

SH 16

I-25 / SH 16 East Entrance to Fort Carson

AIR QUALITY ANALYSIS TECHNICAL MEMORANDUM

Prepared for:

Colorado Department of Transportation



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Air Quality

Existing Conditions

Air quality issues in the State Highway 16 (SH 16) study area include visibility and gaseous pollutant levels related primarily industrial sources (power plant, ready-mix concrete plant, electronics manufacturing facilities, quarries, and extensive military operations). Other sources include vehicle emissions, re-entrained dust and wood burning. SH 16 is one of the primary east-west roadway facilities serving the City of Fountain, which lies at the southeast edge of the Colorado Springs metropolitan area. The limits of this project encompass approximately two miles of roadway and associated interchanges from the entrance to Fort Carson at Gate 20 to Syracuse Street east of US 85. SH 16 extends west to the Fort Carson Military Reservation property line and becomes Magrath Road, the access road into Gate 20.

The Proposed Action is to improve SH 16 between Fort Carson Army Base Gate 20 and Syracuse Street following an alignment along existing SH 16 with a minor shift to the north as SH 16 approaches the Interstate 25 (I-25) interchange. The existing interchange at I-25 will be replaced with a partial cloverleaf interchange featuring a large loop ramp in the southwest quadrant. At US 85 the existing interchange will be reconstructed to improve the on- and off-ramps and provide additional spacing with the adjacent frontage roads.

Both interchanges and the structure crossing Fountain Creek will be designed and built to accommodate Department of Defense Heavy Equipment Transporter System loads.

Data pertinent to traffic volumes and traffic Level of Service (LOS) in this section are drawn from traffic data presented in *SH 16 Traffic Data for Air Quality Analysis Technical Memorandum (2004)* and *The Powers Boulevard Sensitivity Analysis with Fort Carson Growth Technical Memorandum (2005)*.

All the affected interchanges were designed to safely accommodate the new volumes of traffic with an acceptable level of service (LOS), at LOS C or better. Modified or replaced interchange/intersections and other intersections indirectly affected by anticipated Fort Carson traffic are listed in **Table 1**. The location of the study area intersections are depicted in **Figure 1**. The operation of each intersection is indicated by the LOS analyzed specifically for the existing traffic conditions during peak morning and peak evening (2002), the year 2030 conditions for the No Action and Build Alternatives.

Table 1
Intersections affected within and near the SH 16 Study Area

| SH 16 Intersection | Type | Level of Service by Alternative (AM/PM) | | |
|---|--------------------------------|---|----------------|------------|
| | | Existing 2002 | No Action 2030 | Build 2030 |
| Interstate 25 - West side - East side | Signalized Diamond Interchange | B/D A/B | D/F E/F | C/D C/A |
| Bandley Road | Signalized intersection | C/C | -- | -- |
| US 85 -North side -South side | Signalized Intersections | B/B A/B | B/B C/C | D/C C/D |
| Syracuse Street | Signalized Intersection | C/C | D/D | E/C |
| Fountain Mesa Road | Signalized Intersection | -- | E/D | D/D |
| Mesa Ridge Parkway | Signalized T-Intersection | -- | C/C | C/D |

Figure 1
Location of Study Area



To accommodate better traffic movements and base development and facilitate commercial and residential development within the eastern portion of the study area, SH 16 will be widened to four through lanes between Syracuse Street and Fort Carson. Project level air quality analyses are typically completed for signalized intersections demonstrating deficient levels of service, LOS D or worse. Lower congestion and shorter time delays are demonstrative of traffic flow benefits resulting from widening and improved ramp flow compared to the more congested condition of the No Action Alternative. Better relative air quality is expected due to less congestion and delays—less idling vehicle engines and exhaust related emissions in better LOS rankings.

National Ambient Air Quality Standards

The U.S. Environmental Protection Agency (EPA) has established National Ambient Air Quality Standards (NAAQS) for each of seven “criteria pollutants” to protect the public from the health hazards associated with air pollution. These seven criteria pollutants are carbon monoxide (CO), ozone (O₃), nitrogen oxide (NO₂), sulfur dioxide (SO₂), particulate matter less than 10 microns in diameter (PM₁₀), particulate matter less than 2.5 microns in diameter (PM_{2.5}), and lead (Pb) (see **Table 2**).

The Air Pollution Control Division (APCD) of the Colorado Department of Public Health and Environment, under the authority of the US Environmental Protection Agency (EPA) monitors concentrations of these pollutants. Geographic areas that violate a particular pollutant standard are considered "non-attainment" areas for that pollutant. Violations are determined by a prescribed number of exceedances of the particular standard.

Table 2
National Ambient Air Quality Standards for Criteria Pollutants

| Pollutant/Averaging Time | Primary Standard | Secondary Standard |
|---|-----------------------------------|---------------------------------|
| Carbon Monoxide (CO) | | |
| 8-hour | 10,000 ug/m ³ (9 ppm) | -- |
| 1-hour | 40,000 ug/m ³ (35 ppm) | -- |
| Ozone (O ₃) | | |
| 1-hour | 235 ug/m ³ (0.12ppm) | 235 ug/m ³ (0.12ppm) |
| 8-hour | 157 ug/m ³ (0.08ppm) | 157 ug/m ³ (0.08ppm) |
| Particulate Matter less than 10 microns (PM ₁₀) | | |
| Annual | 50 ug/m ³ | 50 ug/m ³ |
| 24-hour | 150 ug/m ³ | 150 ug/m ³ |
| Particulate Matter less than 2.5 microns (PM _{2.5}) | | |
| Annual | 15 ug/m ³ | 15 ug/m ³ |
| 24-hour | 65 ug/m ³ | 65 ug/m ³ |
| Sulfur Dioxide (SO ₂) | | |
| Annual | 80 ug/m ³ (0.03ppm) | -- |
| 24-hour | 365 ug/m ³ (0.14ppm) | -- |
| 3-hour | -- | 1300 ug/m ³ (0.5ppm) |

Continued

Table 2 (continued)
National Ambient Air Quality Standards for Criteria Pollutants

| Pollutant/Averaging Time | Primary Standard | Secondary Standard |
|-------------------------------------|----------------------------------|----------------------------------|
| Nitrogen Dioxide (NO ₂) | | |
| Annual | 100 ug/m ³ (0.053ppm) | 100 ug/m ³ (0.053ppm) |
| Lead (Pb) | | |
| Calendar Quarter | 1.5 ug/m ³ | -- |

ug/m³ = micrograms per cubic meter.
ppm = parts per million.

Climate and Meteorology

The Pikes Peak Regional airshed includes El Paso, Teller and Park counties. Eastern El Paso County is rural prairie, while the western part, along with Park and Teller counties, is mountainous. The Colorado Springs metropolitan area is one of the more rapidly growing areas within the airshed.

The Fountain-Fort Carson area enjoys moderate temperatures throughout the year and is protected from harsh weather by two natural barriers: The Rocky Mountains to the west and the Palmer (Monument) Divide to the north. Over the past 20 years, the mean temperatures for January and July are approximately 32°F and 72°F, respectively. The average annual precipitation is approximately 14.76 inches with an average snowfall of approximately 42.7 inches. The average annual humidity is approximately 48 percent. Predominant winds are out of the south and north.

Warm Pacific air frequently overrides colder air trapped in the valleys and mountain front producing inversions, causing poor pollutant dispersion. Inversions are common, and during the fall and winter can persist for many days.

Air Quality Monitoring

There are currently six active monitoring stations in Colorado Springs and Manitou Springs, operated by the El Paso County Department of Health and Environment. The types of pollution monitored vary by site, as listed in **Table 3**. CO, O₃, PM₁₀, PM_{2.5}, total suspended particulates (TSP), and lead (Pb) are monitored within the general area. Lead is generally considered an industrial pollutant. The closest monitoring stations are located in downtown Colorado Springs, about six miles north of the study area.

Table 3
Air Quality Monitoring Stations near Study Area and the Pollutants Monitored at Each

| ID | Monitoring Station Location | CO | O ₃ | PM ₁₀ | PM _{2.5} | TSP | Pb |
|----|--------------------------------------|----|----------------|------------------|-------------------|-----|----|
| 1 | I-25 & Uintah Street (downtown CS) | X | | | | | |
| 2 | 3730 Meadowlands (northeast CS) | | | X | X | | X |
| 3 | 101 W Costilla Street (downtown CS) | | | X | X | X | X |
| 4 | USAF Academy, Road 640 (north of CS) | | X | | | | |
| 5 | 690 W.SH 24 (west downtown CS) | X | | | | | |
| 6 | 101 Banks Place (Manitou Springs) | | X | | | | |

Class I Air Quality and Visibility Areas

The EPA has designated a number of areas in the state of Colorado as Mandatory Class I federal areas where visibility is an important value. Generally these areas contain wilderness areas greater than 5,000 acres or National Parks, Forests, and Indian Lands greater than 6,000 acres that are determined to require special air quality. The nearest Class I federal area is Great Sand Dunes National Monument over 80 miles southwest of the study area.

State Implementation Plans and Air Quality Conformity

The transportation conformity provisions of Section 176(c)(2)(A) of the Clean Air Act require regional transportation plans and programs to show that emissions expected from implementation of plans and programs are consistent with estimates of emissions from motor vehicles and necessary emissions reductions contained in the applicable state implementation plan. The establishment of a mobile source emission budget in this maintenance plan assures that transportation plans and programs and their resulting emissions will conform to the emission projections and the demonstration of long-term maintenance of the CO NAAQS documented in this maintenance plan.

The Pikes Peak Region has an emissions budget for CO because violations of the CO standard occurred in the 1970s and 1980s. The most recent violation was 17 years ago, in 1989. The region has not had violations of the other criteria pollutants and for many years has monitored ambient concentrations well below (better than) the standards for all of the criteria pollutants, with one exception, ozone, as discussed below.

Ozone levels in the Pikes Peak Region, while still below the NAAQS, have been increasing since 1997. PPACG and the Colorado Department of Public Health and Environment are initiating proactive efforts to reduce the potential for a future violation of the federal 8-hour ozone standard (0.08 ppm). Because stop-and-go traffic results in

higher emissions of ozone precursor pollutants (hydrocarbons, and oxides of nitrogen) than traffic at moderate speeds, measures that improve traffic flow have the potential to benefit air quality.

Additionally, to address ozone problems in the Denver metropolitan area, the EPA since 2004 has mandated the use of lower volatility gasoline than was allowed in the past. Since Colorado Springs receives fuel from the same refinery and supply system, the new reduced-volatility is also being sold in the Pikes Peak Region. This is expected to slow the upward trend in ozone concentrations that has been observed local in recent years.

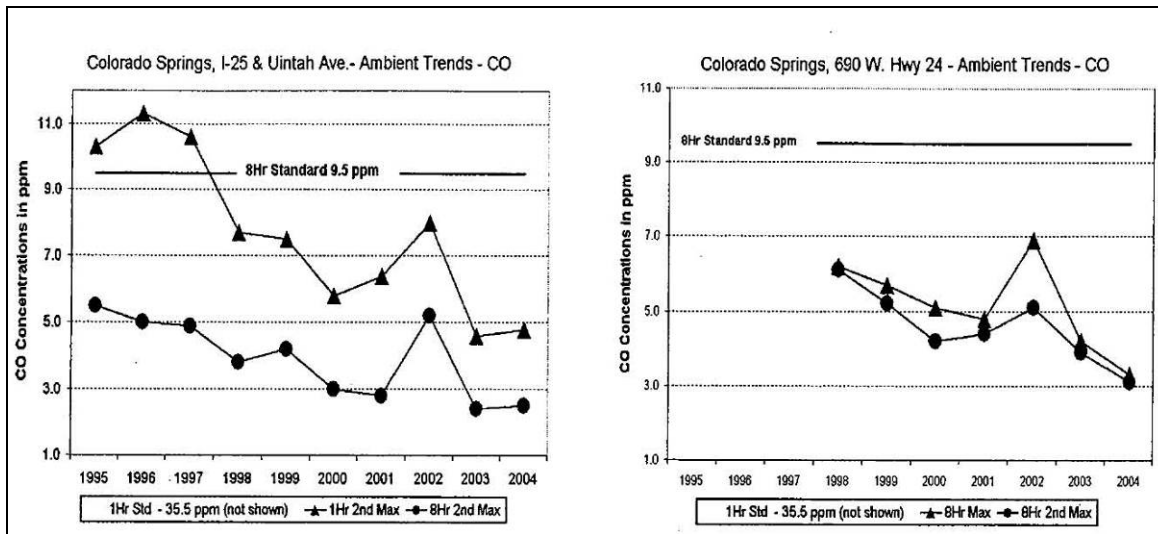
Environmental Consequences

The Proposed Action is located within the Colorado Springs attainment/maintenance area for carbon monoxide. Therefore, the conformity provisions of the federal Clean Air Act apply. The impacts of motor vehicle emissions in the study area on concentrations of CO were analyzed for the No Action and Build Alternatives.

Carbon Monoxide

The Colorado Springs attainment/maintenance area mobile source emission budget is 531 tons/day for 2010 and beyond. The 531 tons per day budget replaces the prior EPA approved budget of 270 tons per day, which applied for the period 2001 and beyond. None of the monitoring stations have recorded a CO standard exceedance since 1989. Local trends of decreasing levels of CO are illustrated in **Figure 2**.

Figure 2
CO Level Trends within the Pikes Peak Region



From Colorado 2004 Air Quality Data Report, 2005; Air Pollution Control Division, Colorado Dept. Public Health and Environment.

The conformity analysis for PPACG's FY2005-10 Transportation Improvement Program indicates that total regional emissions will remain at least 40% below the emissions budget for the future years 2010, 2020, and 2030. The conformity analysis for the draft FY2007-2012 shows a compatible result. This is an indication that the likelihood of violating the carbon monoxide standard anywhere in the region in the foreseeable future is minimal.

Hotspot Analysis—Methodology

The EPA's CAL3QHC computer model was used for the hot-spot analysis. CAL3QHC is a microcomputer-based model that predicts CO pollutant concentrations from motor vehicles at roadway intersections. The CAL3QHC model accounts for emissions from both moving and idling vehicles. Inputs for the model included projected traffic volumes, motor vehicle emission rates, roadway geometries, traffic signal timing and worst-case meteorological conditions. The APCD provided the motor vehicle emission rates (composite and idle) using EPA's MOBILE6.2 emission factor model. Inputs for the MOBILE6.2 model included vehicle mix, running speeds, ambient temperature, and vehicle hot/cold start operating percentages. The APCD also provided idle motor vehicle emission rates using the MOBILE6.2 emission factor model and an EPA method for estimating idle emissions from composite emissions. Regionally, CO atmospheric concentrations are declining due to successful implementation of various air quality programs and lower emission rated vehicle engines. Future 2030 CO emissions are anticipated to follow this trend to be lower than existing conditions. To simulate the worse-case conditions, 2006 emission factors were utilized in this hot-spot analysis. Copies of these data are in Appendix C.

Worst-case meteorological conditions included low wind speed (1 meter/second) and atmospheric stability class D. The CAL3QHC model determines the worst-case wind direction by selecting the wind direction that results in the highest carbon monoxide concentration at each receptor.

The methodology for this air quality analysis was consistent with the two EPA guidance manuals related to intersection "hot-spot" analysis:

1. *Guidelines for Modeling Carbon Monoxide from Roadway Intersections*, EPA, November 1992.
2. *User's Guide to CAL3QHC Version 2.0: A Modeling Methodology for Predicting Pollutant Concentrations Near Roadway Intersections*, EPA, November 1992.

Per EPA guidance, receptors were modeled 10 feet from the edge of the outside travel lane on the queue links at the selected intersections. Receptors located according to EPA guidance represent worst-case locations for modeling possible violations of federal CO standards.

Air Quality Standards for CO

The National Ambient Air Quality Standards for CO concentrations are as follows:

- 1-Hour = 35.0 ppm
- 8-Hour = 9.0 ppm

According to the NAAQS, 9.1 ppm is considered a violation based on modeled CO concentrations.

Intersection Screening

Traffic volumes and level of service data for these intersections was reviewed to determine the most appropriate locations for “hot-spot” analysis. The project team identified two intersections within the study area that might experience an increase in vehicular volume and poor traffic operating conditions as a result of the Proposed Action. The Team concluded that the I-25 Northbound Ramp and Bandley Drive intersections are representative worst-case intersections, based on total volume and level of service ratings due to the Proposed Action. These intersections were modeled together due to the short separation distance and the shared vehicle storage.

Results of CO “Hot-spot” Analysis

The results of the analysis indicated that no violations of either the 8-hour or the 1-hour standards for CO emissions would occur. The results are summarized in **Table 4**. The analysis addressed the average peak hour for the No-Action and Proposed Action for the Year 2030. Appendix B contains the peak hour turning movement data used in the analysis. Background concentrations for conversion of 1-hour CO concentrations to 8-hour CO concentrations were provided by APCD; altitude adjustment factor of 1.2 and persistence factor of 0.57 used. Copies of the CO emissions rate data sheets with receptor locations and wind angle information are in Appendix C.

Table 4
CO Hotspot Analysis for Proposed Action Condition 2030

| | 1-Hour Highest Concentration | 1-Hour Background | 8-Hour Background Concentration | 8-Hour Average Concentration |
|-----------------|------------------------------|-------------------|---------------------------------|------------------------------|
| No-Action | 6.1 ppm | 3.3 ppm | 1.6 ppm | 3.62 ppm |
| Proposed Action | 7.70 ppm | 3.3 ppm | 1.6 ppm | 4.77 ppm |
| NAAQ Standard | 35.0 ppm | -- | -- | 9.0 ppm |

PM₁₀

The study area is in attainment for PM₁₀. According to the El Paso County emissions inventory, the major sources of particulate matter in the study area are re-entrained road dust, construction, wood burning, and industrial (stationary) sources. Motor vehicle-related PM₁₀ emissions are a minor source of PM₁₀ in the study area. The nearest point of comparison at the Costilla Street station has had no exceedance of the 24-hour, 150ug/m³ standard or the annual PM₁₀ standard since 1995. Monitoring began at the Costilla Street in 1987. Throughout the late 1980s and early 1990s wood burning, engine combustion and street cleaning activities resulted in exceedance of the 150ug/m³ standard. Less reliance on wood burning and improved engine combustion and street

cleaning technologies have decreased PM₁₀ levels have decreased by about half since the late 1980s.

The existing roadway system is near capacity, making the future changes in the No Action traffic condition minimal due to the lack of available capacity. The expected 2030 traffic volumes due to Fort Carson troop increases could not be handled by the local existing roadway network without degradation of service levels. Under the Proposed Action increased roadway capacity together with the expected traffic volume increases would result in more vehicle miles traveled than the No Action, but would result in far less idling emissions due to congestion.

The conceptual design for the Proposed Action includes dust re-entrainment control elements such as surfaced shoulders, adding curb and gutter, and consolidating and surfacing gravel and dirt approaches.

PM_{2.5}

The study area is in attainment for PM_{2.5}. The nearest point of comparison at the Costilla Street station has had no exceedances since monitoring began in 1999.

Ozone

Ozone is not directly emitted by motor vehicles; it is an indirect by-product of motor vehicle emissions. Ozone is created by the reaction of nitrogen oxides (NOX) and volatile organic compounds (VOCs), primarily on hot summer days. Since ozone formation depends on the dispersion and reaction of the NOX and VOCs and occurs over several hours, ozone is predominantly a regional pollutant and cannot be quantified at the project level.

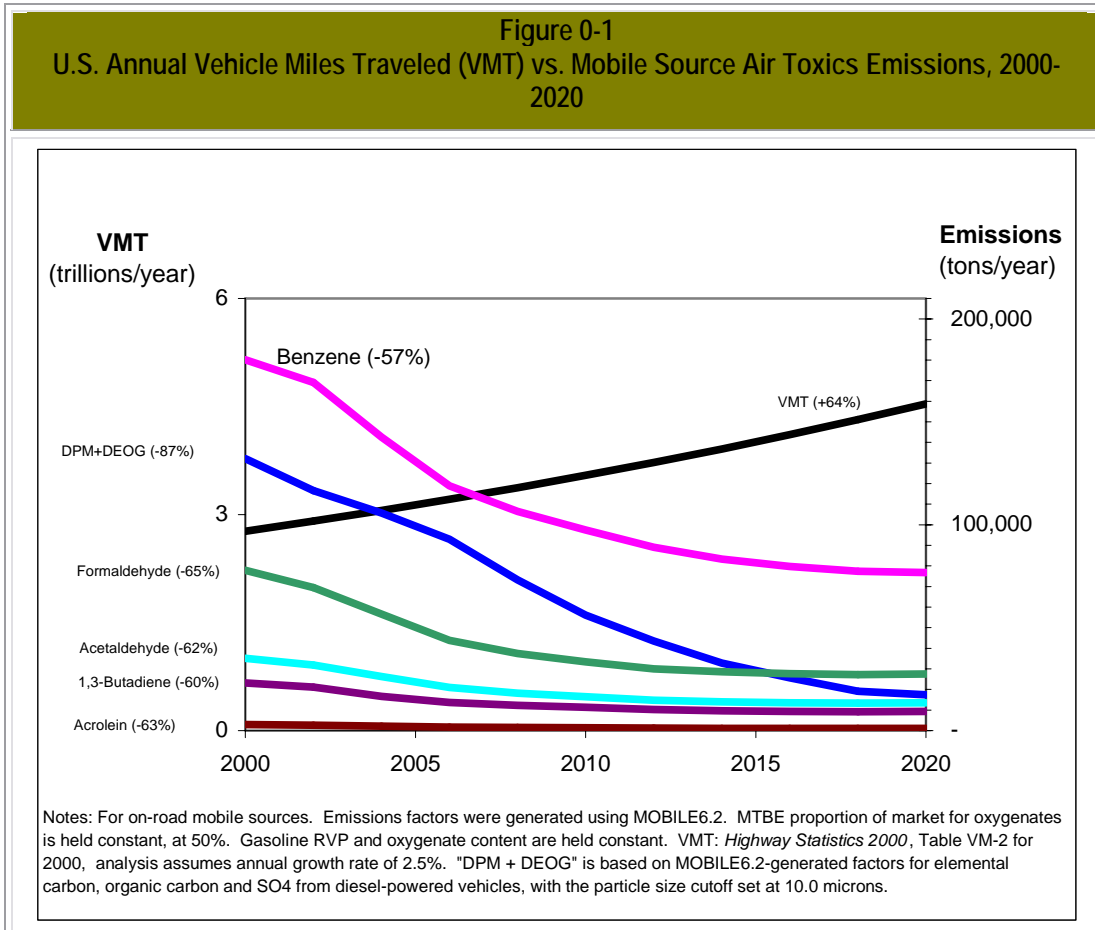
The SH-16 study area is in attainment for ozone. There are no monitoring stations located near the study area. The El Paso County emission inventory shows motorized vehicles as the primary source of NOX and a major contributing source of VOCs as estimated in 2002.

Mobile Source Air Toxics

The Clean Air Act identified 188 air toxics, also known as hazardous air pollutants. The Environmental Protection Agency (EPA) has assessed this expansive list of toxics and identified a group of 21 as mobile source air toxics, which are set forth in an EPA final rule, *Control of Emissions of Hazardous Air Pollutants from Mobile Sources (66 FR 17235)*. The EPA also extracted a subset of this list of 21 that it now labels as the six priority MSATs. These are *benzene, formaldehyde, acetaldehyde, diesel particulate matter/diesel exhaust organic gases, acrolein, and 1,3-butadiene*. While these MSATs are considered the priority transportation toxics, the EPA stresses that the lists are subject to change and may be adjusted in future rules.

The EPA has issued a number of regulations that will dramatically decrease MSATs through cleaner fuels and cleaner engines. According to additional FHWA analysis,

even if VMT increases by 64 percent, reductions of 57 percent to 87 percent in MSATs are projected from 2000 to 2020, as shown in **Figure 0-1**.



National trend information is provided as background. For specific locations, the trend lines may be different, depending on local parameters defining vehicle mix, fuels, meteorology and other factors.

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 impacts from MSATs are limited, as discussed in the *Air Quality Technical Report* that can be found on the CD attached to this EA. These limitations impede FHWA's ability to evaluate how mobile source health risks should factor into project-level decision-making under the National Environmental Policy Act (NEPA). In addition, EPA has not established regulatory concentration targets for the six relevant MSAT pollutants appropriate for use in the project development process.

Nonetheless, air toxics are being raised more frequently on transportation projects during the NEPA process. As the science emerges, we are increasingly expected by the public and other agencies to address MSAT impacts in our environmental documents. FHWA has several research projects underway to try to more clearly define potential risks from MSAT emissions associated with transportation projects. However, while this research is ongoing, FHWA is issuing interim guidance on how MSATs should be addressed in NEPA documents for highway projects. The FHWA will continue to monitor the developing research in this emerging field.

1.1.1.2 Unavailable Information for Project Specific MSAT Impact Analysis

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

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

1. **Emissions:** The EPA tools to estimate MSAT emissions from motor vehicles are not sensitive to key variables determining emissions of MSATs 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. Also, the emissions rates used in MOBILE 6.2 for both particulate matter and MSATs are based on a limited number of tests of mostly older-technology vehicles. Lastly, in its discussions of PM under the conformity rule, EPA has identified problems with MOBILE6.2 as an obstacle to quantitative analysis.

These deficiencies compromise the capability 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. The EPA's current regulatory models, CALINE3 and CAL3QHC, were developed and validated more than a decade ago for the purpose of predicting episodic concentrations of carbon monoxide 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. The NCHRP is conducting research 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 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.

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 either are statistically associated with adverse health outcomes through epidemiological studies (frequently based on emissions levels found in occupational settings) or that animals demonstrate adverse health outcomes when exposed to large doses.

Exposure to toxics has been a focus of a number of EPA efforts. Most notably, the agency conducted the National Air Toxics Assessment (NATA) in 1996 to evaluate modeled estimates of human exposure applicable to the county level. While not intended for use as a measure of or benchmark for local exposure, the modeled estimates in the NATA database best illustrate the levels of various toxics when aggregated to a national or State level.

The EPA is in the process of assessing the risks of various kinds of exposures to these pollutants. The EPA 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 IRIS database is located at <http://www.epa.gov/iris>. The following toxicity information for the six prioritized MSATs was taken from the IRIS database *Weight of Evidence Characterization* summaries. This information is taken verbatim from EPA'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 (DE)** 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.

There have been other studies that address MSAT health impacts in proximity to roadways. The Health Effects Institute, a non-profit organization funded by EPA, 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 problems¹. Much of this research is not specific to MSATs, instead surveying the full spectrum of both criteria and other pollutants. The FHWA cannot evaluate the validity of these studies, but more importantly, they do not provide information that would be useful to alleviate the uncertainties listed above and enable us to perform a more comprehensive evaluation of the health impacts specific to this project.

Relevance of Unavailable or Incomplete Information to Evaluating Reasonably Foreseeable Significant Adverse Impacts on the Environment, and Evaluation of impacts based upon theoretical approaches or research methods generally accepted in the scientific community. Because of the uncertainties outlined above, a quantitative assessment of the effects of air toxic emissions impacts 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."

In this document, FHWA has provided a quantitative analysis of MSAT emissions relative to the various alternatives, (or a qualitative assessment, as applicable) and has acknowledged that (some, all, or identify by alternative) the project alternatives may result in increased exposure to MSAT emissions in certain locations, although the concentrations and duration of exposures are uncertain, and because of this uncertainty, the health effects from these emissions cannot be estimated.

As discussed above, technical shortcomings of emissions and dispersion models and uncertain science with respect to health effects prevent meaningful or reliable estimates of MSAT emissions and effects of this project. However, even though reliable methods do not exist to accurately estimate the health impacts of MSATs at the project level, it is

¹ South Coast Air Quality Management District, Multiple Air Toxic Exposure Study-II (2000); Highway Health Hazards, The Sierra Club (2004) summarizing 24 Studies on the relationship between health and air quality); NEPA's Uncertainty in the Federal Legal Scheme Controlling Air Pollution from Motor Vehicles, Environmental Law Institute, 35 ELR 10273 (2005) with health studies cited therein.

possible to qualitatively assess the levels of future MSAT emissions under the project. Although a qualitative analysis cannot identify and measure health impacts from MSATs, it can give a basis for identifying and comparing the potential differences among MSAT emissions—if any—from the various alternatives. The qualitative assessment presented below is derived in part from a study conducted by the FHWA entitled *A Methodology for Evaluating Mobile Source Air Toxic Emissions Among Transportation Project Alternatives*, found at: www.fhwa.dot.gov/environment/airtoxic/msatcompare/msatemissions.htm

For each alternative in this EA, the amount of MSATs emitted would be proportional to the vehicle miles traveled, or VMT, assuming that other variables such as fleet mix are the same for each alternative. Due to the nature and size of the project area, VMT are not available for the SH 16 study area and daily peak volumes are used instead. The daily peak volume estimated for the Proposed Action is slightly higher than that for the No-Action Alternative, because the additional capacity increases the efficiency of the roadway and attracts rerouted trips from elsewhere in the transportation network (see **Table 0-1**). This increase in daily peak volume would lead to higher MSAT emissions for the action alternative along the highway corridor, along with a corresponding decrease in MSAT emissions along the parallel routes, which may be in closer proximity to critical receptors. The emissions increase is offset somewhat by lower MSAT emission rates due to increased speeds; according to EPA’s MOBILE6 emissions model, emissions of all of the priority MSATs except for diesel particulate matter decrease as speed increases. The extent to which these speed-related emissions decreases will offset daily peak volume-related emissions increases cannot be reliably projected due to the inherent deficiencies of technical models.

**Table 0-1:
Proposed Action VMT/Daily Peak Volume vs. No-Action Alternative VMT/Daily Peak Volume**

| | Total Regional VMT Per PPACG Model | Daily Peak Volume within the SH 16 Study Area |
|--|---------------------------------------|--|
| No-Action Alternative Year 2030 | 19,547,186 | 32,000 |
| Proposed Action Year 2030 | 19,974,248 | 36,000 |
| Difference between Alternatives Year 2030 | 2.18% | 12.5 % |

Because the estimated VMT under each of the Alternatives are nearly the same, varying by less than 2 percent, it is expected there would be no appreciable difference in overall MSAT emissions among the various alternatives. Also, regardless of the alternative chosen, emissions will likely be lower than present levels in the design year as a result of EPA’s national control programs that are projected to reduce MSAT emissions by 57 to 87 percent between 2000 and 2020. Local conditions may differ from these national projections in terms of fleet mix and turnover, VMT growth rates, and local control measures. However, the magnitude of the EPA-projected reductions is so great (even

after accounting for VMT/Daily Peak Volume growth) that MSAT emissions in the study area are likely to be lower in the future in nearly all cases.

The additional travel lanes contemplated as part of the project alternatives will have the effect of moving some traffic closer to nearby homes, schools and businesses; therefore, under each alternative there may be localized areas where ambient concentrations of MSATs could be higher under the Proposed Action than the No-Action Alternative. The localized increases in MSAT concentrations would likely be most pronounced along the expanded roadway sections that would be built at the homes north of SH 16 under the Proposed Action. However, as discussed above, the magnitude and the duration of these potential increases compared to the No-Action Alternative cannot be accurately quantified due to the inherent deficiencies of current models. In sum, when a highway is widened and, as a result, moves closer to receptors, the localized level of MSAT emissions for the Proposed Action could be higher relative to the No-Action Alternative, but this could be offset due to increases in speeds and reductions in congestion (which are associated with lower MSAT emissions). Also, MSATs will be lower in other locations when traffic shifts away from them. However, on a regional basis, EPA's vehicle and fuel regulations, coupled with fleet turnover, will over time cause substantial reductions that, in almost all cases, will cause region-wide MSAT levels to be significantly lower than today.

Mitigation

Even though motor vehicle emissions in the study area would increase, they would not result in any exceedance of the NAAQS; therefore, no direct project air quality mitigation is necessary.

Construction Mitigation

Emissions associated with heavy-duty construction equipment contribute to degraded air quality. Typical pollutants generated by heavy equipment are nitrogen oxides (NOX), reactive organic gases (VOC), and particulates associated both with dust entrainment and direct diesel emissions.

Mitigation measures for construction activities associated with any build alternative include the following:

- An air quality mitigation plan will be prepared by CDOT and will describe all feasible measures to reduce air quality impacts from their project. CDOT staff must review and endorse construction mitigation plans prior to work on a project site.
- Emissions will be reduced through the use of late model engines, low emission diesel products, alternative fuels, engine retrofit technology, and after-treatment products where feasible.

- All construction equipment will be properly tuned and maintained. Idling time will be minimized to 10 minutes – this saves fuel and reduces emissions.
- An operational water truck will be on site at all times to apply water to control dust as needed to prevent dust impacts offsite.
- No open burning of removed vegetation. Vegetation will be chipped or delivered to waste energy facilities.
- Existing power sources or clean fuel generators will be used instead of temporary power generators when feasible.
- A traffic plan will be developed to minimize traffic flow interference from construction equipment and activities. The plan may include advance public notice of routing, use of public transportation, and satellite parking areas with a shuttle service. Operations affecting traffic will be scheduled for off-peak hours whenever reasonable.
- Obstructions of through-traffic lanes will be minimized. Traffic will be guided by a flag person to improve circulation and ensure safety at construction sites where feasible.

Coordination

SH 16 widening and interchange improvements are included in the fiscally-constrained, conforming 2030 Regional Transportation Plan. The revised Fort Carson troop population has been incorporated into the August 9, 2006 Revised Small Area Forecast for 2030. The SH16 project has been included in PPACG's current, adopted (June 14, 2006) Transportation Improvement Program for 2007 to 2112. This project has been coordinated with CDOT Region 2, CDOT Environmental Programs Branch and the Colorado Department of Public Health and Environment Air Pollution Control Division (APCD). An APCD concurrence is pending; a concurrence letter from the APCD will be in the future FHWA Decision Document associated with this EA.

**Appendix A:
Traffic**

**Appendix B:
Hot-Spot Analyses**