3.4 Air Quality

3.4.1 CHANGES TO THIS CHAPTER SINCE THE DEIS

Since the Draft Environmental Impact Statement (DEIS), this chapter has been revised to update Table 3.4-3 to reflect the current pollutants being monitored by local monitoring sites and to include the impacts from the Refined Recommended Preferred Alternative (RPA).

3.4.2 HOW ARE AIR QUALITY STANDARDS REGULATED?

The U.S. EPA has established the NAAQS for atmospheric pollutants that are considered harmful to public health and the environment in accordance with the Clean Air Act of 1970, amended (CAA). The CAA section 176(c) requires that federal transportation projects be consistent with state air quality goals found in the State Implementation Plan (SIP) which was developed by South Carolina Department of Health and Environmental Control (SCDHEC). The process to ensure this consistency is called Transportation Conformity and means that transportation activities will not cause new violations of the NAAQS, worsen existing violations of the standard, or delay timely attainment of the standard. Atmospheric pollutants which are considered by the NAAQS include carbon monoxide (CO), lead (Pb), nitrogen dioxide (NO_2), ozone (O_3), particulate matter (PM_{10} and $PM_{2.5}$) and sulfur dioxide (SO_2). The EPA also regulates mobile source air toxics (MSATs). Due to their association with roadway transportation sources, CO, O_3, $PM_{2.5}$, and MSATs are typically reviewed for potential effects on nearby receptors with respect to roadway projects. The SCDHEC's Bureau of Air Quality is responsible for regulating and ensuring compliance with the CAA in South Carolina.

Transportation Conformity ensures that proposed projects will not cause new violations to National Ambient Air Quality Standards or worsen existing violations.

Section 107 of the CAA requires the EPA to publish a list of all geographic areas in compliance with the NAAQS as well as those not in compliance. This designation is made on a pollutant-by-pollutant basis for a particular geographic area. The EPA's current designations and scale of an area are found in Table 3.4-1.

Table 3.4-1 Attainment Classifications and Definitions

Attainment	Unclassified	Maintenance	Nonattainment
Area is in compliance with the NAAQS.	Area has insufficient data to make determination and is treated as being in attainment.	Area once classified as nonattainment but has since demonstrated attainment of the NAAQS.	Area is not in compliance with the NAAQS.

NAAQS have been previously established by the EPA and can be found in Table 3.4-2. The sources of these pollutants, effects on human health and the nation's welfare, and occurrence in the atmosphere are documented and vary considerably. The Columbia, South Carolina area is considered in attainment based on air quality monitoring data collected in the region.[1] Because the region is in attainment with the NAAQS, Transportation Conformity does not apply to the proposed action.

The project study area is in attainment with the National Ambient Air Quality Standards.

Table 3.4-2 National Ambient Air Quality Standards

Pollutant	Primary standards		Secondary standards	
	Level	Averaging time	Level	Averaging time
Carbon monoxide	9 ppm ($10\ mg/m^3$)	8-hour	None	
	35 ppm ($40\ mg/m^3$)	1-hour		
Lead	$0.15\ \mu g/m^3$	Rolling 3-month average	Same as primary	
Nitrogen dioxide	0.053 ppm ($100\ \mu g/m^3$)	Annual (arithmetic mean)	Same as primary	
	0.100 ppm	1-hour	0.053 ppm ($100\ \mu g/m^3$)	Annual (arithmetic mean)
Particulate matter (PM_{10})	$150\ \mu g/m^3$	24-hour	Same as Primary	
Particulate matter ($PM_{2.5}$)	$12.0\ \mu g/m^3$	Annual (arithmetic mean)	$15.0\ \mu g/m^3$	Same as primary
	$35\ \mu g/m^3$	24-hour	Same as primary	
Ozone	0.070 ppm (2015 std)	8-hour	Same as primary	
Sulfur dioxide	0.075 ppm	99th percentile of 1-hour daily maximum concentrations, averaged over 3 years	0.5 ppm ($1300\ \mu g/m^3$)	Not to be exceeded more than once per year

Source: USEPA, 2015.

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

Monitoring stations near the project study area for the proposed project are listed in Table 3.4-3.

[1] http://www.scdhec.gov/HomeAndEnvironment/Air/MostCommonPollutants/NonAttainmentAreas/

Table 3.4-3 Air Quality Monitoring Stations near Project Study Area

Site ID	Site name	City	County	Pollutant(s)
450630008	IRMO	Seven Oaks	Lexington	$PM_{2.5}$ and SO_2
450630010	Cayce City Hall	Cayce	Lexington	PM_{10}
450790007	Parklane	Dentsville (Dents)	Richland	PM_{10}, $PM_{2.5}$, CO, SO_2, and ozone

Source: One EPA Workplace GeoPlatform. 2017 & 2019.

3.4.3 WHAT ABOUT MSATS?

3.4.3.1 Background

Controlling air toxic emissions became a national priority with the passage of the Clean Air Act Amendments (CAAA) of 1990, whereby Congress mandated that the U.S. Environmental Protection Agency (EPA) regulate 188 air toxics, also known as hazardous air pollutants. The EPA assessed this expansive list in its rule on the Control of Hazardous Air Pollutants from Mobile Sources (Federal Register, Vol. 72, No. 37, page 8430, February 26, 2007), and identified a group of 93 compounds emitted from mobile sources that are part of EPA's Integrated Risk Information System (IRIS) In addition, EPA identified nine compounds with significant contributions from mobile sources that are among the national and regional-scale cancer risk drivers or contributors and non-cancer hazard contributors from the 2011 National Air Toxics Assessment (NATA). These are *1,3-butadiene, acetaldehyde, acrolein, benzene, diesel particulate matter (diesel PM), ethylbenzene, formaldehyde, naphthalene, and polycyclic organic matter.* While FHWA considers these the priority mobile source air toxics, the list is subject to change and may be adjusted in consideration of future EPA rules.

3.4.3.2 Motor Vehicle Emissions Simulator (MOVES)

According to EPA, MOVES2014 is a major revision to MOVES2010 and improves upon it in many respects. MOVES2014 includes new data, new emissions standards, and new functional improvements and features. It incorporates substantial new data for emissions, fleet, and activity developed since the release of MOVES2010. These new emissions data are for light- and heavy-duty vehicles, exhaust and evaporative emissions, and fuel effects. MOVES2014 also adds updated vehicle sales, population, age distribution, and vehicle miles travelled (VMT) data. MOVES2014 incorporates the effects of three new Federal emissions standard rules not included in MOVES2010. These new standards are all expected to impact MSAT emissions and include Tier 3 emissions and fuel standards starting in 2017 (79 FR 60344), heavy-duty greenhouse gas regulations that phase in during model years 2014-2018 (79 FR 60344), and the second phase of light duty greenhouse gas regulations that phase in during model years 2017-2025 (79 FR 60344). Since the release of MOVES2014, EPA has released MOVES2014a. In the November 2015 MOVES2014a Questions and Answers Guide, EPA states that for on-road emissions, MOVES2014a adds new options requested by users for the input of local VMT, includes minor updates to the default fuel tables, and corrects an error in MOVES2014 brake wear emissions. The change in brake wear emissions results in small decreases in PM emissions, while emissions for other criteria pollutants remain essentially the same as MOVES2014.

Using EPA's MOVES2014a model, as shown in Figure 3.4-1, FHWA estimates that even if VMT increases by 45 percent from 2010 to 2050 as forecast, a combined reduction of 91 percent in the total annual emissions for the priority MSAT is projected for the same time period.

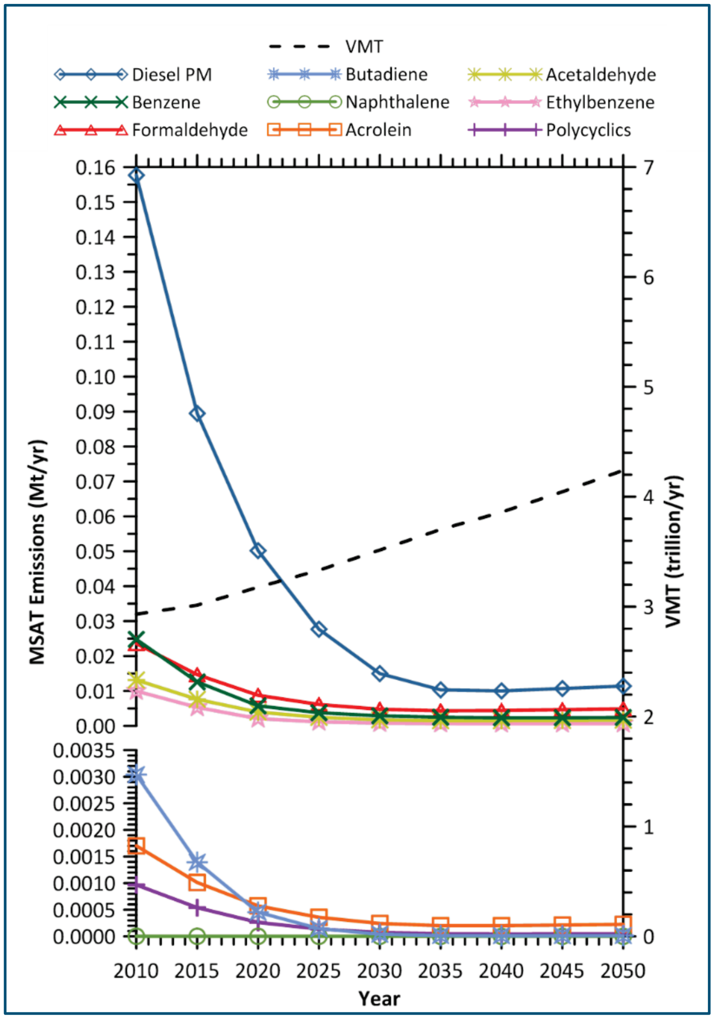

Figure 3.4-1 FHWA projected national MSAT emission trends 2010 – 2050 for vehicles operating on roadways using EPA's MOVES2014a Model

3.4.3.3 MSAT Research

Air toxics analysis is a continuing area of research. While much work has been done to assess the overall health risk of air toxics, many questions remain unanswered. In particular, the tools and techniques for assessing project-specific health outcomes as a result of lifetime MSAT exposure remain limited. These limitations impede the ability to evaluate how potential public health risks posed by MSAT exposure should be factored into project-level decision-making within the context of NEPA.

Nonetheless, air toxics concerns continue to arise on highway projects during the NEPA process. Even as the science emerges, the public and other agencies expect FHWA to address MSAT impacts in its environmental documents. The FHWA, EPA, the Health Effects Institute, and others have funded and conducted research studies to try to more clearly define potential risks from MSAT emissions associated with highway projects. The FHWA will continue to monitor the developing research in this field.

3.4.3.4 NEPA Context

The NEPA requires, to the fullest extent possible, that the policies, regulations, and laws of the Federal Government be interpreted and administered in accordance with its environmental protection goals, and that Federal agencies use an interdisciplinary approach in planning and decision-making for any action that adversely impacts the environment (42 U.S.C. 4332). In addition to evaluating the potential environmental effects, FHWA must also take into account the need for safe and efficient transportation in reaching a decision that is in the best overall public interest (23 U.S.C. 109(h)). The FHWA policies and procedures for implementing NEPA are contained in regulation at 23 CFR Part 771.

On October 18, 2016, the Federal Highway Administration (FHWA) issued an interim guidance update regarding analyzing MSAT in National Environmental Policy Act (NEPA) documents for highway projects. Depending on the specific project circumstances, FHWA has identified three levels of analysis:

1. No analysis for project with no potential for meaningful MSAT effects.
2. Qualitative analysis for projects with low potential MSAT effects.
3. Quantitative analysis to differentiate alternatives for projects with higher potential MSAT effects.

Because the Carolina Crossroads project would result in changes in traffic volumes and potentially vehicle mix, it would have the potential for MSAT effects and therefore does not fall within the first analysis category. Most highway projects, including minor widening and new interchanges, among others, where design year traffic is expected to be less than 140,000 to 150,000 annual average daily traffic (AADT) fall into the "projects with low potential MSAT effects" category. The maximum AADT on the entire corridor is below 140,000 in the base year (2014). In the design year of 2040, with a projected 0.7 percent annual growth rate, each segment of the corridor continues to fall below 141,000 AADT. It was determined in coordination with FHWA that a qualitative analysis is the appropriate level of review. A qualitative analysis provides a basis for identifying and comparing the potential differences among MSAT emissions, if any, from the various alternatives. The qualitative assessment presented below is derived in part from a study conducted by FHWA entitled *A Methodology for Evaluating Mobile Source Air Toxic Emissions Among Transportation Project Alternatives.*

For both the RPA and the Refined RPA, the amount of mobile source air toxics (MSAT) emitted would be proportional to the vehicle miles traveled, or VMT. The VMT estimated for the RPA and the Refined RPA is slightly higher than that for the No-build alternative, because the additional capacity would increase the efficiency of the roadway and attract rerouted trips from elsewhere in the transportation network. Refer to Table 3.4-4. This increase in VMT would lead to higher MSAT emissions for the RPA and the Refined RPA along the highway corridor, along with a corresponding decrease in MSAT emissions along the parallel routes. The emissions increase is offset somewhat by lower MSAT emission rates due to increased speeds; according to the Environmental Protection Agency's (EPA) MOVES2014 model, emissions of all of the priority MSATs decrease as speed increases. Emissions will likely be lower than present levels in the design year as a result of the EPA's national control programs that are projected to reduce annual MSAT emissions by over 90 percent from 2010 to 2050 (Updated Interim Guidance on Mobile Source Air Toxic Analysis in NEPA Documents, Federal Highway Administration, October 12, 2016). Local conditions may differ from these national projections in terms of fleet mix and turnover, VMT growth rates, and local control measures. However, the magnitude of the EPA-projected reductions is so great (even after accounting for VMT growth) that MSAT emissions in the project study area are likely to be lower in the future in virtually all cases.

Under the RPA or the Refined RPA there may be localized areas where VMT would increase, and other areas where VMT would decrease. Therefore, it is possible that localized increases and decreases in MSAT emissions would occur. The localized increases in MSAT emissions would likely be most pronounced along the new roadway sections that would be built from the Broad River to Broad River Road (Exit 65) on I-20 Westbound, under the RPA or the Refined RPA. However, even if these increases did occur, they too would be substantially reduced in the future due to implementation of EPA's vehicle and fuel regulations.

In summary, under the RPA or the Refined RPA in the design year, it is expected there would be reduced MSAT emissions in the immediate area of the project, relative to the No Build Alternative, due to the reduced VMT associated with more direct routing, and due to EPA's MSAT reduction programs.

Table 3.4-4 Vehicle Miles Traveled for the Alternatives

	No-build	RPA	Refined RPA
Annual VMT – 2040	2,132,263	2,251,265	2,216,679
Variance to No-build	-	+4.7%	+4.0%

Source: Economic Analysis Memo, 2018

Regardless of the alternative chosen, emissions would likely be lower than present levels in the design year as a result of EPA's national control programs that are projected to reduce annual MSAT emissions by over 90 percent between 2010 and 2050. Local conditions may differ from these national projections in terms of fleet mix and turnover, VMT growth rates, and local control measures. However, the magnitude of the EPA-projected reductions is so great (even after accounting for VMT growth) that MSAT emissions in the project study area are likely to be lower in the future in nearly all cases.

The additional travel lanes contemplated as part of the RPA and the Refined RPA would have the effect of moving some traffic closer to nearby homes, schools, and businesses; therefore, under either alternative there may be localized areas where ambient concentrations of MSAT could be higher than the No-build alternative. The localized increases in MSAT concentrations would likely be most pronounced along the expanded roadway sections that would be built along I-26, under the RPA or the Refined RPA. However, the magnitude and the duration of these potential increases compared to the No-build alternative cannot be reliably quantified due to incomplete or unavailable information in forecasting project-specific MSAT health impacts. In sum, when a highway is widened, the localized level of MSAT emissions for the build alternative could be higher relative to the No-build alternative, but this could be offset due to increases in speeds and reductions in congestion (which are associated with lower MSAT emissions). Also, MSATs would be lower in other locations when traffic shifts away from them. However, on a regional basis, EPA's vehicle and fuel regulations, coupled with fleet turnover, will over time cause substantial reductions that, in almost all cases, will cause region-wide MSAT levels to be significantly lower than today.

3.4.3.5 Incomplete or Unavailable Information for Project-Specific MSAT Health Impacts Analysis

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

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

Other organizations are also active in the research and analyses of the human health effects of MSAT, including the Health Effects Institute (HEI). A number of HEI studies are summarized in Appendix D of FHWA's Updated Interim Guidance on Mobile Source Air Toxic Analysis in NEPA Documents. Among the adverse health effects linked to MSAT compounds at high exposures are: cancer in humans in occupational settings; cancer in animals; and irritation to the respiratory tract, including the exacerbation of asthma. Less obvious is the adverse human health effects of MSAT compounds at current environmental concentrations (HEI Special Report 16,https://www.healtheffects.org/publication/mobile-source-air-toxics-critical-review-literature-exposure-and-health-effects) or in the future as vehicle emissions substantially decrease.

The methodologies for forecasting health impacts include emissions modeling; dispersion modeling; exposure modeling; and then final determination of health impacts – each step in the process building on the model predictions obtained in the previous step. All are encumbered by technical shortcomings or uncertain science that prevents a more complete differentiation of the MSAT health impacts among a set of project alternatives. These difficulties are magnified for lifetime (i.e., 70 year) assessments, particularly because unsupportable assumptions would have to be made regarding changes in travel patterns and vehicle technology (which affects emissions rates) over that time frame, since such information is unavailable.

It is particularly difficult to reliably forecast 70-year lifetime MSAT concentrations and exposure near roadways; to determine the portion of time that people are actually exposed at a specific location; and to establish the extent attributable to a proposed action, especially given that some of the information needed is unavailable.

There are considerable uncertainties associated with the existing estimates of toxicity of the various MSAT, because of factors such as low-dose extrapolation and translation of occupational exposure data to the general population, a concern expressed by HEI (Special Report 16, https://www.healtheffects.org/publication/mobile-source-air-toxics-critical-review-literature-exposure-and-health-effects). As a result, there is no national consensus on air dose-response values assumed to protect the public health and welfare for MSAT compounds, and in particular for diesel PM. The EPA states that with respect to diesel engine exhaust, "[t]he absence of adequate data to develop a sufficiently confident dose-response relationship from the epidemiologic studies has prevented the estimation of inhalation carcinogenic risk (EPA IRIS database, Diesel Engine Exhaust, Section II.C.https://cfpub.epa.gov/ncea/iris/iris_documents/documents/subst/0642.htm#quainhal)."

There is also the lack of a national consensus on an acceptable level of risk. The current context is the process used by the EPA as provided by the Clean Air Act to determine whether more stringent controls are required in order to provide an ample margin of safety to protect public health or to prevent an adverse environmental effect for industrial sources subject to the maximum achievable control technology standards, such as benzene emissions from refineries. The decision framework is a two-step process. The first step requires EPA to determine an "acceptable" level of risk due to emissions from a source, which is generally no greater than approximately 100 in a million. Additional factors are considered in the second step, the goal of which is to maximize the number of people with risks less than 1 in a million due to emissions from a source. The results of this statutory two-step process do not guarantee that cancer risks from exposure to air toxics are less than 1 in a million; in some cases, the residual risk determination could result in maximum individual cancer risks that are as high as approximately 100 in a million. In a June 2008 decision, the U.S. Court of Appeals for the District of Columbia Circuit upheld EPA's approach to addressing risk in its two step decision framework. Information is incomplete or unavailable to establish that even the largest of highway projects would result in levels of risk greater than deemed acceptable.[2]

Differences in health impacts between alternatives are difficult to predict because of limited methodologies for forecasting health impacts. Due to the uncertainty of predicting health impacts, the results of such assessments would not be useful to decision makers, who would need to weigh these uncertainties against quantitative analyses used to predict project benefits such as reducing traffic congestion, accident rates, and fatalities plus improved access for emergency response. Weighing the uncertain health impact predictions against quantitative analyses would not be a beneficial comparison.

[2] https://www.cadc.uscourts.gov/internet/opinions.nsf/284E23FFE079CD59852578000050C9DA/$file/07-1053-1120274.pdf

3.4.4 HOW WOULD THE NO-BUILD ALTERNATIVE IMPACT AIR QUALITY?

The no-build alternative would result in a continual upward trend of pollutants proportional to the amount of traffic congestion and vehicular idling. As population and industry increases throughout the state, and the need to connect to the coastal ports, it is expected that these numbers will increase. Vehicles which spend more time in the corridor due to traffic congestion and slower speeds will contribute more to the amount of pollution released, to the detriment of local air quality. It is possible that there will be some offset due to the increased use of alternative powered vehicles, however this is not possible to currently model. The no-build alternative is not anticipated to put the region into nonattainment or maintenance for any of the NAAQS.

3.4.5 HOW WOULD THE RPA AND THE REFINED RPA IMPACT AIR QUALITY?

The project could result in increased exposure to MSAT emissions in certain locations, but neither the RPA nor the Refined RPA would have an appreciable impact on regional MSAT levels. Regardless of the alternative chosen, emissions would likely be lower than present levels in the design year as a result of EPA's national control programs that are projected to reduce annual MSAT emissions by over 90 percent between 2010 and 2050. Local conditions may differ from these national projections in terms of fleet mix and turnover, VMT growth rates, and local control measures. However, the magnitude of the EPA-projected reductions is so great (even after accounting for VMT growth) that MSAT emissions in the project study area are likely to be lower in the future in nearly all cases. Neither the RPA nor the Refined RPA is anticipated to put the region into nonattainment or maintenance for any of the NAAQS

Construction-related effects to Air Quality are discussed in Section 3.13..

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