# New Mexico Climate Pollution Reduction Grant Greenhouse Gas Emissions Inventory Quality Assurance Review: Quantitative & Qualitative Analysis

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This analysis of the results and methodologies used in the State and Federal emissions inventories for New Mexico was developed according to the New Mexico Environment Department (NMED) Climate Pollution Reduction Grant (CPRG) Quality Assurance Project Plan (QAPP) Revision 3, dated August 19, 2025 and signed by EPA on August 26, 2025. The QA review supports grant number 02F36101 with a period of performance from July 3rd, 2023, to June 30, 2027.

Analysis was performed by Samantha Valentine and Maxine Paul of Adelante Consulting and Mark Edwards of NMED. The analysis report was drafted by Samantha Valentine and Maxine Paul of Adelante Consulting and Mark Edwards of NMED.

NMED's published oil and gas sector and economy-wide greenhouse gas (GHG) emissions inventories published prior to the date on which the QAPP Revision 3 was drafted and approved were reviewed. These inventories include (in reverse chronological order in terms of report date):

- New Mexico Greenhouse Gas Emissions Inventory and Forecast: 2021 Emissions Inventory and 2030-2050 Forecast, Energy and Environmental Economics Inc. (E3), dated December 2024
- New Mexico Oil and Gas Greenhouse Gas Emissions Inventory for Year 2005, Eastern Research Group, Inc. (ERG), dated December 2024
- New Mexico Oil and Gas Greenhouse Gas Emissions Inventory for Year 2020, ERG, dated August 2022 (note that results were scaled to calendar year 2021 by E3 and incorporated into the economy-wide calendar year 2021 inventory; the scaled 2021 values are the subject of this quantitative QA review)
- New Mexico Greenhouse Gas Emissions Inventory and Forecast (calendar year 2018), E3, dated October 2020

A calendar year 2005 baseline inventory estimate was provided in both the December 2024 E3 report and the October 2020 E3 report. The December 2024 E3 report uses updated and improved methods, and the baseline calendar year 2005 values supersede those provided in the October 2020 report; therefore, only the 2005 values provided in the December 2024 E3 report were evaluated here.

In this QA review, a quantitative comparison of GHG emissions by sector between state emissions inventories and the U.S. Environmental Protection Agency's (EPA's) GHG emissions inventory disaggregated to the NM state level was performed[1]. Where the absolute value of differences between sector emissions of greater than 5% were observed, a qualitative evaluation of the reason(s) for the difference was subsequently performed. The equation used to compute the percent difference between the State and Federal inventories for each sector is as follows:

$$\text{Percent Difference} = \frac{\text{State estimate} - \text{Federal Estimate}}{\left(\frac{\text{State estimate} + \text{Federal Estimate}}{2}\right)} \times 100\%$$

The data source used for this comparison is derived from the 1990–2021 Federal GHG emissions inventory disaggregated to the state level as outlined in the QAPP for this project; the New Mexico state-wide values from the subsequent 1990–2022 disaggregated inventory may vary from the values presented here due to changes in methods, assumptions, or underlying datasets used by EPA in the development in the annually updated disaggregated inventory. The comparison between changes in emissions estimates for the same sector and calendar year across different releases of the disaggregated Federal inventory is outside the scope of this document.

**Task 1 – Oil and Gas**:

- The available State inventory reports were reviewed by a technical reviewer. Analytical methods and results were deemed to be clearly explained, technical terms are defined, conclusions are reasonable based on information presented, and level of technical detail is appropriate.
- The State total oil and gas estimate for 2021 is 34.39 million metric tons (MMT) carbon dioxide equivalent ($CO_2e$). The Federal total oil and gas estimate for the state of NM in 2021 is 19.91 MMT $CO_2e$. The State total oil and gas estimate for 2021 is 53% greater than the Federal estimate for the state of NM in 2021, which is greater than the 5% difference threshold, indicating a need for a qualitative evaluation of methods (Table 1).
- The State total oil and gas estimate for 2018 is 60.40 MMT $CO_2e$. The Federal total oil and gas estimate for the state of NM in 2018 is 19.49 MMT $CO_2e$. The State total oil and gas estimate for 2018 is 102% greater than the Federal estimate for the state of NM in 2018, which is greater than the 5% difference threshold, indicating a need for a qualitative evaluation of methods (Table 1).
- The State total oil and gas estimate for 2005 is 38.82 MMT $CO_2e$. The Federal total oil and gas estimate for the state of NM in 2005 is 19.11 MT $CO_2e$. The State total oil and gas estimate for 2005 is 68% greater than the Federal estimate for the state of NM in 2005, which is greater than the 5% difference threshold, indicating a need for a qualitative evaluation of methods (Table 1).

[1] https://www.epa.gov/system/files/other-files/2023-02/State-Level-GHG-data.zip, accessed June 6, 2025

- **2021 State estimate method:**
    - GHGRP emissions data used for the majority of emissions sources (subparts W and C)
    - 2021 values were calculated from 2020 values via a scaling factor for the processing and transmission sectors
        - The values in the 2020 NM O&G Inventory produced by ERG used a methane ($CH_4$) global warming potential (GWP) of 27. When scaled to 2021, a GWP of 28 was applied by E3 in order to remain consistent with the rest of the GHGI
    - NMED Minor Source Emissions Inventory (MSEI) emissions data was used for gathering and boosting, natural gas processing, and transmission and storage stations that were not collected by the GHGRP
        - The NMED MSEI, first collected in 2020, collects CAP and GHG emissions data for all oil and gas facilities in operation regardless of permit, and those that are below the GHGRP subpart W reporting threshold of 25,000 MT of $CO_2e$ per year
        - Companies reporting to the NMED MSEI were required to follow subpart W and subpart C methodologies and only included data for NM operations
        - Data from over 40 oil and gas organizations was collected in 2020
            - Each organization can have hundreds of facilities with multiple types of equipment
    - The following sources in each industry segment used emissions data sources other than the GHGRP subpart W or the EPA GHGI (Federal estimate method)
        - Exploration and Production
            - Mud Degassing: NEI tool and $CO_2$:$CH_4$ ratio
            - Well Pad Equipment Leaks: Pasci et al. 2019 and Rutherford et al. 2021 studies for emissions factors and well data from NM OCD. Used $CO_2$:$CH_4$ ratio for $CO_2$ emissions.
            - Hydrocarbon Liquid Storage Tank Unloading: NEI tool and $CO_2$:$CH_4$ ratio
        - Gathering and Boosting
            - Station leaks, compressor venting and storage tanks: emissions data from a CH4 emissions measurement study (Zimmerle et al. 2020)
        - Transmission and Storage:
            - Reciprocating compressors: partially subpart W and emissions factors from a PRCI white paper. Used $CO_2$:$CH_4$ ratio for $CO_2$ emissions.
            - Centrifugal compressors: partially subpart W and emissions factors from a PRCI white paper. Used $CO_2$:$CH_4$ ratio for $CO_2$ emissions.
        - Internal Combustion Engine Exhaust
            - $CH_4$ emissions factor data for natural gas-fired ICE exhaust

                - Emissions factors from AP-42 used for all O&G industry segments
                - Fractions of rich burn and lean burn 4-stroke natural gas engines developed from NMED MSEI
                - Composite emissions factors developed for production, G&B, processing and transmission segments based on AP-42 emission factors and engine fractions from NMED MSEI
            - Inactive Wells
                - Emissions factors from Townsend-Small et al. 2016 and 2021 used for plugged and unplugged inactive wells
    - Two types of facilities were evaluated for each industry segment:
        - Group 1: facilities for which emissions data are available (GHGRP subpart W and NMED MSEI)
        - Group 2: facilities for which emissions data are not available
            - Emissions estimates for Group 2 facilities were developed using data from the Group 1 facilities[2]
    - This methodology includes an estimate of emissions from both fuel combustion and fugitive emissions associated with oil and gas activities[3]

- **2018 State estimate method:**
    - Methods employed for the 2018 State oil and gas sector inventory differ substantially from methods used in the ERG inventories for 2005 and 2020 (the latter of which was scaled to 2021 by E3).
    - The primary source of emissions information for the 2018 inventory is the Western Regional Air Partnership (WRAP) oil and gas working group, which performed a study estimating oil and gas emissions in New Mexico from 2014 to 2016 that was subsequently scaled to 2018 by E3.
    - The E3 2018 state inventory report cites a report entitled “Revised Final Report: 2028 Future Year Oil and Gas Emission Inventory for WESTAR-WRAP States - Scenario #1: Continuation of Historical Trends” as a primary source of information regarding the WRAP 2014 to 2016 GHG emissions inventory for New Mexico. However, that report does not contain 2014-2016 emissions inventory information for New Mexico, nor for the specific basins that are scaled by E3 to compute 2018 emissions as shown in the 2018 E3 report. The WRAP 2028 Future Year Report *does* include references to earlier studies with emissions inventory information; however, links to those studies are no longer active so a detailed analysis of the data that were scaled to 2018 is not possible.
    - The E3 2018 report does contain information about the scaled WRAP 2014–2016 data and scaling methods, which are described here.
        - Fuel combustion emissions, fugitive methane emissions, non-fuel combustion emissions, and “WRAP emissions” (interpreted to mean other sources included in the WRAP inventory not included in previous

[2] p.32 of the 2020 NM O&G GHGI
[3] p.10 of the 2021 NM GHGI

categories) are scaled based on a production forecast and a projected emissions intensity for New Mexico, where the emissions intensity is interpolated from values provided for 2014–2016 and 2023.
        - Downstream fuel combustion emissions not included in the WRAP inventory used EIA State Energy Data System (SEDS) information to allocate fuel demand to the oil and gas industry for fuels typically associated with the oil and gas industry, such as petroleum coke and still gas.
        - Natural gas transmission and distribution fugitive emissions—which are not included in the WRAP inventory estimate—were calculated using the EPA SIT tool.

- **2005 State estimate method:**
    - Methods for the 2005 inventory (ERG, December 2024) are substantively the same as those used in the 2021 inventory except for the scaling from calendar year 2020 to 2021 which was not performed for 2005; therefore, the description of 2021 methods above can be referred to for 2005.

- **Federal estimate method:**
    - Oil and gas industry emissions are reported under the “Energy” sector of the inventory by IPCC category and under the “Industrial” sector of the inventory by economic sector. Oil and gas emissions are categorized into three sources: natural gas systems, petroleum systems, and abandoned oil and gas wells.
    - Excludes all combustion emissions except for flaring $CO_2$ emissions (did not use GHGRP subpart C)
    - All combustion emissions except for flaring are included in the fossil fuel combustion section
        - EPA fossil fuel combustion emissions are not broken down by fuel type or source, therefore the fossil fuel combustion emissions associated with oil and gas activities are unable to be disaggregated without more information than is publicly available.
    - “Petroleum systems” include emissions from:
        - Fugitive emissions from leaks, venting and flaring like those from onshore and offshore crude oil production, transportation and refining operations.
    - “Natural Gas systems” include emissions from:
        - Fugitive emissions from leaks, venting and flaring like those from normal operations (natural gas engine and turbine uncombusted exhaust, flaring and leak emissions), routine maintenance (pipelines, equipment and wells during repair and maintenance activities) and system upsets (pressure surge relief systems and accidents)
        - Hundreds of thousands of wells, hundreds of processing facilities, and over a million miles of gathering, transmission and distribution pipelines were analyzed for the national inventory
    - “Abandoned Oil and Gas Wells" includes emissions from:

        - Wells with no recent production that are not plugged and wells that have been plugged to prevent migration of gas or fluids
    - Both Petroleum and Natural Gas Systems use a “hybrid” approach to estimate state-level emissions:
        - Approach 1: Estimates built by applying national methods directly to geographically disaggregated data (at the state or finer level).
        - Approach 2: Estimates disaggregated from national-level estimates using geographic proxies or other indicators (e.g. population, production capacity, GHGRP). A key factor in this approach is how well emissions correlate with proxies.
    - Abandoned Oil and Gas Wells use Approach 1 to estimate state level emissions
    - Data Sources:
        - Petroleum Systems
            - Exploration and Production
                - Primarily used emissions data collected by the GHGRP
                - For sources where recent data are unavailable from the GHGRP, emissions factors from GRI/EPA (1996) and Radian (1999) studies were used
                - Oil well counts and production levels from Enverus and total crude oil production from the EIA
                - State level proxy data sets that were used include the fraction of oil wells in each state relative to national totals, the number of oil well completions without hydraulic fracturing in each state, and the total volume of oil produced in each state, all from the Enverus time series of oil and gas well data
            - Crude Oil Transport
                - Combination of crude oil transportation and pipeline and crude deliveries data from the EIA, the American Petroleum Institute, and the Oil and Gas Journal
                - Vented emissions from truck loading and rail loading were allocated based on onshore levels of oil well production in each state from Enverus
                - All other transport emissions (tanks, pump stations, floating roof tanks) were allocated based on the relative state counts of oil refineries from GHGRP subpart Y
            - Refineries
                - Data from GHGRP subpart Y and national level activity data
                - Activities not reported to the GHGRP were estimated using data from Radian (1999)
                - State-level estimates were based on that state’s share of refinery emissions of each gas as reported to GHGRP subpart Y

- Natural Gas Systems
  - Exploration and Production
    - Data collected from the GHGRP for most sources and data from a GRI/EPA 1996 study for sources where recent data are unavailable
    - Zimmerle et al. (2019) was also used and production and well count data were from Enverus
    - Emissions data was scaled to the state level using either well counts or gas production from Enverus
    - "Emissions from gathering and boosting were allocated based on the relative emissions in each state of all other production sources"[4] implies that gathering and boosting emissions were included in the exploration and production category
  - Processing
    - Data collected from the GHGRP for most sources and data from a GRI/EPA 1996 study for sources where recent data are unavailable
    - Key activity data include processing plant counts from the Oil and Gas Journal
    - Disaggregated national level estimates based on the fraction of national onshore marketed natural gas production occurring in each state (EIA 2023)
  - Transmission and Storage
    - Used emissions data collected by the GHGRP and data from a Zimmerle et al. (2015) study for most sources
    - Used data from GRI/EPA (1996) for sources where recent data are unavailable
    - Key activity data include transmission stations (PHMSA and FERC data), storage stations (Zimmerle et al. and EIA data), and transmission pipeline miles (PHMSA 2024)
    - Disaggregated national level estimates based on the fraction of national transmission pipeline mileage occurring in each state
    - Anomalous events added to storage emission totals
  - Distribution
    - Used emissions data collected by the GHGRP and data from a Lamb et al. (2015) study for most sources
    - Used data from GRI/EPA (1996) for sources where recent data are unavailable
    - Key activity data include pipeline mileage by material (PHMSA), metering and regulation station counts (GHGRP

[4] https://www.epa.gov/system/files/documents/2024-09/method-report_ghgibystate-508-september.pdf

subpart W), and number of natural gas residential, commercial, and industrial consumers (EIA)
- Went from national level to state level based on the relative pipeline mileage by material (cast iron, unprotected/protected steel, plastic) in each state, the relative number of natural gas residential, commercial, and industrial consumers in each state from EIA, and the number of above- and below-grade stations in each state as reported to the GHGRP (scaled up by the ratio of PHMSA to GHGRP pipeline mileage in each state to include non-reporters).

- Post-meter sources
  - Sources include leak emissions from residential and commercial appliances, industrial facilities and power plants, and natural gas fueled vehicles
  - Key activity data include counts of homes with natural gas appliances (American Housing Survey), the number of commercial natural gas customers (EIA), natural gas consumption volumes for industrial and electric generating units (EIA), and counts of CNG vehicles (EPA MOVES)
  - Emissions from residential and commercial appliances were allocated to states using the relative number of residential and commercial natural gas customers in each state from EIA
  - "Industrial and electric generating unit emissions were allocated based on the relative consumption volumes from the EIA SEDS and compressed natural gas vehicles were allocated to the number of compressed natural gas vehicles in each state, derived from the MOVES model."[5]

- Abandoned Oil and Gas Wells
  - Key data sources include Kang et al. (2016) and Townsend-Small et al. (2016) for emissions factors and the Enverus database and "historical state level datasets" for abandoned well counts
  - Well type and plugging status derived from Enverus

- **Comparison of 2021 Oil and Gas Methods**
  - The 2020 and scaled 2021 State and Federal methods for estimating oil and gas emissions for New Mexico rely heavily on the GHGRP. The State method also relies on GHGRP information reported in subparts W (petroleum and natural gas systems) and C (general stationary fuel combustion sources).
    - Components included in the State method that are not included in the Federal method include emissions estimates from facilities reporting to

[5] https://www.epa.gov/system/files/documents/2024-09/method-report_ghgibystate-508-september.pdf

the NM MSEI and emissions from fuel combustion (Fuel combustion accounts for 46% of the State method 2021 O&G emissions).[6]

- By assuming that 72% of industrial combustion emissions in New Mexico are from the oil and gas industry (this was estimated in the 2018 inventory; see Industry section below), the Federal estimate for oil and gas emissions in 2021 would increase to 25.62 MMT $CO_2e$, still substantially less than the State estimate of 34.39 MMT $CO_2e$. Therefore, some—but not all—of the discrepancy between the state and federal estimates can be accounted for by the inclusion or exclusion of combustion emissions from the oil and gas sector.

- Components included in the Federal method that are not included in the State method include natural gas distribution and post-meter sources and petroleum refining and transportation (These sources account for 1.7% of the Federal method's State O&G emissions).[7]

- Across sectors, the State method uses more *recent* and *local* emissions factors than the Federal method.
  - For example, within the Exploration and Production sector, the Federal estimate uses emissions factors from GRI/EPA (1996) and Radian (1999) studies while the State method uses Pasci et al. (2019) and Rutherford et al. (2021) estimates for production well pad equipment leaks which contain measurement data from the Western U.S.
  - For inactive/abandoned oil and gas wells, the Federal method uses Kang et al. (2016) and Townsend-Small et al. (2016) for emissions factors, while the State method uses Townsend-Small et al. (2016) and Townsend-Small et al. (2021). The State method studies use measured data from the Western U.S. and the Permian Basin while the Federal method studies use measured data from both the Western and Eastern U.S.
  - For internal combustion engine exhaust across sectors, the Federal method uses a single emission factor for all engine types combusting natural gas, based on the 1996 GRI/EPA study. This emissions factor does not account for engine technology type (i.e., rich burn and lean burn).[8] The State method developed specific emissions factors for ICE exhaust in each sector based on AP-42 emissions factors and engine fractions from NMED MSEI.
- A potential source of the difference in Exploration and Production emissions between the two methods is the different datasets used for well counts.
  - Emissions for well pad equipment leaks, which used well data from NM OCD, account for 29% the State method Exploration and Production

[6] Table 49 in NM O&G GHGI
[7] Quantitative QC Excel spreadsheet
[8] p.29 of NM O&G GHGI

emissions[9]. The Federal method used a database from Enverus for both scaling and calculating Exploration and Production emissions. It is likely that the NM OCD well count is more appropriate than the Enverus well count because it is a New Mexico-specific, measurement-based dataset. Both methods estimate emissions for sources where data are unavailable.

- The use of more recent and local data sets in the State method compared to the Federal method suggests that the State's method is more accurate.
  - The Federal method includes some sources of emissions that the State method does not include. The State method also includes sources that the Federal method does not.
  - Emissions included in the State method that are not included in the Federal method are of a much greater magnitude, which contributes to the 72% greater O&G emissions estimate via the State method compared to the Federal method.

- **Comparison of 2018 Oil and Gas Methods**
  - Based on the lack of information available about the 2018 State oil and gas methods, a detailed comparison between the State and Federal methods cannot be performed.

- **Comparison of 2005 Oil and Gas Methods:**
  - Methods for the 2005 inventory (ERG, December 2024) are similar to those used in the 2020/2021 inventory; therefore, the comparison of 2020/2021 methods above is applicable to the 2005 inventory.

Table 1 – New Mexico Oil & Gas Industry Emissions Estimate Comparison

| Year | State Estimate (MMT $CO_2e$) | Federal Estimate (MMT $CO_2e$) | Percent Difference |
|---|---|---|---|
| 2021 | 34.39 | 19.91 | 53% |
| 2018 | 60.40 | 19.49 | 102% |
| 2005 | 38.82 | 19.11 | 68% |

- **Editor Review**
  - The State inventories were reviewed for writing clarity and the presence of grammatical and typographical errors. The writing was identified as being clear, and the following grammatical or typographical errors were identified.
    - MMT unit error in table 3 in 2021 NM GHGI (should be in MT, not Million MT) based on 2020 oil and gas inventory values, which are listed as MT.
    - The header of the 2021 NM GHGI inventory contains a typo: "IntroductionNew Mexico Greenhouse Gas Emissions Inventory and

[9] Table 3 in the 2021 NM GHGI

ForecastNew Mexico Greenhouse Gas Emissions Inventory and Forecast".

**Task 2 – Transportation Sector**:

- The State inventories were reviewed by a technical reviewer. Analytical methods and results were deemed to be clearly explained, technical terms are defined, conclusions are reasonable based on information presented, and level of technical detail is appropriate.

- The 2021 State estimate for transportation emissions is 16.77 MMT $CO_2e$. The 2021 Federal estimate for the state of NM is 16.90 MMT $CO_2e$. The State 2021 estimate is 0.8% less than the Federal 2021 estimate for the state of NM, which is less than the 5% difference threshold needed for a qualitative evaluation of methods (Table 2).

- The 2018 State estimate for transportation emissions is 15.80 MMT $CO_2e$. The 2018 Federal estimate for the state of NM is 15.57 MMT $CO_2e$. The State 2018 estimate is 1.5% greater than the Federal 2018 estimate for the state of NM, which is less than the 5% difference threshold needed for a qualitative evaluation of methods (Table 2).

- The 2005 State estimate for transportation emissions is 15.85 MMT $CO_2e$. The 2005 Federal estimate for the state of NM is 16.09 MMT $CO_2e$. The State 2005 estimate is 1.5% less than the Federal 2005 estimate for the state of NM, which is less than the 5% difference threshold needed for a qualitative evaluation of methods (Table 2).

Table 2 – New Mexico Transportation Emissions Estimate Comparison

| Year | State Transportation Emissions Estimate (MMT CO2e) | Federal Transportation Emissions Estimate (MMT CO2e) | Percent Difference |
|---|---|---|---|
| 2021 | 16.77 | 16.90 | -0.8% |
| 2018 | 15.80 | 15.57 | 1.5% |
| 2005 | 15.85 | 16.09 | -1.5% |

- **Editor Review**
  - The State inventories were reviewed for writing clarity and the presence of grammatical and typographical errors. The writing was identified as being clear, and the following grammatical or typographical errors were identified.
    - Typo in Table 9 of 2021 NM GHGI under "Transportation" row and "2030 Mitigation (MMT CO2e)" column, value for Diesel should be 6.64 instead of "6064".

**Task 3 – Electric Generation Sector**:

- The State inventories were reviewed by a technical reviewer. Analytical methods and results were deemed to be clearly explained, technical terms are defined, conclusions are reasonable based on information presented, and level of technical detail is appropriate.

- The 2021 State estimate is 10.31 MMT $CO_2e$. The 2021 Federal estimate for the state of NM is 17.67 MMT $CO_2e$. The 2021 State estimate is 53% less than the 2021 Federal estimate for the state of NM, which is greater than the 5% difference threshold, indicating a need for a qualitative evaluation of methods (Table 3).

- The 2018 State estimate is 12.10 MMT $CO_2e$. The 2018 Federal estimate for the state of NM is 18.85 MMT $CO_2e$. The 2018 State estimate is 44% less than the 2018 Federal estimate for the state of NM, which is greater than the 5% difference threshold, indicating a need for a qualitative evaluation of methods (Table 3).

- The 2005 State estimate is 16.33 MMT $CO_2e$. The 2005 Federal estimate for the state of NM is 33.23 MMT $CO_2e$. The 2005 State estimate is 68% less than the 2005 Federal estimate for the state of NM, which is greater than the 5% difference threshold, indicating a need for a qualitative evaluation of methods (Table 3).

- **2021 State estimate method:**
  - Considered all in-state generating units where the State has regulatory authority
  - Used historical eGrid data[10]
  - Excluded Four Corners power plant emissions and generation because it does not fall under State authority

- **2018 State estimate method:**
  - The same methods described in the 2018 State inventory section above were used to compute 2005 electricity sector emissions.

- **2005 State estimate method:**
  - The same methods described in the 2021 State inventory section above were used to compute 2005 electricity sector emissions.

- **Federal estimate method:**
  - Determined total fuel consumption by fuel type and sector from EIA's SEDS
    - adjusted to match national totals as applicable
  - Multiplied by default emissions factors for each fuel type
  - "For fuels where the SEDS totals did not match the national totals (i.e., coal, natural gas, and petroleum coke), fuel use in each sector was adjusted to match

[10] https://www.epa.gov/egrid/historical-egrid-data

the national totals used in the national inventory. This calculation was based on the percentage of each fuel used in each state from the SEDS data."[11]

- **Comparison of State and Federal Methods:**
  - Because eGrid is a database of EIA data—and both NMED and EPA use EIA data to estimate electricity sector emissions—the primary difference between the two methods is determined to be the inclusion (Federal method) or exclusion (State method) of the Four Corners power plant emissions and generation. The Four Corners power plant is situated within the geographical boundaries of New Mexico on Navajo Nation land. It is operated by the Arizona Public Service Company and provides power to locations in Arizona and New Mexico (13% NM). Due to Navajo Nation Tribal sovereignty, the State of New Mexico does not have regulatory authority over the Four Corners power plant. Therefore, the State method is determined to be more accurate because the scope of the inventory is defined as where the state has regulatory authority.

  - To illustrate how the inclusion or exclusion of the Four Corners power plant explains the differences between the State and Federal electricity sector emissions estimates, 100% of Four Corners electric generation emissions in 2021 were added to the State estimate (from the same database that the State estimate was derived from - eGrid 2021 data)[12] to compare to the Federal estimate for the state of NM, which included electric generation from the Four Corners power plant. In this scenario, the State's electricity sector emissions estimate would be 18.10 MMT $CO_2e$, while the federal estimate for the state of NM remains at 17.67 MMT $CO_2e$. In this scenario, the State estimate is only 2.4% greater than the Federal estimate for the state of NM. The inclusion or exclusion of the Four Corners power plant electric generation emissions accounts for the majority of the difference between the two methods.

Table 3 - New Mexico Electricity Generation Emissions Estimate Comparison

| Year | State Electricity Emissions Estimate (MMT $CO_2e$) | Federal Electricity Emissions Estimate (MMT $CO_2e$) | Percent Difference |
|---|---|---|---|
| 2021 | 10.31 | 17.67 | -53% |
| 2018 | 12.10 | 18.85 | -44% |
| 2005 | 16.33 | 33.23 | -68% |

- **Editor Review**

[11] p.2-6 of the Methodology Report: Inventory of U.S. GHG Emissions and Sinks by State
[12] https://www.epa.gov/egrid/historical-egrid-data

- The State inventories were reviewed for writing clarity and the presence of grammatical and typographical errors. The writing was identified as being clear, and no grammatical or typographical errors were identified.

**Task 4 – Commercial and Residential Buildings Sector**:

- The State inventories were reviewed by a technical reviewer. Analytical methods and results were deemed to be clearly explained, technical terms are defined, conclusions are reasonable based on information presented, and level of technical detail is appropriate.

  The 2021 State estimate of residential emissions is 2.36 MMT $CO_2e$, compared to the Federal estimate of New Mexico residential emissions of 2.51 MMT $CO_2e$ during the same year. The 2021 State residential estimate is 6.2% less than the 2021 Federal residential estimate for the state of NM, which is greater than the 5% difference threshold, indicating a need for a qualitative evaluation of methods (Table 4).

- The 2021 State estimate of commercial emissions is 1.79 MMT $CO_2e$, compared to the Federal estimate of New Mexico commercial emissions of 3.05 MMT $CO_2e$ during the same year. The 2021 State commercial estimate is 52% less than the Federal commercial estimate for the state of NM, which is greater than the 5% difference threshold, indicating a need for a qualitative evaluation of methods (Table 4).

- The 2018 State estimate of residential emissions is 2.20 MMT $CO_2e$, compared to the Federal estimate of New Mexico residential emissions of 2.35 MMT $CO_2e$ during the same year. The 2018 State residential estimate is 6.7% less than the 2018 Federal residential estimate for the state of NM, which is greater than the 5% difference threshold, indicating a need for a qualitative evaluation of methods (Table 4).

- The 2018 State estimate of commercial emissions is 1.70 MMT $CO_2e$, compared to the Federal estimate of New Mexico commercial emissions of 3.10 MMT $CO_2e$ during the same year. The 2018 State commercial estimate is 58% less than the Federal commercial estimate for the state of NM, which is greater than the 5% difference threshold, indicating a need for a qualitative evaluation of methods (Table 4).

- The 2005 State estimate of residential emissions is 2.37 MMT $CO_2e$, compared to the Federal estimate of New Mexico residential emissions of 2.41 MMT $CO_2e$ during the same year. The 2005 State residential estimate is 1.6% less than the 2005 Federal residential estimate for the state of NM, which is less than the 5% difference threshold, indicating no need for a qualitative evaluation of methods (Table 4).

- The 2005 State estimate of commercial emissions is 1.70 MMT $CO_2e$, compared to the Federal estimate of New Mexico commercial emissions of 3.13 MMT $CO_2e$ during the same year. The 2005 State commercial estimate is 59% less than the Federal

commercial estimate for the state of NM, which is greater than the 5% difference threshold, indicating a need for a qualitative evaluation of methods (Table 4)

- **2021 State estimate method:**
    - Attributes direct emissions from energy consumed in buildings to the residential or commercial sector, respectively
    - Emissions from residential and commercial buildings are associated with fuel combustion on site
    - Emissions associated with electricity consumption in buildings are attributed to the electricity sector
    - Used data from EPA National GHG Inventory broken down by state

- **2018 State estimate method:**
    - Uses energy consumption from EIA SEDS, multiplies by fuel-specific emissions factors from EPA SIT. Where 2018 SIT outputs were not available, 2017 data were instead used.

- **2005 State estimate method:**
    - The same methods described in the 2021 State inventory section above were used to compute 2005 commercial and residential building sector emissions.

- **Federal estimate method:**
    - EPA National GHG Inventory broken down by state
    - Fuel consumption activity data from EIA's Monthly Energy Review
    - Allocated to states based on EIA SEDS
    - Includes uses of fluorinated gases for both residential and commercial emissions
    - Includes landfills and waste services for commercial emissions

- **Comparison of Methods:**
    - Commercial
        - By removing the emissions associated with the use of fluorinated gases, landfills, wastewater treatment, and composting from the Federal commercial estimate, then the State method estimate differs from the Federal estimate by -0.07% (for 2005) to 0.34% (for 2018); this difference is less than the 5% difference threshold and can be attributed to rounding.
        - Therefore, the inclusion of emissions associated with fluorinated gases, landfills, wastewater treatment, and composting in the Federal commercial estimate is determined to be the primary difference from the State commercial estimate for calendar years 2005, 2018, and 2021.
    - Residential

- By removing the emissions associated with the use of fluorinated gases from the Federal residential estimate, then the State method estimate differs from the Federal estimate by -1.20% (for 2018) to 1.28% (for 2021); this difference is less than the 5% difference threshold and can be attributed to rounding.
- Therefore, the inclusion of emissions associated with the use of fluorinated gases in the Federal residential estimate is determined to be the primary difference from the State residential estimates

- Because the State defines the residential and commercial buildings sector to only include fuel combustion on-site and exclude fluorinated gases and waste, the State method better fits this definition and is therefore more accurate for this scope definition.

Table 4 - New Mexico Buildings Emissions Estimate Comparison

| Year | Buildings Sub-Sector | State Estimate (MMT $CO_2e$) | Federal Estimate (MMT $CO_2e$) | Percent Difference |
|---|---|---|---|---|
| 2021 | Residential | 2.36 | 2.51 | -6.2% |
| 2018 | | 2.20 | 2.35 | -6.7% |
| 2005 | | 2.37 | 2.41 | -1.6% |
| 2021 | Commercial | 1.79 | 3.05 | -52% |
| 2018 | | 1.70 | 3.10 | -58% |
| 2005 | | 1.70 | 3.13 | -59% |

- **Editor Review**
  - The State inventories were reviewed for writing clarity and the presence of grammatical and typographical errors. The writing was identified as being clear, and no grammatical or typographical errors were identified.

**Task 5 – Other Sectors**:

- The State inventories were reviewed by a technical reviewer. Analytical methods and results were deemed to be clearly explained, technical terms are defined, conclusions are reasonable based on information presented, and level of technical detail is appropriate.

Waste

- The 2021 State estimate of waste sector emissions is 1.06 MMT $CO_2e$. The Federal estimate for the state of NM waste emissions during the same year is also 1.06 MMT $CO_2e$. The computed 0.1% difference between the estimates is less than the 5%

difference threshold required for qualitative evaluation, and can be attributed to rounding (Table 5).

- The 2018 State estimate is 1.80 MMT $CO_2e$. The 2018 Federal estimate for the state of NM is 1.24 MMT $CO_2e$. The 2018 State estimate is 37% greater than the 2018 Federal estimate for the state of NM, which is greater than the 5% difference threshold, indicating a need for a qualitative evaluation of methods (Table 5).

- The 2005 State estimate of waste sector emissions is 1.32 MMT $CO_2e$. The Federal estimate for the state of NM waste emissions during the same year is also 1.32 MMT $CO_2e$. The computed 0.2% difference between the estimates is less than the 5% difference threshold required for qualitative evaluation, and can be attributed to rounding (Table 5).

- **2021 State estimate method:**
  - "E3 used data from the EPA National GHG Inventory to estimate emissions from the [waste] sector"[13]
  - The 2021 NM GHGI data spreadsheet indicates that the waste sector includes biological treatment of solid waste, solid waste disposal, and wastewater treatment and discharge

- **2018 State estimate method:**
  - Default EPA SIT outputs were used for the 2018 State GHG emissions inventory.

- **2005 State estimate method:**
  - The same methods described in the 2021 State inventory section above were used to compute 2005 waste sector emissions.

- **Federal estimate method:**
  - EPA National GHG Inventory broken down by state
  - Consists of biological treatment of solid waste, solid waste disposal and wastewater treatment and discharge
  - Approach 2, where geographic proxies or other indicators are used to scale the national inventory data to the state level, was used for the waste sector
  - EPA GHGI Inventory data by state found under "state level GHG data,"[14] which is the same source that the State used as evidenced by the 2021 NM GHGI data Excel spreadsheet[15]

- **Comparison of Methods:**
  - State and Federal methods are identical for 2005 and 2021.

[13] 2021 NM GHGI, p. 11
[14] https://www.epa.gov/ghgemissions/methodology-report-inventory-us-greenhouse-gas-emissions-and-sinks-state-1990-2022
[15] https://www.env.nm.gov/climate-change-bureau/greenhouse-gas-emissions-inventories/

- The State method for the 2018 inventory differed from the Federal method, and used default EPA SIT outputs as opposed to disaggregated national inventory methods. This is because disaggregated national inventory data were not available when the 2018 inventory was developed.
- EPA documentation notes that SIT outputs and the disaggregated state-level national inventory data are not necessarily expected to agree due to methodological and data differences. An August 2024 EPA document provides a crosswalk between the national inventory and SIT outputs for the waste sector[16].

Coal Mining & Abandoned Mines

- The 2021 State estimate is 0.93 MMT $CO_2e$. The 2021 Federal estimate for coal mining and abandoned mine emissions in the state of NM is also 0.93 MMT $CO_2e$. The computed 0.5% difference between the estimates is less than the 5% difference threshold required for qualitative evaluation, and can be attributed to rounding (Table 5).

- The 2018 State estimate is 0.90 MMT $CO_2e$. The 2018 Federal estimate for coal mining and abandoned mine emissions in the state of NM is 0.77 MMT $CO_2e$. The computed 15% difference between the estimates exceeds the 5% difference threshold required for qualitative evaluation (Table 5).

- The 2005 State estimate is 1.69 MMT $CO_2e$. The 2005 Federal estimate for coal mining and abandoned mine emissions in the state of NM is also 1.69 MMT $CO_2e$. The computed 0.1% difference between the estimates is less than the 5% difference threshold required for qualitative evaluation, and can be attributed to rounding (Table 5).

- **2021 State estimate method:**
  - EPA National GHG Inventory data disaggregated to the state level for NM were used in the 2021 State inventory.

- **2018 State estimate method:**
  - Default EPA SIT outputs were used for the 2018 State GHG emissions inventory.

- **2005 State estimate method:**
  - The same methods described in the 2021 State inventory section above were used to compute 2005 waste sector emissions.

- **Federal estimate method:**
  - Methane emissions from underground mines are estimated using mine-specific data on ventilation systems and degasification systems.
  - Methane emissions from surface mines and post-mining activities are estimated using basin-specific information about coal gas content and combining it with an emissions factor.

[16] https://www.epa.gov/system/files/documents/2024-09/factsheet_crosswalk-between-ghgibystate-and-sit_august_2024.pdf. Accessed June 6, 2025.

- Fugitive $CO_2$ emissions from coal mines are estimated by summing the $CO_2$ from underground mining and from methane flaring and subtracting the amount of $CO_2$ in recovered gas. The $CO_2$ emissions from underground mining use an emission factor based upon the mass of coal produced, and the $CO_2$ emissions from flaring assuming 98% flare efficiency. The $CO_2$ in recovered gas is estimated using an emission factor.

- **Comparison of Methods:**
  - State and Federal methods are identical for 2005 and 2021.
  - The State method for the 2018 inventory differed from the Federal method, and used default EPA SIT outputs as opposed to disaggregated national inventory methods. This is because disaggregated national inventory data were not available when the 2018 inventory was developed.
  - EPA documentation notes that SIT outputs and the disaggregated state-level national inventory data are not necessarily expected to agree due to methodological and data differences. An August 2024 EPA document provides a crosswalk between the national inventory and SIT outputs for the coal mining and abandoned mines sector[17]. This crosswalk notes that the SIT and National Inventory use the same data and method for coal mining and abandoned coal mines. However, this document also notes that fugitive $CO_2$ emissions from coal mining are not included in SIT and that the approach to calculating underground coal mine emissions differs slightly between the two resources.

Agriculture

- The 2021 State estimate of agriculture emissions is 10.25 MMT $CO_2e$. The 2021 Federal estimate for agriculture emissions in the state of NM is also 10.25 MMT $CO_2e$. The computed 0.0% difference between the estimates is less than the 5% difference threshold required for qualitative evaluation (Table 5).

- The 2018 State estimate of agriculture emissions is 7.70 MMT $CO_2e$. The 2018 Federal estimate for agriculture emissions in the state of NM is 10.74 MMT $CO_2e$. The computed 33% difference between the estimates exceeds the 5% difference threshold required for qualitative evaluation (Table 5).

- The 2005 State estimate of agriculture emissions is 11.15 MMT $CO_2e$. The 2005 Federal estimate for agriculture emissions in the state of NM is also 11.15 MMT $CO_2e$. The computed 0.0% difference between the estimates is less than the 5% difference threshold required for qualitative evaluation (Table 5).

- **2021 State estimate method:**
  - EPA National GHG Inventory data disaggregated to the state level for NM were used in the 2021 State inventory.

[17] https://www.epa.gov/system/files/documents/2024-09/factsheet_crosswalk-between-ghgibystate-and-sit_august_2024.pdf. Accessed June 6, 2025.

- **2018 State estimate method:**
    - Default EPA SIT outputs were used for the 2018 State GHG emissions inventory.

- **2005 State estimate method:**
    - The same methods described in the 2021 State inventory section above were used to compute 2005 waste sector emissions.

- **Federal estimate method:**
    - The Federal emissions inventory provides agriculture emissions from enteric fermentation, manure management, rice cultivation (not relevant to New Mexico), agricultural soil management, liming, urea fertilization, and field burning of agricultural residues. Enteric fermentation, manure management, and agricultural soil management are responsible for nearly all agricultural GHG emissions in New Mexico and their calculation methods are described in turn below.
    - Enteric fermentation emissions are estimated using IPCC Tier 2 methods for cattle (which are responsible for most enteric fermentation emissions), and Tier 1 methods for other livestock.
        - USDA datasets, academic studies, and IPCC data are used to develop cattle enteric fermentation estimates.
    - Manure management emissions are estimated using a combination of Tier 1 and Tier 2 methods to estimate emissions of both N2O and methane.
        - IPCC Tier 1 N2O emissions factors and methane conversion factors (MCFs) are used for dry systems
        - U.S.-specific MCFs are used for liquid systems
        - U.S.-specific values for volatile solids production and nitrogen excretion rates for some animal types, including cattle from the Cattle Enteric Fermentation Model
        - Activity data are sourced from USDA datasets, IPCC factors, and the EPA AgSTAR project database
    - Agricultural soil management emissions Agricultural soil management emissions are aggregated from five components: direct emissions from nitrogen additions, direct emissions from soil organic matter mineralization, direct emissions from drainage of organic soils, direct emissions from soils from manure deposition, and indirect emissions.
        - Direct emissions use IPCC Tier 1 and Tier 3 approaches, with the Tier 3 method utilizing the DayCent model. Datasets used include USDA datasets, the Forest Inventory Analysis (FIA) dataset, the National Land Cover Dataset from Yang et al. 2018[18], NASA products, and other academic studies and soil survey information. Tier 1 methods of

[18] Yang, L., Jin, S., Danielson, P., Homer, C., Gass, L., Bender, S. M., ... & Xian, G. (2018). A new generation of the United States National Land Cover Database: Requirements, research priorities, design, and implementation strategies. ISPRS journal of photogrammetry and remote sensing, 146, 108-123.

estimating direct N2O emissions use soil fertilizer sale data, USDA datasets, IPCC factors, and academic studies.
    - Indirect emissions are estimated using Tier 1 and Tier 3 methods, where the DayCent model is used for Tier 3 methods. An IPCC emission factor extrapolated beyond 2020 is used to estimate $N_2O$ emissions.

- **Comparison of Methods:**
    - State and Federal methods are identical for 2005 and 2021.
    - The State method for the 2018 inventory differed from the Federal method, and used default EPA SIT outputs as opposed to disaggregated national inventory methods. This is because disaggregated national inventory data were not available when the 2018 inventory was developed.
    - EPA documentation notes that SIT outputs and the disaggregated state-level national inventory data are not necessarily expected to agree due to methodological and data differences. An August 2024 EPA document provides a crosswalk between the national inventory and SIT outputs for the agriculture sector[19]. The crosswalk notes that there are different data or methods used between the two tools for agricultural soil management, and also notes slight differences in methods for manure management and field burning of agricultural residues.

Industrial Processes

- The 2021 State estimate of industrial process emissions is 1.48 MMT $CO_2e$. The 2021 Federal estimate for industrial process emissions in the state of NM is also 1.48 MMT $CO_2e$. The computed 0.0% difference between the estimates is less than the 5% difference threshold required for qualitative evaluation (Table 5).

- The 2018 State estimate of industrial process emissions is 2.70 MMT $CO_2e$. The 2018 Federal estimate for industrial process emissions in the state of NM is 1.36 MMT $CO_2e$. The computed 66% difference between the estimates exceeds the 5% difference threshold required for qualitative evaluation (Table 5).

- The 2005 State estimate of industrial process emissions is 2.53 MMT $CO_2e$. The 2005 Federal estimate for industrial process emissions in the state of NM is also 2.53 MMT $CO_2e$. The computed 0.0% difference between the estimates is less than the 5% difference threshold required for qualitative evaluation (Table 5).

- **2021 State estimate method:**
    - EPA National GHG Inventory data disaggregated to the state level for NM were used in the 2021 State inventory.

[19] https://www.epa.gov/system/files/documents/2024-09/factsheet_crosswalk-between-ghgibystate-and-sit_august_2024.pdf. Accessed June 6, 2025.

- **2018 State estimate method:**
    - Default EPA SIT outputs were used for the 2018 State GHG emissions inventory.

- **2005 State estimate method:**
    - The same methods described in the 2021 State inventory section above were used to compute 2005 waste sector emissions.

- **Federal estimate method:**
    - Industrial process emissions are summarized within the “industrial processes and product use” section of the disaggregated inventory by IPCC sector. The three largest emitters of GHGs categorized within the industrial process emissions section of the disaggregated inventory for New Mexico are (in descending order) the substitution of ozone-depleting substances, other process uses of carbonates, and cement production. Collectively, these components were responsible for approximately 87% of New Mexico’s 2021 industrial process emissions.
    - The national inventory uses a Tier 2 method for estimating the emissions associated with the substitution of ozone-depleting substances, including HFCs, PFCs, and $CO_2$. The method uses a “Vintaging Model” to predict the use of ozone-depleting substance substitutes and then applies leak rates and release profiles to the modeled population of equipment.
    - The national inventory uses a Tier 2 method for estimating the emissions associated with other process uses of carbonates. Constants for the amount of $CO_2$ per unit of limestone and dolomite are multiplied by activity data about limestone or dolomite consumption. Activity data over the years relevant to this QA review document are from United States Geologic Survey datasets, American Iron and Steel Institute data, and data submitted to the EPA Greenhouse Gas Reporting Program.
    - The national inventory uses Tier 2 methods to estimate cement production $CO_2$ emissions. The method uses an emissions factor per mass of clinker (cement precursor material) and default IPCC assumptions about calcined cement kiln dust correction. This is combined with USGS information about clinker production.

- **Comparison of Methods:**
    - State and Federal methods are identical for 2005 and 2021.
    - The State method for the 2018 inventory differed from the Federal method, and used default EPA SIT outputs as opposed to disaggregated national inventory methods. This is because disaggregated national inventory data were not available when the 2018 inventory was developed.
    - EPA documentation notes that SIT outputs and the disaggregated state-level national inventory data are not necessarily expected to agree due to methodological and data differences. An August 2024 EPA document provides a crosswalk between the national inventory and SIT outputs for the agriculture

sector[20]. The crosswalk notes that there are differences in the data or methods used for every component of industrial process emissions for at least some years except for the substitution of ozone-depleting substances.

Industrial

- The 2021 State estimate of industrial emissions is 3.63 MMT $CO_2e$. The 2021 Federal estimate for industrial emissions in the state of NM is 25.38 MMT $CO_2e$. The computed 150% difference between the estimates exceeds the 5% difference threshold required for qualitative evaluation (Table 5).

- The 2018 State estimate of industrial emissions is 2.10 MMT $CO_2e$. The 2018 Federal estimate for industrial emissions in the state of NM is 25.93 MMT $CO_2e$. The computed 170% difference between the estimates exceeds the 5% difference threshold required for qualitative evaluation (Table 5).

- The 2005 State estimate of industrial emissions is 4.68 MMT $CO_2e$. The 2005 Federal estimate for industrial emissions in the state of NM is 30.49 MMT $CO_2e$. The computed 147% difference between the estimates exceeds the 5% difference threshold required for qualitative evaluation (Table 5).

- **State estimate method:**
    - The State estimate method is consistent for reported 2005, 2018, and 2021 emissions.
    - Includes fuel combustion emissions from industries except for oil and gas; non-combustion emissions are categorized in the “industrial processes” sector.
    - Used the EPA SIT tool to calculate industrial emissions associated with coal, petroleum and natural gas combustion in New Mexico
    - Used the EIA Natural Gas Annual report data to estimate the share of natural gas consumption that can be attributed to the fossil fuel industry
    - Excluded the natural gas emissions attributable to the fossil fuel industry because these are included in the oil and gas sector, which is responsible for the majority of industrial emissions in the state and is therefore treated as its own sector in the state inventory.
        - Avoids double counting from including natural gas emissions associated with oil and gas in the “industrial” sector

- **Federal estimate method:**
    - Industrial emissions are categorized within the “industrial” economic sector
    - Includes fossil fuel combustion emissions from non-oil-and-gas industries, non-combustion emissions from the mineral, chemical, metal, and other industries,

[20] https://www.epa.gov/system/files/documents/2024-09/factsheet_crosswalk-between-ghgibystate-and-sit_august_2024.pdf. Accessed June 6, 2025.

and emissions from the production and use of fluorinated gases (i.e., it includes non-combustion emissions within the “industrial” economic sector).
    - The federal “industrial” economic sector also includes coal mining and underground mines, which are separated in the State inventory as described above.

- **Comparison of methods:**
    - The State method includes non-combustion emissions from all non-oil-and-gas industries in the Industrial Processes sector, whereas these are included in the Industry sector of the disaggregated national inventory.
        - These emissions represent from 5.2% (for 2018) to 8.3% (for 2005) of total industrial emissions, i.e., the inclusion or exclusion of industrial process emissions is not responsible for the large (>100%) differences between State and Federal industrial emissions estimates.
    - The most significant difference between the two methods is the inclusion of oil and gas industry fossil fuel combustion emissions in the industrial sector of the federal inventory.
        - The 2018 State inventory contains a summary of industrial combustion emissions both including (7.71 MMT $CO_2e$) and excluding (2.13 MMT $CO_2e$) the oil and gas industry (Table 7). Thus, the oil and gas industry was responsible for approximately 72% of industrial fossil fuel emissions in 2018 in New Mexico, demonstrating that the exclusion or inclusion of this industry has a large impact on the total industrial emissions estimated for the state.

<u>Natural & Working Lands</u>

- Natural and working lands emissions are included for 2005 and 2021 for informational purposes only and are not included in net calculated New Mexico emissions due to the following caveat (emphasis added): "Due to significant data uncertainty around the size of the natural land use sources and sinks in the state, throughout this report we provide emissions using a ‘gross’ framework, which includes emissions from all sectors *excluding* the natural and working lands sector, while providing current best estimates of natural and working lands emissions for reference." In the 2021 inventory report, E3 notes that this is due to large changes in soil carbon flux over time that can not readily be explained, thus resulting in a large change in natural & working lands emissions reported for New Mexico from 2005 to 2021.

- The 2021 State estimate of natural & working lands emissions is 2.95 MMT $CO_2e$. The 2021 Federal estimate for natural & working lands emissions in the state of NM is also 2.95 MMT $CO_2e$. The computed 0.0% difference between the estimates is less than the 5% difference threshold required for qualitative evaluation (Table 5).

- The 2018 State estimate of natural & working lands emissions is 6.10 MMT $CO_2e$. The 2018 Federal estimate for natural & working lands emissions in the state of NM is 3.80 MMT $CO_2e$. The computed 46% difference between the estimates exceeds the 5% difference threshold required for qualitative evaluation (Table 5).

- The 2005 State estimate of natural & working lands emissions is 9.57 MMT $CO_2e$. The 2005 Federal estimate for natural & working lands emissions in the state of NM is also 9.57 MMT $CO_2e$. The computed 0.0% difference between the estimates is less than the 5% difference threshold required for qualitative evaluation (Table 5).

- **2021 State estimate method:**
    - EPA National GHG Inventory data disaggregated to the state level for NM were used in the 2021 State inventory.

- **2018 State estimate method:**
    - Default EPA SIT outputs were used for the 2018 State GHG emissions inventory.

- **2005 State estimate method:**
    - The same methods described in the 2021 State inventory section above were used to compute 2005 waste sector emissions.

- **Federal estimate method:**
    - The national GHG emissions inventory provides estimates of net GHG flux (i.e., emissions or sequestration) from ten categories: forest land remaining forest land, land converted to forest land, cropland remaining cropland, land converted to cropland, grassland remaining grassland, land converted to grassland, wetlands remaining wetlands, land converted to wetlands, settlements remaining settlements, and land remaining settlements. Carbon stock change, methane emissions, and $N_2O$ emissions are accounted for.
    - To estimate LULUCF / natural & working lands emissions, the inventory first uses USDA datasets and the National Land Cover Dataset to represent land areas. It then uses information from federal datasets, scientific publications, and the IPCC to generate estimates of carbon fluxes and GHG emissions. Tier 1, 2, and 3 methods are implemented as described in the Federal national inventory report.

- **Comparison of Methods:**
    - State and Federal methods are identical for 2005 and 2021.
    - The State method for the 2018 inventory differed from the Federal method, and used default EPA SIT outputs as opposed to disaggregated national inventory methods. This is because disaggregated national inventory data were not available when the 2018 inventory was developed.
    - EPA documentation notes that SIT outputs and the disaggregated state-level national inventory data are not necessarily expected to agree due to methodological and data differences. An August 2024 EPA document provides a

crosswalk between the national inventory and SIT outputs for the agriculture sector[21]. The crosswalk notes significant differences in the source and sink categories included in the SIT and the disaggregated national inventory. It also notes differences in the data and methodology used for source categories that are common between the two data sources.

Table 5 - New Mexico Other Sector Emissions Estimate Comparison

| Sector | Year | State Estimate (MMT $CO_2e$) | Federal Estimate (MMT $CO_2e$) | Percent Difference |
|---|---|---|---|---|
| Waste | 2021 | 1.06 | 1.06 | 0.1% |
| | 2018 | 1.80 | 1.24 | 37% |
| | 2005 | 1.32 | 1.32 | 0.2% |
| Coal Mining & Abandoned Mines | 2021 | 0.93 | 0.93 | -0.5% |
| | 2018 | 0.90 | 0.77 | 15% |
| | 2005 | 1.69 | 1.69 | -0.1% |
| Agriculture | 2021 | 10.25 | 10.25 | 0.0% |
| | 2018 | 7.70 | 10.74 | -33% |
| | 20 05 | 11.15 | 11.15 | 0.0% |
| Industrial Processes | 2021 | 1.48 | 1.48 | 0.0% |
| | 2018 | 2.70 | 1.36 | 66% |
| | 2005 | 2.53 | 2.53 | 0.2% |
| Industry | 2021 | 3.63 | 25.38 | -150% |
| | 2018 | 2.10 | 25.93 | -170% |
| | 2005 | 4.68 | 30.49 | -147% |
| Natural & Working Lands | 2021 | 2.95 | 2.95 | 0.0% |
| | 2018 | 6.10 | 3.80 | 46% |
| | 2005 | 9.57 | 9.57 | 0.0% |

- **Editor Review**
  - The State inventories were reviewed for writing clarity and the presence of grammatical and typographical errors. The writing was identified as being clear, and no grammatical errors were identified.
  - A typographical error was identified on Page 10 of the 2021 State inventory. A period is missing between two sentences: “A significant share of natural gas fuel use which EIA categorizes as industrial is used as lease fuel or plant fuel for oil

[21] https://www.epa.gov/system/files/documents/2024-09/factsheet_crosswalk-between-ghgibystate-and-sit_august_2024.pdf. Accessed June 6, 2025.

and gas operations The emissions associated with these natural gas end uses are categorized within the oil and gas sector in this inventory."

- A typographical error throughout the header of all sections was identified, where every section was labeled "introduction" and the phrase "New Mexico Greenhouse Gas Emissions Inventory and Forecast" was repeated twice.

**New Mexico Environment Department**
**Documentation of QA Review and Approval of Electronic Deliverables**

*Approvals on this form verify that all technical and editorial reviews have been completed and the deliverable meets the criteria for scientific defesibility, technical, and editorial accuracy, and presentation clarity as outlined in the Quality Assurance (QA) Project Plan, QA Narrative, Quality Management Plan, and/or according to direction from the EPA PO.*

**Client:** EPA Region 6
**Grant Number:** 02F36101
**EPA Project Officer:** Mariama Mitchell
**Project Number:** N/A
**Project Name:** New Mexico Climate Pollution Reduction Grant
**Grantee Org. Project Manager:** Claudia Borchert
**QA Form Details**

| | File Name | | Deliverable | | | | QA Review Information | | | | | QA Review Information | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Item Number | (copy the name of the file reviewed) | Deliverable Description | Date Sent to Client | (Draft) | (Final) | Document Originator | (Review Type) | (Reviewer Name) | (Date Review was Performed) | (Brief Summary of Review Findings and Other Notes) | (Have All Findings Been Resolved) | (Originator Signature) | (Reviewer Signature) | (File Location) |
| 01 | New Mexico Greenhouse Gas Emissions Inventory (2021) and Forecast (2030-2050), December 2024, by Energy and Environmental Economics (E3)<br>Data file: 2021 NM GHG Inventory (E3, 2024) | Quantitative & qualitative analysis including review of the following sectors:<br>Task 1: Oil & Gas<br>Task 2: Transportation<br>Task 3: Electric Generation<br>Task 4: Commercial & Residential Buildings<br>Task 5: Other Sectors (Waste, Coal Mining & Abandoned Mines, Agriculture, Industrial Processes, Industrual, Natural & Working Lands. | 10/17/2025 | | TRUE | E3 and NMED | Technical | Samantha Valentine | 1/1/25 - 1/29/25 | The following typographical errors were identified and corrected:<br>-Missing period between two sentences on Page 10<br>-Header typo: every section labeled as "introduction" and "New Mexico Greenhouse Gas Emissions Inventory and Forecast" is repeated twice<br>-Table 3, O&G emissions column headers should be in units of MT, not MMT<br>-Table 9, 2030 diesel mitigation value should be 6.64 not 6064 | YES | Angela Raso<br>Digitally signed by Angela Raso<br>Date: 2025.10.15 13:34:28 -06'00' | Samantha M Valentine | OneDrive - State of New Mexico\Documents - ENV-CCTF Staff Team\GHG Emissions\2021 NM Inventory & Forecast (E3) |
| 02 | New Mexico Oil and Gas Greenhouse Gas Emissions Inventory for Year 2020, August 2022, by Eastern Research Group (ERG)<br>Data file: 2020 Oil and Gas emissions inventory (ERG, 2022) | Quantitative & qualitative analysis including review of oil & gas sector emissions. | 10/17/2025 | | TRUE | ERG and NMED | Technical | Samantha Valentine | 1/1/25 - 1/29/25 | No errors were identified. | YES | Angela Raso Digitally signed by Angela Raso Date: 2025.10.15 13:34:41 -06'00' | Samantha M Valentine | OneDrive - State of New Mexico\Documents - ENV-CCTF Staff Team\GHG Emissions\2020 O&G Inventory & Projections (ERG) |
| 03 | New Mexico Oil and Gas Greenhouse Gas Emissions Inventory for Year 2005, December 2024, by Eastern Research Group (ERG)<br>Data file: 2005 Oil and Gas emissions inventory (ERG, 2024) | Quantitative & qualitative analysis including review of oil & gas sector emissions. | 10/17/2025 | | TRUE | ERG and NMED | Technical | Samantha Valentine | 1/1/25 - 1/29/25 | No errors were identified. | YES | Angela Raso Digitally signed by Angela Raso Date: 2025.10.15 13:34:53 -06'00' | Samantha M Valentine | OneDrive - State of New Mexico\Documents - ENV-CCTF Staff Team\GHG Emissions\2005 O&G Inventory & Projections (ERG) |
| 04 | New Mexico Greenhouse Gas Emissions Inventory (2018), October 2020, by Energy and Environmental Economics (E3)<br>Data file: 2018 NM GHG Inventory (E3, 2020) | Quantitative & qualitative analysis including review of the following sectors:<br>Task 1: Oil & Gas<br>Task 2: Transportation<br>Task 3: Electric Generation<br>Task 4: Commercial & Residential Buildings<br>Task 5: Other Sectors (Waste, Coal Mining & Abandoned Mines, Agriculture, Industrial Processes, Industrual, Natural & Working Lands. | 10/17/2025 | | TRUE | E3 and NMED | Technical | Mark Edwards | 1/29/25-6/11/25 | No errors were identified. | YES | Angela Raso<br>Digitally signed by Angela Raso<br>Date: 2025.10.15 13:35:07 -06'00' | Mark Edwards Digitally signed by Mark Edwards Date: 2025.10.15 11:33:44 -06'00' | OneDrive - State of New Mexico\Documents - ENV-CCTF Staff Team\GHG Emissions\2018 NM Inventory & Forecast (E3+CNEE) |