APPENDIX D: MOBILE SOURCE AIR TOXICS TECHNICAL REPORT

Introduction

The purpose of the proposed project is to improve operational efficiency and reduce delays at the US 281 and Loop 1604 interchange by constructing direct connectors between the two roadways. The proposed US 281 at Loop 1604 Interchange project is located in Bexar County, an area that has recently been classified as non-attainment under the Federal 8-hour ozone National Ambient Air Quality Standards (NAAQS). However, the effective date of this designation has been deferred. Due to the proactive efforts of the San Antonio area in implementing Early Action Compact (EAC) measures, transportation conformity would not apply in the area.

The proposed action is included in and consistent with financially constrained San Antonio Bexar County Metropolitan Transportation Plan (MTP) – *Mobility 2030* and the 2008-2011 Transportation Improvement Program (TIP). The predicted 2035 traffic volumes and direct connector movements for each individual direct connector are shown in **Table 1**.

Table 1: 2035 Direct Connector Traffic Volumes

DIRECT CONNECTOR MOVEMENT DIRECTION	TRAFFIC VOLUME (ADT)
Northbound US 281 to Westbound Loop 1604	44,300
Eastbound Loop 1604 to Southbound US 281	36,800
Westbound Loop 1604 to Southbound US 281	36,300
Northbound US 281 to Eastbound Loop 1604	35,100

Source: 2006 URS Traffic Study

Because none of the direct connectors would have an ADT exceeding 140,000, a quantitative analysis of MSAT is not required.

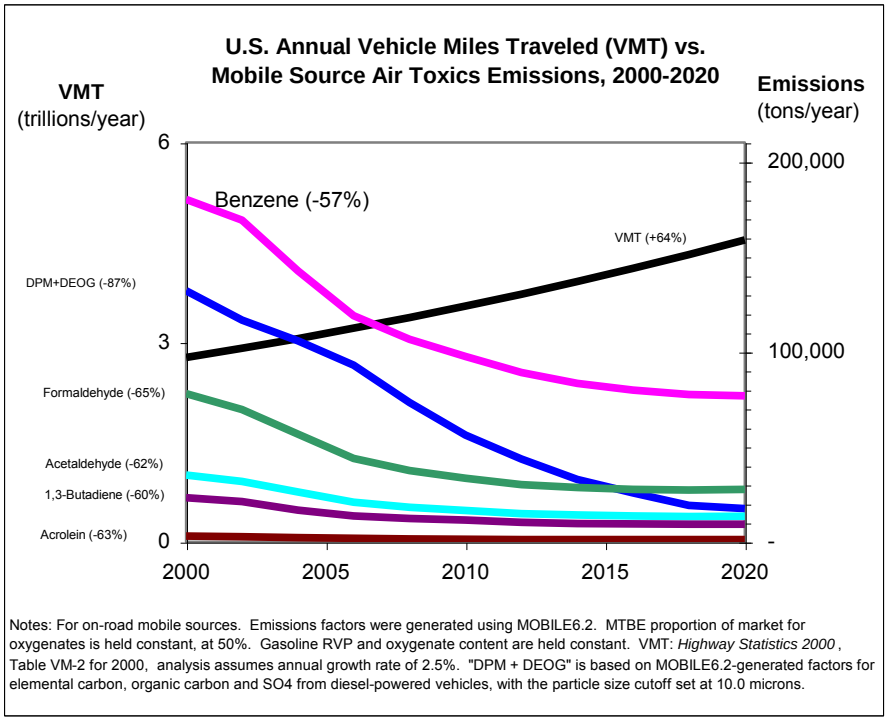
Mobile Source Air Toxics

In addition to the criteria air pollutants for which there are NAAQS, the U.S. Environmental Protection Agency (EPA) also regulates other air pollutants termed air toxics. One hundred and eighty-eight air toxics are defined by the Clean Air Act (CAA). Most originate from human-made sources, including on-road mobile sources, non-road mobile sources (e.g., airplanes), area sources (e.g., dry cleaners) and stationary sources (e.g., factories or refineries).

Mobile Source Air Toxics (MSATs) are a subset of air toxics; specifically, those emitted from highway vehicles and non-road equipment. Some MSATs are present in fuel and are emitted when the fuel evaporates or passes through the engine unburned. Other

MSATs are emitted from the incomplete combustion of fuels or as secondary combustion products. Metal MSATs also result from engine wear or from impurities in oil or gasoline.

The EPA is the lead Federal Agency for administering the CAA and has certain responsibilities regarding the health effects of MSATs. The EPA issued a Final Rule regarding MSATs in 2001[1]. This rule examined the impacts of the EPA's existing and newly promulgated MSAT control programs, including its reformulated gasoline program, its national low emission vehicle standards, its Tier 2 motor vehicle emissions standards and gasoline sulfur control requirements, and its proposed heavy duty engine and vehicle standards and on-highway diesel fuel sulfur control requirements. FHWA projects that even with a 64 percent projected increase in vehicle miles of travel (VMT) between 2000 and 2020, these programs will reduce on-highway emissions of benzene, formaldehyde, 1,3-butadiene, and acetaldehyde by 57 percent to 65 percent, and will reduce on-highway diesel particulate matter (PM) emissions by 87 percent, as depicted in the following graph:



Source: U.S. Environmental Protection Agency, 2001, as cited by FHWA

[1] Environmental Protection Agency. *Controlling Emissions of Hazardous Air Pollutants from Mobile Sources.* (66 FR 17229). March 29, 2001 Available on-line at http://www.epa.gov/otaq/toxics.htm

In an ongoing review of MSATs, the EPA finalized additional rules under authority of CAA Section 202(l) to further reduce MSAT emissions that are not reflected in the above graph. In Chapter 3 of its Regulatory Impact Analysis (RIA) for the 2007 MSAT rules, EPA states that there are a number of additional significant uncertainties associated with the air quality, exposure and risk modeling. The modeling also has certain key limitations such as the results are most accurate for large geographic areas, exposure modeling does not fully reflect variation among individuals, and non-inhalation exposure pathways and indoor sources are not taken into account. Chapter 3 of the RIA is found at: http://www.epa.gov/otaq/regs/toxics/fr-ria-sections.htm.

The EPA issued Final Rules on Control of Hazardous Air Pollutants from Mobile Sources (72 FR 8427, February 26, 2007) under Title 40 Code of Federal Regulations Parts 59, 80, 85 and 86. The rule changes were effective April 27, 2007. As a result of this review, EPA adopted the following new requirements to significantly lower emissions of benzene and the other MSATs by: (1) lowering the benzene content in gasoline; (2) reducing non-methane hydrocarbon (NMHC) exhaust emissions from passenger vehicles operated at cold temperatures (under 75 degrees Fahrenheit); and (3) reducing evaporative emissions that permeate through portable fuel containers.

Beginning in 2011, petroleum refiners must meet an annual average gasoline benzene content standard of 0.62 percent by volume, for both reformulated and conventional gasolines, nationwide. EPA has also adopted more stringent evaporative emission standards (equivalent to current California standards) for new passenger vehicles. The new standards become effective in 2009 for light vehicles and in 2010 for heavy vehicles. In addition to the reductions from the 2001 rule, the new rules will significantly reduce annual national MSAT emissions. For example, EPA estimates that emissions in the year 2030, when compared to emissions in the base year prior to the rule, will show a reduction of 330,000 tons of MSATs (including 61,000 tons of benzene), reductions of more than 1,000,000 tons of volatile organic compounds, and reductions of more than 19,000 tons of PM2.5.

Project Specific MSAT Analysis

Numerous technical shortcomings of emissions and dispersion models and uncertain science with respect to health effects prevent meaningful or reliable estimates of MSAT emissions and effects of the proposed project (see "*Information Unavailable for Project Specific MSAT Impact Analysis"* at the end of this section for more information). The national benzene content of gasoline in 2007 is about 1.0 percent by volume. EPA standards to reduce NMHC exhaust emissions from new gasoline-fueled vehicles will become effective in phases. Standards for light-duty vehicles and trucks (less than or

equal to 6000 pounds [lbs]) become effective during the period of 2010 to 2013, and standards for heavy light-duty trucks (6,000 to 8,000 lbs) and medium-duty passenger vehicles (up to 10,000 lbs) become effective during the period of 2012 to 2015. Evaporative requirements for portable gas containers become effective with containers manufactured in 2009. Evaporative emissions must be limited to 0.3 grams of hydrocarbons per gallon per day.

However, it is possible to qualitatively assess the levels of future MSAT emissions under the project. Although a qualitative assessment cannot identify and measure health impacts from MSATs, it can give a basis for identifying and comparing the potential differences among MSAT emissions, if any, from various alternatives. The qualitative assessment presented below is derived in part from a study conducted by the FHWA entitled *A Methodology for Evaluating Mobile Source Air Toxic Emissions Among Transportation Project Alternatives*[2]. For the proposed project described in this Categorical Exclusion (CE), the amount of MSATs emitted would be proportional to the vehicle VMT, assuming that other variables such as fleet mix are the same. The VMT estimated for the proposed project increases because the improvements increase the efficiency of the roadway and attracts rerouted trips from elsewhere in the transportation network. This increase in VMT would lead to higher MSAT emissions along the project area, along with a corresponding decrease in MSAT along parallel routes. The emissions increase is offset somewhat by lower MSAT emission rates due to increased speeds; according to EPA's MOBILE6 emissions model, emissions of all of the priority MSATs except for diesel particulate matter decreases as speed increases. The extent to which these speed-related emissions decreases will offset VMT-related emissions increases cannot be reliably projected due to the inherent deficiencies of technical models.

In addition, emissions will likely be lower than present levels in the design year as a result of EPA's national control programs that are projected to reduce MSAT emissions by 57 to 87 percent between 2000 and 2020. The US 281 at Loop 1604 Interchange project area 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 study area are likely to be lower in the future in nearly all cases.

[2] Federal Highway Administration *A Methodology for Evaluating Mobile Source Air Toxic Emissions Among Transportation Project Alternatives* , Mike Michael Claggett Ph.D. FHWA and Terry L. Miller Ph.D., P.E. Associate Professor, Department of Civil and Environmental Engineering The University of Tennessee: www.fhwa.dot.gov/ENVIRONMENT/airtoxic/msatcompare/msatemissions.htm

The new direct connectors will have the effect of moving some traffic closer to nearby homes, schools and businesses; therefore there may be localized areas where ambient concentrations of MSATs would be higher. The localized differences in MSAT concentrations would likely be most pronounced along the new connectors that would be built. However, even if these increases do occur, they too will be substantially reduced in the future due to implementation of EPA's vehicle and fuel regulations.

In addition, as discussed above, the magnitude and duration of these potential increases cannot be accurately quantified because of limitations on modeling techniques. Further, overall future of MSATs are expected to be substantially lower than today due to implementation of EPA's vehicle and fuel regulations. Finally, on a regional basis, EPA's vehicle and fuel regulations coupled with fleet turnover will cause region-wide MSAT levels to be significantly lower than today in almost all cases.

Sensitive Receptor Assessment

There may be localized areas where ambient concentrations of MSATs are slightly higher in any build scenario than in the no build scenario. Dispersion studies have shown that the "roadway" air toxics start to drop off at about 100 meters (328 feet). By 500 meters (1,640 feet), most studies have found it very difficult to distinguish the roadway from background toxic concentrations in any given area. Therefore, the study area for sensitive receptors includes the areas 500 meters from the project area. Sensitive receptors include those facilities most likely to contain large concentrations of the more sensitive population (hospitals, schools, licensed daycare facilities, and elder care facilities). The Department of Family and Protective Services childcare licensing website was searched to identify childcare facilities within 100 and 500 meters of the project area[3]. No licensed daycare facilities were found to exist within the project area.

A field survey was conducted to verify and identify potential sensitive receptors located within 500 meters of the project area. Nine sensitive receptors were found within 500 meters of the project area (**Figure 7**). As shown in **Table 2**, three of these sensitive receptors are within 328 ft (100 m) and six are between 328 ft (100 m) and 1,640 ft (500 m) from the road.

[3] Department of Family and Protected Services. Childcare licensing – Search Texas Childcare website: http://www.dfps.state.tx.us/Child_Care/Search_Texas_Child_Care/

TABLE 2: SENSITIVE RECEPTORS

Facility Name	Address	Located within 328 feet (100m) from the right-of-way	Located within 1,640 feet (500m) from the right-of-way
St. Thomas Episcopal Church and School	1416 N SL-1604 E San Antonio, TX 78232	X	
Northern Hills Church and School	3703 N Loop 1604 E San Antonio, TX 78247		X
Community Bible Church and Pre-School	2477 North Loop 1604 E San Antonio, TX 78232		X
Concordia Lutheran Church and Pre- School	16801 Huebner Rd San Antonio, TX 78258		X
Harvest Fellowship Church and Pre-School	1270 N Loop 1604 E San Antonio, TX 78232	X	
Abiding Presence Lutheran Church and Pre-School	14700 San Pedro Ave San Antonio, TX 78232	X	
Parkhills Baptist Church and School	17747 San Pedro Ave San Antonio, TX 78232		X
Christian Family Church and School	3607 N Loop 1604 E, San Antonio, TX 78232		X
Coker Elementary School	302 Heimer Road, San Antonio TX 78232		X

Information that is Unavailable or Incomplete

Evaluating the environmental and health impacts from MSATs on a proposed highway project would involve several key elements, including emissions modeling, dispersion modeling in order to estimate ambient concentrations resulting from the estimated emissions, exposure modeling in order to estimate human exposure to the estimated concentrations, and then final determination of health impacts based on the estimated exposure. Each of these steps is encumbered by technical shortcomings or uncertain science that prevents a more complete determination of the MSAT health impacts of this project.

Unavailable Information for Project Specific MSAT Impact Analysis

This CE includes a basic analysis of the likely MSAT emission impacts of this project. However, available technical tools do not enable the prediction of the project-specific

health impacts of the emission changes associated with the proposed project described in this CE. Due to these limitations, the following discussion is included in accordance with CEQ regulations (40 CFR 1502.22(b)) regarding incomplete or unavailable information.

i. Emissions

The EPA tools to estimate MSAT emissions from motor vehicles are not sensitive to key variables determining emissions of MSATs in the context of highway projects. While MOBILE6.2 is used to predict emissions at a regional level, it has limited applicability at the project level. MOBILE6.2 is a trip-based model--emission factors are projected based on a typical trip of 7.5 miles, and on average speeds for this typical trip. This means that MOBILE6.2 does not have the ability to predict emission factors for a specific vehicle operating condition at a specific location at a specific time. Because of this limitation, MOBILE6.2 can only approximate the operating speeds and levels of congestion likely to be present on the largest-scale projects, and cannot adequately capture emissions effects of smaller projects. For particulate matter, the model results are not sensitive to average trip speed, although the other MSAT emission rates do change with changes in trip speed. Also, the emissions rates used in MOBILE6.2 for both particulate matter and MSATs are based on a limited number of tests of mostly older-technology vehicles. Lastly, in its discussions of PM under the conformity rule, EPA has identified problems with MOBILE6.2 as an obstacle to quantitative analysis.

These deficiencies compromise the capability of MOBILE6.2 to estimate MSAT emissions. MOBILE6.2 is an adequate tool for projecting emissions trends, and performing relative analyses between alternatives for very large projects, but it is not sensitive enough to capture the effects of travel changes tied to smaller projects or to predict emissions near specific roadside locations. However, MOBILE 6.2 is currently the only available tool for use by FHWA/TxDOT and may function adequately for larger scale projects for comparison of alternatives.

ii. Dispersion

The tools to predict how MSATs disperse are also limited. The EPA's current regulatory models, CALINE3 and CAL3QHC, were developed and validated more than a decade ago for the purpose of predicting episodic concentrations of carbon monoxide to determine compliance with the NAAQS. The performance of dispersion models is more accurate for predicting maximum concentrations that can occur at some time at some location within a geographic area. This limitation makes it difficult to predict accurate exposure patterns at specific times at specific highway project locations across an urban area to assess potential health risk. Along with these general limitations of dispersion

models, FHWA is also faced with a lack of monitoring data in most areas for use in establishing project-specific MSAT background concentrations.

iii. Exposure Levels and Health Effects

Finally, even if emission levels and concentrations of MSATs could be accurately predicted, shortcomings in current techniques for exposure assessment and risk analysis preclude us from reaching meaningful conclusions about project-specific health impacts. Exposure assessments are difficult because it is difficult to accurately calculate annual concentrations of MSATs near roadways, and to determine the portion of a year that people are actually exposed to those concentrations at a specific location. These difficulties are magnified for 70-year cancer assessments, particularly because unsupportable assumptions would have to be made regarding changes in travel patterns and vehicle technology (which affects emissions rates) over a 70-year period. There are also considerable uncertainties associated with the 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. Because of these shortcomings, any calculated difference in health impacts between alternatives is likely to be much smaller than the uncertainties associated with calculating the impacts. Consequently, the results of such assessments would not be useful to decision makers, who would need to weigh this information against other project impacts that are better suited for quantitative analysis.

Summary of Existing Credible Scientific Evidence Relevant to Evaluating the Impacts of MSATs.

Research into the health impacts of MSATs is ongoing. For different emission types, there are a variety of studies that show that some either are statistically associated with adverse health outcomes through epidemiological studies (frequently based on emissions levels found in occupational settings) or that animals demonstrate adverse health outcomes when exposed to large doses.

Exposure to toxics has been a focus of a number of EPA efforts. Most notably, the agency conducted the National Air Toxics Assessment (NATA) in 1996 to evaluate modeled estimates of human exposure applicable to the county level. While not intended for use as a measure of or benchmark for local exposure, the modeled estimates in the NATA database best illustrate the levels of various toxics when aggregated to a national or state level.

The EPA is in the process of assessing the risks of various kinds of exposures to these pollutants. The EPA Integrated Risk Information System (IRIS) is a database of human health effects that may result from exposure to various substances found in the environment[4]. The following toxicity information for the six prioritized MSATs was taken from the IRIS database *Weight of Evidence Characterization* summaries. This information is taken from EPA's IRIS database and represents the Agency's most current evaluations of the potential hazards and toxicology of these chemicals or mixtures.

- **Benzene** is characterized as a known human carcinogen.
- The potential carcinogenicity of **acrolein** 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.
- **Formaldehyde** is a probable human carcinogen, based on limited evidence in humans, and sufficient evidence in animals.
- **1,3-butadiene** is characterized as carcinogenic to humans by inhalation.
- **Acetaldehyde** is a probable human carcinogen based on increased incidence of nasal tumors in male and female rats and laryngeal tumors in male and female hamsters after inhalation exposure.
- **Diesel exhaust** (DE) is likely to be carcinogenic to humans by inhalation from environmental exposures. Diesel exhaust as reviewed in this document is the combination of diesel particulate matter and diesel exhaust organic gases.
- **Diesel exhaust** also represents chronic respiratory effects, possibly the primary noncancer hazard from MSATs. Prolonged exposures may impair pulmonary function and could produce symptoms, such as cough, phlegm, and

[4] Environmental Protection Agency. *Integrated Risk Information System.* Available on-line at http://www.epa.gov/iris/

chronic bronchitis. Exposure relationships have not been developed from these studies.

There have been other studies that address MSAT health impacts in proximity to roadways. The Health Effects Institute, a non-profit organization funded by EPA, FHWA, and industry, has undertaken a major series of studies to research near-roadway MSAT hot spots, the health implications of the entire mix of mobile source pollutants, and other topics. The final summary of the series is not expected for several years.

Some recent studies have reported that proximity to roadways is related to adverse health outcomes -- particularly respiratory problems[5]. Much of this research is not specific to MSATs, instead surveying the full spectrum of both criteria and other pollutants. The FHWA cannot evaluate the validity of these studies, but more importantly, they do not provide information that would be useful to alleviate the uncertainties listed above and enable us to perform a more comprehensive evaluation of the health impacts specific to this project.

In the preamble to the 2007 MSAT rule, EPA summarized recent studies with the following statement: "Significant scientific uncertainties remain in our understanding of the relationship between adverse health effects and near-road exposure, including the exposures of greatest concern, the importance of chronic versus acute exposures, the role of fuel type (e.g., diesel or gasoline) and composition (e.g., % aromatics), relevant traffic patterns, the role of co-stressors including noise and socioeconomic status, and the role of differential susceptibility within the "exposed" populations." (Volume 73 Federal Register Page 8441 (February 26, 2007) Control of Hazardous Air Pollutants from Mobile Sources).

Relevance of Unavailable or Incomplete Information

Because of the uncertainties outlined above, a quantitative assessment of the effects of air toxic emissions impacts on human health cannot be made at the project level. While available tools do allow us to reasonably predict relative emissions changes between alternatives for larger projects, the amount of MSAT emissions from each of the project alternatives and MSAT concentrations or exposures created by the project cannot be predicted with enough accuracy to be useful in estimating health impacts. (As noted

[5] South Coast Air Quality Management District, Multiple Air Toxic Exposure Study-II (2000); Highway Health Hazards, The Sierra Club (2004) summarizing 24 Studies on the relationship between health and air quality); NEPA's Uncertainty in the Federal Legal Scheme Controlling Air Pollution from Motor Vehicles, Environmental Law Institute, 35 ELR 10273 (2005) with health studies cited therein.

above, the current emissions model is not capable of serving as a meaningful emissions analysis tool for smaller projects.) Therefore, the relevance of the unavailable or incomplete information is that it is not possible to make a determination of whether the proposed project would have "significant adverse impacts on the human environment."

In this document, a qualitative assessment has been provided of MSAT emissions and has acknowledged that the proposed project may result in increased exposure to MSAT emissions in certain locations, although concentrations and duration of exposures are uncertain, and because of this uncertainty, the health effects from these emissions cannot be estimated.