3.5 AIR QUALITY

In accordance with the Clean Air Act (CAA), the Environmental Protection Agency (EPA) requires all states to submit a State Implementation Plan (SIP) to address all areas that do not comply with the National Ambient Air Quality Standards (NAAQS). A SIP contains the set of actions or control measures that the state plans to implement to meet NAAQS. Non-attainment areas contain one or more pollutants levels that are in violation of NAAQS.

Attainment/maintenance areas are those areas where the NAAQS have been achieved and a long-term maintenance plan has been approved by EPA.

What's in Section 3.5?

3.5.1 Regulatory Framework

Air quality standards establish the concentration above which a pollutant is known to cause adverse health effects to sensitive groups in the population, such as children and the elderly. The amount of pollutants released and the atmosphere's ability to transport and disperse the pollutants affect a given pollutant's concentration in the atmosphere. Factors affecting transport and dispersion include terrain, wind, atmospheric stability, and, for photochemical pollutants, sunlight. The Front Range's air quality can largely be attributed to emissions, topography, and meteorology.

The CAA as amended led EPA to establish NAAQS for each of six criteria pollutants to protect the public from the health hazards associated with air pollution. The six criteria pollutants are carbon monoxide (CO), lead, nitrogen dioxide, ozone, particulate matter, and sulfur dioxide. NAAQS for these criteria pollutants were established based on known human health effects and measurable, health-related threshold values.

Carbon monoxide is a gas produced when carbon contained in fuel is not completely burned. Sources include motor-vehicle exhaust, industrial processes, or forest fires. CO affects the central nervous system by depriving the body of oxygen and mostly affects people with respiratory, cardiovascular, or blood anemia sensitivities.

Lead is a metal that is typically ingested and accumulates in blood, bones, and soft tissues. It can adversely affect the kidneys, liver, nervous system, and other organs. With the near elimination of lead as an additive in gasoline, the non-industrial emissions of lead have been reduced significantly.

Nitrogen dioxide is a gas that can be an irritant to the eyes and throat. Oxides of nitrogen (nitric oxide and nitrogen dioxide) are formed when the nitrogen and oxygen in the air are combined in high-temperature combustion, such as at power plants and in motor vehicle engines.

Ground-level **ozone** is a gas that is not emitted directly from a source, as are other pollutants, but forms as a secondary pollutant. Its precursors are certain reactive hydrocarbons and nitrogen oxides, which react chemically in sunlight to form ozone. The main sources for these reactive hydrocarbons are automobile exhaust, gasoline, oil storage and transfer facilities, industrial paint and ink solvents, degreasing agents, and cleaning fluids. Exposure to ozone has been linked to a number of health effects, including significant decreases in lung function, inflammation of the airways, and increased respiratory symptoms, such as cough and pain when taking a deep breath.

Particle pollution (particulate matter) is a mixture of suspended microscopic solids and liquid droplets made up of various components, including acids, organic chemicals, metals, dust particles, and pollen or mold spores. The size of a particle is directly linked to its potential for causing health problems. Small particles, that is, those less than 10 micrometers (PM_{10}) in diameter, pose the greatest problems because of their ability to penetrate deeply into the lungs and bloodstream. Exposure to such particles can affect both the lungs and heart. Particles larger than 10 micrometers (PM_{10}) act as an irritant to the eyes and throat.

Fine particulate matter with a diameter less than 2.5 micrometers is called $PM_{2.5}$. Sources of fine particles include all types of combustion, including motor vehicles, particularly diesel exhaust, power plants, residential wood burning, forest fires, agricultural burning, and some industrial processes. Because these smaller particles penetrate deeper into the respiratory system, they have a strong association with circulatory (heart disease and strokes) disease and mortality.

Sulfur dioxides are formed when fuels containing sulfur (mainly coal and oil) are burned at power plants or for other industrial processes. Fuel combustion, largely from electricity generation, accounts for most of the total sulfur dioxide emissions. High concentrations of sulfur dioxide can result in temporary breathing impairment for asthmatic children and adults who are active outdoors.

The NAAQS for the six criteria pollutants are shown in **Table 3.5-1**.

Table 3.5-1 National Ambient Air Quality Standards for Criteria Pollutants

Pollutant/Averaging Time	Primary Standard*	Secondary Standard*
Carbon monoxide (CO)		
8-hour[1]	9.0 ppm**	--
1-hour[1]	35 ppm	--
Lead (Pb)		
Rolling 3-Month Average	0.15 $\mu g/m^3$	0.15 $\mu g/m^3$
Calendar quarter[2]	1.5 $\mu g/m^3$	1.5 $\mu g/m^3$
Nitrogen dioxide (NO_2)		
Annual Arithmetic Mean	53 ppb	53 ppb
1-hour	100 ppb	100 ppb
Ozone (O_3)		
1-hour[3]	0.12 ppm	0.12 ppm
8-hour[4]	0.075 ppm	0.075 ppm
Particulate matter less than 10 microns (PM_{10})		
Annual[5]	Revoked	Revoked
24-hour[6]	150 $\mu g/m^3$	150 $\mu g/m^3$
Particulate matter less than 2.5 microns ($PM_{2.5}$)		
Annual[7]	15 $\mu g/m^3$	15 $\mu g/m^3$
24-hour[8]	35 $\mu g/m^3$	35 $\mu g/m^3$
Sulfur dioxide (SO_2)		
Annual Arithmetic Mean	0.03 ppm	--
24-hour[1]	0.14 ppm	--
1-hour	75 ppb	--
3-hour[1]	--	0.5 ppm

* Primary standards set limits to protect public health, including the health of "sensitive" populations such as asthmatics, children, and the elderly. Secondary standards set limits to protect public welfare, including protection against visibility impairment, damage to animals, crops, vegetation, and buildings.

** Due to mathematical rounding, a measured value of 9.5 ppm or greater is necessary to exceed the standard.

μg/m3... micrograms per cubic meter
ppm...... parts per million
ppb....... parts per billion

1 Not to be exceeded more than once per year

2 This level may not be exceeded in any quarter of a year.

3 The 1-hour ozone standard was revoked on April 15, 2009 for the Denver metro area and the north Front Range.

4 The standard is attained when the expected number of days per calendar year with maximum hourly average concentrations above 0.075 ppm is < 1;To attain this standard, the 3-year average of the fourth-highest daily maximum 8-hour average ozone concentrations measured at each monitor within an area over each year must not exceed 0.075 ppm.

5 Due to a lack of evidence linking health problems to long-term exposure to coarse particle pollution, the EPA revoked the annual PM_{10} standard in 2006, effective December 17, 2006.

6 Not to be exceeded more than once per year on average over 3 years.

7 To attain this standard, the 3-year average of the weighted annual mean $PM_{2.5}$ concentrations from single or multiple community-oriented monitors must not exceed 15 $\mu g/m^3$.

8 To attain this standard, the 3-year average of the 98th percentile of 24-hour concentrations at each population-oriented monitor within an area must not exceed 35 $\mu g/m^3$, effective December 17, 2006.

Source: EPA

The Colorado Department of Public Health and Environment's Air Pollution Control Division (CDPHE-APCD) monitors concentrations of these pollutants. Geographic areas that violate a particular NAAQS are considered "non-attainment" areas for that pollutant. Violations are determined by a prescribed number of exceedances of the particular standard over a specific interval of time.

3.5.2 Affected Environment

The North I-25 regional study area includes the cities of Boulder, Brighton, Broomfield, Fort Collins, Greeley, Longmont, Loveland, Northglenn, Thornton, and northern Denver, plus numerous other small towns. The core of the regional study area is experiencing urban growth resulting in increased conversion of farmland and open ranchlands to residential development and urbanization.

Ozone is formed as a by-product of combining the precursor pollutants of oxides of nitrogen (NO_x) and volatile organic compounds (VOCs) with sunlight. Air quality modeling has established emission levels for the 2005 base year and 2010 attainment year.

Effective November 20, 2007, the EPA designated the Denver metro area and the North Front Range as a non-attainment area for 8-hour ozone (O_3). In March 2008, EPA lowered (strengthened) the NAAQS for the 8-hour ozone standard from 0.08 ppm to 0.075 ppm. Ambient air quality data for the years 2005 to 2007 were collected from monitoring stations. In July 2007, there were exceedances of the 8-hour ozone standard recorded which violated the NAAQS of 0.08 ppm. Therefore, EPA designated this area as a non-attainment area.

Weld County contains over 10,000 active oil and gas wells and production facilities. Revisions to Colorado AQCC Regulation No. 7 provide more stringent emissions controls for these facilities that produce flash hydrocarbon and VOC emissions. Agricultural sources, such as fertilizers, animals, and off-road mobile sources, are also important sources of ozone precursor emissions in Weld County

Four areas in the regional study area are in CO attainment/maintenance: Denver, Fort Collins, Greeley, and Longmont. Denver is also in attainment/maintenance for particulate matter under 10 micrometers in size (PM_{10}). In 2004, EPA determined particulate matter under 2.5 micrometers in size ($PM_{2.5}$) within the Denver Metro area and the North Front Range area had met the 1997 air quality standards; therefore, designating the Denver metro area and north Front Range as an attainment area. In 2006, EPA strengthened the 24-hour $PM_{2.5}$ standard from 65 micrograms per cubic meter ($\mu g/m^3$) to 35 $\mu g/m^3$. Due to the lack of evidence linking health problems to long-term exposure to coarse particle pollutions, the EPA revoked the annual PM_{10} standard in 2006. Modeling of $PM_{2.5}$ emissions was not conducted since the Denver Metro area and the North Front Range are designated as attainment areas. Precursors of $PM_{2.5}$ include NO_x and VOC which were modeled for this project.

Figure 3.5-1 shows the location of the Denver, Fort Collins, Greeley, and Longmont criteria pollutant non-attainment and attainment/maintenance areas.

All other criteria pollutants in the Denver Metro area and North Front Range are in attainment and not considered pollutants of concern. In addition, the portions of the regional study area located outside of the Denver Metro area and North Front Range are designated as attainment areas for all criteria pollutants. Criteria pollutants in attainment areas are not considered pollutants of concern.

3.5.2.1 METEOROLOGY

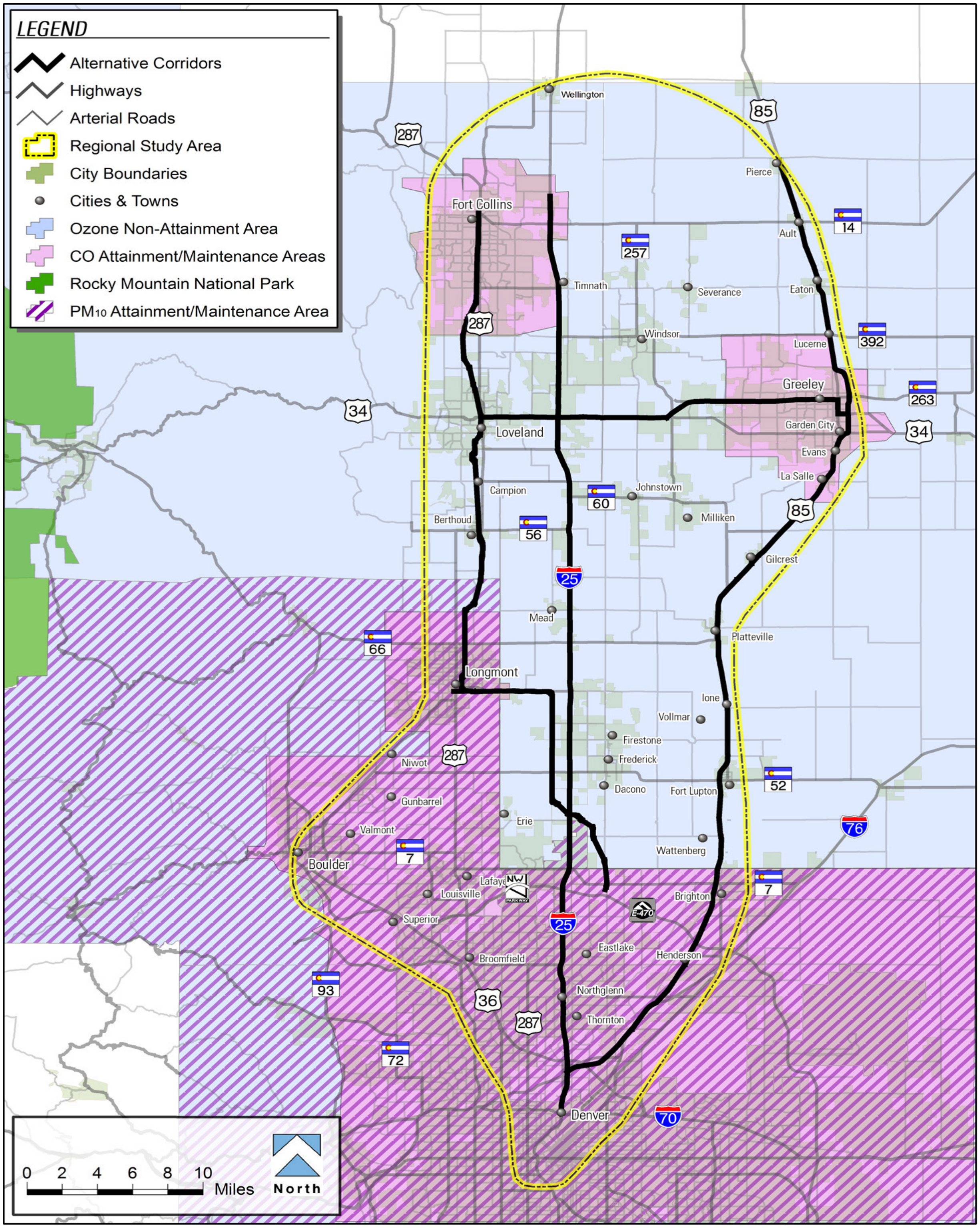
Regionally, weather systems emanate from the west across the Front Range to the plains. Winds are generally strong when associated with a low-pressure system or temperature front. These turbulent weather conditions help disperse atmospheric pollutants.

Atmospheric inversions are common in the Front Range where geomorphic basin landforms are configured to allow cold mountain air to override warm basin-filling air, forming a “ceiling” to atmospheric mixing. The air trapped in the “inversion” layer remains stagnant, concentrating pollutants, and leading to poor air quality conditions, particularly in winter.

Wind direction data from monitoring sites west of I-25 along the foothills demonstrate westerly and northwesterly prevailing winds. Wind distributions from farther east along the I-25 corridor show more widely distributed wind patterns, but include a strong bi-directional north and south wind preference. Denver area sites located in the Platte River valley have wind patterns favoring the elongated southwest-northeast axis of the valley.

The dry, windy climate of the I-25 corridor from north Denver to the Wyoming border is prone to blowing soil particles disturbed by grazing, farming, or construction. The area averages 10 to 19 inches of precipitation per year, and 48 to 83 inches of snowfall annually. Temperatures average 32°F and 73°F for January and July, respectively.

Figure 3.5-1 Non-Attainment and Attainment/Maintenance Areas



3.5.2.2 Air Quality Monitoring Results

Based on 2009 and 2010 data, there are 19 active air quality monitoring stations located in the regional study area. Monitoring station locations and monitored mobile source related criteria pollutants are summarized in **Table 3.5-2**. CO, NO_x, ozone, PM_{10}, $PM_{2.5}$, total suspended particulate matter less than approximately 40 microns in diameter (TSP), lead, and sulfur dioxide are monitored in the general area. Lead and sulfur dioxide are generally considered to be industrial pollutants and are not included in **Table 3.5-2**.

Table 3.5-2 2009-2010 Criteria Pollutant Monitoring Stations

Monitoring Stations			**Criteria Pollutants**					
County	**Site Name**	**Location**	**CO**	**NO_x**	**O_3**	**PM_{10}**	**$PM_{2.5}$**	**TSP**
Adams	Commerce City	7101 Birch St.				X	X	
	Welby	78th Ave. & Steele St.	X	X	X	X		
Boulder	Boulder	2440 Pearl St.				X	X	
	Boulder	2102 Athens St.					X	
	Boulder	1405 ½ S. Foothills Hwy			X			
	Longmont	350 Kimbark St.				X	X	
	Longmont	440 Main St.	X					
	Denver CAMP	2105 Broadway	X	X		X	X	
	Denver Firehouse #6	1300 Blake St.	X					
Denver	Denver Visitors Center	225 W Colfax Ave.				X		
	Denver	2325 Irving Street			X			X
	Denver	4650 Columbine Street					X	
Larimer	Fort Collins	251 Edison St.				X	X	
	Fort Collins	708 S Madison St.	X		X			
	Fort Collins	3416 La Porte Ave			X			
Weld	Greeley	1516 Hospital Rd.				X	X	
	Greeley	3101 35th Ave.			X			
	Greeley	905 10th Ave.	X					
	Platteville	1004 Main St.					X	

CAMP ...Continuous Ambient Monitoring Program
O_3 ....ozone
TSP.......total suspended particulates
Source: CDPHE-APCD, Colorado Annual Monitoring Network Plan 2009 - 2010 (June 30, 2009a).

Criteria Pollutants and Critical Pollutant Data Trends

Monitoring data from the stations noted in **Table 3.5-2** illustrate the following trends in criteria pollutants concentrations:

- Carbon monoxide 8-hour concentrations (2nd maximum) have declined steadily across the regional study area over the past 10 years and are below the 9.0 ppm standard.
- NO_x levels have remained relatively flat in spite of increasing vehicle miles traveled.
- Ozone concentrations have fluctuated and currently remain above the national standard. Concentrations at monitoring stations throughout the regional study area returned to levels below the 8-hour standard concentrations after the 2003 peak. However, concentrations

peaked again after 2005 and currently remain above the 8-hour standard. In 2006, Fort Collins added a new monitoring station to monitor ozone concentrations (3416 La Porte Avenue). This monitoring station had the highest concentrations of ozone within the North Front Range.

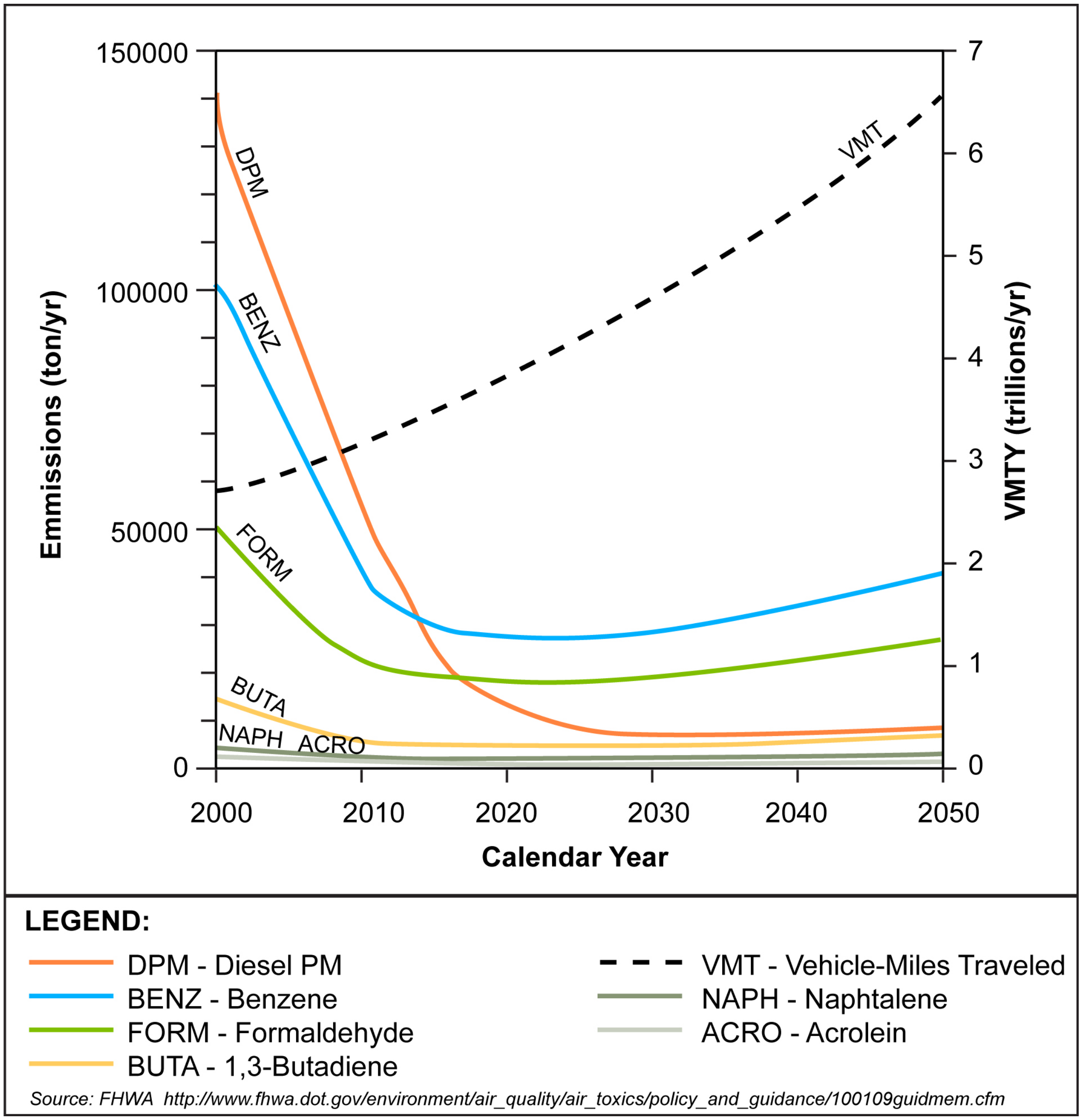
- PM_{10} 24-hour maximum concentrations have been much more irregular, but show a trend of gradually increasing in concentration in many areas. Concentrations at all stations remained below the 150 μg/m^3 standard.
- $PM_{2.5}$ annual average concentrations have remained flat and below the particulate matter standards over the past 10 years throughout the regional study area. $PM_{2.5}$ 24-hour maximum concentration shows a steady decrease over the last few years but has only consistently remained under the new 35 μg/m^3 standard in Fort Collins and Boulder. The Greeley and Longmont areas show a steady decline in the past five years and are currently below the 35 μg/m^3 standard.
- A portion of the project area is located within the City of Fort Collins which is designated as an attainment area for particulate matter. However, particulate matter levels even below the NAAQS can impact the health of individuals with respiratory sensitivity. Therefore, the City of Fort Collins has implemented a policy to "continually improve air quality as the city grows".

Mobile Source Air Toxics

Controlling air toxic emissions became a national priority with the passage of the Clean Air Act Amendments (CAAA) of 1990, whereby Congress mandated that the EPA regulate 188 air toxics, also known as hazardous air pollutants. The EPA has assessed this expansive list in their latest rule on the Control of Hazardous Air Pollutants form Mobile Sources (Federal Register, Vol. 72, No.37, page 8430, February 26, 2007) and identified a group of 93 compounds emitted from mobile sources that are listed in their Integrated Risk Information System (IRIS) (http://www.epa.gov/ncea/iris/index.html). In addition, EPA identified seven compounds with significant contributions from mobile sources that are among the national and regional-scale cancer risk drivers from their 1999 National Air Toxics Assessment (NATA) (http://www.epa.gov/ttn/atw/nata1999/). These components are acrolein, benzene, 1, 3-butadiene, diesel particulate matter plus diesel exhaust organic gases (diesel PM), formaldehyde, naphthalene, and polycyclic organic matter. While FHWA considers these the priority mobile source air toxics, the list is subject to change and may be adjusted in consideration of future EPA rules.

The 2007 EPA rule mentioned above requires controls that will dramatically decrease MSAT emissions through cleaner fuels and cleaner engines. According to an FHWA analysis using EPA's MOBILE6.2 model, even if vehicle activity (vehicle-miles traveled, VMT) increases by 145 percent as assumed, a combined reduction of 72 percent in the total annual emission rate for the priority MSAT is projected from 1999 to 2050, as shown in **Figure 3.5-2**.

Figure 3.5-2 National MSAT Emission Trends 1999 to 2050 for Vehicles Operating



On Roadways Using EPA's Mobile 6.2 Model

Notes:

1 Annual emissions of polycyclic organic matter are projected to be 561 tons/yr for 1999, decreasing to 373 tons/yr for 2050.

2 Trends for specific locations may be different, depending on locally derived information representing vehicle-miles travelled, vehicle speeds, vehicle mix, fuels, emission control programs, meteorology, and other factors

Source: EPA, MOBILE6.2 Model run 20 August 2009.

Unavailable Information for Project Specific MSAT Impact Analysis

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

Other organizations are also active in the research and analyses of the human health effects of MSAT, including the Health Effects Institute (HEI). Two HEI studies are summarized in Appendix D of FHWA's Interim Guidance Update on Mobile Source Air Toxic Analysis in NEPA Documents. Among the adverse health effects linked to MSAT compounds at high exposures are cancer in humans in occupational settings; cancer in animals; and irritation to the respiratory tract, including the exacerbation of asthma. Less obvious is the adverse human health effects of MSAT compounds at current environmental concentrations (HEI, http://pubs.healtheffects.org/view.php?id=282) or in the future as vehicle emissions substantially decrease (HEI, http://pubs.healtheffects.org/view.php?id=306).

The methodologies for forecasting health impacts include emissions modeling; dispersion modeling; exposure modeling; and then final determination of health impacts - each step in the process building on the model predictions obtained in the previous step. All are encumbered by technical shortcomings or uncertain science that prevents a more complete differentiation of the MSAT health impacts among a set of project alternatives. These difficulties are magnified for lifetime (i.e., 70 year) assessments, particularly because unsupportable assumptions would have to be made regarding changes in travel patterns and vehicle technology (which affects emissions rates) over that time frame, since such information is unavailable. The results produced by the EPA's MOBILE6.2 model, the California EPA's Emfac2007 model, and the EPA's DraftMOVES2009 model in forecasting MSAT emissions are highly inconsistent. Indications from the development of the MOVES model are that MOBILE6.2 significantly underestimates diesel particulate matter (PM) emissions and significantly overestimates benzene emissions.

Regarding air dispersion modeling, an extensive evaluation of EPA's guideline CAL3QHC model was conducted in an NCHRP study (http://www.epa.gov/scram001/dispersion_alt.htm#hyroad), which documents poor model performance at ten sites across the country - three where intensive monitoring was conducted plus an additional seven with less intensive monitoring. The study indicates a bias of the CAL3QHC model to overestimate concentrations near highly congested intersections and underestimate concentrations near uncongested intersections. The consequence of this is a tendency to overstate the air quality benefits of mitigating congestion at intersections. Such poor model performance is less difficult to manage for demonstrating compliance with NAAQS for relatively short time frames than it is for forecasting individual exposure over an entire lifetime, especially given that some information needed for estimating 70-year lifetime exposure is unavailable. It is particularly difficult to reliably forecast MSAT exposure near roadways, and to determine the portion of time that people are actually exposed at a specific location.

There are considerable uncertainties associated with the existing estimates of toxicity of the various MSAT, because of factors such as low-dose extrapolation and translation of occupational exposure data to the general population, a concern expressed by HEI (http://pubs.healtheffects.org/view.php?id=282). As a result, there is no national consensus on air dose-response values assumed to protect the public health and welfare for MSAT compounds, and in particular for diesel PM. The EPA (http://www.epa.gov/risk/basicinformation.htm#g) and the HEI (http://pubs.healtheffects.org/getfile.php?u=395) have not established a basis for quantitative risk assessment of diesel PM in ambient settings.

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

Because of the limitations in the methodologies for forecasting health impacts described, any predicted difference in health impacts between alternatives is likely to be much smaller than the uncertainties associated with predicting the impacts. Consequently, the results of such assessments would not be useful to decision makers, who would need to weigh this information against project benefits, such as reducing traffic congestion, accident rates, and fatalities plus improved access for emergency response, that are better suited for quantitative analysis.

In FHWA's view, information is incomplete or unavailable to credibly predict the project-specific health impacts due to changes in MSAT emissions associated with a proposed set of highway alternatives. The outcome of such an assessment, adverse or not, would be influenced more by the uncertainty introduced into the process through assumption and speculation rather than any genuine insight into the actual health impacts directly attributable to MSAT exposure associated with a proposed action.

3.5.2.3 FUGITIVE DUST

Fugitive dust from unpaved roads is a notable contributor to particulate matter emissions in rural Boulder, Larimer, and Weld counties where 50 percent to 80 percent of roads, or over 3,450 miles, are unpaved. Each of these counties employ dust suppressant programs utilizing magnesium chloride and/or other additives to establish a hard surface and promote moisture retention on unpaved roadways. The more urbanized areas, such as Boulder, Denver, Fort Collins and other municipalities, as well as CDOT, have instituted street sweeping programs after winter-storm sanding operations to minimize excess roadside sand available for re-entrainment. Winter liquid de-icing operations used by CDOT and local road departments for winter operations also help to reduce fugitive dust emissions throughout the regional study area.

3.5.2.4 Class I Federal Areas and Nitrogen Deposition

Combustion of fossil fuels, such as petroleum and coal, generates emissions that form NO_x in the atmosphere and is the major contributor to nitrogen deposition. Agricultural releases of nitrogen are primarily in the form of NH_3 from fertilizer manufacturing, livestock production activities, and cultivation of various crops. Ammonia is also emitted from vehicle catalytic converters. Both NO_x and ammonia are evaluated here because they contribute to nitrogen deposition in the project area.

Nitrogen Oxides (NO_x)

Class I Federal Areas include areas such as nationally protected forests, wilderness areas, and parks larger than 6,000 acres, designated for their natural environment and attributes. Rocky Mountain National Park (RMNP) is a Class I federal area of 267,370 acres, straddling the Continental Divide in the northern Front Range. The park was created to protect the scenic beauty and unique natural resources of the region and its ecosystems are managed to be as natural or unimpaired as possible. The park is 93 percent existing or proposed wilderness.

High-elevation ecosystems in RMNP are vulnerable to atmospheric nitrogen deposition and have been affected by regional pollutants as evidenced by about a 2 percent per year increase in nitrogen deposition over the past 20 years. There is more nitrogen deposited in high-elevation ecosystems than plants can use, and excess nitrogen is leaching into park lakes and streams during certain times of the year. Pine and fir trees are experiencing excess nitrogen-derived disease. Experiments near the park show that nitrogen increases change the kind and diversity of plants that grow in the tundra. Grasses and sedges out-compete flowering plants, a change that could reduce habitat for some animals and diminish alpine flowers in the park. Potential consequences of nitrogen saturation on terrestrial systems include loss of species biodiversity, changes in forest species composition, and increased incursion by more nitrogen-tolerant invasive species.

Nitrogen-affected ecosystems and the accompanying changes in species composition, soil, water, and tree chemistry have been documented in eastern areas of RMNP. Total annual wet and dry nitrogen depositions monitored in the park since the mid 1990s average around 21 pounds/acre/year. Pre-industrial or "natural" levels of nitrogen deposition are estimated to be about one pound/acre/year.

Nitrogen deposition is a growing concern not only in RMNP but also in sensitive mountain environments all along the Front Range. NO_x and ammonia (NH_3) can be transported long distances and eventually are deposited on land and water through precipitation in wet deposition or as gases and particles in dry deposition. This process is known as nitrogen deposition. The transport of these pollutants typically occurs from the west to east. However, large snowfall events east of the Continental Divide, associated with easterly upslope flow, can bring pollutants from the Front Range urban corridor and eastern plains. Further, localized upslope flows from the morning heating of the east-facing slopes can also transport pollutants from the Denver-Boulder-Fort Collins urban area. The morning heating can also trigger convective rain shower leading to precipitation events in the park which contributes to wet deposition. Therefore, emissions from the Front Range are also a large contributor to nitrogen deposition in the RMNP.

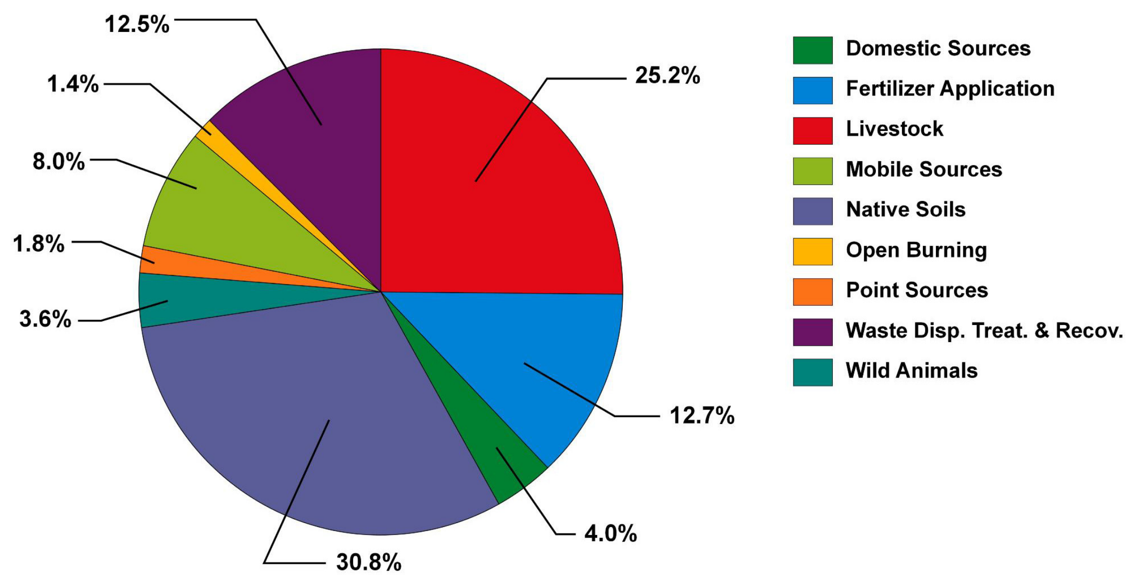
The Colorado Front Range area experienced a rapid population growth from 1980 to 2000. In addition, the RMNP has over 3 million visitors per year and the community of Estes Park borders the RMNP which also attracts many visitors. The majority of these travelers arrive by gasoline and diesel powered vehicles which contribute to the NO_x emissions deposited in the RMNP. As a result of population increases and recreational use, emissions from point and mobile sources were responsible for most of the emission increases.

Ammonia (NH_3)

Over 3,254 tons of NH_3 were estimated along the Front Range in 2002. Regional studies indicate that Front Range NH_3 emissions due to mobile sources would grow to over 3,700 tons by 2018 (Taipale, 2006).

Unlike transportation and utility NO_x emissions, agricultural NH_3 emissions are not regulated. Front Range sources of ammonia are graphically represented in **Figure 3.5 3**.

Figure 3.5-3 2002 Ammonia Emissions for the Front Range Area



Note: The following 12 counties comprise the Front Range:
Adams, Arapahoe, Boulder, Denver, Douglas, El Paso, Jefferson, Larimer, Morgan, Pueblo, and Weld.

Source: Adapted from Taipale, 2006; Colorado 2002 Ammonia Emissions Inventory, Colorado Department of Public Health and Environment, Air Pollution Control Division.

Visibility

Under the 1977 amendments to the CAAA, Congress set national goals for visibility as “the prevention of any future, and the remedying of any existing, impairment of visibility in mandatory Class I Federal areas which impairment results from manmade air pollution” (CDPHE-APCD, 2007b). The federal visibility regulations (40 CFR Part 51 Subpart P – Visibility Protection 51.300 – 309), which were divided into two phases, were set forth to determine existing impairment in each of the Class I areas, how to remedy such impairment, and how to establish goals to restore visibility to “natural conditions” by the year 2064. The first phase addresses Reasonably Attributable Visibility Impairment (RAVI) impacts in Class I areas by evaluating source specific visibility impacts, or plume blight, from individual sources or small groups of sources. In 1999, another section (second phase) was added to the CAAA to address Regional Haze which focuses on the overall decreases in visual range, clarity, color, and ability to discern texture and details in Class I areas. EPA finalized the Regional Haze

Rule (RHR) requiring states to adopt a SIP to address visibility impairment in Class 1 areas. Colorado has developed a SIP and has set the initial planning period (2007- 2018) as the “foundation plan”.

The RHR requires that Class I areas establish goals to improve visibility for the most impaired (20 percent worst) days over the period of the implementation plan and ensure no degradation in visibility for the least impaired (20 percent best) days over the same period to ultimately meet the National Visibility Goal established by Congress by 2064 [40 CFR 51.308(d)]. Tracking of visibility conditions in terms of the haze index (HI) metric is expressed in the deciview (dv) unit.

As shown in **Table 3.5-3**, baseline conditions are the worst at the RMNP (13.83 dv) compared to the other class I areas. In order to achieve natural conditions by 2064, a calculation of a uniform rate of progress (UPG) is used. The amount of visibility improvement needed per year over the 60-year period is multiplied by the number of years in the initial planning period (14 years). This will determine the uniform progress needed by 2018 (initial planning year) to be on the path to achieving natural visibility conditions by 2064. The 2064 visibility goal for the RMNP is 7.24 dv.

Table 3.5-3 Uniform Rate of Progress for Each Colorado Class I Area

Baseline Summary of Best and Worst Days in Haze Index Metric*

Mandatory Class I Federal Area	**20% Worst Days**					**20% Best Days**
	Baseline Condition (Deciview)	2018 Uniform Progress Goal (Deciview)	2018 Goal Delta (Deciview)	2064 Natural Conditions (Deciview)	2064 Delta (Baseline 2064 NC) (Deciview)	Baseline Condition (Deciview)
Great Sand Dunes National Park and Preserve	12.78	11.35	1.43	6.66	6.12	4.50
Mesa Verde National Park	13.03	11.59	1.44	6.83	6.20	4.32
Mount Zirkel and Rawah Wilderness Area	10.52	9.56	0.96	6.14	1.08	1.61
Rocky Mountain National Park	13.83	12.29	1.54	7.24	6.59	2.29
Black Canyon of the Gunnison National Park, Weminuche and La Garita Wilderness Areas	10.33	9.38	0.95	6.24	4.09	3.11
Eagle Nest, Flat Tops, Maroon Bells—Snowmass and West Elk Wilderness Areas	9.61	8.89	0.72	6.54	3.07	0.70

*Baseline Period (2000-2004)

Source: *Colorado Visibility and Regional Haze State Implementation Plan for the Twelve Mandatory Class I Federal Areas in Colorado, (CDPHE-APCD, 2007b).*

In order to establish these goals, states are required to inventory emissions from pollutants that are reasonably anticipated to cause or contribute to visibility impairment in any Class I area [40 CFR 51.308(d)(4)(v)]. **Section 3.5.3** summarizes regional and project emissions as a result of this project.

3.5.2.5 Transportation Conformity

Transportation conformity, as a provision of the CAA (as amended in 1990), helps to ensure that transportation funds go to projects that are consistent with local air quality goals outlined in the SIP. Conformity applies to federally funded or approved transportation plans, transportation improvement programs, and highway and transit projects. Conformity requires that these actions be included in a fiscally constrained Regional Transportation Plan (RTP) and Transportation Improvement Program (TIP) that meet certain statutory and regulatory air quality tests. This is required for areas that do not meet, or have not in the past met, air quality standards for CO, nitrogen dioxide, ozone, or particulate matter. A conformity determination includes a regional emissions analysis at the RTP and TIP level, and demonstrates that those emissions are within the limits set by the SIP. Federal projects require a separate project-level conformity determination, which includes an evaluation of localized pollutant concentrations if the project is in a CO or PM area.

One of the first steps in the development of a SIP is the preparation of an emissions inventory, which is based on the actual or modeled emissions from all sources of air pollution within the non-attainment or attainment/maintenance area. The inventory of mobile source emissions is further categorized by on-road and non-road emissions. The emissions inventory helps define the extent of the pollution problem relative to air quality standards in current and future years. Emission estimates for on-road mobile sources are usually based on the combination of two fundamental measures: VMT and emissions rates (the rate of pollutants emitted in the course of travel based on vehicle speed and other factors).

The SIP identifies the allowable on-road emissions levels to attain the air quality standards as an emissions budget. These budgets act as a cap on emissions and represent the "holding capacity" of the area.

Project Phasing and Regional Conformity

Because there is not enough money in the fiscally constrained and air quality conforming 2035 RTPs for either DRCOG or NFR, only the portion of the Preferred Alternative that is included in the fiscally constrained and air quality conforming 2035 RTPs can be approved by FHWA in the ROD. Multiple conformity analyses were performed. To ensure that air quality conformity would not be an issue if money were to become available to completely build out the Preferred Alternative or other alternative evaluated in the document, conformity analyses were performed. As required by law, the Phase 1 of the Preferred Alternative was analyzed separately and will be included in the fiscally constrained and air quality conforming RTPs prior to FHWA approval in the ROD.

Project Level (Hot Spot) Conformity

At the project level, CDOT is most concerned with CO since it is directly emitted from the tail pipes of motor vehicles. PM_{10} emissions are also a local project concern, often derived from motor vehicle exhaust. However, most PM_{10} in the atmosphere is generated as fugitive dust-fine fine dust created by vehicle re-entrainment of excess roadside sand and disturbed ground surfaces from both farming and construction. Conformity at the project-level requires "hot spot" analysis if an area is "nonattainment" or "maintenance" for CO and/or particulate matter. In general, projects must not cause the CO or PM standard to be violated, and in "nonattainment" areas the project must not cause any increase in the number and severity of violations. If a known CO or PM violation is located in the project vicinity, the project must include measures to reduce or eliminate the existing violation(s) as well.

3.5.3 Environmental Consequences

3.5.3.1 CORRIDOR ANALYSIS

Emissions from mobile sources for various air pollutants within the entire regional study area were estimated for the existing condition (Year 2005), the No-Action Alternative (2035), Package A (2035), Package B (2035), Phase 1 (2035), and Preferred Alternative (2035). The existing condition year is the year that the travel demand models were calibrated (see Travel Demand Traffic Technical Report for more detail). Future emissions were based on anticipated traffic levels for each alternative for the design year 2035 (see **Table 3.5-4**). Emissions levels included winter-summer seasonal influence, expected vehicle types, and traffic composition. Portions of all six SIP areas were included within this evaluation. Fugitive dust and construction generated emissions were not included in these analyses.

Information for Phase 1 is provided throughout the rest of this section because that is the only portion of the Preferred Alternative that is on the two Regional Transportation Plans. For more information about Phase 1, please see **Section ES 8** *Phased Project Implementation* or **Chapter 8** *Phased Project Implementation*.

Travel demand forecasting completed for this Final EIS generated a calculation of VMT for the regional study area. The traffic network was evaluated by roadway linkages (as described in **Chapter 4** *Transportation Impacts*) and found an influence from proposed project changes on traffic volume of 5 percent or more around the primary travel corridors of US 287, I-25, and US 85.

Results tabulated in **Table 3.5-4** illustrate the trend of decreasing criteria pollutant emissions with increasing VMT in future years. The reason for this is increasing controls on the vehicle sources. Regional VMT measured over the regional study area would increase approximately 80 percent between 2005 and 2035. Regional analyses of total criteria pollutants show reductions in total emissions between 2005 and 2035, although the difference is more pronounced in some cases than others: CO decreases 12 percent, VOC decreases 55 percent, NO_x decreases 76 percent, and PM_{10} decreases 1 percent.

Criteria pollutant emissions for all of the 2035 build alternatives (Package A, Package B, the Preferred Alternative, and Phase 1) would average about 1 percent higher than the 2035 No-Action emissions. Package B and Phase 1 would generate slightly fewer criteria pollutant emissions than Package A or the Preferred Alternative due to proposed transit improvements for Package A and the Preferred Alternative.

Table 3.5-4 Daily Region-Wide Total Mobile Source Emissions Estimates

Pollutant	Year	No-Action Alternative	Package A	Package B	Preferred Alternative	Phase 1
	2005	**2035**	**2035**	**2035**	**2035**	**2035**
Vehicle VMT (daily)	76,951,721	135,156,908	135,478,050	135,272,142	135,414,740	135,370,346
Rail VMT [commuter rail] (daily)	NA	NA	2,567	NA	2,400	NA
CO (tons/day)	1,831.548	1,608.643	1,620.79	1,608.513	1,619.953	1,609.990
VOC (tons/day)	105.737	46.842	47.620	47.041	47.526	47.127
NOx (tons/day)	164.989	38.291	39.207	38.537	39.167	38.593
PM_{10} (tons/day)	3.654	3.559	3.629	3.574	3.625	3.577
Acetaldehyde (tons/day)	0.766	0.354	0.361	0.360	0.361	0.361
Acrolein (tons/day)	0.062	0.030	0.031	0.031	0.031	0.031
Benzene (tons/day)	3.023	1.406	1.410	1.408	1.409	1.410
1,3-butadiene (tons/day)	0.372	0.159	0.162	0.162	0.162	0.162
Diesel particulates (tons/day)	1.441	0.103	0.109	0.108	0.109	0.108
Formaldehyde (tons/day)	1.317	0.645	0.663	0.662	0.662	0.663
Total Emissions (tons/day)	**2,112.909**	**1,700.033**	**1,713.98**	**1,700.397**	**1,713.005**	**1,702.023**

NA=Not Applicable

Source: CDPHE-APCD

The decrease in regional CO and PM_{10} emissions from year 2005 to 2035 are related to changes in the vehicle composition and future emissions characteristics. The Tier 1 and Tier 2 regulations implemented by EPA beginning in 1994 and 2004, respectively, placed tighter controls on CO, VOC and NO_x emissions from light duty motor vehicles. EPA has also adopted tighter emission standards for heavy duty highway vehicles beginning with the 2007 model year, more stringent Tier 3 and Tier 4 emission standards for heavy duty nonroad engines (e.g., locomotives), and lower limits on the sulfur content of gasoline and diesel fuel. The vehicle fleet used in transportation air quality modeling is projected 25 years into the future, allowing for increasingly stringent emissions controls and improved engine efficiency. Once fleet turnover is complete (e.g., all vehicles meet the most recent set of emissions standards), then emissions rates start to go back up primarily because of VMT increases.

The differences in annual regional total emissions between the 2035 No-Action and the build alternatives (Package A, Package B, the Preferred Alternative, and Phase 1) is less than 1 percent or approximately 13.95, 0.364, 12.97, and 5.118 tpd, respectively. The total pollutant emissions increases are attributed primarily to the 1 percent higher year 2035 VMT for Package A, Package B, the Preferred Alternative, and Phase 1.

Total 2035 emissions for Package A and the Preferred Alternative would be 13.59 and 10.98 tpd, respectively, more than total emissions for Package B or Phase 1. Approximately 8.40 and 7.86 tpd would be emissions from the commuter rail components for Package A and the Preferred Alternative.

Because ozone emissions are a regional pollutant created from photochemical reactions between NO_x and VOCs in the atmosphere, localized sources of these ozone precursors are not easily related to direct ozone effects within the regional study area. Ozone is also created from emissions from non-mobile sources such as lawn mowers, small engine equipment, and industrial sources. Ozone concentration is highly susceptible to weather conditions, such as local upslope winds or regional upper level wind patterns. Because ozone is a regional-scale pollutant, the conformity rule does not require analysis of ozone at the project level. However, the conforming TIPs or RTPs do not include regional ozone analyses that include Package A, Package B, or the Preferred Alternative. Only Phase 1 improvements are included in the RTPs.

MSAT emissions would be reduced between 51 percent and 57 percent for acetaldehyde, acrolein, benzene, 1,3-butadiene, and formaldehyde between 2005 and the 2035 No-Action Alternative. Diesel particulate matter (DPM) were reduced by over 93 percent during that same timeframe. PM_{10} emissions reductions shown in **Table 3.5-4** are much less than reductions in DPM emissions because PM_{10} is made up of more components than DPM, including gasoline and diesel engine exhaust and evaporative emissions, brake wear, tire wear, and road dust.

Forecasted emissions for MSATs would in all cases be increased between No-Action levels in 2035 and those predicted for the Preferred Alternative and Phase 1. On a percentage basis, the increase are less than one percent for benzene and acrolein. Acetaldehyde and 1,3-butadiene would both be increased between one and two percent. For formaldehyde, percent increase would be 2.6 percent with the Preferred Alternative and 2.8 percent with Phase 1.Percent increases would be highest with diesel particulates: 5.8 percent than the Preferred Alternative and 4.8 for Phase 1. Phase 1 emissions would be slightly higher than Preferred Alternative for two pollutants: benzene and formaldehyde. The reason for this is that the vehicle mix for the Preferred Alternative would include more heavy trucks because it would have more travel on freeways.

3.5.3.2 Attainment/Maintenance Area Analysis

Emissions for various air pollutants within each attainment/maintenance area were estimated to provide a comparison against important mobile source air quality area pollutant emission burdens calculated by local planning and air quality agencies for each SIP area. These emission calculations are similar to the attainment/maintenance area conformity modeling and include the North I-25 regional study area. Comparisons are meant to compare emissions generated among the project alternatives.

Future emissions were based on traffic distributions, speeds and volumes for each component located in each of the attainment/maintenance areas. Emissions levels included seasonal influences, vehicle types and traffic composition.

The following tables show emissions levels for the criteria and MSAT pollutants by SIP (attainment/maintenance) area. In general, emissions from each SIP area mimic the regional trend of decreasing pollutant emissions from current 2005 levels to the year 2035. Emissions budgets calculated by the various metropolitan planning organizations and published by CDPHE-APCD in the SIP maintenance plan revisions are projected to planning years in the future. Not all planning organizations have updated their plans to a consistent planning year, therefore; emissions budgets listed in the following SIP area data tables may be for different years.

Fort Collins Attainment/Maintenance Area For CO

Package A, Package B, Preferred Alternative, and Phase 1 2035 components within the Fort Collins SIP area would generate between 18 and 20 percent fewer total emissions than are estimated for the baseline condition in 2005. The 2035 design year total CO emissions for Package A, Package B, Preferred Alternative, and Phase 1 would range between 60.679 to 62.649 and (see **Table 3.5-5**) less than the Fort Collins CO attainment/maintenance plan emissions budget attributed to mobile sources for 2015.

The Preferred Alternative 2035 total CO emissions would be about 0.436 to 1.971 tons more than the other build alternatives in 2035. This increase would be attributed in part to the vehicle VMT since increased VMT is directly linked to increased emissions.

Greeley Attainment/Maintenance Area For CO

Package A, Package B, Preferred Alternative, and Phase 1 2035 components within the Greeley SIP would generate between 13 and 14 percent fewer total emissions than are estimated for the baseline condition in 2005. The 2035 design year total CO emissions for Package A, Package B, Preferred Alternative, and Phase 1 would be 31.43, 31.60, 31.39, and 31.60 tons, respectively, less than the estimated Greeley CO attainment/maintenance plan emissions budget attributed to mobile sources for 2015 (see **Table 3.5-6**).

A comparison shows that Package B and Phase 1 within the Greeley SIP area would contribute more emissions of CO than Package A and the Preferred Alternative. The higher emissions would be due to corresponding higher VMT.

Longmont Attainment/Maintenance Area For CO

Package A, Package B, Preferred Alternative, and Phase 1 2035 components within the Longmont SIP would generate between 25 and 28 percent fewer total emissions than are estimated for the baseline condition in 2005. The 2035 design year total CO emissions for Package A, Package B, Preferred Alternative, and Phase 1 would be 23.03, 22.43, 23.170, and 22.39 tons, respectively, less than the Longmont CO attainment/maintenance plan emissions budget attributed to mobile sources for 2020 (see **Table 3.5-7**).

A comparison shows that Package A and the Preferred Alternative within the Longmont SIP area would contribute more emissions of CO than Package B and Phase 1. The higher emissions would be due to corresponding higher vehicle and rail VMT associated with Package A and the Preferred Alternative.

Table 3.5-5 Daily Fort Collins Attainment/Maintenance Area Emissions Estimates

Pollutant	Area Mobile Emissions Budget	Baseline Year	No-Action Alternative	Package A	Package B	Preferred Alternative	Phase 1
	2015	2005	2035	2035	2035	2035	2035
Vehicle VMT(daily)	NA	2,856,687	4,181,220	4,243,464	4,232,612	4,275,237	4,260,610
Rail VMT[A-T1] (daily)	NA	NA	NA	415	NA	400	NA
CO (tons/day)	94.0	70.616	59.857	62.213	60.679	62.649	61.177
VOC (tons/day)	NA	5.077	2.030	2.138	2.052	2.145	2.062
NOx (tons/day)	NA	5.509	1.736	1.854	1.761	1.8661	1.777
PM_{10} (tons/day)	NA	0.126	0.108	0.1179	0.109	0.1186	0.110
Acetaldehyde (tons/day)	NA	0.032	0.015	0.015	0.015	0.015	0.015
Acrolein (tons/day)	NA	0.003	0.001	0.001	0.001	0.001	0.001
Benzene (tons/day)	NA	0.134	0.067	0.068	0.068	0.068	0.068
1,3-butadiene (tons/day)	NA	0.016	0.007	0.007	0.007	0.007	0.007
Diesel particulates (tons/day)	NA	0.044	0.002	0.002	0.002	0.002	0.002
Formaldehyde (tons/day)	NA	0.053	0.024	0.025	0.025	0.025	0.025
Total Emissions (tons/day)	**NA**	**81.609**	**63.847**	**66.441**	**64.719**	**66.898**	**65.245**

NA=Not Applicable

Source: CDPHE-APCD

1 **Table 3.5-6 Daily Greeley Attainment/Maintenance Area Emissions Estimates**

Pollutant	Area Mobile Emissions Budget	Year	No-Action Alternative	Package A	Package B	Preferred Alternative	Phase 1
	2015	2005	2035	2035	2035	2035	2035
Vehicle VMT(daily)	NA	1,360,778	2,229,606	2,205,071	2,216,494	2,202,006	2,216,501
Rail VMT (daily)	NA	NA	NA	0	NA	0	NA
CO (tons/day)	60.0	33.684	31.728	31.430	31.598	31.394	31.598
VOC (tons/day)	NA	2.385	1.072	1.059	1.064	1.057	1.064
NO_x (tons/day)	NA	2.539	0.912	0.901	0.906	0.900	0.906
PM_{10} (tons/day)	NA	0.061	0.058	0.057	0.057	0.057	0.057
Acetaldehyde (tons/day)	NA	0.015	0.008	0.008	0.008	0.008	0.008
Acrolein (tons/day)	NA	0.001	0.001	0.001	0.001	0.001	0.001
Benzene (tons/day)	NA	0.063	0.035	0.035	0.035	0.035	0.035
1,3-butadiene (tons/day)	NA	0.007	0.004	0.004	0.004	0.004	0.004
Diesel particulates (tons/day)	NA	0.022	0.001	0.001	0.001	0.001	0.001
Formaldehyde (tons/day)	NA	0.025	0.013	0.013	0.013	0.013	0.013
Total Emissions (tons/day)	**NA**	**38.802**	**33.832**	**33.508**	**33.686**	**33.469**	**33.687**

NA=Not Applicable

Source: CDPHE-APCD

1 **Table 3.5-7 Daily Longmont Attainment/Maintenance Area Emissions Estimates**

Pollutant	Area Mobile Emissions Budget	Baseline Year	No-Action Alternative	Package A	Package B	Preferred Alternative	Phase 1
	2020	**2005**	**2035**	**2035**	**2035**	**2035**	**2035**
Vehicle VMT(daily)	NA	1,228,313	1,986,785	1,932,519	1,969,994	1,927,143	1,966,115
Rail VMT [A-T2](daily)	NA	NA	NA	350	NA	420	NA
CO (tons/day)	43.0	28.725	22.801	23.03	22.430	23.170	22.386
VOC (tons/day)	NA	1.635	0.615	0.6704	0.612	0.6823	0.611
NO_x (tons/day)	NA	2.188	0.480	0.5423	0.483	0.555	0.482
PM_{10} (tons/day)	NA	0.051	0.051	0.0567	0.051	0.058	0.051
Acetaldehyde (tons/day)	NA	0.012	0.004	0.004	0.004	0.004	0.004
Acrolein (tons/day)	NA	0.001	0.000	0.000	0.000	0.000	0.000
Benzene (tons/day)	NA	0.048	0.019	0.018	0.018	0.018	0.018
1,3-butadiene (tons/day)	NA	0.006	0.002	0.002	0.002	0.002	0.002
Diesel particulates (tons/day)	NA	0.016	0.001	0.001	0.001	0.001	0.001
Formaldehyde (tons/day)	NA	0.020	0.007	0.008	0.008	0.008	0.008
Total Emissions (tons/day)	NA	**32.702**	**23.981**	**24.333**	**23.611**	**24.499**	**23.564**

NA=Not Applicable

Source: CDPHE-APCD

2

Denver Attainment/Maintenance Areas For Ozone and PM_{10}

Package A, Package B, Preferred Alternative, and Phase 1 2035 components within the Denver ozone and PM_{10} SIPs would generate approximately 24 percent fewer total emissions than are estimated for the baseline condition in 2005 (see **Table 3.5-8**). The 2035 design year average VOC and NOx emissions differ by approximately 0.04 tons between the build alternatives. The emissions would be less than the Denver attainment/maintenance plan emissions budget attributed to mobile sources for 2020.

The 2035 design year total PM_{10} emissions for Package A, Package B, the Preferred Alternative, and Phase 1 would be 2.915, 2.913, 2.912, and 2.912 tons, respectively, less than the Denver PM_{10} attainment/maintenance plan emissions budget attributed to mobile sources for 2020.

A comparison shows that Package A and Package B within the Denver ozone and PM_{10} SIP areas would contribute more overall criteria pollutant emissions than the Preferred Alternative and Phase 1. The higher emissions would be due to corresponding higher VMT associated with Package A and Package B.

Denver Attainment/Maintenance Areas For CO

Package A, Package B, Preferred Alternative, and Phase 1 2035 components within the Denver CO SIP would generate 24 percent fewer total emissions than are estimated for the baseline condition in 2005 (see **Table 3.5-9Error! Reference source not found.**). The 2035 design year total CO emissions for Package A, Package B, Preferred Alternative, and Phase 1 would range between 1204.84 to 1206.17, less than the Denver CO attainment/maintenance plan emissions budget attributed to mobile sources for 2021.

A comparison shows that Package A and the Preferred Alternative within the Denver CO SIP area would contribute more CO emissions than Package B and Phase 1. This increase would be attributed in part to the commuter rail component associated with Package A and the Preferred Alternative.

3.5.3.3 PROJECT-LEVEL CO ANALYSIS

Carbon monoxide emissions rates have been steadily declining over the past 10 years due to improvements in vehicle engine emission controls, motor efficiency, and fuel composition. However, traffic volumes due to increasing population and travel trips are continuing to rise over time. Ambient monitoring levels for CO concentrations within the regional study area have remained below 9 ppm since 2005. The highest 2008 readings for 8-hour CO in the regional study area were 3.0 ppm, 2.7 ppm, and 3.1 ppm for monitors located in Fort Collins, Longmont, and Denver CAMP, respectively.

Pollutant levels from CO emissions were estimated using CAL3QHC air quality dispersion modeling. This model is used to estimate CO concentrations at poorly operating signalized intersections to simulate worst-case localized air pollutant emissions at points where vehicles congregate, incorporating idling emissions and start-stop traffic conditions. High volume intersections and interchanges within the project area affected by Package A, Package B, the Preferred Alternative, and Phase 1 traffic conditions, and operating with unacceptable levels of congestion (LOS D or worse) were selected through consultation with CDPHE-APCD, EPA, and FHWA for project-level "hot spot" analysis during the Draft EIS. Consultation was conducted with CDOT and CDPHE-APCD for the Final EIS. The same intersections were modeled since these remain the worst operating intersections:

- Harmony Road and I-25 (Fort Collins SIP)
- Evans Bus Station at 31st Street and US 85 (Greeley SIP)
- Sugar Mill Transit Station at SH 119 and County Line Road (Longmont SIP)
- SH 7 and I-25 (Denver SIP)
- Thornton Parkway and I-25 (Denver SIP)

In addition, modeling was conducted for a No-Action scenario (no improvements in Phase 1) to represent an interim year since improvements are not anticipated until 2035.

Traffic volumes at these intersections are among the highest in their respective corridors and SIP areas. All of the above intersections experience current congestion at peak hours. These intersections and interchanges would continue to experience congestion in the future under the No-Action Alternative, Package A, Package B, the Preferred Alternative, or Phase 1. Each location was modeled for the proposed 2035 traffic volumes, number of through lanes, turning lanes, and signalization.

Motor vehicle emissions rates for 2005 were combined with projected 2035 peak-hour traffic volumes at each intersection to utilize the highest emissions rate with the highest traffic volumes, to represent the worst-case modeling conditions for future years (**Table 3.5-10**).

Inputs for the model included projected traffic volumes, motor vehicle emission rates, roadway geometries, traffic signal timing and worst-case meteorological conditions. The CDPHE-APCD provided the motor vehicle emission rates (composite running emissions 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 CDPHE-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. Copies of this data are in the *Air Quality Technical Addendum, Appendix A* (Jacobs, 2011c*)*.

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 CO concentration at each receptor. Per EPA guidance, receptors were modeled 20 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 CO standards.

The highest modeled 8–hour average concentration was 8.4 ppm associated with the poorly operating intersection of Harmony and I-25 in Fort Collins for the No-Action Alternative. This value is below the federal 8–hour CO NAAQS of 9 ppm. Therefore, since the project-level CO analyses resulted in no exceedances of the NAAQS at any of the identified interchanges and intersections representing the highest volume and worst operations within the regional study area, project-level conformity has been met for CO.

1 **Table 3.5-8 Daily Denver Attainment/Maintenance Area Emissions Estimates (Ozone and PM_{10} Area)**

Pollutant	Area Mobile Emissions Budget	Baseline Year	No-Action Alternative	Package A	Package B	Preferred Alternative	Phase 1
	2020	2005	2035	2035	2035	2035	2035
Vehicle VMT(daily)	NA	64,319,797	110,171,887	110,090,058	110,068,097	109,985,427	110,044,051
Rail VMT (daily)	NA	NA	NA	85	NA	100	NA
CO (tons/day)	1,600.00	1,513.380	1,251.444	1,247.961	1,247.360	1,246.863	1,247.061
VOC (tons/day)	109.2	84.846	35.224	35.404	35.336	35.525	35.346
NO_x (tons/day)	122.9	135.929	27.919	28.061	28.035	28.040	28.028
PM_{10} (tons/day)	55.00	2.997	2.905	2.915	2.913	2.912	2.912
Acetaldehyde (tons/day)	NA	0.631	0.267	0.272	0.272	0.272	0.272
Acrolein (tons/day)	NA	0.051	0.023	0.024	0.024	0.024	0.024
Benzene (tons/day)	NA	2.474	1.024	1.024	1.023	1.023	1.024
1,3-butadiene (tons/day)	NA	0.307	0.117	0.120	0.119	0.119	0.119
Diesel particulates (tons/day)	NA	1.150	0.085	0.090	0.090	0.090	0.090
Formaldehyde (tons/day)	NA	1.087	0.496	0.511	0.510	0.510	0.510
Total Emissions (tons/day)	**NA**	**1,742.853**	**1,319.504**	**1,316.382**	**1,315.683**	**1,315.377**	**1,315.385**

NA=Not Applicable

Source: CDPHE-APCD

2

Table 3.5-9 Daily Denver Attainment/Maintenance Area Emissions Estimate (CO area)

Pollutant	Area Mobile Emissions Budget	Baseline Year	No-Action Alternative	Package A	Package B	Preferred Alternative	Phase 1
	2020	2005	2015	2035	2035	2035	2035
Vehicle VMT(daily)	NA	62,004,903	106,396,435	106,376,899	106,315,567	106,279,595	106,290,868
Rail VMT (daily)	NA	NA	NA	85	NA	100	NA
CO (tons/day)	1,600.00	1,459.400	1,208.005	1,206.171	1,205.140	1205.15	1,204.836
VOC (tons/day)	109.2	81.837	34.081	34.270	34.191	34.195	34.200
NOx (tons/day)	122.9	131.454	27.018	27.148	27.113	27.128	27.105
PM_{10} (tons/day)	55.00	2.892	2.808	2.817	2.814	2.815	2.813
Acetaldehyde (tons/day)	NA	0.609	0.259	0.263	0.263	0.263	0.263
Acrolein (tons/day)	NA	0.049	0.023	0.023	0.023	0.023	0.023
Benzene (tons/day)	NA	2.387	0.990	0.991	0.990	0.989	0.990
1,3-butadiene (tons/day)	NA	0.296	0.113	0.116	0.115	0.115	0.115
Diesel particulates (tons/day)	NA	1.111	0.084	0.087	0.087	0.087	0.087
Formaldehyde (tons/day)	NA	1.049	0.482	0.495	0.494	0.494	0.494
Total Emissions (tons/day)	**NA**	**1,681.082**	**1,273.862**	**1,272.381**	**1,271.230**	**1,271.259**	**1,270.926**

NA=Not Applicable

Source: CDPHE-APCD

1 **Table 3.5-10 Results of Hot Spot Analyses for Carbon Monoxide**

Location	Alternative	2035 Traffic Volume (vpd)	NAAQS 1-hour Standard CO[2]	Maximum 1-Hour CO Concentration[2]	NAAQS 8-hour Standard CO[2]	Maximum 8-Hour CO Concentration[2]
Harmony Road and I-25[1]	No-Action	64,850	35 ppm	15.1	9 ppm	8.4
Harmony Road and I-25[1]	Package A	67,050	35 ppm	11.8	9 ppm	6.6
Harmony Road and I-25[1]	Package B	67,550	35 ppm	10.8	9 ppm	6.8
Harmony Road and I-25[1]	Preferred Alternative	64,950	35 ppm	12.8	9 ppm	7.2
Evans Bus Station, 31st and US 85**	Package A	48,900	35 ppm	7.1	9 ppm	4.3
Evans Bus Station, 31st and US 85	Preferred Alternative and Phase 1	54,050	35 ppm	8.8	9 ppm	5.2
Sugar Mill Rail Station Site E[1] **	Package A	40,750	35 ppm	13.3	9 ppm	7.2
Sugar Mill Rail Station Site E1	Preferred Alternative	63,600	35 ppm	12.8	9 ppm	6.9
SH 7 and I-25[1]	Package A	67,400	35 ppm	10.3	9 ppm	6.2
SH 7 and I-25[1]	Package B	71,300	35 ppm	11.5	9 ppm	6.9
SH 7 and I-25[1]	Preferred Alternative	71,100	35 ppm	9.0	9 ppm	5.5
SH 7 and I-25[1]	Phase 1	67,350	35 ppm	8.8	9 ppm	5.4
Thornton Parkway and I-25	Package A	41,850	35 ppm	13.8	9 ppm	7.7
Thornton Parkway and I-25	Package B	42,800	35 ppm	14.1	9 ppm	7.9
Thornton Parkway and I-25	Preferred Alternative and Phase 1	44,650	35 ppm	12.8	9 ppm	7.1

[1] Includes traffic operations associated with egress/ingress at transit stations.
[2] Parts per million concentration
**re-modeled with revised emission and idling factors.

3.5.3.4 PROJECT-LEVEL PM_{10} ANALYSIS

This section summarizes the results of two separate PM_{10} analyses. First, a qualitative analysis was performed for the portions of the project within the Denver PM_{10} maintenance area, where the Clean Air Act transportation conformity requirements apply. Second, a similar analysis was performed for elements of the project located outside of the PM_{10} maintenance area, for purposes of characterizing the likely impacts of these aspects of the project.

PM_{10} CONFORMITY ANALYSIS

The conformity analysis followed the guidelines presented in the *Transportation Conformity Guidance for Qualitative Hot-Spot Analyses in $PM_{2.5}$ and PM_{10} Non-attainment and Maintenance Areas* (2006). The following elements were included in the PM_{10} hot-spot analysis:

- Description of proposed project
- Description of the type of PM_{10} emissions
- Contributing Factors
- Description of analysis years
- Description of existing conditions
- Description of changes resulting from project
- Description of analysis method chosen
- Professional Judgment of Impact
- Discussion of any mitigation measures
- Conclusion on how project meets 40 CFR 93.116 and 93.123.

The PM_{10} qualitative hotspot analysis was conducted for the worst-case transit station and parking facility within the regional study area (located within the Denver PM_{10} attainment/maintenance area), along with the worst-case traffic location. Where regional SIP modeling exists, the analyses used comparisons of nodal emissions estimated values for future years. The commuter rail comparative analysis incorporated dispersion modeling and analysis undertaken for a nearby transit project. The Regional Transportation District (RTD) sourced emissions factors were used by that project.

Description of Proposed Project

A description of the North I-25 project is provided in **Chapter 1** *Purpose and Need*, and **Chapter 2** *Alternatives Considered*.

The conformity regulations require a PM hotspot analysis for “projects of air quality concern,” which are defined in 40 CFR 93.123(b)(1). This project is considered a project of air quality concern under 93.123(b)(1)(iii), “new bus and rail terminals and transfer points that have a significant number of diesel vehicles congregating at a single location.”

Description of the Type of PM_{10} Emissions

The hot spot analysis was based on directly emitted emissions from vehicles, including tailpipe, brake wear, and tire wear. Re-entrained road dust is also addressed in this analysis as required by USEPA and FHWA guidance.

Construction related PM_{10} emissions were not included in this hot spot analysis because these emissions would be considered temporary since construction on any one phase would last less than 5 years (40 CFR 93.123[c][5]). Secondary PM_{10} precursor emissions would be associated with regional impacts and, therefore, are not required to be included in the hot spot analysis.

Interagency consultation was conducted in September 2004, July 2006, and March 2007 with CDPHE-APCD, EPA, FHWA, FTA, and CDOT/EPB. It was determined that a $PM_{2.5}$ hot spot analysis would not be required since the Denver Metro area and the North Front Range are designated as attainment areas. Precursor emissions of $PM_{2.5}$ include NO_x and VOC which were estimated for this project elsewhere in this document.

Contributing Factors

PM_{10} is one of the air quality criteria pollutants outlined in the CAA that is generated, in part, by motor vehicles. PM_{10} is a pollutant of concern in the Denver attainment/maintenance area. Although this analysis addresses emissions generated by mobile sources, area and point source PM_{10} emissions in the Denver area include the Denver International Airport, Buckley Air Force Base, a large oil refinery complex, four power generation plants, and other industrial sources. Existing conditions of air quality in the project area are presented in **Section 3.5.2**.

Emissions from mobile sources within the entire regional study area and the attainment/maintenance areas were estimated for existing and future conditions. The existing condition year (2005) is the year that the travel demand models were calibrated (see *Travel Demand Traffic Technical Report (Jacobs, 2011)* for more detail). Future emissions were based on anticipated traffic levels, traffic distributions, and speeds. Emissions levels included winter-summer seasonal influence, expected vehicle types, and traffic composition.

Travel demand forecasting completed for the FEIS generated a calculation of vehicle-miles traveled for the regional study area (see **Chapter 4** *Transportation Impacts* of this Final EIS).

Some PM_{10} particles are formed by eroded natural surface rock and soil material and enter the air through a variety of actions including "entrainment" into the atmosphere by wind-blown dust. This is particularly important to the Denver Metro Area because it is situated within a low-lying basin where atmospheric temperature inversions trap entrained dust and other pollutants underneath a ceiling of overriding cold air. This frequent condition creates stagnant air within the Denver Metro Area and acts to concentrate pollutants. Counteracting this condition, Denver also experiences very strong westerly winds that effectively disperse pollutants. These same winds accelerate entrainment of exposed dust and sand.

Particles from winter road sanding, brake and tire wear, pavement wear, and other vehicle degenerative processes contribute to PM_{10}. Fugitive dust is one of the major contributors of PM_{10} in the regional study area. Fugitive dust is mainly dust from roads, fields and construction sites. Mobile sources of fugitive dust includes road dust generated from vehicle entrainment of excess roadside sand, as well as non-roadway vehicle dust contributed from motorized vehicles that typically operate off-road, such as farming equipment, recreational vehicles, construction equipment, and airport vehicles. The primary vehicular emissions source of PM_{10} comes from diesel engines which are critical to both the transit and transportation freight industries.

The CDPHE–APCD enforces several regulations through the auspices of the Air Quality Control Commission (AQCC) to reduce particulate emissions from mobile sources as control strategies and contingency measures for non-attainment areas, including gas and diesel motor vehicle inspections and maintenance programs (Regulations 11 and 12) and street-sanding and sweeping standards to clean up winter sanding operations and excess roadside sand accumulations (Regulation 16).

Description of Analysis Years

The analysis year examined needs to be the year that the peak emissions from the project are expected. The current adopted transportation plans (20 years) in the Denver metro area and the north front range area are the DRCOG 2035 MVRTP, the NFR 2035 RTP and the UFR 2035 RTP.

The Colorado PM_{10} maintenance plan presents emission inventories through 2030 which shows a trend of increasing mobile sources emissions. The maintenance plan does not cover years beyond 2030. However, based on the trend of emissions, it is assumed that emissions will continue to increase through 2035. Therefore, 2035 was selected as the year with peak PM_{10} emissions and the highest PM_{10} background concentrations for the PM_{10} hot spot analysis.

Description of Existing Conditions

The daily VMT for the existing conditions (2005) within the project area is approximately 30 million miles.

A survey of PM_{10} levels recorded from monitoring stations within the regional study area for the years 2005 to 2008 shows that there have not been any exceedances of the annual or 24-hour PM_{10} NAAQS from monitoring stations within the Denver metro and northern Front Range areas. The annual average PM_{10} standard was revoked by the EPA in December 2006. Therefore, only the 24-hour maximum concentrations recorded at area monitoring stations in 2009 have been listed in **Table 3.5-11.**

Table 3.5-11 2009 Maximum 24-Hour Particulate Matter Concentrations

Monitoring Station	PM_{10}	
	24-Hour	
	Std	Maximum Monitored
Commerce City 7101 Birch Street	150	96
Welby 3174 E 78th Avenue	150	66
Boulder 2440 Pearl St	150	40
Longmont 350 Kimbark Street	150	38
Denver CAMP 2105 Broadway	150	62
Denver Municipal Animal Shelter 678 S Jason Street	150	53
Denver Visitors Center 225 W Colfax Avenue	150	56
Fort Collins 251 Edison Drive	150	61
Greeley 1516 Hospital Road	150	63

Source: EPA

Description of Changes Resulting from Project

Change of VMT: Daily corridor-wide VMT for the build alternatives would be similar, within 1 to 2 percent and would increase approximately 42 to 43 percent compared to existing 2005 conditions. The worst case daily traffic volumes along I-25 for the build alternatives would range between 246,400 and 253,500 vpd in 2035, at the southern terminus of the project near I-25 and 84th Avenue. These traffic volumes are lower than those currently experienced at the interchange at I-25 and I-70, where violations of the NAAQS have not been monitored or modeled in the SIP.

Change of LOS: Hot spots of PM_{10} generally occur where there is a high percentage of trucks in heavily congested areas. Even though traffic is expected to increase as a result of the proposed roadway improvements, the projected LOS would improve or remain the same within the regional study area compared to No-Action conditions due to expanded capacity and efficiency (see **Chapter 4** *Transportation Impacts* for more information).

Change of Vehicle Emissions: Overall vehicle emissions are shown in **Table 3.4-5**, Daily Region-Wide Total Mobile Source Emissions Estimates. Daily vehicle emissions of PM_{10} are higher for Package A and the Preferred Alternative compared to Package B and Phase 1. However, emissions from all of the build alternatives would be lower than existing 2005 emissions.

Change of Re-entrained Dust Emissions: According to Chapter 13.2.1 of *AP-42, Fifth Edition, Compilation of Air Pollutant Emission Factors*, road re-entrained dust emissions are a function of road silt content, average weight of vehicles, and VMT. Uncontrolled and controlled dust emissions were calculated for the No-Action, Package A, Package B, Preferred Alternative, and Phase I. Total VMT for each alternative within the study area were used for the calculations. In addition, default values for other inputs such as silt content, vehicle weight, and control efficiency were obtained from the AP-42 Fifth Edition. As shown in **Table 3.5-12**, fugitive dust emissions would be approximately 0.01 percent higher for all build alternatives compared to the No-Action Alternative. Although dust emissions are anticipated to be slightly higher compared to the No-Action Alternative, the increase is not expected to cause an exceedance of the NAAQS.

Note that the total emissions are representative of the study area to show a worst case scenario. However, the controlled emissions would be lower since regulation 16 only controls fugitive dust emissions within the DRCOG PM_{10} maintenance area.

Table 3.5-12 Fugitive Dust Emissions

Alternative	Uncontrolled Emissions (tons/day)	Controlled Emissions (tons/day)
No-Action	90.5	76.1
Package A	91.1	76.6
Package B	90.9	76.4
Preferred Alternative	91.2	76.6
Phase 1	91.1	76.5

Description of Analysis Method Chosen

Consultation with CDPHE-APCD, EPA, and FHWA , CDOT/EPB, and FTA was conducted in September 2004, July 2006, and March 2007, and determined that the project-level hot spot analysis would be conducted at a worst-case transit station parking facility within the regional study area and a comparative analysis for the proposed bus and rail maintenance facilities located outside of the Denver PM_{10} attainment/maintenance area.

The following two methods were chosen for the PM_{10} hot spot analysis as outlined in Section 4.1 of the March 2006 USEPA/FHWA guidance: air quality studies for the proposed project location and comparison to another location with similar characteristics.

The intention of these project-level qualitative analyses is to assess whether the project would be likely to cause or contribute to any new localized PM_{10} violations or increase the frequency or severity of any existing violations (40 CFR 93.116).

Air Quality Studies for the Proposed Project

Only the southernmost segment of the 61-mile long regional study area, including Package A commuter rail, Package B new BRT-express lanes, Preferred Alternative express and commuter bus, Phase 1 commuter bus, and station facilities associated with each package, is located in the Denver attainment/maintenance area for PM_{10}. For the sections of I-25 within the PM_{10} modeling domain, the grid cells with the maximum modeled 24-hour PM_{10} concentrations were selected to represent the worst-case PM_{10} concentrations within the project corridor.

The project-level analysis did not include fugitive dust or construction-generated emissions. Road re-entrained dust emission is a function of road silt content, average weight of vehicles, and VMT. Because only VMT would change as a result of the build alternatives, fugitive dust from roads would be proportionate to VMT. All of the build alternatives would increase road re-entrained dust by approximately 42 percent compared to existing levels, but only 0.01 percent compared to the No-Action Alternative.

Worst-Case Transit and Parking Station

The predicted highest-volume transit station with the largest associated parking lot occurs at the SH 7 BRT station in the morning peak hours. This site is expected to have a maximum idling congregation of four express buses at any one-peak hour in Package B and eight express buses during any one-peak hour in the Preferred Alternative and Phase 1. There would be four peak hour commuter buses with Package A and Package B. The site would accommodate 180 parked vehicles under Package A as a commuter parking lot; 469 parked vehicles under the BRT station parking in Package B; and 280 parking spaces each with the Preferred Alternative and Phase 1. Average individual bus idling times are approximately 40 seconds per stop. The maximum number of buses coincident to one parking station at any one peak hour occurs in the peak hours when feeder and mainline I-25 bus headways are shortest. Transit headway refers to the frequency of circulating buses in any one direction on a transit route. A 30-minute headway would be equivalent to two buses per hour. The analyses did not include fugitive dust pollution. Only tailpipe emissions were analyzed.

Traffic accessing the parking facility is expected to operate at an acceptable level of service during peak morning hours. Level of service in the afternoon peak hours is expected to operate less adequately (LOS D). Passing and parking traffic volumes are listed in **Table .3.5-13**.

Table 3.5-13 Characteristics of SH7 BRT (or Express Bus) Station and Parking Facility

Peak Hour	2035				
	No-Action	Package A	Package B	Preferred Alternative	Phase 1
Idling BRT/Express Bus volume (# of buses)	NA	NA	4	8	8
Parked vehicles	0	180	469	280	280
Internal parking travel (VMT)	0	74	266	128	128
Parking access and pass-by vehicles (VMT)	5,685	5,715	5720	5720	5720

There are no PM_{10} monitoring stations located near the SH 7 BRT (or express bus) station and parking lot. The *Colorado SIP for PM_{10} Revised 2005 Summary of Dispersion Model Results* was used to formulate a comparison between total emissions model grid cell data at the SH 7 BRT (or express bus) station and parking site (Grid Cell No.155) and at a known similar RTD commuter park-n-Ride facility at the Thornton Parkway (Grid Cell No.125) for purposes of assessing whether the new facility would likely cause or contribute to any new localized PM_{10} violations or increase the frequency or severity of any existing violations (40 CFR 93.116) over the project timeline (see **Table 3.5-14**). The Denver area PM_{10} maintenance plan dispersion modeling incorporates both area-wide analysis and hot spot analyses to determine regional PM_{10} concentrations. Grid cells at the northern periphery of the modeling domain evaluate an area approximately one kilometer by one kilometer in size and include many more emissions than just the featured sites.

Table 3.5-14 Comparison of PM_{10} Dispersion Model Data at SH 7 BRT Station and Parking Lot [B-T1 Component] and Thornton Parkway RTD Facility

Location Description	Grid Cell Number	NAAQS ($\mu g/m^3$)	Total Concentration (6th highest value) ($\mu g/m^3$)
			2030
I-25 and Thornton Parkway RTD Facility	125	150	103.13
I-25 and SH 7 BRT Station and Parking Facility	155	150	89.42

*6th highest modeled values are used to determine compliance with the PM_{10} NAAQS

VMT comparisons for the two sites show that, in the year 2030, the total VMT would only increase 0.007 percent due to the new SH 7 facility. Based on the modeled values from the PM_{10} maintenance plan, presented above, a 0.007 percent increase in emissions would clearly not be sufficient to cause either of these locations to exceed the 150 ug/m3 NAAQS. Although emission rates will continue to decline or level off between current conditions and the design year 2035, VMT will continue to rise. Therefore, the maximum expected emissions would be in the year 2035 which are demonstratively below the NAAQS of 150 $\mu g/m^3$.

Professional Judgment of Impact

Based on the PM_{10} maintenance plan modeling results and the comparison to another location with similar characteristics to the project, the project is not expected to cause an exceedance of the PM_{10} NAAQS as a result of implementation of Package A, Packable B or the Preferred Alternative.

In addition, regional PM_{10} modeling was conducted by CDPHE-APCD. Concentrations of PM_{10} within the regional study area for Package A, Package B, the Preferred Alternative, and Phase 1 would be 3.629, 3.574, 3.625, and 3.577 tons/day, respectively. Modeling was also conducted by CDPHE-APCD for the attainment/maintenance areas. The 2035 total PM_{10} emissions within the Denver attainment/maintenance area for Package A, Package B, the Preferred Alternative, and Phase 1 would be 2.915, 2.913, 2.912, and 2.912 tons, respectively. The emissions would be less than the Denver PM_{10} attainment/maintenance plan emissions budget attributed to mobile sources for 2020 and well below the PM_{10} NAAQS. Therefore, regional and attainment/maintenance area emissions would be well below the PM_{10} NAAQS and the emissions budget as a result of this project.

Discussion of Mitigation Measures

The results of the hot spot analysis concluded no exceedances to the PM_{10} standard are likely as a result of the Preferred Alternative or Phase 1 improvements. However, best management practices (BMPs) will be implemented to reduce air quality effects. Details of the regional PM_{10} control measures are presented in the *Air Quality Technical Report Addendum, Section 5.0 Mitigation Measures* (Jacobs, 2011c). In addition, the following BMPs will be implemented to reduce PM emissions.

- Routing existing traffic away from populated areas (e.g., truck restricted zone)
- Replace a significant number of older buses with cleaner buses (e.g., those meeting 2007 heavy-duty diesel standards, as practical, hybrid-electric vehicles, etc.)
- Prepare street cleaning and site watering plans to be followed during construction

CDOT has also developed an Air Quality Action Plan which will generate programmatic emission reduction mitigation solutions statewide. Most of these programs are planned. However, two pilots testing effectiveness of particulate emissions reduction programs are in progress: diesel particulate matter reductions through an *Off-road Diesel Vehicle Retrofit Demonstration Project* installing test maintenance vehicles with DOC filters and particulate emissions reductions through *Engines Off! Colorado* a statewide outreach program to provide communities, individuals and local governments with web-based idling restriction strategies, emissions reduction education, and idling ordinance tool-kits.

Conclusion on how project meets conformity regulations for hot-spots (40 CFR 93.116 and 93.123)

Based on the analyses discussed above, the lack of monitor violations or exceedances, the North I-25 corridor project is not anticipated to cause any new or worsen the existing violations of NAAQS. The Denver metro area is currently in attainment of the PM_{10} NAAQS; thus, this project, by definition, will not delay attainment of the NAAQS. Therefore, the project meets the conformity requirements in 40 CFR 93.116 and 91.123 for PM_{10}.

PM_{10} ANALYSIS FOR ELEMENTS OF THE PROJECT NOT SUBJECT TO CONFORMITY

Comparison to Another Location with Similar Characteristics

The Berthoud Rail Maintenance Yard and Greeley Maintenance facility are located outside of the PM_{10} maintenance area. Therefore, conformity does not apply. However, these sites were used for the following analyses to report likely PM_{10} effects for purposes of this Final EIS.

Rail Hot Spot Analysis

The North Fort Collins and Berthoud Rail maintenance facility were used in the comparative analysis conducted for the Draft EIS. However, the North Fort Collins rail maintenance facility is not included in the Preferred Alternative and therefore will not be assessed in this analysis for the Final EIS. The Berthoud Rail maintenance facility is assessed and emissions are compared to the FasTracks Fox North commuter rail maintenance facility.

The Berthoud Rail commuter rail maintenance yard was delineated to a conceptual level of design. Although yard site functions and general operational capacities have been identified, site specific track layout and rail operations and repair schedules have not yet been defined.

Emissions that would occur for the future years of the Preferred Alternative were estimated using the operational data for DMU trains. Each DMU train car would be individually powered by multiple onboard engines (three heavy duty diesel engines per train car). Emissions were calculated using the total miles traveled per DMU train, the number of cars per train, and the number of trains entering and exiting the facility per day. Emission factors used for each DMU engine were obtained from the RTD Commuter Rail Maintenance Facility (CRMF) EA that was prepared in July 2009. Emissions factors used in the RTD CRMF EA were derived from USEPA's MOBILE6.2 program for heavy-duty diesel trucks.

This analysis was based on directly emitted PM_{10} emissions from tailpipe, break wear, and tire wear. Re--entrained road dusts were not included in the analysis, assuming that the operation of DMU and vehicles within the facility would not cause significant fugitive dust emissions.

Table 3.5-15 summarizes the maintenance yard operations for the Berthoud Rail yard. The emissions generated at this site are well below the PM_{10} NAAQS for the maximum predicted 24-hour and annual emissions levels. Therefore, it is unlikely that emissions from this facility would cause or contribute to any new localized PM_{10} violations or increase the frequency or severity of any existing violations.

Table 3.5-15 North I-25 Commuter Rail Maintenance Yard

Rail Yard	Rail Type	VMT			Number of Diesel Cars			Number of Engines Per Cars			Total Emissions
		Pull-in	Pull-out	Idling	Pull-in	Pull-out	Idling	Pull-in	Pull-out	Idling	
Berthoud Package A	DMU	0.6	0.6	N/A	22	22	67	3	3	3	0.080
Berthoud Preferred Alternative	DMU	0.6	0.6	N/A	22	22	67	3	3	3	0.080

Note: Emissions calculated for pull-in, pull-out, and idling activities only.

Comparison of the Berthoud Rail yards to the Fox North Rail yard shows similar function, but a much smaller operating engine fleet as tabulated in **Table 3.5-16** The emissions generated at the Fox North facility would be well below the PM_{10} NAAQS for the maximum predicted 24-hour and annual emissions levels. Therefore, emissions generated at the proposed Berthoud yard would be less than the NAAQS and would be unlikely to cause or contribute to any new localized PM_{10} violations or increase the frequency or severity of any existing violations.

Table 3.5-16 Comparisons of Commuter Rail Maintenance Yards

Rail Yard	Rail Type	Engine Fleet Size	Yard Ground Size (acre)	Functions and Operations	Conclusion
Fox North Rail Yard	DMU	84	36	Similar	Emissions are below 24-hour and annual NAAQS levels for PM_{10}
Berthoud Package A	DMU	6-8	58	Similar	Emissions would be less than Fox North Yard
Berthoud Preferred Alternative	DMU	6-8	58	Similar	Emissions would be less than Fox North yard

Greeley Commuter Bus/BRT Maintenance Facility

The proposed commuter bus operations and maintenance facility proposed at 31st Street and 1st Avenue in Greeley would accommodate covered storage, repair and inspection of the bus fleet consisting of 38 buses for Package A US 85 commuter service, 43 total buses for Package B bus rapid transit and feeder bus service, 41 buses for the Preferred Alternative, and 37 buses for Phase 1.

The site is estimated to be 4.6 acres of service buildings, administration offices, employee services, tire and parts storage, parking, water quality facilities, on-site fueling centers, areas for vehicle cleaning, paint and body shops, and repair bays. The entire 2 acre open yard area would be paved and have multiple access points.

The area surrounding the proposed 31st Street and 1st Avenue bus maintenance yard is commercial and undeveloped land.

The Preferred Alternative includes bus service from Greeley on both I-25 and US 85. The Preferred Alternative has one route that serves the South Transit Center in Fort Collins that requires four fleet buses (the remainder of the routes serves only the I-25 corridor). Given these service patterns, it was recognized that the Greeley location for the bus maintenance facility would generate less out of direction travel for buses to and from the service facility. Therefore, due to less out-of-direction travel with the Greeley location compared to the Fort Collins site, the Preferred Alternative includes the Greeley site for a bus maintenance facility.

Commuter Bus and BRT Hot Spot Analysis

The PM_{10} monitoring stations located near the proposed Greeley maintenance facility recorded maximum 24-hour PM_{10} concentrations of 96 μg/m^3 in the past 10 years. Because the Greeley monitoring station is outside the PM_{10} Maintenance Plan modeling domain, projection of a 2035 PM_{10} concentration was not interpolated from Denver area data.

The Greeley commuter bus and BRT maintenance yard was delineated to a conceptual level of design. Although yard site functions and general operational capacities have been identified, site specific circulation, storage and repair schedules have not yet been defined. A relative comparison of facility bus fleet and site size at each facility was used to indicate whether the proposed maintenance facilities would be likely to generate more or less emissions than a similarly functioning bus maintenance facility located at Commerce City within the Denver PM_{10} attainment/maintenance area (see **Table 3.15-17**).

The *Colorado SIP for PM_{10} Revised 2005 Summary of Dispersion Model Results* was used to formulate a comparison using total emissions model grid cell data for the area of the Commerce City maintenance facility (Grid Cell No.96). The modeled grid data is used to establish emissions concentrations associated with a larger, modeled bus maintenance facility within the PM_{10} attainment/maintenance area. The Commerce City site is located in a highly industrialized area. The regional PM_{10} modeling grid point includes emissions generated from other sources than vehicular mobile sources, such as industrial and urban area generators, and therefore provides a more conservative reference to compare to the Greeley site.

Table 3.5-17 Comparisons of Physical Attributes of the Commuter Bus Maintenance Facility in Commerce City to Greeley Bus and BRT Maintenance Facility

Maintenance Facility	Bus Type	Bus Fleet Size	Yard Ground Size	Functions and Operations	Comparative Emissions Estimate
Commerce City (Commuter and Regional Bus Service)	Standard Diesel Commuter Bus and Diesel Coach	118	14 acres	Similar	Emissions are some of the highest within the conformity modeling area.
Greeley Package A (commuter bus) or Package B (BRT)	Standard Diesel Commuter or Diesel Coach	38-43	4.6 acres	Similar	Emissions are estimated to be 68% less than the Commerce City facility.
Greeley Maintenance Facility Preferred Alternative (commuter bus and Express Bus)	Standard Diesel Commuter or Diesel Coach	37	4.6 acres	Similar	Emissions are estimated to be 69% less than the Commerce City RTD Facility
Greeley Maintenance Facility Phase 1 (commuter bus)	Standard Diesel Commuter or Diesel Coach	41	4.6 acres	Similar	Emissions are estimated to be 65% less than the Commerce City RTD Facility

Total PM_{10} emissions for the Commerce City site were projected in the SIP for the year 2030 (see **Table 3.5-18**). This site is located within the PM_{10} maintenance area, in an area with high background concentrations of $PM_{10.}$ The bus parking area being examined for the North I-25 EIS project is not within the PM_{10} maintenance area and it is within an area with low background concentrations of $PM_{10.}$ In addition, the fleet size at the Commerce City site is significantly larger than what is proposed for the build alternatives. Therefore, concentrations predicted in the SIP for the year 2030 for the Commerce City site are sufficient to show that there will be no exceedance of NAAQS in Greeley by the year 2035 as a result of the build alternatives.

Table 3.5-18 Comparison of Commerce City RTD and Greeley Maintenance Facilities

Location Description	Grid Cell Number	NAAQS PM_{10} (µg/m^3)	Total PM_{10} Concentrations (6th highest value) (µg/m^3) 2030
Commerce City Maintenance Facility	96	150	149.85*
Greeley Bus Maintenance Facility (Proportional emissions) Packages A and B	NA	150	57.29
Greeley Bus Maintenance Facility (Proportional emissions) Preferred Alternative	NA	150	55.50
Greeley Bus Maintenance Facility (Proportional emissions) Phase 1	NA	150	62.66

*Total PM_{10} concentration projected for 2030

3.5.3.5 PROJECT-LEVEL MSAT ANALYSIS

A basic quantitative analysis of mobile source air toxic (MSAT) emissions from the regional study area of the proposed project was completed using the latest version of the EPA's mobile emission factor model (MOBILE6.2) as discussed in **Section 3.5.3.1** *Regional Analysis*. The local study area used for this traffic analysis includes all major roadways potentially affected by the proposed new transportation facility. Specific emissions levels for each transit station along the BRT and feeder bus routes were not evaluated in this study.

Project level MSAT analyses was conducted for commuter bus and BRT maintenance facilities using emission factors generated specifically for bus emissions through diesel research conducted by the California Air Resources Board (Ayala, 2003). Overall VMT relationships among packages were utilized to estimate future trends in MSAT emissions.

Table 3.5-19 describes the MSAT emissions associated with Package A, Package B, Preferred Alternative, and Phase 1. The build alternatives would generate between 1.3 percent to 1.5 percent higher emissions than the No-Action Alternative in the year 2035. The MSAT emissions in the year 2005 base case were much higher than any of the build or No-Action alternatives in the year 2035. This is reflective of the overall national trend in MSATs as previously described.

Table 3.5-19 MSAT Emissions (tons per year) by Package

Pollutant	2005	2035				
	Existing	No-Action	Package A	Package B	Preferred Alternative	Phase 1
Vehicle VMT (Daily)	76,951,721	135,156,908	135,478,050	135,272,142	135,414,740	135,370,346
Acetaldehyde	279.59	129.21	131.765	131.4	131.765	131.765
Acrolein	22.63	10.95	11.315	11.315	11.315	11.315
Benzene	1103.395	513.19	514.65	513.92	514.285	514.65
1,3-Butadiene	135.78	58.035	59.13	59.13	59.13	59.13
Diesel Particulates	525.965	37.595	39.785	39.42	39.785	39.42
Formaldehyde	480.705	235.425	241.995	241.63	241.63	241.995
Total Emissions (Tons/year)	**2548.065**	**984.405**	**998.64**	**996.815**	**997.91**	**998.275**

Regardless of the alternative chosen, MSAT emissions would be lower than present levels in the future year as a result of EPA's national control programs that are projected to reduce annual MSAT emissions by 72 percent between 1999 and 2050. 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 that MSAT emissions in the regional study area would be lower in the future in all cases.

When evaluating the future options for upgrading a transportation corridor, the major mitigating factor in reducing MSAT emissions is the implementation of the EPA's new motor vehicle emission control standards. Substantial decreases in MSAT emissions would be realized from a current base year (2005) through an estimated future year. Accounting for anticipated increases in VMT and varying degrees of efficiency of vehicle operation, total MSAT emissions were predicted to decline approximately 61 percent from 2005 to 2035.

The MSATs from mobile sources, especially benzene, have dropped dramatically since 1995, and are expected to continue dropping. In addition, Tier 2 automobiles introduced in model year 2004 would continue to help reduce MSATs. Diesel exhaust emissions have been falling since the early 1990s with the passage of the CAAA. The CAAA provided for improvement in diesel fuel through reductions in sulfur and other components.

The Urban Air Toxics Pilot Program in Denver monitored three locations, all of which are within the regional study area: the downtown Denver CAMP, Swansea Station located at 4650 Columbine Street in metro Denver, and Welby Station located near 78th Avenue and Steele Street in the heart of the Platte River industrial district. Although not all MSATs were monitored at these sites, acetaldehyde, benzene, 1,3-butadiene, and formaldehyde were sampled during the period of May 2002 through April 2003 and were detected 90 percent or more of the time at all three monitoring locations.

Calculated regional MSAT emissions associated with Package A, Package B, Preferred Alternative, and Phase 1 would be 14.24, 12.4, 13.5, and 13.87 tons per year (tpy), respectively, more than the No-Action Alternative by the design year of 2035. Decreases from the base year would be substantial even with the associated increase in VMT in the regional study area because the build alternatives would reduce congestion which in turn would reduce emissions. Some sensitive receptors do exist in the project vicinity, but their MSAT emissions exposure would decrease by the 2035 design year and beyond due to implementation of EPA's control measures. Sensitive receptors include homes, schools, churches and community centers.

Summary of MSAT Analysis Findings

Localized increases in MSAT concentrations would likely be most pronounced along the roadway sections with the highest VMT. Potential impacts from MSATs are greatest near highly developed residential areas and major intersections. In general, emissions would be higher (compared to No-Action) as roadways move closer to receivers. However, with implementation of the build alternative (higher speeds and less congestion), emissions would be lower. On a regional basis, EPA's vehicle and fuel regulations, coupled with fleet turnover, would over time cause substantial reductions that, in almost all cases, would cause region-wide MSAT levels to be substantially lower than today.

Summary of MSAT Analysis: Package A—Air quality emissions from Package A commuter rail and bus service would be incrementally neutral. Diesel emissions generated by rail locomotion (DMU) and diesel-operated transit bus engines are anticipated to be less than current operating levels due to introduction of low-sulfur fuels and Tier 3 and 4 diesel engine emission controls. Transit service would remove an estimated 6,100 vehicles daily from the roadway network in the year 2035. The commuter bus and feeder systems would provide roughly 1,600 daily riders with service between various northern Front Range sites to Denver and DIA. However, the reduction associated with vehicles removed from the roadways by Package A transit options would account for approximately 0.01 percent of total regional study area VMT.

Summary of MSAT Analysis: Package B— Air quality emissions from Package B BRT and feeder bus service would occur from diesel emissions generated by buses running in the dedicated transit lane. Diesel emission levels would be anticipated to be less than those currently experienced on buses in use in the regional study area, due to introduction of low-sulfur fuels and Tier 3 and 4 diesel engine emission controls. Transit service would remove an estimated 10,200 vehicles daily from the roadway network in the year 2035. However, the reduction associated with vehicles removed from the roadways by Package B transit options would account for approximately 0.02 percent of total regional study area VMT.

Preferred Alternative

Air quality emissions from the Preferred Alternative express bus service and commuter rail and bus service is incrementally neutral. Diesel emissions generated by rail locomotion (DMU) and diesel-operated bus engines are anticipated to be less than current operating levels due to introduction of Tier 3 and 4 low-sulfur fuels and diesel engine emission controls. Transit service would remove an estimated 11,500 vehicles daily from the roadway network in the year 2035. However, the reduction associated with vehicles removed from the roadways by the Preferred Alternative transit options would account for only approximately 0.02 percent of the total regional study area VMT.

Phase 1

Air quality emissions from Phase 1 commuter bus service would occur from diesel emissions generated by buses running in the dedicated transit lane. Diesel emission levels would be anticipated to be less than those currently experienced on buses in use in the regional study area, due to introduction of Tier 3 and 4 low-sulfur fuels and diesel engine emission controls. Transit service would remove an estimated 6,300 vehicles daily from the roadway network in the year 2035. However, the reduction associated with vehicles removed from the roadways by Phase 1 transit options would account for 0.01 percent of the total regional study area VMT.

3.5.3.6 Localized Effects of Commuter Rail and BRT Stations

Commuter rail and BRT or express bus stations would result in local increases of some pollutants due to increasing emissions from transit vehicles themselves and from automobile, truck and bus traffic accessing the stations. These emissions would be greater than with the No-Action Alternative at these particular locations, but in no cases would there be exceedances of the NAAQS.

Table 3.5-22 to **Table 3.5-23** show the stations with residential or other sensitive land uses that could be affected by these localized increases in emissions as a result of the build alternatives.

Table 3.5-20 Sensitive Land Uses Affected by Package A

Transit Station Location	Sensitive Land Uses in the Vicinity
Fort Collins Downtown Transit Center Rail Station: Mason and Cherry Streets	Residential, church and educational land uses within 600 feet.
CSU Commuter Rail Station: South Mason Street between West Laurel Street and Old Main Dr.	Church and college residential and uses within 600 feet of the commuter rail.
South Fort Collins Transit Center Commuter Rail Station [A-H2 Component]: US 287 and Harmony Road	Commuter rail station would be 500 feet from residential areas.
North Loveland Commuter Rail Station: 29th Street and US 287	Commuter rail station would be 100 feet from residential development and 600 feet from school and church facilities.
Downtown Loveland Commuter Rail Station: N. 4th Street and Cleveland Avenue (US 287)	Commuter rail station would be 700 feet from residential, school, community health, and church facilities.
Berthoud Commuter Rail Station: US 287 and Mountain Avenue (SH 56)	Commuter rail station would be 100 feet from residential land uses.
North Longmont Commuter Rail Station: SH 66, between US 287 and N. 115th Street	Commuter rail station would be 100 feet from residential land uses.
Longmont at Sugar Mill Commuter Rail Station: Three sites are under consideration: The first site is south of Sugar Mill Road, north of Ken Pratt Boulevard, and west of N. 119th Street. The second site is on north side of Sugar Mill Road. The third site is at County Line Road and SH 119.	Commuter rail station would be 600 feet, 1,000 feet and less than 100 feet respectively, from residential land uses.
I-25 and WCR 8 Commuter Rail Station: I-25 and WCR 8	No sensitive land uses in close proximity. Nearest sensitive land use is 2,300 feet from site.
Fort Collins Commuter Rail Maintenance Facility: Vine Drive and Timberline Road	Commuter rail facilities would be within 500 feet from residential, church and health facilities.
Berthoud Commuter Rail Maintenance Facility: CR 46 and US 287	Scattered residential land use within 100 feet of the maintenance facility. No other sensitive land uses in area.
Greeley Commuter Bus Station: US 85 and D Street A	Commuter bus facilities would be 300 feet from residential area and community facility.
South Greeley Commuter Bus Station: US 85 and US 34 interchange on the southwest corner of 26th Street and 9th Avenue	Commuter bus facilities would be 100 feet from closest residential land use. Most sensitive land use areas are located more than 1,100 feet from site.
Evans Commuter Bus Station: US 85 and 42nd Street	Commuter bus facilities would be 100 feet from residential areas and church facilities.
Platteville Commuter Bus Station: US 85 and SH 66	Commuter bus facilities would be 300 feet from sensitive land use areas.
Fort Lupton Commuter Bus Station: US 85 just south of 14th Street	Commuter bus facilities would be 850 feet from sensitive land use areas.
Greeley Bus Maintenance Facility: 31st Street and 1st Avenue	Commuter bus facilities would be 700 feet from residential areas and church facilities.

Table 3.5-21 Sensitive Land Uses Affected by Package B

BRT Station Location	Sensitive Land Uses in the Vicinity
South Fort Collins Transit Center BRT Station: US 287 and Harmony Road	Commuter BRT facilities would be 500 feet from residential areas.
Harmony Road and Timberline BRT Station: Harmony Road and Timberline	Commuter BRT facilities would be 300 feet from closest residential areas.
I-25 and Harmony Road BRT Station: I- 25 and Harmony Road	No sensitive land use areas in close proximity. Nearest residential development 2,000 feet from site.
Windsor BRT Station: I-25 and SH 392	Commuter BRT facilities would be 300 feet from residential areas.
Crossroads BRT Station: There are two sites: Site O is northeast of I-25 and Crossroads Boulevard. Site M is located southwest of I-25 and Crossroads Boulevard	No sensitive land use areas within 0.5 mile proximity.
US 34 and SH 257 BRT Station: US 34 and SH 257	No residential areas in close proximity.
West Greeley BRT Station: US 34 (Business Loop) and 83rd Avenue	Commuter BRT facilities would be 100 feet from residential areas.
Greeley Downtown Transfer Center BRT Station: Downtown Greeley between 9th Avenue and 8th Avenue on 7th Street	Commuter BRT facilities would be greater than 1,000 feet from residential areas.
Berthoud BRT Station: I-25 and SH 56	Commuter BRT facilities would be 600 feet from residential areas.
Firestone BRT Station: I-25, south of SH 119	Commuter BRT facilities would be less than 300 feet from residential areas.
Frederick/Dacono BRT Station: I-25, 0.5 mile north of SH 52	No sensitive land use areas in close proximity.
I-25 and SH 7 BRT Station: Two sites: Site E Is east of I-25 and 0.5 mile north of SH 7 Site C is located on the southwest corner of the I-25 and SH 7 interchange	Both commuter BRT facilities would be less than 300 feet from the closest sensitive land use.
Fort Collins BRT Maintenance Facility: Portner Road, just north of Trilby Road	Commuter BRT facilities would be less than 100 feet from residential areas.

Table 3.5-22 Sensitive Land Uses Affected by the Preferred Alternative

Transit Station Location	Sensitive Land Uses in the Vicinity
Fort Collins Downtown Transit Center Rail Station: BNSF and Maple Street	Residential, church and educational land uses within 600 feet.
CSU Commuter Rail Station: Mason Street south of University Avenue and north of West Pitkin	Church and college residential and uses within 600 feet of the commuter rail.
South Fort Collins Transit Center Commuter Rail Station [I-25 between SH 14 and SH 60]: Mason Street and West Fairway Lane	Commuter rail station would be 500 feet from residential areas.
North Loveland Commuter Rail Station: BNSF and 29th Street	Commuter rail station would be 100 feet from residential development and 600 feet from school and church facilities.
Downtown Loveland Commuter Rail Station: BNSF and approximately 6th Street	Commuter rail station would be 700 feet from residential, school, community health, and church facilities.
Berthoud Commuter Rail Station: East of BNSF and north of SH 56	Commuter rail station would be 100 feet from residential land uses.
North Longmont Commuter Rail Station: East of BNSF and north of SH 66	Commuter rail station would be 100 feet from residential land uses.
Longmont at Sugar Mill Commuter Rail Station: North of alignment and south of Rogers Road.	Commuter rail station would be 1,000 feet from residential land uses.
I-25 and WCR 8 Commuter Rail Station: I-25 and WCR 8	No sensitive land uses in close proximity. Nearest sensitive land use is 2,300 feet from site.
Berthoud Commuter Rail Maintenance Facility: CR 46 and US 287	Scattered residential land use within 100 feet of the maintenance facility. No other sensitive land uses in area.
Greeley Commuter Bus Station: US 85 and D Street	Commuter bus facilities would be 300 feet from residential area and community facility.
South Greeley Commuter Bus Station: US 85 and US 34 interchange on the southwest corner of 26th Street and 9th Avenue	Commuter bus facilities would be 100 feet from closest residential land use. Most sensitive land use areas are located more than 1,100 feet from site.
Evans Commuter Bus Station: US 85 and 42nd Street	Commuter bus facilities would be 100 feet from residential areas and church facilities.
Platteville Commuter Bus Station: US 85 and SH 66	Commuter bus facilities would be 300 feet from sensitive land use areas.
Fort Lupton Commuter Bus Station: US 85 just south of 14th Street	Commuter bus facilities would be 850 feet from sensitive land use areas.
Greeley Bus Maintenance Facility: 31st Street and 1st Avenue	Commuter bus facilities would be 700 feet from residential areas and church facilities.
I-25 and Harmony Road Express Bus Station: I- 25 and Harmony Road	No sensitive land use areas in close proximity. Nearest residential development 2,000 feet from site.
Windsor Express Bus Station: located southeast of I-25 and SH 392	Commuter express bus facilities would be 500 feet from residential areas.
Crossroads Express Bus Station: Site M is southwest of I-25 and Crossroads Boulevard	No sensitive land use areas within 0.5 mile proximity.
US 34 and SH 257 Express Bus Station: US 34 and SH 257	No residential areas in close proximity.

1 **Table 3.5-22 Sensitive Land Uses Affected by the Preferred Alternative (cont'd.)**

Transit Station Location	Sensitive Land Uses in the Vicinity
West Greeley Express Bus Station: US 34 (Business Loop) and 83rd Avenue	Commuter express bus facilities would be 100 feet from residential areas.
Berthoud Express Bus Station: I-25 and SH 56.	Commuter express bus facilities would be 600 feet from residential areas.
Firestone Express Bus Station: I-25, south of SH 119.	Commuter express bus facilities would be less than 300 feet from residential areas.
Frederick/Dacono Express Bus Station: I-25, 0.5 mile north of SH 52	No sensitive land use areas in close proximity.
I-25 and SH 7 Express Bus Station: Site C is on the southwest corner of the I-25 and SH 7 interchange	Both commuter express bus facilities would be less than 300 feet from the closest sensitive land use.

2 **Table 3.5-23 Sensitive Land Uses Affected by Phase 1**

Transit Station Location	Sensitive Land Uses in the Vicinity
Greeley Commuter Bus Station: US 85 and D Street A	Commuter bus facilities would be 300 feet from residential area and community facility.
South Greeley Commuter Bus Station: US 85 and US 34 interchange on the southwest corner of 26th Street and 9th Avenue	Commuter bus facilities would be 100 feet from closest residential land use. Most sensitive land use areas are located more than 1,100 feet from site.
Evans Commuter Bus Station: US 85 and 42nd Street	Commuter bus facilities would be 100 feet from residential areas and church facilities.
Platteville Commuter Bus Station: US 85 and SH 66	Commuter bus facilities would be 300 feet from sensitive land use areas.
Fort Lupton Commuter Bus Station: US 85 just south of 14th Street	Commuter bus facilities would be 850 feet from sensitive land use areas.
I-25 and Harmony Road BRT Station: I-25 and Harmony Road	No sensitive land use areas in close proximity. Nearest residential development 2,000 feet from site.
West Greeley Express Bus Station: US 34 (Business Loop) and 83rd Avenue	Commuter express bus facilities would be 100 feet from residential areas.
Greeley Downtown Transfer Center Express Bus Station: Downtown Greeley between 9th Avenue and 8th Avenue on 7th Street	Commuter express bus facilities would be greater than 1,000 feet from residential areas.
Firestone Express Bus Station: I-25, south of SH 119.	Commuter express bus facilities would be less than 300 feet from residential areas.
I-25 and SH 7 Express Bus Station: Two sites: Site E Is east of I-25 and ½ mile north of SH 7 Site C is located on the southwest corner of the I-25 and SH 7 interchange	Both commuter express bus facilities would be less than 100 feet from the closest sensitive land use.

3.5.3.7 INDIRECT EFFECTS

Indirect effects are reasonably foreseeable and can be linked together and extended to estimate further consequences. The most apparent link to air quality is incremental population growth, land use, and development changes caused as a result of the North I-25 corridor project. These growth and development changes would affect traffic and traffic patterns which would then affect air quality. In areas of anticipated transit oriented development, air quality would be anticipated to improve due to more efficient travel patterns. This improvement would be more noticeable with Package A and the Preferred Alternative than Package B and Phase 1.

Another indirect air quality effect could be the continued conversion of agricultural land use which is the dominant source of ammonia along the Front Range (see **Figure 3.5-3**). This land is being converted to residential and commercial uses which would lessen agricultural sources of nitrogen deposition effects to the Rocky Mountain National Park and other sensitive environments in the future.

Ammonia emissions from mobile sources increase due to VMT increasing in the corridor and emissions rates from mobile sources (in terms of ammonia per mile of driving) also increase slightly. Ammonia is a by-product of catalytic converter systems on vehicles to reduce NO_x emissions. Therefore, as more on-road and non-road vehicles are equipped with catalytic converters, ammonia emissions from the average vehicle will increase somewhat. Package A and the Preferred Alternative are estimated to have higher VMT compared to Package B or Phase 1 (see **Table 3.5-4**). Therefore, since these alternatives would have more on-road and non-road vehicles likely to be equipped with catalytic converters, ammonia emissions are anticipated to be marginally higher for Package A and the Preferred Alternative, as listed:

- No-Action .... 858.1 tons per year
- Package A .... 871.1 tons per year
- Package B .... 865.8 tons per year
- Preferred Alternative... 872.8 tons per year
- Phase 1 .... 870.0 tons per year

These emissions do not include any benefit from regional transit improvements planned by RTD and included with Package A, Package B, the Preferred Alternative, and Phase 1 nor do these emissions assume any market penetration of hybrid vehicles or other advanced technologies between now and 2035. Non-road sources of nitrogen are estimated to decrease an average 61 percent or over 12,000 tons per year for NO_x and 11 tons per year for ammonia, over this same time period (Houk, 2007).

The overall decrease in total nitrogen emissions would contribute to the RMNP goal of reducing nitrogen deposition rates by the year 2018, although the transportation emissions of ammonia would increase in the future since increases in VMT are linked directly to increased ammonia emissions.

3.5.4 Mitigation Measures

Regional and local agency strategies that could be used to reduce criteria pollutant and MSAT emissions, especially diesel particulate matter from existing diesel engines, include but are not limited to: tailpipe retrofits, closed crankcase filtration systems, cleaner fuels, engine rebuild and replacement requirements, contract requirements, anti-idling ordinances and legislation, truck stop electrification programs, and aggressive fleet turnover policies. Implementation of a vehicle purchase/recycle program would also help to reduce air pollution within the regional study area by reducing highly polluting vehicles off the road. Air quality impacts are not anticipated to result from this project.

The following mitigation measures are recommended to mitigate potential air quality emissions from commuter rail:

- New commuter rail, BRT, commuter, and feeder bus vehicles will be required to meet Tier 3 and Tier 4 standards (see **Section 3.5.3.1**).
- Alternative bus fleet vehicle selections will be investigated for more energy and emissions efficient vehicles, such as hybrids, electric buses, etc.

The following mitigation measures are recommended for construction activities associated with any of the build alternatives:

- An air quality mitigation plan will be prepared describing all feasible measures to reduce air quality emissions from the project. CDOT staff must review and endorse construction mitigation plans prior to work on a project site.
- Acceptable options for reducing emissions could include use of late model engines, low-emission diesel products, alternative fuels, engine retrofit technology, and after-treatment products.
- The contractor will ensure that all construction equipment is properly tuned and maintained.
- Idling time will be minimized to 10 minutes—to save fuel and reduce emissions.
- An operational water truck will be on site at all times. Water will be applied to control dust as needed to prevent dust impacts off site.
- There will be 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 utilized rather than temporary power generators.
- Operations affecting traffic for off-peak hours will be scheduled whenever reasonable.
- Obstructions of through-traffic lanes will be minimized. A flag person will be provided to guide traffic properly minimizing congestion and to ensure safety at construction sites.

These improvement measures would be enacted along with the project phases (see **Section 2.2** *Alternatives Advanced for Detailed Evaluation*) for which the measures are relevant.

The CDPHE-APCD enforces several regulations through the auspices of the Air Quality Control Commission (AQCC) to reduce particulate emissions from mobile sources as control strategies and contingency measures for non-attainment areas, including gas and diesel motor vehicle inspections and maintenance programs (Regulations 11 and 12) and street-sanding and sweeping standards to clean up winter sanding operations and excess roadside sand accumulations (Regulation 16).

Non-Transportation Related Mitigation

According to EPA, it is important to reduce both NO_x and NH_3 emissions. However, a reduction of 1 ton of ammonia is more effective than a 1-ton reduction of NO_x. While there are more NO_x emissions along the Front Range and NH_4 and NO_3 contribute approximately 50 percent to the mass of nitrogen deposited at monitoring stations within the RMNP, a 1-ton reduction of ammonia should have a greater benefit. As discussed in the *Air Quality Technical Addendum,* **Sections 3.4.5** *and* **4.3.9** (Jacobs, 2011c), ammonia emissions are generated mostly from agricultural livestock and crop production. Although there are no agricultural uses associated with this project, implementing best management practices (BMPs) for agricultural production could help to reduce ammonia emissions.

The following improvement measures were identified which could be applicable to other agricultural projects in the area that others could implement to help reduce ammonia emissions within the regional study area:

- Choose a nitrogen fertilizer appropriate for a given cropping system that will have the lowest nitrogen volatilization on the soil type to which it is applied.
- Incorporating fertilizer or manure as soon as possible into the soils will greatly reduce ammonia volatilization, minimize the loss of ammonia, and make more applied nitrogen available for plants.
- Properly store and manage commercial fertilizer to minimize emissions of ammonia from leaks, spills, or other problems.
- The use of feed additive and supplemental hormones in animal production has proven to greatly improve nutrient utilization, resulting in more efficient milk and meat production. Use of these products may decrease nitrogen excretion per day and/or reduce the total number of days on feed, thereby reducing overall nitrogen excretion and subsequent ammonia volatilization.
- Ammonia volatilization occurs soon after manure is deposited on barn floors. BMPs should be implemented such as scraping and flushing the floors and alleyways, drying manure and cooling barn temperatures, installing filters/scrubbers on air exchange systems, etc.
- Areas such as lawns, open spaces, parks, and golf courses require large amounts of water as well as significant amounts of fertilizers to help them stay green. Therefore, appropriate fertilizers should be applied and BMPs for re-treatment of wastewater run-off should be implemented.