Strategy Effectiveness Analysis

Technical Report

August 31, 2010

Prepared by:

Alamo Area Council of Governments

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Abstract:
The Alamo Area Council of Governments (AACOG), as part of its role in regional air quality planning, continues to maintain relationships with local governments and organizations to help develop policies to reduce ozone precursor emissions. AACOG continues to research, identify, and quantify possible State Implementation Plan (SIP) emission reductions from control strategies implemented by local organizations. Analysis included recently developed control strategies for on-road vehicles, non-road vehicles and equipment, energy efficiency, and renewable energy. Emission reductions from adopted control strategies were 822 lbs of NO_x and 136 lbs of VOC per ozone season weekday. The most successful control measures are CPS Energy's STEP program and the City of San Antonio's vehicle replacement policy. Traffic re-signalization and VIA Metropolitan Transit's vehicle fleet replacement are also effective control measures. AACOG will continue developing and analyzing local control strategies according to the standards developed by the TCEQ Air Quality Planning Section. There will be continual expansion of the emission reductions under CPS Energy's STEP program. All new control strategies will be analyzed for SIP credit under future SIP requirements.

Related Reports:	**Distribution Statement:**	**Permanent File:**
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Introduction

The Alamo Area Council of Governments (AACOG), as part of its role in regional air quality planning, continues to maintain relationships with local governments and organizations to help develop policies to reduce ozone precursor emissions. AACOG researches, identifies, and quantifies the emission reduction benefits of control strategies implemented by local organizations. Analysis of local emission control measures described here focused on recently implemented control strategies for on-road vehicles, non-road vehicles and equipment, energy efficiency, and renewable energy. Local control strategies were evaluated to estimate their impact on air quality and their possible use as SIP credit. Conducting these evaluations involved estimating the ozone precursor reductions due to implementation of:

- San Antonio's Mission Verde Sustainability Plan
- Save for Tomorrow Energy Plan (STEP)
- Vehicle Replacement by the City of San Antonio (COSA)
- NuRide
- River Cities Rideshare
- Traffic Re-signalization
- VIA Metropolitan Transit's Vehicle Replacement Program
- Solar Energy Projects

Table 1 summarizes the emission benefits of the locally-adopted control strategies listed above. The most successful control measures, in terms of emission reductions, are CPS Energy's STEP program and COSA's vehicle replacement policy. A traffic re-signalization project conducted in San Antonio and VIA's vehicle fleet replacement program are also effective control measures.

Table 1: Emission Reductions for Adopted Control Strategies in San Antonio MSA

Programs and Strategies	Control Strategy Implementation Years	Emission Reduction tons/year, 2013		Emission Reduction lbs/day, 2013	
		NO_x	VOC	NO_x	VOC
Mission Verde Sustainability Plan	2009 - 2020	34.18	1.42	18.73	7.78
STEP program	2009	42.85	1.78	234.77	9.76
COSA Vehicle Replacement	2010 - 2020	46.91	9.69	257.02	53.10
NuRide	2010	2.66	3.88	14.56	21.25
River City Ride Share	2010	0.41	0.60	2.26	3.30
Traffic Re-signalization	2010	24.96	5.12	136.66	28.05
VIA Vehicle Replacement	2010	28.72	2.40	157.37	13.17
Solar Energy Projects	2010	0.12	0.01	0.68	0.03
Total Reductions		180.80	24.90	822.04	136.44

AACOG will continue to analyze local control strategies according to the standards developed by the TCEQ Air Quality Planning Section. Some control strategies listed in Table 1 are in the early stages of implementation and will need to be re-evaluated as further emission reductions are achieved under each program. For example, CPS Energy's STEP program is expected to provide emission benefits through 2020, yet this report only provides emission reductions for the first 9 months of the program. Future reductions in ozone precursor emissions will be documented in subsequent reports as the programs are fully implemented. In addition, new control strategies will be analyzed for SIP credit under future SIP requirements. Consideration of future control strategies for appropriate analysis may include TCEQ's "Control Measures Catalog for Rider 8 Areas".

The finalized control strategy analyses will contain sufficient information so that TCEQ and AACOG modeling staff can modify emissions inventory input files and the TCEQ's Air Quality Planning Section may properly document the strategies in any SIP revision. Future local control strategies must meet the four criteria for SIP credit (quantifiable, enforceable, surplus, and permanent). Future control strategy analyses will include comments and direction given by the Air Improvement Resources Committee of AACOG.

San Antonio's Mission Verde Sustainability Plan

Background

Originally discussed by the City of San Antonio (COSA) Council in January 2009 and formally adopted on February 4, 2010, the plan is an economic approach to sustainability with a focus on energy conservation, which calls for diversification of energy sources, updates to the transportation system, creation of green jobs, and reuse and revitalization of San Antonio's resources.[1]

Data Collection

A list of initiatives included in the Mission Verde Sustainability Plan was obtained from the City's Office of Environmental Policy, which included information on funding sources, type of project, energy savings, and the value of grant funding obtained from various sources to support the Mission Verde projects.[2] The initiatives this program encompasses are funded by federal, state, and local grants, including[3]:

- US Department of Energy
  - Energy Efficiency and Conservation Block Grant (EECBG)
  - Weatherization Assistance Program
  - Better Building

Data on energy savings associated with the above grants will be used to calculate VOC and NO_x emission reductions for each project.

Methodology

Ozone precursor emissions for the programs listed above were calculated using emissions provided by CPS Energy for 2013. The utility estimates that generating one megawatt hour (MWh) of electricity creates, on average, 0.041 pounds of VOCs and 0.979 pounds of NOx system-wide. Emissions benefits for projects under Mission Verde Plan were calculated using the formula:

Equation (1)

$AES_A = MWh_A \times EF / 2000$ lbs/short ton

Where,

AES_A = Annual emissions saving for project A (VOC or NO_x)
MWh_A = Annual megawatt hours saved for project A (from COSA)
EF = Emission factor for VOC or NO_x (from CPS Energy)

Sample calculation:

Annual VOC emissions saving for the "Weatherization" program:

AES_A = 10,581 MWh x 0.041 lbs of VOC per MWh / 2000 lbs/short ton
= 0.22 tons of VOC per year

[1] City of San Antonio, Feb. 4, 2010. "Mission Verde Sustainability Plan", Office of Environmental Policy. Available online: http://www.sanantonio.gov/oep/SustainabilityPlan.asp. Accessed 08/12/2010.
[2] City of San Antonio, Aug. 4, 2010. "Mission Verde Update Presentation", Office of Environmental Policy. Available online: http://www.sanantonio.gov/oep/pdf/OEP-MV-BSession-2010.pdf. Accessed 08/12/2010.
[3] *Ibid.*

The following table lists calculated emission savings associated with implementing the Mission Verde programs. Note that energy savings were estimated by CoSA Office of Environmental Policy. With expansion of the programs on which these estimates are based continuing through 2013, the savings shown represent conservative estimates for 2013.

Table 2: Mission Verde Sustainability Program Energy and Emission reductions, 2013

Grant	Energy Saving (MWh)[4]	NO_x Saving (tons/year)	VOC Saving (tons/year)	NO_x Saving (lbs/day)	VOC Saving (lbs/day)
Weatherization (Casa Verde SA)	10,581	5.18	0.22	2.84	1.18
Energy Efficiency (EECBG)	17,209	8.43	0.35	4.62	1.92
Better Building Program	42,000	20.57	0.85	11.27	4.68
Total	69,790	34.18	1.42	18.73	7.78

The Casa Verde SA weatherization program is a partnership between the COSA and CPS Energy and is supported with grants from state and federal sources. Introduced in 2009, Casa Verde will use federal and state stimulus funds to weatherize more than 1,400 local homes over a two-year period.[5] This program will eventually become a component of CPS Energy's Save for Tomorrow Energy Plan (STEP) program through 2020.[6]

As part of the energy efficiency and conservation block grant (EECBG), the City's Small Business Lighting Efficiency Program, City Lights, will leverage the already existing CPS Energy rebate program to assist commercial customers in reducing their energy costs.[7] This program was launched in July 2010 and will provide zero-interest loans for lighting upgrades to 1,500 CPS Energy commercial costumers over the next two years.[8] The program will remain in effect as original loans are paid back. The energy and emissions savings from this program are not included in CPS Energy's STEP program.

The Department of Energy selected San Antonio to receive a $10 million grant as part of the American Recovery and Reinvestment Act to fund building retrofit projects and initiatives that will lead to energy saving for residential, commercial, and industrial buildings. Referred to as the Better Building Program, this initiative[9] will provide finance for building energy-efficiency improvements through revolving loans, regular commercial loans, and performance contracting. The City will increase conservation awareness and marketing efforts to gain participation in the program by conducting door-to-door outreach campaigns. The City's program is currently under development.

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[4] *Ibid*., p. 34.
[5] CPS Energy, 2010. "Casa Verde SA". San Antonio, Texas. Available online: http://www.cpsenergy.com/Casaverde/. Accessed 08/23/2010.
[6] City of San Antonio, Aug. 4, 2010. "Mission Verde Update Presentation". Office of Environmental Policy. San Antonio, Texas. p. 11. Available online: http://www.sanantonio.gov/oep/pdf/OEP-MV-BSession-2010.pdf. Accessed 08/12/2010.
[7] City of San Antonio, Aug. 4, 2010. "Small Business Lighting Efficiency Program", Office of Environmental Policy. San Antonio, Texas. Available online: http://www.sanantonio.gov/oep/citylights.asp?res=1440&ver=true. Accessed 08/23/2010.
[8] City of San Antonio, Aug. 4, 2010. "Mission Verde Update Presentation", Office of Environmental Policy. San Antonio, Texas. p. 11. Available online: http://www.sanantonio.gov/oep/pdf/OEP-MV-BSession-2010.pdf. Accessed 08/12/2010.
[9] City of San Antonio, May 1, 2010. "Noticias Verdes". Office of Environmental Policy. San Antonio, Texas. Available online: http://www.sanantonio.gov/oep/Newsletter/May2010Eblast.html

Save for Tomorrow Energy Plan program

Background

The STEP program is sponsored by CPS Energy and comprises energy conservation efforts with a goal of saving 771 MW of electricity between 2009 and 2020 by providing financial incentives to residential and commercial customers to improve heating, ventilation, insulation, and air conditioning systems as well as to increase the use of compact fluorescent lamps and programmable thermostats, expand lighting retrofits, and other commercial programs. The results of this program will create an efficient energy market leading to significant environmental benefits from reduced emissions. "The reduction in electricity consumption would be accomplished by providing residential and commercial customers with financial incentives and assistance such as: replacement of current light bulbs with energy efficient light bulbs, and replacement of existing household appliances with energy efficient appliances. COSA has established a set of accountability procedures for STEP, which requires CPS Energy to provide quarterly and annual reports to the COSA indicating year to date STEP activity and emissions (NO_x and VOC) reductions per rebate program area."[10]

CPS Energy launched two new residential rebate programs in 2009 – "Air Flow Performance" and "Wash Right". In late summer of 2009, the "Commercial Demand Response Program" was added to CPS Energy's inventory of commercial rebates and programs. The 2009 energy efficiency savings and cumulative kilowatt reductions for all programs included in the STEP initiative are in CPS Energy's annual report published for the fiscal year 2009.[11] CPS Energy used the services of a third party, Nexant, Inc., to conduct an independent measurement and verification (M&V) evaluation of CPS Energy's 2009 demand side management programs.[12]

Methodology

Ozone precursor emissions were calculated using emission factors from CPS Energy's 2013 projections. VOC and NO_x emission factors, 0.041 and 0.979 lbs respectively, are based on the system-wide generation of one megawatt hour (MWh) of energy. The net emissions benefits were calculated based on the formula provided below:

Equation (1)

$AES_A = MWh_A \times EF / 2000$ lbs/short ton

Where,

AES_A = Annual emissions saving for rebate program A (VOC or NO_x)
MWh_A = Annual megawatt hours saved for rebate program A (from Nexant, Inc. report)
EF = Emission factor for VOC or NO_x (from CPS Energy)

Sample calculation:

Annual VOC emissions saving for the "Compact Fluorescent Lamp" rebate program:

AES_A = 52,277 MWh x 0.041 lbs of VOC per MWh / 2000 lbs/short ton
= 1.10 tons of VOC per year

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[10] City of San Antonio, 2010. "Save for Tomorrow Energy Plan (STEP) Reporting and Accountability". Office of Environmental Policy. San Antonio, Texas. Available online: http://www.sanantonio.gov/oep/step.asp?res=1440&ver=true. Accessed 8/26/2010.

[11] Nexant, Inc. May, 2010. "Measurement and Verification of CPS Energy's 2009 DSM Program Offerings". San Francisco, CA. Table 1-1A. Available online: http://www.sanantonio.gov/oep/pdf/STEP/FY09AnnualReport.pdf. Accessed 8/12/2010.

[12] *Ibid.*

Annual and daily emission reductions from the STEP program are shown in the following table for each rebate program.

Table 3: STEP Program Energy and Emission reductions, 2013

Rebate Program	Net Energy Saving (MWh)	NO_x Reduction Tons/year	VOC Reduction Tons/Year	NO_x Reduction lbs/day	VOC Reduction lbs/day
Compact Fluorescent Lamp	52,277	25.60	1.06	140.27	5.83
Home Efficiency	1,816	0.89	0.04	4.87	0.20
Residential HVAC	6,815	3.34	0.14	18.29	0.76
Peak Saver	736	0.36	0.01	1.97	0.08
Solar Initiative	328	0.16	0.01	0.88	0.04
Air Flow Performance	442	0.22	0.01	1.19	0.05
Wash Right	310	0.15	0.01	0.83	0.03
Commercial Lighting	18,479	9.05	0.38	49.58	2.06
Commercial HVAC	5,258	2.57	0.11	14.11	0.59
Commercial Other	419	0.20	0.01	1.12	0.05
Demand Response	615	0.30	0.01	1.65	0.07
Total	87,493	42.85	1.78	234.77	9.76

City of San Antonio's Fleet Control Strategies

Background

The COSA Office of Environmental Policy initiated a comprehensive fleet study as part of the FY 2010 budget development process. The City's staff recommended a vehicle fleet purchasing policy to the City Council, which was approved on April 15, 2010. An emissions inventory, conducted by the AACOG, provided a baseline for ozone precursor emissions in 2009 and a target for future emission reductions. Emissions benefits associated with vehicle replacement policies and use of alternative fueled vehicles were calculated to assist the City in its commitment to reduce emissions. The goals of this initiative are consistent with the Mission Verde Sustainability Plan and other adopted policies to remain in attainment of the EPA's air quality standards.

> "This Policy will improve air quality in San Antonio and establishes an air quality gas emissions reduction target of 30% below 2009 levels by 2020 to support regional Air Quality Attainment status and help the region to remain in compliance with federal air quality standards. According to the AACOG Inventory Report, in 2009 the level of nitrogen oxides (NO_x), a representative air quality emission, directly attributable to City vehicles was 156.35 tons. A 30% reduction in these levels will result in an air quality gas emission level attributable to City vehicles of 109.45 tons by 2020."[13]

Implementation

The City Council approved the Vehicle Fleet Environmental Acquisition Policy on April 15, 2010. There are plans to implement this policy in two phases:

> "Phase I - includes the FY 2010 purchase of all Hybrid sedan non-emergency vehicles within an upcoming sedan procurement. This phase also includes a pilot program to use an Ethanol (E85) fuel blend for selected flex fuel vehicles and the purchase of propane trucks.
>
> Phase II - will include the annual evaluation of acquisitions strategy as part of the budget development process. In addition, this phase will include city-wide conversion to Ethanol (E10) fuel blend for all traditional gasoline vehicles."[14]
>
> "This Vehicle Fleet Acquisition Policy provides a framework for future fleet acquisitions, addresses environmental strategy, and promotes the use of alternative fuels. The goal of this policy is to help improve air quality in San Antonio, reduce greenhouse gas emissions and reduce dependency on the use of oil as the fuel source for vehicles."[15]

Control Strategies

The City currently has over 4,400 units in its motorized vehicle fleet consisting of police cruisers, sedans, trucks, and heavy equipment such as street paving machines. A number of City

[13] City of San Antonio, 4/15/2010. "Vehicle Fleet Environmental Acquisition Policy". San Antonio, Texas. Exhibit A, p. 4.
[14] *Ibid.*
[15] *Ibid.*

vehicles currently have the capacity to use alternative fuels,[16] hence alternative fuels were studied for their possible environmental benefits along with Hybrid vehicles and replacement of older vehicles with the EPA's Tier2 vehicles, which are built to meet stringent emission standards and achieve significant reductions in pollution. The control strategies that were studied and suggested to the City were the following:

Gasoline Vehicles

- Total benefits of replacing older vehicles with Tier2 vehicles (pre -2005)
- Total benefits if all existing vehicles are fueled with E10 (1995+)[17]
- Additional benefits if all vehicles are Tier2 and fueled with E10
- Additional benefits if all vehicles are Tier2 and fueled with E85[18]
- Benefits if existing E85 vehicles are fueled with E85
- Additional benefits if Tier2 vehicles are replaced with available Tier2 Hybrid vehicles[19]
- Additional benefits if Tier2 vehicles are replaced with available Tier2 PHEV10 Hybrid vehicles[20]
- Additional benefits if Tier2 vehicles are replaced with available Tier2 PHEV40 Hybrid vehicles[21]
- Additional benefits if Tier2 vehicles are replaced with available Tier2 CNG vehicles[22]
- Additional benefits if Tier2 vehicles are replaced with available electric vehicles[23]
- Additional benefits if Tier2 vehicles are replaced with Tier2 propane vehicles[24]

Diesel Vehicles

- Total benefits of replacing older vehicles with 2007 Highway Rule diesel vehicles (pre -2007)
- Additional benefits if replacing the 2007 Highway Rule diesel vehicles with CNG vehicles[25]
- Benefits if 5% Biodiesel (B5) is used in all existing diesel vehicles[26]

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[16] City of San Antonio, 4/15/2010. "Vehicle Fleet Environmental Acquisition Policy". San Antonio, Texas. Exhibit A, p. 2.

[17] Department of Energy, 07/10/2009. "Energy Efficiency & Renewable Energy". Alternative Fuels and Advanced Vehicles Data Center. Washington, DC. Available online: http://www.afdc.energy.gov/afdc/vehicles/emissions_e10.html. Accessed 06/15/2010.

[18] *Ibid*.

[19] U.S. Environmental Protection Agency, June 15, 2010. "Green Vehicle Guide". Washington, DC. Available online: http://www.epa.gov/greenvehicles/Trio.do. Accessed 06/15/2010.

[20] National Research Council, 2009. "Transitions To Alternative Transportation Technologies; Plug-In Hybrid Electric Vehicles". Available online: http://gas2.org/2009/12/14/new-federal-report-plug-in-hybrids-wont-help-for-decades/. Accessed 06/15/2010.

21 *Ibid*.

[22] Department of Energy, July 10, 2009. "Alternative Fuels and Advanced Vehicles Data Center". Energy Efficiency & Renewable Energy, Washington, DC. Available online: http://www.afdc.energy.gov/afdc/vehicles/emissions_natural_gas.html. Accessed 06/15/2010.

[23] CPS Energy, Oct. 27, 2009, San Antonio, Texas, email communication.

[24] Energetics, 11/30/2009. "Propane Reduces Greenhouse Gas Emissions: A Comparative Analysis". VSE Corporation, Washington, DC. Available online: http://www.energetics.com/resourcecenter/products/studies/samples/Pages/prop-greenhouse-report.aspx. Accessed 06/15/2010.

[25] Natural Gas Vehicles for America, 2006. "NGV's and the Environment". Washington, DC. Available online: http://www.ngvc.org/about_ngv/ngv_environ.html. Accessed 06/15/2010.

[26] Department of Energy, July 10, 2009. "Alternative Fuels and Advanced Vehicles Data Center". Energy Efficiency & Renewable Energy, Washington, DC. Available online: http://www.afdc.energy.gov/afdc/vehicles/emissions_natural_gas.html. Accessed 06/15/2010.

- Benefits if 20% Biodiesel (B20) with additive is used in all existing diesel Vehicles[27]

Data Collection

Mobile combustion sources at COSA are identified as on-road vehicles and non-road equipment. A comprehensive list of on-road and non-road vehicles and equipment was obtained from the City's fleet maintenance department, which included information on vehicles' weight, model year, annual usage rates, and fuel types.

Methodology

EPA's MOBILE6.2[28] model was used to generate per mile VOC and NO_x emission factors for all diesel and gasoline vehicles. Each COSA vehicle was classified based on the 28 vehicle classes and their model years used in the MOBILE6.2 model. NO_x and VOC emission factors generated by MOBIL6.2 were used to calculate baseline emissions for each vehicle. Baseline on-road emissions were calculated using the formula described below:

Equation (1)

$AE_A = MIL_A \times EF_A / 453.59237$ g/lbs.

Where,

AE_A = Annual emissions for vehicle A (VOC or NO_x)
MIL_A = Annual miles traveled for vehicle A (from COSA)
EF_A = Emission factor for vehicle A (from MOBILE6.2)

Sample calculation:
Annual baseline VOC emissions for a 2000 model LDGV:

AE_A = 1,746 miles x 0.33 grams of VOC per mile / 453.59237 g/lbs.
= 1.27 lbs. of VOC per year

To calculate VOC and NO_x emission reductions from vehicle replacements, per vehicle emission reductions are calculated using the following formula:

Equation (2)

$AER_A = AE_A - (MIL_A \times T2EF / 453.59237$ g/lbs.)

Where,

AER_A = Annual VOC or NO_x emissions reduction for vehicle A
AE_A = Annual VOC or NO_x baseline emissions for vehicle A (from Equation 1)
MIL_A = Annual miles traveled for vehicle A (from COSA)
T2EF = Emission factor for Tier2 vehicle by vehicle type (from MOBILE6.2)

Sample calculation
Annual VOC emission reductions from replacing a 2000 model LDGV with a new Tire2 vehicle:

AER_A = 1.27 lbs. per year – (1,746 miles x 0.01 grams of VOC per mile / 453.59237 g/lbs.)
= 1.23 lbs. of VOC reduction per year

[27] *Ibid*.
[28] Office of Transportation and Air Quality, August 2003. "MOBILE6.2". U.S. Environmental Protection Agency, Washington, DC. Available online: http://www.epa.gov/otaq/m6.htm. Accessed 06/15/2010.

Final Results

Annual baseline emissions for COSA's on-road gasoline vehicles are estimated at 6.15 tons of VOC and 19.76 tons of NO_x and the baseline emissions for on-road diesel vehicles are estimated at 4.30 tons of VOC and 59.93 tons of NO_x. When estimated emissions from non-road equipment and alternative fuel vehicles are added to those from on-road vehicles, the total NOx baseline emissions for San Antonio's fleet annually is 156.35 tons of NOx. COSA is committed to reducing NOx emissions from the city's fleet by 30%, or down to a yearly average of 109.44 tons by 2020.

The emission reductions estimated for each control strategy are shown in Table 4. As the results indicate, the most effective control strategy is replacement of pre-Tier2 vehicles with Tier2 vehicles. Once specific control strategies are implemented by COSA, results should be updated using the MOVES model[29] to improve the accuracy of the emission reduction calculations and to ensure that San Antonio can receive SIP credit for any control measures.

Table 4: Emission Benefits of Proposed Control Strategies for COSA On-road Vehicle Fleet

Vehicle Type	Emission Control Strategy	# of Vehicles	VMT	Emission Reductions	
				VOC (t/yr)	NO_x (t/yr)
On-Road Gasoline Vehicles	Benefits of Replacing Pre-2005 Vehicles with Tier2 Vehicles	889	6,421,250	1.89	8.67
	Additional Benefits if Tier2 Vehicles Replaced with Tier2 Hybrid Vehicles	2,186	26,963,785	0.00	0.12
	Additional Benefits if Tier2 Vehicles Replaced with Tier2 PHEV10 Hybrid Vehicles	2,186	26,963,785	0.06	0.19
	Additional Benefits if Tier2 Vehicles Replaced with Tier2 PHEV40 Hybrid Vehicles	2,186	26,963,785	0.15	0.53
On-Road Diesel	Total Benefits of Replacing Pre-tier2 Vehicles with Tier2 Vehicles (pre -2007)	557	5,261,703	1.02	33.92

[29] U.S. EPA, December 2009. Office of Transportation and Air Quality Washington, DC. Motor Vehicle Emission Simulator. Available online: http://www.epa.gov/otaq/models/moves/index.htm. Accessed 07/21/10.

NuRide Commuting Program

Background

NuRide is a Web-based program for employees that choose to walk, bike, telecommute, carpool, vanpool, bus, or work a compressed week.[30] Through this program, commuters are rewarded with discount coupons and other incentives for their commitment to leave their personal vehicles at home and either share a ride with others or choose other environmentally friendly means of getting to work. In San Antonio, the partnership between USAA and NuRide began in August 2008 as a way for USAA to promote alternative commuting modes among its employees. Since then, the number of participant agencies registered with NuRide has increased significantly and their employees log their trips online to claim commuting rewards. This logging process enables NuRide to maintain accounts of traveling miles saved, which is translated into money and fuel savings. NuRide members reduce traffic congestion, pollution, and energy consumption by their commitment to change their commuting patterns.

Data Collection

Data on mileage, average one-way commute distance, and the number of participants were downloaded from NuRide's Web site for each county in the 8-county San Antonio MSA region (table 5). To calculate emission reductions, data from August 1, 2009 to July 31, 2010 was used in the formula. The MOVES model[31] was used to calculate average Bexar County emission factors for diesel and gasoline fueled passenger vehicles.

Methodology

Information from NuRide's database and weighted average emission factors from the MOVES model were used to calculate total emission reductions. MOVES 2013 emission factors for light duty passenger vehicles in Bexar County were used for all eight counties (0.84 grams of NO_x per mile and 0.58 grams of VOC per mile).

To calculate VOC and NO_x reductions, the following formula was used:

Equation (1)

$AER_A = MIL_A \times AEF / 907{,}184.74$ g/short ton

Where,

AER_A = Annual VOC or NO_x emissions reduction for county A
MIL_A = Annual saved miles for county A (from NuRide's database)
AEF = Average weighted emission factors for VOC or NO_x from a light duty passenger vehicle, 2013 (from MOVES model)

Sample calculation

Annual NO_x emission reduction for Bexar County:

AER_A = 1,626,194 miles x 0.84 grams of NO_x per mile / 907,184.74 g/short ton
= 1.51 tons of NO_x per year

[30] NuRide Inc., 2002. "NuRide: About Us". New London, Connecticut. Available online: http://www.nuride.com/nuride/public/p_about_us.jsp. Accessed 8/20/2010.

[31] U.S. EPA, December 2009. Office of Transportation and Air Quality Washington, DC. Motor Vehicle Emission Simulator. Available online: http://www.epa.gov/otaq/models/moves/index.htm. Accessed 07/21/10.

Table 5: NuRide Emission Benefits in the San Antonio MSA, 2013

County	Number of Registered Users	Average Commute Distance	Total Annual Miles Reduced	VOC Reductions (tons/year)	NO_x Reductions (tons/year)	VOC Reductions (lbs/day)	NO_x Reductions (lbs/day)
Atascosa	48	41.2	331,291	0.21	0.31	1.16	1.69
Bandera	52	38.6	196,110	0.12	0.18	0.68	1.00
Bexar	2,427	17.4	1,626,194	1.04	1.51	5.68	8.28
Comal	161	33.7	549,110	0.35	0.51	1.92	2.80
Guadalupe	169	38.9	433,299	0.28	0.40	1.51	2.21
Kendall	151	31.8	321,815	0.20	0.30	1.12	1.64
Medina	140	25.8	285,869	0.18	0.27	1.00	1.46
Wilson	108	39.3	428,488	0.27	0.40	1.50	2.18
Total	3,256	NA	4,172,176	2.66	3.88	14.56	21.25

These are not proposed as SIP credits per se. There is no enforcement clause in the agreements between NuRide users and AACOG or any other air quality agency.

About NuRide and River Cities Rideshare

River Cities Rideshare, which is discussed in the following pages, and the NuRide ridesharing program are independently operated ridesharing programs serving the AACOG/CAPCOG region and the immediate San Antonio region, respectively. Although they provide similar and highly complementary ridesharing services, they are distinct programs as noted here:

- NuRide is designed to provide employers the opportunity to promote ridesharing within their employee base. Typically, the employer provides direct financial support to the NuRide system and only employees have access to the NuRide system catering uniquely to that employer.
    - The strengths of this system include: only employees share rides with other employees of the same employer, which helps promote safety assurances. The employer is given a unique “dashboard,” an online homepage & sign-in page for the rideshare service unique to that employer and accessible uniquely by employees. This also helps increase the home-to-work and work-to-home location matches considerably as, typically, all employees work in one or a limited number of work locations. The cost for participation by employers in NuRide has traditionally been elevated; however, the cost supports the hiring of a NuRide employee in the city where NuRide builds adequate program/investment support. The NuRide employee has as chief task to find supporters, typically local commercial firms, able to provide incentives which NuRide uses to reward frequent local users of the NuRide rideshare program. These incentives help insure greater continuing participation in the NuRide program.
- River Cities Rideshare is designed to provide anyone in the service region access to a free online rideshare matching program. The River Cities Rideshare program serves the entire combined AACOG/CAPCOG regions.
    - Because the program is free to anyone in the entire south central Texas COG region, and is not designed around worker/employer rideshare pools or working hours, the program is very flexible in range and timeframe. The program is suitable to establishing daily home-to-work commutes for ridesharing, or for special events occurring anywhere in the combined regions. There is no additional cost for businesses to use the program. All ridesharing operations occur through one convenient website address, www.rcride.com.

River Cities Rideshare Program

Background

River Cities Rideshare (RCRide) was launched in 2007 for long distance commuters using software and hosting provided by Ecology & Environment, Inc.[32] The program provides commuting information and an automated carpool matching service covering the 12-county AACOG region. Shortly after its inception, the service area was expanded to include the 10 counties in the CAPCOG Region. It is sponsored by the Commute Solutions program at AACOG, CAPCOG, and the Capital Area Metropolitan Planning Organization (CAMPO). In addition to carpool matching and information, RCRide provides matching among bike riders and a link to VIA Metropolitan Transit for VIA's vanpool matching and local transit information. RCRide provides links to Web sites sponsored by AACOG, such as Clean Air Drive, where readers can find gasoline-saving tips. In providing these services, the program intends to help reduce vehicle emissions and vehicle congestion through the reduction of single-occupant vehicle trips and to encourage other gasoline conservation techniques including limiting engine idling, driving non-aggressively, and maintaining vehicles. RCRide is also promoted among parents to carpool their children to school through the SchoolPool program.

RCRide provides for online record keeping of trips by carpool, vanpool, walking, busing, telecommuting, and multimodal trips. To use the carpool service, a person would register, providing name, starting address, destination address, and details regarding commuting times, range of miles they want to search within, etc. Participates are provided a list of first names of those who want to commute in the same geographical area. Potential rideshare matches would discuss particulars such as who would drive on what day, and then decide whether they want to ride together or not.

RCRide's Sponsors

The RCRide program began as a collaboration between CAMPO and the AACOG on May 25, 2007. Since the joint effort began, RCRide has acquired several new partners, including VIA Transit in San Antonio and Capital Metro in Austin. Partners include:

Alamo Area Council of Governments
Capital Area Metropolitan Planning Organization (Austin)
Capital Area Council of Governments (Austin)
San Antonio-Bexar County Metropolitan Planning Organization
VIA Metropolitan Transit
Capital Metro (Austin)
Lower Colorado River Authority (Austin)
Advanced Micro Devices (Austin)

RCRide's Service Area

Counties covered by the program include Atascosa, Bandera, Bexar, Comal, Frio, Gillespie, Guadalupe, Karnes, Kendall, Kerr, Medina, and Wilson for the AACOG Region and Bastrop, Blanco, Burnet, Caldwell, Fayette, Hays, Lee, Llano, Travis, and Williamson for the CAPCOG Region.

[32] River Cities Rideshare. 2007. Ecology and Environment, Inc. International Specialists in the Environment. Available online: http://www.rivercitiesrideshare.com/en-US/usage.aspx. Accessed 8/13/2010.

Data Collection

RCRide's Web site contains total miles reduced, which can be used for calculating emission reductions attributed to the RCRide program. The data on reduced mileage, average one-way commute distance, and the number of participants were downloaded from RCRide's Web site for each county in the 8-county San Antonio Region. To calculate emission reductions due to the program, commuter data from August 1, 2009 to July 31, 2010 was selected. MOVES model[33] was used to calculate average emission factors for diesel and gasoline fueled passenger vehicles. Table 6 lists the emission reductions for each county.

Methodology

Information from RCRide's database and weighted average emission factors from MOVES model were used to calculate total emission reductions. MOVES 2013 emission factors for light duty passenger vehicles in Bexar County were used for all eight counties (0.84 grams of NO_x per mile and 0.58 grams of VOC per mile). For calculating the VOC and NO_x reductions, the following formula was used:

Equation (1)

$AER_A = MIL_A \times AEF / 907{,}184.74$ g/short ton

Where,

AER_A = Annual VOC or NO_x emissions reduction for county A
MIL_A = Annual saved miles for county A (from RCRide's database)
AEF = Average weighted emission factor for VOC or NO_x emissions from a light duty passenger vehicle, 2013 (from MOVES model)

Annual NO_x emission reduction for Bexar County was calculated as follows:

AER_A = 434,529 miles x 0.84 grams of NO_x per mile / 907,184.74 g/short ton
= 0.41 ton of NO_x per year

Table 6: River Cities Ride Share Emission Benefits in the San Antonio Region MSA, 2010

County	Number of Registered Users	Average Commute Distance	Annual Miles Reduced	VOC Reductions (tons/year)	NO_x Reductions (tons/year)	VOC Reductions (lbs/day)	NO_x Reductions (lbs/day)
Atascosa	5	37	11,418	0.01	0.01	0.04	0.06
Bandera	5	44	13,578	0.01	0.01	0.05	0.07
Bexar	338	21	434,529	0.28	0.40	1.52	2.21
Comal	18	24	26,940	0.02	0.03	0.09	0.14
Guadalupe	27	56	93,734	0.06	0.09	0.33	0.48
Kendall	3	22	4,166	0.00	0.00	0.01	0.02
Medina	6	42	15,553	0.01	0.01	0.05	0.08
Wilson	19	40	46,906	0.03	0.04	0.16	0.24
Total	421	NA	646,824	0.41	0.60	2.26	3.30

These are not proposed as SIP credits per se. There is no enforcement clause in the agreements between NuRide users and AACOG or any other air quality agency.

[33] U.S. EPA, December 2009. Office of Transportation and Air Quality Washington, DC. Motor Vehicle Emission Simulator. Available online: http://www.epa.gov/otaq/models/moves/index.htm. Accessed 07/21/10.

Traffic Signalization

Background

The Bexar County Metropolitan Planning Organization (MPO) sponsored three Traffic Signal Re-Timing Projects starting in 2004 to optimize traffic signal timing plans along specific corridors within the city of San Antonio.[34,35,36] The optimized signal timing plans derived from modeling were implemented for each respective phase of the study, resulting in decreases in travel time and vehicular delay, with increases in average vehicle speeds along the study corridors. The San Antonio-Bexar County MPO, the Texas Department of Transportation (TxDOT), and the Federal Highway Administration (FHWA) funded the traffic re-signalization project.

Data Collection

Baseline traffic data was collected for the analysis, consisting of arterial traffic counts, travel time runs, and intersection turning movement counts. The data were used to determine the traffic flow characteristics of the individual arterials and intersections of the study and later served as input to the developed signal optimization models. Turning movement counts for each intersection were gathered for AM Peak, Off-Peak, and PM Peak time periods. Additional 24-hour arterial tube counts were also gathered in each case in order to evaluate directional traffic flows throughout the day and develop an appropriate time-of-day schedule for implementing multiple timing plans (i.e. peak and off peak). Travel time data was gathered after implementation of the timing plans to assist in the analysis and evaluation of arterial operations.

Methodology

The three traffic signalization projects are:

- Phase II study includes 83 signalized intersections operated by the COSA grouped into six systems along major arterial corridors within the city.
- Phase III study includes 52 of the total signalized intersections, with intersections grouped into four systems.
- Phase IV study includes 89 signalized intersections, with intersections grouped into four systems.

Upon field installation and fine tuning of the proposed coordinated timing plans for each phase, the travel time study, and final *Synchro*[37] signal timing models, the results were analyzed to estimate changes in effectiveness for each system. Two initial models were developed for each system: a Base Model of existing conditions and an Optimized Model for future timing plan implementation.

For the Base Model, the roadway/signal system base was constructed and all existing geometry and signal timing parameters input. The differences between the “before” and “after” travel time runs indicates the amount of improvement in the time that traffic is able to travel from one end of

[34] Gilmer D. Gaston, September 2007. “Traffic Signal Re-Timing Project II: Final Report”. Pape-Dawson Engineers, Inc. San Antonio, Texas

[35] John Friebele, March 23, 2009. “The Bexar County Metropolitan Planning Organization (MPO) Traffic Signal Re-Timing Project III: Draft Report”. Wilbur Smith Associates. San Antonio, Texas

[36] John Friebele, June, 2010. “Traffic Signal Re-Timing Project IV: Final Report”. Wilbur Smith Associates. San Antonio, Texas

[37] Trafficware Ltd. “Synchro 7: Get signals, intersections, bells & whistles”. Available online: http://www.trafficware.com/synchro7.html. Accessed 08/27/2010.

the system to the other. The measures of effectiveness analyzed in the travel time studies were change in delay (vehicle-hours), fuel consumption, travel time (seconds), and speed (mph).

To calculate emission reductions, change in hours delayed from the *Synchro* modeling runs was multiplied by the 2013 hourly emission factors calculated by MOVES[38]. The hourly emission factors are based on light-duty passenger vehicles traveling on unrestricted urban roads. MOVES was run for the weekdays and 24 daily hours were selected for evaluation. When the MOVES results were aggregated, exhaust emission factors were 17.492 grams of NO_x and 3.591 grams of VOC per source hours operating (SHO).

Equation (1)

$AER_A = AHR_A \times AEF / 907{,}184.74$ g/short ton

Where,

AER_A = Annual VOC or NO_x emissions reduction for intersection system A

AHR_A = Annual hours saved for intersection system A (from Traffic Signal Re-Timing Project)

AEF = Weighted average hourly exhaust emission factors for VOC or NO_x from light duty vehicles, 2013 (from MOVES model)

Sample calculation

Annual NO_x emission reduction for the Eisenhauer traffic light system was calculated as follows:

AER_A = 82,654 hours x 17.492 grams of NO_x per hour / 907,184.74 g/short ton

= 1.59 ton of NO_x per year

The re-timing of traffic signals resulted in decreases in travel time and vehicular delay, and increases in average vehicle speeds along the study corridors. Emission reductions that are estimated under the new signal timing regimes are shown in Table 7.

Table 7: Theoretical Reductions in Ozone Precursor Emissions from Synchro Model

Study Phase	Traffic System	NO_x Reductions (tons/year)	VOC Reductions (tons/year)	NO_x Reductions (lbs/day)	VOC Reductions (lbs/day)
II	Alamo	0.49	0.10	2.68	0.55
	Bandera/Callaghan	0.27	0.06	1.48	0.33
	Blanco	0.25	0.05	1.37	0.27
	Broadway	0.85	0.17	4.66	0.93
	Fredericksburg	2.30	0.47	12.60	2.58
	St. Cloud	0.18	0.04	0.99	0.22
III	Blanco/West	2.24	0.46	12.27	2.52
	Lockhill-Selma	0.58	0.12	3.18	0.66
	Marbach/Military	0.20	0.04	1.10	0.22
	Culebra/Grissom	1.56	0.32	8.55	1.75
IV	Flores/Pleasanton	0.21	0.04	1.15	0.22
	Near West Side	12.93	2.65	70.85	14.52
	Eisenhauer	1.59	0.33	8.71	1.81
	Rittiman	1.29	0.27	7.07	1.48
Total		24.96	5.12	136.66	28.05

[38] U.S. EPA, December 2009. Office of Transportation and Air Quality Washington, DC. Motor Vehicle Emission Simulator. Available online: http://www.epa.gov/otaq/models/moves/index.htm. Accessed 07/21/10.

VIA Vehicle Replacement

Background

VIA Metropolitan Transit is upgrading San Antonio's transit bus fleet with newer technology buses. In May 2010, VIA replaced 4 older diesel buses with CNG fueled transit buses to be used in the downtown area.[39] In addition, 30 hybrid diesel busses have been put into service beginning August 2010 to replace older diesel buses[40] and provide a significant reduction of ozone precursor emissions. VIA will put 3 new electric buses into service by the end of 2010; these buses will provide pollution-free public transportation for the San Antonio downtown area because the batteries will be charged by solar panels.[41] The air quality control strategies implemented by VIA are:

- Four new CNG transit buses
- Thirty new hybrid transit buses
- Three new electric buses

Data Collection

The annual miles traveled for new buses, model year, and fuel type are required to calculate emissions benefits of VIA's initiatives. Data on the transit buses was provided by VIA. The 30 hybrid buses will be used on existing Express routes. The electric buses will be used in the downtown area from 7:00 am to midnight during the weekdays and 9:00 am to midnight on weekends to accommodate both tourists and employees in the downtown area.

Methodology

The MOVES model[42] was used to calculate VOC and NO_x emission factors for 1992, 1999, and 2010 model year diesel transit buses. Information on the number of VIA's replaced vehicles, the total annual miles they traveled, and the MOVES-generated emission factors was used to calculate baseline emissions.

Equation (1)

$$ABE_A = POP_A \times MIL_A \times EF_A / 907{,}184.74 \text{ g/short ton}$$

Where,

ABE_A = Annual baseline emissions for model year A (VOC or NO_x)
POP_A = Number of replaced buses for model year A (from VIA)
MIL_A = Annual miles traveled for model year A (from VIA)
EF_A = Emission factor for model year A (from MOVES model)

Sample calculation

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[39] VIA Metropolitan Transit, August 2, 2010. "VIA unveils new hybrid buses". Media releases. Available online: http://viainfo.net/Communications/ViewArticle.aspx?ArticleId=1558. Accessed 08/19/2010.

[40] "VIA unveils — and begins using — new hybrid buses," Josh Baugh, San Antonio Express-News, 08/03/2010; http://www.mysanantonio.com/livinggreensa/via_unveils__and_begins_using__new_hybrid_buses_99785914.html . Accessed 9/14/10.

[41] *Ibid.*

[42] U.S. EPA, December 2009. Office of Transportation and Air Quality Washington, DC. Motor Vehicle Emission Simulator. Available online: http://www.epa.gov/otaq/models/moves/index.htm. Accessed 07/21/10.

Annual baseline VOC emissions for 1992 model buses:

ABE_A = 19 buses x 45,000 miles x 1.43 grams of VOC per mile / 907,184.74 g/short ton
= 1.35 tons of VOC per year

To calculate the VOC and NO_x reductions from VIA's vehicle replacement policies, the following formula was used:

Equation (2)

$AER_A = (ABE_A – (MIL_A \times EF_{2010})) / 907,184.74$ g/short ton

Where,

AER_A = Annual VOC or NO_x emission reduction for model year A
ABE_A = Annual VOC or NO_x baseline emissions for model year A (from equation 1)
MIL_A = Annual miles traveled for model year A (from VIA)
EF_{2010} = Emission factor for a 2010 transit bus model year (from MOVES model)

Sample calculation
Annual VOC emission reductions from replacing the 1992 model buses with new 2010 model buses (CNG and diesel buses will have the same EF for VOC and NO_x in 2010):

AER_A = 1.35 tons of VOC per year – (45,000 annual miles x 0.08 grams VOC per mile / 907,184.74 g/short ton)
= 1.27 tons of VOC reduction per year

The following table indicates emissions benefits associated with replacement of buses. Electric buses are new additions to VIA's fleet and emissions are compared to a 2010 model year diesel bus.

Table 8: Emission Reductions due to VIA's Vehicle Replacement Policy, 2010

Model Year (MY)	Number of Vehicle Replaced	Annual Miles	Replaced Diesel Transit Buses (tons/year)		MY 2010 Transit Buses (tons/year)		Total Reduction (tons/year)		Total Reduction (lbs/day)	
			NO_x	VOC	NO_x	VOC	NO_x	VOC	NO_x	VOC
1992	19	855,000	18.86	1.35	0.74	0.08	18.12	1.27	99.29	6.97
1999	15	750,000	11.09	1.18	0.65	0.07	10.44	1.12	57.22	6.11
2010	3	179,910	0.16	0.02	0	0	0.16	0.02	0.85	0.09
Total	34	1,605,000	29.95	2.53	1.38	0.14	28.56	2.39	157.37	13.17

Solar Energy Projects

Background

State mandates such as Senate Bill 5 (SB5) and Senate Bill 12 (SB 12)[43], and local emission reduction policies, such as CPS Energy's STEP program, have promoted the installation of solar projects in the San Antonio area. CPS Energy is committed to generate up to 100 megawatts of electricity from solar energy by 2020.[44] CPS Energy has partnered with Republic Services, Inc. to cover the closed surface of the Tessman Road Landfill with flexible photovoltaic solar collection strips for conversion into electricity.[45] Other political entities and jurisdictions in the San Antonio area have also implemented solar projects. Current active solar projects include:

- Eagle Pass High School - CC Winn Campus
- East Central ISD
- James Madison High School
- John Jay High School
- Roosevelt High School
- Utopia ISD
- City Public Services of San Antonio, Northside
- Del Rio High School
- Kendall Elementary School
- Uvalde Junior High School
- City Public Services Primary Control Center
- Tessman Road Landfill

Emission reductions from the above projects are not included in the calculated emission reductions for CPS Energy's STEP program; rather they are independently analyzed below.

Data Collection

CPS Energy, reports published by the Solid Waste Association of North America (SAWANA)[46], and the Texas A&M Energy System Laboratory[47] provided information on solar projects. Table 9 lists the projects and calculated emission benefits.

Methodology

Ozone precursor emissions were calculated using emission factors from CPS Energy's 2013 projections. VOC and NO_x emission factors, 0.041 and 0.979 lbs respectively, are based on the system-wide generation of one megawatt hour (MWh) of energy. Emissions benefits for projects were calculated using the formula:

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[43] State Energy Conservation Office, Aug. 2010. "Energy Efficiency: Texas' Newest Energy Resource." Available online: http://www.seco.cpa.state.tx.us/sb5compliance.php. Accessed 08/24/2010.

[44] CPS Energy, Aug. 2010. "Capturing South Texas Sun for San Antonio Power". Available online: http://www.cpsenergy.com/Services/Generate_Deliver_Energy/Solar_Power/index.asp. Accessed 08/24/2010.

[45] Republic Service Inc. March 2010. "Tessman Road Landfill Solar energy Cover". SWANA, Silver Spring, MD. Available online: http://swana.org/Portals/0/pdfs/2010Noms/LFR-Gold.pdf. Accessed 08/24/2010.

[46] *Ibid.*

[47] TCEQ, July 2007. "Energy Efficiency/Renewable Energy Impact in the Texas Emissions Reduction Plan". Energy Systems Laboratory, Texas A&M University System. College Station, TX. Available online: http://repository.tamu.edu/bitstream/handle/1969.1/6354/ESL-TR-06-12-02.pdf?sequence=1. Accessed 08/24/2010.

Equation (1)

AES_A = MWh_A X EF / 2000 lbs/short ton

Where,

AES_A = Annual emissions saving for project A (VOC or NO_x)

MWh_A = Annual megawatt hours saved for project A (from SAWANA or Texas A&M laboratory report)

EF = Emission factor for VOC or NO_x (from CPS Energy)

Sample calculation

Annual NO_x emissions saving for "Tessman Road Landfill" solar energy program:

AES_A = 182.32 MWh x 0.979 lbs of NO_x per MWh / 2000 lbs/short ton

= 0.09 tons of NO_x per year

The following table provides emission reductions for each solar project.

Table 9: Energy and Emissions Savings due to Solar Energy Projects, 2013

Grant	Energy Saving (MWh)	NO_x Saving (tons/year)	VOC Saving (tons/year)	NO_x Saving (lbs/day)	VOC Saving (lbs/day)
Eagle Pass High School	1.21	0.00	0.00	0.00	0.00
East Central ISD	1.41	0.00	0.00	0.00	0.00
James Madison High School	1.21	0.00	0.00	0.00	0.00
John Jay High School	1.01	0.00	0.00	0.00	0.00
Roosevelt High School	1.67	0.00	0.00	0.00	0.00
Utopia ISD	1.78	0.00	0.00	0.00	0.00
City Public Services, Northside	24.90	0.01	0.00	0.07	0.00
Del Rio High School	6.17	0.00	0.00	0.02	0.00
Kendall Elementary School	1.22	0.00	0.00	0.00	0.00
Uvalde Junior High School	6.17	0.00	0.00	0.02	0.00
CPS Primary Control Center	24.90	0.01	0.00	0.07	0.00
Tessman Road Landfill	182.32	0.09	0.00	0.49	0.02
Total	253.94	0.12	0.01	0.68	0.03