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EMISSIONS FROM OIL AND GAS PRODUCTION FACILITIES

FINAL REPORT

TCEQ Contract 582-7-84003
Work Order No. 1

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LIST OF ACRONYMS

Acronym	Definition
API	American Petroleum Institute
CAPP	Canadian Association of Petroleum Producers
CBM	Coal Bed Methane
CERR	Consolidated Emissions Reporting Rule
CO	Carbon Monoxide
DOE	U.S. Department of Energy
EIA	Energy Information Administration
ERG	Eastern Research Group
GPA	Gas Processors Association
HARC	Houston Advanced Research Center
hp	Horsepower
H_2S	Hydrogen Sulfide
MMBBL	Million Barrels
MMBTU	Million British Thermal Units
MMS	Minerals Management Service
MMscf	Million Standard Cubic Feet
Mscf	Thousand Standard Cubic Feet
MW	Molecular Weight
NEI	National Emissions Inventory
NH_3	Ammonia
NIF	NEI Input Format
NO_x	Nitrogen Oxides
OFW	Offshore Federal Waters
OSW	Offshore State Waters
OE	Onshore Exploration
OP	Onshore Production
OSD	Ozone Season Daily
PM	Particulate Matter
PM_{10}	PM with particle diameter less than 10 micrometers
$PM_{2.5}$	PM with particle diameter less than 2.5 micrometers
SCC	Source Classification Code
scf	Standard Cubic Feet
SIP	State Implementation Plan
SO_2	Sulfur Dioxide
TCEQ	Texas Commission on Environmental Quality
TexAER	Texas Air Emissions Repository
THC	Total Hydrocarbons
TRC	Texas Railroad Commission
TXCO	Texas Exploration Company
US EPA	United States Environmental Protection Agency
VOC	Volatile Organic Compounds
WRAP	Western Regional Air Partnership
WYDEQ	Wyoming Department of Environmental Quality

EXECUTIVE SUMMARY

The purpose of this study was to compile a comprehensive emissions inventory for onshore and offshore oil and gas exploration and production facilities in Texas for the base year 2005. The inventory was compiled for criteria pollutant emissions as permissible with available emission factors. Attempts were also made to include lead and ammonia (NH_3) emissions as appropriate; however, this was not done due to a lack of credible emission factors for these pollutants. The emissions inventory will be used for general inventory compilation and tracking purposes, trends analysis, and potential control strategy development purposes. Related to this, the inventory will also potentially serve as improved input data to photochemical air quality dispersion modeling, emissions sensitivity analyses, State Implementation Plan (SIP), and rule development activities.

This project addressed the development of an emissions inventory for oil and gas industry sources in Texas that have not been well characterized previously. The oil and gas exploration and production industry is a large and complex one with many different potential sources of air pollution. The larger sources such as refineries, bulk plants, and large transmission/distribution stations are generally well identified and typically treated as major point sources for inventory purposes. The Texas Commission on Environmental Quality (TCEQ) already has good quality inventories on these sources. The industry, however, contains many smaller and much more diffuse sources that occur in the course of exploring for oil and gas and bringing these products to the marketplace. Many of these sources may be identified as non-point or area sources, and they have emissions below major source thresholds limits. These area sources are large in number and are geographically dispersed. Historically many of these area oil and gas sources have not been adequately inventoried. These "missing" source emissions, their identification and locations can be significant.

The goals of this study were to identify the extent of the area oil and gas source categories, including defining new categories not previously identified, and to develop preliminary baseline emissions estimates for as many of the identified categories as possible using readily available data from studies completed in the last few years. The emissions estimates were developed using top-down, area source methods (i.e., the inventory was not intended to be on a source-by-source, bottom-up basis). This approach was taken to be consistent with the resources and time limitations that are available for the project. The oil and gas industry in Texas is very large and diverse. Compiling an inventory on a point source basis for a state the size of Texas would be very resource intensive and costly. By applying these broader area source methods, preliminary emission estimates could be obtained that start to give some reference points for the level of emissions attributable to these previously uncharacterized sources. It also helps provide input on where effort should be placed in the future to refine and improve the data.

The oil and gas source categories that were the focus of initial investigations included the following. Sources were organized into three groups – onshore exploration, onshore production, and offshore production.

Exploration sources:

- Drilling Rigs
- Gas Well Completions
- Oil Well Completions
- Gas Well Pneumatic Devices
- Oil Well Pneumatic Devices

Production sources:

- Wellheads
- Compressor Engines
- Dehydrators
- Heater Treaters
- Oil and Condensate Storage Tanks
- Loading of Oil and Condensate for Transportation
- Pump and Piping Component Fugitive Losses
- Coal Bed Methane (CBM) Engines

Offshore platforms:

- Oil and Gas Exploration and Production Platforms Operating in Texas State Waters (0-10 miles from shore)
- Oil and Gas Platforms Operating in Federal Waters (>10-25 miles from shore)

These are the source types included in the emissions inventory. In some cases, these source categories have multiple emission sources associated with them. For example, for Drilling Rigs, emission estimates were assembled for drilling rig power engines and for mud degassing operations.

Emission estimates were constructed for each source at the county level. Both annual and ozone season daily emission estimates were calculated. Much of the activity data used to develop the emission estimates came from records maintained by the Texas Railroad Commission (TRC). The 2005 base year emission estimates were also projected to future years. Projection years included 2010, 2015, and 2020. A procedure involving the use of U.S Department of Energy (DOE), Energy Information Administration (EIA) oil and gas production growth estimates for the Texas region was used to perform the projections.

For emissions of nitrogen oxides (NO_x), onshore drilling rig engine and compressor engine sources were found to contribute the greatest amounts to statewide area source oil and gas emissions. These two categories were responsible for roughly 95% of statewide emissions from oil and gas area sources. The largest sources of volatile organic compounds (VOC), comprising 62.4% of the state area sources oil and gas total, were found to be onshore production glycol dehydrators (26.9%), onshore condensate storage tanks (22.9%), and onshore gas production wellheads (12.6%). Sulfur dioxide (SO_2) emissions were dominated by onshore drilling rig engines (97.4%). Similarly for carbon monoxide (CO), the largest oil and gas area sources were onshore production compressor engines (70.5%), onshore drilling rig engines (21.8%), offshore platform compressor engines (3.6%), and onshore production gas well completions (1.7%). Emissions of particulate matter (PM) from oil and gas area sources, PM_{10} and $PM_{2.5}$, were found to be dominated by onshore production drilling rig engines (53.8% for PM_{10} and 53.3% for

$PM_{2.5}$) and onshore compressor engines (42.5% for PM_{10} and 43% for $PM_{2.5}$). The final 2005 emission estimates were put into National Emissions Inventory (NEI) Input Format (NIF) to facilitate reporting to EPA under Consolidated Emissions Reporting Rule (CERR) requirements.

1.0 INTRODUCTION

1.1 Purpose and Objectives

The purpose of this study is to compile a comprehensive emissions inventory for onshore oil and gas exploration and production facilities in Texas and for offshore production platforms (within 25 miles of the Texas coast) for the base year 2005. The list of onshore oil and gas sources addressed in the study, as defined in the Work Order, is as follows.

Exploration sources including:

- Drilling Rigs
  - diesel engines
  - degassing of drilling muds
- Gas Well Completions
  - flaring
  - venting
- Oil Well Completions
  - flaring
  - venting
- Gas Well Pneumatic Devices
- Oil Well Pneumatic Devices

Production sources including:

- Wellheads
- Compressor Engines
- Dehydrators
- Heater Treaters
- Oil and Condensate Storage Tanks
- Loading of Oil and Condensate for Transportation
- Pump and Piping Component Fugitive Losses
- Coal Bed Methane (CBM) Pump Engines

Offshore oil and gas production platforms were inventoried in both state waters off the coast, which spans from shore out to a distance of 10 miles, and in federal waters out to a distance of 25 miles (basically the band between 10 and 25 miles). Emissions from oil and gas exploration sources were also addressed for the state waters area. The inventory was compiled for criteria pollutant emissions.

This study primarily pertains to the development of an emissions inventory for oil and gas industry sources in Texas that have not been well characterized previously. The oil and gas exploration and production industry is large and complex in Texas with many different potential sources of air pollution. The larger sources in the state such as refineries, bulk plants, and large transmission/distribution stations are generally well identified and typically treated as major point sources for inventory purposes. The TCEQ already has good quality inventories on these sources. The industry though contains many smaller and much more diffuse sources that occur in the course of exploring for oil and gas and bringing these products to the marketplace. Many

of these sources fit the definition of being non-point or area sources, i.e., they have emissions below major sources thresholds, they are large in number, and are geographically dispersed. Historically, many of these area oil and gas sources have not been adequately identified and inventoried. Identifying, locating, and quantifying these "missing" source emissions is a significant task.

The goals of this study are to identify the extent of these area oil and gas source categories, including defining new categories not previously inventoried, and to develop preliminary baseline emissions estimates for 2005 for as many of the identified categories as possible using currently available data (i.e., time and resources for extensive surveys and/or new source testing are not available). Studies within the last three years by TCEQ, the Houston Advanced Research Center (HARC), and the Western Regional Partnership (WRAP) have produced data and methods that can be applied for the purposes of this inventory (HARC, 2005; HARC, 2006a; HARC, 2006b; WRAP, 2005). The emissions estimates were developed using top-down, area source methods (i.e., the inventory was not estimated on a source-by-source, bottom-up basis). Compiling an inventory on a point source basis would be very resource intensive and take more time than was available for this study. By applying broader area source methods, preliminary emission estimates can be obtained that start to give some reference points for the level of emissions attributable to these previously uncharacterized sources. It also helps provide input on where effort should be placed in the future to refine and improve the data. The study results will be used for general inventory compilation and tracking purposes, trends analysis, and potential control strategy development purposes. The results can also serve as improved input data to photochemical air quality dispersion modeling, emissions sensitivity analyses, SIP planning, and possible rule development activities.

For planning purposes, the 2005 base year estimates were projected to future years 2010, 2015, and 2020. Also, the final base year inventory estimates were provided in National Emissions Inventory (NEI) Input Format (NIF) for the purposes of submittal to EPA in order to comply with Consolidated Emissions Reporting Rule (CERR) requirements, and to facilitate entry of the data into the state's TexAER (Texas Air Emissions Repository) database.

1.2 Report Organization

Section 2.0 of this report more thoroughly identifies the oil and gas source categories addressed in the emissions inventory and describes how each emission source is being treated in terms of the inventory development. The emissions aspects of each category are described, along with an identification of the pollutants being inventoried for each. Each emission source is assigned a Source Classification Code (SCC) for tracking purposes and a table of all SCCs is presented. Section 2.0 provides explanations of any assumptions or manipulations that had to be made to source categories to facilitate the development of area source emission estimates.

The summary results of the 2005 emissions inventory development process are presented in Section 3.0. Summary emissions tables are provided on a statewide and county level basis for both annual and ozone season daily (OSD) emissions. The emissions estimates are described in terms of known uncertainties and weaknesses, and suggestions for possible improvements are provided. Discussion and analysis is also provided to compare and contrast how sources rank

relative to each other for each pollutant. Emissions are also presented to show geographic concentrations by county.

Section 4.0 presents information and data on the projection of the 2005 base year estimates to three future years (2010, 2015, and 2020). The data and methods used to construct projection techniques are described and statewide and county level emission estimate are provided for all three projection years. Section 5.0 contains reference citations for the report.

The full documentation and detailed county level 2005 emissions estimates data for each inventoried source category are provided in Appendices A, B, and C. The appendices address the onshore exploration, onshore production, and offshore production source groupings, respectively. Each appendix discussion provides full and transparent documentation on how each category's estimates were derived, the procedures and assumptions used, and the input emission factor and activity data applied to determine all emission estimates.

2.0 CHARACTERIZATION OF OIL AND GAS SOURCES INVENTORIED

2.1 Definition of Oil and Gas Sources and SCCs

The majority of the list of onshore oil and gas exploration and production source categories addressed in this project was taken from a Western Regional Air Partnership (WRAP) study on area source oil and gas emissions (WRAP, 2005). In the WRAP study, volatile organic compounds (VOC), nitrogen oxides (NO_x), carbon monoxide (CO), and sulfur dioxide (SO_2) emission estimates were generated for several non-point oil and gas sources in 14 states of the WRAP region (note: not all applicable pollutants were estimated for every source). Many of these same sources are prevalent in Texas. Other oil and gas emissions sources were specified by TCEQ and in oil and gas industry data produced by the Minerals Management Service (MMS) for offshore oil and gas platforms in Texas state waters and federal waters (MMS, 2004; TCEQ, 2007b). The TCEQ provided information on the names and location coordinates for over 200 oil and gas platforms located within 25 miles of the Texas coastline. The MMS information characterizes emissions from 16 platform emission unit types (e.g., boiler, engines, turbines, amine units, glycol dehydrators, fugitives) at the equipment level for base year 2005. Currently, base year 2005 estimates are being finalized; however, MMS has provided authorization for TCEQ to use these draft data for the purposes of this project, provided the data are marked as draft and are not released, cited, quoted, or otherwise used outside of TCEQ until such time as MMS publishes the data as final.

In this project, the oil and gas source categories have been divided into three major groups: onshore exploration sources, onshore production sources, and offshore production platforms. For exploration and production, depending on the definition of the operations used, there is clearly some potential for overlap occurring between some emission sources, i.e., a source such as completion venting could be considered exploration or production. For the purposes of this project, exploration, production, and offshore sources are identified as follows.

Exploration sources include:

- Drilling Rigs
- Gas Well Completions
- Oil Well Completions
- Gas Well Pneumatic Devices
- Oil Well Pneumatic Devices

Production sources include:

- Wellheads
- Compressor Engines
- Dehydrators
- Heater Treaters
- Oil and Condensate Storage Tanks
- Loading of Oil and Condensate for Transportation
- Pump and Piping Component Fugitive Losses
- Coal Bed Methane Pump Engines

Offshore stationary sources include:

- Oil and Gas Exploration and Production Platforms Operating in Texas State Waters (sources 0-10 miles from shore)
- Oil and Gas Production Platforms Operating in Federal Waters (sources >10-25 miles from shore)

Emission totals in Section 3.0 are presented according to these groupings.

Table 2-1 (a, b, and c) provides a summary of the source categories evaluated in the emissions inventory (according to their grouping), the specific operations or processes that generate air emissions, and an identification of the pollutants associated with each source. Table 2-2 (organized as a, b, and c for the three groupings) further delineates these source category types into specific emission processes, and presents SCCs for each individual emissions process. For onshore exploration and production sources, most of the SCC assignments originate as new codes proposed by TCEQ (TCEQ, 2007a) or codes proposed by ERG as a result of assessing all of the emission processes included in the inventory. The offshore SCC assignments are a combination of ones on the official EPA list and ones proposed by ERG.

2.2 Emission and Activity Data Issues

This discussion further describes and clarifies the oil and gas emission sources included in the inventory. Factors affecting emissions are discussed and the rationales for using certain assumptions (related to source operation) for the purposes of the inventory are explained. General information is provided on how source emissions will be estimated. The detailed procedural description of the estimation processes and the accompanying input data and calculations are presented in Appendices A, B, and C. The inventory was compiled for criteria pollutant emissions as permissible with available emission factors. Attempts were also made to include lead and NH_3 emissions as appropriate; however, this was not done due to a lack of credible emission factors.

2.2.1 Onshore Exploration Sources

Drilling Rigs/Engines

This category pertains to the engines used to generate power to run drilling rigs in the exploration field. These engines are assumed to be burning diesel fuel. Emission factors for diesel-fired engines operating drilling rigs were taken from AP-42 (US EPA, 1996). Drilling rig engines were assumed to operate with a maximum horsepower (hp) greater than 600 hp (Engeser, 2004). For SO_2 emissions, the weight percent of sulfur used in the diesel fuel (low sulfur fuel) is assumed to be 3400 ppmv or 0.34% by weight for every county in Texas (EPA, 2004b). It is possible that some counties in Texas may be using fuels with a lower or higher sulfur content.

Table 2-1a. Identification of Source Categories Addressed in the Texas Oil and Gas Emission Inventory in the Onshore Exploration Grouping

Onshore Exploration Source Type	Specific Emission Sources	Potential Pollutants[a]
Drilling Rigs	Diesel engines to run electricity generators	SO_2, NO_x, VOC, PM_{10}, $PM_{2.5}$, CO
	Drill mud degassing (open pits or storage tanks)	VOC
Gas Well Completion	Emissions from flaring from the gas well completion phase	CO, NO_X, VOC
	Emissions from venting from the gas well completion phase	VOC
Oil Well Completion	Emissions from flaring from the oil well completion phase	CO, NO_X, VOC, SO_2
	Emissions from venting from the oil well completion phase	VOC
Gas Well Pneumatic Devices	Fugitive emissions from pneumatic devices used during gas well exploration and production	VOC
Oil Well Pneumatic Devices	Fugitive emissions from pneumatic devices used during oil well exploration and production	VOC

[a] PM = Particulate Matter

Table 2-1b. Identification of Source Categories Addressed in the Texas Oil and Gas Emission Inventory in the Onshore Production Grouping

Onshore Production Source Type	Specific Emission Sources	Potential Pollutants[a]
Oil and Gas Well Wellheads	Emissions from wellhead assemblies and rod pumps	VOC
Compressor Engines	Combustion emissions from compressor engines associated with oil and gas production	SO_2, NO_x, VOC, PM_{10}, $PM_{2.5}$, CO
Dehydrators/Separators	Emissions from glycol dehydrator reboilers	VOC
Heater Treaters	Emissions from natural gas-fired heater treaters	NO_x, CO
Oil and Condensate Storage Tanks	Working, breathing, and flashing losses from oil and condensate storage tanks	VOC
Loading of Oil and Condensate	Fugitive emissions from truck and/or railcar loading	VOC
Pump and Piping Component Fugitive Losses	Fugitive emissions from pumps and piping components	VOC
Coal Bed Methane Pump Engines	Natural gas engine emissions used to de-water coal beds	SO_2, NO_x, VOC, PM_{10}, $PM_{2.5}$, CO

[a] PM = Particulate Matter

Table 2-1c. Identification of Source Categories Addressed in the Texas Oil and Gas Emission Inventory in the Offshore Production Grouping

Offshore Production Source Type	Specific Emission Sources	Potential Pollutants[a]
Offshore Platforms – State Waters	Stack and fugitive process emissions for oil and natural gas platforms operating in the Texas state waters (0-10 miles from shore)	SO_2, NO_x, VOC, PM_{10}, $PM_{2.5}$, CO
Offshore Platforms – Federal Waters	Stack and fugitive process emissions for oil and natural gas platforms operating in the federal waters (>10-25 miles from shore)	SO_2, NO_x, VOC, PM_{10}, $PM_{2.5}$, CO

[a] PM = Particulate Matter

Table 2-2a. Assignment of SCCs to Texas Oil and Gas Sources in the Onshore Exploration Grouping

Onshore Exploration Source Types and Emission Processes	Proposed SCC	SCC Description (abbreviated)[a]
Drilling Rigs		
- Diesel Engines	2310001200	ERG proposed SCC; Drilling Rig Engines using diesel fuel
- Mud Degassing	2310001100	ERG proposed SCC; Mud Degassing Activities
Gas Well Completion – Flaring	2310021701	ERG proposed SCC; Flaring during Gas Well Completions
Gas Well Completion – Venting	2310021702	ERG proposed SCC; Venting during Gas Well Completions
Oil Well Completion – Flaring	2310011701	ERG proposed SCC; Flaring during Oil Well Completions
Oil Well Completion – Venting	2310011702	ERG proposed SCC; Venting during Oil Well Completions
Gas Well Pneumatic Pumps	2310021401	ERG proposed SCC; Gas Well Pneumatic Pumps
Oil Well Pneumatic Pumps	2310011401	ERG proposed SCC; Oil Well Pneumatic Pumps

[a]Unless otherwise noted, SCCs were obtained from EPA's official SCC list (US EPA, 2004a).

Table 2-2b. Assignment of SCCs to Texas Oil and Gas Sources in the Onshore Production Grouping

Onshore Production Source Types and Emission Processes	Proposed SCC	SCC Description (abbreviated)[a]
Oil Well – Wellhead	2310011450	ERG Proposed SCC; Onshore Oil Production – Wellhead Activities
Gas Well – Wellhead	2310021450	ERG Proposed SCC; Onshore Natural Gas Production – Wellhead Activities
Compressor Engines		
- 2-cycle, lean	2310021100	TCEQ TexAER SCC; Onshore Natural Gas Production – Compressor Engines: 2-cycle, lean
- 2-cycle, lean, less than 50hp	2310021101	TCEQ TexAER SCC; Onshore Natural Gas Production – Compressor Engines: 2-cycle, lean, less than 50hp
- 2-cycle, lean, 50-499hp	2310021102	ERG Proposed SCC; Onshore Natural Gas Production – Compressor Engines: 2-cycle, lean, 50-499hp
- 2-cycle, lean, 500+hp	2310021103	TCEQ TexAER SCC; Onshore Natural Gas Production – Compressor Engines: 2-cycle, lean, 500+hp
- 4-cycle, lean	2310021200	TCEQ TexAER SCC; Onshore Natural Gas Production – Compressor Engines: 4-cycle, lean
- 4-cycle, lean, less than 50hp	2310021201	TCEQ TexAER SCC; Onshore Natural Gas Production – Compressor Engines: 4-cycle, lean, less than 50hp
- 4-cycle, lean, 50-499hp	2310021202	TCEQ TexAER SCC; Onshore Natural Gas Production – Compressor Engines: 4-cycle, lean, 50-499hp
- 4-cycle, lean, 500+hp	2310021203	TCEQ TexAER SCC; Onshore Natural Gas Production – Compressor Engines: 4-cycle, lean, 500+hp
- 4-cycle, rich	2310021300	TCEQ TexAER SCC; Onshore Natural Gas Production – Compressor Engines: 4-cycle, rich
- 4-cycle, rich, less than 50hp	2310021301	TCEQ TexAER SCC; Onshore Natural Gas Production – Compressor Engines: 4-cycle, rich, less than 50hp
- 4-cycle, rich, 50-499hp	2310021302	TCEQ TexAER SCC; Onshore Natural Gas Production – Compressor Engines: 4-cycle, rich, 50-499hp
- 4-cycle, rich 500+hp	2310021303	TCEQ TexAER SCC; Onshore Natural Gas Production – Compressor Engines: 4-cycle, rich 500+hp
- 4-cycle, rich w/NSCR	2310021321	TCEQ TexAER SCC; Onshore Natural Gas Production – Compressor Engines: 4-cycle, rich w/NSCR
- 4-cycle, rich, less than 50hp w/NSCR	2310021331	TCEQ TexAER SCC; Onshore Natural Gas Production – Compressor Engines: 4-cycle, rich, less than 50hp w/NSCR

Table 2-2b. Assignment of SCCs to Texas Oil and Gas Sources in the Onshore Production Grouping (Continued)

Onshore Production Source Types and Emission Processes	Proposed SCC	SCC Description (abbreviated)[a]
- 4-cycle, rich, 50-499hp w/NSCR	2310021341	TCEQ TexAER SCC; Onshore Natural Gas Production – Compressor Engines: 4-cycle, rich, 50-499hp w/NSCR
- 4-cycle, rich, 500+hp w/NSCR	2310021351	TCEQ TexAER SCC; Onshore Natural Gas Production – Compressor Engines: 4-cycle, rich, 500+hp w/NSCR
Gas Well – Dehydrator	2310021400	TCEQ Proposed SCC; Onshore Natural Gas Production – Dehydrator
Oil Well – Heater Treater	2310011100	ERG Proposed SCC; Onshore Oil Production – Heater Treater
Oil Well – Oil Storage Tanks	2310011020	TCEQ Proposed SCC; Onshore Oil Production – Crude Oil Tank
Gas Well – Condensate Storage Tanks	2310011010	ERG Proposed SCC; Onshore Oil Production – Condensate Tank
Tank Truck/Railcar Loading – Oil	2310011201	ERG Proposed SCC; Onshore Oil Production – Tank Truck/Railcar Loading: Condensate
Tank Truck/Railcar Loading – Condensate	2310011202	ERG Proposed SCC; Onshore Oil Production – Tank Truck/Railcar Loading: Oil
Oil Well – Fugitive Emissions		
- Connection	2310011501	ERG Proposed SCC; Onshore Oil Production – Fugitives: Connectors
- Flange	2310011502	ERG Proposed SCC; Onshore Oil Production – Fugitives: Flanges
- Open End	2310011503	ERG Proposed SCC; Onshore Oil Production – Fugitives: Open Ended Lines
- Pump	2310011504	ERG Proposed SCC; Onshore Oil Production – Fugitives: Pumps
- Valve	2310011505	ERG Proposed SCC; Onshore Oil Production – Fugitives: Valves
- Other	2310011506	ERG Proposed SCC; Onshore Oil Production – Fugitives: Other
Gas Well – Fugitive Emissions		
- Connection	2310021501	ERG Proposed SCC; Onshore Natural Gas Production – Fugitives: Connectors
- Flange	2310021502	ERG Proposed SCC; Onshore Natural Gas Production – Fugitives: Flanges
- Open End	2310021503	ERG Proposed SCC; Onshore Natural Gas Production – Fugitives: Open Ended Lines
- Pump	2310021504	ERG Proposed SCC; Onshore Natural Gas Production – Fugitives: Pumps
- Valve	2310021505	ERG Proposed SCC; Onshore Natural Gas Production – Fugitives: Valves

Table 2-2b. Assignment of SCCs to Texas Oil and Gas Sources in the Onshore Production Grouping (Continued)

Onshore Production Source Types and Emission Processes	Proposed SCC	SCC Description (abbreviated)[a]
- Other	2310021506	ERG Proposed SCC; Onshore Natural Gas Production – Fugitives: Other
Coal Bed Methane Pump Engines	2310021800	ERG proposed SCC; Coal Bed Methane Pump Engines

[a]Unless otherwise noted, SCCs were obtained from EPA's official SCC list (US EPA, 2004a).

Table 2-2c. Assignment of SCCs to Texas Oil and Gas Sources in the Offshore Production Grouping

Offshore Production Source Types and Emission Processes	Proposed SCC	SCC Description (abbreviated)[a]
Offshore Platforms (State & Federal Waters)		
- Boiler/Heater/Treater, <10 MMBTU/hr	10200603	External Industrial Combustion: Natural Gas (<10 MMBTU/hr)
- Diesel Engine	20200102	Internal Industrial Combustion Reciprocating Engine: Diesel Oil
- Natural Gas Turbine	20200201	Internal Industrial Combustion: Turbine: Natural Gas
- Natural Gas Engine, 2-cycle lean	20200252	Internal Industrial Combustion: Natural Gas (2-cycle-lean)
- Natural Gas Engine, 4-cycle Rich	20200253	Internal Industrial Combustion: Natural Gas (4-cycle-rich)
- Natural Gas Engine, 4-cycle Clean	20200254	Internal Industrial Combustion: Natural Gas (4-cycle-lean)
- Natural Gas Engine, 2-cycle Clean	20200255	Internal Industrial Combustion: Natural Gas (2-cycle-clean)
- Natural Gas Engine, 4-cycle Clean	20200256	Internal Industrial Combustion: Natural Gas (4-cycle-clean)
- Cold Vents	31000123	Oil and Gas Production – Vents
- Losses from Flashing	31000132	Oil and Gas Production - Flashing Losses
- Pneumatic Pumps	31000224	Oil and Gas Production – Pneumatic Devices
- Glycol Dehydrators using Triethylene Glycol	31000301	Oil and Gas Production - Glycol Dehydrators using TEG
- Pressure Relief Valves	31000307	Oil and Gas Production - Relief Valves
- Fugitive Emissions: Other	31088811	Oil and Gas Production - Fugitive Emissions
- Storage Tank: Condensate	40400321	Oil and Gas Production – Storage Tank Condensate
- Storage Tank: Crude Oil	40400322	Oil and Gas Production – Storage Tank: Crude Oil
- Natural Gas Engines: 4-Cycle, Rich	2310002001	ERG Proposed SCC; Offshore Production – Compressor Engines: 4-cycle rich
- Storage Tanks - Condensate	2310002010	ERG Proposed SCC; Offshore Production - Storage Tanks: Condensate
- Storage Tanks - Crude Oil	2310002020	ERG Proposed SCC; Offshore Production - Storage Tanks: Crude Oil
- Natural Gas Turbines	2310002051	ERG Proposed SCC; Offshore Production – Turbines: Natural Gas
- Boilers/Heaters	2310002100	ERG Proposed SCC; Offshore Production – Boilers/Heaters: Natural Gas
- Diesel Engines	2310002105	ERG Proposed SCC; Offshore Production – Diesel Engines
- Drilling Rig Engines	2310002200	ERG Proposed SCC; Offshore Production – Drilling Rig Engines
- Loading: Barge - Oil	2310002201	ERG Proposed SCC; Offshore Production – Loading Operations via Barge: crude oil

Table 2-2c. Assignment of SCCs to Texas Oil and Gas Sources in the Offshore Production Grouping (Cont.)

Offshore Production Source Types and Emission Processes	Proposed SCC	SCC Description (abbreviated)[a]
- Mud Degassing	2310002210	ERG Proposed SCC; Offshore Production – Mud degassing activities
- Flare - pilot light	2310002301	ERG Proposed SCC; Offshore Production – Flares: continuous pilot light
- Flare - flaring	2310002305	ERG Proposed SCC; Offshore Production – Flares: Flaring Operations
- Glycol Dehydrators	2310002400	ERG Proposed SCC; Offshore Production – Glycol Dehydrators: triethylene glycol
- Pneumatic Pumps-Gas and Oil Wells	2310002401	ERG Proposed SCC; Offshore Production – Pneumatic Pumps: Gas and Oil Wells
- Pressure/Level Controllers	2310002411	ERG Proposed SCC; Offshore Production – Pressure/Level Controllers
- Cold Vents	2310002421	ERG Proposed SCC; Offshore Production – Cold Vents
- Fugitives - Connectors: gas streams	2310002501	ERG Proposed SCC; Offshore Production – Fugitives, Connectors: gas streams
- Fugitives - Flanges: gas streams	2310002502	ERG Proposed SCC; Offshore Production – Fugitives, Flanges: gas streams
- Fugitives - Valves: gas	2310002505	ERG Proposed SCC; Offshore Production – Fugitives, Valves: gas
- Fugitives - Other: gas	2310002506	ERG Proposed SCC; Offshore Production – Fugitives, Other: gas
- Fugitives - Connectors: oil streams	2310002511	ERG Proposed SCC; Offshore Production – Fugitives, Connectors: oil streams
- Fugitives - Flanges: oil	2310002512	ERG Proposed SCC; Offshore Production – Fugitives, Flanges: oil
- Fugitives - Valves: oil	2310002515	ERG Proposed SCC; Offshore Production – Fugitives, Valves: oil
- Fugitives - Other: oil	2310002516	ERG Proposed SCC; Offshore Production – Fugitives, Other: oil
- Fugitives - Connectors: oil/water streams	2310002521	ERG Proposed SCC; Offshore Production – Fugitives, Connectors: oil/water streams
- Fugitives - Flanges: oil/water	2310002522	ERG Proposed SCC; Offshore Production – Fugitives, Flanges: oil/water
- Fugitives - Valves: oil/water	2310002525	ERG Proposed SCC; Offshore Production – Fugitives, Valves: oil/water
- Fugitives - Other: oil/water	2310002526	ERG Proposed SCC; Offshore Production – Fugitives, Other: oil/water

[a]Unless otherwise noted, SCCs were obtained from EPA's official SCC list (US EPA, 2004a).

All exploratory oil and gas drilling in Texas requires a permit. On the Texas Railroad Commission (TRC) website, a listing of year 2005 approved drilling permits was available, with the assumption being made that this would be typical for actual drilling activities that occurred in 2005. It is possible that drilling permits approved in 2005, did not have actual drilling commence until 2006. Conversely, actual drilling may have taken place in 2005 under permit approvals made in 2004. An additional parameter retrieved for each approved permit is well depth.

For most of the drilling permit data, the "spud date", or the date in which drilling commenced, and the completed drilling date are included. Thus, actual number of drilling days can be calculated for each permit. Unfortunately, the effort required for obtaining this information for over 11,000 permits was time and resource prohibitive. As an alternative, representative drilling profiles were developed for each county and wellbore type (vertical, horizontal, directional, etc.) by obtaining the number of days drilled (from spud date and completed drilling date) for the permit with the maximum well depth. A total of 430 county-wellbore drilling profiles were developed and applied to over 11,000 permits. As expected, wellbore profiles that were "horizontal" took longer to drill significant depths when compared to "vertical" wellbores. Approximately 85% of identified drilling permits indicated the use of wellbore drilling. Using industry guidance, average horsepower ratings can be assigned for lightweight, intermediate, or heavyweight drilling operations (Engeser, 2004). These classifications are based on well depth. For example, lightweight rigs are generally used for well depths between 1,500 to 2,000 meters (4,900 – 6,500 feet). The average horsepower for lightweight rigs is 650 hp. Similar factors are available for intermediate and heavy weight rigs. Drilling operations are assumed to be 24-hours a day during the drilling period. Thus, total engine power output in terms of horsepower-hours (hp-hr) can be calculated for each permitted drilling operation, which in turn allows for the estimation of emissions.

Drilling Rigs/Mud Degassing

Various drilling fluids or muds are used during the drilling process to cool and lubricate the drill bit. These muds are returned to the surface contaminated with organic materials from the well. Upon reaching the surface, offgasing occurs and VOC are emitted into the air. No VOC emission factor was found in AP-42 or elsewhere for mud degassing operations occurring during drilling activities. However, a VOC emission factor can be derived using information from an MMS study for offshore platforms (MMS, 2004). The VOC emission factor for mud degassing was derived from a total hydrocarbon (THC) emission factor used by the MMS in their studies of platforms in the Gulf of Mexico. For drilling fluids using water-based muds, the THC emission factor is 881.81 lbs/day. To convert to a VOC emission factor, it was assumed that 8.61% of THCs are VOCs by weight (GPA, 2004), and this value was applied to develop a VOC emission factor:

$$EF_{VOC} = (881.81 \text{ lb THC/day}) * (\text{VOC wt\%})$$
$$EF_{VOC} = (881.81) * (8.61/100) = 75.93 \text{ lb VOC/day}$$

For mud degassing activities, the number of drilling days per operation (obtained from TRC data) will be applied to the VOC emission factor to determine emissions.

Oil and Gas Well Completions

After drilling and casing a well, it must be "completed." Completion is the process in which the well is enabled to produce oil or gas. Once the desired well depth is reached, the formation must be tested and evaluated to determine whether the well will be completed for production, or plugged and abandoned. To complete the well production, casing is installed and cemented and the drilling rig is dismantled and moved to the next site. A service rig is brought in to perforate the production casing and run production tubing. If no further pre-production servicing is needed, the christmas tree is installed and the production cycle begins. This category addresses emissions associated with the completion process at oil and gas wells.

Emission factors for gas and oil well completions are specified as flaring and venting activities. It was assumed that both activities occur during the well completion phase. Flaring emission factors for CO and NO_x were taken from AP-42 for Industrial Flares (US EPA, 1991). It is assumed that flares are smokeless, and thus no PM emissions are expected. There are no AP-42 flaring emission factors for SO_2 or VOC. The displacement equation will be used to calculate those emissions (see Completions discussion in Appendix A sections A.3 and A.4). Similarly, VOC emissions from venting activities were calculated using the displacement equation.

Well completion statistics were obtained from a resource known as The Drilling Observer, which summarizes well completion data that has been collected and archived by TRC (The Drilling Observer, 2007). Included in these statistics are the 24-hour potential test results of natural gas, condensate, and casinghead gas flow for each completed oil and gas well. Using this information, the daily volume of gas vented and/or flared can be calculated on a per well basis. The TRC regulations allow up to 10 days of venting after a well is completed, and then flaring must be used (TRC, 2007b). For this study, it is assumed conservatively that venting occurs for 10 days and flaring occurs on one day.

Oil and Gas Well Pneumatic Devices

Pneumatic devices powered by pressurized natural gas are widely used in the natural gas industry as liquid level controllers, pressure regulators, and valve controllers. As part of normal operation, pneumatic devices release or bleed natural gas to the atmosphere and, as such, are a source of VOC emissions. The extent of the emissions depends largely on the design of the device in use (US EPA, 2003).

No available VOC emission factors for gas-actuated pneumatic pumps used during drilling and production activities could be located. However, the WRAP study assumed an average fuel usage rate of 5 scf/hr of natural gas used to run a pneumatic pump (WRAP, 2005). For oil wells, the average VOC weight percent is 33.20% of the casinghead gas; for gas wells, the average VOC weight percent of the dry gas is 8.61% and for condensate gas it is 5.39% (GPA, 2004).

Actual operating oil and gas well counts by county were retrieved from the TRC (TRC, 2005a; TRC 2005b), yielding total pumps on a county basis.

2.2.2 Onshore Production Sources

Oil and Gas Wellheads

The wellhead is the part of an oil or gas well that terminates at the surface whether on land or offshore, where oil or gas products can be withdrawn. The primary function of the wellhead is to hold the casings and the production tubing of the well. On top of the wellhead sits the tubing hanger, from which the production tubing is run. The well christmas tree rests on top of the tubing hanger, as well as surface flow-control facilities in preparation for the production phase of the well. The wellhead is a source of VOC emissions from various fugitive outlets.

The AP-42 emission factor used to calculate VOC emissions from oil wellheads is based on the number of oil wellheads in place. The TRC collects and maintains oil wellhead counts by county in Texas (TRC, 2005a). The AP-42 emission factor for VOC emissions from gas wellheads is based on gas production. Gas production data by county in Texas is also available from the TRC (TRC, 2005c).

Compressor Engines

This category concerns gas field compressor engines used to boost the wellhead pressure of natural gas so that it can be injected into gathering lines and moved into subsequent processing stages of the gas industry. Reciprocating engines, fueled with raw natural gas, are normally used to drive gas field compressors. The results of 2005 and 2006 studies of natural gas compressor engines by the HARC were applied for this project to generate emission factors for engines at oil and gas production facilities (HARC, 2005; HARC, 2006a). Emission factors were calculated using the following equation provided in the HARC report:

$$EF_{ijk} = F_{1i} * F_{2j} * C_i * H_j * EF_{jk} * 1/2000$$

Where:

EF_{ijk} = Emission factor for county i, for engine type j, and pollutant k (tons/MSCF)
F_{1i} = Fraction of wells requiring compression in county i
F_{2j} = Fraction of compression load represented by engines of type j
C_i = Compression requirements for county i (hp-hr/MSCF)
H_j = Brake specific fuel consumption for engine type j (MMBtu/hp-hr)
EF_{jk} = Emission factor for engine type j, and pollutant k (lb/MMBtu)
1/2000 = Conversion from lbs of emissions to tons of emissions

Although county-specific data are not available for all these variables, the HARC study developed compression requirements and compression loads for three distinct districts in eastern Texas, including one attainment area and two nonattainment areas (Houston and Dallas). For this project, these data were applied to the other Texas counties, according to attainment status, to generate county-specific emission factors for compressor engines.

The HARC study assumed the fraction of wells requiring compression is equal to the fraction of wells greater than one year old (HARC, 2005). The fraction of wells greater than one

year old was relatively constant in the three districts examined by the HARC study. For this inventory project, it was assumed that this fraction remains constant across the entire state for the purpose of estimating emissions from compressor engines.

While the initial report (HARC, 2005) focused on engines less than 500 hp, the follow-up report (HARC, 2006a) included engines with greater than 500 hp and also provided a more detailed breakdown of engines less than 500 hp. The distribution of engine types presented in the 2006 follow-up report was used for this inventory study to estimate the fractions of various engine types in attainment and nonattainment areas of Texas. The compression requirements in the three districts included in the previous HARC study were relatively consistent. An average of these factors was applied to the entire state in both attainment and nonattainment areas.

The HARC study selected representative engine models for each category of engine and used the average fuel consumption for each of those engines to represent the fuel consumption for each of those engine types as a whole. For this oil and gas inventory study, the fuel consumption data for those same representative engines was used to estimate fuel consumption from each engine type.

Pollutant- and engine-specific emission factors were taken from AP-42 to estimate pollutant emissions from each engine type based on the county-by-county breakdown of engine use described above. Gas production data, the basis for the emissions estimation equation, were obtained from county-specific production data collected by the TRC.

Dehydrators

Glycol dehydrators are used by the natural gas industry to remove water from raw natural gas to improve its quality for sale, and to help prevent corrosion in downstream pipelines. As the dehydrator system removes moisture from the gas, some methane and VOC is also absorbed and then lost to the atmosphere in the glycol reboiler process. For this project, uncontrolled VOC emissions from dehydrators were estimated using a gas production-based emission factor provided by the Wyoming Department of Environmental Quality (WYDEQ) for use in the WRAP study (WRAP, 2005). The emission factor was applied to Texas county gas production figures obtained from the TRC.

Heater Treaters

Heater treaters are devices used at oil wells to separate oil-water emulsions that are present. These devices are found in both horizontal and vertical designs with a firebox on the bottom. The units are usually fueled by natural gas or demulsified crude oil. Emissions from the fuel combustion process are being estimated in this project.

Uncontrolled NO_X and CO emissions from heater treaters were estimated using the emission factors provided by the WYDEQ for use in the WRAP oil and gas sources inventory report (WRAP, 2005). The emission factors are based on the quantity of oil produced, and oil production data by county was obtained from the TRC (TRC, 2005c).

Oil and Condensate Storage Tanks

At oil and gas wells, oil and condensate are collected in storage tanks prior to being transferred for processing. The storage tanks are sources of VOC emissions from working, breathing, and flashing losses. Uncontrolled VOC emissions from oil and condensate storage tanks were calculated using emission factors presented for comparison in the study "VOC Emissions from Oil and Condensate Storage Tanks" prepared by the HARC in October 2006 (HARC, 2006b). The emission factors used came from factors developed and published by the WYDEQ. While the HARC study made emission measurements at 33 tank batteries in three geographic areas of Texas and calculated average values, the confidence intervals of the results were very large and the averages themselves were considerably higher than established emission factors from both Wyoming and Colorado (see WRAP, 2005). Because of this high degree of data uncertainty with the HARC study measurements, the WYDEQ emission factors were selected as the best choice to estimate VOC emissions for oil and condensate storage tanks. The emission factors are applied to county-specific oil and condensate production figures obtained from the TRC (TRC, 2005c).

Oil and Condensate Loading

Oil and condensate stored in storage tanks is transferred to trucks and railcars for shipment for further processing. Fugitive VOC emissions are released from these loading processes. Emissions from the loading of oil and condensate were estimated using an AP-42 equation (US EPA, 1995a) and county-specific temperature data for Texas. The AP-42 equation to calculate loadout emission factors is:

$$L_L = 12.46 * S * P * M / T$$

Where:

L_L = Loading loss (lb/1,000 gal of liquid loaded)
S = Saturation factor (based on type of loading operation)
P = True vapor pressure of liquid loaded (psia)
M = Molecular weight of tank vapors (lb/lb-mole)
T = Temperature of bulk liquid loaded (^oR)

To determine the saturation factor, the type of loading operation employed throughout the state of Texas is assumed to be submerged loading with a dedicated vapor balance (S = 1.00 in the equation above). The true vapor pressure of oil and condensate was determined by using average temperature data for each county in Texas and temperature-dependent vapor pressures of crude oil from AP-42. Temperature data from 87 weather stations throughout Texas were obtained and isotherms were developed to estimate average annual temperatures for each county in Texas. These temperatures determined both the true vapor pressure using AP-42 data and the average temperature of the bulk liquid (T). The molecular weight of tank vapors was assumed constant and equal to AP-42 data for crude oil (50 lb/lb-mole) and gasoline (RVP 7) (68 lb/lb-mole) at 60°F for oil and condensate, respectively. The gasoline value was used for condensate since no specific number for condensate was available.

The AP-42 equation to calculate temperature-dependent emission factors for loadout losses generates an emission factor based on the amount of liquid loaded (US EPA, 1995a). The calculated emission factors were applied to the amount of oil and condensate produced in each county, which was obtained from data provided by the TRC (TRC, 2005c).

Pump and Piping Component Fugitive Losses

At producing well sites, there are numerous pumps and piping configurations used to move oil and gas products and get them into the processing and distribution systems. These pieces of equipment contain numerous components such flanges, valves, and seals that are potential sources of fugitive VOC emissions. Emissions from these sources were estimated for the purposes of this inventory. Fugitive (uncontrolled) emissions from pump and piping components were estimated using emission factors developed by the American Petroleum Institute (API) in their publication number 4615 (API, 1995). These API emission factors are available for connections, flanges, open ends, pumps, valves, and other (including instruments, loading arms, pressure relief valves, stuffing boxes, compressor seals, dump lever arms, and vents) in units of lb/component-day for both gas and oil service. The API factors were developed for THC emissions. Therefore, the THC factors were multiplied by the average weight fraction of VOCs in onshore light crude and onshore gas production (0.292 and 0.035, respectively) to obtain the VOC emission factors used in the inventory.

The API emission factors for fugitive VOC emissions from pump and piping components are on a "per component" basis. In order to apply these "per component" factors on a county basis, average equipment counts for oil and gas facilities were obtained. The most complete and descriptive information found on component counts came from a study conducted by the Canadian Association of Petroleum Producers (CAPP, 1999). These data provide the numbers of valves, connectors, pressure relief valves and open-ended lines in both gas and liquid service at a typical battery. According to the results of the 33 batteries surveyed for HARC's study of "VOC Emissions from Oil and Condensate Storage Tanks" (HARC, 2006b) and HARC's "Natural Gas Compressor Engine Survey for Gas Production and Processing Facilities" (HARC, 2005), the average number of wellheads served per battery is 2.8. These factors were used in conjunction with county wellhead data to estimate fugitive emissions from pump and piping components.

Coal Bed Methane Sources

Emissions from coalbed methane (CBM) pumps were on the initial source category list considered for this inventory. CBM is natural gas that can be extracted from coal seams, and is high in methane content. Emissions occur from pumping the water from the well (or dewatering the coal seam) using small pumps. CBM production is a major natural gas source in some western states, such as Wyoming, Colorado, and New Mexico. In 2001, the first CBM field in Texas was discovered in the Sacatosa (Olmos) Field in Maverick County, TX. From 2001 to 2004, attempts were made by The Texas Exploration Company (TXCO) to have CBM be a viable, economic option for natural gas production (TXCO, 2004). Nearly 50 wells were drilled during that time. However, TXCO sold their CBM operations to Encana in 2005, and it is believed that CBM production was halted for 2005. Thus, no emission estimates were developed for CBM pumps for the Maverick County site for 2005.

2.2.3 Offshore Production Sources

This category addresses emissions from oil and gas platforms in state and federal waters off the coast of Texas. State waters are defined to be the area lying 0 – 10 miles from shore, while federal waters are the area >10 – 25 miles from shore. For the state waters area, exploration and production sources are addressed, while in federal waters only production source emissions are inventoried. Emission estimates for these sources were determined in several ways. Emission estimates for the federal waters sources were obtained directly from the 2005 draft emission inventory for oil and gas platforms in the Gulf of Mexico produced by MMS (MMS, 2007). As of August 2007, the MMS inventory data and report are considered draft, and while MMS is allowing the emission estimate data to be used for the purposes of this TCEQ project, no data are to be published, cited, quoted, or released outside of TCEQ until such time that MMS publishes the 2005 results as final.

State waters estimates were derived by a combination of approaches. The TCEQ industrial point source group supplied emission estimate data for five production platforms in state waters. Other information on the number and locations of additional platforms in state waters was developed from TRC data and data provided by the TCEQ Project Representative.

The five platforms provided by TCEQ represent a portion of the total facilities operating in Texas state waters. Based on production information, characteristics, and fuel consumption (as outlined in Appendix C.2), it is estimated that there are 17 oil platforms and 18 natural gas platforms operating in Texas state waters. To calculate emissions for all platforms operating in Texas state waters, a model platform with typical equipment types and counts was developed. Operating parameters for the model platform equipment types were developed using data from the 2005 MMS dataset (i.e., platforms included in the MMS 2005 inventory of platforms in federal waters). Information on typical hours of operation, fuel input rate, fuel usage rate, and fuel type were used to develop combustion source profiles. Other information, such as drilling days, barge loading of oil, and total oil and condensate produced were obtained from the TRC website and used to model evaporative losses. Once the model platform was developed, it was applied to the estimated number of platforms to generate total state waters activity. The total activity data was then apportioned to the appropriate offshore county via oil and gas production for 2005.

3.0 SUMMARY OF 2005 BASE YEAR EMISSIONS

This section of the project report presents summarized results of the Texas area source oil and gas emission inventory development effort. Emission inventory estimates are presented on both statewide and county-specific bases according to the previously identified groupings of onshore exploration sources, onshore production sources, and offshore production sources (Section 3.1). In addition to presenting the inventory results, discussion is provided on the strengths and weaknesses of the inventory, inventory uncertainties, and possible improvements that can be made to the emission estimates. Section 3.2 describes how the various individual source categories compare and rank relative to each other for each of the estimated pollutants. Section 3.3 provides input on the level of emissions per county and what counties represent the largest share of statewide emissions. In Section 3.4, emissions are examined in terms of county attainment/nonattainment designations. The distribution of emissions by designation is presented.

3.1 Oil and Gas Emissions Summary

For the 2005 base year, emission estimates were prepared on both an annual and ozone season daily (OSD) basis. The specific details on how each category's emissions were calculated can be found in Appendix A (for onshore exploration sources), Appendix B (for onshore production sources), and Appendix C (for offshore production sources). Any required derivations of activity or emission factor data are explained, and all data used for the derivations are shown. All applied equations are presented and discussed, and every variable, constant, and conversion factor used is defined and documented. Each source appendix section presents emission estimates (in tabular form) on an SCC basis for every applicable county in the state. All of these individual emissions data are summed to provide the tables in Section 3.0. Electronic Excel® spreadsheet files are provided along with this hard copy report that mimic all of the information in the documentation appendices.

Table 3-1 presents a summary of annual statewide criteria pollutant emissions from individual area source oil and gas categories. Table 3-2 presents the same statewide information, but for emissions on an OSD basis as opposed to annual. The emissions data in Tables 3-1 and 3-2 are organized by the exploration, production, and offshore (divided into state and federal waters) groupings. As shown in Table 3-1, the largest amount of CO emissions (70.6%) comes from onshore production sources (primarily from natural gas compressor engines). Emissions of NO_x are dominated by onshore exploration (54.2%) and onshore production sources (41.6%). Drilling rig engines are the most significant NO_x exploration category, while compressor engines are the major production-related NO_x source.

For VOC emissions, onshore production sources make up 85.1% of the total VOC and onshore exploration sources at 14.3%. The chief production sources contributing to VOC are glycol dehydrators (26.9%), condensate storage tanks (22.9%), and gas wellheads (12.6%). The onshore exploration grouping, namely drilling rig engines, constitute 98.4% of SO_2 emissions. Drilling rig engines (onshore exploration) and compressor engines (onshore production) together are responsible for roughly 96.4% of PM (PM_{10} and $PM_{2.5}$) emissions. The source category contributions are summarized by pollutant in Table 3-3.

Table 3-1. Summary of Annual Statewide Criteria Pollutant Emissions

Oil and Gas Emission Sources	Annual Emissions (tons/yr)					
	CO	**NO_X**	**PM_{10}**	**$PM_{2.5}$**	**SO_2**	**VOC**
Onshore Exploration						
Drilling Rig Engines	27,442	119,647	1,998	1,954	13,697	3,183
Mud Degassing	--	--	--	--	--	10,674
Pneumatic Pumps-Gas Wells	--	--	--	--	--	73,474
Pneumatic Pumps-Oil Wells	--	--	--	--	--	19,764
Well Completions: Gas Wells	2,180	401	--	--	--	19,764
Well Completions: Oil Wells	74	14	--	--	138	13,145
Onshore Exploration Total	29,695	120,061	1,998	1,954	13,835	120,240
Onshore Production						
Fugitives - All Components	--	--	--	--	--	42,652
Glycol Dehydrators	--	--	--	--	--	225,860
Heater Treater	195	977	--	--	--	--
Loading: Truck/Railcar - Condensate	--	--	--	--	--	6,188
Loading: Truck/Railcar - Oil	--	--	--	--	--	26,691
Natural Gas Compressor Engines: All types	88,754	91,021	1,578	1,578	44	5,058
Storage Tanks - Condensate	--	--	--	--	--	192,744
Storage Tanks - Crude Oil	--	--	--	--	--	76,552
Wellheads - Gas Production	--	--	--	--	--	105,881
Wellheads - Oil Production	--	--	--	--	--	34,315
Onshore Production Total	88,949	91,998	1,578	1,578	44	715,941
Offshore-State Waters (0-10 miles from TX coast)						
Boilers/Heaters	14	16	0.3	0.3	0.1	1
Cold Vents	--	--	--	--	--	986
Diesel Engines	217	1,006	71	71	78	75
Drilling Rig Engines	123	537	9	9	61	14
Flares	614	114	<0.1	<0.1	1	10
Fugitives - All Components	--	--	--	--	--	520
Glycol Dehydrators	--	--	--	--	--	189
Loading: Barge – Oil	--	--	--	--	--	1
Mud Degassing	--	--	--	--	--	70
Natural Gas Compressor Engines: All types	861	847	11	11	0.4	25
Natural Gas Turbines	851	3,321	20	20	36	22
Pneumatic Pumps-Gas and Oil Wells	--	--	--	--	--	29
Pressure/Level Controllers	--	--	--	--	--	1
Storage Tanks - Condensate	--	--	--	--	--	1,982
Storage Tanks - Crude Oil	--	--	--	--	--	99
Offshore-State Waters Total	2,680	5,841	110	110	177	4,025

Table 3-1. Summary of Annual Statewide Criteria Pollutant Emissions (Continued)

Oil and Gas Emission Sources	Annual Emissions (tons/yr)					
	CO	NO_X	PM_{10}	$PM_{2.5}$	SO_2	VOC
Offshore-Federal Waters (within 10-25 miles of TX coast)						
Boilers/Heaters	5	6	0.1	0.1	<0.1	0.3
Cold Vents	--	--	--	--	--	155
Diesel Engines	32	141	8	8	6	9
Fugitives - All components	--	--	--	--	--	667
Glycol Dehydrators	--	--	--	--	--	43
Natural Gas Compressor Engines: All types	4,585	3,225	16	16	1	87
Natural Gas Turbines	22	86	1	1	0.2	1
Pneumatic Pumps-Gas and Oil Wells	--	--	--	--	--	63
Pressure/Level Controllers	--	--	--	--	--	25
Storage Tanks - Condensate	--	--	--	--	--	1
Storage Tanks - Crude Oil	--	--	--	--	--	37
Storage Tanks - Flashing Losses	--	--	--	--	--	0.1
Offshore-Federal Waters Total	4,644	3,457	25	25	7	1,088
Grand Total - All Sources	125,968	221,357	3,711	3,667	14,064	841,295

Table 3-2. Summary of Ozone Season Daily (OSD) Statewide Criteria Pollutant Emissions

Oil and Gas Emission Sources	Ozone Season Daily (tons/day)					
	CO	NO_X	PM_{10}	$PM_{2.5}$	SO_2	VOC
Onshore Exploration						
Drilling Rig Engines	74.82	326.21	5.45	5.33	37.34	8.68
Mud Degassing	--	--	--	--	--	29.10
Pneumatic Pumps-Gas Wells	--	--	--	--	--	200.21
Pneumatic Pumps-Oil Wells	--	--	--	--	--	182.12
Well Completions: Gas Wells	5.94	1.09	--	--	--	53.88
Well Completions: Oil Wells	0.20	0.04	--	--	0.38	35.81
Onshore Exploration Total	80.96	327.33	5.45	5.33	37.72	327.88
Onshore Production						
Fugitives - All Components	--	--	--	--	--	116.22
Glycol Dehydrators	--	--	--	--	--	615.51
Heater Treater	0.53	2.66	--	--	--	--
Loading: Truck/Railcar - Condensate	--	--	--	--	--	16.86
Loading: Truck/Railcar – Oil	--	--	--	--	--	72.71
Natural Gas Compressor Engines: All types	241.88	248.06	4.30	4.30	0.12	13.78
Storage Tanks – Condensate	--	--	--	--	--	525.27
Storage Tanks - Crude Oil	--	--	--	--	--	208.54
Wellheads - Gas Production	--	--	--	--	--	288.55
Wellheads - Oil Production	--	--	--	--	--	93.50
Onshore Production Total	242.41	250.72	4.30	4.30	0.12	1,950.95
Offshore-State Waters (0-10 miles from TX coast)						
Boilers/Heaters	0.04	0.04	<0.01	<0.01	<0.01	<0.01
Cold Vents	--	--	--	--	--	2.68
Diesel Engines	0.59	2.74	0.19	0.19	0.21	0.20
Drilling Rig Engines	0.34	1.46	0.02	0.02	0.17	0.04
Flares	1.67	0.31	<0.01	<0.01	<0.01	0.03
Fugitives - All Components	--	--	--	--	--	1.42
Glycol Dehydrators	--	--	--	--	--	0.52
Loading: Barge – Oil	--	--	--	--	--	<0.01
Mud Degassing	--	--	--	--	--	0.19
Natural Gas Compressor Engines: All types	2.35	2.30	0.03	0.03	<0.01	0.07
Natural Gas Turbines	2.32	9.04	0.05	0.05	0.10	0.06
Pneumatic Pumps-Gas and Oil Wells	--	--	--	--	--	0.08
Pressure/Level Controllers	--	--	--	--	--	<0.01
Storage Tanks – Condensate	--	--	--	--	--	5.40
Storage Tanks - Crude Oil	--	--	--	--	--	0.27
Offshore-State Waters Total	7.30	15.90	0.30	0.30	0.48	10.95

Table 3-2. Summary of Ozone Season Daily (OSD) Statewide Criteria Pollutant Emissions (Continued)

Oil and Gas Emission Sources	Ozone Season Daily (tons/day)					
	CO	NO_X	PM_{10}	$PM_{2.5}$	SO_2	VOC
Offshore-Federal Waters (within 10-25 miles of TX coast)						
Boilers/Heaters	0.01	0.02	<0.01	<0.01	<0.01	<0.01
Cold Vents	--	--	--	--	--	0.42
Diesel Engines	0.09	0.38	0.02	0.02	0.02	0.02
Fugitives - All components	--	--	--	--	--	1.82
Glycol Dehydrators	--	--	--	--	--	0.12
Natural Gas Compressor Engines: All types	12.49	8.78	0.04	0.04	<0.01	0.24
Natural Gas Turbines	0.06	0.23	<0.01	<0.01	<0.01	<0.01
Pneumatic Pumps-Gas and Oil Wells	--	--	--	--	--	0.17
Pressure/Level Controllers	--	--	--	--	--	0.07
Storage Tanks – Condensate	--	--	--	--	--	<0.01
Storage Tanks - Crude Oil	--	--	--	--	--	0.10
Storage Tanks - Flashing Losses	--	--	--	--	--	<0.01
Offshore-Federal Waters Total	12.65	9.41	0.07	0.07	0.02	2.96
Grand Total - All Sources	343.31	603.37	10.11	9.99	38.34	2,292.55

Table 3-3. Summary of Oil and Gas Category Emission Contribution Rankings by Pollutant

CO Emissions Contributions	NO_x Emissions Contributions	VOC Emissions Contributions	PM_{10} Emissions Contributions	$PM_{2.5}$ Emissions Contributions	SO_2 Emissions Contributions
Compressor Engines (OP) – 70.5%	Drilling Rig Engines (OE) – 54.1%	Glycol Dehydrators (OP) – 26.9%	Drilling Rig Engines (OE) - 53.8%	Drilling Rig Engines (OE) - 53.3%	Drilling Rig Engines (OE) – 97.4%
Drilling Rig Engines (OE) – 21.8%	Compressor Engines (OP) – 41.2%	Condensate Storage Tanks (OP) – 22.9%	Compressor Engines (OP) – 42.5%	Compressor Engines (OP) – 43%	Oil Well Completions (OE) – 1.0%
Gas Well Completions (OE) – 1.7%	Natural Gas Turbines (OSW) – 1.5%	Gas Wellheads (OP) – 12.6%	Diesel Engines (OSW) – 1.9%	Diesel Engines (OSW) – 1.9%	All others - <1% each
All others - <1% each	Compressor Engines (OFW) – 1.5%	Crude Oil Storage Tanks (OP) – 9.1%	All others - <1% each	All others - <1% each	
	All others - <1% each	Gas & Oil Well Pneumatic Devices (OE) – 8.7%			
		Pump & Piping Fugitives (OP) – 5.1%			
		Oil Wellheads (OP) – 4.1%			
		Oil Loading (OP) – 3.2%			
		Gas Well Completions (OE) – 2.4%			
		Oil Well Completions (OE) – 1.6%			
		Mud Degassing (OE) – 1.3%			
		All others - <1% each			

OE = Onshore Exploration
OP = Onshore Production
OSW = Offshore State Waters
OFW = Offshore Federal Waters

Tables 3-4a, 3-4b, and 3-4c provide a view of criteria pollutant emissions at the individual county level. Table 3-4a lists annual and OSD emissions estimates collectively for all onshore exploration sources. The county level estimates for each specific exploration category are detailed in Appendix A. Similarly, Tables 3-4b and 3-4c present county level estimates for onshore production and offshore production categories, respectively. Appendix B provides county-specific estimates and documentation for all onshore production categories. Emissions from offshore production sources in state and federal waters are addressed by county and lease block in Appendix C.

One of the greatest uncertainties regarding the emissions inventory has to be the potential existence of emission controls at onshore sources. Attempts to gather input on the likelihood and extent of controls did not yield much information. Since many of these operations would be covered by the TCEQ permit-by-rule program, calls were made to these contacts to try and determine if there was any state data on the extent of controls. Essentially no useful information in regards to controls could be identified. Within the resource constraints of this project, it was not feasible to conduct an investigation into this specific issue. As described in the previous Task 2 Technical Memorandum, essentially all of the onshore exploration and production source estimates reflect uncontrolled emissions. This is particularly important for two of the categories found to be prominent VOC emitters – glycol dehydrators and condensate storage tanks. If a significant number of these units do have VOC controls, the estimated inventory results for VOC would be impacted. In addition to the permit-by-rule for oil and gas sources, a specific TCEQ rule (Rule §115.112) is in effect for VOC storage. That rule applies to oil and condensate storage on a per tank/tank battery basis based on total throughput. Since this category was addressed as an area source for this inventory, determining the rule applicability for all of the tanks/tank batteries in Texas was beyond the resources and feasibility of this project. Additional investigation would be needed to estimate tank/tank battery throughputs such that possible rule applicability and control impacts could be assessed.

As with any inventory development process, assumptions and concessions have to be made because of lack of data and time and resource limitations. The estimation procedures used in this inventory were detailed in the previous Task 2 Technical Memorandum and approved by TCEQ. These procedures represent sound and valid estimation techniques; however, if future improvements could be made, the overall quality of the resulting emission estimates could be improved. Some of these possible improvements are listed below.

Drilling Rig Engines: develop data on actual fuel usage and/or rig horsepower sizes. If these data are too cumbersome to obtain, then get the actual number of drilling days. These data should eventually be available from the TRC. However, it should be noted that the drilling profile days profiles approach used in the inventory represents a much more accurate level of drilling than just using an arbitrary number (e.g., like 15 days per 10,000 feet).

Table 3-4a. County-Level Annual and Ozone Season Daily (OSD) Criteria Pollutant Emissions for Exploration Sources

Texas County/FIPS	CO-ANN tons/yr	CO-OSD tons/day	NO_X-ANN tons/yr	NO_X-OSD tons/day	PM_{10}-ANN tons/yr	PM_{10}-OSD tons/day	$PM_{2.5}$-ANN tons/yr	$PM_{2.5}$-OSD tons/day	SO_2-ANN tons/yr	SO_2-OSD tons/day	VOC-ANN tons/yr	VOC-OSD tons/day
Anderson/48001	45.3	0.123	196.6	0.535	3.3	0.009	3.2	0.009	22.5	0.061	257.1	0.700
Andrews/48003	72.2	0.197	307.3	0.837	5.1	0.014	5.0	0.014	38.5	0.105	3324.6	9.054
Angelina/48005	24.0	0.065	97.0	0.264	1.6	0.004	1.6	0.004	11.1	0.030	27.9	0.076
Aransas/48007	5.1	0.014	19.8	0.054	0.3	0.001	0.3	0.001	2.8	0.008	72.0	0.196
Archer/48009	35.8	0.097	156.0	0.425	2.6	0.007	2.5	0.007	17.9	0.049	1395.0	3.799
Armstrong/48011												
Atascosa/48013	23.7	0.065	102.3	0.279	1.7	0.005	1.7	0.005	11.7	0.032	536.3	1.462
Austin/48015	24.3	0.066	93.8	0.256	1.6	0.004	1.5	0.004	11.2	0.031	137.5	0.375
Bailey/48017												
Bandera/48019											0.4	0.001
Bastrop/48021											144.3	0.393
Baylor/48023	3.7	0.010	16.0	0.044	0.3	0.001	0.3	0.001	1.8	0.005	65.0	0.177
Bee/48025	196.6	0.535	814.4	2.218	13.6	0.037	13.3	0.036	93.0	0.253	287.1	0.782
Bell/48027												
Bexar/48029											1238.1	3.375
Blanco/48031												
Borden/48033	35.0	0.095	151.9	0.414	2.5	0.007	2.5	0.007	17.7	0.048	329.3	0.897
Bosque/48035	3.2	0.009	13.9	0.038	0.2	0.001	0.2	0.001	1.6	0.004	2.1	0.006
Bowie/48037	2.3	0.006	10.0	0.027	0.2	0.000	0.2	0.000	1.2	0.003	10.3	0.028
Brazoria/48039	161.1	0.439	666.3	1.817	11.1	0.030	10.9	0.030	76.5	0.209	335.8	0.916
Brazos/48041	41.9	0.114	170.2	0.463	2.8	0.008	2.8	0.008	21.7	0.059	467.9	1.274
Brewster/48043												
Briscoe/48045												
Brooks/48047	188.7	0.514	727.4	1.981	12.1	0.033	11.8	0.032	83.6	0.228	420.0	1.144
Brown/48049	4.6	0.012	19.8	0.054	0.3	0.001	0.3	0.001	2.3	0.006	355.5	0.968
Burleson/48051	29.7	0.081	121.8	0.332	2.0	0.006	2.0	0.005	17.3	0.047	798.3	2.174
Burnet/48053												
Caldwell/48055	27.2	0.074	118.8	0.324	2.0	0.005	1.9	0.005	13.6	0.037	1400.1	3.816
Calhoun/48057	59.8	0.163	244.0	0.665	4.1	0.011	4.0	0.011	27.9	0.076	103.1	0.281
Callahan/48059	2.5	0.007	10.6	0.029	0.2	0.000	0.2	0.000	1.3	0.004	389.3	1.060

Table 3-4a. County-Level Annual and Ozone Season Daily (OSD) Criteria Pollutant Emissions for Exploration Sources (Cont.)

Texas County/FIPS	CO-ANN tons/yr	CO-OSD tons/day	NO_X-ANN tons/yr	NO_X-OSD tons/day	PM_{10}-ANN tons/yr	PM_{10}-OSD tons/day	$PM_{2.5}$-ANN tons/yr	$PM_{2.5}$-OSD tons/day	SO_2-ANN tons/yr	SO_2-OSD tons/day	VOC-ANN tons/yr	VOC-OSD tons/day
Cameron/48061											1.1	0.003
Camp/48063											41.7	0.113
Carson/48065	1.1	0.003	4.0	0.011	0.1	0.000	0.1	0.000	0.5	0.001	705.9	1.922
Cass/48067	5.5	0.015	21.6	0.059	0.4	0.001	0.4	0.001	2.5	0.007	72.5	0.198
Castro/48069												
Chambers/48071	45.2	0.123	161.4	0.440	2.7	0.007	2.6	0.007	20.5	0.056	395.5	1.079
Cherokee/48073	88.8	0.242	356.3	0.970	5.9	0.016	5.8	0.016	40.7	0.111	163.7	0.446
Childress/48075											3.1	0.008
Clay/48077	11.8	0.032	51.3	0.140	0.9	0.002	0.8	0.002	6.0	0.016	543.1	1.479
Cochran/48079	12.6	0.034	54.4	0.148	0.9	0.002	0.9	0.002	6.4	0.017	892.1	2.429
Coke/48081	12.8	0.035	55.0	0.150	0.9	0.002	0.9	0.002	6.7	0.018	167.8	0.457
Coleman/48083	1.2	0.003	5.0	0.013	0.1	0.000	0.1	0.000	0.6	0.002	333.5	0.908
Collin/48085												
Collingsworth/48087											42.5	0.116
Colorado/48089	163.2	0.444	674.5	1.837	11.2	0.031	11.0	0.030	77.0	0.210	204.9	0.558
Comal/48091												
Comanche/48093	0.5	0.001	2.3	0.006	0.0	0.000	0.0	0.000	0.3	0.001	42.6	0.116
Concho/48095	29.3	0.080	118.7	0.323	2.0	0.005	1.9	0.005	13.7	0.037	156.9	0.427
Cooke/48097	175.1	0.477	759.9	2.070	12.7	0.035	12.4	0.034	87.4	0.238	1053.2	2.868
Coryell/48099												
Cottle/48101	37.0	0.101	154.3	0.420	2.6	0.007	2.5	0.007	17.6	0.048	52.0	0.142
Crane/48103	51.2	0.139	204.4	0.557	3.4	0.009	3.3	0.009	25.0	0.068	1903.3	5.183
Crockett/48105	745.2	2.029	2987.0	8.135	49.7	0.135	48.6	0.132	343.9	0.936	2623.8	7.145
Crosby/48107											171.0	0.466
Culberson/48109	4.7	0.013	20.4	0.055	0.3	0.001	0.3	0.001	2.3	0.006	40.9	0.111
Dallam/48111												
Dallas/48113												
Dawson/48115	18.9	0.051	81.6	0.222	1.4	0.004	1.3	0.004	9.7	0.026	547.7	1.492
Deaf Smith/48117												

Table 3-4a. County-Level Annual and Ozone Season Daily (OSD) Criteria Pollutant Emissions for Exploration Sources (Cont.)

Texas County/FIPS	CO-ANN tons/yr	CO-OSD tons/day	NO_X-ANN tons/yr	NO_X-OSD tons/day	PM_{10}-ANN tons/yr	PM_{10}-OSD tons/day	$PM_{2.5}$-ANN tons/yr	$PM_{2.5}$-OSD tons/day	SO_2-ANN tons/yr	SO_2-OSD tons/day	VOC-ANN tons/yr	VOC-OSD tons/day
Delta/48119												
Denton/48121	731.4	1.992	2829.9	7.707	47.0	0.128	46.0	0.125	322.5	0.878	1348.5	3.672
De Witt/48123	199.1	0.542	791.5	2.155	13.2	0.036	12.9	0.035	90.3	0.246	289.2	0.787
Dickens/48125	12.0	0.033	51.7	0.141	0.9	0.002	0.8	0.002	6.1	0.017	112.3	0.306
Dimmit/48127	53.1	0.145	213.1	0.580	3.5	0.010	3.5	0.009	25.2	0.069	407.0	1.108
Donley/48129											0.4	0.001
Duval/48131	173.7	0.473	658.9	1.794	10.9	0.030	10.7	0.029	75.4	0.205	728.4	1.984
Eastland/48133	37.1	0.101	160.5	0.437	2.7	0.007	2.6	0.007	18.5	0.051	399.8	1.089
Ector/48135	202.3	0.551	877.7	2.390	14.7	0.040	14.3	0.039	102.3	0.279	2875.7	7.831
Edwards/48137	30.5	0.083	124.6	0.339	2.1	0.006	2.0	0.006	14.2	0.039	106.9	0.291
Ellis/48139	2.5	0.007	9.6	0.026	0.2	0.000	0.2	0.000	1.1	0.003	3.9	0.011
El Paso/48141												
Erath/48143	8.5	0.023	32.4	0.088	0.5	0.001	0.5	0.001	3.8	0.010	52.8	0.144
Falls/48145	2.7	0.007	11.7	0.032	0.2	0.001	0.2	0.001	1.3	0.004	14.2	0.039
Fannin/48147												
Fayette/48149	41.6	0.113	177.6	0.484	3.0	0.008	2.9	0.008	21.7	0.059	429.5	1.170
Fisher/48151	3.5	0.010	14.9	0.041	0.2	0.001	0.2	0.001	2.0	0.005	206.3	0.562
Floyd/48153	3.2	0.009	13.7	0.037	0.2	0.001	0.2	0.001	1.6	0.004	2.6	0.007
Foard/48155	3.6	0.010	14.4	0.039	0.2	0.001	0.2	0.001	1.6	0.004	42.1	0.115
Fort Bend/48157	107.4	0.293	417.7	1.139	6.9	0.019	6.8	0.019	47.9	0.131	334.9	0.913
Franklin/48159	27.9	0.076	118.8	0.323	2.0	0.005	1.9	0.005	14.3	0.039	138.7	0.378
Freestone/48161	616.0	1.677	2464.5	6.712	41.0	0.112	40.1	0.109	281.0	0.765	910.7	2.480
Frio/48163	6.3	0.017	27.3	0.074	0.5	0.001	0.4	0.001	3.1	0.009	245.7	0.669
Gaines/48165	405.9	1.105	1752.2	4.772	29.2	0.080	28.6	0.078	202.4	0.551	1887.8	5.141
Galveston/48167	19.5	0.053	78.6	0.214	1.3	0.004	1.3	0.003	9.6	0.026	137.4	0.375
Garza/48169	40.7	0.111	177.3	0.483	3.0	0.008	2.9	0.008	20.3	0.055	933.6	2.543
Gillespie/48171												
Glasscock/48173	26.0	0.071	109.3	0.298	1.8	0.005	1.8	0.005	14.0	0.038	645.7	1.759
Goliad/48175	444.1	1.209	1667.8	4.542	27.7	0.075	27.0	0.074	189.9	0.517	895.4	2.438

Table 3-4a. County-Level Annual and Ozone Season Daily (OSD) Criteria Pollutant Emissions for Exploration Sources (Cont.)

Texas County/FIPS	CO-ANN tons/yr	CO-OSD tons/day	NO_X-ANN tons/yr	NO_X-OSD tons/day	PM_{10}-ANN tons/yr	PM_{10}-OSD tons/day	$PM_{2.5}$-ANN tons/yr	$PM_{2.5}$-OSD tons/day	SO_2-ANN tons/yr	SO_2-OSD tons/day	VOC-ANN tons/yr	VOC-OSD tons/day
Gonzales/48177	6.4	0.018	28.1	0.077	0.5	0.001	0.5	0.001	3.2	0.009	82.6	0.225
Gray/48179	8.5	0.023	32.1	0.087	0.5	0.001	0.5	0.001	3.7	0.010	1318.8	3.592
Grayson/48181	88.8	0.242	382.6	1.042	6.4	0.017	6.2	0.017	45.8	0.125	533.2	1.452
Gregg/48183	126.7	0.350	446.7	1.233	7.4	0.020	7.2	0.020	50.7	0.140	1706.4	4.709
Grimes/48185	86.9	0.237	270.9	0.738	4.4	0.012	4.3	0.012	30.5	0.083	290.0	0.790
Guadalupe/48187	11.8	0.032	51.5	0.140	0.9	0.002	0.8	0.002	5.9	0.016	905.0	2.467
Hale/48189	7.7	0.021	32.8	0.089	0.5	0.001	0.5	0.001	4.1	0.011	106.0	0.289
Hall/48191												
Hamilton/48193	0.7	0.002	3.0	0.008	0.1	0.000	0.0	0.000	0.3	0.001	2.5	0.007
Hansford/48195	41.9	0.114	170.4	0.464	2.8	0.008	2.8	0.008	19.4	0.053	168.0	0.458
Hardeman/48197	59.6	0.162	259.5	0.707	4.3	0.012	4.2	0.012	29.9	0.081	149.4	0.407
Hardin/48199	59.7	0.162	238.3	0.648	4.0	0.011	3.9	0.011	28.5	0.077	549.0	1.492
Harris/48201	61.8	0.169	261.7	0.714	4.4	0.012	4.3	0.012	30.0	0.082	235.2	0.641
Harrison/48203	626.3	1.728	2538.1	7.004	42.2	0.117	41.3	0.114	293.6	0.810	1365.2	3.767
Hartley/48205	10.2	0.028	42.0	0.114	0.7	0.002	0.7	0.002	4.8	0.013	32.0	0.087
Haskell/48207	0.7	0.002	3.0	0.008	0.0	0.000	0.0	0.000	0.3	0.001	122.0	0.332
Hays/48209												
Hemphill/48211	3534.0	9.624	15159.2	41.283	252.9	0.689	247.4	0.674	1739.0	4.736	2596.0	7.070
Henderson/48213	30.6	0.083	115.5	0.315	1.9	0.005	1.9	0.005	13.2	0.036	151.8	0.413
Hidalgo/48215	411.0	1.119	1531.2	4.170	25.4	0.069	24.8	0.068	174.0	0.474	845.8	2.304
Hill/48217	67.7	0.184	293.4	0.799	4.9	0.013	4.8	0.013	33.6	0.091	42.2	0.115
Hockley/48219	86.5	0.236	371.2	1.011	6.2	0.017	6.1	0.016	45.2	0.123	2127.1	5.793
Hood/48221	48.0	0.131	171.9	0.468	2.8	0.008	2.8	0.008	19.5	0.053	131.9	0.359
Hopkins/48223	1.8	0.005	7.7	0.021	0.1	0.000	0.1	0.000	0.9	0.002	31.4	0.085
Houston/48225	68.9	0.188	255.0	0.694	4.2	0.012	4.1	0.011	29.0	0.079	219.2	0.597
Howard/48227	21.9	0.060	92.8	0.253	1.5	0.004	1.5	0.004	11.9	0.032	1643.2	4.475
Hudspeth/48229												
Hunt/48231												
Hutchinson/48233	24.1	0.066	99.4	0.271	1.7	0.005	1.6	0.004	11.3	0.031	1443.4	3.931

Table 3-4a. County-Level Annual and Ozone Season Daily (OSD) Criteria Pollutant Emissions for Exploration Sources (Cont.)

Texas County/FIPS	CO-ANN tons/yr	CO-OSD tons/day	NO_X-ANN tons/yr	NO_X-OSD tons/day	PM_{10}-ANN tons/yr	PM_{10}-OSD tons/day	$PM_{2.5}$-ANN tons/yr	$PM_{2.5}$-OSD tons/day	SO_2-ANN tons/yr	SO_2-OSD tons/day	VOC-ANN tons/yr	VOC-OSD tons/day
Irion/48235	218.9	0.596	939.1	2.557	15.7	0.043	15.3	0.042	108.5	0.296	886.0	2.413
Jack/48237	102.4	0.279	425.0	1.157	7.1	0.019	6.9	0.019	49.3	0.134	1021.3	2.781
Jackson/48239	63.1	0.172	216.8	0.591	3.6	0.010	3.5	0.010	25.3	0.069	340.9	0.928
Jasper/48241	5.3	0.014	16.0	0.043	0.3	0.001	0.3	0.001	3.3	0.009	187.3	0.510
Jeff Davis/48243												
Jefferson/48245	90.2	0.245	333.2	0.905	5.5	0.015	5.4	0.015	38.8	0.105	327.7	0.891
Jim Hogg/48247	211.8	0.577	874.6	2.382	14.6	0.040	14.2	0.039	100.0	0.272	262.3	0.714
Jim Wells/48249	19.5	0.053	78.2	0.213	1.3	0.004	1.3	0.003	9.0	0.024	99.4	0.271
Johnson/48251	309.2	0.840	979.3	2.661	16.1	0.044	15.7	0.043	110.3	0.300	931.1	2.530
Jones/48253	12.2	0.033	51.8	0.141	0.9	0.002	0.8	0.002	6.4	0.018	374.1	1.019
Karnes/48255	33.3	0.091	134.0	0.365	2.2	0.006	2.2	0.006	15.9	0.043	150.9	0.411
Kaufman/48257											8.4	0.023
Kendall/48259												
Kenedy/48261	159.4	0.434	621.3	1.692	10.3	0.028	10.1	0.027	70.8	0.193	239.7	0.653
Kent/48263	2.7	0.007	11.8	0.032	0.2	0.001	0.2	0.001	1.4	0.004	230.3	0.627
Kerr/48265											0.4	0.001
Kimble/48267	2.4	0.006	9.1	0.025	0.2	0.000	0.1	0.000	1.0	0.003	6.9	0.019
King/48269	15.8	0.043	68.2	0.186	1.1	0.003	1.1	0.003	7.9	0.021	216.4	0.589
Kinney/48271												
Kleberg/48273	58.4	0.159	223.4	0.608	3.7	0.010	3.6	0.010	25.4	0.069	123.7	0.337
Knox/48275	0.9	0.002	3.8	0.010	0.1	0.000	0.1	0.000	0.4	0.001	90.1	0.245
Lamar/48277												
Lamb/48279	0.0	0.000	0.0	0.000					0.0	0.000	25.8	0.070
Lampasas/48281	0.4	0.001	1.7	0.005	0.0	0.000	0.0	0.000	0.2	0.001	0.4	0.001
La Salle/48283	563.4	1.534	2420.9	6.593	40.4	0.110	39.5	0.108	277.4	0.756	525.7	1.432
Lavaca/48285	170.2	0.464	644.0	1.754	10.7	0.029	10.4	0.028	73.2	0.199	340.3	0.927
Lee/48287	56.0	0.153	221.2	0.602	3.7	0.010	3.6	0.010	34.5	0.094	1281.5	3.490
Leon/48289	527.8	1.437	2188.1	5.959	36.5	0.099	35.7	0.097	250.0	0.681	578.4	1.575
Liberty/48291	180.7	0.493	673.5	1.837	11.2	0.030	10.9	0.030	77.2	0.210	659.8	1.799

Table 3-4a. County-Level Annual and Ozone Season Daily (OSD) Criteria Pollutant Emissions for Exploration Sources (Cont.)

Texas County/FIPS	CO-ANN tons/yr	CO-OSD tons/day	NO_X-ANN tons/yr	NO_X-OSD tons/day	PM_{10}-ANN tons/yr	PM_{10}-OSD tons/day	$PM_{2.5}$-ANN tons/yr	$PM_{2.5}$-OSD tons/day	SO_2-ANN tons/yr	SO_2-OSD tons/day	VOC-ANN tons/yr	VOC-OSD tons/day
Limestone/48293	273.9	0.746	1095.0	2.982	18.2	0.050	17.8	0.049	124.8	0.340	424.2	1.155
Lipscomb/48295	200.6	0.546	745.3	2.030	12.4	0.034	12.1	0.033	88.1	0.240	905.0	2.465
Live Oak/48297	492.2	1.340	2107.6	5.740	35.2	0.096	34.4	0.094	241.3	0.657	481.0	1.310
Llano/48299												
Loving/48301	292.7	0.797	1114.0	3.034	18.5	0.050	18.1	0.049	126.8	0.345	768.4	2.093
Lubbock/48303	7.9	0.021	34.3	0.093	0.6	0.002	0.6	0.002	3.9	0.011	195.0	0.531
Lynn/48305	6.3	0.017	27.3	0.074	0.5	0.001	0.4	0.001	3.2	0.009	47.6	0.130
McCulloch/48307	8.0	0.022	34.7	0.094	0.6	0.002	0.6	0.002	4.0	0.011	42.6	0.116
McLennan/48309											27.1	0.074
McMullen/48311	333.6	0.909	1283.0	3.494	21.3	0.058	20.8	0.057	146.6	0.399	846.1	2.304
Madison/48313	30.5	0.083	130.6	0.356	2.2	0.006	2.1	0.006	15.9	0.043	183.4	0.499
Marion/48315	23.6	0.064	95.2	0.259	1.6	0.004	1.5	0.004	11.3	0.031	162.5	0.443
Martin/48317	120.0	0.327	520.3	1.417	8.7	0.024	8.5	0.023	60.9	0.166	937.7	2.554
Mason/48319												
Matagorda/48321	151.9	0.414	559.9	1.525	9.3	0.025	9.1	0.025	64.9	0.177	472.1	1.286
Maverick/48323	147.8	0.403	642.4	1.749	10.7	0.029	10.5	0.029	74.3	0.202	422.0	1.149
Medina/48325	1.2	0.003	5.1	0.014	0.1	0.000	0.1	0.000	0.6	0.002	679.9	1.853
Menard/48327	2.5	0.007	10.9	0.030	0.2	0.000	0.2	0.000	1.2	0.003	51.5	0.140
Midland/48329	266.3	0.725	1151.9	3.137	19.2	0.052	18.8	0.051	134.8	0.367	2385.0	6.495
Milam/48331	4.2	0.011	18.1	0.049	0.3	0.001	0.3	0.001	2.1	0.006	467.0	1.272
Mills/48333	12.1	0.033	52.7	0.144	0.9	0.002	0.9	0.002	6.0	0.016	7.0	0.019
Mitchell/48335	24.1	0.066	104.8	0.285	1.8	0.005	1.7	0.005	12.1	0.033	985.0	2.682
Montague/48337	107.8	0.294	465.5	1.268	7.8	0.021	7.6	0.021	55.0	0.150	1176.4	3.204
Montgomery/48339	37.6	0.103	160.2	0.437	2.7	0.007	2.6	0.007	18.3	0.050	103.0	0.281
Moore/48341	17.7	0.048	71.6	0.195	1.2	0.003	1.2	0.003	8.3	0.023	462.2	1.259
Morris/48343											0.4	0.001
Motley/48345											8.4	0.023
Nacogdoches/48347	257.8	0.702	920.3	2.506	15.2	0.041	14.9	0.041	104.3	0.284	635.3	1.730
Navarro/48349	13.8	0.038	58.2	0.159	1.0	0.003	0.9	0.003	6.8	0.018	370.0	1.008

Table 3-4a. County-Level Annual and Ozone Season Daily (OSD) Criteria Pollutant Emissions for Exploration Sources (Cont.)

Texas County/FIPS	CO-ANN tons/yr	CO-OSD tons/day	NO_X-ANN tons/yr	NO_X-OSD tons/day	PM_{10}-ANN tons/yr	PM_{10}-OSD tons/day	$PM_{2.5}$-ANN tons/yr	$PM_{2.5}$-OSD tons/day	SO_2-ANN tons/yr	SO_2-OSD tons/day	VOC-ANN tons/yr	VOC-OSD tons/day
Newton/48351	40.5	0.110	170.4	0.464	2.8	0.008	2.8	0.008	21.8	0.059	288.5	0.786
Nolan/48353	15.3	0.042	66.3	0.181	1.1	0.003	1.1	0.003	7.8	0.021	231.1	0.629
Nueces/48355	194.6	0.531	795.7	2.169	13.2	0.036	13.0	0.035	91.4	0.249	400.1	1.091
Ochiltree/48357	56.6	0.154	213.7	0.582	3.5	0.010	3.5	0.009	25.0	0.068	465.4	1.268
Oldham/48359	0.1	0.000	0.0	0.000							8.5	0.023
Orange/48361	32.8	0.089	143.1	0.389	2.4	0.006	2.3	0.006	16.4	0.045	79.3	0.215
Palo Pinto/48363	21.8	0.059	75.8	0.206	1.3	0.003	1.2	0.003	9.3	0.025	422.5	1.151
Panola/48365	704.9	1.920	2710.8	7.382	45.0	0.123	44.0	0.120	311.8	0.849	1898.0	5.169
Parker/48367	175.8	0.478	712.6	1.936	11.9	0.032	11.6	0.032	82.4	0.224	409.3	1.112
Parmer/48369												
Pecos/48371	204.8	0.558	813.3	2.215	13.5	0.037	13.2	0.036	93.3	0.254	1688.2	4.597
Polk/48373	36.6	0.100	147.9	0.403	2.5	0.007	2.4	0.007	16.9	0.046	104.2	0.284
Potter/48375	37.8	0.103	155.9	0.425	2.6	0.007	2.5	0.007	17.8	0.049	336.6	0.917
Presidio/48377												
Rains/48379											1.3	0.003
Randall/48381												
Reagan/48383	493.0	1.343	2140.0	5.828	35.7	0.097	34.9	0.095	248.2	0.676	2215.2	6.033
Real/48385	0.4	0.001	1.6	0.004	0.0	0.000	0.0	0.000	0.2	0.001	1.7	0.005
Red River/48387											24.0	0.065
Reeves/48389	77.4	0.211	330.0	0.899	5.5	0.015	5.4	0.015	38.1	0.104	410.3	1.117
Refugio/48391	68.3	0.186	260.3	0.709	4.3	0.012	4.2	0.012	34.1	0.093	931.4	2.536
Roberts/48393	168.5	0.459	651.2	1.773	10.8	0.029	10.6	0.029	77.7	0.212	715.9	1.950
Robertson/48395	583.5	1.589	2352.5	6.407	39.1	0.107	38.3	0.104	268.4	0.731	743.7	2.025
Rockwall/48397												
Runnels/48399	36.4	0.099	156.4	0.426	2.6	0.007	2.6	0.007	18.9	0.051	326.7	0.890
Rusk/48401	440.7	1.216	1682.5	4.643	27.9	0.077	27.3	0.075	191.4	0.528	1631.0	4.501
Sabine/48403	2.8	0.008	12.1	0.033	0.2	0.001	0.2	0.001	1.4	0.004	4.7	0.013
San Augustine/48405											4.2	0.011
San Jacinto/48407	29.0	0.079	118.1	0.322	2.0	0.005	1.9	0.005	13.5	0.037	43.3	0.118

Table 3-4a. County-Level Annual and Ozone Season Daily (OSD) Criteria Pollutant Emissions for Exploration Sources (Cont.)

Texas County/FIPS	CO-ANN tons/yr	CO-OSD tons/day	NO_X-ANN tons/yr	NO_X-OSD tons/day	PM_{10}-ANN tons/yr	PM_{10}-OSD tons/day	$PM_{2.5}$-ANN tons/yr	$PM_{2.5}$-OSD tons/day	SO_2-ANN tons/yr	SO_2-OSD tons/day	VOC-ANN tons/yr	VOC-OSD tons/day
San Patricio/48409	183.0	0.499	767.7	2.093	12.8	0.035	12.5	0.034	87.7	0.239	235.2	0.641
San Saba/48411												
Schleicher/48413	56.0	0.153	177.6	0.484	2.9	0.008	2.9	0.008	20.5	0.056	382.3	1.041
Scurry/48415	102.8	0.280	435.9	1.187	7.3	0.020	7.1	0.019	55.3	0.151	1660.5	4.522
Shackelford/48417	11.8	0.032	50.7	0.138	0.8	0.002	0.8	0.002	5.9	0.016	881.1	2.399
Shelby/48419	95.6	0.260	364.2	0.992	6.0	0.016	5.9	0.016	43.0	0.117	344.1	0.937
Sherman/48421	7.3	0.020	29.2	0.079	0.5	0.001	0.5	0.001	3.3	0.009	102.2	0.278
Smith/48423	1258.9	3.474	5165.4	14.253	86.0	0.237	84.1	0.232	590.6	1.630	1444.1	3.985
Somervell/48425	2.9	0.008	11.9	0.032	0.2	0.001	0.2	0.001	1.4	0.004	3.2	0.009
Starr/48427	149.9	0.408	472.9	1.288	7.8	0.021	7.6	0.021	53.7	0.146	662.5	1.804
Stephens/48429	28.9	0.079	121.1	0.330	2.0	0.005	2.0	0.005	14.3	0.039	695.9	1.895
Sterling/48431	50.8	0.138	216.3	0.589	3.6	0.010	3.5	0.010	25.8	0.070	772.8	2.105
Stonewall/48433	5.0	0.014	21.8	0.059	0.4	0.001	0.4	0.001	2.5	0.007	279.7	0.762
Sutton/48435	76.7	0.209	266.6	0.726	4.4	0.012	4.3	0.012	30.2	0.082	586.8	1.598
Swisher/48437												
Tarrant/48439	329.7	0.896	1110.4	3.017	18.3	0.050	17.9	0.049	125.5	0.341	901.7	2.450
Taylor/48441	1.6	0.004	6.3	0.017	0.1	0.000	0.1	0.000	1.0	0.003	233.9	0.637
Terrell/48443	127.9	0.348	504.3	1.373	8.4	0.023	8.2	0.022	58.1	0.158	279.1	0.760
Terry/48445	30.6	0.083	133.3	0.363	2.2	0.006	2.2	0.006	15.4	0.042	444.3	1.210
Throckmorton/48447	5.3	0.015	22.8	0.062	0.4	0.001	0.4	0.001	2.8	0.008	476.3	1.297
Titus/48449	1.3	0.004	5.7	0.016	0.1	0.000	0.1	0.000	0.7	0.002	87.5	0.238
Tom Green/48451	67.8	0.185	293.8	0.800	4.9	0.013	4.8	0.013	33.8	0.092	346.8	0.944
Travis/48453											13.3	0.036
Trinity/48455	0.2	0.001	0.9	0.002	0.0	0.000	0.0	0.000	0.1	0.000	10.6	0.029
Tyler/48457	305.2	0.831	1265.4	3.446	21.1	0.057	20.6	0.056	144.6	0.394	311.6	0.849
Upshur/48459	241.1	0.665	1005.1	2.773	16.7	0.046	16.4	0.045	115.0	0.317	321.3	0.887
Upton/48461	602.7	1.641	2465.6	6.715	41.0	0.112	40.1	0.109	287.4	0.783	2147.7	5.849
Uvalde/48463											0.2	0.000
Val Verde/48465	66.5	0.181	272.4	0.742	4.5	0.012	4.4	0.012	31.1	0.085	94.8	0.258

Table 3-4a. County-Level Annual and Ozone Season Daily (OSD) Criteria Pollutant Emissions for Exploration Sources (Cont.)

Texas County/FIPS	CO-ANN tons/yr	CO-OSD tons/day	NO_X-ANN tons/yr	NO_X-OSD tons/day	PM_{10}-ANN tons/yr	PM_{10}-OSD tons/day	$PM_{2.5}$-ANN tons/yr	$PM_{2.5}$-OSD tons/day	SO_2-ANN tons/yr	SO_2-OSD tons/day	VOC-ANN tons/yr	VOC-OSD tons/day
Van Zandt/48467	3.8	0.010	16.7	0.045	0.3	0.001	0.3	0.001	1.9	0.005	253.4	0.690
Victoria/48469	30.7	0.084	110.2	0.300	1.8	0.005	1.8	0.005	12.8	0.035	201.1	0.548
Walker/48471	9.9	0.027	41.2	0.112	0.7	0.002	0.7	0.002	4.9	0.013	33.7	0.092
Waller/48473	33.4	0.091	140.1	0.382	2.3	0.006	2.3	0.006	16.9	0.046	214.4	0.585
Ward/48475	218.1	0.594	942.0	2.565	15.7	0.043	15.4	0.042	110.2	0.300	1560.7	4.250
Washington/48477	58.3	0.159	208.8	0.569	3.5	0.009	3.4	0.009	23.8	0.065	197.0	0.536
Webb/48479	718.3	1.956	2738.4	7.458	45.4	0.124	44.4	0.121	311.5	0.848	1634.9	4.452
Wharton/48481	224.6	0.612	877.0	2.388	14.6	0.040	14.2	0.039	100.5	0.274	529.8	1.443
Wheeler/48483	2246.7	6.118	9524.6	25.938	158.8	0.433	155.3	0.423	1090.4	2.970	1861.1	5.068
Wichita/48485	14.4	0.039	62.7	0.171	1.0	0.003	1.0	0.003	7.2	0.020	2600.5	7.082
Wilbarger/48487	39.5	0.107	171.9	0.468	2.9	0.008	2.8	0.008	19.7	0.054	419.9	1.144
Willacy/48489	51.9	0.141	194.7	0.530	3.2	0.009	3.2	0.009	22.4	0.061	159.3	0.434
Williamson/48491											21.4	0.058
Wilson/48493	7.4	0.020	32.1	0.088	0.5	0.001	0.5	0.001	3.7	0.010	289.9	0.790
Winkler/48495	183.1	0.499	779.6	2.123	13.0	0.035	12.7	0.035	92.5	0.252	1309.7	3.567
Wise/48497	609.3	1.656	2407.0	6.541	40.0	0.109	39.1	0.106	278.7	0.757	1838.5	4.996
Wood/48499	8.7	0.024	37.6	0.102	0.6	0.002	0.6	0.002	4.4	0.012	296.2	0.807
Yoakum/48501	116.2	0.316	497.5	1.355	8.3	0.023	8.1	0.022	59.9	0.163	1889.3	5.145
Young/48503	10.6	0.029	45.3	0.123	0.8	0.002	0.7	0.002	5.3	0.014	1209.5	3.294
Zapata/48505	1115.6	3.038	4175.0	11.370	69.2	0.188	67.7	0.184	474.5	1.292	2134.7	5.813
Zavala/48507	44.4	0.121	193.4	0.527	3.2	0.009	3.2	0.009	22.3	0.061	123.5	0.336
Total	29,695	80.96	120,061	327.33	1,998	5.45	1,954	5.33	13,835	37.72	120,240	327.68

In order to reflect significant figures, estimates should be interpreted as follows: 0.0 = <0.1; 0.00 = <0.01; and 0.000 = <0.001.

Table 3-4b. County-Level Annual and Ozone Season Daily (OSD) Criteria Pollutant Emissions for Production Sources

Texas County/FIPS	CO-ANN tons/yr	CO-OSD tons/day	NO_X-ANN tons/yr	NO_X-OSD tons/day	PM_{10}-ANN tons/yr	PM_{10}-OSD tons/day	$PM_{2.5}$-ANN tons/yr	$PM_{2.5}$-OSD tons/day	SO_2-ANN tons/yr	SO_2-OSD tons/day	VOC-ANN tons/yr	VOC-OSD tons/day
Anderson/48001	179.8	0.490	185.8	0.506	3.1	0.008	3.1	0.008	0.1	0.000	1483.7	4.041
Andrews/48003	562.0	1.531	623.2	1.697	9.4	0.026	9.4	0.026	0.3	0.001	12150.6	33.090
Angelina/48005	21.2	0.058	21.8	0.059	0.4	0.001	0.4	0.001	0.0	0.000	100.8	0.274
Aransas/48007	94.2	0.257	96.9	0.264	1.6	0.004	1.6	0.004	0.0	0.000	933.5	2.544
Archer/48009	8.9	0.024	11.2	0.031	0.1	0.000	0.1	0.000	0.0	0.000	1744.9	4.752
Armstrong/48011												
Atascosa/48013	94.5	0.258	98.2	0.268	1.6	0.004	1.6	0.004	0.0	0.000	1154.8	3.148
Austin/48015	205.3	0.560	211.0	0.576	3.5	0.010	3.5	0.010	0.1	0.000	1552.0	4.233
Bailey/48017												
Bandera/48019	0.0	0.000	0.0	0.000							0.9	0.002
Bastrop/48021	5.8	0.016	6.1	0.017	0.1	0.000	0.1	0.000	0.0	0.000	255.2	0.696
Baylor/48023	0.1	0.000	0.3	0.001	0.0	0.000	0.0	0.000	0.0	0.000	96.5	0.263
Bee/48025	616.1	1.678	632.1	1.721	10.5	0.029	10.5	0.029	0.3	0.001	3240.7	8.825
Bell/48027												
Bexar/48029	0.1	0.000	0.3	0.001	0.0	0.000	0.0	0.000	0.0	0.000	1314.5	3.583
Blanco/48031												
Borden/48033	42.5	0.116	52.3	0.142	0.7	0.002	0.7	0.002	0.0	0.000	1724.0	4.695
Bosque/48035												
Bowie/48037	4.9	0.013	5.2	0.014	0.1	0.000	0.1	0.000	0.0	0.000	83.7	0.228
Brazoria/48039	221.4	0.604	266.9	0.728	9.5	0.026	9.5	0.026	0.3	0.001	6955.2	18.969
Brazos/48041	184.8	0.503	193.3	0.526	3.1	0.009	3.1	0.009	0.1	0.000	1905.8	5.190
Brewster/48043												
Briscoe/48045												
Brooks/48047	1258.6	3.428	1291.9	3.518	21.4	0.058	21.4	0.058	0.6	0.002	9651.3	26.283
Brown/48049	24.9	0.068	25.7	0.070	0.4	0.001	0.4	0.001	0.0	0.000	505.5	1.377
Burleson/48051	226.4	0.617	236.4	0.644	3.8	0.010	3.8	0.010	0.1	0.000	2410.0	6.563
Burnet/48053												
Caldwell/48055	7.8	0.021	9.8	0.027	0.1	0.000	0.1	0.000	0.0	0.000	1727.2	4.708
Calhoun/48057	189.8	0.517	195.5	0.532	3.2	0.009	3.2	0.009	0.1	0.000	1484.5	4.043
Callahan/48059	15.8	0.043	16.6	0.045	0.3	0.001	0.3	0.001	0.0	0.000	516.1	1.406

Table 3-4b. County-Level Annual and Ozone Season Daily (OSD) Criteria Pollutant Emissions for Production Sources (Cont.)

Texas County/FIPS	CO-ANN tons/yr	CO-OSD tons/day	NO_X-ANN tons/yr	NO_X-OSD tons/day	PM_{10}-ANN tons/yr	PM_{10}-OSD tons/day	$PM_{2.5}$-ANN tons/yr	$PM_{2.5}$-OSD tons/day	SO_2-ANN tons/yr	SO_2-OSD tons/day	VOC-ANN tons/yr	VOC-OSD tons/day
Cameron/48061	3.0	0.008	3.0	0.008	0.1	0.000	0.1	0.000	0.0	0.000	13.8	0.038
Camp/48063	14.2	0.039	15.0	0.041	0.2	0.001	0.2	0.001	0.0	0.000	163.4	0.445
Carson/48065	312.1	0.850	320.3	0.872	5.3	0.014	5.3	0.014	0.1	0.000	1946.8	5.302
Cass/48067	56.2	0.153	58.2	0.158	1.0	0.003	1.0	0.003	0.0	0.000	488.2	1.329
Castro/48069												
Chambers/48071	101.5	0.277	122.7	0.335	4.3	0.012	4.3	0.012	0.1	0.000	3413.3	9.309
Cherokee/48073	229.4	0.625	235.6	0.642	3.9	0.011	3.9	0.011	0.1	0.000	1488.3	4.053
Childress/48075	0.0	0.000	0.1	0.000	0.0	0.000	0.0	0.000	0.0	0.000	12.8	0.035
Clay/48077	13.7	0.037	15.5	0.042	0.2	0.001	0.2	0.001	0.0	0.000	859.8	2.341
Cochran/48079	44.2	0.120	52.9	0.144	0.7	0.002	0.7	0.002	0.0	0.000	2164.7	5.895
Coke/48081	54.2	0.148	56.4	0.154	0.9	0.003	0.9	0.003	0.0	0.000	468.4	1.276
Coleman/48083	30.6	0.083	31.9	0.087	0.5	0.001	0.5	0.001	0.0	0.000	557.7	1.519
Collin/48085												
Collingsworth/48087	20.9	0.057	21.4	0.058	0.4	0.001	0.4	0.001	0.0	0.000	124.6	0.339
Colorado/48089	347.6	0.947	356.8	0.972	5.9	0.016	5.9	0.016	0.2	0.000	2407.5	6.556
Comal/48091												
Comanche/48093	11.4	0.031	11.7	0.032	0.2	0.001	0.2	0.001	0.0	0.000	97.0	0.264
Concho/48095	23.8	0.065	25.2	0.069	0.4	0.001	0.4	0.001	0.0	0.000	345.6	0.941
Cooke/48097	21.5	0.059	25.2	0.069	0.4	0.001	0.4	0.001	0.0	0.000	1630.2	4.440
Coryell/48099												
Cottle/48101	78.5	0.214	80.6	0.219	1.3	0.004	1.3	0.004	0.0	0.000	537.4	1.464
Crane/48103	956.9	2.606	999.9	2.723	16.2	0.044	16.2	0.044	0.4	0.001	8484.7	23.107
Crockett/48105	1847.8	5.032	1901.4	5.178	31.5	0.086	31.5	0.086	0.9	0.002	10799.4	29.410
Crosby/48107	1.2	0.003	2.3	0.006	0.0	0.000	0.0	0.000	0.0	0.000	337.8	0.920
Culberson/48109	24.7	0.067	25.6	0.070	0.4	0.001	0.4	0.001	0.0	0.000	186.3	0.507
Dallam/48111												
Dallas/48113												
Dawson/48115	39.9	0.109	49.9	0.136	0.6	0.002	0.6	0.002	0.0	0.000	1992.5	5.426
Deaf Smith/48117												
Delta/48119												

Table 3-4b. County-Level Annual and Ozone Season Daily (OSD) Criteria Pollutant Emissions for Production Sources (Cont.)

Texas County/FIPS	CO-ANN tons/yr	CO-OSD tons/day	NO_X-ANN tons/yr	NO_X-OSD tons/day	PM_{10}-ANN tons/yr	PM_{10}-OSD tons/day	$PM_{2.5}$-ANN tons/yr	$PM_{2.5}$-OSD tons/day	SO_2-ANN tons/yr	SO_2-OSD tons/day	VOC-ANN tons/yr	VOC-OSD tons/day
Denton/48121	1615.0	4.398	1616.7	4.403	38.7	0.105	38.7	0.105	1.1	0.003	12189.4	33.196
De Witt/48123	502.6	1.369	516.2	1.406	8.6	0.023	8.6	0.023	0.2	0.001	4992.6	13.596
Dickens/48125	2.9	0.008	6.0	0.016	0.0	0.000	0.0	0.000	0.0	0.000	545.0	1.484
Dimmit/48127	59.0	0.161	62.4	0.170	1.0	0.003	1.0	0.003	0.0	0.000	913.6	2.488
Donley/48129	0.3	0.001	0.3	0.001	0.0	0.000	0.0	0.000	0.0	0.000	1.4	0.004
Duval/48131	1038.8	2.829	1066.7	2.905	17.7	0.048	17.7	0.048	0.5	0.001	6019.8	16.394
Eastland/48133	76.3	0.208	78.8	0.215	1.3	0.004	1.3	0.004	0.0	0.000	836.8	2.279
Ector/48135	709.4	1.932	764.8	2.083	11.9	0.032	11.9	0.032	0.3	0.001	10891.8	29.662
Edwards/48137	287.1	0.782	294.0	0.801	4.9	0.013	4.9	0.013	0.1	0.000	1122.9	3.058
Ellis/48139	0.5	0.001	0.5	0.001	0.0	0.000	0.0	0.000	0.0	0.000	3.0	0.008
El Paso/48141												
Erath/48143	32.1	0.087	32.9	0.089	0.5	0.001	0.5	0.001	0.0	0.000	156.6	0.427
Falls/48145	0.0	0.000	0.0	0.000	0.0	0.000	0.0	0.000	0.0	0.000	12.5	0.034
Fannin/48147												
Fayette/48149	367.9	1.002	380.3	1.036	6.3	0.017	6.3	0.017	0.2	0.000	3528.9	9.610
Fisher/48151	12.8	0.035	14.2	0.039	0.2	0.001	0.2	0.001	0.0	0.000	404.7	1.102
Floyd/48153	0.0	0.000	0.0	0.000							1.4	0.004
Foard/48155	14.4	0.039	14.9	0.041	0.2	0.001	0.2	0.001	0.0	0.000	122.0	0.332
Fort Bend/48157	228.6	0.623	276.0	0.753	9.7	0.027	9.7	0.027	0.3	0.001	8222.1	22.424
Franklin/48159	53.9	0.147	56.1	0.153	0.9	0.002	0.9	0.002	0.0	0.000	664.9	1.811
Freestone/48161	4309.4	11.736	4414.3	12.021	73.5	0.200	73.5	0.200	2.0	0.006	16757.9	45.637
Frio/48163	18.4	0.050	20.0	0.054	0.3	0.001	0.3	0.001	0.0	0.000	485.7	1.323
Gaines/48165	544.1	1.482	614.9	1.675	9.0	0.025	9.0	0.025	0.2	0.001	11929.3	32.487
Galveston/48167	70.3	0.192	85.8	0.234	3.0	0.008	3.0	0.008	0.1	0.000	4305.4	11.742
Garza/48169	16.1	0.044	24.6	0.067	0.2	0.001	0.2	0.001	0.0	0.000	2173.4	5.919
Gillespie/48171												
Glasscock/48173	212.6	0.579	225.0	0.613	3.6	0.010	3.6	0.010	0.1	0.000	2459.3	6.697
Goliad/48175	1203.0	3.276	1234.0	3.361	20.5	0.056	20.5	0.056	0.6	0.002	7080.2	19.282
Gonzales/48177	19.1	0.052	20.1	0.055	0.3	0.001	0.3	0.001	0.0	0.000	269.1	0.733
Gray/48179	217.1	0.591	224.9	0.612	3.7	0.010	3.7	0.010	0.1	0.000	2529.8	6.889

Table 3-4b. County-Level Annual and Ozone Season Daily (OSD) Criteria Pollutant Emissions for Production Sources (Cont.)

Texas County/FIPS	CO-ANN tons/yr	CO-OSD tons/day	NO_X-ANN tons/yr	NO_X-OSD tons/day	PM_{10}-ANN tons/yr	PM_{10}-OSD tons/day	$PM_{2.5}$-ANN tons/yr	$PM_{2.5}$-OSD tons/day	SO_2-ANN tons/yr	SO_2-OSD tons/day	VOC-ANN tons/yr	VOC-OSD tons/day
Grayson/48181	100.9	0.275	106.3	0.289	1.7	0.005	1.7	0.005	0.0	0.000	1172.9	3.194
Gregg/48183	1079.8	2.979	1111.8	3.068	18.4	0.051	18.4	0.051	0.5	0.001	7108.9	19.616
Grimes/48185	304.6	0.830	312.3	0.851	5.2	0.014	5.2	0.014	0.1	0.000	1483.2	4.039
Guadalupe/48187	1.5	0.004	4.6	0.012	0.0	0.000	0.0	0.000	0.0	0.000	1381.0	3.764
Hale/48189	19.7	0.054	25.8	0.070	0.3	0.001	0.3	0.001	0.0	0.000	950.0	2.587
Hall/48191												
Hamilton/48193	2.6	0.007	2.7	0.007	0.0	0.000	0.0	0.000	0.0	0.000	14.7	0.040
Hansford/48195	403.1	1.098	413.2	1.125	6.9	0.019	6.9	0.019	0.2	0.001	1741.8	4.743
Hardeman/48197	10.7	0.029	14.6	0.040	0.2	0.000	0.2	0.000	0.0	0.000	672.8	1.832
Hardin/48199	77.0	0.209	85.0	0.231	2.3	0.006	2.3	0.006	0.1	0.000	3492.2	9.490
Harris/48201	160.6	0.438	194.0	0.529	6.9	0.019	6.9	0.019	0.2	0.001	4855.7	13.243
Harrison/48203	1228.4	3.390	1260.2	3.477	20.9	0.058	20.9	0.058	0.6	0.002	7537.5	20.799
Hartley/48205	37.5	0.102	38.8	0.106	0.6	0.002	0.6	0.002	0.0	0.000	214.3	0.584
Haskell/48207	0.9	0.002	1.6	0.004	0.0	0.000	0.0	0.000	0.0	0.000	231.5	0.631
Hays/48209												
Hemphill/48211	1720.9	4.686	1765.0	4.807	29.3	0.080	29.3	0.080	0.8	0.002	11346.1	30.899
Henderson/48213	636.9	1.734	653.5	1.780	10.9	0.030	10.9	0.030	0.3	0.001	2765.7	7.532
Hidalgo/48215	3336.6	9.086	3422.9	9.322	56.9	0.155	56.9	0.155	1.6	0.004	25063.7	68.256
Hill/48217	0.1	0.000	0.1	0.000	0.0	0.000	0.0	0.000	0.0	0.000	0.7	0.002
Hockley/48219	164.9	0.449	208.7	0.568	2.6	0.007	2.6	0.007	0.1	0.000	8252.6	22.474
Hood/48221	86.6	0.236	88.8	0.242	1.5	0.004	1.5	0.004	0.0	0.000	482.3	1.314
Hopkins/48223	20.4	0.056	21.7	0.059	0.3	0.001	0.3	0.001	0.0	0.000	223.4	0.608
Houston/48225	182.4	0.497	188.3	0.513	3.1	0.008	3.1	0.008	0.1	0.000	1107.2	3.015
Howard/48227	104.0	0.283	118.5	0.323	1.7	0.005	1.7	0.005	0.0	0.000	3760.2	10.240
Hudspeth/48229												
Hunt/48231												
Hutchinson/48233	241.0	0.656	248.5	0.677	4.1	0.011	4.1	0.011	0.1	0.000	2606.2	7.097
Irion/48235	150.3	0.409	156.8	0.427	2.5	0.007	2.5	0.007	0.1	0.000	1749.5	4.765
Jack/48237	246.1	0.670	253.4	0.690	4.2	0.011	4.2	0.011	0.1	0.000	2398.3	6.531
Jackson/48239	460.1	1.253	473.3	1.289	7.8	0.021	7.8	0.021	0.2	0.001	3368.7	9.174

Table 3-4b. County-Level Annual and Ozone Season Daily (OSD) Criteria Pollutant Emissions for Production Sources (Cont.)

Texas County/FIPS	CO-ANN tons/yr	CO-OSD tons/day	NO_X-ANN tons/yr	NO_X-OSD tons/day	PM_{10}-ANN tons/yr	PM_{10}-OSD tons/day	$PM_{2.5}$-ANN tons/yr	$PM_{2.5}$-OSD tons/day	SO_2-ANN tons/yr	SO_2-OSD tons/day	VOC-ANN tons/yr	VOC-OSD tons/day
Jasper/48241	137.8	0.375	142.0	0.387	2.3	0.006	2.3	0.006	0.1	0.000	1833.8	4.994
Jeff Davis/48243												
Jefferson/48245	328.0	0.891	353.3	0.960	9.9	0.027	9.9	0.027	0.3	0.001	11891.4	32.314
Jim Hogg/48247	436.1	1.188	447.3	1.218	7.4	0.020	7.4	0.020	0.2	0.001	2799.7	7.625
Jim Wells/48249	149.7	0.408	153.7	0.419	2.5	0.007	2.5	0.007	0.1	0.000	872.3	2.376
Johnson/48251	688.5	1.871	688.6	1.871	16.5	0.045	16.5	0.045	0.5	0.001	3738.0	10.158
Jones/48253	10.3	0.028	12.2	0.033	0.2	0.000	0.2	0.000	0.0	0.000	613.7	1.671
Karnes/48255	145.4	0.396	149.6	0.407	2.5	0.007	2.5	0.007	0.1	0.000	1021.7	2.782
Kaufman/48257	0.1	0.000	0.2	0.001	0.0	0.000	0.0	0.000	0.0	0.000	25.9	0.070
Kendall/48259												
Kenedy/48261	778.5	2.120	797.9	2.173	13.3	0.036	13.3	0.036	0.4	0.001	3584.1	9.761
Kent/48263	136.5	0.372	149.7	0.408	2.3	0.006	2.3	0.006	0.1	0.000	2171.6	5.914
Kerr/48265	0.0	0.000	0.0	0.000							0.8	0.002
Kimble/48267	5.0	0.014	5.2	0.014	0.1	0.000	0.1	0.000	0.0	0.000	21.1	0.057
King/48269	34.9	0.095	39.9	0.109	0.6	0.002	0.6	0.002	0.0	0.000	983.9	2.680
Kinney/48271												
Kleberg/48273	448.0	1.220	459.7	1.252	7.6	0.021	7.6	0.021	0.2	0.001	3475.4	9.465
Knox/48275	0.1	0.000	0.6	0.002	0.0	0.000	0.0	0.000	0.0	0.000	161.8	0.441
Lamar/48277												
Lamb/48279	3.6	0.010	5.3	0.015	0.1	0.000	0.1	0.000	0.0	0.000	286.9	0.781
Lampasas/48281												
La Salle/48283	225.2	0.613	231.2	0.630	3.8	0.010	3.8	0.010	0.1	0.000	1782.0	4.853
Lavaca/48285	1106.0	3.012	1133.9	3.088	18.9	0.051	18.9	0.051	0.5	0.001	5761.3	15.690
Lee/48287	216.3	0.589	224.9	0.612	3.7	0.010	3.7	0.010	0.1	0.000	1931.5	5.260
Leon/48289	672.5	1.831	690.8	1.881	11.5	0.031	11.5	0.031	0.3	0.001	3129.3	8.522
Liberty/48291	353.1	0.963	424.9	1.159	15.1	0.041	15.1	0.041	0.5	0.001	15220.0	41.509
Limestone/48293	1129.1	3.075	1156.7	3.150	19.2	0.052	19.2	0.052	0.5	0.001	4550.6	12.393
Lipscomb/48295	793.0	2.159	813.6	2.216	13.5	0.037	13.5	0.037	0.4	0.001	4691.9	12.778
Live Oak/48297	386.7	1.053	397.3	1.082	6.6	0.018	6.6	0.018	0.2	0.000	2446.0	6.661
Llano/48299												

Table 3-4b. County-Level Annual and Ozone Season Daily (OSD) Criteria Pollutant Emissions for Production Sources (Cont.)

Texas County/FIPS	CO-ANN tons/yr	CO-OSD tons/day	NO_X-ANN tons/yr	NO_X-OSD tons/day	PM_{10}-ANN tons/yr	PM_{10}-OSD tons/day	$PM_{2.5}$-ANN tons/yr	$PM_{2.5}$-OSD tons/day	SO_2-ANN tons/yr	SO_2-OSD tons/day	VOC-ANN tons/yr	VOC-OSD tons/day
Loving/48301	1045.8	2.848	1073.2	2.923	17.8	0.049	17.8	0.049	0.5	0.001	4630.8	12.611
Lubbock/48303	2.4	0.007	5.6	0.015	0.0	0.000	0.0	0.000	0.0	0.000	659.2	1.795
Lynn/48305	0.9	0.002	1.3	0.003	0.0	0.000	0.0	0.000	0.0	0.000	98.9	0.269
McCulloch/48307	0.5	0.001	0.7	0.002	0.0	0.000	0.0	0.000	0.0	0.000	65.2	0.177
McLennan/48309	0.0	0.000	0.0	0.000							28.5	0.078
McMullen/48311	929.0	2.530	954.0	2.598	15.8	0.043	15.8	0.043	0.4	0.001	4906.3	13.361
Madison/48313	121.7	0.331	125.7	0.342	2.1	0.006	2.1	0.006	0.1	0.000	843.2	2.296
Marion/48315	82.6	0.225	85.0	0.231	1.4	0.004	1.4	0.004	0.0	0.000	689.8	1.878
Martin/48317	174.6	0.475	189.1	0.515	2.9	0.008	2.9	0.008	0.1	0.000	2919.1	7.950
Mason/48319												
Matagorda/48321	471.7	1.285	485.5	1.322	8.0	0.022	8.0	0.022	0.2	0.001	5113.3	13.925
Maverick/48323	75.0	0.204	79.2	0.216	1.3	0.003	1.3	0.003	0.0	0.000	1122.8	3.058
Medina/48325	0.2	0.001	0.4	0.001	0.0	0.000	0.0	0.000	0.0	0.000	725.7	1.978
Menard/48327	1.8	0.005	2.1	0.006	0.0	0.000	0.0	0.000	0.0	0.000	93.8	0.255
Midland/48329	887.7	2.417	930.2	2.533	15.0	0.041	15.0	0.041	0.4	0.001	9843.2	26.806
Milam/48331	6.6	0.018	7.7	0.021	0.1	0.000	0.1	0.000	0.0	0.000	654.7	1.783
Mills/48333	0.2	0.001	0.3	0.001	0.0	0.000	0.0	0.000	0.0	0.000	1.2	0.003
Mitchell/48335	9.3	0.025	15.8	0.043	0.1	0.000	0.1	0.000	0.0	0.000	1948.1	5.305
Montague/48337	39.2	0.107	43.1	0.117	0.7	0.002	0.7	0.002	0.0	0.000	1583.2	4.311
Montgomery/48339	57.5	0.157	69.7	0.190	2.4	0.007	2.4	0.007	0.1	0.000	1619.6	4.417
Moore/48341	677.6	1.845	694.6	1.892	11.5	0.031	11.5	0.031	0.3	0.001	2985.3	8.130
Morris/48343	0.0	0.000	0.0	0.000							1.1	0.003
Motley/48345	0.0	0.000	0.1	0.000	0.0	0.000	0.0	0.000	0.0	0.000	21.9	0.060
Nacogdoches/48347	1025.6	2.793	1051.0	2.862	17.5	0.048	17.5	0.048	0.5	0.001	5198.6	14.157
Navarro/48349	8.8	0.024	9.6	0.026	0.1	0.000	0.1	0.000	0.0	0.000	508.3	1.384
Newton/48351	54.7	0.149	57.3	0.156	0.9	0.003	0.9	0.003	0.0	0.000	759.1	2.067
Nolan/48353	32.5	0.089	35.9	0.098	0.5	0.001	0.5	0.001	0.0	0.000	719.7	1.960
Nueces/48355	990.2	2.699	1016.9	2.772	16.9	0.046	16.9	0.046	0.5	0.001	7879.1	21.477
Ochiltree/48357	442.5	1.205	455.0	1.239	7.5	0.021	7.5	0.021	0.2	0.001	2605.6	7.096
Oldham/48359	3.5	0.010	3.7	0.010	0.1	0.000	0.1	0.000	0.0	0.000	40.3	0.110

Table 3-4b. County-Level Annual and Ozone Season Daily (OSD) Criteria Pollutant Emissions for Production Sources (Cont.)

Texas County/FIPS	CO-ANN tons/yr	CO-OSD tons/day	NO_X-ANN tons/yr	NO_X-OSD tons/day	PM_{10}-ANN tons/yr	PM_{10}-OSD tons/day	$PM_{2.5}$-ANN tons/yr	$PM_{2.5}$-OSD tons/day	SO_2-ANN tons/yr	SO_2-OSD tons/day	VOC-ANN tons/yr	VOC-OSD tons/day
Orange/48361	108.9	0.296	117.3	0.319	3.3	0.009	3.3	0.009	0.1	0.000	3884.3	10.555
Palo Pinto/48363	226.3	0.616	232.4	0.633	3.9	0.011	3.9	0.011	0.1	0.000	1508.1	4.107
Panola/48365	4282.2	11.662	4390.3	11.956	73.0	0.199	73.0	0.199	2.0	0.005	24328.0	66.253
Parker/48367	231.3	0.629	231.5	0.629	5.5	0.015	5.5	0.015	0.2	0.000	1660.5	4.512
Parmer/48369												
Pecos/48371	2951.9	8.039	3045.7	8.294	50.2	0.137	50.2	0.137	1.4	0.004	16122.6	43.907
Polk/48373	348.1	0.948	358.7	0.977	5.9	0.016	5.9	0.016	0.2	0.000	3973.1	10.820
Potter/48375	257.8	0.702	264.3	0.720	4.4	0.012	4.4	0.012	0.1	0.000	1265.6	3.447
Presidio/48377												
Rains/48379	90.5	0.246	92.7	0.252	1.5	0.004	1.5	0.004	0.0	0.000	326.9	0.890
Randall/48381												
Reagan/48383	445.4	1.213	466.4	1.270	7.5	0.021	7.5	0.021	0.2	0.001	5000.9	13.619
Real/48385	7.7	0.021	7.9	0.021	0.1	0.000	0.1	0.000	0.0	0.000	32.5	0.088
Red River/48387	0.1	0.000	0.4	0.001	0.0	0.000	0.0	0.000	0.0	0.000	74.5	0.203
Reeves/48389	425.5	1.159	437.4	1.191	7.2	0.020	7.2	0.020	0.2	0.001	2266.1	6.171
Refugio/48391	768.9	2.094	797.4	2.171	13.1	0.036	13.1	0.036	0.4	0.001	4720.4	12.855
Roberts/48393	565.1	1.539	580.5	1.581	9.6	0.026	9.6	0.026	0.3	0.001	3836.4	10.448
Robertson/48395	1831.9	4.989	1878.5	5.116	31.2	0.085	31.2	0.085	0.9	0.002	7193.5	19.590
Rockwall/48397												
Runnels/48399	25.3	0.069	26.9	0.073	0.4	0.001	0.4	0.001	0.0	0.000	442.8	1.206
Rusk/48401	1465.6	4.044	1506.5	4.157	25.0	0.069	25.0	0.069	0.7	0.002	8654.4	23.881
Sabine/48403	0.6	0.002	0.6	0.002	0.0	0.000	0.0	0.000	0.0	0.000	7.3	0.020
San Augustine/48405	0.5	0.001	0.5	0.001	0.0	0.000	0.0	0.000	0.0	0.000	8.1	0.022
San Jacinto/48407	93.2	0.254	95.9	0.262	1.6	0.004	1.6	0.004	0.0	0.000	1250.9	3.412
San Patricio/48409	497.1	1.355	512.0	1.396	8.5	0.023	8.5	0.023	0.2	0.001	6503.4	17.727
San Saba/48411												
Schleicher/48413	199.1	0.542	204.8	0.558	3.4	0.009	3.4	0.009	0.1	0.000	1358.1	3.698
Scurry/48415	421.1	1.147	463.7	1.263	7.0	0.019	7.0	0.019	0.2	0.001	7415.7	20.195
Shackelford/48417	52.5	0.143	55.2	0.150	0.9	0.002	0.9	0.002	0.0	0.000	1349.2	3.674
Shelby/48419	617.1	1.681	632.6	1.723	10.5	0.029	10.5	0.029	0.3	0.001	3207.4	8.735

Table 3-4b. County-Level Annual and Ozone Season Daily (OSD) Criteria Pollutant Emissions for Production Sources (Cont.)

Texas County/FIPS	CO-ANN tons/yr	CO-OSD tons/day	NO_X-ANN tons/yr	NO_X-OSD tons/day	PM_{10}-ANN tons/yr	PM_{10}-OSD tons/day	$PM_{2.5}$-ANN tons/yr	$PM_{2.5}$-OSD tons/day	SO_2-ANN tons/yr	SO_2-OSD tons/day	VOC-ANN tons/yr	VOC-OSD tons/day
Sherman/48421	350.1	0.953	358.8	0.977	6.0	0.016	6.0	0.016	0.2	0.000	1402.7	3.820
Smith/48423	824.0	2.274	847.2	2.338	14.0	0.039	14.0	0.039	0.4	0.001	5538.5	15.283
Somervell/48425	1.9	0.005	2.0	0.005	0.0	0.000	0.0	0.000	0.0	0.000	7.3	0.020
Starr/48427	2053.2	5.591	2107.6	5.740	35.0	0.095	35.0	0.095	1.0	0.003	16049.7	43.708
Stephens/48429	200.7	0.546	210.1	0.572	3.4	0.009	3.4	0.009	0.1	0.000	2206.1	6.008
Sterling/48431	264.9	0.721	273.8	0.746	4.5	0.012	4.5	0.012	0.1	0.000	2348.2	6.395
Stonewall/48433	8.3	0.023	10.6	0.029	0.1	0.000	0.1	0.000	0.0	0.000	615.7	1.677
Sutton/48435	1320.9	3.597	1353.1	3.685	22.5	0.061	22.5	0.061	0.6	0.002	5554.1	15.126
Swisher/48437												
Tarrant/48439	1283.6	3.488	1283.8	3.489	30.7	0.084	30.7	0.084	0.9	0.002	6887.4	18.716
Taylor/48441	3.9	0.011	5.1	0.014	0.1	0.000	0.1	0.000	0.0	0.000	390.3	1.063
Terrell/48443	1060.9	2.889	1087.2	2.961	18.1	0.049	18.1	0.049	0.5	0.001	5101.1	13.892
Terry/48445	24.0	0.065	32.9	0.090	0.4	0.001	0.4	0.001	0.0	0.000	1719.6	4.683
Throckmorton/48447	25.7	0.070	28.0	0.076	0.4	0.001	0.4	0.001	0.0	0.000	817.9	2.227
Titus/48449	0.3	0.001	1.3	0.004	0.0	0.000	0.0	0.000	0.0	0.000	238.6	0.650
Tom Green/48451	41.9	0.114	43.9	0.120	0.7	0.002	0.7	0.002	0.0	0.000	621.8	1.693
Travis/48453	0.0	0.000	0.0	0.000	0.0	0.000	0.0	0.000	0.0	0.000	14.2	0.039
Trinity/48455	3.4	0.009	3.7	0.010	0.1	0.000	0.1	0.000	0.0	0.000	63.2	0.172
Tyler/48457	298.8	0.814	311.0	0.847	5.1	0.014	5.1	0.014	0.1	0.000	11513.9	31.356
Upshur/48459	834.2	2.302	855.7	2.361	14.2	0.039	14.2	0.039	0.4	0.001	5617.3	15.500
Upton/48461	1232.3	3.356	1284.3	3.498	20.9	0.057	20.9	0.057	0.6	0.002	15899.5	43.299
Uvalde/48463	0.0	0.000	0.0	0.000	0.0	0.000	0.0	0.000	0.0	0.000	0.3	0.001
Val Verde/48465	291.7	0.794	298.8	0.814	5.0	0.014	5.0	0.014	0.1	0.000	1081.4	2.945
Van Zandt/48467	117.5	0.320	122.2	0.333	2.0	0.005	2.0	0.005	0.1	0.000	995.6	2.711
Victoria/48469	345.0	0.939	355.0	0.967	5.9	0.016	5.9	0.016	0.2	0.000	2322.9	6.326
Walker/48471	17.8	0.049	18.3	0.050	0.3	0.001	0.3	0.001	0.0	0.000	87.5	0.238
Waller/48473	27.1	0.074	34.4	0.094	1.1	0.003	1.1	0.003	0.0	0.000	1036.7	2.827
Ward/48475	787.0	2.143	815.6	2.221	13.4	0.036	13.4	0.036	0.4	0.001	5951.2	16.207
Washington/48477	418.5	1.140	429.9	1.171	7.1	0.019	7.1	0.019	0.2	0.001	2515.7	6.851
Webb/48479	3826.4	10.420	3921.9	10.681	65.2	0.178	65.2	0.178	1.8	0.005	20396.4	55.546

Table 3-4b. County-Level Annual and Ozone Season Daily (OSD) Criteria Pollutant Emissions for Production Sources (Cont.)

Texas County/FIPS	CO-ANN tons/yr	CO-OSD tons/day	NO_X-ANN tons/yr	NO_X-OSD tons/day	PM_{10}-ANN tons/yr	PM_{10}-OSD tons/day	$PM_{2.5}$-ANN tons/yr	$PM_{2.5}$-OSD tons/day	SO_2-ANN tons/yr	SO_2-OSD tons/day	VOC-ANN tons/yr	VOC-OSD tons/day
Wharton/48481	903.9	2.462	929.8	2.532	15.4	0.042	15.4	0.042	0.4	0.001	7502.1	20.431
Wheeler/48483	1016.8	2.769	1044.3	2.844	17.3	0.047	17.3	0.047	0.5	0.001	9032.0	24.597
Wichita/48485	5.0	0.014	9.4	0.026	0.1	0.000	0.1	0.000	0.0	0.000	3310.2	9.015
Wilbarger/48487	0.7	0.002	2.2	0.006	0.0	0.000	0.0	0.000	0.0	0.000	612.5	1.668
Willacy/48489	453.2	1.234	466.5	1.271	7.7	0.021	7.7	0.021	0.2	0.001	5056.5	13.771
Williamson/48491	0.0	0.000	0.0	0.000	0.0	0.000	0.0	0.000	0.0	0.000	24.9	0.068
Wilson/48493	0.6	0.002	1.2	0.003	0.0	0.000	0.0	0.000	0.0	0.000	377.8	1.030
Winkler/48495	627.9	1.710	650.4	1.771	10.7	0.029	10.7	0.029	0.3	0.001	4688.6	12.768
Wise/48497	2774.8	7.540	2844.0	7.728	47.3	0.129	47.3	0.129	1.3	0.004	13743.7	37.347
Wood/48499	216.8	0.590	230.7	0.628	3.7	0.010	3.7	0.010	0.1	0.000	2511.6	6.840
Yoakum/48501	442.0	1.204	503.4	1.371	7.3	0.020	7.3	0.020	0.2	0.001	10557.4	28.751
Young/48503	55.2	0.150	59.1	0.161	0.9	0.003	0.9	0.003	0.0	0.000	1843.8	5.021
Zapata/48505	4938.6	13.449	5058.8	13.777	84.2	0.229	84.2	0.229	2.3	0.006	19494.0	53.088
Zavala/48507	22.2	0.061	24.5	0.067	0.4	0.001	0.4	0.001	0.0	0.000	428.6	1.167
Total	88,949	242.41	91,998	250.72	1,578	4.30	1,578	4.30	44	0.12	715,941	1,950.95

In order to reflect significant figures, estimates should be interpreted as follows: 0.0 = <0.1; 0.00 = <0.01; and 0.000 = <0.001.

Table 3-4c. County-Level Annual and Ozone Season Daily (OSD) Criteria Pollutant Emissions for Offshore Platforms

Texas County/FIPS	CO-ANN tons/yr	CO-OSD tons/day	NO_X-ANN tons/yr	NO_X-OSD tons/day	PM_{10}-ANN tons/yr	PM_{10}-OSD tons/day	$PM_{2.5}$-ANN tons/yr	$PM_{2.5}$-OSD tons/day	SO_2-ANN tons/yr	SO_2-OSD tons/day	VOC-ANN tons/yr	VOC-OSD tons/day
Aransas/48007	70.1	0.191	195.3	0.532	3.5	0.010	3.5	0.009	13.1	0.036	116.3	0.317
Brazoria/48039	239.0	0.652	495.8	1.352	9.5	0.026	9.5	0.026	10.8	0.030	292.3	0.797
Calhoun/48057	456.8	1.244	947.7	2.581	18.1	0.049	18.1	0.049	20.7	0.056	367.9	1.002
Cameron/48061												
Chambers/48071	54.4	0.148	112.8	0.308	2.2	0.006	2.2	0.006	2.5	0.007	46.9	0.128
Galveston/48167	223.2	0.609	531.1	1.448	9.8	0.027	9.8	0.027	23.6	0.064	814.7	2.222
Jefferson/48245	750.0	2.038	1646.6	4.474	31.1	0.084	31.0	0.084	52.0	0.141	627.8	1.706
Kenedy/48261	231.9	0.631	481.1	1.310	9.2	0.025	9.2	0.025	10.5	0.029	908.1	2.473
Kleberg/48273	131.3	0.358	272.4	0.742	5.2	0.014	5.2	0.014	5.9	0.016	285.3	0.777
Matagorda/48321	385.3	1.049	802.2	2.185	15.3	0.042	15.3	0.042	18.0	0.049	357.3	0.973
Nueces/48355	137.7	0.375	355.8	0.970	6.5	0.018	6.4	0.018	20.2	0.055	208.2	0.568
San Patricio/48409												
Willacy/48489												
Brazos, Block 376	13.3	0.036	8.8	0.024	0.1	0.000	0.1	0.000	0.0	0.000	6.5	0.018
Brazos, Block 397	127.1	0.346	82.2	0.224	0.3	0.001	0.3	0.001	0.0	0.000	16.1	0.044
Brazos, Block 415	0.0	0.000	0.0	0.000	0.0	0.000	0.0	0.000	0.0	0.000	0.1	0.000
Brazos, Block 451	245.2	0.668	158.9	0.433	0.7	0.002	0.7	0.002	0.0	0.000	19.6	0.053
Brazos, Block 453	139.6	0.380	91.6	0.249	0.4	0.001	0.4	0.001	2.0	0.005	16.0	0.044
Brazos, Block 491	21.9	0.060	14.2	0.039	0.1	0.000	0.1	0.000	0.0	0.000	11.6	0.032
Brazos, Block 542	0.0	0.000	0.0	0.000	0.0	0.000	0.0	0.000	0.0	0.000	5.7	0.015
Galveston, Block 190	17.6	0.048	16.6	0.045	0.4	0.001	0.4	0.001	0.0	0.000	5.3	0.014
Galveston, Block 209	116.3	0.317	271.8	0.740	4.7	0.013	4.7	0.013	0.1	0.000	53.2	0.145
Galveston, Block 223	10.3	0.028	15.6	0.043	0.0	0.000	0.0	0.000	0.0	0.000	2.3	0.006
Galveston, Block 225											2.9	0.008
Galveston, Block 239	0.0	0.000	0.0	0.000	0.0	0.000	0.0	0.000	0.0	0.000	7.0	0.019
Galveston, Block 255	29.1	0.079	19.3	0.053	0.1	0.000	0.1	0.000	0.0	0.000	1.1	0.003
Galveston, Block 273	95.0	0.259	68.6	0.187	0.8	0.002	0.8	0.002	0.0	0.000	13.8	0.037
Galveston, Block 301	10.0	0.027	7.3	0.020	0.0	0.000	0.0	0.000	0.0	0.000	16.5	0.045
Galveston, Block 303	0.0	0.000	0.0	0.000	0.0	0.000	0.0	0.000	0.0	0.000	7.6	0.021
Galveston, Block 333	2.5	0.007	10.7	0.029	0.7	0.002	0.7	0.002	0.0	0.000	23.2	0.063

Table 3-4c. County-Level Annual and Ozone Season Daily (OSD) Criteria Pollutant Emissions for Offshore Platforms (Cont.)

Texas County/FIPS	CO-ANN tons/yr	CO-OSD tons/day	NO_X-ANN tons/yr	NO_X-OSD tons/day	PM_{10}-ANN tons/yr	PM_{10}-OSD tons/day	$PM_{2.5}$-ANN tons/yr	$PM_{2.5}$-OSD tons/day	SO_2-ANN tons/yr	SO_2-OSD tons/day	VOC-ANN tons/yr	VOC-OSD tons/day
Galveston, Block 343	84.6	0.231	56.9	0.155	0.0	0.000	0.0	0.000	0.1	0.000	40.2	0.109
Galveston, Block 395	10.3	0.028	6.9	0.019	0.0	0.000	0.0	0.000	0.0	0.000	11.8	0.032
High Island, Block 021											0.1	0.000
High Island, Block 022	36.5	0.099	23.6	0.064	0.1	0.000	0.1	0.000	0.0	0.000	5.5	0.015
High Island, Block 034	0.0	0.000	0.0	0.000	0.0	0.000	0.0	0.000	0.0	0.000	0.3	0.001
High Island, Block 037	0.2	0.001	0.3	0.001	0.0	0.000	0.0	0.000	0.0	0.000	22.6	0.061
High Island, Block 039	59.4	0.162	38.4	0.105	0.2	0.000	0.2	0.000	0.0	0.000	0.8	0.002
High Island, Block 045	122.9	0.335	79.5	0.217	0.3	0.001	0.3	0.001	0.0	0.000	5.3	0.014
High Island, Block 046	3.2	0.009	2.2	0.006	0.0	0.000	0.0	0.000	0.0	0.000	2.4	0.006
High Island, Block 052	15.3	0.042	9.9	0.027	0.0	0.000	0.0	0.000	0.0	0.000	26.6	0.072
High Island, Block 072											5.7	0.015
High Island, Block 084	7.8	0.021	11.9	0.032	0.0	0.000	0.0	0.000	0.0	0.000	12.6	0.034
High Island, Block 085	148.8	0.405	96.3	0.262	0.4	0.001	0.4	0.001	0.0	0.000	9.8	0.027
High Island, Block 110	56.6	0.154	37.7	0.103	0.2	0.001	0.2	0.001	0.0	0.000	6.9	0.019
High Island, Block 116	67.5	0.184	44.0	0.120	0.2	0.001	0.2	0.001	0.0	0.000	17.7	0.048
High Island, Block 136	123.2	0.335	82.0	0.223	0.5	0.001	0.5	0.001	0.0	0.000	5.8	0.016
High Island, Block 140	39.9	0.109	26.2	0.071	0.1	0.000	0.1	0.000	0.0	0.000	14.9	0.041
High Island, Block 154	12.4	0.034	13.6	0.037	0.2	0.001	0.2	0.001	0.0	0.000	46.4	0.126
High Island, Block 176	274.5	0.748	179.0	0.487	0.9	0.002	0.9	0.002	0.0	0.000	70.0	0.191
High Island, Block 177	96.2	0.262	79.3	0.216	0.9	0.002	0.9	0.002	0.0	0.000	5.4	0.015
High Island, Block 179	172.3	0.469	115.8	0.315	0.5	0.001	0.5	0.001	0.0	0.000	41.3	0.112
High Island, Block 194											7.0	0.019
Matagorda Island, Block 487	65.0	0.177	42.1	0.115	0.2	0.000	0.2	0.000	0.0	0.000	15.3	0.042
Matagorda Island, Block 555	112.6	0.307	75.0	0.204	0.5	0.001	0.5	0.001	0.0	0.000	82.2	0.224
Matagorda Island, Block 566	2.8	0.008	4.3	0.012	0.0	0.000	0.0	0.000	0.0	0.000	9.9	0.027
Matagorda Island, Block 587	153.6	0.418	99.5	0.271	0.4	0.001	0.4	0.001	0.0	0.000	1.3	0.004

Table 3-4c. County-Level Annual and Ozone Season Daily (OSD) Criteria Pollutant Emissions for Offshore Platforms (Cont.)

Texas County/FIPS	CO-ANN tons/yr	CO-OSD tons/day	NO_X-ANN tons/yr	NO_X-OSD tons/day	PM_{10}-ANN tons/yr	PM_{10}-OSD tons/day	$PM_{2.5}$-ANN tons/yr	$PM_{2.5}$-OSD tons/day	SO_2-ANN tons/yr	SO_2-OSD tons/day	VOC-ANN tons/yr	VOC-OSD tons/day
Matagorda Island, Block 588	0.0	0.000	0.0	0.000	0.0	0.000	0.0	0.000	0.0	0.000	8.5	0.023
Matagorda Island, Block 603	0.6	0.002	0.4	0.001	0.0	0.000	0.0	0.000	0.0	0.000	0.3	0.001
Matagorda Island, Block 604	219.7	0.598	144.6	0.394	0.8	0.002	0.8	0.002	0.0	0.000	16.3	0.045
Matagorda Island, Block 605	69.0	0.188	44.7	0.122	0.2	0.001	0.2	0.001	0.0	0.000	7.2	0.020
Matagorda Island, Block 618	31.1	0.085	29.4	0.080	0.1	0.000	0.1	0.000	0.0	0.000	11.6	0.032
Matagorda Island, Block 622	173.7	0.473	192.0	0.523	1.3	0.004	1.3	0.004	4.4	0.012	80.6	0.220
Matagorda Island, Block 623	187.7	0.511	127.0	0.346	1.0	0.003	1.0	0.003	0.0	0.000	23.7	0.065
Matagorda Island, Block 631	145.3	0.396	94.1	0.256	0.4	0.001	0.4	0.001	0.0	0.000	12.8	0.035
Matagorda Island, Block 632	180.7	0.492	117.6	0.320	0.5	0.001	0.5	0.001	0.1	0.000	2.3	0.006
Matagorda Island, Block 633	32.4	0.088	39.9	0.109	0.1	0.000	0.1	0.000	0.0	0.000	45.4	0.124
Matagorda Island, Block 635	0.0	0.000	0.0	0.000	0.0	0.000	0.0	0.000	0.0	0.000	7.1	0.019
Matagorda Island, Block 638	74.8	0.204	48.4	0.132	0.2	0.001	0.2	0.001	0.0	0.000	13.6	0.037
Matagorda Island, Block 657	1.4	0.004	6.4	0.017	0.5	0.001	0.5	0.001	0.0	0.000	1.0	0.003
Matagorda Island, Block 685	1.2	0.003	1.9	0.005	0.0	0.000	0.0	0.000	0.0	0.000	8.2	0.022
Matagorda Island, Block 686	150.9	0.411	98.9	0.269	0.5	0.001	0.5	0.001	0.0	0.000	14.3	0.039
Matagorda Island, Block 696	63.7	0.174	41.3	0.112	0.2	0.000	0.2	0.000	0.0	0.000	4.6	0.013
Matagorda Island, Block 699	72.7	0.198	47.2	0.129	0.2	0.001	0.2	0.001	0.0	0.000	23.7	0.065

Table 3-4c. County-Level Annual and Ozone Season Daily (OSD) Criteria Pollutant Emissions for Offshore Platforms (Cont.)

Texas County/FIPS	CO-ANN tons/yr	CO-OSD tons/day	NO_X-ANN tons/yr	NO_X-OSD tons/day	PM_{10}-ANN tons/yr	PM_{10}-OSD tons/day	$PM_{2.5}$-ANN tons/yr	$PM_{2.5}$-OSD tons/day	SO_2-ANN tons/yr	SO_2-OSD tons/day	VOC-ANN tons/yr	VOC-OSD tons/day
Mustang Island, Block 726	0.4	0.001	0.7	0.002	0.0	0.000	0.0	0.000	0.0	0.000	1.6	0.004
Mustang Island, Block 754	3.2	0.009	4.9	0.013	0.0	0.000	0.0	0.000	0.0	0.000	13.1	0.036
Mustang Island, Block 858	1.9	0.005	2.9	0.008	0.0	0.000	0.0	0.000	0.0	0.000	1.0	0.003
Sabine Pass-Louisiana, Block 006	0.0	0.000	0.0	0.000	0.0	0.000	0.0	0.000	0.0	0.000	0.0	0.000
Sabine Pass-Louisiana, Block 010	162.3	0.442	105.3	0.287	0.5	0.001	0.5	0.001	0.0	0.000	23.0	0.063
Sabine Pass-Louisiana, Block 012	0.4	0.001	0.5	0.001	0.0	0.000	0.0	0.000	0.0	0.000	7.5	0.020
Sabine Pass-Louisiana, Block 013	272.9	0.743	185.3	0.505	1.5	0.004	1.5	0.004	0.0	0.000	10.0	0.027
Sabine Pass-Texas, Block 018	69.0	0.188	44.7	0.122	0.2	0.001	0.2	0.001	0.0	0.000	3.7	0.010
West Cameron, Block 021	0.0	0.000	0.1	0.000	0.0	0.000	0.0	0.000	0.0	0.000	0.1	0.000
West Cameron, Block 022	0.6	0.002	0.8	0.002	0.0	0.000	0.0	0.000	0.0	0.000	7.2	0.020
West Cameron, Block 043	0.0	0.000	0.0	0.000	0.0	0.000	0.0	0.000	0.0	0.000	1.7	0.005
West Cameron, Block 044	49.3	0.134	57.0	0.155	2.2	0.006	2.2	0.006	0.0	0.000	2.8	0.008
West Cameron, Block 045	5.0	0.014	3.3	0.009	0.0	0.000	0.0	0.000	0.0	0.000	17.7	0.048
West Cameron, Block 048	151.6	0.413	99.5	0.271	0.4	0.001	0.4	0.001	0.0	0.000	29.0	0.079
West Cameron, Block 053	20.3	0.055	19.1	0.052	0.0	0.000	0.0	0.000	0.0	0.000	6.1	0.017
West Cameron, Block 116	0.0	0.000	0.0	0.000	0.0	0.000	0.0	0.000	0.0	0.000	1.4	0.004
West Cameron, Block 130	7.8	0.021	8.8	0.024	0.3	0.001	0.3	0.001	0.0	0.000	4.7	0.013
West Cameron, Block 153											0.1	0.000
Total	7,323	19.94	9,298	25.32	135	0.37	135	0.37	185	0.50	5,113	13.93

In order to reflect significant figures, estimates should be interpreted as follows: 0.0 = <0.1; 0.00 = <0.01; and 0.000 = <0.001.

Mud Degasssing: similar to drilling rig engines, it would be preferred to obtain the actual number of drilling days. Another piece of information that could help produce more accurate estimates would be the mud types used at all sites. The inventory was constructed assuming water-based muds, but some operators may use synthetic or oil-based muds. As indicated in the literature (MMS, 2007), the emission factors for synthetic – or oil-based muds are different.

Well completions: More site-specific information on actual or typical number of venting and flaring days during well completions is needed. Based on the requirements in the applicable TRC regulations, the inventory was developed assuming a conservative value of 10 days of venting.

Offshore-state waters: Obtaining better information on the actual number of platforms in state waters would improve this part of the inventory. Platform activity by area-block information was available, but the inventory had to be developed using an assumption for number of platforms per lease. As per a TCEQ Houston-Galveston area inventory, it was assumed that for oil, one oil platform per oil lease was used and for gas, one gas platform per six gas leases was used (TCEQ, 2000).

Dehydrators and Condensate Storage: The emission factors used for these categories came from the WRAP oil and gas study, and reflect factors developed in a different state. While the factors appear to be totally valid and acceptable, the inventory could be improved if emissions and controls information for these sources in Texas could be developed to better validate the factors used.

3.2 Source Category Contributions by Pollutant

3.2.1 Carbon Monoxide Emissions

Total statewide emissions of CO for onshore exploration and production and offshore production sources are estimated to be 125,968 tons per year. The top contributor to this amount is natural gas compressor engines used for onshore production (88,754 tons). Compressor engines were responsible then for 70.5% of total CO emissions in the oil and gas area source inventory. The next largest source after compressors was drilling rig engines used in exploration, constituting 21.8% of the CO emissions. The next four largest CO contributors are offshore platforms-federal waters compressor engines (3.6%), gas well completions (1.7%), offshore platforms-state waters compressor engines (0.68%), and offshore platforms-state waters natural gas turbines (0.68%). These six categories generate nearly 99% of the CO statewide estimate from oil and gas area sources.

3.2.2 Nitrogen Oxide Emissions

Similar to CO emissions, oil and gas area source NO_x emissions are also dominated by onshore exploration drilling rig engines and onshore production compressor engines. Total estimated NO_x emissions for all oil and gas area sources included in this inventory are 221,357 tons per year. Onshore exploration drilling rig engines make up 54.1% of this amount, while

onshore production compressor engines are responsible for 41.1%. The two categories combined generate over 95% of all estimated NO_x emissions. The most significant of the remaining sources include offshore platforms-state waters natural gas turbines (1.5%), offshore platforms-federal waters compressor engines (1.5%), offshore platforms-state waters diesel engines (0.45%), onshore production heater treaters (0.44%), and offshore platforms-state waters compressor engines (0.38%). These seven categories constitute 99.4% of the NO_x emissions estimated for oil and gas area sources statewide (including offshore sources).

3.2.3 Volatile Organic Compound Emissions

Practically every source in the inventory emits VOC, some less than 1 ton a year, while others are estimated to release several hundred thousand tons per year. Total statewide VOC from the sources included in the inventory have been estimated at 841,295 tons per year. Five categories dominate this emissions total (80.2% of all VOC) – onshore production glycol dehydrators (26.9%), onshore production condensate storage tanks (22.9%), onshore production gas wellheads (12.6%), onshore production crude oil storage tanks (9.1%), and pneumatic devices associated with onshore production gas and oil wells (8.7%). Of the remaining VOC emissions sources, six are responsible for 17.5% of VOC emissions, making these 11 categories the source of nearly 98% of all oil and gas area sources VOC emissions. The six categories comprising the 17.5% of emissions consists of onshore production pump and piping fugitives (5.1%), onshore production oil wellheads (4.1%), onshore production oil loading (3.2%), onshore exploration gas well completions (2.4%), exploration oil well completions (1.6%), and onshore exploration mud degassing (1.3%).

3.2.4 Sulfur Dioxide Emissions

Estimated emissions of SO_2 are clearly dominated by one source category – onshore exploration drilling rig engines. This category is estimated to release 97.4% of the total SO_2 emissions from oil and gas area sources. The next largest source of SO_2 is onshore exploration oil well completions at 138 tons per year or 0.98% of total emissions. Diesel engines and drilling rig engines on offshore platforms-state waters are responsible for 0.56% and 0.44%, respectively, of total SO_2 emissions. The remaining categories are estimated to be very minor SO_2 emitters.

3.2.5 Particulate Matter Emissions

Contributions to PM_{10} and $PM_{2.5}$ emissions track very consistently. Two categories dominate (over 96% of emissions) both PM_{10} and $PM_{2.5}$ emissions – onshore exploration drilling rig engines and onshore production natural gas compressor engines. The contributions to emissions are summarized as follows.

PM_{10}

Drilling Rig Engines – 53.8% of emissions
Compressor Engines – 42.5% of emissions

$PM_{2.5}$

Drilling Rig Engines – 53.3% of emissions
Compressor Engines – 43.0% of emissions

The only other PM emissions category that is estimated to contribute at least 1% to total PM_{10} or $PM_{2.5}$ emissions is diesel engines at offshore state waters platforms. This source category is responsible for approximately 1.9% of PM_{10} and $PM_{2.5}$ emissions. All remaining PM_{10} and $PM_{2.5}$ categories are less than 1% contributors.

3.3 Comparison of Emissions by County

Table 3-5 contains a listing of pollutant emissions by county for all sources included in this inventory, i.e., the values represent the sum of all onshore exploration, onshore production, and offshore production platform emissions for each county. Both annual and OSD emission estimates are provided. For the offshore federal waters data, emissions are listed by lease block since these are not assigned to counties. Discussions regarding the contribution of emissions by county for each source grouping are provided below.

3.3.1 Onshore Exploration

Annual and OSD emissions for all pollutants are presented at the county level for onshore exploration sources collectively in Table 3-4a. For counties emitting all pollutants (i.e., have both combustion sources and evaporative sources), a total of 14 counties make up roughly 50% of all emissions. These counties (in approximate descending order) are:

- Hemphill,
- Wheeler,
- Smith,
- Zapata,
- Crockett,
- Denton,
- Webb,
- Panola,
- Harrison,
- Freestone,
- Upton,
- Wise,
- LaSalle, and
- Robertson.

The lowest level of these counties represents about 2.0% of the emissions of any given pollutant such as CO, NO_x, PM_{10}, $PM_{2.5}$ or SO_2. The majority of the remaining Texas counties contribute less than 1% to total onshore exploration emissions, and many have emissions constituting less than 0.1% of the statewide total.

Table 3-5. Combined County-Level Emission Estimates for All Sources Included in the Inventory

Texas County/FIPS	CO-ANN	CO-OSD	NO_X-ANN	NO_X-OSD	PM_{10}-ANN	PM_{10}-OSD	$PM_{2.5}$-ANN	$PM_{2.5}$-OSD	SO_2-ANN	SO_2-OSD	VOC-ANN	VOC-OSD
	tons/yr	tons/day	tons/yr	tons/day	tons/yr	tons/day	tons/yr	tons/day	tons/yr	tons/day	tons/yr	tons/day
Anderson/48001	225.2	0.613	382.4	1.041	6.3	0.017	6.3	0.017	22.6	0.062	1740.9	4.741
Andrews/48003	634.2	1.727	930.5	2.534	14.5	0.039	14.4	0.039	38.8	0.106	15475.2	42.144
Angelina/48005	45.2	0.123	118.8	0.324	2.0	0.005	1.9	0.005	11.1	0.030	128.7	0.350
Aransas/48007	169.4	0.462	312.0	0.850	5.4	0.015	5.4	0.015	15.9	0.043	1121.8	3.058
Archer/48009	44.7	0.122	167.2	0.455	2.7	0.007	2.7	0.007	17.9	0.049	3139.9	8.551
Armstrong/48011												
Atascosa/48013	118.1	0.322	200.5	0.547	3.3	0.009	3.3	0.009	11.7	0.032	1691.0	4.610
Austin/48015	229.6	0.626	304.8	0.831	5.1	0.014	5.0	0.014	11.3	0.031	1689.5	4.608
Bailey/48017												
Bandera/48019	0.0	0.000	0.0	0.000							1.4	0.004
Bastrop/48021	5.8	0.016	6.1	0.017	0.1	0.000	0.1	0.000	0.0	0.000	399.4	1.089
Baylor/48023	3.7	0.010	16.3	0.044	0.3	0.001	0.3	0.001	1.8	0.005	161.4	0.440
Bee/48025	812.7	2.213	1446.5	3.939	24.1	0.066	23.8	0.065	93.3	0.254	3527.8	9.607
Bell/48027												
Bexar/48029	0.1	0.000	0.3	0.001	0.0	0.000	0.0	0.000	0.0	0.000	2552.7	6.958
Blanco/48031												
Borden/48033	77.5	0.211	204.2	0.556	3.2	0.009	3.2	0.009	17.8	0.048	2053.4	5.592
Bosque/48035	3.2	0.009	13.9	0.038	0.2	0.001	0.2	0.001	1.6	0.004	2.1	0.006
Bowie/48037	7.2	0.020	15.2	0.042	0.2	0.001	0.2	0.001	1.2	0.003	94.1	0.256
Brazoria/48039	621.6	1.695	1429.0	3.897	30.0	0.082	29.8	0.081	87.7	0.239	7583.3	20.682
Brazos/48041	226.7	0.617	363.5	0.990	6.0	0.016	5.9	0.016	21.8	0.059	2373.7	6.464
Brewster/48043												
Briscoe/48045												
Brooks/48047	1447.3	3.941	2019.3	5.499	33.5	0.091	33.3	0.091	84.2	0.229	10071.3	27.427
Brown/48049	29.5	0.080	45.5	0.124	0.8	0.002	0.7	0.002	2.3	0.006	861.0	2.345
Burleson/48051	256.1	0.697	358.2	0.975	5.9	0.016	5.8	0.016	17.4	0.047	3208.3	8.737
Burnet/48053												
Caldwell/48055	35.0	0.095	128.6	0.350	2.1	0.006	2.1	0.006	13.6	0.037	3127.3	8.525
Calhoun/48057	706.5	1.924	1387.2	3.778	25.4	0.069	25.3	0.069	48.6	0.132	1955.5	5.325
Callahan/48059	18.3	0.050	27.2	0.074	0.4	0.001	0.4	0.001	1.3	0.004	905.4	2.466

Table 3-5. Combined County-Level Emission Estimates for All Sources Included in the Inventory (Cont.)

Texas County/FIPS	CO-ANN	CO-OSD	NO_X-ANN	NO_X-OSD	PM_{10}-ANN	PM_{10}-OSD	$PM_{2.5}$-ANN	$PM_{2.5}$-OSD	SO_2-ANN	SO_2-OSD	VOC-ANN	VOC-OSD
	tons/yr	tons/day	tons/yr	tons/day	tons/yr	tons/day	tons/yr	tons/day	tons/yr	tons/day	tons/yr	tons/day
Cameron/48061	3.0	0.008	3.0	0.008	0.1	0.000	0.1	0.000	0.0	0.000	14.9	0.041
Camp/48063	14.2	0.039	15.0	0.041	0.2	0.001	0.2	0.001	0.0	0.000	205.0	0.558
Carson/48065	313.1	0.853	324.2	0.883	5.4	0.015	5.4	0.015	0.7	0.002	2652.7	7.224
Cass/48067	61.7	0.168	79.7	0.217	1.3	0.004	1.3	0.004	2.5	0.007	560.7	1.527
Castro/48069												
Chambers/48071	201.1	0.548	396.9	1.083	9.2	0.025	9.1	0.025	23.2	0.063	3855.8	10.516
Cherokee/48073	318.3	0.867	591.9	1.612	9.8	0.027	9.7	0.026	40.8	0.111	1652.0	4.499
Childress/48075	0.0	0.000	0.1	0.000	0.0	0.000	0.0	0.000	0.0	0.000	15.9	0.043
Clay/48077	25.5	0.070	66.8	0.182	1.1	0.003	1.1	0.003	6.0	0.016	1402.8	3.820
Cochran/48079	56.8	0.155	107.3	0.292	1.6	0.004	1.6	0.004	6.4	0.018	3056.8	8.325
Coke/48081	67.0	0.182	111.4	0.303	1.8	0.005	1.8	0.005	6.7	0.018	636.2	1.733
Coleman/48083	31.9	0.087	36.9	0.100	0.6	0.002	0.6	0.002	0.6	0.002	891.2	2.427
Collin/48085												
Collingsworth/48087	20.9	0.057	21.4	0.058	0.4	0.001	0.4	0.001	0.0	0.000	167.1	0.455
Colorado/48089	510.8	1.391	1031.4	2.809	17.2	0.047	16.9	0.046	77.2	0.210	2612.3	7.114
Comal/48091												
Comanche/48093	11.9	0.033	14.0	0.038	0.2	0.001	0.2	0.001	0.3	0.001	139.6	0.380
Concho/48095	53.0	0.144	143.9	0.392	2.4	0.006	2.3	0.006	13.7	0.037	502.5	1.368
Cooke/48097	196.6	0.535	785.2	2.138	13.0	0.036	12.8	0.035	87.4	0.238	2683.4	7.308
Coryell/48099												
Cottle/48101	115.4	0.314	234.9	0.640	3.9	0.011	3.9	0.010	17.7	0.048	589.5	1.605
Crane/48103	1008.1	2.745	1204.3	3.280	19.6	0.053	19.6	0.053	25.4	0.069	10388.0	28.290
Crockett/48105	2593.0	7.061	4888.4	13.313	81.1	0.221	80.1	0.218	344.7	0.939	13423.2	36.555
Crosby/48107	1.2	0.003	2.3	0.006	0.0	0.000	0.0	0.000	0.0	0.000	508.8	1.386
Culberson/48109	29.4	0.080	45.9	0.125	0.8	0.002	0.8	0.002	2.3	0.006	227.2	0.619
Dallam/48111												
Dallas/48113												
Dawson/48115	58.8	0.160	131.6	0.358	2.0	0.005	2.0	0.005	9.7	0.026	2540.2	6.918
Deaf Smith/48117												
Delta/48119												

Table 3-5. Combined County-Level Emission Estimates for All Sources Included in the Inventory (Cont.)

Texas County/FIPS	CO-ANN tons/yr	CO-OSD tons/day	NO_X-ANN tons/yr	NO_X-OSD tons/day	PM_{10}-ANN tons/yr	PM_{10}-OSD tons/day	$PM_{2.5}$-ANN tons/yr	$PM_{2.5}$-OSD tons/day	SO_2-ANN tons/yr	SO_2-OSD tons/day	VOC-ANN tons/yr	VOC-OSD tons/day
Denton/48121	2346.5	6.390	4446.7	12.110	85.7	0.233	84.6	0.230	323.6	0.881	13537.9	36.868
De Witt/48123	701.7	1.911	1307.7	3.561	21.7	0.059	21.4	0.058	90.5	0.246	5281.7	14.384
Dickens/48125	14.9	0.041	57.8	0.157	0.9	0.002	0.9	0.002	6.1	0.017	657.2	1.790
Dimmit/48127	112.1	0.305	275.5	0.750	4.5	0.012	4.5	0.012	25.3	0.069	1320.6	3.596
Donley/48129	0.3	0.001	0.3	0.001	0.0	0.000	0.0	0.000	0.0	0.000	1.7	0.005
Duval/48131	1212.5	3.302	1725.6	4.699	28.6	0.078	28.4	0.077	75.9	0.207	6748.1	18.377
Eastland/48133	113.4	0.309	239.3	0.652	4.0	0.011	3.9	0.011	18.6	0.051	1236.6	3.368
Ector/48135	911.7	2.483	1642.4	4.473	26.6	0.072	26.3	0.072	102.7	0.280	13767.6	37.493
Edwards/48137	317.6	0.865	418.6	1.140	7.0	0.019	6.9	0.019	14.4	0.039	1229.8	3.349
Ellis/48139	3.0	0.008	10.1	0.027	0.2	0.000	0.2	0.000	1.1	0.003	6.9	0.019
El Paso/48141												
Erath/48143	40.5	0.110	65.3	0.178	1.1	0.003	1.1	0.003	3.8	0.010	209.4	0.570
Falls/48145	2.7	0.007	11.7	0.032	0.2	0.001	0.2	0.001	1.3	0.004	26.7	0.073
Fannin/48147												
Fayette/48149	409.5	1.115	557.8	1.519	9.2	0.025	9.2	0.025	21.9	0.060	3958.4	10.780
Fisher/48151	16.3	0.044	29.1	0.079	0.5	0.001	0.5	0.001	2.0	0.005	611.0	1.664
Floyd/48153	3.2	0.009	13.7	0.037	0.2	0.001	0.2	0.001	1.6	0.004	4.0	0.011
Foard/48155	17.9	0.049	29.4	0.080	0.5	0.001	0.5	0.001	1.7	0.005	164.1	0.447
Fort Bend/48157	336.0	0.916	693.7	1.892	16.7	0.046	16.5	0.045	48.3	0.132	8556.9	23.337
Franklin/48159	81.8	0.223	174.8	0.476	2.9	0.008	2.9	0.008	14.3	0.039	803.6	2.188
Freestone/48161	4925.4	13.413	6878.8	18.733	114.5	0.312	113.6	0.309	283.0	0.771	17668.5	48.117
Frio/48163	24.7	0.067	47.2	0.129	0.8	0.002	0.8	0.002	3.1	0.009	731.4	1.992
Gaines/48165	950.0	2.587	2367.0	6.446	38.3	0.104	37.6	0.102	202.7	0.552	13817.1	37.628
Galveston/48167	313.0	0.854	695.6	1.897	14.1	0.039	14.1	0.038	33.3	0.091	5257.5	14.339
Garza/48169	56.8	0.155	202.0	0.550	3.2	0.009	3.1	0.009	20.3	0.055	3107.0	8.461
Gillespie/48171												
Glasscock/48173	238.6	0.650	334.3	0.910	5.4	0.015	5.4	0.015	14.1	0.038	3105.0	8.456
Goliad/48175	1647.1	4.485	2901.9	7.903	48.2	0.131	47.5	0.129	190.5	0.519	7975.6	21.720
Gonzales/48177	25.6	0.070	48.2	0.131	0.8	0.002	0.8	0.002	3.2	0.009	351.7	0.958
Gray/48179	225.6	0.614	257.0	0.700	4.2	0.012	4.2	0.011	3.8	0.010	3848.6	10.481

Table 3-5. Combined County-Level Emission Estimates for All Sources Included in the Inventory (Cont.)

Texas County/FIPS	CO-ANN tons/yr	CO-OSD tons/day	NO_X-ANN tons/yr	NO_X-OSD tons/day	PM_{10}-ANN tons/yr	PM_{10}-OSD tons/day	$PM_{2.5}$-ANN tons/yr	$PM_{2.5}$-OSD tons/day	SO_2-ANN tons/yr	SO_2-OSD tons/day	VOC-ANN tons/yr	VOC-OSD tons/day
Grayson/48181	189.7	0.517	488.9	1.331	8.1	0.022	8.0	0.022	45.8	0.125	1706.0	4.646
Gregg/48183	1206.5	3.329	1558.5	4.300	25.8	0.071	25.6	0.071	51.2	0.141	8815.3	24.325
Grimes/48185	391.5	1.066	583.2	1.588	9.6	0.026	9.5	0.026	30.6	0.083	1773.2	4.829
Guadalupe/48187	13.3	0.036	56.1	0.153	0.9	0.002	0.9	0.002	5.9	0.016	2285.9	6.231
Hale/48189	27.4	0.075	58.6	0.159	0.9	0.002	0.8	0.002	4.1	0.011	1056.0	2.876
Hall/48191												
Hamilton/48193	3.3	0.009	5.7	0.016	0.1	0.000	0.1	0.000	0.3	0.001	17.2	0.047
Hansford/48195	445.0	1.212	583.6	1.589	9.7	0.026	9.6	0.026	19.6	0.053	1909.8	5.201
Hardeman/48197	70.3	0.191	274.0	0.746	4.5	0.012	4.4	0.012	29.9	0.081	822.2	2.239
Hardin/48199	136.7	0.372	323.3	0.879	6.3	0.017	6.2	0.017	28.6	0.078	4041.1	10.981
Harris/48201	222.5	0.607	455.7	1.243	11.2	0.031	11.1	0.030	30.2	0.082	5090.9	13.884
Harrison/48203	1854.8	5.118	3798.3	10.481	63.2	0.174	62.2	0.172	294.2	0.812	8902.6	24.566
Hartley/48205	47.6	0.130	80.8	0.220	1.3	0.004	1.3	0.004	4.8	0.013	246.3	0.671
Haskell/48207	1.6	0.004	4.6	0.012	0.1	0.000	0.1	0.000	0.3	0.001	353.6	0.963
Hays/48209												
Hemphill/48211	5254.9	14.311	16924.1	46.090	282.3	0.769	276.7	0.754	1739.8	4.738	13942.1	37.969
Henderson/48213	667.5	1.818	769.1	2.094	12.8	0.035	12.7	0.035	13.5	0.037	2917.5	7.945
Hidalgo/48215	3747.6	10.206	4954.2	13.492	82.2	0.224	81.7	0.222	175.6	0.478	25909.5	70.560
Hill/48217	67.8	0.185	293.4	0.799	4.9	0.013	4.8	0.013	33.6	0.091	42.8	0.117
Hockley/48219	251.4	0.685	579.9	1.579	8.8	0.024	8.7	0.024	45.3	0.123	10379.7	28.267
Hood/48221	134.6	0.367	260.7	0.710	4.3	0.012	4.3	0.012	19.5	0.053	614.3	1.673
Hopkins/48223	22.2	0.060	29.4	0.080	0.5	0.001	0.5	0.001	0.9	0.002	254.8	0.694
Houston/48225	251.2	0.684	443.3	1.207	7.3	0.020	7.2	0.020	29.1	0.079	1326.4	3.612
Howard/48227	125.9	0.343	211.3	0.575	3.3	0.009	3.2	0.009	11.9	0.032	5403.4	14.715
Hudspeth/48229												
Hunt/48231												
Hutchinson/48233	265.1	0.722	347.9	0.947	5.8	0.016	5.7	0.016	11.5	0.031	4049.5	11.028
Irion/48235	369.2	1.005	1095.9	2.985	18.2	0.050	17.9	0.049	108.6	0.296	2635.5	7.177
Jack/48237	348.5	0.949	678.3	1.847	11.3	0.031	11.1	0.030	49.4	0.135	3419.6	9.313
Jackson/48239	523.1	1.425	690.2	1.880	11.4	0.031	11.3	0.031	25.5	0.069	3709.6	10.102

Table 3-5. Combined County-Level Emission Estimates for All Sources Included in the Inventory (Cont.)

Texas County/FIPS	CO-ANN	CO-OSD	NO_X-ANN	NO_X-OSD	PM_{10}-ANN	PM_{10}-OSD	$PM_{2.5}$-ANN	$PM_{2.5}$-OSD	SO_2-ANN	SO_2-OSD	VOC-ANN	VOC-OSD
	tons/yr	tons/day	tons/yr	tons/day	tons/yr	tons/day	tons/yr	tons/day	tons/yr	tons/day	tons/yr	tons/day
Jasper/48241	143.0	0.390	158.0	0.430	2.6	0.007	2.6	0.007	3.4	0.009	2021.1	5.504
Jeff Davis/48243												
Jefferson/48245	1168.1	3.174	2333.1	6.340	46.4	0.126	46.2	0.126	91.1	0.248	12846.9	34.910
Jim Hogg/48247	647.9	1.765	1321.9	3.600	22.0	0.060	21.7	0.059	100.2	0.273	3062.0	8.339
Jim Wells/48249	169.2	0.461	231.9	0.632	3.9	0.010	3.8	0.010	9.1	0.025	971.7	2.646
Johnson/48251	997.6	2.711	1667.9	4.532	32.6	0.089	32.2	0.088	110.7	0.301	4669.2	12.688
Jones/48253	22.5	0.061	64.0	0.174	1.0	0.003	1.0	0.003	6.4	0.018	987.8	2.690
Karnes/48255	178.7	0.487	283.6	0.772	4.7	0.013	4.7	0.013	15.9	0.043	1172.6	3.193
Kaufman/48257	0.1	0.000	0.2	0.001	0.0	0.000	0.0	0.000	0.0	0.000	34.3	0.093
Kendall/48259												
Kenedy/48261	1169.9	3.186	1900.3	5.175	32.8	0.089	32.6	0.089	81.6	0.222	4731.9	12.886
Kent/48263	139.3	0.379	161.5	0.440	2.5	0.007	2.5	0.007	1.4	0.004	2401.9	6.541
Kerr/48265	0.0	0.000	0.0	0.000							1.2	0.003
Kimble/48267	7.4	0.020	14.3	0.039	0.2	0.001	0.2	0.001	1.0	0.003	28.0	0.076
King/48269	50.7	0.138	108.1	0.294	1.7	0.005	1.7	0.005	7.9	0.021	1200.3	3.269
Kinney/48271												
Kleberg/48273	637.7	1.737	955.5	2.602	16.5	0.045	16.5	0.045	31.6	0.086	3884.3	10.578
Knox/48275	1.0	0.003	4.4	0.012	0.1	0.000	0.1	0.000	0.4	0.001	251.9	0.686
Lamar/48277												
Lamb/48279	3.6	0.010	5.3	0.015	0.1	0.000	0.1	0.000	0.0	0.000	312.7	0.852
Lampasas/48281	0.4	0.001	1.7	0.005	0.0	0.000	0.0	0.000	0.2	0.001	0.4	0.001
La Salle/48283	788.5	2.147	2652.1	7.223	44.2	0.120	43.3	0.118	277.5	0.756	2307.6	6.284
Lavaca/48285	1276.2	3.476	1778.0	4.842	29.5	0.080	29.3	0.080	73.8	0.201	6101.6	16.617
Lee/48287	272.3	0.742	446.0	1.215	7.3	0.020	7.3	0.020	34.6	0.094	3213.0	8.750
Leon/48289	1200.3	3.269	2879.0	7.840	47.9	0.130	47.1	0.128	250.3	0.682	3707.6	10.097
Liberty/48291	533.8	1.456	1098.5	2.996	26.2	0.072	26.0	0.071	77.7	0.212	15879.8	43.309
Limestone/48293	1402.9	3.821	2251.7	6.132	37.5	0.102	37.1	0.101	125.4	0.341	4974.8	13.548
Lipscomb/48295	993.5	2.706	1558.9	4.246	25.9	0.070	25.6	0.070	88.5	0.241	5596.9	15.242
Live Oak/48297	878.9	2.394	2504.9	6.822	41.7	0.114	41.0	0.112	241.5	0.658	2927.0	7.971
Llano/48299												

Table 3-5. Combined County-Level Emission Estimates for All Sources Included in the Inventory (Cont.)

Texas County/FIPS	CO-ANN	CO-OSD	NO_X-ANN	NO_X-OSD	PM_{10}-ANN	PM_{10}-OSD	$PM_{2.5}$-ANN	$PM_{2.5}$-OSD	SO_2-ANN	SO_2-OSD	VOC-ANN	VOC-OSD
	tons/yr	tons/day	tons/yr	tons/day	tons/yr	tons/day	tons/yr	tons/day	tons/yr	tons/day	tons/yr	tons/day
Loving/48301	1338.5	3.645	2187.1	5.956	36.3	0.099	35.9	0.098	127.3	0.347	5399.2	14.704
Lubbock/48303	10.3	0.028	39.9	0.109	0.6	0.002	0.6	0.002	3.9	0.011	854.2	2.326
Lynn/48305	7.2	0.020	28.6	0.078	0.5	0.001	0.5	0.001	3.2	0.009	146.6	0.399
McCulloch/48307	8.4	0.023	35.4	0.096	0.6	0.002	0.6	0.002	4.0	0.011	107.8	0.293
McLennan/48309	0.0	0.000	0.0	0.000							55.6	0.151
McMullen/48311	1262.6	3.438	2237.0	6.092	37.1	0.101	36.7	0.100	147.0	0.400	5752.5	15.666
Madison/48313	152.2	0.414	256.4	0.698	4.3	0.012	4.2	0.011	16.0	0.044	1026.6	2.796
Marion/48315	106.2	0.289	180.1	0.491	3.0	0.008	3.0	0.008	11.3	0.031	852.3	2.321
Martin/48317	294.6	0.802	709.4	1.932	11.6	0.032	11.4	0.031	61.0	0.166	3856.8	10.503
Mason/48319												
Matagorda/48321	1009.0	2.748	1847.6	5.032	32.6	0.089	32.4	0.088	83.1	0.226	5942.7	16.184
Maverick/48323	222.8	0.607	721.6	1.965	12.0	0.033	11.8	0.032	74.3	0.202	1544.8	4.207
Medina/48325	1.4	0.004	5.5	0.015	0.1	0.000	0.1	0.000	0.6	0.002	1405.6	3.831
Menard/48327	4.3	0.012	13.0	0.035	0.2	0.001	0.2	0.001	1.2	0.003	145.3	0.396
Midland/48329	1153.9	3.143	2082.1	5.670	34.3	0.093	33.8	0.092	135.2	0.368	12228.3	33.301
Milam/48331	10.7	0.029	25.8	0.070	0.4	0.001	0.4	0.001	2.1	0.006	1121.7	3.055
Mills/48333	12.3	0.034	53.0	0.144	0.9	0.002	0.9	0.002	6.0	0.016	8.2	0.022
Mitchell/48335	33.3	0.091	120.6	0.328	1.9	0.005	1.8	0.005	12.1	0.033	2933.1	7.988
Montague/48337	147.0	0.400	508.6	1.385	8.4	0.023	8.3	0.022	55.0	0.150	2759.5	7.515
Montgomery/48339	95.1	0.259	229.9	0.627	5.1	0.014	5.1	0.014	18.4	0.050	1722.6	4.698
Moore/48341	695.2	1.893	766.2	2.087	12.7	0.035	12.7	0.035	8.6	0.023	3447.4	9.388
Morris/48343	0.0	0.000	0.0	0.000							1.6	0.004
Motley/48345	0.0	0.000	0.1	0.000	0.0	0.000	0.0	0.000	0.0	0.000	30.4	0.083
Nacogdoches/48347	1283.4	3.495	1971.3	5.368	32.7	0.089	32.4	0.088	104.8	0.285	5834.0	15.888
Navarro/48349	22.7	0.062	67.8	0.185	1.1	0.003	1.1	0.003	6.8	0.018	878.4	2.392
Newton/48351	95.2	0.259	227.7	0.620	3.8	0.010	3.7	0.010	21.8	0.059	1047.7	2.853
Nolan/48353	47.9	0.130	102.2	0.278	1.7	0.004	1.6	0.004	7.8	0.021	950.8	2.589
Nueces/48355	1322.6	3.605	2168.4	5.911	36.6	0.100	36.3	0.099	112.0	0.305	8487.5	23.136
Ochiltree/48357	499.0	1.359	668.7	1.821	11.1	0.030	11.0	0.030	25.2	0.069	3071.1	8.363
Oldham/48359	3.6	0.010	3.8	0.010	0.1	0.000	0.1	0.000	0.0	0.000	48.8	0.133

Table 3-5. Combined County-Level Emission Estimates for All Sources Included in the Inventory (Cont.)

Texas County/FIPS	CO-ANN	CO-OSD	NO_X-ANN	NO_X-OSD	PM_{10}-ANN	PM_{10}-OSD	$PM_{2.5}$-ANN	$PM_{2.5}$-OSD	SO_2-ANN	SO_2-OSD	VOC-ANN	VOC-OSD
	tons/yr	tons/day	tons/yr	tons/day	tons/yr	tons/day	tons/yr	tons/day	tons/yr	tons/day	tons/yr	tons/day
Orange/48361	141.7	0.385	260.4	0.708	5.7	0.015	5.6	0.015	16.5	0.045	3963.6	10.771
Palo Pinto/48363	248.1	0.676	308.2	0.839	5.1	0.014	5.1	0.014	9.4	0.026	1930.6	5.258
Panola/48365	4987.1	13.581	7101.1	19.338	118.0	0.321	117.0	0.319	313.8	0.855	26226.0	71.421
Parker/48367	407.1	1.106	944.1	2.565	17.4	0.047	17.1	0.047	82.5	0.224	2069.8	5.625
Parmer/48369												
Pecos/48371	3156.7	8.597	3859.0	10.509	63.8	0.174	63.5	0.173	94.7	0.258	17810.7	48.504
Polk/48373	384.7	1.048	506.6	1.380	8.4	0.023	8.3	0.023	17.0	0.046	4077.3	11.104
Potter/48375	295.6	0.805	420.3	1.145	7.0	0.019	6.9	0.019	17.9	0.049	1602.1	4.363
Presidio/48377												
Rains/48379	90.5	0.246	92.7	0.252	1.5	0.004	1.5	0.004	0.0	0.000	328.2	0.894
Randall/48381												
Reagan/48383	938.3	2.555	2606.4	7.098	43.3	0.118	42.5	0.116	248.4	0.677	7216.0	19.652
Real/48385	8.0	0.022	9.5	0.026	0.2	0.000	0.2	0.000	0.2	0.001	34.2	0.093
Red River/48387	0.1	0.000	0.4	0.001	0.0	0.000	0.0	0.000	0.0	0.000	98.5	0.268
Reeves/48389	502.9	1.369	767.4	2.090	12.8	0.035	12.6	0.034	38.3	0.104	2676.4	7.289
Refugio/48391	837.2	2.280	1057.7	2.880	17.4	0.047	17.3	0.047	34.5	0.094	5651.8	15.391
Roberts/48393	733.6	1.998	1231.6	3.354	20.4	0.056	20.2	0.055	78.0	0.212	4552.3	12.397
Robertson/48395	2415.4	6.578	4231.1	11.522	70.4	0.192	69.5	0.189	269.3	0.733	7937.2	21.616
Rockwall/48397												
Runnels/48399	61.7	0.168	183.3	0.499	3.0	0.008	3.0	0.008	18.9	0.051	769.5	2.096
Rusk/48401	1906.2	5.260	3188.9	8.799	52.9	0.146	52.3	0.144	192.1	0.530	10285.4	28.381
Sabine/48403	3.3	0.009	12.6	0.034	0.2	0.001	0.2	0.001	1.4	0.004	11.9	0.033
San Augustine/48405	0.5	0.001	0.5	0.001	0.0	0.000	0.0	0.000	0.0	0.000	12.3	0.034
San Jacinto/48407	122.2	0.333	214.0	0.584	3.6	0.010	3.5	0.010	13.5	0.037	1294.2	3.530
San Patricio/48409	680.1	1.854	1279.7	3.488	21.3	0.058	21.0	0.057	88.0	0.240	6738.6	18.368
San Saba/48411												
Schleicher/48413	255.2	0.695	382.5	1.042	6.3	0.017	6.2	0.017	20.6	0.056	1740.3	4.739
Scurry/48415	523.8	1.427	899.6	2.450	14.3	0.039	14.1	0.039	55.5	0.151	9076.2	24.717
Shackelford/48417	64.3	0.175	105.9	0.289	1.7	0.005	1.7	0.005	5.9	0.016	2230.3	6.074

Table 3-5. Combined County-Level Emission Estimates for All Sources Included in the Inventory (Cont.)

Texas County/FIPS	CO-ANN	CO-OSD	NO_X-ANN	NO_X-OSD	PM_{10}-ANN	PM_{10}-OSD	$PM_{2.5}$-ANN	$PM_{2.5}$-OSD	SO_2-ANN	SO_2-OSD	VOC-ANN	VOC-OSD
	tons/yr	tons/day	tons/yr	tons/day	tons/yr	tons/day	tons/yr	tons/day	tons/yr	tons/day	tons/yr	tons/day
Shelby/48419	712.7	1.941	996.8	2.714	16.6	0.045	16.4	0.045	43.3	0.118	3551.4	9.672
Sherman/48421	357.4	0.973	388.0	1.057	6.5	0.018	6.4	0.018	3.5	0.010	1504.9	4.098
Smith/48423	2082.9	5.748	6012.6	16.591	100.0	0.276	98.2	0.271	591.0	1.631	6982.6	19.268
Somervell/48425	4.8	0.013	13.9	0.038	0.2	0.001	0.2	0.001	1.4	0.004	10.5	0.029
Starr/48427	2203.1	6.000	2580.6	7.028	42.7	0.116	42.6	0.116	54.7	0.149	16712.2	45.513
Stephens/48429	229.5	0.625	331.2	0.902	5.4	0.015	5.4	0.015	14.4	0.039	2902.0	7.903
Sterling/48431	315.7	0.860	490.1	1.335	8.1	0.022	8.0	0.022	25.9	0.071	3121.1	8.500
Stonewall/48433	13.3	0.036	32.4	0.088	0.5	0.001	0.5	0.001	2.5	0.007	895.5	2.439
Sutton/48435	1397.6	3.806	1619.6	4.411	26.9	0.073	26.8	0.073	30.8	0.084	6140.9	16.724
Swisher/48437												
Tarrant/48439	1613.3	4.384	2394.1	6.506	49.0	0.133	48.6	0.132	126.4	0.343	7789.1	21.166
Taylor/48441	5.5	0.015	11.4	0.031	0.2	0.000	0.2	0.000	1.0	0.003	624.2	1.700
Terrell/48443	1188.8	3.238	1591.4	4.334	26.5	0.072	26.3	0.072	58.6	0.160	5380.2	14.652
Terry/48445	54.7	0.149	166.2	0.453	2.6	0.007	2.6	0.007	15.4	0.042	2163.9	5.893
Throckmorton/48447	31.0	0.085	50.8	0.138	0.8	0.002	0.8	0.002	2.8	0.008	1294.2	3.525
Titus/48449	1.6	0.004	7.0	0.019	0.1	0.000	0.1	0.000	0.7	0.002	326.0	0.888
Tom Green/48451	109.7	0.299	337.7	0.920	5.6	0.015	5.5	0.015	33.9	0.092	968.5	2.638
Travis/48453	0.0	0.000	0.0	0.000	0.0	0.000	0.0	0.000	0.0	0.000	27.5	0.075
Trinity/48455	3.6	0.010	4.5	0.012	0.1	0.000	0.1	0.000	0.1	0.000	73.8	0.201
Tyler/48457	604.0	1.645	1576.4	4.293	26.2	0.071	25.7	0.070	144.8	0.394	11825.5	32.205
Upshur/48459	1075.2	2.967	1860.8	5.135	31.0	0.085	30.6	0.084	115.4	0.319	5938.6	16.387
Upton/48461	1835.0	4.997	3749.9	10.212	62.0	0.169	61.1	0.166	288.0	0.784	18047.2	49.148
Uvalde/48463	0.0	0.000	0.0	0.000	0.0	0.000	0.0	0.000	0.0	0.000	0.5	0.001
Val Verde/48465	358.2	0.976	571.2	1.555	9.5	0.026	9.4	0.026	31.2	0.085	1176.2	3.203
Van Zandt/48467	121.3	0.330	138.9	0.378	2.3	0.006	2.3	0.006	2.0	0.005	1249.0	3.401
Victoria/48469	375.7	1.023	465.2	1.267	7.7	0.021	7.7	0.021	12.9	0.035	2524.0	6.874
Walker/48471	27.8	0.076	59.5	0.162	1.0	0.003	1.0	0.003	4.9	0.013	121.2	0.330
Waller/48473	60.5	0.165	174.4	0.476	3.5	0.009	3.4	0.009	16.9	0.046	1251.1	3.412
Ward/48475	1005.2	2.737	1757.6	4.786	29.1	0.079	28.8	0.078	110.5	0.301	7511.9	20.457
Washington/48477	476.9	1.299	638.8	1.740	10.6	0.029	10.5	0.029	24.0	0.065	2712.7	7.388

Table 3-5. Combined County-Level Emission Estimates for All Sources Included in the Inventory (Cont.)

Texas County/FIPS	CO-ANN	CO-OSD	NO_X-ANN	NO_X-OSD	PM_{10}-ANN	PM_{10}-OSD	$PM_{2.5}$-ANN	$PM_{2.5}$-OSD	SO_2-ANN	SO_2-OSD	VOC-ANN	VOC-OSD
	tons/yr	tons/day	tons/yr	tons/day	tons/yr	tons/day	tons/yr	tons/day	tons/yr	tons/day	tons/yr	tons/day
Webb/48479	4544.7	12.377	6660.3	18.138	110.7	0.301	109.7	0.299	313.3	0.853	22031.3	59.998
Wharton/48481	1128.5	3.073	1806.8	4.920	30.0	0.082	29.6	0.081	100.9	0.275	8031.9	21.874
Wheeler/48483	3263.5	8.888	10568.9	28.782	176.2	0.480	172.7	0.470	1090.9	2.971	10893.1	29.665
Wichita/48485	19.4	0.053	72.0	0.196	1.1	0.003	1.1	0.003	7.2	0.020	5910.8	16.097
Wilbarger/48487	40.2	0.109	174.1	0.474	2.9	0.008	2.8	0.008	19.7	0.054	1032.4	2.812
Willacy/48489	505.1	1.376	661.2	1.801	10.9	0.030	10.9	0.030	22.6	0.061	5215.9	14.204
Williamson/48491	0.0	0.000	0.0	0.000	0.0	0.000	0.0	0.000	0.0	0.000	46.3	0.126
Wilson/48493	8.0	0.022	33.3	0.091	0.5	0.001	0.5	0.001	3.7	0.010	667.7	1.820
Winkler/48495	811.0	2.209	1430.0	3.894	23.7	0.064	23.4	0.064	92.8	0.253	5998.3	16.335
Wise/48497	3384.1	9.196	5251.0	14.269	87.3	0.237	86.4	0.235	280.0	0.761	15582.2	42.343
Wood/48499	225.5	0.614	268.3	0.731	4.3	0.012	4.3	0.012	4.5	0.012	2807.8	7.647
Yoakum/48501	558.2	1.520	1000.9	2.726	15.6	0.043	15.4	0.042	60.1	0.164	12446.7	33.896
Young/48503	65.9	0.179	104.4	0.284	1.7	0.005	1.7	0.005	5.3	0.014	3053.3	8.315
Zapata/48505	6054.2	16.488	9233.8	25.147	153.4	0.418	151.9	0.414	476.8	1.298	21628.7	58.902
Zavala/48507	66.7	0.182	217.9	0.593	3.6	0.010	3.5	0.010	22.3	0.061	552.2	1.504
Brazos, Block 376	13.3	0.036	8.8	0.024	0.1	0.000	0.1	0.000	0.0	0.000	6.5	0.018
Brazos, Block 397	127.1	0.346	82.2	0.224	0.3	0.001	0.3	0.001	0.0	0.000	16.1	0.044
Brazos, Block 415	0.0	0.000	0.0	0.000	0.0	0.000	0.0	0.000	0.0	0.000	0.1	0.000
Brazos, Block 451	245.2	0.668	158.9	0.433	0.7	0.002	0.7	0.002	0.0	0.000	19.6	0.053
Brazos, Block 453	139.6	0.380	91.6	0.249	0.4	0.001	0.4	0.001	2.0	0.005	16.0	0.044
Brazos, Block 491	21.9	0.060	14.2	0.039	0.1	0.000	0.1	0.000	0.0	0.000	11.6	0.032
Brazos, Block 542	0.0	0.000	0.0	0.000	0.0	0.000	0.0	0.000	0.0	0.000	5.7	0.015
Galveston, Block 190	17.6	0.048	16.6	0.045	0.4	0.001	0.4	0.001	0.0	0.000	5.3	0.014
Galveston, Block 209	116.3	0.317	271.8	0.740	4.7	0.013	4.7	0.013	0.1	0.000	53.2	0.145
Galveston, Block 223	10.3	0.028	15.6	0.043	0.0	0.000	0.0	0.000	0.0	0.000	2.3	0.006
Galveston, Block 225											2.9	0.008
Galveston, Block 239	0.0	0.000	0.0	0.000	0.0	0.000	0.0	0.000	0.0	0.000	7.0	0.019
Galveston, Block 255	29.1	0.079	19.3	0.053	0.1	0.000	0.1	0.000	0.0	0.000	1.1	0.003
Galveston, Block 273	95.0	0.259	68.6	0.187	0.8	0.002	0.8	0.002	0.0	0.000	13.8	0.037
Galveston, Block 301	10.0	0.027	7.3	0.020	0.0	0.000	0.0	0.000	0.0	0.000	16.5	0.045

Table 3-5. Combined County-Level Emission Estimates for All Sources Included in the Inventory (Cont.)

Texas County/FIPS	CO-ANN	CO-OSD	NO_X-ANN	NO_X-OSD	PM_{10}-ANN	PM_{10}-OSD	$PM_{2.5}$-ANN	$PM_{2.5}$-OSD	SO_2-ANN	SO_2-OSD	VOC-ANN	VOC-OSD
	tons/yr	tons/day	tons/yr	tons/day	tons/yr	tons/day	tons/yr	tons/day	tons/yr	tons/day	tons/yr	tons/day
Galveston, Block 303	0.0	0.000	0.0	0.000	0.0	0.000	0.0	0.000	0.0	0.000	7.6	0.021
Galveston, Block 333	2.5	0.007	10.7	0.029	0.7	0.002	0.7	0.002	0.0	0.000	23.2	0.063
Galveston, Block 343	84.6	0.231	56.9	0.155	0.0	0.000	0.0	0.000	0.1	0.000	40.2	0.109
Galveston, Block 395	10.3	0.028	6.9	0.019	0.0	0.000	0.0	0.000	0.0	0.000	11.8	0.032
High Island, Block 021											0.1	0.000
High Island, Block 022	36.5	0.099	23.6	0.064	0.1	0.000	0.1	0.000	0.0	0.000	5.5	0.015
High Island, Block 034	0.0	0.000	0.0	0.000	0.0	0.000	0.0	0.000	0.0	0.000	0.3	0.001
High Island, Block 037	0.2	0.001	0.3	0.001	0.0	0.000	0.0	0.000	0.0	0.000	22.6	0.061
High Island, Block 039	59.4	0.162	38.4	0.105	0.2	0.000	0.2	0.000	0.0	0.000	0.8	0.002
High Island, Block 045	122.9	0.335	79.5	0.217	0.3	0.001	0.3	0.001	0.0	0.000	5.3	0.014
High Island, Block 046	3.2	0.009	2.2	0.006	0.0	0.000	0.0	0.000	0.0	0.000	2.4	0.006
High Island, Block 052	15.3	0.042	9.9	0.027	0.0	0.000	0.0	0.000	0.0	0.000	26.6	0.072
High Island, Block 072											5.7	0.015
High Island, Block 084	7.8	0.021	11.9	0.032	0.0	0.000	0.0	0.000	0.0	0.000	12.6	0.034
High Island, Block 085	148.8	0.405	96.3	0.262	0.4	0.001	0.4	0.001	0.0	0.000	9.8	0.027
High Island, Block 110	56.6	0.154	37.7	0.103	0.2	0.001	0.2	0.001	0.0	0.000	6.9	0.019
High Island, Block 116	67.5	0.184	44.0	0.120	0.2	0.001	0.2	0.001	0.0	0.000	17.7	0.048
High Island, Block 136	123.2	0.335	82.0	0.223	0.5	0.001	0.5	0.001	0.0	0.000	5.8	0.016
High Island, Block 140	39.9	0.109	26.2	0.071	0.1	0.000	0.1	0.000	0.0	0.000	14.9	0.041
High Island, Block 154	12.4	0.034	13.6	0.037	0.2	0.001	0.2	0.001	0.0	0.000	46.4	0.126
High Island, Block 176	274.5	0.748	179.0	0.487	0.9	0.002	0.9	0.002	0.0	0.000	70.0	0.191
High Island, Block 177	96.2	0.262	79.3	0.216	0.9	0.002	0.9	0.002	0.0	0.000	5.4	0.015
High Island, Block 179	172.3	0.469	115.8	0.315	0.5	0.001	0.5	0.001	0.0	0.000	41.3	0.112
High Island, Block 194											7.0	0.019
Matagorda Island, Block 487	65.0	0.177	42.1	0.115	0.2	0.000	0.2	0.000	0.0	0.000	15.3	0.042
Matagorda Island, Block 555	112.6	0.307	75.0	0.204	0.5	0.001	0.5	0.001	0.0	0.000	82.2	0.224
Matagorda Island, Block 566	2.8	0.008	4.3	0.012	0.0	0.000	0.0	0.000	0.0	0.000	9.9	0.027
Matagorda Island, Block 587	153.6	0.418	99.5	0.271	0.4	0.001	0.4	0.001	0.0	0.000	1.3	0.004
Matagorda Island, Block 588	0.0	0.000	0.0	0.000	0.0	0.000	0.0	0.000	0.0	0.000	8.5	0.023
Matagorda Island, Block 603	0.6	0.002	0.4	0.001	0.0	0.000	0.0	0.000	0.0	0.000	0.3	0.001

Table 3-5. Combined County-Level Emission Estimates for All Sources Included in the Inventory (Cont.)

Texas County/FIPS	CO-ANN tons/yr	CO-OSD tons/day	NO_X-ANN tons/yr	NO_X-OSD tons/day	PM_{10}-ANN tons/yr	PM_{10}-OSD tons/day	$PM_{2.5}$-ANN tons/yr	$PM_{2.5}$-OSD tons/day	SO_2-ANN tons/yr	SO_2-OSD tons/day	VOC-ANN tons/yr	VOC-OSD tons/day
Matagorda Island, Block 604	219.7	0.598	144.6	0.394	0.8	0.002	0.8	0.002	0.0	0.000	16.3	0.045
Matagorda Island, Block 605	69.0	0.188	44.7	0.122	0.2	0.001	0.2	0.001	0.0	0.000	7.2	0.020
Matagorda Island, Block 618	31.1	0.085	29.4	0.080	0.1	0.000	0.1	0.000	0.0	0.000	11.6	0.032
Matagorda Island, Block 622	173.7	0.473	192.0	0.523	1.3	0.004	1.3	0.004	4.4	0.012	80.6	0.220
Matagorda Island, Block 623	187.7	0.511	127.0	0.346	1.0	0.003	1.0	0.003	0.0	0.000	23.7	0.065
Matagorda Island, Block 631	145.3	0.396	94.1	0.256	0.4	0.001	0.4	0.001	0.0	0.000	12.8	0.035
Matagorda Island, Block 632	180.7	0.492	117.6	0.320	0.5	0.001	0.5	0.001	0.1	0.000	2.3	0.006
Matagorda Island, Block 633	32.4	0.088	39.9	0.109	0.1	0.000	0.1	0.000	0.0	0.000	45.4	0.124
Matagorda Island, Block 635	0.0	0.000	0.0	0.000	0.0	0.000	0.0	0.000	0.0	0.000	7.1	0.019
Matagorda Island, Block 638	74.8	0.204	48.4	0.132	0.2	0.001	0.2	0.001	0.0	0.000	13.6	0.037
Matagorda Island, Block 657	1.4	0.004	6.4	0.017	0.5	0.001	0.5	0.001	0.0	0.000	1.0	0.003
Matagorda Island, Block 685	1.2	0.003	1.9	0.005	0.0	0.000	0.0	0.000	0.0	0.000	8.2	0.022
Matagorda Island, Block 686	150.9	0.411	98.9	0.269	0.5	0.001	0.5	0.001	0.0	0.000	14.3	0.039
Matagorda Island, Block 696	63.7	0.174	41.3	0.112	0.2	0.000	0.2	0.000	0.0	0.000	4.6	0.013
Matagorda Island, Block 699	72.7	0.198	47.2	0.129	0.2	0.001	0.2	0.001	0.0	0.000	23.7	0.065
Mustang Island, Block 726	0.4	0.001	0.7	0.002	0.0	0.000	0.0	0.000	0.0	0.000	1.6	0.004
Mustang Island, Block 754	3.2	0.009	4.9	0.013	0.0	0.000	0.0	0.000	0.0	0.000	13.1	0.036
Mustang Island, Block 858	1.9	0.005	2.9	0.008	0.0	0.000	0.0	0.000	0.0	0.000	1.0	0.003
Sabine Pass-Louisiana, Block 006	0.0	0.000	0.0	0.000	0.0	0.000	0.0	0.000	0.0	0.000	0.0	0.000
Sabine Pass-Louisiana, Block 010	162.3	0.442	105.3	0.287	0.5	0.001	0.5	0.001	0.0	0.000	23.0	0.063
Sabine Pass-Louisiana, Block 012	0.4	0.001	0.5	0.001	0.0	0.000	0.0	0.000	0.0	0.000	7.5	0.020
Sabine Pass-Louisiana, Block 013	272.9	0.743	185.3	0.505	1.5	0.004	1.5	0.004	0.0	0.000	10.0	0.027
Sabine Pass-Texas, Block 018	69.0	0.188	44.7	0.122	0.2	0.001	0.2	0.001	0.0	0.000	3.7	0.010
West Cameron, Block 021	0.0	0.000	0.1	0.000	0.0	0.000	0.0	0.000	0.0	0.000	0.1	0.000
West Cameron, Block 022	0.6	0.002	0.8	0.002	0.0	0.000	0.0	0.000	0.0	0.000	7.2	0.020
West Cameron, Block 043	0.0	0.000	0.0	0.000	0.0	0.000	0.0	0.000	0.0	0.000	1.7	0.005
West Cameron, Block 044	49.3	0.134	57.0	0.155	2.2	0.006	2.2	0.006	0.0	0.000	2.8	0.008

Table 3-5. Combined County-Level Emission Estimates for All Sources Included in the Inventory (Cont.)

Texas County/FIPS	CO-ANN tons/yr	CO-OSD tons/day	NO_X-ANN tons/yr	NO_X-OSD tons/day	PM_{10}-ANN tons/yr	PM_{10}-OSD tons/day	$PM_{2.5}$-ANN tons/yr	$PM_{2.5}$-OSD tons/day	SO_2-ANN tons/yr	SO_2-OSD tons/day	VOC-ANN tons/yr	VOC-OSD tons/day
West Cameron, Block 045	5.0	0.014	3.3	0.009	0.0	0.000	0.0	0.000	0.0	0.000	17.7	0.048
West Cameron, Block 048	151.6	0.413	99.5	0.271	0.4	0.001	0.4	0.001	0.0	0.000	29.0	0.079
West Cameron, Block 053	20.3	0.055	19.1	0.052	0.0	0.000	0.0	0.000	0.0	0.000	6.1	0.017
West Cameron, Block 116	0.0	0.000	0.0	0.000	0.0	0.000	0.0	0.000	0.0	0.000	1.4	0.004
West Cameron, Block 130	7.8	0.021	8.8	0.024	0.3	0.001	0.3	0.001	0.0	0.000	4.7	0.013
West Cameron, Block 153											0.1	0.000
Total	125,968	343.31	221,357	603.37	3,711	10.11	3,667	9.99	14,064	38.34	841,295	2292.56

In order to reflect significant figures, estimates should be interpreted as follows: 0.0 = <0.1; 0.00 = <0.01; and 0.000 = <0.001.

When considering only VOC emissions, the county distribution for onshore exploration is somewhat different as illustrated below. These 14 counties constitute 26.6% of total statewide VOC from oil and gas onshore exploration area sources.

- Andrews (2.76%)
- Ector (2.39%)
- Crockett (2.18%)
- Wichita (2.16%)
- Hemphill (2.16%)
- Midland (1.98%)
- Upton (1.79%)
- Zapata (1.78%)
- Crane (1.58%)
- Panola (1.58%)
- Yoakum (1.57%)
- Gaines (1.57%)
- Wheeler (1.55%)
- Wise (1.53%)

For all other counties for VOC, emission contributions are less than 1.5%.

3.3.2 Onshore Production

Annual and OSD emissions for all pollutants are presented at the county level for onshore production sources collectively in Table 3-4b. Considering only VOC emissions, 18 counties are responsible for nearly 40% of statewide emissions from oil and gas area sources. The ranking of these counties for VOC for onshore production is as follows.

- Hidalgo (3.5%)
- Panola (3.4%)
- Webb (2.85%)
- Zapata (2.72%)
- Freestone (2.34%)
- Pecos (2.25%)
- Starr (2.24%)
- Upton (2.22%)
- Liberty (2.13%)
- Wise (1.92%)
- Denton (1.7%)
- Andrews (1.7%)
- Gaines (1.67%)
- Jefferson (1.66%)
- Tyler (1.61%)
- Hemphill (1.58%)
- Ector (1.52%)
- Crockett (1.51%)

All other counties contribute less than 1.5% and the majority are below 1%.

In looking at the remaining pollutants that mainly come from onshore production combustion sources, a total of 13 counties constitute over 41% of all other pollutant emissions (i.e., CO, NO_x, PM_{10}, $PM_{2.5}$ and SO_2). For any one of these pollutants, the primary county contributors are in order (note: to illustrate the relative contribution levels, the values for NO_x are shown below, values for the other pollutants follow similar relative tracks):

- Zapata (5.50%)
- Freestone (4.80%)
- Panola (4.77%)
- Webb (4.26%)
- Hidalgo (3.72%)
- Pecos (3.31%)
- Wise (3.09%)
- Starr (2.29%)
- Crockett (2.07%)
- Robertson (2.04%)
- Hemphill (1.92%)
- Denton (1.76%)
- Rusk (1.64%)

3.3.3 Offshore Production Sources

County- and lease block-level emission estimates for offshore production platforms are provided in Table 3-4c. As described previously, offshore sources are divided into two groups – state waters (coastline out to 10 miles) and federal waters (from 10 to 25 miles from shore). For VOC emissions, the majority of emissions were shown to occur from state waters sources. The principal counties and their percent contribution to total offshore VOC emissions is shown below. These nine counties comprise roughly 78% of the estimated offshore VOC emissions.

- Kenedy (17.8%)
- Galveston (15.9%)
- Jefferson (12.3%)
- Calhoun (7.2%)
- Matagorda (7.0%)
- Brazoria (5.7%)
- Kleberg (5.6%)
- Nueces (4.1%)
- Aransas (2.3%)

In the federal waters offshore area, only four lease blocks had VOC emissions constituting at least 1% of total offshore emissions. These blocks include Matagorda Island-Block 555 (1.61%), Matagorda Island-Block 622 (1.58%), High Island-Block 176 (1.37%), and Galveston-Block 209 (1.0%). All other counties and lease blocks were less than 1% of total VOC emissions.

For combustion–related pollutants, the picture is similar, but with some differences. For pollutants like NO_X , CO, and SO_2, Jefferson County (state waters) is shown to be the primary source of emissions (CO-10.2%, NO_X-17.7%, PM_{10}- 22.9%, and SO_2-28.2%). After Jefferson, the main contributors to combustion pollutant emissions were Calhoun, Matagorda, Galveston, and Brazoria. These all occur in state waters. The contribution of sources in state waters (in these 5 to 7 counties) to total emissions of these pollutants is as follows.

- CO – 36.6%
- NO_x – 62.8%
- PM_{10} – 81.5%
- $PM_{2.5}$ – 81.4%
- SO_2 – 96%

In federal waters, most of the contributions for lease blocks for combustion-related pollutants are less than 1%. However, there are some exceptions for specific pollutants. For CO, the following lease blocks have significant contributions.

- High Island-Block176 (3.75%)
- Sabine Pass-Louisiana-Block 013 (3.73%)
- Brazos-Block 451 (3.35%)
- Matagorda Island-Block 623 (2.56%)
- Matagorda Island-Block 622 (2.37%)
- High Island-Block 179 (2.35%)

Galveston-Block 209, Matagorda Island-Block 622, and Sabine Pass-Louisiana-Block 013 are significant contributors for NO_x, PM_{10}, and $PM_{2.5}$.

3.4 Comparison of Emissions by Attainment Status

The inventory data results were analyzed to evaluate how much of each pollutant emission was occurring in counties classified as attainment and nonattainment (for any pollutant). All counties were assigned an attainment status based on information from the TCEQ web site and the U.S. EPA (US EPA, 2007) and all pollutant emissions were summed by county based on its classification. The results of that assessment are summarized in Table 3-6.

Table 3-6. Summary of Oil and Gas Area Source Emissions by Attainment Status

Pollutant	Attainment Status	Total Emissions (tons/yr)	Percent of Total
CO	Attainment Counties	119,116	94.6%
	Nonattainment Counties	6,851	5.4%
NO_x	Attainment Counties	208,250	94.1%
	Nonattainment Counties	13,107	5.9%
VOC	Attainment Counties	756,676	89.9%
	Nonattainment Counties	84,619	10.1%
SO_2	Attainment Counties	13,271	94.4%
	Nonattainment Counties	792	5.6%
PM_{10}	Attainment Counties	3,437	92.6%
	Nonattainment Counties	274	7.4%
$PM_{2.5}$	Attainment Counties	3,395	92.6%
	Nonattainment Counties	271	7.4%

As indicated in Table 3-6, for every pollutant, attainment counties contain the bulk of the emissions. Given the shear number of total counties in Texas and the relatively low number of nonattainment counties, this result is not unexpected.

4.0 EMISSIONS PROJECTIONS

4.1 Projections Methodology

Statewide emission projections were developed for base years 2010, 2015, and 2020 using information from the Energy Information Administration's (EIA) Supplemental Tables to the Annual Energy Outlook (EIA, 2007). The EIA data tables (specifically Tables 103 and 104) present annual estimated crude oil and natural gas for the years 2004-2030. The geographic level of the projected data is by EIA Region.

Portions of Texas fall into three EIA Regions: Gulf Coast; Southwest; and Midcontinent. The majority of the State is in the Gulf Coast and Southwest EIA Regions. Only a small portion (area to the west of Oklahoma) is in the Midcontinent Region. Because the Midcontinent EIA Region contains six other states, any projections data for the Midcontinent EIA Region may not be reflective of Texas operations. Thus, it was assumed that the Southwest EIA Region is likely more representative of the Texas portion of the Midcontinent EIA Region.

Similarly, the Gulf Coast EIA Region includes mostly east Texas counties, but also includes four other states. The Southwest EIA Region includes almost all of west Texas, and the eastern half of New Mexico. The EIA data also has projections for offshore platforms that are "Offshore-shallow" and "Offshore-deep." It was assumed that the "Offshore-shallow" EIA Region is a suitable surrogate for platforms in Texas state waters and the "Offshore-deep" EIA Region is a suitable surrogate for platforms in federal waters. Tables 4-1(a-d) identify the Texas counties with the appropriate EIA Region.

Tables 4-2(a-c) present the steps for developing the projected oil and natural gas production for 2010, 2015, and 2020. Projection factors for each year were developed and applied to the counties in the applicable EIA Region, and summed together. Additionally, only one projection factor was developed to account for all oil and gas operations. Thus, the oil and natural gas production data were converted to BTU and then summed together.

For example, year 2005 oil production for the "Onshore-Gulf Coast" EIA Region was 0.54 million barrels (MMBBL) per day. Using an average heating value of 134,010 BTU/gal for crude oil, this equates to 1.11 billion MMBTU. The year 2005 natural gas production for the same region was 4.65 trillion cubic feet. Using an average heating value of 1036 BTU/scf, this equates to 4.82 billion MMBTU. Summing the oil and natural gas production yields a total of 5.93 billion MMBTU. In 2010, the same data parameters yield 0.719 billion MMBTU for oil and 4.64 billion MMBTU for natural gas. The total for year 2010 is 5.36 billion MMBTU.

Therefore, the projection factor from 2005 to 2010 is:

2005 to 2010 projection factor = 2010 total MMBTU/2005 total MMBTU

2005 to 2010 projection factor = 5.36 billion MMBTU/5.93 billion MMBTU

2005 to 2010 projection factor = 0.90

Table 4-1a. Texas Counties in the Onshore-Gulf Coast EIA Region

Anderson	Franklin	Lavaca	Sabine
Angelina	Freestone	Lee	San Augustine
Aransas	Frio	Leon	San Jacinto
Atascosa	Galveston	Liberty	San Patricio
Austin	Goliad	Limestone	Shelby
Bastrop	Gonzales	Live Oak	Smith
Bee	Gregg	Martin	Starr
Bexar	Grimes	Matagorda	Titus
Bowie	Guadalupe	Mclennan	Travis
Brazoria	Hardin	Mcmullen	Trinity
Brazos	Harris	Medina	Tyler
Brooks	Harrison	Milam	Upshur
Burleson	Henderson	Montgomery	Uvalde
Caldwell	Hidalgo	Morris	Van Zandt
Calhoun	Hopkins	Nacogdoches	Victoria
Cameron	Houston	Navarro	Walker
Camp	Jackson	Newton	Waller
Cass	Jasper	Nueces	Washington
Chambers	Jefferson	Orange	Webb
Cherokee	Jim Hogg	Panola	Wharton
Colorado	Jim Wells	Polk	Willacy
Denton	Karnes	Rains	Williamson
Dimmit	Kaufman	Red River	Wilson
Duval	Kenedy	Refugio	Wood
Falls	Kleberg	Robertson	Zapata
Fayette	La Salle	Rusk	Zavala
Fort Bend	Lampasas		

Table 4-1b. Texas Counties in the Onshore-Southwest EIA Region

Andrews	Edwards	Kimble	Roberts
Archer	Ellis	King	Runnels
Bandera	Erath	Knox	Schleicher
Baylor	Fisher	Lamb	Scurry
Borden	Floyd	Lipscomb	Shackelford
Bosque	Foard	Loving	Sherman
Brown	Gaines	Lubbock	Somervell
Callahan	Garza	Lynn	Stephens
Carson	Glasscock	Madison	Sterling
Childress	Gray	Marion	Stonewall
Clay	Grayson	Maverick	Sutton
Cochran	Hale	Mcculloch	Tarrant
Coke	Hamilton	Menard	Taylor
Coleman	Hansford	Midland	Terrell
Collingsworth	Hardeman	Mills	Terry
Comanche	Hartley	Mitchell	Throckmorton
Concho	Haskell	Montague	Tom Green
Cooke	Hemphill	Moore	Upton
Cottle	Hill	Motley	Val Verde
Crane	Hockley	Nolan	Ward
Crockett	Hood	Ochiltree	Wheeler
Crosby	Howard	Oldham	Wichita
Culberson	Hutchinson	Palo Pinto	Wilbarger
Dawson	Irion	Parker	Winkler
De Witt	Jack	Pecos	Wise
Dickens	Johnson	Potter	Yoakum
Donley	Jones	Reagan	Young
Eastland	Kent	Real	
Ector	Kerr	Reeves	

Table 4-1c. Texas Counties in the Offshore-Shallow EIA Region

Aransas	Jefferson
Brazoria	Kenedy
Calhoun	Kleberg
Chambers	Matagorda
Galveston	Nueces

Table 4-1d. Area-Blocks in the Offshore-Deep EIA Region

Brazos, Block 376	High Island, Block 052	Matagorda Island, Block 633
Brazos, Block 397	High Island, Block 072	Matagorda Island, Block 635
Brazos, Block 415	High Island, Block 084	Matagorda Island, Block 638
Brazos, Block 451	High Island, Block 085	Matagorda Island, Block 657
Brazos, Block 453	High Island, Block 110	Matagorda Island, Block 685
Brazos, Block 491	High Island, Block 116	Matagorda Island, Block 686
Brazos, Block 542	High Island, Block 136	Matagorda Island, Block 696
Galveston, Block 190	High Island, Block 140	Matagorda Island, Block 699
Galveston, Block 209	High Island, Block 154	Mustang Island, Block 726
Galveston, Block 223	High Island, Block 176	Mustang Island, Block 754
Galveston, Block 225	High Island, Block 177	Mustang Island, Block 858
Galveston, Block 239	High Island, Block 179	Sabine Pass-Louisiana, Block 006
Galveston, Block 255	High Island, Block 194	Sabine Pass-Louisiana, Block 010
Galveston, Block 273	Matagorda Island, Block 487	Sabine Pass-Louisiana, Block 012
Galveston, Block 301	Matagorda Island, Block 555	Sabine Pass-Louisiana, Block 013
Galveston, Block 303	Matagorda Island, Block 566	Sabine Pass-Texas, Block 018
Galveston, Block 333	Matagorda Island, Block 587	West Cameron, Block 021
Galveston, Block 343	Matagorda Island, Block 588	West Cameron, Block 022
Galveston, Block 395	Matagorda Island, Block 603	West Cameron, Block 043
High Island, Block 021	Matagorda Island, Block 604	West Cameron, Block 044
High Island, Block 022	Matagorda Island, Block 605	West Cameron, Block 045
High Island, Block 034	Matagorda Island, Block 618	West Cameron, Block 048
High Island, Block 037	Matagorda Island, Block 622	West Cameron, Block 053
High Island, Block 039	Matagorda Island, Block 623	West Cameron, Block 116
High Island, Block 045	Matagorda Island, Block 631	West Cameron, Block 130
High Island, Block 046	Matagorda Island, Block 632	West Cameron, Block 153

Table 4-2a. Projected EIA Production

Location	Oil Production				Natural Gas Production			
	2005	2010	2015	2020	2005	2010	2015	2020
	(MMBBL/day)				TSCF			
Offshore-Deep	0.84	1.62	1.98	1.85	1.37	2.27	3.05	2.68
Offshore-Shallow	0.47	0.34	0.3	0.32	1.98	1.59	1.49	1.39
Onshore-Gulf Coast	0.54	0.35	0.27	0.27	4.65	4.48	4.11	3.94
Onshore-Southwest	0.93	0.93	0.91	0.9	1.81	2.02	1.95	1.9

Table 4-2b. Projected EIA Production (MMBTU)

Location	Oil Production				Natural Gas Production			
	2005	2010	2015	2020	2005	2010	2015	2020
	Billion MMBTU				Billion MMBTU			
Offshore-Deep	1.73	3.33	4.07	3.80	1.42	2.35	3.16	2.78
Offshore-Shallow	0.97	0.70	0.62	0.66	2.05	1.65	1.54	1.44
Onshore-Gulf Coast	1.11	0.72	0.55	0.55	4.82	4.64	4.26	4.08
Onshore-Southwest	1.91	1.91	1.87	1.85	1.88	2.09	2.02	1.97

Table 4-2c. Final Projection Factors by EIA Region

Location	Total Oil and Natural Gas Production				Projection Factors from 2005			
	2005	2010	2015	2020	2005	2010	2015	2020
	Billion MMBTU				Unitless			
Offshore-Deep	3.14	5.68	7.23	6.58	1.00	1.81	2.30	2.09
Offshore-Shallow	3.02	2.35	2.16	2.10	1.00	0.78	0.72	0.70
Onshore-Gulf Coast	5.93	5.36	4.81	4.64	1.00	0.90	0.81	0.78
Onshore-Southwest	3.79	4.00	3.89	3.82	1.00	1.06	1.03	1.01

4.2 Summary of Oil and Gas Area Sources Projected Emissions

Tables 4-3(a-f) are summaries of the projected statewide emissions by location (onshore, offshore), type (exploration, production, and offshore), and pollutant. Generally, emissions are projected to decline from 2005 to 2020 for onshore production (~14%), onshore exploration (~11%), and offshore-state waters (~30%). Conversely, emissions from offshore-federal waters are projected to increase during the same time period (~109%).

Table 4-3a. CO Projected Emissions by Location and Type

Pollutant	Location	Type	2005 Emissions (tpy)	2010 Emissions (tpy)	2015 Emissions (tpy)	2020 Emissions (tpy)
CO	Onshore	Exploration	29,695	29,021	27,209	26,462
CO	Onshore	Production	88,949	85,299	79,260	76,919
CO	Offshore-Federal Waters	Offshore	4,644	8,405	10,680	9,705
CO	Offshore-State Waters	Offshore	2,680	2,090	1,929	1,876
		Total	125,968	124,815	119,079	114,962

Table 4-3b. NO_x Projected Emissions by Location and Type

Pollutant	Location	Type	2005 Emissions (tpy)	2010 Emissions (tpy)	2015 Emissions (tpy)	2020 Emissions (tpy)
NO_x	Onshore	Exploration	120,061	117,570	110,333	107,326
NO_x	Onshore	Production	91,998	88,253	82,018	79,599
NO_x	Offshore-Federal Waters	Offshore	3,457	6,257	7,951	7,225
NO_x	Offshore-State Waters	Offshore	5,841	4,556	4,205	4,089
		Total	221,357	216,636	204,507	198,239

Table 4-3c. PM_{10}-PRI Projected Emissions by Location and Type

Pollutant	Location	Type	2005 Emissions (tpy)	2010 Emissions (tpy)	2015 Emissions (tpy)	2020 Emissions (tpy)
PM_{10}-PRI	Onshore	Exploration	1,998	1,957	1,836	1,786
PM_{10}-PRI	Onshore	Production	1,578	1,511	1,404	1,362
PM_{10}-PRI	Offshore-Federal Waters	Offshore	25	45	58	52
PM_{10}-PRI	Offshore-State Waters	Offshore	110	86	79	77
		Total	3,711	3,599	3,377	3,278

Table 4-3d. $PM_{2.5}$-PRI Projected Emissions by Location and Type

Pollutant	Location	Type	2005 Emissions (tpy)	2010 Emissions (tpy)	2015 Emissions (tpy)	2020 Emissions (tpy)
$PM_{2.5}$-PRI	Onshore	Exploration	1,954	1,914	1,796	1,747
$PM_{2.5}$-PRI	Onshore	Production	1,578	1,511	1,404	1,362
$PM_{2.5}$-PRI	Offshore-Federal Waters	Offshore	25	45	58	52
$PM_{2.5}$-PRI	Offshore-State Waters	Offshore	110	86	79	77
		Total	3,667	3,556	3,336	3,238

Table 4-3e. SO_2 Projected Emissions by Location and Type

Pollutant	Location	Type	2005 Emissions (tpy)	2010 Emissions (tpy)	2015 Emissions (tpy)	2020 Emissions (tpy)
SO_2	Onshore	Exploration	13,835	13,552	12,719	12,373
SO_2	Onshore	Production	44	42	39	38
SO_2	Offshore-Federal Waters	Offshore	7	13	17	15
SO_2	Offshore-State Waters	Offshore	177	138	128	124
		Total	14,064	13,745	12,903	12,550

Table 4-3f. VOC Projected Emissions by Location and Type

Pollutant	Location	Type	2005 Emissions (tpy)	2010 Emissions (tpy)	2015 Emissions (tpy)	2020 Emissions (tpy)
VOC	Onshore	Exploration	120,240	120,202	113,875	111,017
VOC	Onshore	Production	715,941	692,079	645,543	627,048
VOC	Offshore-Federal Waters	Offshore	1,088	1,970	2,503	2,274
VOC	Offshore-State Waters	Offshore	4,025	3,139	2,898	2,817
		Total	841,295	817,389	764,818	743,156

5.0 REFERENCES

American Petroleum Institute (API), 1995. Emission Factors for Oil and Gas Production Operations. API Publication No. 4615. January 1995.

Canadian Association of Petroleum Producers (CAPP), 1999. CH4 and VOC Emissions from the Canadian Upstream Oil and Gas Industry. July 1999. Internet address: http://www.capp.ca/raw.asp?x=1&dt=NTV&e=PDF&dn=84181

Energy Information Administration (EIA), 2007. Supplemental Tables to the Annual Energy Outlook 2007, Data Tables 103 and 104. Data released February 2007. Washington, D.C. http://www.eia.doe.gov/oiaf/aeo/supplement/index.html

Engeser, B, 2004. Fundamentals of Drilling, Part 1, pg. 37. International Continental Scientific Drilling Program. Sept. 2004. Accessed June 5, 2007. Internet address: http://www.icdp-online.de/news/training/Bosumtwi/engeser/drillfund1.pdf

Gas Processors Association (GPA), 2004. The Gas Processing Industry, Its Function and Role in Energy Supplies. Tables 1 and 2. Tulsa, OK. Accessed June 7, 2007. Internet address: http://www.gasprocessors.com/pdffiles/itsfunctionandrole04.pdf

Gas Research Institute (GRI), 1992. Venting and Flaring Emissions from Production, Processing, and Storage in the Natural Gas Industry. Prepared by Radian Corporation, Austin, Texas. 1992.

Houston Advanced Research Center (HARC), 2005. Natural Gas Compressor Engine Survey and Engine NO_X Emissions at Gas Production Facilities. Prepared by Eastern Research Group, Inc. August 31, 2005.

Houston Advanced Research Center (HARC), 2006a. Natural Gas Compressor Engine Survey for Gas Production and Processing Facilities. Prepared by Eastern Research Group, Inc. October 5, 2006.

Houston Advanced Research Center (HARC), 2006b. VOC Emissions from Oil and Condensate Storage Tanks. Prepared by URS Corporation, COMM Engineering, and Trimeric Corporation. October 31, 2006.

Minerals Management Service (MMS), 2007. Year 2005 Gulfwide Emission Inventory Study: Draft Report. U.S. Dept. of Interior, MMS, Gulf of Mexico OCS Region, New Orleans, LA. Prepared by Wilson, D.L., R.S. Billings, R.G. Oommen, and R.K. Chang, Eastern Research Group, Inc. Report No. MMS 2007-XXX. August 2007.

Minerals Management Service (MMS), 2004. Gulfwide Emission Inventory Study for Regional Haze and Ozone Modeling Effort. Prepared by Eastern Research Group, Inc. Report No. MMS 2004-072. October 2004. Internet address: http://www.wrapair.org/forums/ssjf/documents/eictts/OilGas/WRAP_Oil&Gas_Final_Report.122805.pdf

National Climatic Data Center (NCDC), 2007. Meteorological Data for National Weather Service Stations in Texas. Unedited Local Climatological Data Series. Data retrieved June, 2007. Internet address: http://www.ncdc.noaa.gov

Texas Commission on Environmental Quality (TCEQ), 2007a. New Oil and Gas SCCs. Data provided by Mr. Charlie Rubick, TCEQ. February 28, 2007. Email communication from Charlie Rubick, TCEQ to Rick Baker, Eastern Research Group, Inc.

Texas Commission on Environmental Quality (TCEQ), 2007b. Texas Oil and Gas Platform Emissions Data for Baseyear 2005. Data provided by Mr. Bertie Fernando, TCEQ. June 21, 2007. Email communication from Bertie Fernando, TCEQ to Garry Brooks, Eastern Research Group, Inc.

Texas Commission on Environmental Quality (TCEQ), 2000. Rate of Progress for Houston-Galveston Area; Improvements to the 1999 Area Sources Inventory. Data provided by Mr. Charlie Rubick, TCEQ. July 6, 2007. Email communication from Charlie Rubick, TCEQ to Regi Oommen, Eastern Research Group, Inc.

Texas Railroad Commission (TRC), 2007b. Gas Well Gas and Casinghead Gas Shall Be Utilized for Legal Purposes. TAC 16, Part 1, Chapter 3, Rule 3.32. Accessed from internet June 1, 2007. Internet address: http://info.sos.state.tx.us/pls/pub/readtac$ext.TacPage?sl=R&app=9&p_dir=&p_rloc=&p_tloc=&p_ploc=&pg=1&p_tac=&ti=16&pt=1&ch=3&rl=32

Texas Railroad Commission (TRC), 2005a. Oil Well Counts By County As Of September 2005. September 3, 2005. Accessed June 4, 2007. Internet address: http://www.rrc.state.tx.us/divisions/og/statistics/wells/wellcount/oilwlct0905.pdf

Texas Railroad Commission (TRC), 2005b. Gas Well Counts By County As Of September 2005. September 3, 2005. Accessed June 4, 2007. Internet address: http://www.rrc.state.tx.us/divisions/og/statistics/wells/wellcount/gaswlct0905.pdf

Texas Railroad Commission (TRC), 2005c. General Production Query Results for Oil, Casinghead, Gas, and Condensate for Oil Leases and Gas Wells by Onshore County, January 2005 through December 2005. Accessed July 2, 2007. Internet address: http://webapps.rrc.state.tx.us/PDQ/generalReportAction.do

The Drilling Observer, 2007. The Oil and Gas Regulatory Report, A Weekly Newsletter (multiple). Austin, TX. Data sent to Regi Oommen, Eastern Research Group, Inc. June 28, 2007.

The Texas Exploration Company (TXCO). 2004 Annual Report, Letter to Shareholders. Accessed June 11, 2007. Internet address: http://www.txco.com/txco04ar.pdf

US Environmental Protection Agency (US EPA), 2007. Welcome to the Green Book - Nonattainment Areas for Criteria Pollutants. Prepared by the US EPA Office of Air Quality Planning and Standards, Research Triangle Park, NC. http://www.epa.gov/air/oaqps/greenbk/

US Environmental Protection Agency (US EPA), 2006. Compilation of Air Pollutant Emission Factors, 5th Edition and Supplements (AP-42); Liquid Storage Tanks, Table 7.1-2. November 2006. Internet address: http://www.epa.gov/ttn/chief/ap42/ch07/final/c07s01.pdf

US Environmental Protection Agency (US EPA), 2005. WebFIRE Emission Factors. Accessed June 26, 2007. Internet address: http://cfpub.epa.gov/oarweb/download/WebFIREFactors.csv

US Environmental Protection Agency (US EPA), 2004a. Source Classification Codes. Prepared by the Emissions Inventory and Analysis Group (EIAG). February 2004. Internet address: http://www.epa.gov/ttn/chief/codes/scc_feb2004.xls

US Environmental Protection Agency (US EPA), 2004b. Overview of EPA's Low Sulfur Diesel Fuel Programs. Office of Transportation and Air Quality. Presentation made November 2004. Internet address: http://www.epa.gov/cleandiesel/presentations/overviewulsdprgrm.pdf

US Environmental Protection Agency (US EPA), 2003. Lessons Learned from Natural Gas STAR Partners – Options for Reducing Methane Emissions From Pneumatic Devices in the Natural Gas Industry. EPA Report No. EPA430-B-03-004. US Environmental Protection Agency. July 2003. Internet address: http://www.epa.gov/gasstar/pdf/lessons/ll_pneumatics.pdf. Site accessed August 3, 2007.

US Environmental Protection Agency (US EPA, 1999). Preferred and Alternate Methods for Estimating Air Emissions from Oil and Gas Field Production and Processing Operations. September, 1999. Internet address: http://www.epa.gov/ttnchie1/eiip/techreport/volume02/ii10.pdf

US Environmental Protection Agency (US EPA), 1996. Compilation of Air Pollutant Emission Factors, 5th Edition and Supplements (AP-42); Large Stationary Diesel and All Stationary Diesel-fuel Engines, Table 3.4-1. October 1996. Internet address: http://www.epa.gov/ttn/chief/ap42/ch03/final/c03s04.pdf

US Environmental Protection Agency (US EPA), 1995a. Compilation of Air Pollutant Emission Factors, 5th Edition and Supplements (AP-42); Transportation and Marketing of Petroleum Liquids. January 1995. Internet address: http://www.epa.gov/ttn/chief/ap42/ch05/final/c05s02.pdf

US Environmental Protection Agency (US EPA), 1991. Compilation of Air Pollutant Emission Factors, 5th Edition and Supplements (AP-42); Industrial Flares, Table 13-5. September, 1991. Internet address: http://www.epa.gov/ttn/chief/ap42/ch13/final/c13s05.pdf

Western Regional Air Partnership (WRAP), 2005. Oil and Gas Emission Inventories for the Western States. Prepared by ENVIRON International. December 27, 2005. Internet address: http://www.wrapair.org/forums/ssjf/documents/eictts/OilGas/WRAP_Oil&Gas_Final_Report.122805.pdf

Appendix A – Documentation of Exploration Sources Emissions

Appendix B – Documentation of Production Sources Emissions

Appendix C – Documentation of Offshore Sources Emissions