

Denver Metro/North Front Range Projection of 2017 Oil and Gas Emissions to 2023/2028 By the Colorado Air Pollution Control Division (APCD) January 2020

The purpose of this effort is to update the 2017 oil and gas emissions inventory using actual emissions data for Colorado and project future year emissions based on production trends, accounting for increasing production from new horizontal wells and decreasing production from existing horizontal and legacy vertical wells for the purposes of ozone and regional haze planning. This document and the associated Excel Workbook (titled “Colorado_OilGasEmissionProjection.xlsx”) describe the development of the Colorado 2017 oil and gas emissions and projection to 2020 and 2023, with 2020 being the attainment year for the upcoming Denver Metro/North Front Range (DM/NFR) Serious Nonattainment Area State Implementation Plan (SIP) Attainment Demonstration for the 2008 Ozone National Ambient Air Quality Standard (NAAQS) and 2023 being a surrogate for 2028 for the purposes of the Western Regional Air Partnership (WRAP) regional haze planning.

Overall Approach

For nearly the past decade, most of the growth in Colorado has been in the Denver-Julesburg (DJ) Basin, which is located in large part within the Denver Metro/North Front Range ozone nonattainment area, with seven of the nine nonattainment area counties having some level of current oil and gas activity. Two of these counties, Weld and Larimer, are partially in and partially outside of the nonattainment area. Based on data from the Colorado Oil and Gas Conservation Commission (COGCC), the trend in oil production outside of the DJ Basin has been flat over the last five years (2014 through 2018) as shows in the accompanying Excel Workbook, (tab “Projection”).

2017 Emissions Inventory Development

For the 2017 oil and gas inventory, emissions were based on 2017 data from the Colorado Air Pollutant Emission Notice (APEN) database, the Colorado Oil and Gas Conservation Commission (COGCC), and data reported directly by industry. A survey from several of the largest oil and gas producers in the State provided information on actual production and emissions from 2017 on a per facility basis. From this data a facility level storage tank battery emission factor (EF) was calculated in pounds per barrel (lbs/bbl) based on provided uncontrolled¹ emissions rates from condensate tanks. Each storage tank battery facility was then binned and a corresponding control factor² applied as follows:

- **≥ 9.0 lbs/bbl = 60.0%** (0.75*0.80)
- **≥ 1.0 lbs/bbl = 78.9%** (0.95*0.83)
- **< 1.0 lbs/bbl = 85.1%** (0.99*0.86)

Oil production data reported by operators to the COGCC combined with emission rates reported on APENs were utilized to calculate condensate tank emissions if information was not provided by operators in the survey effort.

Emissions from spuds (i.e. new wells), which includes completion flaring, drilling, and fracing, was estimated by developing a per spud emission rate, in lb/bbl, based on operator reported 2017 spud emissions data and multiplying it by the number of spuds in 2017.

Other facility related emissions were calculated using equipment specific emission factors that were generated based on data collected during the survey effort. Facilities were binned into one of three categories based on their

¹ Uncontrolled emissions are the emissions in pounds per barrel of oil from the last separator stage before storage. Many operators use multiple stages of separation to minimize the potential for leaks from the storage tank that do not reach the control device.

² Control Factor = Capture Efficiency (CE) * Rule Effectiveness (RE); Tank Emissions = (Facility Production) * EF * (1-DE*(CE * RE)); where EF = Facility level storage tank battery emission factor and DE = destruction efficiency of the control device.

uncontrolled emission rate as reported in either the survey or on APENs. Equipment specific emission factors were generated for each of the bins and utilized to calculate emissions.

2020 and 2023 Emissions Inventory Projections

Emissions projections are provided in the (“Projection2020”) and (“Projection2023”) tabs of the Workbook for years 2020 and 2023/2028 respectively. For new wells, it was assumed that production will be well-controlled in the future to minimize leaks and avoid non-compliance with Colorado regulations, thus emissions from new production was estimated based on of a subset of data from the industry survey of sources with emissions less than one (1) lbs/bbl of oil of uncontrolled emissions.

Based on a regression analysis of the historic oil production data from 2014-2018 in the accompanying Excel Workbook, (tab “Projection”), the growth in oil production was determined to be 27.16% per year between 2018 to 2023. Whole county data for the counties in the Denver Metro/North Front Range nonattainment area were used in the analysis. Emissions from new production was grown by the ratio of the of the new oil production to the total oil production from these sources. In the tab (“comparison”), this trend is compared to trends from the Bureau of Land Management (BLM) and RAMBOLL, and this projection falls between these two trends for 2023. A low trend scenario could be developed from the RAMBOLL data, while a high trend scenario could be developed from the BLM data. For spuds, emissions were multiplied by ratio of the five-year average number of spuds per year to the number of spuds in 2017 to get the 2020 and 2023/2028 total spud related emissions.

For existing wells, there has been an overall decline in production, which is provided in the (“Projection of Existing”) tab of the Workbook. This trend was determined from data in the COGCC annual production reports for 2012 and 2018, which provide production data by well. Production from 2012 was compared to production from to the same wells in 2015 and 2018, respectively. These three year and five year decline rates were used to determine a future rate of decline in production of 83.6%. For existing sources, 2017 emissions for most sources were multiplied by the 83.6% decline in oil production. However, emissions from some source categories, such as pneumatic devices and heater/treaters (burners), were not reduced since their emissions do not vary by oil production but instead by the number of facilities. As summary of total emissions in the DM/NFR ozone nonattainment area are provided in Table 1.

Table 1 - Summary of Nonattainment Area Production and Emissions

Year	Annual Barrels of Oil	Tons Per Year VOC	Tons Per Year NOx
2017	108,704,469	55,225	14,381
2020	197,272,853	38,218	12,807
2023/2028	285,841,236	32,370	13,856

Midstream (Point Sources)

For oil and gas midstream source emissions, data from the 2018 Colorado APEN Database was used to project to 2023/2028.

Contact Information

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