Appendix D
1999 Base Case EI Development

Austin-Round Rock MSA
1999 Ozone Precursor
Emissions Inventory

Capital Area Planning Council (CAPCO)

Austin, Texas,
March 2004

Executive Summary

This document presents the 1999 Emissions Inventory (EI) for the five county region of the Austin Round Rock Metropolitan Statistical Area (MSA), which was completed for use in photochemical modeling of the September 1999 ozone episode. The five counties included in this EI are Bastrop, Caldwell, Hays, Travis, and Williamson counties. In analyzing air quality, three criteria air pollutants were inventoried: volatile organic compounds (VOC), oxides of nitrogen (NOx) and carbon monoxide (CO). The source of these pollutants is broken down into five major source categories of these criteria air pollutants: nonroad mobile sources, area sources, biogenic sources, point sources and on-road mobile sources. Unless indicated otherwise, "per day" references indicate rates on typical ozone days.

Area sources encompass a large number of diverse sources—everything from bakeries and breweries to asphalt paving and degreasing operations. These sources include facilities whose individual emissions do not qualify them as point sources (each facility emits less than 100 tons of VOC or NOx per year), however; collectively they can release significant quantities of pollutants. Area sources emit 90.56 tons per day of VOCs, 13.79 tons per day of CO, and 7.82 tons per day of NOx in the MSA for an average ozone weekday. The methodologies used for estimating emissions from area sources varied by subcategory. These can be found individually in Section 2 of the EI.

On-road mobile sources consist of vehicles operated on the streets and highways. The vehicles are broken down into gasoline- and diesel-powered vehicles. This category represents the largest source of emissions from non-stationary sources, producing 50.19 tons per day of VOCs and 97.86 tons per day of NOx and 650.10 tons per day of CO in the Austin-Round Rock MSA region. The methodologies used by the Texas Transportation Institute for calculating these emissions with emission factors from the EPA MOBILE6 Model and the results of the emissions calculations are provided in Section 3.

Nonroad mobile sources consist of all vehicles and equipment not routinely operated on streets and highways. These include recreational boats, recreational vehicles, railroad cars, agricultural

equipment, construction equipment, mining equipment, logging equipment, residential equipment (lawnmowers etc.), and commercial and industrial equipment. Military/airport sources include both public and military aircraft, as well as military groundside emissions and airport support vehicles. Military/airport emissions also include on-road emissions generated on the base and nonroad mobile-source emissions. Military activity is limited within the CAPCO region and emissions are insignificant. Civilian airports included in the inventory are Austin-Bergstrom International Airport and 14 municipal airports located throughout the CAPCO region. The total non road mobile emissions are 22.49 tons per day of VOC, 28.44 tons per day of NOx and 153.77 tons per day of CO in the Austin-Round Rock MSA for an average ozone weekday. Section 4 lists the methodologies for estimating emissions for each subcategory of nonroad mobile sources. Also, a chart is provided showing a breakdown of the emissions in tons per weekday, Saturday, and Sunday.

Point source emissions are from stationary sources such as electrical generating plants and other industrial facilities. Major point sources are well documented, in accordance with the TCEQ (former TNRCC) rules, and emit over 100 tons of NOx or 100 tons of VOC per facility each year. This category [1]contributes 3.7 tons of VOCs per day, 33.98 tons per day of NOx, and 19.35 tons per day of CO to the inventory of emissions in the MSA for an average ozone weekday. Section 5 contains the data for point sources by company and county to include the results of a minor point source survey conducted by the TCEQ. Efforts ware made to eliminate the possibility of double counting across point and area source categories.

Biogenic sources are emissions from natural sources such as vegetation and microbial activity. This is the only category that is from a non-anthropogenic source. Example sources include trees and grasses, as well as emissions from soil microbes. This category accounts for 394.10 tons per day of VOCs, 25.03 tons per day of NOx and 0.00 tpd of CO in Austin-Round Rock MSA Counties. The biogenic model used to estimate emissions was GLOBEIS. A complete description of the methodology used for this category is located in Section 6 of the EI.

[1] Note that point source emissions consist of major and minor point sources. The summary tables for major and minor point sources are listed in the Point Source section

Different agencies contributed information to this inventory, making preparation of the document possible. Population data for 1999 were obtained from the Texas State Data Center. The Alamo Area Council of Governments (AACOG) staff prepared, under contract to CAPCO, the initial estimate of emissions for many of the source categories in the CAPCO region. Employment figures were taken from the Texas Workforce Commission and the 1999 Census County Business Patterns. The Texas Department of Transportation (TxDOT) supplied highway vehicle registration data and developed vehicle miles traveled (VMT) estimates and vehicle travel parameters, which were used as input into the MOBILE6 emissions model. Texas Transportation Institute provided on-road emission estimates for the MSA region. The TCEQ provided data for a number of categories including point source emissions and several area source categories. Eastern Research Group, Inc. (ERG) developed emissions estimates for some area and non road mobile source categories under contract to CAPCO or TCEQ.

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APPENDIX C.....Emissions from Portable Gasoline Containers In Texas, ERG 2001
APPENDIX D.....Austin/San Marcos Metropolitan Statistical Area
On-road Mobile Source Emissions Inventories: 1999, 2002, 2005, 2007, and 2012
APPENDIX E.....Biogenic Sources, Environ, August 2001

AUSTIN MSA	YES
DAY/YEAR	DAILY

Weekday Emissions [tpd]			Pollutant		
County	SCC Category	Description	CO	NOX	VOC
Bastrp	Agriculture Production	Agriculture Production - Crops (Fertilizer)	0.000	0.000	0.000
		FIFRA Related Products: Other FIFRA Related Products	0.000	0.337	0.000
		Pesticide Application: All Processes	0.000	0.000	0.485
	Fuel Storage and Transport	Aircraft Refueling: All Fuels	0.000	0.000	0.000
		Storage and Transport (Organic chemical storage)	0.000	0.000	0.000
		Storage and Transport (Petroleum Breathing loss)	0.000	0.000	0.000
		Storage and Transport (Petroleum)	0.000	0.000	0.265
	Industrial Processes (Food)	Bakery Products	0.000	0.000	0.003
		Fermentation/Beverages:Breweries	0.000	0.000	0.000
		Fermentation/Beverages:Wineries	0.000	0.000	0.000
		Industrial Processes (Construction)	0.000	0.000	0.000
	Industrial Processes (Oil&Gas Production)	Oil and Gas Production (All Processes - Well)	0.080	0.120	1.660
		Oil and Gas Production (Natural Gas - Produced)	0.000	0.000	0.000
	Miscellaneous Area Sources - Acidental Releases	All Catastrophic/Accidential Releases	0.000	0.000	0.002
	Miscellaneous Area Sources - Fires	Miscellaneous Area Sources (Motor Vehicle Fires)	0.002	0.000	0.000
	Miscellaneous Area Sources - Other Combustion	Agricultural Field Burning-whole field	0.050	0.003	0.006
		Forest Wildfires	0.410	0.005	0.020
		Miscellaneous Area Sources (Motor Vehicle Fires)	0.000	0.000	0.000
		Prescribed Burning for Forest Management	0.100	0.021	0.139
		Structure Fires	0.009	0.002	0.002
	Service Stations	Gasoline Service Stations/Stage1	0.000	0.000	0.260
		Gasoline Service Stations/Stage2:Total	0.000	0.000	0.260
		GasolineServiceStations/Stage2:Spillage	0.000	0.000	0.010
	Solvent Utilization - Asphalt	All Asphalt Aplications (Cutback and Emulsified)	0.000	0.000	0.116
		Cutback Asphalt	0.000	0.000	0.000
		Emulsified Asphalt	0.000	0.000	0.000
	Solvent Utilization - Degreasing	All Industries: Cold Cleaning	0.000	0.000	0.007
		Auto Repair Services/Cold Cleaning	0.000	0.000	0.006
		Automotive Dealers/Cold Cleaning	0.000	0.000	0.035
		Dry Cleaning	0.000	0.000	0.000
		Fabricated Metal Product/Open Top	0.000	0.000	0.023
		FabricatedMetalProduct/Cold Clean	0.000	0.000	0.006
		Furniture/Fixtures/Cold Cleaning	0.000	0.000	0.001
		Furniture/Fixtures/Open Top	0.000	0.000	0.006
		Industry Machinery/Equip/Cold Clean	0.000	0.000	0.000
		Industry Machinery/Equip/Open Top	0.000	0.000	0.006
		Instrument/Related Product/OpenTop	0.000	0.000	0.006
	Solvent Utilization - Dry Cleaning	Comm/Indust Cleaners:Special Naphthas	0.000	0.000	0.010
	Solvent Utilization - Graphic Arts	Graphic Arts	0.000	0.000	0.020
	Solvent Utilization - Miscellaneous	Adhesive (Industrial) Application	0.000	0.000	0.020
		All Adhesives and Sealants	0.000	0.000	0.000
		All Automotive Aftermarket Products	0.000	0.000	0.000

		All FIFRA Related Products	0.000	0.000	0.037
		All Household Products	0.000	0.000	0.000
		All Personal Care Products	0.000	0.000	0.000
		Consumer: Adhesives and Sealants	0.000	0.000	0.000
		Consumer: Auto Aftermarket Products	0.000	0.000	0.051
		Consumer: Household Products	0.000	0.000	0.079
		Consumer: Personal Care Products	0.000	0.000	0.119
		Electronic and Other Electrical	0.000	0.000	0.010
		Misc Products (Not Otherwise Covered)	0.000	0.000	0.043
		Solvent-BasedMaintCoat/Clean-Up&Thinning	0.000	0.000	0.003
	Solvent Utilization - Surface Coating	All Coatings and Related Products	0.000	0.000	0.000
		Architectural Coatings	0.000	0.000	0.113
		Auto Refinishing	0.000	0.000	0.010
		Coating Solvents (Coatings & Rel.)	0.000	0.000	0.134
		Factory Finished Wood	0.000	0.000	0.004
		Flat Paints	0.000	0.000	0.020
		Industrial Maintenance Coatings	0.000	0.000	0.010
		Laquers/Clear	0.000	0.000	0.009
		Large Appliances	0.000	0.000	0.001
		Machinery and Equipment	0.000	0.000	0.017
		Marine	0.000	0.000	0.000
		Metal Coils	0.000	0.000	0.050
		Metal Furniture	0.000	0.000	0.040
		Miscellaneous Manufacturing	0.000	0.000	0.020
		Non-Flat Paints/High Gloss	0.000	0.000	0.009
		Non-Flat Paints/Low&Medium Gloss	0.000	0.000	0.020
		Other Special Purpose Coatings	0.000	0.000	0.081
		Paper	0.000	0.000	0.002
		Primers,Sealers,Undercoats	0.000	0.000	0.020
		Primers,Sealers,Undercoats/Quick-Dry	0.000	0.000	0.010
		Quick-Dry Enamels	0.000	0.000	0.010
		Solvent Utilization (Comercial)	0.000	0.000	0.000
		Solvent Utilization (Metal Cans)	0.000	0.000	0.000
		Solvent Utilization (Surface Coating - Motor Vehicles)	0.000	0.000	0.000
		Solvent Utilization (Surface Coating)	0.000	0.000	0.000
		Stains/Semi-Transparent	0.000	0.000	0.030
		Traffic Markings	0.000	0.000	0.010
		Wood Furniture	0.000	0.000	0.065
	Stationary Source Fuel Combustion	Catalytic Woodstoves:General	0.000	0.000	0.000
		Comm/Institutional: Residual Oil	0.000	0.000	0.000
		Commercial/Institutional/Distillate Oil	0.001	0.002	0.000
		Commercial/Institutional/LPG	0.000	0.000	0.000
		Commercial/Institutional/Natural Gas	0.010	0.010	0.001
		Fireplace Inserts/non-EPA certified	0.000	0.000	0.000
		FireplaceInserts/catalytic/EPAcertified	0.000	0.000	0.000
		FireplaceInserts/noncatalytic/EPAcertify	0.000	0.000	0.000
		Industrial/Distillate Oil	0.004	0.010	0.000
		Industrial/LPG	0.000	0.001	0.000
		Industrial/Natural Gas	0.001	0.004	0.000

		Industrial/Residual Oil	0.000	0.010	0.000
		Non-catalytic Woodstoves:General	0.000	0.000	0.000
		Res:Bituminous/SubbituminousCoal	0.000	0.000	0.000
		Residential/Anthracite Coal	0.000	0.000	0.000
		Residential/Distillate Oil	0.000	0.000	0.000
		Residential/LPG	0.004	0.018	0.000
		Residential/Natural Gas	0.010	0.050	0.000
		Residential/Residual Oil	0.000	0.000	0.000
		Wood: Fireplaces	0.000	0.000	0.000
		Woodstoves:General	0.000	0.000	0.000
	Storage and Transport	GasServStat/UndergroundTank:Breath&Empty	0.000	0.000	0.024
		Trucks in Transit	0.000	0.000	0.002
	Waste Disposal, Treatment, and Recovery	All Categories/Land Clearing Debris	0.340	0.000	0.020
		AllCategories/YardWaste-BrushSpUnspecify	0.010	0.000	0.002
		AllCategories/YardWaste-LeafSpUnspecify	0.010	0.000	0.003
		Landfills	0.000	0.000	0.032
		Residential/Household Waste	0.190	0.010	0.008
		Waste Disposal, Treatment, and Recovery	0.000	0.000	0.000
		Waste Disposal, Treatment, and Recovery (Leaking Underground Storage Tanks)	0.000	0.000	0.016
		Waste Disposal, Treatment, and Recovery (Wastewater Treatment)	0.000	0.000	0.000
		Wastewater Treatment/Public Owned	0.000	0.000	0.011
Bastrp Total			1.231	0.603	4.519
Caldwell	Agriculture Production	Agriculture Production - Crops (Fertilizer)	0.000	0.000	0.000
		FIFRA Related Products: Other FIFRA Related Products	0.000	0.393	0.000
		Pesticide Application: All Processes	0.000	0.000	0.458
	Fuel Storage and Transport	Aircraft Refueling: All Fuels	0.000	0.000	0.000
		Storage and Transport (Organic chemical storage)	0.000	0.000	0.000
		Storage and Transport (Petroleum Breathing loss)	0.000	0.000	0.000
		Storage and Transport (Petroleum)	0.000	0.000	0.159
	Industrial Processes (Food)	Bakery Products	0.000	0.000	0.003
		Fermentation/Beverages:Breweries	0.000	0.000	0.000
		Fermentation/Beverages:Wineries	0.000	0.000	0.000
		Industrial Processes (Construction)	0.000	0.000	0.000
	Industrial Processes (Oil&Gas Production)	Oil and Gas Production (All Processes - Well)	0.020	0.040	12.920
		Oil and Gas Production (Natural Gas - Produced)	0.000	0.000	0.000
	Miscellaneous Area Sources - Acidental Releases	All Catastrophic/Accidential Releases	0.000	0.000	0.047
	Miscellaneous Area Sources - Other Combustion	Agricultural Field Burning-whole field	0.030	0.002	0.004
		Forest Wildfires	0.170	0.002	0.010
		Miscellaneous Area Sources (Motor Vehicle Fires)	0.001	0.000	0.000
		Prescribed Burning for Forest Management	0.070	0.016	0.104
		Structure Fires	0.005	0.001	0.001
	Service Stations	Gasoline Service Stations/Stage1	0.000	0.000	0.320
		Gasoline Service Stations/Stage2:Total	0.000	0.000	0.270
		GasolineServiceStations/Stage2:Spillage	0.000	0.000	0.020
	Solvent Utilization - Asphalt	All Asphalt Aplications (Cutback and Emulsified)	0.000	0.000	0.102
		Cutback Asphalt	0.000	0.000	0.000
		Emulsified Asphalt	0.000	0.000	0.000
	Solvent Utilization - Degreasing	All Industries: Cold Cleaning	0.000	0.000	0.006
		Auto Repair Services/Cold Cleaning	0.000	0.000	0.006

		Automotive Dealers/Cold Cleaning	0.000	0.000	0.017
		Dry Cleaning	0.000	0.000	0.000
		Electronic/Other Elec/Open Top	0.000	0.000	0.001
		Fabricated Metal Product/Open Top	0.000	0.000	0.001
		Industry Machinery/Equip/Cold Clean	0.000	0.000	0.000
		Industry Machinery/Equip/Open Top	0.000	0.000	0.001
		Instrument/Related Product/OpenTop	0.000	0.000	0.023
		Instrument/RelateProduct/ColdClean	0.000	0.000	0.000
		Primary Metal Industries/Open Top	0.000	0.000	0.001
		Transportation Equip/Open Top	0.000	0.000	0.000
	Solvent Utilization - Dry Cleaning	Comm/Indust Cleaners:Special Naphthas	0.000	0.000	0.010
	Solvent Utilization - Graphic Arts	Graphic Arts	0.000	0.000	0.000
	Solvent Utilization - Miscellaneous	Adhesive (Industrial) Application	0.000	0.000	0.013
		All Adhesives and Sealants	0.000	0.000	0.000
		All Automotive Aftermarket Products	0.000	0.000	0.000
		All FIFRA Related Products	0.000	0.000	0.023
		All Household Products	0.000	0.000	0.000
		All Personal Care Products	0.000	0.000	0.000
		Consumer: Adhesives and Sealants	0.000	0.000	0.000
		Consumer: Auto Aftermarket Products	0.000	0.000	0.032
		Consumer: Household Products	0.000	0.000	0.049
		Consumer: Personal Care Products	0.000	0.000	0.074
		Electronic and Other Electrical	0.000	0.000	0.010
		Misc Products (Not Otherwise Covered)	0.000	0.000	0.027
	Solvent Utilization - Surface Coating	All Coatings and Related Products	0.000	0.000	0.000
		Architectural Coatings	0.000	0.000	0.050
		Auto Refinishing	0.000	0.000	0.004
		Coating Solvents (Coatings & Rel.)	0.000	0.000	0.084
		Factory Finished Wood	0.000	0.000	0.031
		Flat Paints	0.000	0.000	0.010
		Industrial Maintenance Coatings	0.000	0.000	0.000
		Laquers/Clear	0.000	0.000	0.006
		Large Appliances	0.000	0.000	0.000
		Machinery and Equipment	0.000	0.000	0.006
		Marine	0.000	0.000	0.000
		Metal Coils	0.000	0.000	0.033
		Metal Furniture	0.000	0.000	0.090
		Miscellaneous Manufacturing	0.000	0.000	0.000
		Non-Flat Paints/High Gloss	0.000	0.000	0.006
		Non-Flat Paints/Low&Medium Gloss	0.000	0.000	0.010
		Other Special Purpose Coatings	0.000	0.000	0.050
		Primers,Sealers,Undercoats	0.000	0.000	0.010
		Primers,Sealers,Undercoats/Quick-Dry	0.000	0.000	0.010
		Quick-Dry Enamels	0.000	0.000	0.007
		Solvent Utilization (Comercial)	0.000	0.000	0.001
		Solvent Utilization (Metal Cans)	0.000	0.000	0.000
		Solvent Utilization (Surface Coating - Motor Vehicles)	0.000	0.000	0.004
		Solvent Utilization (Surface Coating)	0.000	0.000	0.000
		Stains/Semi-Transparent	0.000	0.000	0.010

		Traffic Markings	0.000	0.000	0.010
		Wood Furniture	0.000	0.000	0.005
	Stationary Source Fuel Combustion	Catalytic Woodstoves:General	0.000	0.000	0.000
		Comm/Institutional: Residual Oil	0.000	0.000	0.000
		Commercial/Institutional/Distillate Oil	0.001	0.000	0.000
		Commercial/Institutional/LPG	0.000	0.000	0.000
		Commercial/Institutional/Natural Gas	0.009	0.010	0.001
		Fireplace Inserts/non-EPA certified	0.000	0.000	0.000
		FireplaceInserts/catalytic/EPAcertified	0.000	0.000	0.000
		FireplaceInserts/noncatalytic/EPAcertify	0.000	0.000	0.000
		Industrial/Distillate Oil	0.003	0.010	0.000
		Industrial/LPG	0.000	0.000	0.000
		Industrial/Natural Gas	0.001	0.003	0.000
		Industrial/Residual Oil	0.000	0.003	0.000
		Non-catalytic Woodstoves:General	0.000	0.000	0.000
		Res:Bituminous/SubbituminousCoal	0.000	0.000	0.000
		Residential/Anthracite Coal	0.000	0.000	0.000
		Residential/Distillate Oil	0.000	0.000	0.000
		Residential/LPG	0.002	0.009	0.000
		Residential/Natural Gas	0.010	0.040	0.001
		Residential/Residual Oil	0.000	0.000	0.000
		Wood: Fireplaces	0.000	0.000	0.000
		Woodstoves:General	0.000	0.000	0.000
	Storage and Transport	GasServStat/UndergroundTank:Breath&Empty	0.000	0.000	0.023
		Trucks in Transit	0.000	0.000	0.002
	Waste Disposal, Treatment, and Recovery	All Categories/Land Clearing Debris	0.320	0.000	0.020
		AllCategories/YardWaste-BrushSpUnspecify	0.007	0.000	0.001
		AllCategories/YardWaste-LeafSpUnspecify	0.006	0.000	0.001
		Landfills	0.000	0.000	0.018
		Residential/Household Waste	0.090	0.007	0.004
		TSDFs	0.000	0.000	0.050
		Waste Disposal, Treatment, and Recovery	0.000	0.000	0.000
		Waste Disposal, Treatment, and Recovery (Leaking Underground Storage Tanks)	0.000	0.000	0.005
		Waste Disposal, Treatment, and Recovery (Wastewater Treatment)	0.000	0.000	0.000
		Wastewater Treatment/Public Owned	0.000	0.000	0.015
Caldwell Total			0.745	0.537	15.288
Hays	Agriculture Production	Agriculture Production - Crops (Fertilizer)	0.000	0.000	0.000
		FIFRA Related Products: Other FIFRA Related Products	0.000	0.299	0.000
		Pesticide Application: All Processes	0.000	0.000	0.329
	Fuel Storage and Transport	Aircraft	0.000	0.000	0.080
		Aircraft Refueling: All Fuels	0.000	0.000	0.000
		Storage and Transport (Organic chemical storage)	0.000	0.000	0.000
		Storage and Transport (Petroleum Breathing loss)	0.000	0.000	0.000
		Storage and Transport (Petroleum)	0.000	0.000	0.185
	Industrial Processes (Food)	Bakery Products	0.000	0.000	0.011
		Fermentation/Beverages:Breweries	0.000	0.000	0.000
		Fermentation/Beverages:Wineries	0.000	0.000	0.000
		Industrial Processes (Construction)	0.000	0.000	0.000
	Industrial Processes (Oil&Gas Production)	Oil and Gas Production (All Processes - Well)	0.000	0.000	0.000

	Oil and Gas Production (Natural Gas - Produced)	0.000	0.000	0.000
Miscellaneous Area Sources - Acidental Releases	All Catastrophic/Accidential Releases	0.000	0.000	0.036
Miscellaneous Area Sources - Other Combustion	Agricultural Field Burning-whole field	0.110	0.007	0.010
	Forest Wildfires	0.180	0.002	0.010
	Miscellaneous Area Sources (Motor Vehicle Fires)	0.003	0.000	0.001
	Prescribed Burning for Forest Management	0.200	0.042	0.273
	Structure Fires	0.014	0.003	0.002
Service Stations	Gasoline Service Stations/Stage1	0.000	0.000	0.830
	Gasoline Service Stations/Stage2:Total	0.000	0.000	0.760
	GasolineServiceStations/Stage2:Spillage	0.000	0.000	0.050
Solvent Utilization - Asphalt	All Asphalt Aplications (Cutback and Emulsified)	0.000	0.000	0.095
	Cutback Asphalt	0.000	0.000	0.000
	Emulsified Asphalt	0.000	0.000	0.000
Solvent Utilization - Degreasing	All Industries: Cold Cleaning	0.000	0.000	0.078
	Auto Repair Services/Cold Cleaning	0.000	0.000	0.017
	Automotive Dealers/Cold Cleaning	0.000	0.000	0.081
	Dry Cleaning	0.000	0.000	0.000
	Electronic/Other Elec/Cold Cleaning	0.000	0.000	0.006
	Electronic/Other Elec/Open Top	0.000	0.000	0.081
	Fabricated Metal Product/Open Top	0.000	0.000	0.063
	FabricatedMetalProduct/Cold Clean	0.000	0.000	0.017
	Industry Machinery/Equip/Cold Clean	0.000	0.000	0.000
	Industry Machinery/Equip/Open Top	0.000	0.000	0.006
	Instrument/Related Product/OpenTop	0.000	0.000	0.012
	Instrument/RelateProduct/ColdClean	0.000	0.000	0.000
Solvent Utilization - Dry Cleaning	Comm/Indust Cleaners:Special Naphthas	0.000	0.000	0.200
Solvent Utilization - Graphic Arts	Graphic Arts	0.000	0.000	0.030
Solvent Utilization - Miscellaneous	Adhesive (Industrial) Application	0.000	0.000	0.035
	All Adhesives and Sealants	0.000	0.000	0.000
	All Automotive Aftermarket Products	0.000	0.000	0.000
	All FIFRA Related Products	0.000	0.000	0.064
	All Household Products	0.000	0.000	0.000
	All Personal Care Products	0.000	0.000	0.000
	Consumer: Adhesives and Sealants	0.000	0.000	0.000
	Consumer: Auto Aftermarket Products	0.000	0.000	0.090
	Consumer: Household Products	0.000	0.000	0.139
	Consumer: Personal Care Products	0.000	0.000	0.209
	Electronic and Other Electrical	0.000	0.000	0.002
	Misc Products (Not Otherwise Covered)	0.000	0.000	0.076
	Rubber/Plastics	0.000	0.000	0.002
	Solvent-BasedMaintCoat/Clean-Up&Thinning	0.000	0.000	0.003
Solvent Utilization - Surface Coating	All Coatings and Related Products	0.000	0.000	0.000
	Architectural Coatings	0.000	0.000	0.140
	Auto Refinishing	0.000	0.000	0.020
	Coating Solvents (Coatings & Rel.)	0.000	0.000	0.236
	Factory Finished Wood	0.000	0.000	0.010
	Flat Paints	0.000	0.000	0.030
	Industrial Maintenance Coatings	0.000	0.000	0.010
	Laquers/Clear	0.000	0.000	0.010

		Large Appliances	0.000	0.000	0.161
		Machinery and Equipment	0.000	0.000	0.030
		Marine	0.000	0.000	0.005
		Metal Coils	0.000	0.000	0.010
		Metal Furniture	0.000	0.000	0.010
		Miscellaneous Manufacturing	0.000	0.000	0.020
		Non-Flat Paints/High Gloss	0.000	0.000	0.010
		Non-Flat Paints/Low&Medium Gloss	0.000	0.000	0.040
		Other Special Purpose Coatings	0.000	0.000	0.142
		Paper	0.000	0.000	0.040
		Primers,Sealers,Undercoats	0.000	0.000	0.030
		Primers,Sealers,Undercoats/Quick-Dry	0.000	0.000	0.020
		Quick-Dry Enamels	0.000	0.000	0.010
		Solvent Utilization (Comercial)	0.000	0.000	0.004
		Solvent Utilization (Metal Cans)	0.000	0.000	0.000
		Solvent Utilization (Surface Coating - Motor Vehicles)	0.000	0.000	0.018
		Solvent Utilization (Surface Coating)	0.000	0.000	0.000
		Stains/Semi-Transparent	0.000	0.000	0.040
		Traffic Markings	0.000	0.000	0.001
		Wood Furniture	0.000	0.000	0.090
	Stationary Source Fuel Combustion	Catalytic Woodstoves:General	0.000	0.000	0.000
		Comm/Institutional: Residual Oil	0.000	0.000	0.000
		Commercial/Institutional/Distillate Oil	0.003	0.006	0.000
		Commercial/Institutional/LPG	0.000	0.001	0.000
		Commercial/Institutional/Natural Gas	0.050	0.060	0.004
		Fireplace Inserts/non-EPA certified	0.000	0.000	0.000
		FireplaceInserts/catalytic/EPAcertified	0.000	0.000	0.000
		FireplaceInserts/noncatalytic/EPAcertify	0.000	0.000	0.000
		Industrial/Distillate Oil	0.010	0.030	0.000
		Industrial/LPG	0.000	0.002	0.000
		Industrial/Natural Gas	0.002	0.010	0.000
		Industrial/Residual Oil	0.001	0.010	0.000
		Non-catalytic Woodstoves:General	0.000	0.000	0.000
		Res:Bituminous/SubbituminousCoal	0.000	0.000	0.000
		Residential/Anthracite Coal	0.000	0.000	0.000
		Residential/Distillate Oil	0.000	0.000	0.000
		Residential/LPG	0.003	0.014	0.000
		Residential/Natural Gas	0.020	0.080	0.001
		Residential/Residual Oil	0.000	0.000	0.000
		Wood: Fireplaces	0.000	0.000	0.000
		Woodstoves:General	0.000	0.000	0.000
	Storage and Transport	GasServStat/UndergroundTank:Breath&Empty	0.000	0.000	0.037
		Trucks in Transit	0.000	0.000	0.006
	Waste Disposal, Treatment, and Recovery	All Categories/Land Clearing Debris	0.380	0.000	0.020
		Landfills	0.000	0.000	0.030
		Residential/Household Waste	0.270	0.010	0.010
		Waste Disposal, Treatment, and Recovery	0.000	0.000	0.000
		Waste Disposal, Treatment, and Recovery (Leaking Underground Storage Tanks)	0.000	0.000	0.302
		Waste Disposal, Treatment, and Recovery (Wastewater Treatment)	0.000	0.000	0.000

		Wastewater Treatment/Public Owned	0.000	0.000	0.033
Hays Total			1.246	0.576	5.465
Travis	Agriculture Production	Agriculture Production - Crops (Fertilizer)	0.000	0.000	0.000
		FIFRA Related Products: Other FIFRA Related Products	0.000	0.679	0.000
		Pesticide Application: All Processes	0.000	0.000	0.731
	Fuel Storage and Transport	Aircraft	0.000	0.000	0.390
		Aircraft Refueling: All Fuels	0.000	0.000	0.004
		Storage and Transport (Organic chemical storage)	0.000	0.000	0.000
		Storage and Transport (Petroleum Breathing loss)	0.000	0.000	0.002
		Storage and Transport (Petroleum)	0.000	0.000	2.264
	Industrial Processes (Food)	Bakery Products	0.000	0.000	0.369
		Fermentation/Beverages:Breweries	0.000	0.000	0.016
		Fermentation/Beverages:Wineries	0.000	0.000	0.000
		Industrial Processes (Construction)	0.000	0.000	0.000
	Industrial Processes (Oil&Gas Production)	Oil and Gas Production (All Processes - Well)	0.000	0.000	0.000
		Oil and Gas Production (Natural Gas - Produced)	0.000	0.000	0.000
	Miscellaneous Area Sources - Acidental Releases	All Catastrophic/Accidential Releases	0.000	0.000	0.011
	Miscellaneous Area Sources - Other Combustion	Agricultural Field Burning-whole field	0.240	0.010	0.020
		Forest Wildfires	0.010	0.000	0.001
		Miscellaneous Area Sources (Motor Vehicle Fires)	0.033	0.001	0.009
		Prescribed Burning for Forest Management	0.230	0.047	0.307
		Structure Fires	0.129	0.030	0.024
	Service Stations	Gasoline Service Stations/Stage1	0.000	0.000	5.410
		Gasoline Service Stations/Stage2:Total	0.000	0.000	4.860
		GasolineServiceStations/Stage2:Spillage	0.000	0.000	0.360
	Solvent Utilization - Asphalt	All Asphalt Aplications (Cutback and Emulsified)	0.000	0.000	1.260
		Cutback Asphalt	0.000	0.000	0.000
		Emulsified Asphalt	0.000	0.000	0.000
	Solvent Utilization - Degreasing	All Industries: Cold Cleaning	0.000	0.000	2.363
		Auto Repair Services/Cold Cleaning	0.000	0.000	0.604
		Automotive Dealers/Cold Cleaning	0.000	0.000	0.920
		Dry Cleaning	0.000	0.000	0.000
		Electronic/Other Elec/Cold Cleaning	0.000	0.000	0.265
		Electronic/Other Elec/Open Top	0.000	0.000	2.513
		Fabricated Metal Product/Open Top	0.000	0.000	0.121
		FabricatedMetalProduct/Cold Clean	0.000	0.000	0.029
		Furniture/Fixtures/Cold Cleaning	0.000	0.000	0.023
		Furniture/Fixtures/Open Top	0.000	0.000	0.023
		Industry Machinery/Equip/Cold Clean	0.000	0.000	0.150
		Industry Machinery/Equip/Open Top	0.000	0.000	0.443
		Instrument/Related Product/OpenTop	0.000	0.000	0.288
		Instrument/RelateProduct/ColdClean	0.000	0.000	0.029
		Misc Manufacturing/Cold Cleaning	0.000	0.000	0.086
		Misc Manufacturing/Open Top	0.000	0.000	0.121
		Misc Repair Services/Cold Cleaning	0.000	0.000	0.001
		Primary Metal Industries/Open Top	0.000	0.000	0.035
		Primary Metal Industry/Cold Clean	0.000	0.000	0.006
		Transportation Equip/Cold Cleaning	0.000	0.000	0.006
		Transportation Equip/Open Top	0.000	0.000	0.035

Solvent Utilization - Dry Cleaning	Comm/Indust Cleaners:Special Naphthas	0.000	0.000	2.490
Solvent Utilization - Graphic Arts	Graphic Arts	0.000	0.000	0.490
Solvent Utilization - Miscellaneous	Adhesive (Industrial) Application	0.000	0.000	0.279
	All Adhesives and Sealants	0.000	0.000	0.000
	All Automotive Aftermarket Products	0.000	0.000	0.000
	All FIFRA Related Products	0.000	0.000	0.507
	All Household Products	0.000	0.000	0.000
	All Personal Care Products	0.000	0.000	0.000
	Consumer: Adhesives and Sealants	0.000	0.000	0.454
	Consumer: Auto Aftermarket Products	0.000	0.000	1.083
	Consumer: Household Products	0.000	0.000	0.629
	Consumer: Personal Care Products	0.000	0.000	1.847
	Electronic and Other Electrical	0.000	0.000	0.011
	Misc Products (Not Otherwise Covered)	0.000	0.000	0.597
	Rubber/Plastics	0.000	0.000	0.070
	Solvent-BasedMaintCoat/Clean-Up&Thinning	0.000	0.000	0.220
Solvent Utilization - Surface Coating	All Coatings and Related Products	0.000	0.000	0.000
	Architectural Coatings	0.000	0.000	1.250
	Auto Refinishing	0.000	0.000	0.410
	Coating Solvents (Coatings & Rel.)	0.000	0.000	1.861
	Factory Finished Wood	0.000	0.000	0.040
	Flat Paints	0.000	0.000	0.330
	Industrial Maintenance Coatings	0.000	0.000	0.970
	Laquers/Clear	0.000	0.000	0.120
	Large Appliances	0.000	0.000	0.001
	Machinery and Equipment	0.000	0.000	0.280
	Marine	0.000	0.000	0.010
	Metal Coils	0.000	0.000	0.570
	Metal Furniture	0.000	0.000	0.350
	Miscellaneous Manufacturing	0.000	0.000	1.490
	Non-Flat Paints/High Gloss	0.000	0.000	0.120
	Non-Flat Paints/Low&Medium Gloss	0.000	0.000	0.370
	Other Special Purpose Coatings	0.000	0.000	1.117
	Paper	0.000	0.000	0.008
	Primers,Sealers,Undercoats	0.000	0.000	0.260
	Primers,Sealers,Undercoats/Quick-Dry	0.000	0.000	0.200
	Quick-Dry Enamels	0.000	0.000	0.140
	Railroad	0.000	0.000	0.050
	Solvent Utilization (Comercial)	0.000	0.000	0.066
	Solvent Utilization (Metal Cans)	0.000	0.000	0.070
	Solvent Utilization (Surface Coating - Motor Vehicles)	0.000	0.000	0.028
	Solvent Utilization (Surface Coating)	0.000	0.000	0.000
	Stains/Semi-Transparent	0.000	0.000	0.400
	Traffic Markings	0.000	0.000	0.114
	Wood Furniture	0.000	0.000	0.320
Stationary Source Fuel Combustion	Catalytic Woodstoves:General	0.000	0.000	0.000
	Comm/Institutional: Residual Oil	0.000	0.002	0.000
	Commercial/Institutional/Distillate Oil	0.017	0.040	0.000
	Commercial/Institutional/LPG	0.002	0.007	0.000

		Commercial/Institutional/Natural Gas	0.990	1.180	0.060
		Fireplace Inserts/non-EPA certified	0.000	0.000	0.000
		FireplaceInserts/catalytic/EPAcertified	0.000	0.000	0.000
		FireplaceInserts/noncatalytic/EPAcertify	0.000	0.000	0.000
		Industrial/Distillate Oil	0.060	0.220	0.002
		Industrial/LPG	0.005	0.024	0.001
		Industrial/Natural Gas	0.020	0.070	0.001
		Industrial/Residual Oil	0.010	0.070	0.000
		Non-catalytic Woodstoves:General	0.000	0.000	0.000
		Res:Bituminous/SubbituminousCoal	0.000	0.000	0.000
		Residential/Anthracite Coal	0.000	0.000	0.000
		Residential/Distillate Oil	0.000	0.000	0.000
		Residential/LPG	0.008	0.033	0.000
		Residential/Natural Gas	0.150	0.760	0.040
		Residential/Residual Oil	0.000	0.000	0.000
		Wood: Fireplaces	0.000	0.000	0.000
		Woodstoves:General	0.000	0.000	0.000
	Storage and Transport	GasServStat/UndergroundTank:Breath&Empty	0.000	0.000	0.308
		Trucks in Transit	0.000	0.000	0.040
	Waste Disposal, Treatment, and Recovery	All Categories/Land Clearing Debris	5.070	0.000	0.340
		Landfills	0.000	0.000	0.466
		Residential/Household Waste	0.600	0.040	0.020
		TSDFs	0.000	0.000	5.460
		Waste Disposal, Treatment, and Recovery	0.000	0.000	0.000
		Waste Disposal, Treatment, and Recovery (Leaking Underground Storage Tanks)	0.000	0.000	0.130
		Waste Disposal, Treatment, and Recovery (Wastewater Treatment)	0.000	0.000	0.000
		Wastewater Treatment/Public Owned	0.000	0.000	0.020
Travis Total			7.574	3.215	50.603
Williamson	Agriculture Production	Agriculture Production - Crops (Fertilizer)	0.000	0.000	0.000
		FIFRA Related Products: Other FIFRA Related Products	0.000	2.429	0.000
		Pesticide Application: All Processes	0.000	0.000	2.546
	Fuel Storage and Transport	Aircraft	0.000	0.000	0.001
		Aircraft Refueling: All Fuels	0.000	0.000	0.001
		Storage and Transport (Organic chemical storage)	0.000	0.000	0.000
		Storage and Transport (Petroleum Breathing loss)	0.000	0.002	0.000
		Storage and Transport (Petroleum)	0.000	0.000	0.747
	Industrial Processes (Food)	Bakery Products	0.000	0.000	0.045
		Fermentation/Beverages:Breweries	0.000	0.000	0.000
		Fermentation/Beverages:Wineries	0.000	0.000	0.000
		Industrial Processes (Construction)	0.000	0.000	0.000
	Industrial Processes (Oil&Gas Production)	Oil and Gas Production (All Processes - Well)	0.001	0.002	0.300
		Oil and Gas Production (Natural Gas - Produced)	0.000	0.000	0.000
	Miscellaneous Area Sources - Acidental Releases	All Catastrophic/Accidental Releases	0.000	0.000	0.084
	Miscellaneous Area Sources - Other Combustion	Agricultural Field Burning-whole field	0.780	0.030	0.090
		Forest Wildfires	0.200	0.002	0.010
		Miscellaneous Area Sources (Motor Vehicle Fires)	0.002	0.000	0.001
		Prescribed Burning for Forest Management	0.170	0.034	0.226
		Structure Fires	0.026	0.006	0.005
	Service Stations	Gasoline Service Stations/Stage1	0.000	0.000	1.230

		Gasoline Service Stations/Stage2:Total	0.000	0.000	1.290
		GasolineServiceStations/Stage2:Spillage	0.000	0.000	0.090
	Solvent Utilization - Asphalt	All Asphalt Aplications (Cutback and Emulsified)	0.000	0.000	0.421
		Cutback Asphalt	0.000	0.000	0.000
		Emulsified Asphalt	0.000	0.000	0.000
	Solvent Utilization - Degreasing	All Industries: Cold Cleaning	0.000	0.000	0.210
		Auto Repair Services/Cold Cleaning	0.000	0.000	0.046
		Automotive Dealers/Cold Cleaning	0.000	0.000	0.138
		Dry Cleaning	0.000	0.000	0.000
		Electronic/Other Elec/Cold Cleaning	0.000	0.000	0.017
		Electronic/Other Elec/Open Top	0.000	0.000	0.167
		Fabricated Metal Product/Open Top	0.000	0.000	0.035
		FabricatedMetalProduct/Cold Clean	0.000	0.000	0.012
		Furniture/Fixtures/Cold Cleaning	0.000	0.000	0.006
		Furniture/Fixtures/Open Top	0.000	0.000	0.006
		Industry Machinery/Equip/Cold Clean	0.000	0.000	0.023
		Industry Machinery/Equip/Open Top	0.000	0.000	0.063
		Instrument/Related Product/OpenTop	0.000	0.000	0.046
		Instrument/RelateProduct/ColdClean	0.000	0.000	0.006
		Misc Manufacturing/Cold Cleaning	0.000	0.000	0.001
		Misc Manufacturing/Open Top	0.000	0.000	0.001
		Primary Metal Industries/Open Top	0.000	0.000	0.001
		Transportation Equip/Cold Cleaning	0.000	0.000	0.000
		Transportation Equip/Open Top	0.000	0.000	0.001
	Solvent Utilization - Dry Cleaning	Comm/Indust Cleaners:Special Naphthas	0.000	0.000	0.230
	Solvent Utilization - Graphic Arts	Graphic Arts	0.000	0.000	0.040
	Solvent Utilization - Miscellaneous	Adhesive (Industrial) Application	0.000	0.000	0.090
		All Adhesives and Sealants	0.000	0.000	0.000
		All Automotive Aftermarket Products	0.000	0.000	0.000
		All FIFRA Related Products	0.000	0.000	0.163
		All Household Products	0.000	0.000	0.000
		All Personal Care Products	0.000	0.000	0.000
		Consumer: Adhesives and Sealants	0.000	0.000	0.000
		Consumer: Auto Aftermarket Products	0.000	0.000	0.227
		Consumer: Household Products	0.000	0.000	0.531
		Consumer: Personal Care Products	0.000	0.000	0.531
		Electronic and Other Electrical	0.000	0.000	0.006
		Misc Products (Not Otherwise Covered)	0.000	0.000	0.192
		Rubber/Plastics	0.000	0.000	0.070
		Solvent-BasedMaintCoat/Clean-Up&Thinning	0.000	0.000	0.040
	Solvent Utilization - Surface Coating	All Coatings and Related Products	0.000	0.000	0.000
		Architectural Coatings	0.000	0.000	0.390
		Auto Refinishing	0.000	0.000	0.110
		Coating Solvents (Coatings & Rel.)	0.000	0.000	0.598
		Factory Finished Wood	0.000	0.000	0.010
		Flat Paints	0.000	0.000	0.100
		Industrial Maintenance Coatings	0.000	0.000	0.170
		Laquers/Clear	0.000	0.000	0.030
		Large Appliances	0.000	0.000	0.010

		Machinery and Equipment	0.000	0.000	0.080
		Marine	0.000	0.000	0.001
		Metal Coils	0.000	0.000	1.000
		Metal Furniture	0.000	0.000	0.120
		Miscellaneous Manufacturing	0.000	0.000	0.320
		Non-Flat Paints/High Gloss	0.000	0.000	0.030
		Non-Flat Paints/Low&Medium Gloss	0.000	0.000	0.110
		Other Special Purpose Coatings	0.000	0.000	0.359
		Paper	0.000	0.000	0.020
		Primers,Sealers,Undercoats	0.000	0.000	0.080
		Primers,Sealers,Undercoats/Quick-Dry	0.000	0.000	0.060
		Quick-Dry Enamels	0.000	0.000	0.040
		Solvent Utilization (Comercial)	0.000	0.000	0.024
		Solvent Utilization (Metal Cans)	0.000	0.000	0.000
		Solvent Utilization (Surface Coating - Motor Vehicles)	0.000	0.000	0.005
		Solvent Utilization (Surface Coating)	0.000	0.000	0.000
		Stains/Semi-Transparent	0.000	0.000	0.130
		Traffic Markings	0.000	0.000	0.002
		Wood Furniture	0.000	0.000	0.380
	Stationary Source Fuel Combustion	Catalytic Woodstoves:General	0.000	0.000	0.000
		Comm/Institutional: Residual Oil	0.000	0.001	0.000
		Commercial/Institutional/Distillate Oil	0.005	0.013	0.000
		Commercial/Institutional/LPG	0.001	0.002	0.000
		Commercial/Institutional/Natural Gas	0.130	0.160	0.009
		Fireplace Inserts/non-EPA certified	0.000	0.000	0.000
		FireplaceInserts/catalytic/EPAcertified	0.000	0.000	0.000
		FireplaceInserts/noncatalytic/EPAcertify	0.000	0.000	0.000
		Industrial/Distillate Oil	0.010	0.050	0.001
		Industrial/LPG	0.001	0.006	0.000
		Industrial/Natural Gas	0.003	0.020	0.000
		Industrial/Residual Oil	0.001	0.020	0.000
		Non-catalytic Woodstoves:General	0.000	0.000	0.000
		Res:Bituminous/SubbituminousCoal	0.000	0.000	0.000
		Residential/Anthracite Coal	0.000	0.000	0.000
		Residential/Distillate Oil	0.000	0.000	0.000
		Residential/LPG	0.004	0.019	0.000
		Residential/Natural Gas	0.040	0.190	0.010
		Residential/Residual Oil	0.000	0.000	0.000
		Wood: Fireplaces	0.000	0.000	0.000
		Woodstoves:General	0.000	0.000	0.000
	Storage and Transport	GasServStat/UndergroundTank:Breath&Empty	0.000	0.000	0.097
		Trucks in Transit	0.000	0.000	0.010
	Waste Disposal, Treatment, and Recovery	All Categories/Land Clearing Debris	1.270	0.000	0.080
		Landfills	0.000	0.000	0.139
		Residential/Household Waste	0.350	0.020	0.010
		Waste Disposal, Treatment, and Recovery	0.000	0.000	0.000
		Waste Disposal, Treatment, and Recovery (Leaking Underground Storage Tanks)	0.000	0.000	0.028
		Waste Disposal, Treatment, and Recovery (Wastewater Treatment)	0.000	0.000	0.000
		Wastewater Treatment/Public Owned	0.000	0.000	0.135

Williamson Total	2.995	3.004	14.681
Grand Total	13.791	7.934	90.558

1 INTRODUCTION

Since the promulgation of the Clean Air Act (CAA) by the United States Congress some forty years ago, the impetus nationwide to maintain high air quality standards has only increased. For most of the intervening time, the Austin region has enjoyed the clear skies and clean air associated with many of the less densely populated areas of the country.

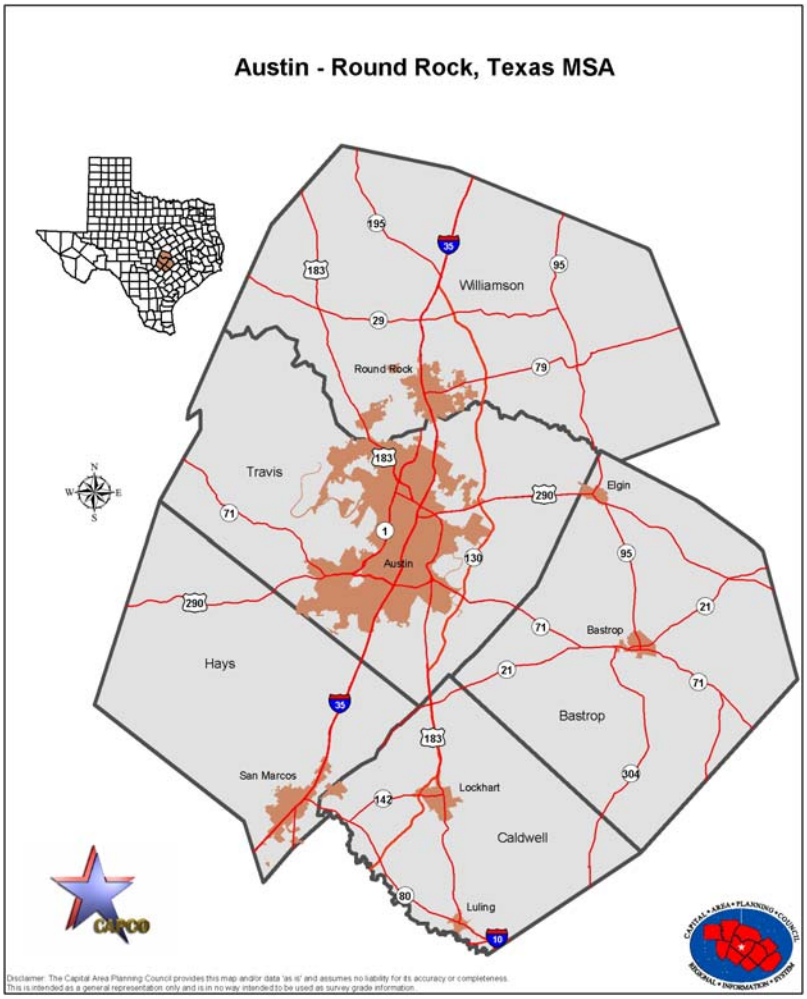
In 1997, air quality monitors began to compile the three-year set of eight-hour average ozone readings required by the amended National Ambient Air Quality Standards (NAAQS). This amendment, recently upheld by the Supreme Court, sets a stricter standard intended to more aggressively protect human health and the environment. As a consequence, air quality considerations take on increased importance as regions develop plans for meeting the revised ozone standard.

The compilation of the 1999 emissions inventory for the Austin-Round Rock MSA (5 Counties: Bastrop, Caldwell, Hays, Travis and Williamson) required extensive research and analysis. This emissions inventory (EI) provides a vast database of the many regional pollution sources, their emissions and emission rates. By understanding these varied sources that together create ozone pollution, planners, political leaders and common citizens can work together to better manage them. Understanding and management skills are necessary to achieve and maintain air quality. This 1999 emissions inventory provides an important tool that will be used for the planning and management process.

An initial step in developing an emissions inventory is delineating the coverage area. This inventory encompasses the five Austin-Round Rock MSA counties, which includes Travis, the most populous county of the region, and the four surrounding counties of Bastrop, Caldwell, Hays, and Williamson (see figure 1-1).

The 1999 Austin-Round Rock MSA emissions inventory is divided into six categories of emission sources. These include biogenic sources and four anthropogenic emission source categories: point, on-road, non-road, and area sources, as described below:

Figure 1-1. Map of the Austin - Round Rock MSA Region



- Point sources are those stationary emitters individually producing enough pollution that a description of each singular source is warranted. The state of Texas, through the Texas Commission of Environmental Quality (former TNRCC), maintains records of point sources. This category is further subdivided between major and minor point sources.

- The on-road mobile category is a self-descriptive term referring to the many vehicles, cars, trucks, buses, and so on, traveling the regional roads and highways.
- Non-road mobile sources account for the emissions of mobile equipment that are operated in areas other than public thoroughfares. The non-road category includes such sources as farm vehicles, lawn and garden equipment, construction, mining, and industrial equipment, railroad locomotives, and others.
- Area sources are sources that are so numerous and individually produce such low levels of contaminants that identification of individual sources is untenable because individually these sources do not approach the threshold amounts that would trigger reporting requirements. Nevertheless the cumulative impact of the area source contribution to overall emissions can be significant.
- Biogenic sources include emissions from trees, other vegetations, and soil.

Ozone forms from the chemical reactions of air pollutants – volatile organic compounds (VOC), nitrous oxides (NOx) and, to a lesser extent, carbon monoxide (CO) – in the presence of sunlight. Therefore, the intent of this emissions inventory is to identify and quantify ozone precursor emissions as completely and accurately as possible. To accomplish this, EPA guidance was consulted and, whenever time or other constraints permitted, EPA's preferred methodology was used to develop emission estimations. The agency's preferred methodology typically requires the use of site-specific data, which is primarily obtained from surveys. Although surveying is a costly and time-consuming process, it ensures that specific production, operation or employment figures are used in the emission calculation process.

Once data is obtained through either the use of surveys or alternative methods, emissions are estimated and allocated to the proper biogenic or anthropogenic category. Figures 1-2 through 1-7 provide a graphical comparison of emissions of VOC, NOx and CO by source category in tons per average ozone weekday. Travis County source categories are provided in one set of pie charts, while emissions from the surrounding four counties are consolidated in the other set. Tables 1-8 through 1-10 list VOC, NOx and CO emissions

in tons per average ozone weekday by major category for each of the five Austin-Round Rock MSA Counties.

One of the conclusions that can be drawn from these tables is that, in the Austin-Round Rock MSA region, on-road sources are a primary contributor of VOC, NOx and CO anthropogenic emissions. In Travis County for example, on-road sources generate 63.06 tons of NOx emissions on a typical ozone summer day. The next highest contribution comes from non-road sources, 16.69 tons per day, followed by point sources, 15.34 tons, and area sources, 3.17 tons. With regards to anthropogenic VOC emissions, on-road sources in Travis County produce 32.61 tons per typical ozone season day, while area sources produce 50.6 tons, non-road sources generate 15.59 tons, and point sources produce 3.7 tons.

The following chapters describe in detail the methodology used to determine emissions from the numerous sources of VOC, NOx and CO in the Austin-Round Rock MSA. In addition, the chapters provide the results of the emission calculations for each source category in tons per year and tons per day (typical summer ozone season day).

Figure 1-2 Austin-Round Rock MSA NOx Emissions

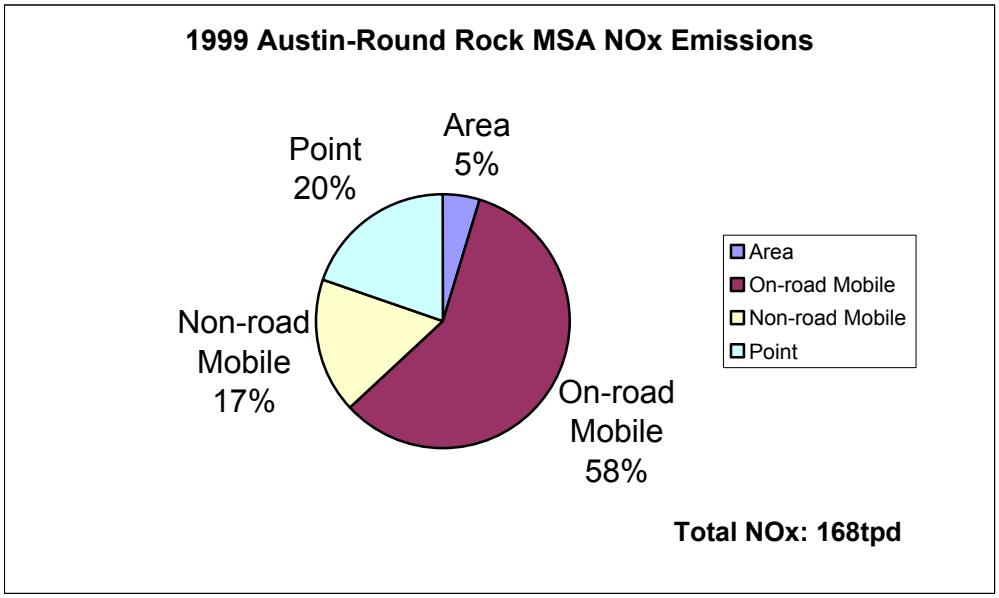


Figure 1-3 Austin-Round Rock MSA VOC Emissions

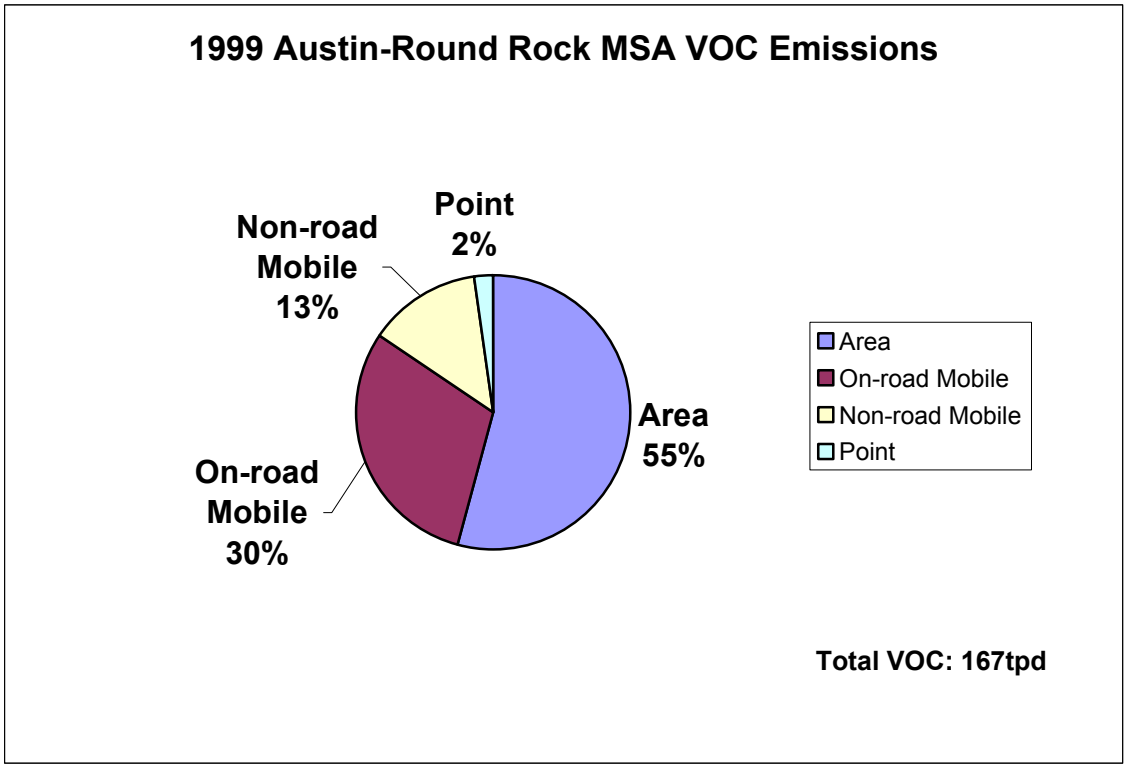


Figure 1-4 Austin-Round Rock MSA CO Emissions

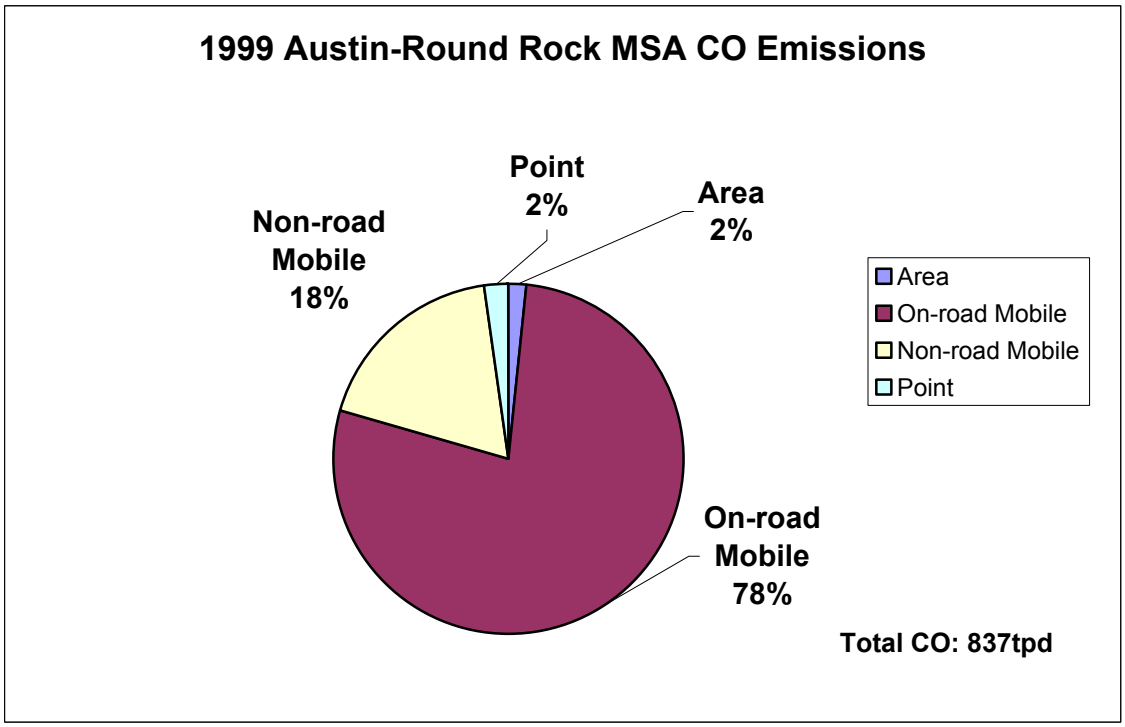


Figure 1-5. Travis County VOC Emissions.

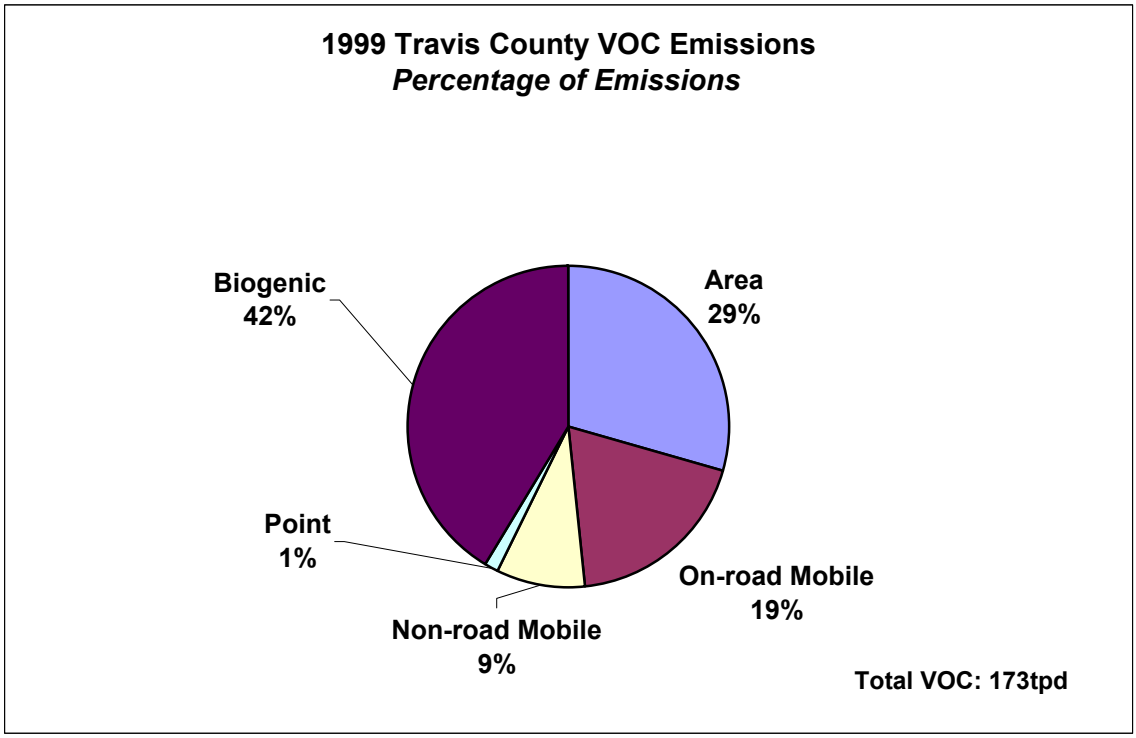


Figure 1-6. Surrounding Counties VOC Emissions.

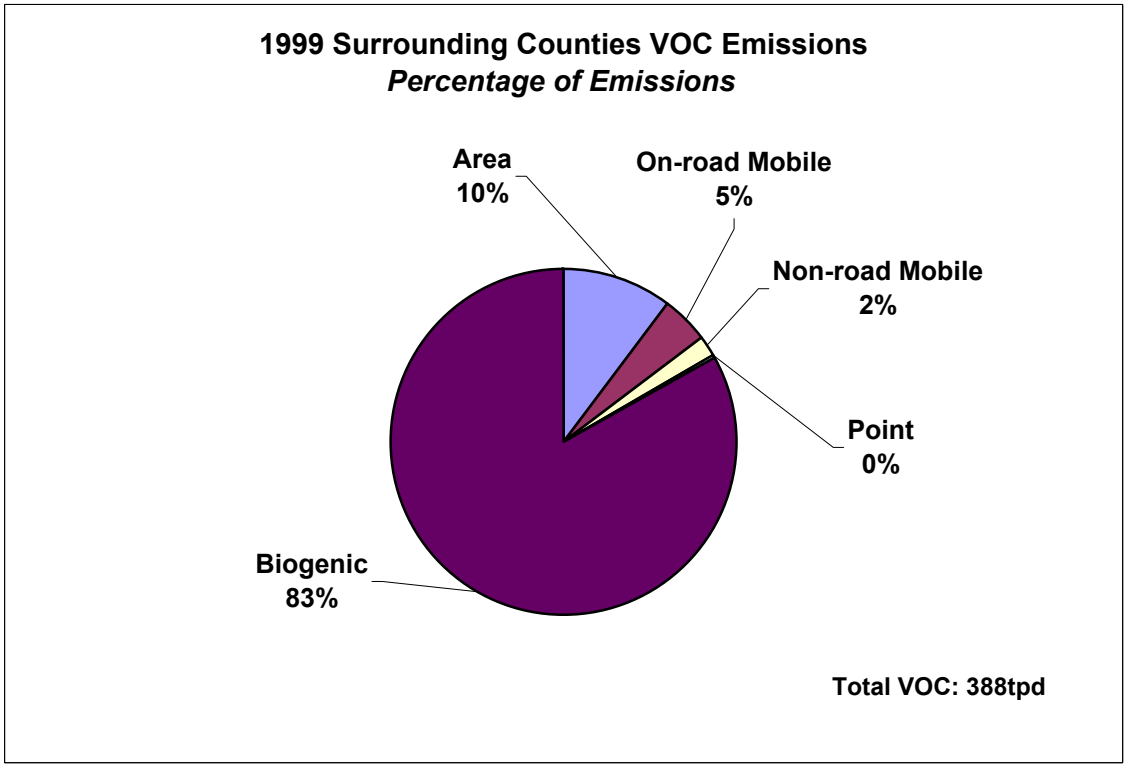


Figure 1-7. Travis County NOx Emissions.

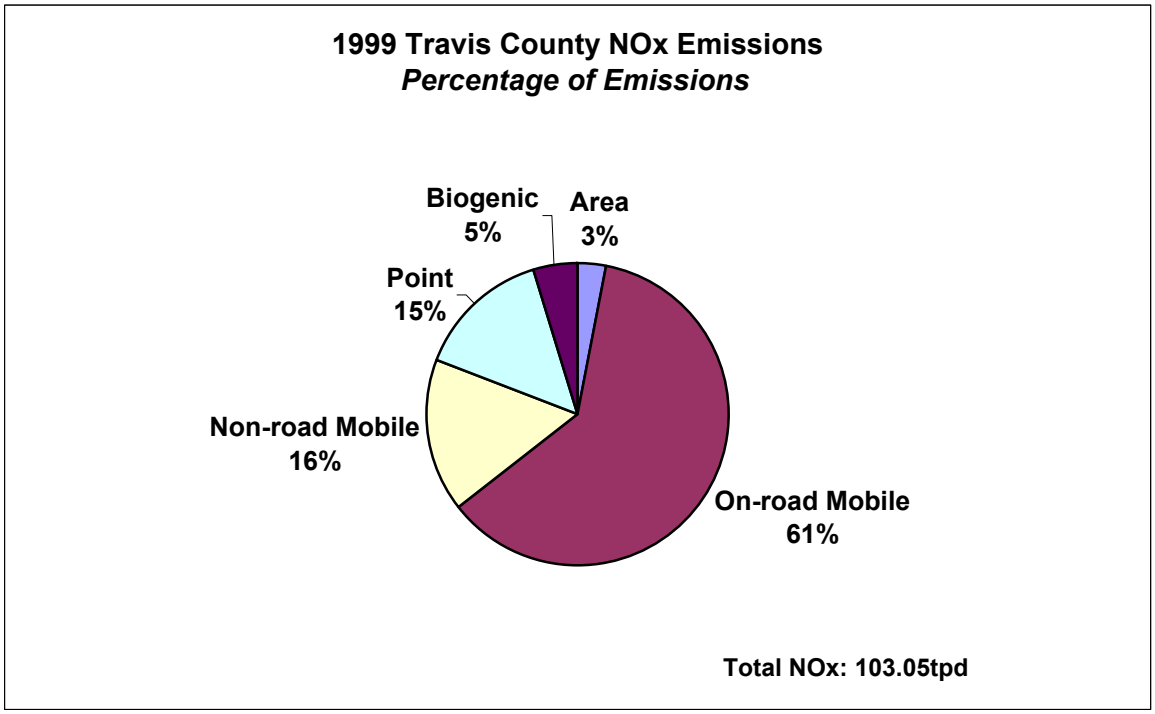


Figure 1-8. Surrounding Counties NOx Emissions.

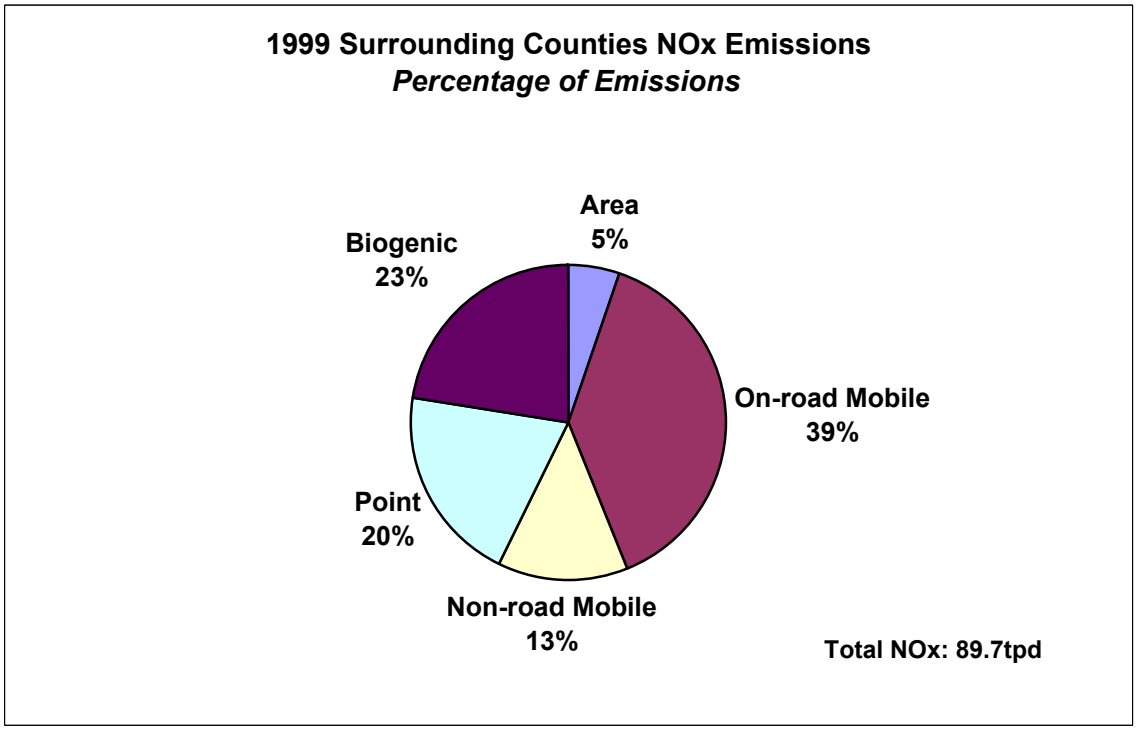


Figure 1-9. Travis County CO Emissions.

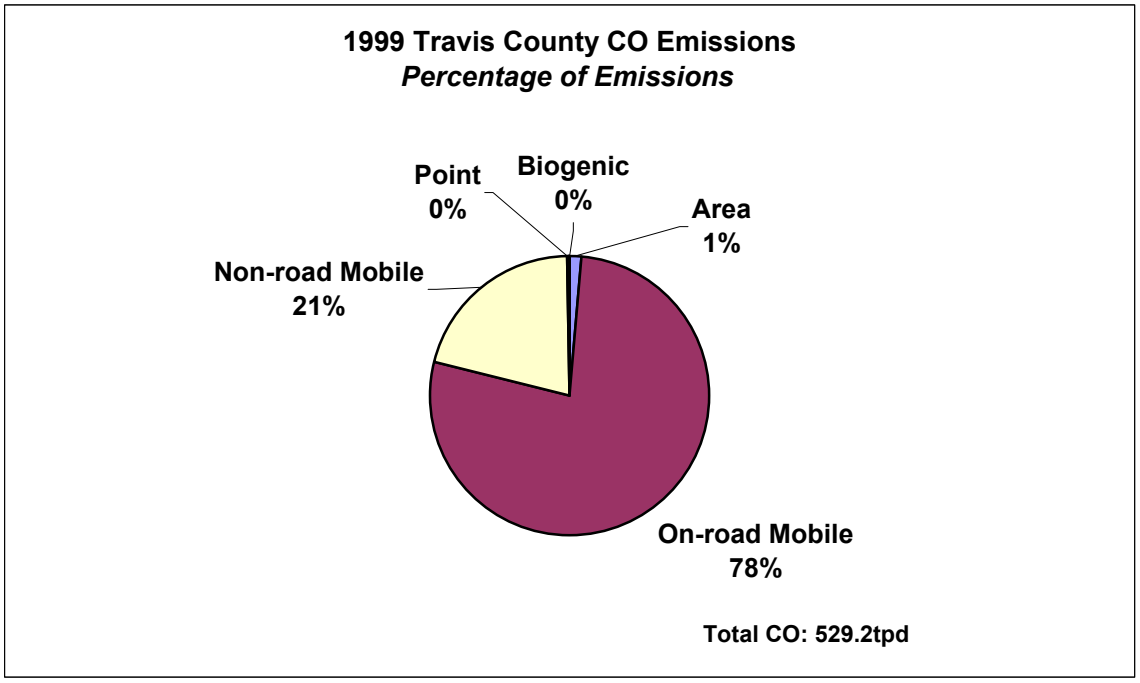


Figure 1-10. Surrounding Counties CO Emissions.

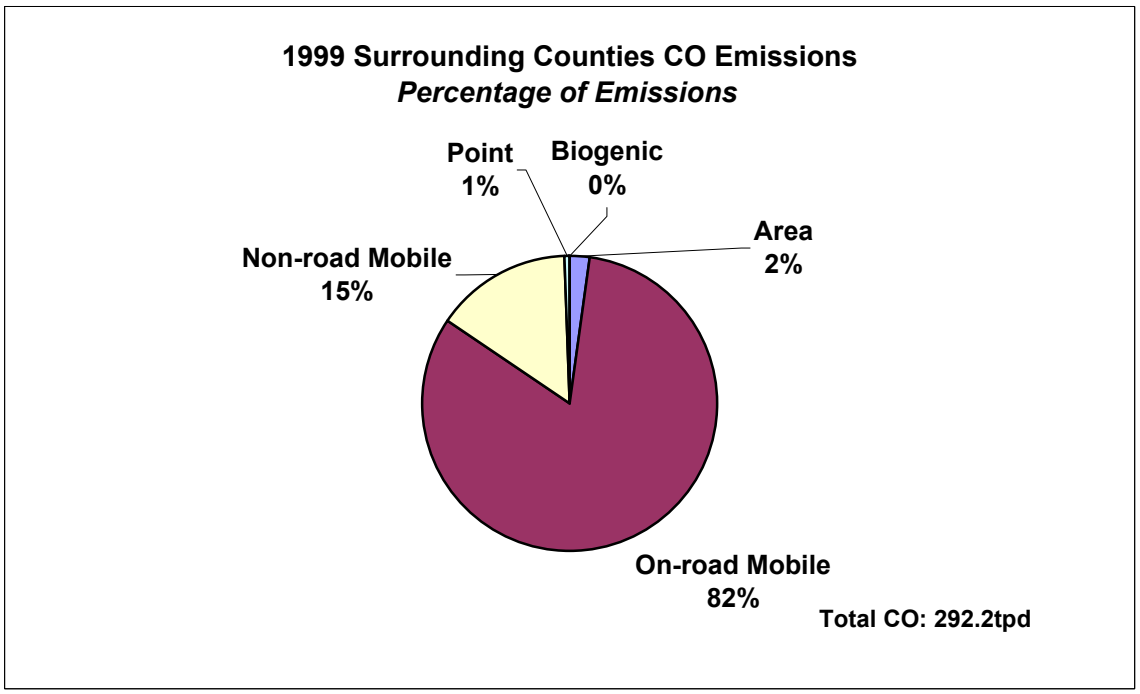


Table 1-8 1999 VOC Emissions by Source Category for Each of the Counties (tons per day for Average Ozone Week Day)

VOC 1999 Ozone Season tpd Emissions

COUNTY	Area	On-road Mobile	Non-road Mobile	Point	Biogenic	Total	**Anthropogenic**
BASTROP	4.52	2.54	0.92	0.42	123.89	**132.29**	**8.40**
CALDWELL	15.29	1.30	0.61	0.47	80.95	**98.62**	**17.67**
HAYS	5.47	4.85	1.53	0.34	49.42	**61.61**	**12.19**
TRAVIS	50.60	32.61	15.59	2.13	71.64	**172.57**	**100.93**
WILLIAMSON	14.68	8.89	3.84	0.34	68.2	**95.95**	**27.75**
Grand Total	**90.56**	**50.19**	**22.49**	**3.70**	**394.10**	**561.03**	**166.93**

Table 1-9 1999 NOx Emissions by Source Category for Each of the Counties (tons per day for Average Ozone Week Day)

NOx 1999 Ozone Season tpd Emissions

COUNTY	Area	On-road Mobile	Non-road Mobile	Point	Biogenic	Total	**Anthropogenic**
BASTROP	0.60	3.95	1.72	7.3	2.18	**15.70**	**13.52**
CALDWELL	0.54	2.32	1.42	3.6	4.93	**12.75**	**7.82**
HAYS	0.54	11.44	1.88	7.3	3.29	**24.43**	**21.14**
TRAVIS	3.17	63.06	16.69	15.3	4.78	**103.05**	**98.27**
WILLIAMSON	2.97	17.09	6.73	0.6	9.85	**37.20**	**27.35**
Grand Total	**7.82**	**97.86**	**28.44**	**33.98**	**25.03**	**193.13**	**168.10**

Table 1-10 1999 VOC Emissions by Source Category for Each of the Counties (tons per day for Average Ozone Week Day)

CO 1999 Ozone Season tpd Emissions

COUNTY	Area	On-road Mobile	Non-road Mobile	Point	Biogenic	Total	**Anthropogenic**
BASTROP	1.23	34.12	4.93	0.60	0.00	**40.87**	**40.87**
CALDWELL	0.75	17.78	3.79	1.31	0.00	**23.62**	**23.62**
HAYS	1.25	70.52	8.31	10.01	0.00	**90.09**	**90.09**
TRAVIS	7.57	409.47	110.02	7.32	0.00	**534.38**	**534.38**
WILLIAMSON	2.99	118.21	26.73	0.11	0.00	**148.04**	**148.04**
Grand Total	**13.79**	**650.10**	**153.77**	**19.35**	**0.00**	**837.02**	**837.02**

Ozone Season, Weekday Emissions				POLLUTANT		
COUNTY	SOURCE CATEGORY	SCC DESCRIPTION	SCC	CO	NOx	VOC
Bastrop	Agricultural Equipment	2-Wheel Tractors	2265005010	0.0033	0.0000	0.0001
			2270005010	0.0000	0.0000	0.0000
		Agricultural Mowers	2265005030	0.0027	0.0000	0.0001
		Agricultural Tractors	2265005015	0.0107	0.0002	0.0003
			2270005015	0.1433	0.2187	0.0304
		Balers	2265005025	0.0062	0.0001	0.0003
			2270005025	0.0001	0.0001	0.0000
		Combines	2265005020	0.0001	0.0000	0.0000
			2270005020	0.0061	0.0175	0.0016
		Hydro-power Units	2260005050	0.0001	0.0000	0.0001
			2265005050	0.0202	0.0001	0.0005
			2267005050	0.0001	0.0000	0.0000
			2270005050	0.0002	0.0004	0.0001
		Irrigation Sets	2265005060	0.0178	0.0003	0.0006
			2267005060	0.0000	0.0000	0.0000
			2268005060	0.0037	0.0009	0.0000
			2270005060	0.0013	0.0029	0.0005
		Other Agricultural Equipment	2265005055	0.0156	0.0002	0.0005
			2267005055	0.0000	0.0000	0.0000
			2268005055	0.0000	0.0000	0.0000
			2270005055	0.0028	0.0044	0.0007
		Sprayers	2260005035	0.0010	0.0000	0.0005
			2265005035	0.0261	0.0002	0.0011
			2270005035	0.0009	0.0012	0.0004
		Swathers	2265005045	0.0101	0.0002	0.0004
			2270005045	0.0006	0.0015	0.0001
		Tillers > 6 HP	2265005040	0.0601	0.0002	0.0019
	Aircraft	Military Aircraft	2275001000	0.0790	0.0004	0.0014
	Commercial Equip.	Air Compressors	2260006015	0.0000	0.0000	0.0000
			2265006015	0.0556	0.0005	0.0019
			2267006015	0.0011	0.0004	0.0001
			2268006015	0.0001	0.0000	0.0000
			2270006015	0.0023	0.0045	0.0006
		Gas Compressors	2268006020	0.0060	0.0013	0.0000
			2270006020	0.0000	0.0000	0.0000
		Generator Sets	2260006005	0.0016	0.0000	0.0008
			2265006005	0.4707	0.0024	0.0142
			2267006005	0.0037	0.0014	0.0003

COUNTY	SOURCE CATEGORY	SCC DESCRIPTION	SCC	CO	NOx	VOC
			2268006005	0.0014	0.0005	0.0000
			2270006005	0.0045	0.0074	0.0012
		Pressure Washers	2265006030	0.2016	0.0011	0.0075
			2267006030	0.0000	0.0000	0.0000
			2270006030	0.0001	0.0002	0.0000
		Pumps	2260006010	0.0122	0.0000	0.0059
			2265006010	0.1080	0.0008	0.0043
			2267006010	0.0009	0.0003	0.0001
			2268006010	0.0001	0.0000	0.0000
			2270006010	0.0010	0.0017	0.0003
		Welders	2265006025	0.1335	0.0010	0.0032
			2267006025	0.0021	0.0005	0.0001
			2270006025	0.0035	0.0022	0.0010
	Construction Equip.	Bore/Drill Rigs	2265002033	0.0053	0.0000	0.0003
			2267002033	0.0001	0.0000	0.0000
			2270002033	0.0015	0.0036	0.0004
		Cement and Mortar Mixers	2265002042	0.0175	0.0001	0.0008
			2270002042	0.0001	0.0001	0.0000
		Concrete/Industrial Saws	2260002039	0.0160	0.0001	0.0060
			2265002039	0.0401	0.0003	0.0009
			2267002039	0.0003	0.0001	0.0000
			2270002039	0.0001	0.0002	0.0000
		Cranes	2265002045	0.0011	0.0000	0.0000
			2267002045	0.0001	0.0000	0.0000
			2270002045	0.0015	0.0050	0.0004
		Crawler Tractor/Dozers	2270002069	0.0184	0.0362	0.0033
		Crushing/Processing Equipment	2260002054	0.0001	0.0000	0.0000
			2265002054	0.0024	0.0000	0.0001
			2267002054	0.0000	0.0000	0.0000
			2270002054	0.0004	0.0011	0.0001
		Dumpers/Tenders	2265002078	0.0028	0.0000	0.0001
			2270002078	0.0000	0.0000	0.0000
		Excavators	2270002036	0.0114	0.0234	0.0021
		Graders	2270002048	0.0036	0.0080	0.0007
		Off-highway Tractors	2270002075	0.0014	0.0021	0.0002
		Off-highway Trucks	2270002051	0.0133	0.0253	0.0022
		Other Construction Equipment	2265002081	0.0014	0.0000	0.0001
			2267002081	0.0002	0.0000	0.0000
			2268002081	0.0000	0.0000	0.0000
			2270002081	0.0020	0.0033	0.0003
		Pavers	2265002003	0.0056	0.0000	0.0001

COUNTY	SOURCE CATEGORY	SCC DESCRIPTION	SCC	CO	NOx	VOC
			2267002003	0.0001	0.0000	0.0000
			2270002003	0.0012	0.0021	0.0002
		Paving Equipment	2260002021	0.0004	0.0000	0.0002
			2265002021	0.0197	0.0001	0.0006
			2267002021	0.0000	0.0000	0.0000
			2270002021	0.0003	0.0005	0.0001
		Plate Compactors	2260002009	0.0003	0.0000	0.0001
			2265002009	0.0100	0.0001	0.0004
			2270002009	0.0000	0.0001	0.0000
		Rollers	2265002015	0.0103	0.0001	0.0002
			2267002015	0.0002	0.0000	0.0000
			2270002015	0.0037	0.0057	0.0007
		Rough Terrain Forklifts	2265002057	0.0017	0.0000	0.0001
			2267002057	0.0002	0.0001	0.0000
			2270002057	0.0053	0.0070	0.0010
		Rubber Tire Loaders	2265002060	0.0041	0.0001	0.0001
			2267002060	0.0006	0.0001	0.0000
			2270002060	0.0171	0.0339	0.0030
		Scrapers	2270002018	0.0041	0.0083	0.0007
		Signal Boards/Light Plants	2260002027	0.0000	0.0000	0.0000
			2265002027	0.0004	0.0000	0.0000
			2270002027	0.0003	0.0005	0.0001
		Skid Steer Loaders	2265002072	0.0073	0.0001	0.0002
			2267002072	0.0004	0.0001	0.0000
			2270002072	0.0124	0.0093	0.0036
		Surfacing Equipment	2265002024	0.0086	0.0001	0.0002
			2267002024	0.0000	0.0000	0.0000
			2270002024	0.0001	0.0001	0.0000
		Tampers/Rammers	2260002006	0.0059	0.0000	0.0022
			2265002006	0.0000	0.0000	0.0000
		Tractors/Loaders/Backhoes	2265002066	0.0123	0.0001	0.0003
			2267002066	0.0001	0.0000	0.0000
			2270002066	0.0177	0.0186	0.0045
		Trenchers	2265002030	0.0172	0.0001	0.0005
			2267002030	0.0004	0.0001	0.0000
			2270002030	0.0020	0.0023	0.0004
	Industrial Equipment	AC\Refrigeration	2265003060	0.0021	0.0000	0.0000
			2268003060	0.0001	0.0000	0.0000
			2270003060	0.0120	0.0209	0.0035
		Aerial Lifts	2265003010	0.0195	0.0003	0.0006
			2267003010	0.0017	0.0004	0.0001

COUNTY	SOURCE CATEGORY	SCC DESCRIPTION	SCC	CO	NOx	VOC
			2270003010	0.0005	0.0006	0.0002
		Forklifts	2265003020	0.0582	0.0011	0.0020
			2267003020	0.1604	0.0403	0.0109
			2268003020	0.0122	0.0031	0.0000
			2270003020	0.0032	0.0049	0.0006
		Other General Industrial Equipment	2260003040	0.0000	0.0000	0.0000
			2265003040	0.0342	0.0002	0.0014
			2267003040	0.0004	0.0001	0.0000
			2268003040	0.0000	0.0000	0.0000
			2270003040	0.0011	0.0031	0.0003
		Other Material Handling Equipment	2265003050	0.0016	0.0000	0.0000
			2267003050	0.0001	0.0000	0.0000
			2270003050	0.0001	0.0002	0.0000
		Sweepers/Scrubbers	2260003030	0.0002	0.0000	0.0001
			2265003030	0.0170	0.0002	0.0005
			2267003030	0.0013	0.0003	0.0001
			2268003030	0.0000	0.0000	0.0000
			2270003030	0.0011	0.0028	0.0003
		Terminal Tractors	2265003070	0.0060	0.0001	0.0002
			2267003070	0.0008	0.0002	0.0001
			2268003070	0.0000	0.0000	0.0000
			2270003070	0.0015	0.0033	0.0003
	Lawn & Garden Equip.	Chain Saws < 6 HP (Residential)	2260004020	0.0250	0.0000	0.0131
		Lawn and Garden Tractors (Residential)	2265004055	1.3130	0.0069	0.0357
		Lawn Mowers (Residential)	2265004010	0.4177	0.0018	0.0374
		Leafblowers/Vacuums (Residential)	2260004030	0.0270	0.0000	0.0132
			2265004030	0.0044	0.0000	0.0004
		Other Lawn and Garden Equipment (Residential)	2265004075	0.0428	0.0002	0.0027
		Rear Engine Riding Mowers (Residential)	2265004040	0.0981	0.0005	0.0029
		Rotary Tillers < 6 HP (Residential)	2260004015	0.0024	0.0000	0.0011
			2265004015	0.0354	0.0002	0.0032
		Trimmers/Edgers/Brush Cutters (Residential)	2260004025	0.0430	0.0001	0.0207
			2265004025	0.0023	0.0000	0.0002
	Lawn and Garden Equipment	Chain Saws < 6 HP (Commercial)	2260004021		0.0010	0.0607
		Chippers/Stump Grinders (Commercial)	2265004066		0.0078	0.0184
			2267004066		0.0000	0.0000
			2270004066		0.0097	0.0014
		Front Mowers (Commercial)	2265004046		0.0002	0.0007
			2270004046		0.0067	0.0013
		Lawn and Garden Tractors (Commercial)	2265004056		0.0000	0.0000
			2270004056		0.0000	0.0000

COUNTY	SOURCE CATEGORY	SCC DESCRIPTION	SCC	CO	NOx	VOC
		Lawn Mowers (Commercial)	2265004011		0.0030	0.0371
		Lawn Mowers (Residential)	2265004010		0.0018	0.1945
		Leafblowers/Vacuums (Commercial)	2260004031		0.0009	0.0266
			2265004031		0.0005	0.0014
			2270004031		0.0000	0.0000
		Other Lawn and Garden Equipment (Commercial)	2265004076		0.0005	0.0049
			2270004076		0.0001	0.0000
		Rear Engine Riding Mowers (Commercial)	2265004041		0.0042	0.0139
		Rotary Tillers < 6 HP (Commercial)	2260004016		0.0001	0.0060
			2265004016		0.0002	0.0028
		Shredders < 6 HP (Commercial)	2265004051		0.0000	0.0002
		Trimmers/Edgers/Brush Cutters (Commercial)	2260004026		0.0004	0.0120
			2265004026		0.0000	0.0001
		Turf Equipment (Commercial)	2260004071		0.0000	0.0000
			2265004071		0.0005	0.0018
			2270004071		0.0018	0.0002
	Railroad and Locomotive	Railway Maintenance (Diesel)	2285002015	0.0015	0.0021	0.0004
		Railway Maintenance (Gasoline, 4-Stroke)	2285004015	0.0034	0.0000	0.0001
		Railway Maintenance (LPG)	2285006015	0.0000	0.0000	0.0000
		Total Railroad Equipment (Diesel)	2285002000	0.0106	1.1078	0.0474
	Recreational Equipment	All Terrain Vehicles	2260001030	0.0328	0.0001	0.0365
			2265001030	0.2095	0.0013	0.0130
		Golf Carts	2265001050	0.2643	0.0015	0.0057
		Inboard/Sterndrive	2282010005	0.0333	0.0010	0.0060
			2282020005	0.0002	0.0011	0.0000
		Motorcycles: Off-road	2260001010	0.0766	0.0002	0.0850
			2265001010	0.0355	0.0002	0.0019
		Outboard	2282005010	0.0646	0.0007	0.0454
			2282020010	0.0000	0.0000	0.0000
		Personal Water Craft	2282005015	0.0280	0.0001	0.0184
		Specialty Vehicles/Carts	2260001060	0.0437	0.0002	0.0014
			2265001060	0.0407	0.0002	0.0014
			2267001060	0.0004	0.0001	0.0000
			2270001060	0.0015	0.0011	0.0004
Bastrop Total				**4.93**	**1.72**	**0.92**
Caldwell	Agricultural Equipment	2-Wheel Tractors	2265005010	0.0035	0.0000	0.0001
			2270005010	0.0000	0.0000	0.0000
		Agricultural Mowers	2265005030	0.0029	0.0000	0.0001
		Agricultural Tractors	2265005015	0.0115	0.0002	0.0004
			2270005015	0.1540	0.2351	0.0327
		Balers	2265005025	0.0066	0.0001	0.0003

COUNTY	SOURCE CATEGORY	SCC DESCRIPTION	SCC	CO	NOx	VOC
			2270005025	0.0001	0.0001	0.0000
		Combines	2265005020	0.0001	0.0000	0.0000
			2270005020	0.0066	0.0188	0.0018
		Hydro-power Units	2260005050	0.0002	0.0000	0.0001
			2265005050	0.0217	0.0001	0.0006
			2267005050	0.0001	0.0000	0.0000
			2270005050	0.0002	0.0004	0.0001
		Irrigation Sets	2265005060	0.0191	0.0004	0.0007
			2267005060	0.0000	0.0000	0.0000
			2268005060	0.0040	0.0010	0.0000
			2270005060	0.0014	0.0031	0.0005
		Other Agricultural Equipment	2265005055	0.0167	0.0002	0.0006
			2267005055	0.0000	0.0000	0.0000
			2268005055	0.0000	0.0000	0.0000
			2270005055	0.0030	0.0047	0.0007
		Sprayers	2260005035	0.0011	0.0000	0.0005
			2265005035	0.0280	0.0002	0.0012
			2270005035	0.0010	0.0013	0.0004
		Swathers	2265005045	0.0108	0.0002	0.0004
			2270005045	0.0006	0.0016	0.0002
		Tillers > 6 HP	2265005040	0.0646	0.0002	0.0020
	Aircraft	Military Aircraft	2275001000	0.5665	0.0031	0.0187
	Commercial Equip.	Air Compressors	2260006015	0.0000	0.0000	0.0000
			2265006015	0.0375	0.0003	0.0013
			2267006015	0.0008	0.0003	0.0001
			2268006015	0.0001	0.0000	0.0000
			2270006015	0.0015	0.0030	0.0004
		Gas Compressors	2268006020	0.0040	0.0009	0.0000
			2270006020	0.0000	0.0000	0.0000
		Generator Sets	2260006005	0.0011	0.0000	0.0005
			2265006005	0.3181	0.0016	0.0096
			2267006005	0.0025	0.0009	0.0002
			2268006005	0.0010	0.0004	0.0000
			2270006005	0.0031	0.0050	0.0008
		Pressure Washers	2265006030	0.1362	0.0008	0.0051
			2267006030	0.0000	0.0000	0.0000
			2270006030	0.0001	0.0001	0.0000
		Pumps	2260006010	0.0083	0.0000	0.0040
			2265006010	0.0730	0.0005	0.0029
			2267006010	0.0006	0.0002	0.0000
			2268006010	0.0000	0.0000	0.0000

COUNTY	SOURCE CATEGORY	SCC DESCRIPTION	SCC	CO	NOx	VOC
			2270006010	0.0007	0.0011	0.0002
		Welders	2265006025	0.0902	0.0007	0.0022
			2267006025	0.0014	0.0004	0.0001
			2270006025	0.0023	0.0015	0.0006
	Construction Equip.	Bore/Drill Rigs	2265002033	0.0034	0.0000	0.0002
			2267002033	0.0001	0.0000	0.0000
			2270002033	0.0010	0.0023	0.0002
		Cement and Mortar Mixers	2265002042	0.0113	0.0000	0.0005
			2270002042	0.0000	0.0001	0.0000
		Concrete/Industrial Saws	2260002039	0.0103	0.0000	0.0039
			2265002039	0.0259	0.0002	0.0006
			2267002039	0.0002	0.0001	0.0000
			2270002039	0.0001	0.0001	0.0000
		Cranes	2265002045	0.0007	0.0000	0.0000
			2267002045	0.0001	0.0000	0.0000
			2270002045	0.0010	0.0032	0.0003
		Crawler Tractor/Dozers	2270002069	0.0119	0.0233	0.0021
		Crushing/Processing Equipment	2260002054	0.0000	0.0000	0.0000
			2265002054	0.0015	0.0000	0.0000
			2267002054	0.0000	0.0000	0.0000
			2270002054	0.0003	0.0007	0.0001
		Dumpers/Tenders	2265002078	0.0018	0.0000	0.0001
			2270002078	0.0000	0.0000	0.0000
		Excavators	2270002036	0.0073	0.0151	0.0014
		Graders	2270002048	0.0023	0.0051	0.0004
		Off-highway Tractors	2270002075	0.0009	0.0014	0.0001
		Off-highway Trucks	2270002051	0.0086	0.0163	0.0014
		Other Construction Equipment	2265002081	0.0009	0.0000	0.0000
			2267002081	0.0001	0.0000	0.0000
			2268002081	0.0000	0.0000	0.0000
			2270002081	0.0013	0.0021	0.0002
		Pavers	2265002003	0.0036	0.0000	0.0001
			2267002003	0.0001	0.0000	0.0000
			2270002003	0.0008	0.0013	0.0001
		Paving Equipment	2260002021	0.0002	0.0000	0.0001
			2265002021	0.0127	0.0001	0.0004
			2267002021	0.0000	0.0000	0.0000
			2270002021	0.0002	0.0003	0.0000
		Plate Compactors	2260002009	0.0002	0.0000	0.0001
			2265002009	0.0064	0.0000	0.0003
			2270002009	0.0000	0.0000	0.0000

COUNTY	SOURCE CATEGORY	SCC DESCRIPTION	SCC	CO	NOx	VOC
		Rollers	2265002015	0.0067	0.0001	0.0002
			2267002015	0.0001	0.0000	0.0000
			2270002015	0.0024	0.0037	0.0005
		Rough Terrain Forklifts	2265002057	0.0011	0.0000	0.0000
			2267002057	0.0001	0.0000	0.0000
			2270002057	0.0034	0.0045	0.0006
		Rubber Tire Loaders	2265002060	0.0026	0.0001	0.0001
			2267002060	0.0004	0.0001	0.0000
			2270002060	0.0110	0.0219	0.0019
		Scrapers	2270002018	0.0027	0.0054	0.0004
		Signal Boards/Light Plants	2260002027	0.0000	0.0000	0.0000
			2265002027	0.0003	0.0000	0.0000
			2270002027	0.0002	0.0003	0.0001
		Skid Steer Loaders	2265002072	0.0047	0.0001	0.0001
			2267002072	0.0003	0.0001	0.0000
			2270002072	0.0080	0.0060	0.0023
		Surfacing Equipment	2265002024	0.0055	0.0000	0.0002
			2267002024	0.0000	0.0000	0.0000
			2270002024	0.0001	0.0001	0.0000
		Tampers/Rammers	2260002006	0.0038	0.0000	0.0014
			2265002006	0.0000	0.0000	0.0000
		Tractors/Loaders/Backhoes	2265002066	0.0080	0.0001	0.0002
			2267002066	0.0000	0.0000	0.0000
			2270002066	0.0114	0.0120	0.0029
		Trenchers	2265002030	0.0111	0.0001	0.0003
			2267002030	0.0002	0.0001	0.0000
			2270002030	0.0013	0.0015	0.0002
	Industrial Equipment	AC\Refrigeration	2265003060	0.0013	0.0000	0.0000
			2268003060	0.0000	0.0000	0.0000
			2270003060	0.0077	0.0135	0.0023
		Aerial Lifts	2265003010	0.0082	0.0001	0.0003
			2267003010	0.0007	0.0002	0.0000
			2270003010	0.0002	0.0003	0.0001
		Forklifts	2265003020	0.0244	0.0005	0.0008
			2267003020	0.0674	0.0169	0.0046
			2268003020	0.0051	0.0013	0.0000
			2270003020	0.0013	0.0021	0.0002
		Other General Industrial Equipment	2260003040	0.0000	0.0000	0.0000
			2265003040	0.0144	0.0001	0.0006
			2267003040	0.0002	0.0000	0.0000
			2268003040	0.0000	0.0000	0.0000

COUNTY	SOURCE CATEGORY	SCC DESCRIPTION	SCC	CO	NOx	VOC
			2270003040	0.0004	0.0013	0.0001
		Other Material Handling Equipment	2265003050	0.0007	0.0000	0.0000
			2267003050	0.0000	0.0000	0.0000
			2270003050	0.0000	0.0001	0.0000
		Sweepers/Scrubbers	2260003030	0.0001	0.0000	0.0000
			2265003030	0.0071	0.0001	0.0002
			2267003030	0.0005	0.0001	0.0000
			2268003030	0.0000	0.0000	0.0000
			2270003030	0.0005	0.0012	0.0001
		Terminal Tractors	2265003070	0.0025	0.0000	0.0001
			2267003070	0.0003	0.0001	0.0000
			2268003070	0.0000	0.0000	0.0000
			2270003070	0.0006	0.0014	0.0001
	Lawn & Garden Equip.	Chain Saws < 6 HP (Residential)	2260004020	0.0155	0.0000	0.0081
		Lawn and Garden Tractors (Residential)	2265004055	0.8127	0.0043	0.0221
		Lawn Mowers (Residential)	2265004010	0.2586	0.0011	0.0232
		Leafblowers/Vacuums (Residential)	2260004030	0.0167	0.0000	0.0082
			2265004030	0.0027	0.0000	0.0002
		Other Lawn and Garden Equipment (Residential)	2265004075	0.0265	0.0001	0.0017
		Rear Engine Riding Mowers (Residential)	2265004040	0.0607	0.0003	0.0018
		Rotary Tillers < 6 HP (Residential)	2260004015	0.0015	0.0000	0.0007
			2265004015	0.0219	0.0001	0.0020
		Trimmers/Edgers/Brush Cutters (Residential)	2260004025	0.0266	0.0000	0.0128
			2265004025	0.0014	0.0000	0.0001
	Lawn and Garden Equipment	Chain Saws < 6 HP (Commercial)	2260004021		0.0005	0.0326
		Chippers/Stump Grinders (Commercial)	2265004066		0.0042	0.0099
			2267004066		0.0000	0.0000
			2270004066		0.0052	0.0008
		Front Mowers (Commercial)	2265004046		0.0001	0.0004
			2270004046		0.0036	0.0007
		Lawn and Garden Tractors (Commercial)	2265004056		0.0000	0.0000
			2270004056		0.0000	0.0000
		Lawn Mowers (Commercial)	2265004011		0.0016	0.0199
		Lawn Mowers (Residential)	2265004010		0.0011	0.1075
		Leafblowers/Vacuums (Commercial)	2260004031		0.0005	0.0143
			2265004031		0.0003	0.0008
			2270004031		0.0000	0.0000
		Other Lawn and Garden Equipment (Commercial)	2265004076		0.0003	0.0026
			2270004076		0.0000	0.0000
		Rear Engine Riding Mowers (Commercial)	2265004041		0.0022	0.0075
		Rotary Tillers < 6 HP (Commercial)	2260004016		0.0001	0.0032

COUNTY	SOURCE CATEGORY	SCC DESCRIPTION	SCC	CO	NOx	VOC
			2265004016		0.0001	0.0015
		Shredders < 6 HP (Commercial)	2265004051		0.0000	0.0001
		Trimmers/Edgers/Brush Cutters (Commercial)	2260004026		0.0002	0.0064
			2265004026		0.0000	0.0001
		Turf Equipment (Commercial)	2260004071		0.0000	0.0000
			2265004071		0.0002	0.0010
			2270004071		0.0009	0.0001
	Railroad and Locomotive	Railway Maintenance (Diesel)	2285002015	0.0010	0.0013	0.0003
		Railway Maintenance (Gasoline, 4-Stroke)	2285004015	0.0022	0.0000	0.0001
		Railway Maintenance (LPG)	2285006015	0.0000	0.0000	0.0000
		Total Railroad Equipment (Diesel)	2285000000	0.1183	0.9322	0.0399
	Recreational Equipment	All Terrain Vehicles	2260001030	0.0328	0.0001	0.0365
			2265001030	0.2095	0.0013	0.0130
		Inboard/Sterndrive	2282010005	0.0070	0.0002	0.0013
			2282020005	0.0000	0.0002	0.0000
		Motorcycles: Off-road	2260001010	0.0766	0.0002	0.0850
			2265001010	0.0355	0.0002	0.0019
		Outboard	2282005010	0.0136	0.0002	0.0096
			2282020010	0.0000	0.0000	0.0000
		Personal Water Craft	2282005015	0.0059	0.0000	0.0039
		Specialty Vehicles/Carts	2260001060	0.0437	0.0002	0.0014
			2265001060	0.0407	0.0002	0.0014
			2267001060	0.0004	0.0001	0.0000
			2270001060	0.0015	0.0011	0.0004
Caldwell Total				**3.79**	**1.42**	**0.61**
Hays	Agricultural Equipment	2-Wheel Tractors	2265005010	0.0018	0.0000	0.0000
			2270005010	0.0000	0.0000	0.0000
		Agricultural Mowers	2265005030	0.0015	0.0000	0.0000
		Agricultural Tractors	2265005015	0.0060	0.0001	0.0002
			2270005015	0.0800	0.1221	0.0170
		Balers	2265005025	0.0034	0.0001	0.0001
			2270005025	0.0000	0.0001	0.0000
		Combines	2265005020	0.0000	0.0000	0.0000
			2270005020	0.0034	0.0098	0.0009
		Hydro-power Units	2260005050	0.0001	0.0000	0.0000
			2265005050	0.0113	0.0001	0.0003
			2267005050	0.0000	0.0000	0.0000
			2270005050	0.0001	0.0002	0.0000
		Irrigation Sets	2265005060	0.0099	0.0002	0.0003
			2267005060	0.0000	0.0000	0.0000
			2268005060	0.0021	0.0005	0.0000

COUNTY	SOURCE CATEGORY	SCC DESCRIPTION	SCC	CO	NOx	VOC
			2270005060	0.0007	0.0016	0.0003
		Other Agricultural Equipment	2265005055	0.0087	0.0001	0.0003
			2267005055	0.0000	0.0000	0.0000
			2268005055	0.0000	0.0000	0.0000
			2270005055	0.0015	0.0024	0.0004
		Sprayers	2260005035	0.0006	0.0000	0.0003
			2265005035	0.0145	0.0001	0.0006
			2270005035	0.0005	0.0007	0.0002
		Swathers	2265005045	0.0056	0.0001	0.0002
			2270005045	0.0003	0.0008	0.0001
		Tillers > 6 HP	2265005040	0.0336	0.0001	0.0011
	Commercial Equip.	Air Compressors	2260006015	0.0000	0.0000	0.0000
			2265006015	0.1126	0.0010	0.0039
			2267006015	0.0023	0.0008	0.0002
			2268006015	0.0002	0.0001	0.0000
			2270006015	0.0046	0.0090	0.0012
		Gas Compressors	2268006020	0.0121	0.0027	0.0000
			2270006020	0.0000	0.0000	0.0000
		Generator Sets	2260006005	0.0033	0.0000	0.0016
			2265006005	0.9543	0.0048	0.0288
			2267006005	0.0076	0.0028	0.0006
			2268006005	0.0029	0.0011	0.0000
			2270006005	0.0092	0.0150	0.0025
		Pressure Washers	2265006030	0.4087	0.0023	0.0153
			2267006030	0.0001	0.0000	0.0000
			2270006030	0.0003	0.0004	0.0001
		Pumps	2260006010	0.0248	0.0000	0.0120
			2265006010	0.2189	0.0015	0.0088
			2267006010	0.0019	0.0007	0.0001
			2268006010	0.0001	0.0001	0.0000
			2270006010	0.0020	0.0034	0.0005
		Welders	2265006025	0.2706	0.0021	0.0066
			2267006025	0.0043	0.0011	0.0003
			2270006025	0.0070	0.0045	0.0019
	Construction Equip.	Bore/Drill Rigs	2265002033	0.0148	0.0001	0.0008
			2267002033	0.0003	0.0001	0.0000
			2270002033	0.0042	0.0100	0.0010
		Cement and Mortar Mixers	2265002042	0.0492	0.0002	0.0021
			2270002042	0.0002	0.0004	0.0001
		Concrete/Industrial Saws	2260002039	0.0449	0.0002	0.0169
			2265002039	0.1128	0.0008	0.0025

COUNTY	SOURCE CATEGORY	SCC DESCRIPTION	SCC	CO	NOx	VOC
			2267002039	0.0010	0.0002	0.0001
			2270002039	0.0004	0.0004	0.0001
		Cranes	2265002045	0.0031	0.0001	0.0001
			2267002045	0.0003	0.0001	0.0000
			2270002045	0.0042	0.0141	0.0012
		Crawler Tractor/Dozers	2270002069	0.0517	0.1016	0.0092
		Crushing/Processing Equipment	2260002054	0.0002	0.0000	0.0001
			2265002054	0.0066	0.0000	0.0002
			2267002054	0.0001	0.0000	0.0000
			2270002054	0.0012	0.0030	0.0003
		Dumpers/Tenders	2265002078	0.0078	0.0000	0.0003
			2270002078	0.0001	0.0001	0.0000
		Excavators	2270002036	0.0319	0.0657	0.0059
		Graders	2270002048	0.0101	0.0224	0.0020
		Off-highway Tractors	2270002075	0.0039	0.0059	0.0006
		Off-highway Trucks	2270002051	0.0375	0.0710	0.0061
		Other Construction Equipment	2265002081	0.0040	0.0001	0.0001
			2267002081	0.0005	0.0001	0.0000
			2268002081	0.0000	0.0000	0.0000
			2270002081	0.0056	0.0092	0.0009
		Pavers	2265002003	0.0157	0.0001	0.0004
			2267002003	0.0003	0.0001	0.0000
			2270002003	0.0034	0.0059	0.0006
		Paving Equipment	2260002021	0.0010	0.0000	0.0005
			2265002021	0.0553	0.0003	0.0018
			2267002021	0.0001	0.0000	0.0000
			2270002021	0.0009	0.0014	0.0002
		Plate Compactors	2260002009	0.0008	0.0000	0.0004
			2265002009	0.0280	0.0001	0.0012
			2270002009	0.0001	0.0002	0.0000
		Rollers	2265002015	0.0290	0.0002	0.0007
			2267002015	0.0006	0.0001	0.0000
			2270002015	0.0104	0.0160	0.0020
		Rough Terrain Forklifts	2265002057	0.0047	0.0001	0.0002
			2267002057	0.0006	0.0002	0.0000
			2270002057	0.0148	0.0196	0.0027
		Rubber Tire Loaders	2265002060	0.0115	0.0002	0.0004
			2267002060	0.0016	0.0004	0.0001
			2270002060	0.0480	0.0952	0.0084
		Scrapers	2270002018	0.0117	0.0234	0.0019
		Signal Boards/Light Plants	2260002027	0.0000	0.0000	0.0000

COUNTY	SOURCE CATEGORY	SCC DESCRIPTION	SCC	CO	NOx	VOC
			2265002027	0.0012	0.0000	0.0000
			2270002027	0.0009	0.0014	0.0003
		Skid Steer Loaders	2265002072	0.0206	0.0002	0.0006
			2267002072	0.0011	0.0003	0.0001
			2270002072	0.0347	0.0260	0.0100
		Surfacing Equipment	2265002024	0.0240	0.0001	0.0007
			2267002024	0.0001	0.0000	0.0000
			2270002024	0.0003	0.0003	0.0001
		Tampers/Rammers	2260002006	0.0167	0.0001	0.0061
			2265002006	0.0001	0.0000	0.0000
		Tractors/Loaders/Backhoes	2265002066	0.0346	0.0002	0.0007
			2267002066	0.0002	0.0000	0.0000
			2270002066	0.0497	0.0522	0.0125
		Trenchers	2265002030	0.0484	0.0004	0.0015
			2267002030	0.0010	0.0003	0.0001
			2270002030	0.0055	0.0066	0.0011
	Industrial Equipment	AC\Refrigeration	2265003060	0.0036	0.0000	0.0001
			2268003060	0.0001	0.0000	0.0000
			2270003060	0.0211	0.0368	0.0062
		Aerial Lifts	2265003010	0.0601	0.0008	0.0019
			2267003010	0.0053	0.0013	0.0004
			2270003010	0.0017	0.0020	0.0005
		Forklifts	2265003020	0.1795	0.0034	0.0060
			2267003020	0.4950	0.1243	0.0336
			2268003020	0.0376	0.0094	0.0002
			2270003020	0.0099	0.0153	0.0018
		Other General Industrial Equipment	2260003040	0.0000	0.0000	0.0000
			2265003040	0.1056	0.0007	0.0043
			2267003040	0.0012	0.0003	0.0001
			2268003040	0.0000	0.0000	0.0000
			2270003040	0.0033	0.0095	0.0009
		Other Material Handling Equipment	2265003050	0.0049	0.0001	0.0001
			2267003050	0.0003	0.0001	0.0000
			2270003050	0.0003	0.0005	0.0001
		Other Oil Field Equipment	2265010010	0.0240	0.0001	0.0005
			2268010010	0.0024	0.0006	0.0000
			2270010010	0.0007	0.0019	0.0002
		Sweepers/Scrubbers	2260003030	0.0005	0.0000	0.0002
			2265003030	0.0525	0.0007	0.0016
			2267003030	0.0039	0.0010	0.0003
			2268003030	0.0000	0.0000	0.0000

COUNTY	SOURCE CATEGORY	SCC DESCRIPTION	SCC	CO	NOx	VOC
			2270003030	0.0033	0.0086	0.0010
		Terminal Tractors	2265003070	0.0184	0.0003	0.0006
			2267003070	0.0024	0.0006	0.0002
			2268003070	0.0001	0.0000	0.0000
			2270003070	0.0046	0.0101	0.0009
	Lawn & Garden Equip.	Chain Saws < 6 HP (Residential)	2260004020	0.0363	0.0000	0.0190
		Lawn and Garden Tractors (Residential)	2265004055	1.9067	0.0100	0.0518
		Lawn Mowers (Residential)	2265004010	0.6067	0.0026	0.0543
		Leafblowers/Vacuums (Residential)	2260004030	0.0392	0.0000	0.0191
			2265004030	0.0064	0.0000	0.0005
		Other Lawn and Garden Equipment (Residential)	2265004075	0.0621	0.0003	0.0039
		Rear Engine Riding Mowers (Residential)	2265004040	0.1425	0.0007	0.0042
		Rotary Tillers < 6 HP (Residential)	2260004015	0.0035	0.0000	0.0016
			2265004015	0.0513	0.0002	0.0047
		Trimmers/Edgers/Brush Cutters (Residential)	2260004025	0.0624	0.0001	0.0301
			2265004025	0.0034	0.0000	0.0003
	Lawn and Garden Equipment	Chain Saws < 6 HP (Commercial)	2260004021		0.0017	0.1077
		Chippers/Stump Grinders (Commercial)	2265004066		0.0138	0.0326
			2267004066		0.0000	0.0000
			2270004066		0.0172	0.0026
		Front Mowers (Commercial)	2265004046		0.0003	0.0013
			2270004046		0.0119	0.0023
		Lawn and Garden Tractors (Commercial)	2265004056		0.0000	0.0000
			2270004056		0.0000	0.0000
		Lawn Mowers (Commercial)	2265004011		0.0053	0.0657
		Lawn Mowers (Residential)	2265004010		0.0026	0.3330
		Leafblowers/Vacuums (Commercial)	2260004031		0.0015	0.0471
			2265004031		0.0009	0.0025
			2270004031		0.0001	0.0000
		Other Lawn and Garden Equipment (Commercial)	2265004076		0.0010	0.0086
			2270004076		0.0001	0.0000
		Rear Engine Riding Mowers (Commercial)	2265004041		0.0074	0.0247
		Rotary Tillers < 6 HP (Commercial)	2260004016		0.0002	0.0106
			2265004016		0.0004	0.0050
		Shredders < 6 HP (Commercial)	2265004051		0.0000	0.0004
		Trimmers/Edgers/Brush Cutters (Commercial)	2260004026		0.0007	0.0213
			2265004026		0.0000	0.0003
		Turf Equipment (Commercial)	2260004071		0.0000	0.0000
			2265004071		0.0008	0.0033
			2270004071		0.0031	0.0004
	Railroad and Locomotive	Railway Maintenance (Diesel)	2285002015	0.0027	0.0036	0.0007

COUNTY	SOURCE CATEGORY	SCC DESCRIPTION	SCC	CO	NOx	VOC
		Railway Maintenance (Gasoline, 4-Stroke)	2285004015	0.0060	0.0000	0.0002
		Railway Maintenance (LPG)	2285006015	0.0000	0.0000	0.0000
		Total Railroad Equipment (Diesel)	2285002000	0.1020	0.8038	0.0344
	Recreational Equipment	All Terrain Vehicles	2260001030	0.0820	0.0002	0.0912
			2265001030	0.5237	0.0031	0.0326
		Inboard/Sterndrive	2282010005	0.0070	0.0002	0.0013
			2282020005	0.0000	0.0002	0.0000
		Motorcycles: Off-road	2260001010	0.1915	0.0005	0.2126
			2265001010	0.0887	0.0005	0.0048
		Outboard	2282005010	0.0136	0.0002	0.0096
			2282020010	0.0000	0.0000	0.0000
		Personal Water Craft	2282005015	0.0059	0.0000	0.0039
		Specialty Vehicles/Carts	2260001060	0.1093	0.0006	0.0036
			2265001060	0.1017	0.0005	0.0034
			2267001060	0.0009	0.0002	0.0001
			2270001060	0.0039	0.0027	0.0010
Hays Total				**8.31**	**1.88**	**1.53**
Travis	Agricultural Equipment	2-Wheel Tractors	2265005010	0.0053	0.0000	0.0001
			2270005010	0.0000	0.0000	0.0000
		Agricultural Mowers	2265005030	0.0044	0.0000	0.0001
		Agricultural Tractors	2265005015	0.0173	0.0003	0.0005
			2270005015	0.2309	0.3527	0.0490
		Balers	2265005025	0.0099	0.0002	0.0004
			2270005025	0.0001	0.0002	0.0000
		Combines	2265005020	0.0001	0.0000	0.0000
			2270005020	0.0099	0.0282	0.0026
		Hydro-power Units	2260005050	0.0002	0.0000	0.0001
			2265005050	0.0326	0.0002	0.0009
			2267005050	0.0001	0.0000	0.0000
			2270005050	0.0003	0.0006	0.0001
		Irrigation Sets	2265005060	0.0286	0.0005	0.0010
			2267005060	0.0000	0.0000	0.0000
			2268005060	0.0060	0.0014	0.0000
			2270005060	0.0021	0.0047	0.0007
		Other Agricultural Equipment	2265005055	0.0251	0.0004	0.0008
			2267005055	0.0000	0.0000	0.0000
			2268005055	0.0000	0.0000	0.0000
			2270005055	0.0045	0.0070	0.0011
		Sprayers	2260005035	0.0016	0.0000	0.0008
			2265005035	0.0420	0.0003	0.0017
			2270005035	0.0015	0.0020	0.0006

COUNTY	SOURCE CATEGORY	SCC DESCRIPTION	SCC	CO	NOx	VOC
		Swathers	2265005045	0.0162	0.0003	0.0006
			2270005045	0.0009	0.0023	0.0002
		Tillers > 6 HP	2265005040	0.0969	0.0003	0.0030
	Aircraft	Military Aircraft	2275001000	2.3341	1.1608	3.0801
		Refueling: All Fuels	2275900000	0.0000	0.0000	0.0018
	Airport Ground Support Equipment	Boilers (Natural Gas)	2102006001	0.0003		
		Light Duty Gasoline Vehicles (LDGV)	2201001000	0.6934	0.0526	0.0797
		Natural Gas	2102006001		0.0016	0.0003
		Off-highway Vehicle Diesel	2270008000	3.8847	0.2892	0.0888
	Commercial Equip.	Air Compressors	2260006015	0.0002	0.0000	0.0001
			2265006015	2.1363	0.0199	0.0738
			2267006015	0.0431	0.0158	0.0033
			2268006015	0.0040	0.0015	0.0000
			2270006015	0.0866	0.1712	0.0235
		Gas Compressors	2268006020	0.2303	0.0515	0.0009
			2270006020	0.0001	0.0002	0.0000
		Generator Sets	2260006005	0.0619	0.0001	0.0299
			2265006005	18.1067	0.0917	0.5455
			2267006005	0.1437	0.0528	0.0109
			2268006005	0.0549	0.0201	0.0002
			2270006005	0.1736	0.2854	0.0478
		Pressure Washers	2265006030	7.7533	0.0433	0.2899
			2267006030	0.0010	0.0003	0.0001
			2270006030	0.0050	0.0082	0.0014
		Pumps	2260006010	0.4710	0.0005	0.2279
			2265006010	4.1533	0.0294	0.1669
			2267006010	0.0355	0.0130	0.0027
			2268006010	0.0027	0.0010	0.0000
			2270006010	0.0378	0.0640	0.0101
		Welders	2265006025	5.1333	0.0395	0.1246
			2267006025	0.0809	0.0204	0.0055
			2270006025	0.1336	0.0845	0.0366
	Construction Equip.	Bore/Drill Rigs	2265002033	0.2291	0.0017	0.0117
			2267002033	0.0051	0.0013	0.0003
			2270002033	0.0660	0.1558	0.0155
		Cement and Mortar Mixers	2265002042	0.7650	0.0033	0.0330
			2270002042	0.0031	0.0062	0.0008
		Concrete/Industrial Saws	2260002039	0.6980	0.0027	0.2628
			2265002039	1.7517	0.0117	0.0387
			2267002039	0.0151	0.0037	0.0010
			2270002039	0.0062	0.0066	0.0013

COUNTY	SOURCE CATEGORY	SCC DESCRIPTION	SCC	CO	NOx	VOC
		Cranes	2265002045	0.0476	0.0008	0.0016
			2267002045	0.0054	0.0013	0.0004
			2270002045	0.0657	0.2196	0.0185
		Crawler Tractor/Dozers	2270002069	0.8030	1.5780	0.1429
		Crushing/Processing Equipment	2260002054	0.0032	0.0000	0.0015
			2265002054	0.1030	0.0007	0.0029
			2267002054	0.0009	0.0002	0.0001
			2270002054	0.0187	0.0473	0.0046
		Dumpers/Tenders	2265002078	0.1205	0.0005	0.0043
			2270002078	0.0010	0.0010	0.0003
		Excavators	2270002036	0.4957	1.0200	0.0919
		Graders	2270002048	0.1567	0.3480	0.0303
		Off-highway Tractors	2270002075	0.0605	0.0920	0.0099
		Off-highway Trucks	2270002051	0.5817	1.1027	0.0951
		Other Construction Equipment	2265002081	0.0624	0.0012	0.0022
			2267002081	0.0082	0.0021	0.0006
			2268002081	0.0003	0.0001	0.0000
			2270002081	0.0872	0.1436	0.0137
		Pavers	2265002003	0.2440	0.0020	0.0061
			2267002003	0.0051	0.0013	0.0003
			2270002003	0.0533	0.0910	0.0100
		Paving Equipment	2260002021	0.0156	0.0000	0.0074
			2265002021	0.8587	0.0047	0.0277
			2267002021	0.0013	0.0003	0.0001
			2270002021	0.0136	0.0211	0.0025
		Plate Compactors	2260002009	0.0129	0.0000	0.0062
			2265002009	0.4347	0.0023	0.0192
			2270002009	0.0018	0.0031	0.0006
		Rollers	2265002015	0.4510	0.0036	0.0103
			2267002015	0.0086	0.0021	0.0006
			2270002015	0.1616	0.2480	0.0309
		Rough Terrain Forklifts	2265002057	0.0726	0.0014	0.0025
			2267002057	0.0098	0.0025	0.0007
			2270002057	0.2297	0.3050	0.0423
		Rubber Tire Loaders	2265002060	0.1788	0.0035	0.0061
			2267002060	0.0247	0.0062	0.0017
			2270002060	0.7457	1.4793	0.1298
		Scrapers	2270002018	0.1810	0.3643	0.0287
		Signal Boards/Light Plants	2260002027	0.0001	0.0000	0.0001
			2265002027	0.0192	0.0001	0.0007
			2270002027	0.0134	0.0224	0.0043

COUNTY	SOURCE CATEGORY	SCC DESCRIPTION	SCC	CO	NOx	VOC
		Skid Steer Loaders	2265002072	0.3204	0.0038	0.0093
			2267002072	0.0176	0.0044	0.0012
			2270002072	0.5390	0.4040	0.1560
		Surfacing Equipment	2265002024	0.3730	0.0023	0.0107
			2267002024	0.0009	0.0002	0.0001
			2270002024	0.0041	0.0051	0.0008
		Tampers/Rammers	2260002006	0.2588	0.0011	0.0944
			2265002006	0.0019	0.0000	0.0000
		Tractors/Loaders/Backhoes	2265002066	0.5380	0.0036	0.0114
			2267002066	0.0026	0.0007	0.0002
			2270002066	0.7720	0.8117	0.1945
		Trenchers	2265002030	0.7523	0.0059	0.0228
			2267002030	0.0156	0.0039	0.0011
			2270002030	0.0851	0.1020	0.0167
	Industrial Equipment	AC\Refrigeration	2265003060	0.0292	0.0002	0.0006
			2268003060	0.0010	0.0002	0.0000
			2270003060	0.1698	0.2960	0.0497
		Aerial Lifts	2265003010	1.0100	0.0138	0.0318
			2267003010	0.0890	0.0224	0.0060
			2270003010	0.0278	0.0330	0.0087
		Forklifts	2265003020	3.0170	0.0572	0.1013
			2267003020	8.3233	2.0893	0.5642
			2268003020	0.6320	0.1583	0.0025
			2270003020	0.1655	0.2563	0.0298
		Other General Industrial Equipment	2260003040	0.0007	0.0000	0.0003
			2265003040	1.7747	0.0112	0.0717
			2267003040	0.0196	0.0049	0.0013
			2268003040	0.0004	0.0001	0.0000
			2270003040	0.0552	0.1602	0.0157
		Other Material Handling Equipment	2265003050	0.0828	0.0011	0.0025
			2267003050	0.0047	0.0012	0.0003
			2270003050	0.0048	0.0081	0.0015
		Other Oil Field Equipment	2265010010	0.8707	0.0050	0.0184
			2268010010	0.0885	0.0214	0.0004
			2270010010	0.0263	0.0687	0.0064
		Sweepers/Scrubbers	2260003030	0.0080	0.0000	0.0039
			2265003030	0.8823	0.0110	0.0265
			2267003030	0.0649	0.0162	0.0044
			2268003030	0.0007	0.0002	0.0000
			2270003030	0.0559	0.1437	0.0161
		Terminal Tractors	2265003070	0.3098	0.0058	0.0103

COUNTY	SOURCE CATEGORY	SCC DESCRIPTION	SCC	CO	NOx	VOC
			2267003070	0.0404	0.0101	0.0027
			2268003070	0.0021	0.0005	0.0000
			2270003070	0.0766	0.1702	0.0151
	Lawn & Garden Equip.	Chain Saws < 6 HP (Residential)	2260004020	0.3297	0.0004	0.1729
		Lawn and Garden Tractors (Residential)	2265004055	17.3367	0.0908	0.4709
		Lawn Mowers (Residential)	2265004010	5.5167	0.0239	0.4942
		Leafblowers/Vacuums (Residential)	2260004030	0.3563	0.0004	0.1740
			2265004030	0.0585	0.0003	0.0047
		Other Lawn and Garden Equipment (Residential)	2265004075	0.5647	0.0023	0.0353
		Rear Engine Riding Mowers (Residential)	2265004040	1.2960	0.0067	0.0383
		Rotary Tillers < 6 HP (Residential)	2260004015	0.0322	0.0000	0.0146
			2265004015	0.4670	0.0020	0.0424
		Trimmers/Edgers/Brush Cutters (Residential)	2260004025	0.5673	0.0007	0.2737
			2265004025	0.0306	0.0001	0.0026
	Lawn and Garden Equipment	Chain Saws < 6 HP (Commercial)	2260004021		0.0129	0.8015
		Chippers/Stump Grinders (Commercial)	2265004066		0.1024	0.2428
			2267004066		0.0000	0.0000
			2270004066		0.1280	0.0191
		Front Mowers (Commercial)	2265004046		0.0025	0.0098
			2270004046		0.0887	0.0173
		Lawn and Garden Tractors (Commercial)	2265004056		0.0000	0.0000
			2270004056		0.0000	0.0000
		Lawn Mowers (Commercial)	2265004011		0.0392	0.4891
		Lawn Mowers (Residential)	2265004010		0.0239	2.5672
		Leafblowers/Vacuums (Commercial)	2260004031		0.0115	0.3506
			2265004031		0.0065	0.0185
			2270004031		0.0004	0.0001
		Other Lawn and Garden Equipment (Commercial)	2265004076		0.0072	0.0643
			2270004076		0.0011	0.0000
		Rear Engine Riding Mowers (Commercial)	2265004041		0.0552	0.1835
		Rotary Tillers < 6 HP (Commercial)	2260004016		0.0015	0.0791
			2265004016		0.0032	0.0371
		Shredders < 6 HP (Commercial)	2265004051		0.0002	0.0027
		Trimmers/Edgers/Brush Cutters (Commercial)	2260004026		0.0054	0.1585
			2265004026		0.0002	0.0019
		Turf Equipment (Commercial)	2260004071		0.0000	0.0000
			2265004071		0.0060	0.0244
			2270004071		0.0231	0.0027
	Railroad and Locomotive	Railway Maintenance (Diesel)	2285002015	0.0200	0.0300	0.0059
		Railway Maintenance (Gasoline, 4-Stroke)	2285004015	0.0500	0.0003	0.0015
		Railway Maintenance (LPG)	2285006015	0.0002	0.0000	0.0000

COUNTY	SOURCE CATEGORY	SCC DESCRIPTION	SCC	CO	NOx	VOC
		Total Railroad Equipment (Diesel)	2285002000	0.1038	0.8173	0.0350
	Recreational Equipment	All Terrain Vehicles	2260001030	0.1969	0.0005	0.2189
			2265001030	1.2570	0.0075	0.0783
		Golf Carts	2265001050	2.3790	0.0138	0.0512
		Inboard/Sterndrive	2282010005	0.1473	0.0043	0.0265
			2282020005	0.0008	0.0049	0.0002
		Motorcycles: Off-road	2260001010	0.4593	0.0012	0.5101
			2265001010	0.2128	0.0013	0.0114
		Outboard	2282005010	0.2856	0.0032	0.2007
			2282020010	0.0000	0.0000	0.0000
		Personal Water Craft	2282005015	0.1236	0.0005	0.0815
		Specialty Vehicles/Carts	2260001060	0.2624	0.0014	0.0086
			2265001060	0.2442	0.0011	0.0082
			2267001060	0.0021	0.0005	0.0001
			2270001060	0.0092	0.0066	0.0023
Travis Total				**110.02**	**16.69**	**15.59**
Williamson	Agricultural Equipment	2-Wheel Tractors	2265005010	0.0183	0.0001	0.0004
			2270005010	0.0000	0.0000	0.0000
		Agricultural Mowers	2265005030	0.0151	0.0001	0.0004
		Agricultural Tractors	2265005015	0.0595	0.0010	0.0018
			2270005015	0.7960	1.2150	0.1688
		Balers	2265005025	0.0342	0.0007	0.0014
			2270005025	0.0004	0.0005	0.0002
		Combines	2265005020	0.0004	0.0000	0.0000
			2270005020	0.0341	0.0973	0.0091
		Hydro-power Units	2260005050	0.0008	0.0000	0.0004
			2265005050	0.1123	0.0007	0.0030
			2267005050	0.0003	0.0001	0.0000
			2270005050	0.0011	0.0020	0.0004
		Irrigation Sets	2265005060	0.0987	0.0019	0.0034
			2267005060	0.0001	0.0000	0.0000
			2268005060	0.0206	0.0049	0.0001
			2270005060	0.0073	0.0162	0.0025
		Other Agricultural Equipment	2265005055	0.0865	0.0013	0.0029
			2267005055	0.0001	0.0000	0.0000
			2268005055	0.0002	0.0000	0.0000
			2270005055	0.0153	0.0243	0.0037
		Sprayers	2260005035	0.0055	0.0000	0.0026
			2265005035	0.1448	0.0011	0.0060
			2270005035	0.0052	0.0069	0.0019
		Swathers	2265005045	0.0560	0.0011	0.0022

COUNTY	SOURCE CATEGORY	SCC DESCRIPTION	SCC	CO	NOx	VOC
			2270005045	0.0032	0.0081	0.0008
		Tillers > 6 HP	2265005040	0.3340	0.0011	0.0105
	Aircraft	Military Aircraft	2275001000	1.0028	0.0044	0.0331
	Commercial Equip.	Air Compressors	2260006015	0.0000	0.0000	0.0000
			2265006015	0.3650	0.0034	0.0126
			2267006015	0.0074	0.0027	0.0006
			2268006015	0.0007	0.0002	0.0000
			2270006015	0.0148	0.0292	0.0040
		Gas Compressors	2268006020	0.0393	0.0088	0.0002
			2270006020	0.0000	0.0000	0.0000
		Generator Sets	2260006005	0.0106	0.0000	0.0051
			2265006005	3.0920	0.0157	0.0931
			2267006005	0.0245	0.0090	0.0019
			2268006005	0.0094	0.0034	0.0000
			2270006005	0.0297	0.0487	0.0082
		Pressure Washers	2265006030	1.3240	0.0074	0.0495
			2267006030	0.0002	0.0000	0.0000
			2270006030	0.0009	0.0014	0.0002
		Pumps	2260006010	0.0804	0.0001	0.0389
			2265006010	0.7093	0.0050	0.0285
			2267006010	0.0061	0.0022	0.0005
			2268006010	0.0005	0.0002	0.0000
			2270006010	0.0064	0.0109	0.0017
		Welders	2265006025	0.8767	0.0067	0.0213
			2267006025	0.0138	0.0035	0.0009
			2270006025	0.0228	0.0144	0.0063
	Construction Equip.	Bore/Drill Rigs	2265002033	0.0709	0.0005	0.0036
			2267002033	0.0016	0.0004	0.0001
			2270002033	0.0204	0.0482	0.0048
		Cement and Mortar Mixers	2265002042	0.2366	0.0010	0.0102
			2270002042	0.0010	0.0019	0.0003
		Concrete/Industrial Saws	2260002039	0.2159	0.0008	0.0813
			2265002039	0.5417	0.0036	0.0120
			2267002039	0.0047	0.0012	0.0003
			2270002039	0.0019	0.0020	0.0004
		Cranes	2265002045	0.0147	0.0003	0.0005
			2267002045	0.0017	0.0004	0.0001
			2270002045	0.0203	0.0679	0.0057
		Crawler Tractor/Dozers	2270002069	0.2484	0.4880	0.0442
		Crushing/Processing Equipment	2260002054	0.0010	0.0000	0.0005
			2265002054	0.0319	0.0002	0.0009

COUNTY	SOURCE CATEGORY	SCC DESCRIPTION	SCC	CO	NOx	VOC
			2267002054	0.0003	0.0001	0.0000
			2270002054	0.0058	0.0146	0.0014
		Dumpers/Tenders	2265002078	0.0373	0.0002	0.0013
			2270002078	0.0003	0.0003	0.0001
		Excavators	2270002036	0.1533	0.3155	0.0284
		Graders	2270002048	0.0485	0.1076	0.0094
		Off-highway Tractors	2270002075	0.0187	0.0284	0.0031
		Off-highway Trucks	2270002051	0.1800	0.3410	0.0294
		Other Construction Equipment	2265002081	0.0193	0.0004	0.0007
			2267002081	0.0025	0.0006	0.0002
			2268002081	0.0001	0.0000	0.0000
			2270002081	0.0270	0.0444	0.0042
		Pavers	2265002003	0.0755	0.0006	0.0019
			2267002003	0.0016	0.0004	0.0001
			2270002003	0.0165	0.0282	0.0031
		Paving Equipment	2260002021	0.0048	0.0000	0.0023
			2265002021	0.2656	0.0015	0.0086
			2267002021	0.0004	0.0001	0.0000
			2270002021	0.0042	0.0065	0.0008
		Plate Compactors	2260002009	0.0040	0.0000	0.0019
			2265002009	0.1345	0.0007	0.0059
			2270002009	0.0005	0.0010	0.0002
		Rollers	2265002015	0.1395	0.0011	0.0032
			2267002015	0.0027	0.0007	0.0002
			2270002015	0.0500	0.0767	0.0096
		Rough Terrain Forklifts	2265002057	0.0224	0.0004	0.0008
			2267002057	0.0030	0.0008	0.0002
			2270002057	0.0711	0.0943	0.0131
		Rubber Tire Loaders	2265002060	0.0553	0.0011	0.0019
			2267002060	0.0076	0.0019	0.0005
			2270002060	0.2306	0.4577	0.0402
		Scrapers	2270002018	0.0560	0.1126	0.0089
		Signal Boards/Light Plants	2260002027	0.0000	0.0000	0.0000
			2265002027	0.0059	0.0000	0.0002
			2270002027	0.0042	0.0069	0.0013
		Skid Steer Loaders	2265002072	0.0991	0.0012	0.0029
			2267002072	0.0055	0.0014	0.0004
			2270002072	0.1667	0.1250	0.0483
		Surfacing Equipment	2265002024	0.1154	0.0007	0.0033
			2267002024	0.0003	0.0001	0.0000
			2270002024	0.0013	0.0016	0.0002

COUNTY	SOURCE CATEGORY	SCC DESCRIPTION	SCC	CO	NOx	VOC
		Tampers/Rammers	2260002006	0.0801	0.0004	0.0292
			2265002006	0.0006	0.0000	0.0000
		Tractors/Loaders/Backhoes	2265002066	0.1664	0.0011	0.0035
			2267002066	0.0008	0.0002	0.0001
			2270002066	0.2388	0.2511	0.0602
		Trenchers	2265002030	0.2327	0.0018	0.0070
			2267002030	0.0048	0.0012	0.0003
			2270002030	0.0263	0.0315	0.0052
	Industrial Equipment	AC\Refrigeration	2265003060	0.0089	0.0001	0.0002
			2268003060	0.0003	0.0001	0.0000
			2270003060	0.0515	0.0898	0.0151
		Aerial Lifts	2265003010	0.1597	0.0022	0.0050
			2267003010	0.0141	0.0036	0.0010
			2270003010	0.0044	0.0052	0.0014
		Forklifts	2265003020	0.4770	0.0090	0.0160
			2267003020	1.3157	0.3304	0.0892
			2268003020	0.0999	0.0250	0.0004
			2270003020	0.0262	0.0405	0.0047
		Other General Industrial Equipment	2260003040	0.0001	0.0000	0.0001
			2265003040	0.2806	0.0018	0.0113
			2267003040	0.0031	0.0008	0.0002
			2268003040	0.0001	0.0000	0.0000
			2270003040	0.0087	0.0253	0.0025
		Other Material Handling Equipment	2265003050	0.0131	0.0002	0.0004
			2267003050	0.0007	0.0002	0.0001
			2270003050	0.0008	0.0013	0.0002
		Sweepers/Scrubbers	2260003030	0.0013	0.0000	0.0006
			2265003030	0.1395	0.0017	0.0042
			2267003030	0.0103	0.0026	0.0007
			2268003030	0.0001	0.0000	0.0000
			2270003030	0.0088	0.0227	0.0025
		Terminal Tractors	2265003070	0.0490	0.0009	0.0016
			2267003070	0.0064	0.0016	0.0004
			2268003070	0.0003	0.0001	0.0000
			2270003070	0.0121	0.0269	0.0024
	Lawn & Garden Equip.	Chain Saws < 6 HP (Residential)	2260004020	0.1111	0.0001	0.0583
		Lawn and Garden Tractors (Residential)	2265004055	5.8433	0.0306	0.1587
		Lawn Mowers (Residential)	2265004010	1.8597	0.0081	0.1665
		Leafblowers/Vacuums (Residential)	2260004030	0.1201	0.0001	0.0587
			2265004030	0.0197	0.0001	0.0016
		Other Lawn and Garden Equipment (Residential)	2265004075	0.1903	0.0008	0.0119

COUNTY	SOURCE CATEGORY	SCC DESCRIPTION	SCC	CO	NOx	VOC
		Rear Engine Riding Mowers (Residential)	2265004040	0.4367	0.0023	0.0129
		Rotary Tillers < 6 HP (Residential)	2260004015	0.0108	0.0000	0.0049
			2265004015	0.1574	0.0007	0.0143
		Trimmers/Edgers/Brush Cutters (Residential)	2260004025	0.1912	0.0002	0.0922
			2265004025	0.0103	0.0000	0.0009
	Lawn and Garden Equipment	Chain Saws < 6 HP (Commercial)	2260004021		0.0044	0.2727
		Chippers/Stump Grinders (Commercial)	2265004066		0.0348	0.0826
			2267004066		0.0000	0.0000
			2270004066		0.0436	0.0065
		Front Mowers (Commercial)	2265004046		0.0009	0.0033
			2270004046		0.0302	0.0059
		Lawn and Garden Tractors (Commercial)	2265004056		0.0000	0.0000
			2270004056		0.0000	0.0000
		Lawn Mowers (Commercial)	2265004011		0.0133	0.1664
		Lawn Mowers (Residential)	2265004010		0.0081	0.8718
		Leafblowers/Vacuums (Commercial)	2260004031		0.0039	0.1193
			2265004031		0.0022	0.0063
			2270004031		0.0001	0.0000
		Other Lawn and Garden Equipment (Commercial)	2265004076		0.0024	0.0219
			2270004076		0.0004	0.0000
		Rear Engine Riding Mowers (Commercial)	2265004041		0.0188	0.0624
		Rotary Tillers < 6 HP (Commercial)	2260004016		0.0005	0.0269
			2265004016		0.0011	0.0126
		Shredders < 6 HP (Commercial)	2265004051		0.0001	0.0009
		Trimmers/Edgers/Brush Cutters (Commercial)	2260004026		0.0018	0.0539
			2265004026		0.0001	0.0006
		Turf Equipment (Commercial)	2260004071		0.0000	0.0000
			2265004071		0.0021	0.0083
			2270004071		0.0079	0.0009
	Railroad and Locomotive	Railway Maintenance (Diesel)	2285002015	0.0064	0.0087	0.0017
		Railway Maintenance (Gasoline, 4-Stroke)	2285004015	0.0100	0.0001	0.0004
		Railway Maintenance (LPG)	2285006015	0.0001	0.0000	0.0000
		Total Railroad Equipment (Diesel)	2285002000	0.2101	1.6549	0.0708
	Recreational Equipment	All Terrain Vehicles	2260001030	0.0328	0.0001	0.0365
			2265001030	0.2095	0.0013	0.0130
		Golf Carts	2265001050	0.5287	0.0031	0.0114
		Inboard/Sterndrive	2282010005	0.0544	0.0016	0.0098
			2282020005	0.0003	0.0018	0.0001
		Motorcycles: Off-road	2260001010	0.0766	0.0002	0.0850
			2265001010	0.0355	0.0002	0.0019
		Outboard	2282005010	0.1054	0.0012	0.0740

COUNTY	SOURCE CATEGORY	SCC DESCRIPTION	SCC	CO	NOx	VOC
			2282020010	0.0000	0.0000	0.0000
		Personal Water Craft	2282005015	0.0456	0.0002	0.0301
		Specialty Vehicles/Carts	2260001060	0.0437	0.0002	0.0014
			2265001060	0.0407	0.0002	0.0014
			2267001060	0.0004	0.0001	0.0000
			2270001060	0.0015	0.0011	0.0004
Williamson Total				**26.73**	**6.73**	**3.84**
Grand Total				**153.77**	**28.44**	**22.49**

Austin-Round Rock MSA
1999 Ozone Precursor
Emissions Inventory

Capital Area Planning Council (CAPCO)

Austin, Texas,
March 2004

Executive Summary

This document presents the 1999 Emissions Inventory (EI) for the five county region of the Austin Round Rock Metropolitan Statistical Area (MSA), which was completed for use in photochemical modeling of the September 1999 ozone episode. The five counties included in this EI are Bastrop, Caldwell, Hays, Travis, and Williamson counties. In analyzing air quality, three criteria air pollutants were inventoried: volatile organic compounds (VOC), oxides of nitrogen (NOx) and carbon monoxide (CO). The source of these pollutants is broken down into five major source categories of these criteria air pollutants: nonroad mobile sources, area sources, biogenic sources, point sources and on-road mobile sources. Unless indicated otherwise, "per day" references indicate rates on typical ozone days.

Area sources encompass a large number of diverse sources—everything from bakeries and breweries to asphalt paving and degreasing operations. These sources include facilities whose individual emissions do not qualify them as point sources (each facility emits less than 100 tons of VOC or NOx per year), however; collectively they can release significant quantities of pollutants. Area sources emit 90.56 tons per day of VOCs, 13.79 tons per day of CO, and 7.82 tons per day of NOx in the MSA for an average ozone weekday. The methodologies used for estimating emissions from area sources varied by subcategory. These can be found individually in Section 2 of the EI.

On-road mobile sources consist of vehicles operated on the streets and highways. The vehicles are broken down into gasoline- and diesel-powered vehicles. This category represents the largest source of emissions from non-stationary sources, producing 50.19 tons per day of VOCs and 97.86 tons per day of NOx and 650.10 tons per day of CO in the Austin-Round Rock MSA region. The methodologies used by the Texas Transportation Institute for calculating these emissions with emission factors from the EPA MOBILE6 Model and the results of the emissions calculations are provided in Section 3.

Nonroad mobile sources consist of all vehicles and equipment not routinely operated on streets and highways. These include recreational boats, recreational vehicles, railroad cars, agricultural

equipment, construction equipment, mining equipment, logging equipment, residential equipment (lawnmowers etc.), and commercial and industrial equipment. Military/airport sources include both public and military aircraft, as well as military groundside emissions and airport support vehicles. Military/airport emissions also include on-road emissions generated on the base and nonroad mobile-source emissions. Military activity is limited within the CAPCO region and emissions are insignificant. Civilian airports included in the inventory are Austin-Bergstrom International Airport and 14 municipal airports located throughout the CAPCO region. The total non road mobile emissions are 22.49 tons per day of VOC, 28.44 tons per day of NOx and 153.77 tons per day of CO in the Austin-Round Rock MSA for an average ozone weekday. Section 4 lists the methodologies for estimating emissions for each subcategory of nonroad mobile sources. Also, a chart is provided showing a breakdown of the emissions in tons per weekday, Saturday, and Sunday.

Point source emissions are from stationary sources such as electrical generating plants and other industrial facilities. Major point sources are well documented, in accordance with the TCEQ (former TNRCC) rules, and emit over 100 tons of NOx or 100 tons of VOC per facility each year. This category [1]contributes 3.7 tons of VOCs per day, 33.98 tons per day of NOx, and 19.35 tons per day of CO to the inventory of emissions in the MSA for an average ozone weekday. Section 5 contains the data for point sources by company and county to include the results of a minor point source survey conducted by the TCEQ. Efforts ware made to eliminate the possibility of double counting across point and area source categories.

Biogenic sources are emissions from natural sources such as vegetation and microbial activity. This is the only category that is from a non-anthropogenic source. Example sources include trees and grasses, as well as emissions from soil microbes. This category accounts for 394.10 tons per day of VOCs, 25.03 tons per day of NOx and 0.00 tpd of CO in Austin-Round Rock MSA Counties. The biogenic model used to estimate emissions was GLOBEIS. A complete description of the methodology used for this category is located in Section 6 of the EI.

[1] Note that point source emissions consist of major and minor point sources. The summary tables for major and minor point sources are listed in the Point Source section

Different agencies contributed information to this inventory, making preparation of the document possible. Population data for 1999 were obtained from the Texas State Data Center. The Alamo Area Council of Governments (AACOG) staff prepared, under contract to CAPCO, the initial estimate of emissions for many of the source categories in the CAPCO region. Employment figures were taken from the Texas Workforce Commission and the 1999 Census County Business Patterns. The Texas Department of Transportation (TxDOT) supplied highway vehicle registration data and developed vehicle miles traveled (VMT) estimates and vehicle travel parameters, which were used as input into the MOBILE6 emissions model. Texas Transportation Institute provided on-road emission estimates for the MSA region. The TCEQ provided data for a number of categories including point source emissions and several area source categories. Eastern Research Group, Inc. (ERG) developed emissions estimates for some area and non road mobile source categories under contract to CAPCO or TCEQ.

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On-road Mobile Source Emissions Inventories: 1999, 2002, 2005, 2007, and 2012
APPENDIX E.....Biogenic Sources, Environ, August 2001

2 1999 AREA SOURCE METHODOLOGY

2.1 Introduction to Area Source Methodology

An area source may be defined as a collection of similar emission units within a geographic area. Commonly, area sources have been defined at the county level, and most area source methods are designed to estimate area source emissions at the county level. However, any specified area (e.g., city, town, or census division) could be used to define an area source.

Area sources collectively represent individual sources that are small and numerous, and that have not been inventoried as specific point, mobile, or biogenic sources. Individual sources are typically grouped with other like sources into area source categories. These source categories are grouped in such a way that they can be estimated collectively using one methodology. For these sources, the distinction between point and area is usually defined by a cutoff point typically based on annual emissions. SIP ozone inventories, for example, define volatile organic compound (VOC) point sources as individual facilities emitting more than 10 tons of VOCs per year. Emissions from smaller facilities are treated as an area-source group.

True area-wide sources, such as pesticide use and commercial/consumer product use, are examples of this source type. The boundaries of the individual activities associated with these sources are often hard to determine or are, at best, arbitrary. Even within a point source facility, some activities occur that are more easily treated as area source emissions. Some emissions associated with surface coating operations such as equipment cleaning, for example, can be more practically estimated using area source methods even though other surface coating emissions may be reported as part of the point source inventory.

Under Solvents there are many subcategories. Some of these subcategories are described under one heading because the methodology was the same for all of them; a few of the subcategories were broken out and described separately because of the different methodologies involved.

The main distinction between point and area sources is the methodology used to estimate emissions. Point sources are inventoried individually, and area sources are inventoried collectively. While all stationary sources could be treated as either point sources or area sources, for practical reasons some cutoff is usually set to distinguish between them. The end use of the inventory, the desired accuracy of the emissions, and the resources available for inventory development all affect where that cutoff is set.

Table 2.1 Area Sources Summary (1999 Emissions)

	CO	NOx	VOC
Bastrop County	1.23	0.60	4.52
Caldwell County	0.75	0.54	15.29
Hays County	1.25	0.54	5.47
Travis County	7.57	3.17	50.60
Williamson County	2.99	2.97	14.68
Grand Total	**13.79**	**7.82**	**90.56**

Figure 2.2 1999 Area Source VOC Emissions

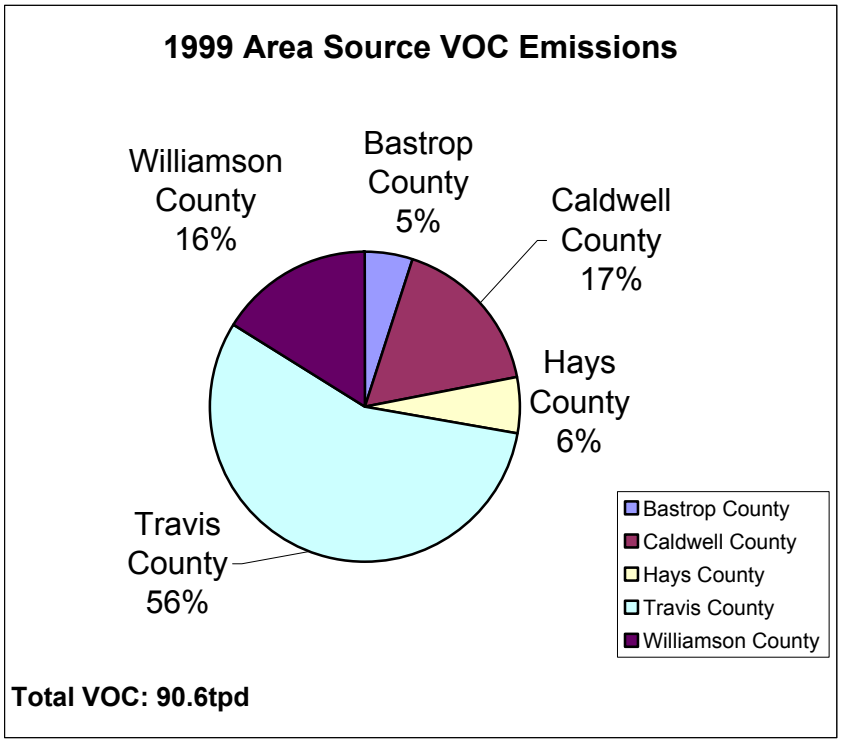


Figure 2.3 1999 Area Source NOx Emissions

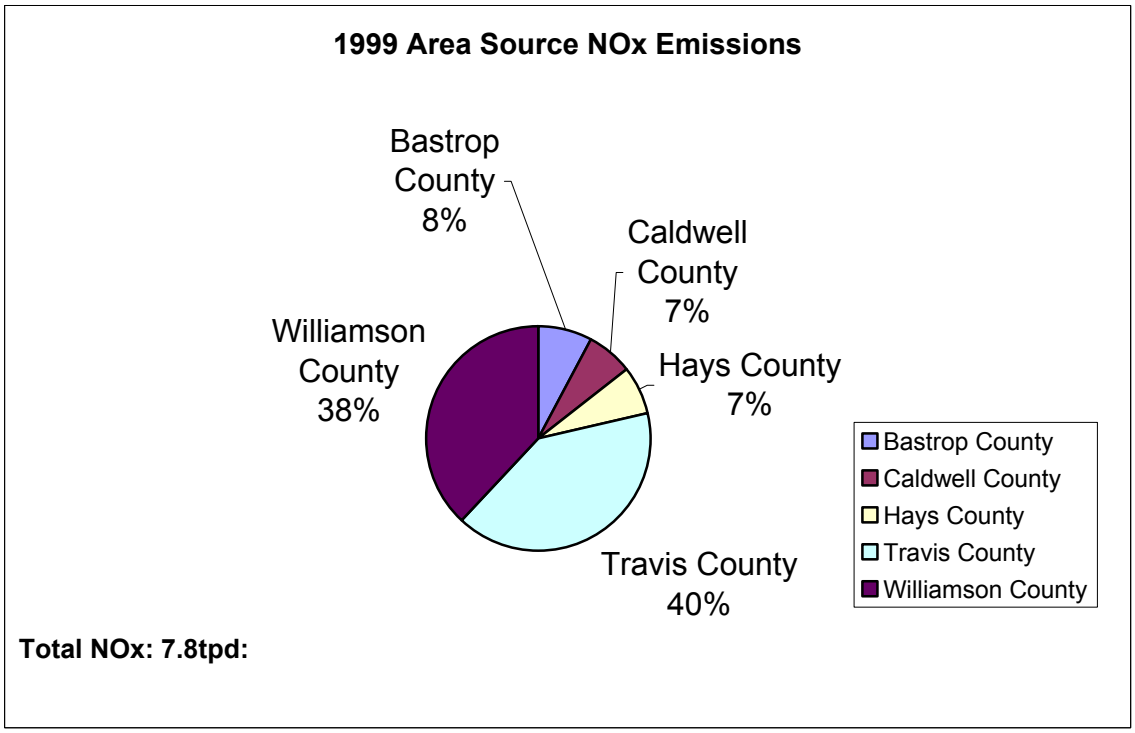
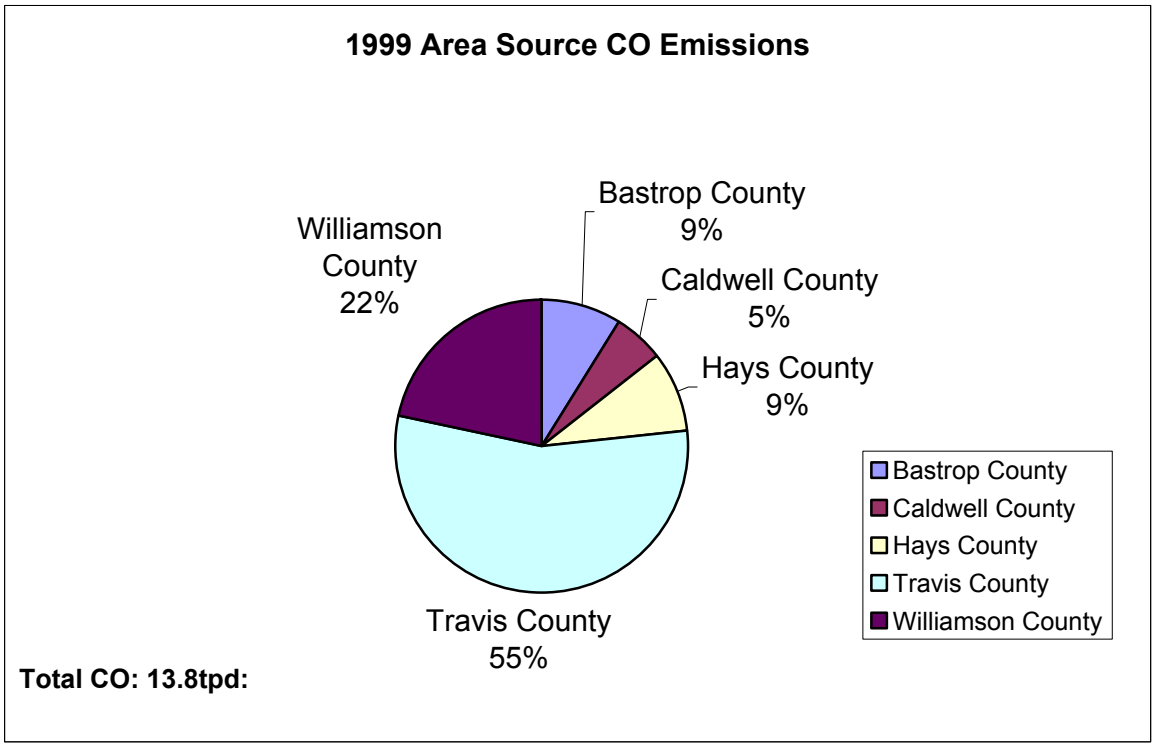


Figure 2.3 1999 Area Source CO Emissions



2.2 Residential Fuel Combustion

2.2.1 Residential Natural Gas Combustion

Sub-category Description

This source category covers air emissions from natural gas combustion in the residential sectors for space heating, water heating, or cooking. The residential sector is composed of all kinds of housing units.

Methodology

See Appendix A, Section 2.2, pg. 2-3. ENVIRON calculated 1999 emissions for this source category under contract to the Texas Commission on Environmental Quality.

2.2.2 Residential LPG Consumption

Sub-category Description

The statewide consumption of LPG by residential uses in 1997 was estimated by EIA at 97,104,000 gallons.[1] This is the most current, up-to-date information available.

Methodology

Assuming that the ratio of households using LPG in a county to households using LPG in the state stays the same from 1990 to 1997, the statewide LPG usage in 1999 was multiplied by the ratio to yield the amount of LPG usage for each county. The data of housing units using LPG is available from 1990 census.

The amount of LPG usage for each county was multiplied by an EF (VOC = 0.4 lb./1000 gal; CO = 2.1 lb./1000 gal; NO_x = 15 lb./1000 gal)[2] (EPA, 1999). Then the emission amount by gallons was converted to tons per year by dividing by 2000. Finally, the seasonal adjustment factor was applied to yield the emission amount of tons per day. The seasonal adjustment factor for VOC is 0.3 and its annual activity day is 365. The seasonal adjustment factor for CO is 1.7 and its annual activity day is 365. The seasonal adjustment factor for CO is uniform (1) and its annual activity day is 365.[3]

Sample Calculation

Williamson County has 4,398 housing units using LPG and Texas has 473,533 housing units using LPG in 1990 (U.S. Census Bureau, 1999). The statewide consumption of natural gas in 1997 by residential users is 97,104,000 gallons. If "P" is statewide consumption, "H" is statewide housing units using LPG; "h" is countywide housing units using natural gas, and "p" is countywide consumption:

p = P x h / H = 97,104,000 x 4,398 / 473,533 = 901,866 (gallons) consumed in Williamson

VOC: 901,866 x 0.4 / 1000 = 360.746467 (lbs.)
360.746467 / 2000 = 0.180373 (tons/yr.)
Seasonally adjusted: 0.180373 x 0.3 / 365 = 0.000148 (tons/day)

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[1] Energy Information Administration (EIA), 1999. "State Energy Profiles." Available: http://www.eia.doe.gov/emeu/states/_states_ng.html (1999, Oct 1).
[2] The higher factors for butane were used since no information is available as to whether the LPG is butane, propane, or a mixture of both.
[3] Texas Air Control Board, 1991. 1990 Base Year Ozone Emission Inventory of Volatile Organic Compound (VOC), Nitrogen Oxides (NOx), and Carbon Monoxide (CO) Emissions for Dallas/Fort Worth, Texas Nonattainment Area, Austin, Texas.

CO: 901,866 x 2.1 / 1000 = 1893.918952 (lbs.)
1893.918952 / 2000 = 0.946959 (tons/yr.)
Seasonally adjusted: 0.946959 x 1.7 / 365 = 0.004410 (tons/day)

NOx 901,866 x 15 / 1000 = 13527.992516 (lbs.)
13527.992516 / 2000 = 6.763996 (tons/yr.)
Seasonally adjusted: 6.763996 / 365 = 0.018531 (tons/day)

2.2.3 Residential Wood Combustion

Sub-category Description

This category is used to characterize wood burning emissions from residential woodstoves and fireplaces.

Methodology

Appendix A, Section 5.5, page 5-7. ENVIRON calculated the 1999 emissions from this source category under contract to the Texas Commission on Environmental Quality.

2.3 Industrial Commercial and Institutional Fuel Combustion

Category Description

This category consists, in turn, of eight headings that further define the groups consuming fuel oil products. These are Industrial Distillate Oil Consumption, Industrial Residual Oil Consumption, Industrial Natural Gas Consumption, Commercial & Institutional Distillate Consumption, Commercial and Institutional Residual Consumption, Commercial and Institutional Natural Gas Combustion, Commercial LPG Consumption and Industrial LPG Consumption.

2.3.1 Industrial Distillate Oil Consumption

Methodology

EPA default numbers were used (*Procedures Document For National Emission Inventory, Criteria Air Pollutants 1985-1999*, EPA-454/R-01-006). The data for this category was acquired from TCEQ.

2.3.2 Industrial Residual Oil Consumption

Methodology

EPA default numbers were used (*Procedures Document For National Emission Inventory, Criteria Air Pollutants 1985-1999*, EPA-454/R-01-006). The data for this category was acquired from TCEQ.

2.3.3 Industrial Natural Gas Consumption

Methodology

EPA default numbers were used (*Procedures Document For National Emission Inventory, Criteria Air Pollutants 1985-1999*, EPA-454/R-01-006). The data for this category was acquired from TCEQ.

2.3.4 Commercial and Institutional Distillate Consumption

Sub-category Description

The total amount of distillate fuel oil consumed by commercial operations in Texas in 1999 is estimated to be 72,240,000.4

Methodology

It is first assumed that the commercial consumption of distillate fuel oil in each county is proportionate to the statewide consumption in the same manner as total county employment in the consuming industry to the industry's statewide employment. The SIC code of the commercial industry consuming distillate fuel oils is from SIC codes 50 to 87,

[4] Energy Information Administration (EIA), 1999. "State Energy Profiles." Available: http://www.eia.doe.gov/emeu/states/_states.ng.html (1999, Oct 1).

and 89. Therefore, statewide commercial consumption of distillate fuel oil is divided by the statewide employment in the SIC codes industry and multiplied by the industry's employment in county to come up with the county's commercial consumption of distillate fuel oil. Numbers of employees by SIC code per county are available from the Texas Workforce Commission. The distillate fuel oil consumption is then multiplied by the EFs of individual pollutants (VOC = 0.34 lb./1000 gal; CO = 5 lb./1000 gal; NOx = 20 lb./1000 gal) (EPA, 1999). The number of pounds is converted to tons per year by dividing by 2000. The tons per year are then seasonally adjusted to tons per day by multiplying a seasonal adjustment factor and dividing by the annual activity day.5 The seasonal adjustment factor for VOC is 0.6 and its annual activity day is 312 (Assuming its weekly activity days is 6 so the annual activity day is 6 days * 52 weeks = 312 days per year). The seasonal adjustment factor for CO is 1.4 and its annual activity day is 312. The seasonal adjustment factor for NOx is uniform (=1) and its annual activity day is 365

Sample Calculation

Bastrop County has 6667 employees in commercial SIC code 50-87 and 89. The statewide employment in these SIC codes is 7,709,900.6 The distillate fuel oil consumed for commercial use in Texas in 1999 is 72,240,000 gallons. In the following calculation, "O" is statewide consumption, "E" is statewide commercial employment; "e" is countywide commercial employment for Bastrop County, and "o" is countywide consumption for Bastrop County:

o = O x e / E = 72,240,000 x 6,667 / 7,709,900 = 62468.26547 (gallons of fuel oil consumed in Bastrop County in 1999)

VOC: 62,468.26547 x 0.34 / 1000 = 21.239210 (lbs. VOC/yr.)
21.239210 / 2000 = 0.010620 (tons/yr.)
Seasonally and weekly adjusted: 0.010620 x 0.6 / 312 = 0.000020 (tons/average ozone season day)

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[5] U.S. Environmental Protection Agency (EPA), 1991. Procedures for the Preparation of Emission Inventories for Carbon Monoxide and Precursors of Ozone, Volume 1. (National Technical Information Service), Springfield, VA.
[6] U.S. Census Bureau, 1999a. County Business Patterns. Available: http://tier2.census.gov/cbp/cpb_sts.htm (1999, Oct 1).

CO: 62,468.26547 x 5 / 1000 = 312.341327 (lbs.)
312.341327 / 2000 = 0.156171 (tons/yr.)
Seasonally and weekly adjusted: 0.156171 x 1.4 / 312 = 0.000701

NOx 62468.26547 x 20 / 1000 = 1249.365310
1249.365310 / 2000 = 0.624683 (tons/yr.)
Seasonally and weekly adjusted: 0.624683 = 0.001711 (tons/day)

2.3.5 Commercial and Institutional Residual Consumption

This was reported as point source emissions only. No emissions were calculated for area sources.

2.3.6 Commercial and Institutional Natural Gas Combustion

Sub-category Description

This source category covers air emissions from natural gas combustion in the commercial sector, including small boilers, furnaces, and heating units. The commercial/institutional sector consists of wholesale and retail businesses and social, educational, health, and government institutions. For natural gas combustion, the commercial/ institutional sector also includes agriculture, forestry, and fishing.

Methodology

See Appendix A, Section 2.3, pg. 2-5. ENVIRON calculated the 1999 emissions from this source category under contract to the Texas Commission on Environmental Quality.

2.3.7 Commercial LPG Consumption

Sub-category Description

Statewide consumption of LPG by commercial establishments in Texas in 1997 was estimated by EIA at 17,136,000 [7]gallons this is the most current, up-to-date information available.

Methodology

The statewide consumption is to be allocated to each county based on the number of employees in the commercial SIC codes (50-87 and 89). The amount of LPG was multiplied by the county number of commercial employees and divided by the state number of commercial employees to yield the county's consumption of LPG. This figure was then multiplied by an EF (VOC = 0.4 lb./1000 gal; CO = 2.1 lb./1000 gal; NOx = 15 lb./1000 gal) (EPA, 1999). The emission amount by pounds was converted to tons per year by dividing by 2000. Finally, the seasonal adjustment factor is applied to yield the emission amount of tons per day. The seasonal adjustment factor for VOC is 0.6 and its annual activity day is 312. The seasonal adjustment factor for CO is 1.4 and its annual activity day is 312. The seasonal adjustment factor for NOx is uniform (1) and its annual activity day is [8]365

Sample Calculation

Travis County has 157,032 employees in commercial SIC code 50-87 and 89. The statewide number of employees in these SIC codes was 7,709,900 in 1999.9 The LPG consumed for commercial use in Texas in 1997 is 17,136,000 gallons. If "P" is statewide consumption, "E" is statewide commercial employment; "e" is countywide commercial employment, and "p" is countywide consumption:

p = P x e / E = 17,136,000 x 157,032 / 7,709,900 = 349018.839674 (gallons) consumed in Travis County

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[7] Energy Information Administration (EIA), 1999. "State Energy Profiles." Available: http://www.eia.doe.gov/emeu/states/_states_ng.html (1999, Oct 1).
[8] Texas Air Control Board, 1991. 1990 Base Year Ozone Emission Inventory of Volatile Organic Compound (VOC), Nitrogen Oxides (NOx), and Carbon Monoxide (CO) Emissions for Dallas/Fort Worth, Texas Nonattainment Area, Austin, Texas.
[9] U.S. Census Bureau, 1999a. County Business Patterns. Available: http://tier2.census.gov/cbp/cpb_sts.htm (1999, Oct 1).

VOC: 349018.839674 x 0.4 / 1000 = 139.607536 (lbs.)
139.607536 / 2000 = 0.069804 (tons/yr.)
Seasonally adjusted: 0.069804 * 0.3 / 365 = 0.000134 (tons/day)

CO: 349018.839674 x 2.1 / 1000 = 732.939563 (lbs.)
732.939563 / 2000 = 0.366470 (tons/yr.)
Seasonally adjusted: 0.366470 x 1.7 / 365 = 0.001644 (tons/day)

NOx 349018.839674 x 15 / 1000 = 5235.282595 (lbs.)
5235.282595 / 2000 = 2.617641 (tons/yr.)
Seasonally adjusted: 2.617641 / 365 = 0.007172 (tons/day)

2.3.8 Industrial LPG Consumption

Sub-category Description

The statewide consumption of LPG for industrial uses in 1997 was 17,070,774,000 [10]gallons. This is the most current, up-to-date information available.

Methodology

The statewide consumption of LPG is to be allocated to each county based on the number of employees in the industrial SIC codes 1-39. The statewide number of employees in these SIC codes was 1,582,890 in 1999. The amount of LPG was multiplied by the county number of industrial employees and divided by the state number of industrial employees to yield the county's consumption of LPG. This figure was then multiplied by an EF (VOC = 0.4 lb./1000 gal; CO = 3.6 lb./1000 gal; NOx = 21 lb./1000 gal).11 The emission amount by pounds was converted to tons per year by dividing by 2000. Finally, the seasonal adjustment factor is applied to yield the emission amount of tons per day. The seasonal adjustment factor for VOC is 1 and its annual activity day is 312. The

[10] Energy Information Administration (EIA), 1999. "State Energy Profiles." Available: http://www.eia.doe.gov/emeu/states/_states_ng.html (1999, Oct 1)
[11] U.S. Environmental Protection Agency (EPA), 1999. Compilation of Air Pollutant Emission Factors AP-42, Fifth Edition, Volume 1: Stationary Point and Area Sources. Available: http://www.epa.gov/ttn/chief/ap42.html (1999, Oct 1).

seasonal adjustment factor for CO is 1 and its annual activity day is 312. The seasonal adjustment factor for NOx is 1 and its annual activity day is 365.12

Sample Calculation

Hays County has 8,669 employees in industries of SIC codes 1-39 in 1999. The statewide employment in industries of SIC codes 1-39 is 2,125,625.13 LPG consumed statewide for industries of SIC codes 1-39 is 17,070,774,000 gallons. If "P" is statewide consumption, "E" is statewide commercial employment; "e" is countywide commercial employment, and "p" is countywide consumption:

p = P x e / E = 17,070,774,000 x (8,669 / 2,125,625) = 69,620,248 (gallons) consumed in Hays County in 1999

VOC: 69,620,248 x 0.4 / 1000 = 27848.099 (lbs.)
27848.099 / 2000 = 13.92405 (tons/yr.)
Seasonally adjusted: 13.92405 / 312 = 0.044628 (ton/day)

CO: 69,620,248 x 3.6 / 1000 = 250,632.89 (lbs.)
250,632.89 / 2000 = 125.31645 (tons/yr.)
Seasonally adjusted: 125.31645 / 312 = 0.401655 (tons/day)

NOx 69,620,248 x 21 / 1000 = 1,462,025.2 (lbs.)
1,462,025.2 / 2000 = 731.01260 (tons/yr.)
Seasonally adjusted: 731.01260 / 365 = 2.002774 (tons/day)

2.4 Aircraft Refueling: All Fuels

Category Description

There are evaporative emissions that result from refueling general aviation aircraft and from fuel spillage. The EPA methodology for calculating refueling losses was provided

[12] Texas Air Control Board, 1992. 1990 Base Year Ozone Emission Inventory of Volatile Organic Compound (VOC), Nitrogen Oxides (NOx), and Carbon Monoxide (CO) Emissions for Dallas/Fort Worth, Texas Nonattainment Area, Austin, Texas.
[13] U.S. Census Bureau, 1999a. County Business Patterns. Available: http://tier2.census.gov/cbp/cbp_sts.htm (1999, Oct 1)

in an EPA Office of Air and Radiation memorandum from Mary Manners to Susan Willis dated October 20, 1996; Subject: Revised Methodology for Calculating the Refueling Losses for General Aviation Aircraft. The calculated refueling and spillage loss of an aircraft was 4.61 grams of HC per gallon of fuel consumed. Fuel consumption per aircraft was estimated to calculate the emission from refueling. The Texas Transportation Institute (TTI) recently completed the fuel consumption analysis for the Texas airport system plan forecast (see Texas Airport System Plan Technical Note). The related analysis results were used for this project (Table 2.4.1).

TABLE 2.4. Fuel Consumption per Aircraft Estimation

Year	Fuel Consumption (million of gallons)	Active GA Aircraft (number of aircraft)	Fuel Consumed per Aircraft (thousands of gallons/aircraft)
1996	83.388	14,861	5.6
1999	93.802	15,402	6.09
2007	123,619	16,760	7.37

Methodology

The data for Aircraft refueling emissions were acquired from TCEQ (1996, 1999, and 2007 Airport Emissions Inventory, TTI, Technical Note 402011-8)

2.5 Bakeries

Category Description

The primary VOC emitted from bakeries is ethanol, which is formed from yeast leavening of baked goods at commercial and retail bakeries. Commercial bakeries are included in the SIC code 2051. Retail bakeries are covered by SIC code 5461. Bakery emissions from grocery stores have the SIC code 5411. According to a memo from the

Radian Corporation, bakeries with more than 50 employees should be treated as point sources and should not be included in area source emissions.[14]

Bakery products that are yeast leavened include bread, bread-type rolls, pretzels, and sweet yeast goods such as doughnuts. There are two basic types of yeast dough mixing processes used in bakeries: sponge-dough and straight dough. During straight-dough leavening (used less by commercial bakers) ingredients are mixed, the yeast is allowed to ferment, and then the bread is baked. The sponge-dough process uses a larger amount of yeast to start the bread, but a smaller portion of other ingredients until baking. The emissions (99%) from sponge-dough leavening take place during baking. The straight-dough process produces a lower 77% amount of emissions during baking, 23% during other steps, and it retains a much higher concentration of ethanol in the baked bread.[15]

Methodology

To calculate area source emissions for bakeries, the per employee EF method was used. The businesses using yeast products were identified for each county using SIC codes 2051 (commercial) and 5461 (retail). Grocery stores with bakeries located inside should also be included in the area source emissions using SIC code 5411.[16]

For SIC 2051 and 5461, the total number of employees for each bakery were added and used to project the emissions for each county. Bakeries were cross-referenced with minor point sources to ensure no double counting. The bakeries that are in the minor point source database were removed from area source calculations. The number of employees in each county is multiplied by a per employee emission factor of 0.11 tons of VOC. The seasonal adjustment factor is 1. Bakeries have a weekly adjustment factor of 365 days per year (open 7 days a week). To calculate tons per day, divide the tons per year by 365.

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[14]Adams, Lucy. (April 1992). VOC Emissions from Bakeries. Radian Corporation, Memorandum to USEPA. Research Triangle Park, NC.
[15]Ibid.
[16] Texas Workforce Commission. 1995. Austin, TX.

Sample Calculation for Small Bakeries:

(bakery employees/county) * (per employee emission factor) = tons VOC/year

Hays County Bakery Emissions

38 employees * 0.11 tons VOC = 4.18 tons of VOC per year

4.18 tons VOC per year / 365 = 0.1145 tons per day

For grocery store bakeries (SIC 5411), the regional offices of the major grocery store chains were contacted to determine the number of people they have working in their bakery. The percentage of bakery employment at each store was then calculated to devise an emission factor. Based on a survey in the CAPCO and AACOG regions, it was determined that 5.4% of the grocery store employees are in the bakery section.

Sample Calculation for Grocery Stores:

Hays County Grocery Store Bakery Emissions

Hays County has 352 grocery store employees

352(total) x 0.054(emission factor) = 19 bakery employees at grocery stores for Hays county

19 employees x 0.11 tons VOC = 2.09 tons of VOC per year

2.09 tons of VOC per year / 365 days = 0.00573 tons of VOC per day

To assure the quality of the emission estimation, minor point sources were cross-referenced with area source employment files to ensure no double counting occurred.

2.6 Fermentation/Beverages: Breweries

Source Category

Breweries are emitters of VOCs (e.g., ethanol, acetate, myrcene, etc.) due to the various steps utilized in the manufacturing of beer.

Methodology

The EFs are based on brewery size (i.e. "large" >60,000 barrels per year, "small and micro" <60,000 barrels per year). This factor will be multiplied by the production level of the breweries (in barrels) to obtain the pounds of VOC emitted per year. This figure will be converted to tons per year and tons per day. The number of days the facility was in production was determined for each facility from the survey data. Then a sum is taken for the county.[17] When production figures were not accessible, best estimates were used. This was the case for a few of the microbreweries or brewpubs within the region. In such instances, production was estimated to be equal to that of establishments of similar size.

Sample Calculation

The production level of a microbrewery is the number of barrels per year with an EF of 56.8 lbs./1000 barrels (.0568 lbs./barrel). Activity was two days/week, or 104 days/yr.

Number barrels/yr. x .0568 lbs./barrel = lbs. VOC/yr.
Lbs. VOC/yr. x 1 ton/2000 lbs. = Tons VOC/yr.
Tons VOC/yr. x 1 yr./104 activity days = Tons VOC/day

2.7 Oil and Gas Production

2.7.1 Oil and Gas Production (All Processes - Well)

Category Description

[17] Radian Corporation, February 1992. VOC Emissions from breweries. Research Triangle Park, North Carolina.

Emissions considered in this category come from crude oil and natural gas production in each County in 1999. The production information was obtained from the Oil & Gas Division of the Railroad Commission of Texas.

Methodology

The methodology is described in Appendix A, section 2.4, pg 2-7. ENVIRON calculated the 1999 emissions from this source category under contract to the Texas Commission on Environmental Quality.

2.7.2 Oil and Gas Production (Natural Gas - Produced)

Sub-category Description

The EI of the oil and gas producing industry begins at the wellhead. It includes the gathering, transmission and refining operations, and ends with the tank farms of wholesale storage operation.

The most accurate wellhead data would be from the Texas Railroad Commission's API Well Data File and the Well Status Report File. The Well Data File would site each individual well by latitude and longitude coordinates and assigns a specific well identification number. The Well Status Report would specify the daily production from each well (barrels for oil and MCF for gas wells) and enable the placement of production activity directly into the proper grid squares. There are now EFs based upon equipment components (valves, connections, tanks, etc.) and a composite equipment structure of a representative well from each field could be modeled and the emissions from each well determined whether the well was in or out of production. These data files were not available for this inventory so a cruder methodology was employed.

Methodology

The TNRCC provided a paper [18]copy of the Texas Railroad Commission's Oil Well Counts by County Report as of February 2001 which was used as the basis for

[18] Texas Railroad Commission through the Texas Natural Resource Conservation Commission

determining the number of wells and their oil and gas production in 1999. These counts were multiplied by the emissions factor of 396 lbs. of VOC per operating oil well, and 35 lbs. of VOC per million cubic feet of gas produced by each operating gas well.

Sample Calculation:
Bastrop County:
(421 Producing oil wells) x (EPA EF 396 lbs./well/yr.) / 2000 = 83.358 tons/yr. VOC emissions

(610,844 MCF gas produced/100000) x (EPA EF 35 lbs./yr.) / 2000 = 0.1068977 tons/yr. VOC emissions

Seasonal Adjustment Factor = 1
Weekly Adjustment Factor = 7 day week

2.8 Architectural and Industrial Maintenance Coatings

Sub-category Description

Architectural surface coating operations (SIC 17) consist of applying a thin layer of coating such as paint, paint primer, varnish, or lacquer to architectural surfaces, and the use of solvents as thinners and for cleanup. Architectural surface coatings protect the substrates to which they are applied from corrosion, abrasion, decay, ultraviolet light damage, and/or the penetration of water. Some architectural coatings also increase the aesthetic value of a structure by changing the color or texture of its surface. Architectural coatings are alsoimportant in construction of structures. Examples of the latter are concrete form release compounds, which prevent concrete from sticking to forms, and concrete curing compounds, which allow concrete to cure properly (Brandau, 1990). It should be noted that this category does not include auto refinishing, traffic marking, surface coating during manufacturing, industrial maintenance coatings, special purpose coatings, or paints used in graphic arts applications.

A wide range of coatings are used to cover both the interior and exterior surfaces of architectural structures. The majority of architectural surface coatings are applied by homeowners and painting/surface coating contractors to domestic, industrial, institutional, and governmental structures throughout a geographic area. Because the emissions from this source category are likely to be scattered throughout the inventory region, it is recommended that this source category usually be treated as an area source. However, emissions from this category may also be estimated as one of many processes occurring at a point source, for the purposes of permitting and emission trade offs.

Because the coated architectural surface dries or cures in the ambient air, the use of exterior architectural coatings may be limited to periods when local climatic conditions facilitate acceptable coating curing. Although interior coating applications are less influenced by outdoor conditions, complete curing of these coatings also can be hampered by cool, moist weather (i.e., when evaporation rates are reduced).

Volatile organic compounds (VOCs) that are used as solvents in the coatings are emitted during application of the coating and as the coating dries. The amount of coating used and the VOC content of the coating are the factors that primarily determine emissions from architectural surface coating operations. Secondary sources of VOC emissions are from the solvents used to clean the architectural coating application equipment and VOC released as reaction byproducts while the coating drys and hardens. VOC emitted from this chemical reaction is determined by the resins used in a particular coating. The VOC emitted from any of these sources could include HAP (EPA, 1993a). Emission factors and area source estimation methods have been developed for VOC and HAP emissions but not for PM emissions. If all architectural surface coatings are applied using brushes and rollers, then it is reasonable not to consider PM emissions. However, many commercial paints use spray guns; if a significant amount of the paint is applied in this manner (particularly to exterior surfaces), then inventories of PM may need to address emissions from this source category. Point source methods and factors can be used to estimate PM emissions from architectural surface coatings.

There are many solvents that may be used in architectural surface coating operations. Some compounds may be considered nonreactive and should not be counted in an ozone (VOC) inventory, but would need to be quantified for air modeling, or HAP inventory.

Coating types may be considered to be solvent based or water based, depending on whether the principle flow controller is an organic solvent or is water. Solvent based coatings are defined by the U.S. EPA as coatings that only contain organic solvents, with water, if it is present at all, only present in trace quantities. Water based coatings have more than 5 weight percent water as their volatile fraction. Another way of looking at the distinction between the two types of coatings is that solvent based coatings have resins dissolved in organic solvents and water based coatings have resin systems suspended in water as liquid emulsions of solid dispersion (EPA, 1993a). The EPA is using regulatory negotiation to prepare a national rulemaking for controlling VOC emissions from architectural and industrial coatings. Currently, no federal EPA regulations are in place to limit VOC content or VOC emissions from architectural surface coatings. However, since Occupational Safety and Health Administration (OSHA) regulations limit worker exposure to solvents, OSHA rules can indirectly affect the VOC content of coatings and the solvents used in them. The OSHA exposure limits vary with compound toxicity and as a result, manufacturers must consider the composition of coatings during product development to minimize the exposure hazards (EPA, 1993a).

Five states—Arizona (AZ), California (CA), New Jersey (NJ), New York (NY), and Texas (TX)—have coating regulations that affect architectural surface coatings; Maryland has a draft rule.

Methodology

See Appendix A, Section 2.5, pg. 2-12. ENVIRON calculated the 1999 emissions from this source category under contract to the Texas Commission on Environmental Quality.

2.9 Automobile Refinishing

Category Description

Auto body refinishing is the repairing of worn or damaged automobiles, light trucks, and other vehicles, and refers to any coating applications that occur subsequent to those at original equipment manufacturer (OEM) assembly plants. (Coating of new cars is not included in this category.) The majority of these operations occur at small body shops that repair and refinish automobiles. This category covers solvent emissions from the refinishing of automobiles, including paint solvents, thinning solvents, and solvents used for surface preparation and cleanup. According to data published in 1994, nationwide solvent usage in automobile refinishing was estimated to be 37.5 million gallons per year (Kline and Company, 1995). Data published in 1998 estimate that about 64,000 auto body shops were operating in the United States (Dun and Bradstreet, 1998). Facilities performing these operations are classified with the Standard Industrial Classification (SIC) code 7532 (establishments primarily engaged in the repair of automotive tops, bodies, and interiors, or automotive painting and refinishing). Two parts of SIC code 7532 are *top and body repair shops*, which are establishments primarily engaged in the repair of automobile tops and bodies with or without painting, and *refinishing and paint shops*, which include establishments primarily engaged in automobile painting and refinishing. Coatings applied at OEM assembly plants are classified with SIC code 3711, and are not included here.

Most auto refinishing jobs are performed as part of collision repair and involve only a small portion of a vehicle, such as a panel or a spot on a panel ("spot" repair). About 17 percent of refinishing jobs involve the entire vehicle. For a typical shop, approximately 90 percent of the work consists of spot and panel repairing, and the entire vehicle is completely refinished only about ten percent of the time. Shops specializing in repainting entire automobiles are referred to as "production" shops.

Auto body refinishing shops may be area or point sources, but the majority of shops are considered area sources of emissions. Point source emissions must be subtracted from total emissions to produce an estimate of auto body refinishing area source emissions.

Auto body refinishing operations consist of four steps: (1) vehicle preparation, (2) primer application, (3) topcoat application, and (4) spray equipment cleaning. The products and equipment used in these steps are usually bought from distributors, also known as jobbers. Prior to any painting, the surface is prepared, *i.e.*, washed thoroughly with water and detergent and allowed to dry. It is then cleaned with a solvent (generally a blend of toluene, xylene, and other petroleum distillates) to remove any wax, grease, and dirt to ensure proper adhesion of the primer and topcoats. Solvents typically used are 100 percent volatile, with the volatile organic compound (VOC) content ranging from 5.8 pounds VOC per gallon to 6.5 pounds VOC per gallon (EPA, 1994a). A tack cloth is often used as a final step to remove any remaining dirt or debris prior to the coating application.

Next, the surface is primed to provide corrosion resistance, fill surface imperfections, and provide a bond for the topcoat. Primers fall into four general categories: prepcoat, primer-surfacers, primer-sealers, and sealers. A prepcoat is a metal conditioner that etches the surface and prevents flash rusting, which can occur from base metal exposure to the atmosphere. Prepcoats have good corrosion resistance and adhesion properties, but have little or no filling capacity. Primer-surfacers provide the best filling or "build" properties for deep scratches or dents, but some of these provide limited corrosion protection. They are frequently used over prepcoats. The three types of primer-surfacers are nitrocellulose lacquer, acrylic lacquer, and alkyd enamel. Primer-sealers combine the corrosion resistance and adhesion properties of prepcoats with some of the scratch-filling capacity of primer-surfacers. Primer-sealers also add a sealing property needed when an old finish is being repainted. This type of primer is typically enamel-based. Sealers differ from primer-sealers in that they cannot be used as a primer and must be sprayed over a prepcoat, a primer-surfacer, or an old finish. Sealers are acrylic lacquer-based products.

The third step is topcoat application, which consists of a series of coats applied over the primer. Topcoat determines the final color and appearance of the refinished area. For optional results, topcoats (as well as other coating applications) are typically applied in a spray booth, which minimizes the possibility of dirt adhering to the wet coating. Metallic finishes and some other finishes require a two-stage topcoat system, consisting of a basecoat and a clearcoat. Since most repairs are spot and panel repairs, the refinisher is concerned with matching the OEM color as closely as possible. Paint mixing machines are typically provided by the shop's paint supplier. These machines are capable of mixing coatings to manufacturer's specifications to allow for precise matching. As paints fade, it becomes increasingly difficult for refinishers to match OEM paints to the faded paint. OEM paints manufactured after 1991 typically have more durability and less fading, which makes matching paints easier, but older paints are more likely to fade. In some cases, the paint may be so faded that it is impossible to match colors. Topcoats can be divided into four categories: acrylic lacquer, alkyd enamel, acrylic enamel, and polyurethane. Based on 1994 data derived from the *Chemical Economics Handbook* (SRI International, 1997), acrylic lacquers accounted for 20 percent of topcoats, acrylic and alkyd enamels 20 percent, and urethanes 60 percent.

The last step in auto body refinishing is spray equipment cleaning. Spray equipment can be cleaned manually or with gun cleaning systems specially designed for this purpose. Shops that do not have spray gun cleaning systems usually rinse the outside of the gun and cup, add solvent to the cup, and then spray the solvent into the air or into a drum set aside for spent solvent (EPA, 1994a). The cleaning solvent is recirculated until it is too contaminated to use. Waste solvents are then disposed of by evaporation or incineration, or are reclaimed via distillation. The EIIP chapter on solvent cleaning contains a thorough description of equipment cleaning operations.

The breakdown of solvent usage and emissions among the four steps is approximately 2 percent for vehicle preparation, 20 percent for primer application, 70 percent for topcoats, and 8 percent for equipment cleaning (EPA, 1994a).

Methodology

See Appendix A, Section 2.6, page 2-21. ENVIRON calculated 1999 emissions for this source category under contract to the Texas Commission on Environmental Quality.

2.10 Traffic Markings

Category Description

Traffic marking operations consist of marking of highway center lines, edge stripes, and directional markings and painting on other paved and nonpaved surfaces, such as markings in parking lots. Materials used for traffic markings include solvent-based paints, water-based paints, thermoplastics, preformed tapes, field-reacted materials, and permanent markers. Solvent-based formulations of alkyd resins or chlorinated rubber resins are the most commonly used traffic paints. This chapter focuses on applications of traffic paints that emit a significant quantity of volatile organic compounds (VOCs). The use of traffic paints is entirely an area source.

Traffic paints are applied by maintenance crews or by contractors during new road construction, resurfacing, and other maintenance operations. The method of application is usually a spray. The paints are subjected to harsher conditions than most other paints and must withstand wear from tires, rain, sun, and other environmental factors for a considerable period of time.

Solvent- and water-based paints have roughly the same durability, with both beginning to deteriorate about a year after their application. Both solvent- and water-based paints must be applied in dry conditions and at temperatures above 40°F. If applied properly, water-based paint is considered to be of better quality than solvent-based paint; however, application of water-based paint is more susceptible to weather constraints such as humidity. Plastic-based paints (i.e., thermoplastics, preformed tapes, and field-reacted systems) are more durable than either solvent- or water-based paints.

VOC emissions result from the evaporation of organic solvents during and shortly after the application of the marking paint. Of the painting materials commonly used for traffic marking, three types emit VOCs in appreciable amounts:

- Nonaerosol traffic paint, water- and solvent-based: Solvent-based paints include aliphatic hydrocarbons, toluene, xylene, ketones, and chlorinated hydrocarbons. Water-based paints contain some organic solvent components, usually emulsions of glycols and alcohols; however, the VOC emissions are considerably lower than those from solvent-based paints.

- Aerosol marking paint, water- and solvent-based: These paints are used to apply stripes or markings to outdoor surfaces, such as streets, golf courses, athletic fields, or construction sites. Markings can be either temporary or permanent. Chapter 5, of this volume, *Consumer and Commercial Solvent Use*, page A-9, includes an emission factor of 0.0254 lb/person for the use of these products. Total annual emissions in the U.S. for this subcategory are estimated as 3,154 tons of reactive VOC per year. Emissions from these paints are not included in this chapter.

- Preformed tapes applied with adhesive primer: Emissions from traffic marking adhesives are included as part of Chapter 5, *Consumer and Commercial Solvent Use*, on page A-7, under the subcategory of "other adhesives." Emissions from these adhesives are not included in this chapter.

VOC emissions are negligible from application of some alternative paints including thermoplastics, preformed tapes with no adhesive primer, and two-component, field-reacted systems. In addition to the painting material used, VOCs from solvents utilized in cleaning the striping equipment should be quantified in the category.

Methodology

Two different methodologies were used to calculate emissions from this source category. Emissions for 1999 were calculated by both ENVIRON and by Alamo Area Council of Governments (AACOG) under contract to Capital Area Planning Council. See p. 5-14 in Appendix A for the work done by ENVIRON to estimate the emissions for Bastrop and Caldwell counties.

The methodology used by AACOG to calculate emissions for 1999 for Hays, Travis, and Williamson counties follows:

Surveys were distributed among the county and city highway and road departments inquiring on traffic paint usage. The surveys contained questions regarding the types and amounts of traffic marking paints used for 1999. When the surveys were returned, the amount of paint was multiplied by an EF in order to obtain VOC emissions. The paint used in each individual county and city was calculated and totaled to get a countywide emission total.

The first step in calculating traffic marking emissions is to identify an EF. The surveys that were distributed requested specific information regarding the paint used such as the paint's specific gravity, product VOC weight percent, or the VOC content in pounds per gallon. In some cases, the information provided was incomplete. Because of this several methodologies were employed in order to assess emission amounts. Depending on the type of information provided an EF was devised or a default factor, provided by the EPA, was used.

The EIIP recommends the three methodologies employed in the calculation of traffic marking emissions. One involves the specific gravity of the paint to be multiplied with the density of water, which is 8.34 lbs./gal to obtain the product density.

The product density was then multiplied by the gallons of product utilized to yield the pounds of product used. Then pounds of product were multiplied to the pollutant (VOC) weight percent in order to yield pounds of emissions that were emitted by the paint.

If the pounds of VOCs per gallon for the paint used was provided, then the amount of product used was multiplied by that amount.

For some instances, when specifics for the paint used was not provided, default factors were used. Table 4-29 illustrates the EFs.[19]

Table 2.5. Paint Default EFs

Type of Paint Used	Default EF (lbs./gal)
Water	0.72
Solvent	3.64
Water/Solvent	3.36

Sample Calculations

If specific gravity and weight percent was provided.

Travis County

Travis County used 35,585 gallons of paint in 1999. The paint had VOC weight percent of 1.6% for one solvent and 2.3% for another solvent. The specific gravity was 1.

Amount of Paint Used in Pounds

Product Density = (Product Specific Gravity) x 8.34 lbs./gal.

= (1) x 8.34 lbs./gal

= 8.34 lbs./gal

Pounds of Product = Gallons of Product x Product Density

= 35,585 gallons x 8.35 lbs./gal

= 297,134.75 lbs.

[19] United States Environmental Protection Agency, May 1997. Emission Inventory Improvement Program/Area Sources Committee Volume III: Chapter 14. Research Triangle Park, North Carolina.

For VOC weight of 1.6%

Pollutant Emissions (lbs.) = Pounds of Product x Pollutant Weight %

= 297,134.75 lb. x 1.6%

= 4,748.46 lbs. of VOCs / 2000 lbs.

= 2.374 tons/yr.

VOC Tons/day = 2.374 tons/yr. / 312 days

= 0.00761 tons/day

For VOC weight of 2.3%

Pollutant Emissions (lb.) = 297,134.75 lbs. x 2.3%

= 6,825.91 lbs. of VOCs / 2000 lbs.

= 3.413 tons/yr.

VOC Tons/day = 3.413 tons/yr. / 312 days

= 0.0109 tons/day

TOTAL = 0.01770 VOC tons/day

If the pounds of VOCs per gallon is provided.

<u>Travis County</u>

Travis County used 12,793.20 gallons of paint with 3.4 pounds of VOC per gallon in 1999.

VOC Emissions (lbs.) = Amount of product (gal) x VOCs per gallon

= 12,793.20 gal x 3.4 lbs./gal

= 43,496.88 lbs. of VOCs

= 43,496.88 lbs. / 2000 lbs.

= 21.748 tons/yr. of VOC / 312 days

TOTAL = 0.0697 VOC tons/day

If no specific information was provided, the EPA EF was used.

2.11 Solvent Utilization (Surface Coating - Motor Vehicles)

Category Description

The surface coating industry contains many different types of coatings, which include paints, varnishes, printing inks, polishes, sealers, etc. Typically, coatings provide protection or decoration to a substrate or surface. In a typical coating sequence, three coatings are used: a primer, an intermediate coat, and a topcoat.

The majority of emissions that are produced during surface coatings are due to evaporation of the solvents contained in the coatings. The most commonly used solvents include organic compounds such as ketones, esters, aromatics, and alcohols. Other constituents of surface coatings, such as metals and particulates, may also be emitted during coating operations.

Methodology

Per employee emissions factors were used in calculating the emissions for the categories listed below. The EPA's Procedures for the Preparation of Emission Inventories for Carbon Monoxide and Precursors of Ozone, Volume I[20] was used to acquire the EFs and the activity days per week, which is five days, for each category. The Texas Work Force Commission provided data on the number of employees by SIC codes for each of the following categories.[21] Three of the categories SIC codes illustrated in Table 4-28 were not available, thus the per capita emission factors were utilized. County populations were

[20] U.S. Environmental Protection Agency, May 1991. Procedures for the Preparation of Emission Inventories for Carbon Monoxide and Precursors of Ozone, Volume I. (Office of Air Quality Planning and Standards), Research Triangle Park, North Carolina, 44-22/4-25.

[21] Texas Workforce Commission, 3rd quarter 1998. Texas Workforce Commission Employer Location File. Austin, Texas.

provided by Texas State Data Center.[22] The point source emissions were subtracted from the area source categories to prevent any overlapping.

Table 2.6. SIC Codes and EFs for Surface Coating Operations

Category	SIC Code(s)	Lbs./Yr. Per Employee	Lbs./Yr. Per Capita
Furniture and Fixtures	25	944	2.0
Metal Containers	341	6,029	1.3
Automobiles	3711	794	1.1
Machinery & Equipment	35	77	0.7
Appliances	363	463	0.2
Other Trans. Equip.	37, except 3711 & 373	35	0.2
Sheet, Strip, & Coil	3479	2,877	0.5
Factory Finished Wood	2426-9, 243-245, 2492, 2499	131	0.3
Electrical Insulation	3357, 3612	290	0.1
Other Product Coatings	N/A	N/A	0.6
High-Performance Maintenance	N/A	N/A	0.8
Marine Coatings	373	308	0.2
Other Spec. Purpose Coatings	N/A	N/A	0.8

Calculation Example:

Travis County (FIPS 48453) employment in SIC code 3711 = 13 Automobiles

Automobile EF = 794 lb. VOC per employee

13 x 794 lb. VOC per employee = 10,322 lbs. VOC

10,322/2000 = 5.161 tons/yr. VOC

5.161/260 = 0.01985 tons/day VOC

Activity Days = 260

The seasonal adjustment factor was uniform and activity days were 5 days a week.

[22] Texas State Data Center, Texas A&M University, August 2000. Texas State Data Center Population Estimates Program. College Station, Texas.

2.12 Industrial Surface Coating

Category Description

Surface coating operations involve applying a thin layer of coating (e.g., paint, lacquer, enamel, varnish, etc.) to an object for decorative or protective purposes. The surface coating products include either a water-based or solvent-based liquid carrier that generally evaporates in the drying or curing process. In 1989, approximately 3.8 billion pounds of organic solvents, roughly one third of all solvents purchased that year, were used in surface coating operations. These solvents were used both as carriers for coatings and to clean up coating equipment (EPA, 1991).

The use of surface coatings by manufacturing industries and other sectors of the economy is pervasive. Applications include: (1) coatings that are applied during the manufacture of a wide variety of products by Original Equipment Manufacturers (OEMs) including furniture, cans, automobiles, other transportation equipment, machinery, appliances, metal coils, flat wood, wire, and other miscellaneous products, (2) architectural coatings, and (3) special purpose coatings used for applications such as maintenance operations at industrial and other facilities, auto refinishing, traffic paints, marine finishes, and aerosol sprays. For area source purposes, the small industrial surface coating category includes OEM applications, some marine coatings, and maintenance coatings not accounted for by point sources. This category does not include architectural surface coatings, traffic markings, automobile refinishing, or aerosols.

Ideally, all industrial surface coating facilities would be inventoried as point sources. Preferred and alternative methods for estimating point source emissions from industrial surface coating operations are given in EIIP Volume II, Chapter 7. That chapter also includes more detailed discussion of surface coatings technology and controls, as well as process descriptions for industries having significant point source emissions. As a practical matter, it is not usually possible to account for all industrial surface coating facilities as point sources. Although the majority of industrial surface coating emissions may be inventoried as point sources, remaining emissions of volatile organic compounds

(VOCs) and hazardous air pollutants (HAPs) from industrial surface coating operations must be accounted for as area sources. Since the use of surface coatings by manufacturing industries is so widespread, it is extremely difficult to identify all of the industries in which coating materials are consumed. This makes the job of compiling a truly complete and accurate area source inventory for this category a difficult one.

Methodology

See Appendix A, Section 2.8, page 2-32. ENVIRON calculated 1999 emissions for this source category under contract for the Texas Commission on Environmental Quality.

2.13 Solvent Degreasing

Category Description

Solvent cleaning operations are an integral part of many industries and involve the use of solvents or solvent vapor to remove water-insoluble contaminants such as grease, oils, waxes, carbon deposits, fluxes, and tars from metal, plastic, glass, and other surfaces. Solvent cleaning is usually performed prior to painting, plating, inspection, repair, assembly, heat treating, and machining (EPA, 1991; EPA, 1993a).

Batch and in-line solvent cleaning machines are characterized by three operating modes that have characteristic emission mechanisms. The operating modes are idling, working, and downtime. Cold cleaners do not have an idling mode. Fugitive emissions also occur as a result of leaks, filling/draining losses, wastewater losses, start-up/shutdown losses, distillation losses, and solvent decomposition losses.

Idling emissions occur when the cleaning machine is turned on and ready to operate, but is not actively processing parts. Air and solvent interface losses consist of solvent vapor diffusion (or evaporation from liquid solvent in cold cleaning machines) and solvent convection caused by a warm freeboard (freeboard is the distance between the top of the tank and the solvent/air interface). Diffusion occurs because solvent molecules move

from areas of higher concentration in the vapor zone to areas of lower concentration in the air. Idling diffusion is the greatest then air flow is introduced across the solvent/air interface from room drafts. Drafts can also sweep solvent-laden air from the freeboard area into the ambient air. Convection occurs from the tank walls being heated from the heated liquid solvent and vapor. Emissions occur as a result of the convective flow up along the freeboard that carries solvent vapor out of the cleaning machine. If freeboards are kept at ambient temperatures, emissions will be minimized. Emission rate variance can be explained by the varying primary condensing temperatures; however, emission rates are lowest when the primary condenser temperature of the cleaning machine is the lowest. Typical idling losses are 0.03 lb/ft /hr (EPA, 1993a).

Working emissions occur when the cleaning machine is turned on and operating and include idling emissions with additional emissions from the introduction of parts being cleaned, the cleaning process (e.g., spraying), the evaporation of solvent from the part as the workload is pulled out of the cleaning machine, and solvent carryout. Working emissions from cold cleaners include solvent carryout and cleaning process losses. The typical emission rate for working emissions is 0.40 lb/ft /hr. Emission rate variability is caused by varying operational parameters [2] (EPA, 1993a).

Downtime emissions occur when the heat to the sump (cleaning machine tank) is turned off and the cleaning machine is not operating. Downtime emission mechanisms include evaporation of solvent from the liquid solvent surface and subsequent diffusion into the air. Downtime emission rates are estimated to be 0.30 lb/ft /hr (EPA, 1993a).

Emission sources from the use of cleanup solvents occur due to solvent evaporation. Typical sources of evaporation are emissions from storage and handling of fresh and spent solvents, solvent evaporation from the cleaned surfaces, evaporation as the solvent is splashed or sprayed, fugitive emissions from flushing or spray systems, and evaporation from solvent-soaked rags or cleaning tools. All solvent not recycled or sent to waste disposal is eventually emitted into the atmosphere (EPA, 1994b).

2.13.1 Degreasing – Cold Cleaning

Sub-category Description

Batch cold cleaning machines use solvent in the liquid phase to clean and remove foreign material such as oils and grease from the surface of materials. These machines are batch loaded, and cleaning operations include spraying, flushing, solvent or parts agitation, wipe cleaning, brushing, and immersion. Both halogenated and nonhalogenated solvents are used in batch cold cleaning machines. Carburetor cleaners use halogenated solvents and Stoddard solvent. The predominant solvent used for all other batch cleaning machines are nonhalogenated solvents.

The data for the Cold Cleaning Degreasing category is originating from EPA 1999 NEI Inventory database, it was supplied to CAPCO by TCEQ. See Appendix A for emissions total. Emissions for this category are reported under:

2415305000 Furniture/Fixtures/Cold Cleaning
2415310000 Primary Metal Industry/Cold Clean
2415320000 FabricatedMetalProduct/Cold Clean
2415325000 Industry Machinery/Equip/Cold Clean
2415330000 Electronic/Other Elec/Cold Cleaning
2415335000 Transportation Equip/Cold Cleaning
2415340000 Instrument/RelateProduct/ColdClean
2415345000 Misc Manufacturing/Cold Cleaning
2415355000 Automotive Dealers/Cold Cleaning
2415360000 Auto Repair Services/Cold Cleaning
2415365000 Misc Repair Services/Cold Cleaning

The following CAPCO data was used for SCC 2415300000 All Industries: Cold Cleaning and the methodology is as follows:

VOC emissions from degreasing operations were calculated using EPA-approved EFs. These factors were developed for degreasing based on equipment type and SIC as illustrated in Table 4-16. By multiplying the EF times the number of people employed within each applicable SIC, the total emissions for each degreasing category were determined. SIP Inventory Guidance suggests uniform activity throughout the year (no

seasonal adjustment) and a six-day workweek when facility-specific information is unavailable. The calculations performed here are based on this default.[23]

Table 2.7. Degreasing Equipment SIC Codes and EFs

Subcategory	SIC Codes	Per Employer Factors (lb. VOC/year/employee)
Cold Cleaning		
Automobile Repair	417, 423	270
	551-552, 554-556	
	753	
Manufacturing	25	24
	33-39	
Vapor and In-Line Cleaning		
Electronics and Electrical	36	29
Other	25	9.8
	33-39	
	417, 423	
	551-552, 554-556	
	753	

Texas State Rules

According to Safety Kleen's San Antonio regional Health and Safety Manager, Safety Kleen degreasing units have been in compliance with §30 TAC 115.412 and applicable versions of §106.454 regulations and the 1994 Standard Exemption (SE) 107 controls during or before 1996 when he began working for Safety Kleen[24]. It is from these general requirements that reductions are taken to prevent complete evaporation of the cleaning solvent during use. With controls in place, emissions are estimated for the EAC plans using a material balance methodology which replaces the dated AP-42 factor[25] allowing 4 pound per capita annual emission factor. This AP-42 emission factor has a rating of C, indicating that tests supporting the emission factor were based on an unproven or new methodology which lacks significant background information[26].

To establish a more accurate estimate of emissions for degreasers in the area of concern, area activity data from industry is used to profile the operation and emissions of local degreasing units. The number of units, industry practices and the amount of solvent used

[23] U.S. Environmental Protection Agency, Emission Inventory Improvement Program (EIIP)/Area Source Committee Volume II: Chapter 6. Office of Air Quality Planning and Standards, Research Triangle Park, North Carolina.
[24] January & February 2004 communications between Karla Hardison and Safety Kleen representative Ricardo Saucedo P.E. Environmental, Health and Safety Manager, San Antonio
[25] Page 3, AP-42, Fifth Edition, Volume I, Chapter 4: Evaporation Loss Sources; 4.6 Solvent Degreasing; available on EPA's website: http://www.epa.gov/ttn/chief/ap42/ch04/final/c4s06.pdf; Table 4.6-1, Nonmethane VOC Emissions From Small Cold Cleaning Degreasing Operations
[26] Page 9, AP-42 Introduction, Emission Factor Ratings; available on EPA's website: http://www.epa.gov/ttn/chief/ap42/c00s00.pdf

and VOC content of solvent are profiled using the following methods and assumptions, based on information from industry representatives from Safety Kleen[27]:

Degreasing Methodology

Assumptions
- Safety Kleen operations capture approximately 50% of the market share in the San Antonio and Austin regions.
- Solvent solutions used in 85% of the units contain between 6.4 and 6.5 pounds per gallon.
- Aqueous solutions used in 15% of the units have approximately 1% solvent.
- On average, two 55 gallon drums of spent solvent are reclaimed and picked up by a waste hauler every other month.
- Approximately 10 % of the cleaning solutions is used and not reclaimed during the degreasing process.
- Local competitors follow the same practices.

These assumptions reflect representative profiles of standard degreasing operations based on activity data (number of units, manufacturer instructions, Material Safety Data Sheets and waste manifests) from Safety Kleen.

Sample Calculation

The emissions from vapor and inline cleaning from the electronics and electrical industries (SIC 36) in Travis County were calculated as follows:

Number of people employed in the electronic/electrical industry in Travis County = 24,976

24,976 x 29 (EIIP EF) = 724,304 lbs. of VOC/yr.

724,304 / 2000 = 362.152 tons of VOC/yr.

Based on a six-day workweek, the daily emission rate from the electronic/electrical industry in Travis County is:

362.15 / 312 = 1.160744 tons/day

[27] January & February 2004 communications between Karla Hardison and Safety Kleen representative Ricardo Saucedo P.E. Environmental, Health and Safety Manager, San Antonio

Due to the TCEQ rules §30 TAC 115.412 and applicable versions of §106.454 it follws:
Rule penetration (RP) = 50%
Rule efficiency (RE) = 100%
Control effectiveness (CE) = 85%

Therefore
Emissions in Travis County = (1.160744 tons/day)*(RP)*(1-CE)) + (1.160744 tons/day)*(RP) = 0.66738tpd

Computations were based on population data and 4.3 EIIP per capita EF for the counties of Blanco, Burnet, Fayette, Lee and Llano. Texas Workforce Commission files were not available for these counties.

2.13.2 Degreasing – Open Top

Sub-category Description
Batch vapor cleaning machines represent the largest source of halogenated solvent (e.g., TCA, TCE, methylene chloride, PERC, carbon tetrachloride, and chloroform) emissions. The most common type of batch vapor cleaning machine is the Open Top Vapor Cleaner (OTVC). The OTVC is a tank designed to generate and contain solvent vapor. The tank is equipped with a heating system that uses steam, electricity, hot water, or a heat pump to boil the liquid solvent.

As the solvent boils, dense solvent vapors rise and displace the air in the tank. Coolant is circulated in condensing coils on the top of the tank to create a controlled vapor zone within the tank. Condensing solvent vapors dissolve the contaminants on the surface of the workload and flush both the dissolved and undissolved contaminants from the workload. When the temperature of the workload equals the temperature of the vapor, no further cleaning will occur by this mechanism (because solvent will no longer condense on the part). The vapor cleaning phase may be supplemented, or even replaced, by the

immersion of the workload into the hot liquid solvent. Several operational variations are possible. The cleaning cycle can be modified from a basic vapor cleaning cycle to improve cleaning efficiency. One OTVC operational variation is the immersion-vapor-spray cycle where the workload is first immersed in the warm or boiling solvent for precleaning. The workload is then cleaned in the vapor section and sprayed with the solvent. Organic impurities (e.g., grease and oil) do not contaminate the vapor because of their higher boiling points. Because the solvent remains clean, it can be used for longer periods of time compared to cold cleaning.

Methodology

The data for the Open Top Degreasing category is originating from EPA 1999 NEI Inventory database, it was supplied to CAPCO by TCEQ. See Appendix A for emissions total. Emissions for this category are reported under:

2415105000	Furniture/Fixtures/Open Top
2415110000	Primary Metal Industries/Open Top
2415120000	Fabricated Metal Product/Open Top
2415125000	Industry Machinery/Equip/Open Top
2415130000	Electronic/Other Elec/Open Top
2415135000	Transportation Equip/Open Top
2415140000	Instrument/Related Product/OpenTop
2415145000	Misc Manufacturing/Open Top

2.14 Dry Cleaning

Category Description

Volatile organic solvents that are used as cleaning solvents are emitted during the dry cleaning process. The petroleum solvents most commonly used in dry cleaning are Stoddard solvent (mineral spirits) and 140-F (EPA, 1985). The synthetic solvents that are used in dry cleaning, PERC, TCA, and CFC-113, are not considered photochemically reactive and should not be included in an ozone (volatile organic compound [VOC]) inventory; PERC and TCA, however, are hazardous air pollutants (HAPs) that should be

included in an air toxic inventory. TCA and CFC-113 are ozone-depleting substances (ODSs), and CFC-113 may be listed in some state regulations as a toxic air pollutant.

It is estimated that 82 percent of all dry cleaning facilities use PERC, 15 percent use petroleum solvents, 3 percent use CFC-113, and less than 1 percent use TCA (EPA, 1991a). However, based on a study of national solvent use, 57 percent of all dry cleaning solvents are petroleum solvents (primarily mineral spirits), 39 percent of the solvents are PERC, and 3 and 1 percent are TCA and CFC-113, respectively, with a minor amount of unspecified solvents (Frost & Sullivan, 1990). Small dry cleaning facilities, such as coin-operated sites use PERC exclusively, and larger facilities, such as commercial facilities use petroleum solvents, resulting in this disparity.

2.14.1 Dry Cleaning

Sub-category Description

The VOCs emitted from dry cleaners are from the solvents used in the dry cleaning process. Dry cleaning operations typically use either synthetic halogenated or petroleum distillate organic solvents for cleaning purposes. The VOCs may be emitted in the dry cleaning process or during the solvent reclamation process. Petroleum solvents most commonly used in the dry cleaning process are Stoddard solvent (mineral spirits) and 140-F. Synthetic solvents used in the dry cleaning process include PERC (Perchloroethane), TCA (Trichloroethane), and CFC-113 (Chlorofluorocarbons).

There are three types of dry cleaning operations. The two major types are coin-operated (SIC code 7215) and commercial (SIC code 7216). Industrial launderers (SIC 7218) usually use soap and detergent when cleaning, but may also use large-capacity dry cleaning units that should be monitored for emissions. Coin-operated dry cleaning units are self-service machines that are usually found in laundromats. Commercial dry cleaners are small businesses that offer cleaning services to the public. Some sites may not be emission sources because some of the stores are for drop-off and pick-up only.

Industrial launderers that use dry cleaning solvents are usually part of a business operation that generates soiled fabrics. Industrial cleaners may also be large businesses that provide uniform and rental services to its clients.

Methodology

The preferred method to estimate emissions for coin-operated dry cleaners is the development of local per facility or per dry cleaning unit emission factor. For commercial dry cleaners and industrial launderers, a per facility emission factor method is the preferred approach. Unless information with actual emission values is available, developing emission factors require surveying dry cleaning businesses. Sending surveys to request information is a time consuming and sometimes frustrating process.

The Radian Corporation, in its EIIP (May 1996), states alternative methods for estimating emissions using the national per employee EF and the national per facility EF. The national per employee factor requires the employee count of each dry cleaning business. This can be acquired using the SIC codes from state or local labor departments. If the employee count is not included, refer to the national per facility EF. This factor is a sum of the number of facilities located within the EI. The weekly adjustment factor is 312 days per year (6-day workweek). The seasonal adjustment factor is 1.[28]

2.14.2 Industrial Dry Cleaners (SIC 7216 and 7218)

Sub-Category Description

The national per employee factor should not be used to estimate emissions from industrial launderers. The alternative method is by developing a local per employee EF through a survey. There will be a significant difference between the per employee emissions of commercial and industrial laundries. Survey forms included solvent use, employment numbers, operating days and hours, equipment types and solvent use, off-site waste disposal, and controls. Industrial dry cleaners that responded to the survey

[28] Radian Corporation. 1996. "Dry Cleaning: Final Report". Area Sources Committee Emission Inventory Improvement Program, Vol. III: Chapter 4.

only used soap detergents. Therefore no emissions are produced. To assure the quality of the emission estimation, minor point sources were cross-referenced with area source employment files to ensure no double counting occurred.

Methodology

The data for the Dry Cleaning category is originating from EPA 1999 NEI Inventory database, it was supplied to CAPCO by TCEQ. See Appendix A for emissions total. Emissions for this category are reported under 2420010370 Comm/Indust Cleaners: Special Naphthas.

2.15 Graphic Arts

Source Description

The graphic arts industry is characterized by the use of several different printing technologies, printing substrates, and hundreds of different printing inks, washes, and process solutions. It contains predominantly small facilities operating without emission controls. Because of the large number of small sources that exist and the highly diverse operations and materials they use, it has historically been difficult to develop accurate emission inventories for the category. The objective of this project was to develop a 1999 base year emission inventory for volatile organic compound (VOC) and hazardous air pollutant (HAP) emissions from graphic arts area sources in Texas. Annual and ozone season daily emission estimates were to be calculated. The emissions were to be spatially allocated to at least the county level and to the specific individual facility level if possible. The primary source of data to conduct the inventory development effort was a survey of graphic arts area sources in Texas. Approximately 2,400 individual facilities were sent a survey in order to collect data on organic materials usage and emission controls. Industry trade associations participated in the project and provided significant assistance in conducting the facility survey. Of the 2,400 facilities surveyed, a 4.7% response rate was achieved. The data that were obtained were used to develop an emissions estimation methodology. The survey data received were used to develop

average material consumption estimates for model facility within each major printing technology (e.g., lithography, flexography, etc.). The models were designed to mirror the area source facility configurations found in Texas.

VOC and HAP emission estimates were developed for each model based on specifications of the VOC and HAP content of the average materials consumed by each model facility. The model facility emissions were then assigned to their corresponding facility type according to the Texas graphic arts area source facility profile found in the U.S. Census Bureau's *County Business Patterns* database. Emissions were determined on a county and statewide level. Statewide VOC emissions in 1999 were estimated to be 1,383.12 tons/year and 5.32 tons/ozone season day from graphic arts area sources.

Methodology

See Appendix B for the methodology. The details of the characterization is found in the TCEQ report prepared by Eastern Research Group, Inc. entitled *1999 Emissions Inventory for Texas Graphic Arts Area Sources*.

2.16 Solvent Utilization (Rubber/Plastics)

Category Description

Solvent degreasing (or solvent cleaning) is the physical process of using organic solvents to remove grease, fats, oils, wax or soil from various metal, glass, or plastic items. The types of equipment used in this method are categorized as cold cleaners, open top vapor degreasers, or conveyorized degreasers. Nonaqueous solvents such as petroleum distillates, chlorinated hydrocarbons, ketones, and alcohols are used. Solvent selection is based on the solubility of the substance to be removed and on the toxicity, flammability, flash point, evaporation rate, boiling point, cost, and several other properties of the solvent. Solvent cleaning is also used in industries such as printing, chemicals, plastics, rubber, textiles, glass, paper, and electric power.

Methodology

The data for Rubber/Plastic solvent use category is originating from EPA 1999 NEI Inventory database, it was supplied to CAPCO by TCEQ. See Appendix A for emissions total. Emissions for this category are reported under SCC: 2430000000.

2.17 Asphalt (Cutback and Emulsified)

Category Description

Asphalt concrete is grouped into three universal categories: hot-mix, cutback, and emulsified. Hot-mix asphalt is the most commonly used paving asphalt for surfaces 2 to 6 inches thick, while cutback and emulsified asphalt is used in tack and seal operations. Emissions from asphalt paving operations occur when asphalt mixtures are applied and as they cure.

Hot mix was not calculated for this emissions inventory study, hot mix produces minimal emissions, which are about one order of magnitude lower than the national estimates of cutback asphalt paving (EIIP, III, Ch. 17).[29] Hot mix asphalt is prepared at a plant where strict controls are placed on emissions from the plant and those emissions are calculated in the section on asphalt plants.

Cutback asphalt is used primarily in tack and seal operations, and for priming roadbeds for hot-mix application. Cut back asphalt is prepared by diluting asphalt cement with petroleum distillates. Cutback asphalt has the highest diluent content of the three asphalt categories and emits the highest levels of VOCs per ton used. According to the Texas Department of Transportation most businesses no longer use cutback asphalt.

Adding water and an emulsifying agent, such as soap produces emulsified asphalt, although it can contain up to 12% solvent. Emulsified asphalt is used in most of the same

applications as cutback asphalt but is lower emitting, energy saving, and a safer alternative to the cutback asphalt.

Methodology

The methodology used to estimate VOC emissions from the use of cutback and emulsified asphalts is from Volume III, Chapter 17 of the Emissions Inventory Improvement Project's area source documentation on Asphalt Paving, revised January 2001. Further, the method is from Section 5, Alternative Methods for Estimating Emissions and the basic formula selected is from p. 17.5-3. The formula is as follows:

Mass Emissions	=	Weight of Cutback Used	x	Weight % of Cutback that evaporates

The Texas Department of Transportation (TxDOT) was able to supply a number for 1999 total cutback asphalt usage, in gallons, which was 11,538,000. Similarly, the statewide usage for emulsified asphalt was 44,898,000 gallons. Since there was no county-specific usage available a reasonable surrogate was selected to be used to allocate the statewide usage to the counties. The Texas Comptroller of Public Accounts publishes an annual report of Statewide Expenditures by County for Construction and Highway Maintenance. The county number of dollars expended construction and highway maintenance was used to develop a percentage (total dollars expended for 1999 statewide was $2,563,510,993). The percentages as applied to the statewide usage and the resulting numbers of gallons per county of cutback and emulsified asphalt are as follows:

Table 2.8. Asphalt usage by County 1999

County	**Dollars: County Dollars/ $2,563,510,933**	**Percentage**	**Gallons Per County—Cutback**	**Gallons Per County--Emulsified**
Bastrop	$5,985,392	0.22%	25831.00	100516.56
Caldwell	$4,805,828	0.18%	20740.38	80707.38
Hays	$5,260,585	0.20%	22702.97	88344.41
Travis	$65,273,905	2.44%	281700.85	1096186.92

Williamson	$21,802,465	0.82%	94092.32	366142.90

The next step in the emissions estimation process was to further allocate the pounds of asphalt used in each county according to type (i.e., there are a number of different types of cutback asphalt and each may have a different percentage by volume of diluent. At this point it will be more illustrative to shift to a specific example for Travis County.

Table 2 below shows the various types of cutback and emulsified asphalt (first column at the left) being used in Travis County in 1999, according to information provided by the Texas Department of Transportation. The gallons shown in the second column from the left are the number of gallons of cutback (see Table 1 above) allocated according to type using the fractions (fourth column from left) developed by dividing the number of loads of each type of asphalt by the total number of loads used in the county. For example, the number of pounds of MC-30 cutback used is developed by multiplying .58852341 x 281700.8 = 162,688.807 gallons.

Having estimated and allocated the number of gallons of each type, one must then multiply the number of gallons times the pounds per gallon, which are shown in the fourth column from the right) in order to calculated the weight of asphalt used. This number, in turn is multiplied by the diluent percentage by volume, which was provided by TxDOT from their testing of asphalts in their laboratory, and then multiplied by an evaporative factor (see fifth column from right). The evaporative factors are interpolations developed from EPA's Table 17.5-1, p. 17.5-3, Volume III, Chapter 17, EIIP Area Source Committee document, Asphalt Paving (see copy below). The pounds are converted to tons per year of VOC emissions by dividing the number of pounds by 2000. Finally, the tons per year of VOC are divided by 365 (reflects an activity occurring 7 days per week, 52 weeks per year) to derive the tons per day of VOC emissions.

Table 2.9. Asphalt Types

Type of Cutback[b]	Percent, by Volume, of Diluent In Cutback[c]		
	25%	35%	45%
Rapid cure (RC)	17	24	32
Medium cure (MC)	14	20	26
Slow cure (SC)	5	8	10

[a] These numbers represent the percent, by weight, of cutback asphalt evaporated. *AP-42* Emission Factor Rating: C

[b] Typical densities assumed for diluents used in RC, MC, and SC cutback asphalts are 0.7, 0.8, and 0.9 kg/liter, respectively.

[c] Diluent contents typically range between 25 - 45%, by volume. Emissions may be linearly interpolated for any given type of cutback asphalt between these

Table 2.10. Asphalt Emissions

Type	Gallons	Loads	Fraction	Diluent	Evap Factor	lbs/gal 77F	Pounds	TPY	TPD
	281700.8			% by vol.	(interpolated)				
MC-30	162688.807	1110	0.57752341	40.97	0.24	7.825202	305537.5	152.7687	0.418544
MC-800	19200.2106	131	0.06815817	14.79	0.08	8.31334	12769.43	6.384715	0.017492
MC-3000	9673.38855	66	0.03433923	11.73	0.07	8.38831	5680.037	2.840018	0.007781
MC-2400L	27261.3677	186	0.09677419	9.23	0.05	8.325002	11347.55	5.673774	0.015545
RC-250	60238.8287	411	0.21383975	22.76	0.16	8.141742	78471.84	39.23592	0.107496
SCM-1	2638.19688	18	0.00936524	11.85	0.02	8.270857	436.403	0.218201	0.000598
Emulsion	1096187						45656.19	22.82809	0.062543
Total		1922							0.629999

One final adjustment was made to the emissions estimates. Since nothing is known about private contractor usage or the usage of cities or county governments, a very conservative approach was taken of doubling the VOC emissions estimates for each county.

2.18 Agricultural Pesticide Applications

Data Gathering Methodology

The photochemical model for the region requires the use of data from Bastrop, Blanco, Burnet, Caldwell, Fayette, Hays, Lee, Llano, Travis, and Williamson counties. This was based on harvested acres for different types of crops as indicated in the AC97-A-43, Census of Agriculture for 1997, and the data gathering methodology established in the 1996 EI for the AACOG Region.

Agricultural pesticides are substances used to cost effectively control the growth of insects, rodents, fungi, weeds, or microorganisms that pose a threat to crop yields and quality. Home and garden pesticides are included in the consumer/commercial solvent category of this emissions inventory. Pesticides are made by combining a pest-killing substance (i.e., an active ingredient) and a variety of solvents (i.e., an inert ingredient). Both the active and inert ingredients contain VOCs that have the potential to be emitted into the air because of pesticide application and evaporation as a function of time. When considering criteria pollutants, agricultural pesticides emit VOCs.

Integrating Data Elements

An EF of 3.5 lbs. (based on an average from a recommended 2-5 lbs.) per harvested acre was used in calculating VOC emissions from pesticide application on the CAPCO Region crops that include: corn, sorghum, small grains, cotton, and peanuts. Hay does not require any pesticide applications. The following mathematical model (based on the default method for estimating the VOC content of pesticide emissions) was used to calculate the agricultural pesticide VOC emission amounts:[30]

Total acres harvested x pesticide use (lbs. pesticide per acre-year) x lbs. pesticide active ingredient per lb. of VOC x pesticide evaporation rate = lbs. VOC/yr.

The following example calculations (i.e., for the corn crop in Caldwell County) determine lbs. VOC per year:

2358 acres x 3.5 lbs. pesticide per acre-year x 0.8 lbs. active ingredient per lb. pesticide x 2.45 lbs. VOC per lb. active ingredient x 0.9 = 14558.292 lbs. VOC/yr.

Lbs. VOC per year / lbs. per ton = tons VOC per year

The following example calculations (i.e., for the corn crop in Caldwell County) determine tons VOC per year:

14558.292 lbs. VOC per year / 2000 lbs. per ton = 7.279146 tons VOC/yr.

Tons VOC per year / number of days per year x seasonal adjustment factor = tons VOC per day

The following example calculations (i.e., for the corn crop in Caldwell County) determine tons VOC per day:

[30] TRC Environmental Corporation, 1997. Pesticides – Agricultural and Nonagricultural, Volume III: Chapter 9, Emission Inventory Improvement Program

7.279146 tons VOC per year / 312 days per year x 1.3 = 0.030330 tons VOC/day

Table 2-111 illustrates the total VOC pesticide emissions/yr. for the Caldwell County corn crop.

Table 2-11. VOC Pesticide Emissions for CAPCO Counties (Caldwell) Corn Crop

VOC Pesticide Emissions for CAPCO Counties (Caldwell) Corn Crop - 1999					
Crop	Acres Harvested	Emission Factor (lbs./acre-yr.)	Emission Amounts (lbs./yr.)	Emission Amount (tons/yr.)	Emission Amounts (tons/day)
Corn	2624	3.5	16200.5760	8.100288	0.033751

2.19 Consumer and Commercial Products

Category Description

This section involves all non-industrial solvents that are used in commercial or consumer applications. The solvent-containing products in this category include personal care products, household products, automotive aftermarket products, coatings, adhesives and sealants, FIFRA regulated products, and other miscellaneous commercial or consumer products that may emit VOCs. The primary solvents used in the formulation of these products are generally ethanol and isopropanol.

Personal care products include hair products, deodorants and antiperspirants, perfumes, colognes, and nail care products. Household products primarily consist of cleaning products for hard surfaces, clothing, carpet, dishes, waxes, polishes, air fresheners, and charcoal fluids. As a side note, this subdivision of commercial and consumer products may also contain propane, butane, and isobutene as propellants. Automotive consumer products are divided into two categories: (1) detailing products, and (2) maintenance and repair products. Detailing products include those used for cleaning, polishing, and waxing. Maintenance and repair products include engine and parts cleaners, carburetor/fuel injection cleaners, lubricants, antifreeze, radiator cleaners, and brake

fluids. Adhesives include cements, glues, and pastes. Pesticides include substances or mixtures that are used to prevent, destroy, repel, or mitigate pests and, finally, the coatings portion of this product group includes aerosol spray paints and related products such as paint removers.

Solvents contained in these types of products are primarily released during product use. However, residual amounts of solvent may also remain in discarded product packaging, enter the municipal solid waste streams, and be disposed of in landfills. The EPA concluded, however, that there was not enough information available on the fate of VOCs in consumer products in landfills to make any adjustments for VOC-release mechanisms at this time. Therefore, the VOC emission factors presented in this inventory section have been adjusted to account for biodegradation of VOCs that enter the wastewater stream, but not those that enter landfills. Landfill emissions are covered in the landfill emissions section of the EI.

Methodology

The methodology employed to calculate emissions from consumer and commercial products uses per capita EFs for the product categories of interest. Multiply per capita EFs by population data provided by the Office of the Comptroller of Texas for the base year of interest to obtain total VOC emissions for that year. The following example demonstrates this method.

Sample Calculation:

The equation to estimate VOC emissions from all personal care products is demonstrated as follows:[31]

Yearly Calculation for Total for Personal Care Products

Yearly Emissions = Population x Per Capita EF

= 726,355 (persons) x 2.32 (lbs./yr./person) /2000 tons

= 842.5718 tons/yr.

Where, the Travis County population for 1999 was 726,355

.

Per Capita EF for Personal Care Products from EPA Table 5.4-1 is 2.32 (lbs./yr./person)

Daily Emissions = Yearly Emission x Seasonal Adjustment Factor/Activity Days

= 842.5718 (tons/year) / 365

= 2.3084 (tons/day)

Yearly emissions are 842.5718 (tons/yr.)

Consumer and commercial product use is not influenced by the seasons. The use of consumer and commercial products is generally assumed to occur 7 days a week throughout the year. Thus, the annual emissions estimate is divided by 365 in order to calculate a daily emission estimate.

The Environmental Protection Agency promulgated a final Consumer Products Rule September 11, 1998 which mandated changes in product formulations that will result in a twenty (percent) reduction in emissions (See 40 CFR Parts 9 and 59, National Volatile Organic Compound Emission Standards for Consumer Products). This twenty percent reduction will be applied to each of the Consumer/Commercial Solvent Use products.

Applying the twenty percent reduction to the tons per day estimated for Travis County for Personal Care Products is done as follows:

2.3084 tons/day x .80 = 1.8467 tons/day

Please note that per footnote "d" in Table 5.4-1 the emissions from FIFRA-regulated products have been removed from the inventory for this category to avoid double counting. Those emissions are included in the Agricultural Pesticides Application category.

Table 2.12. Per Capita Consumer and Commercial Solvent VOC Emission Factors[a,b]

Product Category	Per Capita Emission Factor (lb VOC/person)[c]
Personal Care Products	2.32
Household Products	0.79
Automotive Aftermarket Products	1.36
Adhesives and Sealants	0.57
FIFRA-Regulated Products[d]	1.78
Coatings and Related Products	0.95
Miscellaneous Products	0.07
Total for All Consumer and Commercial Products	7.84

Environmental Protection Agency (EPA), August 1996. Emissions Inventory Improvement Program/Area Sources Committee Volume III: Chapter 5. Research Triangle Park, NC

[a] Source: Adapted from EPA, 1995.
[b] Emission factors are based on usage and population data for 1990.
[c] Compounds listed as nonreactive by the EPA as of April 1996 have been excluded. Significant changes to earlier definitions are the removal of acetone from the list of reactive VOCs.
[d] Care should be taken to avoid double counting in applying this VOC emission factor if the alternative estimation method given in Chapter 9 of the EIIP document for consumer and commercial pesticide use is used.

2.20 Storage and Transport (Petroleum)

Category Description

This category of emissions is generated from old underground storage tanks containing VOCs that have been unearthed for removal. It is assumed that the soil will produce VOC emissions for approximately 30 days after tank removal.

Methodology

Table 4-32 illustrates the number of underground storage tank removals for each county in the CAPCO region, which was obtained from the Petroleum Storage Tank Division of the TNRCC.[32] These figures were used to calculate VOC emissions from the soil after tank removal.

[32] Texas Natural Resource Conservation Commission, August 1998. List of Underground Storage Tanks Removed in 1999. Petroleum Storage Tank Division. Austin, Texas.

Table 2.13. Remediated Tanks in 1999

County	Tanks
Bastrop	14
Blanco	
Brunet	
Caldwell	4
Fayette	
Hays	10
Lee	
Llano	
Travis	111
Williamson	24

Technical guidance was available in the form of a memorandum from Radian, Inc., which estimated a median value of 28 pounds of VOC compounds per tank remediation, based upon an analysis of soil removed and its hydrocarbon content in parts per million. The statistic only applies to tanks remediated during the ozone season, and assumes that the duration of emissions is approximately 30 days.[33] Therefore, the equation to estimate emissions, including conversion to tons per day, is:

$E_{voc,tpd}$ = (((tanks x 28)/2000)/4)/3

Sample calculation:

VOC emissions = 24 tanks removed in Williamson x 28/2000/4/3 = 0.0280 tons/day

Spatial Allocation

The emissions were spatially allocated according to the population in each county based on 1990 census tracks and block groups. It was not spatially allocated based on location of the tank because the number of tanks remediated in each county was obtained but the location within the county was not listed. The database only listed the address of the company that owned the tank not the address where the tank was located.

[33] Radian Corporation, May 1992. Memorandum: VOC Emissions from Underground Storage Tanks. Research Triangle Park, North Carolina.

2.21 Gasoline Service Stations

Category Description

This source category includes area source emissions from the gasoline distribution system. Stage I and Stage II emissions (occurring during the transfer of gasoline from tank trucks to storage tanks at service stations, and subsequent transfer to the vehicle gasoline tank, respectively) are covered, as well as emissions from delivery trucks in transit, gasoline station storage tanks, and spillage. Separate emissions estimation methodologies were used to develop emissions from the individual process that comprise this source category.

Gasoline throughput was the activity data used in calculating 1999 emissions from each gasoline distribution SCC (throughput was based on consumption). Monthly state-level gasoline consumption data were obtained from the Texas Comptroller Public Accounts (TCPA, 2001). For tank truck unloading, vehicle refueling, and spillage, the gasoline consumption in Texas was apportioned by winter versus summer season. The winter consumption was calculated by adding the consumption during January, February, March, October, November, and December. The summer consumption was calculated by adding the consumption during April, May, June, July, August, and September. State gasoline consumption was apportioned to each county based on the proportion of 1997 year sales at service stations in each county, which was computed from Bureau of Census data (BOC, 1999)

The annual VOC emissions from *vehicle refueling* and *spillage* were calculated by applying the MOBILE6 emission factor for winter and summer for each county to the winter and summer gasoline consumption calculated for each county. The sum of the winter and summer emissions for a county was the total VOC emissions for the year for that county. The MOBILE6 emission factors incorporate the effects of emission control programs.

The annual VOC emissions from tank truck unloading were calculated by applying the TCEQ (former TNRCC) supplied LL factor for winter and summer for each county to the winter and summer gasoline consumption calculated for each county. The sum of the winter and summer emissions for a county was the total VOC emissions for the year for that county. These emissions were controlled in nonattainment areas using CE, RP, and RE values supplied by TCEQ (former TNRCCC).

The annual VOC emissions for tank breathing losses and tank trucks in transit were calculated by applying emission factors to the number of gallons of gasoline consumption for 1999. A gasoline transportation adjustment factor of 1.25 was applied to the tanks in transit calculation (EIIP, 2001). The ozone nonattainment county emissions for tank trucks in transit were modeled using CE, RP, and RE values supplied by TCEQ.

Methodology

See Appendix A, Section 2.13, page 2-46. ENVIRON calculated 1999 emissions for this source category under contract for the Texas Commission on Environmental Quality.

2.22 Open Burning

Category Description

Open burning is the purposeful burning of materials in outdoor areas such as forests and yards. The types of open burning included in this chapter are fires that: (1) result from anthropogenic activities; and, (2) are intentionally set in order to dispose of non-hazardous wastes by burning. This category excludes burning in dedicated combustion devices and buildings, and fires that are accidental, such as forest wildfires or structure fires. Open burning subcategories included in this chapter are open burning of residential municipal (household) solid wastes (MSW), land clearing wastes, and yard wastes. In many cases, however, the approaches for preparing emission estimates for some of the accidental fires may be very similar to the approaches presented here for intentional fires.

2.22.1 Residential Municipal Solid Wastes (MSW).

Residential MSW is the nonhazardous refuse produced by households. MSW includes paper, plastics, metals, wood, glass, rubber, leather, textiles, and food wastes. Open burning of MSW at municipal landfills was prohibited by federal law in 1979 (40 CFR 257), therefore, burning of residential MSW is practiced only by private individuals. Most municipalities and some states have laws that prohibit on-site burning of residential MSW. Open burning of residential MSW is a concern mostly in rural areas, where burning is seen as an easier or cheaper alternative to landfilling.

2.22.2 Land Clearing Wastes.

The clearing of land for the construction of new buildings and highways often results in debris consisting of trees, shrubs, and brush. This debris may be burned in place but it is usually collected in piles for burning. The burning of land clearing wastes may be practiced by private individuals, corporations, and government agencies (e.g., highway construction department). There are no federal laws restricting the open burning of land clearing wastes, although state or local laws may exist.

2.22.3 Yard Wastes.

Yard waste burning is the open burning of materials such as grass clippings, leaves, and trimmings from trees and shrubs. Yard waste burning takes place where the waste is generated (i.e., residences, parks, institutions such as universities or hospitals, office complexes or other areas where grounds maintenance generates this type of waste) or waste disposal sites where wastes have been collected. Although there are no federal regulations restricting the open burning of yard wastes, many municipalities prohibit or restrict the burning of yard wastes, and promote composting as an alternative.

Methodology

See Appendix A, Section 2.14, page 2-57. ENVIRON calculated 1999 emissions for this source category under contract to the Texas Commission on Environmental Quality.

2.23 Landfill Emissions

Category Description

As the materials in landfills decompose, the waste emits gases, collectively known as landfill gas. Approximately 50 percent of landfill gas is methane (CH_4), or natural gas, and the remainder is primarily carbon dioxide (CO_2).[34] Landfill gas also consists of trace amounts of non-methane organic compounds (NMOC) and other air pollutants. The characteristics of landfill gas, including generation rate, are a function of the quantity of waste in place, waste composition, climate, presence and distribution of microorganisms, pH, and other factors.[35] Gas emissions are also a function of time. During a landfill's initial phase, which lasts from six months to two years,[36] waste decomposes under aerobic conditions and the primary gas produced is CO_2. As oxygen is depleted, CO_2 production decreases and the production of H_2, CH_4, and other gases, including VOCs, begins.[37]

By the time gas generation meets steady state conditions, CO_2 and CH_4 each make up roughly half of the landfill gas; trace amounts of other pollutants make up the remainder, as described above.

The landfill emission estimation was developed using applicable guidelines and methodologies described in Preferred Method of estimation for landfill emissions in the EIIP[1] document. The emissions estimation covers landfills located in all counties. The

[34] Radian Corporation and Eastern Research Group (February 1998). *User's Manual: Landfill Gas Emissions Model, Version 2.0*, Research Triangle Park, NC. Pp1-4.
[35] Eastern Research Group (September 1997). *Emission Inventory Improvement Program, Volume III: Chapter 15, Landfills*. Morrisville, NC. Pp. 15.2-1
[36] U.S. Environmental Protection Agency (January 1999). *Landfill Gas-to-Energy Project Opportunities, EPA-430-K-99-002*. Available: http://www.epa/gov/lmop/profiles.htm

[37] U.S. Environmental Protection Agency. Air Pollutant Emission Factors, *AP-42, Volume I Stationary and Area Sources, Chapter 2.4 Municipal Solid Waste Landfills*. Available: http://www.epa.gov/ttn/chief/ap42/cho2

landfill gas, mainly methane, and the VOC were estimated using the seven steps as described in the EIIP[1]. The VOC content of the landfill gas was calculated using data from AP-42.

Methodology

Data from Municipal Solid Waste Division was used to estimate the emissions.

Step one : Estimate the total quantity of **waste in place**[2] at all landfill sites in Texas over the previous thirty years. An estimated 1999 Texas population and per capita waste per year were used for the step one calculation. A default value may be used for the 30-year multiplier.

Step two : Estimate the waste in place at large and small landfills in1999. A default factor of 81% of the total waste in place was used for the estimation of the waste in place for large landfill sites. A large landfill site is where waste is over one million tons in place.

Step three : Use the fact that Texas is a non-arid state where the rainfall is more than 25 inches.

Step four: Estimate the methane generation from small landfill sites by using the equation[3] for non-arid as indicated.

Step five: Estimate the methane generation from large landfill site by using the equation[4] for non-arid as stated.

Step six: Estimate the uncontrolled methane emission from the landfill sites using the information from the EPA publication[5]. The controlled amount of methane is considered to be burned in flares, collected and compressed for later use or burned to generate electricity. The difference between the total methane generation and the controlled amount of methane is determined to be the uncontrolled methane emissions.

Step seven: Convert the net methane emission nonmethane organic compounds or VOC emission using the data from AP-42[6]. An average NMOC value of 595 ppmv may be used for the calculation of the net VOC emission from the state.

Step eight : Calculate the VOC emissions for individual counties using ratio method and using the step seven data, the VOC emissions for the state, and the 1999 population data.

The 1999 population data was estimated using the TNRCC projected censes population for 1999 and the 2000 US Censes population data.

Step nine: Determine the landfill emissions generated only from the area sources. This was done by subtracting the point source emissions for SIC 4953 from the PSDB from the estimated landfill emissions. Use the reported county level landfill emissions from the step eight. This is to eliminate double counting of emissions for the category.

Reference:
1. EIIP, Volume VIII, Chapter 5, pg 5.4-3,Preferred Method
2. EIIP, Volume VIII, Chapter 5, pg 5.4-5,Preferred Method
3. EIIP, Volume VIII, Chapter 5, pg 5.4-6,Preferred Method
4. EIIP, Volume VIII, Chapter 5, pg 5.4-7,Preferred Method
5. The EPA 430-K-99-029, Exhibit 1, pg TX-2
6. The EPA AP-42, Fifth Edition, pg 2.4-4

2.24 Wastewater Emissions

The state of Texas assumed the authority to administer the National Pollutant Discharge Elimination System (NPDES) program in Texas on Sept. 14, 1998. The NPDES is a federal regulatory program to control discharges of pollutants to surface waters of the United States. The TNRCC's Texas Pollutant Discharge Elimination System (TPDES) program now has federal regulatory authority over discharges of pollutants to Texas surface water, with the exception of discharges associated with oil, gas, and geothermal exploration and development activities, which are regulated by the Railroad Commission of Texas. [38] Accordingly, the TNRCC permitting records provide a record of all in the state who create wastewater discharge according to the following guidelines:[39]
Discharges of waste from industry and municipal treatment works, including publicly owned treatment works (POTWs) Discharges and land application of waste from concentrated animal feeding operations (CAFOs) Discharges of storm water associated

[38] Texas Pollutant Discharge Elimination System (TPDES), Texas Natural Resource Conservation Commission (TNRCC), http://www.tnrcc.state.tx.us/permitting/waterperm/wwperm/tpdes.html, February 20, 2001
[39] TPDES Program Summary, TNRCC, http://www.state.tx.us/permitting/waterperm/wwperm/summary.pdf, October 14, 1999

with industrial activities, including construction sites Discharges of storm water associated with city storm sewers, known formally in the regulations as municipal separate storm sewer systems (MS4s) Oversight of municipal pretreatment programs operated by publicly owned treatment works Disposal and use of sewage sludge

AACOG requested permitting information from the TNRCC for all municipalities, school districts, trailer parks, municipal utility districts (MUDs), etc., which have been charged with handling wastewater discharge from industries, wastewater collection systems, and other miscellaneous sources. The data requested includes daily average flows and operating-days parameters, as well as a list of geographical coordinates (latitude and longitude) to allow geocoding of discharge locations in the future. Within the 79 records in the TNRCC data set, there are just four unique SIC codes as illustrated in Table 4-33. They are:[40]

Table 2.14. SIC Codes for Wastewater Systems

SIC code	SIC Code Description	Number of records
4952	Sewerage Systems	74
4941	Water Supply Systems, except irrigation	3
7032	Sporting and Recreational Camps	1
6552	Land Sub-dividers & Developers, Except Cemeteries	1

These classifications fall within two broad categories of wastewater treatment plants defined by the EPA: Publicly owned waste treatment (POWT) facilities and Package plants. POWTs are government-owned entities charged with the handling of wastewater discharge from industries, wastewater collection systems, and other miscellaneous sources. Package plants refer to small, automated (usually) domestic waste treatment plants that do not require full-time supervision. In general, these facilities treat less than one million gallons per day (MGD).[41]

[40] Standard Industrial Classification Search, http://www.osha.gov/oshstats/sicser.html, Occupational Safety & Health Administration (OSHA), U.S. Department of Labor, October 15, 1999.
[41] Procedures for the Preparation of Emission Inventories for Carbon Monoxide and Precursors of Ozone, Volume I: General Guidance for Stationary Sources, U.S. Environmental Protection Agency, Publication No. EPA-450/491-016, p. 3-13 and 3-14, May 1991 Edition.

Methodology

For both categories, it is first assumed that the industrial wastewater VOCs represent the single most important source of the volatile organic constituents in the entire wastewater stream, while only representing a percentage of the flow total. With this assumption, EFs can be derived by applying EFs suitable to the total industrial flow. EPA guidance allows a default value of 1.1×10^{-4} pounds of VOC per gallon of industrial wastewater discharged.[42] Since discharge units are typically in MGD, we have:

(1.1×10^{-4} pounds of VOC per gallon of wastewater) x (1×10^{6} gallons per million gallons) = 110 pounds of VOC emitter per million gallons of industrial wastewater

The results of this calculation provide an EF of 110 pounds of VOC emitted per million gallons of industrial wastewater discharged to a POTW or package plant. This factor is recommended for estimating VOC emissions from POTWs and package plants where measured emissions data are not available. The EPA-recommended default value is that total wastewater flow is composed of 16 percent industrial wastewater.[43] Therefore, for every 6.25 million gallons of wastewater discharged, 16% or 1 million gallons of the discharge is considered industrial wastewater, which produces 110 lbs. VOC.

The data provided by the TNRCC included the daily flow averages in MGD, per site, for each month in 1999, and the days of operation for each month. These figures were used to estimate the average tons per day (TPD) of VOCs per county for an average ozone day in 1999 as well as the annual per county tons per year (TPY) of VOCs.

The daily average flows were multiplied by the number of days operated per month at each location to estimate the monthly volume (in millions of gallons) of wastewater per site. The per-site monthly volumes were summed by county, once for those months in the ozone season (May through October) and for the entire year. The ozone season sum was divided by the number of days in the ozone season to attain an average 1999 ozone day

[42] Ibid.
[43] Ibid.

wastewater flow rate (gallons per day) per county. This ozone day average was multiplied by 0.16 to approximate the industrial waste component of this waste stream. This result was multiplied by 110 to convert the figure to pounds of VOC per county per day in July 1996. Finally, this number was divided by 2000 to give the average 1996 ozone season VOC total TPD per county.

A sample calculation of TPD of VOC during an average ozone season day is given for Bastrop County:

(County sum, 10^6 gallons per month summed over ozone season/days in 1999 ozone season) x (16% x lbs. VOC/million gallons wastewater)/(tons/lb.)
(292.7077/244) x [(0.16 x 110)/(2000)] = (1.1996) x (0.0088) = 0.0106 TPD VOC.

Table 2.15 illustrates the per county wastewater flow in millions of gallons per day for an average ozone day in 1999. In addition, Table 2-XY also illustrates the per county wastewater flow as an annual average for 1999, in millions of gallons (annually). This last column is achieved by summing the monthly totals as described above.

Table 2.15. Annual Average and Ozone Day Wastewater Flow by County

County Name	**Wastewater Flow in Millions of Gallons per Day, Average Ozone Day, 1999**	**Wastewater Flow, 1999 Annual Average, Millions of Gallons**
Bastrop	1.1996	413.0519
Blanco	0.0558	25.2238
Burnet	0.4721	155.1529
Caldwell	1.6925	606.4391
Fayette	0.9493	334.6809
Hays	3.7478	1399.9177
Lee	0.7803	282.2596
Llano	0.2760	96.0539
Travis	92.1795	32,883.0774
Williamson	15.3821	5,523.2468

The availability of month-specific records obviated the need to calculate a seasonal factor. Wastewater treatment was considered a seven-day-per-week operation for the

sewerage SIC codes; no daily factors were considered. Additionally, this category of emissions produces only VOC gases. The final results are illustrated in Table 2-XZ.

Table 2.16. Annual Wastewater VOC Emission Amounts

County Name	VOC tons/average ozone day 1999	VOC tons/yr. 1999
Bastrop	0.0106	3.6349
Blanco	0.0005	0.2220
Burnet	0.0042	1.3653
Caldwell	0.0149	5.3367
Fayette	0.0084	2.9452
Hays	0.0330	12.319
Lee	0.0069	2.4839
Llano	0.0024	0.8453
Travis	0.8112	289.37
Williamson	0.1354	48.605

2.25 Waste Disposal Treatment and Recovery (TSFD)

Category Description

Landfills that accept hazardous waste should be classified as treatment, storage, and disposal facilities (TSDFs).

Methodology

The data for treatment, storage, and disposal facilities (TSDFs) category is originating from EPA 1999 NEI Inventory database, it was supplied to CAPCO by TCEQ. See Appendix A for emissions total. Emissions for this category are reported under SCC: 2640000000.

2.26 Waste Disposal Treatment and Recovery (LUST)

Category Description

Working and breathing losses from petroleum storage tanks result in the emission of VOCs. These emissions will be added and referred to as total losses. Emissions from above and under ground storage tanks were estimated using the TANKS 4.0 model[44], which is available through the Technology Transfer Network (TTN) Bulletin Board System maintained by the EPA. The TANKS model was designed to estimate emissions for specific liquids being stored. Once specific tank and fluid properties are entered, the model uses AP-42 methodology and emission factors to calculate total losses in lbs. per year.[45] The TNRCC provided the database of tanks within the CAPCO Region.[46]

Methodology

To effectively estimate losses from the petroleum storage tanks with the CAPCO Region without entering all active tanks into the model, model runs were performed for distinct volumes for each RVP value and chemical stored. The database of storage tanks was culled to remove tanks at gas stations, diesel tanks, empty tanks, tanks abandoned in place and tanks removed from the ground (for USTs). Emissions for gas stations were calculated in the Gasoline Distribution section. All valid tanks remaining in the database were then sorted by volume and substance stored in order to allow for categorization. Tanks located at point sources will also not be included, as they will be part of the point sources inventory. Whether or not Stage 1 controls were in place for underground storage tanks was not included in the database. Many attempts to acquire a more thorough database were made without success.

The next categorization consisted of creating a model run spreadsheet in order to avoid a duplication of volume and chemical type. For example, if a tank holding gasoline with a capacity of 500 gallons were chosen, then losses from the tank with a 500-gallon capacity would be used to estimate emissions for all tanks with a volume of 500 gallons. To account for different RVP values within the region, losses for tanks within Travis and

[44] TANKS 4.0 Emissions Estimation Software, http://www.epa.gov/ttn/chief/software/tanks/index.html.
[45] U.S. Environmental Protection Agency, AP-42: Organic Liquid Storage Tanks. Chapter 7, Section 7.1. Research Triangle Park, North Carolina.
[46] Julie Farland, 1999, TCEQ (former Texas Natural Resource Conservation Commission), Austin, Texas.

two adjacent counties were calculated using an RVP value of 8, whereas losses in outlying counties were calculated using an RVP value of 9.

2.27 Agricultural Field Burning

Category Description

This source category covers agricultural field burning practices used to clear and/or prepare land for planting. Operations included under this category are stubble burning, burning of standing field crops as part of harvesting (e.g. sugarcane) and burning of agricultural crop residues. The burning of sugarcane residue is allowed in Texas since there is no feasible alternative. On the other hand, other agricultural waste can be managed in number of ways. Emissions for this category include: CO, VOC, NOx, PM_{10}, $PM_{2.5}$ and NH_3. Emissions for this category are reported under SCC 2801500000.

Methodology

See Appendix A, Section 2.15, page 2-68. ENVIRON calculated 1999 emissions for this source category under contract to the Texas Commission on Environmental Quality.

2.28 Wildfires

Category Description

The wildfires category contains emissions from unplanned burning of wild vegetation (e.g., fires started by lightning). Wildfire emissions include CO, NOx, VOC, PM10, PM2.5, and ammonia (NH3). Wildfires can produce very large, short-term emissions. The emissions for this category are reported under SCC 2810001000.

Methodology

The preferred methodology for estimating emissions for this category would be to collect activity data by county on the number of acres burned by wildfires, the type of fuel, fuel

loading factors, and the time and duration of each fire. This activity information would then be used with emissions factors to estimate annual and seasonal emissions for 1999. However, collection of the activity data from the various county, state, and federal land management agencies requires extensive time and resources which were not available for preparing the 1999 area source inventory of Texas.

The UT, Austin developed estimates of wildfire emissions for 1996 and 1997 (CEER, 2000). Because of the large number of agencies that manage land affected by wildfires in Texas, and the lack of a centralized system for reporting wildfire activity, UT employed a number of agency-specific methods to develop wildfire activity estimates for 1996 and 1997. Given the random nature of the level of wildfire activity, the 1997 inventory prepared by UT was used for the 1999 inventory.
See Appendix A, Section 2.16, pg. 71-72. ENVIRON calculated 1999 emissions for this source category under contract to the Texas Commission on Environmental Quality

2.29 Managed Burning; Prescribed

(SCC: 2810020000 filed under: 2810015000)

Category Description
Prescribed rangeland burning is defined as non-agricultural controlled rangeland management fires. Prescribed rangeland burning is used for several purposes including: suppression of brush, cacti, and other unwanted plant species; encouragement of grass growth; and control of parasites and insects. The prescribed rangeland burning source category was the predominant burning category in the state-wide burning inventory (i.e., >50 percent of emissions for all pollutants except for NO_x) (Allen and Dennis, 2000). It was also the second largest air toxics area source category in Texas, after consumer and commercial solvent use (19.2% of total air toxics) (ERG, 2001). However, the activity data for this category has the greatest associated uncertainty.

Prescribed rangeland burning activity data used in the 1999 burning inventory were obtained from a survey of Agricultural Extension Service (AEXS) agents. Surveys were sent to 250 AEXS agents with 170 returned surveys. The extrapolation methods used for the TEXFIRS wildfire and prescribed wildland burning were also used for prescribed rangeland burning. It was estimated in the burning inventory that approximately 1 percent of Texas rangeland is burned annually. It is expected that the amount of prescribed rangeland burning will not vary significantly from year to year. However, regional differences may exist.

Methodology

CAPCO EAC area VOC emission estimates for prescribed rangeland burning were obtained from the 1999 air toxics inventory (ERG, 2001). CAPCO EAC area NO_x emission estimates were estimated using prescribed rangeland burning acreage combined with NO_x emission factors from the 1999 burning inventory (Allen and Dennis, 2000).

Ozone season daily emissions for prescribed rangeland burning were not available from either the 1999 air toxics inventory or the 1996/1997 burning inventory. Ozone season emissions for 1999 were calculated by multiplying the 1999 VOC and NO_x estimates by the ratio of 1996/1997 ozone season emissions (i.e., April through October) divided by 1996/1997 annual emissions. Ozone season daily emissions were then calculated by dividing 1999 ozone season daily emissions by 214 (i.e., the number of days in the ozone season). It should be noted that the level of prescribed rangeland burning varies from year-to-year and that the distribution of 1996/1997 activity may not actually represent conditions in 1999.

2.30 Structure Fires

Category Description

Structures are traditionally classified as either residential or non-residential. For the purposes of this EI, all non-residential structures will be referred to as structure fires and

all residential structure fires will be referred to as residential fires and will be covered later in this section.

Methodology

A lack of satisfactory data pertaining to square footage for both structures in general and structures involved in fires led to the need for alternative methods of calculating emissions. Fuel loading estimates are necessary to convert the number of fires into a value compatible with EFs, which are based upon the total weight of material burned. The fuel-loading factor calculates the mass of combustible material consumed per fire. A fuel-loading factor of 1.15 tons consumed per structure fire was used as well as a methodology developed by the California Air Resources Board [47](CARB).

Sample Calculation

VOC (TPD) = ((# of fires) x (EF) x (fuel-loading factor)) / days/yr.

For Travis County, 1999.

((705)*(0.0055) x (1.15))/365 = 0.012217 tons VOC / day

Where 705 equals the number of fires, 0.0055 is the EF for VOC in tons material burned, 1.15 is the fuel loading factor (CARB) and 365 is the number of activity days per year.

2.31 Miscellaneous Area Source; Motor Vehicle Fires

Category Description

This covers air emissions from accidental vehicle fires. Vehicles included are any commercial or private mode of transportation that is authorized for use on public roads.

[47] This method is listed in EIIP Volume III and is derived from the CARB Emission Inventory Procedure Manual, Volume III: Methods for Assessing Area Source Emissions, developed by the California Environmental Protection Agency: Air Resources Board.

Methodology

Data concerning vehicle fires in Travis County was gathered through the TDI. If unavailable, numbers for vehicle fires in the surrounding counties were estimated based on population, as listed in the EIIP, Volume III, as an alternative method. To determine fuel loading, an estimate must be made on how much material burns in a vehicle fire. The estimate used for this parameter is that each vehicle contains approximately 500 pounds (.25 tons) of material that can burn in a fire, based on the average weight of a vehicle being about 3,700 pounds (CARB, 1995).

Sample Calculation for Travis County:

The EF for VOC is 4 lbs./ton burned (EPA, 1996) Converting to tons, 4/2000 = 0.002 tons VOC / ton burned.

Tons NOx/ day = (Activity x fuel loading x EF)/365 days/yr.
= (779 fires x .25 tons/fire x 0.016 tons VOC)/365 days/yr.
= 0.008537 tons VOC/day resulting from vehicle fires.

2.32 All Catastrophic/Accidental Releases

Category Description

Accidental spills and releases of petroleum products or other chemicals can come from sources such as tanker trucks, refueling stations or ruptured pipelines. Factors affecting emissions include the type of fuel or petroleum product and the time taken to clean up the spill (if cleaned).

Information on spills in the region was acquired through the TNRCC.[48] Information provided categorized spills by material and amount. Also given were location, date, company and type of clean-up effort.

[48] TCEQ (former TNRCC) Emergency Response Team.

Methodology

Once amounts for each spill are acquired, an estimate must be made on how much of the spill will be subject to generating emissions and lost to evaporation. Estimates are that 10% of crude lost will evaporate, 20% of gas well liquid (condensate) will evaporate, and 100% of gasoline and diesel will evaporate. The number of gallons lost will be multiplied by an EF made available from AP-42. These factors are in pounds per gallon, based on the density of the material spilled. The factors are first converted to tons per gallon and then multiplied by the EF, resulting emissions will be converted into tons per day. The seasonal adjustment factor is 1 and activity is seven days per week.

Example Calculation:

In 1999, 1,130 gallons of diesel fuel were spilled in Travis County. The following formula was used to illustrate the method described above. The spilled amount, in gallons, must first be multiplied by a density factor (lbs./ gallon).[49] This value is then converted to tons. Emission =((tons spilled) x (percent evaporated) x (emission factor))/365 days.

Tons spilled = ((1,130 gallons) x (6 lbs./gallon density factor for diesel)) / (2000 lbs./ton) = 3.39 tons

Tons/day VOC in Travis (from diesel) = ((3.39 tons of diesel) x (1.0) x (1.0))/365 days

= 0.009287671

During 1999, the study area had 8,970.25 gallons of VOC containing materials spilled. This yielded 0.145005832 tons of VOC per day.

[49] All emission factors from AP-42.

2.33 Summary of All Area Source Emissions

3 ON-ROAD MOBILE EMISSIONS

Introduction to On-Road Mobile Methodology

The on-road mobile emissions are generated by the many vehicles, cars, trucks, buses, and so on, traveling the regional roads and highways. In the Austin MSA region, on-road sources are a primary contributor of VOC, NOx, and CO anthropogenic emissions. Emissions for this category were developed by the Texas Transportation Institute (TTI) using emission factors from EPA's MOBILE6 Model in conjunction with Travel Demand model (TDM)-based vehicle miles of travel (VMT) and HPMS-based VMT.

Table 3.1 Summary of the On-Road Mobile Emissions

	VOC	CO	NOx
Bastrop	2.54	34.12	3.95
Caldwell	1.30	17.78	2.32
Hays	4.85	70.52	11.44
Travis	32.61	409.47	63.06
Williamson	8.89	118.21	17.09
Total	**50.19**	**650.10**	**97.86**

Table 3.1 Emissions by vehicle category

Appendix D contains the documentation on On-Road emissions methodology prepared by TTI for the Austin MSA.

Table 3-2 On-Road Mobile Sources. Vehicle emissions by category (TTI, 2003)

	Bastrop			Caldwell			Hays			Travis			Williamson		
M6 Category	VOC	CO	NOx	VOC	CO	NOx	VOC	CO	NOx	VOC	CO	NOx	VOC	CO	NOx
LDGV	1.639	21.458	1.415	0.842	11.244	0.732	3.166	45.141	2.824	21.119	259.409	17.620	5.746	74.677	4.904
LDGT1	0.157	2.240	0.116	0.079	1.147	0.059	0.289	4.427	0.223	1.947	26.051	1.388	0.538	7.581	0.394
LDGT2	0.534	7.665	0.455	0.269	3.923	0.231	0.983	15.142	0.871	6.638	89.122	5.436	1.833	25.932	1.543
LDGT3	0.070	1.181	0.075	0.035	0.601	0.038	0.127	2.299	0.140	0.863	13.459	0.879	0.240	3.962	0.252
LDGT4	0.033	0.549	0.041	0.017	0.279	0.021	0.060	1.067	0.077	0.408	6.251	0.483	0.114	1.840	0.138
HDGV2b	0.010	0.148	0.062	0.005	0.083	0.032	0.020	0.331	0.128	0.150	2.065	0.736	0.039	0.588	0.211
HDGV3	0.008	0.130	0.035	0.004	0.073	0.018	0.015	0.291	0.072	0.114	1.816	0.413	0.030	0.517	0.118
HDGV4	0.002	0.031	0.010	0.001	0.018	0.005	0.004	0.070	0.020	0.032	0.438	0.116	0.008	0.125	0.033
HDGV5	0.003	0.039	0.007	0.001	0.022	0.003	0.005	0.087	0.014	0.036	0.544	0.078	0.010	0.155	0.022
HDGV6	0.010	0.154	0.028	0.005	0.086	0.014	0.019	0.345	0.057	0.143	2.153	0.328	0.038	0.613	0.094
HDGV7	0.003	0.048	0.009	0.001	0.027	0.005	0.005	0.106	0.019	0.040	0.664	0.111	0.011	0.189	0.032
HDGV8a	0.004	0.065	0.010	0.002	0.036	0.005	0.007	0.145	0.020	0.055	0.904	0.115	0.014	0.257	0.033
HDGV8b	0.000	0.003	0.001	0.000	0.002	0.001	0.000	0.006	0.002	0.002	0.039	0.013	0.001	0.011	0.004
LDDV	0.002	0.005	0.006	0.001	0.003	0.003	0.004	0.010	0.013	0.030	0.064	0.069	0.008	0.018	0.021
LDDT12	0.002	0.003	0.002	0.001	0.002	0.001	0.004	0.007	0.005	0.026	0.043	0.028	0.007	0.012	0.009
HDDV2b	0.004	0.014	0.083	0.002	0.008	0.048	0.007	0.030	0.210	0.050	0.202	1.071	0.013	0.055	0.323
HDDV8	0.001	0.005	0.033	0.001	0.003	0.019	0.003	0.011	0.084	0.021	0.074	0.429	0.005	0.020	0.129
HDDV4	0.001	0.004	0.024	0.001	0.002	0.014	0.002	0.008	0.061	0.015	0.053	0.311	0.004	0.014	0.094
HDDV5	0.001	0.003	0.014	0.000	0.001	0.008	0.001	0.005	0.036	0.009	0.037	0.186	0.002	0.010	0.056
HDDV6	0.004	0.013	0.091	0.002	0.007	0.053	0.008	0.029	0.240	0.058	0.193	1.232	0.015	0.053	0.364
HDDV7	0.004	0.013	0.077	0.002	0.007	0.045	0.007	0.028	0.200	0.052	0.184	1.028	0.013	0.050	0.305
HDDV8a	0.007	0.037	0.207	0.004	0.021	0.121	0.013	0.081	0.571	0.096	0.540	3.027	0.025	0.147	0.864
HDDV8b	0.022	0.111	1.059	0.013	0.071	0.787	0.065	0.390	5.348	0.446	2.356	26.904	0.106	0.601	6.846
MC	0.007	0.026	0.002	0.004	0.016	0.001	0.014	0.066	0.005	0.088	0.370	0.026	0.025	0.112	0.008
HDGB	0.008	0.160	0.010	0.004	0.094	0.006	0.015	0.367	0.022	0.113	2.213	0.123	0.029	0.611	0.034
HDDBT	0.002	0.009	0.038	0.001	0.005	0.022	0.003	0.020	0.094	0.024	0.131	0.470	0.006	0.035	0.139
HDDBS	0.002	0.005	0.033	0.001	0.003	0.020	0.003	0.011	0.083	0.023	0.075	0.417	0.006	0.020	0.123
LDDT34	0.001	0.001	0.002	0.000	0.001	0.001	0.001	0.003	0.005	0.011	0.019	0.028	0.003	0.005	0.009
TOTAL	2.540	34.119	3.946	1.299	17.782	2.315	4.853	70.524	11.444	32.606	409.470	63.063	8.889	118.208	17.092

4 NON-ROAD MOBILE SOURCES

Introduction and Scope

The base year for non-road mobile sources is 1999. Four categories were considered in Non-Road Mobile Sources: aircraft, marine vessels, locomotives, and off-road engines. Aircraft emissions estimates were based on activity data from the Texas department of Transportation, Aviation Division. Locomotive emissions estimates relied upon data from the Railroad Commission of Texas (RCT). Off-road engines emissions were estimated from the Non-Road mobile source emissions model. Table 4-1 summarizes nonroad emissions for the five County region.

Table 4-1 Austin MSA Non-Road Mobile Emissions

1999 EMISSIONS	Tons per Day (TPD)		
COUNTY	**NOx**	**VOC**	**CO**
Bastrop	1.72	0.92	4.93
Caldwell	1.42	0.61	3.79
Hays	1.88	1.53	8.31
Travis	16.69	15.59	110.02
Williamson	6.73	3.84	26.73
Grand Total	**28.44**	**22.49**	**153.77**

Figure 4-1 Nonroad Sources NOx Emissions

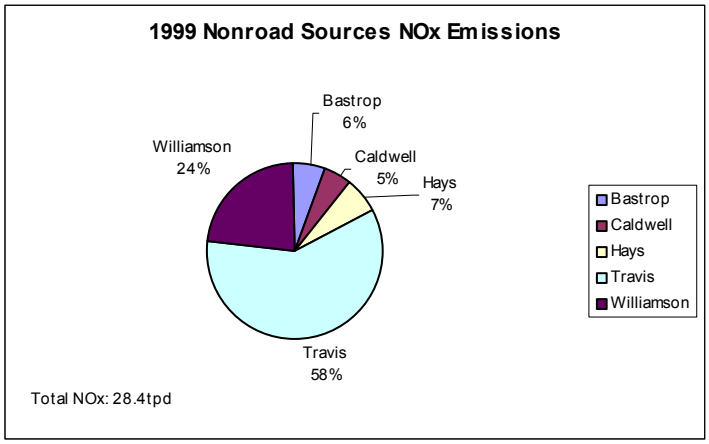
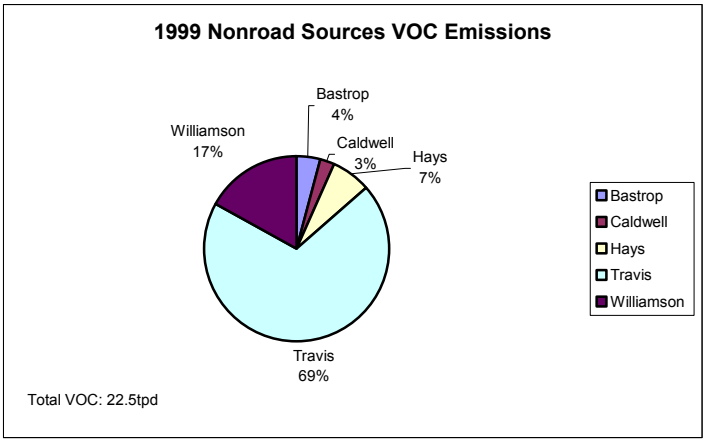


Figure 4-2 Nonroad Sources VOC Emissions



Methodology and Approach

Methodologies used for estimating the non-road mobile source activity levels and emissions come from EPA's (ENVIRON) Non-Road Mobile Model (v 2002a), and previous studies from the TNRCC. Since the Nonroad model does not calculate railroad (locomotive emissions) and airport those categories were evaluated separately. In addition to the locomotives and airport emissions, lawn and garden equipment and gas cans were estimated by survey methods beyond Nonroad model defaults.

Modeling assumptions

The modeling domain was the Austin-Round Rock MSA. The modeled period was for the September 1999 episode. The average, min and max episode temperature was calculated from the TCEQ monitoring data. Each monitoring site records the ozone levels with basic meteorological data (e.g. temperature, wind speed and wind direction). The average temperature was obtained by averaging Austin monitors temperature data over every site for each day of the episode. The maximum and minimum temperature for weekday and weekend were calculated from the data. The following figures presents modeling assumptions and parameters used for the EPA nonroad model.

Figure 4-3. Option file assumptions

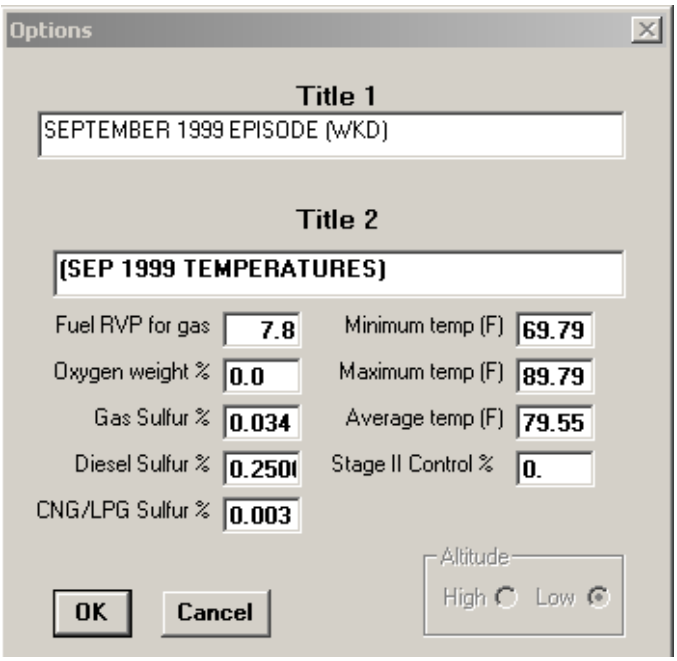


Figure 4-4. Period assumptions

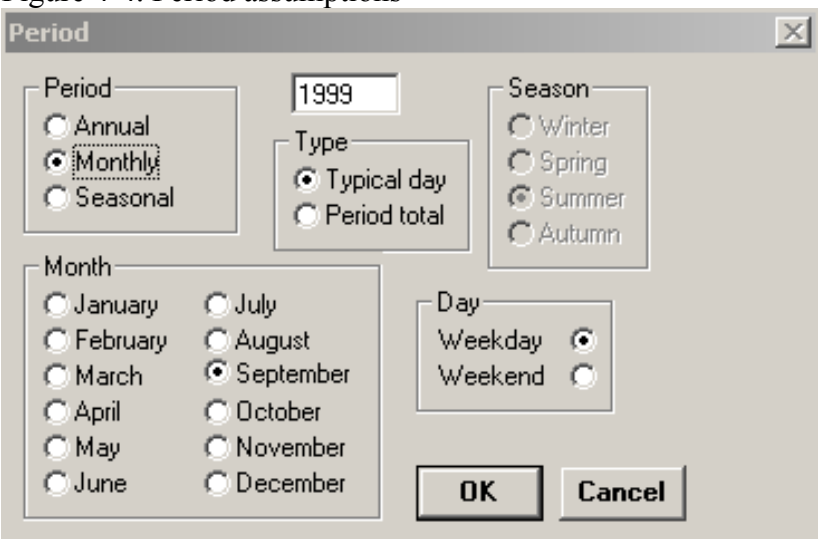
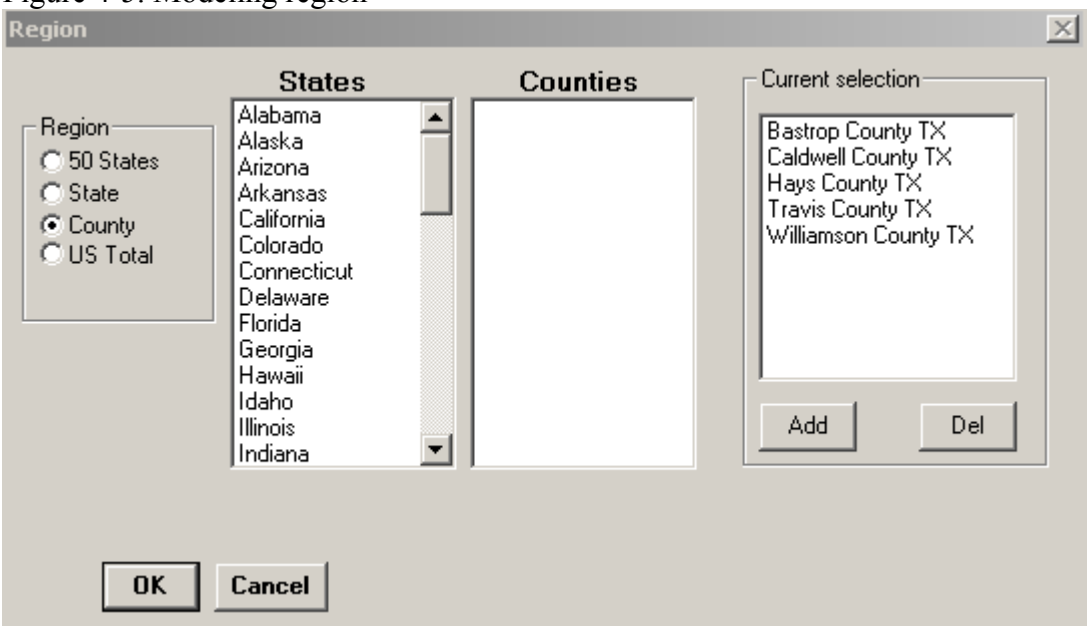


Figure 4-5. Modeling region



Note that Nonroad EPS output contains emissions for a 30-day period. All emissions were re-calculated to daily values (by dividing all emissions with 30). Also note that Nonroad model outputs total hydro-carbons (THC) instead of VOC, so additional conversion was necessary. The conversion table was provided by TCEQ.

Table 4-3. THC to VOC Conversion factors

Engine Type	TOG/THC	NMOG/THC	NMHC/THC	VOC/THC
2-Stroke Gasoline [2]	1.044	1.035	0.991	1.034
4-Stroke Gasoline [2, 3]	1.043	0.943	0.9	0.933
Diesel [4]	1.07	1.054	0.984	1.053
LPG [5]	1.099	1.019	0.92	0.995
CNG [5]	1.002	0.049	0.048	0.004

Each non-road category was grouped into one of the above categories (by engine type) and an appropriate factor was applied.

Emissions for the locomotives (Railroad), airport, commercial lawn and garden equipment and residential gas can emissions were calculated separately. The methodologies for those categories are described in the following chapters.

Quality Assurance Measures

The data was compared with existing EPA and ENVIRON inventories in order to find any significant discrepancies. Note that there were major differences between existing nonroad inventories. Table 4-4 summarizes some of the differences between old NR model, new EPA NR model and local 1999 done by AACOG. Note that ERG developed a diesel construction equipment inventory for the Austin MSA area that was significantly different from the previous version of the EPA's model, but very close to latest EPA model. The emissions for the diesel construction equipment were taken from the EPA's model in order to preserve consistency with methodologies for the future emissions (i.e. 2002 and 2007)

Table 4-4. Comparison between different EPA's and local nonroad inventories

Austin MSA Nonroad Emissions	Sep-99						
Methodology	Diesel Construction Equipment				All Equipment		
	NOx	VOC	CO		NOx	VOC	CO
2002 Nonroad AT	23.78	3.61	15.84	2002 Nonroad AT	38.26	23.68	309.06
EPA's 2002 Nonroad	12.11	1.47	7.26	EPA's 2002 Nonroad	23.06	23.12	324.9
ERG	11.83	1.65	7.39	AACOG (w/ ERG)	31.06	25.48	315.59

Summary of Non-road Mobile Source Emissions

Total non-road mobile emissions from the Austin MSA Area is calculated for tons/yr and tons/day of VOC, tons/yr and tons/day of NOx, and tons/yr and tons/day of CO during the September 1999 episode.

The non-road mobile source emissions are broken down by specific category for each county in the area for typical summer weekday. The emissions tables are at the end of the Nonroad section.

4.1 Commercial Lawn and Garden Equipment

Introduction

In 2002 the Texas Natural Resource Conservation Commission (now the Texas Commission on Environmental Quality, TCEQ) tasked Eastern Research Group (ERG) to develop emission inventory estimates for portable gasoline containers, recreational marine engines, and lawn and garden equipment operating in Texas (TNRCC Contract # 582-0-34730, Work Order # 34730-02-42). As part of this Work Order, ERG and its subcontractors Starcrest Consulting and NuStats, developed surveys to assess ownership and operation patterns for lawn and garden equipment across the state. ERG and Starcrest used the survey results to estimate ton per ozone season weekday emissions of VOC and NOx emissions for both residential and commercial uses of this equipment. Subsequent work performed by ERG for the Capital Area Planning Council (CAPCO) revised and updated the results of the initial analysis. This report describes the survey process, as well as the updated methodology and assumptions used in calculating the emission inventory for these sources.

Methodology

This study refined and updated the default NONROAD2002 model inputs for population counts for lawn & garden equipment, as the categories are defined in the NONROAD model. These categories include two and four stroke gasoline engines used in the following applications, both residential and commercial:

1. Lawnmowers
2. Chainsaws
3. Tractors (not agricultural)
4. Leaf-blowers
5. Chippers / grinders
6. Tillers
7. Shredders
8. Edgers/Trimmers/Other

ERG developed surveys to determine information on both gas can and lawn and garden equipment ownership and use. Separate surveys were developed for the residential and commercial sectors. NuStats administered Random Digit Dial surveys across all Texas households for the residential sector. NuStats also developed a random call list for all Texas companies under SIC 0782, Lawn and Garden Services, for the commercial sector survey. Over 200 residential and 125 commercial surveys were completed.

Analysis of residential results found no significant difference with the NONROAD model population assumptions, so model defaults were used for this sector. However, results from the commercial lawn and garden survey were significantly different than those in the NONROAD model. Therefore alternative population (POP) and allocation (ALO) files were developed from the survey data for the commercial sector.

Commercial survey totals were scaled up to the state level using the total number of firms registered with the Texas Comptroller's office under SIC 0782 in 2002 (8,797). In most cases

the fuel splits between 2-stroke, 4-stroke, and diesel for any given equipment category were pulled from the NONROAD defaults, although survey data were used in a few instances where the subcategory survey populations were high enough to render statistically significant results. Also, NONROAD defaults were used for the following categories for equipment greater than 25 hp (not surveyed by NuStats) – leaf blowers, chippers/grinders, commercial turf, and other lawn and garden equipment. The scaled survey results were combined with the default values specified above to create a new, state-wide NONROAD POP file for commercial lawn and garden equipment. In addition, county level Texas Comptroller data was used to generate a new ALO file for NONROAD as well.

NONROAD2002 was run using typical ozone season day temperatures and fuel properties to generate revised area-specific emissions estimates for the commercial lawn and garden sector, for both the 1999 base year and 2007 future control year.

4.2 Austin Area Airports And Military Installations

Overview

In 1999, there were five airports and two US Army Camps operating in the Austin area. The airports were Austin Executive Airpark, Bird's Nest Airport, Lakeway Airpark, Robert Mueller Municipal and the Austin-Bergstrom International Airport (ABIA). The two Army installations were Camp Mabry and Camp Swift.

4.2.1 Airports

The Austin Executive Airpark (3R3) located north of Austin at 811 Dessau Road closed in May 1999 as part of the Mueller-Bergstrom-Executive relocation package.

The Bird's Nest Airport is located south of Austin near Buda at 1480 South FM 1626. It has a lighted paved 2718' X 25' and an unpaved 2500' X 90' runway and offers aircraft parking but no fuel service.1

The Austin Lakeway Airpark is located at 115 Flying Scott Road and has an unlit paved 4000' X 70' runway and offers aircraft parking and 100 Low Lead (LL) aviation fuel.2

In 1999, the City of Austin operated two municipal airports, Robert Mueller (AUS) and Bergstrom International.

The Robert Mueller Municipal Airport was located in near northeast Austin at 3600 Manor Road and had two illuminated and paved runways of 5006' X 150' and 7269' X 150'. The airport had scheduled air carrier, freight, repair, fueling and full Fixed Base Operator (FBO) services. 3

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[1] Texas Airport Directory, Texas Department of Transportation, Austin, TX, 1994 and 2000-2001
[2] Ibid
[3] Ibid

Mueller hosted scheduled air carrier and general aviation operations until the evening of May 22, 1999 when all air operations ceased, the runways closed, and all equipment was transported overland to Bergstrom. The Texas Army National Guard, the State of Texas, and air freight operations moved onto ABIA at varying dates prior to opening the airport to scheduled air carrier service on May 23, 1999.

On May 23, Bergstrom reopened as the ABIA serving as the principal airport for the Austin Region. The ABIA is located on the site of the former Bergstrom Air Force Base, in southeast Austin on Texas Hwy. 71 near the intersection with U.S. Hwy. 183. ABIA consists of the 600,000 square foot terminal Barbara Jordan Terminal, which has 25 gates of which 24 are leased, two parallel runways, 12,250 feet and 9,000 feet, 10,777 public parking places, SuperShuttle shared-ride, door-to-door service, Capital Metro local bus service, taxicab, and limousine service.4

The ABIA has 3,000+ employees on site including airlines, Federal Aviation Administration (FAA), cargo, rental cars, concessions, parking, 300+ Department of Aviation employees, and Federal Inspection Services.5

Over 7.6 million passengers per year pass through the ABIA on approximately 270 commercial passenger flights per day, of which 34 are non-stop flights. Scheduled air carriers, charter and freight carriers serving Austin as of December 1999, consisted of Air Transport, Amerijet, Capital Cargo, DHL, Emery Worldwide, Express One, Express Net Airlines, Federal Express, Fine Airlines, Kitty Hawk Air Cargo, Pace, Ryan, Sun Country, United Parcel, USA Jet, Allegiant Air, America West, American, American Eagle, Atlantic Southeast, Casino Express, Champion, Continental, Delta, Miami Air, Northwest, Pan American World, Reliant, Southwest, Spirit Air, Trans World, Transmeridian, and United. 6

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[4] City of Austin, 2001, Information at a Glance. Available: http://www.ci.austin.tx.us/austinairport/genfact.htm.
[5] Ibid.
[6] Ibid.

Scheduled air carriers and the Austin Department of Aviation submit an annual report to the U.S. Department of Transportation (USDOT) listing all landings in the year 1999 by aircraft model and engine family (if available).7 This report is the basis on which landing fees are paid to the city for utilization and is officially agreed upon by both, for determining the number, type and model of aircraft on which to calculate the emissions inventory, and incorporated into Table 7 of their annual report. The USDOT 1999 report divided the number of aircraft operations between the two airports but the division apparently is erroneous. They credit most of the air activity to the Mueller Airport although it operated only from January to near the end of May. Other FAA databases list the runway configurations for Mueller as those for the Austin Airport. Unable to separate the activity accurately between the two airports, all emissions were credited to the ABIA. This was done for two reasons; most of the emissions were generated at the ABIA since cargo and other non-carrier operations had already moved there before 23 May, and during the ozone season all emissions were generated at ABIA and will then be correctly geo coded for photochemical modeling

The State of Texas based and operated their fleet of aircraft in their complex on the southeast corner of the ABIA. There are two FBOs on the airport, Austin Aero and Signature Flight Support which provide general aviation service including aircraft hangaring, parking, and rentals, flight instruction and enroute service to transient aircraft.

4.2.2 Military Installations

the Camp Mabry site is just over 375 acres, and the building space is approximately 700,000 square feet. Currently, the post houses the Texas Military Forces Academy, which is the second state building constructed and opened on June 15, 1984. The educational facility conducts the Officer Candidate School, the Noncommissioned Officer (NCO) Academy, Medical Specialist Course and numerous other specialized schools.8 Also located on the post is the United States

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[7] U.S. Bureau of Transportation Statistics, Airport Activity Statistics of Certificated Air Carriers Summary Tables Twelve Months Ending December 31, 1999, BTS01-03, Washington, DC.

[8] Texas Army National Guard, Environmental Resources Management Branch Available at: http://www.agtx-ev.pollution.org/cr/c_mabry.htm.

Property and Fiscal Office, one of two state Combined Support Maintenance Shops, the Texas National Guard Armory Board, the armory of the Headquarters of the 49th Armored Division, a troop medical clinic, a parachute packing and storehouse facility, plus numerous supply and warehouse facilities. The Texas National Guard Academy opened at Camp Mabry in June 1984. Also located on the post are the headquarters of the Texas Air National Guard, the Texas State Guard, the United States Property and Fiscal Office, the Texas National Guard Armory Board, the Headquarters Armory of the Forty-ninth Armored Division, a clinic, a parachute packing and storage facility, and numerous supply and warehouse facilities.

Camp Swift is on U.S. Highway 290 twenty-eight miles east of Austin and seven miles north of Bastrop in Bastrop County. It was built in 1942 on 55,906 acres and initially had 2,750 buildings designed to accommodate 44,000 troops. After the war, much of the site was returned to former owners. The government retained 11,700 acres as a military reservation. That land housed parts of the Texas National Guard, a medium-security federal prison, and a University of Texas cancer research center.

Methodology

This document was prepared in accordance with FAA promulgated guidelines. The air quality assessment procedures require an EI to be conducted for the existing airport and future years. The EI allows alternatives to be compared by total mass of pollutants emitted.

To assist in the preparation of an accurate EI, the FAA microcomputer models, and EDMS Version 3.01 were used with all prescribed data input methodologies. All EFs and estimation techniques are approved EPA methods.

The Emissions and Dispersion Modeling System (EDMS) was selected as the software application to receive, standardize and calculate the EI. The EDMS was developed by the FAA in cooperation with the U.S. Air Force (USAF) in the mid-1980's as a complex source microcomputer model to assess the air quality impacts of proposed airport development

projects.9 It has since been the FAA-preferred model for airport air quality analysis. On July 20, 1993, the EPA accepted the EDMS as a formal EPA "Preferred Guideline" model for use in civil airports and military bases. In response to the growing needs of the air quality analysis community and changes in regulations, the FAA in cooperation with the USAF re-engineered and enhanced EDMS in 1997 to create the EDMS Version 3.0. The EDMS Version 3.0 was built under the guidance of a government and industry advisory board composed of experts from the scientific, environmental policy, and analysis fields.

The EDMS was selected because the survey used for the model was an effective instrument for collecting a wide range of airport-related data like 1) aircraft model, 2) engine type, 3) aircraft destination, 4) specific types of ground support equipment used on the different types of aircraft, 5) type of fuel used, and 6) the duration of ground support equipment operation for each aircraft.

The EDMS model does not estimate GSE equipment populations as a whole, but rather bases them on the number of landing and take-off cycles for different types of aircraft, i.e. two baggage loaders per landing and take-off cycle for some types of passenger planes.

The EDMS model accounts for different types of aircraft: taking into account the number and type of the GSE that is used for different types of aircraft is significant. For example, military planes require different types of GSE than commercial aircraft.

The EDMS model provides another benefit in terms of how the results can be used. The EDMS model results are for a single airport. This provides benefits in terms of spatially allocating the aircraft GSE emissions. Spatial allocation of emissions has a significant impact on ozone levels. The EDMS provides for almost all emission sources relative to an airport and its operation. For an inventory to be informative, all sources must be considered. For this project analysis at the ABIA, the following major sources were identified:

aircraft
GSE
boilers (heating plants)

[9] U.S. Federal Aviation Administration Available: http://www.aee.faa.gov/aee-100/aee-120/EDMS/EDMS2.htm.

motor vehicles (parking lots and roadways)
fuel storage
fueling operations

4.2.3 Aircraft Emissions

Each aircraft type and model operating at the ABIA may be equipped with several different engines, according to year of manufacture, retrofitting, and customer preference. Table 7 of the USDOT report lists the aircraft landing at the ABIA by manufacturer, model and engine type.10 The most common engine type for each aircraft is listed as the default value in EDMS. When an engine type, other than the default value was specifically listed in the report, it was entered as the engine in the inventory

The number of aircraft operations was supplied by the FAA control tower in their monthly activity reports. Scheduled Air Carrier data was supplied by the FAA in their annual airport summary. Aircraft types for air taxi and general aviation were obtained from interviews with the tower staff and fixed base operators. However, each aircraft type may be equipped with several different engines, according to year of manufacture, retrofitting, and customer preference. Through a review of published literature, engine types for each aircraft model were determined. Then a comparison was made to the aircraft types included in the EDMS and the actual aircraft fleet mix placed in categories with similar engines contained in the EDMS. The results of this aircraft type determination are presented in Table 4.2-1.

The EFs for aircraft relate the time at individual throttle settings and the amount of fuel used to predict emissions released to the atmosphere from the aircraft. For this report, the EDMS default times-in-mode was used for all modes except idle/taxi. In this case, the best information available was from discussions with airport operations staff who indicated the most accurately described aircraft times in mode as shown in Table 4.2-2.

[10] U.S. Bureau of Transportation Statistics, Airport Activity Statistics of Certificated Air Carriers Summary Tables Twelve Months Ending December 31, 1999, BTS01-03, Washington, DC.

The times shown in Table 4.2-2 were used for the ground movements at ABIA. Default values were used for takeoff, cruise, and approach times in mode.

Aircraft Types Used in Analysis

Aircraft from four major groups combine to operate at the airport. The scheduled air carriers are well documented at the airport derives landing fees for each landing. The records were obtained from the U.S. DOT in Washington, D.C. The remaining counts were from the FAA Control Tower daily activity records and are divided into Air Taxi, General Aviation, and Military operations. Tables 4.2-3 through 4.2-5 summarize airport activity by category for the year 1999.

Table 4.2-1. Aircraft and/or their Equivalent used in the EDMS

Aircraft	EDMS Aircraft
72710A	72710A
72720A	72720A
737	737
737300	737300
737400	737400
737500	737500
757-W	757-W
757RR	757RR
767CF6	767CF6
777	777
HS74 8A	HS74 8A
BEC58P	SF340
CNA44 1	Can Air Reg 100
COMJET	COMJET
DC101O	DC101O
DC1O3O	DC1O3O
DC9Q7	DC9Q7

DC9Q9	DC9Q9
DHC8	DHC8
DHC6	DHC6
F10065	F10065
GASEPV	Cessna 150
MD82	MD82
MD83	MD83
SD330	SD330
LEAR 25	LEAR 25

Table 4.2-2 Aggregate Taxi and Queue Times

Year 1999	Idle/taxi time = 11 min	Queue time = 1.0 min

Table 4.2-3 Military Activity at the Austin International Airport in 1999 (estimated by type of aircraft)

Aircraft	L/TO Cycles	T&G Cycles	Low Approaches	Total Activity
T-37	0	297	135	432
C-23	93	18	5	116
T-1	56	417	139	612
UH-60	326	0	46	372
OH-58	77	0	54	131
C12	75	34	49	158
Totals	627	766	428	1821

Activity is distributed across the most common aircraft in the Austin
Source: CPT Robert Gale, Operations Officer, Texas Air National Guard

Table 4.2-4 General Aviation Activity at the Austin International Airport in 1999

Aircraft Type	Average Taxi Time	1999-Operations**	L/TO Cycles	T&Gs***
Cherokee 6	15 Min	30,628	22,971	7,657
GSE/AGE	Number Used	Minutes/Sortie		
Diesel Baggage Tug	0	0		
Gasoline Baggage Tug	0	0		

Cherokee 6 used in EDMS as the most representative of the single engine aircraft.
**FAA tower records show 61,256 General Aviation activities (a takeoff is one activity and a landing is a separate activity). One cycle (i.e. touch & go) is composed to two activities.
***Full-stop landings and touch & gos were divided 75% full stops as per staff estimates.

Table 4.2-5. Air Taxi Operations at the Austin International Airport in 1999

Aircraft Type	Average Taxi Time	1999-Operations
SW-2/3*	10 Min	20,306
GSE/AGE	Number Used	Minutes/Sortie/Plane
Diesel Baggage Tug	1	50
Gasoline Baggage Tug	2	50

* The FAA advised the Metro 3 was the most representative of the air taxi aircraft using the ABIA. The Metro 2 is the closest aircraft in EDMS and uses the same Garrett TPE-311-11-612G engines.

4.2.4 GSE

The GSE must also be considered at an airport. The EDMS, dependent upon aircraft evaluated, automatically includes these emissions based on EPA EFs.

Interviews with the ABIA staff disclosed the ABIA operations were identical to those of the San Antonio Airport International Airport (SAIA) in that the facility was a non-HUB airport where aircraft landed, deplaned passengers luggage and mail, then enplaned passengers luggage and mail and departed without performing the fueling and service operations which are usually performed at the HUB airports such as Dallas-Fort Worth International Airport (DFW) and the Bush International Airport in Houston.

The survey of the GSE used by operators at the SAIA was found to accurately reflect the composite set of support vehicles in actual operation servicing aircraft on the ABIA flight line. It was used as input to the EDMS for the GSE.

A survey program was developed for the SAIA, which determined what specific pieces of the GSE were used by each airline/cargo carrier to service each specific model of airplane they operated at the SAIA. This inventory resulted in a ground support package of the GSE used for each aircraft arriving at the airport including the number, fuel type, and minutes of operation for each item. Discussions with the ABIA staff indicated operations at the ABIA were identical with those at the SAIA in that the same types of aircraft served the airport, both were not HUB operations, and the times required to perform the baggage and freight operations were the same. This information was then used to build a package for each aircraft type in the EDMS model for the ABIA.

4.2.5 Boilers (Heating Plants)

The maintenance supervisor at the ABIA reported that approximately 992,820 cubic meters of natural gas were burned at the ABIA in 1999. These values were utilized in this analysis. Because natural gas was used, no other control measures were evaluated.

4.2.6 Motor Vehicles

Roadways

A single roadway was modeled for this analysis. The roadway included in this analysis is listed in Table 4.2-6. The airport staff supplied roadway length with the distance traveled by a vehicle completing one circuit of the airport at 2 miles.

Table 4.2-6. Roadways Used in Analysis

Roadway	Length (M)	Peak hr. Volume	Speed
Airport Blvd. Loop	3,218	2,970	25

It was assumed that any vehicle accessing the terminal stopped, and two minutes of idle time was included. This assumption was based on a site visit to the airport to review curb-front activity. The only available terminal trip generation data was from the year 2000, which estimated the average day peak month (ADPM) to be 40,880 vehicles/day.

Parking

A total of 10,777 parking spaces exist at the ABIA including the covered parking garage which provides 2,419 covered short-term public parking on the first and second levels. (Car rental returns are located on the third level.) 11

Close-in Surface Parking (Lot A) and long-term lots (Lots B, C, D, E, F, and G) provide 8,358 parking spaces. Shuttle buses run every 7-10 minutes and 24 hours/day from the parking lots. Airport shuttles from all surface parking lots pick up at shuttle stops within the lots and discharge departing passengers in front of the terminal on the upper concourse level. Airport parking shuttles pick up arriving passengers outside the lower baggage level in front of the terminal and take them to surface parking lots.

An average of 6,620 daily the ABIA parking transactions were reported during the peak month of July 2000 and monthly values were estimated at 80% of that monthly value for 1999.12 It was assumed, based on mapping that the average trip in a surface lot was approximately 700 feet. In the parking garages, it was assumed the average trip in the lot was 600 feet. Accounting for vehicle movements, a total of 483.3 vehicle miles is traveled in the parking lots each day. A speed of 10mph was assumed in the parking lots. In addition, the cars were assumed to be evenly split between the hot-start mode and cold-start mode.

[11] City of Austin, Austin Bergstrom International Airport. Available: http://www.ci.austin.tx.us/austinairport/parking.htm
[12] City of Austin, Austin Bergstrom International Airport. Available: http://www.ci.austin.tx.us/austinairport/parking.htm

4.2.7 Fuel Storage and Operations

In 1999, fuel throughput at the Airport as reported by the FBOs included Jet-A fuel (15,744.59 kiloliters) and aviation gasoline (1,749.399 kiloliters). Stage I vapor recovery was assumed for all cases. No Stage II vapor recovery was assumed.

Presentation and Discussion of Results

Table 4.2-7. Lists the 1999 EI results from the ABIA.

NAME	CO Tons/yr.	HC Tons/yr.	NOX Tons/yr.
Aircraft	445.885	105.304	421.502
GSE/AGE/APU*	1417.900	32.239	105.543
Roadways	215.602	24.562	17.854
Parking Lots	37.491	4.371	1.342
Fueling Ops	-	.64	-
Stationary Sources	0.12	0.1	0.60
Total	2116.878	166.476	546.241

*Note: GSE/AGE/APU stands for ground support equipment, aerospace ground equipment and auxiliary power unit, respectively.

4.2.8 Military Installations

Camp Mabry

Discussions with the environmental office revealed the installation has no EI data. The camp is a reserve and National Guard facility with less vehicle traffic than the surrounding area. No significant vehicle or emissions activity could be reported for this inventory. Suggestions were made to begin to collect vehicle, fuel consumption, and natural gas consumption data for future inventories.

Camp Swift

The environmental office at Camp Mabry reported minimal activity at Camp Swift. The base is a limited training facility for National Guard and reserve units with a skeleton permanent staff. No environmental emissions data could be found for Camp Swift.

4.2.9 Smaller Airports

Category Description

This section contains details on emissions emitted from small airports within the CAPCO Region. Emission estimates from larger airports will be included in a separate subcategory.

The data presented in the following tables are from the 1996, 1999, and 2007 Airport Emission Inventory.13 This document was prepared by the Texas Transportation Institute of the Texas A & M University System and sponsored by the TNRCC. The emissions are only comprised of sources from aircraft at small public use airports. Groundside emissions are insignificant.

Methodology

The emissions contain both military and civilian aircraft emissions at small public-use airports. Because it is not unusual for military activity to occur at public-use airports, a separate table had to be constructed. In Texas, a total of 95 public-use airports had military operations in 1996. It is expected that in 1999, 107 public-use airports will have military operations. Information was derived from the Texas Transportation Institute appendices J (1999). To calculate VOC amounts, the HC content was multiplied by 1.005.

Information from the Texas Transportation Institute was also used for civilian aircraft emissions. The HC column had to be converted into VOCs by multiplying the HC by 1.005. The source for this information is in appendix D for the 1999 Emission Inventory for General Aviation Airports.

Spatial Allocation

All emission areas were geo-coded to 4-km grids based on locations at the airport.

[13] J. Borowiec, T. Qu, and C. Bell, 1996, 1999, and 2007 Airport Emission Inventory, March 2000. College Station, TX.

4.3 Railroads

Sub-category Description

Diesel-electric locomotives use a diesel engine and an alternator or generator to produce the electricity for powering traction motors. Emissions produced by these diesel engines include hydrocarbons, CO, NOx, sulfur dioxide, and particulate matter.

Methodology

Railroads can be separated into three classes based on size: Class I, Class II, and Class III. Locomotives within each of these classes can perform two different types of operations: line haul and yard (or switch). Class I represents the type of railroad system in our region of study. Two steps are necessary in order to assess locomotive emissions within an inventory area. First, railroad operations are separated into two distinct categories: class I haul and yard operations. Second, emissions for each pollutant are calculated for each of the categories using the recommended methods described in section 6.2 of Procedures for Emission Inventory Preparation Volume IV: Mobile [14]Sources.

For Class I haul locomotives, emissions are calculated by multiplying the amount of fuel consumed in the inventory area by the appropriate EFs.

Inventory Area Emissions = Fuel Consumption x EFs

The recommended method for yard locomotives is different from the method used for line haul locomotives. Multiplying the number of yard locomotives operating within the inventory area by the amount of emissions generated by each unit during the year proved most effective.

[14] United States Environmental Protection Agency, Office of Air Quality Planning and Standards Procedures for Emission Inventory Preparation, Volume IV: Mobile Sources, 1992, Research Triangle Park, North Carolina.

Inventory Area Emissions = Number of Yard Locomotives x Annual Emissions Per Yard Locomotive

The following are the assumptions used in deriving the fuel consumption data:15

The fuel consumption factors used were 1.385 gallons per 1000 gross ton-miles (GTM) for Union Pacific Railroad. This is the system average fuel consumption factor for the railroad for 1999.

Gross Ton-Miles used to calculate the fuel consumption includes locomotive weight.

The equation used in calculating the fuel consumption for line haul locomotives is GTM x miles of track in segment.

Fuel consumption for switching operations was calculated based on an equivalent number of locomotives operating 24 hrs/day, 365 days/yr. (Union Pacific Railroad Company).

Sample Calculation

The fuel consumption numbers provided by the Union Pacific Railroad were used to calculate EFs described in Table 4.3-1.

Table 4.3-1. Railroad Emission Factors

Emission	Factor (Lbs./Yr.)
VOC	0.0211
NOx	0.4931
CO	0.0626

VOC Emission Total per County (ton/yr.) = Total Fuel Consumption x VOC EF

Williamson County

VOC Emission = (2,450,000 x 0.0211 (lbs./yr.))/2000 lbs.

= 25.85 (ton/yr.)

[15] Union Pacific Railroad, Letter and data received from Deb Schafer, Manager, Environmental Field Operations – Southern Region, 1999, Omaha, Nebraska.

Railway Maintenance Equipment

This category consists of emissions produced from equipment used for railway maintenance. Emission estimates for the CAPCO region were calculated for diesel, LPG, and 4-stroke railway maintenance equipment.

Methodology

Railroad equipment emissions within the ten-county CAPCO region were calculated using the EPA's Nonroad Emission Inventory Model.16 This model is used to estimate past, current, and future inventories for most nonroad equipment categories. The model produces emission estimates for all criteria pollutants, as well as carbon dioxide, down to the county level.

The model contains several parameters that can be adjusted to fit desired scenarios. For the purposes of this EI, the following parameters were used to produce a separate run for each county in the CAPCO region.

Options

Fuel RVP for gas	: Varies by County (see below)
Bastrop, Caldwell, Hays, Travis, Williamson17	: 7.8 psi
Blanco, Burnet, Fayette, Lee, Llano18	: 8.7 psi
Oxygen Weight %	: Default
Gas Sulfur %	: Default
Diesel Sulfur %	: Default
CNG/LPG Sulfur %	: Default
Minimum Temp (F)19	: 68.6

[16] Environmental Protection Agency, June 1998. National Nonroad Emissions Model: Draft Version. Ann Arbor, MI.
[17] Julie Klumpyan, Ultramar Diamond Shamrock, (personal communication, March 19, 2001).
[18] Mary McGarry-Barber, Texas Natural Resource Conservation Commission, (personal communication, March 20, 2001).
[19] National Weather Service, no date. Climate Data and Daily Records for Austin, Del Rio, and San Antonio (April-October, 1999). (Online) Available: http://www.srh.noaa.gov/ewx/html/climatsum.htm.

Maximum Temp (F)[20]	: 89.6
Average Temp (F)[21]	: 79.1
Stage II Control %	: Default

Period

Period	: Seasonal
Type	: Typical Day
Year of Episode	: 1999
Season	: Summer
Month	:
Day	: Weekday

Region

Region Level	: County

Local Inputs

Geographic Allocation	1999 Population Projection[22]
Bastrop	52,442
Blanco	7,905
Burnet	31,590
Caldwell	32,599
Fayette	21,842
Hays	92,048
Lee	14,717
Llano	13,977
Travis	726,355
Williamson	233,524

[20] Ibid.
[21] Ibid.
[22] Texas State Data Center, August 2000. 1999 Population Estimates for Texas Counties, July 1, 1999. College Station, Texas.

These parameters were used for each county to produce an emissions report in tons/day for a typical summer weekday, and for each type of equipment. Annual emissions and weekend day emissions were then calculated using the following factors:

Nonroad Weekday and Weekend Day Activity Allocation Fractions[23]

Equipment Category	Weekday	Total Week	Wkend Day	Total Wkend
Railway Maintenance Eqmt.	0.1800000	0.9000000	0.0500000	0.1000000

There were 261 weekdays in 1999, and 104 weekend days. Annual emissions were estimated for each piece and type of equipment by multiplying the ton/day results from the Nonroad model run by the number of weekdays in 1999, and dividing this total by the weekly allocation factors as represented in the following formula:

Annual Emissions = (tons/day total) x (261 weekdays in 1999)
/ (0.9000000 wkly alloc.)

Weekend day emissions were then calculated by multiplying the tons/year total for each piece of equipment by the weekend allocation factors, and dividing this total by the number of weekend days in 1999.

Wkend Day Emiss = (tons/year) x (0.1000000 wkend alloc.)
/ (104 weekend days in 1999)

[23] Janssen, Greg and Carey, March 31, 1999. Weekend and Weekend Day Temporal Allocation of Activity In The NONROAD Model: Report No. NR-015. Environmental Protection Agency.

4.4 Residential Gas Cans

The emissions were estimated from the ERG report (attached below). Since all emissions were estimated for the year 2002, adjustments were made to estimate 1999 emissions.
The annual growth factor of 3% was assumed by ERG in their report. Emissions for 1999 were back-projected and added to the base inventory. Since there is no SCC category for the portable gas cans, the estimated emissions were lumped with the Residential Lawn and Garden equipment category. Note that adjustment for spillage contribution was performed in order to avoid double counting. Also note that state gas can totals was allocated using population for residential lawn and garden, and Comptroller data regarding the number of businesses for commercial.

The Appendix C has the ERG report that was prepared for TCEQ, August 2002. The detailed emissions calculation methodologies and survey examples are presented in the paper.

5 POINT SOURCE EMISSIONS

INTRODUCTION AND SCOPE

For the purposes of this inventory, point sources are defined as stationary, commercial or industrial operations that emit more than 10 tons per year of VOC or 25 tons per year of NOx and CO. Point sources are broken down into two subsets, major sources and minor sources. Major sources are sources that emit a criteria pollutant at an emission rate greater than 100 tons per year and are part of the TCEQ (formerly TNRCC) statewide emission inventory system. Minor sources are everything not identified as major.

5.1 Major Sources

METHODOLOGY AND APPROACH

As part of the statewide emissions inventory major industrial sources in the Austin MSA area was inventoried by the TNRCC in 1999. The major point source inventory consists of actual emissions for 1999. The TNRCC provided the list of major sources that is part of their Point Source Database (PSDB).

QUALITY ASSURANCE MEASURES

As a part of the EAC public involvement process the point source stakeholder committee was formed. The purpose of that committee was to establish contacts with individual point source representatives.

Note that all point sources had their representative at the EAC stakeholder group; nevertheless the major point sources like Lover Colorado River Authority (LCRA) and Austin Energy (AE) were represented. The September 1999 episode hourly data to be used in modeling was provided for each of EGU (power plants) representative and daily totals were provided to non EGU representatives for their review and correction if needed.. The following are the updates/changes

that were made on the original TCEQ 1999 database as a direct result of the EAC process and because of the responses provided by stakeholders.

Austin Energy submitted the corrected coordinates for all of their Austin Area stacks. Updated emissions for VOC and CO from all stacks were also provided. Table 5-1 and Table 5-2 presents VOC and CO updates respectively. Bob Breeze, Austin Energy, provided the data.

Table 5-1. VOC Updates. Daily totals for all stacks at Decker and Holly plant (Austin Energy)

			Pollutant
Episode Day	Facility Name	Data	43104
September 13	DECKER LAKE POWER PLANT	TCEQ VOC Emissions	0.44
		AE VOC Emissions	0.21
	HOLLY STREET POWER PLANT	TCEQ VOC Emissions	0.11
		AE VOC Emissions	0.02
September 14	DECKER LAKE POWER PLANT	TCEQ VOC Emissions	0.30
		AE VOC Emissions	0.16
	HOLLY STREET POWER PLANT	TCEQ VOC Emissions	0.08
		AE VOC Emissions	0.01
September 15	DECKER LAKE POWER PLANT	TCEQ VOC Emissions	0.30
		AE VOC Emissions	0.14
	HOLLY STREET POWER PLANT	TCEQ VOC Emissions	0.08
		AE VOC Emissions	0.01
September 16	DECKER LAKE POWER PLANT	TCEQ VOC Emissions	0.30
		AE VOC Emissions	0.13
	HOLLY STREET POWER PLANT	TCEQ VOC Emissions	0.08
		AE VOC Emissions	0.01
September 17	DECKER LAKE POWER PLANT	TCEQ VOC Emissions	0.30
		AE VOC Emissions	0.14
	HOLLY STREET POWER PLANT	TCEQ VOC Emissions	0.08
		AE VOC Emissions	0.01
September 18	DECKER LAKE POWER PLANT	TCEQ VOC Emissions	0.30
		AE VOC Emissions	0.14
	HOLLY STREET POWER PLANT	TCEQ VOC Emissions	0.03
		AE VOC Emissions	0.01
September 19	DECKER LAKE POWER PLANT	TCEQ VOC Emissions	0.30
		AE VOC Emissions	0.14
	HOLLY STREET POWER PLANT	TCEQ VOC Emissions	0.03
		AE VOC Emissions	0.01
September 20	DECKER LAKE POWER PLANT	TCEQ VOC Emissions	0.30
		AE VOC Emissions	0.17
	HOLLY STREET POWER PLANT	TCEQ VOC Emissions	0.06
		AE VOC Emissions	0.01
Total TCEQ VOC Emissions			**3.10**
Total AE VOC Emissions			**1.31**

Table 5-2. CO Updates. Daily totals for all stacks at Decker and Holly plant (Austin Energy)

			Pollutant
Day	Facility Name	Data	42101
September 13	DECKER LAKE POWER PLANT	TCEQ CO Emission	4.76
		AE CO Emissions	0.01
	HOLLY STREET POWER PLANT	TCEQ CO Emission	0.98
		AE CO Emissions	0.16
September 14	DECKER LAKE POWER PLANT	TCEQ CO Emission	3.01
		AE CO Emissions	0.01
	HOLLY STREET POWER PLANT	TCEQ CO Emission	0.85
		AE CO Emissions	0.13
September 15	DECKER LAKE POWER PLANT	TCEQ CO Emission	3.01
		AE CO Emissions	0.01
	HOLLY STREET POWER PLANT	TCEQ CO Emission	0.85
		AE CO Emissions	0.11
September 16	DECKER LAKE POWER PLANT	TCEQ CO Emission	3.01
		AE CO Emissions	0.01
	HOLLY STREET POWER PLANT	TCEQ CO Emission	0.85
		AE CO Emissions	0.11
September 17	DECKER LAKE POWER PLANT	TCEQ CO Emission	3.01
		AE CO Emissions	0.01
	HOLLY STREET POWER PLANT	TCEQ CO Emission	0.85
		AE CO Emissions	0.12
September 18	DECKER LAKE POWER PLANT	TCEQ CO Emission	3.01
		AE CO Emissions	0.01
	HOLLY STREET POWER PLANT	TCEQ CO Emission	0.15
		AE CO Emissions	0.10
September 19	DECKER LAKE POWER PLANT	TCEQ CO Emission	3.01
		AE CO Emissions	0.01
	HOLLY STREET POWER PLANT	TCEQ CO Emission	0.15
		AE CO Emissions	0.11
September 20	DECKER LAKE POWER PLANT	TCEQ CO Emission	3.01
		AE CO Emissions	0.01
	HOLLY STREET POWER PLANT	TCEQ CO Emission	0.28
		AE CO Emissions	0.13
Total TCEQ CO Emission			**30.81**
Total AE CO Emissions			**1.05**

The other stakeholders confirmed 1999 base emissions. Note that most of the other updates were mainly concerning post 1999 and future case emissions inventory (2007 EI). Those updates will be discussed in the 2007 inventory documentation.

SUMMARY OF POINT SOURCE EMISSIONS

Table 5.3 at the end of this section reflect the major point source emissions for 1999 by source, and total for each county emissions for the core counties.

Table 5.3. Major Point Sources within and 25 miles around Austin MSA

County	Company Name	Facility Name	Acc Code	NOx	VOC	CO
BASTROP	LOWER COLORADO RIVER AUTHORITY	Sam Gideon Electric Power Plant	BC0015L	7.01	0.33	0.23
BASTROP TOTAL				**7.01**	**0.33**	**0.23**
CALDWELL	DUROL WESTERN MANUFACTURING INC		CA0058V	0.00	0.01	0.00
	JL DAVIS	Luling Gas Plant	CA0011B	0.89	0.26	1.13
	NAGEL MFG & SUPPLY CO	Maxwell Facility	CA0010D	0.00	0.15	0.00
	OASIS PIPELINE CO TEXAS LP	Prairie Lea Compressor Station	CA0027J	2.66	0.04	0.18
	TEPPCO CRUDE OIL LLC, Luling Station		CA-0068-S	0.00	0.01	0.00
CALDWELL TOTAL				**3.55**	**0.47**	**1.31**
COMAL	APG LIME CORP			1.15	0.00	n/a
	SUNBELT CEMENT OF TEXAS LP			7.61	0.12	n/a
	TXIOPERATIONS LP			3.34	0.14	n/a
COMAL TOTAL				**12.10**	**0.27**	**n/a**
Fayette	AQUILA GAS PIPELINE CORP		FC0051I	0.63	0.05	0.42
	AQUILA SOUTHWEST		FC0109C	0.00	0.00	0.00
	GPM GAS SERVICES		(blank)	0.10	0.01	0.10
	GPM GAS SERVICES CO		FC-0033-K	2.83	0.33	2.05
	LOWER COLORADO RIVER AUTHORITY		FC0018G	55.24	0.77	5.06
	OASIS PIPE LINE CO TEXAS LP		FC-0034-I	0.59	0.01	0.16
	PHILLIPS NATURAL GAS CO		FC-0130-L	0.07	0.01	0.10
	UNION PACIFIC RESOURCES CO		FC-0183-N	0.00	0.00	0.00
FAYETTE TOTAL				**59.46**	**1.18**	**7.90**
HAYS	PARKVIEW METAL PRODUCTS INC		HK0046W	0.00	0.10	0.00
	SOUTHERN POST CO A COMMERCIAL METALS		HK0086K	0.00	0.06	0.00
	SOUTHWEST SOLVENTS AND CHEMICALS		HK0051G	0.00	0.00	0.00
	TEXAS LEHIGH CEMENT CO	Portland Cement Manufacturing Facility	HK0014M	7.20	0.18	10.00
HAYS TOTAL				**7.20**	**0.34**	**10.00**
MILAM	ALUMINUM COMPANY OF AMERICA			54.26	4.25	n/a
	Sandow Steam Electric			24.20	0.33	n/a
MILAM TOTAL				**78.46**	**4.58**	**n/a**
TRAVIS	3MCO	RIN3M Austin Center	TH0243G	0.15	0.03	0.42
	ADVANCED MICRO DEVICES INC		TH0142N	0.00	0.00	0.00
	AUSTIN WHITELIME CO	Austin White Lime Company	TH0010I	0.89	0.00	0.43
	CITY OF AUSTIN	Decker Lake Power Plant	TH0004D	8.15	0.44	4.76
		Holly Street Power Plant	TH0006W	2.88	0.12	1.03
	IBM CORP		TH0051R	0.09	0.04	0.02
	LITHOPRINT COMPANY INC		TH0732J	0.00	0.05	0.00
	MOTOROLA INCORPORATED	Motorola-Ed Bluestein	TH0065G	0.46	0.17	0.15
	MOTOROLA INTEGRATED CIRCUIT DIVISION		TH0172E	0.09	0.08	0.02
	MULTILAYER TEK LP		TH0700W	0.00	0.18	0.00
	RAYTHEON SYSTEMS CO		TH0093B	0.02	0.02	0.00
	TWOMEY WELCH AEROCORP INC		TH0013C	0.00	0.00	0.00
	UNIVERSITY OF TEXAS AT AUSTIN	Hal C Weaver Power Plant	TH0104V	1.99	0.03	0.22
TRAVIS TOTAL				**14.72**	**1.16**	**7.06**
WILLIAMSON	AQUATIC INDUSTRIES INC		WK0116E	0.00	0.11	0.00
WILLIAMSON TOTAL				**0.00**	**0.11**	**0.00**
Grand Total				**182.5**	**8.4**	**n/a**
Austin-Round Rock MSA Total				**32.48**	**2.41**	**18.60**

5.2 Minor Sources

Methodology And Approach

Minor source emissions were provided by the TCEQ through a questionnaire that they mailed companies. The following is a copy the TCEQ summary (Table 5.4).

Table 5.4 Summary of Minor Source Emissions for 1999

EMISSIONS [tons per day]		POLLUTANT		
COUNTY	COMPANY NAME	CO	NOx	VOC
Bastrop	ELGIN-BUTLER BRICK CO	0.05	0.02	0
	GULFMARK ENERGY INC			0.01
	LOWER COLORADO RIVER AUTHORITY	0	0	0.06
	MEYERS SAUSAGE CO INC	0	0	0
	SOUTHSIDE MARKET & BBQ INC	0	0	0
	TIFFANY BRICK CO L P	0.32	0.1	0.03
Bastrop Total		**0.37**	**0.12**	**0.09**
Hays	INDUSTRIAL ASPHALT INC	0.01	0.04	0
	WELBORNE-HUTCHISON CO			0
Hays Total		**0.01**	**0.04**	**0**
Travis	ADVANCED MICRO DEVICES INC	0.07	0.09	0.12
	AUSTIN COUNTER TOPS	0	0	0.03
	CAPITOL AGGREGATES LTD	0.04	0.04	0.09
	CELIS BREWERY INC	0	0	0
	CIBOLO METAL WORKS	0	0	0
	CLASSIC MARBLE CO INC			0.03
	COMMUNICATION SPECIALISTS INC			0.05
	COPYRIGHT PRINTING INC			0.01
	COX TEXAS NEWSPAPERS LP	0	0	0.12
	CUSTOM QUALITY MARBLE INC			0.01
	ECONO AUTO PAINTING OF TEXAS INC			0.01
	KOCH MATERIALS CO	0	0	0
	PETTY IND COATERS INC			0.03
	PRESS CORPS INC			0.03
	PURE CASTINGS CO	0	0	0
	SAMSUNG AUSTIN SEMICONDUCTOR L L C	0.02	0.05	0.07
	TEXAS INDUSTRIES INC	0	0	0
	TEXAS MEAT PURVEYORS	0	0	0
Travis Total		**0.26**	**0.31**	**0.97**
Williamson	BLACKLANDS PUBLICATIONS INC			0.01
	CAPITOL AGGREGATES LTD	0.09	0.09	0.12
	CONTEMPORARY PRODUCTS OF TEXAS INC		0.14	0.03
	LABORATORY TOPS INC	0	0	0.05
	LONESTAR LINEN INC		0	0

	MCNEIL-PPC INC	0	0.01	0.01
	TEXAS ELECTRIC COOPERATIVES INC			0.01
	TEXAS HEAT TREATING INC	0.01	0.05	
Williamson Total		**0.11**	**0.28**	**0.23**
Grand Total		**0.75**	**0.75**	**1.29**

6 BIOGENIC EMISSIONS

6.1 Introduction to Biogenic Emissions

While biogenic emission sources are an important component of the inventory, the existing 1999 NEI database includes biogenic emissions developed through use of the PC-BEIS model. In support of TCEQ's current regional scale air quality modeling efforts, ENVIRON recently developed an updated statewide county level biogenic emission inventory using the latest version of the GLOBEIS model (Yarwood et al, 2001). As part of this project, the ENVIRON team has reviewed this biogenic inventory and completed the necessary steps required to generate ozone season day biogenic emission estimates.

See Appendix E, ENVIRON calculated 1999 emissions for this source category under contract to the Texas Commission on Environmental Quality (TCEQ, former TNRCC).

Table 6.1 Summary of the Biogenic emissions for the 1999, Austin MSA region

COUNTY	FIPS	POLLUTANT	TOTAL	UNIT
BASTROP	021	ISO	101.07	TPD
		MONO	6.9	TPD
		NOX	2.17	TPD
		OTHERVOC	15.9	TPD
		VOC	123.88	TPD
CALDWELL	055	ISO	67.23	TPD
		MONO	2.62	TPD
		NOX	4.93	TPD
		OTHERVOC	11.09	TPD
		VOC	80.95	TPD
HAYS	209	ISO	27.91	TPD
		MONO	5.05	TPD
		NOX	3.29	TPD
		OTHERVOC	16.44	TPD
		VOC	49.41	TPD
TRAVIS	453	ISO	52.19	TPD
		MONO	4.69	TPD
		NOX	4.78	TPD
		OTHERVOC	14.75	TPD
		VOC	71.63	TPD
WILLIAMSON	491	ISO	50.38	TPD
		MONO	4.28	TPD
		NOX	9.75	TPD
		OTHERVOC	13.53	TPD
		VOC	68.19	TPD

TOTAL NOx	**24.92**	TPD
TOTAL VOC	**394.06**	TPD