3.1 Climate and Air Quality

3.1.1 Overview of Issues, Regulations, and Coordination

Air Quality Issues
- Motor vehicle emissions
- Motor vehicle direct particulate matter emissions, including re-entrained dust from highway and street sanding and unpaved roads
- Visibility in and near Class I and II Wilderness Areas

Air quality issues in the Corridor include motor vehicle emissions, woodburning, and re-entrained dust from highway and street sand and unpaved roads. Visibility in and near Class I and II Wilderness Areas is also a concern for the Corridor. There are 156 Mandatory Federal Class I Areas where visibility is an important value. Class I areas include certain national parks (more than 6,000 acres), wilderness areas (more than 5,000 acres), national memorial parks (more than 5,000 acres), and international parks that were in existence as of August 7, 1977. As part of the Denver air quality region, Jefferson County is the only county within the Corridor that has ever been part of an area designated as nonattainment for federal air quality standards. The Denver region is currently designated an attainment/maintenance area for carbon monoxide, PM_{10}, and the 1-hour ozone standard.

3.1.1.1 National Ambient Air Quality Standards

The US Environmental Protection Agency (EPA) has established National Ambient Air Quality Standards (NAAQS) for each of six criteria pollutants (listed in Table 3.1-1) to protect the public from the health effects associated with air pollution. These six criteria pollutants are carbon monoxide (CO), ozone (O_3), nitrogen dioxide (NO_2), sulfur dioxide (SO_2), particulate matter (PM_{10} and $PM_{2.5}$), and lead (Pb). Geographic areas that violate NAAQS for a pollutant are designated as a nonattainment area for that pollutant.

Table 3.1-1. National Ambient Air Quality Standards for Criteria Pollutants

Pollutant/Averaging Time	Primary Standard	Secondary Standard
Particulate Matter Less Than 10 Microns (PM_{10})		
Annual	50 $\mu g/m^3$	Same as primary
24-hour	150 $\mu g/m^3$	
Particulate Matter Less Than 2.5 Microns ($PM_{2.5}$)		
Annual	15 $\mu g/m^3$	Same as primary
24-hour	65 $\mu g/m^3$	
Sulfur Dioxide (SO_2)		
Annual	80 $\mu g/m^3$ (0.03 ppm)	—
24-hour	365 $\mu g/m^3$ (0.14 ppm)	—
3-hour	—	1,300 $\mu g/m^3$ (0.5 ppm)
Nitrogen Dioxide (NO_2)		
Annual	100 $\mu g/m^3$ (0.053 ppm)	Same as primary
Ozone (O_3)		
1-hour	235 $\mu g/m^3$ (0.12 ppm)	Same as primary
8-hour	157 $\mu g/m^3$ (0.08 ppm)	
Carbon Monoxide (CO)		
8-hour	10,000 $\mu g/m^3$ (9 ppm)	—
1-hour	40,000 $\mu g/m^3$ (35 ppm)	—
Lead (Pb)		
Calendar quarter	1.5 $\mu g/m^3$	Same as primary

$\mu g/m^3$ = micrograms per cubic meter, ppm = parts per million

Supporting Documentation
- Appendix A, Environmental Analysis and Data

The Colorado Department of Transportation (CDOT) and Federal Highway Administration (FHWA) have coordinated the air quality issues on this project with the EPA and the Air Pollution Control Division (APCD) of the Colorado Department of Public Health and Environment (CDPHE).

3.1.1.2 County Monitoring Stations

The APCD is responsible for air quality monitoring within the state. Table 3.1-2 lists the air quality data for the Corridor obtained from monitoring stations, and Appendix A, Environmental Analysis and Data, describes the methods used for the air quality analysis. PM_{10} is the primary pollutant of concern in mountain areas and is the only pollutant monitored in the project area west of Jefferson County. CO and O_3 are monitored in Jefferson County. In the mountain areas, the APCD determined that airflow patterns and wind speed tend to disperse pollutants sufficiently so that pollutant concentrations meet NAAQS. Haze is most likely to be visible in the valleys throughout the Corridor during winter and summer midafternoon hours. Late afternoon and evening downvalley winds, combined with occasional rain or snow showers, tend to minimize the duration of hazy conditions.

Table 3.1-2. Monitoring Stations and Pollutants Monitored Within the Corridor

County	Station Site	Pb	CO	O_3	PM_{10}	NO_2
Garfield	Glenwood Springs, 806 Cooper				X	
Eagle	Vail, 846 Forest Road				X	
Summit	Silverthorne, 430 Rainbow				X	
Clear Creek	No stations					
Jefferson	Arvada, West 57th and Garrison		X	X		
Jefferson	Lakewood, 12400 West SH 285			X		
Jefferson	Golden, 20th and Quaker			X		

3.1.2 Affected Environment

3.1.2.1 Garfield County

Climate and Background

Glenwood Springs is located at the western terminus of the Corridor project area at an elevation of 5,746 feet above mean sea level (AMSL) at the mouth of Glenwood Canyon. Regionally, winds are out of the west. The local winds generated diurnally (upvalley in daytime and downvalley in evening) shift air within the steep valley with a net flushing of the valley air mass downhill into Glenwood Springs where the valley widens and flattens. Thermal inversions where warmer air becomes trapped beneath a boundary layer of cooler air are common in Glenwood Canyon. The Glenwood Springs area also experiences inversions during both winter and summer when wind speeds are low and mixing is limited.

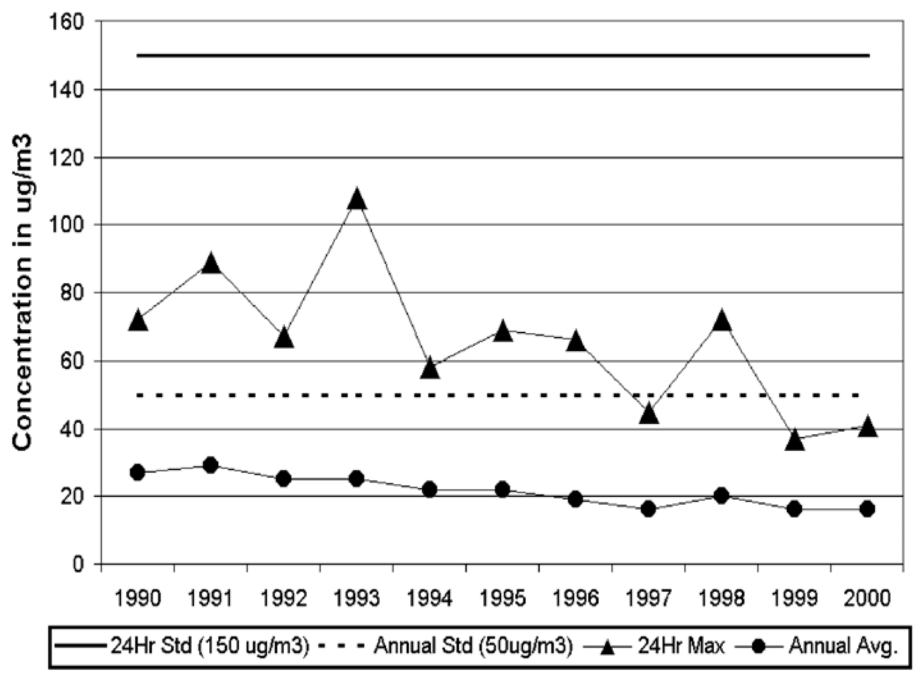
Air Pollution Sources

The dry climate in Garfield County is a factor contributing to PM_{10} emissions from windblown dust. Woodburning and re-entrained dust from highway and street sand also contribute to PM_{10} emissions during the winter. Garfield County is currently investigating the possible air quality impacts of increased oil and gas drilling in the county because of the increase in the miles of dirt roads and other ground disturbance associated with drilling operations.

Monitoring

Three PM_{10} monitoring stations are located in Garfield County: one each in Rifle and Parachute, both outside the project area, and one in Glenwood Springs. The PM_{10} monitoring station in Glenwood Springs has not recorded any exceedances of either the 24-hour or annual average PM_{10} standards since PM_{10} monitoring began in 1986. Chart 3.1-1 illustrates the historic trend of PM_{10} average readings at the Glenwood Springs station.

Chart 3.1-1. Historic Comparison of PM_{10} at Glenwood Springs (806 Cooper Street)



3.1.2.2 Eagle County

Climate and Background

The project Corridor through Eagle County changes elevation from 6,400 feet near the head of Glenwood Canyon on the west to 10,600 feet at Vail Pass on the east. The towns of Dotsero, Gypsum, Eagle, and Avon are located within the valley of the Eagle River at increasing elevations from west to east. At Dowd Canyon, I-70 leaves the Eagle River valley and follows the narrow Gore Creek valley through Vail and to the summit of Vail Pass.

Prevailing winds blow from west to east, but local wind patterns are influenced by the varying terrain. Occasional thermal inversions occur in the Vail valley when winds are weak and local in extent. Under these conditions, less air is mixing to dilute air pollutants. Winds are generally stronger in the broader valley of the Eagle River, resulting in greater mixing and dispersion of pollutants.

Air Pollution Sources

The dry climate in Eagle County is a factor contributing to PM_{10} emissions from windblown dust. Woodburning and re-entrained dust from highway and street sand also contribute to PM_{10} emissions during the winter. Windblown dust from sand and gravel mining and construction activities is also a source of PM_{10} emissions.

Monitoring

PM_{10} monitoring conducted in Vail between 1993 and 2001 showed no exceedances of either the 24-hour or annual average PM_{10} standards. The APCD discontinued PM_{10} monitoring in Vail in 2001.

Class I and II Wilderness Areas

The EPA has designated 12 areas in Colorado as Mandatory Federal Class I Areas where visibility is an important value. These areas include three national parks or monuments and nine wilderness areas. Portions of the Eagles Nest Wilderness Area are located in Eagle County. The Holy Cross Wilderness Area is a designated Class II area located 3 to 5 miles south of I-70 and the Eagle Valley.

3.1.2.3 Summit County

Climate and Background

The terrain east of Vail Pass is steep and rugged, opening eastward into the narrow valley of Tenmile Creek. Further east, the Corridor passes through the broader valley of the Blue River before ascending the eastbound approach to the Eisenhower-Johnson Memorial Tunnels (EJMT). Although the prevailing winds blow from the west, local wind patterns are strongly influenced by terrain and the Tenmile Creek, Blue River, and Straight Creek drainages, which converge near Dillon. Diurnal shifts in wind direction are common in the mountain valleys.

Air Pollution Sources

The dry climate in Summit County contributes to PM_{10} emissions from windblown dust. Re-entrained dust from highway and street sand also contributes to PM_{10} emissions during the winter. Other sources of fugitive dust are sand and gravel mining and construction. Woodburning is a smaller contributor to PM_{10} emissions because of restrictions on fireplaces and woodburning stoves in Summit County.

Monitoring

PM_{10} monitoring stations located in Silverthorne have not recorded any exceedances of PM_{10} standards since monitoring began in 1993 (see Chart 3.1-2). A PM_{10} monitor in Breckenridge located 9 miles south of the Corridor recorded one exceedance (182 $\mu g/m^3$) of the 24-hour PM_{10} standard of 150 $\mu g/m^3$ in February 2000 (see Chart 3.1-3).

Chart 3.1-2. Historic Comparison of PM_{10} in Silverthorne (151 4th Street)

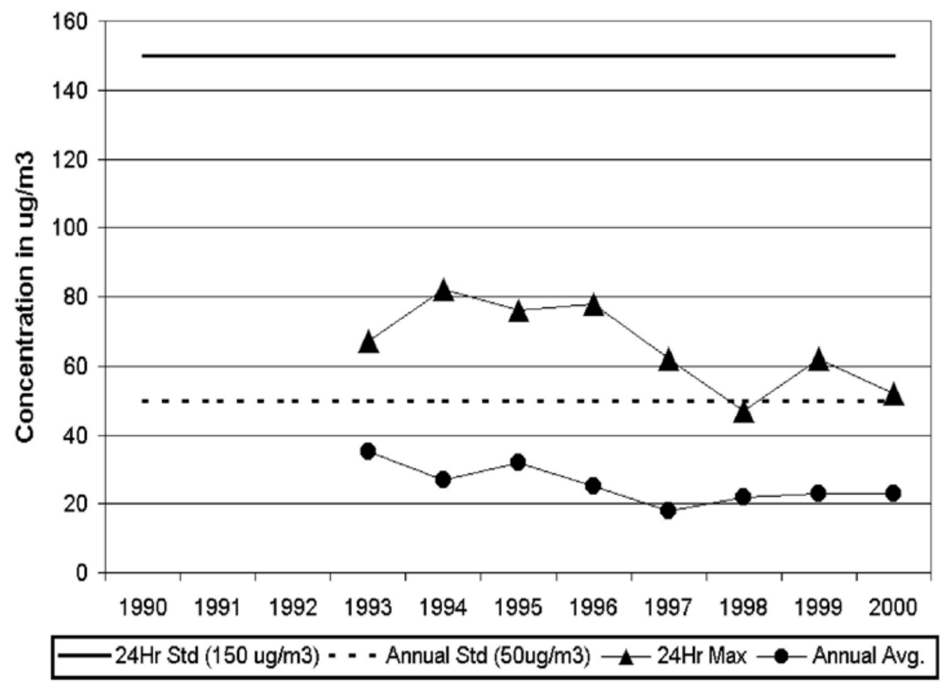
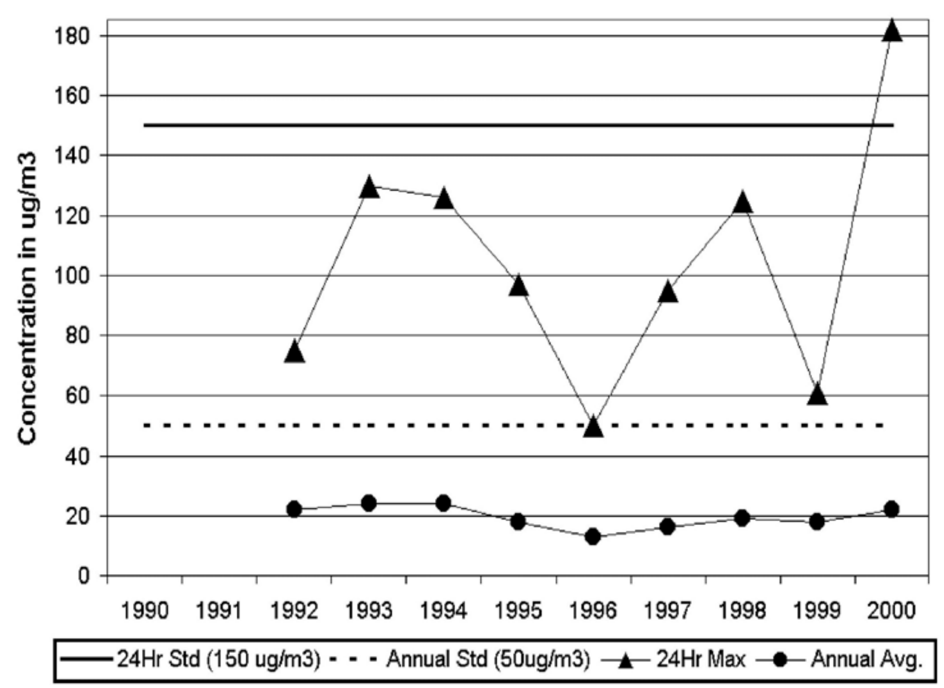


Chart 3.1-3. Historic Comparison of PM_{10} in Breckenridge (County Justice Center)



Class I and II Wilderness Areas

Portions of the Eagles Nest Wilderness Area are located in Summit County. The Eagles Nest Wilderness Area is a Mandatory Federal Class I Area for visibility. The Ptarmigan Peaks Wilderness Area is a Class II area located 1 mile north of I-70 between the EJMT and Silverthorne.

3.1.2.4 Clear Creek County

Climate and Background

The Corridor east of the EJMT is located within Clear Creek Canyon. In this area east of the Continental Divide, the upper-level winds tend to dip lower into the valleys, creating vertical mixing and generally higher wind speeds. The prevailing winds blow from west to east and are generally stronger than local diurnal upvalley and downvalley winds.

Air Pollution Sources

The dry climate in Clear Creek County contributes to PM_{10} emissions from windblown dust. Re-entrained dust from highway and street sand also contributes to PM_{10} emissions during the winter. Windblown dust from mine tailings is also a source of PM_{10} emissions. Woodburning is a small contributor of PM_{10} emissions. There are no woodburning restrictions in Clear Creek County.

Monitoring

Because the APCD does not conduct air quality monitoring in Clear Creek County, actual concentrations of air pollutants in the county are not known. However, concentrations of pollutants would be quite low compared to federal standards due to favorable meteorological conditions that result in rapid dispersion of pollutants.

CDOT conducted CO monitoring in Clear Creek between December 7, 1989, and February 6, 1990. The monitoring stations were located at Hidden Valley (milepost 243) and Idaho Springs (milepost 240). Both stations used calibrated and approved CO measurement equipment. The results of the monitoring show similar measured CO readings. No exceedances of CO standards were monitored. The highest 1-hour concentration of 9.8 ppm was recorded on February 4, 1990, at the Idaho Springs monitor. The 1-hour CO standard is 35 ppm. The two highest 8-hour average CO concentrations were 3.7 ppm and 3.2 ppm recorded in Idaho Springs on December 27, 1989, and February 4, 1990. The 8-hour average CO standard is 9 ppm. These highest 8-hour average CO concentrations correlated to dates with high traffic volumes and low wind speeds. The typical daily wind speed during the monitoring period was 25.9 mph. The average reported wind speed during the time period for the higher CO concentrations was 6.4 mph.

Class I and II Wilderness Areas

The Mount Evans Class II Wilderness Area is located approximately 3 to 5 miles south of I-70 between Georgetown and Idaho Springs. Byers Peak and Vasquez Wilderness Areas, part of the Arapaho National Forest and located 8 to 20 miles north of the interstate, have been designated Class II.

3.1.2.5 Jefferson County

Climate and Background

The Jefferson County segment of the Corridor generally follows Mount Vernon Canyon to the eastern project terminus at the I-70/C-470 interchange. Within Mount Vernon Canyon, the prevailing winds are from the west. Near the project terminus in the foothills west of Denver, the prevailing winds are from the south. However, strong wind gusts and rapid shifts in wind direction frequently accompany passing frontal systems. Temperature inversions during the autumn and winter are common in the Denver basin, affecting the easternmost edge of the project area.

Air Pollution Sources

The dry climate in Jefferson County is a factor contributing to PM_{10} emissions from windblown dust. Re-entrained dust from highway and street sanding also contributes to PM_{10} emissions during the winter. Woodburning is a small contributor of PM_{10} emission because of regulations on fireplaces and woodburning stoves and restricted “no-burn” days throughout the Denver metropolitan area. Although areas in Jefferson County above 7,000 feet in elevation are exempt from “no-burn” day restrictions, new fireplaces and woodburning stoves must comply with EPA standards for certified woodburning devices.

Monitoring

Jefferson County is part of the Denver air basin and monitoring region. Jefferson County monitoring stations are included in the list of monitoring stations within the Corridor (see Table 3.1-2).

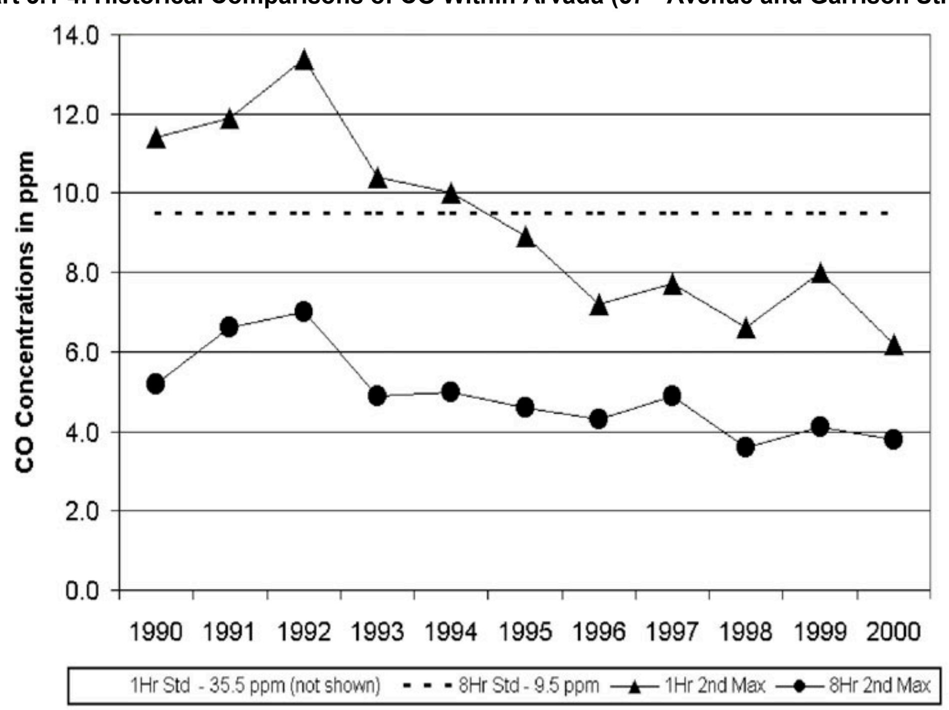
PM_{10}

PM_{10} is not currently monitored in Jefferson County. Before 2001, PM_{10} was monitored at five stations at Rocky Flats located approximately 12 miles north of the I-70/C-470 interchange. Although Rocky Flats is outside the project area, monitored PM_{10} concentrations at Rocky Flats are indicative of PM_{10} concentrations near the foothills of the Denver metropolitan area. No exceedances of either the 24-hour or the annual average PM_{10} standards were monitored at these stations. PM_{10} monitoring at Rocky Flats was discontinued in 2001. The Denver metropolitan area is designated an attainment/maintenance area for PM_{10}.

Carbon Monoxide

The only CO monitoring site in Jefferson County is in Arvada, which is outside the Corridor area. Chart 3.1-4 shows historical CO levels at the Arvada site. There have been no exceedances of the 8-hour average CO standard of 9.0 ppm since 1995. The Denver metropolitan area is designated an attainment/maintenance area for CO.

Chart 3.1-4. Historical Comparisons of CO Within Arvada (57th Avenue and Garrison Street)



Nitrogen Dioxide

NO_2 is monitored at two stations in Rocky Flats. No violations of the NO_2 standard have occurred in Colorado since 1977.

Sulfur Dioxide

There are no SO_2 monitoring stations within the project area. The Denver metropolitan area is in attainment of SO_2 standards, and monitored SO_2 concentrations are far below federal standards.

Lead

Pb is not monitored within the project area.

Ozone

Ozone monitoring within the project area is conducted at Rocky Flats, Arvada, Golden, and Welch stations. Airflow associated with hot summer temperatures, combined with the topographic characteristics of the South Platte River valley, results in a generally westward flow of air toward the foothills. These conditions result in higher O_3 concentrations near the foothills compared to other locations in the Denver metropolitan area. No exceedances of the 1-hour O_3 standard have been monitored in the Denver metropolitan area since 1987. The Denver metropolitan area is designated an attainment/maintenance area for the 1-hour O_3 standard. Chart 3.1-5 and Chart 3.1-6 show historical 1-hour O_3 concentrations at the Jefferson County monitors.

Chart 3.1-5. Historical Comparisons of 1-Hour O_3 at Monitoring Stations Within Arvada (57th Avenue and Garrison Street)

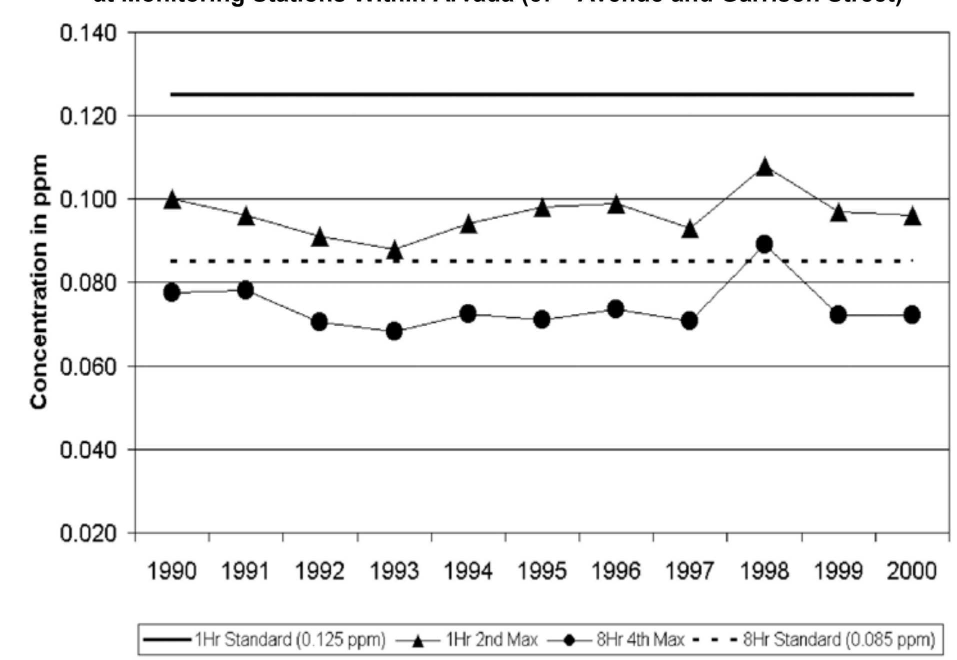
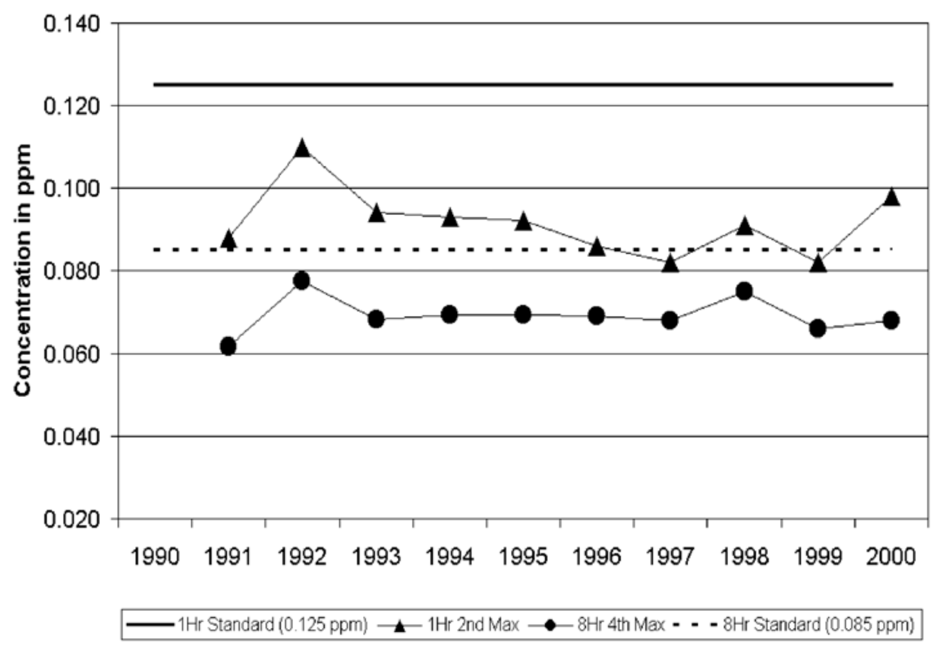


Chart 3.1-6. Historical Comparisons of 1-Hour O_3 at Monitoring Stations Within Welch (12400 West Highway 285)



During the summer of 2003, the 8-hour O_3 standard was exceeded at all four O_3 monitoring stations in Jefferson County. Fifteen exceedance days were recorded at the Golden monitor, which is located approximately 4 miles northeast of the I-70/C-470 interchange. Because of topography, meteorological conditions, and relatively close proximity to the Golden monitor, 8-hour O_3 concentrations near the I-70/C-470 interchange would be comparable to the Golden monitor.

In April 2004, EPA designated and classified areas in the US that violated the 8-hour O_3 standard. Based on monitoring data for 2001 to 2003, EPA proposed to designate the Denver region as a nonattainment area for the 8-hour O_3 standard. Air quality planning agencies in the Denver region have developed an Early Action Compact for achieving the 8-hour O_3 standard by December 31, 2007. By implementing the Early Action Compact, EPA has deferred the effective date of the nonattainment designation as long as the Denver region continues to meet the milestones of the Early Action Compact.

Air Quality Conformity

Jefferson County is included in the metropolitan Denver air quality region, which is currently classified as attainment/maintenance for PM_{10}, CO, and the 1-hour O_3 standard. As such, the conformity provisions of the Clean Air Act will apply to any projects on the Jefferson County segment of I-70. Furthermore, I-70 projects in Jefferson County will need to be included in the conforming Denver Regional Transportation Plan before FHWA can approve a NEPA decision document for the project.

3.1.2.6 Visibility and Wilderness

The I-70 Corridor passes through some of most scenic areas in Colorado. On very clear days, visual range from some of the highest peaks in the Corridor is more than 200 miles. Recognizing the importance of maintaining a high standard of visibility in pristine areas in the US, Congress passed legislation to prevent significant deterioration in visibility in these areas. The 1977 Clear Air Act Amendments established Mandatory Federal Class I Areas where visibility is an important value to be protected. Strict limits are placed on the amount of additional pollution above baseline values allowed in Class I areas. There are 156 Class I areas in the US, including 10 wilderness areas and 2 national parks in Colorado. The Eagles Nest Wilderness Area in Summit and Eagle counties is the closest Class I area to the I-70 Corridor. In some sections of I-70 between Copper Mountain and Vail, the wilderness boundary is within 1,000 feet of I-70.

The Clean Air Act also established Class II and III areas, where some additional pollution over baseline concentrations is allowed. Wilderness areas established after August 1977 are Class II areas. The Ptarmigan Peaks Wilderness Area is a Class II area located north of I-70 between the EJMT and Silverthorne. The southern boundary of the Ptarmigan Peaks Wilderness Area is within 1,000 to 2,000 feet of I-70.

Pollutants that contribute to visibility impairment include both gaseous (primarily oxides of nitrogen and sulfur) and particulate (soot and dust) emissions. There are no major industrial sources of pollution in the Corridor, for example, power plants, factories, or refineries. As mentioned previously, woodburning and windblown dust are the primary sources of PM_{10}. Re-entrained road dust is also a source of PM_{10} in winter due to highway sanding during snowstorms. Emissions of fine particulates ($PM_{2.5}$) from motor vehicles include tailpipe exhaust and brake and tire wear. Gaseous exhaust emissions include volatile organic compounds, nitrogen oxides, SO_2, and ammonia. Gaseous emissions disperse through the atmosphere, and under the right meteorological conditions, react and form secondary particulates, such as ammonium nitrate and ammonium sulfate, which adds to the mix of fine particulates in the air. Although smaller in mass than the coarse particulates ($PM_{2.5}$–PM_{10}), fine particulates contribute the most to light scattering and visibility impairment.

Visibility monitoring data from the US Forest Service (USFS) indicate that visibility conditions for the Eagles Nest Wilderness Area are among the best in the US. The median Standard Visual Range (SVR) for the Eagles Nest Wilderness Area is 140 miles; that is, the visibility range is more than 140 miles on half of all days. Ten percent of all days have a visual range greater than 195 miles. Ten percent of all days have a visual range less than 65 miles. Overall, the data indicate that the Eagles Nest Wilderness Area has the best visual conditions of five wilderness areas monitored in Colorado. No monitoring data are available for the Ptarmigan Peaks Wilderness Area.

3.1.2.7 Nitrogen Deposition

Nitrogen, in the form of nitrogen oxides and ammonia, is among the many pollutants emitted by motor vehicles. Data for the 11 contiguous western states show that approximately 40 percent of nitrogen emitted as nitrogen oxides and 5 percent of nitrogen emitted as ammonia comes from motor vehicles (Fenn et al. 2003). Emissions of nitrogen oxides and ammonia not only contribute to visibility impairment, but are also a source of nitrogen deposition in water and soil. Over time, nitrogen deposition in the soil above long-term baseline amounts results in soil acidification, which can have substantial impacts on various ecosystems. Most noticeably are changes in plant communities, where more nitrogen tolerant plants crowd out and replace less nitrogen tolerant plants. This, in turn, results in changes in the habitat for many animals, including insects, birds, and large and small mammals. Once thriving populations of particular species may disappear from some areas. Similar impacts occur to lakes, streams, and groundwater. Nitrogen deposition results in acidification in lakes and streams, which can have substantial impacts on aquatic life. There are also potential impacts on drinking water, from both surface water and groundwater sources.

Monitoring data show nitrogen deposition rates range from 4 to 8 kilograms of nitrogen per hectare per year at high-elevation sites in the Colorado Front Range. Deposition rates are lower west of the Continental Divide because there are fewer sources of nitrogen emissions. Also, westerly winds prevent nitrogen-enriched air masses originating along the heavily urbanized Front Range from crossing the divide (Fenn et al. 2003). Unlike the other pollutants, there are no NAAQS for nitrogen deposition.

3.1.2.8 Air Toxics

In addition to the NAAQS set forth by EPA for the six criteria pollutants, EPA has established a list of 33 urban air toxics. Urban air toxics, also known as hazardous air pollutants, are those pollutants that cause or may cause cancer or other serious health effects or adverse environmental and ecological effects. Most air toxics originate from man-made sources, including road mobile sources (such as cars, trucks, or buses), nonroad mobile sources (such as airplanes or lawnmowers), and stationary sources (such as factories, refineries, or power plants), as well as indoor sources (such as building materials). Some air toxics are also released from natural sources such as volcanic eruption and forest fires.

These pollutants are in the atmosphere as a result of industrialized society, but science has been providing more evidence about the risks they pose to human health. The health risks for people exposed to urban toxics at sufficiently high concentrations or durations include an increased risk of cancer or other serious health effects. These health effects can include damage to the immune system, as well as neurological, reproductive, developmental, respiratory and other human health problems.

In 2001, EPA identified 21 toxic compounds as mobile source air toxics (MSAT) and issued regulations to control emissions of MSATs. Under these regulations, between 1990 and 2020, on-highway emissions of benzene, formaldehyde, 1,3-butadiene, and acetaldehyde will be reduced by 67 to 76 percent, and on-highway diesel particulate matter emissions will be reduced by 90 percent. These reductions are due to the impacts of national mobile source control programs, including the reformulated gasoline program, a new cap on the toxics content of gasoline, the national low emission vehicle standards, the Tier 2 motor vehicle emissions standards and gasoline sulfur control requirements, and the heavy-duty engine and vehicle standards and on-highway diesel fuel sulfur control requirements. These are net emissions reductions; that is, the reductions that will be experienced even after growth in vehicle miles traveled (VMT) is taken into account.

3.1.3 Environmental Consequences

3.1.3.1 Common Direct and Indirect Impacts

The entire Corridor is in attainment of all NAAQS. Part of the Corridor in Jefferson County is within the Denver attainment/maintenance area (formerly nonattainment) for CO, PM_{10}, and the 1-hour O_3 standard; therefore, it is subject to the conformity provisions of the Clean Air Act. The primary pollutants of concern in the Corridor are CO and particulate emissions from motor vehicles. To compare the air quality impacts among the various alternatives, total daily CO and particulate emissions were calculated for each alternative. Because emissions of both pollutants are directly related to VMT in the Corridor, alternatives with higher VMT generally have higher total daily emissions.

Motor Vehicle Carbon Monoxide (CO) Emissions

CO emissions are also influenced by speed and traffic congestion. CO emissions are highest at both high, free-flow speeds (60 to 70 mph) and low, congested speeds (15 to 20 mph). There is a wide variation in speed and congestion in the Corridor depending on season, day of the week, time of day, and weather conditions. Total daily CO emissions were calculated based on average running speeds for four time periods: morning peak, midday off-peak, afternoon peak, and night off-peak periods. Morning and afternoon peak periods represent more congested conditions and, therefore, lower speeds and higher CO emissions. Wintertime Saturday traffic volumes were used in the analysis because they are typical ski weekend volumes and represent the "worst-case" combination of traffic volumes and emission rates. They, therefore, provide the highest estimate of total daily CO emissions.

EPA Standards. CO hot spot modeling was completed to determine the "worst-case" CO concentrations in the Corridor. CO concentrations were modeled along I-70 through Idaho Springs. Idaho Springs was selected because of the close proximity of residences and businesses to the highway. Worst-case modeling conditions were based on Saturday traffic volumes in winter and used the highest projected future (2025) traffic volumes for any of the project alternatives. The hot spot modeling was completed according to EPA modeling guidance. The highest modeled 8-hour average CO concentrations were 4.0 to 5.0 ppm for receptors located 20 feet from the edge of the outside travel lane. The 8-hour average CO standard established by EPA is 9.0 ppm. Therefore, no exceedances of federal CO standards would occur in the Corridor for any of the alternatives, including the No Action alternative. Furthermore, the modeled concentrations represent "worst-case" meteorological conditions of low wind speed (approximately 2 miles per hour) and constant wind direction; that is, the wind direction that results in the highest modeled concentrations. These meteorological conditions are not typical along I-70 through Idaho Springs. Also, the worst-case receptor locations are within the highway right-of-way; therefore, concentrations are higher than would be expected at residences or businesses along I-70. In 2025, the annual maximum 8-hour average CO concentration within Idaho Springs would more likely be between 2.0 and 3.0 ppm.

Alternative Comparisons. For all alternatives, CO emissions in 2025 are anticipated to be less than current day emissions, even though 2025 traffic volumes will be higher than current day volumes (based on 2000 traffic volumes). Emissions in the future are assumed to be lower because older, higher-polluting vehicles will continue to be replaced by newer, lower-polluting vehicles. As shown in Appendix A, Environmental Analysis and Data, CO emissions in 2025 for the No Action alternative would be approximately 40 percent lower than present day CO emissions in the Corridor. CO emissions in 2025 for the Minimal Action and Transit alternatives would be approximately 2 percent to 6 percent lower than those of the No Action alternative. Because traffic volumes for the Highway and Combination alternatives would be higher than those of the No Action alternative, CO emissions would also be higher. CO emissions for the Combination alternatives would be approximately 7 percent to 9 percent higher than those of the No Action alternative, while the Six-Lane Highway (55 or 65 mph) alternatives would result in emissions approximately 13 percent higher than those of the No Action alternative. The Reversible/HOV/HOT alternative would have the highest CO emissions in 2025 (approximately 29 percent higher than those of the No Action alternative) as a result of higher traffic volumes during peak hours. The reversible lane would provide a fourth lane in the peak direction.

Motor Vehicle Direct Particulate Matter Emissions

The primary source of particulate emissions (PM_{10} and $PM_{2.5}$) from motor vehicles is re-entrained road dust associated with highway sanding in winter. Other direct vehicle sources of particulate emissions include tailpipe exhaust and brake and tire wear. Direct vehicle particulate emissions and re-entrained dust emissions for each alternative are shown in Appendix A. Unlike CO emissions, which continue to decrease in the future, re-entrained dust emissions will increase as traffic volumes increase.

EPA Standards. There is no EPA-approved hot spot model for PM_{10}. However, FHWA has developed qualitative guidance for evaluating the localized impacts of mobile source PM_{10} emissions. Application of this guidance to the Corridor included an assessment of available PM_{10} monitoring data in the Corridor and projecting future PM_{10} concentrations based on projected increases in traffic volume on I-70.

The APCD of the CDPHE conducted PM_{10} monitoring in Silverthorne and Vail between 1993 and 2001. No exceedances of the federal 24-hour average PM_{10} standard of 150 μg/m³ were recorded at either location. The highest monitored 24-hour average PM_{10} concentrations were 100 μg/m³ in Vail (recorded in 1993) and 82 μg/m³ in Silverthorne (recorded in 1994). The monitors were located approximately 500 to 1,000 feet from I-70. The monitored concentrations included re-entrained road dust emissions from traffic on I-70 and local roads, plus particulate emissions from woodburning fireplaces and restaurant grills.

Between February 20, 1997, and May 2, 1997, CDOT conducted PM_{10} monitoring near the eastbound I-70 chain-up station located approximately 0.5 mile east of the Dillon/Silverthorne interchange and at the Dillon Valley Fire Station. The monitoring was done to address public concerns regarding particulate emissions from diesel trucks idling while using the chain-up station. The monitor at the chain-up station can be considered a PM_{10} hot spot because it was located approximately 25 feet from the edge of the outside eastbound I-70 travel lane. Because the monitor at the fire station was located approximately 600 to 700 feet south of I-70, PM_{10} concentrations were not as heavily influenced by traffic on I-70 as was the chain-up station. Because the monitors were activated during snowstorms, PM_{10} concentrations at the chain-up station were dominated by emissions from trucks using the chain-up station, as well as re-entrained dust from I-70, which was sanded during the snowstorms. The highest monitored 24-hour average PM_{10} concentrations were 15.6 μg/m³ at the chain-up station and 11.1 μg/m³ at the fire station.

Because re-entrained road dust emissions are directly proportional to traffic volumes, a roll-forward method can be used to project future PM_{10} concentrations at the chain-up station. The roll-forward method is more applicable to monitors or receptors located closer to the highway than for receptors farther away, such as the fire station, which was influenced by emissions from other roads and from woodburning. Depending on the project alternative, traffic volumes on I-70 are projected to increase between 100 and 150 percent by 2025 compared to 1997 volumes. Using the highest monitored concentration of 15.6 μg/m³ in 1997 at the chain-up station and a 150 percent increase in traffic volume results in a maximum predicted PM_{10} concentration of 39 μg/m³ along I-70 near Silverthorne in 2025. This is less than one-third of the 24-hour average PM_{10} standard of 150 μg/m³.

Regional dispersion modeling for the metropolitan Denver PM_{10} attainment/maintenance area includes the eastern terminus of the Corridor near C-470. The maximum predicted 24-hour average PM_{10} concentration in the vicinity of the I-70/C-470 interchange is 130 μg/m³ for the 2015 maintenance year. Higher PM_{10} concentrations are to be expected in the Denver region given the vast roadway network and substantially higher traffic volumes than that in the Corridor. Stationary sources, such as power plants and industrial sources, and secondary particulate precursors (NO_2 and SO_2) are also a larger component of PM_{10} emissions in the Denver region compared to the Corridor. The *Denver PM_{10} Maintenance Plan* did not project PM_{10} concentrations beyond 2015. PM_{10} concentrations in 2025 near the I-70/C-470 interchange would not be substantially higher than those in 2015 because the projected change from 2005 to 2015 is only 6 μg/m³, resulting in 124 μg/m³ in 2005 as compared to 130 μg/m³ in 2015. Given this small increase over 10 years, and assuming a linear increase in PM_{10} emissions without additional controls on emissions, the maximum PM_{10} concentration in 2025 near the I-70/C-470 interchange would be approximately 136 μg/m³. Therefore, no exceedances of federal PM_{10} standards would occur in the Corridor, regardless of which alternative is selected, including the No Action alternative.

Alternative Comparisons. As shown in Appendix A, Environmental Analysis and Data, PM_{10} is predicted to be higher for all alternatives in 2025 than current day as a result of expected higher traffic volumes. The No Action alternative would result in PM_{10} emissions approximately 31 percent higher than those of current day levels. The Minimal Action alternative would be similar to the No Action alternative (1 percent higher PM_{10} emissions), and the Transit alternatives would result in somewhat lower PM_{10} emissions (between 1 percent and 6 percent) than those of the No Action alternative. The Highway and Combination alternatives would result in PM_{10} emissions approximately 8 percent to 15 percent higher than those of the No Action alternative.

Mobile Source Air Toxics

The EPA has not yet determined how to evaluate the impacts of new or expanded roadways and interchanges on the ambient concentrations of urban air toxics. Currently there are no models or techniques to accurately quantify the health impacts of localized concentrations of MSATs near roadways or of changes in MSAT emissions due to changes in VMT associated with these roadways. Unlike the NAAQS, there are no federal standards regulating the concentrations of MSATs in ambient air. Without the necessary standards and analytical methods, CDOT and FHWA cannot determine the specific impacts or contribution of the Corridor to MSATs. With the information currently available, CDOT and FHWA can conclude that (1) localized concentrations of MSATs in the vicinity of I-70 and along other roadways in the Corridor would be similar to those experienced by individuals, residences, businesses, and other facilities located at similar distances from roadways with similar volumes and operating characteristics, (2) because I-70 is the only major roadway throughout most of the Corridor, unlike large urban areas, there is only a minimal amount of additional emissions of MSATs associated with other roadways, and (3) regardless of the alternative selected, MSAT emissions in the project area will decrease over time as a result of EPA's national MSATs control programs.

Visibility

The visibility impacts of the project alternatives were analyzed by comparing future (2025) emissions of motor vehicle pollutants and re-entrained road dust with existing (2000) emissions. Emissions were calculated for PM_{10}, $PM_{2.5}$, SO_2, and nitrogen oxides. $PM_{2.5}$ emissions include particulates in tailpipe exhaust (carbon and sulfates), plus brake and tire wear. SO_2 and nitrogen oxides are gaseous emissions that contribute to secondary particle formation as explained in section 3.1.2.6. To determine the relative impacts on visibility of each alternative, a weighted total of gross emissions for each pollutant was calculated based on the light scattering efficiency of each pollutant, as shown in Appendix A Fine particulates, such as secondary particles formed by sulfur and nitrogen oxide emissions, are at least four times more efficient at scattering light than are coarse particles.

Alternative Comparisons. As shown in Appendix A, Environmental Analysis and Data, total daily emissions in 2025 of all pollutants that contribute to visibility impairment would be less than emissions in 2000, although 2025 traffic volumes would be higher. Future emissions of tailpipe exhaust pollutants would be lower because of stricter standards on vehicle emissions and the lower sulfur content of diesel fuel. The numbers shown in Appendix A are projected emissions of pollutants that contribute to visibility impairment and cannot be directly correlated to a visibility index or visual range because emissions from other sources, as well as atmospheric conditions, also contribute to visibility impairment. However, because future emissions of these pollutants would be less than current day emissions, the future impacts on visibility from traffic on I-70 would be less than existing conditions. None of the project alternatives would contribute to any deterioration in visibility in Class I areas.

Nitrogen Deposition

Similar to visibility impacts, the potential for nitrogen deposition associated with the project alternatives was analyzed by comparing future (2025) emissions of nitrogen with existing (2000) emissions. Motor vehicle nitrogen oxide emissions were assumed to be nitric oxide (NO) because this is the primary form of the many forms of nitrogen oxides first emitted before exhaust gases reach the catalytic converter. Nitrogen from ammonia in vehicle exhaust was also included.

Alternative Comparisons. As shown in Appendix A, Environmental Analysis and Data, total daily nitrogen emissions in 2025, for all alternatives, would be less than current day (2000) nitrogen emissions. In 2025, emissions of nitrogen oxides would be 70 percent to 80 percent lower than 2000 emissions because of stricter standards on vehicle emissions, particularly heavy-duty diesel trucks. Future emissions of ammonia will increase as traffic volumes increase because emission control technology does not reduce ammonia emissions. However, nitrogen emissions from ammonia are only 15 percent to 20 percent of total motor vehicle nitrogen emissions. Therefore, total nitrogen emissions and the impacts of nitrogen deposition associated with nitrogen emissions from traffic on I-70 would be less in 2025 than existing conditions.

Class I and II Wilderness Areas

Current monitoring of values related to air quality indicates very good to excellent air quality in the Class I and Class II Wilderness Areas managed by the USFS. Only one ambient air quality monitor station is located in the White River National Forest on Ajax Mountain. Two camera sites have been in operation on the forest to monitor visibility in the Eagles Nest Wilderness Area and the Maroon Bells-Snowmass Wilderness Area. Current data indicate that visibility at these areas is the best found in the Rocky Mountain Region of the USFS (USDA Forest Service 2002).

Pollutant sources are both local and regional. Local sources include the populated areas of the Western Slope, development of ski areas, and vehicular exhaust and re-entrained road dust from increasing traffic. Regional air quality impacts are from the coal-fired power plants in the Four Corners Area and large population areas in southern California (USDA Forest Service 2002). Emissions affecting visibility can come from very distant sources. Monitoring can identify different types of materials, but the speciation cannot be attributed to any particular source. Therefore, the contribution from I-70 would be very difficult to determine.

Motor vehicle emissions are related to VMT. The Highway alternatives and Combination Highway/Transit alternatives would have a greater VMT than the Transit alternatives and would, therefore, have a greater potential to affect air quality. As indicated above, re-entrained dust particles would increase as traffic volumes increase. Air emissions from I-70 would be localized and would have less influence on air quality in the Class I and II Wilderness Areas than regional emissions from populated and industrial areas that are experiencing additional growth. The trends in air quality monitoring in the Class I Wilderness Areas have not shown any degradation to visibility or other values related to air quality.

3.1.4 Mitigation Measures

Because project alternatives are not anticipated to cause or result in violations of any NAAQS, mitigation measures for air quality would center on controlling fugitive dust during construction. Mitigation measures for air quality will be developed and refined at the Tier 2 level of study in context of a specific project. However, mitigation measures that normally apply to construction projects to reduce impacts are addressed in the text below.

Construction impacts would primarily be mitigated through implementation of appropriate best management practices. Conceptual techniques for mitigation of impacts could include the following:

- Control fugitive dust through a fugitive dust control plan, including wetting of disturbed areas.
- Use the cleanest fuels available at the time for construction equipment and vehicles to reduce exhaust emissions.
- Keep construction equipment well maintained to ensure that exhaust systems are in good working order.
- To minimize wind-blown dust from blasting, particularly near community areas, control blasting and avoid blasting on days with high winds.
- Minimize dust from construction in tailing areas.

Additionally, highway maintenance strategies will continue to be explored to minimize the amount of sand used for winter maintenance and to remove the sand from the roadway to minimize re-entrained dust.