TECHNICAL EVALUATION: MOBILE SOURCE AIR TOXICS

Background

The purpose of this document is to provide an assessment of mobile source air toxic (MSAT) emissions associated with the Northwest Corridor project in the Atlanta, Georgia metropolitan area.

There are no National Ambient Air Quality Standards (NAAQS) established for air toxics, as there are for the criteria pollutants (carbon monoxide, ozone, particulate matter, etc.) Controlling air toxic emissions became a national priority with the passage of the Clean Air Act Amendments 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 has assessed this expansive list in their latest 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 listed in their Integrated Risk Information System (IRIS) (http://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 their 1999 National Air Toxics Assessment (NATA) (http://www.epa.gov/ttn/atw/nata1999/). These are acrolein, benzene, 1,3-butadiene, diesel particulate matter plus diesel exhaust organic gases (diesel PM), formaldehyde, naphthalene, and polycyclic organic matter. While FHWA considers these the priority mobile source air toxics, the list is subject to change and may be adjusted in consideration of future EPA rules. The 2007 EPA rule requires controls that will substantially decrease MSAT emissions through cleaner fuels and cleaner engines (http://www.epa.gov/otaq/regs/toxics/420f07017.pdf).

Based on an FHWA analysis using EPA's MOVES2010b model, as shown in Figure 1, even if vehicle-miles travelled (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 MSAT is projected for the same time period.

Analysis of MSAT in NEPA Documents

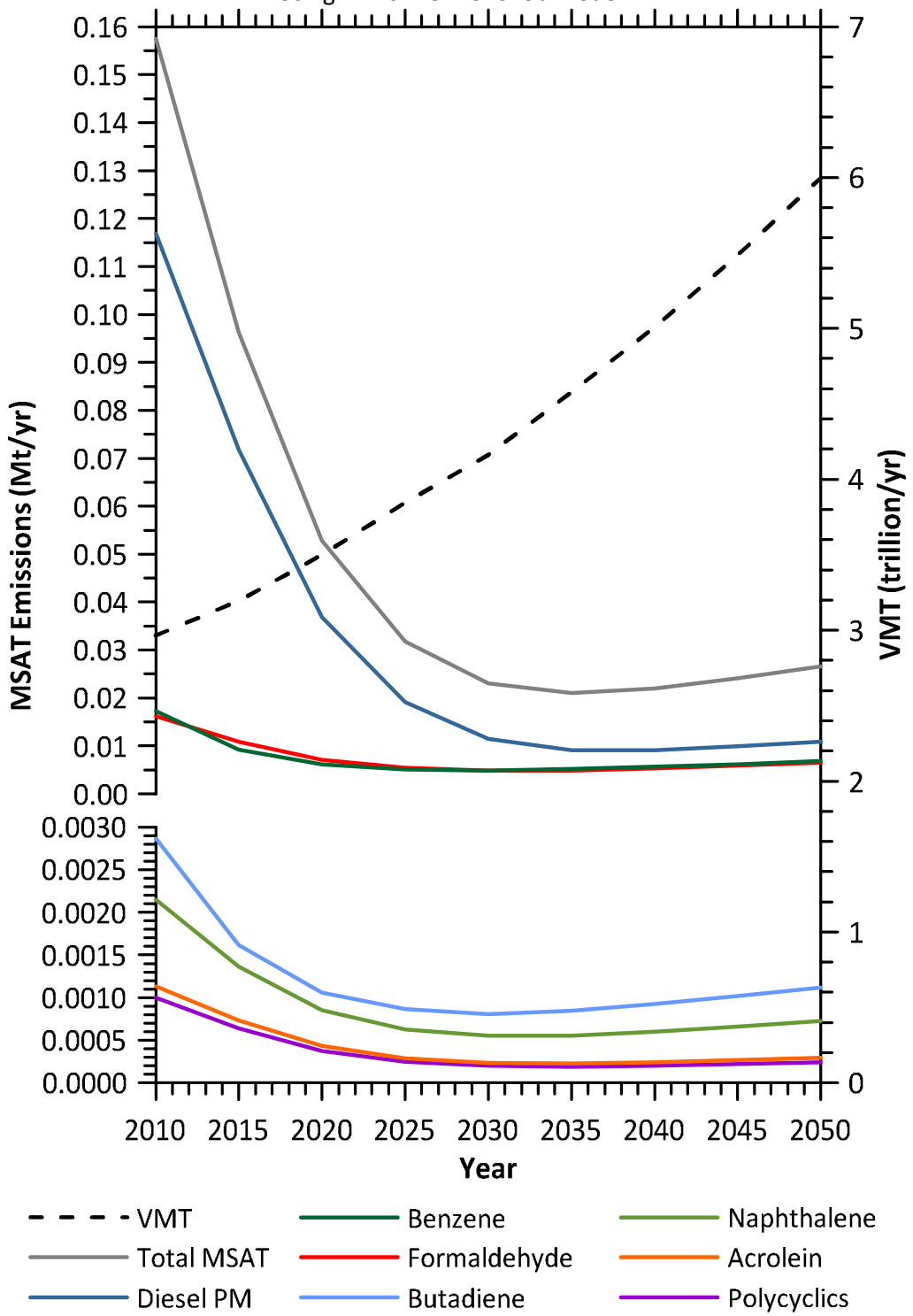
FHWA issued guidance in 2006 for analysis of MSAT from highway projects, and updated this guidance in 2012 (Interim Guidance Update on Mobile Source Air Toxic Analysis in NEPA, http://www.fhwa.dot.gov/environment/air_quality/air_toxics/policy_and_guidance/aqintguidmem.cfm). FHWA has developed a tiered approach with three categories for analyzing MSAT in NEPA documents, depending on specific project circumstances:

1) No analysis for projects with no potential for meaningful MSAT effects;

2) Qualitative analysis for projects with low potential MSAT effects; or

3) Quantitative analysis to differentiate alternatives for projects with higher potential MSAT effects.

Figure 1. National MSAT Emission Trends 2010 – 2050 for Vehicles Operating on Roadways Using EPA's MOVES2010b Model.



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

Source: EPA MOVES2010b model runs conducted during May – June 2012 by FHWA.

The types of projects included in the first category are:

- Projects qualifying as a categorical exclusion under 23 CFR 771.117(c) (subject to consideration whether unusual circumstances exist under 23 CFR 771.117(b));

- Projects exempt under the Clean Air Act conformity rule under 40 CFR 93.126; or

- Other projects with no meaningful impacts on traffic volumes or vehicle mix.

The second category of projects includes those that serve to improve operations of highway, transit, or freight without adding substantial new capacity or without creating a facility that is likely to meaningfully increase MSAT emissions. This category covers a broad range of projects. Most highway projects that need an MSAT assessment fall into this category. Examples of these types of projects are minor widening projects; new interchanges; replacing a signalized intersection on a surface street; or projects where design year traffic is projected to be less than 140,000 to 150,000 annual average daily traffic (AADT).

The third category includes projects that have the potential for meaningful differences in MSAT emissions among project alternatives. To fall into this category, a project should:

- Create or significantly alter a major intermodal freight facility that has the potential to concentrate high levels of diesel particulate matter in a single location, involving a significant number of diesel vehicles for new projects, or accommodating with a significant increase in the number of diesel vehicles for expansion projects; or

- Create new or add significant capacity to urban highways such as interstates, urban arterials, or urban collector-distributor routes with traffic volumes where the AADT is projected to be in the range of 140,000 to 150,000[1] or greater by the design year;

  And also

- Proposed to be located in proximity to populated areas.

The Northwest Corridor project falls into the third category of projects because of the traffic volumes and location proximity to populated areas associated with the project. The projected design year (2035) traffic volumes near the south end of the project of 301,800 vehicles per day (I-75 south of Delk Road) exceed the 140,000 to 150,000 AADT threshold in FHWA's guidance. As a result, a quantitative MSAT emissions analysis was completed for the project.

[1] Using EPA's MOVES2010b emissions model, FHWA staff determined that this range of AADT would result in emissions significantly lower than the Clean Air Act definition of a major hazardous air pollutant (HAP) source, i.e. 25 tons/yr for all HAPs or 10 tons/yr for any single HAP. Variation in conditions such as congestion or vehicle mix could warrant a different range for AADT.

Project-specific MSAT Emissions

When conducting MSAT emissions analysis, FHWA generally estimates emissions in multiple calendar years. First, FHWA estimates emissions for a base year (in this case, 2010). This provides reviewers with an estimate of emissions that the population affected by the project is currently experiencing. Next estimates of emissions in the future project first year of operation and design year (2018 and 2035, respectively, in this case), both with and without the project, are made. This comparison between existing conditions, future build, and future no-build conditions enables reviewers to see the overall trend in emissions over time, and to understand how much difference the project makes in overall emissions levels.

The emissions analysis begins with the identification of an affected transportation network – those segments of the Atlanta metropolitan network where travel activity and emissions are expected to be affected by the proposed project in a meaningful way. The purpose is to capture the anticipated changes in MSAT emissions as a direct result of a proposed project, providing a framework for an objective quantitative assessment, minimizing uncertainty and bias. The metrics considered in determining meaningful changes in travel activity and emissions include:

- ± 5% or more in average daily traffic (ADT) on congested highway links of level of service (LOS) D or worse;
- ± 10% or more in AADT on uncongested highway links of LOS C or better;
- ± 10% or more in travel time; and
- ± 10% or more in intersection delay.

Figure 2 shows the transportation network affected by the proposed project based on information provided in the Northwest Corridor Traffic Technical Report 2013 Addendum. FHWA used a total of five transportation network scenarios: a 2010 baseline network**;** a 2018 network without the project**;** a 2018 network with the project completed**;** a 2035 network without the project**;** and a 2035 network with the project in place.

Once the necessary travel data were compiled, FHWA used EPA's MOVES2010b model to estimate emissions for each network. MOVES2010b is an emissions model created by EPA and used in all states (except for California) for regulatory analysis of motor vehicle emissions, including MSAT. The MOVES2010b inputs used in this MSAT analysis are consistent with those used by the Atlanta Regional Commission (ARC) regional conformity analysis of fine particulate matter. The Georgia Department of Transportation (GDOT) and the ARC provided the traffic data and local MOVES2010b inputs used in this analysis (refer to Table 1).

The results of the MSAT emissions analysis are presented in Figure 3. A discussion of the emission levels associated with each project scenario follows.

Figure 2. NWC Project Affected Transportation Network.

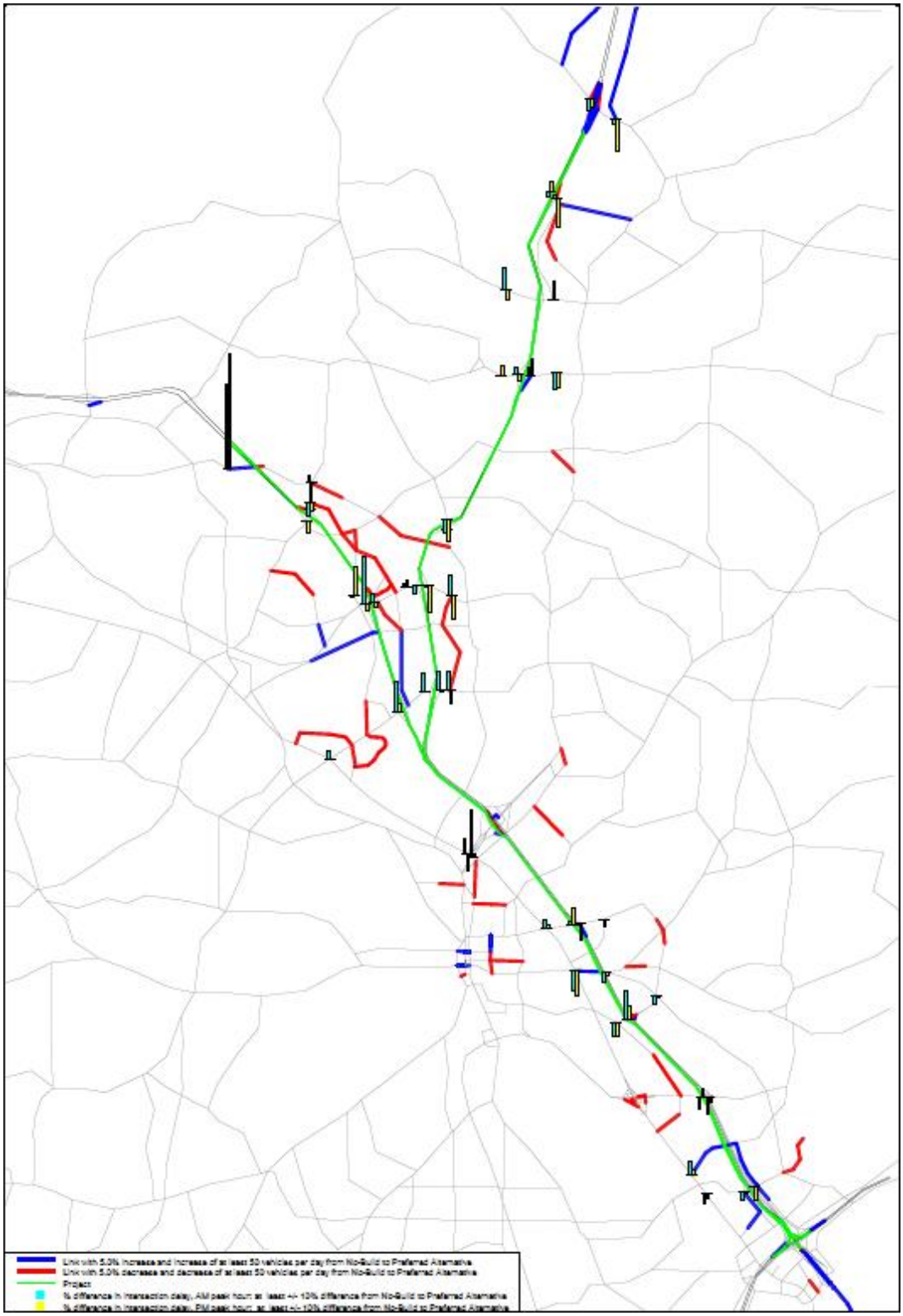
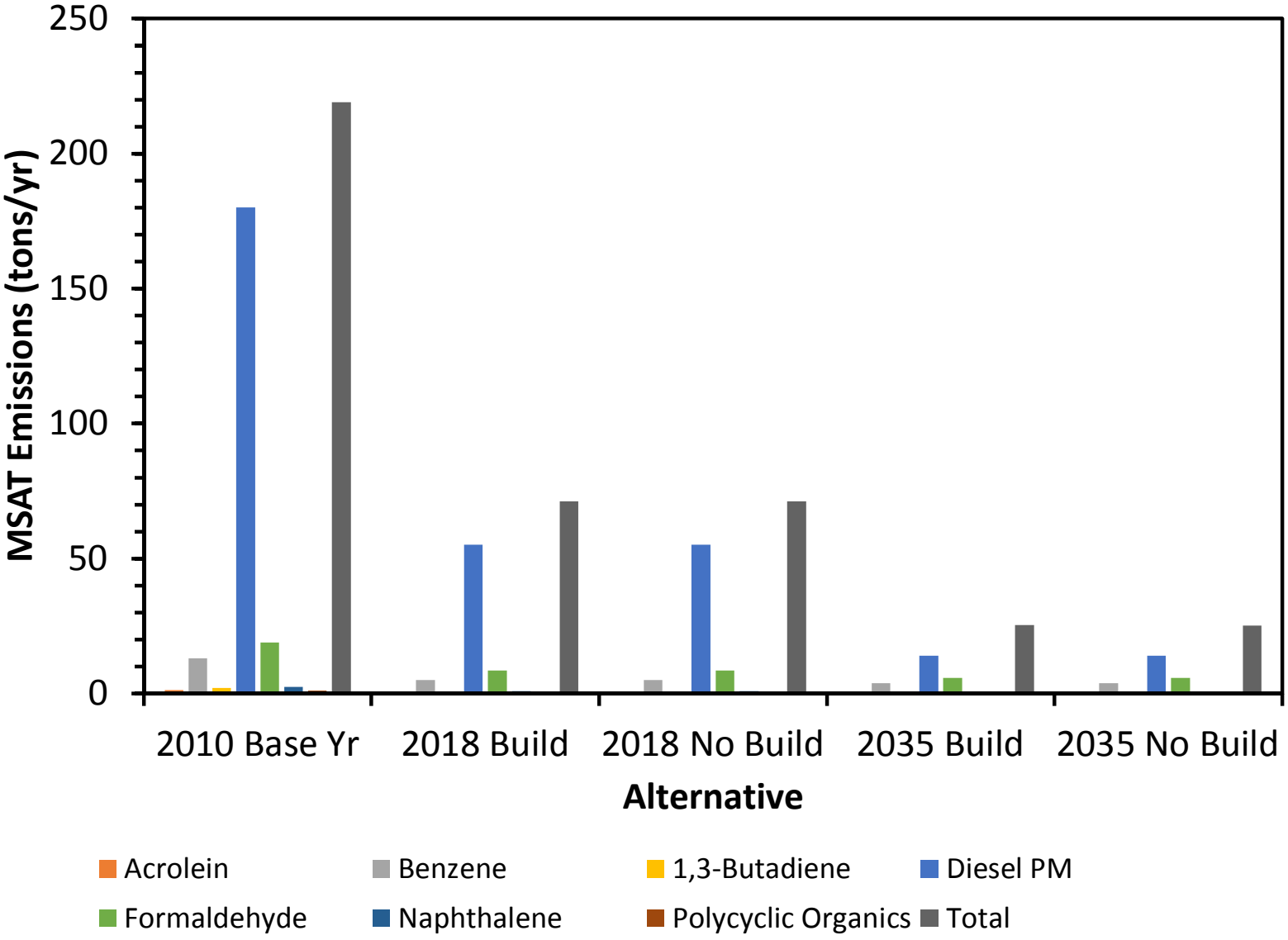


Table 1. MOVES County Data Manager Data Tables for MSAT Analysis.

Data Table	Alternative by County				
	Bartow / Cherokee / Cobb / Fulton				
	2010	2018		2035	
	No Build	Build	No Build	Build	No Build
Age Distribution	ARC	ARC	ARC	ARC	ARC
Average Speed Distribution	GDOT	GDOT	GDOT	GDOT	GDOT
Fueltype and Technologies	Default	Default	Default	Default	Default
Fuel Supply[a]	ARC	ARC	ARC	ARC	ARC
Fuel Formulation[a]	ARC	ARC	ARC	ARC	ARC
Meteorology Data	ARC	ARC	ARC	ARC	ARC
Ramp Fraction[b]	GDOT	GDOT	GDOT	GDOT	GDOT
Road Type Distribution	GDOT	GDOT	GDOT	GDOT	GDOT
Source Type Population	ARC	ARC	ARC	ARC	ARC
HPMS Vehicle Type Year[c]	GDOT	GDOT	GDOT	GDOT	GDOT
Month VMT Fraction[c]	ARC	ARC	ARC	ARC	ARC
Day VMT Fraction[c]	ARC	ARC	ARC	ARC	ARC
Hour VMT Fraction[c]	ARC	ARC	ARC	ARC	ARC
I/M Programs	ARC	ARC	ARC	ARC	ARC

[a]Fuel tab
[b]Ramp Fraction = 0 %; ramp activity is accounted for in the traffic data provided by GDOT
[c]Vehicle Type VMT tab
ARC – Data table provided by ARC
GDOT – Data table developed from traffic provided by GDOT
Default – MOVES default

Figure 3. Project-specific MSAT Emission Trends.



Total MSAT emissions from the transportation network affected by the project are estimated to decline by almost 90% between the 2010 and 2035 (refer to Table 2 and Figure 4). Especially large reductions are seen for diesel particulate matter, which is classified as a probable human carcinogen by EPA, and benzene, which is a known carcinogen. These reductions are primarily due to EPA's motor vehicle and fuel control programs. The Build Alternative has total MSAT emissions that are indistinguishable from the No-Build Alternative for the analysis years 2018 (first year of operation) and 2035 (design year).

Table 1. MSAT Emissions for Each Project Alternative (tons/yr).

MSAT Compound	2010 Base Year	2018 No Build	2018 Build	2035 No Build	2035 Build
Acrolein	1.4	0.55	0.55	0.27	0.27
Benzene	13	5.0	5.0	3.9	3.9
1,3-Butadiene	2.1	0.77	0.77	0.52	0.53
Diesel PM	180	55	55	14	14
Formaldehyde	19	8.6	8.6	5.8	5.9
Naphthalene	2.4	0.95	0.95	0.56	0.57
Polycyclic Organics	1.2	0.41	0.41	0.13	0.13
Total	220	71	71	25	25

Uncertainties Associated with the MSAT Analysis

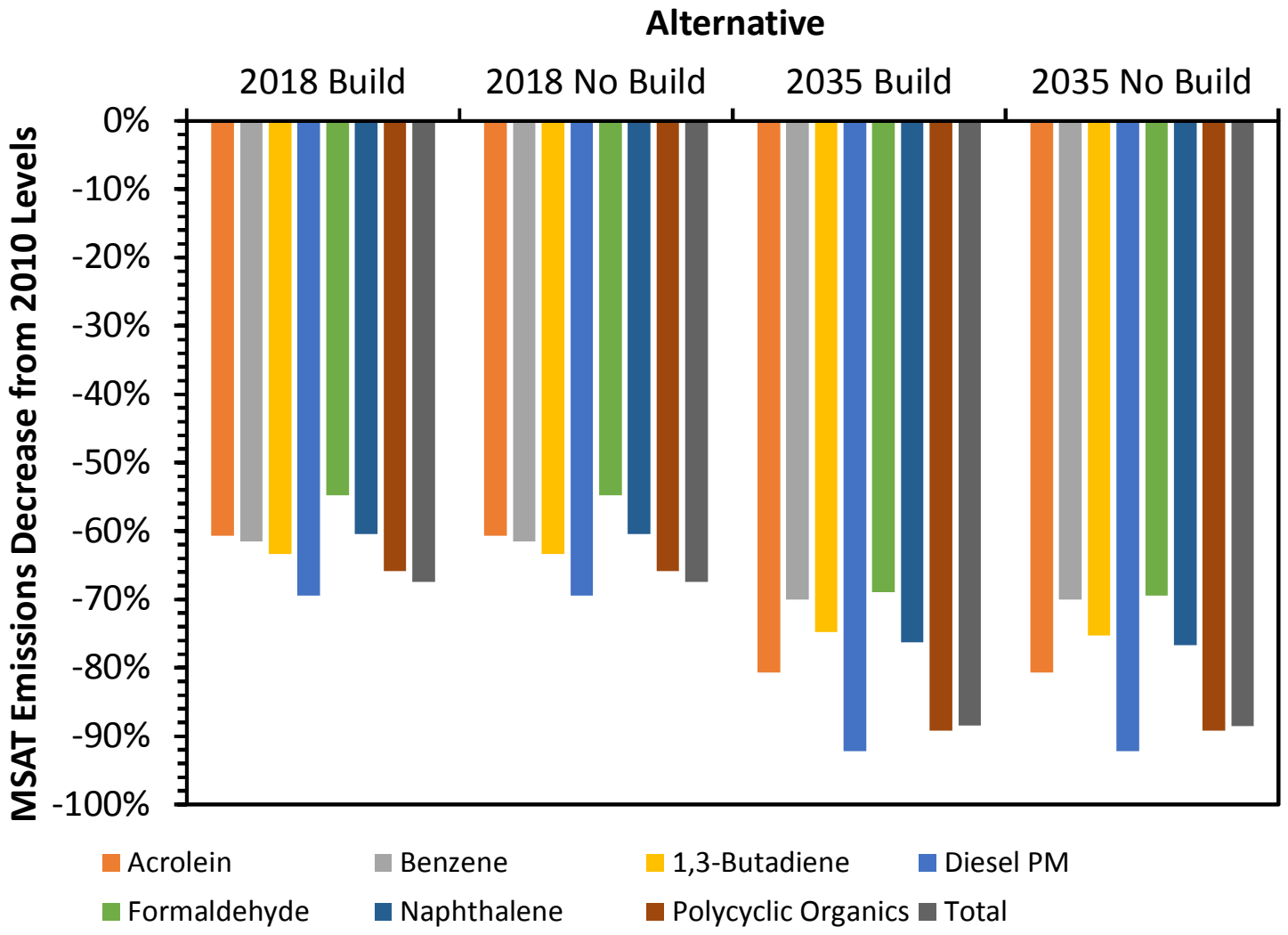
The emission estimates presented in this analysis are accurate to the extent that the input data and tools used to develop them are accurate. The results of the analysis predict a considerable decrease in MSAT emissions over time and little discernable difference between building and not building the Northwest Corridor project. In addition, it is difficult to determine the potential health impacts attributable to the MSAT compounds at current and projected emission levels, much less any differences in emission levels among project alternatives. While there have been studies attempting to find a causation between MSAT emissions and health effects, there is no study that shows correlations to specific MSAT compounds at current environmental concentrations. According to the Health Effects Institute in their special report of mobile source air toxics (http://pubs.healtheffects.org/view.php?id=282), "(b)ecause exposures to MSATs occur as part of complex mixtures (which can also include non-MSAT compounds), it is especially difficult to deconvolute the contributions of any given compound to human health risks". Accordingly, when the science is incomplete or unavailable, 40 CFR 1502.22 provides instruction.

CEQ Provisions Covering Incomplete or Unavailable Information (40 CFR 1502.22)

Sec. 1502.22 INCOMPETE OR UNAVAILABLE INFORMATION

When an agency is evaluating reasonably foreseeable significant adverse effects on the human environment in an environmental impact statement and there is incomplete or unavailable information, the agency shall always make clear that such information is lacking.

Figure 4. Project-specific MSAT Emission Reduction Trends.



a) *If the incomplete information relevant to reasonably foreseeable significant adverse impacts is essential to a reasoned choice among alternatives and the overall costs of obtaining it are not exorbitant, the agency shall include the information in the environmental impact statement.*

b) *If the information relevant to reasonably foreseeable significant adverse impacts cannot be obtained because the overall costs of obtaining it are exorbitant or the means to obtain it are not known, the agency shall include within the environmental impact statement:*

    1. *a statement that such information is incomplete or unavailable;*
    2. *a statement of the relevance of the incomplete or unavailable information to evaluating reasonably foreseeable significant adverse impacts on the human environment;*
    3. *a summary of existing credible scientific evidence which is relevant to evaluating the reasonably foreseeable significant adverse impacts on the human environment; and*
    4. *the agency's evaluation of such impacts based upon theoretical approaches or research methods generally accepted in the scientific community. For the purposes of this section, "reasonably foreseeable" includes impacts that have catastrophic consequences, even if their probability of occurrence is low, provided that the analysis of the impacts is supported by credible scientific evidence, is not based on pure conjecture, and is within the rule of reason.*

c) *The amended regulation will be applicable to all environmental impact statements for which a Notice to Intent (40 CFR 1508.22) is published in the Federal Register on or after May 27, 1986. For environmental impact statements in progress, agencies may choose to comply with the requirements of either the original or amended regulation.*

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 U.S. EPA is responsible for protecting the public health and welfare from any known or anticipated effect of an air pollutant. They are the lead authority for administering the Clean Air Act and its amendments and have specific statutory obligations with respect to hazardous air pollutants and MSAT. The EPA is in the continual process of assessing human health effects, exposures, and risks posed by air pollutants. They maintain the Integrated Risk Information System (IRIS), which is "a compilation of electronic reports on specific substances found in the environment and their potential to cause human health effects" (EPA, http://www.epa.gov/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). Two HEI studies are summarized in Appendix D of FHWA's Interim Guidance Update on Mobile source Air Toxic Analysis in NEPA Documents. Among the adverse health effects linked to MSAT compounds at high exposures are; cancer in humans in occupational settings; cancer in animals; and irritation to the respiratory tract, including the exacerbation of asthma. Less obvious is the adverse human health effects of MSAT compounds at current environmental concentrations (HEI, http://pubs.healtheffects.org/view.php?id=282) or in the future as vehicle emissions substantially decrease (HEI, http://pubs.healtheffects.org/view.php?id=306).

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

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 (http://pubs.healtheffects.org/view.php?id=282). As a result, there is no national consensus on air dose-response values assumed to protect the public health and welfare for MSAT compounds, and in particular for diesel PM. The EPA (http://www.epa.gov/risk/basicinformation.htm#g) and the HEI (http://pubs.healtheffects.org/getfile.php?u=395) have not established a basis for quantitative risk assessment of diesel PM in ambient settings.

There is also the lack of a national consensus on an acceptable level of risk. The current context is the process used by the EPA as provided by the Clean Air Act to determine whether more stringent controls are required in order to provide an ample margin of safety to protect public health or to prevent an adverse environmental effect for industrial sources subject to the maximum achievable control technology standards, such as benzene emissions from refineries. The decision framework is a two-step process. The first step requires EPA to determine 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.

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

Conclusion

FHWA conducted an MSAT emissions analysis for the Northwest Corridor project, following the procedures outlined in its 2012 MSAT guidance. The analysis concludes that reductions in MSAT emissions will occur for the transportation network affected by the project regardless of whether the project is constructed. Differences in emissions between the Build and No-Build alternatives are indistinguishable. Compared to 2010 levels, emissions are reduced by almost 90% for either the Build or No Build alternatives. As discussed, uncertainties in available information and tools preclude FHWA from being able to estimate the potential health impacts attributable to the MSAT compounds at current and projected emission levels, much less any differences in emission levels among project alternatives.