



Bexar County

ENVIRONMENTAL ASSESSMENT OF BEXAR COUNTY GREENHOUSE GAS (GHG) EMISSIONS – GHG EMISSION INVENTORY

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EXECUTIVE SUMMARY

An important first step in preparing an emission inventory (EI) is developing an understanding of the types of facilities, emission sources, and the specific stationary combustion equipment for which emissions must be considered and accounted. This report provides an overview of Bexar County's facilities, major emission sources, and an accounting of greenhouse gas (GHG) emissions.

Bexar County owns and operates a variety of facilities that cover a large geographic area that includes office buildings, parks, parking structures, exterior lighting, and vehicle fleets. The bulleted list below provides a partial representation of the types and approximate number of Bexar County Facilities.

- 38 Owned and occupied buildings;
- 28 Leased and occupied buildings;
- 1 Parking structure;
- 52 Stationary combustion units (boilers, generators, and other combustion units);
- 425 Fleet vehicles;
- 147 Heavy duty vehicles;
- 5,000 Employees commuting to Bexar County facilities and parks;
- 1,519.2 Tons per year of solid waste;
- 1,068,475,003 Gallons per year water used; and

This inventory is based on 2005 data and includes all reasonably foreseeable operations that generate GHG emissions.

The data collection technical approach was to identify emissions from annual usage data. For the most part, data collected to support this effort was based on fuel purchase records, utility purchase records, facility configuration, and real-time survey data (i.e., commuter survey).

The emissions were categorized by scope, source, and facility. Results show the largest contribution to the Bexar County GHG emissions are from electricity use and combustion of fossil fuel at County owned facilities.

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ACRONYMS AND ABBREVIATIONS

AACOG	Alamo Area Council of Governments
EI	Emission Inventory
Btu	British thermal unit(s)
Btu/scf	British thermal unit (s) per standard cubic foot
Btu/MMBtu	British thermal unit (s) per million British thermal unit (s)
CARB	California Air Resources Board
CCAR	California Climate Action Registry
cu ft	cubic foot
CFC	chlorofluorocarbon
CH ₄	methane
CO ₂	carbon dioxide
CO _{2e}	carbon dioxide equivalent
cu yd	cubic yard
EF	emission factor
g	gram(s)
g/mi	gram per mile
gal/yr	gallon per year
g/MMBtu	grams per million British thermal unit (s)
GHG	greenhouse gas
GWP	global warming potential
H	hydrogen
HC	hydrocarbon
HFC	hydrofluorocarbon
ICLEI	Local Governments for Sustainability
IPCC	Intergovernmental Panel on Climate Change
kg	kilogram(s)
kg/MMBtu	kilogram per million British thermal unit (s)
kg/yr	kilogram per year
kW	kilowatt
kWh	kilowatt-hour
kW/yr	kilowatt per year
lb(s)	pound(s)
lbs/MWh	pounds per megawatt
LPG	liquefied petroleum gas
mi/gal	mile per gallon
mi/year	mile per year
MMBtu	one million British thermal units
MMBtu/hr	million british thermal unit (s) per hour
MPG	miles per gallon
Mton	metric ton(s)
Mton/yr	metric ton per year
Mton/kg	metric ton per kilogram
Mton/g	metric ton per gram
MWh	megawatt-hour(s)
MWh/yr	megawatt per year

ACRONYMS AND ABBREVIATIONS (Continued)

N	nitrogen
N ₂ O	nitrous oxide
PFC	perfluorocarbon
SF ₆	sulfur hexafluoride
scf	standard cubic foot
scf/yr	standard cubic foot per year
SN	serial number
SW	solid waste
tons/yr	tons per year
U.S. EPA	United States Environmental Protection Agency
V	volume
VMT	vehicle miles traveled
WBCSD	World Business Council for Sustainable Development
WRI	World Resources Institute
WT	weight
WWTP	wastewater treatment plant

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1.0 INTRODUCTION

1.1 TASK ORDER BACKGROUND

This report has been prepared as a step toward reducing Bexar County's carbon footprint. The report establishes a greenhouse gas (GHG) emissions baseline, using data from 2005, the first year for which comprehensive data are available.

Bexar County is committed to reducing its GHG emissions significantly in the short term, and to dramatically reducing its GHG emissions and through offsetting the remainder over the long term. The first step in the commitment includes implementing three short term actions during the next year. These include,

- Determining the GHG Emission Inventory (EI) for the County;
- Developing a comprehensive plan to achieve climate neutrality as soon as possible; and
- Initiating tangible actions to reduce GHG in the short term while the comprehensive plan is being developed.

This report satisfies the first commitment in identifying the GHG EI for the County.

1.2 OVERVIEW OF ASSESSMENT METHODS

Throughout this assessment, Tetra Tech referenced The Local Government Operations Protocol (Protocol). This protocol is designed to provide a standardized set of guidelines to assist local governments in quantifying and reporting GHG emissions associated with their government operations.

The Protocol was developed in partnership by the California Air Resources Board (CARB), California Climate Action Registry (CCAR), and Local Governments for Sustainability (ICLEI), in collaboration with The Climate Registry and dozens of stakeholders. Through the Protocol, the partners have sought to enable local governments to measure and report GHG emissions associated with government operations in a harmonized fashion.

The Protocol facilitates the standardized and rigorous inventorying of GHG emissions, which can help track emissions reduction progress over time and in comparison with regards to GHG reduction targets. The Protocol provides the principles, approach, methodology, and procedures needed to develop a local government operations GHG EI. It is designed to support the complete, transparent, and accurate reporting of a local government's GHG emissions. The Protocol guides participants through emissions calculation methodologies and reporting guidance applicable to all United States (U.S.) local governments.

The Protocol served as a guidance document along with calculation workbooks to quantify emissions. Throughout the inventory process, Tetra Tech followed the GHG Protocols as closely as possible. Source documentation is provided for equations and emission factors used to support the GHG EI. Additionally, the Alamo Area Council of Governments (AACOG) was consulted throughout the inventory process to ensure EI compatibility with the regional GHG EI.

1.2.1 Data Collection Summary

An important step in preparing a GHG EI is developing an understanding of the types of facilities, emission sources, and sinks to be included. The major contributing sources for Bexar County were standard in that the Protocol was followed as a matrix to data collection. The list below provides a partial representation of the types and approximate numbers of sources contributing to GHG emissions.

- 38 Owned and occupied buildings;
- 28 Leased and occupied buildings;
- 1 Parking structure;
- 52 Stationary combustion units (boilers, generators, and other combustion units);
- 425 Fleet vehicles;
- 147 Heavy duty vehicles;
- 5,000 Employees commute to Bexar County facilities and parks;
- 1519.2 Tons per year solid waste; and
- 1,068,475,003 gallons per year water used.

Emission data is organized by scope, facility, and emission device (if applicable). Additionally, each source is assigned a unique identification number and will serve as the basis for an emissions tracking database for future years, as well as for identifying potential emission reduction opportunities.

1.2.2 Emission Sources

The following lists specific data needs for the preparation of a complete GHG EI for 2005.

- Fuel consumption data for all combustion sources including fuel use data for mobile and stationary combustion sources;
- Natural gas use for all facilities;
- Electricity use for all facilities and exterior lighting;
- Water use for all facilities and parks;
- Refuse or waste disposal records for facilities;
- Refrigerant use; and
- Fertilizer use.

1.2.3 Data Gaps

The combustion of biomass was not included for this inventory. Although some fuel combusted in County owned fleet vehicles may contain ethanol, all fleet usage records, including the heavy duty fleet, listed fuel as gasoline, diesel, or propane. Biomass combustion was not included because usage information is not readily available. Also, GHG emissions associated with fertilizer use for grounds keeping and refrigerant use for both automobile and building air conditioning was not inventoried because usage information was not readily available.

1.2.4 Fugitive Emissions

Fugitive emissions refer to GHG emissions that are not physically controlled, by result for the unintentional release of emissions. For example, the release of methane (CH₄) emissions during a fueling process for fleet vehicles is not accounted for in this EI. The fugitive emissions were not quantified as a part of this baseline effort; however, the design of the emission database can accommodate new source categories and additional emission quantification for a specific emission source.

1.2.5 Carbon Sequestration

Carbon sequestration is the process of incorporating atmospheric carbon into plants, soil, and water. Those resources or processes that absorb atmospheric carbon are commonly referred to as “carbon sinks” because of their ability to absorb GHG emissions. This “mass balance” of emissions was not considered during this effort. While Bexar County maintains several park areas that are good sources of carbon sinks, the calculation of reduction potential is dependant on vegetation and soil composition. Accounting for carbon sinks in GHG emission inventories is an evolving practice with little guidance developed to date at the organizational level. For this reason, carbon sinks are not included in this EI.

1.2.6 Baseline Year

The Bexar County GHG EI baseline year is calendar year 2005. This is the first year that complete data are available for most emissions sources and the agreed upon baseline year as part of the AACOG effort. Throughout the report, the data was converted from fiscal year to calendar year when necessary.

1.2.7 Data Management

The primary goal of this GHG EI was to identify and compile emission source data and resulting calculations in a Microsoft Access database. This report supplements and summarizes the information stored in the database. The database is intended to be a management tool for tracking air emissions and sources. The emission units, emission factors and data used to calculate emissions have been loaded into the database. The database calculates emissions from each emissions unit or device. Output tables were designed to summarize GHG emission by scope, facility location, and by each device or emissions unit (if applicable). Emission units were assigned source identification numbers to ensure a complete accounting in the GHG EI database.

1.3 ORGANIZATIONAL BOUNDARY

Local governments vary in their legal and organizational structures, and may contain a diverse number of departments, boards, facilities, and joint ventures. For the purposes of financial accounting, entities are

treated to established rules that depend on the structure of the organization and the relationships among parties involved.

Bexar County based their GHG EI on their operational control which accounts for 100 percent of the GHG emissions from operations over which it has control. It does not account for GHG emissions from operations in which it owns an interest but has no control. Tetra Tech applied this criterion throughout the entire identification process to determine which sources were applicable to the GHG EI baseline.

The Bexar County GHG EI includes emissions from owned and operated sources as well as leased facilities and vehicles associated with the facilities. In accordance with the Protocol, the emissions were reported as Scope 1 and Scope 2 emissions where Bexar County has operating control over the lease. For example, Bexar County has control over the lighting and use of electricity in the leased facilities.

1.4 OPERATIONAL BASELINE

The operational baseline identifies emission sources to be included in the emissions assessment. Following the Protocol, these sources are grouped into “scopes.” Scope 1 emissions include direct GHG emissions from sources owned or controlled by Bexar County. Scope 2 accounts for GHG emissions associated with the generation of purchased electricity or steam. Scope 3 allows for treatment of all other indirect emissions. Scope 3 emissions include those from sources not owned or controlled by Bexar County, or other sources not included in Scopes 1 and 2.

1.4.1 Emissions Calculation and GWP

Emissions were reported in metric tons (MTon) for each GHG pollutant and metric tons of CO₂ equivalent (CO₂e). A complete list of GHGs including individual hydrofluorocarbons (HFC) and perfluorocarbons (PFC) is provided in the Protocol and summarized in Table 1-1.

**Table 1-1
Summary of Global Warming Potential (GWP)**

Pollutant Name	Abbreviation	Sources Contributing to GHG Emissions	GWP
Carbon dioxide	CO ₂	Fossil fuel combustion	1
Methane	CH ₄	Fossil fuel combustion and landfill activities	21
Nitrous oxide	N ₂ O	Fossil fuel combustion and fertilizer use	310
Sulfur hexafluoride	SF ₆	Electrical transmission	23,900
Hydrofluorocarbons	HFCs	Refrigeration gases	120-12,000*
Perfluorocarbons	PFCs	Mostly process oriented emissions from manufacturing	5,700 – 11,900*

Notes: * GWP depends on specific compound. Additional GWPs are available by specified compounds. Source: ICLEI 2008
 GHG Greenhouse Gas
 GWP Global Warming Potential.

1.4.2 Summary of Scope 1-3 Emission Sources

To separately account for direct and indirect emissions, improve transparency, and provide utility for different types of climate policies and goals, this Protocol follows the World Resources Institute/World Business Council for Sustainable Development (WRI/WBCSD) GHG Protocol in categorizing direct and indirect emissions into “scopes” as follows:

- Scope 1: All direct GHG emissions (with the exception of direct CO₂ emissions from biomass combustion).
- Scope 2: Indirect GHG emissions associated with the consumption of purchased or acquired electricity, steam, heating, or cooling.
- Scope 3: All other indirect emissions not covered in Scope 2, such as upstream and downstream emissions, emissions resulting from the extraction and production of purchased materials and fuels, transport-related activities in vehicles not owned or controlled by the reporting entity (e.g., employee commuting and business travel), outsourced activities, and waste disposal.

Together, the three scopes provide a comprehensive accounting framework for managing and reducing direct and indirect emissions.

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2.0 EMISSION SUMMARY

This section summarizes Bexar County emissions for Scope 1, 2, and 3.

2.1 SCOPE 1 EMISSIONS

The Scope 1 emissions for Bexar County are summarized in Table 2-1. On road fleet vehicles were the largest contributing source, at 4,307 CO₂e per year.

Table 2-1
Summary of Scope 1 Emissions

Scope 1 Source	Annual Emissions (CO₂e/year)	Percent Contribution to Scope 1
On Road Fleet Vehicles	4307	45.67
Diesel Combustion	346	3.66
Heavy Duty Fleet Vehicles	1797	19.06
Natural Gas, Owned Facilities	2980	31.60
Total	9430	100

Note: CO₂e carbon dioxide equivalent

2.2 SCOPE 2 EMISSIONS

The Scope 2 emissions for Bexar County are summarized in Table 2-2. Electricity use at owned facilities was the largest contributing source, at 28,376 CO₂e per year.

Table 2-2
Summary of Scope 2 Emissions

Scope 2 Source	Annual Emissions (CO₂e/year)	Percent Contribution to Scope 2
Electricity Use, Owned Facilities	28376	82.24
Electricity Use, Leased Facilities	5700	16.52
Electricity Use, Exterior Lighting	248	0.72
Natural Gas, Leased Facilities	179	0.52
Total	34503	100

Note: CO₂e carbon dioxide equivalent

2.3 SCOPE 3 EMISSIONS

The Scope 3 emissions for Bexar County are summarized in Table 2-3. Commute vehicles was the largest contributing source, at 14,632 CO₂e.

Table 2-3
Summary of Scope 3 Emissions

Scope 3 Source	Annual Emissions (CO₂ e/year)	Percent Contribution to Scope 3
Commute Vehicles	14632	96.36
Solid Waste	350	2.31
Wastewater	203	1.33
Total	15185	100

Note: CO₂e carbon dioxide equivalent

3.0 EMISSIONS FROM INDIVIDUAL SOURCES

This section summarizes the emissions from each source category. Each section summarizes the annual GHG emissions for calendar year 2005. The emission sources are:

- Stationary combustion
 - Natural gas combustion, owned facilities (Scope 1)
 - Natural gas combustion, leased facilities (Scope 2)
 - Diesel combustion, owned facilities (Scope 1)
- Mobile source combustion
 - On road fleet vehicles (Scope 1)
 - On road heavy duty fleet vehicles (Scope 1)
 - On road commuter vehicles (Scope 3)
- Electricity use
 - Owned facilities (Scope 2)
 - Leased facilities (Scope 2)
 - External lighting (Scope 2)
- Solid waste (Scope 3)
- Wastewater (Scope 3)

3.1 STATIONARY COMBUSTION

Stationary combustion refers to the combustion of fuels to produce electricity, heat, or motive power using equipment in a fixed location. Stationary combustion is a Scope 1 emission source. Typical stationary sources found in buildings and facilities include furnaces, boilers, burners and internal combustion engines that consume fossil fuels such as natural gas, heating oil, coal, and diesel.

3.1.1 Natural Gas Combustion

A summary of the natural gas usage at owned and leased facilities is listed in Table 3-1.

**Table 3-1
Natural Gas Use at Bexar County Facilities**

Facility Name	Square Footage	Fuel Use (scf/yr)	Owned or Leased
Adult Probation	25,918	3,854.97	Leased
Adult Probation	30,073	4,472.97	Leased
Auditors Office	13,555	2,016.13	Leased
Budget Planning & Resource Management	7,986	1,187.81	Leased
Budget Planning & Resource Management [Expansion]	4,876	725.24	Leased
Civil Service	7,260	1,079.83	Leased
Criminal Justice	2,100	312.35	Leased
Elections Warehouse	22,400	3,331.71	Leased
Elections Warehouse	3,960	589.00	Leased
Information Services	6,327	941.06	Leased
Jp Pct 4 Constable Pct 4	7,586	1,128.32	Leased
JP 2 And CONSTABLE 2	8,071	1,200.46	Leased
Jp Pct 1 Place 3 Constable Pct 1	5,520	821.03	Leased
Jp Pct 3 Constable Pct 3	10,629	1,580.93	Leased
Juvenile Department (Eastside)	3,225	479.68	Leased
Juvenile Department (Northeast)	2,851	424.05	Leased
Juvenile Department (Northwest)	2,741	407.69	Leased
Juvenile Department (Southside)	4,500	669.32	Leased
Juvenile Department (Westside)	2,685	399.36	Leased
Public Defenders	1,941	288.70	Leased
Public Defenders [Small]	969	144.13	Leased
Public Defenders Mental Health Advocacy	2,975	442.49	Leased
Sheriff's Downtown Substation	5,117	761.09	Leased
Sheriff's Eastside Substation	9,278	1,379.98	Leased
Tax Office (Northside)	5,300	788.31	Leased
Tax Office [Westside]	5,080	755.58	Leased
Tax Office[Southside]	5,477	814.63	Leased
Texas Cooperative Extension	7,030	1,045.62	Leased
Adult Detention Center (Jail)	634,560	2,242,845.00	Owned
Adult Detention Center Annex	70,000	321,160.00	Owned
Cadena-Reeves Justice Center	275,600	147,783.00	Owned
Courthouse	260,900	186,315.00	Owned
Courthouse Annex	56,700	26,510.00	Owned
Elections Warehouse	20,000		Owned
Harlandale Civic Center	4,000	6,342.00	Owned

**Table 3-1 (Continued)
Natural Gas Use at Bexar County Facilities**

Facility Name	Square Footage	Fuel Use (scf/yr)	Owned or Leased
Juvenile Detention Center	99,200	212,112.00	Owned

Krier Juvenile Treatment Center	64,330	763,047.00	Owned
Milagros Treatment Center	10,000	1,274.00	Owned
Navajo Civic Center	3,000	1,914.00	Owned
Northeast Service Center	12,139	3,758.00	Owned
South San Civic Center	3,500	9,753.00	Owned
Southeast Service Center	11,500	31,052.00	Owned

Notes: scf Standard Cubic Foot
yr Year

The natural gas combustion sources for owned facilities are listed in Table 3-2. The natural gas combustion sources for leased facilities are not applicable to this inventory. This is due to the fact that Bexar County does not have organizational or operational control for the individual source.

Table 3-2
Natural Gas Combustion Sources

Facility Name	Make	Model	SN	Heat Input (MMBtu/hr)
Adult Detention Center (Jail)	Ajax	WRFG-3350	67387	3.35
Adult Detention Center Annex	Lochinvar	CBN1795	K007208	1.795
Adult Detention Center Annex	RBI	WHD105OE-02	100022062	1.05
Adult Detention Center Annex	RBI	WHD105OE-02	Missing data	1.05
Adult Detention Center Annex	RBI	SW250NEOC5PS	Missing data	0.25
Adult Detention Center Annex	RBI	SW250NEOC5PS	Missing data	0.25
Commanche County Park	Industrial Inc.	PR650NBRT	E02116852	0.04
Courthouse	Kewanee	KF2.0-962-G	4888F	0.002678
Courthouse	Kewanee	KF2.0-962-G	4888F	0.002678
Courthouse Annex	Ajax	W0-1250	90 42914	1.25
Harlandale Civic Center	Industrial Inc.	SBT75NE7F	F91200909	0.0751
Adult Detention Center (Jail)	Ajax	WRFG-3350	67388	3.35
Harlandale Civic Center	Trane	XCH150C3LBCA	Unknown 1	0.15
Juvenile Detention Center	Raypak	140730		6.63
Juvenile Detention Center	PVI	1000-2N600A-TP	89688963	0.8
Juvenile Detention Center	Energy Labs	PF-8M	9602-819	0.175
Juvenile Detention Center	Energy Labs	PF-3M	9602-819	0.1
Juvenile Detention Center	Raytheon	JT75CG	OTCK9704012444	0.165
Juvenile Detention Center	Raytheon	JT75CG	OTCK9704012439	0.165
Juvenile Detention Center	Energy Labs	PF-4	9602-819-8	0.125
Juvenile Detention Center	Energy Labs	PF-4	9602-819-5	0.125
Juvenile Detention Center	Energy Labs	PF-10	9602-819-10	0.2
Adult Detention Center (Jail)	Brooks	CB700-80	L800-26	3.347

Table 3-2 (Continued)
Natural Gas Combustion Sources

Facility Name	Make	Model	SN	Heat Input (MMBtu/hr)
Juvenile Detention Center	Energy Labs	PF-4	9602-819-6	0.125
Juvenile Detention Center	Energy Labs	PF-4	9602-819-7	0.125
Krier Juvenile Treatment Center	Hamilton Engineering	HEDN 496	I06H00190622	0.495
Krier Juvenile Treatment Center	Raypack	280589	803280589	0.399
Krier Juvenile Treatment Center	TeleDyne	HH2450IN18LCACD	096J08406	2.45
Krier Juvenile Treatment Center	TeleDyne	HH4500INI8LCACD	C96J08406	4.5
Krier Juvenile Treatment Center	Hamilton Engineering	HET76080	K06213	
Krier Juvenile Treatment Center	Hamilton Engineering	HET76080	K06215	
Krier Juvenile Treatment Center	Hamilton Engineering	HET 080	BH6583982	
Krier Juvenile Treatment Center	A/O Smith Clever	BTC200962	MJ96-0582 015-962	0.199
Adult Detention Center (Jail)	Brooks	CB700-80	L800-27	3.347
Milagros Treatment Center	Thermo-Pak	GWE1475	11W101	1.476
Cadena-Reeves Justice Center	Raypak	269132		2.34
Cadena-Reeves Justice Center	Raypak	247504		2.34
Southeast Service Center	Modine	PDP125SEO130	381101124	0.125
Southeast Service Center	Modine	PDP125SEO130	No Data	0.125
Southeast Service Center	Modine	PDP125SEO130	No Data	0.125
Southeast Service Center	Modine	PDP125SEO130	No Data	0.125
Southeast Service Center	Modine	PDP125SEO130	No Data	0.125
Southeast Service Center	Modine	PDP125SEO130	No Data	0.125
South San Civic Center	Rheem	21V40-7	RHNG1198116090	0.034
Adult Detention Center (Jail)	PVI	35WBHE 130A-TP	18759971	1.17
South San Civic Center	Trane	XCH150C3LBCA	Z16101420D	0.15
Adult Detention Center (Jail)	PVI	35WBHE 130A-TP	18759970	1.17
Adult Detention Center (Jail)	Ajax	WRFG-2100	69242	1.67
Adult Detention Center (Jail)	Ajax	WRFG-2100	69243	1.67
Adult Detention Center Annex	Lochinvar	CBN1795	K007209	1.795

Notes: SN Serial Number
MMBtu/hr Million British Thermal Unit (s) per Hour

Tetra Tech used the following steps to determine the direct emissions from the stationary combustion units.

1. Determined annual consumption of each fuel combusted at the listed facilities;

2. Determined the appropriate CO₂ emission factors for natural gas;
3. Determined the appropriate CH₄ and N₂O emission factors for natural gas;
4. Calculated combustion CO₂ emissions for each facility;
5. Calculated combustion CH₄ and N₂O emissions for each facility; and
6. Converted CH₄ and N₂O emissions to CO₂ equivalent and determine total emissions.

3.1.2 Calculation Methodology

GHG emissions from natural gas combustion were estimated with the following equation:

$$E_{\text{pol, fac}} = EF_{\text{pol}} * U_{\text{Fac}} * HC * C1 * C2$$

Where,

$E_{\text{pol, fac}}$ = Emissions of a particular pollutant at a particular facility, metric tons per year (MTon/yr)

EF_{pol} = Pollutant Specific Emission Factor, kilograms per million British thermal units (kg/MMBtu) or grams per million British thermal units (g/MMBtu)

U_{Fac} = Usage by Facility, standard cubic feet per year (scf/yr)

HC = Heat Content, British thermal units per standard cubic foot (1,050 Btu/scf)

C1 = Conversion factor to MMBTU, British thermal unit per million British thermal units (1,000,000 BTU/MMBtu)

C2 = Conversion factor to metric tons, metric tons per kilogram (0.001 MTon/kg) or metric tons per gram (0.000001 MTon/g)

Billing records for owned facilities were used to determine the fuel usage rate. Additionally, a natural gas usage rate, in terms of standard cubic foot (scf) of natural gas per gross square footage of facility space, was calculated and applied to the leased facilities to determine the leased facility natural gas usage rate.

In addition, to provide a breakdown of emissions by individual combustion unit at owned facilities, the total natural gas usage per facility was distributed to each device located at that facility based on the rated heat input for each device. The equation used to calculate emissions is as follows:

$$E_{\text{pol, Com}} = E_{\text{pol, fac}} * (HC_{\text{Com}} / HC_{\text{Fac}})$$

Where,

$E_{\text{pol, Com}}$ = Emissions of a particular pollutant from a combustion Device (MTon/yr)

$E_{\text{pol, fac}}$ = Emissions of a particular pollutant at a particular facility (MTon/yr)

HC_{Com} = Rated Heat Capacity of Combustion Device, million British thermal units per hour (MMBtu/hr)

HC_{Fac} = Total Rated Heat Capacity of Facility (MMBtu/hr)

The emission factors used to calculate natural gas combustion emissions are listed in Table 3-3.

Table 3-3
Emission Factors for Natural Gas Combustion

Pollutant	Emission Factor	Units
CO ₂	53.46	kg/MMBtu
N ₂ O	0.1	g/MMBtu
CH ₄	5	g/MMBtu

Notes: Local Government Operations Manual –Table G.1 Default Factors for Calculating CO₂ Emissions from Fossil Fuel Combustion & Table G.3 Default CH₄ and N₂O Emission Factors by Fuel Type and Sector.
g Gram
kg Kilogram
MMBTU Million British Thermal Units

3.1.3 Emission Results

The GHG emissions from natural gas combustion at owned and leased facilities are summarized in Table 3-4.

Table 3-4
GHG Emissions from Natural Gas Combustion

Make	CO ₂	N ₂ O as CO ₂	CH ₄ as CO ₂	CO ₂ e
Ajax	243.80	0.142	0.482	244.43
Ajax	243.80	0.142	0.482	244.43
Clever Brooks	243.59	0.142	0.482	244.21
Clever Brooks	243.59	0.142	0.482	244.21
PVI	85.27	0.050	0.169	85.49
PVI	85.27	0.050	0.169	85.49
Ajax	121.54	0.071	0.241	121.85
Ajax	121.54	0.071	0.241	121.85
Lochinvar	74.12	0.043	0.147	74.31
Lochinvar	74.12	0.043	0.147	74.31
RBI	43.36	0.025	0.086	43.47
RBI	43.36	0.025	0.086	43.47
RBI	10.32	0.006	0.020	10.35
RBI	10.32	0.006	0.020	10.35
Kewanee	173.00	0.101	0.342	173.45
Kewanee	173.00	0.101	0.342	173.45
Ajax	73.85	0.043	0.146	74.04

Table 3-4 (Continued)
GHG Emissions from Natural Gas Combustion

Make	CO₂	N₂O as CO₂	CH₄ as CO₂	CO₂e
State Industrial Inc.	3.93	0.002	0.008	3.94
Trane	7.85	0.005	0.016	7.87
Raypak	74.75	0.044	0.148	74.94
PVI	9.02	0.005	0.018	9.04
Energy Labs	1.97	0.001	0.004	1.98
Energy Labs	1.13	0.001	0.002	1.13
Raytheon	1.86	0.001	0.004	1.86
Raytheon	1.86	0.001	0.004	1.86
Energy Labs	1.41	0.001	0.003	1.41
Energy Labs	1.41	0.001	0.003	1.41
Energy Labs	2.25	0.001	0.004	2.26
Energy Labs	1.41	0.001	0.003	1.41
Energy Labs	1.41	0.001	0.003	1.41
Hamilton Engineering	28.23	0.016	0.056	28.30
Raypack	22.75	0.013	0.045	22.81
TeleDyne	139.71	0.082	0.276	140.07
TeleDyne	256.61	0.150	0.508	257.27
Hamilton Engineering	4.57	0.003	0.009	4.58
Hamilton Engineering	4.57	0.003	0.009	4.58
Hamilton Engineering	4.57	0.003	0.009	4.58
A/O Smith	11.35	0.007	0.022	11.38
Thermo-Pak	3.55	0.002	0.007	3.56
Raypak	137.22	0.080	0.272	137.58
Raypak	137.22	0.080	0.272	137.58
Modine	4.12	0.002	0.008	4.13
Modine	4.12	0.002	0.008	4.13
Modine	4.12	0.002	0.008	4.13
Modine	4.12	0.002	0.008	4.13
Modine	4.12	0.002	0.008	4.13
Modine	4.12	0.002	0.008	4.13
Rheem	3.35	0.002	0.007	3.36
Trane	14.77	0.009	0.029	14.80
	5.33	0.003	0.011	5.35
Total	2,972.62	1.74	5.88	2,980.24

3.1.4 Diesel Combustion

Bexar County owns 27 diesel combustion units that are listed in Table 3-5.

**Table 3-5
Diesel Combustion Units**

Facility	Make	Model	SN	MMBtu/hr
Adult Detention Center (Jail)	Caterpillar	3508 STD	23Z01760	9.10
Adult Detention Center (Jail)	Cummings			
Adult Detention Center (Jail)	Cummings	QST30-61	1095	8.27
Adult Detention Center Annex	Caterpillar	3412	3FZ02072	5.67
Adult Detention Center Annex	Onan	NTA 855-G3	6438	3.86
Southwest Service Center	North Star			0.07
Southwest Service Center	No data			0.06
Courthouse	Holt			1.10
	Briggs and			
Courthouse	Stratton			
Tejeda Juvenile Justice Center	Genrac	92460		0.88
Juvenile Detention Center	Genrac			1.38
Juvenile Detention Center	Kohler			0.66
	Ingersol			
Krier Juvenile Treatment Center	Rand	RG6081H292111	6081HF 0708.T	2.73
	Ingersol			
Krier Juvenile Treatment Center	Rand	RG6081H292111		2.73
Krier Juvenile Treatment Center	Kohler	10637305	06AO473492	2.21
Krier Juvenile Treatment Center	Kohler	10637305		2.21
Krier Juvenile Treatment Center	Kohler	10637305		2.21
Krier Juvenile Treatment Center	Genrac			1.65
Krier Juvenile Treatment Center	Genrac			1.65
Cadena-Reeves Justice Center	Caterpillar	3406BDT	4RG00230	3.86
Southeast Service Center	Dayton			0.06
Vista Verde Plaza	Olympian	1038804	7AK01430	0.88

Tetra Tech performed the following steps to determine the direct emissions from the diesel combustion units.

1. Determined annual operating hours per unit;
2. Determined the appropriate CO₂ emission factors for diesel;
3. Determined the appropriate CH₄ and N₂O emission factors diesel;
4. Calculated each combustion CO₂ emissions;
5. Calculated combustion CH₄ and N₂O emissions; and
6. Converted CH₄ and N₂O emissions to CO₂ equivalent and determine total emissions.

3.1.5 Calculation Methodology

Diesel combustion emissions were calculated using the emission factors in Table 3-6. The methodology required converting the kilowatt electrical kW_e to kilowatt mechanical kW_m. Additionally, the mechanical loss due to efficiency is estimated at 30 percent. The hours of operation for the diesel combustion units is estimated at 24 hours per year. The equation used to calculate GHG emissions is as follows:

$$E_{pol} = FC * H * EF_{pol} C$$

Where,

E_{pol} = Emissions of a particular pollutant (MTon/yr)

FC = Fuel Combustion (MMBtu/hr)

H = Annual operating hours, hours per year (hr/yr)

EF_{pol} = Emission Factor (kg/MMBtu)

C = Conversion Factor (0.001Mton/kg) or (0.000001MTon/g)

The emission factors used to calculate the diesel combustion unit emissions are listed in Table 3-6.

**Table 3-6
Emission Factors for Diesel Combustion**

Pollutant	Emission Factor	Units
CO ₂	73.15	kg/MMBtu
N ₂ O	0.6	g/MMBtu
CH ₄	11	g/MMBtu

Notes: Local Government Operations Manual – Table G.1 Default Factors for Calculating CO₂ Emissions from Fossil Fuel Combustion & Table G.3 Default CH₄ and N₂O Emission Factors by Fuel Type and Sector
 g Gram
 kg Kilogram
 MMBtu Million British Thermal Units

3.1.6 Emission Results

The GHG emissions from diesel combustion are summarized in Table 3-7.

**Table 3-7
GHG Emissions from Diesel Combustion**

Facility Name	Make	CO₂	N₂O as CO₂	CH₄ as CO₂	CO₂e
Tejeda Juvenile Justice Center	Genrac	1.549	3.938	0.445	5.93
Juvenile Detention Center	Genrac	2.420	6.152	0.695	9.27
Juvenile Detention Center	Kohler	1.161	2.953	0.333	4.45
Krier Juvenile Treatment Center	Ingersol Rand	4.801	12.206	1.378	18.39
Krier Juvenile Treatment Center	Ingersol Rand	4.801	12.206	1.378	18.39
Krier Juvenile Treatment Center	Kohler	3.871	9.844	1.111	14.83
Krier Juvenile Treatment Center	Kohler	3.871	9.844	1.111	14.83
Krier Juvenile Treatment Center	Kohler	3.871	9.844	1.111	14.83
Krier Juvenile Treatment Center	Genrac	2.904	7.383	0.834	11.12
Krier Juvenile Treatment Center	Genrac	2.904	7.383	0.834	11.12
Cadena-Reeves Justice Center	Caterpillar	6.775	17.227	1.945	25.95
Southwest Service Center	Dayton	0.097	0.246	0.028	0.37
Southwest Service Center		0.097	0.246	0.028	0.37
Southwest Service Center		0.097	0.246	0.028	0.37
Southwest Service Center		0.097	0.246	0.028	0.37
Vista Verde Plaza	Olympian	1.549	3.938	0.445	5.93
Adult Detention Center (Jail)	Caterpillar	15.970	40.606	4.585	61.16
Adult Detention Center (Jail)	Cummings	0.000	0.000	0.000	0.00
Adult Detention Center (Jail)	Cummings	14.518	36.915	4.168	55.60
Adult Detention Center Annex	Caterpillar	9.947	25.291	2.855	38.09
Adult Detention Center Annex	Onan	6.775	17.227	1.945	25.95
Southwest Service Center	North Star	0.126	0.320	0.036	0.48
Southwest Service Center	No data	0.097	0.246	0.028	0.37
Courthouse	Holt	1.936	4.922	0.556	7.41
Courthouse	Briggs and Stratton	0.000	0.000	0.000	0.00
Total		90.23	229.43	25.90	345.56

* Data not available

3.2 MOBILE SOURCE COMBUSTION

Bexar County operates vehicles throughout its organization. The fleet contains a wide array of vehicles that operate on a variety of fuels including gasoline, propane, E85 (85 percent ethanol blended with 15 percent gasoline), and diesel.

Tetra Tech calculated emissions from fleet vehicles generated during combustion. Required data to calculate fugitive emissions from mobile air conditioning; and biogenic CO₂ emissions from the combustion of biofuels was not available and therefore was not calculated or included in this inventory.

3.2.1 On Road Fleet Vehicles

Bexar County operates 425 on road fleet vehicles.

Tetra Tech performed the following steps to determine direct emissions from on-road fleet vehicles. Emissions from mobile combustion can be estimated based on vehicle fuel use and miles traveled data. Tetra Tech based the CO₂ (e) emissions on combustion of the fuel and vehicles miles traveled.

1. Identified the total annual fuel consumption by fuel type;
2. Determined the appropriate CO₂ emission factor for the fuel used;
3. Determined the appropriate CH₄ and N₂O emission factors for the fuel used;
4. Calculated the combustion CO₂ emissions;
5. Calculated combustion CH₄ and N₂O emissions; and
6. Converted CH₄ and N₂O emissions to CO₂ equivalent and determine total emissions.

Fleet activity and fuel records were identified from fuel purchase records. The activity data (i.e., miles driven) are based on national average fuel economy data and manufacturer's data and are listed in the database.

3.2.2 Calculation Methodology

Bexar County's fleet vehicle operations were calculated in accordance with recommended method from the Protocol. The recommended method is based on known fuel usage in combination with fuel-specific emission factors. GHG emissions were calculated for gasoline, diesel and propane-fueled vehicles. Fuel usage was determined from fuel purchase records from the City of San Antonio and other purchase records.

The equation used to calculate emissions is as follows:

$$E_{CO_2} = FC * EF_{fuel} * 0.001$$

Where,

E_{CO_2} = Emissions of a particular pollutant (MTon/yr)

FC = Fuel consumption, gallon per year (gal/year)

EF_{fuel} = Emission Factor, kilogram per gallon (kg/gal)

0.001 factor to convert kilograms to MTon

The emission factors used to calculate CO₂ emissions from fleet vehicle emissions are listed in Table 3-8. The emission factors for N₂O and CH₄ emission factors are listed in the Protocol, Table G.10 (ICLEI 2008). Emission factors are for highway vehicles by model year.

**Table 3-8
Emission Factors for CO₂ from On Road Fleet Vehicles**

Fuel	Emission Factor	Units
Gasoline	8.81	kg/gal
Diesel	10.15	kg/gal
LPG	5.79	kg/gal
Methanol	4.1	kg/gal
Ethanol	5.56	kg/gal
Propane	5.74	kg/gal

Notes: Local Government Operations Manual –Table G.1 Default Factors for Calculating CO₂ Emissions from Fossil Fuel Combustion.
gal Gallon
kg Kilogram

N₂O and CH₄ emissions for the County fleet operation were calculated based on the preferred alternate method from the Protocol. This method is based the fuel use by vehicle type, model year and fuel type in conjunction with default emission factors by fuel type and vehicle type.

The first step of this method requires the estimation of annual mileage according to the following equation:

$$VMT_{\text{Model,Year}} = FC * MPG_{\text{Model,Year}}$$

Where,

$VMT_{\text{Model, FuelType,Year}}$ = Vehicle miles traveled by model, fuel type and year, mile per year (mi/year)

FC = Fuel consumption (gal/year)

$MPG_{\text{Model, FuelType,Year}}$ = Vehicle fuel economy by model, fuel type and year, mile per gallon (mi/gal)

Vehicle fuel economy was determined from the U.S. Environmental Protection Agency's (EPA's) fuel economy website (www.fueleconomy.gov)

The annual mileage estimated above is used to calculate N₂O and CH₄ emissions as follows:

$$E_{\text{Model, FuelType,Year}} = VMT_{\text{Model, FuelType,Year}} * EF_{\text{Model, FuelType,Year}} * 0.000001$$

Where,

$VMT_{\text{Model,Year}}$ = Vehicle miles traveled by model, fuel type and year (mi/year)

$EF_{\text{Model, FuelType,Year}}$ = Vehicle emission factor by model, fuel type and year, grams per mile (g/mi)

0.000001 = Factor to convert grams to MTon

3.2.3 Emission Results

The GHG emissions from fleet vehicles are summarized in the database and the total emissions are provided in Table 3-9.

Table 3-9
GHG Emissions from On Road Fleet Vehicles

Number of Vehicles	CO ₂	N ₂ OasCO ₂	CH ₄ asCO ₂	CO ₂ e
425	4,254.23	49.75	2.89	4306.88

3.2.4 Heavy Duty Fleet Vehicles

Bexar County operates 147 heavy duty fleet vehicles that are summarized in Table 3-10. The vehicles and equipment are used during various operation and maintenance activities including construction, facility maintenance, and landscaping.

Table 3-10
Heavy Duty Fleet Vehicles

Make/Model	Fuel Type	Gallons per Year	Number of Vehicles
Caterpillar V25D	Diesel	16.1	1
Ford F150	Gasoline	399	1
International 4700 4x2	Diesel	667.86	1
International 4700 4x2	Diesel	333.27	1
Ford F 450	Diesel	621.87	2
International 4700 4x2	Diesel	5076.82	9
Ford F Series	Diesel	2057.44	1
Ford F Series / Etnyre	Diesel	1413.75	1
Ford F350	Propane	13.01	1
New Holland 6640SL	Diesel	55.33	1
Ferguson SP912	Diesel	0.7	1
Ford Econoline 350	Gasoline	90.18	1
Ford F Series	Diesel	1335.37	1
GMC T8500/Linear Dynamic	Diesel	4866.77	1
International 2574 6x4	Diesel	2226.2	3
International 2674 6x4	Diesel	3462.45	1
International 4700 4x2	Diesel	5467.92	6
Broce Broom RJ350	Diesel	19.89	1
Chevrolet C3500	Diesel	1843.75	2
Chevrolet C3500HD	Diesel	1932.25	2
Ford F150	Gasoline	20.02	1
Ford F150	Propane	1470.96	3
Gradall G3WD	Diesel	2021.71	1
International 2574 6x4	Diesel	8462.37	4
International 4700 4x2	Diesel	1120.27	4
New Holland 6610S	Diesel	8.01	1
Broce Broom RJ350	Diesel	18.18	1

Table 3-10 (Continued)
Heavy Duty Fleet Vehicles

Make/Model	Fuel Type	Gallons per Year	Number of Vehicles
Chevrolet C6500	Diesel	28993.74	1
Gradall G3WD	Diesel	304.1	1
John Deere 260	Diesel	60.3	1
John Deere 670CH	Diesel	19.6	1
New Holland 6610S	Diesel	4.8	1
Caterpillar PS150B	Diesel	35.56	1
Chevrolet C3500HD	Diesel	922.91	1
Ferguson 5-8 B	Diesel	0.6	1
Ford F 450	Diesel	636.36	1
Ford F150	Gasoline	1192.76	2
Ford F350SD	Diesel	998.01	2
Ford F750	Diesel	5372.52	6
Freightliner FL70	Diesel	4033.54	5
Ingersol Rand 185	Diesel	18.9	1
John Deere 260	Diesel	72.14	1
Midland SA-M	Diesel	6.93	1
Navistar 2574 6x4	Diesel	3197.47	3
Navistar 2674 6x4	Diesel	3832.11	1
Sterling L9613	Diesel	8059.24	6
Terex TV1200DPR	Diesel	28	1
Daewoo G25E-3	Propane	17.35	2
Ford F150	Propane	1011.43	3
Ford F150 4x4	Propane	129.42	1
Gradall XL4100	Diesel	3050.43	1
Broce Broom RJ350	Diesel	43.59	1
Ford F150	Propane	282.58	1
Ford F150 4x4	Propane	3411.85	5
Ford F350SD	Diesel	1996.59	2
Leeboy L7000T	Diesel	632.16	1
Sterling M7500	Diesel	1702.93	7
Terex TV1200-1	Diesel	0.54	1
Caterpillar PS150B	Diesel	100.05	1
Ford F 750 Etnyre	Diesel	1107.68	1
Ford F650 Fuel Truck	Diesel	41872.17	1
Chevrolet	Gasoline	446.52	3
Ford F150 4x4	Diesel	658.19	1
Ford F150 4x4	Gasoline	867.93	1
Ford F250SD	Diesel	94.8	1
Ford F450SD	Diesel	2978.64	4
Ford F750	Diesel	231.89	1
Ford F750 Crewcab Dump Truck	Diesel	235.51	1

Table 3-10 (Continued)
Heavy Duty Fleet Vehicles

Make/Model	Fuel Type	Gallons per Year	Number of Vehicles
Gradall XL3100	Diesel	263.8	1
International 4200/TYMC	Diesel	981.12	1
International 4300 SBA 4x	Diesel	342.5	1
Sterling Acterra M8500	Diesel	6185.48	8
Sterling LT9500	Diesel	6831.37	4
Total		178287.6	146

Tetra Tech used the following steps to determine direct emissions from the heavy duty fleet vehicles. GHG emissions from fuel combustion were estimated based on vehicle fuel usage data.

1. Identified the total annual fuel consumption by fuel type;
2. Determined the appropriate emission factor for the fuel used;
3. Determined the appropriate CH₄ and N₂O emission factors for the fuel used;
4. Calculated the combustion CO₂ emissions;
5. Calculated combustion CH₄ and N₂O emissions; and
6. Converted CH₄ and N₂O emissions to CO₂ equivalent and determine total emissions.

Fleet activity and fuel records were identified from fuel purchase records.

3.2.5 Calculation Methodology

The equation used to calculate GHG emissions from heavy duty vehicles is as follows:

$$E_{\text{pol}} = \text{FC} * \text{EF}_{\text{fuel}} * 0.001$$

Where,

E_{pol} = Emissions of a particular pollutant (MTon/yr)

FC = Fuel consumption (gal/year)

EF_{fuel} = Emission Factor (kg/gal)

0.001 = Factor to convert kilograms to MTon

The emission factors used to calculate GHG emissions from heavy duty vehicles are listed in Table 3-11. Emission factors expressed as grams per mile (g/mile) were converted to grams per gallon (g/gal) assuming a 10 miles per gallon fuel efficiency

**Table 3-11
Emission Factors for Heavy Duty Vehicles**

Fuel	CO ₂		
	Emission Factor (kilogram per gallon [kg/gal])	N ₂ O Emission Factor	CH ₄ Emission Factor
Gasoline	8.81	0.22 (g/gal)	0.50 (g/gal)
Diesel	10.15	0.26 (g/gal)	0.58 (g/gal)
LPG	5.74	0.175 (g/mile)	0.066 (g/mile)

Notes: Local Government Operations Manual –Tables G.9, G11, and G12

g Gram
gal Gallon

3.2.6 Emission Results

The GHG emissions from on road heavy duty fleet vehicles are summarized in Table 3-12.

**Table 3-12
GHG Emissions from Heavy Duty Fleet Vehicles**

Make/Model	Fuel Type	Number of Units	CO ₂	N ₂ O as CO ₂	CH ₄ as CO ₂	CO ₂ e
Caterpillar V25D	Diesel	1	0.16	0.001	0.000	0.16
Ford F150	Gasoline	1	3.52	0.027	0.004	3.55
International 4700 4x2	Diesel	1	6.78	0.054	0.008	6.84
International 4700 4x2	Diesel	1	3.38	0.027	0.004	3.41
Ford F 450	Diesel	2	6.31	0.050	0.008	6.37
International 4700 4x2	Diesel	9	51.53	0.409	0.062	52.00
Ford F Series	Diesel	1	20.88	0.166	0.025	21.07
Ford F Series / Etnyre	Diesel	1	14.35	0.114	0.017	14.48
Ford F350	Propane	1	0.07	0.007	0.000	0.08
New Holland 6640SL	Diesel	1	0.56	0.004	0.001	0.57
Ferguson SP912	Diesel	1	0.01	0.000	0.000	0.01
Ford Econoline 350	Gasoline	1	0.79	0.006	0.001	0.80
Ford F Series	Diesel	1	13.55	0.108	0.016	13.68
GMC T8500/Linear						
Dynamic	Diesel	1	49.40	0.392	0.059	49.85
International 2574 6x4	Diesel	3	22.60	0.179	0.027	22.80
International 2674 6x4	Diesel	1	35.14	0.279	0.042	35.47
International 4700 4x2	Diesel	6	55.50	0.441	0.067	56.01
Broce Broom RJ350	Diesel	1	0.20	0.002	0.000	0.20
Chevrolet C3500	Diesel	2	18.71	0.149	0.022	18.89
Chevrolet C3500HD	Diesel	2	19.61	0.156	0.024	19.79
Ford F150	Gasoline	1	0.18	0.001	0.000	0.18
Ford F150	Propane	3	8.44	0.798	0.020	9.26
Gradall G3WD	Diesel	1	20.52	0.163	0.025	20.71
International 2574 6x4	Diesel	4	85.89	0.682	0.103	86.68
International 4700 4x2	Diesel	4	11.37	0.090	0.014	11.47
New Holland 6610S	Diesel	1	0.08	0.001	0.000	0.08

Table 3-12 (Continued)
GHG Emissions from Heavy Duty Fleet Vehicles

Make/Model	Fuel Type	Number of Units	CO ₂	N ₂ O as CO ₂	CH ₄ as CO ₂	CO ₂ e
Caterpillar PS150B	Diesel	1	0.36	0.003	0.000	0.36
Chevrolet C3500HD	Diesel	1	9.37	0.074	0.011	9.45
Ferguson 5-8 B	Diesel	1	0.01	0.000	0.000	0.01
Ford F 450	Diesel	1	6.46	0.051	0.008	6.52
Ford F150	Gasoline	2	10.51	0.081	0.013	10.60
Ford F350SD	Diesel	2	10.13	0.080	0.012	10.22
Ford F750	Diesel	6	54.53	0.433	0.065	55.03
Freightliner FL70	Diesel	5	40.94	0.325	0.049	41.31
Ingersol Rand 185	Diesel	1	0.19	0.002	0.000	0.19
John Deere 260	Diesel	1	0.73	0.006	0.001	0.74
Midland SA-M	Diesel	1	0.07	0.001	0.000	0.07
Navistar 2574 6x4	Diesel	3	32.45	0.258	0.039	32.75
Navistar 2674 6x4	Diesel	1	38.90	0.309	0.047	39.25
Sterling L9613	Diesel	6	81.80	0.650	0.098	82.55
Terex TV1200DPR	Diesel	1	0.28	0.002	0.000	0.29
Daewoo G25E-3	Propane	2	0.10	0.009	0.000	0.11
Ford F150	Propane	3	5.81	0.549	0.014	6.37
Ford F150 4x4	Propane	1	0.74	0.070	0.002	0.81
Gradall XL4100	Diesel	1	30.96	0.246	0.037	31.24
Broce Broom RJ350	Diesel	1	0.44	0.004	0.001	0.45
Ford F150	Propane	1	1.62	0.153	0.004	1.78
Ford F150 4x4	Propane	5	19.58	1.851	0.047	21.48
Ford F350SD	Diesel	2	20.27	0.161	0.024	20.45
Leeboy L7000T	Diesel	1	6.42	0.051	0.008	6.48
Sterling M7500	Diesel	7	17.28	0.137	0.021	17.44
Terex TV1200-1	Diesel	1	0.01	0.000	0.000	0.01
Caterpillar PS150B	Diesel	1	1.02	0.008	0.001	1.02
Ford F 750 Etnyre	Diesel	1	11.24	0.089	0.013	11.35
Ford F650 Fuel Truck	Diesel	1	425.00	3.375	0.510	428.89
Chevrolet	Gasoline	3	3.93	0.030	0.005	3.97
Ford F150 4x4	Diesel	1	6.68	0.053	0.008	6.74
Ford F150 4x4	Gasoline	1	7.65	0.059	0.009	7.71
Ford F250SD	Diesel	1	0.96	0.008	0.001	0.97
Ford F450SD	Diesel	4	30.23	0.240	0.036	30.51
Ford F750	Diesel	1	2.35	0.019	0.003	2.38
Ford F750 Crewcab						
Dump Truck	Diesel	1	2.39	0.019	0.003	2.41

Table 3-12 (Continued)
GHG Emissions from Heavy Duty Fleet Vehicles

Make/Model	Fuel Type	Number of Units	CO₂	N₂O as CO₂	CH₄ as CO₂	CO₂e
Gradall XL3100 International	Diesel	1	2.68	0.021	0.003	2.70
4200/TYMC International 4300	Diesel	1	9.96	0.079	0.012	10.05
SBA 4x Sterling Acterra M8500	Diesel	1	3.48	0.028	0.004	3.51
Sterling LT9500	Diesel	8	62.78	0.499	0.075	63.36
	Diesel	4	69.34	0.551	0.083	69.97
	Total	146	1777.63	17.26	2.18	1797.07

3.2.7 On Road Commuter Vehicles

GHG emissions associated with on road commuter travel are Scope 3. Emissions were estimated using preliminary analysis results of a commuter survey conducted for County employees.

3.2.8 Calculation Methodology

The equation used to calculate emissions is as follows:

$$E_{pol} = Di * Day * (1-Bus) * EF_{pol} * 0.0001 * 0.0001$$

Where,

E_{pol} = Emissions of a particular pollutant, kilogram per year (kg/yr)

Di = Average Daily Commute Distance, mile per day (mi/day)¹ 14.9 miles (one-way)

EF_{pol} = Emission Factor, gram per mile (g/mi)

Day = Commute, day per year (days/yr)

Bus = Fraction of commutes by bus (Unitless,=0.074)¹

EF_{pol} = Emission Factor (g/mi)

0.0001 = Factor to convert grams to kilograms

0.0001 = Factor to convert kilograms to MTon

Note: ¹ Value determined from commuter survey

3.2.9 Emission Results

The emissions from commuter vehicles are summarized in Table 3-13.

Table 3-13
GHG Emissions from Commuter Vehicles

Commuter Vehicle	Fuel Type	Number of Units	CO ₂	N ₂ O as CO ₂	CH ₄ as CO ₂	CO ₂ e
Light Duty Vehicle (LDV)	gasoline	5,000	14,311.73	297.83	22.57	14,632.12

3.3 ELECTRICITY USE

GHG emissions associated with electricity use are Scope 2 emissions, a special category of indirect emissions that includes only indirect emissions associated with the consumption of purchased or acquired electricity, steam, heating, or cooling. The electric usage occurs in buildings owned and operated by Bexar County, including leased facilities. Indirect GHG emissions are emissions that are a consequence of activities that take place within the organizational boundaries of the reporting entity, but occur at sources owned or controlled by another entity. Scope 2 emissions physically occur at the facility where electricity is generated. For example, emissions that occur at a utility's power plant as a result of electricity used by a local government's administrative buildings represent the local government's indirect emissions. Scope 2 emissions typically represent one of the largest sources of emissions for local governments; therefore, it embodies a significant opportunity for GHG management and reduction. Bexar County can reduce their use of electricity by investing in energy efficient technologies and energy conservation.

3.3.1 Electricity Use - Facility

Electric usage for Bexar County owned and leased facilities is summarized in Table 3-14 and 3-15; respectively.

Table 3-14
Electricity Use from Owned Facilities

Facility	Gross Square Feet (sq ft)	Electricity Usage, kilowatt hour (kWh)
(Old) Northwest Service Center	*	54,377
Adult Detention Center (Jail)	634,560	12,915,809
Adult Detention Center Annex	70,000	5,710,464
Bullis County Park	600	3,758
Cadena-Reeves Justice Center	275,600	8,017,920
Commanche County Park	24,588	92,865
Courthouse	260,900	2,832,000
Courthouse Annex	56,700	2,543,700
Covington County Park	600	8,313
Elections Warehouse	20,000	*
Fleet Maintenance	10,300	*
Forensic Science	56,000	1,358,686

Table 3-14 (Continued)
Electricity Use from Owned Facilities

Facility	Gross Square Feet (sq ft)	Electricity Usage, kilowatt hour (kWh)
Harlandale Civic Center	4,000	90,120
Juvenile Detention Center	99,200	3,676,608
Krier Juvenile Treatment Center	64,330	2,889,600
Macarthur County Park	13,488	61,875
Milagros Treatment Center	10,000	483,840
Mission County Park	15,323	62,844
Mitchell Building	*	865,152
Navajo Civic Center	3,000	115,340
Northeast Service Center	12,139	92,506
Orsinger County Park	7,750	33,055
Parking Garage	*	328,704
Pletz County Park	3,420	20,727
Raymond Russell County Park	36,031	16,800
Records Center	33,250	293,376
Rodriguez County Park	11,568	15,908
South San Civic Center	3,500	102,657
Southeast Service Center	11,500	236,880
Tejeda Juvenile Justice Center	40,500	1,512,960
Vista Verde Plaza	75,000	2,948,352

* Data not available

Table 3-15
Electricity Use from Leased Facilities

Facility	Average Square Footage	kW-hour
Adult Probation	25,918	1,145,210.967
Adult Probation	30,073	1,328,803.512
Auditors Office	13,555	598,940.2986
Budget Planning & Resource Management	7,986	352,868.8473
Budget Planning & Resource Management (Expansion)	4,876	215,450.601
Civil Service	7,260	320,789.8611
Criminal Justice	2,100	92,790.4557
Elections Warehouse	22,400	989,764.8608
Elections Warehouse	3,960	174,976.2879
Information Services	6,327	279,564.3873
Jp Pct 4 Constable Pct 4	7,586	335,194.4747
JP 2 And Constable 2	8,071	356,624.6514
Jp Pct 1 Place 3 Constable Pct 1	5,520	243,906.3407
Jp Pct 3 Constable Pct 3	10,629	469,652.2637
Juvenile Department (Eastside)	3,225	142,499.6284
Juvenile Department (Northeast)	2,851	125,974.0901
Juvenile Department (Northwest)	2,741	121,113.6377

Table 3-15 (Continued)
Electricity Use from Leased Facilities

Facility	Average Square Footage	kW-hour
Juvenile Department (Southside)	4,500	198,836.6908
Juvenile Department (Westside)	2,685	118,639.2255
Public Defenders	1,941	85,764.89263
Public Defenders [Small]	969	42,816.16742
Public Defenders Mental Health Advocacy	2,975	131,453.1456
Sheriff's Downtown Substation	5,117	226,099.4104
Sheriff's Eastside Substation	9,278	409,957.0705
Tax Office (Northside)	5,300	234,185.4358
Tax Office [Westside]	5,080	224,464.5309
Tax Office[Southside]	5,477	242,006.3457
Texas Cooperative Extension	7,030	310,627.097

Reporting indirect emissions from electricity consumption begins with determining the annual electricity use at each facility. The emissions were estimated based on the annual electricity use from each facility and was determined from monthly electric bills. The monthly megawatt hours (MWh's) were aggregated to determine annual electricity usage. Leased facility electric usage uses the known electrical consumption for the facility based on purchase records and estimates the portion of electricity used based on the square footage of the leased area.

3.3.2 Electricity Use - Exterior Lighting

Bexar County is responsible for the street lighting within the County. The electricity consumption records are not available for the streetlights and traffic signals. In this case, the methodology for estimating the MWh for the exterior lighting (streetlights and signals) was based on average monthly consumption records from Bexar County.

3.3.3 Calculation Methodology

The equation used to calculate GHG emissions from electricity use is as follows

$$E_{pol} = EC * EF_{pol} C$$

Where,

E_{pol} = Emissions of a particular pollutant (MTon/yr)

EC = Electricity Consumption, megawatt hour per year (MWh/yr)

EF_{pol} = Emission Factor, pounds per megawatt hour (lbs/MWh)

C = Conversion Factor, pounds per metric ton (2,204.62 lbs/MTon)

The emission factors used to calculate the emissions from electricity use are listed in Table 3-16.

Table 3-16
Emission Factors for Electricity Use

Pollutant	Emission Factor	Units
CO ₂	1,319	lbs/MWh
N ₂ O	0.00002425	lbs/MWh
CH ₄	0.00003748	lbs/MWh

Notes: Local Government Operations Manual – Table G.7 eGRID Electricity Emission Factors by eGRID Subregion (2004 data)
 lbs Pounds
 MWh Mega Watt Hour

3.3.4 Emission Results

The GHG emissions from owned and leased facility electricity use for Bexar County are summarized in Table 3-17, 3-18, and 3-19; respectively.

Table 3-17
GHG Emissions from Electricity Use at Owned Facilities

Facility	CO₂	N₂O as CO₂	CH₄ as CO₂	CO₂e
(Old) Northwest Service Center	35.07	0.115	0.011	35.20
Adult Detention Center (Jail)	8,329.85	27.267	2.586	8,359.70
Adult Detention Center Annex	3,682.87	12.055	1.143	3,696.07
Bullis County Park	2.42	0.008	0.001	2.43
Cadena-Reeves Justice Center	5,171.03	16.927	1.605	5,189.56
Commanche County Park	59.89	0.196	0.019	60.11
Courthouse	1,826.45	5.979	0.567	1,833.00
Courthouse Annex	1,640.52	5.370	0.509	1,646.40
Covington County Park	5.36	0.018	0.002	5.38
Elections Warehouse	*	*	*	*
Fleet Maintenance	*	*	*	*
Forensic Science	876.26	2.868	0.272	879.40
Harlandale Civic Center	58.12	0.190	0.018	58.33
Juvenile Detention Center	2,371.17	7.762	0.736	2,379.67
Krier Juvenile Treatment Center	1,863.60	6.100	0.579	1,870.28
Macarthur County Park	39.91	0.131	0.012	40.05
Milagros Treatment Center	312.04	1.021	0.097	313.16
Mission County Park	40.53	0.133	0.013	40.68
Mitchell Building	557.97	1.826	0.173	559.97
Navajo Civic Center	74.39	0.243	0.023	74.65
Northeast Service Center	59.66	0.195	0.019	59.87
Orsinger County Park	21.32	0.070	0.007	21.39
Parking Garage	211.99	0.694	0.066	212.75
Pletz County Park	13.37	0.044	0.004	13.42

Table 3-17 (Continued)
GHG Emissions from Electricity Use at Owned Facilities

Facility	CO ₂	N ₂ O as CO ₂	CH ₄ as CO ₂	CO ₂ e
Raymond Russell County Park	10.83	0.035	0.003	10.87
Records Center	189.21	0.619	0.059	189.89
Rodriguez County Park	10.26	0.034	0.003	10.30
South San Civic Center	66.21	0.217	0.021	66.44
Southeast Service Center	152.77	0.500	0.047	153.32
Tejeda Juvenile Justice Center	975.76	3.194	0.303	979.26
Vista Verde Plaza	1,901.49	6.224	0.590	1,908.31
Total	30,661.87	100.37	9.52	30,771.76

* Data not available

Table 3-18
GHG Emissions from Electricity Use at Leased Facilities

Facility	CO ₂	N ₂ O as CO ₂	CH ₄ as CO ₂	CO ₂ e
Adult Probation	1481.504	0.0131	0.0006	1481.52
Auditors Office	358.661	0.0032	0.0001	358.66
Budget Planning & Resource Management	211.307	0.0019	0.0001	211.31
Budget Planning & Resource Management (Expansion)	129.017	0.0011	0.0000	129.02
Civil Service	192.097	0.0017	0.0001	192.10
Criminal Justice	55.565	0.0005	0.0000	55.57
Elections Warehouse	697.477	0.0061	0.0003	697.48
Information Services	167.410	0.0015	0.0001	167.41
Jp Pct 4 Constable Pct 4	200.723	0.0018	0.0001	200.73
JP 2 and Constable 2	213.556	0.0019	0.0001	213.56
Jp Pct 1 Place 3 Constable Pct 1	146.057	0.0013	0.0001	146.06
Jp Pct 3 Constable Pct 3	281.240	0.0025	0.0001	281.24
Juvenile Department (Eastside)	85.332	0.0008	0.0000	85.33
Juvenile Department (Northeast)	75.437	0.0007	0.0000	75.44
Juvenile Department (Northwest)	72.526	0.0006	0.0000	72.53
Juvenile Department (Southside)	119.069	0.0010	0.0000	119.07
Juvenile Department (Westside)	71.044	0.0006	0.0000	71.04
Public Defenders	51.358	0.0005	0.0000	51.36
Public Defenders (Small)	25.639	0.0002	0.0000	25.64
Public Defenders Mental Health Advocacy	78.718	0.0007	0.0000	78.72
Sheriff's Downtown Substation	135.394	0.0012	0.0001	135.40
Sheriff's Eastside Substation	245.493	0.0022	0.0001	245.50
Tax Office (Northside)	140.236	0.0012	0.0001	140.24
Tax Office (Westside)	134.415	0.0012	0.0001	134.42
Tax Office (Southside)	144.920	0.0013	0.0001	144.92
Texas Cooperative Extension	186.012	0.0016	0.0001	186.01
Total	5700.21	0.05	0.00	5700.26

The GHG emissions from electricity use for street lights are summarized in Table 3-19.

Table 3-19
GHG Emissions for Electricity Use for Exterior Lighting

Account Number	Kilowatt per				
	Year (kW/yr)	CO ₂	N ₂ O as CO ₂	CH ₄ as CO ₂	CO ₂ e
3000557734	98	0.0632	0.0002	0.0000	0.06
3000557735	84	0.0542	0.0002	0.0000	0.05
3000557736	2596	1.6742	0.0055	0.0005	1.68
3000557737	109	0.0703	0.0002	0.0000	0.07
3000557738	104	0.0671	0.0002	0.0000	0.07
3000557739	109	0.0703	0.0002	0.0000	0.07
3000557740	113	0.0729	0.0002	0.0000	0.07
3000557741	120	0.0774	0.0003	0.0000	0.08
3000557742	167	0.1077	0.0004	0.0000	0.11
3000557743	108	0.0697	0.0002	0.0000	0.07
3000557744	243	0.1567	0.0005	0.0000	0.16
3000557745	115	0.0742	0.0002	0.0000	0.07
3000557746	95	0.0613	0.0002	0.0000	0.06
3000557747	106	0.0684	0.0002	0.0000	0.07
3000557748	2216	1.4292	0.0047	0.0004	1.43
3000557749	111	0.0716	0.0002	0.0000	0.07
3000557750	99	0.0638	0.0002	0.0000	0.06
3000557751	119	0.0767	0.0003	0.0000	0.08
3000557753	110	0.0709	0.0002	0.0000	0.07
3000557754	102482	66.0942	0.2163	0.0205	66.33
3000557755	114	0.0735	0.0002	0.0000	0.07
3000557756	217	0.1400	0.0005	0.0000	0.14
3000557757	110	0.0709	0.0002	0.0000	0.07
3000557758	8	0.0052	0.0000	0.0000	0.01
3000557759	104	0.0671	0.0002	0.0000	0.07
3000557760	118	0.0761	0.0002	0.0000	0.08
3000557763	56	0.0361	0.0001	0.0000	0.04
3000557765	114	0.0735	0.0002	0.0000	0.07
3000557766	84	0.0542	0.0002	0.0000	0.05
3000557767	128	0.0826	0.0003	0.0000	0.08
3000557768	113	0.0729	0.0002	0.0000	0.07
3000557769	119	0.0767	0.0003	0.0000	0.08
3000557770	1369	0.8829	0.0029	0.0003	0.89
3000557771	1304	0.8410	0.0028	0.0003	0.84
3000557774	111	0.0716	0.0002	0.0000	0.07
3000557775	139	0.0896	0.0003	0.0000	0.09
3000557776	2102	1.3557	0.0044	0.0004	1.36
3000557777	120	0.0774	0.0003	0.0000	0.08
3000557778	169	0.1090	0.0004	0.0000	0.11
3000557779	123	0.0793	0.0003	0.0000	0.08
3000557780	117	0.0755	0.0002	0.0000	0.08
3000557781	116	0.0748	0.0002	0.0000	0.08

Table 3-19 (Continued)
GHG Emissions for Electricity Use for Exterior Lighting

Account Number	Kilowatt per				
	Year (kW/yr)	CO ₂	N ₂ O as CO ₂	CH ₄ as CO ₂	CO ₂ e
3000557782	103	0.0664	0.0002	0.0000	0.07
3000557784	128	0.0826	0.0003	0.0000	0.08
3000557785	130	0.0838	0.0003	0.0000	0.08
3000557786	0	0.0000	0.0000	0.0000	0.00
3000557787	15	0.0097	0.0000	0.0000	0.01
3000557788	114	0.0735	0.0002	0.0000	0.07
3000557789	99	0.0638	0.0002	0.0000	0.06
3000557790	70	0.0451	0.0001	0.0000	0.05
3000557791	198320	127.9034	0.4187	0.0397	128.36
3000557792	4742	3.0583	0.0100	0.0009	3.07
3000557849	62558	40.3458	0.1321	0.0125	40.49
3001292157	578	0.3728	0.0012	0.0001	0.37
Total	383,116.00	247.08	0.81	0.08	247.97

3.4 SOLID WASTE

Bexar County generates solid waste at their facilities. The amount of solid waste generated at the facilities is summarized in Table 3-20

Table 3-20
Summary of Solid Waste by Facility

Facility	Annual Waste,	
	Cubic Yards (cu yd)	Annual Waste (MTon)
Macarthur Park	384	43.2
Comanche Park, April - October 31	504	56.7
Comanche Park	240	27
Mission County Park	336	37.8
Mission County Park	160	18
Raymond Russell Park	252	28.35
Raymond Russell Park	120	13.5
Rodriguez Park, April 1 - October 31	252	28.35
Rodriguez Park	60	6.75
Pletz Park	144	16.2
Orsinger Park	384	43.2
South San Civic Center	144	16.2
Harlandale Civic Center	192	21.6
Bexar County Justice Center	1,440	162
Bexar County Election Center	48	5.4
Mentally Impaired Offenders Facility	288	32.4
Substance Abuse Treatment Facility	288	32.4

Table 3-20 (Continued)
Summary of Solid Waste by Facility

Facility	Annual Waste, Cubic Yards (cu yd)	Annual Waste (MTon)
Forensic Science Center	192	21.6
Juvenile Detention	576	64.8
Southton Facility	576	64.8
Juvenile Probation	576	64.8
Bexar County Annex	576	64.8
Northwest Service Center	192	21.6
Southton Service Center	192	21.6
Northwest Service Center	192	21.6
Fleet Maintenance	144	16.2
Vista Verde Plaza	144	16.2
Milagros	192	21.6
Bexar County Jail	2,940	330.75
Jail Annex	1,344	151.2
Sheriff Sub-Station	48	5.4
Sheriff Sub-Station	96	10.8
Record Management And	96	10.8
Juvenile Justice Academy	192	21.6
Total	13,504	1,519.2

3.4.1 Calculation Methodology

The equation used to calculate GHG emissions is as follows

$$E_{\text{pol}} = \text{SW} * \text{EF}_{\text{pol}} * \text{WT}$$

Where,

E_{pol} = Emissions of a particular pollutant (MTon/yr)

SW = Solid Waste, tons per year (tons/yr)

EF_{pol} = Emission Factor (MTon/ton)

WT = Waste Type (percent)

The composition of waste was based on a national percentage share of municipal solid waste generation, recycling, and disposal records. The percentage share used to calculate emissions from solid waste usage are listed in Table 3-21.

Table 3-21
Waste Composition for Solid Waste

Waste Type	Percentage
Paper Products	34.3
Food Waste	12.3
Plant Debris	12.9
Wood/Textiles	10.1
All Other Waste	30.4

Source: <http://www.epa.gov/epawaste/nonhaz/municipal/msw99.htm>,
Municipal Solid Waste in the United States: 2005 Facts And Figures
(U. S. EPA 2005)

3.4.2 Emission Results

The GHG emissions from solid waste are summarized in Table 3-22.

Table 3-22
GHG Emissions from Solid Waste Generation at Owned Facilities

Location	CO ₂	CO ₂ (e)
MacArthur Park	73.87	73.87
Comanche Park, April - October 31	10.77	10.77
Comanche Park	5.13	5.13
Mission County Park	7.18	7.18
Mission County Park	3.42	3.42
Raymond Russell Park	5.39	5.39
Raymond Russell Park	2.57	2.57
Rodriguez Park, April 1 - October 31	5.39	5.39
Rodriguez Park	1.28	1.28
Pletz Park	3.08	3.08
Orsinger Park	8.21	8.21
South San Civic Center	3.08	3.08
Harlandale Civic Center	4.10	4.10
Bexar County Justice Center	30.78	30.78
Bexar County Election Center	1.03	1.03
Mentally Impaired Offenders Facility	6.16	6.16
Substance Abuse Treatment Facility	6.16	6.16
Forensic Science Center		
Juvenile Detention	12.31	12.31
Southton Facility	12.31	12.31
Juvenile Probation	12.31	12.31
Bexar County Annex	12.31	12.31
Northwest Service Center	4.10	4.10

Table 3-22 (Continued)
GHG Emissions from Solid Waste Generation at Owned Facilities

Location	CO ₂	CO ₂ (e)
Southton Service Center	4.10	4.10
Northwest Service Center	4.10	4.10
Fleet Maintenance	3.08	3.08
Vista Verde Plaza	3.08	3.08
Milagros	4.10	4.10
Bexar County Jail	62.84	62.84
Jail Annex	28.73	28.73
Sheriff Sub-Station	1.03	1.03
Sheriff Sub-Station	2.05	2.05
Record Management	2.05	2.05
Juvenile Justice Academy	4.10	4.10
Total	350.21	350.21

3.5 WASTEWATER

Methane is produced when organic material is broken down during wastewater treatment and the handling of residual waste sludge. Wastewater emissions are based on wastewater produced while on the job site and is based on the total number of employees reporting to Bexar County facilities.

3.5.1 Calculation Methodology

The equation used to calculate GHG wastewater emissions is as follows

$$E_{\text{pol}} = N * P * D * CF * EF_{\text{pol}} * 0.001$$

Where,

E_{pol} = Emissions of a particular pollutant (MTon/yr)

N = Number of employees

P = Percentage of waste produced at work = 0.5

D = Days worked per year = 250

CF = conversion factor (0.001 MTON/kg)

EF_{pol} = Emission Factor, kilogram per person per day (kg/person/day)

The emission factors used to calculate the GHG wastewater emissions are provided in Table 3-23.

**Table 3-23
Emission Factors**

Pollutant	EF (kg/person/day)
CH ₄	0.01530
N ₂ O	0.0000088

Source: IPCC 2006, Guidelines for National Greenhouse Gas Inventories

3.5.2 Emission Results

The GHG emissions from wastewater are summarized in Table 3-24.

**Table 3-24
GHG Emissions from Water Use at Owned Facilities**

Location	CH₄ as CO₂	N₂O as CO₂	CO₂ (e)
Bexar County	200.81	1.71	202.52

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4.0 CONCLUSIONS

4.1 SCOPE 1 EMISSIONS

Scope 1 comprise all direct emissions under management control of the County. The Scope 1 GHG emissions for Bexar County are summarized in Table 4-1 and Figure 4-1. On road fleet and natural gas combustion are the largest contributing sources, comprising over 75 percent of the Scope 1 emissions.

Table 4-1
Summary of Scope 1 Emissions

Scope 1 Source	Annual Emissions (CO₂ e/year)	Percent Contribution
On Road Fleet Vehicles	4307	45.67
Diesel Combustion	346	3.66
Heavy Duty Fleet Vehicles	1797	19.06
Natural Gas, Owned Facilities	2980	31.60
Total	9430	100

4.2 SCOPE 2 EMISSIONS

Scope 2 consists of emissions associated with purchased energy in the form of electricity, heat, cooling, or steam. The Scope 2 GHG emissions for Bexar County are summarized in Table 4-2 and Figure 4-2. Electricity usage at owned facilities was the largest contributor, comprising over 80 percent of Scope 2 emissions.

Table 4-2
Summary of Scope 2 Emissions

Scope 2 Source	Annual Emissions (CO₂ e/year)	Percent Contribution
Electricity Usage, Owned Facilities	28376	82.24
Electricity Usage, Leased Facilities	5700	16.52
Electricity Usage, Street Lights	248	0.72
Natural Gas, Leased Facilities	179	0.52
Total	34503	100

4.3 SCOPE 3 EMISSIONS

Scope 3 emissions include all other indirect sources, such as upstream and downstream emissions, and commuter emissions. The Scope 3 GHG emissions for Bexar County are summarized in Table 4-3 and Figure 4-3. Commuter vehicle emissions were the largest contributing source, at almost 97 percent of Scope 3 emissions.

**Table 4-3
Summary of Scope 3 Emissions**

Scope 3 Source	Annual Emissions (CO₂ e/year)	Percent Contribution to Scope 3
Commute Vehicles	14632	96.36
Solid Waste	350	2.31
Wastewater	203	1.33
Total	15185	100

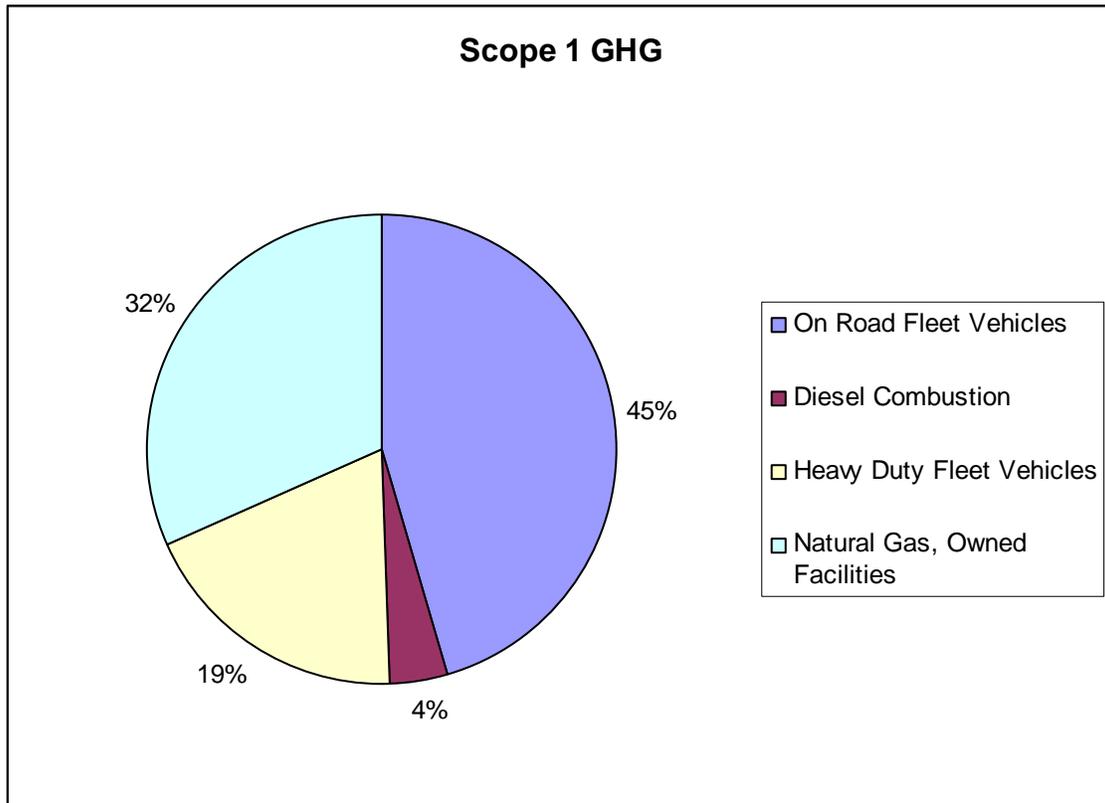


Figure 4-1 Summary of Scope 1 Emissions

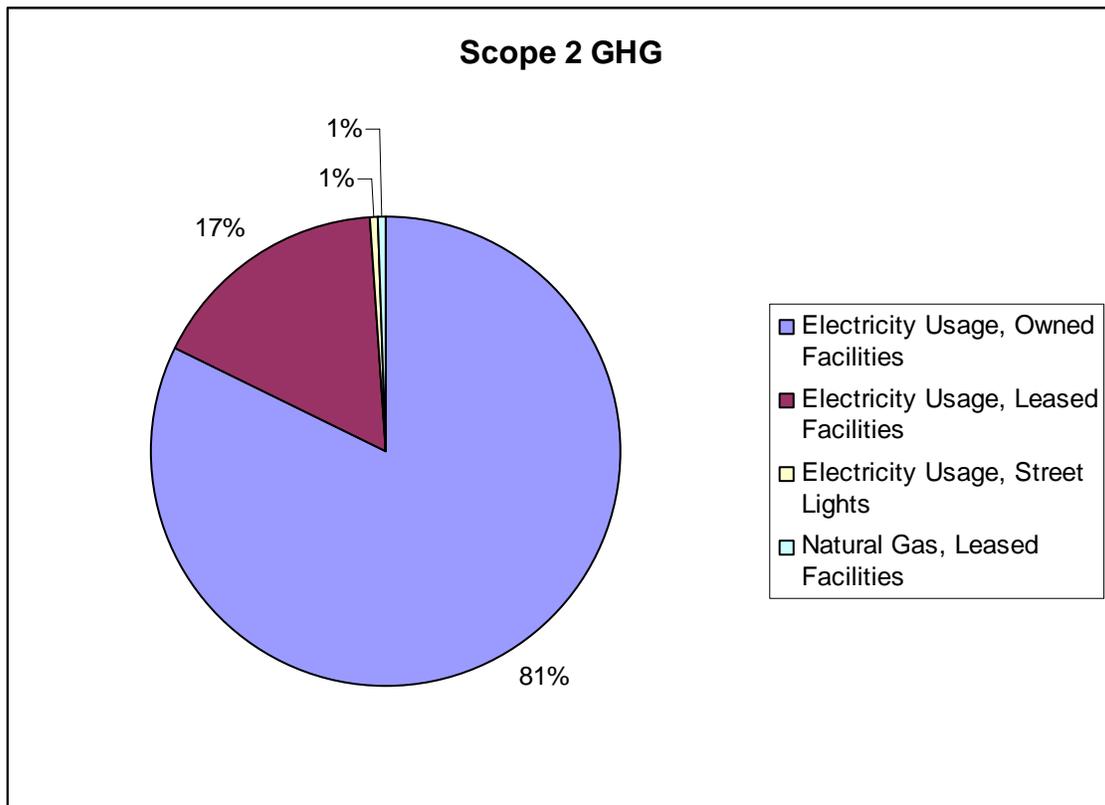


Figure 4-2 Summary of Scope 2 Emissions

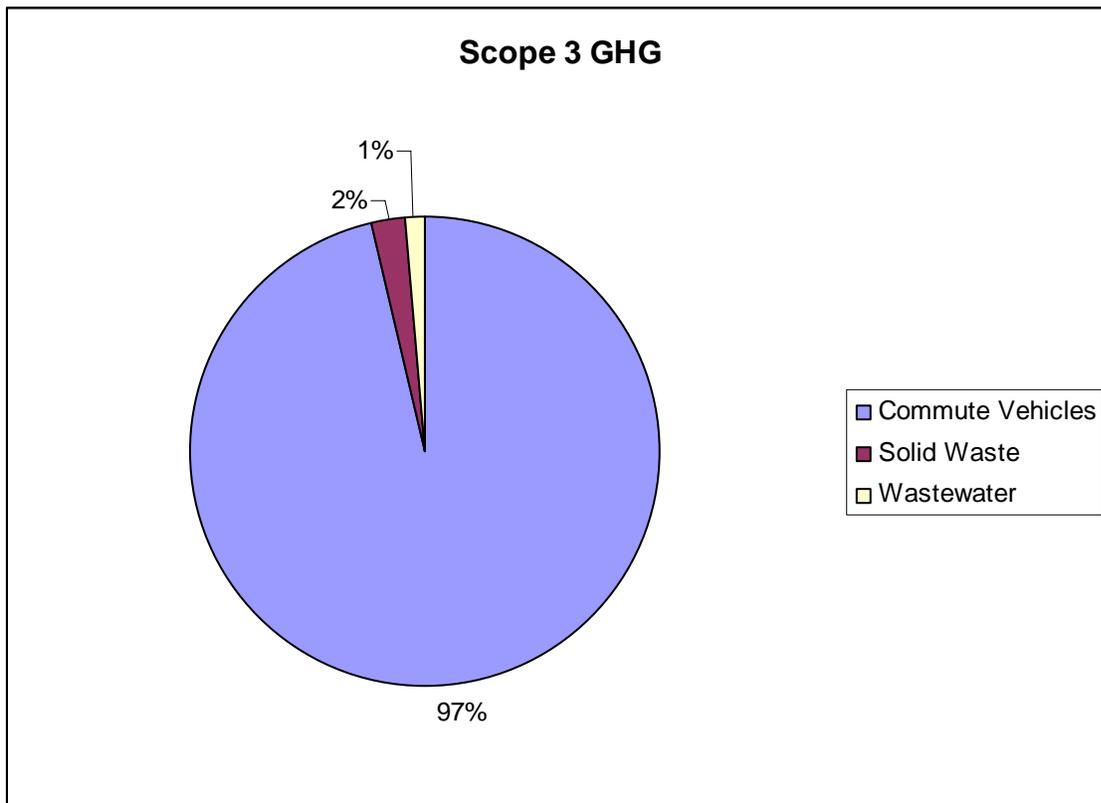


Figure 4-3 Summary of Scope 3 Emissions

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