Air Quality Hot-Spot Analysis and Mobile Source Air Toxics Assessment
Technical Memorandum for the
E. 88th Avenue (I-76 NB Ramps to Highway 2)
Commerce City
Environmental Assessment
STU M245-013
22285
February 2, 2021

1.0 INTRODUCTION

This memorandum was prepared for *E. 88th Avenue (I-76 NB Ramps to Highway 2) Environmental Assessment* and summarizes the methodology and results for a quantitative hot-spot analysis to assess carbon monoxide (CO) impacts in the proposed project corridor, which extends along E. 88th Avenue from Highway 2 on the east to the I-76 interchange on the west, within Commerce City, Colorado. In addition, this memorandum includes a qualitative assessment of the potential effects of mobile source air toxics (MSAT) on air quality. Although the Proposed Action would not meet the criteria for a regionally significant project, it is included in the Denver Regional Council of Government's (DRCOG) *2040 Fiscally Constrained Regional Transportation Plan* (DRCOG, 2020), therefore meets federal air quality conformity standards.[1]

The CO hot-spot analysis is in accordance with requirements under transportation conformity rules in 40 CFR 93, Subpart B, to demonstrate whether the proposed project would cause or contribute to violations of the National Ambient Air Quality Standard (NAAQS) for CO. Those requirements specify that an analysis of a proposed project should be done for intersections that are signalized or proposed to be signalized where the Level of Service (LOS) would be "D" or worse for peak hour traffic.

The traffic study prepared for the *E. 88th Avenue (I-76 NB Ramps to Highway 2) Environmental Assessment* found that only one intersection in the study corridor would have a LOS of D or worse in 2040. This was the intersection of E. 88th Avenue and Brighton Boulevard, for the Proposed Action 2040 design year traffic during the morning (AM) peak hour, for which the LOS was classified as "F." Therefore, the CO hot-spot analysis was performed for this intersection based on projected AM peak hour traffic.

[1] Denver Regional Council of Governments (DRCOG). 2020. 2040 Fiscally Constrained Regional Transportation Plan. https://drcog.org/sites/default/files/resources/FINAL-2040MVRTP-0619.pdf.

2.0 CO HOT-SPOT METHODOLOGY

The air quality (CO) modeling hot-spot analysis was conducted using the Environmental Protection Agency's (EPA) MOVES emissions model and the EPA's CAL3QHC dispersion model. Guidance used in developing the analysis inputs is found in EPA Publication EPA-454/R-92-005: *Guideline for Modeling Carbon Monoxide from Roadway Intersections* (November 1992).

CO emission factors for the road segments approaching and departing the intersection, and other road segments also within 300 meters of the center of the intersection, were developed by the Colorado Department of Public Health and Environment (CDPHE),and provided to HDR (Ed Liebsch) via e-mail dated 12/03/2019 from Kira Shonkwiler of CDPHE. These factors are shown in Table 1, and account for all arterial and freeway road segments within the 300-meter zone (approximately 984 feet), except that local/neighborhood streets are not included, as local street impacts are assumed to be included in the background concentration. These emission factors were provided by CDPHE for calendar year 2023 (the earliest year of potential project opening) to provide a conservative analysis. Because the 2023 emission factors were used together with 2040 traffic projections, the analysis likely overestimates the actual CO impacts. The CDPHE also provided background concentration values of 4.72 parts per million (ppm) and 2.94 ppm for the 1-hour and 8-hour averaging periods, respectively, and a "persistence factor" of 0.622, which is multiplied by the modeled 1-hour concentrations to obtain 8-hour concentrations.

Table 1. MOVES Year 2023 Emission Factors Provided by CDPHE

Link	Avg. Speed (mph)	MOVES Road Type ID	CO EF (g/mi)
Brighton NB @ 88th	4	5	6.48
Brighton SB @ 88th	7	5	4.76
88th WB @ Brighton	10	5	4.07
I-76 off/on Ramps	10	5	4.07
88th EB @ Brighton	17	5	3.41
I-76 Mainline SB @ 88th	37	4	1.93
I-76 Mainline NB @ 88th	69	4	2.27
Queue Links	idle	NA	22.27

The CAL3QHC model was executed for the above free-flow and queue links, as appropriate, to produce 1-hour concentration estimates at 41 receptor locations placed at approximately 10 feet off the edges of driving lanes, and along approaches and departure links for the subject intersection. Traffic volumes input to CAL3QHC were from the traffic study referenced earlier for the intersection of interest, and from other traffic estimates provided by the study team for the I-76 mainline, overpass, and ramps. The model was executed using a wind speed of 1.0 meters/second, and using a stability category of "E" (5), which is appropriate for rural land uses. While the project study area is a mix of urban and rural land use types within the 3-kilometer radius used for the rural/urban determination, slightly more land area within this radius was in the rural category, according to the EPA-recommended Auer land use classifications. Therefore, the rural stability (E) was used in this analysis, which produces more conservative (high) estimate of expected impact.

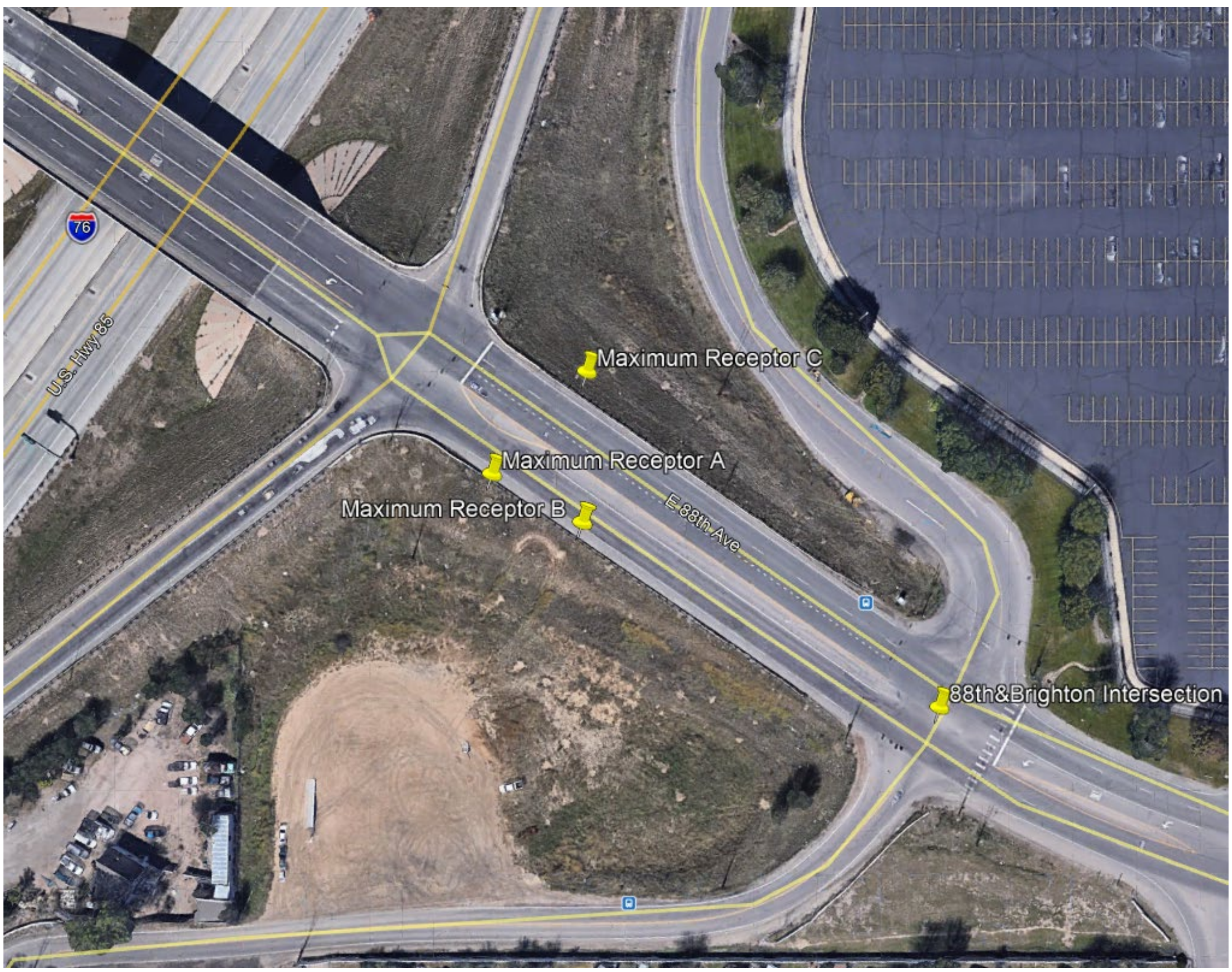
3.0 CO RESULTS

The CAL3QHC model results are summarized in Table 2, showing impact for the worst-case receptors, which are three receptors all located northwest of the E. 88th Avenue/Brighton Boulevard intersection (nearer the ramps for northbound I-76) with a modeled 1-hour impact of 1.0 ppm (Figure 1). The maximum impacts for each averaging period are well below the respective NAAQS. Therefore, project implementation would be in compliance with Transportation Conformity requirements to maintain acceptable air quality.

Table 2. Model Results in Comparison to NAAQS

Averaging Period	UTM Coordinates (m)		CO Concentration (ppm)			
	X	Y	Modeled	Background	Total	NAAQS
1-Hour	507,558.03	4,411,927.0	1.00	4.72	5.72	35
8-Hour	507,558.03	4,411,927.0	0.62	2.94	3.56	9

Figure 1. Maximum Impact Receptor in Relation to Modeled Intersection



4.0 MSAT ASSESSMENT

In addition to the criteria pollutants for which there are NAAQS, the EPA regulates air toxics. Toxic air pollutants are those pollutants known or suspected to cause cancer or other serious health effects. Most air toxics originate from human-made sources, including on-road mobile sources, non-road mobile sources (e.g., airplanes), area sources (e.g., dry cleaners), and stationary sources (e.g., factories or refineries).

The Clean Air Act identified 188 air toxics referred to as hazardous air pollutants (HAP). The EPA has assessed this expansive list in their final rule on the Control of Hazardous Air Pollutants from Mobile Sources (Federal Register, Vol. 72, No. 37, page 8430, February 26, 2007; EPA 2007) and identified a group of 93 compounds emitted from mobile sources that are listed in their Integrated Risk Information System (http://www.epa.gov/ncea/iris/index.html). In addition, EPA identified seven compounds with significant contributions from mobile sources that are among the national and regional-scale cancer risk drivers from their 1999 National Air Toxic Assessment. These MSATs are acrolein, benzene, 1,3-butadiene, diesel particulate matter plus diesel exhaust organic gases, formaldehyde, naphthalene, and polycyclic organic matter. While FHWA considers these the MSATs of concern, the list is subject to change and may be adjusted in consideration of future EPA rules. The 2007 EPA rule mentioned above requires controls that would dramatically decrease MSAT emissions through cleaner fuels and cleaner engines.

Based on an FHWA analysis using EPA's MOVES2010b model, shown in Figure 2, even if vehicle miles traveled (VMT) increases by 102 percent, as assumed from 2010 to 2050, a combined reduction of 83 percent in the total annual emissions for the priority MSAT is projected for the same period.

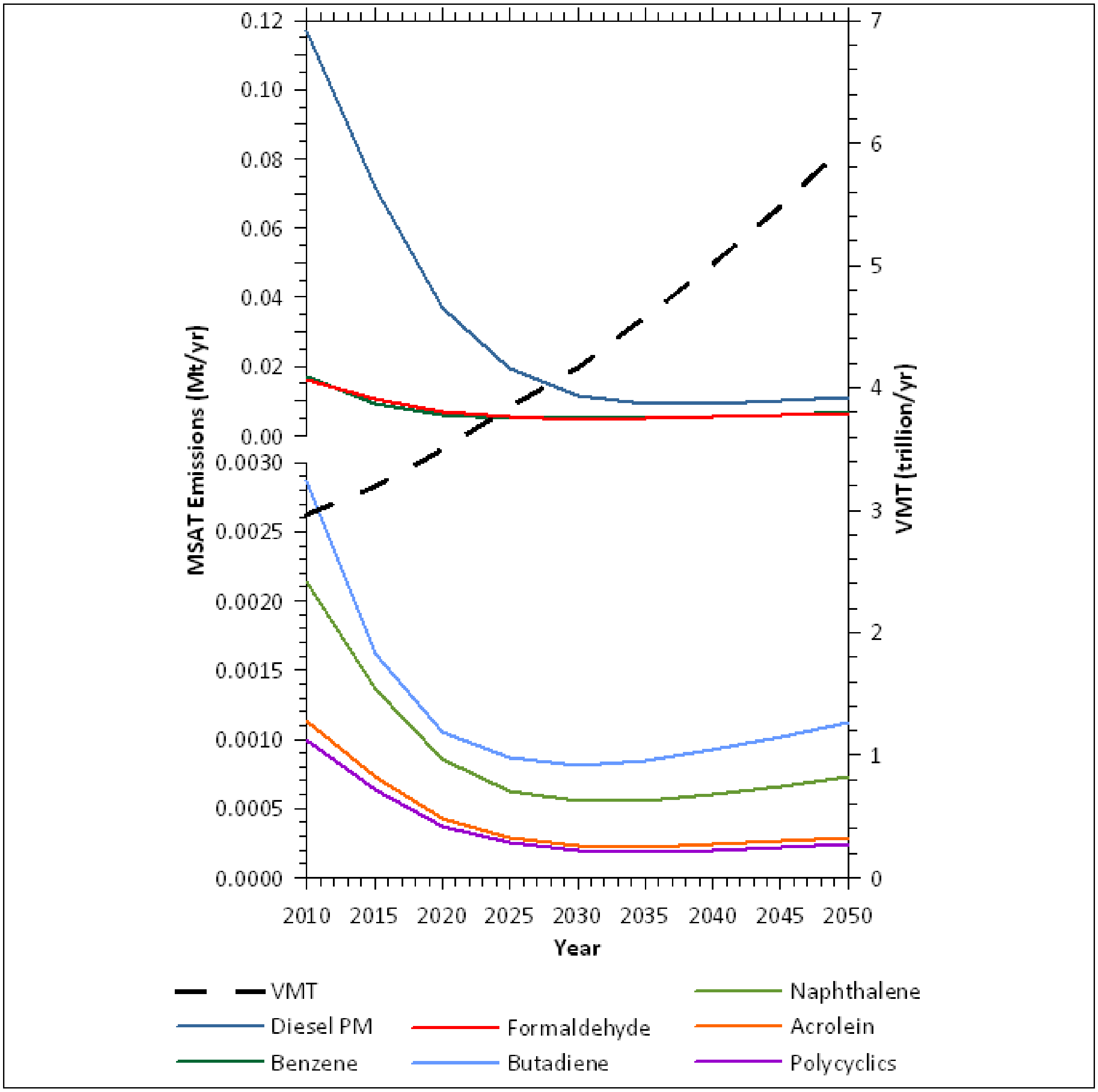
The Proposed Action is considered to be of low potential MSAT effect because it does not create or significantly alter any intermodal freight facilities or aggregate a significant volume of diesel vehicles; and does not add significant capacity to or create an urban highway with average annual daily traffic (AADT) 150,000 or higher in the vicinity of populated areas. The maximum AADT value on project-affected portion of E. 88th Avenue for design year (2040) conditions is 27,500 per DRCOG's travel demand model. In accordance with FHWA guidance (Updated Interim Guidance on Mobile Source Air Toxic Analysis in NEPA Documents, Memorandum from Emily Biondi, October 18, 2016), if affected project roadways do not exceed an annual average daily traffic level of 150,000, a quantitative MSAT emissions analysis is not required.

For any given calendar year, the increase in VMT in the project corridor with Proposed Action implementation would result in slightly higher MSAT emissions than the No-Action Alternative in the project study area. The Proposed Action may result in slight increases in traffic levels in the project corridor (E. 88th Avenue) in comparison to the No-Action Alternative. However, because the magnitude of EPA-projected reductions in MSATs is so great (Figure 2) even after accounting for the VMT growth, the project corridor and urban area MSAT emissions would tend to be much lower in the future than they are today.

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 because of lifetime MSAT exposure remain limited. These limitations impede the ability to evaluate how potential public health risks posed by MSAT exposure should be factored into project-level decision-making within the context of NEPA.

Air toxics concerns continue to be raised on highway projects during the NEPA process. Even as the science emerges, the public and other agencies expect MSAT impacts to be addressed in NEPA documents. The FHWA, EPA, the Health Effects Institute, and others have funded and conducted research studies to more clearly define potential risks from MSAT emissions associated with highway projects. The FHWA continues to monitor the developing research in this field.

Figure 2. FHWA MOVES Model Runs



Source: EPA MOVES2010b model runs conducted during May through June 2012 by FHWA.ote: Trends for specific locations may be different, depending on locally derived information representing vehicle-miles travelled, vehicle speeds, vehicle mix, fuels, emission control programs, meteorology, and other factors.

5.0 GREENHOUSE GAS ASSESSMENT

Human activity is changing the earth's climate by causing the buildup of heat-trapping greenhouse gas (GHG) emissions through the burning of fossil fuels and other human activities. Carbon dioxide (CO2) is the largest component of human-produced emissions; other prominent emissions include methane (CH4), nitrous oxide (N2O), and hydrofluorocarbons. These emissions are different from criteria air pollutants since their effects in the atmosphere are global rather than local, and also since they remain in the atmosphere for decades to centuries, depending on the species.

GHG emissions have accumulated rapidly as the world has industrialized, with concentration of atmospheric CO2 increasing from roughly 300 parts per million (ppm) in 1900 to over 400 ppm today. Over this timeframe, global average temperatures have increased by roughly 1.5 degrees Fahrenheit (1 degree Celsius), and the most rapid increases have occurred over the past 50 years. Scientists have warned that significant and potentially dangerous shifts in climate and weather are possible without substantial reductions in GHG emissions. They have commonly cited 2 degrees Celsius (1 degree Celsius beyond warming that has already occurred) as the total amount of warming the earth can tolerate without serious and potentially irreversible climate effects. For warming to be limited to this level, atmospheric concentrations of CO2 would need to stabilize at a maximum of 450 ppm, requiring annual global emissions to be reduced 40 to 70 percent below 2010 levels by 2050 (IPCC 2014).

State and national governments in many developed countries have set GHG emissions reduction targets of 80 percent below current levels by 2050, recognizing that postindustrial economies are primarily responsible for GHGs already in the atmosphere. As part of a 2014 bilateral agreement with China, the United States pledged to reduce GHG emissions 26 to 28 percent below 2005 levels by 2025; this emissions reduction pathway is intended to support economy-wide reductions of 80 percent or more by 2050 (The White House 2014).

GHG emissions from vehicles using roads are a function of distance traveled (expressed as VMT), vehicle speed, and road grade. A major factor in mitigating increases in VMT is EPA's GHG emissions standards, implemented in concert with national fuel economy standards. The U.S. Energy Information Administration (EIA) projects that vehicle energy efficiency (and thus, GHG emissions) on a per-mile basis will improve by 28 percent between 2012 and 2040 (EIA 2016). This improvement in vehicle emissions rates is more than sufficient to offset the increase in VMT.

Construction and subsequent maintenance of the selected project alternative would generate GHG emissions. Preparing the roadway corridor (for example, by earth-moving activities) would involve a considerable amount of energy consumption and resulting GHG emissions; manufacturing of the materials used in construction and fuel used by construction equipment would also contribute GHG emissions. Typically, construction emissions associated with a new road account for about 5 percent of the total 20-year lifetime emissions from the road, although this can vary widely with the extent of construction activity and the number of vehicles that use the road.

The addition of new road-miles to the roadway network in the project study area would also increase the energy and GHG emissions associated with maintaining those new road-miles in the future. The increase in maintenance needs as a result of adding new roadway infrastructure would be partially offset by the reduced need for maintenance on existing routes (because of lower total traffic and truck volumes on those routes).

6.0 OZONE ASSESSMENT

Ozone is modeled on a regional basis. This project was included in DRCOG's regional model even though it's not regionally significant since it included adding two new travel lanes. This project is in the 2020-2023 Transportation Improvement Program (TIP number 2016-079) and 2040 Metro Vision Regional Transportation Plan (July 15, 2020) as well as the 2021-2024 *Colorado Statewide Transportation Improvement Program* (June 18, 2020).

- DRCOG TIP NEPA #2016-079
- DRCOG TIP Preconstruction #2020-032
- State TIP #SR17012.061

The project design concept and scope, as described in the EA document, are not significantly different from that described in the TIP.

7.0 REFERENCES

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