Development of Texas Nonroad Model 2023 Air Emissions Reporting Requirements and Reasonable Further Progress Emissions Inventories

Final Report

Prepared for:

Cody Mclain
Texas Commission on Environmental Quality
P. O. Box 13087
Austin, TX 78711-3087

Prepared by:

Allison DenBleyker, Ken Zhao, Henry Byoun, and Rick Baker
Eastern Research Group, Inc.
3508 Far West Blvd., Suite 210
Austin, Texas 78731

July 31, 2024

ERG No.: 0488.00.003

Development of Texas Nonroad Model 2023 Air Emissions Reporting Requirements and Reasonable Further Progress Emissions Inventories

Final Report

TCEQ Contract No. 582-23-45976
Work Order No. 2

Prepared for:

Cody McLain
Texas Commission on Environmental Quality
P. O. Box 13087
Austin, TX 78711-3087

Prepared by:

Allison DenBleyker, Ken Zhao, Henry Byoun, and Rick Baker
Eastern Research Group, Inc.
3508 Far West Blvd., Suite 210
Austin, Texas 78731

July 31, 2024

Table of Contents

1.0 Overview 5
2.0 Background 5
3.0 Emissions Benefits from the TERP Program 6
4.0 2023 AERR EI 12
4.1 Inputs for TexN2 12
4.1.1 Fuel Data 13
4.1.2 Meteorology Data 13
4.1.3 Population in the Quarry and Mining Subsector 13
4.2 EI Development and Results 13
4.3 NEI Submittal Materials 21
5.0 RFP EIs for SIP Development 22
6.0 Data Analysis and QA of the EIs 26
7.0 Code Changes to the TexN2.5 Utility 29
8.0 References 30
Appendix A: 2023 AERR EI County-Level Results 32
Appendix B: Mapping of TERP Equipment and Fuel Type to SCCs for Modeling 46

List of Tables

Table 1. 2023 OSD Criteria Emissions by Equipment Classification (Tons/Day) 14
Table 2. 2023 Annual Criteria Emissions by Equipment Classification (Tons/Year) 15
Table 3. 2023 OSD Criteria Emissions by Selected Area (Tons/Day) 15
Table 4. 2023 Annual Criteria Emissions by Selected Area (Tons/Year) 16
Table 5. 2023 Austin Area OSD Criteria Emissions (Tons/Day) 16
Table 6. 2023 Beaumont-Port Arthur Area OSD Criteria Emissions (Tons/Day) 16
Table 7. 2023 Dallas-Fort Worth Area OSD Criteria Emissions (Tons/Day) 17
Table 8. 2023 El Paso OSD Criteria Emissions (Tons/Day) 17
Table 9. 2023 Houston-Galveston-Brazoria Area OSD Criteria Emissions (Tons/Day) 17
Table 10. 2023 San Antonio Area OSD Criteria Emissions (Tons/Day) 17
Table 11. 2023 Tyler-Longview Area OSD Criteria Emissions (Tons/Day) 18
Table 12. 2023 Statewide OSD Hazardous Air Pollutant Emissions (Pounds/Day) 18
Table 13. 2023 Statewide Annual Hazardous Air Pollutant Emissions (Tons/Year) 19
Table 14. NO_X and VOC Emissions for the HGB Six-County Area (Tons/Day) 24
Table 15. NO_X and VOC Emissions for the DFW Nine-County Area (Tons/Day) 25

Table 16. NO_X and VOC Emissions for Bexar County (Tons/Day).....26
Table 17. Differences in Statewide 2023 and 2020 AERR EIs (Tons/Year).....26
Table 18. Differences in Statewide 2023 and 2020 AERR Emissions Divided by Equipment Population (Pounds per Equipment Unit).....27
Table 19. Differences in Statewide Equipment Populations by Fuel Type between the 2017, 2020, and 2023 AERR EIs.....27
Table 20. Large Population Increases between TexN2 versions in the Residential Lawn and Garden Sector.....28
Table A-1. 2023 OSD Criteria Emissions by County (Tons/Day).....32
Table A-2. 2023 Annual Criteria Emissions by County (Tons/Year).....39

List of Figures

Figure 1. Default Scrappage Curve in MOVES-Nonroad (US EPA, 2005).....8
Figure 2. NO_X Benefits by TERP Area, OSD Weekday (Tons/Day).....9
Figure 3. VOC Benefits by TERP Area, OSD Weekday (Tons/Day).....9
Figure 4. Eligible Counties by TERP Area, Seaport and Railyard Grants.....10
Figure 5. Eligible Counties by TERP Area, DERI Grants.....11

ACRONYMS

AERR - Air Emissions Reporting Requirements

AWS – Amazon Web Services

CAP – Criteria Air Pollutant

CAPCOG – Capital Area Council of Governments

CDB – County Database

CERS – Consolidated Emissions Reporting Schema

CNG – Compressed Natural Gas

CO – Carbon Monoxide

DCE – Diesel Construction Equipment

EI – Emission Inventory

EIS – Emissions Inventory System

EPA – Environmental Protection Agency

ERG – Eastern Research Group, Inc.

GUI – Graphical User Interface

HAP – Hazardous Air Pollutant

HP – Horsepower

L&G – Lawn and Garden

LPG – Liquified Petroleum Gas

MOVES – Motor Vehicle Emissions Simulator

NAA – Nonattainment Area

NAAQS – National Ambient Air Quality Standard

NEI – National Emissions Inventory

NH_3 – Ammonia

NLCD – National Land Cover Database

NO_X – Nitrogen Oxides

OSD – Ozone Season Day

PM_{10} – Particulate Matter less than 10 microns in diameter

$PM_{2.5}$ – Particulate Matter less than 2.5 microns in diameter

QA – Quality Assurance

RFG – Reformulated Gasoline

RFP – Reasonable Further Progress

SCC – Source Classification Code

SIP – State Implementation Plan

SO_2 – Sulfur Dioxide

TCEQ – Texas Commission on Environmental Quality

TERP – Texas Emission Reduction Plan

TexAER – Texas Air Emissions Repository

TexN – Texas Nonroad

TexN2 – Texas Nonroad version 2

TPD – Tons per Day

TPY – Tons per Year

TxLED – Texas Low Emission Diesel

VOC – Volatile Organic Compounds

XML – Extensible Markup Language

1.0 Overview

This report is Deliverable 8.1 for the project "Development of Texas Nonroad Model 2023 Air Emissions Reporting Requirements and Reasonable Further Progress Emissions Inventories" (Contract Number 582-23-45976, Work Order 2).

The study developed a set of multipollutant, multiyear emissions inventories (EI) for all nonroad model mobile sources operating in Texas. These EIs are required to fulfill the United States Environmental Protection Agency (EPA)'s Air Emissions Reporting Requirements (AERR) and to support potential State Implementation Plan (SIP) development. The results include annual (tons per year) and average ozone season day (OSD) weekday (tons per day) emissions of criteria air pollutants (CAP), CAP precursors, and hazardous air pollutants (HAP) using the latest version of the Texas Nonroad (TexN) version 2 (TexN2) utility and EPA's Motor Vehicle Emission Simulator (MOVES) version 4 (MOVES4). This study included the multipollutant benefits of the Texas Emission Reduction Plan (TERP) program in regulatory EIs for the first time.

2.0 Background

The Texas Commission on Environmental Quality (TCEQ) contracted with Eastern Research Group, Inc. (ERG) to develop TexN version 1 and subsequent TexN2, which are utilities for estimating Texas-specific emissions from nonroad mobile sources, excluding commercial marine vessels, locomotives, drilling rigs, and aircraft. The TexN model used the EPA's standalone NONROAD model to calculate emissions, whereas TexN2 uses EPA's MOVES-Nonroad model. MOVES is required by the EPA for developing nonroad emissions estimates for SIP revisions, the National Emissions Inventory (NEI), and reasonable further progress (RFP) analyses. Since TexN was first developed, the TCEQ has frequently updated the Texas-specific data and enhanced the utility's functions. The EPA recently updated the MOVES model, releasing the latest version of MOVES4 in January of 2024 (US EPA, 2024a). States are required to use the most recent version of the MOVES model when developing and submitting emissions estimates from specific nonroad mobile sources to EPA. Section 3 of this report discusses the TERP program, data provided by the TERP team at the TCEQ, and ERG's process to transform the data into multipollutant benefits. Section 4 describes the 2023 AERR EI development and results, and Section 5 describes the RFP analyses. Section 6 describes the data analysis and quality assurance (QA) checks performed on the EIs. Section 7 describes the code updates to the utility for compatibility with MOVES4 and to include TERP benefits in the various utility output summaries. All EIs described in this report and its appendices were generated using MOVES4 code version 4.0.1 with database version 'movesdb20240104' and TexN2 code version 2.5.0 with the TexN2 database last updated July 2, 2024.

3.0 Emissions Benefits from the TERP Program

TCEQ's grant program, known as TERP, offers grants to individuals, businesses, and local governments for new and upgraded vehicles and equipment, to reduce pollution and improve the air quality in Texas[1]. The TCEQ employs staff who administer the TERP program and maintain records on nonroad equipment repower and replacements, as well as other sectors that are not pertinent to nonroad. These emissions benefits represent a previously unaccounted for control strategy that Texas can include in SIP efforts. The emissions benefits quantified in this work include historical and active TERP projects related to nonroad equipment repower or replacement.

TCEQ provided the necessary TERP information in the Excel file titled "Filter Removed pbi-oracle-data-4.25 (version 1).xlsb.xlsx" on April 26, 2024[2]. The Excel file included a worksheet named 'Activity' that lists 49,775 grant records from year 2002 through 2024. Over 33,000 of these relate to other sectors not relevant to nonroad. Older grants, or those with replacements of older model year (MY) equipment were also not pertinent to this work.

ERG reviewed the TERP file and narrowed the list of activities with quantifiable benefits, making several corrections along the way. The old and new equipment types each were assigned a source category code (SCC) using the crosswalk in Appendix B. The old and new horsepower (HP) ratings were binned according to the min/max ranges in MOVES-Nonroad. ERG's identification of pertinent records and summary of QA performed on the TERP source data is listed below.

Modification of TERP Source Data	Number of records	Dropped # of records
Original file from TERP	49,775	
Select only nonroad projects	16,257	33,518
Select only valid Activity Status [A]	9,646	6,611
Remove blank model years	9,327	319
Remove blank fuel types	9,325	2
Remove blank rated HP values	9,308	17
Remove "Multiple" area type	9,018	290
Remove unchanged before/after combinations of SCC/MY/HP	8,708	310
Remove unknown equipment types	8,707	1
Remove 1 Gasoline Chevy Pickup	8,706	1
Remove 3 records with "miles per year" activity units	8,703	3
Remove inappropriate equipment replacements [B]	8,699	4
Manually set SCC to Ag Tractor for 2 Make/HP combinations [C]	8,699	0
Removed 1 nonroad switcher because it is a locomotive	8,698	1
Change the MY of 149 Repower projects [D]	8,698	0
Change the MY of 1 Repower from blank to 2005 [E]	8,698	0
Remove 3 records where the new MY < old MY [F]	8,695	3
Remove if New MY > 2 years ahead of the Activity Start	8,652	43
Remove the Ag Tractor with a new HP of 90100	8,651	1

[1] TERP Grant Programs website. Accessed 7/3/2024. https://www.tceq.texas.gov/airquality/terp/programs
[2] Personal communication with Cody McLain of TCEQ, 4/26/2024.

Modification of TERP Source Data	Number of records	Dropped # of records
Change the New HP of Ag Tractor from 1117 to 117 based on make/model	8,651	0
Change the New HP of Off-Highway Truck from 12,000 to 1,200 based on make/model	8,651	0
Change the Old HP of Skid Steer from 330 to 130 based on make/model	8,651	0
Change the equipment type for Tractor/Loader/Backhoes to Ag. Tractor based on make/model	8,651	0
Change the Combine with Old HP 55 to an Ag Tractor based on make/model	8,651	0
Change New HP from 2.84 to 149 for the Rubber Tire Loader, based on the make/model	8,651	0

[A] Only the following three activity statuses of "Active"; "Resolved after Invoice sent"; and "Resolved, Completed" were included.

[B] There were 20 instances where "old equipment" didn't match "new equipment" but most of these appeared to be nomenclature issues (e.g., Haul Trucks vs. Nonroad Terminal Tractors). However, 4 of the cases are suspected data entry errors: 2 Haul Trucks replaced with AC refrigeration units, 1 crawler tractor replaced with a sprayer, 1 ag tractor replaced with a skid steer loader.

[C] The two make/HP were Kubota with 90 HP (new equipment) and Case with 125 HP (old equipment) for both records.

[D] Repower projects' MY should reflect the MY of the new engine, not the equipment (which doesn't change).

[E] This Repower project record appeared to use the "New Equipment Year" (2005) instead of "New Engine Emission Year" (Blank). The old model year was 1981.

[F] Three replacements have same SCC & HP for before/after, but the new model year was older. Suspected data entry problem, so was excluded.

An additional 104 records had a "blank" value for the activity start date. Because this was critical information to determine emissions benefit applicability in the EI year, the TERP analysis instead relied on the new equipment MY as the activity start date year.

The 8,651 records were further reduced when determining applicability to a specific calendar year. For a nonroad equipment replacement to be included in the benefits quantification for this work, two criteria needed to be met. First, the grant activity start year must have begun as of the inventory calendar year under analysis. For example, the 2017 base year for the RFP EIs does not include any TERP emissions benefits from grants that began in 2018 or later. Second, the older equipment replaced under TERP must have been otherwise able to operate in the inventory calendar year based on whether its age is less than the median useful life.

Equation 1 shows the age of equipment, calculated as point-of-reference calendar year minus the equipment model year. For example, TERP application ID 2015-01-0080-ER activity 001 was a replacement of a MY 1997 diesel agricultural tractor with 170 HP. In EI year 2017, this unit is 2017-1997=20 years old.

$$Age\ of\ Equipment\ (years) = Calendar\ Year - Model\ Year \qquad \text{Eqn. 1}$$

Equation 2 shows the MOVES-Nonroad median lifetime in years calculation (US EPA, 2010), equal to the median life in hours divided by the product of annual activity and load factor (LF). In TexN2, the 170 HP diesel agricultural tractor has a median life of

3,933 hours, activity of 328 hours per year, and a LF of 0.48. Therefore, the median lifetime in years is 3,933/(328*0.48)=25 years.

$$Median\ Lifetime\ (years) = \frac{Median\ Life\ (hours)}{Activity\ (hrs/yr)\ x\ Load\ Factor} \qquad \text{Eqn. 2}$$

In the MOVES-Nonroad/TexN2 modeling framework, equipment exits the fleet year-over-year according primarily to the scrappage curve function shown in Figure 1 (U.S. EPA, 2005). TexN2 applies alternative scrappage curves for skid steer loaders and agricultural tractors, rather than MOVES default in Figure 1. As shown in the Figure 1, for fractions between 0 and 1 of the median useful life used, the equipment slowly leaves the fleet relative to what happens when the age approaches median useful life (i.e., fraction = 1). When the curve approaches the fraction of 1 along the X-axis, the percentage scrapped increases sharply, and then returns to a gradual scrappage between 1 and 2 times the median useful life, after which no equipment survives according to MOVES. This analysis made a simplifying assumption that all TERP equipment in operation up to the median useful life are still in the fleet, while equipment that have accrued activity hours that exceed the median useful life are scrapped, and therefore do not accrue emissions benefits from the TERP program.

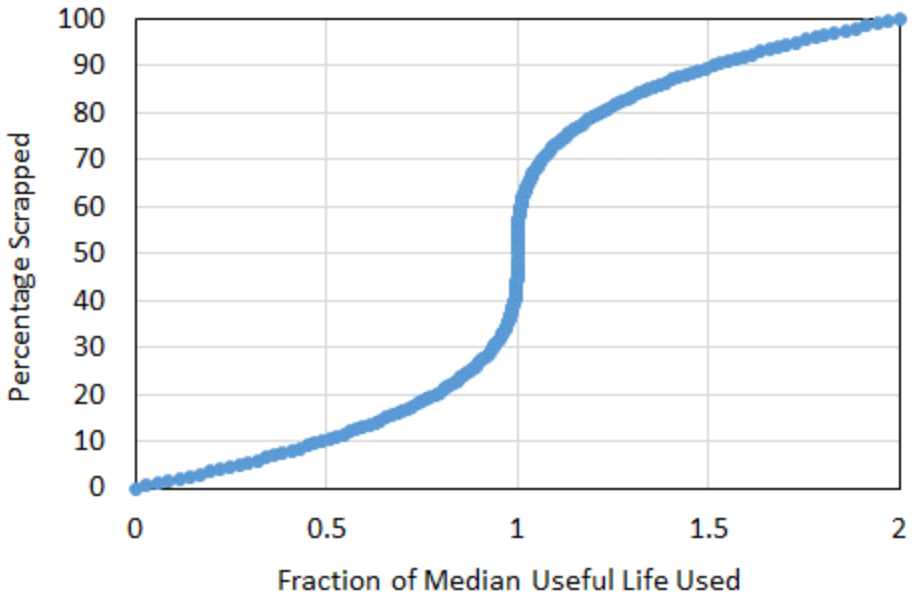
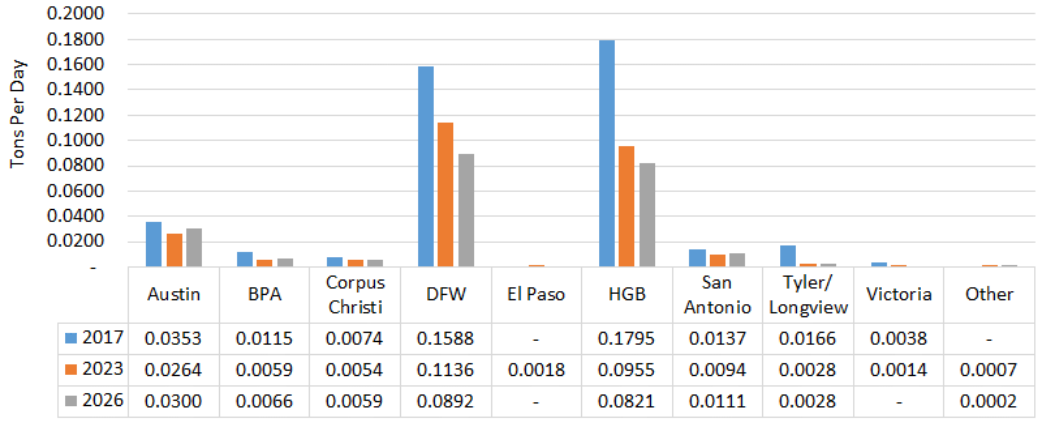


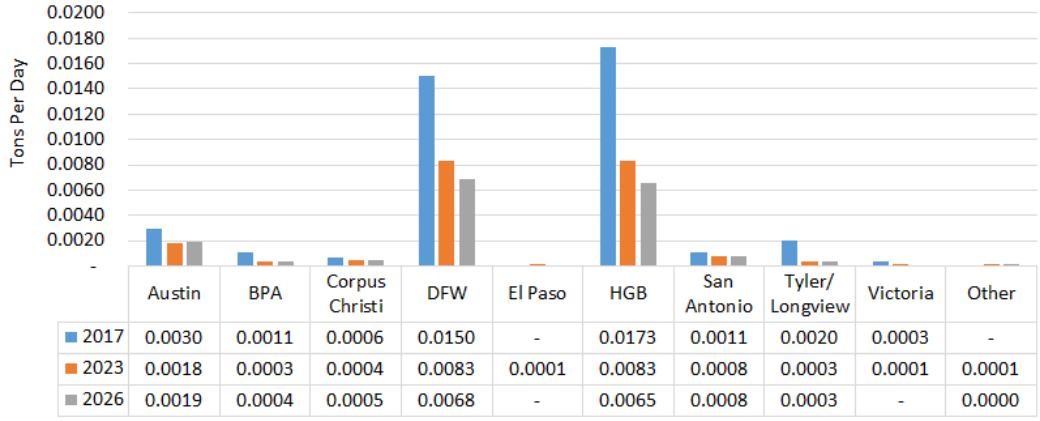
Figure 1. Default Scrappage Curve in MOVES-Nonroad (US EPA, 2005)

Out of the 8,651 possible equipment, only 563, 323, and 275 of the replaced equipment units would have operated in the EI years 2017, 2023, and 2026, respectively. The resulting emissions benefits for an OSD weekday by TERP geographic area are shown in Figure 2 (NO_X) and Figure 3 (VOC). The three geographic areas Beaumont/Port Arthur (BPA), Dallas Fort Worth (DFW), and Houston-Galveston-Brazoria (HGB) are abbreviated in the charts.



	Austin	BPA	Corpus Christi	DFW	El Paso	HGB	San Antonio	Tyler/ Longview	Victoria	Other
2017	0.0353	0.0115	0.0074	0.1588	-	0.1795	0.0137	0.0166	0.0038	-
2023	0.0264	0.0059	0.0054	0.1136	0.0018	0.0955	0.0094	0.0028	0.0014	0.0007
2026	0.0300	0.0066	0.0059	0.0892	-	0.0821	0.0111	0.0028	-	0.0002

Figure 2. NO_X Benefits by TERP Area, OSD Weekday (Tons/Day)



	Austin	BPA	Corpus Christi	DFW	El Paso	HGB	San Antonio	Tyler/ Longview	Victoria	Other
2017	0.0030	0.0011	0.0006	0.0150	-	0.0173	0.0011	0.0020	0.0003	-
2023	0.0018	0.0003	0.0004	0.0083	0.0001	0.0083	0.0008	0.0003	0.0001	0.0001
2026	0.0019	0.0004	0.0005	0.0068	-	0.0065	0.0008	0.0003	-	0.0000

Figure 3. VOC Benefits by TERP Area, OSD Weekday (Tons/Day)

The NO_X reductions in HGB and DFW areas are 0.18 and 0.16 TPD, respectively, in year 2017. In general, the VOC reductions from TERP are an order of magnitude smaller than the NO_X. According to EPA expectations of voluntary mobile emission reduction programs, "…the emission reduction potential of these programs is generally a fraction of one ton per day."[3] The TERP analysis results are consistent with that expectation.

The ten TERP program areas (Austin, BPA, Corpus Christi, DFW, El Paso, HGB, San Antonio, Tyler/Longview, Victoria, and Other) include one or more counties, depending on the area and grant type. For equipment operating at seaports or railyards, Figure 4 shows the applicable TERP counties. For all other nonroad equipment TERP grants, Figure 5 shows the applicable counties.

[3] Guidance on Incorporating Voluntary Mobile Source Emission Reduction Programs in State Implementation Plans, October 1997. Accessed 7/5/2024. https://www.epa.gov/sites/default/files/2016-05/documents/vmep-gud.pdf

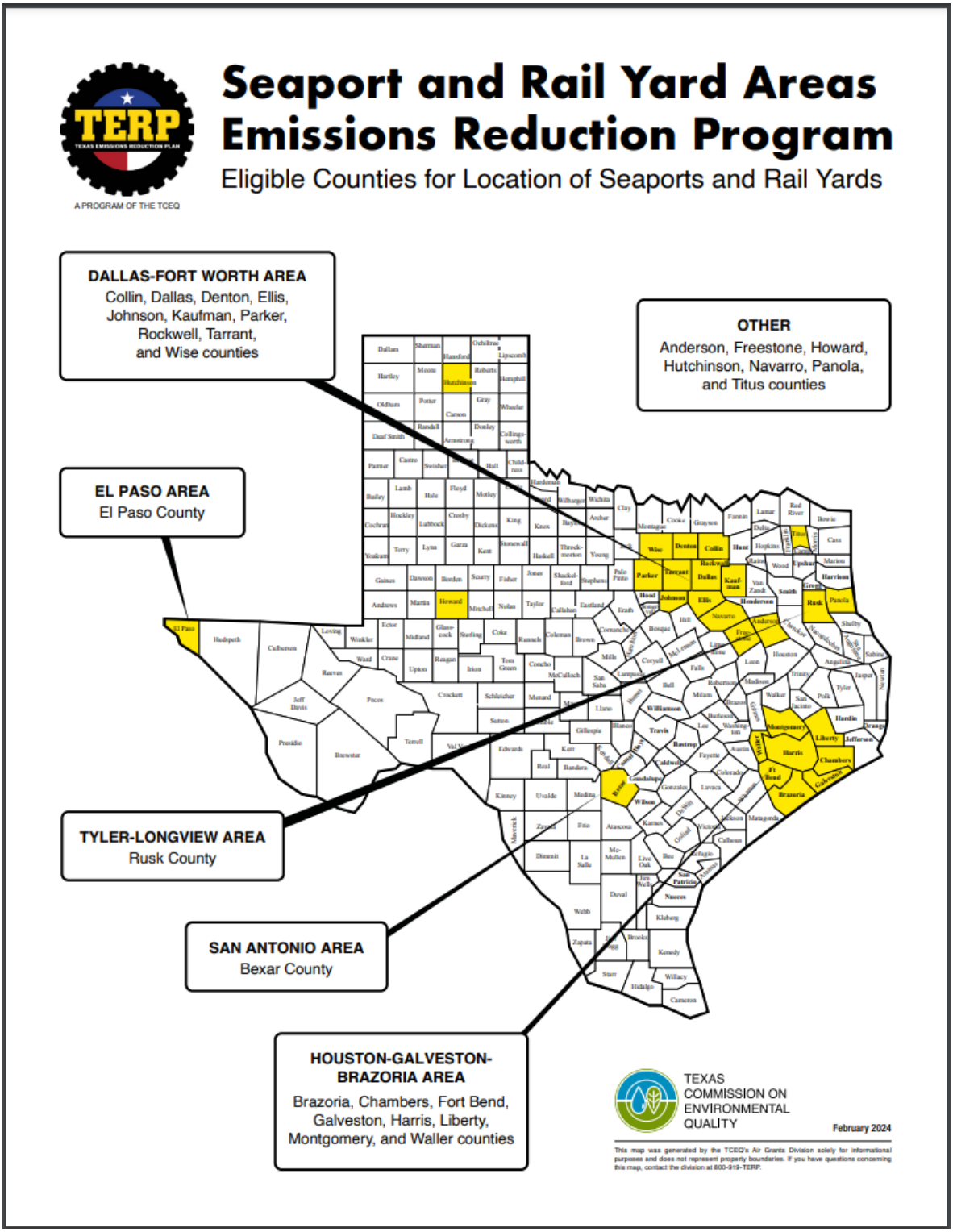


Figure 4. Eligible Counties by TERP Area, Seaport and Railyard Grants[4]

[4] https://www.tceq.texas.gov/downloads/air-quality/terp/spry/spry-24-eligible-counties-location.pdf

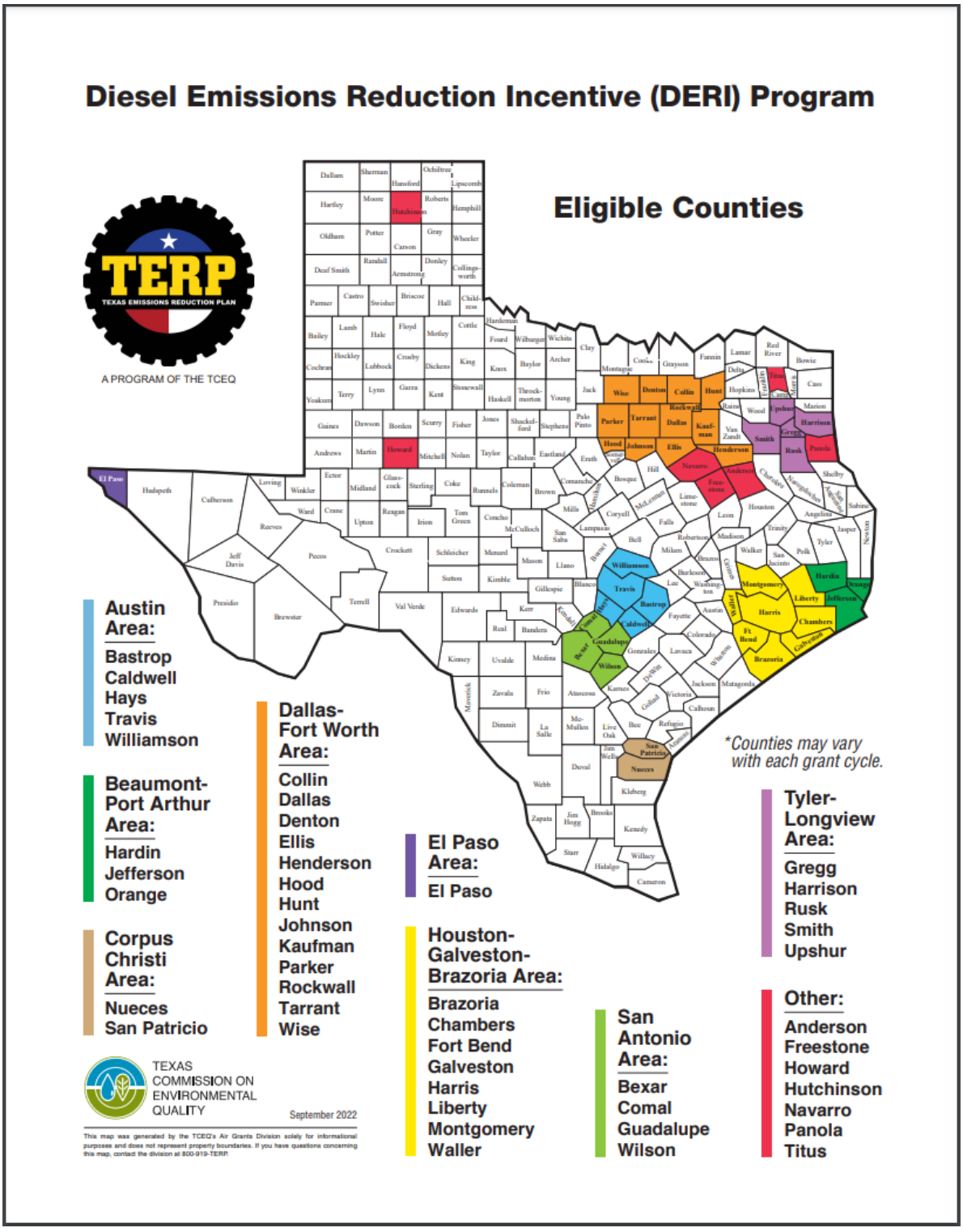


Figure 5. Eligible Counties by TERP Area, DERI Grants[5]

[5] https://www.tceq.texas.gov/downloads/air-quality/terp/rebate/rebate-23-eligible-counties-map.pdf

Spatial allocation factors were created to allocate the emissions benefits by TERP area to its member counties based on the total equipment populations by county. For example, the HGB emissions benefits are allocated 61% to Harris, 12% to Fort Bend, 10% to Montgomery, 6% each to Brazoria and Galveston, 3% to Liberty, 2% to Waller, and 1% to Chambers. The counties included comes from TERP program county eligibility lists, but the weighting factors come from TexN2.

The TexN2 utility has new database tables that enable TERP benefits to be included in either run type – the standard "fully controlled" EI or Automated RFP analysis, for the analysis years 2017, 2023, and 2026. The coverage of calendar years could be expanded in the future. Also in the future, TERP data equipment replacement list should be updated to include new grants for year 2024 and later. Any number of counties may be selected (e.g., entire HGB area or just Harris) and pollutants may be selected. The TERP benefits for each county and all pollutants selected will appear in the reports if the user opts to include them by checking the "Include TERP analysis" box in the `Reports` tab of the TexN2 graphical user interface (GUI). All sources (all SCCs and fuel types) should always be selected if the user wishes to include TERP benefits, however. It is necessary to select a complete inventory (all SCCs/fuels) to understand the TERP program relative contribution to total nonroad emissions.

4.0 2023 AERR EI

The U.S. EPA promulgated the AERR in December 2008, requiring states to submit EIs, and in some cases, inputs for EIs. The EPA requirement of state-submitted inputs for EIs is applicable to the nonroad sector (Section 4.3). The EPA uses state submittals along with other data sources to build the NEI, which is an official accounting of all emissions in the U.S. at a detailed level. The NEI serves as the foundation for trends analyses, air quality planning, regulation development, and health exposure analyses. The CAPs developed for the 2023 AERR EI include volatile organic compounds (VOC), carbon monoxide (CO), nitrogen oxides (NO_X), particulate matter (PM) with an aerodynamic diameter of less than 10 and 2.5 microns (PM_{10} and $PM_{2.5}$), sulfur dioxide (SO_2), and ammonia (NH_3). Although lead is a CAP, MOVES does not produce emissions estimates because lead has been banned from motor vehicle gasoline since 1996. The HAPs are not listed individually in-text due to the large number of pollutants; see Tables 12 and 13 for the full list.

4.1 Inputs for TexN2

ERG implemented three key updates in the TexN2 database prior to developing the 2023 AERR EI, which included seasonal fuel properties and meteorology data.

4.1.1 Fuel Data

The TCEQ periodically collects and analyzes fuel samples taken from vehicle fueling stations across the state. The dataset ensures accuracy of local fuel information and provides the best data available to support SIP control strategy development. ERG incorporated the latest fuel sampling data conducted in the summer of 2023 (TTI, 2024) into TexN2.5. The final data were provided by TCEQ staff on March 5, 2024[6].

4.1.2 Meteorology Data

The TCEQ provided year 2023 meteorology data for the 2023 AERR EI in a file titled "20_21_23_MET_mvs3_mvs4.zip" on April 17, 2024[7]. ERG converted the MOVES formatted database within the file into the level of detail required for the TexN2 database `climate` table, which lists temperature and relative humidity by hour, four seasons, and 254 counties.

4.1.3 Population in the Quarry and Mining Subsector

The TCEQ awarded the Capital Area Council of Governments (CAPCOG) funding for 2023-2024 for ozone-related monitoring and emissions inventory work for the Austin-Round Rock-Georgetown Metropolitan Statistical Area, a 5-county region including Bastrop, Caldwell, Hays, Travis, and Williamson Counties. The funding for monitoring and inventory work was part of the Rider 7 fiscal year 2023-2024 budget. The inventory work resulted in updated equipment populations described in a Final Report (ERG, 2023b).

Prior to generating the 2023 AERR, ERG updated the `populationYears` table of the TexN2 database table for years 2020 through 2060 to account for population changes in the DCE subsector 23 in the five CAPCOG counties.

4.2 EI Development and Results

ERG developed the 2023 EI using MOVES version 4.0.1 and the database version *movesdb20240104*. The TexN2 utility version was 2.5.0, and the database version was imported from the utility file *TexN2_31jul24.sql*, with the latest added description entry of "Added TERP tables" in the TexN2 database `version` table. The TexN2 runs were executed in parallel for all 254 counties in Texas using the Amazon Web Services (AWS) cloud computing environment. The total time to complete the runs on AWS was under two days.

[6] Personal communication with Greg Lauderdale of TCEQ, 3/5/2024.
[7] Personal communication with Cody McLain of TCEQ, 4/172024.

The TexN2 utility estimates nonroad emissions by SCC and county for all fuel types. In addition, it allows for the disaggregation of diesel construction equipment (DCE) SCCs into unique DCE subsectors to account for differences in equipment activity by use in different sectors. Each DCE/SCC combination requires a separate MOVES-Nonroad run, resulting in up to 24 runs for each county, with a separate CDB created by TexN2 for each run. In addition to being disaggregated by DCE subsector, the TexN2 runs were performed with all emissions adjustments (e.g., altitude, humidity, etc.) applied in post-processing except for the Texas Low Emission Diesel (TxLED) adjustment. Per direction from the TCEQ, TxLED benefits were not applied in 2023.

These runs provide the most accurate emissions estimate for each county given the available Texas-specific data, and therefore form the basis of the emissions totals reported for the emissions inventory and this report.

The TexN2 utility generates several standard reports providing emissions by various categories, such as by county, SCC, etc. In addition, the utility outputs summary data adhering to the Consolidated Emissions Reporting Schema (CERS) written in the Extensible Markup Language (XML) compatible with the EPA's Emissions Inventory System (EIS) and the TCEQ's Texas Air Emissions Repository (TexAER). The CERS XML files for the 2023 AERR EI are provided separately as Deliverable 4.2.

Tables 1 through 13, A-1, and A-2 summarize the emissions for the 2023 AERR EI. Section 6.0 describes the relationship to the prior 2020 AERR (ERG, 2021).

Table 1. 2023 OSD Criteria Emissions by Equipment Classification (Tons/Day)

Classification	VOC	NO_X	CO	PM_{10}-PRI	$PM_{2.5}$-PRI	SO_2	NH_3
Agricultural Equipment	4.09	31.49	36.15	3.5	3.4	0.02	0.05
Commercial Equipment	25.74	17.19	789.06	1.59	1.51	0.03	0.06
Construction and Mining Equipment	13.89	63.63	184.38	4.85	4.65	0.07	0.21
Industrial Equipment	3.63	23.15	112.31	1.08	1.07	0.05	0.04
Lawn and Garden Equipment (Com)	64.07	14.58	1299.63	5.66	5.22	0.05	0.08
Lawn and Garden Equipment (Res)	45.18	4.5	620.45	2.29	2.1	0.02	0.03
Logging Equipment	0.11	0.04	1.23	0.02	0.01	0	0
Pleasure Craft	23.79	10.61	127.47	0.26	0.25	0.02	0.02
Railroad Equipment	0.09	0.39	1.45	0.05	0.04	0	0
Recreational Equipment	22.25	1.62	172.22	0.64	0.59	0.01	0.01
Total*	**202.85**	**167.19**	**3344.35**	**19.95**	**18.84**	**0.26**	**0.51**

* Note that totals may not match the sum of counties due to rounding in the values by county. Additional significant digits in the EIs are available in the electronic file **Deliverable_4.1_AERR_Summary_Data_20240729.xlsx** that accompanies this report.

Table 2. 2023 Annual Criteria Emissions by Equipment Classification (Tons/Year)

Classification	VOC	NO_X	CO	PM_{10}-PRI	$PM_{2.5}$-PRI	SO_2	NH_3
Agricultural Equipment	973	7,674	8,614	832	806	4	10
Commercial Equipment	7,911	5,941	237,630	502	475	14	19
Construction and Mining Equipment	3,728	18,257	47,842	1,300	1,245	20	56
Industrial Equipment	1,106	7,590	32,577	323	318	14	12
Lawn and Garden Equipment (Com)	16,713	3,869	308,621	1,531	1,412	14	20
Lawn and Garden Equipment (Res)	15,452	1,762	211,550	891	820	9	12
Logging Equipment	35	14	372	5	4	0	0
Pleasure Craft	8,559	4,942	57,446	120	112	7	9
Railroad Equipment	24	114	407	13	12	0	0
Recreational Equipment	6,923	565	53,353	206	190	2	3
Total*	**61,430**	**50,732**	**958,417**	**5,726**	**5,399**	**89**	**144**

* Note that totals may not match the sum of counties due to rounding in the values by county. Additional significant digits in the EIs are available in the electronic file **Deliverable_4.1_AERR_Summary_Data_20240729.xlsx** that accompanies this report.

Table 3. 2023 OSD Criteria Emissions by Selected Area (Tons/Day)

Regional Group	VOC	NO_X	CO	PM_{10}-PRI	$PM_{2.5}$-PRI	SO_2	NH_3
Alamo Area Council of Governments	19.43	11.34	320.58	1.71	1.61	0.02	0.04
Beaumont-Port Arthur Area	3.12	2.02	54.54	0.26	0.24	0	0.01
Capital Area Council of Governments	16.22	10.89	272.72	1.54	1.44	0.02	0.04
Dallas-Fort Worth Area (10 county)	46.22	36.86	902.88	4.74	4.45	0.06	0.12
El Paso	3.32	2.83	67.62	0.32	0.3	0	0.01
East Texas Council of Governments	4.26	2.95	79.33	0.38	0.36	0.01	0.01
Houston-Galveston-Brazoria Area (8 county)	40.8	32.44	792.83	4.16	3.92	0.06	0.11
Victoria	0.5	0.45	9.01	0.06	0.05	0	0

Table 4. 2023 Annual Criteria Emissions by Selected Area (Tons/Year)

Regional Group	VOC	NO_X	CO	PM_{10}-PRI	$PM_{2.5}$-PRI	SO_2	NH_3
Alamo Area Council of Governments	5,716	3,389	87,768	496	465	7	12
Beaumont-Port Arthur Area	977	666	15,664	77	72	1	2
Capital Area Council of Governments	4,752	3,272	74,705	443	416	7	11
Dallas-Fort Worth Area (10 county)	13,463	11,184	248,453	1,370	1,287	22	33
El Paso	1,020	854	19,302	95	89	1	3
East Texas Council of Governments	1,305	919	22,581	113	107	2	3
Houston-Galveston-Brazoria Area (8 county)	12,106	9,997	222,294	1,211	1,138	21	31
Victoria	154	135	2,609	16	15	0	0

Table 5. 2023 Austin Area OSD Criteria Emissions (Tons/Day)

County	VOC	NO_X	CO	PM_{10}-PRI	$PM_{2.5}$-PRI	SO_2	NH_3
Bastrop	0.57	0.49	9.49	0.06	0.06	0	0
Blanco	0.16	0.07	1.7	0.01	0.01	0	0
Burnet	1.48	0.42	14.14	0.07	0.07	0	0
Caldwell	0.25	0.23	2.54	0.03	0.03	0	0
Fayette	0.36	0.28	4.56	0.03	0.03	0	0
Hays	0.82	0.68	11.81	0.08	0.07	0	0
Lee	0.21	0.2	2.71	0.02	0.02	0	0
Llano	0.43	0.18	3.32	0.02	0.02	0	0
Travis	9.09	5.92	174.17	0.89	0.83	0.01	0.02
Williamson	2.85	2.41	48.28	0.33	0.31	0	0.01
Total	**16.22**	**10.88**	**272.72**	**1.54**	**1.45**	**0.01**	**0.03**

Table 6. 2023 Beaumont-Port Arthur Area OSD Criteria Emissions (Tons/Day)

County	VOC	NO_X	CO	PM_{10}-PRI	$PM_{2.5}$-PRI	SO_2	NH_3
Hardin	0.3	0.16	5.78	0.02	0.02	0	0
Jefferson	2.15	1.47	38.62	0.18	0.17	0	0
Orange	0.67	0.39	10.14	0.05	0.05	0	0
Total	**3.12**	**2.02**	**54.54**	**0.25**	**0.24**	**0**	**0**

Table 7. 2023 Dallas-Fort Worth Area OSD Criteria Emissions (Tons/Day)

County	VOC	NO_X	CO	PM_{10}-PRI	$PM_{2.5}$-PRI	SO_2	NH_3
Collin	7.32	4.94	137.29	0.77	0.73	0.01	0.02
Dallas	18.76	14.8	397.74	1.89	1.78	0.03	0.05
Denton	4.5	3.14	78.06	0.43	0.4	0.01	0.01
Ellis	0.99	1.86	15.67	0.17	0.16	0	0
Johnson	0.74	0.85	13.07	0.09	0.09	0	0
Kaufman	0.69	0.96	10.54	0.09	0.09	0	0
Parker	1.19	0.71	19.09	0.09	0.09	0	0
Rockwall	0.83	0.62	14.62	0.09	0.08	0	0
Tarrant	10.65	8.5	208.81	1.06	0.99	0.01	0.03
Wise	0.55	0.48	7.98	0.05	0.05	0	0
Total	**46.22**	**36.86**	**902.87**	**4.73**	**4.46**	**0.06**	**0.11**

Table 8. 2023 El Paso OSD Criteria Emissions (Tons/Day)

County	VOC	NO_X	CO	PM_{10}-PRI	$PM_{2.5}$-PRI	SO_2	NH_3
El Paso	3.32	2.83	67.62	0.32	0.3	0	0.01

Table 9. 2023 Houston-Galveston-Brazoria Area OSD Criteria Emissions (Tons/Day)

County	VOC	NO_X	CO	PM_{10}-PRI	$PM_{2.5}$-PRI	SO_2	NH_3
Brazoria	2.02	1.99	30.47	0.2	0.19	0	0.01
Chambers	0.45	0.42	4.57	0.03	0.03	0	0
Fort Bend	3.36	2.33	62.13	0.34	0.32	0	0.01
Galveston	2.05	1.69	30.63	0.18	0.17	0	0.01
Harris	28.32	22.87	587.91	2.96	2.79	0.04	0.08
Liberty	0.61	0.45	9.81	0.06	0.05	0	0
Montgomery	3.43	2.38	57.06	0.33	0.31	0	0.01
Waller	0.58	0.33	10.24	0.05	0.05	0	0
Total	**40.82**	**32.46**	**792.82**	**4.15**	**3.91**	**0.04**	**0.12**

Table 10. 2023 San Antonio Area OSD Criteria Emissions (Tons/Day)

County	VOC	NO_X	CO	PM_{10}-PRI	$PM_{2.5}$-PRI	SO_2	NH_3
Atascosa	0.33	0.28	4.75	0.03	0.03	0	0
Bandera	0.74	0.12	5.05	0.03	0.02	0	0
Bexar	12.86	7.34	244.98	1.2	1.12	0.01	0.03
Comal	1.4	1.11	16.14	0.13	0.12	0	0.01

County	VOC	NO_X	CO	PM_{10}-PRI	$PM_{2.5}$-PRI	SO_2	NH_3
Frio	0.12	0.15	1.19	0.02	0.01	0	0
Gillespie	0.32	0.2	4.43	0.02	0.02	0	0
Guadalupe	0.88	0.71	13.18	0.09	0.09	0	0
Karnes	0.06	0.13	0.96	0.01	0.01	0	0
Kendall	0.82	0.29	10.16	0.05	0.05	0	0
Kerr	1.19	0.29	9.89	0.05	0.05	0	0
Medina	0.45	0.45	5.51	0.05	0.05	0	0
Wilson	0.27	0.26	4.35	0.03	0.03	0	0
Total	**19.44**	**11.33**	**320.59**	**1.71**	**1.6**	**0.01**	**0.04**

Table 11. 2023 Tyler-Longview Area OSD Criteria Emissions (Tons/Day)

County	VOC	NO_X	CO	PM_{10}-PRI	$PM_{2.5}$-PRI	SO_2	NH_3
Gregg	1.07	0.7	23.51	0.1	0.1	0	0
Harrison	0.59	0.6	8.85	0.05	0.05	0	0
Rusk	0.4	0.31	5.88	0.03	0.03	0	0
Smith	1.91	1.18	35.85	0.18	0.16	0	0
Upshur	0.29	0.16	5.24	0.02	0.02	0	0
Total	**4.26**	**2.95**	**79.33**	**0.38**	**0.36**	**0**	**0**

Table 12. 2023 Statewide OSD Hazardous Air Pollutant Emissions (Pounds/Day)

NEI Pollutant Code	Pollutant Name	Emissions Total (lbs./day)
108883	Toluene	35,374
1330207	Xylene	27,936
540841	2,2,4-Trimethylpentane	18,385
71432	Benzene	15,089
50000	Formaldehyde	8,181
100414	Ethyl Benzene	9,954
110543	Hexane	5,128
75070	Acetaldehyde	2,390
106990	1,3-Butadiene	1,759
123386	Propionaldehyde	553
100425	Styrene	1,380
107028	Acrolein	515
91203	Naphthalene	558
85018	Phenanthrene	82.9914
208968	Acenaphthylene	58.8785
86737	Fluorene	37.4497

NEI Pollutant Code	Pollutant Name	Emissions Total (lbs./day)
83329	Acenaphthene	22.2105
129000	Pyrene	19.5744
206440	Fluoranthene	16.8999
120127	Anthracene	10.4309
191242	Benzo(g,h,i)perylene	26.8669
7440020	Nickel Compounds	0.5519
56553	Benz(a)anthracene	5.3950
193395	Indeno(1,2,3,c,d)pyrene	10.0826
218019	Chrysene	5.0227
50328	Benzo(a)pyrene	9.9982
205992	Benzo(b)fluoranthene	5.8437
207089	Benzo(k)fluoranthene	5.8186
7439965	Manganese Compounds	0.3101
18540299	Chromium 6+	0.0023
53703	Dibenzo(a,h)anthracene	0.2518
3268879	Octachlorodibenzo-p-dioxin	6.96E-06
35822469	1,2,3,4,6,7,8-Heptachlorodibenzo-p-Dioxin	1.00E-06
39001020	Octachlorodibenzofuran	1.86E-06
67562394	1,2,3,4,6,7,8-Heptachlorodibenzofuran	1.62E-06
19408743	1,2,3,7,8,9-Hexachlorodibenzo-p-Dioxin	8.27E-08
70648269	1,2,3,4,7,8-Hexachlorodibenzofuran	1.88E-07
51207319	2,3,7,8-Tetrachlorodibenzofuran	6.62E-07
60851345	2,3,4,6,7,8-Hexachlorodibenzofuran	1.61E-07
57653857	1,2,3,6,7,8-Hexachlorodibenzo-p-Dioxin	9.89E-08
57117314	2,3,4,7,8-Pentachlorodibenzofuran	2.55E-07
57117449	1,2,3,6,7,8-Hexachlorodibenzofuran	1.79E-07
39227286	1,2,3,4,7,8-Hexachlorodibenzo-p-Dioxin	4.58E-08
57117416	1,2,3,7,8-Pentachlorodibenzofuran	2.36E-07
1746016	2,3,7,8-Tetrachlorodibenzo-p-Dioxin	1.09E-07
72918219	1,2,3,7,8,9-Hexachlorodibenzofuran	6.78E-08
55673897	1,2,3,4,7,8,9-Heptachlorodibenzofuran	5.06E-08
40321764	1,2,3,7,8-Pentachlorodibenzo-p-Dioxin	4.37E-08

Table 13. 2023 Statewide Annual Hazardous Air Pollutant Emissions (Tons/Year)

NEI Pollutant Code	Pollutant Name	Emissions Total (tons/year)
108883	Toluene	5,357
1330207	Xylene	4,305
540841	2,2,4-Trimethylpentane	2,847
71432	Benzene	2,290

NEI Pollutant Code	Pollutant Name	Emissions Total (tons/year)
50000	Formaldehyde	1,174
100414	Ethyl Benzene	1,540
110543	Hexane	737
75070	Acetaldehyde	338
106990	1,3-Butadiene	274
123386	Propionaldehyde	78
100425	Styrene	215
107028	Acrolein	71.2506
91203	Naphthalene	86.2320
85018	Phenanthrene	12.3265
208968	Acenaphthylene	8.9365
86737	Fluorene	5.4672
83329	Acenaphthene	3.2052
129000	Pyrene	3.0074
206440	Fluoranthene	2.6066
120127	Anthracene	1.5898
191242	Benzo(g,h,i)perylene	4.1216
7440020	Nickel Compounds	0.0775
56553	Benz(a)anthracene	0.8294
193395	Indeno(1,2,3,c,d)pyrene	1.5463
218019	Chrysene	0.7713
50328	Benzo(a)pyrene	1.5335
205992	Benzo(b)fluoranthene	0.8986
207089	Benzo(k)fluoranthene	0.8953
7439965	Manganese Compounds	0.0440
18540299	Chromium 6+	0.0003
53703	Dibenzo(a,h)anthracene	0.0382
3268879	Octachlorodibenzo-p-dioxin	1.02E-06
35822469	1,2,3,4,6,7,8-Heptachlorodibenzo-p-Dioxin	1.46E-07
39001020	Octachlorodibenzofuran	2.73E-07
67562394	1,2,3,4,6,7,8-Heptachlorodibenzofuran	2.39E-07
19408743	1,2,3,7,8,9-Hexachlorodibenzo-p-Dioxin	1.21E-08
70648269	1,2,3,4,7,8-Hexachlorodibenzofuran	2.74E-08
51207319	2,3,7,8-Tetrachlorodibenzofuran	9.57E-08
60851345	2,3,4,6,7,8-Hexachlorodibenzofuran	2.39E-08
57653857	1,2,3,6,7,8-Hexachlorodibenzo-p-Dioxin	1.47E-08
57117314	2,3,4,7,8-Pentachlorodibenzofuran	3.66E-08
57117449	1,2,3,6,7,8-Hexachlorodibenzofuran	2.61E-08
39227286	1,2,3,4,7,8-Hexachlorodibenzo-p-Dioxin	6.81E-09
57117416	1,2,3,7,8-Pentachlorodibenzofuran	3.44E-08

NEI Pollutant Code	Pollutant Name	Emissions Total (tons/year)
1746016	2,3,7,8-Tetrachlorodibenzo-p-Dioxin	1.61E-08
72918219	1,2,3,7,8,9-Hexachlorodibenzofuran	9.74E-09
55673897	1,2,3,4,7,8,9-Heptachlorodibenzofuran	7.45E-09
40321764	1,2,3,7,8-Pentachlorodibenzo-p-Dioxin	6.51E-09

4.3 NEI Submittal Materials

As mentioned previously, U.S. EPA requires nonroad model mobile source inputs for the NEI. The required inputs include county databases (CDBs) in MOVES4 format, a QA report, a submittal checklist, and documentation of the data sources and processes used to organize the information into the CDB format (US EPA, 2024b). These materials for the 2023 AERR EI/NEI were provided separately as Deliverable 4.3.

ERG created 254 CDBs in accordance with EPA's expectation of one CDB per county, using the TexN2 utility's feature *Generate CDBs for NEI* (a function on the Run tab of the TexN2 utility) for the calendar year 2023. The *Generate CDBs for NEI* function produced one CDB per county by aggregating populations across the 25 DCE subsectors to arrive at county total equipment populations by SCC and HP. TexN2 names the CDBs following the EPA naming convention of `c48001y2023_nr_20240619` for Anderson County (county ID 48001), year 2023, created on June 19, 2024. These CDBs were created on a local network/in-office personal computer (PC), not on AWS.

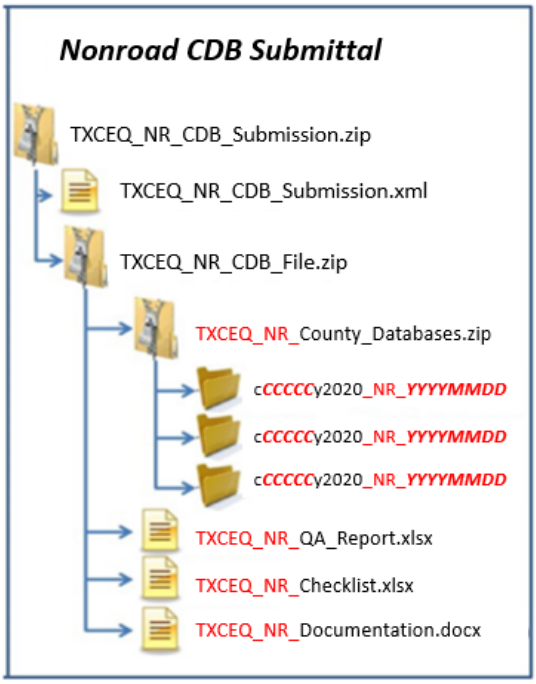
ERG then ran EPA's NEI QA Tool[8] using the built-in feature inside of MOVES4. EPA's QA Tool verifies that all CDB table contents meet the naming convention, format, data validity, and other checks. To run the EPA QA Tool, MOVES4 must be installed on the PC. ERG followed the EPA's instructions. The steps are summarized here to assist TCEQ staff with generating CDBs for EPA submittal in-house in the future. First, ERG opened a command line window from inside the MOVES4 installation directory, which by default is C:\Users\Public\EPA\MOVES\MOVES4.0. Then, ERG created a file list of all 254 Texas CDBs, each database name listed in a separate line. ERG named the file TXCEQ_db_list.txt. Following the QA Tool instructions, ERG ran the file "setenv.bat" from the windows command line inside the MOVES4 directory, then ran the QA tool, listing TXCEQ_db_list.txt as the input file, and providing the filename "TXCEQ_NR_QA_Report.txt" as the output file name. The checks completed in under an hour on a single computer. ERG opened the file TXCEQ_NR_QA_Report.txt to verify that all tables passed the QA checks; there were no errors indicated. The text box below documents the specific steps to initiate the QA Tool from the command line.

[8] Documentation on MOVES NEI Submissions QA Tool. Available online (as of 7/3/2024) https://github.com/USEPA/EPA_MOVES_Model/blob/master/docs/NEIQAInstructions.md

```
C:\Users\Public\EPA\MOVES\MOVES4.0>setenv.bat

C:\Users\Public\EPA\MOVES\MOVES3.0>ant nonroadNEIQA -Dinput=C:\tmp\TXCEQ_db_list.txt -Doutput=C:\tmp\TXCEQ_NR_QA_Report.txt
```

ERG prepared the required NEI submittal checklist starting from EPA's 2024 template file[9] and named the completed file "TXCEQ_NR_Checklist.xlsx." ERG created TXCEQ_NR_Documentation.docx to describe the data sources and processes to create the CDBs. ERG named and organized the submittal package components according to EPA's instructions, which is summarized in the inset figure to the right. To submit the package, the TCEQ should create the CERS XML according to the instructions starting on page 7 of EPA's submittal instructions document (U.S. EPA, 2024b) which is also indicated in footnotes[10] for a direct link to the document. The CERS XML file is indicated by the filename in the inset figure to the right "TXCEQ_NR_CDB_Submission.xml." This XML file should be zipped together with the provided file from ERG named TXCEQ_NR_CDB_File.zip and submitted as "TXCEQ_NR_CDB_Submission.zip" to EIS.



5.0 RFP EIs for SIP Development

ERG developed RFP EIs to assist the TCEQ in developing a potential SIP revision(s) for the 2015 eight-hour ozone NAAQS in the HGB six-county, the DFW nine-county, and Bexar County nonattainment areas. The EIs include ozone season day (OSD) weekday estimates of VOC and NO_X for the base year 2017, milestone year 2023, and attainment year 2026. Like the AERR, the RFP EIs were generated using MOVES4 code version 4.0.1 with database version 'movesdb20240104' and TexN2 code version 2.5.0 with the TexN2 database last updated July 31, 2024.

[9] US EPA MOVES Nonroad County Checklist. Available online as of 7/3/2024: https://gaftp.epa.gov/air/nei/2023/doc/supporting_data/nonroad/2023_MOVES_Nonroad_Agency_Submittal_Checklist.xlsx

[10] US EPA Submittal Instructions. Available online as of 7/3/2024: https://www.epa.gov/system/files/documents/2024-05/instructions-for-submitting-nonroad-source-data-20240405.pdf

The geographic scope of the EIs includes the six-county Houston-Galveston-Brazoria (HGB) area (defined as Brazoria, Chambers, Fort Bend, Galveston, Harris, and Montgomery Counties), the nine-county Dallas-Fort Worth (DFW) area (defined as Collin, Dallas, Denton, Ellis, Johnson, Kaufman, Parker, Tarrant, and Wise Counties) and Bexar County.

The temporal scope of the EIs is OSD weekday for the years 2017, 2023, and 2026. The period type "OSD weekday" represents weekday emissions averaged over the summer months June, July, and August. TexN2 allocates annual activity to these months with monthly and day type allocation factors contained in tables within the TexN2 utility database.

The meteorology data in the EIs was specific to the base year 2017, applied to all RFP analysis years 2017, 2023, and 2026. The fuel types in each analysis year are specific to 2017 for the base year and 2023 for the two later years. At the time of writing (July 2024), year 2023 is the latest available fuel survey data contained in the TexN2 database.

The RFP EIs include VOC and NO_X emissions from ten separate runs that the TexN2 utility automatically initiates in sequence corresponding to the scenarios listed below. The first scenario represents a case without any emission controls. The second through tenth RFP scenarios add successive federal and state emissions controls. TexN2 sets up the MOVES runs for each scenario using alternate versions of the MOVES input table that describes technology fractions by equipment model year. TexN2 disables the inclusion of reformulated gasoline (RFG) in the HGB and DFW areas, until the final RFP scenario, *allRules_cntl*, representing the fully controlled scenario. RFG fuels, where they are in use, are implemented as the final control strategy in all six HGB counties and four of the nine DFW counties (Collin, Dallas, Denton, and Tarrant). Five of the DFW counties and Bexar County do not have RFG fuel, so these areas do not receive any emissions benefits from RFG. Similarly, the benefits of Texas Low Emission Diesel (TxLED) fuel are delayed until the final RFP scenario, where they are included as a post-processing adjustment to NO_X from diesel-fueled equipment. All 16 counties are part of the 110-county TxLED fuel control area. Per direction from the TCEQ, ERG did not apply any TxLED benefit in 2023 or 2026. However, the TxLED benefits that would have been accrued in these analysis years is printed in a separate table below the main table in the Automated RFP report out of the utility. ERG added a line item to the Automated RFP report that includes the benefits of the TERP program described earlier in Section 3.

RFP Scenario Name	Description
smallSprk1_uncntl	No controls
smallSprk1_cntl	Controls through Small nonroad spark ignition (SI) engines (Phase 1)
Tier1_cntl	Controls through Tier 1 nonroad diesel engines
Tier2_3_cntl	Controls through Tiers 2 and 3 nonroad diesel engines
smallSprk2_cntl	Controls through Small nonroad SI engines (Phase II)
largeSprk_cntl	Controls through Large nonroad SI engines
Tier4_cntl	Controls through Tier 4 nonroad diesel engines
recMarine_cntl	Controls through Diesel recreational marine engines
smallSI_cntl	Controls through SI marine engines
allRules_cntl	Controls through SI marine engines, includes RFG and TxLED fuel controls

Tables 14, 15, and 16 show results for each RFP scenario for the HGB area, DFW area, and Bexar County, respectively. They include separate line items showing RFG and TxLED benefits as control scenarios number 9 and 10, and the TERP benefit as control scenario 11. The final scenario (Fully Controlled) corresponds to the "allRules_cntl" RFP scenario. The Fully Controlled case contains the same values as the prior TERP line item because TexN2 does not model any further emission controls after TERP. It remains in the tables for clarity to indicate the cumulative effect of all controls. TxLED benefits (differences from the "RFG" line item) only appear for the analysis year 2017. In 2023 and 2026, the benefits from TxLED were set to zero.

Table 14. NO_X and VOC Emissions for the HGB Six-County Area (Tons/Day)

Emissions Control Scenario	2017 NO_X	2017 VOC	2023 NO_X	2023 VOC	2026 NO_X	2026 VOC
Uncontrolled	124.18	186.13	154.52	207.01	161.89	220.01
1. smallSprk1_cntl	130.16*	135.89	161.20*	151.50	168.97*	160.86
2. Tier1_cntl	129.37	131.17	160.87	146.37	168.94	155.67
3. Tier2_3_cntl	124.70	130.17	158.19	145.81	166.97	155.27
4. smallSprk2_cntl	120.46	79.47	153.43	91.04	161.93	96.74
5. largeSprk_cntl	82.01	66.84	102.47	74.15	104.06	77.74
6. Tier4_cntl	41.04	57.25	36.59	59.86	34.35	62.82
7. recMarine_cntl	41.03	57.25	36.56	59.86	34.32	62.82
8. smallSI_cntl	37.17	39.33	31.96	38.54	29.38	39.94
9. RFG	37.17	38.80	32.12	38.14	29.54	39.52
10. TxLED	35.93	38.80	32.12	38.14	29.54	39.52
11. TERP	35.77	38.79	32.02	38.13	29.47	39.51
Fully Controlled	35.77	38.79	32.02	38.13	29.47	39.51

* Note that NOx increases from the Uncontrolled case to the small nonroad SI engines Phase I (smallSprk1_cntl) case by approximately 6 tons per day in 2017 with similar increases in 2023 and 2026. The minor NOx increases were allowed under the small SI rule, where some equipment have their standards defined in terms of combined hydrocarbons plus NOx.

The NO_X and VOC emissions generally decline from Uncontrolled to Fully Controlled except for small nonroad SI engines Phase 1 (smallSprk1_cntl), which increases NO_X by approximately 6 tons per day in 2017. The minor NO_X increase was allowed under the small SI rule, where some equipment have their standards defined in terms of combined hydrocarbons plus NO_X.

The pre-Tier 4 scenarios all show increased NO_X emissions over the period from 2017 to 2026, whereas the Tier 4 and later controls scenarios show NO_X declines over the same period despite a gradual growth in equipment population. The fully controlled scenarios in all three areas show a slight VOC increase comparing 2026 to 2017 because the emission standards are less stringent for this pollutant, and they're not sufficient to overcome the VOC emissions from increasing equipment populations in the three areas over this time period. The increasing gasoline equipment counts (Table 19) are in part responsible for the VOC increases.

Table 15 for the nine-county DFW area and Table 16 for Bexar County show similar trends to the HGB area. NO_X emissions slightly increase with *smallSprk1_cntl*, then decline or stay the same for all other successive controls.

Table 15. NO_X and VOC Emissions for the DFW Nine-County Area (Tons/Day)

Emissions Control Scenario	2017 NO_X	2017 VOC	2023 NO_X	2023 VOC	2026 NO_X	2026 VOC
Uncontrolled	131.80	207.29	161.31	231.12	170.20	246.12
1. smallSprk1_cntl	138.76*	149.44	169.07*	167.05	178.43*	177.84
2. Tier1_cntl	137.48	146.35	168.23	163.75	177.98	174.57
3. Tier2_3_cntl	132.47	145.28	164.98	163.10	175.42	174.08
4. smallSprk2_cntl	127.52	86.86	159.44	99.77	169.56	106.44
5. largeSprk_cntl	89.21	73.93	108.84	82.63	112.15	87.19
6. Tier4_cntl	45.26	63.69	40.89	67.62	38.76	71.16
7. recMarine_cntl	45.26	63.69	40.88	67.62	38.75	71.16
8. smallSI_cntl	40.93	43.57	35.80	43.76	33.34	45.60
9. RFG	40.93	43.18	35.98	43.28	33.53	45.10
10. TxLED	39.53	43.18	35.98	43.28	33.53	45.10
11. TERP	39.39	43.16	35.87	43.27	33.45	45.09
Fully Controlled	39.39	43.16	35.87	43.27	33.45	45.09

* Note that NOx increases from the Uncontrolled case to the small nonroad SI engines Phase I (smallSprk1_cntl) case by approximately 7 tons per day in 2017 with similar increases in 2023 and 2026. The minor NOx increases were allowed under the small SI rule, where some equipment have their standards defined in terms of combined hydrocarbons plus NOx.

Table 16. NO_X and VOC Emissions for Bexar County (Tons/Day)

Emissions Control Scenario	2017 NO_X	2017 VOC	2023 NO_X	2023 VOC	2026 NO_X	2026 VOC
Uncontrolled	23.16	55.74	28.53	61.50	29.13	65.23
1. smallSprk1_cntl	25.02*	39.45	30.59*	43.59	31.31*	46.20
2. Tier1_cntl	24.75	39.26	30.39	43.41	31.19	46.04
3. Tier2_3_cntl	23.79	39.05	29.77	43.29	30.71	45.95
4. smallSprk2_cntl	22.45	21.73	28.29	24.59	29.14	26.02
5. largeSprk_cntl	18.00	19.68	22.67	21.98	22.86	23.15
6. Tier4_cntl	9.25	17.46	8.76	18.70	8.34	19.73
7. recMarine_cntl	9.25	17.46	8.76	18.70	8.34	19.73
8. smallSI_cntl	8.08	12.10	7.41	12.45	6.92	13.07
9. RFG	8.08	12.10	7.41	12.45	6.92	13.07
10. TxLED	7.80	12.10	7.41	12.45	6.92	13.07
11. TERP	7.79	12.10	7.40	12.45	6.91	13.07
Fully Controlled	7.79	12.10	7.40	12.45	6.91	13.07

* Note that NOx increases from the Uncontrolled case to the small nonroad SI engines Phase I (smallSprk1_cntl) case by almost 2 tons per day in 2017 with similar increases in 2023 and 2026. The minor NOx increases were allowed under the small SI rule, where some equipment have their standards defined in terms of combined hydrocarbons plus NOx.

6.0 Data Analysis and QA of the EIs

Section 6 addresses data analysis and QA, focusing on a comparison of the 2023 AERR EI to the prior 2020 AERR EI. Section 3 detailed the extensive QA and data cleanup implemented on the TERP source data. This section focuses on ensuring the EIs are complete and without errors.

Comparison of the 2023 AERR EI to the prior 20 AERR EI

There are modest differences between the 2023 AERR EI and the prior 2020 AERR EI. Figure 17 summarizes the statewide changes in pollutant tons per year for most of the CAPs. VOC and CO emissions increased 9% while NO_x and PM decreased 8 to 10%. SO_2 emissions increased by 13%.

Table 17. Differences in Statewide 2023 and 2020 AERR EIs (Tons/Year)

Pollutant	Emissions 2020 AERR (with TexN2.2)	Emissions 2023 AERR (with TexN2.5)	Percent Change
VOC	56,232	61,430	9%
CO	880,839	958,417	9%
NO_X	56,225	50,732	-10%

PM_{10}	6,224	5,726	-8%
$PM_{2.5}$	5,904	5,399	-9%
SO_2	79	89	13%

Table 18 shows the differences in statewide emissions totals in tons per year between 2023 and 2020 on a per-equipment unit level. All pollutants have lower emissions per unit in 2023 compared to 2020.

Table 18. Differences in Statewide 2023 and 2020 AERR Emissions Divided by Equipment Population (Pounds per Equipment Unit)

Pollutant	Emissions Per Equipment 2020 AERR (with TexN2.2)	Emissions Per Equipment 2023 AERR (with TexN2.5)	Percent Change
VOC	9.286	6.422	-31%
CO	145.459	100.187	-31%
NO_X	9.285	5.303	-43%
PM_{10}	1.028	0.599	-42%
$PM_{2.5}$	0.975	0.564	-42%
SO_2	0.013	0.009	-28%

Table 19 summarizes the increases in population by fuel type over the AERR years 2017-2023. Relative to 2020, the 2023 gasoline equipment counts markedly increased (61%) and the diesel increased by the smallest amount (6%) over the three-year period.

Table 19. Differences in Statewide Equipment Populations by Fuel Type between the 2017, 2020, and 2023 AERR EIs

Fuel ID	Fuel Type Description	AERR 2017, TexN2.0	AERR 2020, TexN2.2	AERR 2023, TexN2.5	Percent change 2020 to 2023
1	Gasoline	9,961,159	11,342,588	18,309,250	61%
3	Compressed Natural Gas (CNG)	7,557	9,424	10,448	11%
4	Liquefied Petroleum Gas (LPG)	100,719	106,415	119,502	12%
	Subtotal of Non-Diesel	***10,069,435***	***11,458,427***	***18,439,199***	***61%***
23/24	Nonroad & Marine Diesel Fuel	813,501	653,821	693,420	6%
	Total	**10,882,937**	**12,112,248**	**19,132,619**	**58%**

The large increase in gasoline-fueled equipment comes from a recent TCEQ survey of 780 households in urban and rural counties across the state that provided population estimates of 2-stroke, 4-stroke, and electric Lawn and Garden (L&G) equipment

counts[11] (ERG, 2023a). Table 20 shows the large increases in residential L&G equipment, especially small chainsaws, leaf blowers, and rear engine riding mowers. The update to TexN2 occurred between the 2020 and 2023 AERRs and is responsible for the large increase in gasoline-fueled equipment population (Table 19) and contributes to increases in VOC and CO emissions at the state total level.

Table 20. Large Population Increases between TexN2 versions in the Residential Lawn and Garden Sector

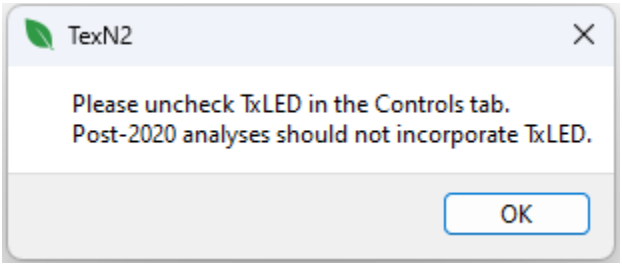
Equipment ID	Equipment Description	2020 AERR (with TexN2.2)	2023 AERR (with TexN2.5)	Percent Change
32	Lawn mowers (res)	3,548,759	5,053,643	42%
34	Rotary Tillers < 6 HP (res)	362,880	523,504	44%
36	Chain Saws < 6 HP (res)	565,901	2,328,471	311%
38	Trimmers/Edgers/Brush Cutter (res)	1,518,639	2,860,683	88%
40	Leafblowers/Vacuums (res)	797,505	2,023,630	154%
42	Snowblowers (res)	10,768	11,323	5%
44	Rear Engine Riding Mowers (res)	189,484	1,219,448	544%
48	Lawn & Garden Tractors (res)	1,294,876	1,069,663	-17%
52	Other Lawn & Garden Eqp. (res)	63,778	67,047	5%
L&G Residential Subtotal		*8,352,589*	*15,157,413*	*81%*
33	Lawn mowers (Com)	155,933	163,970	5%
35	Rotary Tillers < 6 HP (com)	63,303	66,576	5%
37	Chain Saws < 6 HP (com)	74,829	78,683	5%
39	Trimmers/Edgers/Brush Cutter (com)	190,719	200,542	5%
41	Leafblowers/Vacuums (com)	108,468	114,050	5%
43	Snowblowers (com)	495	521	5%
45	Rear Engine Riding Mowers (com)	5,287	5,558	5%
46	Front Mowers (com)	18,225	19,164	5%
47	Shredders < 6 HP (com)	33,201	34,915	5%
49	Lawn & Garden Tractors (com)	41,909	44,063	5%
50	Chippers/Stump Grinders (com)	10,708	11,259	5%
51	Commercial Turf Equipment (com)	106,458	111,938	5%
53	Other Lawn & Garden Eqp. (com)	79,337	83,428	5%
83	Commercial Mowers (com)	22,874	24,046	5%
L&G Commercial Subtotal		*911,747*	*958,711*	*5%*
Grand Total		9,264,336	16,116,124	74%

[11] https://www.tceq.texas.gov/downloads/air-quality/research/reports/emissions-inventory/5822342148fy2023-20230630-erg-emissions-reductions-phase-3-small-spark-ignition-electric-lawn-garden-equipment.pdf

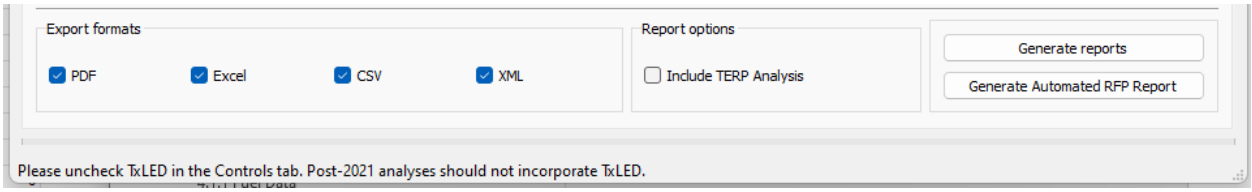
7.0 Code Changes to the TexN2.5 Utility

The TexN2.5 utility has several changes from the TexN2.4 version. The utility looks for a MOVES4 default database name, uses updated run specification (input file) templates, and follows the format of the MOVES4 `zoneMonthHour` table definitions, which differ from MOVES3 and earlier versions of the model.

The TexN2.5 utility now has a warning system with pop-up windows when a user selects a calendar year after 2021 and has the TxLED fuel control checked in the `Controls` tab of the GUI. The user may ignore the warning by clicking OK and not unchecking the appropriate box. The goal of the warning is to alert users to avoid making a mistake, but still allow a choice of whether to include the benefits of TxLED. With Automated RFP runs, the user does not have a choice with TxLED. The main table of successive benefits has TxLED zeroed out if the calendar year is 2021 or later; in 2020 and earlier it is automatically included. For 2021 and later years, there is a secondary table in italics font below the main table of the Automated RFP report showing what the TxLED benefit would have been in the analysis year.



The TexN2.5 utility now has the ability to model TERP program benefits in three calendar years 2017, 2023, and 2026 for an annual period (tons/year) or an OSD weekday (tons/day). Other years and time periods are not currently enabled for TERP benefits. The user may select any pollutants and counties, and the reports of TERP benefits will match the resolution of these choices. However, the user should always select all SCC/Fuel types, or the TERP benefits will not be proportionate to the full inventory. Users can opt to include TERP benefits by checking the new box at the bottom of the `Reports` tab indicating “Include TERP Analysis.” This button works in conjunction with both the “Generate reports” and “Generated Automated RFP Report” buttons. If TERP is included, the standard reports (from “Generate reports”) will include the emissions impact of the applicable equipment replacements, and the Automated RFP report will include a line item specific to TERP benefits. The reports may be run either way, and after the core TexN2 analysis has been completed, so additional runs are not necessary to incorporate or remove TERP benefits.



8.0 References

ERG, 2021. "Development of Texas Nonroad Model Mobile Source Air Emissions Reporting Requirements, Reasonable Further Progress, and Redesignation and Maintenance Emissions Inventories. Final Report." Prepared for the Texas Commission on Environmental Quality, Air Quality Division, Austin, TX 78711-3087. July 29.

ERG, 2023a. "Quantifying Potential Emissions Reductions Associated with Federal Phase 3 Nonroad Small Spark-Ignition (SI) Engine Regulatory Compliance and Lawn and Garden (L&G) Equipment Electrification. Prepared for the TCEQ. Prepared by Eastern Research Group, Inc. June. Available online (as of 7/23/2024) https://www.tceq.texas.gov/downloads/air-quality/research/reports/emissions-inventory/5822342148fy2023-20230630-erg-emissions-reductions-phase-3-small-spark-ignition-electric-lawn-garden-equipment.pdf

ERG, 2023b. "Mine and Quarry Emissions Inventory Work Task 5: Final Report." Prepared for Anton Cox, Capital Area Council of Governments. Prepared by Eastern Research Group, Inc. December 20.

TTI, 2024. "2023 Summer Fuel Field Study." Prepared for the Texas Commission on Environmental Quality. February.

US EPA, 2010. Median Life, Annual Activity, and Load Factor Values for Nonroad Emissions Modeling. EPA-420-R-10-016. Available online (as of 7/5/2024) https://nepis.epa.gov/Exe/ZyPDF.cgi?Dockey=P10081RV.pdf.

US EPA, 2005. Calculation of Age Distributions in the Nonroad Model: Growth and Scrappage. EPA-420-R-05-018. Available online (as of 7/5/2024) https://nepis.epa.gov/Exe/ZyPDF.cgi?Dockey=P1004L8U.pdf.

US EPA, 2024a. "MOVES4: Latest Version of Motor Vehicle Emission Simulator." https://www.epa.gov/moves/latest-version-motor-vehicle-emission-simulator-moves. January. Available online (as of 7/3/2024)

US EPA, 2024b. "Instructions for Submitting Nonroad Inputs for MOVES for the 2023 NEI." April. Available online (as of 7/3/2024) https://www.epa.gov/system/files/documents/2024-05/instructions-for-submitting-nonroad-source-data-20240405.pdf

Appendix A: 2023 AERR EI County-Level Results

Table A-1. 2023 OSD Criteria Emissions by County (Tons/Day)

County	VOC	NO_X	CO	PM_{10}-PRI	$PM_{2.5}$-PRI	SO_2	NH_3
Anderson	0.371	0.231	5.692	0.03	0.028	0	0.001
Andrews	0.068	0.142	1.081	0.012	0.012	0	0
Angelina	0.871	0.456	12.451	0.056	0.053	0.001	0.001
Aransas	1.368	0.589	9.256	0.032	0.03	0.001	0.001
Archer	0.144	0.14	1.354	0.013	0.012	0	0
Armstrong	0.015	0.111	0.175	0.009	0.008	0	0
Atascosa	0.326	0.281	4.75	0.03	0.028	0	0.001
Austin	0.318	0.309	5.115	0.036	0.035	0	0.001
Bailey	0.073	0.296	1.101	0.03	0.029	0	0
Bandera	0.736	0.12	5.05	0.026	0.024	0	0.001
Bastrop	0.572	0.494	9.49	0.058	0.055	0.001	0.002
Baylor	0.203	0.175	1.42	0.013	0.013	0	0
Bee	0.08	0.17	1.287	0.02	0.019	0	0
Bell	1.424	1.193	19.862	0.141	0.134	0.002	0.004
Bexar	12.858	7.343	244.977	1.203	1.124	0.015	0.027
Blanco	0.165	0.071	1.701	0.009	0.009	0	0
Borden	0.048	0.094	0.267	0.007	0.007	0	0
Bosque	0.36	0.201	4.235	0.026	0.025	0	0.001
Bowie	0.645	0.554	10.488	0.061	0.058	0.001	0.002
Brazoria	2.02	1.987	30.474	0.205	0.194	0.003	0.006
Brazos	1.057	0.751	18.121	0.105	0.098	0.001	0.003
Brewster	0.107	0.126	1.029	0.013	0.012	0	0
Briscoe	0.028	0.131	0.328	0.012	0.012	0	0
Brooks	0.214	0.116	1.306	0.01	0.01	0	0
Brown	0.388	0.59	4.127	0.052	0.05	0.001	0.002
Burleson	0.242	0.212	2.975	0.023	0.022	0	0.001
Burnet	1.484	0.425	14.139	0.07	0.066	0.001	0.002
Caldwell	0.247	0.235	2.543	0.027	0.026	0	0.001
Calhoun	2.184	1.188	14.281	0.052	0.049	0.002	0.002
Callahan	0.187	0.149	2.05	0.015	0.015	0	0
Cameron	3.626	1.969	39.673	0.21	0.198	0.004	0.006
Camp	0.206	0.074	2.017	0.011	0.01	0	0
Carson	0.045	0.276	0.598	0.024	0.024	0	0.001
Cass	0.325	0.193	4.979	0.024	0.023	0	0.001
Castro	0.083	0.478	1.035	0.048	0.047	0	0.001
Chambers	0.448	0.416	4.57	0.031	0.03	0.001	0.001

County	VOC	NO_X	CO	PM_{10}-PRI	$PM_{2.5}$-PRI	SO_2	NH_3
Cherokee	0.323	0.28	5.56	0.031	0.029	0	0.001
Childress	0.055	0.177	0.714	0.016	0.015	0	0
Clay	0.178	0.163	1.505	0.016	0.015	0	0
Cochran	0.055	0.334	0.685	0.033	0.032	0	0.001
Coke	0.175	0.101	1.127	0.005	0.005	0	0
Coleman	0.199	0.19	1.874	0.021	0.02	0	0
Collin	7.325	4.942	137.285	0.774	0.725	0.008	0.017
Collingsworth	0.047	0.202	0.633	0.02	0.019	0	0
Colorado	0.323	0.343	4.035	0.036	0.034	0.001	0.002
Comal	1.402	1.107	16.139	0.125	0.119	0.002	0.005
Comanche	0.229	0.265	2.587	0.028	0.027	0	0.001
Concho	0.105	0.176	0.686	0.019	0.018	0	0
Cooke	0.562	0.418	7.502	0.048	0.046	0.001	0.001
Coryell	0.177	0.279	2.301	0.028	0.027	0	0.001
Cottle	0.015	0.091	0.213	0.008	0.007	0	0
Crane	0.02	0.088	0.247	0.008	0.008	0	0
Crockett	0.076	0.05	0.624	0.004	0.003	0	0
Crosby	0.107	0.471	1.406	0.047	0.045	0	0.001
Culberson	0.01	0.093	0.116	0.004	0.004	0	0
Dallam	0.094	0.55	1.299	0.055	0.053	0	0.001
Dallas	18.759	14.797	397.74	1.893	1.779	0.026	0.048
Dawson	0.114	0.544	1.622	0.056	0.055	0	0.001
Deaf Smith	0.083	0.176	1.527	0.014	0.014	0	0.001
Delta	0.086	0.471	1.039	0.038	0.036	0	0.001
Denton	4.5	3.145	78.065	0.431	0.405	0.005	0.011
De Witt	0.142	0.24	2.58	0.027	0.026	0	0.001
Dickens	0.03	0.116	0.331	0.011	0.01	0	0
Dimmit	0.193	0.057	1.344	0.008	0.007	0	0
Donley	0.101	0.115	0.792	0.011	0.011	0	0
Duval	0.062	0.109	0.735	0.01	0.009	0	0
Eastland	0.265	0.232	3.34	0.024	0.023	0	0.001
Ector	0.753	0.816	14.665	0.07	0.066	0.001	0.002
Edwards	0.006	0.033	0.102	0.001	0.001	0	0
Ellis	0.989	1.863	15.669	0.17	0.163	0.003	0.004
El Paso	3.317	2.828	67.618	0.315	0.297	0.004	0.009
Erath	0.248	0.344	4.064	0.036	0.035	0	0.001
Falls	0.148	0.306	2.155	0.034	0.032	0	0.001
Fannin	0.273	0.408	4.513	0.047	0.045	0	0.001
Fayette	0.362	0.281	4.561	0.034	0.033	0	0.001
Fisher	0.051	0.212	0.539	0.021	0.021	0	0

County	VOC	NO_X	CO	PM_{10}-PRI	$PM_{2.5}$-PRI	SO_2	NH_3
Floyd	0.105	0.467	1.515	0.048	0.046	0	0.001
Foard	0.025	0.112	0.314	0.011	0.01	0	0
Fort Bend	3.36	2.331	62.13	0.341	0.32	0.004	0.008
Franklin	0.118	0.091	1.654	0.01	0.01	0	0
Freestone	0.153	0.152	2.351	0.016	0.015	0	0
Frio	0.123	0.148	1.194	0.015	0.014	0	0
Gaines	0.187	0.699	2.443	0.071	0.068	0	0.001
Galveston	2.046	1.687	30.628	0.183	0.173	0.003	0.006
Garza	0.037	0.119	0.522	0.011	0.011	0	0
Gillespie	0.316	0.202	4.428	0.024	0.023	0	0.001
Glasscock	0.027	0.192	0.28	0.019	0.018	0	0
Goliad	0.061	0.069	0.864	0.008	0.007	0	0
Gonzales	0.198	0.192	2.765	0.022	0.021	0	0.001
Gray	0.179	0.222	3.575	0.027	0.026	0	0.001
Grayson	1.145	0.874	16.003	0.105	0.099	0.001	0.002
Gregg	1.067	0.704	23.514	0.101	0.095	0.002	0.002
Grimes	0.328	0.214	4.966	0.027	0.026	0	0.001
Guadalupe	0.879	0.711	13.177	0.091	0.086	0.001	0.002
Hale	0.202	0.794	3.246	0.081	0.078	0.001	0.001
Hall	0.053	0.221	0.694	0.022	0.021	0	0
Hamilton	0.094	0.119	1.426	0.014	0.013	0	0
Hansford	0.067	0.284	1.088	0.029	0.028	0	0
Hardeman	0.111	0.161	0.938	0.017	0.017	0	0
Hardin	0.304	0.159	5.78	0.023	0.021	0	0.001
Harris	28.319	22.867	587.909	2.964	2.789	0.042	0.077
Harrison	0.595	0.603	8.851	0.054	0.051	0.001	0.002
Hartley	0.073	0.358	0.92	0.036	0.035	0	0.001
Haskell	0.11	0.48	0.989	0.048	0.046	0	0.001
Hays	0.823	0.682	11.809	0.079	0.074	0.001	0.002
Hemphill	0.041	0.095	0.604	0.007	0.007	0	0
Henderson	1.278	0.549	16.042	0.072	0.068	0.001	0.002
Hidalgo	3.754	2.128	47.432	0.286	0.27	0.004	0.007
Hill	0.569	0.605	5.782	0.066	0.063	0.001	0.001
Hockley	0.152	0.65	2.192	0.066	0.063	0	0.001
Hood	0.389	0.275	6.28	0.035	0.033	0.001	0.001
Hopkins	0.267	0.292	4.772	0.033	0.032	0	0.001
Houston	0.218	0.175	2.782	0.022	0.021	0	0
Howard	0.196	0.313	2.347	0.03	0.029	0	0.001
Hudspeth	0.086	0.152	0.572	0.012	0.012	0	0
Hunt	0.882	0.599	13.739	0.075	0.071	0.001	0.002

County	VOC	NO_X	CO	PM_{10}-PRI	$PM_{2.5}$-PRI	SO_2	NH_3
Hutchinson	0.126	0.309	1.802	0.021	0.02	0	0.001
Irion	0.015	0.029	0.291	0.002	0.002	0	0
Jack	0.084	0.113	1.214	0.009	0.009	0	0
Jackson	0.241	0.387	2.721	0.04	0.039	0	0.001
Jasper	0.366	0.191	5.128	0.019	0.018	0	0.001
Jeff Davis	0.079	0.038	0.59	0.004	0.004	0	0
Jefferson	2.146	1.473	38.615	0.183	0.172	0.003	0.005
Jim Hogg	0.027	0.154	0.299	0.011	0.011	0	0
Jim Wells	0.204	0.276	3.302	0.034	0.032	0	0.001
Johnson	0.738	0.845	13.074	0.091	0.087	0.001	0.003
Jones	0.265	0.509	3.023	0.052	0.05	0.001	0.001
Karnes	0.063	0.13	0.957	0.014	0.014	0	0
Kaufman	0.69	0.964	10.543	0.091	0.087	0.001	0.003
Kendall	0.818	0.295	10.156	0.05	0.047	0.001	0.001
Kenedy	1.843	0.893	9.472	0.027	0.026	0.002	0.002
Kent	0.018	0.091	0.261	0.008	0.007	0	0
Kerr	1.192	0.29	9.889	0.054	0.051	0.001	0.001
Kimble	0.085	0.041	0.635	0.004	0.004	0	0
King	0.008	0.03	0.046	0.002	0.002	0	0
Kinney	0.015	0.024	0.1	0.001	0.001	0	0
Kleberg	0.919	0.553	6.077	0.034	0.032	0.001	0.001
Knox	0.065	0.261	1.009	0.027	0.026	0	0
Lamar	0.301	0.462	5.109	0.049	0.047	0.001	0.001
Lamb	0.15	0.662	1.975	0.066	0.064	0	0.001
Lampasas	0.23	0.133	2.633	0.016	0.015	0	0
La Salle	0.122	0.133	0.647	0.008	0.008	0	0
Lavaca	0.144	0.229	2.708	0.025	0.024	0	0.001
Lee	0.206	0.2	2.706	0.019	0.018	0	0.001
Leon	0.14	0.185	2.05	0.018	0.017	0	0
Liberty	0.608	0.447	9.814	0.056	0.053	0.001	0.002
Limestone	0.25	0.243	2.993	0.023	0.022	0	0.001
Lipscomb	0.017	0.105	0.25	0.009	0.008	0	0
Live Oak	0.282	0.169	2.357	0.014	0.014	0	0
Llano	0.425	0.175	3.324	0.017	0.016	0	0.001
Loving	0.021	0.04	0.093	0.001	0.001	0	0
Lubbock	1.824	1.826	29.773	0.204	0.193	0.002	0.005
Lynn	0.114	0.646	1.359	0.062	0.06	0	0.001
McCulloch	0.061	0.155	0.686	0.014	0.014	0	0
McLennan	1.463	1.288	26.02	0.156	0.148	0.002	0.004
McMullen	0.151	0.103	0.73	0.005	0.005	0	0

County	VOC	NO_X	CO	PM_{10}-PRI	$PM_{2.5}$-PRI	SO_2	NH_3
Madison	0.085	0.094	1.332	0.01	0.009	0	0
Marion	0.233	0.171	2.236	0.011	0.01	0	0
Martin	0.058	0.261	0.807	0.025	0.024	0	0
Mason	0.081	0.052	0.63	0.006	0.006	0	0
Matagorda	1.705	1.041	13.246	0.068	0.065	0.001	0.002
Maverick	0.202	0.148	2.479	0.012	0.012	0	0
Medina	0.449	0.454	5.514	0.05	0.048	0.001	0.001
Menard	0.014	0.024	0.27	0.002	0.002	0	0
Midland	1.017	0.67	18.362	0.082	0.077	0.001	0.002
Milam	0.273	0.387	4.597	0.044	0.042	0.001	0.001
Mills	0.052	0.081	0.712	0.008	0.007	0	0
Mitchell	0.073	0.238	0.609	0.021	0.021	0	0.001
Montague	0.208	0.182	2.766	0.02	0.019	0	0
Montgomery	3.426	2.376	57.06	0.333	0.312	0.004	0.009
Moore	0.144	0.437	1.91	0.039	0.038	0	0.001
Morris	0.101	0.102	1.855	0.01	0.01	0	0
Motley	0.018	0.081	0.245	0.008	0.007	0	0
Nacogdoches	0.452	0.31	6.022	0.032	0.03	0.001	0.001
Navarro	0.64	0.443	9.617	0.06	0.056	0.001	0.001
Newton	0.22	0.061	2.261	0.011	0.01	0	0
Nolan	0.099	0.26	1.518	0.022	0.021	0	0.001
Nueces	3.167	2.465	42.794	0.254	0.24	0.004	0.007
Ochiltree	0.053	0.141	1.094	0.011	0.011	0	0
Oldham	0.017	0.081	0.285	0.005	0.005	0	0
Orange	0.67	0.386	10.142	0.053	0.049	0.001	0.001
Palo Pinto	0.407	0.259	4.671	0.025	0.023	0	0.001
Panola	0.365	0.238	3.987	0.023	0.021	0	0.001
Parker	1.188	0.71	19.089	0.092	0.086	0.001	0.003
Parmer	0.136	0.533	1.983	0.052	0.051	0	0.001
Pecos	0.244	0.138	1.664	0.014	0.013	0	0
Polk	0.629	0.245	6.832	0.028	0.026	0	0.001
Potter	0.97	0.733	13.472	0.078	0.073	0.001	0.002
Presidio	0.077	0.043	0.528	0.004	0.004	0	0
Rains	0.235	0.126	2.173	0.011	0.011	0	0
Randall	0.551	0.626	9.297	0.064	0.061	0.001	0.002
Reagan	0.027	0.086	0.399	0.008	0.008	0	0
Real	0.146	0.032	0.946	0.006	0.005	0	0
Red River	0.122	0.156	1.746	0.018	0.017	0	0
Reeves	0.079	0.239	0.7	0.01	0.009	0	0.001
Refugio	0.317	0.253	2.47	0.023	0.022	0	0.001

County	VOC	NO_X	CO	PM_{10}-PRI	$PM_{2.5}$-PRI	SO_2	NH_3
Roberts	0.008	0.064	0.088	0.004	0.004	0	0
Robertson	0.166	0.271	2.315	0.024	0.023	0	0.001
Rockwall	0.834	0.62	14.625	0.086	0.081	0.001	0.002
Runnels	0.113	0.408	1.477	0.042	0.041	0	0.001
Rusk	0.403	0.306	5.878	0.029	0.028	0	0.001
Sabine	0.532	0.199	4.009	0.013	0.012	0	0.001
San Augustine	0.338	0.156	2.456	0.008	0.008	0	0
San Jacinto	0.418	0.17	4.244	0.014	0.013	0	0
San Patricio	0.629	0.638	7.857	0.083	0.079	0.001	0.002
San Saba	0.059	0.109	0.732	0.009	0.009	0	0
Schleicher	0.014	0.049	0.249	0.004	0.004	0	0
Scurry	0.186	0.286	2.105	0.029	0.028	0	0.001
Shackelford	0.032	0.085	0.371	0.007	0.007	0	0
Shelby	0.387	0.199	4.86	0.022	0.02	0	0.001
Sherman	0.065	0.397	0.91	0.04	0.039	0	0.001
Smith	1.909	1.178	35.849	0.175	0.165	0.002	0.004
Somervell	0.309	0.105	2.403	0.014	0.013	0	0.001
Starr	0.175	0.573	2.009	0.042	0.04	0	0.002
Stephens	0.189	0.116	1.42	0.007	0.007	0	0
Sterling	0.006	0.038	0.12	0.001	0.001	0	0
Stonewall	0.024	0.091	0.233	0.009	0.008	0	0
Sutton	0.024	0.03	0.448	0.002	0.002	0	0
Swisher	0.067	0.323	1.002	0.032	0.031	0	0.001
Tarrant	10.647	8.495	208.808	1.058	0.995	0.014	0.026
Taylor	0.982	1.036	15.991	0.112	0.106	0.002	0.005
Terrell	0.01	0.091	0.093	0.008	0.008	0	0
Terry	0.105	0.522	1.38	0.053	0.051	0	0.001
Throckmorton	0.035	0.094	0.325	0.009	0.008	0	0
Titus	0.384	0.209	5.397	0.025	0.024	0	0.001
Tom Green	0.902	0.742	12.262	0.085	0.081	0.001	0.002
Travis	9.087	5.916	174.167	0.889	0.833	0.012	0.021
Trinity	0.469	0.115	3.493	0.018	0.017	0	0
Tyler	0.217	0.097	2.701	0.013	0.012	0	0
Upshur	0.289	0.159	5.235	0.024	0.022	0	0.001
Upton	0.016	0.053	0.369	0.004	0.004	0	0
Uvalde	0.556	0.257	3.97	0.036	0.035	0	0.001
Val Verde	0.718	0.289	5.221	0.024	0.023	0	0.001
Van Zandt	0.508	0.321	7.226	0.042	0.039	0.001	0.001
Victoria	0.496	0.449	9.005	0.056	0.053	0.001	0.001
Walker	0.429	0.195	4.677	0.027	0.025	0	0.001

County	VOC	NO_X	CO	PM_{10}-PRI	$PM_{2.5}$-PRI	SO_2	NH_3
Waller	0.577	0.327	10.241	0.052	0.049	0.001	0.001
Ward	0.041	0.063	0.583	0.004	0.004	0	0
Washington	0.509	0.301	8.382	0.044	0.041	0.001	0.001
Webb	1.409	2.244	21.066	0.172	0.164	0.003	0.006
Wharton	0.434	0.667	7.048	0.087	0.084	0.001	0.001
Wheeler	0.049	0.161	0.738	0.013	0.012	0	0
Wichita	0.715	0.759	12.332	0.081	0.077	0.001	0.002
Wilbarger	0.123	0.349	1.312	0.035	0.034	0	0.001
Willacy	0.825	0.601	4.599	0.035	0.034	0.001	0.001
Williamson	2.853	2.415	48.282	0.331	0.312	0.005	0.01
Wilson	0.266	0.256	4.35	0.03	0.029	0	0.001
Winkler	0.033	0.096	0.435	0.008	0.008	0	0
Wise	0.554	0.477	7.984	0.05	0.047	0.001	0.002
Wood	0.738	0.311	8.606	0.038	0.036	0.001	0.001
Yoakum	0.071	0.316	1.101	0.031	0.03	0	0.001
Young	0.273	0.164	2.705	0.018	0.017	0	0
Zapata	0.695	0.234	3.356	0.018	0.017	0	0.001
Zavala	0.049	0.088	0.438	0.009	0.008	0	0
Total*	**202.849**	**167.186**	**3344.342**	**19.95**	**18.849**	**0.234**	**0.5**

* Note that totals may not match the sum of counties due to rounding in the values by county. Additional significant digits in the EIs are available in the electronic file **Deliverable_4.1_AERR_Summary_Data_20240722.xlsx** that accompanies this report.

Table A-2. 2023 Annual Criteria Emissions by County (Tons/Year)

County	VOC	NO_X	CO	PM_{10}-PRI	$PM_{2.5}$-PRI	SO_2	NH_3
Anderson	121	71	1815	9	9	0	0
Andrews	20	38	331	3	3	0	0
Angelina	273	158	3658	17	16	0	0
Aransas	504	258	3657	12	11	0	1
Archer	43	43	459	3	3	0	0
Armstrong	4	29	51	2	2	0	0
Atascosa	107	83	1520	9	8	0	0
Austin	103	91	1560	10	10	0	0
Bailey	20	74	313	7	7	0	0
Bandera	223	40	1610	8	8	0	0
Bastrop	187	149	3003	18	17	0	1
Baylor	62	57	534	4	4	0	0
Bee	25	46	383	5	5	0	0
Bell	442	359	5940	42	39	1	1
Bexar	3714	2206	64943	346	323	5	8
Blanco	49	22	543	3	3	0	0
Borden	15	26	102	2	2	0	0
Bosque	112	61	1284	8	7	0	0
Bowie	207	178	3140	18	17	0	0
Brazoria	645	633	9200	60	57	1	2
Brazos	314	226	4999	30	28	0	1
Brewster	32	33	310	3	3	0	0
Briscoe	8	34	98	3	3	0	0
Brooks	66	34	409	3	3	0	0
Brown	114	172	1290	15	14	0	0
Burleson	80	63	967	7	6	0	0
Burnet	431	135	4229	22	20	0	1
Caldwell	79	68	786	8	7	0	0
Calhoun	798	506	5847	18	17	1	1
Callahan	55	42	663	4	4	0	0
Cameron	1218	697	12761	64	60	1	2
Camp	68	24	667	3	3	0	0
Carson	13	71	176	6	6	0	0
Cass	108	65	1576	7	7	0	0
Castro	22	118	288	12	11	0	0
Chambers	153	152	1629	10	9	0	0
Cherokee	109	86	1817	9	9	0	0
Childress	16	47	221	4	4	0	0
Clay	53	50	536	4	4	0	0

County	VOC	NO_X	CO	PM_{10}-PRI	$PM_{2.5}$-PRI	SO_2	NH_3
Cochran	14	82	192	8	8	0	0
Coke	54	38	445	2	2	0	0
Coleman	59	52	599	6	5	0	0
Collin	2100	1489	36605	220	206	3	5
Collingsworth	13	51	191	5	5	0	0
Colorado	107	102	1303	10	10	0	0
Comal	436	333	4807	37	35	1	1
Comanche	62	73	823	7	7	0	0
Concho	30	45	210	5	4	0	0
Cooke	179	127	2364	14	13	0	0
Coryell	56	80	726	8	7	0	0
Cottle	4	23	63	2	2	0	0
Crane	6	22	73	2	2	0	0
Crockett	22	14	190	1	1	0	0
Crosby	29	117	404	11	11	0	0
Culberson	3	25	35	1	1	0	0
Dallam	26	138	371	13	13	0	0
Dallas	5370	4522	108203	545	512	9	13
Dawson	30	134	454	14	13	0	0
Deaf Smith	25	50	471	4	4	0	0
Delta	25	135	307	10	10	0	0
Denton	1330	963	21694	126	118	2	3
De Witt	42	69	706	7	7	0	0
Dickens	8	30	101	3	3	0	0
Dimmit	56	18	413	2	2	0	0
Donley	30	31	252	3	3	0	0
Duval	19	31	236	3	3	0	0
Eastland	77	66	1053	7	7	0	0
Ector	217	243	4372	21	20	0	1
Edwards	2	9	32	0	0	0	0
Ellis	302	531	4532	47	45	1	1
El Paso	1020	854	19302	95	89	1	3
Erath	69	95	1165	10	9	0	0
Falls	46	81	673	9	8	0	0
Fannin	89	114	1416	13	12	0	0
Fayette	118	83	1459	10	9	0	0
Fisher	14	52	163	5	5	0	0
Floyd	28	115	431	12	11	0	0
Foard	7	29	93	3	3	0	0
Fort Bend	1012	709	17592	100	94	1	2

County	VOC	NO_X	CO	PM_{10}-PRI	$PM_{2.5}$-PRI	SO_2	NH_3
Franklin	40	29	549	3	3	0	0
Freestone	50	46	767	5	4	0	0
Frio	36	41	368	4	4	0	0
Gaines	51	172	720	17	17	0	0
Galveston	660	577	9371	55	52	1	2
Garza	10	31	147	3	3	0	0
Gillespie	93	59	1365	7	7	0	0
Glasscock	7	47	74	5	4	0	0
Goliad	22	21	295	2	2	0	0
Gonzales	64	56	879	6	6	0	0
Gray	57	63	1039	7	7	0	0
Grayson	355	269	4658	30	28	0	1
Gregg	311	220	6386	29	28	1	1
Grimes	104	65	1510	8	8	0	0
Guadalupe	272	210	3844	26	25	0	1
Hale	56	202	933	20	19	0	0
Hall	15	56	209	5	5	0	0
Hamilton	26	32	438	4	3	0	0
Hansford	19	72	313	7	7	0	0
Hardeman	33	42	290	4	4	0	0
Hardin	104	52	1845	8	7	0	0
Harris	8222	6962	162126	856	804	15	22
Harrison	198	190	2843	17	16	0	1
Hartley	20	90	262	9	8	0	0
Haskell	30	120	297	11	11	0	0
Hays	259	206	3516	24	22	0	1
Hemphill	13	27	183	2	2	0	0
Henderson	419	189	5120	23	21	0	1
Hidalgo	1180	649	14356	85	80	1	2
Hill	179	171	1880	18	17	0	0
Hockley	41	162	627	16	16	0	0
Hood	120	85	1812	10	10	0	0
Hopkins	90	85	1536	10	9	0	0
Houston	71	52	909	6	6	0	0
Howard	57	84	711	8	8	0	0
Hudspeth	25	40	173	3	3	0	0
Hunt	295	189	4337	23	21	0	1
Hutchinson	41	90	589	6	6	0	0
Irion	4	8	77	1	0	0	0
Jack	24	33	379	3	2	0	0

County	VOC	NO_X	CO	PM_{10}-PRI	$PM_{2.5}$-PRI	SO_2	NH_3
Jackson	81	113	915	10	10	0	0
Jasper	126	70	1720	7	6	0	0
Jeff Davis	24	11	174	1	1	0	0
Jefferson	662	489	10912	54	50	1	1
Jim Hogg	7	42	88	3	3	0	0
Jim Wells	60	77	957	9	8	0	0
Johnson	222	249	3710	26	25	0	1
Jones	77	132	950	13	13	0	0
Karnes	20	37	301	4	4	0	0
Kaufman	220	288	3202	26	25	0	1
Kendall	238	89	2941	15	14	0	0
Kenedy	666	400	4248	11	10	1	1
Kent	5	23	77	2	2	0	0
Kerr	353	89	2891	17	15	0	0
Kimble	25	12	198	1	1	0	0
King	2	8	17	0	0	0	0
Kinney	4	8	36	0	0	0	0
Kleberg	329	220	2450	11	10	0	0
Knox	18	66	299	6	6	0	0
Lamar	96	137	1547	13	13	0	0
Lamb	41	165	572	16	16	0	0
Lampasas	68	39	845	5	5	0	0
La Salle	36	40	217	2	2	0	0
Lavaca	48	65	863	7	7	0	0
Lee	66	59	861	5	5	0	0
Leon	46	54	674	5	5	0	0
Liberty	205	139	3194	17	16	0	0
Limestone	84	76	1017	7	6	0	0
Lipscomb	5	28	75	2	2	0	0
Live Oak	102	62	878	4	4	0	0
Llano	126	61	1101	5	5	0	0
Loving	7	12	41	0	0	0	0
Lubbock	529	522	8611	57	54	1	1
Lynn	30	160	377	15	14	0	0
McCulloch	18	41	218	4	3	0	0
McLennan	438	384	7369	45	42	1	1
McMullen	51	39	321	2	1	0	0
Madison	28	28	436	3	3	0	0
Marion	84	63	840	4	3	0	0
Martin	15	64	222	6	6	0	0

County	VOC	NO_X	CO	PM_{10}-PRI	$PM_{2.5}$-PRI	SO_2	NH_3
Mason	24	15	194	2	2	0	0
Matagorda	610	416	4989	21	20	1	1
Maverick	62	49	811	4	4	0	0
Medina	135	129	1763	14	13	0	0
Menard	4	7	84	1	1	0	0
Midland	286	201	5141	24	23	0	1
Milam	83	107	1363	12	11	0	0
Mills	15	22	228	2	2	0	0
Mitchell	21	63	196	5	5	0	0
Montague	61	54	898	6	5	0	0
Montgomery	1028	728	16175	98	92	1	2
Moore	45	119	605	10	10	0	0
Morris	34	32	590	3	3	0	0
Motley	5	21	69	2	2	0	0
Nacogdoches	148	105	1895	10	9	0	0
Navarro	201	131	2837	17	16	0	0
Newton	73	22	731	4	3	0	0
Nolan	27	69	451	6	5	0	0
Nueces	1065	833	13372	74	70	1	2
Ochiltree	17	39	342	3	3	0	0
Oldham	5	22	87	1	1	0	0
Orange	211	126	2907	16	15	0	0
Palo Pinto	123	86	1541	8	7	0	0
Panola	121	77	1327	7	7	0	0
Parker	380	214	5900	29	27	0	1
Parmer	38	135	583	13	12	0	0
Pecos	72	39	517	4	4	0	0
Polk	212	92	2341	9	9	0	0
Potter	306	226	4129	23	22	0	1
Presidio	23	13	162	1	1	0	0
Rains	82	45	782	4	3	0	0
Randall	167	185	2761	19	18	0	0
Reagan	8	22	121	2	2	0	0
Real	43	10	281	2	2	0	0
Red River	41	45	568	5	5	0	0
Reeves	23	68	235	3	3	0	0
Refugio	114	87	920	6	6	0	0
Roberts	2	17	27	1	1	0	0
Robertson	54	78	757	6	6	0	0
Rockwall	247	188	3962	25	23	0	1

County	VOC	NO_X	CO	PM_{10}-PRI	$PM_{2.5}$-PRI	SO_2	NH_3
Runnels	31	103	424	10	10	0	0
Rusk	137	98	1938	9	9	0	0
Sabine	183	86	1509	5	4	0	0
San Augustine	119	66	987	3	3	0	0
San Jacinto	145	69	1547	5	5	0	0
San Patricio	197	180	2262	22	21	0	0
San Saba	17	30	232	2	2	0	0
Schleicher	4	13	77	1	1	0	0
Scurry	54	76	639	8	7	0	0
Shackelford	9	23	119	2	2	0	0
Shelby	129	72	1586	7	6	0	0
Sherman	17	99	244	10	9	0	0
Smith	564	362	9784	51	48	1	1
Somervell	97	33	753	4	4	0	0
Starr	56	166	645	12	11	0	0
Stephens	58	42	524	2	2	0	0
Sterling	2	11	35	0	0	0	0
Stonewall	7	23	72	2	2	0	0
Sutton	7	9	139	1	1	0	0
Swisher	18	80	289	8	7	0	0
Tarrant	3112	2597	58038	311	292	5	7
Taylor	278	299	4510	32	30	1	1
Terrell	2	23	23	2	2	0	0
Terry	28	129	397	13	12	0	0
Throckmorton	10	25	106	2	2	0	0
Titus	127	69	1706	8	7	0	0
Tom Green	253	214	3529	24	23	0	1
Travis	2589	1778	45903	254	237	4	6
Trinity	153	41	1176	6	5	0	0
Tyler	75	34	900	4	4	0	0
Upshur	95	50	1629	7	7	0	0
Upton	4	14	109	1	1	0	0
Uvalde	167	73	1216	10	10	0	0
Val Verde	218	106	1779	8	7	0	0
Van Zandt	168	97	2327	13	12	0	0
Victoria	154	135	2609	16	15	0	0
Walker	134	64	1423	8	8	0	0
Waller	181	98	3007	15	14	0	0
Ward	12	18	182	1	1	0	0
Washington	158	92	2420	13	12	0	0

County	VOC	NO_X	CO	PM_{10}-PRI	$PM_{2.5}$-PRI	SO_2	NH_3
Webb	395	660	6148	49	47	1	2
Wharton	126	179	1916	22	21	0	0
Wheeler	14	43	229	3	3	0	0
Wichita	199	227	3548	23	22	0	1
Wilbarger	34	92	406	9	8	0	0
Willacy	295	226	1960	10	10	0	0
Williamson	849	711	13304	95	89	1	3
Wilson	89	73	1416	9	8	0	0
Winkler	9	24	133	2	2	0	0
Wise	180	143	2608	15	14	0	1
Wood	248	108	2844	12	11	0	0
Yoakum	19	79	306	8	7	0	0
Young	81	50	843	5	5	0	0
Zapata	211	87	1241	6	5	0	0
Zavala	14	24	140	2	2	0	0
Total*	**61432**	**50735**	**958412**	**5729**	**5390**	**65**	**118**

* Note that totals may not match the sum of counties due to rounding in the values by county. Additional significant digits in the EIs are available in the electronic file **Deliverable_4.1_AERR_Summary_Data_20240722.xlsx** that accompanies this report

Appendix B: Mapping of TERP Equipment and Fuel Type to SCCs for Modeling

TERP Equipment Type	TERP Fuel Type	SCC	SCC Description
AC/Refrigeration	Texas Low Emission Diesel (TxLED)	2270003060	Dsl - ACRefrigeration
Agricultural Tractors	Diesel	2270005015	Dsl - Agricultural Tractors
Agricultural Tractors	Gasoline	2265005015	4-Str Agricultural Tractors
Balers	Diesel	2270005025	Dsl - Balers
Bore/Drill Rigs	Diesel	2270002033	Dsl - Bore/Drill Rigs
Cement & Mortar Mixers	Diesel	2270002042	Dsl - Cement & Mortar Mixers
Chippers/Stump Grinders (Commercial)	Diesel	2270004066	Dsl - Chippers/Stump Grinders (com)
Chippers/Stump Grinders (Commercial)	Texas Low Emission Diesel (TxLED)	2270004066	Dsl - Chippers/Stump Grinders (com)
Combines	Diesel	2270005020	Dsl - Combines
Container Handling Equipment	Diesel	2270002057	Dsl - Rough Terrain Forklifts
Cranes	Diesel	2270002045	Dsl - Cranes
Crawler Tractors	Diesel	2270002069	Dsl - Crawler Tractor/Dozers
Crawler Tractors	Texas Low Emission Diesel (TxLED)	2270002069	Dsl - Crawler Tractor/Dozers
Crushing/Proc Equipment	Diesel	2270002054	Dsl - Crushing/Proc. Equipment
Dozers	Diesel	2270002069	Dsl - Crawler Tractor/Dozers
Dozers	Texas Low Emission Diesel (TxLED)	2270002069	Dsl - Crawler Tractor/Dozers
Draw Works	Diesel	2270010010	Dsl - Other Oil Field Equipment
Dump Trucks	Texas Low Emission Diesel (TxLED)	2270002078	Dsl - Dumpers/Tenders
Equipment	Diesel	exclude	not specific enough
Excavators	Diesel	2270002036	Dsl - Excavators
Excavators	Texas Low Emission Diesel (TxLED)	2270002036	Dsl - Excavators
Forklifts	Diesel	2270003020	Dsl - Forklifts
Forklifts	Electricity	Electric	
Forklifts	Gasoline	2265003020	4-Str Forklifts
Forklifts	LPG	2267003020	LPG - Forklifts
Forklifts	LPG/Gasoline	2267003020	LPG - Forklifts
Graders	Diesel	2270002048	Dsl - Graders
Haul Trucks	Diesel	2270002051	Dsl - Off-highway Trucks
Haul Trucks	Texas Low Emission Diesel (TxLED)	2270002051	Dsl - Off-highway Trucks
Hydro Power Units	Diesel	2270006035	Dsl - Hydro Power Units
Irrigation Sets	Diesel	2270005060	Dsl - Irrigation Sets
Light Commercial Air Compressors	Diesel	2270006015	Dsl - Air Compressors
Light Commercial Air Compressors	Electricity	Electric	
Light Commercial Gas Compressors	Diesel	2270006020	Dsl - Gas Compressors

TERP Equipment Type	TERP Fuel Type	SCC	SCC Description
Light Commercial Generator Sets	Diesel	2270006005	Dsl - Generator Sets
Light Commercial Pumps	Diesel	2270006010	Dsl - Pumps
Logging Feller/Buncher/Skidders	Diesel	2270007015	Dsl - Forest Eqp - Feller/Bunch/Skidder
Non-Road Switcher	Diesel	exclude	This is a locomotive
Non-Road Terminal Tractors	Diesel	2270003070	Dsl - Terminal Tractors
Off-Highway Tractors	Diesel	2270002075	Dsl - Off-Highway Tractors
Off-Highway Trucks	Diesel	2270002051	Dsl - Off-highway Trucks
Off-Highway Trucks	Gasoline	exclude	no SCC exists for this fuel type
On-Road Terminal Tractors	Diesel	2270003070	Dsl - Terminal Tractors
Other Agricultural Equipment	Diesel	2270005055	Dsl - Other Agricultural Equipment
Other Construction Equipment	Diesel	2270002081	Dsl - Other Construction Equipment
Other General Industrial Equipment	Diesel	2270003040	Dsl - Other General Industrial Eqp
Other Material Handling Equipment	Diesel	2270003050	Dsl - Other Material Handling Eqp
Other Oil Field Equipment	Diesel	2270010010	Dsl - Other Oil Field Equipment
Pavers	Diesel	2270002003	Dsl - Pavers
Paving Equipment	Diesel	2270002003	Dsl - Pavers
Rollers	Diesel	2270002015	Dsl - Rollers
Rollers	Texas Low Emission Diesel (TxLED)	2270002015	Dsl - Rollers
Rough Terrain Forklifts	Diesel	2270002057	Dsl - Rough Terrain Forklifts
Rubber Tire Loaders	Diesel	2270002060	Dsl - Rubber Tire Loaders
Rubber Tire Loaders	LPG	2267002060	LPG - Rubber Tire Loaders
Rubber Tire Loaders	Texas Low Emission Diesel (TxLED)	2270002060	Dsl - Rubber Tire Loaders
Scrapers	Diesel	2270002018	Dsl - Scrapers
Skid Steer Loaders	Diesel	2270002072	Dsl - Skid Steer Loaders
Skid Steer Loaders	Texas Low Emission Diesel (TxLED)	2270002072	Dsl - Skid Steer Loaders
Sprayers	Diesel	2270005035	Dsl - Sprayers
Surfacing Equipment	Diesel	2270002024	Dsl - Surfacing Equipment
Surfacing Equipment	Texas Low Emission Diesel (TxLED)	2270002024	Dsl - Surfacing Equipment
Swathers	Diesel	2270005045	Dsl - Swathers
Sweeper/Scrubbers	CNG	2268003030	CNG - Sweepers/Scrubbers
Sweeper/Scrubbers	Diesel	2270003030	Dsl - Sweepers/Scrubbers
Terminal Tractors	Diesel	2270003070	Dsl - Terminal Tractors
Terminal Tractors (Non-Road)	Diesel	2270003070	Dsl - Terminal Tractors
Tractor Backhoe Loaders	Diesel	2270002066	Dsl - Tractors/Loaders/Backhoes
Tractor Backhoe Loaders	Texas Low Emission Diesel (TxLED)	2270002066	Dsl - Tractors/Loaders/Backhoes