 2.2 Project Data Manager Inputs

After the RunSpecs were created, an input database table for each run was created before running MOVES. This was done using the MOVES Project Data Manager to enter project-specific data. Table 2 summarizes the MOVES Project Data Manager inputs, and they are discussed in more detail below.

**Table 2. MOVES Project Data Manager Inputs**

| Project Data Manager Tab | Data Source |
|---|---|
| Meteorology Data | Provided by APCD |
| Age Distribution | Provided by APCD |
| Fuel | MOVES defaults; and AVFT[a] data provided by CDOT |
| Retrofit | No inputs (not applicable) |
| Inspection and Maintenance (I/M) Program | Provided by APCD |
| Link Source Type | Generated using traffic count data provided by APCD[b] |
| Links | Generic links designed to produce an emissions lookup table |

[a] AVFT = Alternate Vehicle Fuel and Technology
[b] Note that the data provided by APCD are based on local Highway Performance Monitoring System (HPMS) traffic counts and reflect a statewide average for urban freeways, and are only used to define the vehicle type mix for separate "car" and "truck" input files for MOVES. The project-specific fleet mix was represented in the emissions analysis by the DRCOG TDM results for “car” and “truck” traffic volumes.

### 2.2.1 Meteorology Data

The meteorology data for this analysis were consistent with those used in the regional emissions analysis for transportation conformity and were provided by APCD. The relevant data provided by APCD for each modeled season were used to calculate average temperature and humidity for each traffic time period in the two seasons.

### 2.2.2 Vehicle Age Distribution

The vehicle age distribution input for the modeling, provided by APCD, is based on their latest available composite of vehicle registration data from seven Denver area counties (Adams, Arapaho, Boulder, Broomfield, Denver, Douglas, and Jefferson). These data were used to represent the age distribution in the analysis years (2023 and 2050).

### 2.2.3 Fuel

Consistent with APCD's standard practice, the default parameters in MOVES for fuel inputs were used, with the addition of AVFT data from CDOT to reflect the future zero emission vehicle (ZEV) fleet resulting from the state's adoption of the Colorado Clean Cars and Advanced Clean Trucks rules. The AVFT inputs define vehicle sales by fuel type and vehicle type in each past and future model year, and the CDOT-provided file reflects implementation of these Colorado rules.

### 2.2.4 Inspection and Maintenance Parameters

Existing and anticipated future vehicle inspection and maintenance (I/M) program parameters for the Denver metropolitan area were provided by APCD.

### 2.2.5 Link Source Type

Link source type inputs are used to define the fraction of travel on each link by vehicle type. Two separate sets of MOVES runs were conducted, one for light-duty vehicles and one for (heavy-duty) trucks, such that two sets of link source type inputs were needed: one set with fractions for the four types of MOVES light-duty vehicles (MOVES sourcetypes 11, 21, 31, and 32), and one set with fractions for the nine types of heavy-duty vehicles, including buses (MOVES sourcetypes 41, 42, 43, 51, 52, 53, 54, 61, and 62).

For the Express Lanes in the Project Build Alternatives will only permit usage by light-duty vehicles and buses, a third set of link source type fractions representing the Express Lane vehicle mix could be developed. However, this analysis included buses in the "truck" group, and did not model emissions for any buses in the Express Lanes for two reasons:

- Only one Regional Transportation District (RTD) bus route currently uses the corridor, and buses are a very small fraction of total travel.
- The travel activity data provided for this analysis only include traffic volumes for light-duty vehicles and trucks, and not separate traffic volumes for buses.

Automated Traffic Recorder (ATR) data by vehicle class for representative freeway and arterial segments, provided by APCD, was used, along with MOVES default estimates by VMT by source type, to develop link source type inputs for the two groups of vehicles.

### 2.2.6 Links

A links input table was created that represents all possible combinations of road type (urban restricted and unrestricted access) and speed to generate the lookup table of emission factors applicable to any traffic link in the analysis scenarios.

## 2.3 Road Dust Emission Factors

PM road dust emission factors are not modeled by MOVES. APCD provided the road dust emissions factors that are used for the $PM_{10}$ emissions inventories. $PM_{10}$ emissions factors were provided for freeways and arterial roadways, and for normal year-road dust, as well as an incremental "sanding" factor that applies during the winter months (November through March). These factors are listed in Table 3. $PM_{2.5}$ road dust is not modeled because the Denver area is in attainment of the $PM_{2.5}$ NAAQS and neither APCD nor EPA have made a finding that road dust is a significant contributor to $PM_{2.5}$ concentrations.

**Table 3. Road Dust Emissions Factors**

| Pollutant | Road Type | Road Dust Factor, g/mile | Sanding Factor, g/mile |
|---|---|---|---|
| $PM_{10}$ | Freeway | 0.1678 | 0.0513 |
| $PM_{10}$ | Arterial | 0.3543 | 0.0550 |

# Appendix C. I-270 Air Quality Analysis MSAT Discussion

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Transportation projects may affect regional or local air toxic concentrations due to the mobile source air toxic (MSAT) emissions from vehicles. Potential MSAT effects from the I-270 Project operation were evaluated following the Federal Highway Administration (FHWA) memorandum titled *Updated Interim Guidance on Mobile Source Air Toxic Analysis in NEPA Documents* (FHWA 2023).

# 1.0 Background

Controlling air toxic emissions became a national priority with the passage of the Clean Air Act (CAA) Amendments of 1990, whereby Congress mandated that the U.S. Environmental Protection Agency (EPA) regulate 188 air toxics, also known as hazardous air pollutants. The EPA assessed this expansive list in its rule on the Control of Hazardous Air Pollutants from Mobile Sources (72 FR 8430), and identified a group of 93 compounds emitted from mobile sources that are part of EPA's Integrated Risk Information System (IRIS).[19] In addition, EPA identified nine compounds with significant contributions from mobile sources that are among the national and regional-scale cancer risk drivers or contributors and non-cancer hazard contributors from the 2011 National Air Toxics Assessment (NATA).[20] These are 1,3-butadiene, acetaldehyde, acrolein, benzene, diesel particulate matter (Diesel PM), ethylbenzene, formaldehyde, naphthalene, and polycyclic organic matter. While FHWA considers these the priority mobile source air toxics, the list is subject to change and may be adjusted in consideration of future EPA rules.

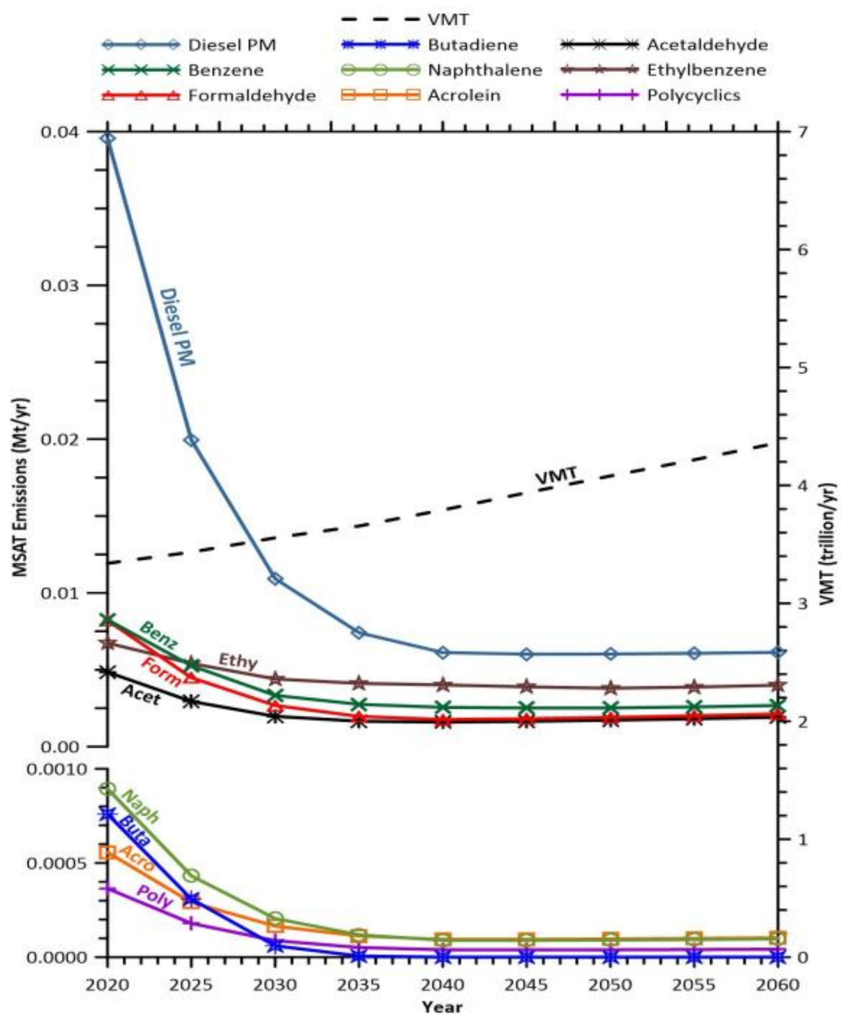
# 2.0 National Trends in Mobile Source Air Toxic (MSAT) Emissions

National trend data projects substantial overall reduction in MSAT emissions due to stricter engine and fuel regulations issued by EPA. Using EPA's MOVES3 model, as shown in Figure 1, FHWA estimates that even if vehicle miles traveled (VMT) increases by 31 percent from 2020 to 2060 as forecast, a combined reduction of 76 percent in the total annual emissions for the priority MSAT is projected for the same time period. Diesel PM is the dominant component of MSAT emissions, making up 36 to 56 percent of all priority MSAT pollutants by mass, depending on calendar year (FHWA 2023).

[19] See https://www.epa.gov/iris.

[20] See https://www.epa.gov/national-air-toxics-assessment. EPA has succeeded NATA with the Air Toxics Screening Assessment, or AirToxScreen (https://www.epa.gov/AirToxScreen).

**Figure 1. FHWA projected national MSAT emissions trends from 2020 to 2060 for vehicles operating on roadways, based on EPA's MOVES3 model runs conducted by FHWA in March 2021 (FHWA 2023). Trends for specific locations may be different, depending on locally derived information representing VMT, vehicle speeds, vehicle mix, fuels, emission control programs, meteorology, and other factors. Mt = million tons.**




# 3.0 MSAT Research

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 the National Environmental Policy Act (NEPA). Nonetheless, air toxics concerns continue to arise on highway projects during the NEPA process. Even as the science emerges, the public and other agencies expect FHWA to address MSAT impacts in its environmental documents. 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 highway projects. The FHWA will continue to monitor the developing research in this field.

# 4.0 Consideration of MSATs in NEPA Documents

The FHWA developed a tiered approach with three categories for analyzing MSATs in NEPA documents, depending on specific project circumstances:

- **No analysis for projects with no potential for meaningful MSAT effects**. The types of projects typically include projects qualifying as a categorical exclusion under 23 CFR 771.117, projects exempt under the conformity rule under 40 CFR 93.126, and other projects with no meaningful impacts on traffic volumes or vehicle mix.
- **Qualitative analysis for projects with low potential MSAT effects**. Projects in this category include those that improve operations of highways, transit, or freight without adding substantial new capacity or without creating a facility that is likely to meaningfully increase MSAT emissions.
- **Quantitative analysis to differentiate alternatives for projects with higher potential MSAT effects**. Projects in this category are located near populated areas. Projects in this category also:
  - Create or significantly alter a major intermodal freight facility that has the potential to concentrate high levels of diesel PM in a single location, involving a significant number of diesel vehicles for new projects or accommodating a significant increase in the number of diesel vehicles for expansion projects; or
  - Create new capacity or add significant capacity to urban highways such as interstates, urban arterials, or urban collector-distributor routes with traffic volumes where the annual average daily traffic (AADT) is projected to be in the range of 140,000 to 150,000 or greater by the design year.

# 5.0 Quantitative Analysis of MSAT Emissions

The I-270 Corridor Improvements Project is located in the populated Denver metropolitan area. Compared with the No Action Alternative, the 3GPL and 2GPL+1EL alternatives are expected to have higher traffic volumes and increased daily VMT due to the addition of a lane on I-270. FHWA determined that the I-270 Corridor Improvements Project meets the criteria for projects with higher potential MSAT effects based on the AADT projected for the design year of the project and the addition of substantial new capacity. The project is also located in proximity to populated areas. Therefore, this project would have higher potential MSAT effects, and a quantitative analysis of the MSAT emissions was conducted in accordance with FHWA's MSAT guidance (FHWA 2023).

Emissions of the nine priority MSAT pollutants for existing conditions in the year 2023 (for the No Action Alternative) and future conditions from the No Action Alternative, 3GPL, and 2GPL+1EL Alternatives in the design year 2050 were modeled using the MOVES4 model. Input parameters for the MOVES4 model are described in Appendix  of the Air Quality Technical Report.

The results of the quantitative MSAT emissions analysis are summarized in Table 1 and Table 2.

**Table 1. NEPA Comparative Analysis of MSAT Air Pollutant Emissions (pounds per day) in January (Typical Weekday)**

| Pollutant | 2023 Existing | 2050 No Action | 2050 3GPL | 2050 2GPL+1EL |
|---|---|---|---|---|
| 1,3-butadiene | 0.549 | 0.000 | 0.000 | 0.000 |
| Acetaldehyde | 3.274 | 0.352 | 0.369 | 0.340 |
| Acrolein | 0.438 | 0.022 | 0.023 | 0.022 |
| Benzene | 4.898 | 0.832 | 0.939 | 0.882 |
| Diesel PM | 53.093 | 0.819 | 0.876 | 0.800 |
| Ethylbenzene | 5.058 | 2.037 | 2.317 | 2.177 |
| Formaldehyde | 5.941 | 0.388 | 0.414 | 0.383 |
| Naphthalene | 0.699 | 0.020 | 0.022 | 0.021 |
| Polycyclic Organic Matter | 0.360 | 0.009 | 0.010 | 0.009 |

**Table 2. NEPA Comparative Analysis of MSAT Air Pollutant Emissions (pounds per day) in July (Typical Weekday)**

| Pollutant | 2023 Existing | 2050 No Action | 2050 3GPL | 2050 2GPL+1EL |
|---|---|---|---|---|
| 1,3-butadiene | 0.616 | 0.000 | 0.00 | 0.000 |
| Acetaldehyde | 3.317 | 0.358 | 0.376 | 0.346 |
| Acrolein | 0.445 | 0.024 | 0.025 | 0.023 |
| Benzene | 6.662 | 1.206 | 1.367 | 1.285 |
| Diesel PM | 53.093 | 0.819 | 0.876 | 0.800 |
| Ethylbenzene | 5.331 | 2.110 | 2.403 | 2.258 |
| Formaldehyde | 6.107 | 0.407 | 0.436 | 0.404 |
| Naphthalene | 0.717 | 0.023 | 0.026 | 0.024 |
| Polycyclic Organic Matter | 0.367 | 0.010 | 0.011 | 0.011 |

The VMT estimated for the 3GPL and 2GPL+1EL Project Alternatives is higher than that for the No Action Alternative because the project would add new travel lanes that would attract additional trips that would not otherwise occur in the study area. Although there is an increase in VMT, MSAT emissions under the 2050 No Action, 3GPL, and 2GPL+1EL alternatives are substantially lower than those of the 2023 Existing Conditions in the study area. In other words, MSAT emissions in the study area are expected to be lower in the future than they are today. The much larger decrease in estimated emissions of diesel PM between 2023 and 2050 compared to the other MSAT is most likely a result of Colorado's adoption of the Advanced

Clean Trucks rule and the corresponding increase of electric vehicles in the medium- and heavy-duty truck fleets by 2050. MSAT emissions under the 3GPL and 2GPL+1EL alternatives are slightly higher than those in the 2050 No Action Alternative for most MSAT pollutants due to the projected increase in VMT.

# 6.0 Incomplete or Unavailable Information for Project-Specific MSAT Health Impact Analysis

The MSAT analysis for the project includes a basic analysis of the likely MSAT impacts of the future Build Alternatives. Due to the limitations of information and methodology of the analysis, the following discussion is included in accordance with Appendix C of the FHWA *Updated Interim Guidance on Mobile Source Air Toxic Analysis in NEPA Documents* (FHWA 2023). The discussion is prototype language taken directly from that Appendix.

In FHWA's view, 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 highway alternatives. The outcome of such an assessment, adverse or not, would be influenced more by the uncertainty introduced into the process through assumption and speculation rather than any genuine insight into the actual health impacts directly attributable to MSAT exposure associated with a proposed action.

The EPA is responsible for protecting the public health and welfare from any known or anticipated effect of an air pollutant. They are the lead authority for administering the CAA and its amendments and have specific statutory obligations with respect to hazardous air pollutants and MSAT. The EPA is in the continual process of assessing human health effects, exposures, and risks posed by air pollutants. They maintain IRIS, which is "a compilation of electronic reports on specific substances found in the environment and their potential to cause human health effects" (EPA, https://www.epa.gov/iris/). Each report contains assessments of non-cancerous and cancerous effects for individual compounds and quantitative estimates of risk levels from lifetime oral and inhalation exposures with uncertainty spanning perhaps an order of magnitude.

Other organizations are also active in the research and analyses of the human health effects of MSATs, including the Health Effects Institute (HEI). A number of HEI studies are summarized in Appendix D of FHWA's *Updated Interim Guidance on Mobile Source Air Toxic Analysis in NEPA Documents* (FHWA 2023). Among the adverse health effects linked to MSAT compounds at high exposures are cancer in humans in occupational settings; cancer in animals; and irritation to the respiratory tract, including the exacerbation of asthma. Less obvious is the adverse human health effects of MSAT compounds at current environmental concentrations[21] or in the future as vehicle emissions substantially decrease.

The methodologies for forecasting health impacts include emissions modeling, dispersion modeling, exposure modeling, and then final determination of health impacts, with each step

[21] See HEI Special Report 16, *Mobile-Source Air Toxics: A Critical Review of the Literature on Exposure and Health Effects*, https://www.healtheffects.org/publication/mobile-source-air-toxics-critical-review-literature-exposure-and-health-effects.

in the process building on the model predictions obtained in the previous step. All are encumbered by technical shortcomings or uncertain science that prevents 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 MSAT because of factors such as low-dose extrapolation and translation of occupational exposure data to the general population, a concern expressed by HEI.[22] 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 states that with respect to diesel engine exhaust, "[t]he absence of adequate data to develop a sufficiently confident dose-response relationship from the epidemiologic studies has prevented the estimation of inhalation carcinogenic risk."[23]

There is also the 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 CAA to determine whether more stringent controls are required in order to provide an ample margin of safety to protect public health or to prevent an adverse environmental effect for industrial sources subject to the maximum achievable control technology standards, such as benzene emissions from refineries. The decision framework is a two-step process. The first step requires EPA to determine an "acceptable" level of risk due to emissions from a source, which is generally no greater than approximately 100 in a million. Additional factors are considered in the second step, the goal of which is to maximize the number of people with risks less than 1 in a million due to emissions from a source. The results of this statutory two-step process do not guarantee that cancer risks from exposure to air toxics are less than 1 in a million; in some cases, the residual risk determination could result in maximum individual cancer risks that are as high as approximately 100 in a million. In a June 2008 decision, the U.S. Court of Appeals for the District of Columbia Circuit upheld EPA's approach to addressing risk in its two-step decision framework. Information is incomplete or unavailable to establish that even the largest of highway projects would result in levels of risk greater than deemed acceptable.[24]

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[22] Ibid.

[23] See EPA IRIS database, Diesel Engine Exhaust, Section II.C., https://iris.epa.gov/static/pdfs/0642_summary.pdf.

[24] United States Court of Appeals for the District of Columbia Circuit. 2008. No. 07-1053. Natural Resources Defense Council and Louisiana Environmental Action Network, Petitioners v. Environmental Protection Agency, Respondent American Chemistry Council, Intervenor.

Because of the limitations in the methodologies for forecasting health impacts described, any predicted difference in health impacts between alternatives 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.

# 7.0 References

Federal Highway Administration (FHWA). 2023. *Updated Interim Guidance on Mobile Source Air Toxic Analysis in NEPA Documents*. HEPN-10. January 18. https://www.fhwa.dot.gov/environment/air_quality/air_toxics/policy_and_guidance/msat/fhwa_nepa_msat_memorandum_2023.pdf.