Contract (Grant) # 582-16-60180
PGA 582-16-60849-01
Task 5.2

Potential Cost of Nonattainment in the San Antonio Metropolitan Area

Study Conducted For:
Alamo Area Council of Governments

Study Conducted By:
Steve Nivin, Ph.D.
Belinda Román, Ph.D.
David Turner, Ph.D.

Steven R. Nivin, Ph.D., LLC

February 21, 2017

The preparation of this report was financed through grants from the State of Texas through the Texas Commission on Environmental Quality.
The content, finding, opinions and conclusions are the work of the authors and do not necessarily represent findings, opinions or conclusions of the TCEQ.

TABLE OF CONTENTS

ACRONYMS AND ABBREVIATIONS viii
1. Introduction to EPA's New Ozone Standard (October 1, 2015) 1
2. Background on Nonattainment Area Requirements 4
2.1. Overview of Nonattainment Area Requirements 4
2.2. Nonattainment New Source Review 9
2.3. Conformity 14
2.3.1. Transportation Conformity 14
2.3.2. General Conformity 18
2.4. Reasonably Available Control Technology 19
2.5. Reasonable Further Progress 20
2.6. Vehicle Inspection and Maintenance (I/M) Programs 21
2.7. Attainment Demonstration 23
2.8. Anti-Backsliding Requirements 24
2.9. Sanctions 24
2.10. Other Requirements 26
3. General Overview of Economic Methodologies 26
3.1. Measuring Impacts on Gross Regional Product and Other Impacts 26
3.2. General Assumptions 27
4. Analysis of Potential Economic Costs of a Nonattainment Designation 29
4.1. Impacts on Expansion/Relocation of Companies 29
4.1.1. Cost of Permitting 29
4.1.2. Costs Associated with Construction Project Delays 30
4.1.3. Potential Loss of a Company Expansion or Location 32
4.1.4. Impact on Small Businesses in the Metropolitan Area 42
4.1.5. Costs of NO_x Reduction at Cement Kilns 44
4.2. Transportation Conformity Costs 45
4.2.1. Costs of Performing Transportation Conformity Analysis 45
4.2.2. Congestion Mitigation 46
4.2.3. Costs due to Delays in Road Construction 52
4.3. General Conformity Costs 54
4.4. Inspection and Repair Costs 55
4.5. Commute Solutions Program 58
4.6. Cost of Voluntary Control Measures 61

4.6.1. Cost of Texas Emissions Reduction Plan 61
4.6.2. Anti-Idling..... 62
5. Conclusion 64
6. References..... 66
Appendix A..... 1

EXECUTIVE SUMMARY AND KEY FINDINGS

In 2015, the United States Environmental Protection Agency (EPA) issued a final rule to revise the primary 8-hour national ambient air quality standard (NAAQS) for ground-level ozone from 0.075 parts per million (ppm) (2008 standard) to 0.070 ppm, or 70 parts per billion (ppb). The EPA also revised the secondary NAAQS for ozone to be the same as the primary standard (*80 Fed. Reg. 65,291*). The final rule became effective on December 28, 2015, although the 2008 ozone standard remains in effect in some areas.

Under newly promulgated ozone NAAQS, the governor of each state must recommend designations of attainment, nonattainment, or unclassifiable under the 2015 8-hour standard for all areas of the state within one year (i.e., by October 1, 2016). The Texas Commission on Environmental Quality (TCEQ) issued its recommendations to the governor on August 3, 2016 (TCEQ, 2016a), which included that Bexar County would be designated as nonattainment with respect to ozone. The EPA makes the final decision on nonattainment area boundaries and could include counties or parts of counties within a Metropolitan Statistical Area (MSA) or other areas they fell that significantly contribute to the nonattainment status. Even though it may be the case that only Bexar County is determined to be in nonattainment, it is assumed that all counties in the San Antonio metropolitan area may be deemed to be in nonattainment.

The purpose of this study is to project the potential costs to the metropolitan economy by county that could arise under receiving either a marginal or moderate nonattainment classification. The health costs and any benefits (e.g., increased construction activity) are outside the scope of this analysis. It is not anticipated that the region would receive one of the more serious impairment classifications. Many of the costs are determined according to the lost gross regional product (GRP) that might occur due to the nonattainment designations. Input-output models are used to measure the effects on GRP, as well as the impacts on employment, incomes, and output within some relevant industries.

Table 1 provides a summary of the projected costs across the San Antonio metropolitan area. The costs will range from $3.2 billion to $27.5 billion under marginal nonattainment and will increase from $7.1 billion to $36.2 billion if the regional is given a moderate nonattainment

classification. There are a couple of points to keep in mind with respect to these figures. The low projection for a lost manufacturing company expansion/relocation is the estimate of a potential lost manufacturing company expansion from which the additional costs of nonattainment may affect the decision of the company to expand. The high projection assumes the cumulative impacts of losing a manufacturing firm of a size equivalent to the five largest manufacturing firms in the region. However, indications are that large businesses are prepared for the nonattainment designation and are able to absorb the additional costs, so the risk of losing such a large firm is relatively small.

Table 1. Summary of Potential Total Costs of Nonattainment in the San Antonio MSA (2016 $)

	Marginal	
	Low Estimate	*High Estimate*
Lost Manufacturing Company Expansion/Relocation	$699,765,642	$24,987,024,423
Cost of Permitting	$24,131,250	$60,328,125
Cost of Project Delays	$1,426,065,502	$1,426,065,502
TERP	$8,598,424	$8,598,424
Costs Associated with Commute Solutions	$14,735,398	$14,735,398
Reductions in GRP due to Inspection Fees	-	-
Lost GRP due to Road Construction Delays	$570,598,370	$570,598,370
Costs of Point Source NOx Reduction	$423,200,000	$447,200,000
Total	**$3,167,094,586**	**$27,514,550,242**

	Moderate	
	Low Estimate	*High Estimate*
Lost Manufacturing Company Expansion/Relocation	$777,517,380	$27,763,360,470
Cost of Permitting	$26,812,500	$67,031,250
Cost of Project Delays	$1,584,517,224	$1,584,517,224
TERP	$9,553,804	$9,553,804
Costs Associated with Commute Solutions	$33,266,979	$33,266,979
Reductions in GRP due to Inspection Fees	$3,375,993,367	$5,430,945,289
Lost GRP due to Road Construction Delays	$855,897,555	$855,897,555
Costs of Point Source NOx Reduction	$464,000,000	$488,000,000
Total	**$7,127,558,809**	**$36,232,572,571**

Given the difficulty, and thus high level of uncertainty, in projecting the potential lost economic activity from a business that decides not to locate or expand in the area, another to view the potential costs of nonattainment is to only consider the hard costs of nonattainment. Most of

these costs would occur in Bexar County, so to be as conservative as possible, only theses costs in Bexar County are presented in the following table.

Table 2. Summary of Potential Hard Costs of Nonattainment for Bexar County (Millions 2016 $)

	Marginal	
	Low Estimate	*High Estimate*
Cost of Permitting	$12,700,000	$31,750,000
Cost of Project Delays	$897,056,940	$897,056,940
Reductions in GRP due to Inspection Fees	$0	$0
Lost GRP due to Road Construction Delays	$458,580,755	$458,580,755
Total	**$1,368,337,695**	**$1,387,387,695**

	Moderate	
	Low Estimate	*High Estimate*
Cost of Permitting	$470,000	$1,175,000
Cost of Project Delays	$33,224,331	$33,224,331
Reductions in GRP due to Inspection Fees	$89,681,277	$89,681,277
Lost GRP due to Road Construction Delays	$22,929,038	$22,929,038
Total	**$146,304,646**	**$147,009,646**

The total costs (including both hard and soft costs) by county are provided in Table 3. As expected, the vast majority of the costs will be absorbed in Bexar County. It is estimated that costs in Bexar County could range from $2.1 billion to $21.5 billion under a marginal nonattainment designation. The costs could increase under a moderate nonattainment designation from $5.3 billion to $28.4 billion. Bandera County is projected to experience the smallest costs from nonattainment.

Table 3. Total Costs of Nonattainment by County (2016 $)

	Marginal	
County	*Low Estimate*	*High Estimate*
Atascosa	$81,555,999	$595,783,801
Bandera	$8,160,646	$230,936,463
Bexar	$2,149,208,831	$21,535,495,334
Comal	$395,791,302	$1,672,395,202
Guadalupe	$405,510,891	$1,956,219,440
Kendall	$22,766,034	$404,291,810
Medina	$67,637,553	$588,729,702
Wilson	$36,463,328	$530,698,487
Total	$3,167,094,584	$27,514,550,240

	Moderate	
County	*Low Estimate*	*High Estimate*
Atascosa	$162,142,123	$776,822,557
Bandera	$40,135,865	$306,492,259
Bexar	$5,267,009,767	$28,443,652,427
Comal	$646,923,066	$2,170,715,754
Guadalupe	$670,024,508	$2,523,875,813
Kendall	$80,931,402	$537,108,519
Medina	$147,309,055	$770,004,583
Wilson	$113,083,022	$703,900,658
Total	$7,127,558,809	$36,232,572,571

NOTE: Differences in the totals compared to Table 1 are due to rounding.

For comparison purposes, we include data from a September 2015 report on the Potential Costs of an Ozone Nonattainment Designation to Central Texas – primarily the Austin-Round Rock metropolitan area (See Table 4). As a regular touchstone for assessing the San Antonio-New Braunfels MSA performance, the Austin report highlights the differences between the two economies. The loss of Samsung investment in the Austin-Round Rock area represents a large portion of the overall costs. On the lower end, abandoning its plans all together represents 78% of the nearly $24.3 billion estimate while at the higher end of the Austin report's estimates, this same project could come to represent 81% of the $41.5 billion estimate. Without diminishing the

importance that such a decision would have for the Austin-Round Rock area, we find that in the case of the San Antonio area, no single company has the same leverage over economic activity, at least for the short-term. Not one of our interviews revealed that a company was considering leaving the area. In fact, our research shows that many larger-scale local companies have taken a proactive approach toward nonattainment and have already equipped existing and planned facilities with more environmentally sound technology. However, we find that on-road mobile sources present a more significant challenge to the area.

Table 4. Overall Economic Impact of Nonattainment Designation from Central Texas Report 2015 (CAPCOG 2015, 3)

Scenario	Low	High
Loss of Samsung Expansion	($21,340,142,448)	($33,893,167,418)
Loss of Texas Lehigh Expansion	($1,811,586,399)	($3,700,575,961)
Decker and Sim Gideon Boiler Replacements	$0	$0
Transportation Conformity-Routine Analysis	($2,300,000)	($7,000,000)
Transportation Conformity-Routine Project Delays	($27,407,176)	($41,471,216)
Transportation Conformity-Lapse-Project Delays	($18,298,801)	($93,012,795)
Transportation Conformity-Loss of Federal Funds	($23,746,747)	($74,646,101)
General Conformity-Rail Expansion Delays	($7,182,369)	($14,364,738)
General Conformity-Aviation Expansion Delays	($22,449,120)	($44,898,240)
NO_x Point Source Emission Reductions	($141,494,537)	($2,047,800,546)
VOC Reductions	($904,917,445)	($1,630,209,506)
TOTAL ECONOMIC IMPACT	**($24,299,525,042)**	**($41,547,146,520)**

ACRONYMS AND ABBREVIATIONS

ACRONYM OR ABBREVIATION	DEFINITION
CAA	Clean Air Act
CBSA	Core-Based Statistical Area
CSA	Combined Statistical Area
CTG	Control technique guideline
EPA	U.S Environmental Protection Agency
FHWA	Federal Highway Administration
FTA	Federal Transit Administration
HAP	Hazardous air pollutant
I/M	Inspection and monitoring
LAER	Lowest achievable emission rate
NA	Nonattainment
NAAQS	National Ambient Air Quality Standards
NNSR	Nonattainment New Source Review
NO_x	Nitrogen oxide (NO and NO_2)
NSR	New Source Review
PAL	Plant-wide applicability limit
PSD	Prevention of significant deterioration
RACM	Reasonably achievable control measures
RACT	Reasonably achievable control technology
RFG	Reformulated gasoline
RFP	Reasonable further progress
SIP	State Implementation Plan
SOCMI	Synthetic Organic Chemical Manufacturing Industry
TCEQ	Texas Commission on Environmental Quality
TCM	Transportation control measures
TXDOT	Texas department of Transportation
TXLED	Texas Low-Emission Diesel
VOC	Volatile organic compounds

1. Introduction to EPA's New Ozone Standard (October 1, 2015)

To meet its obligations under the Clean Air Act (CAA) as amended in 1990, the EPA has established air quality standards in 40 CFR Part 50. In these regulations, the EPA establishes the National Ambient Air Quality Standards (NAAQS) to promote and sustain healthy living conditions. Primary NAAQS are established to protect public health, and secondary NAAQS are established to protect public welfare by safeguarding against environmental and property damage (Table 1.1). These standards define acceptable ambient air concentrations for six criteria air pollutants: nitrogen dioxide (NO_2), ozone (O_3), sulfur dioxide (SO_2), carbon monoxide (CO), lead (Pb), and particulate matter (including PM_{10} and $PM_{2.5}$).

Table 1.1 National Ambient Air Quality Standards (NAAQS) (from EPA, 2016a)

Pollutant		Primary/Secondary	Averaging Time	Level	Form
Carbon Monoxide		Primary	8-hour	9 ppm	Not to be exceeded more than once per year
			1-hour	35 ppm	
Lead		Primary/Secondary	Rolling 3 mo. avg	0.15 μg/m^3	Not to be exceeded
Nitrogen Dioxide		Primary	1-hour	100 ppb	98th percentile of 1-hour daily maximum concentrations, averaged over 3 years
		Primary/Secondary	Annual	53 ppb	Annual Mean
Ozone		Primary/Secondary	8-hour	70 ppb (2015)	Annual fourth-highest daily maximum 8-hour concentration, averaged over 3 years
		Primary/Secondary	8-hour	75 ppb (2008)	Remains in effect in some areas.
Particulate Matter	$PM_{2.5}$	Primary	Annual	12.0 μg/m^3	annual mean, averaged over 3 years
		Secondary	Annual	15.0 μg/m^3	annual mean, averaged over 3 years
		Primary/Secondary	24-hour	35 μg/m^3	98th percentile, averaged over 3 years
	PM_{10}	Primary/Secondary	24-hour	150 μg/m^3	Not to be exceeded more than once per year on average over 3 years

Sulfur Dioxide	Primary	1-hour	75 ppb	99th percentile of 1-hour daily maximum concentrations, averaged over 3 years
	Secondary	3-hour	0.5 ppm	Not to be exceeded more than once per year

EPA requires states to monitor ambient air quality and evaluate compliance with respect to the NAAQS. Based on these evaluations, EPA characterizes the air quality within a defined area with respect to each of the six criteria air pollutants using a compliance-based classification system. Defined areas range in size from portions of cities, to metropolitan statistical area (MSA as defined by the U.S. Bureau of the Census), to large regions composed of many counties. For areas that are in *attainment*, levels for a given criteria air pollutant are below the NAAQS, while areas that are in *nonattainment* have air quality that exceeds the NAAQS. For those areas where there is insufficient available information for classification purposes, a status of *unclassifiable/attainment* is assigned. An ozone nonattainment classification can be further defined as

- Marginal,
- Moderate,
- Serious,
- Severe, or
- Extreme

based on the degree to which the NAAQS is exceeded (Table 1.2).

The ozone nonattainment classification for a given area determines the planning and control requirements that will be imposed to improve the regional air quality and move the area towards attainment status. If an area is designated as nonattainment, then the state must develop (a process that involves public review and comment) revisions to the State Implementation Plan (SIP) that demonstrate how the state plans to bring the area back into attainment status. The SIP revision will require different elements depending on the nonattainment classification.

Table 1.2. 8-Hour Design Values for the 2015 Ozone NAAQS of 70 ppb (from EPA, 2016a,b)

Area Class	8 hour design value (ppb)
Marginal	≥70 to < 81
Moderate	≥ 81 to < 93
Serious	≥ 93 to < 105
Severe-15	≥ 105 to < 111
Severe-17	≥ 111 to < 163
Extreme	≥ 163

On October 26, 2015, EPA issued a final rule to revise the primary eight-hour NAAQS for ground-level ozone from 0.075 parts per million (ppm) (2008 standard) to 0.070 ppm, or 70 parts per billion (ppb). The EPA also revised the secondary NAAQS for ozone to 70 ppb, equivalent to the primary standard (EPA, 2015a; *80 Fed. Reg. 65,291*). The final rule became effective on December 28, 2015, although the 2008 ozone standard remains in effect in some areas; for permitting purposes, the most stringent classification will control when two separate standards apply. Transitioning of these areas to the 2015 ozone standard will be addressed in the implementation rule for the current standard.

With the issuance of the new ozone standard, the EPA also required that the governor of each state must recommend designations of attainment, nonattainment, or unclassifiable under the 2015 8-hour standard for all areas of the state within one year (i.e., by October 1, 2016). The Texas Commission on Environmental Quality (TCEQ) issued its recommendations to the governor on August 3, 2016 (TCEQ, 2016a). Under these recommendations, Bexar County would be designated as nonattainment with respect to ozone, but the degree of nonattainment (e.g., Marginal to Extreme) is not identified. The EPA's final decision on nonattainment area boundaries could include counties or parts of counties within an MSA, Combined Statistical

Area (CSA), or Core-Based Statistical Area (CBSA) or other counties that EPA determines contribute significantly to the nonattainment.

For the purposes of this summary report, it is assumed that the 8-county region that comprises the San Antonio MSA would be classified as either marginal or moderate nonattainment with respect to the 2015 ozone NAAQS. It is not anticipated that the region would receive one of the more serious nonattainment classifications.

2. Background on Nonattainment Area Requirements

Ground-level ozone is not produced through direct emissions. Instead, this ozone is created indirectly by photochemical reactions involving precursor emissions of NO_x and volatile organic compounds (VOC) in the presence of sunlight. Along with natural sources, these precursor chemicals are produced by a wide variety of human activities such as vehicle exhaust, power plants, industrial boilers, refineries, chemical plants, and other industrial operations, making it challenging to identify a single source of emissions. In addition, the complex photochemical reactions that produce ozone vary with local atmospheric conditions such as temperature, and seasonal and daily weather patterns. For example, ozone tends to be highest on hot, sunny days, although certain cold weather air conditions such as temperature inversions can lead to higher ozone levels. Ozone can also be transported by wind, leading to the impairment of air quality in rural areas that are downwind from urban centers that have higher levels of NO_x and VOC that result from human activity (EPA, 2014).

2.1. Overview of Nonattainment Area Requirements

As discussed previously, TCEQ issued its recommendations for area designations with respect to the 2015 eight-hour ozone rule on August 3, 2016 (TCEQ, 2016). TCEQ's recommended designation status for the eight-county study area is identified in Table 2.1.

The recommended designation of Bexar County as nonattainment is based on design values calculated using certified 2013 through 2015 eight-hour ozone data for Texas counties with regulatory monitors (TCEQ, 2016a, Attachment B). The 2015 certified design value for Bexar County was 78 ppb, slightly less than Harris (79 ppb) and Tarrant (80 ppb) in the Houston and Dallas areas. The final EPA designation is anticipated to be based on 2014 – 2016 8-hour ozone data (TCEQ, 2016j), which yields a design value of 73 ppb for Bexar County.

Table 2.1 TCEQ 2015 Eight-Hour Ozone NAAQS Designation Recommendations (from TCEQ, 2016a)

County	**TCEQ Recommended Designation (8/3/2016)**
Atascosa	Unclassifiable/Attainment
Bandera	Unclassifiable/Attainment
Bexar	Nonattainment
Comal	Unclassifiable/Attainment
Guadalupe	Unclassifiable/Attainment
Kendall	Unclassifiable/Attainment
Medina	Unclassifiable/Attainment
Wilson	Unclassifiable/Attainment

Depending on the nonattainment designation, a number of different requirements are imposed with the goal of improving the affected air quality and returning to attainment status. Each increased level of nonattainment (i.e., as air quality impairment becomes more severe, or the area is unable to meet the NAAQS by the attainment date associated with a lower nonattainment classification), incorporates all of the requirements for the lower levels of nonattainment, and adds additional requirements. The result is that the number of requirements for air quality improvement and the associated costs of implementation can increase markedly as regional air quality is degraded. These requirements are established through revisions to the SIP, and for ozone nonattainment, the required SIP elements by nonattainment classification include (EPA, 2016h):

Marginal (3 years to attain):

- Baseline emission inventory, followed by periodic updates
- New source review (NSR) program
    - NSR offset ratio 1.1:1
- Major source emission statements
    - Major source threshold 100 tons per year (tpy), and

- Transportation conformity demonstration

Moderate (6 years to attain):

- All requirements for Marginal classification, with
    - Major source threshold 100 tpy
    - NSR offset ratio 1.15:1
- Major source ($VOC/NO_{x)}$ reasonably available control technology (RACT)
- Attainment demonstration
- 15% reasonable further progress (RFP) over 6 years
- Basic vehicle inspection and maintenance (I/M) program
- Contingency measures for failure to attain
- Stage II gasoline vapor recovery (Note: With the development of on-board vapor recovery technology, EPA determined that Stage II vapory recovery was no longer required and could be removed from state SIPs. EPA approved the revisions to the Texas SIP removing Stage II vapor recovery in April 2014, and gasoline stations were allowed to begin decommissioning Stage II equipment in May 2014 (TCEQ, 2016l).

The following is a brief listing of the controls and requirements that are imposed as a function of nonattainment status (EPA, 2016c,d,e). Examples of controls applied in Texas nonattainment areas are provided in Appendix A for the initial (July 20, 2012) Marginal designation of the Houston-Galveston-Brazoria MSA (designated as Moderate relative to the 2008 ozone standard on December 14, 2016) and the Dallas-Fort Worth MSA (Moderate):

- Nonattainment (Marginal, 3 years to attain):
    - Marginal area nonattainment new source review (NNSR) permitting rules;
    - Transportation Conformity;
    - General Conformity;
    - Emissions Inventory; and
    - Emission Statements;
- Nonattainment (Moderate, 6 years to attain):
    - All Marginal area requirements;
    - Moderate area NNSR permitting rules;

    - NSR offset of 1.15:1
    - Attainment demonstration;
    - Reasonable further progress (RFP) demonstration (15% reduction in VOC emissions);
    - Reasonably available control technology (RACT) for major sources of NO_x;
    - RACT for major sources of VOC;
    - RACT for VOC sources covered by an EPA control technique guideline (CTG) document;
    - Contingency measures for attainment and RFP; and
    - A basic vehicle inspection and maintenance (I/M) program;
- Nonattainment (Serious, 9 years to attain):
    - All Marginal and Moderate area requirements;
    - Serious area NNSR permitting rules;
    - Enhanced I/M program;
    - Enhanced monitoring;
    - Clean Fleet program;
    - Transportation control measures (TCMs) to offset growth in vehicle miles traveled; and
    - Additional 3% per year reduction in NO_x and VOC emissions for RFP;
- Nonattainment (Severe, 15/17 years to attain):
    - All Marginal, Moderate, and Serious area requirements;
    - Severe area NNSR permitting;
    - An emissions fee program if the area fails to attain its standard by its attainment deadline; and
    - Additional 3% per year reduction in NO_x and VOC emissions for RFP;
- Nonattainment (Extreme, 20 years to attain):
    - All Marginal, Moderate, Serious, and Severe area requirements;
    - Extreme area NNSR permitting;
    - Clean Fuel for Boilers; and
    - Additional 3% per year reduction in NO_x and VOC emissions for RFP

If the air quality in an area that has been previously designated as nonattainment improves to meet the NAAQS, the area will be identified as a maintenance area. It is important to consider that even if the regional air quality is improved and achieves a designation of maintenance, the requirements will remain in effect until continued NAAQS compliance can be demonstrated. A general timeline is presented in Figure 2.1 with estimated dates relevant to a nonattainment designation for the San Antonio region given in Table 2.2.

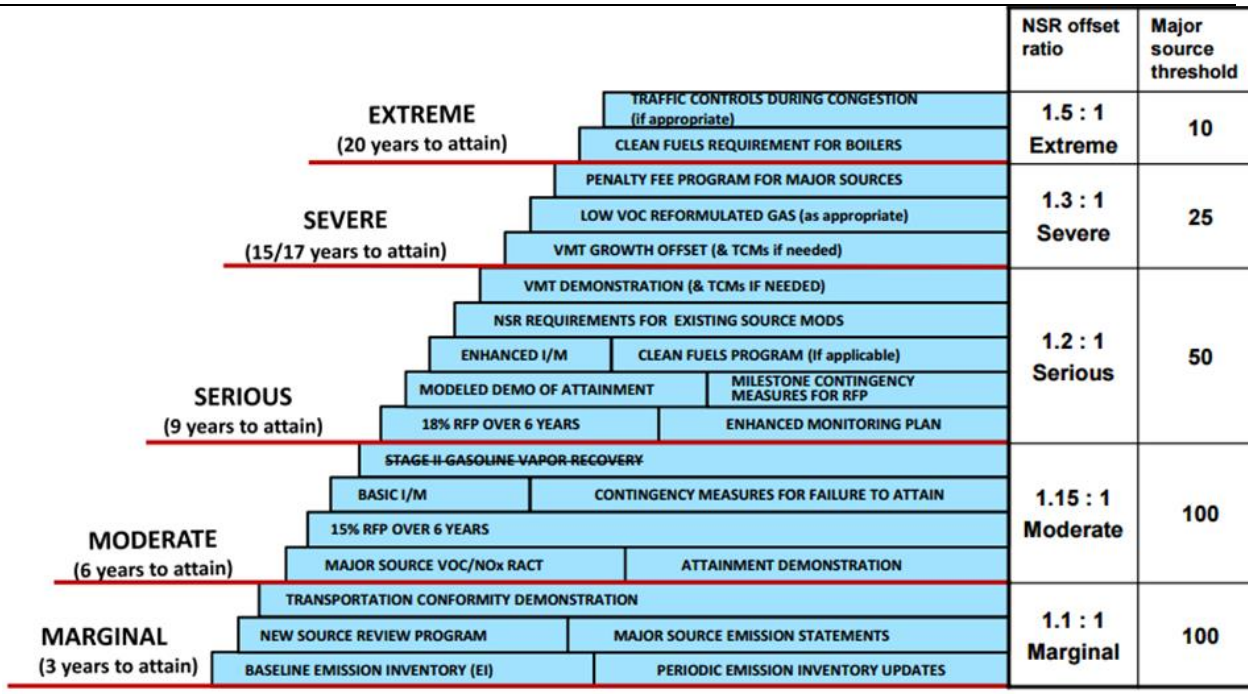

Figure 2.1. Overview of CAA Ozone Planning & Control Requirements by Classification (from EPA, 2015b)

Table 2.2. A general timeline for NAAQS compliance (Modified from TCEQ, 2016j, CAPCOG, 2015)	
October 2015	New Primary Ozone Standard: 70 ppb; Secondary standard same as primary (EPA, 2015a)
August 2016	TCEQ makes recommendations to governor for nonattainment designations (TCEQ, 2016a)
October 2016	State designation recommendations due to EPA
November 2016	EPA proposes implementation rule (EPA, 2016b)
June 2017	EPA sends letter to states with proposed nonattainment area designations
October 2017	EPA to sign (finalize) designations and classifications; EPA to finalize implementation rule
October 2019	Emissions Inventory State Implementation Plan (SIP) revisions due for all nonattainment areas
October 2020-2021	Attainment Demonstration SIP revisions due

Once the SIP revisions are proposed and approved, and the implemented programs are able to improve air quality to meet the 2015 ozone NAAQS, then nonattainment areas are eligible for redesignation. In accordance with the provisions of Section 175 of the CAA, TCEQ would propose a maintenance plan and prepare an attainment redesignation request that would be forwarded to EPA, with up to two years for EPA to consider the requests. If EPA approves the maintenance plan and the redesignation request, then there will be a 10-year maintenance period to ensure that improved air quality can be sustained. Approximately two years before the end of this period, TCEQ will prepare a second 10-year maintenance plan for EPA review and approval. In summary, the designation of an area (or areas) as nonattainment with respect to the ozone NAAQS can result in required controls, analysis, modeling, and monitoring that can cover a period of regulatory oversight that extends from years to decades.

2.2. Nonattainment New Source Review

Nonattainment New Source Review (NNSR) is required for applicants seeking permits to either construct a new major stationary source or install major modifications to an existing major source in a nonattainment area. For NNSR permitting in Marginal and Moderate ozone nonattainment areas, a major source is defined as a facility that has the potential to emit at least 100 tpy of either NO_x or VOC, while a major modification is considered to be a physical modification or change in operations that would increase emissions of NO_x or VOC by at least 40 tpy. The numerical criteria for these definitions are based on the conservative assumption that

a facility is running at 100 percent capacity for 24 hours/day and 365 days/year. A permit that is under consideration as part of an NNSR cannot be approved unless the review determines that a number of location-specific requirements intended to minimize the effects on air quality from the proposed facility or modifications can be met.

TCEQ identifies the types of facilities that often require NNSR (TCEQ, 2016d) (Table 2.3):

Table 2.3. List of facilities, as defined by the Texas Clean Air Act § 382.003(6), typically found at sources that need New Source Review permits (from TCEQ, 2016d).

Abrasive Blasting Operations	Glycol Dehydrator
Absorbers	Grain Elevators
Adsorption Systems	Hot Mix Asphalt Plants
Anhydrous Ammonia Storage and Handling	Incinerators
Asphalt Processing and Asphalt Roofing Manufacturing	Internal Combustion Engines
Boilers	Iron and Steel Industry
Bulk Gasoline Terminals	Liquid Storage Terminals
Bulk Material Handling	Loading Operations
Chrome Plating and Anodizing Operations using Chromic Acid	Metallizing-Metal Spraying Operations
Coating Manufacturing Operations	Oriented Strandboard Mills
Concrete Batch Plants	Painting Operations
Cooling Towers	Petroleum Coke Storage and Transfer
Cotton Gins	Plant Fuel Gas (Under Review)
Degreasing Operations	Polyethylene and Polypropylene Manufacturing
Drum Filling	Printing Operations
Dry Bulk Fertilizer Handling	Process Furnaces and Heaters (Under Review)
Equipment Leak Fugitives	Process Vents
Ethylene Oxide Sterilization Units	Rock Crushing Plants
Fiber Reinforced Plastics and Cultured Marble	Storage Tanks
Flares and Vapor Combustors	Sulfur Recovery Units
Fluid Catalytic Cracking Units	Truck or Railcar Cleaning
Galvanizing Operations	Turbines
Glass Manufacturing	Vapor Oxidizers
	Wastewater

According to the EPA, all NNSR programs "…have to require (1) the installation of the lowest achievable emission rate (LAER), (2) emission offsets, and (3) opportunity for public involvement." (EPA, 2016f).

LAER focuses on setting the emissions limits on new or modified major sources in nonattainment areas. For the purposes of NNSR review, LAER will focus on the most stringent limitations from either of the following:

- The most stringent emissions limitation, which is contained in the SIP, for a class or source category, unless the owner or operator of the source demonstrates that such limitations are not achievable; or

- The most stringent emissions limitation that is achieved in practice by a class or source category. This limitation, when applied to a modification, means the lowest achievable emissions rate for the new or modified facilities.

The LAER requirements that are established as part of the NNSR may be achieved by a combination of methods that could include changes to raw materials, process modifications, or add-on controls. Depending on the specific technologies or processes involved, these methods may increase the cost of either building a new facility that qualifies as a major source, or expanding operations of an existing major source within a nonattainment area. In addition, a typical NNSR includes permitting fees ($75,000 maximum) as well as an extensive review process that can add to facility cost. For example, according to the voluntary TCEQ Expedited Permitting Program (TCEQ, 2016e), the NNSR permitting process can include the additional upfront costs in the form of surcharges above and beyond the costs associated with preparing the permit application:

- New Source Review (NSR) case-by-case permit - $10,000

- Federal NSR permits [Prevention of Significant Deterioration (PSD) including greenhouse gas PSD, Nonattainment (NA), Plantwide Applicability Limit (PAL), and Hazardous Air Pollutant (HAP)] - $20,000

Basic steps for the TCEQ NSR permit program (TCEQ, 2016e), include:

- Pre-Application: This step includes a pre-application meeting, prior to submitting the permit application package. The purpose of this meeting is to establish a general schedule for the permit application review. Prior to the meeting, the applicant submits

- An overview of the project, including a description of the processes involved and the types of emissions (contaminants and approximate quantities);
- A discussion of federal applicability including netting evaluation, if applicable;
- A discussion of best available control technology (BACT);
- A list of permitting questions to resolve in the meeting (BACT, impacts review strategies, calculation methodology, rule applicability, etc.);
- A draft application and modeling protocol, if available; and
- Anticipated submittal date and project timing (e.g., start of construction).

- Draft Application: An early draft of the application is made available to the TCEQ staff for preliminary evaluation of the application and air dispersion modeling protocols. This draft is to be submitted at least three weeks prior to the planned, formal application submittal. The TCEQ staff then has seven days to provide feedback on deficiencies, if any, that they identify in the draft. The applicant has the opportunity to resolve these deficiencies prior to submitting the formal application.

- Application Submittal: After resolving deficiencies and questions from the TCEQ staff on the draft application and the proposed modeling, the applicant submits the formal application electronically, along with the appropriate surcharge as identified previously. If deficiencies are not addressed, then the application may be voided.

- Enhanced Administrative Review: After receiving the formal application and modeling results prepared by the applicant, TCEQ staff conducts a review and identifies any deficiencies. These are communicated to the applicant who has 10 days to respond. The staff will then review the responses – if the responses are not acceptable, then the application will be voided.

- Technical Review: – If the applicant's responses to the EAR are acceptable, the TCEQ conducts a technical review. The review includes proposed control technologies (Best Available Control Technologies (BACT) or LAER in the case of NNSR), modeling calculations, federal applicability, and technical completeness. The TCEQ review will

verify emission rates, and request a complete Air Quality Analysis (AQA) that follows the approved modeling protocol. As with other steps, TCEQ may void the application if the applicant does not provide complete and accurate information within the specified timeframe

- Modeling Audit: The TCEQ Air Dispersion Modeling Team (ADMT) conducts an audit of the modeling results in the context of the agreed upon modeling protocols. The air dispersion modeling must pass the modeling audit two times, or the permit application may be voided. If there are potential public health effect implications, additional impact reviews may need to be conducted by the TCEQ Toxicology Division, with additional time necessary to complete the permit application review

- Draft Permit: If the application passes these review steps, the TCEQ permit reviewer will provide a draft permit (with conditions), triggering a 30-day public comment period. Written comments are addressed by the permit reviewer, and the draft permit is updated as necessary. If a public hearing request is received within the initial 3-day period, the applicant may be required to undergo a second 30-day public notice period.

The length of time to complete the air permitting process depends on factors such as the complexity of the application, TCEQ workload, the availability of TCEQ staff to conduct the review, and the required public participation process (TCEQ, 2016f, g). The target timeframes for the NNSR permit issuance given in Table 2.4 can be as much as 365 days, but as can be seen in the previous outline, inadequate or untimely responses on the part of the applicant at several different stages in the process can void the permit application, costing additional time and resources.

Table 2.4. Air Quality Permitting Target Time Frames (from TCEQ, 2016f)

Project Type	*Permit Issuance (Days)*
New Source Review (NSR) Initial Permits	285
New Source Review Amendments	315
Major NSR New Permits - Federal Timeline	365
Major NSR Amendments - Federal Timeline	365
Federal New Source Review (Prevention of Significant Deterioration, Nonattainment, 112g) Initial & Major Modifications	365

2.3. Conformity

Conformity, established under Title I, Section 176 of the CAA, is a provision that applies to NAAQS nonattainment and maintenance areas and mandates that all federal actions conform to (i.e. meet) the requirements of an approved SIP. For conformity purposes, a *federal action* includes not just federal agency engagement in specific activities, but also federal actions that provide "…support in any way, or provide financial assistance for, license or permit, or approve, any activity that does not conform to an implementation plan…" Federal actions are evaluated as part of a conformity determination prior to proceeding with a given action. The purpose of conformity is to eliminate or reduce violations of the NAAQS and achieve attainment of these air quality standards. Specifically, conforming activities or actions should not cause or contribute to new violations, increase the frequency or severity of existing violations, or delay timely attainment of any standard or interim emission reductions.

Conformity requirements are categorized according to transportation and general conformity, under EPA regulations 40 CFR Part 93. Transportation conformity requirements apply to transportation plans, transportation improvement programs, and highway and transit projects funded or approved by the Federal Highway Administration (FHWA) and the Federal Transit Administration (FTA) (40 CFR Part 93, Subpart A). General conformity requirements apply to all federal actions in nonattainment and maintenance areas not covered by the transportation conformity rule (40 CFR Part 93, Subpart B).

2.3.1. Transportation Conformity

Section 176(c)(6) of the CAA and the conformity regulation at 40 CFR § 93.102(d) provide a one-year grace period from the effective date of designation before transportation conformity applies in areas newly designated as nonattainment for any of the transportation-related NAAQS (ozone, particulate matter, nitrogen dioxide, and/or carbon monoxide) (EPA, 2012). During this grace period, a transportation conformity determination for the region must be completed and submitted to local, state, and federal consultative agencies for review, with the FHWA and FTA providing final approval. In addition, long-term metropolitan transportation plans (MTPs) and

shorter-term transportation improvement programs (TIPs) that are funded in part by federal transportation agencies such as the FHWA and FTA would need to be revised to include an analysis of the potential impact of the plans on regional air quality to demonstrate that the activities "conform to" the SIP (Figure 1). The element of the SIP to which a transportation conformity demonstration must conform is the motor vehicle emission budget (MVEB), which is a representation of an area's projected regional on-road mobile source emissions in the SIP for NAAQS-related pollutants. With respect to the ozone NAAQS, a transportation conformity determination would need to demonstrate that future emissions of ozone precursors (NO_x and VOC) resulting from an area's MTP and TIP would be equal to or less than the MVEB included in the SIP and approved by EPA. The metropolitan planning organization (MPO) in a nonattainment or maintenance area is typically responsible for completing and submitting transportation conformity demonstrations.

Transportation conformity demonstrations are to be made at least every four years, but can occur more frequently if the MTP and TIPs are updated more frequently (FHWA, 2010). If, after the initial nonattainment designation, transportation conformity is not demonstrated and approved by FHWA and FTA, then after a one-year grace period, the region is considered to enter into a conformity "lapse", and federal funds for highway and transit improvements can be restricted. During a lapse, only a limited number of transportation projects can proceed, including:

- Exempt projects such as
  - Safety improvements,
  - Road maintenance,
  - Rehabilitation, or
  - Certain mass transit, bicycle/pedestrian, mass transit, carpool/vanpool projects that can be shown to not have a negative impact on the region's air quality;
- Transportation Control Measures (TCM)s in approved SIPs; and
- Projects or project phases that are already authorized.

Also, during a conformity lapse, no new non-exempt projects can be amended into the MTP or TIP.

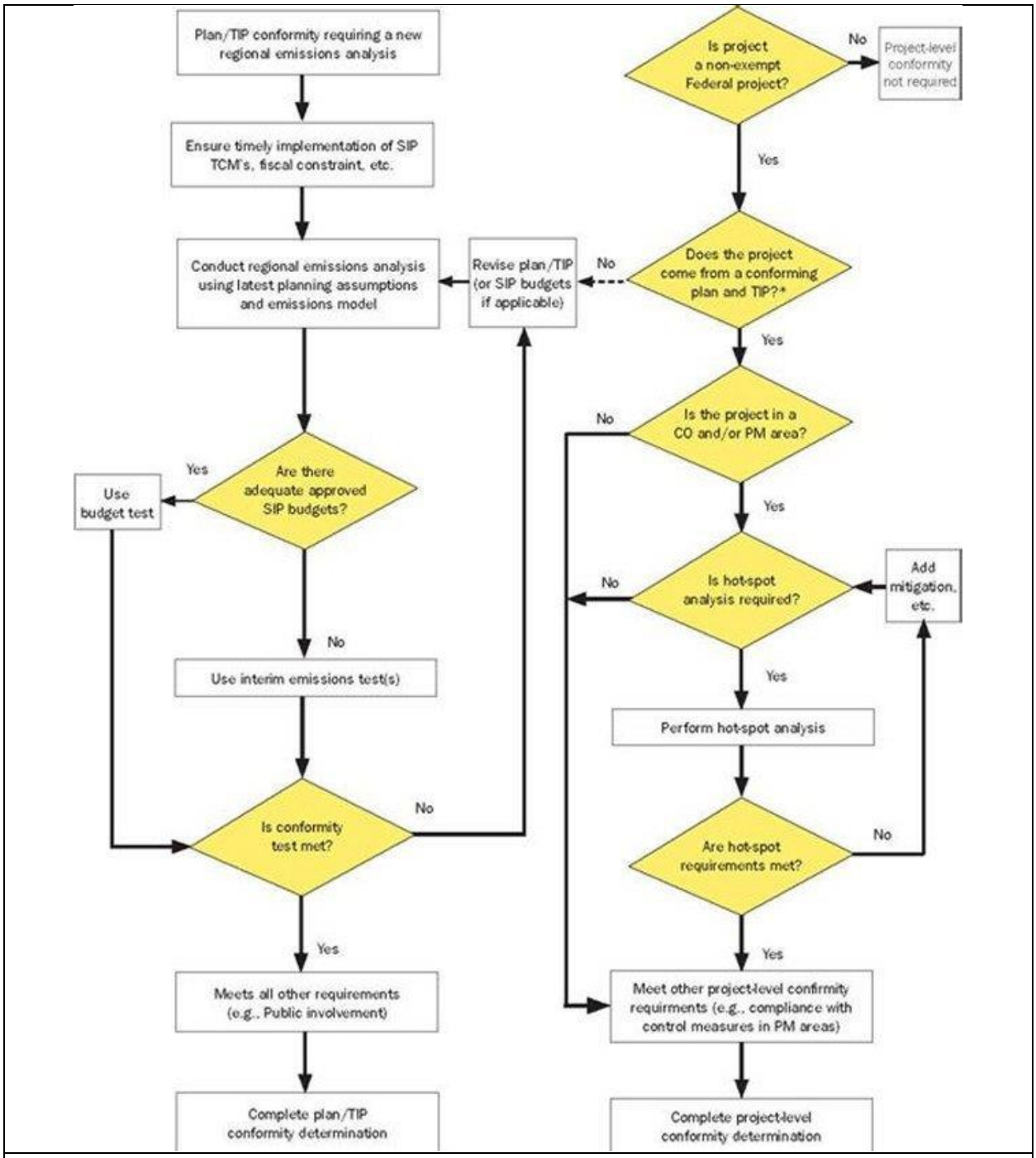

Figure 2.2. Simplified version of the transportation conformity process for metropolitan transportation plans/TIPs and projects (from FHWA, 2010).

For the San Antonio region, the Alamo Area Metropolitan Planning Organization (AAMPO) is the independent local agency that provides direction for the allocation of federal funding for urban transportation planning. In this role, the AAMPO develops and updates the MTP and TIPs

for the region (AAMPO, 2015, 2016a,c). If the region is designated as nonattainment with respect to ozone, then the AAMPO would have the primary responsibility for demonstrating transportation conformity for the MTP, TIPs, and other regionally significant projects. For the purposes of the AAMPO (AAMPO, 2016b), regionally significant projects are those that include

- Roadways that are federally functionally classified as interstate freeways, other freeways, or principal arterials
- Roadways and intermodal connectors included in the federally adopted National Highway System
- Roadways designated as State Highways or US Highways
- Fixed guideway transit facilities

Since demonstrating transportation conformity would require consultation with federal, state, and local agencies, it could potentially add time and cost to transportation planning. For example, currently, the TIP is updated every two years and amended quarterly, but if the region is designated as nonattainment with respect to ozone, then the need for interagency consultation and public outreach would potentially reduce the frequency of the amendments and updates. Conformity would also be considered at the project level, where a project must be demonstrated to come from a conforming MTP and TIP, with a design and scope that has not changed significantly from the conforming plans, and addresses potential localized emissions impacts.

With respect to potential ozone nonattainment designation for the San Antonio region, the working schedule assumptions for the AAMPO (AAMPO, 2016a) are:

- Oct 2015: EPA Ozone NAAQS Final Rule – 70 ppb standard
- Oct 2016: Governors propose nonattainment areas –
    - TCEQ proposed Bexar County only
- Oct 2017: EPA designates nonattainment areas
- Dec 2017 to June 2018: AAMPO Develops Metropolitan Transportation Plan (MTP), Transportation Improvement Program (TIP), Conformity Document and conducts public involvement process

- June 2018: Consultative Partners to Receive MTP, TIP and Conformity Documents
- Oct 2018: Transportation Conformity Determination Due

If the conformity determination cannot be completed and approved to meet the October 2018 deadline, then the region would be considered to be in conformity lapse, and the requirements discussed previously would apply.

2.3.2. General Conformity

General conformity determinations are performed on a project-by-project basis in NAAQS nonattainment and maintenance areas for actions that are federally funded, licensed/permitted, or requires federal agency approval and is not covered by transportation conformity regulations. The federal agency proposing an activity would work with state and local governments to evaluate whether potential activity-related impacts to air quality would conform to the SIP based on regulations in 40 CFR Parts 6, 51, and 93 (EPA, 1993).

In the first step of the process, the federal agency evaluates a proposed project to assess the applicability of general conformity requirements. In making this evaluation, the agency assesses whether:

- The proposed activity is exempt from general conformity requirements (40 CFR § 93.153(c))
- The proposed activity is "presumed to conform" (40 CFR § 93.153(g))
- Total direct and indirect emissions are below the *de minimis* level. For the ozone NAAQS, emissions from ozone precursors determine whether general conformity must be demonstrated for an action, with *de minimis* levels of 100 tons per year of NO_x or VOC for Marginal and Moderate nonattainment areas and for maintenance areas)

If the proposed activity meets any of these criteria, then a general conformity analysis is complete and a detailed determination and analysis is not required. If these criteria are not met, then general conformity requirements are applicable, and the agency will determine whether:

- The affected facility meets an emissions budget approved by the state as part of the SIP
- The action meets all state control requirements
- The action would cause a new violation of the standard or interfere with timely attainment, maintenance, or reasonable further progress
- Total and indirect emissions are specifically identified and accounted for in the SIP
- The state/local air quality agency has provided a written statement that emissions from the project, together with other emissions in the nonattainment/maintenance area will not exceed the SIP emissions budget

As necessary, the proposing federal agency may obtain emissions offsets to ensure that there is no net increase in emissions for the nonattainment or maintenance area. Offsets would occur during the same calendar year as any emissions increase from the proposed action, unless the proposed offsets exceed a ratio to the anticipated emissions of:

- 1.15-to-1 for Moderate nonattainment areas
- 1.1-to-1 for Marginal and maintenance areas.

For the purposes of a general conformity analysis, *direct emissions* are those emissions that are caused/initiated by the proposed federal action, and occur at the same time and place within nonattainment area. As the name suggests, *indirect emissions* are those reasonably foreseeable emissions that are caused/initiated by the proposed federal action, but occur in a different time and place within the nonattainment area. Indirect emissions are further limited to those that the federal agency can "practically control" and for which the agency can maintain control through continuing program responsibility (FAA/EPA, 2002).

2.4. Reasonably Available Control Technology

Should the San Antonio region be classified as a Moderate or higher ozone nonattainment area, sources of emissions within the area will need to demonstrate that they have implemented Reasonably Available Control Technology (RACT). Existing facilities would need to be

retrofitted with pollution control technology, with RACT defined under 40 CFR § 51.100(o) as "…devices, systems, process modifications, or other apparatus or techniques that are reasonably available, taking into account: (1) the necessity of imposing such controls in order to attain and maintain a national ambient air quality standard; (2) the social, environmental, and economic costs of such controls; and (3) alternative means of providing for attainment and maintenance of such standard."

For ozone nonattainment areas, there are three categories of RACT:

- VOC RACT for sources covered by an EPA Control Technique Guideline (CTG) document
- Non-CTG major source VOC RACT, including emission sources covered in an EPA Alternative Control Technology (ACT) document
- Major source NO_x RACT

The EPA defines RACT as the lowest emission limitation that a particular source is capable of meeting by the application of control technology that is reasonably available, considering technological and economic feasibility (EPA, 2016g). In Texas, RACT requirements for ozone established by TCEQ are contained in 30 TAC Chapters 115 (VOC) and 117 (NO_x), and are adopted in the Texas SIP. TCEQ applies these requirements to reduce emissions from existing sources regardless of construction authorization or date of construction for the source (TCEQ, 2011).

2.5. Reasonable Further Progress

Should all or part of the San Antonio region be classified as nonattainment-Moderate with respect to ozone, the CAA requires that the state (TCEQ in this case) submit plans that show reasonable further progress (RFP) towards achieving attainment.

TCEQ would be required to submit an RFP analysis as a revision to the SIP for the nonattainment area within three years of the effective date for the nonattainment designation.

The RFP SIP revision would not be required to demonstrate the attainment of the NAAQS ozone standard, but would instead, as specified in Section 182(c)(2) of the CAA and in 40 CFR §51.910, involve reducing ozone precursor emissions (NO_x and/or VOC) at annual increments between the baseline year and the attainment year. For example, a RFP SIP revision prepared for the moderate nonattainment classification for the Dallas-Fort Worth (DFW) 10-county area included control strategies to achieve reductions in VOC and/or NO_x, as well as annually updated MVEB inventories, transportation modeling, and quantification of control strategies, with milestones for each year of the RFP analysis to demonstrate that the proposed control strategies would result in a reduction of 15% in emissions for the ozone precursors (VOC and/or NO_x) within six years after designation (TCEQ, 2015a). Examples of the control strategies considered for the DFW RFP analysis are included in Table 2.5.

Table 2.5. Summary of DFW NO_x and VOC Cumulative Emissions Reductions from Control Strategies (from TCEQ, 2015a)

Chapter 117 NO_x point source controls
Chapter 115 storage tank rule
Coating/printing rules
Portable fuel container rule
Federal Motor Vehicle Control Program
Inspection and maintenance (I/M)
Reformulated gasoline (RFG)/ East Texas Regional Low Reid Vapor Pressure Gasoline Program
On-road Texas low emission diesel (TxLED)[a]
Tier 1 and 2 locomotive NO_x standards
Small non-road spark ignition (SI) engines (Phase 1)
Heavy duty non-road engines
Tiers 2 and 3 non-road diesel engines
Small non-road SI engines (Phase 2)
Large non-road SI and recreational marine
Non-road TxLED
Non-road RFG
Tier 4 non-road diesel engines
Diesel recreational marine
Small SI (Phase 3)
Chapter 117 NO_x area source engine controls
Drilling rig low emission diesel
2017 Low Sulfur Gasoline Standard
[a]TXLED required in 5 of the 8 counties considered in this report (Atascosa, Bexar, Comal, Guadalupe, and Wilson) (TCEQ, 2016k)

2.6. Vehicle Inspection and Maintenance (I/M) Programs

Vehicle inspection and maintenance (I/M) programs have been used for many years to improve air quality for NAAQS criteria pollutants related to vehicle emissions (CO, Ozone through its precursors NO_x and VOC). I/M programs use special equipment to measure the pollution in a vehicle's exhaust, identifying high-emitting vehicles, and causing them to be repaired.

For areas designated as Moderate nonattainment or higher with respect to ozone, the CAA establishes basic I/M programs. Specifically, under 40 CFR § 51.350(a)(4), "…any area classified as a moderate ozone nonattainment area, and not required to implement enhanced I/M under paragraph (a)(1) of this section, shall implement basic I/M in any

1990 Census-defined urbanized area with a population of 200,000 or more." Additionally, 40 CFR § 51.350(b)(2) specifies that, "outside of ozone transport regions, programs shall nominally cover at least the entire urbanized area, based on the 1990 census. Exclusion of some urban population is allowed as long as an equal number of non-urban residents of the MSA containing the subject urbanized area are included to compensate for the exclusion." Therefore, with respect to the potential nonattainment designation of the San Antonio area, not all of the counties in the eight-county area considered in this study would necessarily be required to have a vehicle I/M program. If the area were to be classified as higher than Moderate, additional I/M requirements in 40 CFR §51.350 could apply and require implementation of an I/M program in other parts of the nonattainment area.

In establishing the basic I/M program, the CAA identified EPA as the agency responsible for developing the performance standards to be met. EPA has revised the I/M performance standards several times to give greater flexibility to nonattainment regions in designing their I/M programs and to meet revisions to the NAAQS ozone standards. Although there is flexibility in designing I/M programs, common methods include visual inspection, emissions testing, and/or accessing the onboard diagnostic computer codes from 1996 and newer vehicles (EPA, 2006).

States can perform testing in a variety of ways, including centralized test-only inspection facility (State- or contractor-operated), or at privately owned and operated decentralized facilities using certified mechanics. If a vehicle does not pass the test, then it is required to be repaired before it can continue to be operated in the area. In Texas, for those nonattainment regions with I/M programs, the programs are integrated with the annual safety inspection program and operated by the Texas Department of Public Safety (DPS) in conjunction with TCEQ (TCEQ, 2016h). The components of existing Texas I/M programs include:

- Motorists must successfully pass both the emissions and safety portions of the inspection prior to receiving a vehicle inspection report, which will be used to obtain a vehicle registration sticker.
- Gasoline vehicles model-year 2 through 24 years old are inspected annually beginning with the vehicle's second anniversary.

- Remote sensing element randomly inspects vehicles emissions on highways.
- All inspections are collected at a central database.
- Recognized Emission Repair Facilities ensure quality repair of vehicles.
- Waivers and time extensions are available for eligible vehicle owners.

The SIP must be revised to include the implementation of a basic I/M program, and the revisions must be reviewed, approved, and overseen by EPA. The I/M program is required to gather test data on individual vehicle tests (including tracking Vehicle Identification Numbers or VINs) as well as quality control data on testing equipment. The I/M program is also required to report I/M program results related to test data, quality assurance, quality control and enforcement.

2.7. Attainment Demonstration

Areas that are classified as Moderate nonattainment or higher with respect to ozone require a demonstration that the area will be able to achieve attainment by the attainment date. The demonstration is accomplished by computer simulations of ozone levels during the last complete ozone season prior to the attainment date. The demonstration also must include evidence that the state has implemented reasonably available control measures (RACM) necessary to advance attainment as well as any additional measures that would be implemented if attainment was not achieved by the established date. Basic ideas of RACM include the following types of criteria for control measures:

- Technologically feasible;
- Economically feasible;
- Does not cause "substantial widespread and long-term adverse impacts;
- Is not "absurd, unenforceable, or impractical;" and
- Can advance the attainment date by at least one year

As with other measures to improve regional air quality, the SIP is revised to include the RACM used to demonstrate attainment, and submitted for review and approval by EPA. The SIP

revision is due within 36 months of an initial nonattainment designation for newly designated Moderate ozone nonattainment areas.

2.8. Anti-Backsliding Requirements

When an area is designated as nonattainment with respect to NAAQS, existing rules, controls, and practices that are incorporated into the approved SIP revisions for that area cannot be relaxed, regardless of changes to the NAAQS, until the air quality improves to restore attainment status for the region. Requirements known as anti-backsliding requirements are imposed to ensure air quality in nonattainment areas will not worsen. EPA is prohibited by the Clean Air Act from approving a revision to the SIP that proposes actions that would interfere with progress towards attainment, and once an attainment designation is achieved, the state must be able to demonstrate that removal of existing controls in the SIP will not degrade or limit the ability to maintain compliance with the standards. Because the San Antonio region has not previously been designated as nonattainment with respect to previous ozone standards, the anti-backsliding requirements would not apply. If more restrictive ozone standards are to be enacted in the future, however, anti-backsliding provisions would require the region to continue to adhere to requirements established in approved SIP revisions based on the 2015 ozone standard (EPA, 2015a).

2.9. Sanctions

Under rare circumstances, Section 179 of the Clean Air Act provides for the EPA to impose automatic sanctions if it makes one of the following findings:

- The state failed to submit a required SIP or revision for the area;
- EPA disapproves of a required SIP or one or more elements of a SIP revision for the area
- One or more elements of the SIP is not being implemented within the area

Sanctions must be applied unless the deficiency is corrected within 18 months after the finding or disapproval. Sanctions are generally of two types (1) offset sanctions and (2) highway

sanctions, and are used to induce states to comply with the requirements to develop strategies that will bring the area into attainment. The first sanction to be imposed is an offset requirement where new or expanded stationary sources must reduce emissions by 2 tons for every 1 ton of emission growth. These types of offsets can be expensive and difficult to obtain. Availability is driven by supply and demand, however, and offsets can be more easily obtained depending on the specific area and circumstances. If the deficiency is not corrected within 6 months of imposition of the offset sanction, highway sanctions may be imposed. Highway sanctions prohibit federal funding for transportation projects within the sanctioned area, including activities (FHWA, 2016) such as:

- The addition of general purpose through lanes to existing roads
- New highway facilities on new locations
- New interchanges on existing highways
- Improvements to, or reconfiguration of existing interchanges
- Additions of new access points to the existing road network
- Increasing functional capacity of the facility
- Relocating existing highway facilities
- Repaving or resurfacing except for safety purposes
- Project development activities, including NEPA documentation and preliminary engineering, right-of-way purchase, equipment purchase, and construction solely for non-exempt projects
- Transportation enhancement activities associated with the rehabilitation and operation of historic transportation buildings, structures, or facilities not categorically exempted.

Certain highway projects related to safety, air quality improvement (that do not encourage single-occupancy vehicle travel), and congressionally authorized projects are exempt from sanctions, but in general the FHWA cannot approve or award any funds in a sanctioned area, and highway sanctions can have significant impacts on transportation planning for the area.

2.10. Other Requirements

As described previously, it is assumed in this report that the San Antonio region would be designated as either Marginal or Moderate nonattainment with respect to ozone. Under the Clean Air Act, EPA has other statutory and regulatory requirements related to Serious, Severe, and Extreme nonattainment classification status, but these additional requirements are not described in this report.

3. General Overview of Economic Methodologies

3.1. Measuring Impacts on Gross Regional Product and Other Impacts

Many of the economic impacts provided in this report are presented in terms of the effects on gross regional product in the area. The impacts on potential lost businesses also include impacts on employment (measured as full-time equivalent positions), income (including benefits), and output. These economic impacts were calculated using the IMPLAN input-output model for each of the counties within the San Antonio-New Braunfels metropolitan area and the entire metropolitan area. Wassily Leontief introduced input-output analysis for which he later received the Nobel Prize in economics in 1973.[1] An input-output model describes the economic interactions or trade flows among businesses, households, and governments and shows how changes in one area of the economy impact other areas. The multipliers that result from these models are the expressions of these interactions. The input-output model provides a more complete picture of the economic impacts beyond direct spending since it also captures the multiplier effects and leakages that might occur as this economic activity reverberates through the local economy.

For instance, if being designated nonattainment creates a reduction in economic activity through a delay in a company's expansion or loss of a business in the area, the direct loss of this economic activity will then reverberate beyond this direct effect, as the firm will not be buying

[1] For an example of his seminal work, see: Leontief, Wassily et al., *Studies in the Structure of the American Economy: Theoretical and Empirical Explorations in Input-Output Analysis,* New York: Oxford University Press, 1953.

materials and other inputs from its suppliers or paying workers who then spend their incomes in the local economy.

As just alluded to, this also generates additional economic activity often referred to as the multiplier effects. The multiplier effects can be separated into two effects: the indirect effect and the induced effect. The indirect effect results from the company purchasing inputs (physical goods or services) from its local suppliers. Of course, this then sets off additional spending by the supplier in its purchases of inputs and payment of salaries and benefits to its employees. The induced effect is derived from the spending of the employees of the company resulting from the incomes they receive.

Of course, not all of this economic activity is captured within the local economy. There are leakages as businesses and individual consumers purchase goods and services outside of the local economy causing some money to leak or flow out of the local economy. This is also the case as federal and state taxes and fees are paid resulting from these activities. These leakages are accounted for in the model and are not counted as part of the economic impacts.

The IMPLAN input-output model is based off data specific to the region, much of it provided by federal government data collection agencies (IMPLAN 2015). The IMPLAN model measures the interactions across 536 industries. Input-output analysis provides snapshot of the economy at a point in time (2015 in the case of the model used for this study. It is also assumed in input-output models that demand equals supply, and as such, the multipliers that are calculated in the model to measure the indirect and induced changes that occur in a regional economy given an initial, direct change in the economy, reflect the structure of the economy at that point in time. This means that projections of future economic impacts based on input-output models assume the structure of the economy (i.e., the flows across industries) remains the same.

3.2. General Assumptions

In order to conduct the economic analysis, it is necessary to make several assumptions about future economic conditions and scenarios. This section outlines some of the general assumptions

used in the analysis. Many of the assumptions will be discussed within the context of the description of the methodology used in the various components of the analysis later in the paper.

- Marginal nonattainment is assumed to be for a 27-year period, and moderate nonattainment is assumed to be for a 30-year period.
- Growth in gross domestic product was assumed to be 3.1%, which is equivalent to the average growth rate in the metropolitan area from 2001 through 2015.
- In order to allocate the costs across each of the counties, the proportion of the population in each county relative to the total population in the metropolitan area was used.
- All dollar values are in 2016 dollars.
- Transportation analysis is based on the Alamo Area Metropolitan Planning Organization definitions.
- In order to allocate the costs across the counties, in many instances this was done based on the proportion of the population in the country relative to the total metropolitan area population. These proportions are provided in the following table.

Table 3.1. County Population as Proportion of MSA Population in 2015

Atascosa	2.1%
Bandera	0.9%
Bexar	79.8%
Comal	5.1%
Guadalupe	6.3%
Kendall	1.6%
Medina	2.1%
Wilson	2.0%

4. Analysis of Potential Economic Costs of a Nonattainment Designation

4.1. Impacts on Expansion/Relocation of Companies

4.1.1. Cost of Permitting

Facilities that are seeking to expand or locate a new operation in the region may be required to conduct an environmental analysis under a new point source review. In our discussions with organizations within the region about the potential cost of conducting a conformity analysis, they project the cost to be somewhere in the range of $100,000 to $250,000. This also fits with costs in other regions (TCEQ 2016h).

In trying to calculate the total cost for these organizations across each county over the time period of the analysis, it is necessary to project the number of permits that will be filed in the future. The basis for the projections in the analysis is the historical permits filed with TCEQ. Specifically, data on the permits filed with TCEQ were downloaded from the TCEQ website. The construction permits that TCEQ received since 2000 were pulled from the database and each permit was designated by the industry of the organization filing the permit. The industries were mostly defined by two-digit NAICS codes and included manufacturing; utilities; mining, quarry, and oil and gas; and crematories (this was defined as NAICS code 812210). The average number of permits per year was calculated and the average for each county was used to project the total number of permits under marginal and moderate nonattainment, which were rounded to the nearest whole number. The total number of permits was then multiplied by the estimated cost of $100,000 and $250,000 to provide a range of the potential total costs. The total costs by county are shown in the following table. Across the metropolitan area, it is projected that total costs will range from $24.2 million to $60.5 million under marginal nonattainment and from $26.9 million to $67.3 million under moderate nonattainment (Table 4.1).

Table 4.1. Total Cost of Permitting by County

	Marginal		Moderate	
County	*Low Estimate*	*High Estimate*	*Low Estimate*	*High Estimate*
Atascosa	$1,500,000	$3,750,000	$1,700,000	$4,250,000
Bandera	$200,000	$500,000	$200,000	$500,000
Bexar	$12,700,000	$31,750,000	$14,100,000	$35,250,000
Comal	$2,500,000	$6,250,000	$2,800,000	$7,000,000
Guadalupe	$2,900,000	$7,250,000	$3,200,000	$8,000,000
Kendall	$200,000	$500,000	$200,000	$500,000
Medina	$3,000,000	$7,500,000	$3,400,000	$8,500,000
Wilson	$1,200,000	$3,000,000	$1,300,000	$3,250,000
MSA	$24,200,000	$60,500,000	$26,900,000	$67,250,000

4.1.2. Costs Associated with Construction Project Delays

A related cost to the permitting process that accompanies the nonattainment designation is the cost of a project being delayed. In other words, if a company wants to expand or locate a facility in an area designated as being in nonattainment, the permitting process through TCEQ could take up to a year if the operations at the facility will be a new source of emissions. For example, a typical standard permit without public notice or a permit by rule will typically take up to 45 days to be issued while a new source review permit could take 285 to 365 days, depending on the type of permit (TCEQ Fact Sheet – Air Permitting, 2). This delay means a lost year of economic activity. While such a delay could result in a lost expansion or location of a new firm to an area, information obtained from discussions with various organizations indicates that this is not likely to be a regular occurrence, at least with larger firms, so this analysis focuses on the cost of the delayed projects.

In order to project the number of new projects that may arise over the time period of this study, the same data on number of permits by industry were used to project the costs of project delays due to permitting. The proportion of permits by industry relative to the total number of permits was calculated and used to proportion the number of future permits by industry by multiplying the proportion for each industry in each county by the total number of permits forecast for each county. This assumes the distribution of permits by industry in each county stays the same over the entire time period. The gross regional product was calculated based on the average size of a

firm in each industry in each county as described in the sections on industry impacts. This assumes that the potential delayed project is the size of the average firm in each county. Such an assumption is probably not too unreasonable because a delayed project could mean the location of a new firm. Additionally, the average numbers used to calculate these impacts on GRP are small relative to the larger firms, which may be engaged in many of these expansions, so using an average firm size may accurately represent such an expansion by a larger firm. It is also possible that the scale of the expansion or new firm could be smaller than is represented by the average, but it is also likely that such a project could be larger. The number of permits for each industry in each county was multiplied by the GRP to get an estimate of the cost of such an expansion. It is also assumed that these costs just occur for one-year, based on information obtained from local businesses. In other words, it is assumed that there is a one-year delay in the project, but the expansion then occurs or the new firm does locate into the region and begins operations after the delay.

The results of the analysis are provided in Table 4.2. Bexar and Guadalupe counties will see the largest impacts from the project delays. Across the entire metropolitan area, the project delays are projected to result in a loss of GRP of $1.4 billion under a marginal nonattainment designation and $1.6 billion under moderate nonattainment.

Table 4.2. Reductions in GRP due to Project Delays by County (2016 $)

County	*Marginal*	*Moderate*
Atascosa	$62,287,056	$69,207,840
Bandera	$267,538	$297,264
Bexar	$897,056,940	$996,729,934
Comal	$56,863,379	$63,181,532
Guadalupe	$348,509,375	$387,232,639
Kendall	$3,291,437	$3,657,152
Medina	$46,681,991	$51,868,879
Wilson	$11,107,787	$12,341,985
MSA	**$1,426,065,502**	**$1,584,517,224**

4.1.3. Potential Loss of a Company Expansion or Location

As previously discussed in the report, being designated as nonattainment will require many local firms that are a source of pollution to install new emissions control systems and engage in other activities to reduce their emissions. One example of the increase in potential costs for an industrial operation is that installing the emissions control systems required under nonattainment will cost about $1-$1.5 million plus an additional one to two staff and materials to maintain the system on an annual basis. Nonattainment will also increase the permitting costs from $30,000 under attainment to $100,000-$150,000 under nonattainment in large part to hire consultants to do additional modeling. This does not include additional staff time at the organization that will be required to work with the consultants and assemble the additional paperwork to file for the permit.[2] Additionally, the availability of offsets may also be a deterrent to firms looking to locate or expand in the region because if there are not any offsets for them to purchase, they will not be able to receive the permits necessary.

These additional costs could cause some companies to decide not to locate or expand in the region. We were able to obtain very little information about companies actually considering not expanding or locating in the region due to the potential of a nonattainment designation. In fact, based on conversations with many local economic development agencies, nonattainment does not appear to be much of an issue, especially for larger firms.

However, one local industrial firm did mention that it is a consideration in their decision to expand in the San Antonio area. The expansion under consideration would increase the productive capacity of the firm by about a third.[3] Using this information, the potential size of the expansion was run through the IMPLAN input-output model, and the annual economic impacts are provided in Table 4.3. Including multiplier effects, the annual impact on gross regional product in the region would be about $25.9 million.

[2] These estimates come from interviews with staff from local industrial firms.
[3] This information is based on a conversation with staff of the firm. They asked that identifying information about the firm be kept confidential.

Table 4.3. Annual Economic Impacts of Potential Lost Manufacturing Company Expansion (2016 $)

Impact Type	*Employment*	*Income*	*Gross Regional Product*	*Output*
Direct Effect	50	$5,327,302	$14,148,313	$33,942,127
Indirect Effect	75	$4,694,377	$7,401,584	$13,849,154
Induced Effect	57	$2,552,346	$4,367,348	$7,589,763
Total Effect	181	$12,574,025	$25,917,246	$55,381,044

While there is no other indication that a large manufacturing firm is considering not expanding or locating in the metropolitan area due to nonattainment, it is possible, and since the costs of such a loss to the economy could be quite substantial, the potential costs of losing a large manufacturing firm was estimated. A large manufacturing firm is assumed to be equivalent in size to the average of the top five largest manufacturing firms[4] in the region, as measured by employment. Such a firm would have employment of 1,070 jobs. If a firm of this size decided to leave the region or not locate in the region due to nonattainment, the annual impacts of such a decision on the regional economy are shown in Table 4.4. The overall annual impacts on gross regional product would amount to about $925.4 million.

Table 4.4. Average Annual Impacts on San Antonio MSA of Large Manufacturing Firms (2016 $)

Impact Type	*Employment*	*Income*	*Gross Regional Product*	*Output*
Direct Effect	1,070	$97,385,518	$576,872,351	$1,646,514,928
Indirect Effect	2,028	$141,808,698	$227,746,573	$401,559,908
Induced Effect	1,618	$70,480,863	$120,826,425	$213,324,511
Total Effect	4,717	$309,675,079	$925,445,349	$2,261,399,347

In order to estimate the range of potential cumulative costs due to the loss of a company expansion or relocation, the potential for the loss of an expansion of a relatively small manufacturing firm, as shown in Table 4.7, was considered to be the low end of the range. This was used because it was the only indication we received that a firm's decisions might be affected by nonattainment. To get the high end of the range of costs, the potential loss of a large manufacturing firm (Table 4.8) was used. The cumulative economic costs over the 27-year and

[4] The top five firms were based on the data provided in the San Antonio Business Journal's *2016-2017 Book of Lists.*

30-year time periods for marginal and moderate nonattainment, respectively, are calculated. The IMPLAN input-output model provides the annual impacts in 2016 dollar values, so assuming similar impacts throughout the time period of the analysis, a simple multiplication by 27 and 30 was used to get the cumulative effects. These results are distributed across counties using the proportion of the population in the county relative to the total population in the MSA. It should be kept in mind that these figures are cumulative over the projected periods for marginal and moderate nonattainment. The employment is in terms of full-time employment (FTE) positions, so when multiplied by the number of years for each nonattainment designation, we have indicated it in terms of FTE person-years. These projections are provided in Tables 4.5 and 4.6.

Table 4.5. Cumulative Economic Impacts of Potential Lost Manufacturing Company Under Marginal Nonattainment by County (2016 $)

Low Estimate				
County	*Employment (FTE Person-Years)*	*Income*	*Gross Regional Product*	*Output*
Atascosa	103	$7,156,272	$14,750,318	$31,519,090
Bandera	45	$3,110,526	$6,411,334	$13,700,004
Bexar	3,903	$270,557,476	$557,665,875	$1,191,643,524
Comal	254	$17,624,151	$36,326,431	$77,623,822
Guadalupe	312	$21,616,379	$44,555,106	$95,207,194
Kendall	77	$5,329,608	$10,985,246	$23,473,727
Medina	104	$7,220,381	$14,882,457	$31,801,449
Wilson	99	$6,883,882	$14,188,875	$30,319,376
MSA	**4,898**	**$339,498,675**	**$699,765,642**	**$1,495,288,188**

High Estimate				
County	*Employment (FTE Person-Years)*	*Income*	*Gross Regional Product*	*Output*
Atascosa	2,684	$176,245,807	$526,699,995	$1,287,033,348
Bandera	1,167	$76,606,536	$228,934,026	$559,418,508
Bexar	101,489	$6,663,332,362	$19,912,968,003	$48,658,921,770
Comal	6,611	$434,050,380	$1,297,133,456	$3,169,648,812
Guadalupe	8,109	$532,371,608	$1,590,960,530	$3,887,638,647
Kendall	1,999	$131,258,421	$392,257,896	$958,513,381
Medina	2,708	$177,824,678	$531,418,356	$1,298,563,038
Wilson	2,582	$169,537,345	$506,652,159	$1,238,044,865

MSA	**127,350**	**$8,361,227,138**	**$24,987,024,423**	**$61,057,782,369**

Table 4.6. Cumulative Economic Impacts of Potential Lost Manufacturing Company Expansion Under Moderate Nonattainment by County (2016 $)

Low Estimate

County	*Employment (FTE Person-Years)*	*Income*	*Gross Regional Product*	*Output*
Atascosa	115	$7,951,414	$16,389,242	$35,021,212
Bandera	50	$3,456,140	$7,123,705	$15,222,227
Bexar	4,337	$300,619,417	$619,628,750	$1,324,048,360
Comal	283	$19,582,390	$40,362,701	$86,248,691
Guadalupe	347	$24,018,199	$49,505,673	$105,785,771
Kendall	85	$5,921,786	$12,205,828	$26,081,919
Medina	116	$8,022,645	$16,536,063	$35,334,944
Wilson	110	$7,648,758	$15,765,417	$33,688,196
MSA	**5,442**	**$377,220,750**	**$777,517,380**	**$1,661,431,320**

High Estimate

County	*Employment (FTE Person-Years)*	*Income*	*Gross Regional Product*	*Output*
Atascosa	2,983	$195,828,675	$585,222,217	$1,430,037,053
Bandera	1,296	$85,118,374	$254,371,140	$621,576,120
Bexar	112,766	$7,403,702,625	$22,125,520,004	$54,065,468,633
Comal	7,346	$482,278,201	$1,441,259,396	$3,521,832,014
Guadalupe	9,010	$591,524,008	$1,767,733,922	$4,319,598,496
Kendall	2,221	$145,842,690	$435,842,107	$1,065,014,868
Medina	3,009	$197,582,976	$590,464,840	$1,442,847,819
Wilson	2,869	$188,374,828	$562,946,844	$1,375,605,406
MSA	**141,500**	**$9,290,252,376**	**$27,763,360,470**	**$67,841,980,410**

The potential cumulative costs of a lost company expansion or location under marginal nonattainment are projected to be in the range of $699.8 million to $25.0 billion in lost GRP. Under moderate nonattainment, the costs are projected to range from $777.5 million to $27.8 billion.

Other industries like the utilities; transportation and warehousing; and mining and oil and gas production industries may also have to consider the costs of having operations in an area designated in nonattainment. While data are not available on the largest firms in these other industries that would allow a similar analysis as was conducted for manufacturing, the impacts of the average size of firms across these industries, as shown in Tables 4.3-4.6, is meant to provide some perspective on the potential costs of losing one of those firms due to the nonattainment designation.

The following methodology was used to calculate these estimated potential losses for each industry.

- Data was pulled on private sector average employment, number of establishments, and average annual pay for each industry by county in 2015 (the most current year available) from the Quarterly Census of Employment and Wages provided by the U.S. Bureau of Labor Statistics.
- Total wages per establishment for each industry across each county was calculated by multiplying the number of establishments by the average annual pay.
- The employment and total wages for each industry was run through the IMPLAN input-output model for each county. This provided the total economic impacts, including the indirect and induced multiplier effects for employment, income, gross regional product, and output shown in Tables 4.7–4.10.

Since the data used for this analysis only included private sector firms, the utilities industry does not include municipally owned utilities like CPS Energy and San Antonio Water System. However, public utilities are not likely to relocate due to nonattainment and are likely to make adjustments to serve the market even under a nonattainment designation. This is evidenced by the fact that these utilities have long been preparing to be able to serve the local market under a nonattainment designation.

Table 4.7. Annual Impacts of Potential Loss of Average Manufacturing Firm by County (2016 $)

Atascosa County				
Impact Type	*Employment*	*Income*	*Gross Regional Product*	*Output*
Direct Effect	16	$723,942	$735,861	$1,575,589
Indirect Effect	2	$78,286	$130,972	$272,207
Induced Effect	3	$86,123	$180,914	$339,484
Total Effect	21	$888,351	$1,047,747	$2,187,280

Bandera County				
Impact Type	*Employment*	*Income*	*Gross Regional Product*	*Output*
Direct Effect	3	$101,927	$116,405	$203,733
Indirect Effect	1	$13,470	$22,058	$68,368
Induced Effect	0	$8,338	$20,077	$42,119
Total Effect	4	$123,735	$158,541	$314,220

Bexar County				
Impact Type	*Employment*	*Income*	*Gross Regional Product*	*Output*
Direct Effect	34	$2,268,715	$3,368,672	$9,464,730
Indirect Effect	20	$1,138,576	$1,603,050	$2,821,950
Induced Effect	19	$869,596	$1,487,988	$2,585,817
Total Effect	73	$4,276,887	$6,459,710	$14,872,497

Comal County				
Impact Type	*Employment*	*Income*	*Gross Regional Product*	*Output*
Direct Effect	22	$1,139,913	$1,113,718	$2,219,362
Indirect Effect	4	$204,078	$314,800	$594,868
Induced Effect	7	$252,303	$467,171	$848,584
Total Effect	33	$1,596,295	$1,895,689	$3,662,814

Guadalupe County				
Impact Type	*Employment*	*Income*	*Gross Regional Product*	*Output*
Direct Effect	54	$13,536,515	$13,666,659	$14,777,108
Indirect Effect	5	$241,756	$366,421	$717,651
Induced Effect	36	$1,140,408	$2,720,343	$4,703,246
Total Effect	95	$14,918,679	$16,753,424	$20,198,005

Kendall County				
Impact Type	*Employment*	*Income*	*Gross Regional Product*	*Output*
Direct Effect	21	$1,585,017	$1,647,978	$2,249,540

Indirect Effect	2	$107,705	$168,338	$315,510
Induced Effect	5	$202,023	$405,434	$718,070
Total Effect	28	$1,894,744	$2,221,749	$3,283,120

Medina County				
Impact Type	*Employment*	*Income*	*Gross Regional Product*	*Output*
Direct Effect	7	$202,530	$208,104	$617,982
Indirect Effect	1	$32,075	$47,058	$98,082
Induced Effect	1	$21,704	$47,521	$90,022
Total Effect	9	$256,310	$302,683	$806,085

Wilson County				
Impact Type	*Employment*	*Income*	*Gross Regional Product*	*Output*
Direct Effect	12	$671,030	$696,492	$1,077,514
Indirect Effect	2	$30,396	$50,389	$177,018
Induced Effect	1	$45,661	$115,136	$203,913
Total Effect	15	$747,087	$862,017	$1,458,445

Table 4.8. Annual Impacts of Potential Loss of Average Transportation and Warehousing Firm (2016$)

Atascosa County				
Impact Type	*Employment*	*Income*	*Gross Regional Product*	*Output*
Direct Effect	12	$1,109,499	$1,192,037	$2,181,378
Indirect Effect	4	$155,725	$245,190	$502,864
Induced Effect	5	$135,108	$285,065	$533,986
Total Effect	21	$1,400,332	$1,722,292	$3,218,227

Bandera County				
Impact Type	*Employment*	*Income*	*Gross Regional Product*	*Output*
Direct Effect	6	$384,284	$403,820	$785,907
Indirect Effect	3	$81,089	$119,739	$283,884
Induced Effect	1	$33,878	$81,847	$171,357
Total Effect	10	$499,251	$605,406	$1,241,148

Bexar County				
Impact Type	*Employment*	*Income*	*Gross Regional Product*	*Output*
Direct Effect	24	$2,122,486	$2,344,966	$4,096,461
Indirect Effect	13	$772,398	$1,159,311	$2,013,498

Induced Effect	17	$747,411	$1,278,973	$2,222,250
Total Effect	54	$3,642,295	$4,783,251	$8,332,209

Comal County				
Impact Type	*Employment*	*Income*	*Gross Regional Product*	*Output*
Direct Effect	22	$1,364,580	$1,571,428	$3,925,650
Indirect Effect	9	$488,077	$730,270	$1,308,109
Induced Effect	9	$346,119	$641,888	$1,164,254
Total Effect	41	$2,198,776	$2,943,586	$6,398,013

Guadalupe County				
Impact Type	*Employment*	*Income*	*Gross Regional Product*	*Output*
Direct Effect	15	$666,597	$776,804	$2,241,143
Indirect Effect	4	$200,476	$294,880	$521,118
Induced Effect	2	$71,082	$167,801	$291,090
Total Effect	22	$938,156	$1,239,485	$3,053,351

Kendall County				
Impact Type	*Employment*	*Income*	*Gross Regional Product*	*Output*
Direct Effect	4	$163,162	$181,459	$500,616
Indirect Effect	1	$68,632	$99,282	$175,720
Induced Effect	1	$28,177	$56,380	$100,117
Total Effect	6	$259,971	$337,121	$776,453

Medina County				
Impact Type	*Employment*	*Income*	*Gross Regional Product*	*Output*
Direct Effect	8	$491,528	$544,770	$1,260,807
Indirect Effect	3	$121,072	$164,710	$431,973
Induced Effect	2	$56,839	$124,901	$236,267
Total Effect	13	$669,440	$834,381	$1,929,047

Wilson County				
Impact Type	*Employment*	*Income*	*Gross Regional Product*	*Output*
Direct Effect	5	$428,508	$460,300	$870,365
Indirect Effect	2	$53,371	$71,728	$157,140
Induced Effect	1	$31,550	$79,924	$141,327
Total Effect	8	$513,428	$611,952	$1,168,832

Table 4.9. Annual Impacts of Potential Loss of Average Mining, Quarrying, & Oil & Gas Production Firm (2016$)

Atascosa County				
Impact Type	*Employment*	*Income*	*Gross Regional Product*	*Output*
Direct Effect	36	$2,842,803	$3,983,055	$6,252,025
Indirect Effect	6	$166,908	$311,911	$738,273
Induced Effect	11	$322,890	$678,656	$1,273,213
Total Effect	53	$3,332,600	$4,973,622	$8,263,512

Bandera County				
Impact Type	*Employment*	*Income*	*Gross Regional Product*	*Output*
Direct Effect	1	$104,669	$127,133	$144,963
Indirect Effect	0	$5,001	$7,988	$25,492
Induced Effect	0	$7,949	$19,169	$40,178
Total Effect	2	$117,619	$154,289	$210,633

Bexar County				
Impact Type	*Employment*	*Income*	*Gross Regional Product*	*Output*
Direct Effect	19	$2,425,956	$2,866,597	$3,490,970
Indirect Effect	7	$359,896	$547,493	$1,032,332
Induced Effect	16	$710,915	$1,216,464	$2,113,967
Total Effect	42	$3,496,768	$4,630,555	$6,637,269

Comal County				
Impact Type	*Employment*	*Income*	*Gross Regional Product*	*Output*
Direct Effect	17	$1,577,809	$1,752,834	$1,756,522
Indirect Effect	4	$183,667	$284,700	$594,583
Induced Effect	9	$328,872	$610,031	$1,106,257
Total Effect	30	$2,090,349	$2,647,565	$3,457,362

Guadalupe County				
Impact Type	*Employment*	*Income*	*Gross Regional Product*	*Output*
Direct Effect	9	$821,400	$1,034,535	$1,296,432
Indirect Effect	1	$53,750	$86,982	$180,876
Induced Effect	2	$71,797	$169,624	$294,176
Total Effect	13	$946,948	$1,291,141	$1,771,485

Kendall County				
Impact Type	*Employment*	*Income*	*Gross Regional Product*	*Output*
Direct Effect	8	$1,386,475	$1,479,199	$1,083,625

Indirect Effect	2	$83,918	$117,044	$245,572
Induced Effect	5	$176,712	$354,238	$628,021
Total Effect	14	$1,647,106	$1,950,481	$1,957,219

Medina County				
Impact Type	*Employment*	*Income*	*Gross Regional Product*	*Output*
Direct Effect	18	$1,165,161	$1,676,056	$2,829,008
Indirect Effect	4	$140,098	$213,174	$557,333
Induced Effect	4	$120,818	$264,711	$501,325
Total Effect	26	$1,426,077	$2,153,942	$3,887,667

Wilson County				
Impact Type	*Employment*	*Income*	*Gross Regional Product*	*Output*
Direct Effect	11	$805,572	$1,059,271	$1,620,143
Indirect Effect	2	$42,308	$72,401	$200,050
Induced Effect	2	$55,273	$139,533	$247,025
Total Effect	14	$903,153	$1,271,205	$2,067,219

Table 4.10. Annual Impacts of Potential Loss of Average Utilities Firm (2016$)

Atascosa County				
Impact Type	*Employment*	*Income*	*Gross Regional Product*	*Output*
Direct Effect	32	$2,631,211	$13,640,975	$42,920,678
Indirect Effect	34	$2,998,793	$11,742,973	$30,833,702
Induced Effect	20	$604,538	$1,269,698	$2,382,752
Total Effect	87	$6,234,542	$26,653,646	$76,137,131

Bexar County				
Impact Type	*Employment*	*Income*	*Gross Regional Product*	*Output*
Direct Effect	18	$1,634,114	$9,529,940	$26,402,992
Indirect Effect	23	$2,487,083	$5,550,251	$11,130,142
Induced Effect	24	$1,064,424	$1,821,451	$3,164,803
Total Effect	65	$5,185,620	$16,901,641	$40,697,937

Guadalupe County				
Impact Type	*Employment*	*Income*	*Gross Regional Product*	*Output*
Direct Effect	30	$2,235,845	$12,897,944	$40,686,729
Indirect Effect	24	$2,630,552	$9,533,205	$24,004,586
Induced Effect	13	$399,049	$942,289	$1,634,469

Total Effect	66	$5,265,446	$23,373,439	$66,325,784

Kendall County				
Impact Type	*Employment*	*Income*	*Gross Regional Product*	*Output*
Direct Effect	6	$320,731	$1,959,311	$7,441,253
Indirect Effect	4	$441,443	$1,294,921	$2,511,676
Induced Effect	2	$92,891	$185,791	$330,041
Total Effect	13	$855,065	$3,440,023	$10,282,970

Wilson County				
Impact Type	*Employment*	*Income*	*Gross Regional Product*	*Output*
Direct Effect	6	$245,341	$1,892,700	$7,446,093
Indirect Effect	4	$341,457	$1,006,772	$2,103,973
Induced Effect	1	$38,047	$95,631	$169,555
Total Effect	11	$624,845	$2,995,103	$9,719,621

NOTE: Only those counties for which data were available are reported.

As previously mentioned, it should be kept in mind that based on information obtained during discussions with various business and economic development organizations, most large organizations are prepared for the nonattainment designation or will be able to absorb the additional costs.

4.1.4. Impact on Small Businesses in the Metropolitan Area

The majority of this report emphasizes the impact of nonattainment on big business but the area consists of many small businesses run by families and individuals. These will also be subject to nonattainment regulation beginning in 2018. As part of this study, a survey instrument was made available to the small business community during December 2016, with the assistance of both the Greater San Antonio Chamber of Commerce and the Hispanic Chamber of Commerce. Unfortunately, a limited number of responses meant a reliable statistical analysis was impossible. Conversations with representatives from these and other business entities suggest that area small businesses may not be wholly aware of the significance of nonattainment and will be caught off guard when these regulations go into effect. According to the U.S. Census Bureau, "small

businesses with less than 100 employees represent 97% of all employer firms in Texas as well as in the metro area of San Antonio" (Halebic and Nivin 2012, 5).

The U.S. Small Business Administration (SBA), Office of Advocacy notes that under the Regulatory Flexibility Act, the EPA is required to convene an SBA Review Panel to assess the impact of regulations on small businesses. This has not happened in part due to "the tailoring rule", which the EPA has interpreted as having a limiting effect on environmental regulations, meaning the EPA assumes that this "rule" will limit the impact of regulation on small businesses. There is debate between the Office of Advocacy and the EPA on this requirement of environmental law, and the Office of Advocacy has emphasized that small businesses such as small brick manufacturers, small foundries and small pulp and paper mills will be subject to regulation. In fact, the Office of Advocacy writes in a letter to the EPA that:

> "[Research] shows how the smallest businesses bear a 45 percent greater burden than their larger competitors. The annual cost per employee for firms with fewer than 20 employees is $7,747 to comply with all regulations. … When it comes to compliance with environmental requirements, small firms with fewer than 20 employees spend four times more, on a per-employee basis, than do businesses with more than 500 employees."
>
> (Thomas M. Sullivan, letter to EPA Administrator Stephen Johnson, Small Business Administration, July, 8, 2008, pp. 5–6.)

Without more input from area small businesses, the true economic costs of nonattainment remain incomplete. One solution would be for local officials to find additional ways to inform and educate the small business community and solicit additional information on employment and operational costs in order to better ascertain the full economic impact of nonattainment on smaller businesses.[5]

[5] A survey of small businesses was attempted, but due to the low response rate, statistically valid results were not obtained.

4.1.5. Costs of NO_x Reduction at Cement Kilns

According to a representative at Zephyr Environmental Corporation who works with several cement producers in the MSA, "… all kilns in the San Antonio and surrounding areas are dry kilns and already have (or will have in case of newly constructed kilns) selective non-catalytic reduction (SNCR) NO_x control systems. The impact of non-attainment would be that these systems would be used more frequently, increasing operating costs" (A. de la Garza, personal communication, January 25, 2017). Under nonattainment, kilns have to operate at 1.5 lbs. of NO_x per ton of clinker. There are two kilns each in Bexar and Comal County that are currently operating above that limit. To estimate the costs of getting below this standard, it was assumed that a selective catalytic reduction (SCR) control system will be installed. According to PCA, it costs $14-$20 million to install such a system on a dry kiln and $3.4 million annually to operate (PCA 2015, 5). Using the $14 million for the low estimate of potential costs and $20 million for the high estimate of costs and the same annual operating costs of $3.4 million in both the low and high estimates, the potential costs of to the kilns of reducing their NO_x was calculated with the projections shown in Table 4.11.

Table 4.11. Potential Costs of Point Source NO_x Reduction by County (2016 $)

	Marginal		**Moderate**	
County	*Low Estimate*	*High Estimate*	*Low Estimate*	*High Estimate*
Atascosa	-	-	-	-
Bandera	-	-	-	-
Bexar	$211,600,000	$223,600,000	$232,000,000	$244,000,000
Comal	$211,600,000	$223,600,000	$232,000,000	$244,000,000
Guadalupe	-	-	-	-
Kendall	-	-	-	-
Medina	-	-	-	-
Wilson	-	-	-	-
Total	**$423,200,000**	**$447,200,000**	**$464,000,000**	**$488,000,000**

4.2. Transportation Conformity Costs

4.2.1. Costs of Performing Transportation Conformity Analysis

The economic costs of nonattainment with respect to transportation conformity in the San Antonio-New Braunfels MSA (SA-NB MSA) center on issues of urban mobility. By this we mean the fluidity with which traffic moves through the MSA. Issues such as long queues of cars and trucks due to congestion contribute to ozone because of idling. The AAMPO estimates that mobile sources are the largest source of NO_x and second largest source of VOCs (see AAMPO Air Quality and Transportation, 2016). AAMPO also notes in its transportation conformity activities that the Clean Air Act of 1977 requires that areas designated in nonattainment must meet certain requirements in order to utilize Federal funds for transportation projects. Specifically, "… regional authorities must demonstrate that transportation improvement projects will improve air quality and public health." (See http://sametroplan.org/AirQuality/)." We assume that the additional cost of completing environmental assessments could range somewhere between $100,000 and $250,000 per project (CAPCOG, 71). This number is based on data contained the Capital Area Council of Government's (CAPCOG) economic impact study (2015). We do not include the construction costs of each project because they form part of the ongoing development of the San Antonio-New Braunfels MSA and would be undertaken as the area and state grow irrespective of nonattainment. Nevertheless, the technical aspects of these activities are guided by predetermined regulations. For example, regional emissions are estimated based on projected travel on existing and planned highway and public transportation facilities consistent with an area's metropolitan transportation plan and TIP. Projected emissions must be based on the latest available information and the latest EPA-approved emissions estimation models. Our economic cost estimates assume that once designated in nonattainment, the SA-NB MSA will not move to undo measures taken despite possible future improvements in the nonattainment designation. In other words, our estimates assume that public policy will hold constant.

A lapse in conformity to the federal regulations would mean a possible loss of federal funds although in the CAPCOG report, is was noted that TxDOT would most likely shift funds

between projects in order to prevent work stoppages. Conversations with local participants of AAMPO suggest that steps to avoid such scenarios as loss of funds have already been included in planning documents. Nevertheless, using data contained in the CAPCOG report, we assume that the SA-NB MSA costs would be similar, that is, anywhere between $1.1 and $1.5 million per year of delay (73). Using a simple calculation of cost divided by 365, we find that delays might cost between $3,000 and $4,000 per day. Clearly, construction projects are not 24/7; therefore, we can assume that the daily cost would be higher when holidays and inclement weather are factored in. This figure does not include costs associated with changing the original construction plans, which according to TTI could range between $96,000 and $450,000 depending on the size of the overall construction project per month. Should the delays extend for a year, then the math is quite straight forward: $96,000 x 12 months = $1,152,000 and $450,000 x 12 = $5,400,000 in costs due to delays (See TTI https://tti.tamu.edu/conferences/tsc11/program/presentations/construction-2/ellis.pdf).

4.2.2. Congestion Mitigation

SATomorrow reports that a survey of San Antonians reveals most MSA drivers (90%) prefer to drive alone. This means that the growing pains of the city will be increasingly felt as congestion grows. If the TTI annual reports on the most congested cities are any gauge of this process, then San Antonio is moving up the ranks of most congested cities from 29th place in 2011 to 24th in 2015. As the report points out, congestion does not grow in step with population growth, meaning if population annual growth rates are 2-3%, the growth rate of congestion in the urban areas exceeds 2-3%. A simple example comparing San Antonio in 2010 versus where it might be in 2020 shows that the distance travelled in 20 minutes is much shorter than what it will be in 2020 (SA Tomorrow 6).

The options available to the MSA for addressing congestion issues under transportation conformity include: transportation control measures such as ride-sharing, bicycling programs and other programs that encourage lower vehicle use as well as programs to improve transit such as High Occupancy Vehicle (HOV) lanes and increasing the number of lanes through designated sections of the region's road network. Finally, it is important to note that we do not address the

possibility of market-based solutions in this document such as peak-hour tolls or fees for traffic on a major transportation artery. These are policy alternatives not highlighted in the original request for this study.

On-road mobility. According to the *Urban Mobility Report*, the average citizen in San Antonio spends more than 38 hours in traffic each year, an increase of 58% over the past decade (Texas Transportation Institute (TTI), 2014). The *Mobility Investment Priorities* report produced by TTI contains information on the high priority roads and improvement plans that will help address congestion and in turn emissions and ozone in Bexar County. Several major road works under consideration include:

- Plans to add lanes along I-35 North of 1604 in Bexar County at a construction cost of $2 billion to add 6- or 8-lanes to a create 12- or 14-lane expressway with a toll
- Plans to expand 1604 to I-10 with a construction cost of $300 - $400 million
- Highway US 281 to I-37 in Bexar County with a construction cost of $335 million
- Highway US 281 to Comal County Line with a construction cost of $521 million

These capacity improvement projects should enhance the flow of traffic through the region. As noted above, a requirement of nonattainment would be that AAMPO (or the implementing agency) model environmental impacts to demonstrate that environmental quality will not be degraded.[6] One such example is the environmental assessment completed for work on 1604 from Potranco Road to FM 471 in western Bexar County ("Final Environmental Assessment Loop 1604 from Road to FM 471 Bexar County, Texas" CSJ# 2452-01-056, May 2016). In this study, the assessment considered a No Build versus Build scenario for the purposes of the impact study. What is important about the nonattainment status is the requirement that planning organizations include environmental analysis for those projects that will use federal funding. Comments from local planning officials indicate that impact assessments are the responsibility of the implementing agency and might not be included in the local planning organization's cost

[6] See http://sametroplan.org/AirQuality/conformity-docs/Regionally%20Significant%20Roadways%2008%2022%202016.pdf

considerations. Furthermore, these officials indicate a marginal or moderate designation might require a re-ordering of projects but no significant change to publicly available plans.[7]

Construction. An example of how a roadway construction project factors into the question of ozone is as follows: According to surveys implemented by interested parties, travel times from Bulverde Road in Bexar County to the 1604 interchange prior to a lane expansion and interchange improvement project averaged approximately 23 minutes but after construction resulted in a decrease in travel time to 18 minutes. During peak travel times – the school year and between the 8 am to 5 pm business day − this stretch of roadway might see between 60,000 and 80,000 vehicles per day. At a mean hourly wage of $19.59, as estimated in the VIA Travel Model Improvement Report, the travel time cost was approximately $7.50 per vehicle for this stretch of road and $450,000 to $600,000 for the 23 minutes each car spent on the 6.2-mile journey. When the project was completed and the travel time was reduced to 18 minutes, using the same wage assumption and same number of cars travelling, the costs fell to $5.88 per vehicle or $352,620 to $470,160 total, or a net savings of between $97,380 to $128,840 overall. For the 6.2 miles of this journey, the cost without the transit improvements would be approximately $3.16 per mile/vehicle. Stated another way, the number of dollars lost to the driver of each vehicle could be $3.16 per mile, dollars that might be spent elsewhere. In other words, the cost of not addressing the congestion in this stretch of road in northern Bexar County could be re-interpreted as a cost of nonattainment in that congestion is a contributing factor to the accumulation of criteria pollutants such as nitrogen oxide that combine with other environmental factors to create ozone. The 5-minute time savings resulting from adding capacity between Bulverde Road and the 1604 interchange resulted in additional time for other activities for the drivers involved.

[7]In fact, Transformation Conformity rules include Air Quality See http://sametroplan.org/AirQuality/) andhttp://sametroplan.org/AirQuality/conformity-docs/AIR%20QUALITY%20AND%20TRANSPORTATION%20CONFORMITY%20April%202016.pdf

Table 4.12. Examples of Costs Associated with Road Construction Projects

Project	Miles of Road	Daily vehicles	Travel time (minutes)	Wage Per Minute ($)	Cost of Time ($)	90% of Vehicles	Daily Cost All Vehicles ($)	Peak Cost/year ($)
US 281 South of Loop 1604	7.4	130,000	25	0.33	8.16	117,000	955,012.50	171,902,250.00
US 281 from Loop 1604 to Comal	7.3	130,000	25	0.33	8.16	117,000	955,012.50	171,902,250.00
Schertz to Loop 1604	2.1	235,000	25	0.33	8.16	211,500	1,726,368.75	310,746,375.00
Downtown I10-I35 Connect	4.2	167,000	25	0.33	8.16	150,300	1,226,823.75	220,828,275.00
Total	**13.6**	**662,000**	**100**	**0.33**	**32.65**	**595,800**	**19,452,870.00**	**875,379,150.00**

Source: For road length and vehicle miles see Mobility Report at TTI. Available at https://mobility.tamu.edu/mip/strategies-pdfs/added-capacity/technical-summary/adding-new-lanes-or-roads-4-pg.pdf . Travel is estimated based on example of 281. Number of single passenger vehicles is based on MPO survey as is hourly wage of $19.59. Daily cost is cost of time multiplied by 91% of vehicles. Peak Cost per year is Daily Cost x 5 days per week x 4 weeks per month x 9 months. Assumptions are based on example of 281.

Table 4.13. Costs if Vehicles travelled at normal speed 60 miles per hour

Project	Miles of Road	Daily vehicles	Travel time (minutes)	Wage Per Minute ($)	Cost of Time ($)	90% of vehicles	Daily Cost All Vehicles ($)	Peak Cost/year ($)
US 281 South of Loop 1604	7.4	130,000	7.4	0.33	2.42	117,000	282,683.70	50,883,066.00
US 281 from Loop 1604 to Comal	7.3	130,000	7.3	0.33	2.38	117,000	278,863.65	50,195,457.00

Schertz to Loop 1604	2.1	235,000	2.1	0.33	0.69	211,500	145,014.98	26,102,695.50
Downtown I10-I35 Connect	4.2	167,000	4.2	0.33	1.37	150,300	206,106.39	37,099,150.20
Total	**13.6**	**662,000**	**21**	**0.33**	**6.86**	**595,800**	**4,085,102.70**	**164,280,368.70**

Source: Previous table with stated adjustments

Table 4.14. Comparison with and without congestion

Project	Miles of Road	Daily vehicles	Travel time (minutes)	Wage Per Minute ($)	Cost of Time ($)	90% of Vehicles	Daily Cost All Vehicles ($)	Peak Cost/year ($)
Total w/ congestion	13.6	662,000	100	0.33	**32.65**	595,800	19,669,013.00	**885,105,585.00**
Total w/o congestion	13.6	662,000	21	0.33	**6.86**	595,800	4,130,492.73	**166,105,706.13**
Difference (savings/cost)			**79**		**25.79**		**15,538,520.27**	**718,999,878.87**

Table 4.12 shows four specific segments of road improvement projects identified by TTI as important for the overall flow of traffic in and around the SA-NB MSA. Together, the four projects represent 13.6 miles of roadway carrying over 660,000 vehicles during peak hours. We have estimated the travel time through each segment as 25 minutes based on our previous example of Bulverde to 1604, leading to a total 100 minutes in travel time for these segments. As the table shows, we have also estimated the wage per minute of travel and further estimated that 90% of the vehicles will have one passenger (SA Tomorrow 6). Under these conditions during the peak hours – the school year week days between 8:00 am and 5:00 pm – we can begin to see that a significant economic cost emerges in the form of lost wages or rather spending opportunities. The figures can be quite staggering when one considers the number of cars and the average value of time over the course of a school year. In short, any project that seeks to lessen

travel times through either increased speeds or fewer vehicles on the roads will lead to some economic benefit.

This type of analysis could be extended to the other transportation projects listed above. With an estimated average wage of $19.59 for the greater metropolitan area, any construction project that limits access to a lane or two will result in additional time spent in congestion. The example above from Bulverde Road to 1604 Interchange, a distance of 6.3 miles, tells us that the cost per mile is approximately $3.10 (with all assumptions remaining unchanged). When construction for improvements increases, some research suggests that delays due to restricting the number of lanes, slow-downs in speed can increase up to 40%, meaning that in the case of Bulverde Road, while construction was in process, the normal travel time increased to 32 minutes and a cost of $4.34 per mile/vehicle or $10.45 in time. The cost of nonattainment in these construction scenarios are complex because, on the one hand, there are the factors of lost time, productivity, and increasing congestion along with possible public health consequences (the latter not covered in this study) if the metropolitan area elects to maintain the status quo. On the other hand, implementing construction projects will create bottlenecks and additional congestion during the construction phase of each project. But these inconveniences will lead to medium- and longer-term benefits once the construction is completed as vehicles can transit through the area at a quicker pace, with less idling time and consequently fewer opportunities for ozone build up. Therefore, great care must be taken when attempting to estimate the impact of construction projects because for every economic cost there will be an economic benefit that arises that might offset the estimated costs. As the environmental impact assessment for Potranco to FM 471 notes, increased speeds through a once congested stretch of roadway offset emissions due to congestion. In fact, according to the EPA MOVES model, emissions of all mobile source air toxic emissions (MSAT) fall when speed increases (Potranco, 12).

Emission reductions. The Potranco to FM 471 study allows for further development of the economic costs of nonattainment. As AAMPO continues down the path of implementation, the environmental assessments of key roadway projects will include estimates of emission reduction. In the Potranco case, the estimate was a 72 percent decline in MSAT (or a decline of nearly 60 tons of emissions) to 2040. (Potranco 14). In a report to the U.S. Congress, the Office of

Management and Budget (OMB) (2013) estimated that for every $1 in reduced emissions from mobile sources, the public health, consumer savings, productivity and the environment received $9 in benefit - applies to the U.S. economy.[8] If we take this number and apply it to the San Antonio New Braunfels MSA, the 60-ton reduction does not lead to a direct correlation. However, the present cost of pollution is estimated at approximately $40 per ton, therefore 60 tons multiplied by 40 gives us an estimate of $2,400 worth of emission reductions. When multiplied by the OMB estimate then $2,400 x $9 gives us $21,600 benefit to the area. Here again, we see the cost of inaction, which would be a loss of $21,600 (See Technical Support Document, https://www.whitehouse.gov/sites/default/files/omb/assets/inforeg/technical-update-social-cost-of-carbon-for-regulator-impact-analysis.). In the next section, we elaborate on the issue of emissions reductions for individual vehicles since these are a significant factor in controlling ground-level ozone.

4.2.3. Costs due to Delays in Road Construction

It is possible that the four road construction projects listed in Table 4.16 could be delayed two to three years due to nonattainment as transportation conformity analyses are performed. These road expansions are expected to cost a total of $3,206,000,000 and take five to ten years complete. The delays in starting the construction will mean that the economic activity derived from the construction activity will also be delayed. The following methodology was used to calculate this delayed economic activity.

- It was assumed the projects will take ten years to complete, which will provide the most conservative estimates of annual spending activity. Under this assumption, the total cost of the projects of $3,206,000,000 was divided by ten to get the annual average amount of construction spending that will occur due to these projects.

[8] See https://www.whitehouse.gov/sites/default/files/omb/inforeg/2013_cb/2013_cost_benefit_report-updated.pdf.

- The construction spending was run through the IMPLAN input-output model for the San Antonio metropolitan area in order to get an estimate of the total impacts on gross regional product this economic activity will have on the regional economy.
  In order to separate out the cost of this delayed economic activity across each county, data were pulled on the private sector employment in the highway, street, and bridge construction industry (NAICS 2373) in each county from the Quarterly Census of Employment and Wages database. For most counties, the employment figures from 2015 were used, as they are the most currently available. However, in Guadalupe, Kendall, and Wilson counties, disclosure rules prevented reporting of the 2015 data, so the most current data reported were used, which was 2014 data for Guadalupe and Kendall Counties and 2012 data for Wilson County. The percentage of employment in this industry in each county relative to the total employment in the metropolitan was calculated and are provided in Table 4.15.
- The average annual GRP was multiplied by two and three to account for the different scenarios under which the delays might occur.
- The GRP was then allocated across the counties according to the proportions given in Table 4.16 to give a cost of the delayed construction in each county.

Table 4.15. Proportion of Highway, Street, and Bridge Construction Employment Relative to Total Industry in MSA

County	*% of Employment*
Atascosa	0.00%
Bandera	0.00%
Bexar	80.37%
Comal	15.37%
Guadalupe	1.50%
Kendall	1.07%
Medina	0.00%
Wilson	1.70%

Table 4.16. Lost GRP due to Road Construction Delays by County (2016 $)

County	*Marginal*	*Moderate*
Atascosa	$0	$0
Bandera	$0	$0
Bexar	$458,580,755	$687,871,132
Comal	$87,677,985	$131,516,978
Guadalupe	$8,574,188	$12,861,282
Kendall	$6,084,907	$9,127,361
Medina	$0	$0
Wilson	$9,680,535	$14,520,802
MSA	**$570,598,370**	**$855,897,555**

4.3. General Conformity Costs

As is widely known, the military and various Department of Defense operations and activities are a very large part of the culture and economy of the San Antonio regional economy. It is the basis for the San Antonio being known as "Military City U.S.A." and the home of military medicine. In 2015, Joint Base San Antonio employed 87,384 military and civilian personnel throughout its various operations. Firms across a wide range of industries throughout the region also received $3.8 billion in contracts through the Department of Defense. The presence of the military bases and vast military medical facilities also attracts a large number of retirees from all branches of the military. There were 56,000 retirees located in the region in 2015 who received $2.4 billion in retirement payments. The combined impact of all of this activity amounts to an annual economic impact of $27.9 billion supporting 209 thousand jobs earning incomes of $12 billion.[9]

If the San Antonio region is deemed to be in nonattainment, the federal government operations in the region, including the military bases, will have to comply with the new regulations to reduce their emissions. These additional costs will put additional pressures on budgets already severely constrained by sequestration. While these additional budgetary pressures may not result in the loss of military missions already present within the area, it is possible that it could cause future

[9] Analysis conducted by Steve Nivin, Ph.D. for the City of San Antonio Office of Military Affairs.

military missions to locate somewhere outside the region. There is no way to know what these future missions might be, so it is impossible to reasonably forecast what the economic cost of losing one of these missions might be.[10]

4.4. Inspection and Repair Costs

Under a moderate nonattainment designation, vehicles that are two to twenty-four years old with light duty or medium duty engines will be required to get on-board diagnostics (OBD) emission inspections done each year. The inspection cost is established by the State of Texas and is currently set at a maximum of $11.50 in El Paso, Travis, and Williamson Counties and $18.50 in Dallas-Fort Worth and Houston. (TX DPS "Cost of Inspection").

These new inspection requirements will impose additional costs on vehicle owners residing within the region. In order to estimate the cost of these inspections, the following assumptions were made.

- Inspection fees will remain at $11.50 and $18.50 over the entire time period of the study (thirty years since these costs only apply under moderate nonattainment). The inspection fee will likely only be a maximum of $11.50 in the San Antonio area, but in order to provide a range of potential costs, the $18.50 fee applicable in the Dallas-Fort Worth and Houston areas was also calculated.
- It is likely that the more rural counties in the San Antonio metropolitan area will only be required to engage in the inspection program, so the costs of the inspections were only calculated for Bexar County.
- Since the eight counties of the San Antonio metropolitan area are linked economically, the overall impacts on gross regional product from the inspection fees were measured across the metropolitan area.

Data on the number of registered vehicles within each county from 2010 through 2015 was provided by the Texas Department of Transportation. An exponential smoothing model was used to project the number of vehicles in Bexar County for the thirty years covered in the analysis.

[10] These statements are based on communications with Joint Base San Antonio officials.

The inspection fees of $11.50 and $18.50 were multiplied by the projected number of vehicles, and the average annual inspection costs was calculated. This equates to average annual inspection fees in Bexar County of $21.8 million and $35.1 million with the $11.50 and $18.50 inspection fees, respectively.

With the assessment of the additional inspection fees, household spending in the region could be affected as disposable incomes decline, similar to a tax being imposed. The impacts of this potential decline in spending on the regional economy were also estimated. The eight counties of the region are considered to be part of the metropolitan area because they are connected economically. Specifically, the U.S. Office of Management and Budget defines the metropolitan areas "as representing larger regions that reflect broader social and economic interactions, such as wholesaling, commodity distribution, and weekend recreation activities..." (OMB Bulletin No. 15-01, 2). The effects of spending on the inspections is only counted in Bexar County since that is likely the only county where they will be assessed, but because of the economic ties among the eight counties within the San Antonio metropolitan region, it makes sense to focus on the impacts throughout the region instead of only measuring it for Bexar County.

Data on household expenditures in Bexar County for 2015 from ESRI were used to estimate the allocation of spending by households. The annual average amount of spending on the two inspection fees was assumed to reduce the amount of spending across each category based on the proportion of the budget spent on each category. This amount was subtracted from the expenditures to estimate the amount of reduced spending by category. This spending activity was run through the IMPLAN input-output model for the San Antonio metropolitan area, and the difference in the impacts on GRP under the different scenarios provided a measure of the reduction in GRP annually due to the assessment of fees. The GRP was projected over thirty years assuming the same average annual growth rate of 3.1%, which is equivalent to the growth in GRP in the San Antonio metropolitan area from 2001 through 2015.[11] The GRP for each year was multiplied by the proportionate reduction in GRP because of the reduced spending. The total reduction in GRP amounts to $3.4 billion under the inspection fee of $11.50 and $5.4 billion,

[11] U.S. Bureau of Economic Analysis Regional Economic Accounts: https://bea.gov/regional/index.htm

assuming an inspection fee of $18.50. The reduction in GRP that will occur in each county was estimated by multiplying the total reduction in GRP for the metropolitan area by the proportion of population in each county relative to the overall population in the metropolitan area. Table 4.17 shows the projected costs in terms of lost GRP in each county.

Table 4.17. Reductions in GRP due to Inspection Fees (2016 $)

	Inspection Fee per Vehicle	
County	$11.50	$18.50
Atascosa	$71,162,363	$114,478,571
Bandera	$30,931,244	$49,758,953
Bexar	$2,690,438,316	$4,328,095,972
Comal	$175,255,519	$281,932,763
Guadalupe	$214,954,454	$345,796,260
Kendall	$52,997,909	$85,257,498
Medina	$71,799,860	$115,504,110
Wilson	$68,453,702	$110,121,162
MSA	**$3,375,993,367**	**$5,430,945,289**

A portion of these vehicles will not pass the inspection and will require repairs. In the Houston-Galveston-Brazoria and Dallas-Fort Worth areas, 4.0% and 3.9% of the vehicles failed their initial inspections, respectively (ERG 2016, 22). These vehicles will require repairs that typically cost in the range of $200 to $300 per vehicle (ERG 2016b, 33). Assuming a 4.0% failure rate and an average repair of $250, the total costs in repairs in Bexar County is projected to be $656,254,648. However, the spending on repairs is a redistribution of spending from one activity to another, so it will not have a direct effect on GRP, so it is not counted in the overall projected reductions in GRP as was done with the inspection.

4.5. Commute Solutions Program

Commute Solutions is a program that is run by AACOG with the purpose of "educating people about the connection between air quality and transportation, informing them of what they could do differently to use less gas, and offering them viable alternatives to driving as a single occupant in a vehicle" (AACOG 2016, 55). Commute Solutions includes the following programs:

1) *NuRide Carpool Matching and Emissions Reduction Tracking System* – "NuRide is a free, online carpool matching system, contracted to operate in Greater San Antonio by AACOG, through which members who do not have carpool partners can search for them" (AACOG 2016, 60). By recording the trips they make by alternative means of transportation at Nuride.com, members can also receive rewards for their efforts (AACOG 2016, 60).

2) *CARE Program* – CARE is the Certified Auto Ride in case of Emergency program. Through this program, people who commute by alternative means may get up to four cab rides home reimbursed up to $50 per ride if they had to get the ride home to address an emergency situation.

3) *Ozone Action Day Alert Program* – Through this program, AACOG's Air Quality staff sends an email or text message to organizations, individuals, and media who have registered to receive messages about Ozone Action Days, including steps they can take to reduce the health risks and the ozone levels. The public education efforts also include providing materials to local television meteorologists about ozone season and Ozone Action Day Alert banners hung in 353 schools in the area. A series of graphics is also being developed to help educate the public about certain air quality concepts (AACOG 2016, 59-60).

4) *Employer / School Outreach* – The bulk of Commute Solutions' outreach efforts takes place through direct contact with area employers and schools, not only to educate and

inform them of AACOG's Commute Solutions programs, but also to inform employers of the federal commuter benefits of which they could be taking advantage. Commute Solutions staff is available to provide presentations and help establish commuting programs at businesses, agencies, schools, and other organizations.

5) *Fresh Air Friday* – While Commute Solutions staff often exhibit materials at area health, transportation, and environmental events, it also hosts its own informative ozone season kickoff event during March. Fresh Air Friday, which is held during the lunch hour on San Antonio's Main Plaza and is open to the public, encourages downtown employees to bring a brown bag or buy lunch from a nearby restaurant instead of driving out to get their lunches. The ultimate goal is to reduce the number of vehicle miles traveled during the mid-day, as modeling done by AACOG indicates that this will have the greatest impact on reducing ozone concentrations relative to trips in the early morning or evenings (AACOG 2016, 55).

6) Walk & Roll Challenge – This is a month-long contest where employees of participating organizations are encouraged to use alternative forms of transportation, such as walking, biking, carpooling, or busing or save trips by telecommuting or using compressed work schedules. Participating employees are eligible for special drawing prizes and the organizations whose employees record the most trips by these modes win the challenge (AACOG 2016, 57).

7) *Air Quality Stewardship Awards* – These annual awards are given to those organizations in the Greater San Antonio area "that have made significant voluntary efforts to reduce air pollution through commuter assistance programs, fleet management, energy efficiency, air quality education, and other means" (AACOG 2016, 58).

8) Media Interaction – Press releases, requests for coverage, and public service announcements are issued to various media outlets to help inform the public about the

air quality status and suggestions for best dealing with the current air quality (AACOG 2016, 60).

For purposes of estimating costs, the focus is on the expansion of employee and school outreach to promote transportation alternatives and inform administrators and employees throughout the eight-county metropolitan area of Commute Solutions' programs as well as other existing commuter benefits. More promotion and outreach of this program is expected to help address the nonattainment designation. In order to project the costs of the Commute Solutions across each county, the following methodology was used.

- The per capita cost of the Commute Solutions in the Houston area was calculated using the TxDOT source of funds for the air quality programs of the Houston-Galveston Area Council of $3,006,421 in 2016 (HGAC 2016, 63). The population of the area used was 6,674,880 in 2016.[12] This gives a per capita cost of $0.45.
- The per capita cost was multiplied by the population projections for each year across each county.[13]
- Since the Houston area is in moderate nonattainment, it was assumed that the costs under marginal nonattainment for the San Antonio area would be fifty percent of the full projected costs calculated. The full costs were used for the cost projections under moderate nonattainment.
- The current amount spent on the Commute Solutions programs in the San Antonio region was subtracted from the cost estimate each year in order to capture just the additional cost due to nonattainment.

The costs per county are shown in Table 4.18.

[12] Texas Demographic Center of the Texas State Demographer: http://osd.texas.gov/Data/TPEPP/Projections/
[13] ibid

Table 4.18. Total Cost of Commute Solutions by County (2016 $)

County	Marginal	Moderate
Atascosa	$315,132	$712,131
Bandera	$123,062	$273,972
Bexar	$11,649,010	$26,279,135
Comal	$792,257	$1,793,836
Guadalupe	$1,003,473	$2,282,960
Kendall	$235,893	$533,650
Medina	$311,687	$702,678
Wilson	$304,882	$688,616
MSA	**$14,735,398**	**$33,266,979**

4.6. Cost of Voluntary Control Measures

4.6.1. Cost of Texas Emissions Reduction Plan

Through the Texas Emissions Reduction Plan (TERP), communities can receive funding to pay for programs that will reduce emissions from transportation sources within the area. These programs include the Diesel Emissions Reduction Incentive Program (DERI), Texas Clean Fleet Program (TCFP), Texas Natural Gas Vehicle Grant Program (TNGVGP), and the Drayage Truck Incentive Program (DTIP).

Based on data provided by TCEQ, San Antonio received $68,061,268 in grants through the DERI program from 2001 through August 2015 and $2,703,326 from the TNGVGP program from 2012-2015. This equates to an average annual amount received of $4,537,418 and $193,095 from the DERI and TNGVGP programs, respectively (TCEQm 2016, 9 and 13). Assuming the community continues to participate in these programs and receives the same amount on average each year, the total cost under marginal nonattainment will amount to $127,723,840, and the total cost under moderate nonattainment will be $141,915,377.

In order to distribute these costs across each of the eight counties in the metropolitan area, it was assumed that the costs in each county will be proportionate to the population level in the county relative to the population in the metropolitan area. Since Bexar, Comal, Guadalupe, and Wilson Counties are already impacted by TERP, there will not be any additional costs in those counties due to nonattainment. The costs by county are shown in Table 4.19.

Table 4.19. Total Cost of TERP by County

County	Marginal	Moderate
Atascosa	$2,684,743	$2,983,047
Bandera	$1,189,962	$1,322,180
Bexar	$0	$0
Comal	$0	$0
Guadalupe	$0	$0
Kendall	$1,999,801	$2,222,001
Medina	$2,723,919	$3,026,576
Wilson	$0	$0
MSA	**$8,598,425**	**$9,553,804**

4.6.2. Anti-Idling

The City of San Antonio passed an anti-idling ordinance effective as of January 1, 2017.[14] While there are numerous exemptions to the ordinance the basic idea for this ordinance was very clear. Limiting the idling of heavy vehicles reduces the amount of emissions. This ordinance applies to vehicles weighing over 14,000 pounds-the fine for idling is no more than $500 and is classified as a Class C Misdemeanor. The City of San Antonio also adopted an anti-idling ordinance for all city vehicles and equipment (dated August 2016).[15] Bexar County also implemented an anti-idling ordinance, which went into effect in 2016. Additionally, company policy for large-scale warehousing operations such as the Wal-Mart Distribution center in New Braunfels or Union

[14] This ordinance was sponsored by Councilman Ron Nirenberg. See City of San Antonio Anti-Idling Ordinance at https://www.sanantonio.gov/sustainability/OrdinancesAndGovernance/AntiIdling

[15] The complete ordinance is available at ttps://www.sanantonio.gov/Portals/0/Files/EmployeeInformation/ADs/AD1-3.pdf

Pacific railroad have also adopted policies designed to limit idling.[16] For example, the Wal-Mart Warehouse in New Braunfels requires that all trucks turn off engines while loading or waiting. Additionally, Union Pacific requires that all trains turn off their engines while in the yards within the city.

[16] See Union Pacific Railroad at https://www.up.com/aboutup/environment/operations/index.htm

5. Conclusion

The San Antonio MSA will likely be designated nonattainment of the 2015 ozone NAAQS beginning October 2017. While the classification of nonattainment, such as marginal or moderate, remains to be clarified, it is clear that future economic growth in the greater San Antonio area brings with it future environmental considerations such as ground level ozone pollution. This study has attempted to estimate the economic costs associated with more stringent environmental quality regulations as specified by the EPA, the Clean Air Act, and other legal and regulatory considerations. While every effort has been made to engage with regional stakeholders, many of the economic outcomes contained in this report rely on assumptions based on research contained in public documents and standards represented in reports similar in scope and content -an example being the report prepared for Austin, Texas.

Table 4.20. Annual Potential Costs of Nonattainment by County (Millions 2016 $)

	Marginal		**Moderate**	
County	*Low Estimate*	*High Estimate*	*Low Estimate*	*High Estimate*
Atascosa	$3.0	$22.1	$5.4	$25.9
Bandera	$0.3	$8.6	$1.3	$10.2
Bexar	$79.6	$797.6	$175.6	$948.1
Comal	$14.7	$61.9	$21.6	$72.4
Guadalupe	$15.0	$72.5	$22.3	$84.1
Kendall	$0.8	$15.0	$2.7	$17.9
Medina	$2.5	$21.8	$4.9	$25.7
Wilson	$1.4	$19.7	$3.8	$23.5
Total	**$117.3**	**$1,019.1**	**$237.6**	**$1,207.8**

The implications of increased economic growth in and around San Antonio are clear. The region will see its GRP increase, implying improvement in the overall standard of living of the local population but this will also carry with it the need for greater environmental awareness as industries expand or relocate to and citizenry transits through the area. In very general terms, the costs to the region could range from $117.3 million to $1,019.1 million per year under a marginal nonattainment designation, and under a moderate designation costs are projected to range from $237.6 million to $1,207.8 million per year (Table 4.20). This means that under

marginal nonattainment total costs could range from $3.2 billion to $27.5 billion over the entire time period. Under moderate nonattainment, the total costs are projected to range from $7.1 billion to $36.2 billion. Based on interviews with local representatives it is apparent that the largest economic entities have an ongoing interest in the regional air quality and include these analyses as part of their planning. In other words, larger-scale companies do not see the nonattainment designation as a significant negative factor. The same may not be said of small businesses who remain silent and perhaps uninformed on this matter.

In terms of transportation conformity, conversations with local stakeholders suggest that many have already undertaken to include air quality in future planning transportation improvement scenarios. In reviewing the impact of possible scenarios, this study finds that while on-road vehicles play a large part in the ozone issue, there are many plans in place to improve regional transit, which in turn would relieve congestion problems, contributing to the reduction in overall ozone levels. As the MSA grows and its overall economic performance improves there will be a tendency for those individuals benefiting from higher incomes to own more vehicles. This fact is contained in the MPO modeling outcomes. Nevertheless, the AAMPO has a number of transit improvement (construction) projects in its pipeline designed to offer the population alternatives to personal vehicles. For this study, the impact on the individual driver in the region appears to be important as increasingly stringent inspection and maintenance programs could lead to losses in GRP of between $3.4 and $5.4 billion dollars. Here the costs would be associated with more rigorous vehicle inspections and costs associated with remedying any mechanical issues. Regarding transportation projects, extant research suggests that there are minor increases in congestion and pollution during the life of the construction projects but these are offset by the longer-term benefits once the projects have been completed.

6. References

Alamo Area Council of Governments (AACOG). 2016. Alamo Ozone Advance Program: Regional Sustainability Initiatives. San Antonio, TX: AACOG. 76pp. https://www.epa.gov/sites/production/files/2016-08/documents/update.july_2016.pdf

Alamo Area Metropolitan Planning Organization (AAMPO). 2016a. Transportation Conformity (Powerpoint Presentation). San Antonio, TX: AAMPO. 11pp. http://www.alamoareampo.org/AirQuality/conformity-docs/16.08.22%20AAMPO%20TPB%20Final%20Ver%20Presentation%20Transportation%20Conformity.pdf (accessed 20 November 2016).

AAMPO. 2016b. Transportation Conformity: Regionally Significant Roadway Definition (Powerpoint Presentation). San Antonio, TX: AAMPO. 23pp. http://www.alamoareampo.org/AirQuality/conformity-docs/Regionally%20Significant%20Roadways%2008%2022%202016.pdf (accessed 20 November 2016).

AAMPO. 2016c. FY 2017 – 2020: Transportation Improvement Program. San Antonio, TX: AAMPO. 134pp. http://www.alamoareampo.org/Plans/TIP/docs/TIP_2017-2020.pdf (accessed 20 November 2016).

AAMPO. 2015. "Mobility 2040". Alamo Area Metropolitan Planning Organization Metropolitan Transportation Plan. San Antonio, TX: AAMPO. 310pp. http://www.alamoareampo.org/Plans/MTP/docs/Mobility2040/Final%20MTP%20Revised%20March%2010%202015.pdf (accessed 20 November 2016).

Blankenheim, C. 2013. Estimating the Economic Impact of Ozone and Fine Particulate Nonattainment in the Twin Cities: A Plan B Paper. M.S. Thesis, University of Minnesota. (April 10, 2013). 63 pp. http://conservancy.umn.edu/bitstream/handle/11299/150030/Blankenheim_Estimating%20the%20Economic%20Impact.pdf;sequence=1 (accessed 31 August 2016).

Capital Area Council of Governments (CAPCOG). 2015. The Potential Costs of an Ozone Nonattainment Designation to Central Texas. PGA FY14-1, Deliverable 1.3.4, Amendment 1. Austin, TX: CAPCOG. (September 22, 2015).

City of Wichita (Kansas). 2012. Consequences of Nonattainment Designation for the Wichita Area. Wichita, KS: Wichita Air Quality Improvement Task Force, Office of Environmental Initiatives Metropolitan Area Planning Department Wichita. April 2, 2012. http://www.wichita.gov/Government/News/Supplemental%20Documents/Consequences%20of%20a%20Nonattainment%20Designation%20042012.pdf (accessed 31 August 2016).

de la Garza, P.E., Anna. Zephyr Environmental Corporation, email correspondence, January 25, 2017.

Eastern Research Group, Inc. 2016. Evaluation of the Texas Vehicle Emissions Inspection and Maintenance Program in the Dallas-Fort Worth and Houston-Galveston-Brazoria Nonattainment Areas. Prepared for Texas Commission on Environmental Quality. June 30, 2016.

Eastern Research Group, Inc. 2016b. Vehicle Emissions Inspection Program Test Fee Analysis for AirCheckTexas Program. July 30, 2016. Prepared for: TCEQ Air Quality Division.

Environ International Corporation. 2015. Final Report Potential Emission Control Strategies Available for Evaluation by the City of San Antonio. Novato, CA: Environ International Corporation. (March 2015). https://www.sanantonio.gov/Portals/0/Files/Sustainability/Environ%20Report.pdf. (accessed 31 August 2016).

Environmental Protection Agency (EPA). 2016a. NAAQS Table. Washington, DC: EPA. https://www.epa.gov/criteria-air-pollutants/naaqs-table (accessed 09 January 2017)

EPA. 2016b. Implementation of the 2015 National Ambient Air Quality Standards for Ozone: Nonattainment Area Classifications and State Implementation Plan Requirements. *Federal Register* Vol. 81, No. 222. November 17, 2016. (81276 – 81317). https://www.gpo.gov/fdsys/pkg/FR-2016-11-17/pdf/2016-27333.pdf (accessed 11 January 2017)

EPA. 2016c. SIP Status and Information | Criteria Air Pollutants | Nonattainment Area & OTR SIP Requirements. Washington, DC: EPA, https://www3.epa.gov/airquality/urbanair/sipstatus/nonattainment.html (accessed 20 September 2016).

EPA. 2016d. SIP Status and Information | Criteria Air Pollutants | Infrastructure SIP Requirements. Washington, DC: EPA. https://www3.epa.gov/airquality/urbanair/sipstatus/infrastructure.html (accessed 20 September 2016).

EPA. 2016e. Status of SIP Requirements for Designated Areas | Nonattainment Area & OTR SIP Requirements | State Implementation Plan Status | Six Common Pollutants | Air & Radiation | Washington, DC: EPA. https://www3.epa.gov/airquality/urbanair/sipstatus/reports/tx_elembypoll.html#ozone-8hr__2008__1404 (accessed 20 September 2016).

EPA. 2016f. New Source Review (NSR) Permitting | Nonattainment NSR Basic Information. Washington, DC: EPA. https://www.epa.gov/nsr/nonattainment-nsr-basic-information (accessed 22 November 2016).

EPA. 2016g. Implementing Reasonably Available Control Technology Requirements for Sources Covered by the 2016 Control Techniques Guidelines for the Oil and Natural Gas Industry. Memo from Anne Marie Wood to Regional Air Division Directors, 1 – 10. https://www.epa.gov/nsr/nonattainment-nsr-basic-information

EPA. 2016h. Required SIP Elements by Nonattainment Classification. Washington, DC: EPA https://www.epa.gov/ozone-pollution/required-sip-elements-nonattainment-classification (accessed 06 December 2016).

EPA. 2015a. 40 CFR Part 50, 51, 52, et al., National Ambient Air Quality Standards for Ozone; Final Rule. *Federal Register* Vol. 80, No. 206. October 26, 2015. (65291 – 65468)

EPA. 2015b. Clean Air Act Anti-backsliding Requirements and Implications for the Houston Area. Presentation by Carl Young, U.S. EPA, Region 6 (March 26, 2015). http://www.h-gac.com/taq/airquality/raqpac/documents/2015/Mar%2026/EPA%20R6%20RAQPAC%20presentation%20for%203-26-2015%20on%20Anti-backsliding.pdf (accessed 15 January 2017).

March 26, 2015EPA. 2014. Regulatory Impact Analysis of the Proposed Revisions to the National Ambient Air Quality Standards for Ground-Level Ozone. EPA-452/P-14-006. Washington, DC: EPA. (November 2014). 575 pp. https://www3.epa.gov/ttnecas1/regdata/RIAs/20141125ria.pdf (accessed 31 August 2016).

EPA. 2012. Transportation Conformity Guidance for 2008 Ozone Nonattainment Areas. EPA-420-B-12-045. Washington, DC: Transportation and Climate Division Office of Transportation and Air Quality EPA. 24 pp. July. http://nepis.epa.gov/Exe/ZyPDF.cgi?Dockey=P100EQWQ.pdf. (accessed 25 October 2016).

EPA. 2006. EPA's Oversight of the Vehicle Inspection and Maintenance Program Needs Improvement. Report No. 2007-P-00001. Washington, DC: Office of the Inspector General, EPA. October 5, 2006. https://www.epa.gov/sites/production/files/2015-11/documents/20061005-2007-p-00001.pdf (accessed 12 December 2016).

EPA. 1993. 40 CFR Part 6, 51, and 93, Determining Conformity of General Federal Actions to State or Federal Implementation Plans; Final Rule. *Federal Register* Vol. 58, No. 228. November 30, 1993. (63213 – 63259)

Federal Aviation Administration/Environmental Protection Agency (FAA/EPA). 2002. General Conformity Guidance for Airports: Questions and Answers. Washington, DC: FAA Office of Airport Planning and Programming, Community and Environmental Needs Division; EPA Office of Air Quality Planning and Standards, Air Quality Strategies and Standards Division. September 25, 2002. https://www.epa.gov/sites/production/files/2016-03/documents/airport_qa.pdf (accessed 20 November 2016).

Federal Highway Administration (FHWA). 2016. Clean Air Act Sanctions. Washington, DC: FHWA. http://www.fhwa.dot.gov/environment/air_quality/highway_sanctions/index.cfm (accessed 13 December 2016).

FHWA. 2010. Transportation Conformity: A Basic Guide for State and Local Officials. FHWA-HEP-11-001. Washington, DC: U.S. Department of Transportation, FHWA. http://www.fhwa.dot.gov/environment/air_quality/conformity/guide/ (accessed 25 October 2016).

Halebic, Maya and Nivin, Steve. 2012. Small Business Study: A Profile of Small Businesses in the San Antonio Metro Area. February 2012. SABER Institute.

Houston-Galveston Area Council (HGAC). 2016. 2016 Budget and Service Plan. http://www.h-gac.com/financial/documents/2016-budget-and-service-plan.pdf (accessed 1 February 2017).

IMPLAN. 2015. IMPLAN Data Sources. http://support.implan.com/index.php?option=com_content&view=article&id=250:250&catid=222:222

NERA Economic Consulting. 2015a. Economic Impacts of a 65 ppb National Ambient Air Quality Standard for Ozone. Prepared for the National Association of Manufacturers. February 2015. 142 pp. http://www.nam.org/Issues/Energy-and-Environment/Ozone/Economic-Impacts-of-a-65-ppb-NAAQS-for-Ozone-(NERA).pdf (accessed 01 September 2016)

NERA Economic Consulting. 2015b. What Could New Ozone Regulations Cost Texas? Prepared for the National Association of Manufacturers. http://www.nam.org/Issues/Energy-and-Environment/Ozone/State-Data/Texas-Ozone-Data-2015.pdf. August 2015. (accessed 31 August 2016)

Office of Management and Budget. 2015. OMB Bulletin No. 15-01: Revised Delineation of Metropolitan Statistical Areas, Micropolitan Statistical Areas, and Combined Statistical Areas, and Guidance on Uses of the Delineations of These Areas. July 15, 2015. https://www.whitehouse.gov/sites/default/files/omb/bulletins/2015/15-01.pdf

PCA. 2015. Ozone NAAQS Concerns. PowerPoint presentation provided by PCA.

San Antonio Business Journal. 2016. *2016-2017 Book of Lists*. Business Journal Publications, Inc. p. 174.

SA Tomorrow. Multimodal Transportation Plan. http://www.satransportationplan.com/app_pages/view/394 (accessed 30 December 2016).

Small Businesses Administration, Office of Advocacy, Thomas M. Sullivan, letter to EPA Administrator Stephen Johnson, Small Business Administration, July, 8, 2008, pp. 5–6, at *http://www.uschamber.com/NR/rdonlyres/ews52uzc7sh7u75ygwbmydmu4jnddkqimtlptavoujofl5uzcwgbtwfj4jp7orw5e7zc7evmcy25nv3aqoxuemk32vb/SBALettertoEPAJuly2008.pdf* (January 19, 2010).

Texas Commission on Environmental Quality (TCEQ). 2016a. Agenda Item Request for Approval of the 2015 Ozone NAAQS Designation Recommendation to the Governor (Docket No. 2016-0399-SIP). Austin, TX: TCEQ. (Agenda Requested: August 3, 2016). https://www.tceq.texas.gov/airquality/sip/eighthour.html (accessed 31 August 2016)

TCEQ. 2016b. Agenda Item Request for State Implementation Plan Revision Adoption. (Docket No. 2015-1380-SIP). Agenda Requested: August 3, 2016. (Agenda Requested: July 6, 2016). https://www.tceq.texas.gov/airquality/sip/eighthour.html (accessed 31 August 2016)

TCEQ. 2016c. Texas Counties Exceeding the 2015 Ozone NAAQS Based on Preliminary 2015 Ozone Design Values. Map (February 29, 2016). Austin, TX: TCEQ. https://www.tceq.texas.gov/airquality/sip/eighthour.html (accessed 31 August 2016).

TCEQ. 2016d. Air NSR Permits: Index of Common Permitted Facilities. Austin, TX: TCEQ. http://tceq.net/permitting/air/guidance/newsourcereview/ (accessed 9 October 2016)

TCEQ. 2016e. Implementation of the Expedited Permitting Program. TCEQ-(APDG 6258v6, Revised 09/16). Austin, TX: TCEQ. https://www.tceq.texas.gov/permitting/air/nav/air_docs_newsource.html (accessed 7 October 2016).

TCEQ. 2016f. Texas Commission on Environmental Quality Fact Sheet - Air Permitting. Austin, TX: TCEQ. March. https://www.tceq.texas.gov/assets/public/permitting/air/factsheets/permit_factsheet.pdf (accessed 7 October 2016).

TCEQ. 2016g. Air Quality Successes - Air Permits. Austin, TX: TCEQ. July. https://www.tceq.texas.gov/airquality/airsuccess/airSuccessPermits (accessed 9 October 2016).

TCEQ. 2016h. Vehicle Emissions Inspections in Texas: Program Overview of the Vehicle Inspection And Maintenance (I/M) Program In Texas. Austin, TX: TCEQ. https://tceq.state.tx.us/airquality/mobilesource/vim/overview.html (accessed 12 December 2016).

TCEQ. 2016i. Fact Sheet – Air Permitting. March 2016. Austin, TX: TCEQ. https://www.tceq.texas.gov/assets/public/permitting/air/factsheets/permit_factsheet.pdf

TCEQ. 2016j. SIP 101. Presentation by to Alamo Area Council of Governments by Dan Robicheaux (September 12, 2016), Austin, TX: SIP Team, Air Quality Planning Section, Air Quality Division, TCEQ. http://www.aacog.com/ArchiveCenter/ViewFile/Item/1462 (accessed 11 January 2017).

TCEQ. 2016k. Texas Low Emission Diesel (TxLED) Program. Austin, TX: TCEQ. https://www.tceq.texas.gov/airquality/mobilesource/txled/cleandiesel.html (accessed 15 January 2017).

TCEQ. 2016l. Gasoline Vapor Recovery (Stages I and II). Austin, TX: TCEQ. https://www.tceq.texas.gov/airquality/mobilesource/vapor_recovery.html (accessed 15 January 2017).

TCEQ. 2016m. Texas Emissions Reduction Program (TERP). January 2016. Austin, TX: TCEQ. https://www.h-gac.com/taq/airquality/raqpac/documents/2016/2016-01-28/TERP%20RAQPAC%20012816%204.pdf

TCEQ. 2015a. Consideration of the Adoption of the Dallas-Fort Worth (DFW) Reasonable Further Progress (RFP) State Implementation Plan (SIP) Revision for the 2008 Eight-Hour Ozone National Ambient Air Quality Standard (NAAQS). Texas Commission on Environmental Quality Agenda Item Request for State Implementation Plan Revision Adoption (Docket No. 2014-1249-SIP). Austin, TX: TCEQ. (Agenda Requested: June 3, 2015).

TCEQ. 2015b. Redesignation Substitute Report For The Houston-Galveston-Brazoria 1997 Eight-Hour Ozone Standard Nonattainment Area. Austin, TX: TCEQ. https://www.tceq.texas.gov/assets/public/implementation/air/sip/hgb/1997ozone_RS_Report/HGB_RS_1997_8Hr_report.pdf (accessed 13 December 2016).

TCEQ. 2011. Air Permit Reviewer Reference Guide: Air Pollution Control. How to Conduct a Pollution Control Evaluation (APDG 6110). Austin, TX: TCEQ. 54 pp. . https://www.tceq.texas.gov/assets/public/permitting/air/Guidance/NewSourceReview/airpoll_guidance.pdf (accessed 22 November 2016).

Texas Department of Public Safety (TX DPS). Cost of Inspection. http://www.dps.texas.gov/RSD/VI/CostOfInsp.htm (accessed 30 December 2017).

Appendix A

Texas Examples of SIP Requirements for Nonattainment Designation

Table A.1. Example of SIP Requirements for Nonattainment Designation - Marginal
Texas: Ozone-(8-hr, 2008) / Houston-Galveston-Brazoria
(From EPA, 2016e)

SIP Requirement	Deadline	Submittal Date	Latest Action	Date of Latest Action	FR Citation Click to view FR notice
Emission Inventory	07/20/2014	07/18/2014	Approval	04/21/2015	80 FR 9204
Emission Statement	07/20/2014	10/27/1992	Approval	10/25/1994	59 FR 44036
Nonattainment NSR rules – Marginal	07/20/2015	11/13/1992	Approval	11/27/1995	60 FR 49781

Table A.2. Example of SIP Requirements for Nonattainment Designation - Moderate
Texas: Ozone (8-hr, 2008) / Dallas-Fort Worth
(From EPA, 2016e)

SIP Requirement	Deadline	Submittal Date	Latest Action	Date of Latest Action	FR Citation Click to view FR notice
Contingency Measures VOC and NO_x	07/20/2015	07/13/2015	Completeness	01/13/2016	
Emission Inventory	07/20/2014	07/18/2014	Approval	04/21/2015	80 FR 9204
Emission Statement	07/20/2014	10/27/1992	Approval	10/25/1994	59 FR 44036
I/M Basic	07/20/2015	07/13/2015	Completeness	01/13/2016	
Nonattainment NSR rules - Moderate	07/20/2015	11/13/1992	Approval	11/27/1995	60 FR 49781
Ozone Attainment Demonstration	07/20/2015	07/13/2015	Completeness	01/13/2016	
RACT Non-CTG VOC for Major Sources	07/20/2014	07/13/2015	Completeness	01/13/2016	
RACT NO_x for Major Sources	07/20/2014	07/13/2015	Completeness	01/13/2016	
RACT VOC CTG Aerospace	07/20/2014	07/13/2015	Completeness	01/13/2016	
RACT VOC CTG Auto and Light-Duty Truck Assembly Coatings (2008)	07/20/2014	07/13/2015	Completeness	01/13/2016	
RACT VOC CTG Bulk Gasoline Plants	07/20/2014	07/13/2015	Completeness	01/13/2016	
RACT VOC CTG Equipment Leaks from Natural Gas/Gasoline Processing Plants	07/20/2014	07/13/2015	Completeness	01/13/2016	
RACT VOC CTG Factory Surface Coating of Flat Wood Paneling	07/20/2014	07/13/2015	Completeness	01/13/2016	
RACT VOC CTG Fiberglass Boat Manufacturing Materials (2008)	07/20/2014	07/13/2015	Completeness	01/13/2016	
RACT VOC CTG Flat Wood Paneling Coatings (2006)	07/20/2014	07/13/2015	Completeness	01/13/2016	
RACT VOC CTG Flexible Packaging Printing Materials (2006)	07/20/2014	07/13/2015	Completeness	01/13/2016	
RACT VOC CTG Fugitive Emissions from Synthetic Organic Chemical Polymer and Resin Manufacturing Equipment	07/20/2014	07/13/2015	Completeness	01/13/2016	
RACT VOC CTG Graphic Arts - Rotogravure and Flexography	07/20/2014	07/13/2015	Completeness	01/13/2016	
RACT VOC CTG Industrial Cleaning Solvents (2006)	07/20/2014	07/13/2015	Completeness	01/13/2016	
RACT VOC CTG Large Appliance Coatings (2007)	07/20/2014	07/13/2015	Completeness	01/13/2016	
RACT VOC CTG Large Petroleum Dry Cleaners	07/20/2014	07/13/2015	Completeness	01/13/2016	
RACT VOC CTG Leaks from Gasoline Tank Trucks and Vapor Collection Systems	07/20/2014	07/13/2015	Completeness	01/13/2016	
RACT VOC CTG Leaks from Petroleum Refinery Equipment	07/20/2014	07/13/2015	Completeness	01/13/2016	
RACT VOC CTG Lithographic Printing Materials and Letterpress Printing Materials (2006)	07/20/2014	07/13/2015	Completeness	01/13/2016	
RACT VOC CTG Manufacture of High-Density Polyethylene, Polypropylene, and Polystyrene Resins	07/20/2014	07/13/2015	Completeness	01/13/2016	
RACT VOC CTG Manufacture of Pneumatic Rubber Tires	07/20/2014	07/13/2015	Completeness	01/13/2016	

RACT VOC CTG Manufacture of Synthesized Pharmaceutical Products	07/20/2014	07/13/2015	Completeness	01/13/2016	
RACT VOC CTG Metal Furniture Coatings (2007)	07/20/2014	07/13/2015	Completeness	01/13/2016	
RACT VOC CTG Miscellaneous Industrial Adhesives (2008)	07/20/2014	07/13/2015	Completeness	01/13/2016	
RACT VOC CTG Miscellaneous Metal Products Coatings (2008)	07/20/2014	07/13/2015	Completeness	01/13/2016	
RACT VOC CTG Paper, Film, and Foil Coatings (2007)	07/20/2014	07/13/2015	Completeness	01/13/2016	
RACT VOC CTG Petroleum Liquid Storage in External Floating Roof Tanks	07/20/2014	07/13/2015	Completeness	01/13/2016	
RACT VOC CTG Plastic Parts Coatings (2008)	07/20/2014	07/13/2015	Completeness	01/13/2016	
RACT VOC CTG Refinery Vacuum Producing Systems, Wastewater Separators, and Process Unit Turnarounds	07/20/2014	07/13/2015	Completeness	01/13/2016	
RACT VOC CTG SOCMI Air Oxidation Processes	07/20/2014	07/13/2015	Completeness	01/13/2016	
RACT VOC CTG SOCMI Distillation and Reactor Processes	07/20/2014	07/13/2015	Completeness	01/13/2016	
RACT VOC CTG Shipbuilding/repair	07/20/2014	07/13/2015	Completeness	01/13/2016	
RACT VOC CTG Solvent Metal Cleaning	07/20/2014	07/13/2015	Completeness	01/13/2016	
RACT VOC CTG Stage I Vapor Control Systems - Gasoline Service Stations	07/20/2014	07/13/2015	Completeness	01/13/2016	
RACT VOC CTG Storage of Petroleum Liquids in Fixed Roof Tanks	07/20/2014	07/13/2015	Completeness	01/13/2016	
RACT VOC CTG Surface Coating for Insulation of Magnet Wire	07/20/2014	07/13/2015	Completeness	01/13/2016	
RACT VOC CTG Surface Coating of Automobiles and Light-Duty Trucks	07/20/2014	07/13/2015	Completeness	01/13/2016	
RACT VOC CTG Surface Coating of Cans	07/20/2014	07/13/2015	Completeness	01/13/2016	
RACT VOC CTG Surface Coating of Coils	07/20/2014	07/13/2015	Completeness	01/13/2016	
RACT VOC CTG Surface Coating of Fabrics	07/20/2014	07/13/2015	Completeness	01/13/2016	
RACT VOC CTG Surface Coating of Large Appliances	07/20/2014	07/13/2015	Completeness	01/13/2016	
RACT VOC CTG Surface Coating of Metal Furniture	07/20/2014	07/13/2015	Completeness	01/13/2016	
RACT VOC CTG Surface Coating of Miscellaneous Metal Parts and Products	07/20/2014	07/13/2015	Completeness	01/13/2016	
RACT VOC CTG Surface Coating of Paper	07/20/2014	07/13/2015	Completeness	01/13/2016	
RACT VOC CTG Tank Truck Gasoline Loading Terminals	07/20/2014	07/13/2015	Completeness	01/13/2016	
RACT VOC CTG Use of Cutback Asphalt	07/20/2014	07/13/2015	Completeness	01/13/2016	
RACT VOC CTG Wood Furniture	07/20/2014	07/13/2015	Completeness	01/13/2016	
RFP VOC and NO_x - Moderate	07/20/2015	07/13/2015	Completeness	01/13/2016	