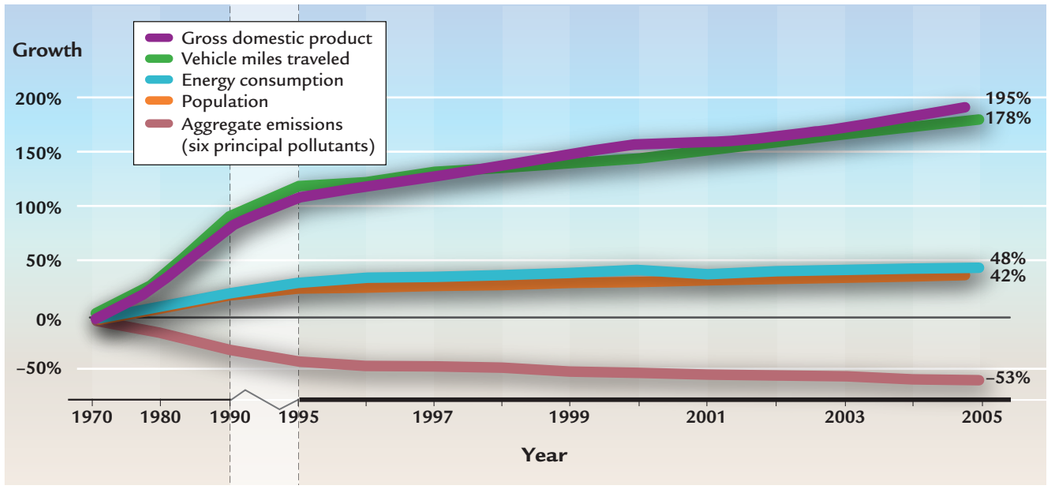
AIR QUALITY

The creation of the Clean Air Act (CAA) in 1963 implemented a national effort to maintain healthy air quality by controlling air pollution. The CAA provides the principal framework for national, State, and local efforts to protect air quality. The 1970, 1977, and 1990 CAA amendments renewed and intensified national efforts to reduce air pollution in the United States.

Air pollution comes from many different sources:

- stationary sources
  - factories
  - power plants
  - dry cleaners
- mobile sources
  - motor vehicles
  - construction equipment
  - planes
  - trains
- natural sources
  - windblown dust
  - wildfires

Figure 4-18 Comparison of National Economic and Demographic Growth Indicators and Air Emissions, 1970–2005



Source: U.S. Environmental Protection Agency, 2006

As major indicators of economic or demographic growth increased over the past 35 years, emissions of six principal air pollutants have been halved.

The wide variety of pollutants from these sources can affect local and regional air quality. For additional information regarding the provisions of the CAA, refer to the EPA Web site, <www.epa.gov>. This section addresses the effects of the proposed action and alternatives, including the No-Action Alternative, on air quality pursuant to the provisions set forth in the CAA, as amended, and related guidance.

REGULATORY OVERVIEW

The environmental awakening of the United States in the middle of the last century launched a series of air pollution control laws, starting with the Air Pollution Control Act of 1955, which identified air pollution as a national problem and recognized the need for research and further action. Eight years later, the 1963 CAA focused on regulating air pollution from stationary sources such as power plants or steel mills. The CAA of 1965 and the Air Quality Act of 1967 set standards for automobile emissions and began to move authority for enforcement of air pollution regulations to the local level. To protect public health, and based on scientific research and analysis of potential health impacts, the 1970 CAA established acceptable concentrations for six criteria air pollutants:[6]

- carbon monoxide (CO)
- nitrogen dioxide (NO_2)
- ozone (O_3)
- particulate matter (PM)
- sulfur dioxide (SO_2)
- lead

Protecting public health continues to be the driving force for modifications and additions to air pollution regulations today. Between 1970 and 2005, emissions of criteria pollutants were cut by more than half, from 273 million metric tons of annual emissions to 133 million metric tons (Figure 4-18). During this period, emissions of CO decreased 54 percent, nitrogen oxides 24 percent, volatile organic compounds (VOCs) (contributors to O_3 formation) 54 percent, SO_2 (a by-product of diesel combustion) 49 percent, and lead 98 percent (Holmstead 2005). These reductions in air pollution occurred during a period of robust economic growth. Between 1970 and 2005, the U.S. economy grew by more than 195 percent, vehicle miles traveled (VMT) increased by 178 percent, and energy consumption grew by 48 percent.

In 1997, the Arizona Legislature passed House Bill 2307, which required reformulated fuels in Area A May 1 through September 30 each year, beginning in 1999. In addition, in 1999, the Arizona Legislature passed House Bill 2347, which requires winter fuel reformulation with 3.5 percent oxygen content in Area A (portions of Maricopa, Yavapai, and Pinal counties) November 1 through March 31 each year, beginning in 2000 (Arizona Administrative Code [A.A.C.] Title 20, Chapter 2, Article 7). EPA's approval notice of the Arizona Clean Burning Gasoline Program was published in the *Federal Register* on March 4, 2004 (MAG 2009f).

CRITERIA POLLUTANTS

While EPA regulates many air pollutants, certain pollutants are known as "criteria" air pollutants because EPA uses health-related criteria for permissible exposure levels. The permissible levels are known as the National Ambient Air Quality Standards (NAAQS). One set of limits (primary standards) protects health; another set (secondary standards) is intended to minimize environmental and property damage (Table 4-27). These pollutants are monitored by State and local agencies. In Maricopa County, the Maricopa County Air Quality Department (MCAQD) and the Arizona Department of Environmental Quality (ADEQ) maintain a network of air quality monitoring sites, most of which are located in Phoenix and surrounding communities. Observations as well as atmospheric measurements (see text box on the next page) are collected for research and analysis. A geographic area in which concentrations of criteria pollutants are less than the primary standard is called an attainment area. A geographic area where the concentration of a criteria pollutant exceeds the primary standard is called a nonattainment area.[7]

Table 4-27 National Ambient Air Quality Standards

Pollutant	Averaging Time	Primary	Secondary
Carbon monoxide	1-hour	35 ppm[a]	no standard
	8-hour	9 ppm	no standard
Nitrogen dioxide	Annual	0.053 ppm	0.053 ppm
	1-hour	0.1 ppm	no standard
Ozone	8-hour	0.075 ppm	0.075 ppm
Particulate matter ($PM_{2.5}$)[c]	24-hour	35 µg/m^3[b]	35 µg/m^3
	Annual	12 µg/m^3	15 µg/m^3
Particulate matter (PM_{10})[d]	24-hour	150 µg/m^3	150 µg/m^3
Lead	rolling 3-month	0.15 µg/m^3	0.15 µg/m^3
Sulfur dioxide (SO_2)	1-hour	75 ppb[e]	NA[f]
	3-hour	NA	0.5 ppm

Source: 40 Code of Federal Regulations Part 50
[a] parts per million [b] micrograms per cubic meter [c] for particles less than or equal to 2.5 microns (2.5 millionths of a meter) in diameter [d] for particles less than or equal to 10 microns (10 millionths of a meter) in diameter [e] parts per billion
[f] not applicable

The six criteria pollutants listed previously in the section *Regulatory Overview* were first regulated by the 1970 CAA. In the Phoenix area, three of the six criteria pollutants have been historically measured at concentrations higher than the NAAQS (i.e., nonattainment). Local actions were required to reduce concentrations of CO, O_3, and PM_{10}. The Study Area currently lies in a nonattainment area for O_3 and PM_{10}. The Maricopa County area was redesignated to attainment for CO in 2005. Discussion of each of the criteria pollutants follows.

Characteristics of Criteria Pollutants

Lead

Lead is a heavy metal that, at certain exposure levels, can harm the kidneys, liver, nervous system and other organs. It may cause neurological impairments, such as seizures, mental retardation, and behavioral and learning disorders. Recent studies also show that lead may be a factor in high blood pressure and subsequent heart disease. Motor vehicles were the main source of lead air pollution in the past. Lead was an "antiknock" additive used in gasoline. EPA set regulations during the 1980s to gradually reduce the amount of lead added to gasoline. A 1996 CAA amendment banned the sale and use of leaded gasoline in the United States. Since then, lead emissions from vehicles have decreased by about 98 percent nationally.[8] The Phoenix area is in attainment for lead.

Nitrogen Dioxide

NO_2 is a reddish-brown gas belonging to the highly reactive family of gases called nitrogen oxides. Prolonged exposure to NO_2 irritates the lungs and may decrease resistance to respiratory infections, especially in people with existing respiratory illnesses such as asthma. NO_2 is a precursor compound in the photochemical formation of O_3 and, also, in the formation of $PM_{2.5}$, a component of the "brown cloud" frequently observed during fall and winter (see text box on this page). Sources of NO_2 in the Phoenix area include on-road vehicles (58 percent), off-road vehicles (27 percent), and other sources (15 percent), such as power-generating stations, naturally occurring soil processes, and manufacturing plants. NO_2 emissions have declined because of the use of reformulated fuels.

Ambient concentrations of NO_2 are well below the annual standard in the Phoenix metropolitan area. During 2009, MCAQD operated five NO_2 monitoring sites, and none recorded an exceedance of either the 1-hour or the annual standard. On February 9, 2010, EPA finalized a new primary 1-hour NO_2 NAAQS of 0.1 part per million (ppm). This level is intended to protect against adverse health effects associated with short-term exposure to NO_2. New networks of near-road NO_2 monitors for the hourly standard are required to be operational between January 1, 2014, and January 1, 2017. The Phoenix area is in attainment for NO_2.

Sulfur Dioxide

SO_2 is a colorless gas that has a pungent odor at higher concentrations. Prolonged exposure to SO_2 irritates the lungs and may reduce airflow through nasal passages and airways, especially in people who have asthma and are exposed to high concentrations and in those exposed to high concentrations through outdoor exercise. Like NO_2, SO_2 is also a precursor compound in the formation of $PM_{2.5}$, a component of the "brown cloud" that forms frequently during the fall and winter.

Sources of SO_2 in the Phoenix area include point sources, such as industry and mining (32 percent); area sources, such as small industry or household activities (26 percent); off-road vehicles (23 percent); and on-road vehicles (19 percent). Major control technology installed in Arizona's copper smelters during the 1980s reduced SO_2 emissions substantially. SO_2 emissions are expected to decline in the future with the introduction of reformulated fuels. Ambient concentrations of SO_2 were measured at two sites during 2009. On June 22, 2010, EPA finalized a new primary 1-hour SO_2 standard and revoked the 24-hour and annual standards. The 3-hour standard remains a secondary standard for SO_2. No exceedances of these standards have been recorded in the region. The Phoenix area is in attainment for SO_2.

Carbon Monoxide

CO is a colorless and odorless gas produced by incomplete combustion of hydrocarbon fuels. When CO enters the bloodstream, it reduces the delivery of oxygen to the body's organs and tissues. Health risks are most serious for those who suffer from cardiovascular disease, particularly those with angina or peripheral vascular disease. Because CO is a gas, it tends to disperse relatively quickly from its source.

Nationwide, 77 percent of CO emissions are from transportation sources, with more than 65 percent of that from on-road sources. In Arizona's metropolitan areas, about 47 percent of CO emissions come from on-road motor vehicles, 50 percent from off-road vehicles or equipment such as construction vehicles and lawn or garden equipment, and 3 percent from fuel combustion from commercial and residential heating. The highest levels of CO are found in the winter months, when thermal inversions tend to trap pollutants near the ground.

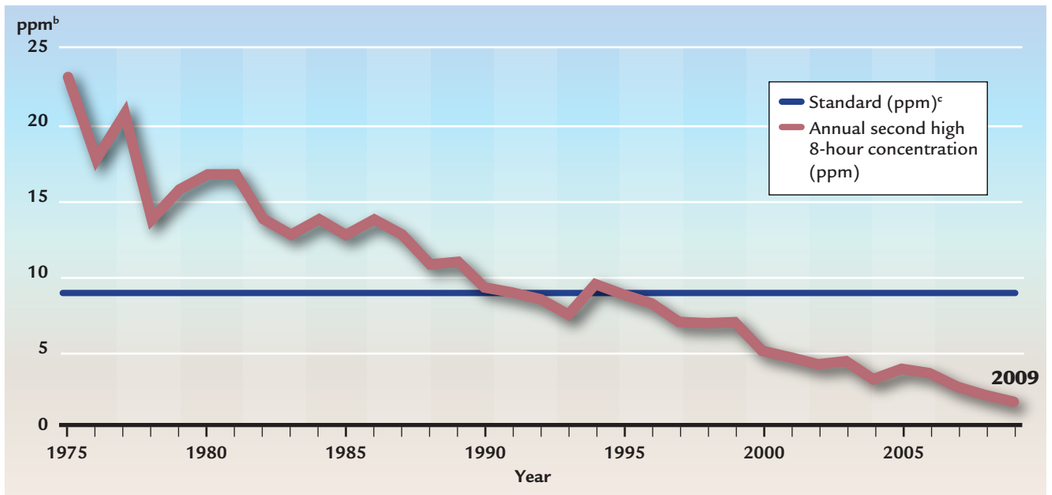
The Maricopa County Carbon Monoxide Maintenance Area was originally classified as a "moderate" nonattainment area in November 1990, and EPA required

A Word about the Brown Cloud

Phoenix's brown cloud is a hazy condition caused by the accumulation in the atmosphere of $PM_{2.5}$, SO_2, and NO_2, with $PM_{2.5}$ being the predominant contributor. In the Phoenix metropolitan area, about 31 percent of $PM_{2.5}$ emissions are attributed to on-road mobile sources. Other $PM_{2.5}$ sources include construction dust and equipment, agriculture, industry, leaf blowers, diesel generators, and fireplaces. In the region, the brown cloud tends to be worse and more frequent in the winter, when temperature inversions tend to trap pollutants near the ground.

The brown cloud is a regional problem that has worsened as the region's population has increased. Source emission standards are expected to dramatically reduce the on-road mobile source contribution to brown cloud pollutants. These standards, phased in between 2006 and 2010, have reduced sulfur content, nitrogen oxides, and $PM_{2.5}$ in heavy-duty diesel truck engines. New engine and gasoline standards for cars and light trucks are also expected to result in substantial reductions in sulfur and nitrogen oxides over the next two decades. However, even with these reductions in on-road mobile source emissions, rapid population growth projected for the region and the many off-road sources of brown cloud precursors likely mean that the brown cloud will continue to be a concern.

Figure 4-19 Annual Second High 8-hour Carbon Monoxide Concentrations, Phoenix,[a] 1980–2009



Source: Maricopa County Air Quality Department, 2010

[a] based on monitoring data from the Central Phoenix monitoring site
[b] concentration in parts per million
[c] National Ambient Air Quality Standard for carbon monoxide, 8-hour concentration

The 8-hour CO concentrations in Phoenix have declined dramatically and generally steadily since the mid-1970s.

attainment by December 1995. The Maricopa County area did not attain the CO standard by this date, and EPA reclassified the area as a "serious" nonattainment area in June 1996. EPA required that MAG prepare a strategy to address the CO problem, and the strategy was included in the State's air quality plan (State Implementation Plan, or SIP). In September 2003, EPA concluded that the Maricopa County area had attained the CO standard. On March 9, 2005, EPA redesignated the Maricopa County area as attainment for CO and approved a maintenance plan for the area. The maintenance plan requires many of the same control measures as the nonattainment SIP; these measures will remain in place through 2015. MAG submitted a second maintenance plan in April 2013 that demonstrated maintenance of the CO standard through 2025 with existing control measures.

CO concentrations have declined in the Maricopa County area by as much as two-thirds since the mid- to late-1970s. The number of days that the 8-hour CO standard was exceeded declined steadily and dramatically from 86 in 1984 to 4 in 1990. There have been no violations of the 8-hour standard in the area since 1996. Most of this improvement can be attributed to federal standards for new-vehicle emissions, augmented by emission reductions from Arizona's Vehicle Emissions Inspection Program (begun in 1976), and the use of oxygenated fuels in the winter (initiated in 1989). During 2009, MCAQD operated 13 CO monitoring sites, and none reported an exceedance of either the 1-hour or the 8-hour standard. Figure 4-19 shows the decrease in concentrations for 8-hour CO exposures at the Central Phoenix monitoring site.[9]

Ozone

Although O_3 in the upper atmosphere is critical to life because it shields the earth from high levels of harmful ultraviolet radiation from the sun, high concentrations of O_3 at ground level can affect plant and animal health. In humans, O_3 has the potential to damage lung tissue, reduce lung function, and sensitize the lungs to other irritants. Exposure to high concentrations of O_3 for as little as several hours has been found to reduce lung function and induce respiratory inflammation.[10]

O_3 is not emitted directly as a tailpipe pollutant, but is formed through complex atmospheric photochemical reactions with other pollutants, primarily VOCs and nitrogen oxides. For this reason, O_3 is considered a regional pollutant. Federal requirements dictate that emissions of compounds that contribute to O_3 formation (known as O_3 precursors) cannot exceed certain limits. In general, on-road vehicle emissions account for nearly one third of the VOC emissions and nearly 60 percent of the nitrogen oxides from the greater Phoenix area (ADEQ 2010). Sunlight and high temperatures accelerate the photochemical reactions that form O_3, so peak O_3 levels in Arizona occur during the summer. MAG conducts regional O_3 studies and analyses. EPA promulgated two health-based regulations: one limited the 1-hour O_3 average concentration and one set an 8-hour average O_3 concentration. The Maricopa Ozone Nonattainment Area, including the Phoenix metropolitan area, was originally designated a nonattainment area in 1991 for not meeting the 1-hour O_3 NAAQS. EPA reclassified the Maricopa area to "serious" nonattainment in 1998 for failing to attain the 1-hour O_3 standard. The State of Arizona requested attainment redesignation in December 2000 as a result of 3 years with no O_3 violations. In May 2001, EPA determined that the Maricopa area had attained the 1-hour O_3 standard. A maintenance plan with a redesignation request was submitted to EPA in April 2004. The 1-hour O_3 maintenance plan and redesignation request were approved by EPA in June 2005, but EPA revoked the 1-hour standard in June 2005 in Arizona.

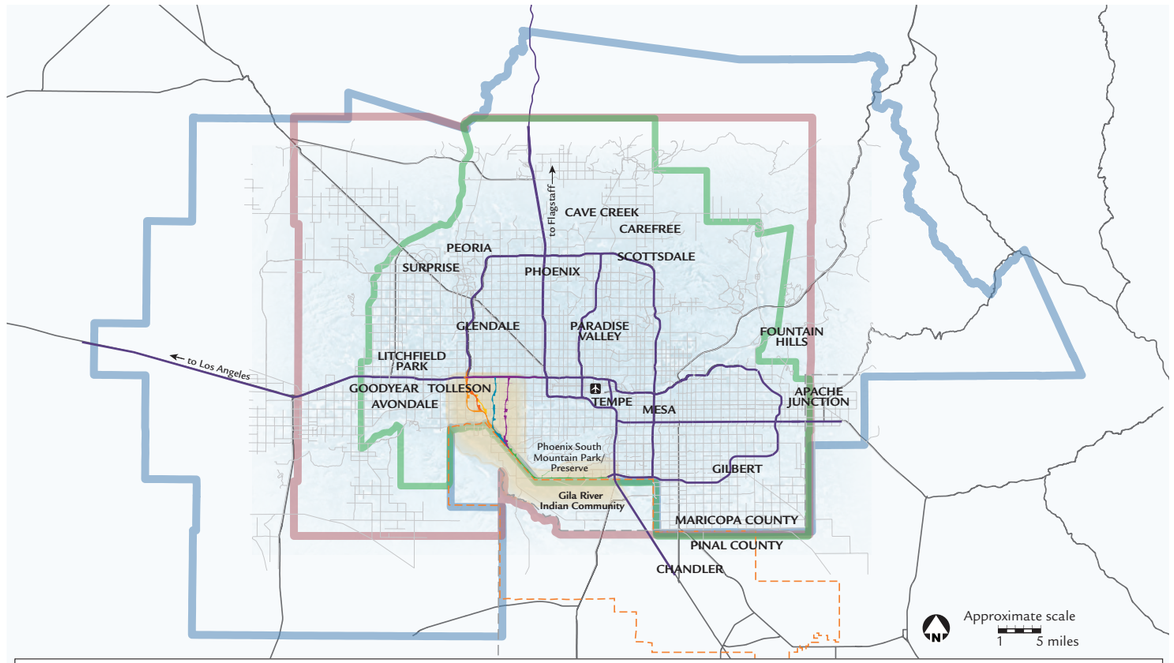
The 8-hour O_3 standard, as adopted by EPA in 1997 and revised in 2008, is expressed as the 3-year average of the annual fourth-highest concentration. In 2004, the Maricopa area was designated a Basic nonattainment area for the 1997 8-hour O_3 standard. The Maricopa 8-hour Ozone Nonattainment Area covers a large area of eastern Maricopa County, including the Phoenix metropolitan area and Apache Junction in Pinal County, as shown on Figure 4-20.

MAG submitted a nonattainment area plan for the 1997 8-hour O_3 standard to EPA in 2007. Based upon monitoring data, there have been no violations of the 1997 8-hour O_3 standard at any monitor since 2004. In 2009, MAG submitted a redesignation request and maintenance plan to EPA for the 1997 8-hour standard. On June 13, 2012, EPA approved the MAG nonattainment area plan for the 1997 8-hour ozone standard.

In 2008, EPA reduced the 8-hour O_3 standard from 0.08 ppm to 0.075 ppm. In May 2012,EPA designated the Maricopa area as a Marginal nonattainment area for the 2008 8-hour O_3 standard. The nonattainment area for the 2008 8-hour O_3 standard is slightly larger than the 1997 8-hour O_3 nonattainment area, expanding farther south and west of Maricopa County to encompass existing power plants.

Long-term trends in 8-hour concentrations of O_3 can be detected by examining data from six sites in the Phoenix area that have been in operation since 1990 (Figure 4-21). The six sites are Central Phoenix, Glendale, North Phoenix, Pinnacle Peak, South Scottsdale, and West Phoenix. In addition to the 3-year average of the annual fourth-highest concentration, the minimum and maximum values are also shown to demonstrate any spatial variability that may exist across the Phoenix area. In general, there is a decrease in 8-hour concentrations from 1990 to 2009, with

Figure 4-20 Nonattainment Areas for Particulate Matter,[a] Carbon Monoxide, and Ozone,[b] Maricopa County



Source: Arizona Department of Transportation, 2010, *Air Quality Assessment South Mountain Freeway 202L Draft Report*

[a] particulate matter greater than or equal to 10 microns (10 millionths of a meter) in diameter
[b] In 2012, the U.S. Environmental Protection Agency finalized the boundary for the 8-hour standard nonattainment area, expanding it slightly to the south and west within Maricopa County to encompass existing power plants.

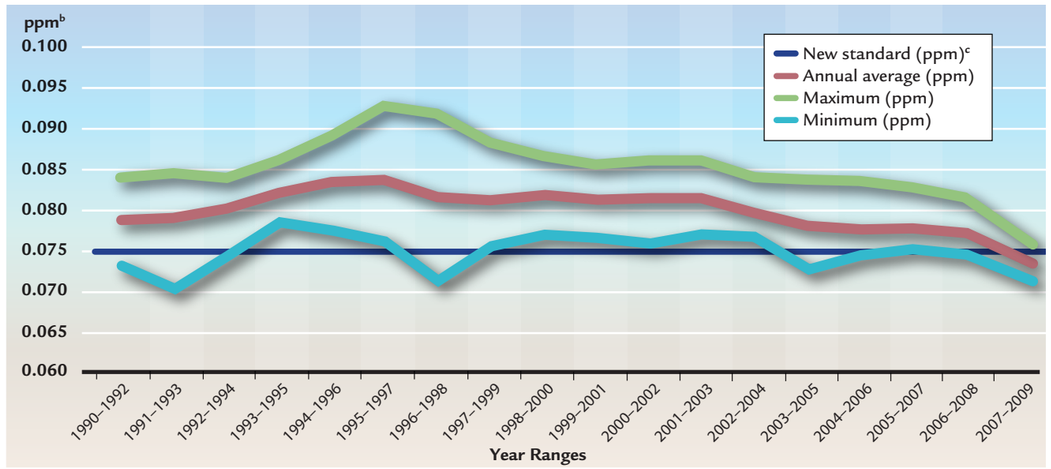
Air quality issues may be regional in nature.

the majority of the decrease occurring from the mid- to late-1990s to 2008 (ADEQ 2010).

Particulate Matter

Particulates are small particles suspended in the atmosphere and may cause irritation and damage to the respiratory system. Exposure to particulates may aggravate existing lung disease, such as asthma or bronchitis, and may increase susceptibility to respiratory infections. Initially, the CAA set standards for all airborne PM. This was referred to as Total Suspended Particulates. In 1987, using additional information on potential health effects, however, EPA began using a new indicator, PM_{10}, which includes only those particles with a diameter less than or equal to 10 microns (micrometers). Ten microns is approximately one-seventh the diameter of a human hair. The PM_{10} fraction of Total Suspended Particulates was considered more important in adversely affecting human health. EPA adopted an annual and a 24-hour standard for PM_{10}. EPA revoked the annual PM_{10} standard, however, in late 2006.

Figure 4-21 Exceedances of Maximum 8-hour Ozone Concentrations, Phoenix,[a] 1990–2009



Source: Arizona Department of Environmental Quality, 2009

[a] based on monitoring data from six sites: Central, North, and West Phoenix; Glendale; Pinnacle Peak; and South Scottsdale
[b] concentration in parts per million
[c] National Ambient Air Quality Standard for ozone, 8-hour concentration

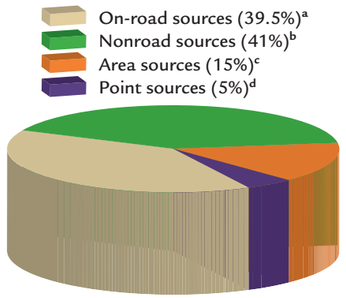
Although the average values at six monitoring sites have generally declined over time, values at some locations exceed the 8-hour ozone standard of 0.075 ppm based on the 2010 to 2012 monitoring data.

Because of its many sources and broad size range, particulate pollution does not have a specific season when it is most troublesome; its effects, however, are aggravated by dry conditions and high winds. On-road travel accounts for 39.5 percent of PM_{10} emissions in Maricopa County, as shown in Figure 4-22.

Air quality in the Maricopa County area does not currently meet the 24-hour PM_{10} NAAQS. The Maricopa County Particulate Matter Nonattainment Area was originally classified in November 1990 as "moderate." The area was reclassified in June 1996 to "serious" nonattainment status, requiring attainment by 2001, as shown on Figure 4-20. The State of Arizona submitted a revised plan to achieve attainment and requested a 5-year extension of the attainment deadline for the 24-hour and annual PM_{10} standards for the Maricopa County area. In July 2002, EPA announced approval of the plan and granted the extension to December 2006.

However, there were numerous exceedances of the 24-hour PM_{10} standard in 2005 and 2006. On June 6, 2007, EPA published a final notice stating that the

Figure 4-22 Regional PM_{10} Emissions Sources, Phoenix, 2008



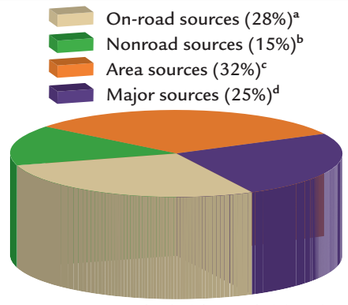
Source: Maricopa Association of Governments, 2009f

Note: Because of rounding, numbers do not add up to 100.

[a] mobile sources
[b] mobile sources including aircraft, locomotives, construction equipment, agriculture
[c] small industrial sources such as dry cleaners, gasoline stations
[d] stationary sources such as power plants and industrial facilities

These relative shares of airborne particulate matter (10 microns in diameter or less) from various emissions sources reflect use of in-place, committed control measures.

Figure 4-23 Sources of the 188 Hazardous Air Pollutants Regulated by the Environmental Protection Agency



Source: Federal Highway Administration, 2006c

[a] mobile sources
[b] mobile sources including aircraft, locomotives, construction equipment
[c] small industrial sources such as dry cleaners, gasoline stations, natural sources (wildfires)
[d] large industrial sources

Nationally, large industrial sources and numerous small businesses and natural sources account for the majority of the 188 hazardous air pollutants regulated by the U.S. Environmental Protection Agency.

nonattainment area had failed to attain the standard by December 31, 2006, triggering the CAA requirement to prepare a Five Percent Plan for PM_{10}. The MAG 2007 Five Percent Plan for PM_{10} was submitted to EPA in December 2007. The plan's committed measures demonstrated at least a 5 percent reduction in PM_{10} emissions per year and attainment of the PM_{10} standard in 2010. On September 9, 2010, EPA proposed a partial approval and disapproval of the MAG 2007 Five Percent Plan. The two major reasons for the proposed disapproval were 1) the 2005 baseline emissions inventory was inaccurate since it overestimated construction and other emissions and 2) the EPA non-concurrence with four high-wind exceptional events at the West 43rd Avenue monitor in 2008 that resulted in a violation of the 24-hour PM_{10} standard. On January 25, 2011, ADEQ withdrew the MAG 2007 Five Percent Plan to address technical approvability issues identified by EPA and include new information. Although the plan was withdrawn, the measures in the plan continue to be implemented. In May 2012, ADEQ submitted to EPA the MAG 2012 Five Percent Plan for PM_{10} as a replacement for the withdrawn MAG 2007 Five Percent Plan. The new MAG 2012 Five Percent Plan contains a wide variety of existing control measures and projects that have been implemented to reduce PM_{10} and a new measure designed to reduce PM_{10} during high-risk conditions, including high winds. The new plan's committed measures demonstrated at least a 5 percent reduction in PM_{10} emissions per year and attainment of the PM_{10} standard in 2012.

Three years of clean monitoring data (an average of no more than one exceedance a year per monitor, averaged over a 3-year period) is needed for the region to attain the PM_{10} standard. Only one exceedance of the PM_{10} standard occurred in 2010. However, in 2011 and 2012, numerous high-wind PM_{10} exceptional event exceedances were recorded as a result of haboobs and dust storms. EPA concurrence with exceptional event documentation prepared by ADEQ would give the region the 3 years of clean data needed for attainment of the PM_{10} standard

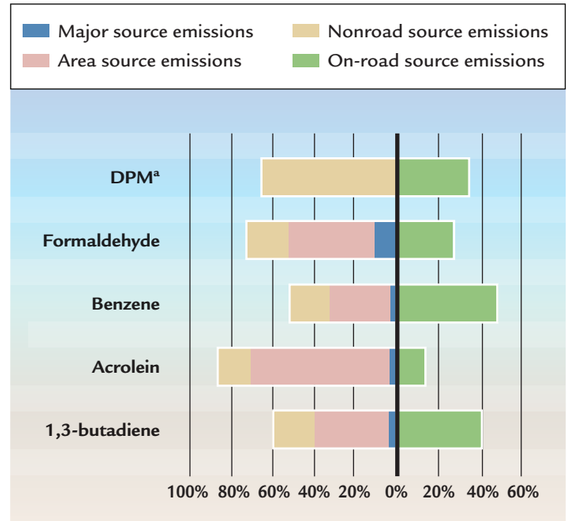
EPA has modified the health standards for particulates. Data suggest that particles 2.5 microns or smaller in diameter ($PM_{2.5}$), may pose the greater threat to human health because they more readily attach to toxic and carcinogenic compounds and penetrate more deeply into the lungs. In December 2012, EPA updated the NAAQS for $PM_{2.5}$, setting the primary annual standard at 12 $\mu g/m^3$ and keeping the 24-hour $PM_{2.5}$ standard at 35 $\mu g/m^3$. Monitoring for $PM_{2.5}$ in the Phoenix metropolitan area indicates $PM_{2.5}$ is below these health standards. According to the Maricopa County 2008 Periodic Emissions Inventory, approximately 34 percent of the total $PM_{2.5}$ emissions are from on-road mobile sources in the Phoenix metropolitan area. Nonroad mobile, area, and point sources are responsible for about 66 percent of total $PM_{2.5}$ emissions.

MOBILE SOURCE AIR TOXICS

In addition to the criteria pollutants, EPA regulates hazardous air pollutants (HAPs), which are a range of compounds known for or suspected of having serious health or environmental impacts. Under the CAA, EPA regulates 188 HAPs. Figure 4-23 shows that most HAPs originate from human-made sources, including indoor sources such as fumes from cooking, home supplies, or building materials, and outdoor sources such as refineries, chemical plants, gasoline stations, and vehicle emissions. Some HAPs are also released from natural sources such as forest fires (FHWA 2006c).

Twenty-eight percent of overall HAPs emissions plus diesel particulate matter (DPM) and diesel organic gases have been classified as on-road mobile source air toxics (MSATs). In March 2001, EPA issued a final rule on *Control of Emissions of Hazardous Air Pollutants from Mobile Sources*, which developed a list of 21 MSATs and then refined it further, compiling a subset of seven pollutants identified as having the greatest influence on health: acrolein, benzene, 1,3-butadiene, DPM, formaldehyde, naphthalene, and polycyclic organic matter (POM). EPA has already placed requirements into law that will limit future emissions of these contaminants from motor vehicles. Unlike the criteria pollutants, however, no NAAQS have yet been established for MSATs. Figure 4-24 summarizes information from 1999 for five of the seven MSATs individually and shows the percentages of emissions from on-road vehicle exhaust as compared with other sources. This figure shows that nationwide emissions of acrolein, formaldehyde, and DPM are predominantly from nonroad and area emissions, while nearly half of the 1,3-butadiene and benzene emissions are from on-road sources (FHWA 2006c).

Figure 4-24 Priority Mobile Source Air Toxics Emissions, 1999, On-road Versus Other Sources



Source: Federal Highway Administration, 2006c

[a] diesel particulate matter

Nationally, emissions from on-road sources are the largest contributors (by weight) to two of the seven priority mobile source air toxics—benzene and 1,3-butadiene.

Discussion of Pollutants

The following sections contain general information about sources, exposures, reactivity, and health risks for the seven MSATs. In general, all these pollutants derive from multiple sources in any urban environment. The most prevalent form of exposure is inhalation.

Acrolein

Acrolein is released into the air as a result of manufacturing acrylic acid, which is used in plastics, coatings, floor polishes, and paints. It can be also formed

from the breakdown of certain pollutants in outdoor air or from burning tobacco or gasoline.[11] Fuel combustion represents the major source of emissions of acrolein to the atmosphere (EPA 2003). According to the Integrated Risk Information System, acrolein's potential carcinogenicity cannot be determined because the existing data are inadequate for an assessment of human carcinogenic potential for either the oral or inhalation route of exposure. Short-term inhalation exposure may result in upper respiratory tract irritation and congestion. No information is available on its reproductive and developmental effects in humans. Acrolein is highly reactive and remains in the atmosphere for only a short time, making it difficult to detect ambient atmospheric concentrations. Acrolein is rapidly metabolized by organisms and does not bioaccumulate.[12]

Benzene

Benzene is a known human carcinogen and a natural component of petroleum. It is added to gasoline as an antiknock agent at concentrations of between 1 and 2 percent. Benzene may be emitted by evaporation of gasoline or from the incomplete combustion of fuel. Benzene is emitted to the air from many different sources. According to EPA's *Toxicity and Exposure Assessments for Children's Health*, benzene concentrations in indoor air are also significant contributors to children's exposures, particularly in homes where people smoke.[13] Benzene levels in homes are usually higher than outdoor levels, often because of venting of gasoline vapors from attached garages. For example, a study in Michigan found that the average concentration of benzene in residential garages was 36.6 $\mu g/m^3$, compared with 0.4 $\mu g/m^3$ outdoors.[14] Other common household sources of benzene are stored gasoline, glues, paints, furniture wax, detergents, and other consumer products. Cigarette smoke also contains high levels of benzene, and smokers have much higher levels of benzene in both their homes and their bodies than nonsmokers. The Stochastic Human Exposure and Dose Simulation – Air Toxics study also indicated that 15 percent of the average annual exposure to benzene occurred inside vehicles while driving and about 15 percent of the exposure occurred during vehicle refueling. The remaining inhalation exposure is from ambient outdoor air. Benzene is widely used as an industrial solvent and as an intermediate in chemical syntheses (Environment Canada 1993). Workers who may be exposed to benzene because of their occupations include steel workers, printers, laboratory technicians, firefighters, gas station employees, and chemical plant workers. Chemical reactions limit the atmospheric residence time of benzene to only a few days, and possibly to only a few hours (Agency for Toxic Substances and Disease Registry 2005).

1,3-butadiene

Large amounts (about 3 billion pounds) of 1,3-butadiene are produced each year from petroleum gases. Over 60 percent of this is used to make components of automobile tires. Smaller percentages are used in the manufacture of nylon, copolymer latexes, neoprene rubber, resins, rocket propellants, specialty copolymer resins, latexes for paints, coatings, adhesives, and as an additive to oil lubricants. Exposure to 1,3-butadiene mainly occurs in the following industries: rubber and latex production, petroleum refining, secondary lead smelting, water treatment, agricultural fungicides, and production of raw material for nylon.[15] Small amounts of 1,3-butadiene are found in gasoline, automobile exhaust, cigarette smoke, and wood smoke. 1,3-butadiene is a colorless gas with a mild, aromatic, gasoline-like odor. It is noncorrosive but highly flammable. The vapor is heavier than air. Under EPA's *Guidelines for Carcinogen Risk Assessment* (2005), 1,3-butadiene is characterized as carcinogenic to humans by inhalation. 1,3-butadiene does not bioaccumulate.[16] Estimates for atmospheric residence time in several U.S. cities ranged from 0.4 hour under clear skies at night in the summer to several days under cloudy skies at night in the winter. Residence times during daylight hours are shorter and vary by season. Given the generally short daytime residence times, the net atmospheric lifetime of 1,3-butadiene is short and there is generally limited potential for long-range transport of this compound (Hughes et al. 2001). It should be noted, however, that 1,3-butadiene is transformed into acrolein and formaldehyde in the atmosphere.[17]

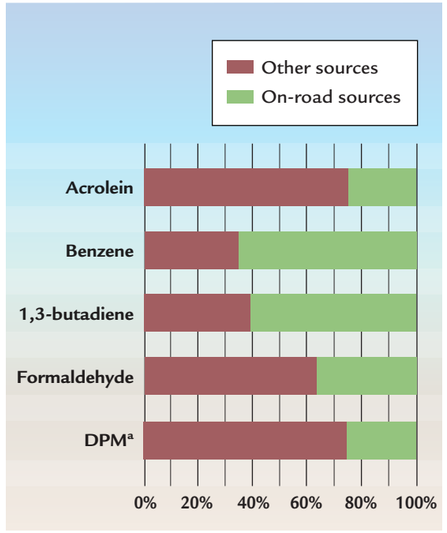
Formaldehyde

Formaldehyde is a colorless gas that is both naturally occurring and the result of human activity. It is one component of diesel exhaust and is a secondary pollutant produced by the atmospheric reactions of other pollutants, including 1,3-butadiene, a chemical found in automobile exhaust.[18] In general, indoor environments consistently have higher concentrations of formaldehyde than outdoor environments because many building materials, consumer products, and fabrics emit formaldehyde. Exposure most often occurs through inhalation of fumes, particularly indoors where concentrations can accumulate because of poor ventilation. Workers can be exposed during direct production, treatment of materials, and production of resins. Healthcare professionals, pathology and histology technicians, and teachers and students who handle preserved specimens may be potentially exposed. Exposure to formaldehyde may irritate the eyes, nose, and throat, and can cause skin and lung allergies.[19] In 1987, EPA classified formaldehyde as a probable human carcinogen under conditions of unusually high or prolonged exposure, according to the Integrated Risk Information System, based on limited evidence in humans, but on sufficient evidence in animals. In June 2004, the International Agency for Research on Cancer reclassified formaldehyde as a known human carcinogen. Formaldehyde breaks down quickly in the atmosphere and does not accumulate in the body.[20]

Diesel Particulate Matter

DPM is emitted by diesel automobiles, generators, light-duty and heavy-duty vehicles, railroad locomotives, and many off-road vehicles including construction equipment. In Maricopa County, heavy-duty trucks and buses account for approximately one-quarter of DPM emissions from all mobile sources.[21] When diesel fuel burns in an engine, the resulting exhaust includes gases and soot that may contain hundreds of different chemical substances. Contaminants emitted as gases condense to form a wide variety of small particles that compose DPM. These fine particles have a large surface area, which makes them an excellent medium for adsorbing organic compounds, including those that can cause health risks. Also, if inhaled, these small particles can reach deeper levels of the lungs. DPM disperses rapidly, but is nonreactive, and it can stay in the air for days or

Figure 4-25 Priority Mobile Source Air Toxics Emissions, Maricopa County



[a] diesel particulate matter

Source: U.S. Environmental Protection Agency, "National Air Toxics Assessment; Emissions Data Tables"

In Maricopa County in 1999, benzene and 1,3-butadiene are the predominant mobile source air toxics emissions (by weight) from on-road sources, the same as reported from national data (see Figure 4-24).

weeks. DPM can accumulate in the lungs over time if exposures continue (EPA 2002). People working near diesel engines in agriculture, construction, and railroads are potentially exposed to elevated levels. According to the Integrated Risk Information System, diesel exhaust is likely to be carcinogenic to humans by inhalation from environmental exposures. DPM as reviewed in this document is the combination of DPM and diesel exhaust organic gases. DPM exacerbates existing respiratory effects. Prolonged exposures may impair pulmonary function and could produce symptoms, such as cough, phlegm, and chronic bronchitis. Exposure relationships have not been developed from these studies.

Naphthalene

Naphthalene is a white crystalline, volatile solid that converts from a solid directly to a gas without an intermediate liquid phase at room temperature so that it exists as a gas in the atmosphere. Naphthalene is produced from petroleum refining and coal tar distillation. It is used in smokeless powder, cutting fluids, lubricants, synthetic resins, tanning product preservatives, and textile chemicals. Naphthalene is released to the air from the burning of coal and oil and from mothballs. Examples of human-made emission sources include paper mills, manufacturers of some wood products, and some combustion processes such as refuse combustion and coal tar pitch fumes. Naphthalene has also been detected in tobacco smoke and vehicle exhaust. Natural emission sources include crude oil and natural uncontrolled combustion. Acute exposure to naphthalene by inhalation, ingestion, and skin contact is associated with hemolytic anemia, liver damage, and, in infants, neurological damage. Symptoms include headache, nausea, vomiting, diarrhea, malaise, confusion, convulsion, and coma. Naphthalene vapors are highly irritating to the eyes, and cataracts have been reported in humans who experience acute exposure to naphthalene. EPA has classified naphthalene as a possible human carcinogen.

Table 4-28 Priority Mobile Source Air Toxics Emissions, Maricopa County, 2002

Pollutant	On-road Mobile Sources (% of total)	Other Sources (% of total)	Total (tons of emissions)
Acrolein	44	56	58
Benzene	54	46	2,008
1,3-butadiene	58	42	242
Formaldehyde	55	45	1,102
Napthalene	21	79	137

Source: U.S. Environmental Protection Agency, 2009

Polycyclic Organic Matter

POM is a broad class of over 100 organic compounds with more than one benzene ring. POM can be divided into two subgroups: polycyclic aromatic hydrocarbons (PAHs) and PAH-derivatives. PAHs are organic compounds that include only carbon and hydrogen; PAH-derivatives contain other elements in addition to carbon and hydrogen. In general, compounds with two rings, such as naphthalene, exist as a gas. Compounds with three to four rings, such as pyrene, exist either as a gas or a particle, depending on the temperature and pressure. Compounds with five rings, such as dibenzo[a,h]anthracen and benzo[a]pyrene, exist as particles in the atmosphere. POM is produced by the incomplete combustion of fossil fuels and vegetable matter and is generally present in the atmosphere in particulate form. Examples of human-made emission sources include cigarette smoke, grilling meat, home heating, fireplaces, vehicle exhaust, coal-fired power plants, petroleum refineries, paper mills, and roofing tar. POM can also be formed from any naturally occurring combustion, such as forest fires. Exposure to POM can occur through inhalation, ingestion, and skin contact. Epidemiological studies have reported an increase in lung cancer in humans exposed to coke oven emissions, roofing tar emissions, and cigarette smoke. Animal studies have reported respiratory tract tumors from inhalation exposure to benzo[a]pyrene and forestomach tumors, leukemia, and lung tumors from oral exposure to benzo[a]pyrene. The exposure of skin to mixtures of carcinogenic PAHs can cause skin disorders; adverse skin effects have been reported following application of solutions containing benzo[a]pyrene.

Table 4-29 Annual Priority Mobile Source Air Toxics Concentrations, South Phoenix

Pollutant	South Phoenix Annual Mean ($\mu g/m^3$)[a]
Benzene	3.5
1,3-butadiene	0.5
Formaldehyde	4.2

Source: Joint Air Toxics Assessment Project Report, 2004 (November)

[a] micrograms per cubic meter

Local Emissions of Priority MSATs

It is possible to estimate the relative contributions (by weight of emissions) of the different local sources of priority MSATs using EPA-compiled information. In June 2009, EPA released the results of its National-Scale Air Toxics Assessment for 2002.[22] The purpose of the national-scale assessment was to identify and prioritize those HAPs that present the greatest potential concern in terms of adversely affecting human health. Table 4-28 and Figure 4-25 show that, in Maricopa County, priority pollutants come from on-road mobile sources (such as cars and trucks) and other sources (such as industrial emissions, dry cleaners, gas stations, construction equipment, and train diesel engines).[23]

Regional emissions can exhibit wide local variations. In the Phoenix area, some monitoring data include several priority MSATs. In 2003, a short-term study under the Joint Air Toxics Assessment Project measured ambient levels of benzene; 1,3-butadiene; and formaldehyde in the South Phoenix area (bounded on the north by Van Buren Street, on the south by Chandler Boulevard, on the east by 1st Street, and on the west by 55th Avenue). The annual mean concentrations for these compounds are presented in Table 4-29 (McCarthy et al. 2004).

Emissions data organized and displayed at the county level can mask wide local variations. For example, compare the emissions percentages of benzene, 1,3-butadiene and formaldehyde in Table 4-28 with the percentages shown

for South Phoenix in Table 4-30 (McCarthy et al. 2004; Sullivan et al. 2004). On-road mobile sources represent a smaller portion of these pollutants in South Phoenix compared with Maricopa County as whole.

ENVIRONMENTAL CONSEQUENCES

Criteria Pollutants

CO

FHWA regulations require a project-level quantitative analysis for CO emissions from motor vehicles on all major transportation projects in nonattainment or maintenance areas. This project-level CO analysis was performed for the existing condition (2010) and for the action and No-Action alternatives in the design year (2035). Two EPA-approved models are used to project local impacts of CO emissions. One model, MOBILE6.2, estimated CO emissions from vehicles operating on the proposed freeway in the design year. Consistent with 40 C.F.R. § 93.111(c), since this project-level CO analysis started before or during the grace period for MOVES2010, MOBILE6.2 was used to estimate CO emissions. The other, a dispersion model (CAL3QHC Version 2), projected ambient CO concentrations in that year.

To address the modeling results, it is important to understand the ambient concentrations of CO in the Study Area. Maricopa County operates a network of air quality monitoring sites in the region. Monitoring results at stations in the Study Area demonstrate that the 1-hour and 8-hour maximum concentrations of CO are well below the NAAQS (see Figure 4-19 on page 4-60 for the 8-hour levels).

For the project-level analysis, projected maximum 1-hour and 8-hour concentrations were calculated for receptors at various distances from the roadway centerline for existing traffic conditions and roadway configurations for I-10, for major arterial street intersections near the proposed action alternatives, and for receptors located at the proposed action alternatives' interchanges. Receptor placement met the criteria for selecting modeling locations as specified in 40 C.F.R. § 93.123(a). In all, over 700 receptor locations were modeled in the Study Area. Projected 8-hour concentrations of CO with the action alternatives were low, with most projected 8-hour concentrations being less than 5 ppm. (The NAAQS for the 8-hour CO concentration level is 9 ppm.) Projected 8-hour concentrations at receptors located at arterial street intersections near I-10 generally exhibited a small decrease from the existing conditions to the action alternatives' scenario. Those receptors located at the arterial street intersections and freeway interchanges south of I-10 exhibited small increases. These projected 8-hour increases associated with the action alternatives were less than 3 ppm.

Table 4-31 illustrates maximum projected 1-hour concentrations: the action alternatives would result in concentrations below the 35 ppm NAAQS for the 1-hour CO concentration level. Table 4-32 illustrates maximum projected 8-hour concentrations: the action alternatives would result in concentrations below the 9 ppm NAAQS for the 8-hour CO concentration level. The CO project-level air quality analysis demonstrated that none of the action alternatives would violate the NAAQS, based on projected 2035 traffic.

Ozone

Since O_3 is a regional pollutant, a meaningful evaluation at the project level is not possible. MAG is responsible for developing plans to reduce emissions of O_3 precursors in the Maricopa area. MAG submitted its Eight-Hour Ozone Plan to EPA in summer 2007 (MAG 2009f). The Preferred Alternative is included in the RTP that has been determined by FHWA and the Federal Transit Administration to conform to the SIP.

Particulate Matter

Transportation projects that are within nonattainment or maintenance areas and are not exempt require an analysis that "… must document that no new local PM_{10} violations will be created and the severity or number of existing violations will not be increased as a result of the project" (FHWA 2001a). In March 2006, EPA and FHWA issued a joint guidance document on performing qualitative hot-spot analyses in $PM_{2.5}$ and PM_{10} nonattainment and maintenance areas. Projects that are of "air quality concern" as defined by 40 C.F.R. § 93.123(b)(1) require a hot-spot analysis. The proposed action is such a project.

Table 4-30 Priority Mobile Source Air Toxics Emissions, South Phoenix

Pollutant	On-Road Mobile Sources		Other Sources		Total
	Tons/year	% of total	Tons/year	% of total	Tons/year
Benzene	26.90	25	80.60	75	107.50
1,3-butadiene	4.40	9	43.46	91	47.86
Formaldehyde	18.90	40	28.62	60	47.52

Source: Joint Air Toxics Assessment Project Report, 2004 (December)

In December 2010, EPA established transportation conformity guidance for performing quantitative $PM_{2.5}$ and PM_{10} hot-spot analyses for transportation projects and established a 2-year grace period. EPA conformity guidance continues to allow qualitative PM_{10} hot-spot conformity analyses for analyses that were started before or during the grace period and if the final environmental document for the project is issued no more than 3 years after issuance of the draft environmental document [40 C.F.R § 93.111(c)]. Qualitative analyses may involve comparing the project area with an area possessing similar characteristics, reviewing findings from air quality studies that may have been performed, or employing other qualitative approaches. A PM_{10} qualitative analysis was performed for this project; it examined the areas that may be adversely affected by the proposed South Mountain Freeway. A $PM_{2.5}$ qualitative analysis was not required.

The qualitative analysis of the potential impacts associated with the proposed action began with a review of future traffic conditions on the Preferred Alternatives: the W59 and E1 Alternatives. The action alternatives' average daily traffic (ADT) levels, percentages of trucks, and level of service (LOS) were reviewed. Four service traffic interchanges were identified for detailed review based on LOS and/or high traffic volumes during the evening peak hour of travel. They were Van Buren Street, Southern Avenue, Desert Foothills Parkway, and 40th Street. The 83rd Avenue interchange was included with the W101 Alternative because no interchange is planned at Southern Avenue with the W101 Alternative. Under the 2020 action scenario, the ADT on arterial streets intersecting the W59

Table 4-31 Maximum Projected 1-hour Carbon Monoxide Concentrations[a] at Intersections/Interchanges

Western Section												
	51st Avenue	W59 Alternative	59th Avenue	67th Avenue	W71 Alternative	75th Avenue	83rd Avenue	91st Avenue	99th Avenue	W101 Alternative Eastern Option	W101 Alternative Central Option	W101 Alternative Western Option
Thomas Road	—[b]	—	—	—	—	—	—	—	—	—	3.8 3.7 3.8	—
McDowell Road	4.2[c] 3.8[d] 4.1[e]	—	4.0 3.9 3.7	4.2 4.1 4.3	—	4.8 4.7 4.8	—	—	5.2 4.6 3.9	—	2.9 3.5 3.5	—
Interstate 10	5.2 4.3 4.0	3.7 3.3 3.2	5.6 4.8 —[f]	5.6 4.8 4.9	3.4 2.9 3.4	4.6 4.4 4.7	—	—	7.0 6.1 4.8	—	7.2 4.6 3.9	—
Van Buren Street	—	5.1 3.5 3.7	4.3 3.8 —[g]	4.1 3.5 3.9	3.3 3.0 3.9	3.8 3.5 3.6	—	—	3.5 3.5 3.8	—	2.6 2.6 4.4	—
Buckeye Road	—	3.6 3.9 4.3	3.8 3.4 —[g]	3.8 3.3 3.4	2.5 2.3 3.2	3.5 3.3 3.2	—	3.7 3.6 5.0	3.5 3.6 3.6	—	3.1 3.2 4.4	3.4 3.4 4.8
Lower Buckeye Road	—	2.5 2.4 4.2	3.5 3.3 3.5	3.2 3.2 3.7	3.8 3.2 3.6	2.8 2.7 3.1	4.0 3.6 4.2	3.4 3.5 4.0	3.1 3.3 3.0	3.1 3.0 3.4	3.1 2.8 3.5	3.0 3.0 3.2
Broadway Road	—	2.0[h] 2.0[h] 3.8	2.0[h] 2.0[h] 2.0[h]	—	2.7 3.1 5.4	2.4 2.8 3.1	2.4 2.7 3.2	2.3 3.1 3.1	—	2.3 2.7 3.6	2.3 2.2 —[f]	—
91st Avenue	—	—	—	—	—	—	—	—	—	—	—	—[g] —[g] 2.9

Western Section												
	51st Avenue	W59 Alternative	59th Avenue	67th Avenue	W71 Alternative	75th Avenue	83rd Avenue	91st Avenue	99th Avenue	W101 Alternative Eastern Option	W101 Alternative Central Option	W101 Alternative Western Option
Southern Avenue	—	2.0[h] 2.0[h] 3.8	2.0[h] 2.0[h] 2.0[h]	—	—	—	—	—	—	—	—	—
Baseline Road	—	2.0[h] 2.0[h] 3.9	2.0[h] 2.0[h] 2.0[h]	—	2.0[h] 2.0[h] 4.3	—	—	—	—	—	2.3 2.3 3.9	—
Dobbins Road	—	2.0[h] 2.0[h] 5.7	2.0[h] 2.0[h] 2.0[h]	—	2.0[h] 2.0[h] 3.0	—	—	—	—	—	—	—
Elliot Road	—	2.0[h] 2.0[h] 4.4	2.0[h] 2.0[h] 2.0[h]	—	2.0[h] 2.0[h] 3.0	—	—	—	—	—	—	—
Free Flow	—	3.9 3.4 5.4	—	—	2.0[h] 2.0[h] 5.2	—	—	—	—	2.0[h] 2.0[h] 5.0	3.3[h] 2.9[h] 5.0[h]	2.0[h] 2.0[h] 4.1

Eastern Section						
	51st Avenue	17th Avenue	Desert Foothills Parkway	24th Street	40th Street	Free Flow
E1 Alternative	2.0[h] 2.0[h] 3.9	2.8 2.2 3.4	2.8 2.2 3.1	2.8 2.5 3.2	2.6 2.5 3.7	2.8 2.4 5.0

[a] all values are in parts per million (ppm); 1-hour standard = 35 ppm [b] not applicable [c] 4.2 – existing conditions
[d] 3.8 – No-Action Alternative [e] 4.1 – action alternatives [f] interchange removed [g] receptor within the right-of-way
[h] no existing roadway near receptor; background levels assumed

or E1 Alternatives would increase by as much as 10,000 vehicles. The largest increases are projected for those arterial streets intersecting the W101 Alternative. The largest of these is at 83rd Avenue, where the ADT would increase by approximately 30,000 vehicles. The percentage of trucks that are heavy trucks (diesel) is estimated at 2 to 7 percent. The 2020 LOS for the identified interchanges were not available, but because of the LOS projected for the same interchanges in 2035 (with higher traffic volumes), it may be assumed that none of these interchanges would operate at LOS E or F during 2020.

Under the 2035 action scenario, the percentage of trucks would remain at the 2020 level with ADT increasing by approximately 84 percent. The largest increases would be associated with the W101 Alternative. Increases of approximately 6 to 33 percent are projected for the W59 Alternative and approximately 23 to 42 percent for the W71 Alternative. With the action alternatives, two of the interchanges (at Van Buren Street and Southern Avenue) would operate at LOS C at both ramps. None of the interchanges would operate at a LOS E or F during 2035. Based on this information, both interchanges were considered as the worst-case traffic scenarios, but the Van Buren Street interchange had a higher ADT. Therefore, the Van Buren Street interchange with the W101 Alternative was analyzed.

The transportation conformity rule also requires that the analysis consider the year of expected peak emissions from the project.

The qualitative analysis compared ambient concentrations of PM_{10} at five MCAQD PM_{10} monitoring sites in the

Table 4-32 Maximum Projected 8-hour Carbon Monoxide Concentrations[a] at Intersections/Interchanges

Western Section												
	51st Avenue	W59 Alternative	59th Avenue	67th Avenue	W71 Alternative	75th Avenue	83rd Avenue	91st Avenue	99th Avenue	W101 Alternative Eastern Option	W101 Alternative Central Option	W101 Alternative Western Option
Thomas Road	—[b]	—	—	—	—	—	—	—	—	—	2.7 2.6 2.7	—
McDowell Road	2.9[c] 2.7[d] 2.9[e]	—	2.8 2.7 2.6	2.9 2.9 3.0	—	3.4 3.3 3.4	—	—	3.6 3.2 2.7	—	2.0 2.5 2.5	—
Interstate 10	3.6 3.0 2.8	2.6 2.3 2.2	3.9 3.4 —[f]	3.9 3.4 3.4	2.4 2.0 2.4	3.2 3.1 3.3	—	—	4.9 4.3 3.4	—	5.0 3.2 2.7	—
Van Buren Street	—	3.6 2.5 2.6	3.0 2.7 —[g]	2.9 2.5 2.7	2.3 2.1 2.7	2.7 2.5 2.5	—	—	2.5 2.5 2.7	—	1.8 1.8 3.1	—
Buckeye Road	—	2.7 2.7 3.3	2.7 2.4 —[g]	2.7 2.3 2.4	1.8 1.6 2.2	2.5 2.3 2.2	—	2.6 2.5 3.5	2.5 2.5 2.5	—	2.2 2.2 3.1	2.4 2.4 3.4
Lower Buckeye Road	—	1.8 1.7 2.9	2.5 2.3 2.5	2.2 2.2 2.6	2.7 2.2 2.5	2.0 1.9 2.2	2.8 2.5 2.9	2.4 2.5 2.8	2.2 2.3 2.1	2.2 2.1 2.4	2.2 2.0 2.5	2.1 2.1 2.2
Broadway Road	—	1.4[h] 1.4[h] 2.7	—	—	1.9 2.2 3.8	1.7 2.0 2.2	1.7 1.9 2.2	1.6 2.2 2.2	—	1.6 1.9 2.5	1.6 1.5 —[f]	—
91st Avenue	—	—	—	—	—	—	—	—	—	—	—	1.4[h] 1.4[h] 2.0

Western Section												
	51st Avenue	W59 Alternative	59th Avenue	67th Avenue	W71 Alternative	75th Avenue	83rd Avenue	91st Avenue	99th Avenue	W101 Alternative Eastern Option	W101 Alternative Central Option	W101 Alternative Western Option
Southern Avenue	—	1.4[h] 1.4[h] 2.7	—	—	—	—	—	—	—	—	—	—
Baseline Road	—	1.4[h] 1.4[h] 2.7	—	—	1.4[h] 1.4[h] 3.0	—	—	—	—	—	1.6 1.6 2.7	—
Dobbins Road	—	1.4[h] 1.4[h] 4.0	—	—	1.4[h] 1.4[h] 2.1	—	—	—	—	—	—	—
Elliot Road	—	1.4[h] 1.4[h] 3.1	—	—	1.4[h] 1.4[h] 2.1	—	—	—	—	—	—	—
Free Flow	—	2.7 2.4 3.8	—	—	1.4[h] 1.4[h] 3.6	—	—	—	—	1.4[h] 1.4[h] 3.5	2.3 2.0 3.5	1.4[h] 1.4[h] 2.9

Eastern Section						
	51st Avenue	17th Avenue	Desert Foothills Parkway	24th Street	40th Street	Free Flow
E1 Alternative	1.4[h] 1.4[h] 2.7	2.0 1.5 2.4	2.0 1.6 2.2	2.2 1.8 2.2	2.0 1.8 2.6	2.0 1.7 3.5

[a] all values are in parts per million (ppm); 8-hour standard = 9 ppm [b] not applicable [c] 2.9 – existing conditions [d] 2.7 – No-Action Alternative [e] 2.9 – action alternatives [f] interchange removed
[g] receptor within the right-of-way [h] no existing roadway near receptor; background levels assumed

Phoenix area. These sites represented urban areas near freeways, urban areas distant from freeways, and rural areas. The ambient concentrations included vehicle-related emissions such as tailpipe exhaust, brake-wear, tire-wear, reentrained road dust, and emissions from construction activities. The identified sites, ambient concentrations of PM_{10} measured during 2009, nearest road, and traffic volumes are presented in Table 4-33 (MCAQD 2010).

A review of the monitoring data suggests that industrial, mining, or agricultural areas have the highest ambient concentrations of PM_{10}. The sites near freeways typically have ambient concentrations below the NAAQS. For example, the Central Phoenix location (Table 4-33) has been in operation for over 40 years. Exceedances of the 24-hour PM_{10} standard have occurred at the Central Phoenix monitor, but most of these exceedances were caused by high-wind exceptional events. Likewise, the Greenwood site is within 200 feet of I-10 and is surrounded by a mix of residential, commercial, and light industrial facilities. This location had one exceedance of the 24-hour standard in 2009, which was noted by ADEQ as an "exceptional event." Exceptional events are adverse air quality events that may be caused by meteorological conditions (e.g., high winds, violent storms) or rare events (e.g., large structure fires or explosions, post-disaster clean-up activities). If such an event occurs and EPA agrees with the determination, data that

Table 4-33 PM_{10} Monitoring Locations, Results, and Nearby Road Characteristics, 2009

Site Name (Location)	Maximum 24-Hour PM_{10} Value ($\mu g/m^3$[a])	2nd Maximum 24-Hour PM_{10} Value ($\mu g/m^3$)	Number of Exceedances of PM_{10} Standard	Nearest Freeway	Distance from Freeway	2009 Traffic Volumes
Urban locations near freeways (<½ mile)						
Central Phoenix (16th Street/Roosevelt)	153	130	0	I-10[b] SR 51[c] SR 202L[d]	¼ mile ¾ mile ¾ mile	248,000 157,000 109,000
Greenwood (27th Avenue/I-10)	229	123	1[f]	I-10 I-17[e]	200 feet ½ mile	293,000 130,000
Urban locations distant from freeways (>½ mile)						
Durango Complex (27th Avenue/Durango Street)	277	161	3	I-17	¾ mile	110,000
West 43rd Avenue (43rd Avenue/Broadway Road)	317[f]	213	7	I-17	2½ miles	124,000
Rural locations						
Buckeye (Highway 85/Maricopa County 85)	439[f]	400	3	I-10	4 miles	37,500

[a] micrograms per cubic meter [b] Interstate 10 [c] State Route 51 [d] State Route 202 (Loop 202) [e] Interstate 17 [f] exceptional event

would have caused an exceedance of the NAAQS are not counted against an area's measure of air quality.

Of the monitoring locations reviewed, the site characteristics of the Central Phoenix and Greenwood monitoring sites would most closely resemble the characteristics of the Buckeye Road and Baseline Road interchanges in 2035. Based on the review of these sites and the projected characteristics of the two interchanges, it is unlikely that the proposed action alternatives would cause or contribute to an exceedance of the PM_{10} standards. This is based on the following factors:

- Fugitive dust sources in Maricopa County are the largest contributors to ambient concentrations of PM_{10}.
- Diesel exhaust is not a major contributor to ambient concentrations of PM_{10}.
- The proposed improvements would reduce travel time and congestion on the freeways and arterial streets in the area, thereby reducing exhaust emissions of PM_{10}.
- The emission factor for PM_{10} in 2035 is projected to be approximately 75 percent of the 2010 value based on the ratio of the PM_{10} emission factors (exhaust brake and tire) from MOBILE6.2.

This conformity determination meets applicable CAA Section 176(c) requirements for federally funded or approved transportation projects, specifically, the requirements for PM hot-spot analysis as codified at 40 C.F.R. §§ 93.116 and 93.123. By meeting these regulatory requirements as well as other requirements in the conformity regulations, this conformity determination demonstrates compliance with the requirements of CAA Section 176(c)(1).

Future Trends in Criteria Pollutants

EPA will continue its successful efforts to further reduce vehicle emissions. These programs include reformulated gasoline, the national low-emission vehicle program, Tier II motor vehicle emissions standards, gasoline sulfur control program, heavy-duty diesel engine program, and on-highway diesel sulfur control programs. Two examples follow.

Heavy-duty Diesel Emissions Standards

In December 2000, EPA issued its final rule in a two-part strategy to reduce diesel emissions from heavy-duty trucks and buses. The standards pertain to diesel engines found in such vehicles (weighing over 8,500 pounds), beginning in model year 2004. Additional standards and procedures were implemented in 2007. EPA required diesel fuel refiners to produce diesel fuels (for highway vehicle use) that have a sulfur content of no more than 15 ppm, effective October 2006, a 97 percent reduction from the previous 500 ppm level.

Tier II Emissions Standards

In December 1999, EPA announced what are known as Tier II new engine and gasoline standards designed to reduce emissions from new passenger cars and light trucks. Effective 2004, gasoline refiners and importers have been required to manufacture gasoline with sulfur levels not exceeding 300 ppm. By 2006, sulfur levels were to meet a 30 ppm average and were not to exceed 80 ppm. As a result of these regulations, nitrogen oxide emissions are predicted to decrease by 61 percent and VOC emissions by 24 percent between 2004 and 2030. Not only will the updated regulations reduce criteria pollutants, they will also reduce MSATs, which are discussed in the next section.

Mobile Source Air Toxics

Controlling air toxic emissions became a national priority with the passage of the Clean Air Act Amendments of 1990, whereby Congress mandated that EPA regulate 188 air toxics, also known as HAPs. EPA has assessed this expansive list in its latest rule on the *Control of Hazardous Air Pollutants from Mobile Sources* (Federal Register 72(37): 8430, February 26, 2007), and identified a group of 93 compounds emitted from mobile sources that are listed in its Integrated Risk Information System <www.epa.gov/iris/>. In addition, EPA identified seven compounds with significant contributions from mobile sources that are among the national- and regional-scale cancer risk drivers from its 1999 National Air Toxics Assessment <www.epa.gov/ttn/atw/nata1999/>. These are acrolein; benzene; 1,3-butadiene; DPM plus diesel exhaust organic gases; formaldehyde; naphthalene; and POM. While FHWA considers these the priority MSATs, the list is subject to change and may be adjusted in consideration of future EPA rules.

Information Availability Constraints in Analyzing Project-Specific MSATs Impacts

This section includes a basic analysis of the likely MSATs emissions impacts of the proposed action and the No-Action Alternative. Available technical tools do not, however, enable the prediction of project-specific health impacts of the emissions changes associated with the action alternatives. Because of these limitations, the following discussion is included in accordance with Council on Environmental Quality (CEQ) regulations [40 C.F.R. § 1502.22(b)] regarding incomplete or unavailable information. 40 C.F.R. § 1502.22(b) addresses situations where analysis of an impact in a NEPA document is restricted by missing or incomplete information, and requires the NEPA document to 1) state that there is missing or incomplete information, 2) discuss the relevance of this information, 3) summarize what is known about the impact in question, and 4) in the face of what is known and not known, present the federal agency's evaluation of the likely impact.

In FHWA's view, information is incomplete or unavailable to credibly predict the project-specific health impacts attributable to changes in MSAT emissions associated with a proposed set of freeway 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.

EPA is responsible for protecting the public health and welfare from any known or anticipated effect of an air pollutant. EPA is the lead authority for administering the CAA and its amendments and has specific statutory obligations with respect to hazardous air pollutants and MSATs. EPA is in the continual process of assessing human health effects, exposures, and risks posed by air pollutants. It maintains Integrated Risk Information System, which is "a compilation of electronic reports on specific substances found in the environment and their potential to cause human health effects" (<www.epa.gov/iris/>). Each report contains assessments of noncancerous 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 MSATs, including the Health Effects Institute (HEI). Two HEI studies are summarized below. 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 are the adverse human health effects of MSAT compounds at current environmental concentrations (<pubs.healtheffects.org/view.php?id=282>) or in the future as vehicle emissions substantially decrease (<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 prevent 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 affect emissions rates) over that time frame, since such information is unavailable.

It is particularly difficult to reliably forecast 70-year lifetime MSAT concentrations and exposure near roadways; to determine a person's duration of actual exposure at a specific location; and to establish the extent of exposure attributable to a proposed action, especially given that some of the information needed is unavailable.

Considerable uncertainties are associated with existing estimates of toxicity of the various MSATs because of factors such as low-dose extrapolation and translation of occupational exposure data to the general population, 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 DPM. The EPA (<www.epa.gov/risk/basicinformation.htm#g>) and HEI (<pubs.healtheffects.org/getfile.php?u=395>) have not established a basis for quantitative risk assessment of DPM in ambient settings.

A national consensus is also lacking on an acceptable level of risk. The current context is the process used by EPA as provided by the CAA to determine whether more stringent controls are needed 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 an "acceptable" level of risk attributable 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 attributable 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 deemed acceptable.

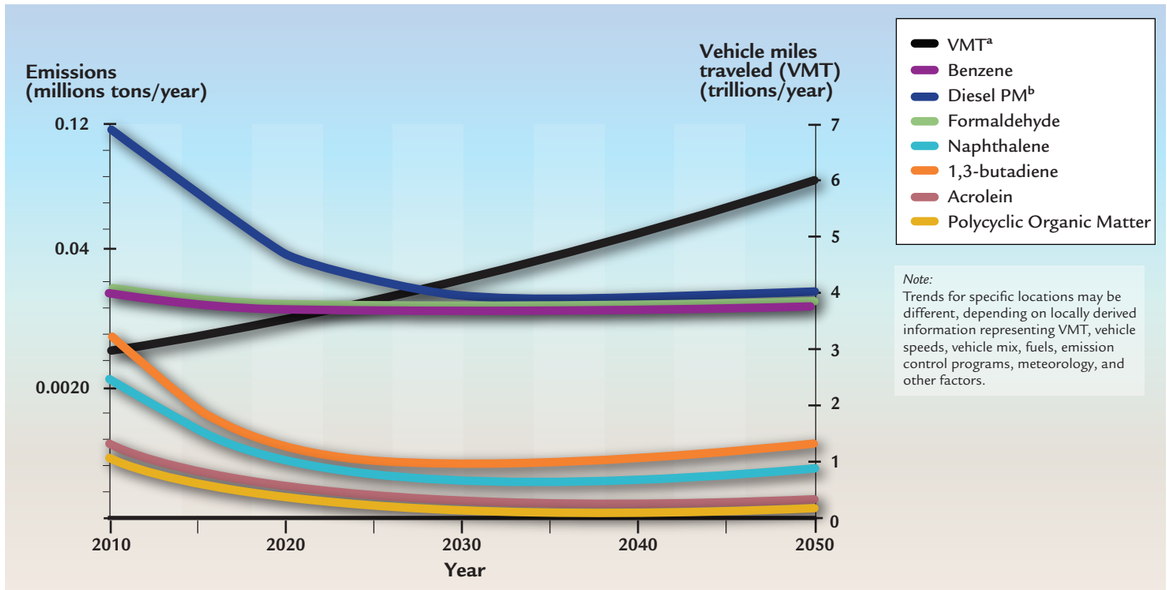
Because of the limitations in the methodologies for forecasting health impacts described, any predicted difference in health impacts between alternatives is likely to be much smaller than the uncertainties associated with predicting the impacts. Consequently, the results of such assessments would not be useful to decision makers,

who would need to weigh this information against project benefits, such as reducing traffic congestion, that are better suited for quantitative analysis

Emissions Model

The EPA emissions model MOBILE6.2 was used to project emissions at a regional level consistent with 40 C.F.R. § 93.111(c), since the MSAT analysis for the proposed action started before or during the grace period for using the MOVES2010 emissions model. According to EPA, MOVES improves upon the MOBILE model in several key aspects: MOVES is based on a vast amount of in-use vehicle data collected and analyzed since the latest release of MOBILE, including millions of emissions measurements from light-duty vehicles. Analysis of these data enhanced EPA's understanding of how mobile sources contribute to emissions inventories and the relative effectiveness of various control strategies. In addition, MOVES accounts for the significant effects that vehicle speed and temperature have on PM emissions estimates, whereas MOBILE did not. MOVES2010b includes all air toxic pollutants in the National Air Toxics Assessment that are emitted by mobile sources. EPA has incorporated more recent data into MOVES2010b to update and enhance the quality of MSAT emission estimates. These data reflect advanced emission control technology and modern fuels, plus additional data for older vehicles.

Figure 4-26 National MSAT Emission Trends, 1999–2050



Source: EPA MOVES2010b model runs conducted from May to June 2012 by FHWA.

[a] vehicle miles traveled
[b] diesel particulate matter

Regulatory initiatives have and will continue to result in reductions of mobile source air toxics (MSATs) emissions in the near term. As vehicle miles traveled steadily increase, MSAT emissions will rise only gradually.

Based on an FHWA analysis using EPA's MOVES2010b model, as shown in Figure 4-26, even if VMT increases by 102 percent as assumed from 2010 to 2050, a combined reduction of 83 percent in the total annual emissions for the priority MSATs is projected for the same time period.

The implications of MOVES related to MSAT emissions estimates compared with MOBILE as used in this analysis are lower estimates of total MSAT emissions; and significantly lower benzene emissions; significantly higher DPM emissions, especially for lower speeds. Consequently, DPM is projected to be the dominant component of the emissions total.

Dispersion Model

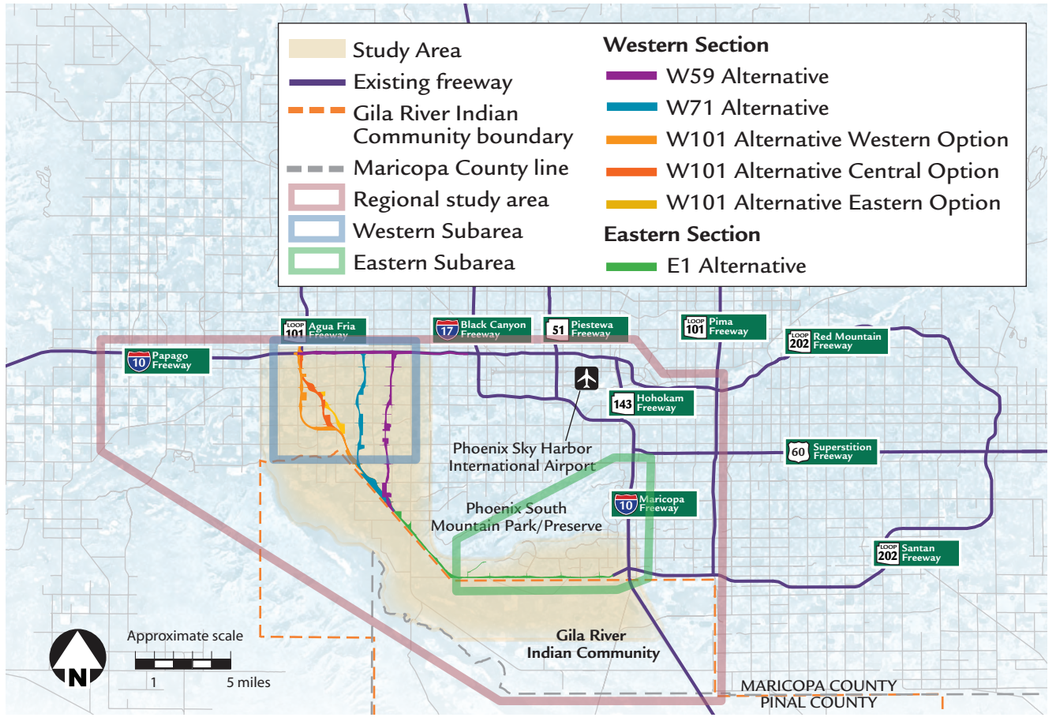
A dispersion model is used to evaluate how projected emissions will disperse into the environment and to estimate pollutant concentrations at specific times and locations. EPA's current dispersion models were developed and validated more than a decade ago for the purpose of projecting episodic concentrations of CO to determine compliance with the NAAQS.

MSAT Emissions Trends

Computer modeling was used to compare the projected emission trends of the action alternatives. The Study Area was divided into two geographic subareas, as shown in Figure 4-27, and emissions trends were modeled for the two subareas. The Eastern Subarea encompassed the general vicinity near Pecos Road, and the Western Subarea covered evaluations of emissions along each of the three Western Section action alternatives' proposed alignments. The No-Action Alternative was also modeled for both subareas. In addition, emissions trends were modeled for the entire Study Area. All modeling was performed for the proposed freeway's opening year (2020) and design year (2035).

This analysis was performed using EPA's MOBILE6.2 model. In accordance with FHWA interim guidance, the methodology employed was approved for use in estimating MSATs emission trends for regional areas and for relative comparisons of alternatives on large projects.

Figure 4-27 Modeled Assessment Areas, Mobile Source Air Toxics, Maricopa County



Source: Maricopa Association of Governments, 2006b; used with permission

Projected mobile source air toxics emissions trends for the action and No-Action alternatives were modeled using two geographic subareas to provide meaningful areas of comparison between 2010 and future conditions (2020 and 2035).

Tables 4-34 through 4-36 summarize the results of this modeling effort. Figure 4-28 shows MSATs emissions as a function of vehicle speed.

Subarea Emissions Impacts

The modeling results for the Western and Eastern Subareas show that future priority MSATs emissions for all of the proposed action alternatives would be substantially lower than the 2010 MSAT emissions even with increases in VMT of up to 70 percent. Reductions of up to 80 percent in MSATs emissions (DPM) are projected for the future years. These results generally agree with EPA's national projections. Results of the modeling are presented in Tables 4-34 and 4-35.

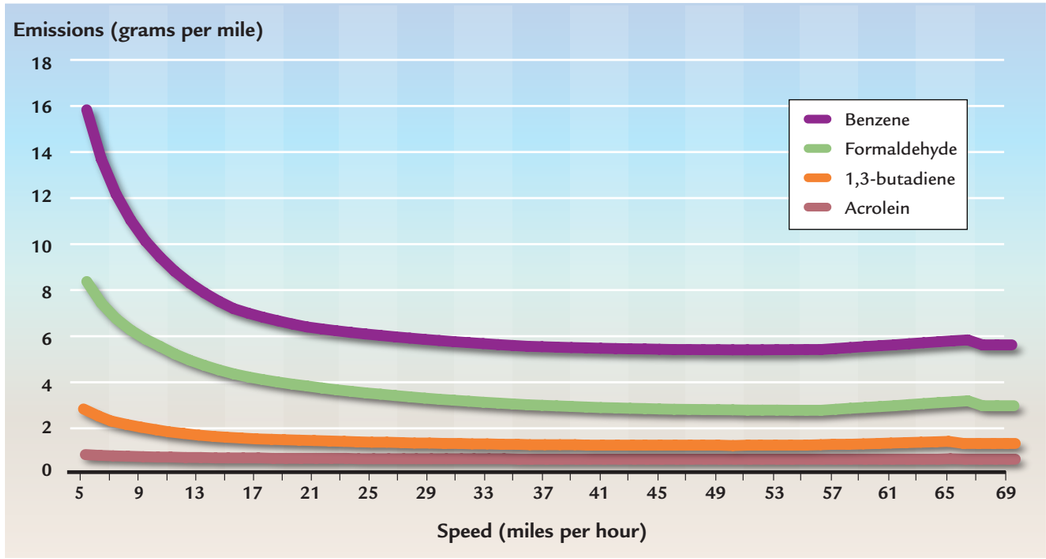
In the Western Subarea, the projected priority MSATs emissions for the proposed action alternatives during 2020 and 2035 would range from 23 to 77 percent lower and 17 to 81 percent lower than 2010 levels, respectively, depending on the action alternative and pollutant. The projected priority MSATs emissions for the No-Action Alternative during 2020 and 2035 would range from 28 to 78 percent lower and 20 to 83 percent lower than 2010 levels, respectively, depending on the pollutant. As shown in Table 4-34, the W59 (Preferred) Alternative shows the lowest MSATs emissions, followed by the W101 Alternative, with the W71 Alternative showing the highest MSATs emissions.

In the Eastern Subarea, the projected priority MSATs emissions for the E1 (Preferred) Alternative during 2020 and 2035 would range from 29 to 73 percent lower and a 1 percent increase to 77 percent lower than 2010 levels, respectively, depending on the pollutant. As shown in Table 4-35, formaldehyde emissions from the W101 Alternative would increase by 1 percent over the No-Action Alternative in 2035. The projected priority MSATs emissions for the No-Action Alternative during 2020 and 2035 would range from 31 to 79 percent lower and 14 to 82 percent lower than 2010 levels, respectively, depending on the pollutant.

Regional Emissions Impacts

The regional emissions modeling demonstrated that future priority MSATs emissions for the W59 (Preferred) Alternative would be substantially lower than the 2010 MSAT emissions, even with increases in VMT of over 50 percent (Table 4-36).

Figure 4-28 Priority Mobile Source Air Toxics Emissions as a Function of Vehicle Speed



Source: Federal Highway Administration, 2006c

Once the average speed of traffic exceeds about 20 miles per hour (mph), priority mobile source air toxics (MSATs) emissions are relatively constant, regardless of vehicle speed. In heavily congested conditions, where traffic speeds are likely below 20 mph, MSATs emissions increase with decreased speeds. More fuel—meaning more emissions—is also consumed because automotive engines do not operate optimally at low speeds.

Table 4-34 Modeled Mobile Source Air Toxics Emissions, Western Subarea Alternatives

MSATs[a] Compound	2010[b]	2020				2035			
		No-Action Alternative[b]	Change from 2010 (%)	Action Alternative[b]	Change from 2010 (%)	No-Action Alternative[b]	Change from 2010 (%)	Action Alternative[b]	Change from 2010 (%)
W59 Alternative									
Daily VMT[c]	3,099,202	3,490,936	13	3,905,597	26	3,810,374	23	4,187,989	35
Acrolein	0.58	0.41	–29	0.44	–24	0.45	–22	0.44	–24
Benzene	25.89	14.95	–42	16.14	–38	16.51	–36	15.82	–39
1,3–butadiene	2.57	1.66	–35	1.78	–31	1.80	–30	1.76	–32
Diesel particulates	13.83	2.99	–78	3.35	–76	2.39	–83	2.62	–81
Formaldehyde	12.84	9.27	–28	9.87	–23	10.26	–20	10.08	–22
Naphthalene	1.64	0.71	–57	0.79	–52	0.69	–58	0.76	–54
POM[d]	1.88	0.81	–57	0.90	–52	0.79	–58	0.86	–54
W71 Alternative									
Daily VMT	3,099,202	3,490,936	13	3,779,856	22	3,810,374	23	4,201,674	36
Acrolein	0.58	0.41	–29	0.43	–26	0.45	–22	0.47	–19
Benzene	25.89	14.95	–42	15.68	–39	16.51	–36	17.04	–34
1,3–butadiene	2.57	1.66	–35	1.73	–33	1.80	–30	1.87	–27
Diesel particulates	13.83	2.99	–78	3.24	–77	2.39	–83	2.63	–81
Formaldehyde	12.84	9.27	–28	9.67	–25	10.26	–20	10.65	–17
Naphthalene	1.64	0.71	–57	0.76	–54	0.69	–58	0.76	–54
POM	1.88	0.81	–57	0.87	–54	0.79	–58	0.87	–54
W101 Alternative									
Daily VMT	3,099,202	3,490,936	13	3,668,498	18	3,810,374	23	4,275,331	38
Acrolein	0.58	0.41	–29	0.37	–36	0.45	–22	0.46	–21
Benzene	25.89	14.95	–42	12.68	–51	16.51	–36	16.14	–38
1,3–butadiene	2.57	1.66	–35	1.47	–43	1.80	–30	1.82	–29
Diesel particulates	13.83	2.99	–78	3.15	–77	2.39	–83	2.68	–81
Formaldehyde	12.84	9.27	–28	8.44	–34	10.26	–20	10.47	–18
Naphthalene	1.64	0.71	–57	0.74	–55	0.69	–58	0.77	–53
POM	1.88	0.81	–57	0.84	–55	0.79	–58	0.88	–53

[a] mobile source air toxics [b] calculated MSATs emissions (tons per year); service traffic interchanges at Interstate 10 and Warner Road, Ray Road, and Chandler Boulevard [c] vehicles miles traveled
[d] polycyclic organic matter

Table 4-35 Modeled Mobile Source Air Toxics Emissions, Eastern Subarea Alternatives

MSATs[a] Compound	2010[b]	2020				2035			
		No-Action Alternative[b]	Change from 2010 (%)	Action Alternative[b]	Change from 2010 (%)	No-Action Alternative[b]	Change from 2010 (%)	Action Alternative[b]	Change from 2010 (%)
W59 Alternative[c]									
Daily VMT[d]	2,329,369	2,533,214	9	3,258,767	40	2,921,031	25	3,866,231	66
Acrolein	0.45	0.30	–33	0.26	–42	0.38	–16	0.42	–7
Benzene	21.18	11.40	–46	8.34	–61	14.59	–31	14.95	–29
1,3–butadiene	2.02	1.23	–39	1.01	–50	1.53	–24	1.66	–18
Diesel particulates	10.40	2.17	–79	2.79	–73	1.83	–82	2.42	–77
Formaldehyde	9.95	6.83	–31	5.84	–41	8.56	–14	9.55	–4
Naphthalene	1.23	0.51	–59	0.66	–46	0.53	–57	0.70	–43
POM[e]	1.40	0.58	–59	0.75	–46	0.60	–57	0.80	–43
W71 Alternative									
Daily VMT	2,329,369	2,533,214	9	3,294,453	41	2,921,031	25	3,900,165	67
Acrolein	0.45	0.30	–33	0.30	–33	0.38	–16	0.43	–4
Benzene	21.18	11.40	–46	10.34	–51	14.59	–31	15.41	–27
1,3–butadiene	2.02	1.23	–39	1.19	–41	1.53	–24	1.70	–16
Diesel particulates	10.40	2.17	–79	2.82	–73	1.83	–82	2.44	–77
Formaldehyde	9.95	6.83	–31	6.80	–32	8.56	–14	9.78	–2
Naphthalene	1.23	0.51	–59	0.66	–46	0.53	–57	0.70	–43
POM	1.40	0.58	–59	0.76	–46	0.60	–57	0.80	–43
W101 Alternative									
Daily VMT	2,329,369	2,533,214	9	3,353,926	44	2,921,031	25	3,940,818	69
Acrolein	0.45	0.30	–33	0.31	–31	0.38	–16	0.44	–2
Benzene	21.18	11.40	–46	10.71	–49	14.59	–31	15.89	–25
1,3–butadiene	2.02	1.23	–39	1.24	–39	1.53	–24	1.75	–13
Diesel particulates	10.40	2.17	–79	2.88	–72	1.83	–82	2.47	–76
Formaldehyde	9.95	6.83	–31	7.04	–29	8.56	–14	10.06	1
Naphthalene	1.23	0.51	–59	0.68	–45	0.53	–57	0.71	–42
POM	1.40	0.58	–59	0.77	–45	0.60	–57	0.81	–42

[a] mobile source air toxics [b] calculated MSATs emissions (tons per year) [c] assumes traffic volumes that would result from connecting the W59 Alternative with the E1 Alternative; a similar assumption applies to the other Western Section alternatives [d] vehicles miles traveled [e] polycyclic organic matter

Table 4-36 Modeled Mobile Source Air Toxics Emissions, Regional Area, Assuming W59 Alternative

MSATs[a] Compound	2010[b]	2020				2035			
		No-Action Alternative[b]	Change from 2010 (%)	Action Alternative[b]	Change from 2010 (%)	No-Action Alternative[b]	Change from 2010 (%)	Action Alternative[b]	Change from 2010 (%)
Daily VMT[c]	27,640,971	32,358,536	17	34,135,774	24	39,875,291	44	41,812,073	51
Acrolein	4.89	3.58	–27	3.52	–28	4.61	–6	4.54	–7
Benzene	219.60	128.80	–41	124.10	–43	168.30	–23	160.30	–27
1,3–butadiene	21.66	14.35	–34	14.04	–35	18.43	–15	17.93	–17
Diesel particulates	123.40	27.73	–78	29.28	–76	24.92	–80	26.23	–79
Formaldehyde	108.20	80.70	–25	79.40	–27	104.90	–3	103.20	–5
Naphthalene	14.59	6.53	–55	6.89	–53	7.21	–51	7.56	–48
POM[d]	16.55	7.45	–55	7.86	–53	8.23	–51	8.63	–48

[a] mobile source air toxics [b] calculated MSATs emissions (tons per year) [c] vehicles miles traveled [d] polycyclic organic matter

Reductions of up to 79 percent in MSATs emissions (DPM) are projected for future years.

For the regional area, constructing the proposed freeway would provide a small net benefit in reducing total MSAT emissions. The model results indicate that the priority MSATs emissions would be reduced by up to 2 percent in the opening and the design years if the freeway were constructed when compared with the No-Action Alternative. Although the W59 Alternative showed 6 percent and 5 percent higher DPM emissions than the No-Action Alternative in the opening and design years, respectively, the 2035 emissions of DPM would be 79 percent lower than 2010 emissions.

MSAT Information Status

What is known about MSATs is still evolving. FHWA is working with stakeholders, EPA, and others to better understand the strengths and weaknesses of developing analysis tools and the applicability on the project-level decision documentation process. Human epidemiology and animal toxicology experiments indicate that many chemicals or mixtures termed air toxics have the potential to affect human health. As toxicology, epidemiology, and air contaminant measurement techniques have improved over the decades, scientists and regulators have increased their focus on the levels of each chemical or material in the air in an effort to link potential exposures with potential health effects. EPA's list of 21 mobile source toxics represents its prioritization of these chemicals or materials for further study and evaluation. EPA's strategy for evaluating air toxic compounds effects is focused on both national trends and local impacts.

Air toxics emissions from mobile sources have the potential to affect human health and often represent a regulatory agency concern. FHWA has responded to this concern by developing an integrated research program to answer the most important transportation community questions related to air toxics, human health, and the NEPA process. To this end, FHWA has performed, funded, or is currently managing several research projects. Many of these projects are based on an Air Toxics Research Workplan that provides a roadmap for agency research efforts (<www.fhwa.dot.gov/environment/air_quality/air_toxics/research_and_analysis/workplan/index.cfm>). These efforts include the studies discussed in the following sections.

National Near Roadway MSAT Study

FHWA, in conjunction with EPA and a consortium of State departments of transportation, studied the concentration and physical behavior of MSATs and mobile source $PM_{2.5}$ in Las Vegas, Nevada and Detroit, Michigan. The study criteria dictated that the study site be open to traffic and have 150,000 annual average daily traffic or more. These studies were intended to provide knowledge about the dispersion of MSAT emissions, with the ultimate goal of enabling more informed transportation and environmental decisions at the project level. These studies are unique in that the monitored data were collected for an entire year. The Las Vegas report revealed there are a large number of influences in this urban setting, and researchers must look beyond the roadway to find all the sources in the near road environment. Additionally, in Las Vegas, meteorology played a large role in the concentrations measured in the near-road study area. More information is available at <www.fhwa.dot.gov/environment/air_quality/air_toxics/research_and_analysis/mobile_source_air_toxics/>.

Traffic-related Air Pollution

Going One Step Beyond: A Neighborhood Scale Air Toxics Assessment in North Denver (The Good Neighbor Project)

In 2007, the Denver Department of Environmental Health issued a technical report entitled *Going One Step Beyond: A Neighborhood Scale Air Toxics Assessment in North Denver (The Good Neighbor Project)*. This research project was funded by FHWA. In this study, the Denver Department of Environmental Health conducted a neighborhood-scale air toxics assessment in North Denver, which includes a portion of the proposed Interstate 70 East project area. Residents in this area have been very concerned about both existing health effects in their neighborhoods (from industrial activities, hazardous waste sites, and traffic) and potential health impacts from changes to Interate 70.

The study was designed to compare modeled levels of the six priority MSATs identified in FHWA's 2006 guidance with measurements at existing MSAT monitoring sites in the study area. MOBILE6.2 emissions factors and the ISC3ST dispersion model were used (some limited testing of the CALPUFF model was also performed). Key findings include: 1) modeled mean annual concentrations from highways

were well below estimated Integrated Risk Information System cancer and noncancerous risk values for all six MSATs, 2) modeled concentrations dropped off sharply within 50 meters of roadways, 3) modeled MSAT concentrations tended to be higher along highways near the Denver Central Business District than along the Interstate 70 East corridor (in some cases, they were higher within the business district itself, as were the monitored values), and 4) dispersion model results were generally lower than monitored concentrations but within a factor of two at all locations.

Mobile Source Air Toxic Hot Spot

Given concerns about the possibility of MSAT exposure in the near-road environment, The HEI dedicated a number of research efforts at trying to find an MSAT "hotspot." In 2011, three studies were published that tested this hypothesis. In general, the authors confirm that while highways are a source of air toxics, they were unable to find that highways were the only source of these pollutants. They determined that near road exposures were often no different or no higher than background or ambient levels of exposure and, hence, no true hot spots were identified. Additional information may be found at <pubs.healtheffects.org/getfile.php?u=659> page 137, <pubs.healtheffects.org/getfile.php?u=656> page 143, and <pubs.healtheffects.org/getfile.php?u=617> page 87, where monitored on-road emissions were higher than emission levels monitored at near-road residences, but the issue of hot spots was not ultimately discussed.

Traffic-Related Air Pollution: A Critical Review of the Literature on Emissions, Exposure, and Health Effects

In January 2010, HEI released Special Report #17, investigating the health effects of traffic-related air pollution. The goal of the research was to synthesize available information on the effects of traffic on health. Researchers looked at linkages between 1) traffic emissions (at the tailpipe) with ambient air pollution in general, 2) concentrations of ambient pollutants with human exposure to pollutants from traffic, 3) exposure to pollutants from traffic with human-health effects and toxicologic data, and 4) toxicologic data with epidemiological associations. Challenges in making exposure assessments, such as quality and quantity of emissions data and models, were investigated, as was the appropriateness of the use of proximity as an exposure-assessment model. Overall, researchers felt that there was "sufficient" evidence for causality for the exacerbation of asthma. Evidence was "suggestive but not sufficient" for other health outcomes such as cardiovascular mortality and others. Study authors also note that past epidemiologic studies may not provide an appropriate assessment of future health associations because vehicle emissions are decreasing over time. The report is available at <http://www.healtheffects.org/>. FHWA provides financial support to HEI's research work.

Health Effects Institute Special Report #16

In November 2007, HEI published Special Report #16: Mobile-Source Air Toxics: A Critical Review of the Literature on Exposure and Health Effects. The purpose of this report was to accomplish the following tasks:

- Use information from the peer-reviewed literature to summarize the health effects of exposure to the 21 MSATs defined by EPA in 2001.
- Critically analyze the literature for a subset of priority MSATs.
- Identify and summarize key gaps in existing research and unresolved questions about the priority MSATs.

HEI chose to review literature for acetaldehyde; acrolein; benzene; 1,3-butadiene; formaldehyde; naphthalene; and POM. Diesel exhaust was included, but not reviewed in this study because it had been reviewed by HEI and EPA recently. In general, the report concluded that the cancer health effects attributable to mobile sources are difficult to discern because the majority of quantitative assessments are derived from occupational cohorts with high concentration exposures and because some cancer potency estimates are derived from animal models. The report suggested that substantial improvements in analytical sensitively and specificity of biomarkers would provide better linkages between exposure and health effects. Noncancer endpoints were not a central focus of most research and, therefore, require further investigation. Subpopulation susceptibility also requires additional evaluation. The study is available from HEI's website at <www.healtheffects.org/>.

Kansas City PM Characterization Study (Kansas City Study)

This study was initiated by EPA to conduct exhaust emissions testing on 480 light-duty, gasoline vehicles in the Kansas City Metropolitan Area. Major goals of the study included characterizing PM emissions distributions of a sample of gasoline vehicles in Kansas City, characterizing gaseous and PM toxics exhaust emissions, and characterizing the fraction of high emitters in the fleet. In the process, sampling methodologies were evaluated. Overall, results from the study were used to populate databases for the MOVES emissions model. FHWA was one of the research sponsors. This study is available on EPA's website at <www.epa.gov/otaq/emission-factors-research/420r08009.pdf>.

Estimating the Transportation Contribution to Particulate Matter Pollution (Air Toxics Supersite Study)

The purpose of this study was to improve understanding of the role of highway transportation sources in PM pollution. In particular, it was important to examine uncertainties, such as the effects of the spatial and temporal distribution of travel patterns, consequences of vehicle fleet mix and fuel type, the contribution of vehicle speed and operating characteristics, and influences of geography and weather. The fundamental methodology of the study was to combine EPA research-grade air quality monitoring data in a representative sample of metropolitan areas with traffic data collected by State departments of transportation and local governments.

Phase I of the study, the planning and data evaluation stage, assessed the characteristics of EPA's ambient PM monitoring initiatives and recruited State departments of transportatoin and local governments to participate in the research. After evaluating and selecting potential

metropolitan areas based on the quality of PM and traffic monitoring data, nine cities were selected to participate in Phase II. The goal of Phase II was to determine whether correlations could be observed between traffic on highway facilities and ambient PM concentrations. The Phase I report was published in September 2002. Phase II included the collection of traffic and air quality data and data analysis. Ultimately, six cities participated: New York City (Queens), Baltimore, Pittsburgh, Atlanta, Detroit and Los Angeles.

In Phase II, air quality and traffic data were collected. The air quality data were obtained from EPA's Aerometric Information Retrieval System Air Quality Subsystem, Supersite personnel, and North American Research Strategy for Tropospheric Ozone and Aerosols data archive site. Traffic data included intelligent transportation systems (roadway surveillance), coverage counts (routine traffic monitoring), and supplemental counts (specifically for the research project). Analyses resulted in the conclusion that only a weak correlation existed between $PM_{2.5}$ concentrations and traffic activity for several of the sites. The existence of general trends indicates a relationship, the assumption that, however, is primarily unquantifiable. Limitations of the study include the assumption that traffic sources are close enough to ambient monitors to provide sufficiently strong source strength, the assumption that vehicle activity is an appropriate surrogate for mobile emissions, and the lack of knowledge of other factors such as nontraffic sources of PM and its precursors. A paper documenting the work of Phase II was presented at the 2004 Emissions Inventory Conference and is available at <www.epa.gov/ttn/chief/conference/ei13/mobile/black.pdf>.

Conformity

The 1990 CAA amendments require transportation projects to conform to (be consistent with) air quality implementation plans. To be a conforming project, a project must be a part of an approved transportation plan (such as the RTP) and transportation improvement program (TIP). The proposed action is contained within the currently approved RTP (2010 Update). MAG's Fiscal Year 2011–2015 TIP contains several references to the South Mountain Freeway project. The 2010 RTP references the proposed action as containing three general purpose lanes and one high-occupancy vehicle (HOV) lane in each direction. Therefore, the proposed action would conform to the approved transportation plan and TIP.

Action Alternatives, Western Section

The CO project-level air quality analysis demonstrated that none of the Western Section action alternatives would violate the NAAQS, based on projected 2035 traffic. Although a meaningful evaluation of O_3 at the project level is not possible, the action alternative is included in the RTP that has been determined by FHWA and the Federal Transit Administration to conform to the SIP.

In the Western Subarea, the projected priority MSAT pollutant emissions for the action alternatives would be comparable to the No-Action Alternative and 24 to 77 percent lower than 2010 levels, depending on the year and pollutant. According to Table 4-34, the W59 (Preferred) Alternative shows the lowest MSATs emissions, followed by the W101 Alternative, with the W71 Alternative showing the highest MSATs emissions.

The proposed action would construct new interchanges at several locations along the Community boundary. As a result, the results of the CO project-level air quality analysis near the proposed interchanges could be applied to the Community. This analysis demonstrated that none of the Western Section action alternatives would violate the CO NAAQS, based on projected 2035 traffic. It is important to note, however, that no residential receptors exist in the Community near the proposed interchanges and few residential receptors exist near the proposed action.

The air quality analysis showed that each of the Western Section action alternatives would conform to all relevant air quality requirements.

Action Alternative, Eastern Section

E1 (Preferred) Alternative

The CO project-level air quality analysis demonstrated that regardless of the Western Section action alternative selected (if any), no receptors in the Eastern Section would violate the NAAQS, based on projected 2035 traffic. Although a meaningful evaluation of O_3 concentrations at the project level is not possible, the action alternative is included in the RTP that has been determined by FHWA and the Federal Transit Administration to conform to the SIP.

Levels of CO near the proposed new fully directional interchanges along the Community boundary are projected to increase; these areas would not, however, violate the NAAQS, based on projected 2035 traffic. It is important to note that no residential receptors currently exist on Community land near the proposed interchanges and few residential receptors exist near the proposed action.

The air quality analysis showed that the E1 Alternative would conform to all relevant air quality requirements.

No-Action Alternative

For the project-level CO analysis, predicted 1-hour and 8-hour concentrations at receptors located at arterial street intersections near I-10 generally exhibited a small decrease from the existing conditions to the action alternatives' scenario (Table 4-32). Those receptors located at the arterial street intersections and freeway interchanges south of I-10 generally exhibited small increases. These projected 1-hour and 8-hour increases associated with the action alternatives were less than 4 ppm and 3 ppm, respectively. None of the action alternatives nor the No-Action Alternative would, however, violate the NAAQS, based on projected 2035 traffic.

MSATs emissions for the entire regional Study Area would decline regardless of whether the proposed action were constructed.

The proposed action is a part of the approved transportation plan and TIP. The No-Action Alternative would not meet the identified regional transportation needs for the proposed action contained within the RTP and TIP; therefore, the No-Action Alternative would not conform to the State's air quality implementation plan.

Mitigation

Construction air quality impacts of the proposed action would be limited to short-term increased fugitive dust and mobile source emissions. Fugitive dust would be generated by haul trucks, concrete trucks, delivery trucks, and other earthmoving vehicles operating around the construction sites. Increased dust levels would be attributable primarily to PM resuspended by vehicle movement over paved and unpaved roads and other surfaces, dirt tracked onto paved surfaces from unpaved areas at access points, and material blown from uncovered haul trucks.

Generally, the distance that particles drift from their source depends on size, height at which the emission occurs, and wind speed. Small particles (30 to 100 micron range) can travel more than 30 feet before settling to the ground, depending on wind speed. Most fugitive dust, however, is made up of relatively large particles (i.e., greater than 100 microns in diameter). These particles are responsible for the reduced visibility often associated with this type of construction. Given their relatively large size, these particles tend to settle within 20–30 feet of their source.

CO is the pollutant of concern when considering localized air quality impacts of motor vehicles. Because CO emissions factors increase with slower vehicle speeds below 35 miles per hour, disruption of traffic during construction could result in short-term elevated concentrations of CO because of the temporary reduction of road capacity and increased queue lengths. To minimize emissions, efforts would be made during the construction phase to limit disruption to traffic, especially during peak travel periods.

To reduce the amount of construction dust generated, particulate control measures related to construction activities must be followed. The following mitigation measures would be followed, when applicable, in accordance with the most recently accepted version of the ADOT *Standard Specifications for Road and Bridge Construction* (2008).

- Site preparation
  - Minimize land disturbance.
  - Use watering trucks to minimize dust.
  - Stabilize the surface of dirt piles if not removed immediately.
  - Use windbreaks to prevent accidental dust pollution.
  - Limit vehicular paths and stabilize temporary roads.
  - To prevent dirt from being tracked or washed onto paved roads, 50-foot-long track-out pads consisting of 12-inch-deep aggregate, 3 to 6 inches in diameter, would be placed over geotextile fabric adjacent to paved roads.
- Construction
  - Use dust suppressants on unpaved traveled paths.
  - Minimize unnecessary vehicular and machinery activities.
  - To prevent dirt from being tracked or washed onto paved roads, 50-foot-long track-out pads consisting of 12-inch-deep aggregate, 3 to 6 inches in diameter, would be placed over geotextile fabric adjacent to paved roads.
- Postconstruction
  - Revegetate or use decomposed granite on all disturbed land (see section, *Mitigation*, beginning on page 4-124, regarding applicable measures to reduce impacts on biological resources).
  - Remove dirt piles and unused materials.
  - Revegetate all vehicular paths created during construction to avoid future off-road vehicular activities.

A traffic control plan would be developed and implemented to help reduce impacts of traffic congestion and associated emissions during construction. Prior to construction and in accordance with Maricopa County Rule 310, Fugitive Dust Ordinance, the contractor shall obtain an approved dust permit from MCAQD for all phases of the proposed action. The permit would describe measures to control and regulate air pollutant emissions during construction.

Greenhouse Gas Emissions (Climate Change)

Climate change is an important national and global concern. While the earth has gone through many natural changes in climate in its history, there is general agreement that the earth's climate is currently changing at an accelerated rate and will continue to do so for the foreseeable future. Anthropogenic (human-caused) greenhouse gas (GHG) emissions contribute to this rapid change. Carbon dioxide (CO_2) makes up the largest component of these GHG emissions. Other prominent transportation-related GHGs include methane and nitrous oxide.

Many GHGs occur naturally. Water vapor is the most abundant GHG and makes up approximately two thirds of the natural greenhouse effect. However, the burning of fossil fuels and other human activities are adding to the concentration of GHGs in the atmosphere. Many GHGs remain in the atmosphere for time periods ranging from decades to centuries. GHGs trap heat in the earth's atmosphere. Because the atmospheric concentration of GHGs continues to climb, our planet will continue to experience climate-related phenomena. For example, warmer global temperatures can cause changes in precipitation and sea levels.

To date, no national standards have been established regarding GHGs, nor has EPA established criteria or thresholds for ambient GHG emissions pursuant to its authority to establish motor vehicle emission standards for CO_2 under the CAA. However, there is a considerable body of scientific literature addressing the sources of GHG emissions and their adverse effects on climate, including reports from the Intergovernmental Panel on Climate Change, the U.S. National Academy of Sciences, EPA, and other federal agencies. GHGs are different than other air pollutants evaluated in federal environmental reviews because their impacts are not localized or regional due to their rapid dispersion into the global atmosphere, which is characteristic of these gases. The *affected environment* for CO_2 and other GHG emissions is the entire planet. In addition, from a quantitative perspective, global climate change is the cumulative result of numerous and varied emissions sources (in terms of both absolute numbers and types), each of which makes a relatively small addition to global atmospheric GHG concentrations. In contrast to broad-scale actions such as those involving an entire industry sector or very large geographic areas, it is difficult to isolate and understand the GHG emissions' impacts for a particular transportation project. Furthermore, presently

there is no scientific methodology for attributing specific climatological changes to a particular transportation project's emissions.

Under NEPA, detailed environmental analysis should focus on issues that are significant and meaningful to decision making [40 C.F.R. §§ 1500.1(b), 1500.2(b), 1500.4(g), and 1501.7]. FHWA has concluded, based on the nature of GHG emissions and the exceedingly small potential GHG impacts of the proposed action (as discussed below and as shown in Table 4-37), that GHG emissions from the proposed action will not result in "reasonably foreseeable significant adverse impacts on the human environment" [40 C.F.R. § 1502.22(b)]. The GHG emissions from the action alternatives would be insignificant and would not play a meaningful role in a determination of the environmentally preferable alternative or identification of the Preferred Alternative. More detailed information on GHG emissions "is not essential to a reasoned choice among reasonable alternatives" [40 C.F.R. § 1502.22(a)] or to making a determination in the best overall public interest based on a balanced consideration of transportation, economic, social, and environmental needs and impacts [23 C.F.R. § 771.105(b)]. For these reasons, no alternatives-level GHG analysis has been performed for this project.

The context in which the emissions from the proposed project would occur, together with the expected GHG emissions contribution from the project, illustrate why the project's GHG emissions would not be significant and would not be a substantial factor in the alternatives screening process. The transportation sector is the second-largest source of total GHG emissions in the United States, behind electricity generation. The transportation sector was responsible for approximately 27 percent of all anthropogenic GHG emissions in the United States in 2009.[24] The majority of transportation-related GHG emissions result from fossil fuel combustion. CO_2 makes up the largest component of these GHG emissions. U.S. CO_2 emissions from the consumption of energy accounted for about 18 percent of worldwide energy consumption CO_2 emissions in 2009.[25] U.S. transportation CO_2 emissions accounted for about 6 percent of worldwide CO_2 emissions.[26]

While the contribution of GHGs from transportation in the United States as a whole is a large component of U.S. GHG emissions, as the scale of analysis is reduced the GHG contributions become quite small. Using CO_2 because of its predominant role in GHG emissions, Table 4-37 presents the relationship between current and projected Arizona highway CO_2 emissions and total global CO_2 emissions, as well as information on the scale of the project relative to statewide travel activity.

Based on emissions estimates from EPA's Motor Vehicle Emissions Simulator model[27] and on global CO_2 estimates and projections from the U.S. Energy Information Administration, CO_2 emissions from motor vehicles in the entire state of Arizona contributed less than one tenth of 1 percent of global emissions in 2010 (0.0986 percent) and are projected to contribute an even smaller fraction (0.0883 percent) in 2035.[28] VMT in the project study area represent slightly less than 20 percent of total Arizona travel activity; the proposed project itself would increase statewide VMT by slightly less than 1 percent. (Note that the project study area, as defined for the MSAT analysis, covers the entire southwestern portion of the Phoenix metropolitan area and, thus, includes travel on many other roadways in addition to the proposed project.) As a result, based on the action alternative with the highest VMT,[29] FHWA estimates that the proposed project could result in a potential increase in global CO_2 emissions in 2035 of 0.00077 percent (less than one thousandth of 1 percent) and a corresponding increase in Arizona's share of global emissions in 2035 of 0.876 percent. This very small change in global emissions is well within the range of uncertainty associated with future emissions estimates.[30,31]

Table 4-37 Statewide and Project Greenhouse Gas Emissions Potential, Relative to Global Totals

Time Frame	Global CO_2[a] Emissions, (million metric tons)[b]	Arizona Motor Vehicle CO_2 Emissions (million metric tons)[c]	Arizona Motor Vehicle Emissions, Percentage of Global Total	Project Study Area VMT[d] Percentage of Statewide VMT	Percentage Change in Statewide VMT Attributable to Project
2010	29,670	29.3	0.0986	19.0	Not applicable
Future Conditions (2035)	42,380	37.4	0.0883	18.6	0.876

Notes: Global emissions estimates are from the U.S. Energy Information Administration's *International Energy Outlook 2010*, data for Figure 104. Arizona emissions and statewide vehicle miles traveled (VMT) estimates are from the U.S. Environmental Protection Agency's Motor Vehicle Emissions Simulator model (2010). Project study area VMT data come from information compiled for the mobile source air toxics analysis documented in the air quality technical report; estimates reflect the action alternative that would result in the highest VMT.

[a] carbon dioxide

[b] Estimates are from the U.S. Energy Information Administration's *International Energy Outlook 2010* and are considered the best available projections of emissions from fossil fuel combustion. These totals do not include other sources of emissions such as cement production, deforestation, or natural sources; reliable future projections for such emissions sources are not available.

[c] The U.S. Environmental Protection Agency's Motor Vehicle Emissions Simulator model projections suggest that Arizona motor vehicle CO_2 emissions may increase by 28 percent between 2010 and 2035. The 2010 Arizona statewide transportation planning framework (www.bqaz.gov/StatewideTransportationPlanningFramework.asp) predicts that statewide vehicle miles travelled (VMT) will increase by 133 percent between 2005 and 2035; the increase in emissions is smaller than the increase in VMT because improved fuel economy in the vehicle fleet (as characterized in the model) would help offset much of the emissions increase that would otherwise occur.

[d] vehicle miles traveled

Mitigation for Global Greenhouse Gas Emissions

To help address the global issue of climate change, USDOT is committed to reducing GHG emissions from vehicles traveling on our nation's highways. USDOT and EPA are working together to reduce these emissions by substantially improving vehicle efficiency and shifting toward lower carbon-intensive fuels. The agencies have

jointly established new, more stringent fuel economy and first-ever GHG emissions standards for model year 2012–2025 cars and light trucks, with an ultimate fuel economy standard of 54.5 miles per gallon for cars and light trucks by model year 2025. Further, on September 15, 2011, the agencies jointly published the first-ever fuel economy and GHG emissions standards for heavy-duty trucks and buses[32]. Increasing use of technological innovations that can improve fuel economy, such as gasoline- and diesel-electric hybrid vehicles, will improve air quality and reduce CO_2 emissions in future years.

Consistent with its view that broad-scale efforts hold the greatest promise for meaningfully addressing the global climate change problem, FHWA is engaged in developing strategies to reduce transportation's contribution to GHGs—particularly CO_2 emissions—and to assess the risks to transportation systems and services from climate change. In an effort to assist States and metropolitan planning organizations in performing GHG analyses, FHWA has developed a *Handbook for Estimating Transportation GHG Emissions for Integration into the Planning Process*. The handbook presents methodologies reflecting good practices for the evaluation of GHG emissions at the transportation program level, and demonstrates how such an evaluation may be integrated into the transportation planning process. FHWA has also developed a tool for use at the statewide level to model a large number of GHG reduction scenarios and alternatives for use in transportation planning, climate action plans, scenario planning exercises, and in meeting state GHG reduction targets and goals. To assist states and metropolitan planning organizations in assessing the climate change vulnerabilities of their transportation networks, FHWA has developed a draft vulnerability and risk assessment conceptual model and has piloted the model in several locations.

Summary of Greenhouse Gas Discussion

This document does not incorporate an analysis of the GHG emissions or climate change effects of each of the action alternatives because the potential change in GHG emissions is very small in the context of the affected environment. Because of the insignificance of the GHG impacts, those impacts will not be meaningful to identification of the Preferred Alternative. As outlined above, FHWA is working to develop strategies to reduce transportation's contribution to GHGs—particularly CO_2 emissions—and to assess the risks to transportation systems and services from climate change. FHWA will continue to pursue these efforts as productive steps to address this important issue. Finally, the construction best practices described above represent practicable project-level measures that, while not substantially reducing global GHG emissions, may help reduce GHG emissions on an incremental basis and could contribute in the long term to meaningful cumulative reduction when considered across the Federal-aid highway program.

CONCLUSIONS

The CO project-level analysis showed that none of the alternatives would result in violation of the NAAQS based on the projected traffic (2035). Furthermore, the Preferred Alternative is included in the RTP that FHWA and the Federal Transit Administration have determined to conform to State air quality plans.

The qualitative analysis of PM conducted for the proposed action was based on a review of monitoring sites that would most closely resemble two interchange locations along the proposed action and the projected characteristics of the two proposed interchanges. Based on this analysis, it is unlikely that the proposed action alternatives would cause or contribute to an exceedance of the PM_{10} standards; therefore, this analysis demonstrates compliance with the requirements of CAA Section 176(a)(1).

Total exposure to MSAT pollutants is a function of exposures near roadways, exposures at other locations visited during the day, exposures incurred as part of traveling on roadways, and exposures from indoor air. Because of this complexity, along with uncertainties associated with the emissions and dispersion models, it is not possible to reasonably characterize the health impacts of the projected action/No-Action emission increases (or decreases) in any particular location. Within these uncertainties, the quantitative analysis performed for the proposed action determined that the action alternatives would likely result in a reduction of total MSATs emissions in the Study Area. Some subareas would likely experience an increase in emissions relative to the No-Action Alternative, while other areas would experience a decrease. In areas where emissions are expected to increase, this would be expected to contribute to increased exposure to MSATs emissions relative to the No-Action Alternative, while the reduced emissions in the Study Area as a whole would be expected to contribute to reduced exposure. Because overall emissions would be lower than 2010 levels, it is reasonable to infer that overall exposures would also be lower than 2010 levels. Because of the limitations in the methodologies of forecasting the health impacts described, any predicted difference in health impacts between alternatives is likely to be much smaller than the uncertainties associated with 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, that are better suited for quantitative analysis.

These limitations notwithstanding, it is important to note that existing and proposed air pollution regulations are predicted to result in dramatic nationwide reductions in MSATs by the design year (2035). The specific analyses conducted for this project also show that emissions will decline, and that reductions on the order of 20 to 83 percent will occur irrespective of whether the proposed action is constructed. Congestion relief as a result of the proposed action would provide localized reductions on arterial streets and at interchanges, and reduced travel times would result in lower exposure to the elevated concentrations of MSATs occurring in traffic. Given the successful history of measurable emissions reductions to date and that projected emissions reductions are based on existing technologies, there is good reason to believe the projected reductions from 2010 levels would be achieved.