

Prepared for:

Michelle McKenzie
City of Granbury
401 N Park St
Granbury, TX 76048

Prepared by:

Ramboll
7250 Redwood Blvd., Suite 105
Novato, California 94945

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Emission Inventory Review and Recommendations for Hood County Final Report

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County
Final Report**

Ramboll
7250 Redwood Boulevard
Suite 105
Novato, CA 94945
USA

T +1 415 899 0700
<https://ramboll.com>

Contents

LIST OF ACRONYMS AND ABBREVIATIONS	iii
Project Summary	1
Executive Summary	2
1.0 Introduction	4
1.1 Background and Purpose	4
1.2 All Source Emissions Overview	6
2.0 Point Source Emissions Review	9
2.1 2022 Point Source Emissions	9
2.2 Point Source Emission Trends	11
2.3 Wolf Hollow III Permit Application Review	14
3.0 Area Source Emissions Review	16
3.1 Overview of Emissions Inventory	16
3.2 Oil and Gas Area Source Emissions	18
3.2.1 Oil and Gas Emissions Analysis	21
3.3 Non-Oil and Gas Area Source Emissions	22
4.0 On-Road Source Emissions Review	25
4.1 Overview of Emissions Inventory	25
4.2 Analysis	27
4.2.1 MOVES5	27
5.0 Off-Road Source Emissions Review	29
5.1 Overview of Emissions Inventory	29
5.2 Analysis	31
5.2.1 Off-Road Equipment	31
5.2.2 Airports	31
5.2.3 Rail	31
6.0 Conclusions and Recommendations	33
7.0 References	35

Table of Figures

Figure 1-1. Location of the active monitor (C73) in Hood County, urban areas and major roadways in the surrounding region.	4
Figure 1-2. Ozone air quality for Hood County from 2011 to 2023.	5
Figure 1-3. Hood County population from 2017 to 2023.,	5

Figure 1-4.	Hood County 2022 annual average daily emissions (tpd) by sector for NOx (top left), VOC (top right), 2022 CO (bottom).	7
Figure 2-1.	2022 NOx emissions from point sources in Hood County.	10
Figure 2-2.	2017-2022 point source NOx emission inventory trends.	11
Figure 2-3.	2017 – 2020 EGU NOx Emissions (tpd) by facility ¹¹ .	12
Figure 2-4.	2017 to 2024 Hood County EGU NOx Emissions (tpd) by month ¹¹ .	14
Figure 3-1.	Hood County 2022 area source NOx emissions by source category.	17
Figure 3-2.	Hood County 2022 area source VOC emissions by source category.	17
Figure 3-3.	Hood County 2022 area CO emissions by source category.	18
Figure 3-4.	2017-2024 active oil and natural gas well count for Hood County based on TRC oil and gas activity data	19
Figure 3-5.	2017-2024 oil and gas production for Hood County based on TRC oil and gas activity data.	19
Figure 3-6.	Texas 2017-2024 oil and gas production from the Barnett Shale.	20
Figure 3-7.	Hood County 2022 oil and gas source NOx emissions by source category.	20
Figure 3-8.	Hood County 2022 oil and gas sources VOC emissions by source category.	21
Figure 4-1.	Hood County 2022 On-Road NOx emissions by source category.	25
Figure 4-2.	Hood County 2022 On-Road VOC emissions by source category.	26
Figure 4-3.	Hood County 2022 On-Road CO emissions by source category.	26
Figure 5-1.	Hood County 2022 off-road NOx emissions by source category.	29
Figure 5-2.	Hood County 2022 off-road VOC emissions by source category.	30
Figure 5-3.	Hood County 2022 off-road CO emissions by source category.	30
Figure 5-4.	Map showing the railroads present in Hood County (excerpt from the 2023 State Railroad Map).	32

Table of Tables

Table 2-1.	Hood County 2022 point sources NOx emissions.	10
Table 2-2.	NOx controls for each Hood County EGU ¹¹ .	13
Table 2-3.	2017 to 2024 annual average NOx emission rates (lb/MWh) for each Hood County EGU facility ¹¹ .	13

LIST OF ACRONYMS AND ABBREVIATIONS

AMPD	Air Markets Program Data
BACT	Best available control technology
CAMD	Clean Air Markets Division
CAMS	Continuous Air Monitoring Station
CEMS	Continuous Emissions Monitoring System
CDB	County database
CDL	Cropland data layer
CO	Carbon Monoxide
CT	Combustion turbine
CTG	Combustion turbine generation
EGU	Electric generating unit
EIA	Energy Information Administration
EPA	US Environmental Protection Agency
GHGRP	Greenhouse Gas Reporting Program
GWhr	gigawatt-hours
hp-hr/MCF	Horsepower-hour per thousand cubic-feet
MMBTU	Million British thermal units
MOVES	Motor Vehicle Emissions Simulator
MW	Megawatt
NAAQS	National Ambient Air Quality Standard
NEI	National Emission Inventory
NO	Nitric Oxide
NOAA	National Oceanic and Atmospheric Administration
NOx	Oxides of Nitrogen
O ₂	Oxygenppb parts per billion
ppbC	parts per billion Carbon
ppmvd	parts per million by volume, dry
SCC	Source Classification Code
scf	Standard cubic feet
SCR	Selective catalytic reduction

SIC	Standard industrial classification
SIP	State Implementation Plan (for the ozone NAAQS)
SMOKE-MOVES	Sparse Matrix Operator Kernel Emissions-MOTOR Vehicle Emission Simulator Tool
SO ₂	sulfur dioxide
PM ₁₀	particulate matter less than 10 microns
PM _{2.5}	particulate matter IPM10 than 2.5 microns
SERA	Smoke Emissions Reference Application
TCEQ	Texas Commission on Environmental Quality
Ton	English short ton (2000 pounds)
tpd	Ton per day
tpy	Ton per year
TRC	Texas Railroad Commission
TTI	Texas A&M Transportation Institute
TXDOT	Texas Department of Transportation
TxLED	Texas Low Emission Diesel
USDA	United States Department of Agriculture
VCP	Volatile Chemical Product
VMT	Vehicle Miles Travelled
VOC	Volatile organic compound
yr	Year

PROJECT SUMMARY

This project reviewed and made recommendations to improve ozone precursor emission inventories in Hood County. Ramboll examined the EPA's most recent historical 2022 emission inventory and provided prioritized recommendations to update and refine it. Key recommendations to enhance the inventory include updating compressor engine activities, incorporating the latest vehicle emission model, and using Texas specific emission estimation tools and approaches for on-road vehicles and off-road equipment. These improvements are expected to enhance the accuracy of Hood County's ozone precursor emission inventory.

EXECUTIVE SUMMARY

The purpose of this study is to review the ozone precursor modeling emission inventories for Hood County to identify sources of emissions that are highly uncertain, missing from the inventory, or are not currently well-characterized. Ramboll reviewed the most recent US Environmental Protection Agency (EPA) ozone precursor (i.e., nitrogen oxides (NO_x), volatile organic compounds (VOC), and carbon monoxide (CO)) emission inventories for anthropogenic sources available for Hood County. This review includes CO emissions but is focused on NO_x and VOC emissions as CO emission impacts on ozone formation are expected to be much smaller than NO_x and VOC. Based on recommendation from TCEQ, the EPA 2022, version 1, Modeling Platform emissions inventory (2022v1) ozone precursor emission inventory was selected for review because it was the most recent historical year ozone precursor emission inventory available at the time that this analysis was conducted. The purpose of the review was to:

- Improve understanding of emissions relevant to the Texas State Implementation Plan (SIP) for ozone;
- Identify potential emission inventory improvements that could benefit the SIP; and
- Make recommendations for carrying out those improvements.

We performed the following tasks during the emission inventory review:

1. Extracted ozone precursor emissions for Hood County from the EPA's 2022v1 emission inventories and determined the breakdown of emissions of NO_x and VOC by emissions source category;
2. Used the VOC/NO_x emission ratio of the Hood County emission inventory to determine that reductions in NO_x (rather than VOC) emissions will be most effective in reducing locally-produced ozone; and
3. Looked for sources of emissions that are highly uncertain, missing from the inventory or are not currently well-characterized.

Based on review of EPA's 2022v1 emission inventory for Hood County, Ramboll has developed the recommendations below for inventory improvements and their implementation. Priority was assigned to each recommendation as follows:

- "High priority" was assigned to emission inventory recommendations that are expected to result in large changes to the NO_x emission inventory¹;
- "Medium priority" was assigned to emission inventory recommendations that are expected to result in substantial, but limited changes to the NO_x emission inventory; and
- "Low priority" was assigned to emission inventory recommendations that are expected to result in minor changes to the NO_x emission inventory and/or changes to the VOC emission inventory.

This report finds that the EPA 2022v1 point, on-road, off-road, and area source ozone precursor emission inventories are generally accurate and complete. Ramboll did not find any emission source categories for which more detailed emissions inventory input at the sub-county level was readily available. Below are Ramboll's recommendations for improving the 2022v1 ozone precursor emission inventory to address sources of emissions that may be under- or over-estimated, and/or accompanied by high levels of uncertainty. Recommendations for emission inventory improvements were all medium and low priority; there were no high priority recommendations. Recommended improvements are expected to result in limited, small changes to Hood County ozone precursor emission inventory.

¹ Changes that would affect the NO_x inventory are prioritized over changes to the VOC inventory because this report (see Section 1.2) and finds that ozone formation in Hood County is limited by the amount of available NO_x.

Ramboll recommendations for improving the EPA 2022v1 ozone precursor emission inventory are summarized below.

1. **Compressor Engines:** Improve estimates of 2022 area source compressor engine emissions (*medium priority*).
Recommendation: Update emissions per unit of oil and gas activity for wellsite compressor engines and include midstream compressor engines not currently incorporated in the point source emission inventory. (Section 3.2.1)
2. **On-road Vehicles:** Implement MOVES5 updates for on-road vehicle emissions and use TCEQ's Texas specific emission inventory approach (*medium priority*).
Recommendation: Update the emission inventory using EPA's MOVES5 model, released in November 2024, which includes updates expected to moderately increase 2022 NOx emissions. Utilize TCEQ's Texas-specific emission inventory approach to more accurately characterize on-road vehicle emissions in Hood County. (Section 4.2)
3. **Off-road Equipment:** Improve emission estimates by using the TexN model (*medium priority*).
Recommendation: Incorporate TexN model results into the emission inventory. (Section 5.2.1)
4. **Pleasure Craft:** Improve estimates of pleasure craft emissions (*medium priority*).
Recommendation: Develop updated pleasure craft population in Hood County on Lake Granbury with special consideration for pleasure craft use when meteorological conditions are favorable to higher ozone concentrations. (Section 5.2.1)
5. **Gasoline Service Stations:** Use local gasoline consumption data as the activity basis for Stage I and storage tank breathing emissions (*low priority*).
Recommendation: Obtain gasoline distribution volume estimates from a state agency. (Section 3.3)
6. **Pneumatic Pumps:** Update emission controls for pneumatic pumps (*low priority*).
Recommendation: Incorporate emission controls required under oil and gas NSPS requirements. Utilize Subpart W data to inform control prevalence. (Section 3.2.1)

1.0 INTRODUCTION

1.1 Background and Purpose

Hood County comprises the Granbury Micropolitan Statistical Area, southwest of the Dallas–Fort Worth–Arlington Metropolitan Statistical Area². Figure 1-1 displays major roadways and urban areas in Hood County. The total population in Hood County in January 2024 was estimated to be 68,856³. Granbury is the largest city in Hood County with an estimated population of 12,934 in 2024, representing about 19% of the total population in Hood County⁴.

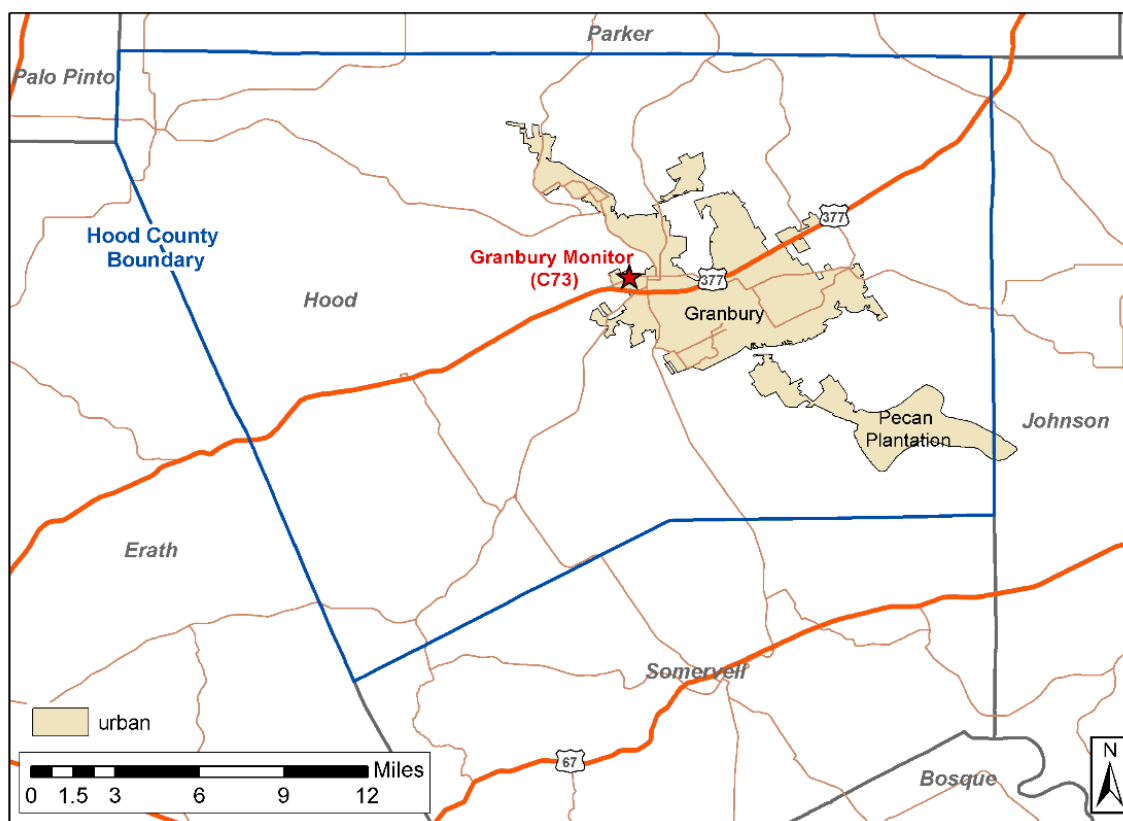


Figure 1-1. Location of the active monitor (C73) in Hood County, urban areas and major roadways in the surrounding region.

The U. S. Environmental Protection Agency (EPA) sets a National Ambient Air Quality Standard (NAAQS) for ozone to protect public health and welfare. Under the Clean Air Act, the EPA is required to review the NAAQS periodically. EPA’s most recent review of the ozone standard was finalized on October 1, 2015, when the EPA lowered the ozone NAAQS from the 75 parts per billion (ppb) standard set in 2008 to a more stringent value of 70 ppb. In August 2018 EPA established attainment designations for the 2015 NAAQS.

The TCEQ operates one Continuous Air Monitoring Station (Granbury C73) in Hood County that determines whether the County is in compliance with the NAAQS for ozone. The location of the monitor is shown above in Figure 1-1. Trends in Hood County ozone levels over the past decade are shown in Figure 1-2, along with a comparison to the ozone NAAQS. The current ozone NAAQS is 70

² <https://www.census.gov/geographies/reference-files/time-series/demo/metro-micro/delineation-files.html>, Accessed online in May 2025.

³ <https://demographics.texas.gov/Data/TPEPP/Estimates/>, Accessed online in May 2025.

⁴ <https://www.census.gov/quickfacts/fact/table/granburycitytexas/PST045223>, Accessed online in May 2025.

ppb for the 3-year running average of annual 4th highest daily maximum 8-hour average concentration (often referred to as the ozone “design value”). The ozone design value for Granbury (Continuous Air Monitoring Station (CAMS)73) exceeded the NAAQS in the two most recent years for which data were available, at 75 ppb in 2023 and 78 ppb in 2024.

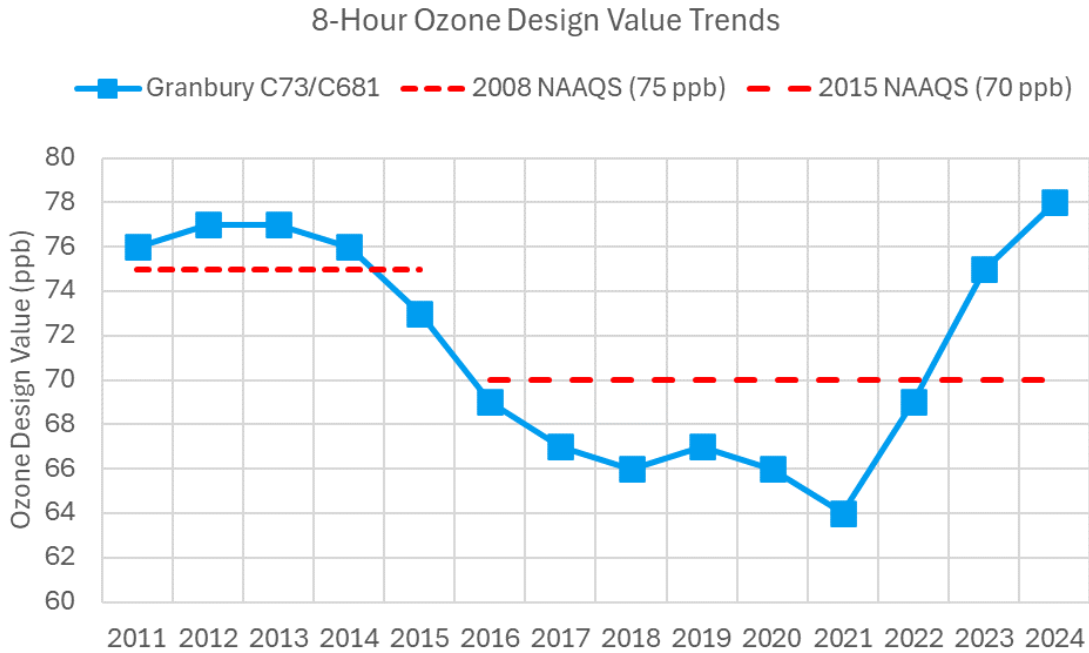


Figure 1-2. Ozone air quality for Hood County from 2011 to 2023.

Between 2017 and 2024, Hood County population grew by 21% as shown in Figure 1-3. Increased populations elevate regional demand for transportation and other services which could lead to increased emissions, or smaller decreases to emissions, from certain source categories.

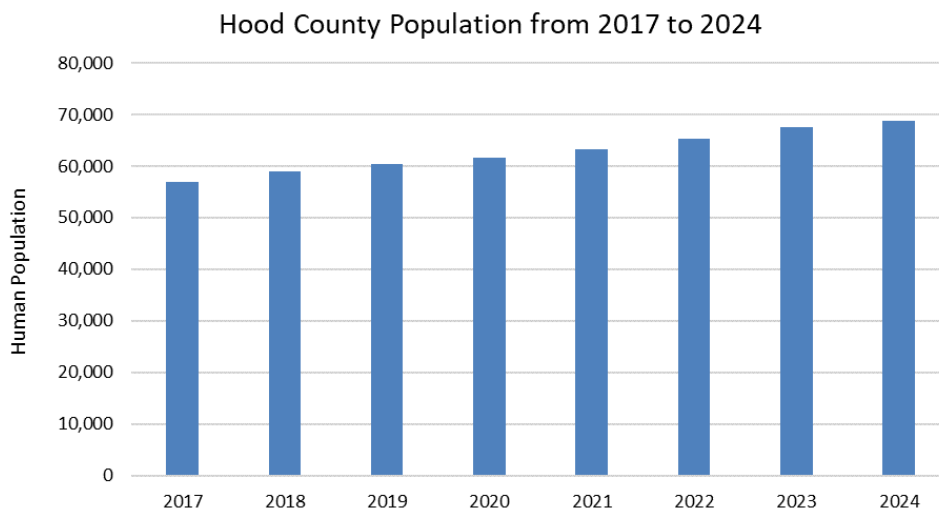


Figure 1-3. Hood County population from 2017 to 2023.^{5,6}

⁵ <https://demographics.texas.gov/Data/TPEPP/Estimates/>. Accessed online in May 2025.

⁶ July 2024 county-level population estimates were not yet available; therefore, the 2024 population is for January 2024. For all years except 2024, July populations are shown.

Emissions inventories are used to assess the nature of an area's ozone problem and can help answer questions such as: (1) whether ozone formation in the region is limited by the amount of available NO_x (oxides of nitrogen) or VOC (volatile organic compounds); and (2) which types of emissions sources are good candidates for emissions controls that could reduce the area's ozone levels.

The purpose of this study is to review the most recent available historical ozone precursor emission inventory to identify sources of emissions that are under- or over-estimated, accompanied by high levels of uncertainty, or for which more detailed emissions inventory input at the sub-county level can be provided. The emission inventory review will provide a better understanding of the completeness and accuracy of the anthropogenic emission inventory for Hood County and prioritization of potential future emission inventory updates. Per input from TCEQ staff⁷, Ramboll reviewed the EPA 2022v1⁸.

Several types of emissions sources are described in this review. Point sources are large stationary emissions sources that exceed a specified emissions threshold and therefore are tracked individually in the emissions inventory. Area sources comprise multitudes of stationary sources that may be spread out geographically and are small individually (such as oil and gas wells), but, taken together, may constitute a sizeable amount of emissions. On-road emissions are from light duty (e.g. passenger cars and light trucks) and heavy-duty (medium- and heavy-duty trucks and buses) vehicles licensed or certified for use on highways. Off-road mobile source emissions are from mobile and portable internal combustion powered equipment not generally licensed or certified for highway use. Biogenic emissions are emitted by natural sources such as trees, agricultural crops and microbial activity in soils.

Ramboll reviewed EPA's 2022v1 anthropogenic ozone precursor (i.e., NO_x, VOC, and CO) emission inventory for Hood County for point, area, on-road mobile, and off-road mobile sources. The 2022v1 emission inventory was analyzed because it represents the most recent historical⁹ emission inventory available for use in ozone air quality planning and modeling inputs. Biogenic emissions are also included. Area sources emissions reported herein exclude point source emissions to avoid double counting.

In this report we summarize the EPA's 2022v1 modeling emission inventories for Hood County, analyze the categories that are the main contributors to each source sector's emissions, examine emissions estimation methodology and identify emissions categories that are overestimated or underestimated, accompanied by high levels of uncertainty, or for which more accurate or detailed emissions are available.

Section 1.0 summarizes the 2022 emission inventory for all sources. Section 2.0 presents a review of 2022 point source emissions. Section 4.0 presents a review of 2022 area source emissions and Section 2.0 presents a review of 2022 on-road source emissions. Section 5.0 presents a review of 2022 off-road source emissions. Section 6.0 presents our recommendations for emission inventory improvements.

1.2 All Source Emissions Overview

The 2022v1 emission inventory for Hood County is summarized below. Figure 1-4 shows Hood County NO_x, VOC, and carbon monoxide (CO) 2022 annual average daily emissions by major source category. Point (44%), area (24%), and on-road (15%) were the largest sources of NO_x emissions in 2022 and

⁷ Email from TCEQ (Shantha Daniel) to Ramboll (John Grant), March 19, 2025.

⁸ <https://www.epa.gov/air-emissions-modeling/2022v1-emissions-modeling-platform>. Accessed online in May 2025.

⁹ A base year inventory is developed based on historical activity inputs and emission factors. In contrast, a future year emission inventory is based on activity and emission factor forecasts.

together accounted for over 80% of Hood County NOx emissions. Biogenic, off-road, and natural wildfires sources contributed smaller amounts of NOx emissions, between 5% and 7% each.

Biogenic emissions comprised a majority (57%) of Hood County 2022 VOC emissions. Area sources were the second largest contributor of VOC emissions, accounting for 20% of VOC emissions followed by natural wildfires (13%). Other source categories (off-road, on-road, and point sources) each accounted for 7% or less of VOC emissions.

Natural wildfires were the largest source of 2022 CO emissions in Hood County (43%). On-road, off-road, and area source emissions each accounted for 13% to 17% of CO emissions. Point and biogenic sources accounted for 7% or less of Hood County 2022 CO emissions.

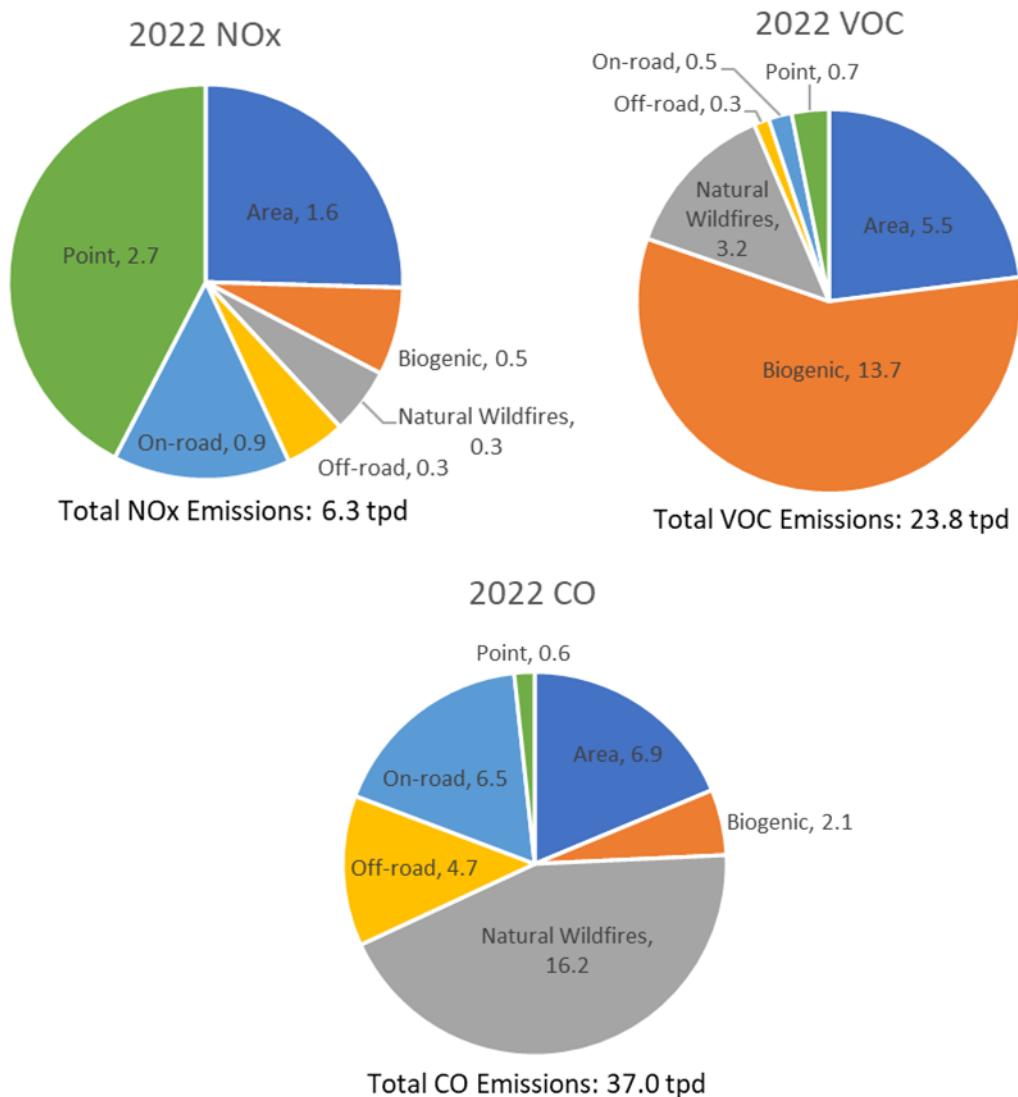


Figure 1-4. Hood County 2022 annual average daily emissions (tpd¹⁰) by sector for NOx (top left), VOC (top right), 2022 CO (bottom).

¹⁰ Tons per day

Biogenic emissions in EPA's 2022v1 modeling platform are based on the Biogenic Emission Inventory System version 4 (BEIS4). BEIS4 emissions were developed with the Biogenic Emissions Landuse Database (BELD) version 6 and year 2022 meteorology (EPA, 2025).

Ozone formation depends on the relative amount of NO_x and VOC present, where the VOC/NO_x ratio is defined in terms of parts per billion by carbon (ppbC) per ppb. When the VOC/NO_x ratio is higher than about 10, ozone formation is limited by the amount of available NO_x and reducing NO_x is most effective in decreasing peak ozone concentrations. However, if the VOC/NO_x ratio is less than about 5, reducing VOC is most effective in decreasing ozone and reducing NO_x may increase ozone (i.e., a NO_x-disbenefit). In this situation, ozone is suppressed in the urban area due to titration by large amounts of fresh nitric oxide (NO) emissions. When NO_x emissions are reduced, suppression of ozone by NO is lessened and ozone increases. For VOC/NO_x ratios between 5 and 10, ozone decreases with reductions in both NO_x and VOC (i.e., a transitional condition).

The EPA 2022v1 Hood County annual average daily emission inventory VOC/NO_x ratio is 12 ppbC/ppb, which is within the NO_x-limited regime. The presence of abundant biogenic VOC emissions ensures that there are generally sufficient VOCs to allow ozone formation. This means local emissions control strategies should focus on reducing NO_x emissions.

2.0 POINT SOURCE EMISSIONS REVIEW

Point sources are large stationary emissions sources that exceed a specified emissions threshold. Point source emissions are frequently but not always released through an exhaust stack. In non-attainment areas, the TCEQ defines a point source to be any industrial, commercial or institutional source that emits actual levels of criteria pollutants at or above the following amounts: 10 tons per year (tpy) of VOC; 25 tpy of NO_x; or 100 tpy of any of the other criteria pollutants including CO, sulfur dioxide (SO₂), particulate matter less than 10 microns (PM₁₀), or particulate matter less than 2.5 microns (PM_{2.5}). In attainment areas of the state, such as Hood County, any facility that emits a minimum of 100 tpy of any criteria pollutant must submit a point source emissions inventory to the TCEQ. Each point source has a well-defined location (latitude and longitude) as well as ancillary information known as stack parameters that indicate the height at which emissions are released, the diameter of the emitting stack and other factors.

EPA requires all existing utility units serving generators with an output capacity of greater than 25 megawatts (MW) and all new utility units to continuously measure and record their emissions of SO₂, NO_x and carbon dioxide (CO₂) as well as other quantities such as fuel heat input. This is accomplished through in-stack monitoring using a continuous emissions monitoring system (CEMS). All sources must submit hourly emissions data to the EPA's Clean Air Market Division (CAMD) Air Markets Program Data (AMPD) on a quarterly basis.

Section 2.1 below reviews 2022 point source emissions from EPA 2022v1. Section 2.2 summarizes recent Hood County point source emission trends. Section 2.3 reviews the Wolf Hollow III Power Plant permit application.

2.1 2022 Point Source Emissions

The 2022v1 point source emission inventory is summarized below in several different ways to establish (1) the geographical distribution of point source emissions, (2) the relative importance of point source emissions by industry and (3) the relative importance of emissions sources by the mass of pollutants emitted. As shown above in Figure 1-4 of Section 1.2, point sources are the largest contributor to NO_x emissions in Hood County, accounting for 44% of total 2022 emissions. Point source emissions make relatively small contributions to total VOC and CO emissions, representing 3.1% of VOC emissions and 1.7% of CO emissions.

Figure 2-1 displays the locations of Hood County point sources in the 2022v1 emission inventory. The size of the circle on the map for each point source is indicative of the amount of NO_x emissions the facility releases; facilities with larger circles have higher emissions. Decordova Steam Electric Station, a natural gas-fueled power plant located in eastern Hood County along the Brazos River, had the largest NO_x emissions (0.98 tpd NO_x) in 2022. There is a cluster of three point sources in southern Hood County, including Wolf Hollow I (0.70 tpd NO_x), Decordova Compressor (0.45 tpd NO_x), and Wolf Hollow II (0.29 tpd NO_x). In addition to these sources, there are several smaller point sources in Hood County with emissions ranging from <0.01 tpd to 0.18 tpd NO_x.

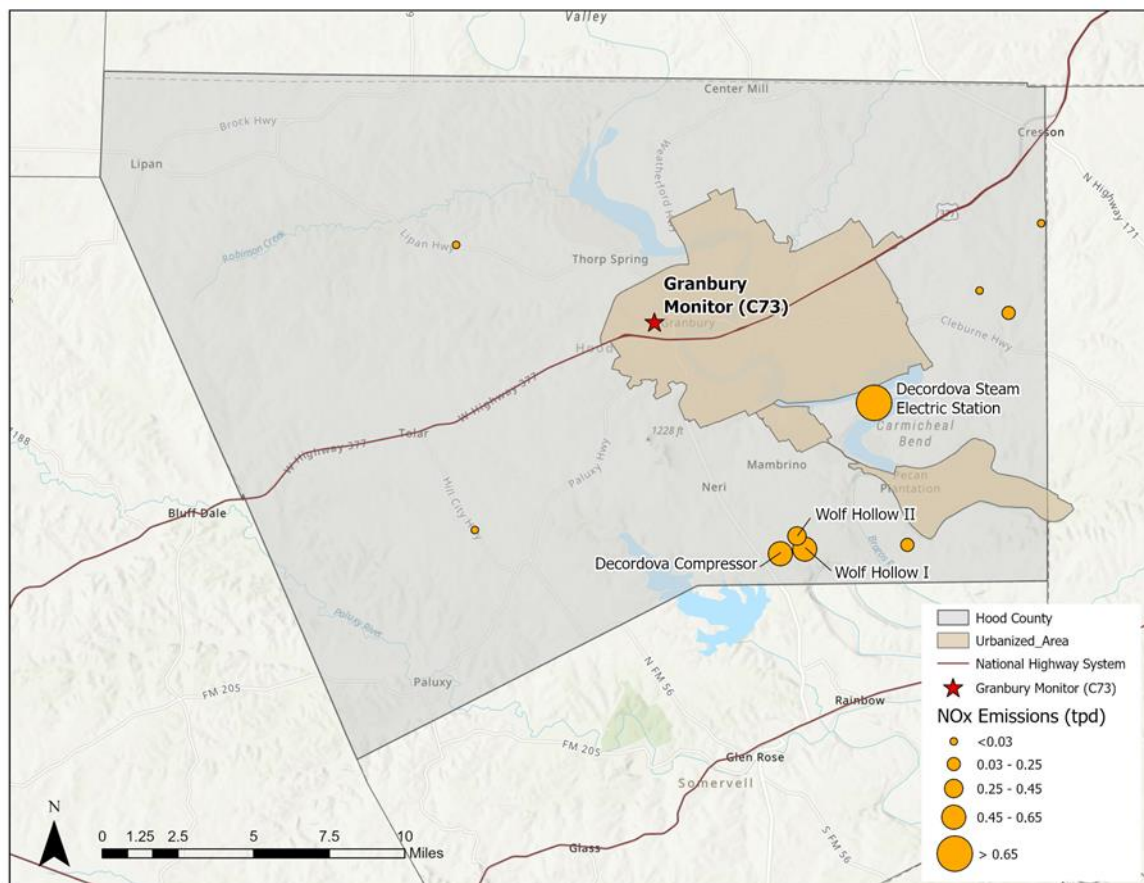


Figure 2-1. 2022 NOx emissions from point sources in Hood County.

Table 2-1 shows Hood County point source emissions by facility in the 2022v1 emission inventory. The electric services sector, comprised of three electrical generating units (EGUs), accounted for close to three-quarters (71%) of all point source emissions. Outside of the electric services sector, all other point sources in Hood County are related to crude oil and/or natural gas and comprised over one-quarter (29%) of NOx emissions from point sources; a majority of non-EGU emissions were from the Decordova Compressor Station.

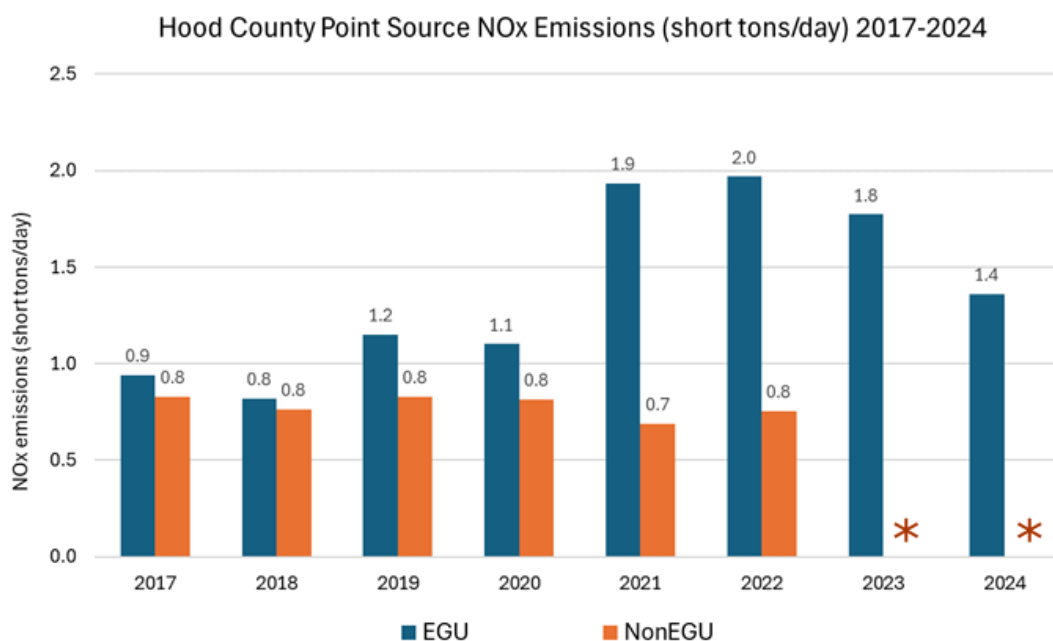
Table 2-1. Hood County 2022 point sources NOx emissions.

Facility Name	SIC ^a Code	SIC ^a Description	NOx Emissions (tpd)	Percent of Hood County Point Source Emissions
Decordova Steam Electric Station	4911	Electric Services	0.98	37%
Wolf Hollow I	4911	Electric Services	0.65	24%
Decordova Compressor Station	1311	Crude Petroleum & Natural Gas	0.45	17%
Wolf Hollow II	4911	Electric Services	0.29	11%
Cowtown Gas Processing Plant	1311	Crude Petroleum & Natural Gas	0.18	7%
Corvette Gas Processing Plant	1321	Natural Gas Liquids	0.08	3%
Black Diamond Gas Plant	1321	Natural Gas Liquids	0.03	1%
Taylor SWD Red Dragon	1311	Crude Petroleum & Natural Gas	0.01	<1%
Tolar Gas Plant	4922	Natural Gas Transmission	<0.01	<1%
Little Hoss V Pad	1311	Crude Petroleum & Natural Gas	<0.01	<1%

^a Standard Industrial Classification

2.2 Point Source Emission Trends

Recent annual point source emission trends were compiled from (i) EPA's Clean Air Markets Program Data (CAMPD)¹¹ for EGUs and (ii) TCEQ's facility-level Point Source Emission Data¹² for non-EGUs. Figure 2-2 includes 2017 to 2024 trends for EGUs and 2017 to 2022 trends for non-EGUs; 2023 and 2024 non-EGU emissions were not available at the time that these data were compiled. From 2017 to 2020, EGUs accounted for a just over half (53% to 58%) of Hood County point source NO_x emissions. From 2020 to 2021, there was a large increase in EGU NO_x emissions and from 2021 to 2022 EGUs accounted for close to three-quarters of point source NO_x emissions. EGU NO_x emissions peaked in 2022 at 2.0 tpd, then decreased to 1.8 tpd in 2023 and 1.4 tpd in 2024. Non-EGU sources remained relatively constant from 2017 to 2022, ranging from 0.7 tpd to 0.8 tpd NO_x.



* 2023 and 2024 non-EGU emissions were not available for inclusion in this analysis

Figure 2-2. 2017-2022 point source NO_x emission inventory trends¹³.

Figure 2-3 shows facility-level EGU 2017 to 2024 NO_x emission trends. The Decordova Steam Electric Station accounted for 56% of 2021, 50% of 2022, and 37% of 2023 EGU NO_x emissions but no more than 28% of emissions in any other year. NO_x emissions from the Wolf Hollow Generating Station were larger than the other two Hood County EGUs, except for in 2021 and 2022 when Decordova Steam Electric Station NO_x emissions were larger. Wolf Hollow Generating Station NO_x emissions increased monotonically from 2018 to 2023, then slightly decreased from 2023 to 2024. Wolf Hollow II NO_x emissions were the smaller than the other two Hood County EGUs, except for in 2017, 2018, and 2024 when Decordova Steam Electric Station NO_x emissions were smaller. Wolf Hollow II NO_x emissions accounted from between 13% and 29% of EGU NO_x emissions from 2017 to 2024.

¹¹ <https://campd.epa.gov/>. Accessed online in May 2025.

¹² <https://www.tceq.texas.gov/airquality/point-source-ei/point-source-emissions-data>. Accessed online in May 2025.

¹³ Data were not available for 2023 and 2024 non-EGU emissions

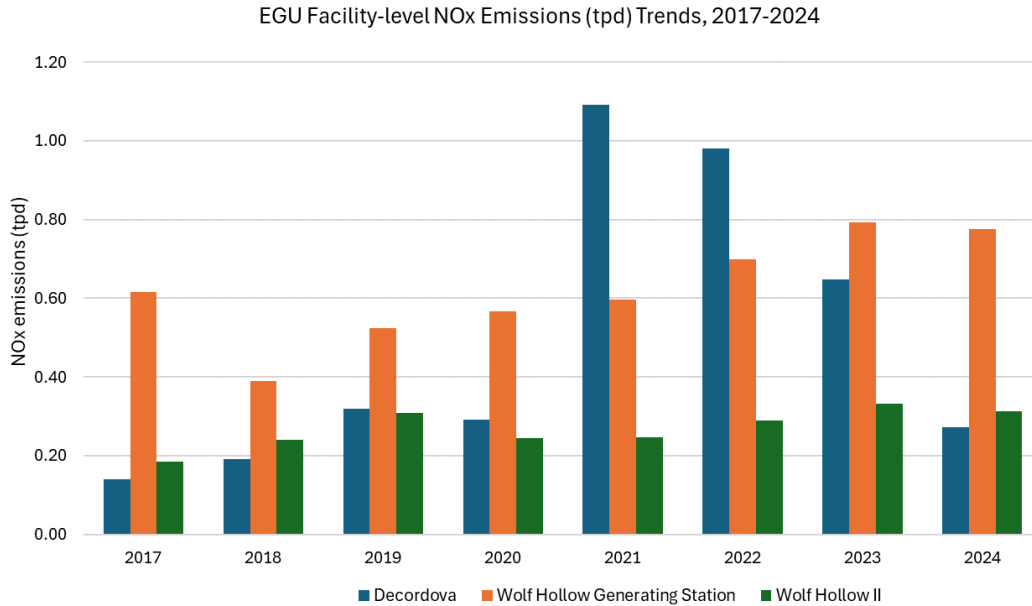


Figure 2-3. 2017 – 2020 EGU NOx Emissions (tpd) by facility¹¹.

EGU emissions trends from 2017 to 2024 were driven by changes to operational activities; there were no changes to emission controls for any Hood County EGU from 2017 to 2024. Table 2-2 shows the NOx emission controls for each facility and unit. Table 2-3 shows annual average NOx emission rates per unit of electricity generation for each Hood County EGU from 2017 to 2024.

The facility-level NOx emission rates reflects the type of unit different NOx emission controls installed at each facility. Decordova Steam Electric Station has the highest emission rates from its four simple cycle units with water injection controls. Wolf Hollow Generating Station has the second highest emission rates from its two combined cycle units with selective catalytic reduction controls. Wolf Hollow II has the lowest emission rates from its two combined cycle units with ammonia injection and selective catalytic reduction controls.

Table 2-2. NOx controls for each Hood County EGU¹¹.

Facility Name	Unit ID	Unit Type	Primary Fuel Type	NOx Emissions Control
Decordova Steam Electric Station	CT1*	Simple cycle	Pipeline Natural Gas	Water Injection
Decordova Steam Electric Station	CT2	Simple cycle	Pipeline Natural Gas	Water Injection
Decordova Steam Electric Station	CT3	Simple cycle	Pipeline Natural Gas	Water Injection
Decordova Steam Electric Station	CT4	Simple cycle	Pipeline Natural Gas	Water Injection
Wolf Hollow Generating Station	CTG1*	Combined cycle	Pipeline Natural Gas	Selective Catalytic Reduction
Wolf Hollow Generating Station	CTG2	Combined cycle	Pipeline Natural Gas	Selective Catalytic Reduction
Wolf Hollow II	CGT4	Combined cycle	Pipeline Natural Gas	Ammonia Injection, Selective Catalytic Reduction
Wolf Hollow II	CGT5	Combined cycle	Pipeline Natural Gas	Ammonia Injection, Selective Catalytic Reduction

*CT: combustion turbine; **CTG: combustion turbine generation

Table 2-3. 2017 to 2024 annual average NOx emission rates (lb/MWh) for each Hood County EGU facility¹¹.

Year	Decordova Steam Electric Station	Wolf Hollow Generating Station	Wolf Hollow II
2017	8.92	0.18	0.04
2018	10.44	0.19	0.03
2019	9.95	0.16	0.03
2020	9.61	0.19	0.03
2021	13.12	0.19	0.03
2022	9.02	0.20	0.03
2023	4.16	0.18	0.03
2024	3.68	0.17	0.03

There is substantial year-to-year variability in the monthly distribution of EGU NOx emissions. Emissions for the six-month period from May to October accounted for 67% of annual EGU NOx emissions, excluding calendar year 2021. Calendar year 2021 was excluded because it showed anomalous monthly contributions, with the highest contributions in February 2021 based on large emissions in that month from the Decordova Steam Electric Station.

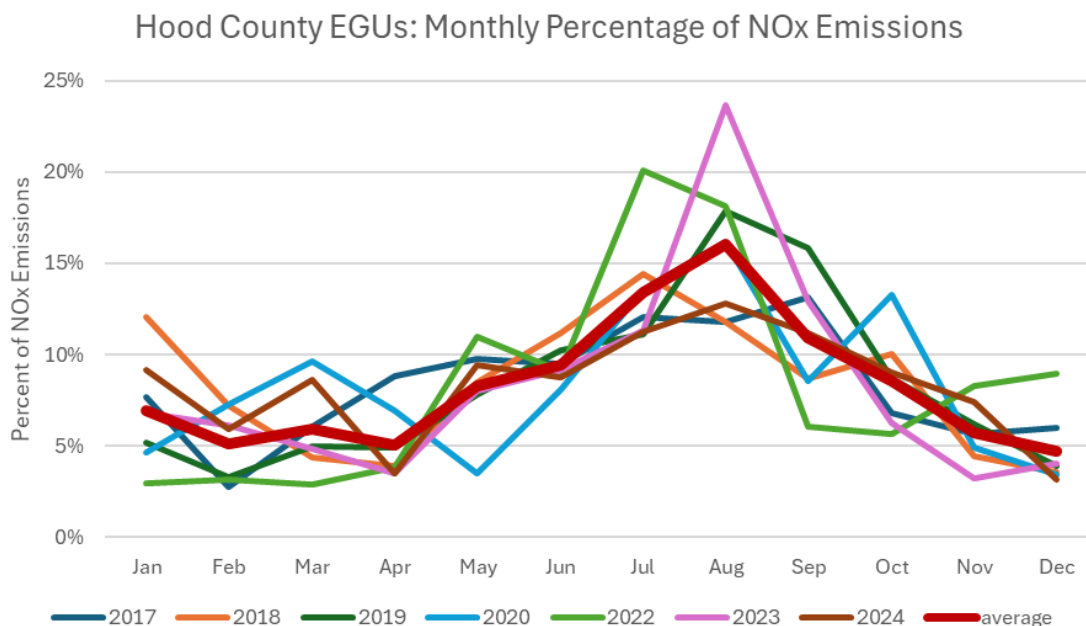


Figure 2-4. 2017 to 2024 Hood County EGU NOx Emissions (tpd) by month^{11,14}.

2.3 Wolf Hollow III Permit Application Review

Currently, Wolf Hollow Power Plant is comprised of two adjacent facilities, Wolf Hollow Generating Station (owned by TotalEnergies) and Wolf Hollow II (owned by Constellation). As noted in the sections above, these two EGUs emit substantial NOx emissions and are located in southern Hood County. There is a pending permit application for Wolf Hollow III¹⁵ which would expand Wolf Hollow II. The main expansion specifications for Wolf Hollow III are listed below:

- Eight GE Model 6B natural gas-fired combustion turbines (simple cycle), each with a power output of 44 MW and dry low-NOx emission control
- 35.3 tons per year NOx emission per year per turbine (70% of emissions during normal operation, 30% during maintenance, startup, or shutdown (MSS))
- 13,076,000 million British thermal units (MMBtu) heat input operating limit combined over all turbines
- 3,500 hours per year of operation (40% capacity factor) for each turbine
- Peaking service

Operations: According to Table A-4 of the Wolf Hollow III permit application, each turbine will operate for up to 3,500 hours per year and 10% of those operating hours would be for MSS. Under the terms of the permit applications, hypothetically, each turbine could operate 350 days per year assuming (i) one hour per day for startup, (ii) eight hours per day for normal operation, and (iii) one hour per day for shutdown.

¹⁴ Year 2021 was excluded because it showed anomalous monthly contributions, with the highest contributions in February 2021 based on large emissions in that month from the Decordova Steam Electric Station.

¹⁵ <https://www.tceq.texas.gov/assets/public/permitting/air/reports/applications/369521-tc.pdf>. Accessed online in May 2025.

According to the Energy Information Administration (EIA)¹⁶, daily peaker plants typically run for relatively short periods, usually a few hours per day and seasonal peaking plants may operate for extended periods—days or weeks—to support the grid during extreme weather conditions. The Government Accountability Office (GAO) defined peaker plants as having a capacity factor of 15% or less¹⁷. The 40% capacity factor and potential operation for 10 hours per day is relatively high compared to the peaker plants as defined above by EIA and GAO.

NOx Controls: According to the Wolf Hollow III permit application, the eight turbines will be sourced from an existing facility in Chicago, Illinois. Since these turbines are previously used and the hourly emissions are not expected to increase, the relocation is not considered to be a “modification” under Federal New Source Performance Standard requirements. The application proposes no modifications of the combustion turbines other than the installation of dry low-NOx burners to satisfy TCEQ Tier I Best Available Control Technology (BACT) requirements for simple cycle combustion turbines. Dry low-NOx emission control is designed to minimize combustion temperatures using a lean pre-mixed air-fuel mixture. The permit notes that the turbines will not exceed 9 parts per million by volume, dry (ppmvd) NOx @15% Oxygen (O₂) during steady-state operations, on a three-hour rolling average basis, excluding startup/shutdown (SUSD) periods in conformity with Tier I BACT requirements.

NOx Emissions for Wolf Hollow III Relative to Operating EGUs in Hood County: Maximum annual NOx emissions for Wolf Hollow III, if permitted, would be 282.41 tpy; on an annual average daily basis maximum NOx emissions would be 0.77 tpd. According to EPA CAMPD¹¹, recent historical year Hood County EGU annual average daily emission are 1.97 tpd NOx (2022), 1.77 tpd NOx (2023) and 1.36 tpd NOx (2024). Maximum potential emissions under the current permit application from Wolf Hollow III would increase Hood County NOx emissions by 39% relative to 2022 levels, 43% relative to 2023 levels, and 57% relative to 2024 levels.

The permit application for Wolf Hollow III indicates a maximum heat input of 13,076,000 MMBtu/year (yr) and, per Table B-7, heat input per unit of electricity generation of 13.34 million British thermal units per megawatt-hour (MMBtu/MWhr). The ratio of the maximum heat input to the heat input per unit of electricity generation yields an estimate of the maximum total electricity generation for Wolf Hollow III of 980 gigawatt-hours (GWhr) per year. The ratio of maximum annual NOx emissions to maximum total electricity generation for Wolf Hollow III is 0.58 lb/MW-hr. Compared to 2024 estimates for EGUs in Hood County, Wolf Hollow III potential NOx emitted per unit of electricity generated is 84% less than Decordova Steam Electric Station, 238% greater than the Wolf Hollow Generating Station, and 1593% greater than Wolf Hollow II.

¹⁶ <https://www.eia.gov/energyexplained/electricity/electricity-in-the-us-generation-capacity-and-sales.php>. Accessed online in May 2025.

¹⁷ <https://www.gao.gov/assets/gao-24-106145.pdf>. Accessed online in May 2025.

3.0 AREA SOURCE EMISSIONS REVIEW

The area source emission inventory treats in aggregate all stationary sources that have emissions below the point source threshold. These are sources that may be spread out geographically and are small individually, but taken together, may constitute a substantial amount of emissions. Examples of area sources include dry cleaners, residential wood heating, autobody painting, fires, oil and gas wells and consumer solvent use. Area source emissions for many source categories are estimated based on EPA AP-42 methods¹⁸. These emissions are typically estimated and reported as county totals and allocated to a finer geographic scale using a surrogate such as population distribution. For example, if a certain amount of VOC emissions are estimated for dry cleaners in a given county, most of those emissions would be allocated to the locations within the county that have the highest population density.

Although all source categories were analyzed, the emissions analysis below focuses on those categories responsible for the preponderance of area source ozone precursor emissions in Hood County for which emission updates could have substantial effects on the emission inventory. Ramboll obtained the Hood County 2022 area source emission inventory from EPA's 2022v1 modeling platform⁸.

3.1 Overview of Emissions Inventory

Figure 3-1, Figure 3-2, and Figure 3-3 show 2022 area source emission contributions by source category for NO_x, VOC, and CO, respectively. Oil and gas emission sources accounted for the majority (79%) of NO_x emissions, with smaller contributions from fuel combustion, prescribed fires, agricultural field burning, and open burning categories. Oil and gas emission sources also accounted for the majority (54%) of VOC emissions with smaller emission contributions from consumer and commercial products (13%), prescribed fires (11%), surface coatings (5%), and gasoline service stations (4%). Prescribed fires, open burning, and agricultural field burning comprised a vast majority of CO emissions, each contributing 43%, 23%, and 18% of CO emissions.

¹⁸ <https://www.epa.gov/air-emissions-factors-and-quantification/ap-42-compilation-air-emissions-factors>. Accessed online in May 2025.

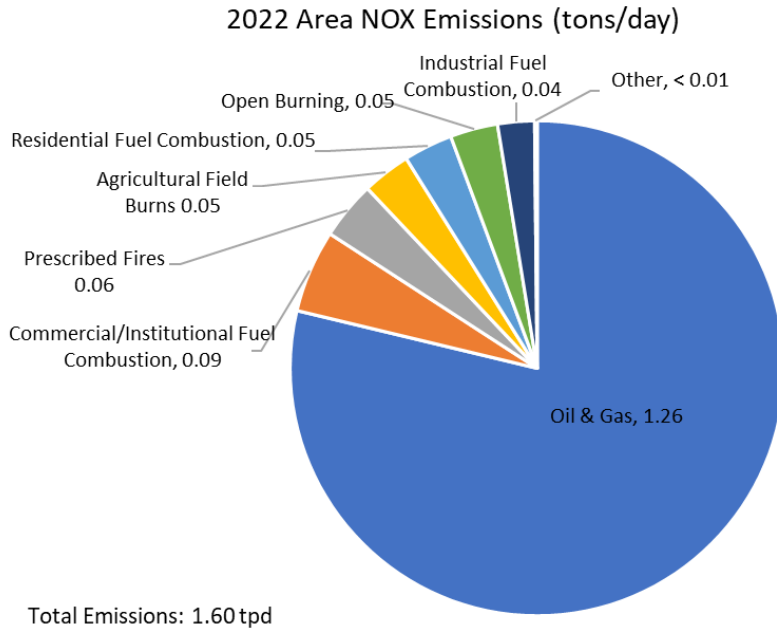


Figure 3-1. Hood County 2022 area source NOx emissions by source category.

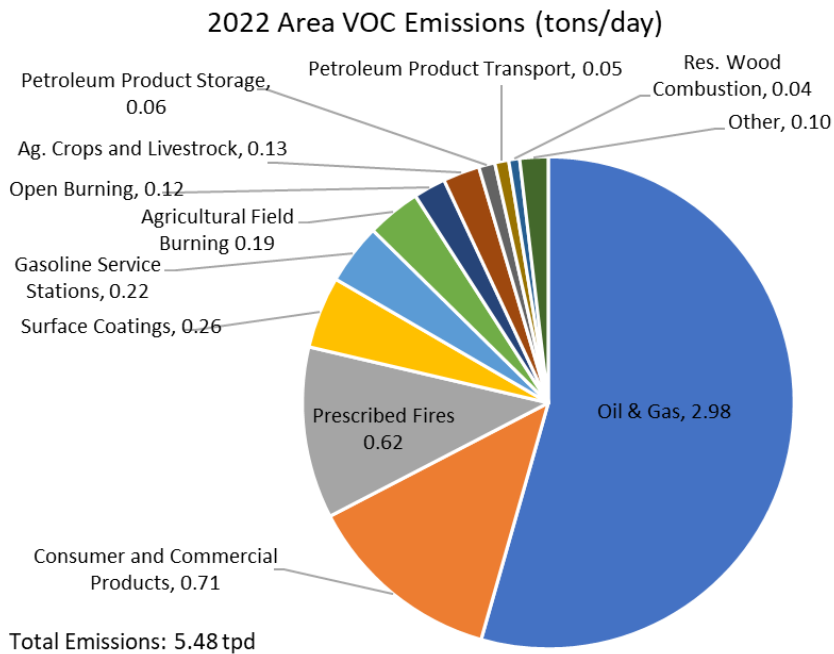


Figure 3-2. Hood County 2022 area source VOC emissions by source category.

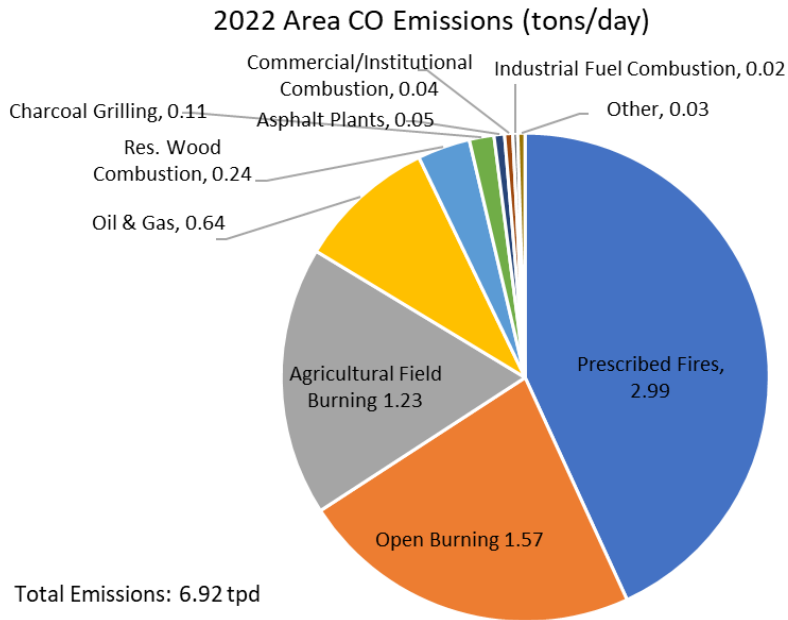


Figure 3-3. Hood County 2022 area CO emissions by source category.

3.2 Oil and Gas Area Source Emissions

Area source oil and gas emissions are substantial sources of VOC and NO_x emissions due to the number of oil and gas wells in Hood County. Hood County lies within the Bend Arch-Fort Worth Basin and the Barnett Shale Play. As shown in Figure 3-4, there are hundreds of oil and gas wells in Hood County. Close to 100% of wells in Hood County are gas wells. Texas Railroad Commission (TRC) data for calendar year 2017 indicated that all 737 wells within Hood County were gas wells; there were no oil wells. The number of gas wells declined to 624 in 2024; there was a single oil well in Hood County in 2024. The majority of the wells in Hood County produce oil and gas from the Barnett Shale formation.

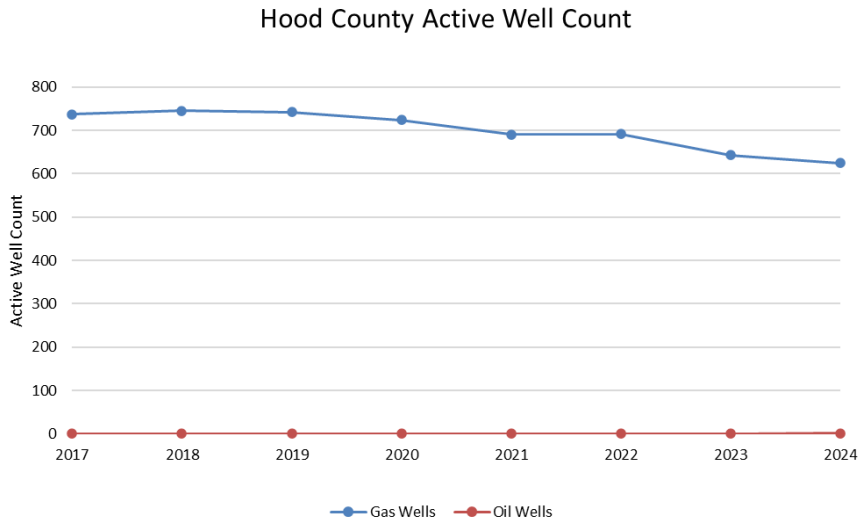


Figure 3-4. 2017-2024 active oil and natural gas well count for Hood County based on TRC oil and gas activity data¹⁹

Hood County oil and gas production has also declined from 2017 to 2024. Hood County gas production decreased by 44% and oil production decreased by 38% between 2017 and 2024. Decreasing oil and gas production trends in Hood County are consistent with the Barnett Shale-wide gas production trend shown in Figure 3-6.

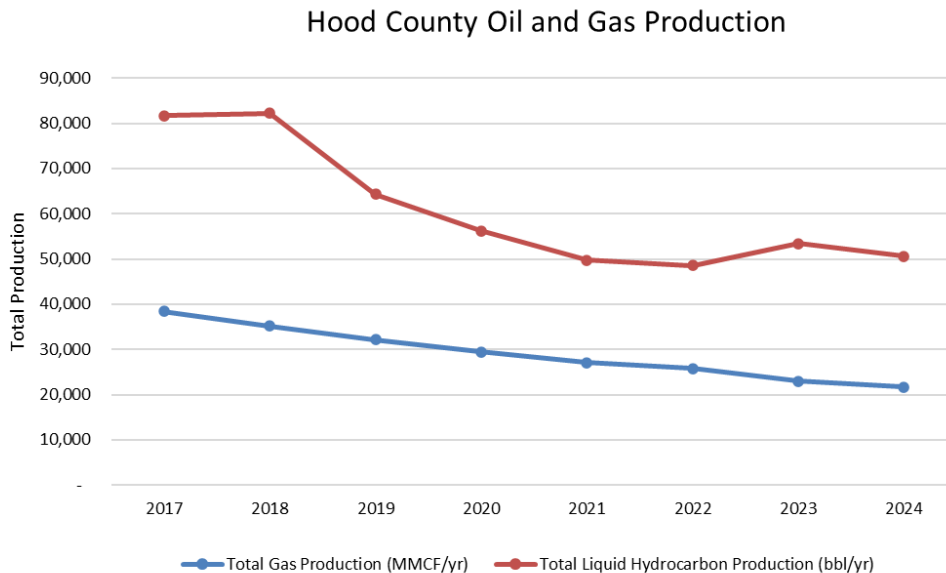


Figure 3-5. 2017-2024 oil and gas production for Hood County based on TRC oil and gas activity data.

¹⁹ Well counts are as of the beginning of February each year except 2022 for which February data was not available and September data is therefore shown.

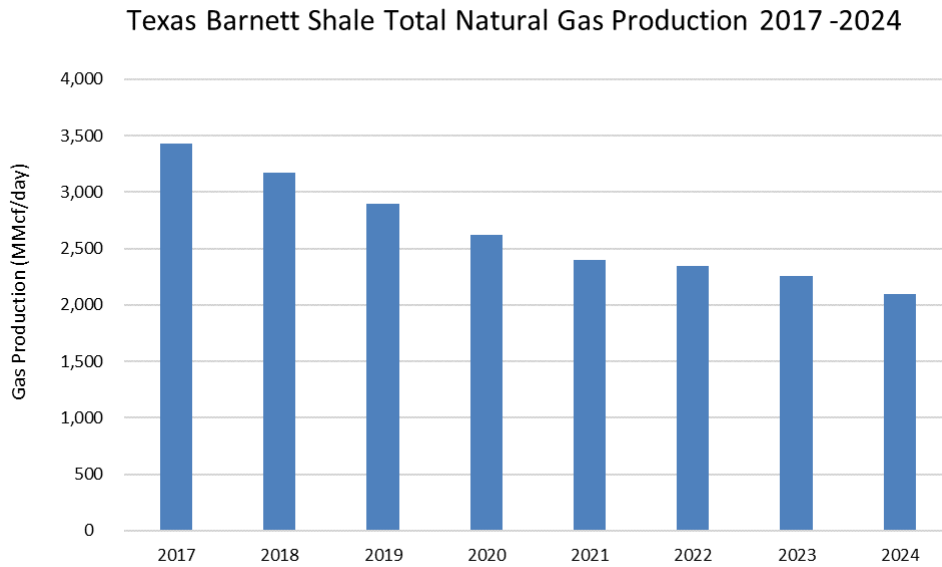


Figure 3-6. Texas 2017-2024 oil and gas production from the Barnett Shale²⁰.

EPA’s 2022v1 emissions inventory includes annual emissions for oil and gas sources; these sources are expected to operate near-continuously, year-round. Close to 100% of area source oil and gas NOx emissions are from compressor engines (Figure 3-7). This is consistent with 2022 well counts which are close to 100% gas wells (Figure 3-4). VOC emissions from area source oil and gas sources are distributed across several emission source categories; fugitive leaks (36%), pneumatic pumps (17%), pneumatic devices (15%), and condensate tanks (9%) together account for over three-quarters of area source oil and gas VOC emissions.

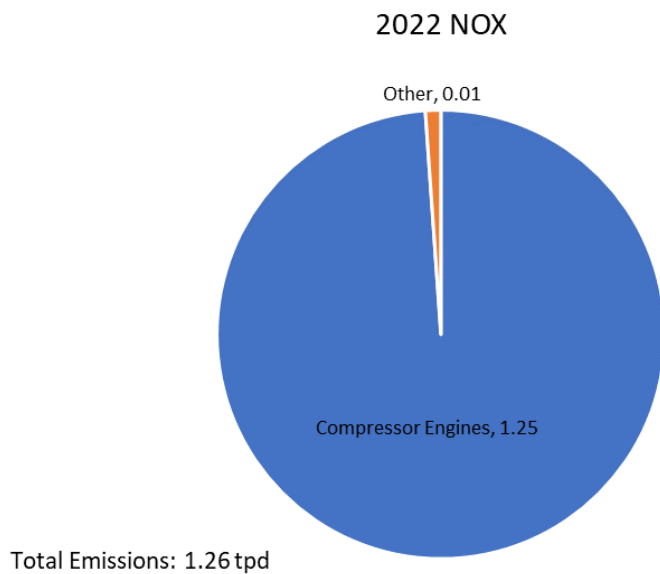


Figure 3-7. Hood County 2022 oil and gas source NOx emissions by source category.

²⁰ <https://www.rrc.texas.gov/oil-and-gas/major-oil-and-gas-formations/barnett-shale/>. Accessed online in May, 2025.

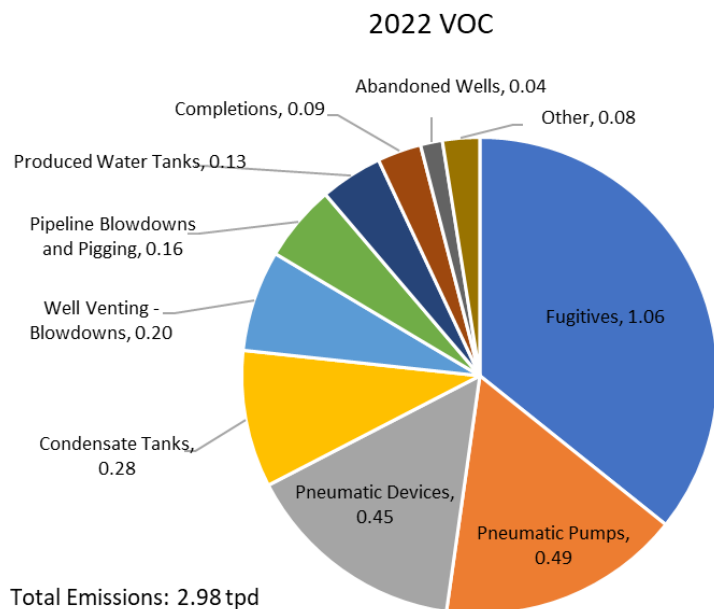


Figure 3-8. Hood County 2022 oil and gas sources VOC emissions by source category.

3.2.1 Oil and Gas Emissions Analysis

EPA 2022v1 emission inventory area source oil and gas emissions are based on TCEQ-submitted emissions for compressor stations and EPA’s O&G Emission Estimation Tool for other oil and gas source categories (EPA 2025).

Compressor engines: As part of the ERG (2018a) study, Texas compressor engines were surveyed. For the survey, information necessary to estimate the ratio of compressor engine energy per unit of gas production in horsepower-hours per thousand cubic feet of gas production (hp-hr/MCF) for each Texas oil and gas basin were estimated.

Survey results estimated 2.33 hp-hr/MCF compression based on a 28% survey response rate (by wellsite gas production) in the Bend Arch-Fort Worth Basin.

It is assumed that all midstream compressor engine emissions are reported in the point source emission inventory. Wellsite compressor engine emissions were reconciled with compressor engines included in the point source emission inventory.

ERG (2018a) indicated that not all midstream compressor engines are reported in the point source emission inventory. ERG (2018a) results indicated that for the Bend Arch-Fort Worth Basin, 85.6% of engines reported emissions to the TCEQ point source emission inventory. Midstream compressor engine NOx emissions may be underestimated as non-permitted midstream compressor engines are not included.

In the EPA 2022v1 emission inventory, area source compressor engines represent 23% of anthropogenic NOx emissions in Hood County. Compressor engine emissions should be considered for update as resources permit to refine area source wellsite compressor engine emissions and add area source midstream compressor engine emissions.

Fugitives Leaks: The number of fugitive devices per well was taken from CENSARA (2012) and Greenhouse Gas Reporting Program (GHGRP) Subpart W data (EPA, 2025). AP-42 emission rates per

device were applied. The fugitive device counts include Hood County-specific data; therefore, no update is suggested for this source category.

Pneumatic Pumps: Pneumatic pump emissions were estimated based on CENSARA (2012) equipment profiles and operational characteristics. Pneumatic pump emissions are not currently based on data specific to Hood County. EPA Oil and Gas New Source Performance Standards requires control of VOC emissions from diaphragm pumps at natural gas well sites. Pneumatic pump control data could be obtained from the GHGRP Subpart W. Updates to pneumatic pump emissions are a low priority update as they will only affect VOC emissions.

Pneumatic Devices: Gas well pneumatic devices emissions were estimated based on GHGRP Subpart W data (EPA, 2025). Oil and Gas NSPS effects on pneumatic device counts are accounted for in pneumatic device emission estimates. The pneumatic device counts include Hood County-specific data; therefore, no update is suggested for this source category.

Condensate Tanks: Condensate tank emissions were estimated based on emission factors developed in ERG (2012) and control prevalence from EPA GHGRP Subpart W data (EPA, 2025). The condensate tank emission factors and control prevalence include Hood County-specific data; therefore, no update is suggested for this source category.

3.3 Non-Oil and Gas Area Source Emissions

The analysis below focuses on the emissions source categories that account for a majority of non-oil and gas area source NO_x and VOC emissions: fuel combustion emissions, solvents (including consumer and commercial products and surface coatings), prescribed fires and agricultural field burning, and gasoline service stations.

For non-oil and gas area sources, average daily emissions were estimated by dividing 2022v1 annual emissions by 365 days per year. Some non-oil and gas area sources emit on a year-round basis (e.g., consumer and commercial products); there are also categories with emissions mainly in winter (e.g., residential wood combustion) and summer (e.g., charcoal grilling).

Fuel Combustion Emissions: TCEQ submitted area source fuel combustion estimates are included in the 2022v1 emission inventory. Fuel combustion emission estimates are based on state-level fuel consumption activity data which includes consumption from point and area sources and is obtained from the EIA. Area source-specific fuel consumption is estimated by allocating state-level consumption to the county-level and reconciling county-level fuel consumption estimates with point source fuel consumption.

ERG (2017) gathered and analyzed data on 2014 natural gas and distillate fuel use based on several sources listed below.

- U.S. Environmental Protection Agency (EPA)'s Boiler Inspector Inventory Database with Projections
- Texas Department of Licensing and Regulation
- TCEQ's New Source Review Permit Information System
- EPA's Greenhouse Gas Reporting Program
- Energy Information Administration (EIA)
- EPA's Point and Nonpoint Sources National Emission Inventory (NEI)
- U.S. Census Bureau
- EPA Regulatory Database for Boilers and Engines

ERG (2018) gathered and analyzed data on 2014 residential natural gas and distillate fuel use based on county-level consumption data for natural gas from the Texas Railroad Commission. For distillate oil, kerosene, and LPG, state-level consumption data from EIA were allocated to the county-level using house heating fuel data from the U.S. Census Bureau and Texas-specific annual average heating degree day (HDD) data from the National Centers for Environmental Information (NCEI).

ERG (2017a) and ERG (2018b) study provides estimates that can be used to reasonably represent 2022 county-level fuel allocations. We do not recommend any updates for this source category.

Solvents (including consumer and commercial products and surface coatings): Solvents include residential, commercial, institutional, and industrial evaporative emission sources such as cleaners, personal care products, adhesives, coatings, printing inks, and pesticides. This sector is often referred to as the volatile chemical product (VCP) sector. 2022v1 emissions for most solvent categories, including consumer and commercial products and surface coatings, were estimated by forecasting 2020 NEI emissions (EPA, 2025). Solvent emissions are based mainly on national-level product use and are allocated to the county-level using activity surrogates such as population or single-family housing counts (EPA, 2023).

Prescribed Fires and Agricultural Field Burning: EPA developed 2022v1 emissions from prescribed fires as described in EPA (2025) based on activity data from EPA's SmartFire2 framework. SmartFire2 is used to compile daily acres burned activity by latitude and longitude from federal and state agency datasets. The SmartFire2 activity was applied in the US Forest Service's BlueSky Pipeline to generate emissions. The BlueSky Pipeline assigns area specific fuel characteristics from LANDFIRE²¹ and fuel consumption estimates, and applies Smoke Emissions Reference Application (SERA)²² emissions factors to estimate emissions. EPA 2022v1 estimates of vegetation types burned by prescribed fires in Hood County include forests (1,941 acres), grassland/shrubland (982 acres), savanna (936 acres), and alfalfa (117 acres).

EPA developed 2022v1 agricultural fire emissions based on day specific fires information from 2022 satellite data. 2022 agricultural burning emissions are derived from National Oceanic and Atmospheric Administration (NOAA) Hazard Mapping System fire activity data. The burn activity is filtered using the 2022 United States Department of Agriculture (USDA) cropland data layer (CDL). Satellite fire detects over agricultural lands are assigned as agricultural burns by crop type. Burning of wheat residues comprised 66%-71% of 2022v1 agricultural field burning ozone precursor emissions. Burning of unspecified crops, corn, fallow fields, red beans, and cotton comprise the remaining agricultural field burning emissions.

Ramboll (2024) developed model-ready fire emissions for TCEQ's 2022 SIP modeling platform from two fire emission inventories, Regional ABI and VIIRS fire Emissions version 2.0 (RAVE2.0) and Global Fire Assimilation System version 1.2 (GFAS1.2) and compared those estimates to EPA's 2022 modeling platform beta version fire emissions inventory. The comparison showed considerable differences in ozone precursor emissions in Texas from fires between the three analyzed fire emission inventories. TCEQ will base its final fire emission inventory choice on emission comparisons and tests that evaluate model results against observed concentrations for ozone, particulate matter, and other important precursors.

Gasoline Service Stations: Gasoline service stations are the main source of emissions from gasoline distribution and are associated with stage I (transfer from tanker truck to service station tanks) and

²¹ Landscape Fire and Resource Management Planning Tools Program, a vegetation, fire, and fuel characteristic mapping program managed by the U.S. Department of Agriculture Forest Service and the U.S. Department of the Interior. <https://landfire.gov/about-landfire>.

²² <https://depts.washington.edu/nwfire/sera/index.php>. Accessed online in May 2025.

storage tank breathing. Stage II (vehicle refueling) emissions in EPA's 2022v1 emission inventory are included in the on-road emission inventory. Stage I emissions accounted for 85% and storage tank breathing accounted for 15% of gasoline service station VOC emissions. 96% of Stage I emissions were from submerged filling.

EPA projected gasoline service station emissions from the 2020 NEI emissions to 2022 based on the ratio of 2022 to 2020 state-level gasoline consumption from the EIA State Energy Data System (SEDS; EPA, 2025). The activity metric for gasoline service stations is the volume of gasoline consumed. In the 2020 NEI, state total gasoline consumption was taken from the SEDS and disaggregated from the state- to county-level based on MOVES model gasoline consumption estimates for both on-road vehicle and off-road equipment (EPA, 2023b). County-level gasoline consumption was multiplied by 1.09 to account for gasoline that was transported more than once.

Records of annual gasoline consumption should be available from a state agency based on sales tax records receipts. However, given the magnitude of emissions from gasoline service stations (0.22 tpd), even large percentage changes in gasoline distribution emissions would only result in small changes to overall anthropogenic VOC emissions. Review and update of this source category is a low priority as this update will only result in marginal changes to VOC emissions.

4.0 ON-ROAD SOURCE EMISSIONS REVIEW

On-road mobile source emissions are from motor vehicles licensed or certified for highway use. On-road vehicles include light duty vehicles such as passenger cars and pickup trucks and heavy-duty vehicles such as delivery trucks, long-haul trucks, and buses. Vehicle emissions occur on roadways, including limited access interstates and freeways and unlimited access arterial and local roads, and off-network from activities such as heavy-duty vehicle hoteling and evaporative emissions from parked vehicles. On-road emissions from EPA 2022v1 are estimated using EPA's MOTO Vehicle Emissions Simulator (MOVES4) model.

4.1 Overview of Emissions Inventory

Figure 4-1, Figure 4-2, and Figure 4-3 show 2022 on-road emission contributions by source category for Hood County for NO_x, VOC, and CO. Combination long-haul and combination short haul trucks (mostly diesel-fueled) together account for 50% of NO_x emissions and passenger cars, passenger trucks, and light commercial trucks (mostly gasoline-fueled) together account for 35% of NO_x emissions. Passenger cars, passenger trucks, and light commercial trucks together account for 83% of VOC emissions and combination long-haul and combination short haul trucks together account for 5% of VOC emissions. For CO, passenger cars, passenger trucks, and light commercial trucks together account for 93% of emissions and combination long-haul and combination short haul trucks together account for 3% of emissions

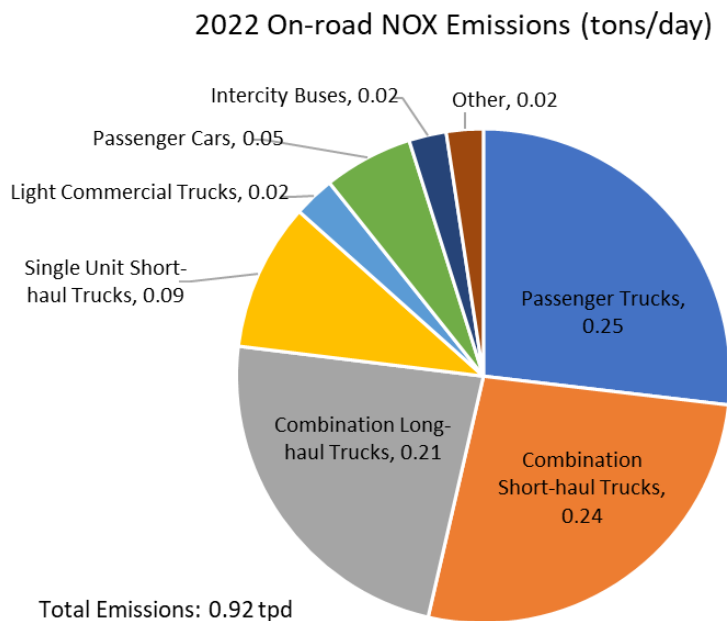


Figure 4-1. Hood County 2022 On-Road NO_x emissions by source category.

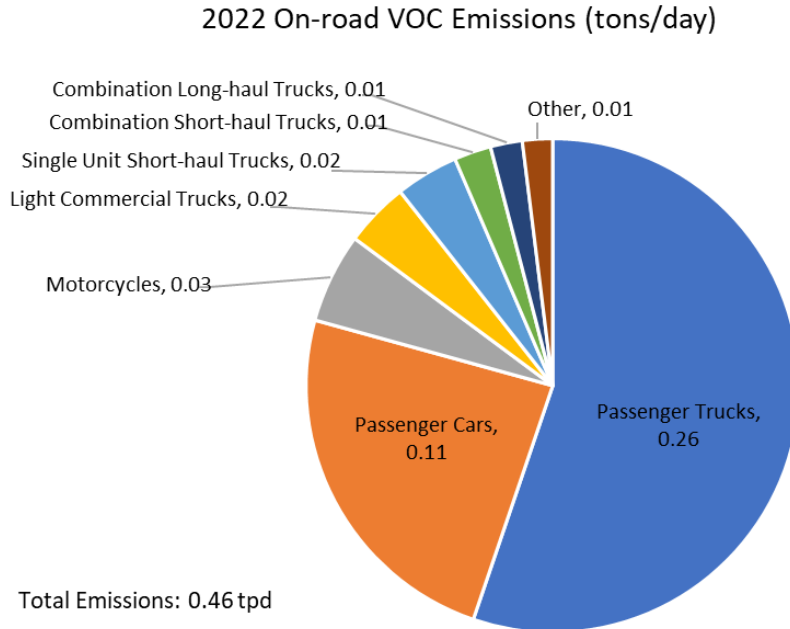


Figure 4-2. Hood County 2022 On-Road VOC emissions by source category.

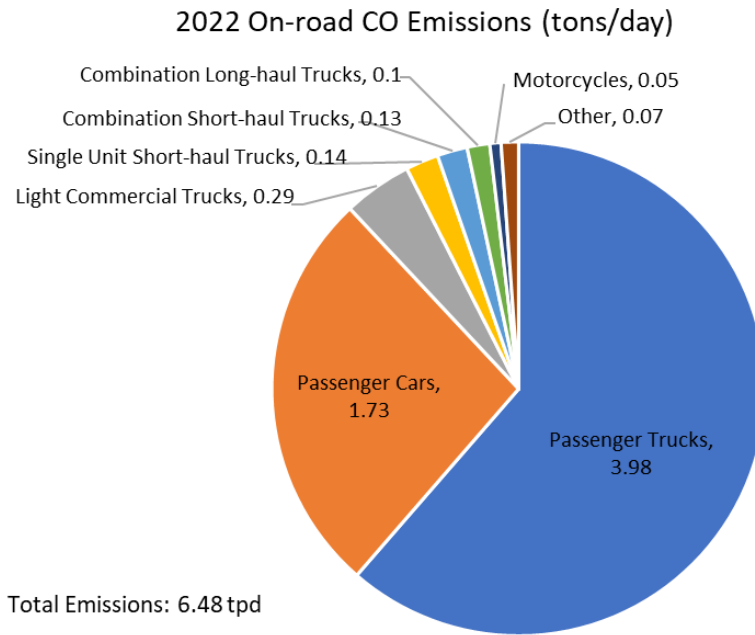


Figure 4-3. Hood County 2022 On-Road CO emissions by source category.

4.2 Analysis

Developing an on-road emission inventory requires several inputs (e.g., vehicle miles traveled (VMT), vehicle population, vehicle starts, vehicle age distribution, speed assumptions). To the extent feasible, on-road emission inventories should be based on local input data (i.e., for a local specific county, metropolitan area, or transportation district).

EPA developed 2022v1 on-road vehicle emissions using the Sparse Matrix Operator Kernel Emissions-MOTOR Vehicle Emission Simulator Tool (SMOKE-MOVES) processor. The SMOKE-MOVES process develops emissions based on (1) highly detailed emission factors generated by MOVES, (2) county-level vehicle activity data; and (3) gridded hourly meteorological data. 2022v1 SMOKE-MOVES emission factors inputs were generated with MOVES4 for representative counties to streamline emissions processing. Bell County was chosen as the representative county for Hood County based mainly on similar fuel, inspection and maintenance program, and average light duty vehicle age.

The 2022v1 MOVES inputs were taken mainly from the 2020 NEI with key exceptions including TCEQ submitted 2022 VMT data and TCEQ submitted hoteling activity for the 2020 NEI that was projected to 2022 based on the ratio of 2022 to 2020 VMT for combination long haul trucks. Other MOVES inputs were mainly based on the MOVES inputs that were implemented in the 2020 NEI. TCEQ submitted several types of inputs that were implemented in the 2020 NEI and carried over to 2022v1, including the following MOVES input tables: AVFT (vehicle fuel type fraction), avgspeeddistribution (average speed distribution), hourvmtfraction (hourly VMT allocations), dayvmtfraction (daily VMT allocations), monthvmtfraction (monthly VMT allocations), imcoverage (inspection and maintenance program requirements), roadtypedistribution (vmt allocations by road type), agedist (vehicle age distribution), sourcetypeyear (vehicle populations).

TCEQ develops on-road vehicle emissions. The most recent, publicly available TCEQ-developed on-road vehicle emission inventory is documented in the Texas A&M Transportation Institute (TTI) report (TTI, 2024) which estimated 2023 emissions using MOVES4. For Hood County, TTI (2024) estimated annual emissions of 0.74 tpd NO_x, 0.40 tpd VOC, and 5.75 tpd CO. Compared to EPA 2022v1, TTI (2024) annual emissions are 13% lower for NO_x, 11% lower for VOC, and 20% lower for CO. EPA 2022v1 and TTI (2024) are reasonably consistent given their different analysis years (2022 for EPA 2022v1 and 2023 for TTI (2024)) and methodological differences. TTI (2023) was not developed with SMOKE-MOVES, but was developed based on transportation demand model link-level activity and other local inputs. The TCEQ-developed on-road vehicle emission inventory estimates, created with Texas-specific approaches such as those from TTI (2024), are generally expected to be more accurate. If available, they should be utilized preferentially, as they are based on more local data, including link-level transportation demand model activity data.

4.2.1 MOVES5

EPA released MOVES5 in November 2024²³. The EPA 2022v1 emission inventory was developed prior to release of MOVES5. EPA Guidance²⁴ states that users that have already done significant work in MOVES4 do not need to revise that work based on MOVES5. Future TCEQ on-road emission inventory development will be transitioned to MOVES5 in accordance with EPA requirements.

MOVES5 includes substantial updates to on-road vehicle emission rates to improve emission estimates for new technology vehicles as summarized below.

²³ EPA Releases MOVES5 Mobile Source Emissions Model: Questions and Answers. <https://nepis.epa.gov/Exe/ZyPDF.cgi?Dockey=P101CTSI.pdf>. Accessed online in May 2025.

²⁴ MOVES5 Technical Guidance: Using MOVES to Prepare Emission Inventories for State Implementation Plans and Transportation Conformity. <https://nepis.epa.gov/Exe/ZyPDF.cgi?Dockey=P101CTM3.pdf>. Accessed online in May 2025.

- EPA incorporated higher projected electrical vehicle fractions, more stringent standards for carbon dioxide, particulate matter, non-methane organic gases and oxides of nitrogen in accordance with EPA's "Light-and Medium-Duty Multi-Pollutant Rule".
- EPA incorporated higher projected EV fractions and updated energy consumption estimates for heavy-duty EVs in accordance with "Heavy-Duty Greenhouse Gas Emissions-Phase 3 Rule".
- EPA incorporated new data on light-duty and heavy-duty brake wear emissions.
- EPA expanded detailed calculations for a given analysis year to vehicles up to 40 years old, instead of 30.
- EPA updated on-road and non-road fuel properties for calendar year 2021 and later.
- EPA updated historical and forecast default vehicle miles travelled, vehicle populations, age distributions, and fuel distributions.

EPA noted that including older vehicles (age 31-40) leads to higher on-road inventories for NO_x, VOC, and CO in the 2020s up to about 2040.

5.0 OFF-ROAD SOURCE EMISSIONS REVIEW

Off-road mobile source emissions are from mobile and portable internal combustion powered equipment not generally licensed or certified for highway use. Off-road equipment categories span a wide range of equipment types such as lawn and garden equipment, heavy-duty construction equipment, aircraft and locomotives. Off-road sources change locations at least once each year (or in certain cases once each season). Off-road emissions for many categories are calculated using EPA's MOVES model. EPA's NON-ROAD computer model, which formerly was used to estimate off-road mobile source emissions, has been incorporated into the EPA's MOVES model.

5.1 Overview of Emissions Inventory

Figure 5-1, Figure 5-2, and Figure 5-3 show 2022 off-road emission contributions by source category for Hood County for NO_x, VOC, and CO respectively. The three largest contributors to 2022 off-road NO_x emissions are construction and mining equipment (36%), rail (19%), and pleasure craft (11%). The two major emitters of VOC emissions within the 2022v1 emission inventory are lawn and garden equipment (52%) and pleasure craft (26%). Lawn and garden equipment (57%) and commercial equipment (16%) are the largest sources of CO emissions. The City of Granbury is bisected by the Brazos River and Lake Granbury as depicted in Figure 2-1, resulting in substantial pleasure craft emissions.

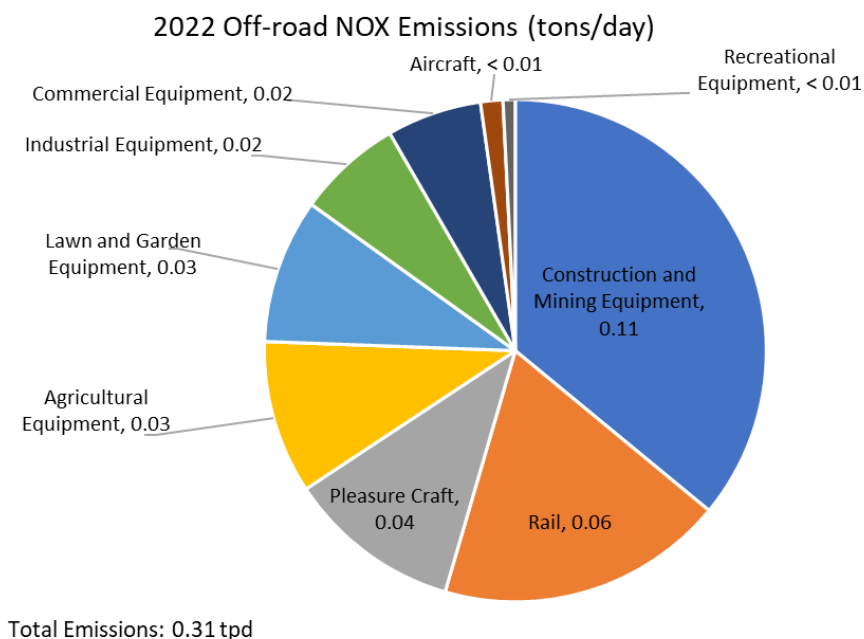


Figure 5-1. Hood County 2022 off-road NO_x emissions by source category.

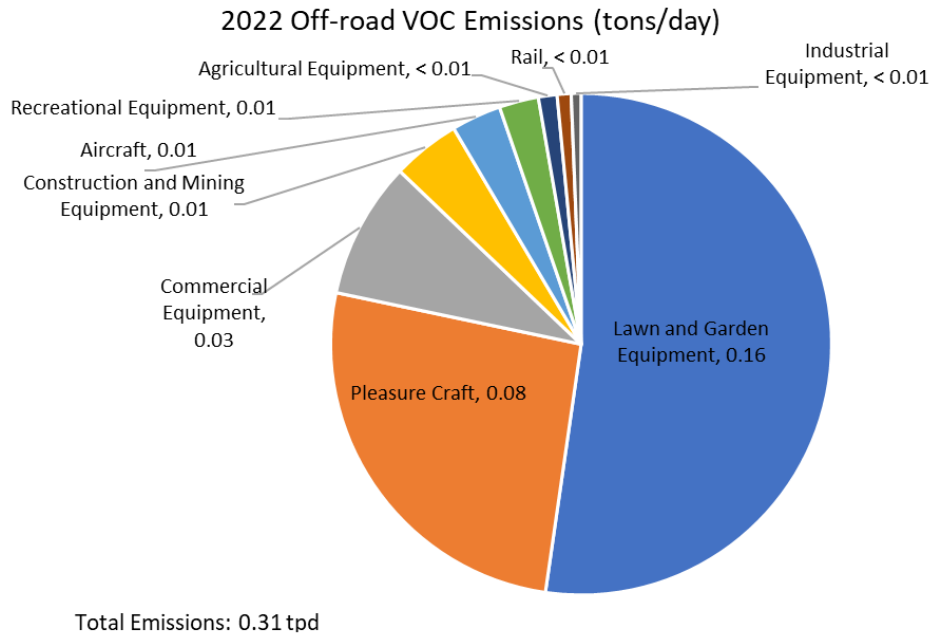


Figure 5-2. Hood County 2022 off-road VOC emissions by source category.

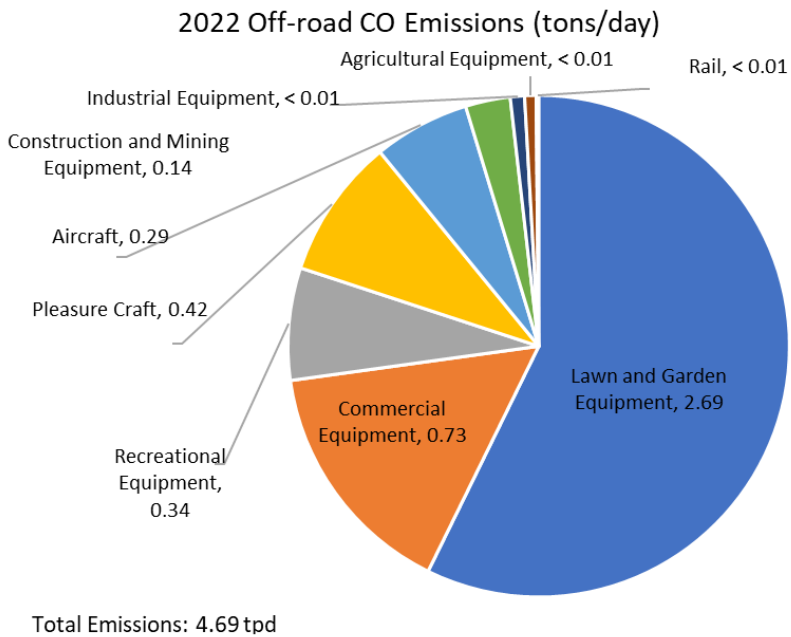


Figure 5-3. Hood County 2022 off-road CO emissions by source category.

5.2 Analysis

In the 2022v1 emission inventory, all Hood County off-road emissions except for emissions from rail and aircraft were estimated in MOVES4.

5.2.1 Off-Road Equipment

TCEQ provided off-road equipment inputs which EPA implemented in the MOVES4 county database (CDB) for equipment populations, population growth, seasonal temporal allocations, and county spatial allocations. There is a newer version of MOVES available (MOVES5) than was applied to estimate off-road equipment emissions for 2022v1; however, there are not expected to be substantial differences in off-road equipment emissions between MOVES4 and MOVES5. The off-road equipment MOVES inputs which TCEQ submitted for use in 2022v1 are based on the Texas specific inputs prepared for the Texas Nonroad Model (TexN).

TCEQ developed TexN to integrate Texas specific off-road equipment activity inputs into EPA's MOVES input framework. Because of the distributed nature of off-road equipment across residential, commercial and industrial sectors, updating model inputs can be resource intensive. The TCEQ funded a series of studies that have developed detailed Texas-specific data for use in TexN as described in ERG (2008), ERG (2014), and ERG (2015).

The Texas Nonroad Model version 2.5.1 (TexN2.5) is the latest version available (ERG, 2024). The TexN2.5 model includes input data that has been updated to more accurately reflect Texas-specific off-road operations as well as EPA MOVES4 default data. There have been a number of emission inventory improvements in TexN2.5, compared to MOVES4, which are typically made on a category-by-category basis and consist of updates to the state-wide equipment population, spatial allocation of equipment population, temporal allocations and/or annual hours of use estimates. Additionally, adjustments to account for emission reductions from Texas Low Emissions Diesel (TxLED) are incorporated into TexN2.

TexN2 pleasure craft population estimates are based on the 2002 report, "Recreational Marine Emissions Inventory" (ERG, 2002). In Hood County, pleasure craft operations are mostly on Lake Granbury. Pleasure craft use may be high during hot days in which meteorological conditions could be favorable to higher ozone concentrations. Therefore, data gathering is recommended to update pleasure craft populations in Hood County with special consideration for pleasure craft use when meteorological conditions are favorable to higher ozone concentrations.

5.2.2 Airports

Airport emissions in the 2022v1 emission inventory are limited to general aviation activities at Granbury Regional Airport. Granbury Regional Airport recently lengthened its runway and built a new airport terminal; increased air traffic and associated emissions are expected in the future. There are several small airfields/airstrips in Hood County, but emissions from the other airfields/airstrips are not expected to be substantial.

5.2.3 Rail

Figure 5-4 shows a map of Hood County railroads. Activity is limited to "other railroads". There is a single railyard, the Cresson Railyard, located in northeast Hood County. A vast majority of rail emissions in the 2022v1 Hood County emission inventory are from Class II/III linehaul (0.06 tpd NO_x); yard locomotives emissions are limited to the Cresson railyard (<0.01 tpd NO_x).

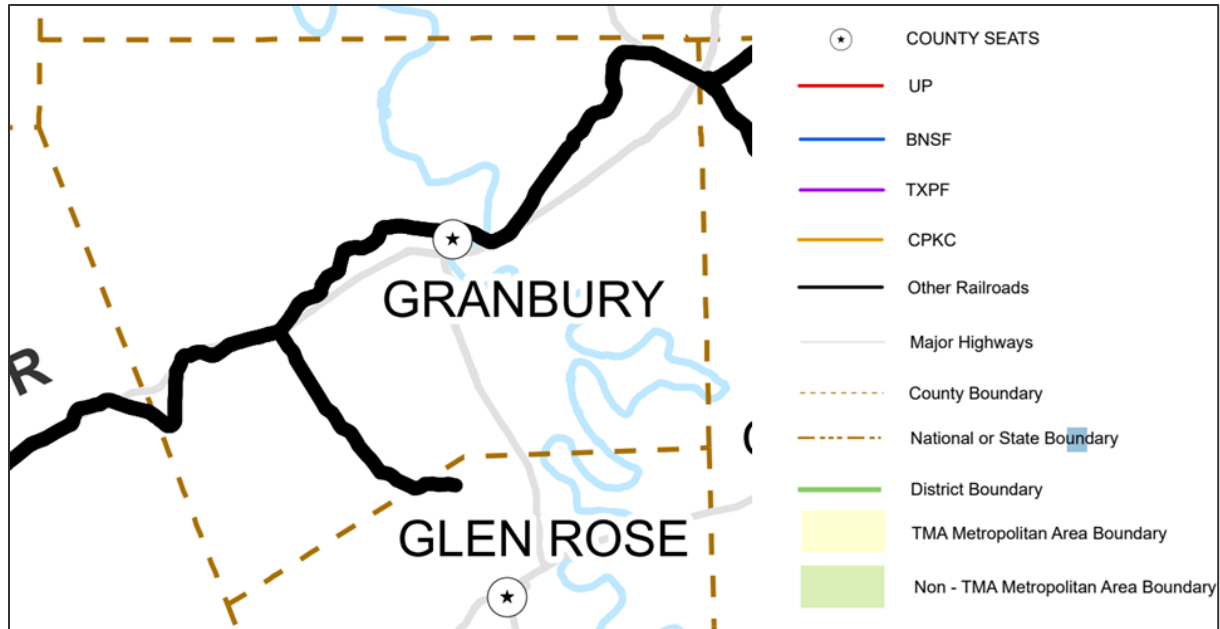


Figure 5-4. Map showing the railroads present in Hood County (excerpt from the 2023 State Railroad Map²⁵).

Locomotives are typically disaggregated for emission inventory development into the categories below.

- Class I: Large freight railroads with operations across many states.
- Class II/III: Smaller freight railroads that operate on rail networks that are limited, geographically.
- Passenger: Interstate AMTRAK and local commuter rail.
- Switching (or Yard): Locomotives that perform logistical functions within a specific yard such as assembling and breaking up trains and performing maintenance and other support functions.

The EPA 2022v1 emission inventory for Hood County includes Class II/III and Cresson railyard locomotive operations and emissions.

Switching or Yard Locomotives: For the 2022v1 inventory, several Class I railyards submitted fuel use and locomotive counts for their railyards. For companies that did not supply railyard fuel use and locomotive counts, Google Earth was used to identify yards and tabulate the number of visible switcher locomotives per yard.

Class II/III rail line locations are based on spatial information collected from the FRA. There is limited data to spatially allocate Class II/III activity. Estimated 2022 nationwide fuel use was allocated to counties based on county-level Class II/III track length.

²⁵ Texas Department of Transportation & Texas A&M Transportation Institute in cooperation with U.S Department of Transportation Federal Railroad Administration, July 25, 2023, <https://www.txdot.gov/content/dam/docs/maps/texas-railroad-map.pdf/>. Accessed online in May 2025.

6.0 CONCLUSIONS AND RECOMMENDATIONS

Based on Ramboll analyses presented in the preceding sections, the EPA 2022v1 point, on-road, off-road, and area source ozone precursor emission inventories are generally accurate and complete.

Recommended Improvements: Ramboll recommends improvements to the 2022 ozone precursor emissions inventory to address sources of emissions that may be under- or over-estimated and/or accompanied by high levels of uncertainty. Ramboll did not find any emission source categories for which more detailed emissions inventory input at the sub-county level was readily available.

Priority Levels: Recommendations for emission inventory improvements are all medium and low priority; there are no high priority recommendations. Ramboll did not make any high priority recommendations because there are no emission inventory improvement suggestions expected to result in large changes to the emission inventory.

Impact: Recommended improvements are expected to result in limited and/or small changes to the Hood County area emission inventory.

Below is a list of recommendations aimed at improving the understanding of ozone precursor emissions in Hood County. These recommendations are prioritized with NOx emission updates marked higher than VOC emission updates because ozone formation in Hood County is expected to be NOx-limited. Priority assignments are as follows: "high priority" for recommendations expected to result in significant changes to the NOx emission inventory; "medium priority" for recommendations expected to result in substantial changes to the NOx emission inventory; and "low priority" for recommendations expected to result in minor changes to the NOx emission inventory and/or substantial changes to the VOC emission inventory. No high priority recommendations are included.

- **Compressor Engines (Medium Priority):** Area source compressor engines represent 23% of anthropogenic NOx emissions in Hood County. Wellsite compressor engine activity data is based on local surveys from ERG (2018a). Currently, data is unavailable to determine the extent of midstream compressor engines which are not reported in the point source emission inventory. Consequently, no midstream compressor engine emissions are included in the area source portion of the 2022v1 emission inventory. Updates are recommended to add area source midstream compressor engine emissions and refine wellsite compressor engine emissions based on collection of new engine survey data.
- **On-road Vehicles (Medium Priority):** The 2022v1 emission inventory is based on EPA's MOVES4 model. The most recent version, MOVES5, released in November 2024, includes updates expected to moderately increase 2022 NOx emissions. This new MOVES version should be implemented in future emission inventories. The current emission inventory was developed using EPA's SMOKE-MOVES platform. TCEQ develops Texas-specific emission inventories (e.g., TTI (2023)), which include the implementation of more highly resolved vehicle activity data and are expected to be more accurate. TCEQ's Texas-specific emission inventories should be used to better characterize on-road vehicle emissions in Hood County.
- **Off-road Equipment (Medium Priority):** The 2022v1 emission inventory relies on EPA's MOVES4 model. TCEQ has developed a Texas-specific off-road equipment emissions estimation model, TexN, which includes substantial locally derived inputs. Although TCEQ submitted off-road equipment activity inputs which were implemented in the development of the 2022v1 emission inventory, the TexN model is expected to more accurately estimate emissions, considering Texas-specific factors such as the use of TxLED for which associated emission reductions may not be reflected in the 2022v1 emission inventory.

- **Pleasure Craft (Medium Priority):** The basis for pleasure craft population in TexN2 is the 2002 report, "Recreational Marine Emissions Inventory" (ERG, 2002). Lake Granbury is a popular boating destination, particularly on hot summer days when meteorological conditions favor higher ozone concentrations. Obtaining recent pleasure craft activity estimates based on local surveys and/or remote sensing data is recommended to more accurately characterize pleasure craft activity and yield more precise NOx and VOC emissions for this source category.
- **Gasoline Service Stations (Low Priority):** Local gasoline consumption estimates based on state agency data from sales tax receipts would more accurately estimate activity for this source category. This is a low priority because impacts are limited to VOC emissions, and the effect on the overall anthropogenic VOC emission inventory is expected to be small.
- **Pneumatic Pumps (Low Priority):** Emission controls required under oil and gas NSPS requirements for recently installed or modified pneumatic pumps are not incorporated into the emission inventory, nor is pneumatic pump activity based on Hood County specific data. Updating pneumatic pump emissions would only affect VOC emissions, moreover the effect on the overall anthropogenic VOC emission inventory is expected to be small. Therefore, this update is a low priority.

7.0 REFERENCES

- Central States Air Resource Agencies (CENSARA), 2012. ENVIRON International Corporation. Oil and Gas Emission Inventory Enhancement Project for CenSARA States. December.
- Environmental Protection Agency (EPA), 2023a. 2020 National Emissions Inventory Technical Support Document: Solvents – All Other Solvent. EPA-454/R-23-001ff. March.
- Environmental Protection Agency (EPA), 2023b. 2020 National Emissions Inventory Technical Support Document: Nonpoint Gasoline Distribution. EPA-454/R-23-001r. March.
- Environmental Protection Agency (EPA), 2025. Technical Support Document (TSD): Preparation of Emissions Inventories for the 2022v1 North American Emissions Modeling Platform. EPA-454/B-25-001. May.
- Eastern Research Group, Inc. (ERG), 2002. "Recreational Marine Emissions Inventory". Prepared for the Texas Commission on Environmental Quality. August.
- Eastern Research Group, Inc. (ERG), 2008. Texas NONROAD (TexN) Model Version 1.0 User's Guide. Eastern Research Group, Inc. August.
- Eastern Research Group, Inc. (ERG), 2012. "Condensate Tank Oil and Gas Activities Final Report". Prepared for the Texas Commission on Environmental Quality. October.
- Eastern Research Group, Inc. (ERG), 2014. "Texas NONROAD Model Update and Enhancement: Final Report". Prepared for the Texas Commission on Environmental Quality. July.
- Eastern Research Group, Inc. (ERG), 2015d. "Development of Texas Statewide 2014 AERR Inventory and Trends Data for NONROAD Model Category Mobile Sources". Prepared for the Texas Commission on Environmental Quality. September.
- Eastern Research Group, Inc. (ERG), 2017. "Industrial, Commercial, and Institutional (ICI) Fuel Use Study: Final". Prepared for the Texas Commission on Environmental Quality. June.
- Eastern Research Group, Inc. (ERG), 2018a. "Upstream Oil and Gas Compressor Engine Study Final report". Prepared for the Texas Commission on Environmental Quality. June.
- Eastern Research Group, Inc. (ERG), 2018b. "Residential Non-wood Combustion: Final". Prepared for the Texas Commission on Environmental Quality. June.
- Eastern Research Group, Inc. (ERG), 2024. "TexN2.5 Utility for use with the US EPA MOVES4 Model TexN2.5 User's Guide Final". Prepared for the Texas Commission on Environmental Quality. July.
- Ramboll, 2024. "Fire Emission Inventory Development for 2022 Modeling Platform Final Report". Prepared for the Texas Commission on Environmental Quality.