

PM_{2.5} AIR QUALITY ANALYSIS

Route 66

Prince William County

**0066-076-113, P101
PPMS 70043
(PPMS 16000)**

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Project Description

The Commonwealth of Virginia plans to add high-occupancy vehicle (HOV) lanes and additional regular lanes on Route 66. This document covers the section from 1.552 kilometers (0.964 miles) west of southbound Route 29 (Gainesville) to 3.716 kilometers (2.309 miles) east of southbound Route 29 in Prince William County, Virginia. The length of this portion is approximately 3.27 miles.

Federal funding is involved requiring compliance with the National Environmental Policy Act (NEPA). Part of the NEPA compliance is to determine the potential operational impacts for any criteria pollutant in a nonattainment or maintenance area from the changes in the roadway and conformity with any State Implementation Plan (SIP). Guidance and requirements on addressing fine particulate matter (PM_{2.5}) were issued in March of 2006.

Alternatives under Consideration

No Build Alternative

The No Build Alternative leaves existing conditions as they are and consists of no action being taken to address traffic conditions.

Build Alternative - Widening Route 66

Under this alternative, the Commonwealth of Virginia would widen Route 66 with the addition of high-occupancy vehicle lanes. The portion under consideration is from 0.964 miles west of Route 29 to 2.309 miles east of Route 29.

Affected Environment

Definition of Resource

Air quality is defined by ambient air concentrations of specific pollutants determined by the U.S. Environmental Protection Agency (EPA) to be of concern with respect to the health and welfare of the general public. The subject pollutants are ozone (O₃), carbon monoxide (CO), nitrogen dioxide (NO₂), sulfur dioxide (SO₂), particulate matter (PM₁₀ and PM_{2.5}), and lead (Pb). EPA established National Ambient Air Quality Standards (NAAQS) for these pollutants (Table 1).

TABLE 1
NATIONAL AMBIENT AIR QUALITY STANDARDS^{1,2}

Pollutant	Averaging Time	Federal	
		Primary	Secondary
Ozone (O ₃) ³	1-hour	0.12 ppm (235 µg/m ³)	0.12 ppm (235 µg/m ³)
	8-hour (new)	0.08 ppm (157 µg/m ³)	0.08 ppm (157 µg/m ³)
Coarse Particulate Matter (PM ₁₀)	24-hour	150 µg/m ³	150 µg/m ³
	Annual AM	50 µg/m ³	50 µg/m ³
	Annual GM	–	–
Fine Particulate Matter (PM _{2.5})	24-hour (new)	65 µg/m ³	65 µg/m ³
	Annual AM (new)	15 µg/m ³	15 µg/m ³
Carbon Monoxide (CO)	1-hour	35 ppm (40 mg/m ³)	–
	8-hour	9 ppm (10 mg/m ³)	–
Nitrogen Dioxide (NO ₂)	1-hour	–	–
	Annual AM	0.053 ppm (100 mg/m ³)	0.053 ppm (100 mg/m ³)
Lead (Pb)	30-day	–	–
	Calendar Quarter	1.5 µg/m ³	1.5 µg/m ³
Sulfur Dioxide (SO ₂)	1-hour	–	–
	3-hour	–	0.5 ppm (1,300 µg/m ³)
	24-hour	0.14 ppm (365 µg/m ³)	–
	Annual AM	0.03 ppm (80 µg/m ³)	–

TABLE 1
NATIONAL AMBIENT AIR QUALITY STANDARDS^{1,2}

Pollutant	Averaging Time	Federal	
		Primary	Secondary
AM – Annual Mean GM – Geometric Mean ppm – parts per million mg/m ³ – milligrams per cubic meter µg/m ³ – micrograms per cubic meter ¹ National standards (other than O ₃ , PM ₁₀ , and those based on annual periods) are not to be exceeded more than once per year. The new ozone standard is based on a 3-year average of the fourth highest 8-hour concentration in each year. For PM, the 24-hour standard is based on 99 percent (PM ₁₀) or 98 percent (PM _{2.5}) of the daily concentrations, averaged over 3 years. ² Equivalent units given in parenthesis are based upon reference conditions of 25 degrees Celsius (°C) and 760 millimeters (mm) mercury. ³ Environmental Protection Agency (EPA)-promulgated new federal 8-hour O ₃ and PM _{2.5} standards on July 18, 1997. The federal 1-hour O ₃ standard continues to apply in areas that remain in violation of that standard.			

Air quality in a given location is described as the concentration of various pollutants in the atmosphere. Air quality is determined by the type and amount of pollutants emitted into the atmosphere, the size and topography of the air basin, and the prevailing meteorological conditions. Air quality standards in Virginia are enforced by the Federal Clean Air Act (CAA) (1970), which established maximum pollutant levels and requires the preparation of a State Implementation Plan (SIP) to outline enforcement and attainment strategies.

Prince William County currently does not meet air quality standards for fine particulate matter (PM_{2.5}). The proposed construction is within the nonattainment area. A nonattainment area has more stringent controls than an area that is classified to be in attainment of the NAAQS.

Existing Conditions

The following discussion of existing conditions applies to the proposed project area as a whole.

Meteorology/Climate

Prince William County is located in the northern part of Virginia, where the temperature ranges from an average daily minimum of 27 degrees Fahrenheit (°F) in January to an average daily maximum of 88 °F in July. The annual precipitation is approximately 42 inches per year.

Ambient Air Quality

Air quality at a given location is a function of several factors, including the amounts and types of pollutants being emitted, both locally and regionally, and the dispersion rates of pollutants within the region. The major factors affecting pollutant dispersion are wind speed and direction, atmospheric stability, temperature, the presence or absence of inversions, and the topographic and geographic features of the region.

Construction Emissions

Emissions from construction are considered to be short-term. Construction emissions include emissions from heavy equipment, fugitive dust, and emissions from construction vehicles traveling to and from the site. An evaluation of the construction impacts must be done in order to determine if mitigation measures should be undertaken on the project but the construction impacts are not included for determination of significance.

Regulatory Standards/Criteria

Section 176(c) of the Clean Air Act

The CAA, under Section 176(c), provides a framework for ensuring that transportation projects conform to the appropriate state or federal implementation plan for achieving the NAAQS. Before any agency or department of the federal government engages in, supports in any way, provides financial assistance for, licenses, permits, or approves any activity, that agency has an affirmative responsibility to ensure that such actions conform to the applicable implementation plan. Conformity to an air quality implementation plan is defined in the CAA, as amended in 1990, as meaning conformity with the plan's purpose in eliminating or reducing the severity and number of violations of the NAAQS and achieving expeditious attainment of these standards. Federal actions must not cause or contribute to any new violation of any standard, increase the frequency or severity of any existing violation, or delay timely attainment of any standard or required interim milestone. If the proposed action does not conform to the SIP, it cannot be approved or allowed to proceed.

Transportation Conformity Rule

The Environmental Protection Agency promulgated the Transportation Conformity Rule concerning the applicability, procedures, and criteria that transportation agencies must use in analyzing and determining conformity of transportation projects. The Transportation Conformity Rule applies to federal-funded transportation projects in areas that violate one or more of the NAAQS (nonattainment areas). The Transportation Conformity Rule sets forth the requirements for determining conformity, which include applicability of the rule and the methodology to be used to perform the analysis, including air dispersion modeling, if necessary.

Current State Implementation Plan

In 1979, EPA required each state to prepare a SIP, which describes how the state will achieve compliance with the NAAQS. A SIP is a compilation of goals, strategies, schedules, and enforcement actions that will lead the state into compliance with all federal air quality standards. Every change in compliance schedule or plan must be incorporated into the SIP. The CAA Amendments of 1990 established new deadlines for achievement of the NAAQS depending on the severity of nonattainment.

Environmental Impacts

Health Effects of Air Pollutants

Air pollutants are recognized to have a variety of health effects on humans. Research by the EPA shows that exposure to high concentrations of air pollutants can trigger respiratory diseases, such as asthma, bronchitis and other respiratory ailments and cardiovascular diseases. A healthy person exposed to high concentrations of air pollutants may become nauseated or dizzy, may develop a headache or cough, or may experience eye irritation and/or a burning sensation in the chest. Inhaled PM, NO₂, and SO₂ can directly irritate the respiratory tract, constrict airways, and interfere with the mucous lining of the airways. When air pollutant levels are high, children, elderly, and people with respiratory problems are advised to remain indoors. Outdoor exercise also is discouraged because strenuous activity may cause shortness of breath and chest pains.

Air Quality Impacts and Mitigation Measures

The PM_{2.5} air quality analyses presented in this section addresses potential local and regional effects from vehicular travel that can be expected as a result of the proposed project.

Long-term impacts are related to emissions produced by traffic volumes affected by the proposed project. Long-term impacts are anticipated to be permanent impacts that are directly associated with the proposed action.

Fine Particulate Matter (PM_{2.5})

On March 10, 2006, EPA published a final rule that establishes the transportation conformity criteria and procedures for determining which transportation projects must be analyzed for local air quality impacts in Particulate Matter (PM_{2.5} and PM₁₀) nonattainment and maintenance areas (71 FR 12468). These rule amendments require the assessment of localized air quality impacts of federally-funded or approved transportation projects in PM_{2.5} or PM₁₀ nonattainment and maintenance areas deemed to be *projects of air quality concern*¹. Prince William County falls within the PM_{2.5} nonattainment area, and this assessment of localized impacts (i.e., “hotspot analysis”) examines potential air quality impacts on a scale smaller than the entire nonattainment or maintenance area.

¹ Criteria for identifying *projects of air quality concern* is described in 40 CRF 93.123(b)(1), as amended.

Qualitative hotspot analysis is required for projects of air quality concern until such time as EPA releases its future quantitative modeling guidance and announces that quantitative PM_{2.5} hotspot analyses are required under 40 CFR 93.123.(b)(4). In the interim, EPA and FHWA have issued joint guidance for conducting qualitative hotspot analyses². EPA requires hotspot findings to be based on directly emitted PM_{2.5}, since secondary particles take several hours to form in the atmosphere, giving emissions time to disperse beyond the immediate area of concern.

Particulate matter (PM) is the term for particles and liquid droplets suspended in the air. Motor vehicles emit direct PM from their tailpipes, as well as from normal brake and tire wear. In addition, vehicles cause dust from paved and unpaved roads to be re-entrained, or re-suspended, in the atmosphere. Also, highway and transit projects construction may cause dust. Finally, gases in vehicle exhaust may react in the atmosphere to form PM.

Particles come in a wide variety of sizes and have been historically assessed based on size, typically measured by the diameter of the particle in micrometers. PM_{2.5}, or fine particulate matter, refers to particles that are 2.5 micrometers in diameter or less. The annual standard is based on a 3-year average of annual PM_{2.5} concentrations; the 24-hour standard is based on a 3-year average of the 98th percentile of the 24-hour concentrations. The NAAQS for fine particulate matter can be found in Table 1.

The Conformity Rule requires PM_{2.5} hotspot analyses to include road dust emissions only if such emissions have been found significant by EPA or the state air agency prior to the PM_{2.5} SIP or as part of an adequate PM_{2.5} SIP motor vehicle emissions budget (40 CFR 93.102(b)(3)). Emissions resulting from construction of the project are not required to be considered in the hotspot analysis if such emissions are considered temporary according to 40 CFR 92.123(c)(5).

Section 176(c) of the Clean Air Act and the federal conformity rule require that transportation plans and programs conform to the intent of the state air quality SIP through a regional emissions analysis in PM_{2.5} nonattainment areas. The National Capital Region 2005 Constrained Long Range Transportation Plan (CLRP) and the 2006-2011 Metropolitan Transportation Improvement Program (TIP) have been determined to conform to the intent of the SIP. The U.S. Department of Transportation made a PM_{2.5} conformity determination on the CLRP and the MTIP on February 21, 2006, and thus there is a currently conforming CLRP and TIP in accordance with 40 CFR 93.114. The current conformity determination is consistent with the final conformity rule found in 40 CFR Parts 51 and 93.

For the portion of the Route 66 widening project under consideration (the interchange with Route 29), one segment has a projected annual average daily traffic (AADT) in the design year that exceeds the threshold established in the final rule and the facility carries a significant number of diesel vehicles. Therefore, a qualitative hotspot analysis was conducted in order to assess whether the project would cause or contribute to any new localized PM_{2.5} violations, or increase the frequency or severity of any existing violations, or delay attainment of the PM_{2.5} NAAQS.

² *Transportation Conformity Guidance for Qualitative Hotspot Analysis in PM_{2.5} and PM₁₀ Nonattainment and Maintenance Areas*. EPA420-B-06-902. March 29, 2006.

According to the guidance issued for assessing impacts on PM_{2.5} emissions from the project, in the absence of a nearby monitor, other appropriate monitors in the nonattainment or maintenance area can also be used. There are currently four air quality monitors in the PM_{2.5} nonattainment area that are in counties adjacent to Prince William County. Table 2 provides a summary of the 2005 air quality monitoring data.

TABLE 2
2005 MONITORS IN FAIRFAX AND LOUDON COUNTIES
 (NEIGHBORING COUNTIES TO PRINCE WILLIAM COUNTY WITHIN THE NONATTAINMENT AREA)

Site ID	Location	County	Number of Observations (24-hour)	98 th Percentile (24-hour)	Annual Mean (24-hour)
510590030	Lee Park, Telegraph Road (Sta. 46-B9)	Fairfax Co.	314	35	13.4
510591005	6507 Columbia Pike	Fairfax Co.	110	35	14.3
510595001	Lewinsville 1437 Balls Hill Rd	Fairfax Co.	95	36	14.7
511071005	38-I, Broad Run High School, Ashburn	Loudoun Co.	104	38	14.5

Source: US EPA, Office of Air Quality Planning and Standards, Information Transfer and Program Integration Information Transfer Group. AirData (<http://www.epa.gov/air/data/monvals.html>).

As indicated in Table 2, the annual mean for each of these monitoring sites is currently below the NAAQS for PM_{2.5} (annual and 24-hour) and no violations have been recorded. These same trends are being experienced by the region as a whole. A recent report published by the Metropolitan Washington Council of Governments (MWWCOG) demonstrates a downward trend in annual average PM_{2.5} design values between 1999 and 2004 for the Metropolitan Washington, DC region.³ The meteorology at these sites as well as along the entire project area can be generally characterized as variable. Light winds generally tend to disperse PM_{2.5} emissions at these sites. In addition, temperature, humidity, and rainfall do not seem to influence the level of PM_{2.5} at the sites.

Average daily traffic (ADT) volumes on Route 66 vary among segments. In 2005, the daily volume estimates range from 57,000 vehicles (Route 15 to Route 29) to 87,000 vehicles (Route 29 - Route 234) and the projected estimates for the design year (2028) range from 100,000 vehicles to 175,000, with eight percent of the daily average being heavy-duty diesel trucks.

In terms of environment, the study area contains a mixture of residential, commercial, industrial and agricultural land uses, including a retirement and golf course community (Heritage Hunt Adult Community) and the Conway-Robinson Memorial State Forest around the interchange under consideration.

For future scenarios, PM_{2.5} annual emissions associated directly to on-road mobile sources are expected to decrease by 56% in 2010 from a 2002 baseline according to a

³ *Air Quality Trends: Metropolitan Washington Region 1993 – 2004*. Metropolitan Washington Council of Governments, 2005.

recent report by the Regional Transportation Planning Board⁴. Emissions estimates using EPA's approved emissions estimation tool, MOBILE6.2, show that PM_{2.5} emissions rates from vehicles will drop by almost 50% between 2010 and 2030. In the MWCOG PM_{2.5} conformity assessment, regional emissions of direct PM_{2.5} from on-road mobile sources are shown to continue to decline through 2020.

Furthermore, according to EPA, the 2007 heavy-duty engine standards will result in the introduction of new, highly effective control technologies for heavy-duty engines. Particulate matter emission levels are expected to be 90% lower on a per vehicle basis than 2000 standard levels due to the 2007 diesel engine and fuel program.⁵

In summary, based on the analysis, it is determined that the Route 66 widening project will not cause or contribute to a new violation of the PM_{2.5} NAAQS, or increase the frequency or severity of a violation for the following reasons:

- Air quality information supplied by the air quality monitors within the nonattainment area located nearest to the project area did not record any current violations for 2005 and all were well below the annual and 24-hour PM_{2.5} standards. These monitors are located in areas where the ADT on adjacent roadways is comparable to the ADT that can be expected on Route 66.
- PM_{2.5} emissions are expected to be reduced in the project area, as demonstrated by projected reductions in the regional emissions analysis conducted by the MWCOG, as well as by national projections by EPA reflecting impacts of national emissions control programs, such as the 2007 Heavy-duty Diesel Rule.
- Any increase in emissions due to traffic changes associated with the project, will be offset by decrease in emissions from the transportation facility due to decreasing on-road vehicle emission trends, as well as decreasing background concentrations. This conclusion is supported by scientific journal articles about the air quality impact of similar projects.

Conclusion

The qualitative PM_{2.5} analysis demonstrated that the proposed project of widening Route 66 at the interchange with Route 29 (portion of the widening from Route 29 to Route 234) would not cause or contribute to a violation of the air quality standards outlined in the NAAQS.

⁴ *Fine Particles (PM_{2.5}) Standards Air Quality Assessment*. National Capital Regional Transportation Planning Board, Metropolitan Washington Council of Governments. December 21, 2005.

⁵ Heavy-duty Engine and Vehicle Standards and Highway Diesel Fuel Sulfur Control Requirements – Final Rule. ("2007 Heavy Duty Highway Final Rule"). Signed December 21, 2000.