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4.6 AIR QUALITY

INTRODUCTION

CDOT and FHWA consulted with the Colorado Department of Public Health and Environment Air Pollution Control Division (APCD), USEPA, DRCOG, and the Regional Air Quality Council (RAQC) to select the most appropriate approach for the analysis of air quality. The analysis followed the established protocols of USEPA and FHWA in looking primarily for potential violations of existing health-based air quality standards. The air quality analysis examined a range of air pollutants. Through the public involvement process, air quality issues have been raised that include concerns regarding ozone, impacts to sensitive receptors, and overall air quality in the study area, particularly around the City of Golden. These concerns are addressed in **Section 4.6.2.4**, **Section 4.6.2.5**, **Section 4.6.2.6**, and **Section 4.6.3**. Additional analysis has been performed to support the findings in this document (see **Northwest Corridor Supporting Document-Air Quality Assessment**).

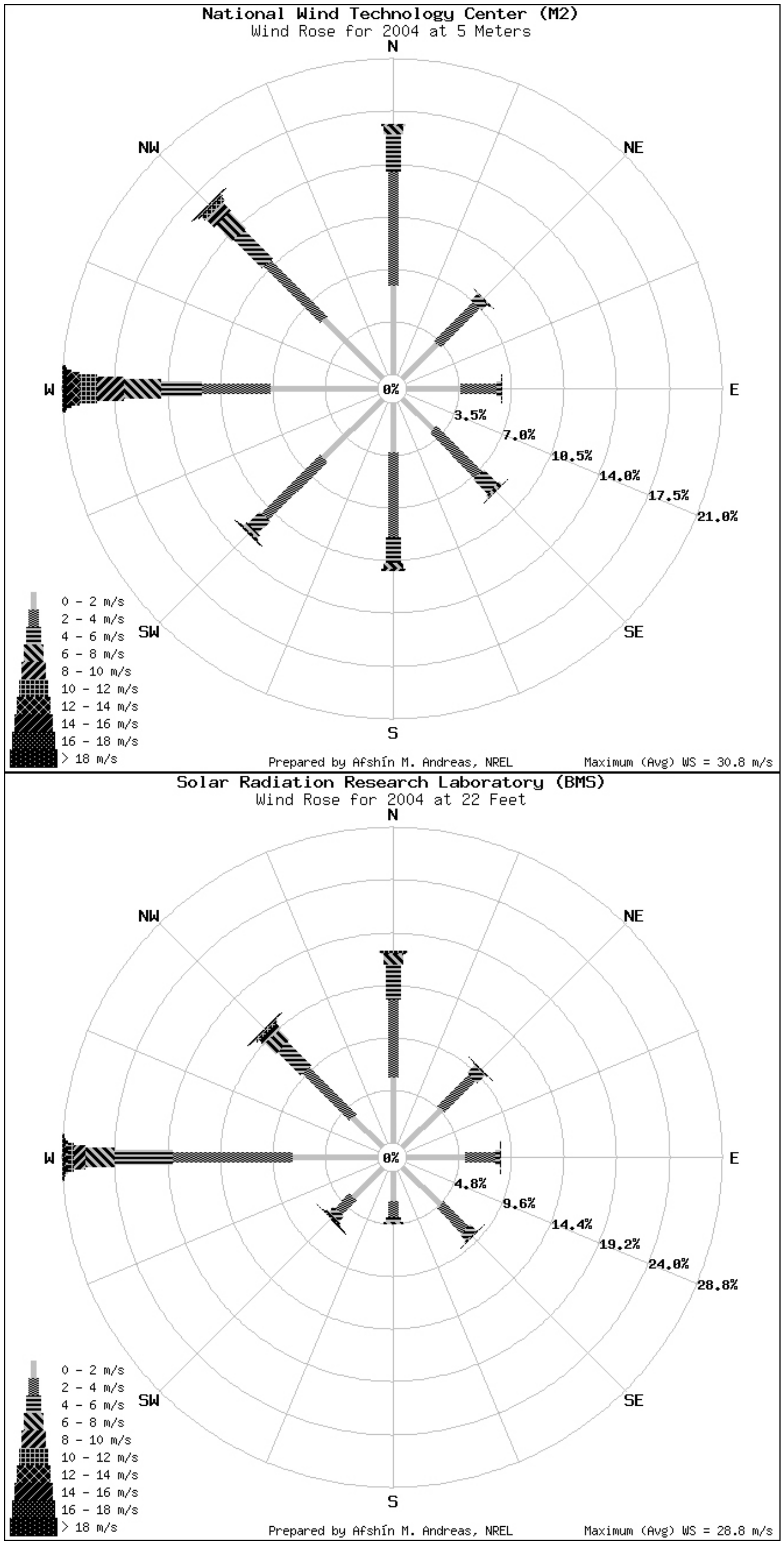
4.6.1 AFFECTED ENVIRONMENT

The Northwest Corridor study area lies at the base of the foothills of the Rocky Mountains west of the Denver metropolitan region. Based on the year 2000 census, the seven-county Denver metropolitan region has approximately 2.4 million residents. The study area elevations are generally between 5,400 and 6,200 feet above sea level. To the west is the much higher Front Range of the Rocky Mountains while to the east, at a lower elevation, is the South Platte River valley leading onto the Great Plains. The study area crosses several creeks that generally run from west to east, the largest being Clear Creek.

Weather can affect air quality. The study area generally receives about 19 inches of precipitation annually; the wettest months are generally May and April. The coldest month for the study area usually is January, with average daily temperature ranges of 20–48 degrees Fahrenheit. The warmest month usually is July, with average daily temperature ranges of 55–90 degrees Fahrenheit. Thermal inversions can occur in the study area during times of low winds that can lead to degraded air quality. These conditions are monitored by the APCD through the air quality program for the Denver metropolitan region. Prevailing winds in the study area can be somewhat variable due to local topography, but the prevailing winds near ground surface at the National Renewal Energy Laboratory sites (NREL) in Golden and at the north side of Rocky Flats National Wildlife Refuge tend to be from the west and north (see **Figure 4.6-1**).

Air quality can be affected at a local level to some degree by local traffic, but traffic is more of a regional issue for an urban area like metropolitan Denver. Air quality monitoring and emissions controls occur at the regional or national level, not at the local project level. The study area includes urban areas as well as undeveloped areas, but the entire study area is classified for air quality according to the status of the larger Denver metropolitan region. The entire study area is subject to the same regional air quality controls and limits; there are no sub-areas within the study area with a different air quality classification or different air quality rules. Therefore, there are no meaningful differences in the air quality situation between the north and south ends of the study area.

Figure 4.6-1 Prevailing Winds, National Renewable Energy Laboratory Sites



Source: National Renewable Energy Laboratory 2005.

4.6.1.1 National Ambient Air Quality Standards Overview

The Clean Air Act and its amendments led to the creation of National Ambient Air Quality Standards (NAAQS) by USEPA for criteria air pollutants: carbon monoxide (CO), sulfur dioxide, ozone (O_3), suspended particulate matter (PM_{10}), nitrogen dioxide, and lead (see **Table 4.6-1**). Most of the NAAQS have been in force for several decades, but in 1997 USEPA modified the O_3 standard from 1 hour to 8 hours and added a standard for very fine particulate matter ($PM_{2.5}$). Implementation of the two newest NAAQS began in 2004.

Table 4.6-1 National Ambient Air Quality Standards

Pollutant	Averaging Time	Primary Standard
Carbon Monoxide	8 hours	9 ppm
	1 hour	35 ppm
Sulfur Dioxide	Annual	0.030 ppm
	24 hours	0.14 ppm
Ozone	8 hours	0.08 ppm
	1 hour (valid only in 14 areas)	0.12 ppm
Particulate Matter <10 µm (PM_{10})	Annual (revoked 12-17-06)	50 µg/m³
	24 hours	150 µg/m³
Particulate Matter <2.5 µm ($PM_{2.5}$)	Annual	15 µg/m³
	24 hours*	35 µg/m³
Nitrogen Dioxide	Annual	0.053 ppm
Lead	Quarterly	1.5 µg/m³

Notes: ppm = parts per million;
µg/m³ = micrograms per cubic meter;
µm = micrometers
*= Effective 12-17-06; prior standard was 65 µg/m³

Source: U.S. Environmental Protection Agency, 2005b.

Under the Clean Air Act, cities and regions have been required to determine their compliance with the NAAQS through air quality monitoring since the early 1970s. Areas that do not meet NAAQS are classified as nonattainment areas for that pollutant and State Implementation Plans designed to bring the areas into compliance with the NAAQS are developed for those pollutants. Areas that do meet the NAAQS are classified as attainment areas. These classifications tend to be long term and do not change often. The Denver metropolitan region has been in attainment of the sulfur dioxide, nitrogen dioxide, and lead NAAQS since monitoring began. The Denver metropolitan region had been a nonattainment area for CO, O_3 (1-hour), and PM_{10} since the early 1970s, so those pollutants have historically been concerns in the study area. A number of successful air quality improvement actions over many years have resulted in cleaner air and in the Denver metropolitan region meeting all of the NAAQS that were in force in 2001. USEPA reclassified the Denver metropolitan region as an attainment/maintenance area in 2001 and 2002 for CO, O_3 (1-hour), and PM_{10}, and regional maintenance plans are now in effect for all of these pollutants.

In 2004, USEPA designated nonattainment areas for the new $PM_{2.5}$ and 8-hour O_3 NAAQS. No areas in Colorado have been designated as nonattainment for $PM_{2.5}$, so it is not a major issue for this study. However, several air quality monitoring stations, including two within the study area (Rocky Flats and the National Renewable Energy Laboratory), have measured exceedences of the 8-hour O_3 NAAQS and often some of the highest O_3 concentrations in the Denver metropolitan region each year are measured in the study area. From this monitoring data, the Denver area air quality agencies learned that there would be an O_3 problem under the 8-hour NAAQS and created an Early Action Compact with USEPA in 2002 to begin reducing O_3 concentrations. The Early Action Compact includes several strategies for reducing emissions of the air pollutants that form O_3 (CAQCC, 2004b): volatile organic compounds (VOCs) and the many oxides of nitrogen (commonly referred to as NO_x) including nitrogen dioxide. The Early Action Compact requires attainment of the 8-hour O_3 NAAQS no later than 2007, which is sooner than would be required under the normal nonattainment status rules. USEPA designated the Denver metropolitan region as nonattainment for the 8-hour O_3 standard in April 2004; however, the nonattainment designation is deferred as long as the region meets the milestones of the Early Action Compact.

CARBON MONOXIDE

CO is an odorless, colorless gas that is most commonly formed by the incomplete combustion of fuel. CO is dangerous because it interferes with the body's ability to absorb oxygen. High concentrations of CO can cause dizziness, headaches, loss of vision, impaired dexterity, and even death if the concentration is high enough. Major sources of CO include vehicle exhaust, coal burning, and forest fires. CO is most commonly a concern in localized areas around the CO sources, such as near congested road intersections. CO can be a regional concern if concentrations are high enough and disperse into the surrounding area.

PARTICULATE MATTER

Particulate matter (both PM_{10} and $PM_{2.5}$) is a complex mix of very small solid particles and liquid droplets. Particulate matter is concerning because it can be inhaled deeply into the lungs and interfere with lung function or lead to other health effects. Particulate matter can aggravate asthma, diminish lung capacity, and cause lung or heart problems. Particulate matter can also cause haze in the atmosphere. Sources of particulate matter include road dust, smoke, and diesel engine exhaust. Particulate matter can be a concern around its sources, but winds can also disperse particulate matter over a larger area and cause regional concerns.

GROUND-LEVEL OZONE

Ground-level O_3 is a gas that is not typically emitted by any common sources; rather O_3 is formed by chemical reactions between other pollutants in the air. NO_x and VOCs in the presence of sunlight and certain weather conditions can form O_3. O_3 is a strong oxidizing agent and can damage cells in lungs and plants. O_3 can cause eye irritation, coughing, and lung damage. There are no major sources of O_3 itself because O_3 is not emitted directly. However, O_3 concentrations are affected by the sources of the precursor pollutants NO_x and VOCs. O_3 is a regional concern because it takes time for O_3 to form and the pollutants can drift a considerable distance from the sources in that time (CARB, 2002). Rural/undeveloped areas can have high O_3 levels because of transported pollutants rather than local emissions (CARB, 2002).

NITROGEN DIOXIDE

The atmosphere is about 80 percent nitrogen gas. When fuel is burned at a high temperature in air, the nitrogen can react with oxygen to form gases such as nitrogen dioxide and other oxides of nitrogen, all of which are commonly referred to as NO_x. NO_x can contribute to O_3 formation, particulate matter formation, and acid deposition. Common sources of NO_x are vehicles and electrical utilities. Nitrogen dioxide can damage cells in lungs and plants and damage water quality. NO_x can be transported over great distances and is a regional concern.

SULFUR DIOXIDE

Sulfur is present in many raw materials such as coal and oil, and sulfur dioxide forms when these materials are burned. The major source of sulfur dioxide is electrical utilities; vehicles are not a major source. Sulfur dioxide can cause respiratory illness and acid deposition. Sulfur dioxide can be transported over great distances and is a regional concern.

LEAD

Lead is a naturally occurring metal. The major sources of lead currently are the metals-processing industries and incinerators. Vehicle exhaust was a dominant source when leaded gasoline was still in wide use, but that has not been the case for several decades. Residual lead concentrations in soil are a concern in some urban areas. Lead can cause organ and brain damage, particularly in children. Lead typically is a local concern near the lead source.

VEHICLE EMISSIONS

Of the NAAQS pollutants, motor vehicles tend to be sources of CO, nitrogen dioxide, and particulate matter as vehicle exhaust includes direct emission of these pollutants. Vehicles also generate particulate matter from road dust and brake and tire wear. Ground-level ozone is not emitted directly from vehicles but rather is the product of a complex reaction between NO_x and VOCs, both of which vehicles emit so vehicles are contributors to ozone pollution. Heavy duty engines can emit sulfur dioxide, but are not major sources of it. Motor vehicles have not been a substantial source of lead since the advent of unleaded gasoline several decades ago.

4.6.1.2 EMISSION TRENDS OVERVIEW

Air pollutants can come from a number of sources, including on-road vehicles, off-road vehicles like construction equipment, area sources like feedlots, and point sources like power plants. For several decades, there has been a nationwide trend of decreasing overall pollutant emissions from vehicles, even when allowing for the growing number of miles driven. These improving results are due to a number of successful emission control regulations.

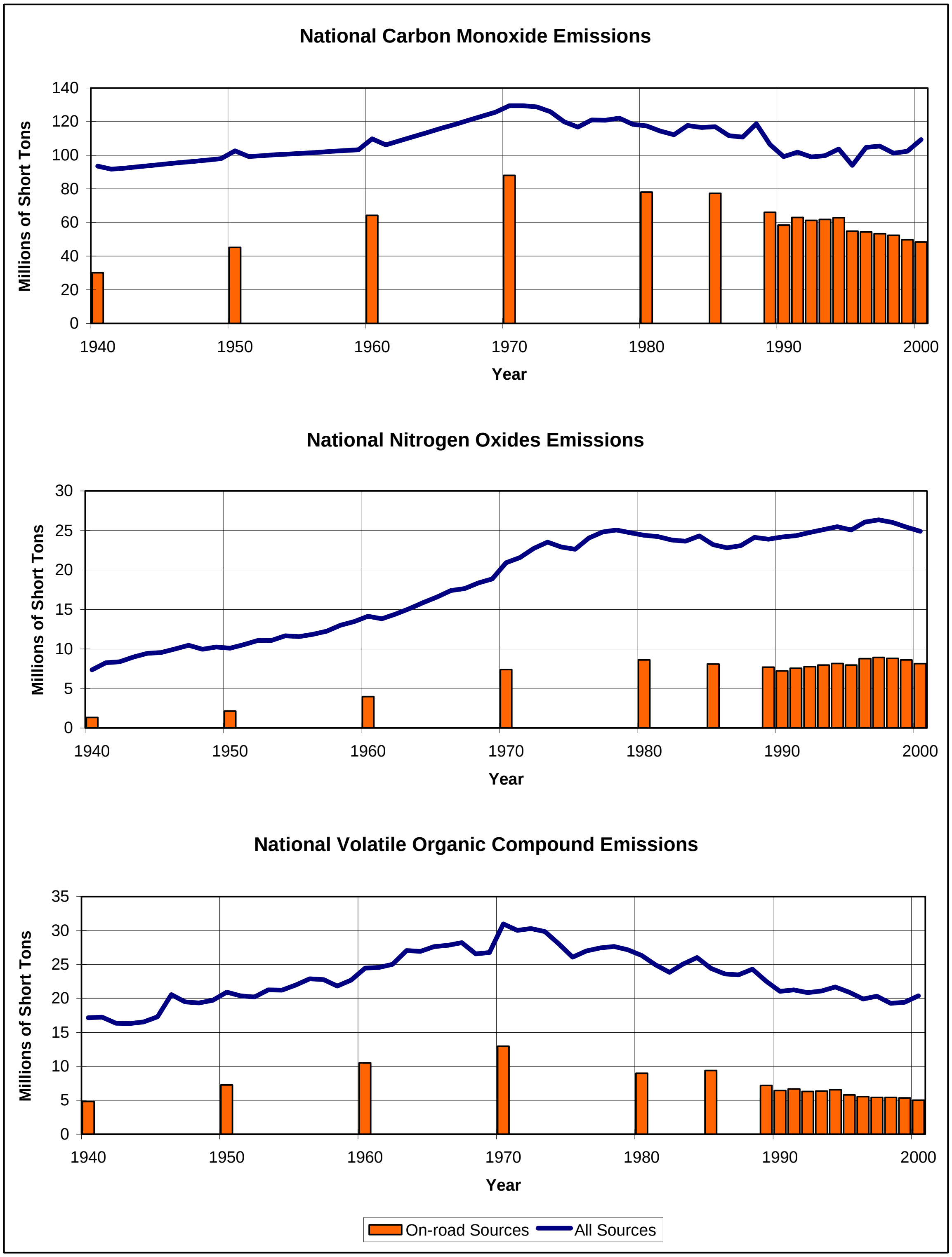
CO, O_3, and PM_{10} are the pollutants of greatest concern in the Denver metropolitan region because of their former nonattainment status. USEPA has studied the nationwide emissions of these pollutants (USEPA, 2000; 2003) and the trends for CO, NO_x, and VOCs have been examined (see **Figure 4.6-2**). NO_x and VOCs are precursors of O_3 and their trends provide an indication of likely O_3 trends. Most of the PM_{10} from vehicles is road dust and that depends on local road conditions rather than tailpipe emissions, so a corresponding graph of tailpipe emissions for PM_{10} is not included.

Vehicle emissions contribute varying amounts to the overall pollutant emissions, but the percentage from vehicles tends to be declining even though national vehicle miles traveled more than doubled over the past 30 years. Advances in vehicle technology, as well as cleaner fuels, have been major reasons for the improvements. Several new federal regulations for vehicle emissions are expected to continue the trend of improvement and further lower vehicle emissions in the future.

The estimated emission trends for the Denver metropolitan region also show decreases for most of the pollutants (RAQC, 2004). A large portion of regional CO emissions are from vehicles and this is expected to decrease in the future as each vehicle will emit less CO (see **Figure 4.6-3**). Vehicles are also a major source of PM_{10}, mainly from road dust (see **Figure 4.6-4**). PM_{10} emissions may rise because of more road dust from more vehicles. Vehicles are substantial sources of VOCs and NO_x, which contribute to O_3, and emissions of these pollutants are expected to decrease due largely to improvements in vehicles and fuel controls (see **Figure 4.6-5** and **Figure 4.6-6**).

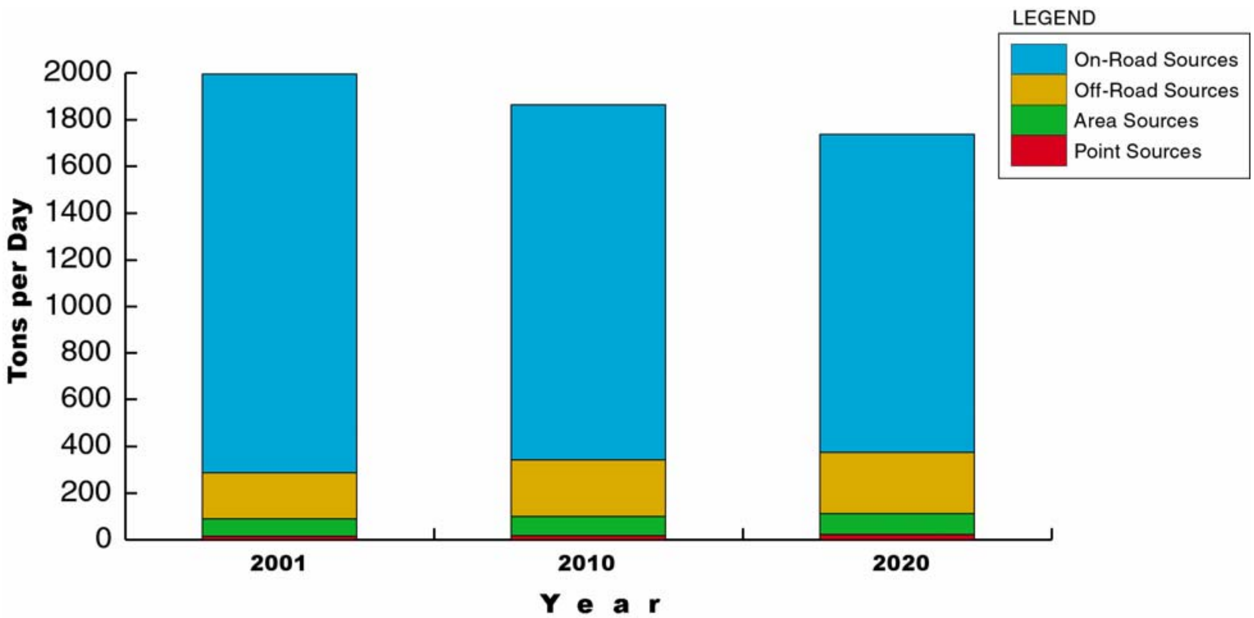
Future average vehicle emissions are estimated using USEPA's MOBILE6 software. Predicted emission rates over time for CO, VOCs, and NO_x for an average vehicle are shown below, along with earlier estimates for comparison (see **Figure 4.6-7**). PM_{10} emissions are mostly from road dust, which is a local trait that MOBILE6 does not calculate, and therefore they are not shown. The federal regulations that are reducing tailpipe emissions do not apply to road dust. There is a trend toward fewer emissions per vehicle for most of the pollutants of concern in Denver, even though there is also a trend of more vehicles and miles traveled. So while each vehicle is expected to emit less in the future, more vehicles are expected to be on the roads.

Figure 4.6-2 National Emissions Trends



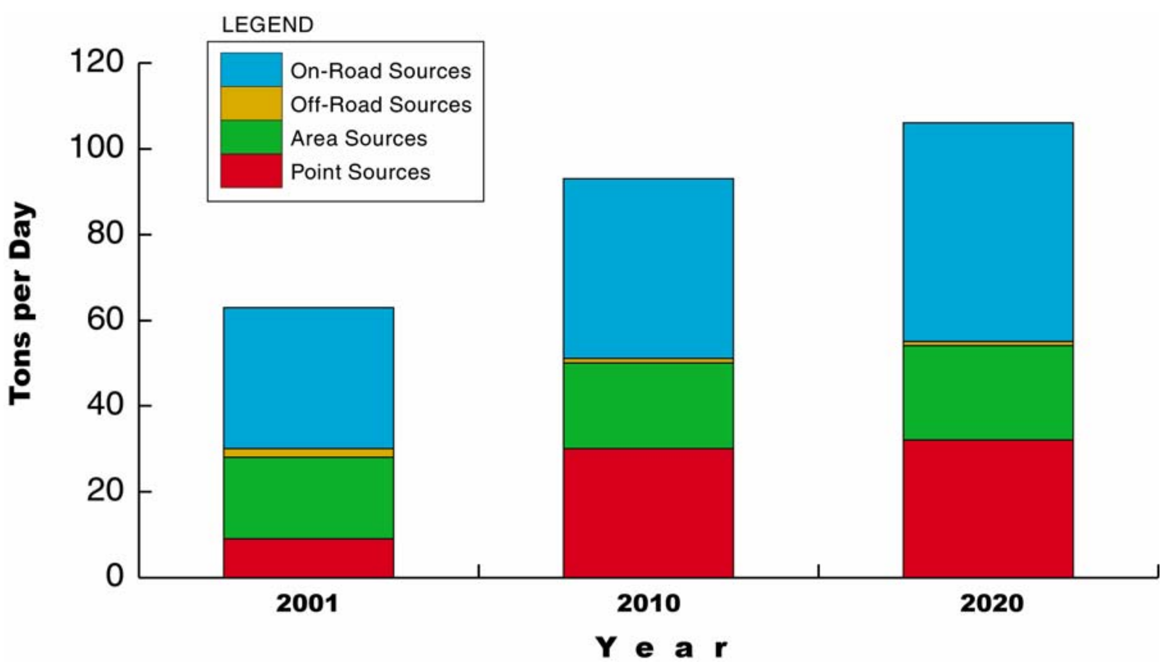
Source: U.S. Environmental Protection Agency, 2000a.

Figure 4.6-3 Denver Regional Carbon Monoxide Emissions Trends



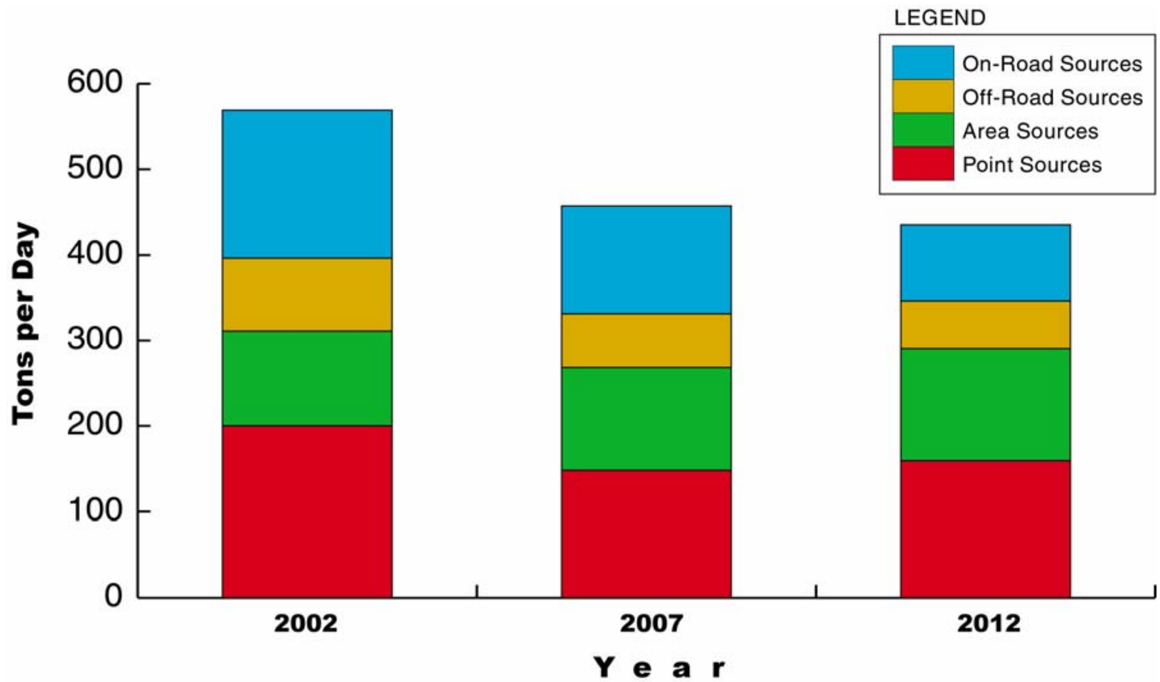
Source: Colorado Air Quality Control Commission, 2005a.

Figure 4.6-4 Denver Regional PM_{10} Emission Trends



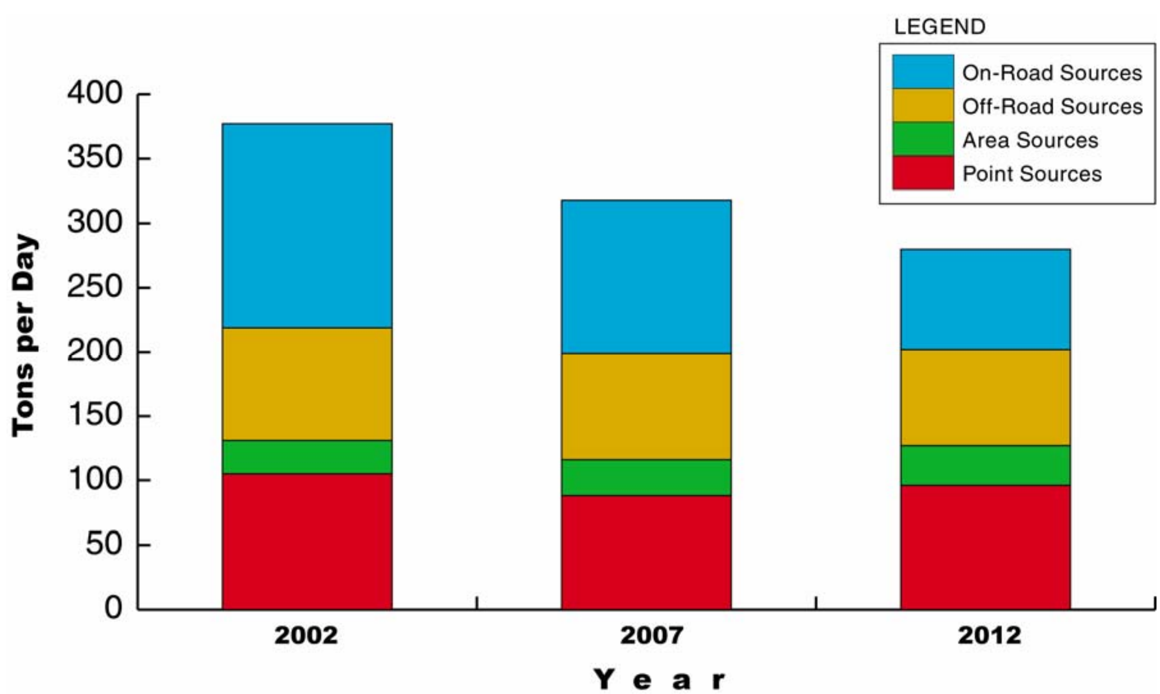
Source: Colorado Air Quality Control Commission, 2005b.

Figure 4.6-5 Denver Regional VOC Emission Trends



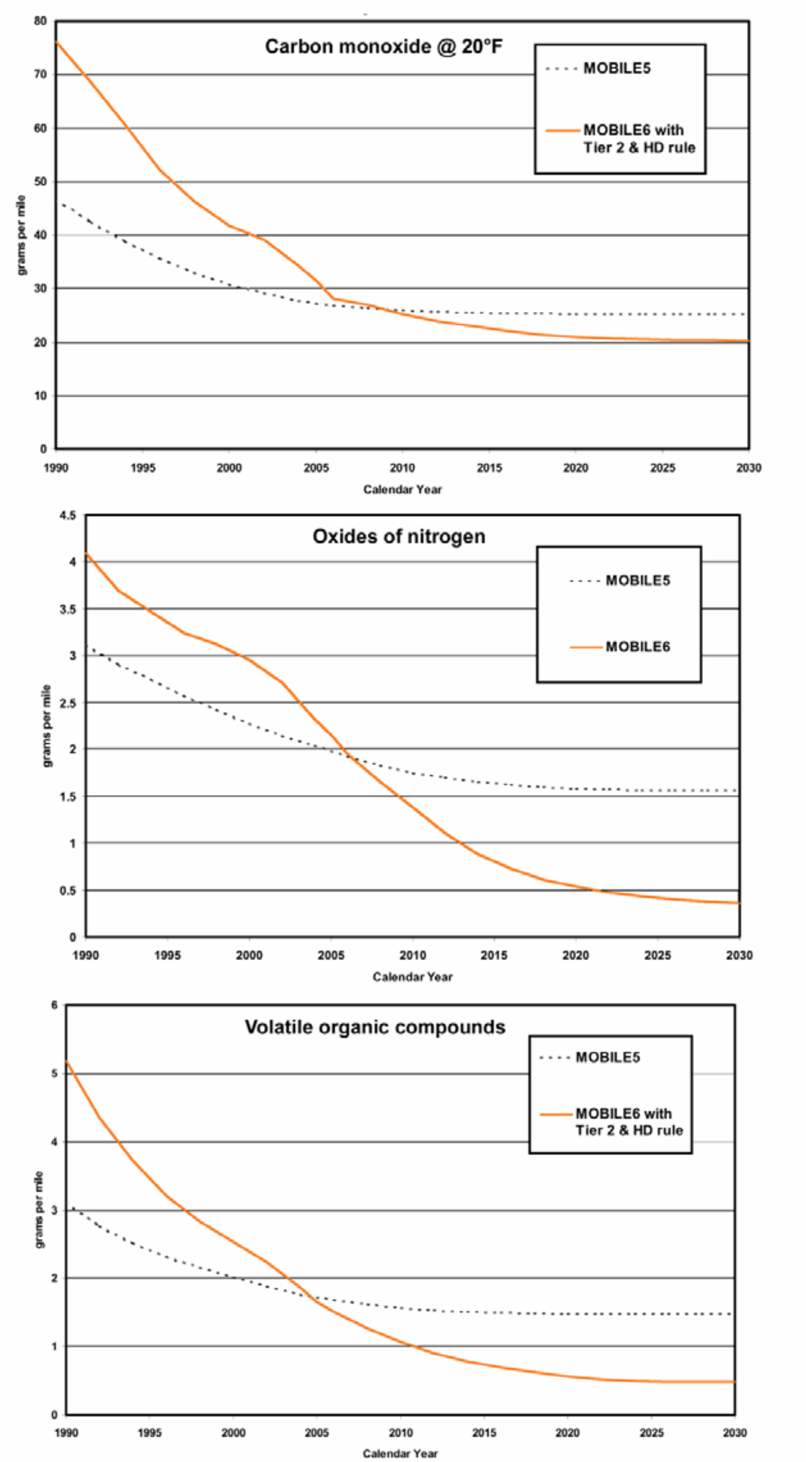
Source: Colorado Air Quality Control Commission, 2004b.

Figure 4.6-6 Denver Regional NO_x Emission Trends



Source: Colorado Air Quality Control Commission, 2004b..

Figure 4.6-7 Average Vehicle Emissions Rates (From Utilizing MOBILE6 and MOBILE5 Software)



Source: U.S. Environmental Protection Agency, 2003.

4.6.1.3 SENSITIVE RECEPTORS

The receptors most likely to be directly affected by pollutants from roads are those closest to the roads. There are approximately 100 developed properties within about 100 feet of the existing major roads (e.g., SH 93) that were examined within the study area. Particular concern was expressed by some members of the public about Mitchell Elementary School in Golden, approximately 225 feet from SH 93. The alternatives being considered in this study may bring major roads closer to some receptors and may move others away from some receptors.

4.6.1.4 NAAQS MONITORING DATA OVERVIEW

There are several air quality monitoring stations operated by the APCD in the Denver metropolitan region that measure the NAAQS pollutants (see **Northwest Corridor Supporting Technical Document-Air Quality Assessment**). Other stations were operated in the past but are now inactive. The active stations closest to the study area and the NAAQS data from each of them used for this analysis are:

- Arvada (CO, O_3)
- Rocky Flats National Wildlife Refuge (O_3)
- National Renewable Energy Laboratory-Golden (O_3)
- 636 Lookout Mountain Road (O_3, only operated in 2004)
- 225 W. Colfax Avenue (PM_{10})
- CAMP-downtown Denver ($PM_{2.5}$, nitrogen dioxide)

Some of these stations are outside the study area, but overall these are the nearest active stations.

The most recent complete data set from these stations is for 2006. In 2006, none of the NAAQS levels were exceeded for CO, PM_{10}, $PM_{2.5}$, or nitrogen dioxide. O_3 exceeded the NAAQS concentration at one station (Rocky Flats National Wildlife Refuge), but did not cause a violation of the NAAQS due to the 3-year averaging requirement (see **Northwest Corridor Supporting Technical Document-Air Quality Assessment**). Monitoring data for the three pollutants (CO, PM_{10}, and O_3) subject to maintenance plans in the Denver metropolitan region are summarized below.

CARBON MONOXIDE

Measured concentrations of CO in the Denver metropolitan region have not violated the NAAQS since 1995 (CAQCC, 2004a).

PARTICULATE MATTER

Measured concentrations of PM_{10} in the Denver metropolitan region have not violated the NAAQS since 1993 (CAQCC, 2004a). Measured concentrations of $PM_{2.5}$ in the Denver metropolitan region have not violated the NAAQS since monitoring began (CAQCC, 2004a).

OZONE

Measured concentrations of 1-hour O_3 in the Denver metropolitan region have not violated the NAAQS since 1987 (CAQCC, 2001). The fourth maximum measured concentrations of 8-hour O_3 at monitoring stations in the Denver metropolitan region exceeded the NAAQS concentration in 2003 and 2006 (see **Table 4.6-2**).

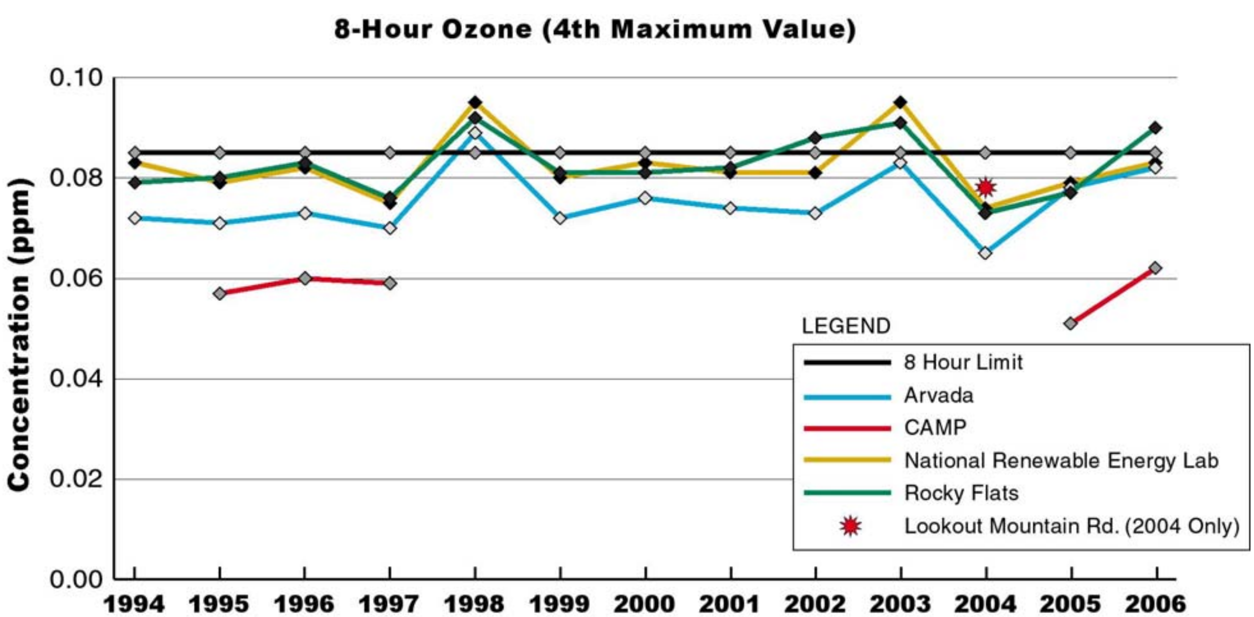
The Denver metropolitan region has had difficulty meeting the 8-hour O_3 NAAQS in recent years. A closer look at past O_3 data is presented (see **Figure 4.6-8** and **Table 4.6-2**). Efforts are underway within the Denver metropolitan region to reduce O_3 levels. Clearly, 2003 was a bad year for O_3. Yet, according to the data, it also appears that there may be progress toward reducing 8-hour O_3 concentrations in the Denver metropolitan region through air quality management strategies. The Early Action Compact (CAQCC, 2004b) includes several such strategies as well as measures to ensure that the O_3 reduction milestones are met. The Early Action Compact requires that the O_3 NAAQS be met by the end of 2007.

Because O_3 is a regional pollutant and both O_3 and O_3 precursors can be transported over great distances before causing O_3 problem areas, control measures need to be on a regional or larger basis to be effective. To that end, the Early Action Compact (CAQCC, 2004b) includes several emission reduction strategies for the northern Front Range area to reduce future O_3 concentrations. In addition, there are air quality improvement actions occurring under other programs. For example, RAQC sponsors several programs to reduce ozone pollution across the Denver metropolitan area, including:

- Repair Your Air , a program using remote sensing to identify high polluting vehicles and assist with vehicle repairs
- Mow Down Pollution, a campaign to replace gasoline-powered lawn mowers with electric mowers
- RapidScreen, a program using remote sensing to identify clean vehicles and simplifying emissions testing
- Summer Chill, a campaign to curtail certain types of activities on high ozone days
- Clean Yellow Fleets For Blue Skies, a program to retrofit diesel school buses and reduce engine idling
- Diesel Initiative For Retrofit Technology, an initiative to reduce emissions from off-road diesel vehicle fleets
- Clean Local Fleets, a program to retrofit on-road diesel vehicles or convert them to alternative fuels

Other regional programs include the RideArrangers and RideSmart Thursdays programs administered by DRCOG and the Regional Transportation District, respectively. These programs receive funding through the federal Congestion Mitigation and Air Quality program. In total, the regional programs represent a substantial commitment by local agencies to improve air quality throughout the Denver metropolitan area.

Figure 4.6-8 Study Area O_3 Concentrations



Source: U.S. Environmental Protection Agency, 2005a.

Table 4.6-2 Summary of 8-Hour Ozone Monitoring Data

Year	Range of Measured Compliance Values	Number of Days Compliance Value Exceeded NAAQS Value
2006	0.082 to 0.090 ppm	Rocky Flats–2 NREL and Arvada–None
2005	0.077 to 0.079 ppm	None
2004	0.065 to 0.078 ppm	None
2003	0.083 to 0.095 ppm	Rocky Flats–12 NREL–9 Arvada–None
2002	0.073 to 0.088 ppm	Rocky Flats–3 NREL and Arvada–None
2001	0.074 to 0.082 ppm	None

Source: U.S. Environmental Protection Agency, 2005a.

4.6.1.5 Other Air Quality Considerations

Other air quality considerations for which NAAQS have not been established are air toxics, localized concerns, and general construction activities.

Air Toxics

In addition to the criteria air pollutants for which there are NAAQS, USEPA also regulates air toxics. FHWA has also issued interim guidance for air toxics analysis (FHWA, 2006a). 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).

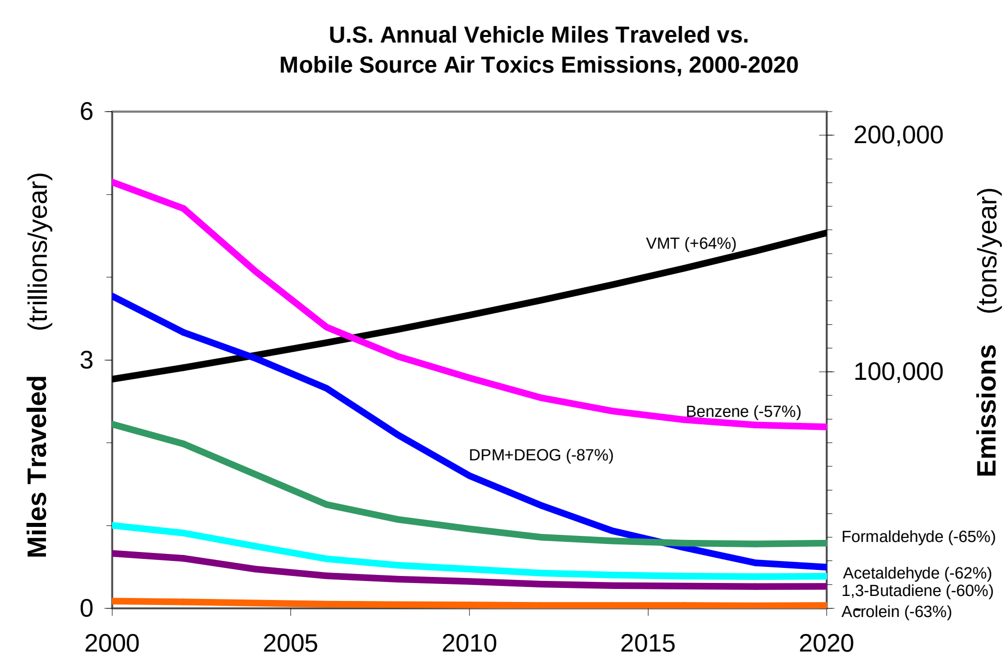
The group of 21 Mobile Source Air Toxics (MSATs) that has been identified by USEPA is a subset of the 188 air toxics defined by the Clean Air Act. MSATs are compounds emitted from highway vehicles and non-road equipment. Some toxic compounds are present in fuel and are emitted to the air when the fuel evaporates or passes through the engine unburned. Other toxics are emitted from the incomplete combustion of fuels or as secondary combustion products. Metal air toxics also result from engine wear or from impurities in oil or gasoline (USEPA, 2000b).

USEPA is the lead Federal Agency for administering the Clean Air Act and has certain responsibilities regarding the health effects of MSATs. USEPA issued a Final Rule under the authority of Section 202 of the Clean Air Act (USEPA, 2001). Through the rule, USEPA examined the impacts of existing and newly promulgated mobile source control programs, including the reformulated gasoline program, the national low emission vehicle standards, the Tier 2 motor vehicle emissions standards and gasoline sulfur control requirements, and the proposed heavy duty engine and vehicle standards and on-highway diesel fuel sulfur control requirements. Through this rule, USEPA identified a reduced list of six priority MSATs: acetaldehyde, benzene, formaldehyde, diesel exhaust, acrolein, and 1,3-butadiene (USEPA, 2001).

Between 2000 and 2020, FHWA projects that even with a 64 percent increase in VMT, these programs will reduce on-highway emissions of benzene, formaldehyde, 1,3-butadiene, and acetaldehyde by 57 percent to 65 percent, and will reduce on-highway diesel particulate emissions by 87 percent (see **Figure 4.6-9**). USEPA is preparing another rule under authority of Section 202(l) of the Clean Air Act that will address these issues and could make adjustments to the full 21 and the primary six MSATs.

The APCD has intermittently monitored ambient concentrations of some MSATs at several stations in the Denver metropolitan region. The most complete MSAT dataset closest to the study area was from the CAMP station in downtown Denver (see **Northwest Corridor Supporting Document-Air Quality Assessment**). The ambient concentrations of two MSATs (benzene and 1,3-butadiene) are illustrated below (see **Figure 4.6-10**). While vehicle emissions are prominent sources of some MSATs, they are not the only sources. Even so, it is likely that the CAMP station concentrations of these two MSATs would be higher than concentrations in the study area due to the greater number and density of vehicles in a more heavily urbanized area.

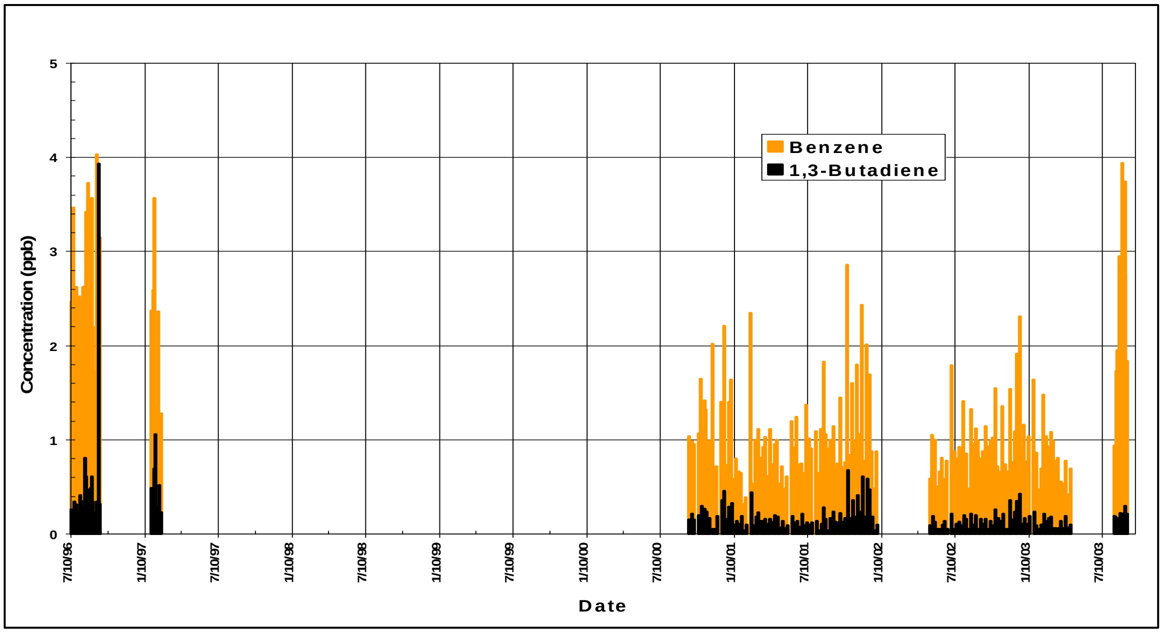
Figure 4.6-9 Projected Yearly MSAT Emissions



Notes: For on-road mobile sources. Emissions factors were generated using MOBILE6.2. MTBE proportion of market for oxygenates is held constant, at 50%. Gasoline RVP and oxygenate content are held constant. VMT: *Highway Statistics 2000*, Table VM-2 for 2000, analysis assumes annual growth rate of 2.5%. "DPM + DEOG" is based on MOBILE6.2-generated factors for elemental carbon, organic carbon and SO4 from diesel-powered vehicles, with the particle size cutoff set at 10.0 microns.

Source: Federal Highway Administration, 2006a.

Figure 4.6-10 Select CAMP Station MSATs Data



Source: Colorado Department of Public Health and Environment, Air Pollution Control Division 2005a.

Summary of Existing Credible Scientific Evidence Relevant to Evaluating the Impacts of MSATs

Research into the health impacts of MSATs is ongoing. For different emission types, there are a variety of studies that show that some emissions either are statistically associated with adverse health outcomes through epidemiological studies or show that animals demonstrate adverse health outcomes when exposed to large doses. Exposure to toxics has been a focus of a number of USEPA efforts. Most notably, USEPA conducted the National Air Toxics Assessment (USEPA, 1996) to evaluate modeled estimates of human exposure applicable to the county level. While not intended for use as a measure of local exposure, the modeled estimates illustrate the levels of various toxics when aggregated to a state or national level.

USEPA is in the process of assessing the risks of various kinds of exposures to these pollutants. The USEPA Integrated Risk Information System (IRIS) is a database of human health effects that may result from exposure to various substances found in the environment. The following toxicity information for the six prioritized MSATs was taken from the IRIS database Weight of Evidence Characterization summaries (USEPA, 2005c). This information is taken verbatim from USEPA's IRIS database and represents the agency's most current evaluations of the potential hazards and toxicology of these chemicals or mixtures.

- Benzene is characterized as a known human carcinogen.
- The potential carcinogenicity of acrolein cannot be determined because the existing data are inadequate for an assessment of human carcinogenic potential for either the oral or inhalation route of exposure.
- Formaldehyde is a probable human carcinogen, based on limited evidence in humans, and sufficient evidence in animals.
- 1,3-butadiene is characterized as carcinogenic to humans by inhalation.
- Acetaldehyde is a probable human carcinogen based on increased incidence of nasal tumors in male and female rats and laryngeal tumors in male and female hamsters after inhalation exposure.

- Diesel exhaust is likely to be carcinogenic to humans by inhalation from environmental exposures. Diesel exhaust as reviewed in this document is the combination of diesel particulate matter and diesel exhaust organic gases.
- Diesel exhaust also represents chronic respiratory effects, possibly the primary noncancer hazard from MSATs. Prolonged exposures may impair pulmonary function and could produce symptoms such as cough, phlegm, and chronic bronchitis. Exposure relationships have not been developed from these studies.

Benzene is unique among the six priority MSATs in that it is present both in fuel and in tailpipe emissions, while the other priority MSATs are generally only in tailpipe emissions. Therefore, benzene emissions can come from more sources than the other priority MSATs and are directly affected by more regulatory controls such as Tier 2 and reformulated gasolines (see **Northwest Corridor Supporting Document-Air Quality Assessment**).

There have been other studies that address MSAT health impacts in proximity to roadways. The Health Effects Institute, a non-profit organization funded by USEPA, FHWA, and industry, has undertaken a major series of studies to research near-roadway MSAT hot spots, the health implications of the entire mix of mobile source pollutants, and other topics. The final summary of the series is not expected for several years.

Some recent studies have reported that proximity to roadways is related to adverse health outcomes, particularly respiratory problems (South Coast Air Quality Management District, 2000; Sierra Club, 2004; and Environmental Law Institute, 2005). Much of this research is not specific to MSATs, but instead surveys the full spectrum of both NAAQS and other pollutants. The FHWA cannot evaluate the validity of these studies, but more importantly, the studies do not provide information that would be useful to alleviate the uncertainties listed above and enable a more comprehensive evaluation of the health impacts specific to this project.

<u>Unavailable or Incomplete Information for Project-Specific MSAT Impact Analysis</u>

This analysis includes a basic assessment of the likely MSAT emission impacts in the study area. However, the available technical tools do not allow prediction of the project-specific health impacts of the emission changes associated with the alternatives. Due to these limitations, the following discussion is included in accordance with CEQ regulations (40 CFR 1502.22(b)) regarding incomplete or unavailable information.

Evaluating the environmental and health impacts from MSATs on a proposed highway project would involve several key elements, including emissions modeling, dispersion modeling to estimate ambient concentrations resulting from the estimated emissions, exposure modeling to estimate human exposure to the estimated concentrations, and then final determination of health impacts based on the estimated exposure. Each of these steps faces technical shortcomings or uncertain science that prevents a more complete determination of the MSAT health impacts in the study area.

1. *Emissions: The USEPA tools to estimate MSAT emissions from motor vehicles are not sensitive to key variables in the context of highway projects. While MOBILE 6.2 is used to predict emissions at a regional level, it has limited applicability at the project level. MOBILE 6.2 is a trip-based model-emission factors are projected based on a typical trip of 7.5 miles, and on average speeds for this typical trip. This means that MOBILE 6.2 does not have the ability to predict emission factors for a specific vehicle operating condition at a specific location at a specific time. Because of this limitation, MOBILE 6.2 can only approximate the operating speeds and levels of congestion likely to be present on the largest-scale projects, and cannot adequately capture emissions effects of smaller projects. For particulate matter, the model results are not sensitive to average trip speed, although the other MSAT emission rates do change with changes in trip speed. Lastly, in its discussions of particulate matter under the conformity rule, USEPA has identified problems with MOBILE6.2 as an obstacle to quantitative analysis.*

These deficiencies compromise the use of MOBILE 6.2 to estimate MSAT emissions. MOBILE6.2 is an adequate tool for projecting emissions trends, and performing relative analyses between alternatives for very large projects, but it is not sensitive enough to capture the effects of travel changes tied to smaller projects or to predict emissions near specific roadside locations.

2. *Dispersion: The tools to predict how MSATs disperse are also limited. USEPA's current regulatory models, CALINE3 and CAL3QHC, were developed and validated more than a decade ago for the purpose of predicting episodic concentrations of CO to determine compliance with the NAAQS. The performance of dispersion models is more accurate for predicting maximum concentrations that can occur at some time at some location within a geographic area. This limitation makes it difficult to predict accurate exposure patterns at specific times at specific highway project locations across an urban area to assess potential health risk. Research is being conducted on best practices in applying models and other technical methods in the analysis of MSATs. This work also will focus on identifying appropriate methods of documenting and communicating MSAT impacts in the NEPA process and to the general public. Along with these general limitations of dispersion models, FHWA is also faced with a lack of monitoring data in most areas for use in establishing project-specific MSAT background concentrations.*

3. *Exposure Levels and Health Effects: Finally, even if emission levels and concentrations of MSATs could be accurately predicted, shortcomings in current techniques for exposure assessment and risk analysis preclude us from reaching meaningful conclusions about project-specific health impacts. Exposure assessments are difficult because it is difficult to accurately calculate annual concentrations of MSATs near roadways, and to determine the portion of a year that people are actually exposed to those concentrations at a specific location. These difficulties are magnified for USEPA's standard 70-year cancer assessments, particularly because unsupportable assumptions would have to be made regarding changes in travel patterns and vehicle technology (which affects emissions rates) over a 70-year period. There are also considerable uncertainties associated with the existing estimates of toxicity of the various MSATs, because of factors such as low-dose extrapolation and translation of occupational exposure data to the general population. Because of these shortcomings, any calculated difference in health impacts between alternatives is likely to be much smaller than the uncertainties associated with calculating the impacts. Consequently, the results of such assessments would not be useful to decision makers, who would need to weigh this information against other project impacts that are better suited for quantitative analysis.*

Relevance of Unavailable or Incomplete Information

Because of the uncertainties described above, FHWA believes a quantitative assessment of the effects of air toxic emissions on human health cannot be made at the project level. While available tools do allow us to reasonably predict relative emissions changes between alternatives for larger projects, the amount of MSAT emissions from each of the project alternatives and MSAT concentrations or exposures created by each of the project alternatives cannot be predicted with enough accuracy to be useful in estimating health impacts. As noted above, the current emissions model is not capable of serving as a meaningful emissions analysis tool for smaller projects. Therefore, the relevance of the unavailable or incomplete information is that it is not possible to make a determination of whether any of the alternatives would have "significant adverse impacts on the human environment."

This air quality analysis provides a qualitative analysis of MSAT emissions relative to the various alternatives, and has acknowledged that all of the project alternatives may result in increased exposure to MSAT emissions in certain locations, although the concentrations and duration of exposures are uncertain. Because of this uncertainty, the health effects from these emissions cannot be estimated.

LOCALIZED AIR QUALITY CONCERNS

On several occasions, members of the public have expressed concern regarding their belief that there is a unique air quality situation in the Clear Creek valley in Golden. The general concern is that air pollutants collect and are trapped in the valley and that nearby air monitors do not reflect Golden's poorer conditions. A consultation meeting was held with APCD in part to address this concern. It was APCD's conclusion that the air quality situation in Golden is understood and monitored appropriately (see **Northwest Corridor Supporting Document-Air Quality Assessment).**

Some questions were also raised by the public about project-specific air quality monitoring. APCD is responsible for air quality monitoring in the Denver metropolitan area; CDOT and FHWA do not perform ambient air quality monitoring, however, CDOT is prepared to assist any local government in the study area in obtaining a surplus PM_{10} monitor from APCD for the local government's use, if requested.

Another potential localized air quality concern raised was the Rocky Flats Environmental Technology Site. Because of the nature of the site, radionuclides could be transported off-site through the air or become airborne from soil disturbance during construction. APCD conducted a multi-year air monitoring program around Rocky Flats through December 2005 (APCD, 2006). These data did not show evidence of airborne radionuclides exiting Rocky Flats. Extensive sampling programs over the years developed considerable data on radionuclides in soil at Rocky Flats and showed that plutonium concentrations in surface soil along Indiana Street that might be disturbed by road construction were well below the site action level of 50 picocuries per gram (Department of Energy, 2005).

GENERAL CONSTRUCTION ACTIVITIES

Finally, air quality impacts from construction can be a concern. Construction air quality impacts include diesel emissions from construction equipment and fugitive dust. No reasonable methods exist to calculate construction emissions impacts; therefore, construction impacts are evaluated qualitatively.

4.6.2 ENVIRONMENTAL CONSEQUENCES

Because of the past and present air quality challenges in the Denver metropolitan area, infrastructure projects that might exacerbate air quality problems must meet certain requirements before they can proceed. In general, projects of the type considered in this study must be analyzed with respect to their potential impact on air quality at both the regional and local levels.

4.6.2.1 METHODS

CDOT and FHWA consulted with the APCD, USEPA, DRCOG, and the RAQC to discuss air quality issues related to the project and to select the most appropriate approach for this study. It was decided that the air quality analysis for the project should consist of the following components:

- A regional conformity evaluation to show that the alternatives are compatible with the several state implementation plans. That analysis would be done by the DRCOG as part of the regional planning and conformity demonstration activities.
- A local "hot spot" analysis for CO to show that the proposed actions will not cause local violations of the NAAQS. Intersections that could be potential hot spots were identified and analyzed for local conformity.
- Qualitative analyses for particulate matter and O_3.
- Daily emission burden calculations for a number of air pollutants of interest.

REGIONAL CONFORMITY

In nonattainment and attainment/maintenance areas, the Clean Air Act requires that fiscally constrained long-range regional transportation plans (RTPs), transportation improvement programs (TIPs), and individual projects cannot:

- cause new violations of the NAAQS
- increase the frequency or severity of existing violations of the NAAQS
- delay attainment of the NAAQS

The transportation conformity process is the mechanism used by the responsible metropolitan planning organization (DRCOG) to ensure requirements of the Clean Air Act are met for transportation improvements. The fiscally constrained RTP and TIP must identify all projects that are expected to receive federal funds or that will require FHWA or Federal Transit Administration approval. These projects and other regionally important projects, regardless of funding source, must be included in a regional emissions analysis demonstrating conformity with the relevant State Implementation Plans. This conformity demonstration requires that RTPs and TIPs:

- are within the motor vehicle emissions budgets in the State Implementation Plans
- implement transportation control measures in a timely manner

A conformity determination is the finding by the metropolitan planning organization policy board, and subsequently by FHWA and/or the Federal Transit Administration, that an RTP/TIP meets the conformity requirements.

Individual projects can demonstrate regional conformity by being part of a conforming, fiscally constrained RTP that looks at longer-range transportation planning, and a TIP that includes projects likely to proceed in the next few years, or the road network used to demonstrate conformity. The 2030 RTP and the 2005–2010 TIP are the current fiscally constrained conforming plans.

The build alternatives envisioned in this study have not yet been included in either the RTP or TIP because the funds to build the project have not been designated or appropriated. The selected recommended alternative must ultimately be included in a conforming and fiscally constrained RTP before regional conformity can be demonstrated. This action will occur sometime in the future through an RTP amendment or update after the recommended alternative has been identified.

LOCAL CONFORMITY

Individual projects must demonstrate that they will not violate the NAAQS in localized areas, known as "hot spots." Among the NAAQS pollutants, an approved quantitative method for hot spot analysis is only available for CO. Hot spot modeling for other NAAQS pollutants or other pollutants from mobile sources is generally not required because there are no accepted USEPA guidelines for hot spot analysis of those pollutants at this time.

Potential CO hot spots were identified through a preliminary evaluation of intersections in the study area. This evaluation consisted of two components:

- Review of the overall level of service (LOS) for signalized intersections from the traffic study (FHU, 2005a) that are within, or proposed to be within the study area (see **Chapter 3**).
- Comparison of LOS from the traffic report for major intersections along the alternative alignments both with and without the possible improvements.

Areas likely to become air pollution hot spots are identified based primarily on traffic volumes and congestion, and a determination is then made whether a detailed analysis is needed for each area. Generally, the need for hot spot analysis of intersections is assessed with respect to three criteria, as suggested by USEPA:

- Will the LOS of a project intersection be D, E, or F?
- Will the project affect locations identified in the State Implementation Plan as sites of actual or potential violations of the CO NAAQS?
- Is a project intersection one of the top three in the State Implementation Plan with respect to traffic volume or worst LOS?

The goal of the selection process is to choose the most congested and heavily trafficked intersections for CO analysis as a worst case representation of the project, with these most congested intersections also representing less congested intersections and areas. If the most congested intersections do not produce hot spot problems, less congested intersections will not either. If an intersection does not meet one of the above criteria, it is unlikely to be a hot spot and need not be assessed further. Regarding specific locations of concern to the public, such as Mitchell Elementary School, the air quality conditions would be better than those at the congested intersections. The nearest hot spot analysis to Mitchell Elementary School is the US 6/SH 93/SH 58 intersection.

Several project intersections were calculated to have a LOS of D or worse and were selected for CO hot spot modeling (see **Table 4.6-3**). Details of the selection process and the analytical methodology are presented in the technical report (see **Northwest Corridor Supporting Document-Air Quality Assessment**).

Table 4.6-3 Study Area Intersections Modeled for Carbon Monoxide

Intersection	2030 LOS	Traffic Volume (vehicles per hour)	Hours of Peak Traffic	Build Alternative Modeled
US 36 WB ramps/ Interlocken Loop	F	8,850	Afternoon	Regional Arterial Alternative
US 6/Johnson Road	F	7,581	Morning	Freeway Alternative
NW Parkway/Tape Drive	F	8,570	Morning	Combined Alternative (Recommended Alternative)
US 6/Heritage Road	F	5,795	Afternoon	Tollway Alternative
SH 93/Washington Avenue	F	7,440	Afternoon	Regional Arterial Alternative
US 6/SH 93/SH 58	F	5,050	Afternoon	Tollway Alternative

Source: Northwest Corridor Supporting Document-Air Quality Assessment.

DAILY BURDEN CALCULATION

In simple terms, the daily burden is the pounds per day of each pollutant emitted by vehicles, calculated by multiplying the vehicle miles of travel on the different road types by the emission factor for that road type. Collector level and higher street classes were included in the calculation. This calculation does not include the extra emissions caused by traffic congestion and idling vehicles.

4.6.2.2 Carbon Monoxide Results

The CO levels forecast for the 2005, 2030, and the "worst case" scenarios are shown (see **Table 4.6-4**). The worst case scenario combines 2005 emission factors and 2030 traffic conditions. The maximum 1-hour CO concentration predicted from any of the models was 11.6 ppm, which is below the NAAQS of 35 ppm. The maximum 8-hour CO concentration predicted for any model year was 6.1 ppm, which is below the NAAQS of 9 ppm. Therefore, no CO hot spots in violation of the NAAQS are predicted and no mitigation is required.

Table 4.6-4 Maximum Modeled Carbon Monoxide Concentrations

Intersection	1-Hour CO Result (ppm)			8-Hour CO Result (ppm)		
	2005	Worst Case	2030	2005	Worst Case	2030
US 36 WB ramps/Interlocken Loop (Regional Arterial Alternative)	9.6	11.6	7.7	5.0	6.1	4.2
US 6/Johnson Road (Freeway Alternative)	9.5	11.1	7.1	4.9	5.8	3.8
NW Parkway/Tape Drive (Combined Alternative) (Recommended Alternative)	N/A*	11.3	7.6	N/A*	6.0	4.1
US 6/Heritage Road (Tollway Alternative)	10.4	10.6	6.9	5.4	5.6	3.7
SH 93/Washington Avenue (Regional Arterial Alternative)	9.0	11.3	7.3	4.6	6.0	3.9
US 6/SH 93/SH 58 (Tollway Alternative)	11.6	11.6	7.7	6.1	6.1	4.2

Note: *N/A Existing traffic data were not available for modeling air quality.

Source: Northwest Corridor Supporting Document-Air Quality Assessment.

CO concentrations are predicted to decrease at the target intersections in the future (2030), even with higher traffic volumes. This is primarily because vehicles will be emitting less CO. This benefit will be from federal vehicle emission regulation and will be realized regardless of which alternative is selected.

Overall, the results from modeling potential CO impacts indicate that none of the alternatives being considered will cause violations of CO standards, so any of them would be acceptable in CO terms. None of the build alternatives have a clear and universal CO benefit over the others. Each alternative has aspects at some locations where it may benefit local air quality more than the other alternatives because of less traffic congestion.

4.6.2.3 Particulate Matter Results

Unlike carbon monoxide pollution, quantitative tools for hot-spot analysis of PM_{10} pollution have not been developed and approved for mobile sources. Therefore, a qualitative process was used for the analysis and details of that analysis are presented in the technical report (see **Northwest Corridor Supporting Document-Air Quality Assessment**). $PM_{2.5}$ is not a concern anywhere in Colorado (see **Section 4.6.1.1**).

The qualitative analysis follows both the procedures in the transportation conformity rule (USEPA, 2006) and the most recent USEPA/FHWA guidance (FHWA, 2006b). The guidance requires that PM_{10} hotspot analyses address the following elements:

- Description of project
- Description of existing conditions and changes resulting from project
- Contributing Factors
  - Air Quality
  - Transportation and traffic conditions
  - Built and natural environment
  - Meteorology, climate, and seasonal data
  - Adopted emissions control measures
- Description of analysis method chosen
- Description of type of emissions considered in the analysis (e.g., exhaust, road dust, construction emissions)
- Description of analysis years; consider full time frame of area's Regional Transportation Plan, and examine year or years in which emissions are expected to peak
- Professional judgment of impact
- Evaluate both forms of PM_{10} standard (24 hour and annual)
- Discussion of any mitigation measures
- Written commitments for mitigation
- Conclusion on how project meets the requirements of 40 CFR 93.116 and 93.123

These items are discussed in the technical report (see **Northwest Corridor Supporting Document-Air Quality Assessment**). Select portions are provided below.

BACKGROUND

Section 93.123(b)(1) of the conformity rule only requires hotspot analysis for "projects of air quality concern," which are defined as projects that feature a large volume of diesel traffic. However, this provision does not apply in Colorado because Colorado's Regulation 10, which contains Colorado's conformity requirements, is based on an older version of the federal transportation conformity rule that does not reflect this provision. Thus, particulate matter hotspot analyses are required for all non-exempt federal projects in Colorado's PM_{10} maintenance areas. This includes the Northwest Corridor project, so whether the project qualifies as a "project of air quality concern" is not relevant. Section 93.123(b)(1) of the federal rule will only apply in Colorado when Regulation 10 has been revised to reflect the most recent federal requirements and the revision has been approved by USEPA.

PROFESSIONAL JUDGMENT OF IMPACT

To evaluate the potential for PM_{10} hotspots, the worst case locations in the Combined Alternative (Recommended Alternative) were compared to existing interchanges that were modeled as part of the PM_{10} maintenance plan. As a comparison location, the intersection of I-25 and C-470 was used. The traffic volume at this location in calendar year 2030 is estimated by DRCOG at approximately 340,000 vehicles per day. The I-25/C-470 interchange reflects similar land use to that of the worst-case interchange in the northern portion of the study area, including significant commercial development, office park development, and some residential land uses. The worst-case interchange in the southern portion of the study area has much less surrounding development. The traffic volumes at the northern worst-case location (173,000 vehicles per day) and the southern worst-case location (297,000 vehicles per day) are lower than the volumes modeled by DRCOG for 2030 at the I-25/C-470 interchange (340,000 vehicles per day).

In the maintenance plan, the 2030 modeled concentrations in the modeling grid including the I-25/C-470 interchange were between 100 and 110 μg/m³, well below the PM_{10} NAAQS of 150 μg/m³ (APCD, 2005b). Because the traffic volumes at the I-25/C-470 location are higher than those of the worst-case locations associated with the Northwest Corridor project, and the APCD modeling of I-25/C-470 shows that it is expected to be below the PM_{10} NAAQS in the worst-case year of 2030, it is expected that the worst-case locations for the Northwest Corridor project will also be below the NAAQS throughout the project lifetime.

DISCUSSION OF ANY MITIGATION MEASURES

As noted above, the Combined Alternative (Recommended Alternative) is not expected to cause or contribute to violations of the PM_{10} standard nor is it expected to interfere with the maintenance plan or its goals. Therefore, no mitigation is necessary to demonstrate conformity for PM_{10}. However, standard particulate control measures during construction will be implemented.

CONCLUSION ABOUT HOW PROJECT MEETS 40 CFR 93.116 AND 93.123

As outlined above, the worst-case locations associated with the Combined Alternative (Recommended Alternative) were evaluated against higher traffic volume locations that were modeled by APCD as part of the Denver PM_{10} Maintenance Plan. This modeling included the impacts of roadway traffic, precursor and construction emissions, and emissions from all other sources that contribute to urban background concentration. The evaluation showed that the worst-case locations, with lower traffic volumes, would not be likely to cause or contribute to violations of the PM_{10} NAAQS.

4.6.2.4 OZONE RESULTS

As was previously discussed, O_3 is a regional pollutant and as such is controlled at a regional level. Emissions of O_3 precursors nearby a particular location are typically not of the greatest significance because the precursors need time to mix and the right weather conditions must be present before O_3 is formed. In that time, the pollutants can drift a considerable distance. However, particular concern was expressed by some members of the public about O_3 in the study area and the potential impacts from any of the build alternatives. A consultation meeting was held with the APCD to address this issue. The APCD reaffirmed that O_3 is a regional pollutant and should be examined at that level (see **Northwest Corridor Supporting Document-Air Quality Assessment**). The regional emissions modeling performed by DRCOG considers all of the sources of O_3 precursors. Any of the build alternatives as well as any other projects in the Denver O_3 maintenance area must, in the aggregate, conform to the O_3 State Implementation Plan and must be compatible with regional O_3 concentration reductions to comply with the NAAQS. That analysis must occur at the regional level. Preliminary analysis has indicated that O_3 precursor emissions are decreasing in the Denver metropolitan region (see **Figure 4.6-5** and **Figure 4.6-6**).

Therefore, inclusion of any proposed improvements in a conforming RTP (which is yet to come) will satisfy conformity for the O_3 NAAQS.

4.6.2.5 NAAQS DAILY BURDEN RESULTS

Daily pollutant burdens were calculated for CO, O_3 precursors (NO_x and VOCs), PM_{10}, and $PM_{2.5}$ for 2005, 2010, 2020, and 2030 (see **Table 4.6-5**, **Table 4.6-6**, **Table 4.6-7** and **Northwest Corridor Supporting Document-Air Quality Assessment**). The purpose of these tables is to allow relative comparison of total vehicle emissions between current conditions and the build alternatives. These data indicate that total future emissions are expected to decrease, even with increases in total miles traveled. This is because vehicles will have to be cleaner in the future to comply with stricter regulations. These data also indicate that there are relatively minor differences in total emissions between the alternatives. It should be noted that these values do not consider the emissions from congested traffic and idling vehicles.

Table 4.6-5 Year 2010 Estimated Study Area Total Emissions

Parameter	2005 Existing	2010 No Action	2010 Freeway Alternative	2010 Tollway Alternative	2010 Regional Arterial Alternative	2010 Combined Alternative (Recommended Alternative)	Units
Carbon monoxide	221,000	208,000	215,000	213,000	211,000	212,000	Pounds per day
Oxides of nitrogen	30,000	19,500	20,100	19,900	19,700	19,900	Pounds per day
PM_{10} (total)	13,200	13,700	14,100	14,000	13,900	14,000	Pounds per day
$PM_{2.5}$ (total)	569	392	402	400	397	400	Pounds per day
Volatile organic compounds	10,000	7,640	7,830	7,810	7,720	7,800	Pounds per day
Miles traveled	8,410,000	8,900,000	9,120,000	9,090,000	9,000,000	9,080,000	Miles per day

Source: *Northwest Corridor Supporting Document-Air Quality Assessment.*

Table 4.6-6 Year 2020 Estimated Study Area Total Emissions

Parameter	2005 Existing	2020 No Action	2020 Freeway Alternative	2020 Tollway Alternative	2020 Regional Arterial Alternative	2020 Combined Alternative Recommended Alternative)	Units
Carbon monoxide	221,000	173,000	187,000	183,000	178,000	181,000	Pounds per day
Oxides of nitrogen	30,000	9,080	9,750	9,610	9,350	9,500	Pounds per day
PM_{10} (total)	13,200	15,000	16,000	15,900	15,500	15,800	Pounds per day
$PM_{2.5}$ (total)	569	291	310	308	300	305	Pounds per day
Volatile organic compounds	10,000	4,890	5,220	5,190	5,020	5,125	Pounds per day
Miles traveled	8,410,000	9,870,000	10,500,000	10,400,000	10,200,000	10,350,000	Miles per day

Source: *Northwest Corridor Supporting Document-Air Quality Assessment.*

Table 4.6-7 Year 2030 Estimated Study Area Total Emissions

Parameter	2005 Existing	2030 No Action	2030 Freeway Alternative	2030 Tollway Alternative	2030 Regional Arterial Alternative	2030 Combined Alternative (Recommended Alternative)	Units
Carbon monoxide	221,000	186,000	202,000	196,000	192,000	195,000	Pounds per day
Oxides of nitrogen	30,000	7,640	8,210	8,070	7,880	8,000	Pounds per day
PM_{10} (total)	13,200	17,500	18,700	18,600	18,100	18,400	Pounds per day
$PM_{2.5}$ (total)	569	321	342	339	331	336	Pounds per day
Volatile organic compounds	10,000	4,990	5,320	5,270	5,130	5,230	Pounds per day
Miles traveled	8,410,000	11,500,000	12,300,000	12,200,000	11,900,000	12,100,000	Miles per day

Source: Northwest Corridor Supporting Document-Air Quality Assessment.

4.6.2.6 PROJECT LEVEL MSAT ANALYSIS

None of the proposed alternatives met the thresholds requiring a quantitative MSAT analysis (FHWA, 2006a). As described previously (see **Section 4.6.1.5)**, FHWA believes the technical shortcomings of emissions and dispersion models and the uncertain science with respect to health effects prevent meaningful or reliable estimates of MSAT emissions and effects from the recommended alternative. However, even though reliable methods do not exist to accurately estimate the health impacts of MSATs at the project level, it is possible to assess qualitatively the levels of future MSAT emissions under the build alternatives. Although a qualitative analysis cannot identify and measure health impacts from MSATs, such an analysis can provide a basis for identifying and comparing the potential differences among MSAT emissions—if any—between the various alternatives. The qualitative assessment presented below is derived in part from a study conducted by the FHWA (FHWA, 2006c). The following analysis was consistent with the FHWA guidance (FHWA, 2006a).

For each alternative, the amount of MSATs emitted would be proportional to the VMT, assuming that other variables such as fleet mix are the same for each alternative. These emissions were estimated for the MSATs of primary interest for each of the alternatives (see **Northwest Corridor Supporting Technical Document-Air Quality Assessment**). Daily burdens were calculated for the years 2005, 2010, 2020, and 2030 (see **Table 4.6-8**, **Table 4.6-9**, and **Table 4.6-10**). The purpose of these tables is to allow relative comparison of total MSAT emissions between the alternatives. There are no standards for MSATs for comparison. These data indicate that total future emissions are expected to decrease from current levels, even with increases in total miles traveled. This is because vehicles will have to be cleaner in the future to comply with stricter regulations. These data also indicate that there are relatively minor differences in total emissions between the alternatives.

Overall, there could be slightly elevated but unquantifiable increases in MSATs to residents and others in a few localized areas where VMT increases and receptors are near the roads, which may be important particularly to any members of sensitive populations. However, there will likely be decreases in MSAT emissions in locations where VMT are reduced or vehicle speeds increase. In general, MSAT levels are likely to decrease over time due to nationally mandated cleaner vehicles and fuels.

Among the alternatives, approximately 100–150 developed residential or commercial properties are within approximately 100 feet of the major current or potential future study area roads. One of these properties includes Mitchell Elementary School, which was of particular concern to some members of the public. A consultation meeting was held with the APCD to address this issue (see **Northwest Corridor Supporting Technical Document-Air Quality Assessment**). As part of another project, the APCD has conducted air quality monitoring for MSATs at an elementary school near I-70 in north Denver. The area monitored for the other project experiences much more traffic on I-70 and has many more nearby industrial emissions than areas in this study area. Based on the results from the MSAT monitoring in north Denver, APCD did not consider MSATs to be a concern for the Mitchell Elementary School or the remainder of the study area (see **Northwest Corridor Supporting Technical Document-Air Quality Assessment**).

Table 4.6-8 Year 2010 Estimated Study Area Total Emissions for MSATs

Pollutant	2005 Existing	2010 No Action	2010 Freeway Alternative	2010 Tollway Alternative	2010 Regional Arterial Alternative	2010 Combined Alternative (Recommended Alternative)	Units
Acetaldehyde	171	105	107	107	106	107	Pounds per day
Acrolein	12	8	8	8	8	8	Pounds per day
Benzene	661	434	445	444	440	443	Pounds per day
Butadiene	76	53	54	54	53	54	Pounds per day
Formaldehyde	261	172	177	176	174	176	Pounds per day
PM_{10} (diesel exhaust)	313	167	171	170	169	170	Pounds per day
Miles traveled	8,410,000	8,900,000	9,120,000	9,090,000	9,000,000	9,080,000	Miles per day

Source: Northwest Corridor Supporting Document-Air Quality Assessment.

Table 4.6-9 Year 2020 Estimated Study Area Total Emissions for MSATs

Pollutant	2005 Existing	2020 No Action	2020 Freeway Alternative	2020 Tollway Alternative	2020 Regional Arterial Alternative	2020 Combined Alternative (Recommended Alternative)	Units
Acetaldehyde	171	70	74	74	72	73	Pounds per day
Acrolein	12	6	6	6	6	6	Pounds per day
Benzene	661	303	324	321	313	318	Pounds per day
Butadiene	76	35	37	37	36	37	Pounds per day
Formaldehyde	261	119	127	126	123	125	Pounds per day
PM_{10} (diesel exhaust)	313	43	45	45	44	45	Pounds per day
Miles traveled	8,410,000	9,870,000	10,500,000	10,400,000	10,200,000	10,350,000	Miles per day

Source: Northwest Corridor Supporting Document-Air Quality Assessment.

Table 4.6-10 Year 2030 Estimated Study Area Total Emissions for MSATs

Pollutant	2005 Existing	2030 No Action	2030 Freeway Alternative	2030 Tollway Alternative	2030 Regional Arterial Alternative	2030 Combined Alternative (Recommended Alternative)	Units
Acetaldehyde	171	70	75	74	72	74	Pounds per day
Acrolein	12	6	6	6	6	6	Pounds per day
Benzene	661	300	320	318	310	314	Pounds per day
Butadiene	76	35	37	37	36	36	Pounds per day
Formaldehyde	261	122	130	129	126	128	Pounds per day
PM_{10} (diesel exhaust)	313	32	34	33	32	33	Pounds per day
Miles traveled	8,410,000	11,500,000	12,300,000	12,200,000	11,900,000	12,100,000	Miles per day

Source: Northwest Corridor Supporting Document-Air Quality Assessment.

4.6.2.7 Construction Impacts

Construction of any of the build alternatives is another potential source of temporary air quality impacts. Construction activities may cause fugitive dust releases or emissions from heavy duty construction equipment. For the build alternatives, the overall construction has the potential to last several years. Adjoining properties in the study area would be near construction activities. Construction emissions differ from regular traffic emissions in several ways:

- Construction emissions last only for the duration of the construction period.
- Construction activities generally are short term and, depending on the nature of the construction operations, could last from seconds (e.g., a truck passing) to months (e.g., constructing a bridge).
- Construction can involve other emission sources, such as fugitive dust from ground disturbance.
- Construction emissions tend to be intermittent and depend on the type of operation, location, and function of the equipment, and the equipment usage cycle, rather than being present in a more continuous fashion as are traffic emissions.

The alternatives are similar in nature to other highway construction projects and the construction emissions should be representative of projects of this type and magnitude. For the build alternatives, the overall construction has the potential to last several years and adjoining properties may be near construction activities for an extended period. These kinds of projects generally do not cause meaningful air quality impacts.

All of the build alternatives would involve some construction activities on the west side of Indiana Street by the Rocky Flats National Wildlife Refuge. This area is a potential concern for radionuclides that may have been released from the former weapons plant. However, numerous studies of the area have shown the radionuclide concentrations in surface soil to be below relevant health-based clean-up levels (see **Section 4.15**). Therefore, fugitive dust from construction would not pose a significant health risk.

4.6.3 Suggested Mitigation

Given that air pollutants are not predicted to exceed the NAAQS or any other relevant air quality standards in the future as a result of implementing any of the alternatives, mitigation measures for air quality are not required. Future emissions from on-road mobile sources could be minimized through several federal regulations (such as emission standards) and regional controls (such as street sanding regulations). The Denver area maintenance plans that are already in place for CO, O_3, and PM_{10} will serve to avoid and/or minimize pollutant emissions from vehicles.

Standard emission minimization measures for construction activities, as described above, are recommended. Construction emission impacts will be minimized somewhat because much of the alternative alignments are located away from sensitive areas such as residences or schools. Even so, neighboring areas could be exposed to construction-related emissions and particular attention will be given to minimizing total emissions near any sensitive areas. To address the temporary elevated air emissions that may be experienced during construction, standard construction mitigation measures could be incorporated into construction contracts. These include following best management practices and relevant CDOT construction specifications, which would include:

- Engines and exhaust systems on equipment kept in good working order. Equipment maintained on a regular basis and subject to inspection by the project manager to ensure maintenance.
- Fugitive dust systematically controlled through diligent implementation of CDOT's *Standard Specifications for Road and Bridge Construction*, particularly Sections 107.24, 209, and 250, and APCD's Air Pollutant Emission Notification requirements. This will also control potential exposure to contaminated soil dust and will be important near Rocky Flats National Wildlife Refuge.
- No excessive idling of inactive equipment or vehicles.

- Construction equipment and vehicles using low sulfur fuel to reduce pollutant emissions.

Other emission reduction actions may include:

- Stationary equipment located as far from sensitive receivers as possible as conditions allow.
- Stricter dust control measures near schools when in session.
- Older construction vehicles retrofitted to reduce emissions.
- Air quality monitoring for specific pollutants.

4.6.4 SUMMARY

The regional conformity analyses must still be done when an alternative is selected but can not be done at this time because the required project funding has not been determined. Project-related air pollutants were evaluated through air quality analysis. Relevant NAAQS air quality standards were reviewed for the future option of implementing any of the alternatives; it was found that operational mitigation measures for air quality are not required. Regardless of which alternative is selected, future emissions from vehicles could be minimized through several federal regulations (such as emission standards) and regional controls (such as street sanding regulations). The Denver area maintenance plans already in place for CO, O_3, and PM_{10} will serve to avoid and/or minimize pollutant emissions from vehicles. Due to cleaner vehicles, future daily air pollutant levels for most pollutants are predicted to be lower than current levels, even with more vehicles on the roads. Total particulate matter levels may increase in the future because of more vehicles, but the preliminary analysis indicates the concentrations would meet the NAAQS. Standard emission minimization measures for construction activities, as previously described, are recommended.

Several air quality concerns related to the possible road improvements were raised through public involvement. These concerns were discussed with the APCD. From these discussions it was concluded that the build alternatives did not represent a substantial health concern.

No build alternative was found to cause violations of health-based air quality standards or other relevant evaluation criteria through the air quality analysis. There was not a clear order of preference of the alternatives in air quality terms. While the No Action Alternative was calculated to have somewhat lower daily air pollutant burdens because of lower VMT, this alternative would also have higher emissions in some localized areas because of more congested traffic. The four build alternatives were found to not be materially different from each other in terms of air quality impacts.

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