COLORADO AIR RESOURCE MANAGEMENT MODELING STUDY (CARMMS)

2025 CAMx MODELING RESULTS FOR THE HIGH, LOW AND MEDIUM OIL AND GAS DEVELOPMENT SCENARIOS

CARMMS 2.0
Final Report

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1.0 INTRODUCTION

1.1 Background

The Bureau of Land Management (BLM) Colorado State Office (COSO) completed the first iteration of the Colorado Air Resources Management Modeling Study (CARMMS 1.0) in early 2015. In this study, projected year 2021 regional air quality and related value impacts were modeled using the West-wide Jump-start Air Quality Modeling Study (WestJUMPAQS) year 2008 modeling platform. Results were published in a January 2015 report: "Colorado Air Resources Management Modeling Study (CARMMS), 2021 Modeling Results for the High, Low and Medium Oil and Gas Development Scenarios" (ENVIRON et al., 2015). This CARMMS 1.0 study included analysis of the air quality (AQ) and air quality related value (AQRV) impacts of oil and natural gas development and mining emissions in the planning areas of individual BLM field offices in Colorado and cumulative AQ and AQRV impacts due to non-Federal oil and gas and mining sources and other regional sources. The Mancos Shale oil and gas development area in north-western New Mexico is adjacent to some of the Colorado BLM Planning Areas and was also included in the CARMMS 1.0 analysis.

The BLM New Mexico State Office funded an intermediate iteration of CARMMS (CARMMS 1.5) that included additional updates to the Mancos Shale inventory and other updates to CARMMS 1.0 such as the consideration of the October 2015 ozone National Ambient Air Quality Standard (NAAQS) of 0.070 ppm. Results were published in a March 2016 report entitled "Colorado Air Resources Management Modeling Study (CARMMS) with Updated Mancos Shale Modeling: 2021 Modeling Results for the High, Low and Medium Oil and Gas Development Scenarios, CARMMS 1.5" (Ramboll Environ and Kleinfelder, 2016a).

Several current Resource Management Plans (RMPs) leverage CARMMS for planning area specific and cumulative future air quality predicted results. These RMPs cover planning for resource management and land-use in Colorado up to 20 years into the future. To support the RMPs and to support other BLM needs, BLM conducted the second iteration of CARMMS (CARMMS 2.0) that will project year 2025 regional air quality using a year 2011 modeling platform with updated information such as new oil and gas reasonable foreseeable development (RFD) estimates for year 2025.

1.2 Purpose

This document presents the approach and results for the CARMMS 2.0 High, Low and Medium Development Scenarios source apportionment modeling and analysis. Presented are the individual AQ and AQRV impacts due to projected BLM-authorized mineral development activities in Field Office planning areas and other cumulative sources. The 2025 modeling results are compared with NAAQS and State Ambient Air Quality Standards (SAAQS) throughout the 12/4 km modeling domain. The contributions of O&G development to AQ and AQRV at Class I and sensitive Class II areas are presented and compared to PSD increment concentrations and visibility and deposition thresholds of concern. Cumulative peak-weighted index (W126) ozone values are also calculated and analyzed for the 2011 Base Year and the 2025 High, Low, and Medium Scenarios.

1.3 Overview of Modeling Approach

The Comprehensive Air Quality Model with Extensions (CAMx) photochemical grid model (PGM) (www.camx.com) is used in CARMMS 2.0 to assess the AQ and AQRV impacts associated with BLM-authorized mineral development on Federal lands within BLM Colorado and the New Mexico Farmington Field Office Planning Areas. CARMMS does not assess the near-source AQ impacts of the O&G and other development activities; those will be addressed at the Project level in the future. The development of a PGM database is quite resource-intensive. Thus, to the extent possible and similar to CARMMS 1.0 and CARMMS 1.5, CARMMS 2.0 leveraged the modeling platform of Western Air Quality Study (WAQS) from the Intermountain West Data Warehouse (IWDW) (views.cira.colostate.edu/tsdw/).

The CARMMS 2.0 CAMx modeling of the 12/4 km modeling domains (Figure 2-1) for a 2025 future year emission scenario using the IWDW WAQS meteorological inputs involved the following activities:

- Future year O&G emissions were developed for a range of potential outcomes which attempt to bound actual future year O&G development in the region. Three 2025 future year O&G development scenarios were modeled within Colorado Planning Areas, the Mancos Shale, and Southern Ute Indian Tribe (SUIT) lands:
  - High Development Scenario;
  - Low Development Scenario; and
  - Medium Development Scenario, which is a mitigated version of the High Development Scenario.

  There are four general types of future year emissions addressed in CARMMS:

  1. BLM-authorized (Federal lands) and other (non-Federal lands) oil and gas and mining emissions within the Colorado BLM planning areas (as well as the BLM Farmington Field Office in northern New Mexico);
  2. Oil and gas and other development areas outside Colorado/northern New Mexico BLM Planning Areas;
  3. Remaining future year anthropogenic emissions; and
  4. Emissions that remained unchanged from the base year in future year scenarios.

- The future year emissions were processed using the SMOKE (Sparse Matrix of Kernel Emissions) system to generate 2025 emissions for the CARMMS 2.0 12/4 km domains.
- 2025 Boundary Condition (BC) inputs for the CARMMS 2.0 12 km modeling domain were generated using output from the 2025 WAQS 12 km CAMx model simulation using the 2011 meteorological inputs.

- CAMx ozone and particulate matter source apportionment simulations were performed for the 2025 High, Low and Medium Development Scenarios and 12/4 km CARMMS 2.0 modeling domains using the 2011 CARMMS 2.0 modeling platform.
    - The CAMx 2025 12/4 km CARMMS 2.0 domains source apportionment output for the High, Low and Medium Development Scenarios were post-processed to obtain the separate AQ and AQRV impacts due to mineral development activities on Federal lands within the BLM New Mexico FFO planning area and each of the 13 Colorado BLM planning areas.
    - The CAMx 2025 High, Low and Medium O&G Development Scenarios output was also post-processed to obtain the cumulative AQ and AQRV impacts due to mineral development on Federal and non-Federal lands within the BLM New Mexico FFO (NMFFO) planning area and 12 BLM planning areas in Colorado, plus SUIT, as well as O&G development throughout the CARMMS 2.0 12/4 km modeling domain.
    - In addition to the CAMx source apportionment simulation, another CAMx simulation that used zero emissions from new Federal O&G in BLM Planning areas in Colorado was conducted for each of the three scenarios to assess their AQ and AQRV impacts with a Brute-Force approach, and the results were compared to the source apportionment results.
- The AQ and AQRV impacts of BLM-authorized oil and gas development on Federal lands in each BLM Colorado planning area and the NMFFO area and cumulative impacts across all planning areas for the 2025 High, Low and Medium Development Scenarios are summarized in this report.

1.4 Air Quality Standards and AQRV Thresholds

1.4.1 Federal and State Air Quality Standards and PSD Increments

EPA sets NAAQS for six pollutants, which are called criteria air pollutants (CAPs). The CAPs are: ozone (O_3), nitrogen dioxide (NO_2), carbon monoxide (CO), suspended Particle Pollution (particulate matter with a mean aerodynamic diameter of less than or equal to 10 and 2.5 microns; PM_{10} and $PM_{2.5}$), sulfur dioxide (SO_2) and lead (Pb). States may also set their own ambient air quality standards, which must be as stringent as the NAAQS but may be more stringent.

Federal air quality regulations adopted and enforced by the states limit incremental emission increases to specific levels defined by the classification of air quality in an area. The Prevention of Significant Deterioration (PSD) Program is designed to limit the incremental increase of specific air pollutant concentrations above a legally defined baseline level. Incremental increases in PSD Class I areas are strictly limited, while increases allowed in Class II areas are less strict. PSD Class I and Class II increments are defined for NO_2, PM_{10}, $PM_{2.5}$ and SO_2. Note the PSD increments are project level thresholds, and are not an appropriate metric for reference against field office level impacts.

Table 1-1 summarizes the NAAQS, the Colorado Ambient and Quality Standards (CAAQS) and the New Mexico Ambient Air Quality Standards (NMAAQS). PSD Class I and Class II increments are also shown in Table 1-1.

Table 1-1. Applicable National and State Ambient Air Quality Standards and PSD concentration increments.

Pollutant/Averaging Time	NAAQS	CAAQS[13]	NMAAQS[14]	PSD Class I Increment[1]	PSD Class II Increment[1]
CO					
1-hour[2]	35 ppm	--	13.1 ppm	--	--
8-hour[2]	9 ppm	--	8.7ppm	--	--
NO_2					
1-hour[3]	100 ppb	--	--	--	--
24-hour	--	--	0.10 ppm	--	--
Annual[4]	53 ppb	--	0.05 ppm	2.5	25
O_3[15]					
8-hour[5]	0.070 ppm	--	--	--	--
PM_{10}					
24-hour[6]	150 µg/m^3	--	--	8	30
Annual[7]	--	--	--	4	17
$PM_{2.5}$					
24-hour[8]	35 µg/m^3	--	--	2	9
Annual[9]	12 µg/m^3	--	--	1	4
SO_2					
1-hour[10]	75 ppb	--	--		
3-hour[11]	0.5 ppm	700 µg/m^3	--	25	512
24-hour[12]	--	--	0.10 ppm	5	91
Annual[4]	--	--	0.02 ppm	2	20

1. The PSD demonstrations serve information purposes only and do not constitute a regulatory PSD increment consumption analysis.
2. No more than one exceedance per calendar year; for NMAAQS - No more than one exceedance per consecutive 12 months
3. 98th percentile, averaged over 3 year; for NMAAQS - not to be exceeded more than once over any 12 consecutive months
4. Annual mean not to be exceeded; for NMAAQS - arithmetic average over any four consecutive quarters not to be exceeded
5. Fourth-highest daily maximum 8-hour ozone concentrations in a year, averaged over 3 years
6. Not to be exceeded more than once per calendar year on average over 3 years.
7. 3 year average of the arithmetic means over a calendar year
8. 98th percentile, averaged over 3 years
9. Annual mean, averaged over 3 years, NAAQS promulgated December 14, 2012
10. 99th percentile of daily maximum 1-hour concentrations in a year, averaged over 3 years
11. No more than one exceedance per calendar year (secondary NAAQS) and no more than one exceedance in 12 consecutive months (CAAQS)
12. For areas in New Mexico not within 3.5 miles of the Chino Mines Company
13. http://www.colorado.gov/cs/Satellite/CDPHE-Main/CBON/1251601911433
14. http://www.nmcpr.state.nm.us/nmac/parts/title20/20.002.0003.htm
15. Finalized on October 1, 2015.

1.4.2 Air Quality Related Value (AQRV) Thresholds

The impacts of each BLM authorized oil and gas and other activities within each BLM Planning area, as well as cumulative impacts of all activities together, at Class I and sensitive Class II areas were assessed for three AQRVs: visibility, deposition and acid neutralizing capacity (ANC). The June 23, 2011 MOU between EPA, USDOI and USDA states that the project and cumulative AQRV impacts at Class I and sensitive Class II areas should be assessed by comparing against thresholds of concern defined by the Federal Land Manager (FLM) for the given Class I or sensitive Class II area in question. In the CARMMS first draft Modeling Protocol and at the October 30, 2013 meeting with the Interagency Air Quality Review Team (IAQRT) we presented the following threshold of concern for AQRVs in Class I and sensitive Class II areas and there were no disagreements in the comments received from the IAQRT:

Visibility impacts for BLM-authorized oil and gas sources within each BLM Planning Area are assessed using the FLAG (2010) procedures that use the new IMPROVE equation, annual average natural visibility background and monthly relative humidity adjustment factors [f(RH)] (see Section 4.6.1). The visibility impacts from mineral development on Federal lands within each separate BLM planning area are compared against a 0.5 and 1.0 change in deciview (dv) haze index threshold of concern and any exceedances reported. We note the dv thresholds are project level thresholds, and not an appropriate metric to reference against field office level or cumulative impacts.

Cumulative sources visibility impacts from multiple BLM Planning Areas are assessed using a new visibility approach and metrics developed by the FLMs based on the regional haze rule visibility metrics for the best and worst 20% visibility days as discussed in Section 4.6.2.

Acid deposition impacts due to mineral development on Federal lands within each separate BLM Planning Area for annual total sulfur (S) and total nitrogen (N) deposition are compared against the 0.005 kg/ha-yr Deposition Analysis Threshold (DAT) for the western states. We note the DAT is a project level threshold, and not an appropriate metric to reference against field office level or cumulative impacts.

Total N and S deposition impacts due to all emissions in the 2011 and 2025 emissions scenarios (i.e., cumulative) are compared to Critical Load values of 2.2 kg/ha-yr for N in Wyoming, 2.3 kg/ha-yr for N in Colorado except for Dinosaur National Monument where a 3.0 kg/ha-yr Critical Load value for N is used. For S, a 5.0 kg/ha-yr critical load value is used everywhere (see Section 4.7).

The predicted annual deposition fluxes of sulfur and nitrogen at sensitive lake receptors due to Federal O&G development from individual BLM Planning Areas are used to estimate the change in ANC in accordance with the January 2000, USFS Rocky Mountain Region's Screening Methodology for Calculating ANC Change to High Elevation Lakes, User's Guide (USFS, 2000). The predicted changes in ANC are compared with the USFS's Level of Acceptable Change (LAC) thresholds of 10% for lakes with ANC values greater than 25 µeq/l and 1 µeq/l for lakes with background ANC values of 25 µeq/l and less (see Section 4.8). We note that the LAC is a project level threshold, and not an appropriate metric to reference against field office level or cumulative impacts.

1.4.3 W126 Cumulative Ozone Exposure Assessment

Although there is no adopted standard to assess the potential vegetation response to ozone as a stress to growth, there has been interest expressed in assessing such an effect with the W126 metric, and such an assessment is included herein. The methodology is discussed in Section 4.9.

2.0 CARMMS 2.0 MODELING APPROACH

The photochemical grid model was applied in CARMMS 2.0 to assess the AQ and AQRV impacts associated with BLM-authorized mineral development on Federal lands within BLM Colorado and the New Mexico Farmington Field Office Planning Areas as well as other cumulative non-Federal sources. CARMMS 2.0 uses data from the modeling platform of Western Air Quality Study (WAQS) from the Intermountain West Data Warehouse (IWDW) for the 2011 base year and 2025 future year air quality modeling.

The CARMMS 2.0 approach was designed to leverage the WAQS-IWDW modeling platform to the largest extent possible, for efficient preparation of input data for the CARMMS 2.0 modeling, and to eliminate the need for a comprehensive model performance evaluation, since the WAQS modeling has already gone through a comprehensive MPE (UNC and Ramboll Environ, 2016). However, due to a few changes made in the CARMMS 2.0 modeling compared to the WAQS platform as discussed below, an abbreviated MPE was conducted to check for equivalency with the WAQS results (see Section 2.4).

There are two main differences between CARMMS 2.0 and the WAQS-IWDW modeling platform, namely the modeling domain and the CAMx model version. It is not computationally practical to run the WAQS-IWDW modeling platform as is for CARMMS, so a subset of the domain is selected for CARMMS 2.0 (Figure 2-1) to reduce the computational burden of the CAMx source apportionment runs for the three 2025 future year cases for the high, medium and low oil and gas scenarios. CARMMS 2.0 uses CAMx version 6.20 while WAQS applied version 6.10. Through test runs, we confirmed that the change in CAMx version from 6.10 to 6.20 does not introduce notable changes in the modeling results for ozone and $PM_{2.5}$ in this domain.

2.1 CAMx Modeling Domains

CARMMS 2.0 adopted a two-way nested 12/4 km horizontal resolution domain as shown in Figure 2-1. Because the southern boundary of the IWDW WAQS 2011 4 km air quality domain does not extend as far south into New Mexico as the CARMMS 1.0 4 km domain (Figure 2-2), the central part of New Mexico was modeled at 12 km resolution in CARMMS 2.0 while all of Colorado and northern New Mexico (including the Farmington Field Office) was modeled at 4 km resolution (Figure 2-1). The grid projection is the standard Regional Planning Organization (RPO) Lambert Conformal Conic projection also used in CARMMS 1.0 and 1.5, with true latitudes at 33°N and 45°N and centered at 40°N, 97°W. The datum (size and shape of earth) is a perfect sphere with radius 6370.0 km.

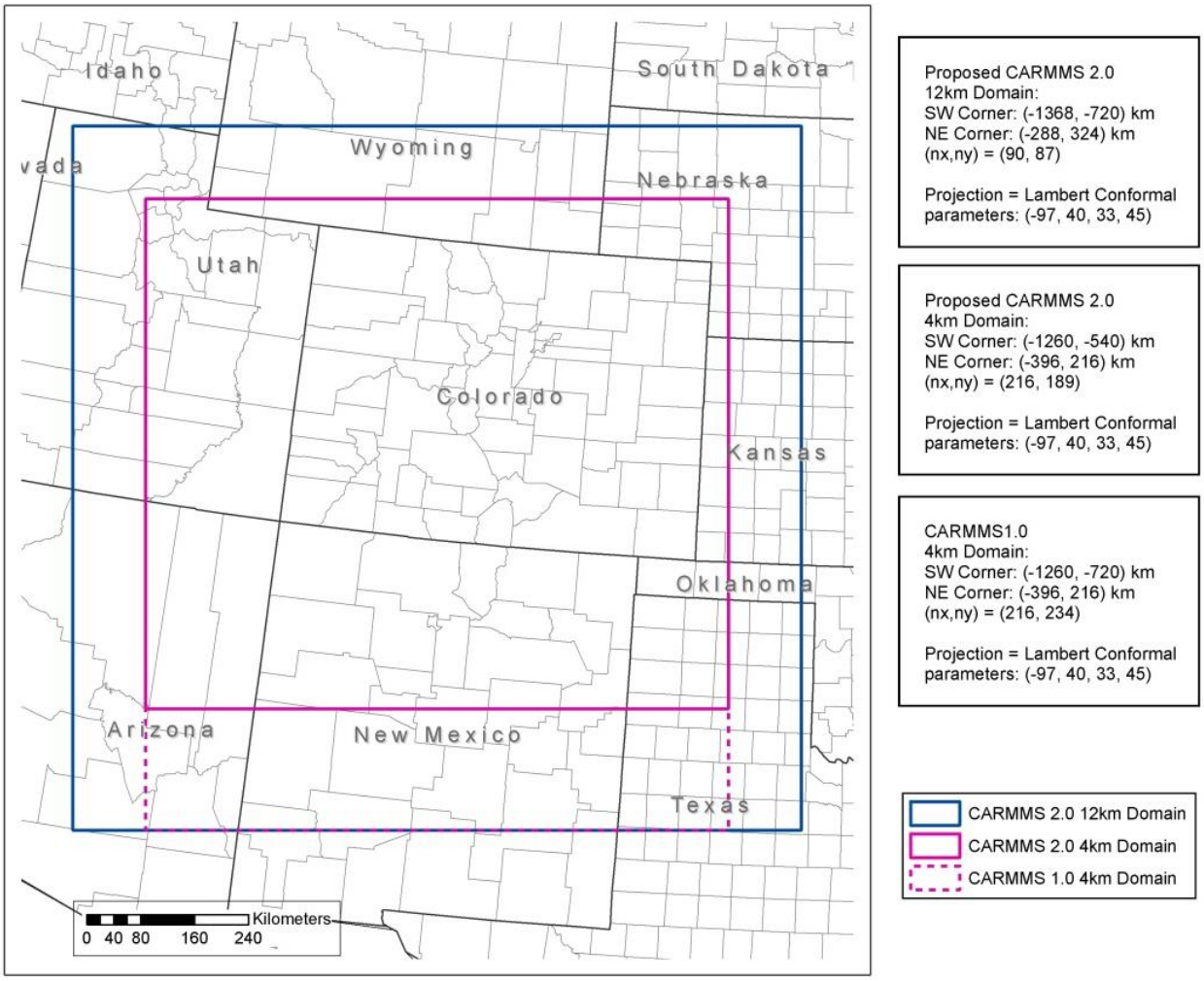

Figure 2-1. CARMMS 2.0 12/4 km air quality modeling domains (CARMMS 1.0 domain also shown for reference).

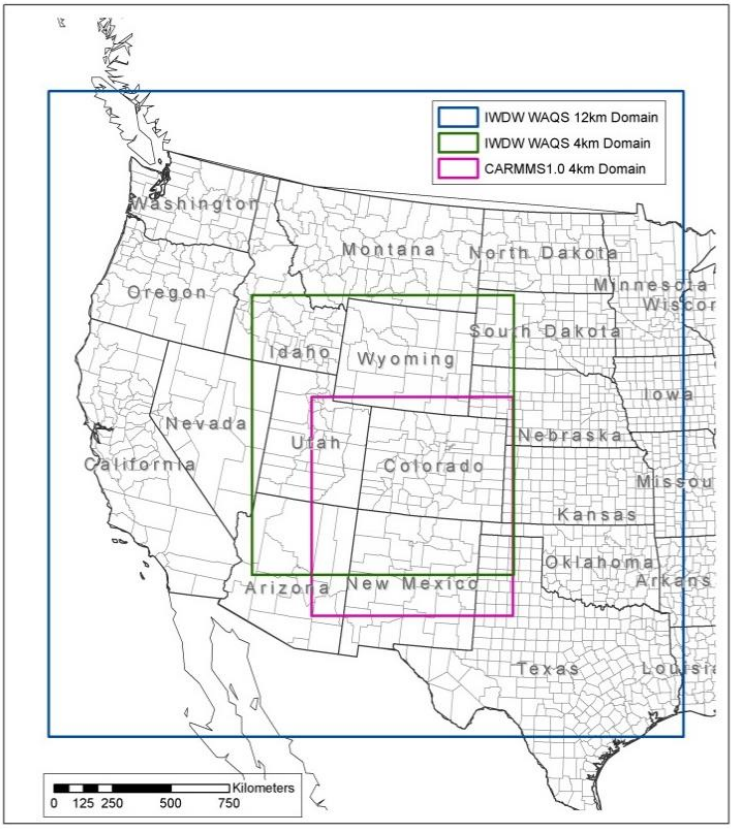

Figure 2-2. IWDW WAQS 2011 12 km (blue) and 4 km (green) and CARMMS 1.0 4 km (pink) air quality modeling domains.

In WAQS, WRF was applied with 37 vertical levels (36 vertical layers using the CAMx definition of layer thicknesses) from the surface up to 50 mb (approximately 19 km high above mean sea level) (http://views.cira.colostate.edu/tsdw/). The WRF model employs a terrain following coordinate system defined by pressure. Table 2-1 shows the mapping between the WRF vertical layers and the 25 vertical layers in CAMx for WAQS and CARMMS 2.0.

Table 2-1. 37 Vertical layer interface definition for WAQS WRF simulations (left most columns), and approach for reducing to 25 vertical layers for CAMx in CARMMS 2.0 by collapsing multiple WRF layers (right columns).

WRF Meteorological Model					CAMx Air Quality Model		
WRF Layer	Sigma	Pressure (mb)	Height (m)	Thickness (m)	CAMx Layer	Height (m)	Thickness (m)
37	0.0000	50.00	19260	2055	25	19260.0	3904.9
36	0.0270	75.65	17205	1850			
35	0.0600	107.00	15355	1725	24	15355.1	3425.4
34	0.1000	145.00	13630	1701			
33	0.1500	192.50	11930	1389	23	11929.7	2569.6
32	0.2000	240.00	10541	1181			
31	0.2500	287.50	9360	1032	22	9360.1	1952.2
30	0.3000	335.00	8328	920			

29	0.3500	382.50	7408	832	21	7407.9	1591.8
28	0.4000	430.00	6576	760			
27	0.4500	477.50	5816	701	20	5816.1	1352.9
26	0.5000	525.00	5115	652			
25	0.5500	572.50	4463	609	19	4463.3	609.2
24	0.6000	620.00	3854	461	18	3854.1	460.7
23	0.6400	658.00	3393	440	17	3393.4	439.6
22	0.6800	696.00	2954	421	16	2953.7	420.6
21	0.7200	734.00	2533	403	15	2533.1	403.3
20	0.7600	772.00	2130	388	14	2129.7	387.6
19	0.8000	810.00	1742	373	13	1742.2	373.1
18	0.8400	848.00	1369	271	12	1369.1	271.1
17	0.8700	876.50	1098	177	11	1098.0	176.8
16	0.8900	895.50	921	174	10	921.2	173.8
15	0.9100	914.50	747	171	9	747.5	170.9
14	0.9300	933.50	577	84	8	576.6	168.1
13	0.9400	943.00	492	84			
12	0.9500	952.50	409	83	7	408.6	83.0
11	0.9600	962.00	326	82	6	325.6	82.4
10	0.9700	971.50	243	82	5	243.2	81.7
9	0.9800	981.00	162	41	4	161.5	64.9
8	0.9850	985.75	121	24			
7	0.9880	988.60	97	24	3	96.6	40.4
6	0.9910	991.45	72	16			
5	0.9930	993.35	56	16	2	56.2	32.2
4	0.9950	995.25	40	16			
3	0.9970	997.15	24	12	1	24.1	24.1
2	0.9985	998.58	12	12			
1	1.0000	1000	0			0	

2.2 Modeling Configuration and Inputs

A prior version of CAMx (v6.1) was run in CARMMS 1.0 and CARMMS 1.5. In CARMMS 2.0, a later version (v6.20) was applied with the Carbon Bond 6 revision 2 (CB6r2) photochemical mechanism. Table 2-2 summarizes the model configurations and options used in CARMMS 2.0 modeling.

Table 2-2. Summary of CAMx Model Configuration for CARMMS 2.0.

Science Options	Configuration
Model Code Version	CAMx V6.20
Horizontal Grid	12/4 km
12 km grid	90 x 87 cells
4 km grid	216 x 189 cells
Vertical Grid	25 vertical layers
Grid Interaction	12/4 km two-way nesting
Initial Conditions	Clean initial conditions with 10-day spin-up
Boundary Conditions	12 km BCs from 2011 WAQS 12km simulation
Land-use Data	Land-use fields based on USGS GIRAS data
Photolysis Rate Preprocessor	TUV V4.8 (Clear-sky photolysis rates from TOMS data)

Science Options	Configuration
Gas-phase chemistry	CB6r2
Aerosol-phase	CF (coarse and fine mode aerosols)
Diffusion Scheme	
Horizontal-grid	Explicit horizontal diffusion
Vertical-grid	K-theory 1st-order closure
Deposition Scheme	
Dry deposition	ZHANG03
Wet deposition	CAMx-specific formulation
Numerical Solvers	
Gas-phase chemistry	Euler Backward Iterative (EBI) solver
Horizontal advection	Piecewise Parabolic Method (PPM)
Vertical advection	Implicit scheme with vertical velocity update

Input data for emissions, meteorology, land use, and initial and boundary conditions for CARMMS 2.0 2011 base year modeling were prepared using data from the WAQS 2011b platform archived by IWDW. Specifically, the merged emission files for the 12 and 4 km WAQS air quality domains from the IWDW database were "windowed" to prepare CAMx-ready emissions for the CARMMS 2.0 12/4 km domain for Year 2011 modeling. Prior to CARMMS 2.0, an error was found in the lightning NOx emissions used in WAQS 2011b modeling; this error was fixed in the merged point source emission files used for CARMMS 2.0 modeling. Meteorological inputs and land use files for the CARMMS 12 km and 4 km modeling domains were windowed from the CAMx-ready WRFCAMx inputs used for WAQS 12 km and 4 km domains, respectively. Initial and boundary conditions for the CARMMS 2.0 12 km domain were extracted from 3-D modeling outputs from WAQS 2011b 12 km domain modeling. 12 km 3-D outputs from the 2025 WAQS modeling were used to generate initial and boundary conditions for the CARMMS 2.0 2025 future year source apportionment modeling. Photolysis rates for input to CAMx were calculated using the Tropospheric visible Ultra-Violet (TUV) model developed by the National Center for Atmospheric Research (Madronich, 1993).

2.3 2011 Base Case Emissions

The CARMMS 2.0 2011 base case emissions were "windowed" (i.e., a smaller spatial extent) and extracted from the final Western Air Quality Study (WAQS) 2011b Base Case emissions to generate CAMx-ready emissions for the CARMMS 2.0 12/4 km domain. The primary source for the WAQS 2011b Base Case emissions is Version 2 of the 2011 National Emissions Inventory (NEI2011v6.2[1]). For most source categories, the SMOKE emissions modeling system was used to process the emissions into the hourly gridded speciated emissions needed as input for CAMx. Table 2-4 summarizes the emission models and sources of the WAQS 2011b base year emissions. The comprehensive and detailed documentation for the WAQS 2011b Base Case

[1] http://www.epa.gov/ttnchie1/net/2008inventory.html

emissions inventory is available on the IWDW website[2] and EPA's Technical Support Document for the 2011v6.2 platform[3].

On-Road Mobile Sources: The Motor Vehicle Emissions Simulator (MOVES) is EPA's current tool to construct on-road mobile source emissions estimates for national, state, and county level inventories of criteria air pollutants, greenhouse gas emissions, and some mobile source air toxics from highway vehicles. For all states except California, MOVES2014 was run for WAQS 2011b to generate 2011 emission factors, which were then used by SMOKE-MOVES to develop model-ready emissions. In Colorado, the on-road refueling emissions were replaced by the state submitted point emissions.

Non-Road Mobiles Sources: For non-road mobile sources, county-level inventory was directly taken from the NEI non-road sector. For all states except California and Texas, non-road mobile equipment emissions were developed with the National Mobile Inventory Model (NMIM) using NONROAD2008 version for WAQS 2011b.

Point Sources (CEM and non-CEM point): For the WAQS 2011b platform, 2011 hourly NO_x and SO_2 emissions for Continuous Emissions Monitor (CEM) sources were obtained from the Clean Air Markets Division (CAMD); other pollutants for CEM sources and non-CEM and non-oil and gas point sources were directly taken from the NEI platform.

Area Sources: The Area (or Non-Point) data category contains emission estimates for sources which individually are too small in magnitude or too numerous to inventory as individual point sources, and which can often be estimated more accurately as a single aggregate source for a County or Tribal area. Area source (non-point) emissions are emissions sources that are summed over a geographic region, rather than specifically located. Examples of area sources include small industrial, residential, consumer product, and agricultural emissions. In the WAQS 2011b Base Case platform, emission inventory from these area sources were directly taken from 2011 NEI platform. For fugitive dust emissions, post-hoc adjustments were applied to account to vegetation scavenging. A meteorology-based algorithm was applied to emissions from fertilizer and residential wood combustion sources to simulate the temporal variability in hourly and daily emissions, respectively. For aircraft, locomotive and marine sources, county-level inventory was also from the NEI platform.

Oil and Gas Sources: For basins covered by the 2011 3SAQS Phase II inventory, including the Denver-Julesburg, Piceance, Uintah, North San Juan, South San Juan, Southwest Wyoming, Wind River, Powder River, Big Horn, Paradox, Raton, and Williston basins, the 2011 3SAQS Phase II inventory was used. Detailed updates to the 2011 3SAQS Phase II inventory is available

[2] http://vibe.cira.colostate.edu/wiki/wiki/2078
[3] https://www.epa.gov/sites/production/files/2015-10/documents/2011v6_2_2017_2025_emismod_tsd_aug2015.pdf

on the IWDW website[4]. For basins not covered by the 2011 3SAQS Phase II inventory, the NEI inventory was used.

Natural Emissions: The latest version of MEGAN (version 2.1) was used to simulate biogenic emissions using the WAQS 2011 meteorology. Emissions from wild fires, prescribed burns and agricultural burning were based on the Particulate Matter Deterministic and Empirical Tagging and Assessment of Impact on Levels (PMDETAIL) 2011 version 2 inventory. Wind-blown dust emissions were from the WRAP dust model[5] with 2011 meteorology. Lightning NOx emissions were generated based on the modified model of Koo et al. (2010) used in the WestJumpAQMS. Sea salt emissions were calculated by an emission processor for use with CAMx.

2.4 Abbreviated Base Year Model Performance Evaluation

The CARMMS 2.0 base year 2011 modeling bears high consistency with the IWDW WAQS 2011b platform, with the only known differences being (1) the model version, (2) the lightning NOx point source emissions, and (3) the difference in model resolution for areas to the north and west of the CARMMS 4 km domain, which were simulated at 12 km resolution in CARMMS 2.0 and at 4 km resolution in WAQS. The extensive use of modeling data from WAQS-IWDW has significantly improved the efficiency of CARMMS 2.0 air quality modeling. Results from the abbreviated CARMMS 2.0 MPE indicate that the modified modeling platform for CARMMS 2.0 shows approximately equivalent model performance with the WAQS-IWDW 2011b modeling platform and also meets relevant goals and criteria for ozone and $PM_{2.5}$ in general. More details of the abbreviated Base Year MPE are provided in Appendix A.

[4] http://vibe.cira.colostate.edu/wiki/wiki/5104/oil-gas-emissions-modeling
[5] http://www.wrapair.org/forums/dejf/documents/WRAP_WBD_PhaseII_Final_Report_050506.pdf

Table 2-4. Summary of sources of emissions and emission models used to generate WAQS 2011b base case emissions for use in CARMMS 2.0

Emissions Component	Configuration	Details
Oil and Gas Emissions	Updated 2011 3AQS Phase II inventory and NEI 2011v2	2011 3SAQS Phase II inventories for the Denver-Julesburg, Piceance, Uintah, North San Juan, South San Juan, Southwest Wyoming, Wind River, Powder River, Big Horn, Paradox, Raton, and Williston basins; for basins not covered by the 2011 3SAQS Phase II inventory, use NEI emissions.
Area Sources Emissions	NEI 2011v2	County-level inventory taken directly from the NEI. Post-hoc adjustments applied to dust emissions to account for vegetation scavenging; meteorology-based algorithm applied to fertilizer and residential wood combustion emissions to simulate the temporal variability in hourly and daily emissions.
On-Road Mobile Emissions	NEI 2011v2	EPA ran MOVES2014 for 2011 in emissions factor mode. The MOVES lookup tables include on-network (RPD), on-network refueling (RPD_RFL), on-network for CA (RPD_CA), off-network starts/stops (RPV), off-network starts/stops refueling (RPV_RFL), off-network starts/stops for CA (RPV_CA), off-network vapor venting (RPP) off-network vapor venting sources for CA (RPP_CA), and extended idling (RPH). These data include the reference county and reference fuel month assignments that EPA used for the MOVES simulation. The CA MOVES estimates were normalized to emissions values provided by CARB.
Off-Road Mobile Emissions	NEI 2011v2	County-level inventories taken directly from the NEI for recreational vehicles, logging equipment, agricultural equipment, construction equipment, industrial equipment, lawn and garden equipment, leaf and snow blowers, and recreational marine. The CA and TX NONROAD estimates were normalized to emissions values provided by these states.
Point Sources Emissions	2011 CEM and NEI 2011v2	2011 Clean Air Markets Division (CAMD) hourly NO_x and SO_2 emissions for CEM sources and county-level inventory taken directly from the NEI for other pollutants and non-CEM and non-oil and gas point sources.
Fires	PMDETAIL 2011 version 2	PMDETAIL 2011 version 2 inventory for wild, prescribed, and agricultural fires in the U.S., Canada, and Mexico; includes pre-computed plume parameters and speciated PM.
Biogenic Sources	MEGAN	MEGAN v2.10 biogenic emissions calculated using the WAQS 2011 meteorology
Wind-Blown Dust Emissions	WRAP wind-blown dust model	WRAP wind-blown dust emissions calculated using the WAQS 2011 meteorology
Sea Salt Emissions	Emissions processor	Sea salt emissions
Lightning Emissions	Modified Lightning NO_x emissions model	Lightning NO2 emissions

3.0 FUTURE YEAR EMISSIONS

In this section, we describe the development of the future year emissions scenario. The future year emissions scenario modeled is 2025. Forecasting future year oil and gas (O&G) emissions has many uncertainties because future O&G emissions depend on economic conditions (e.g., price of natural gas and oil), identification of new O&G plays, availability of exploration and development equipment and regulatory requirements. For CARMMS, future year O&G emissions were developed for a range of potential outcomes which attempt to bound actual future year O&G development in the region. CARMMS developed three levels of 2025 future year O&G development within Colorado Planning Areas, the Mancos Shale, and Southern Ute Indian Tribe (SUIT) lands:

- High Development Scenario;
- Low Development Scenario; and
- Medium Development Scenario, which is a mitigated version of the High Development Scenario.

There are four general types of future year emissions addressed in CARMMS:

1. BLM-authorized (Federal lands) and other (non-Federal lands) oil and gas and mining emissions within the Colorado BLM planning areas (as well as the BLM Farmington Field Office in northern New Mexico)

2. Oil and gas and other development areas outside Colorado/northern New Mexico BLM Planning Areas

3. Remainder future year anthropogenic emissions, and

4. Emissions that remained unchanged from the base year in future year scenarios.

3.1 Colorado BLM Planning Area and Mancos Shale Oil and Gas Emissions Calculators

To address emissions from future BLM-authorized (Federal lands) and non-BLM-authorized (non-Federal lands) oil and gas development in Colorado and northern New Mexico planning areas, CARMMS 2.0 has used several emission calculators. For CARMMS 2.0, we developed a new set of emissions calculators for the Royal Gorge Field Office (RGFO) and updated existing emissions calculators for Western Colorado Field Offices for CARMMS 1.0 (ENVIRON et al.; 2015) and the Mancos Shale for CARMMS 1.5 (Ramboll Environ and Kleinfelder, 2016a). The calculators allow the user to readily modify input assumptions, such as production parameters, emission control assumptions, and wellhead equipment configurations. Emissions were developed for O&G activity on SUIT land based on the Supplemental Environmental Impact Statement (SEIS) for Shale Formation Oil and Gas Plan of Development emissions inventory (Ramboll Environ, 2016).

The new and updated emission calculators were used to develop 2025 future-year O&G emissions inventories for (1) eight western Colorado BLM planning areas, (2) four subareas of

the Royal Gorge Field Office Planning Area, and (3) the Mancos Shale in the Tres Rios and Farmington Field Office Planning Areas.

The RGFO is divided into four separate source groups, with three source groups containing mostly conventional oil and gas well development and one source group containing mostly coal bed methane gas well development. One of the conventional oil and gas well areas (RGFO Area 1, see Figure 3-1) is also a non-attainment area for ozone. One of the four RGFO groups covers South Park. Although there are currently no active wells in South Park, CARMMS 2.0 is intended to support the RGFO RMP where there is a Master Leasing Plan (MLP) Alternative for allowing O&G development in South Park.

For the RGFO calculators, we used an emission calculator template similar to the existing calculators developed in CARMMS 1.0 and CARMMS 1.5 for consistency across field offices. Source data used in the RGFO calculators were based on RGFO specific operations and equipment currently in the field. Similarly, the on-the-books regulations used for emission controls also took into account RGFO specific considerations, such as regulations specific to the non-attainment area. The RGFO calculators, for all four of the RGFO source groups, estimate emissions for 2015 to 2025 using current decline curve data and the most recent version of MOVES2014a (Motor Vehicle Emission Simulator version 2014a; EPA, 2015) to create on-road vehicle and off-road equipment emission factors. The RGFO has both conventional oil and conventional gas wells; however, operations at RGFO oil and gas wells are similar so they were combined into one calculator.

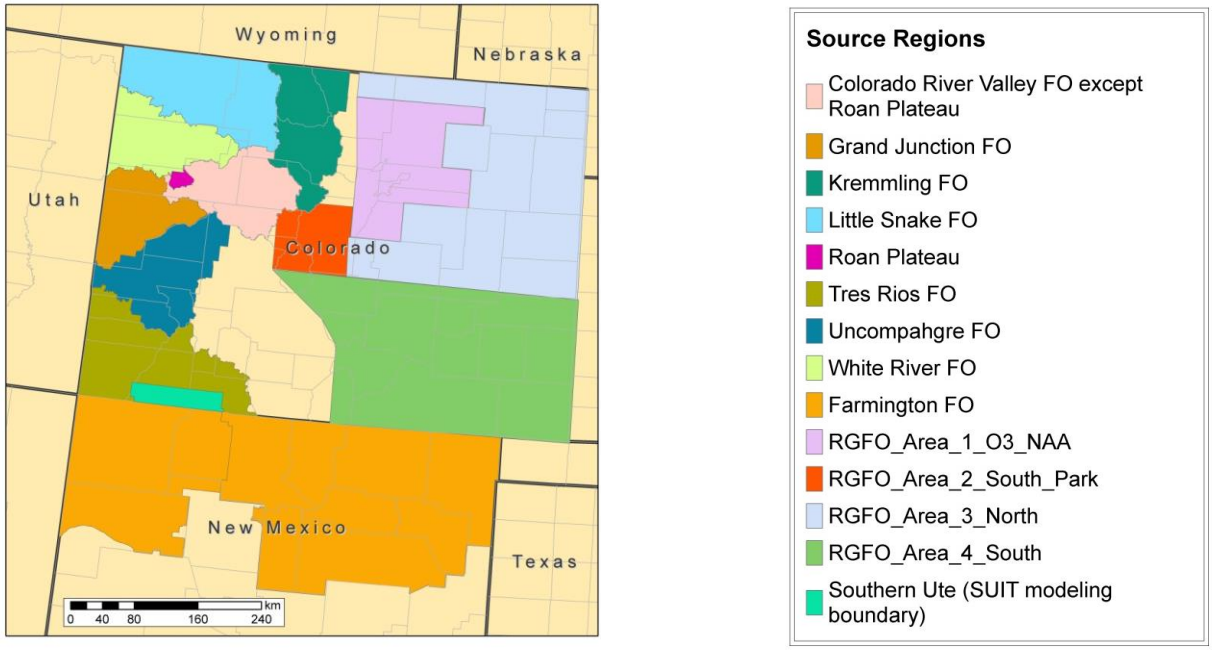

Figure 3-1. Colorado Field Office Planning Areas.

Emission calculator updates for the western Colorado Field Offices and the Mancos Shale include updates to emission controls required by on-the-books regulations, well decline curves, and on-road vehicle and off-road equipment emission factors using the latest version of

MOVES2014a. The Tres Rios Field Office emission calculators were modified to exclude future oil and gas activity on SUIT land because emissions from future oil and gas activity on SUIT land are estimated based on the emissions inventory for the SEIS for Shale Formation Oil and Gas Plan of Development (Ramboll Environ, 2016).

The following sections summarize the emission calculators used to estimate O&G emissions for western Colorado and northern New Mexico. Details on the emission calculators are provided in the Technical Memorandum (Ramboll Environ and Kleinfelder, 2016b), shown in Appendix B.

3.1.1 Overview of Calculators

Emission calculators have been developed for each of the following regions and well types.

- Royal Gorge Field Office
  - Conventional oil and gas
  - Coalbed methane (natural gas) (CBM)
- Western Colorado Field Offices
  - Conventional gas
  - Conventional oil
  - Shale gas
  - Coalbed methane (natural gas) (CBM)
- Mancos Shale
  - Shale gas
  - Shale oil

For each area and well type combination, a separate self-contained emission calculator spreadsheet contains all of the inputs and calculations need to generate well site emissions.

Additionally, a calculator has been developed to estimate midstream emissions for each area. The midstream emission calculator draws upon Colorado Department of Public Health (CDPHE) Air Pollutant Emission Notice (APEN) emissions for base year emission estimates. Future year midstream emission projections are dependent on the change in gas production in a given planning area which can be updated based on linkages to the by well type emission calculators.

3.1.2 Pollutants

The emission calculators include estimates of emissions of criteria air pollutants (CAPs), greenhouse gases (GHGs), and hazardous air pollutants (HAPs) as follows:

Criteria Pollutants

- Carbon monoxide (CO)
- Nitrogen oxides (NO_X)
- Particulate matter less than or equal to 10 microns in diameter (PM_{10})
- Particulate matter less than or equal to 2.5 microns in diameter ($PM_{2.5}$)
- Sulfur dioxide (SO_2)
- Volatile Organic Compounds (VOCs)

Greenhouse Gases[6]

- Carbon dioxide (CO_2)
- Methane (CH_4)
- Nitrous oxide (N_2O)

Hazardous Air Pollutants (HAPs)[7]

While lead (Pb) is a criteria pollutant, emissions of lead in the BLM western Colorado planning areas due to O&G and mining activities are extremely low and are therefore not included in this analysis.

HAP emissions were estimated for each emissions source. For oil and gas emissions sources, HAP emissions from venting and combustion source categories were estimated for formaldehyde, n-hexane, benzene, toluene, ethylbenzene, and xylenes (BTEX).

Anthropogenic greenhouse gas emission inventories typically include carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), and fluorinated gases. Fluorinated gases are not expected to be emitted in appreciable quantities by any category considered in this emission inventory and were therefore not included in this analysis.

The HAP and GHG emissions inventories are provided separately with the CARMMS 2.0 emissions calculators.

3.1.3 Temporal

The calculators estimate annual emissions associated with oil and gas exploration and production. Baseline emissions are estimated for 2015[8] with annual emission forecasts for each year up to 2025. Default temporal profiles available in SMOKE were applied for each source classification code (SCC).

3.1.4 Calculator Inputs

The emission calculator for each well type allows for specification of the following inputs.

- Base year oil and gas activity (gas production, oil production, spud counts, active well counts)
- Well decline estimates
- Level of control by source category
- Gas composition

[6] Note that the CARMMS PGM modeling does not use Greenhouse Gas (GHG) emissions, but the emission calculators provide GHG emission estimates so they can be reported in the RMPs.
[7] Note that the CARMMS PGM modeling does not use HAPs emissions, but the emission calculators provide HAPs emission estimates so they can be reported in the RMPs.
[8] There were several areas (Mancos, RFGO Area 2 and SUIT Land Supplemental Environmental Impact Statement wells) for which there was negligible O&G activity in 2015 and hence zero emissions estimated for 2015. For these areas, emissions were forecast from 2016 (Mancos and RGFO Area 2) or 2018 (SUIT Land Supplemental Environmental Impact Statement wells).

- Equipment configurations (e.g. drill rigs, fracing rigs)
- Gas venting activity (e.g. completions, blowdowns)
- The midstream emission calculator includes estimates of base year 2015 gas plant and compressor station emissions taken from CDPHE APEN data. Base year midstream emissions are forecast to future years based upon the gas production in each planning area.

3.1.5 Emission Calculations

Emission calculations for all emission-generating activities were developed based on typical oil and gas exploration and production emission inventory methodology. Methods used to estimate emissions from each source category are explained in detail in Appendix B. For each source category, emissions for the 2015 baseline were estimated. 2015 baseline emissions are forecasted to future years based on oil and gas activity growth and for applicable sources, emissions controls.

The oil and gas emission estimation methodologies described herein are used consistently in each calculator; however the input data for each calculator was selected to best reflect the operational characteristics of each area and well type combination and thus obtained from literature sources including the following Air Quality Technical Support Documents (AQTSD) from Colorado field office planning areas and BLM emission calculators:

- White River AQTSD (URS, 2012a)
- Colorado River Valley AQTSD (URS, 2012b)
- Grand Junction AQTSD (BLM, 2012b)
- Uncompahgre AQTSD (BLM, 2016c)
- BLM Crude Oil Well Gas Emission Calculator
- BLM Coalbed Natural Gas Well Emission Calculator
- CARMMS information request (BLM 2016a; 2016b)

Emissions are generated in three main phases of oil and gas systems:

- Emissions from Well Construction and Development
- Emissions from the Production Phase (occurring at-or-nearby the well pad)
- Emissions from Midstream Sources (Central Gas Compression and Processing)

The methodologies implemented to estimate base year and future year emissions from oil and gas sources are explained in Appendix B and covered the following source categories:

Well pad construction and development:

- Well pad, access road and pipeline construction equipment;
- Well pad, access road and pipeline construction traffic;
- Drilling and completion equipment;

- Fracing equipment;
- Refracing equipment;
- Drilling and well completion traffic;
- Well pad, access road and pipeline construction wind erosion; and
- Well completion venting.

Production phase emissions:

- Well workover equipment;
- Production traffic;
- Blowdown venting;
- Well recompletion venting;
- Pneumatic devices and fugitive components;
- Water injection pumps;
- Compressor station maintenance traffic exhaust and fugitive dust;
- Condensate or oil tanks flashing and working and breathing losses;
- Loading emissions from condensate and oil tanks;
- Haul trucks traffic emissions;
- Heaters; and
- Dehydrators;

Midstream sources:

- Natural gas processing facilities;
- Natural gas compressor stations; and
- Gas sweetening.

The oil and gas emission calculators are designed to estimate emissions from both BLM-authorized and non-BLM-authorized activities.

3.2 Oil and Gas Emissions outside the Colorado Planning Areas and the Mancos Shale

The following subsections describe the procedures for estimating baseline and future year oil and gas emissions for areas within the CARMMS 2.0 12/4 km modeling domain but outside the Colorado BLM planning areas and the Mancos Shale.

3.2.1 Uinta Basin, Utah

Baseline and future year emissions associated with oil and gas development in the Uinta Basin have been estimated by AECOM for the BLM Utah State Office (UTSO) under the UTSO Air Resource Management Study (ARMS). The UTSO ARMS is using a 2010 baseline year. More details on the oil and gas emissions for the Uinta Basin are available in the UTSO ARMS documentation (AECOM, 2013).

3.2.2 All other O&G basins outside Colorado

Baseline and future year oil and gas emissions for the basins outside Colorado were based on Intermountain West Data Warehouse[9] 2025b inventory.

3.3 Oil and Gas Emissions

The emission calculators were used to generate O&G emissions for the eleven-year period of 2015-2025 for Colorado BLM Planning Areas and the Mancos Shale:

- Royal Gorge Field Office (RGFO)
- Roan Plateau portion of the Colorado River Valley Field Office (CRVFO)
- CRVFO outside the Roan Plateau
- Grand Junction Field Office (GJFO)
- Kremmling Field Office (KFO)
- Little Snake Field Office (LSFO)
- Tres Rios Field Office (TRFO)
- Uncompahgre Field Office (UFO)
- White River Field Office (WRFO)
- Mancos Shale (TRFO, FFO)

For each year from 2015-2025, the emissions calculators were used to estimate O&G emissions for upstream (well site) and midstream emission sources and for O&G development on Federal and non-Federal lands.

Annual 2015-2025 emissions on SUIT land were developed separately from TRFO area emissions for O&G shale activity based on the emissions inventory for the SEIS for Shale Formation Oil and Gas Plan of Development (Ramboll Environ, 2016).

3.3.1 2025 High, Low and Medium Development Scenarios Emissions Overview

The emissions calculators were used to generate O&G emissions within Colorado BLM Planning Areas and the Mancos Shale for 2025 High, Low and Medium Development Scenarios. Oil and gas activity forecasts for BLM Planning Areas in Colorado are based on BLM COSO estimates of RFD O&G future development for the High Development Scenario and historical 5-year average O&G development for the Low Development Scenario. Applicable on-the-books State and Federal controls are applied to the O&G emissions starting in the year that they are required. Mancos Shale oil and gas activity forecasts for the Low Development Scenario and the High Development Scenario remain unchanged from CARMMS1.5. Oil and gas activity forecasts on Southern Ute Indian Tribal land assume 96 spuds and 400 operating wells in 2025 for the High Development Scenario and 48 spuds and 200 active wells in 2025 for the Low Development Scenario. Negligible base year 2015 O&G activity for the Mancos Shale is assumed. Base year emissions on SUIT land are included in TRFO emissions; emissions on SUIT land were distinguished from TRFO emissions only for additional O&G activity resulting from the SEIS for

[9] http://views.cira.colostate.edu/tsdw/

Shale Formation Oil and Gas Plan of Development. All wells drilled as part of the Supplemental Environmental Impact Statement for Shale Formation Oil and Gas Plan of Development are included in this analysis as non-Federal wells.

The Low Development Scenario assumes that in 2025 there are a total of 42,945 active wells in the Royal Gorge Field Office (2% on Federal and 98% on non-Federal land), 27,618 active wells in eight western field offices (51% on Federal and 49% on non-Federal lands), 1,513 active wells in the Mancos Shale (70% on Federal and 30% on non-Federal lands), and 200 active shale wells on SUIT land (all non-Federal). The High Development Scenario assumes that in 2025 there are a total of 55,610 active wells in the Royal Gorge Field Office (4% on Federal and 96% on non-Federal land), 44,018 active wells in eight western field offices (54% on Federal and 46% on non-Federal lands), 3,026 active wells in the Mancos Shale (70% on Federal and 30% on non-Federal lands), and 400 active shale wells on SUIT land (all non-Federal). The 2025 Medium Development Scenario has the same number of wells as the High Development Scenario but assumes additional levels of controls beyond the application of existing state and federal requirements. The Medium Development Scenario assumes additional control of engine and fugitive emission sources for all phases of well-site operation for wells drilled on Federal land and as part of the SUIT land Supplemental Environmental Impact Statement for Shale Formation Oil and Gas Plan of Development after 2015 as shown in Table 3-1.

Table 3-1. Medium scenario additional control assumptions.

Emission Source Category	Medium Scenario Controls
Stationary engines	50% electric engines (50% natural gas-powered)
Pneumatic devices	50% no-bleed (50% low-bleed)
Drilling	Tier 4 gen-set standards for all engines with a horsepower >750; final Tier 4 standards for all engines with horsepower <750
Completion/Fracking	
Blowdowns	25% gas captured and routed to VRUs or flares (75% vented)
Liquids removal system (all produced liquids)	25% taken away by pipeline (75% by truck)
Pneumatic pumps	Unchanged from the High Scenario except in cases where less than 25% of pneumatic pumps emissions are controlled; if less than 25% of pneumatic pumps emissions are controlled then the percentage of pneumatic pumps which are controlled is set to 25%
Unpaved roads dust control	80% fugitive dust control
Construction fugitive dust control	50% fugitive dust control
Condensate Tanks (all produced liquids)	100% of emissions are captured and controlled by VRU or flare
Truck loading emissions	100% of emissions are captured and controlled by VRU or flare
VRUs	50% of emission control devices are assumed to be VRUs (50% flares)

Table 3-2 and Figure 3-2 compare the total 2025 emissions for the Low, Medium, and High Development scenarios across Colorado BLM Planning Areas, SUIT land shale development, and the Mancos Shale. Substantial increases from Low to High Development Scenario emissions result from different O&G activity assumptions (Low and High Development scenarios assume the same level of emissions control). There are substantial decreases in Federal O&G emissions from the High to Medium Development Scenario and smaller decreases from the High to Medium Development Scenario for non-Federal O&G emissions. Differences between the Medium and High Development scenarios are based on increased emissions control for Federal and SUIT O&G shale development in the Medium Development Scenario (activity assumptions are equivalent in the Medium and High Development scenarios). Smaller decreases for non-Federal relative to Federal O&G emissions are because of all non-Federal O&G development, only shale development on SUIT land was assumed to have increased control in the medium scenario.

Table 3-2. Comparison of total oil and gas emissions (tons per year, TPY) across Colorado BLM Planning Areas, SUIT land, and Mancos Shale for 2025 High, Low and Medium Development emission scenarios.

Scenario	VOC	CO	NO_X	PM_{10}	$PM_{2.5}$	SO_2
All Wells						
Low	178,426	107,618	81,136	37,190	7,955	509
Medium	236,734	155,198	125,684	61,621	12,276	1,791
High	251,877	158,478	132,493	66,392	12,977	1,794
Federal Emissions						
Low	26,954	11,814	12,353	2,865	833	308
Medium	43,096	27,785	28,378	4,933	1,692	1,385
High	57,948	30,459	33,919	9,492	2,310	1,387
Non-Federal Emissions						
Low	151,472	95,804	68,783	34,326	7,122	200
Medium	193,638	127,413	97,306	56,688	10,584	406
High	193,929	128,019	98,574	56,900	10,666	407

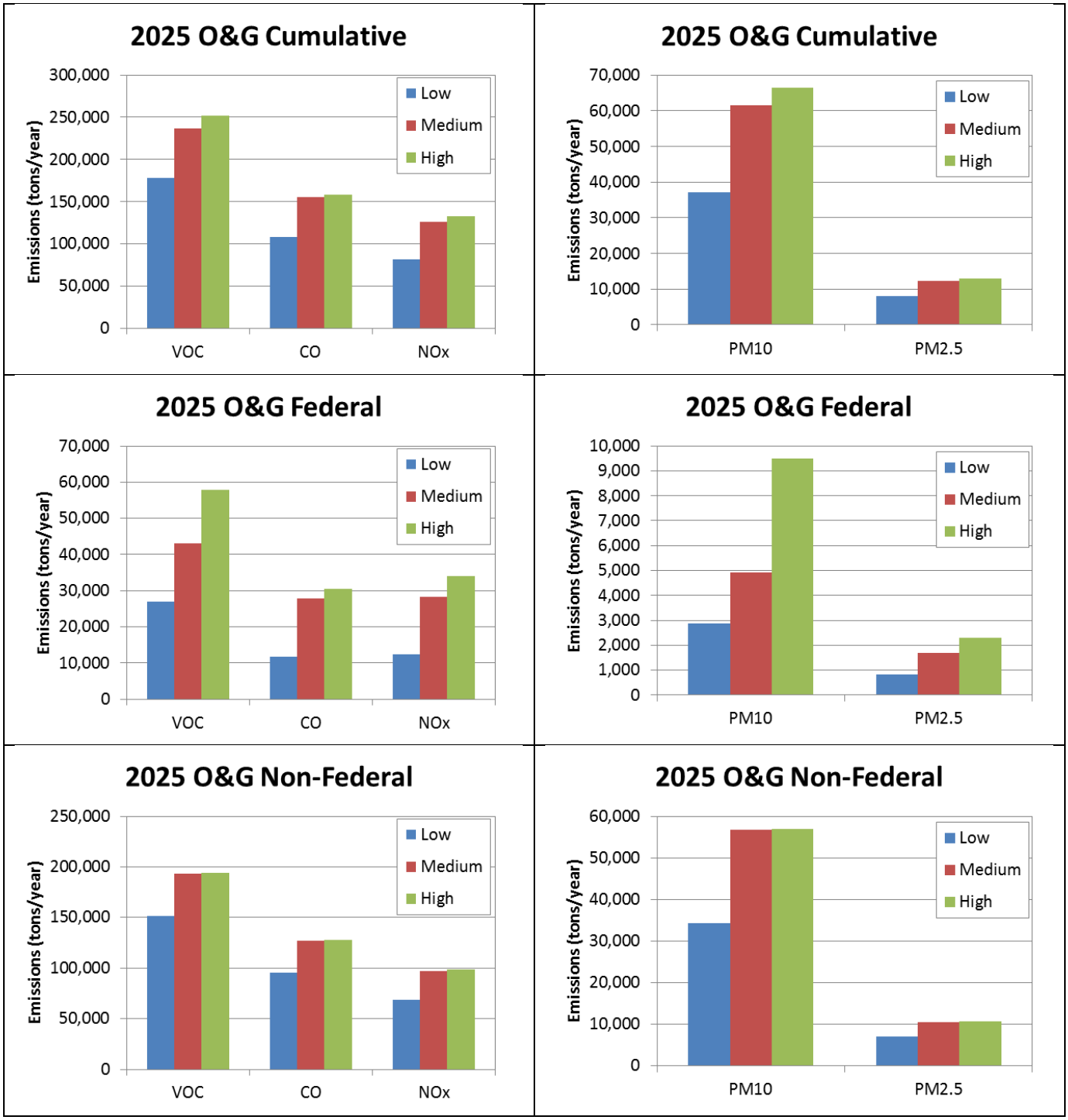

Figure 3-2. Comparison of total oil and gas emissions across Colorado BLM Planning Areas, SUIT land, and Mancos Shale for the 2025 High, Low and Medium Development Scenarios.

As shown in Figure 3-3, increases in 2025 O&G emissions from the Low to Medium Development Scenario are substantial for Federal NOx (130%) and VOC (60%) as well as non-Federal NOx (41%) and VOC (28%) emissions. O&G emission increases from the Medium to the

High Development Scenario are smaller for Federal NOx (20%) and VOC (34%) as well as non-Federal NOx (1%) and VOC (<1%) emissions.

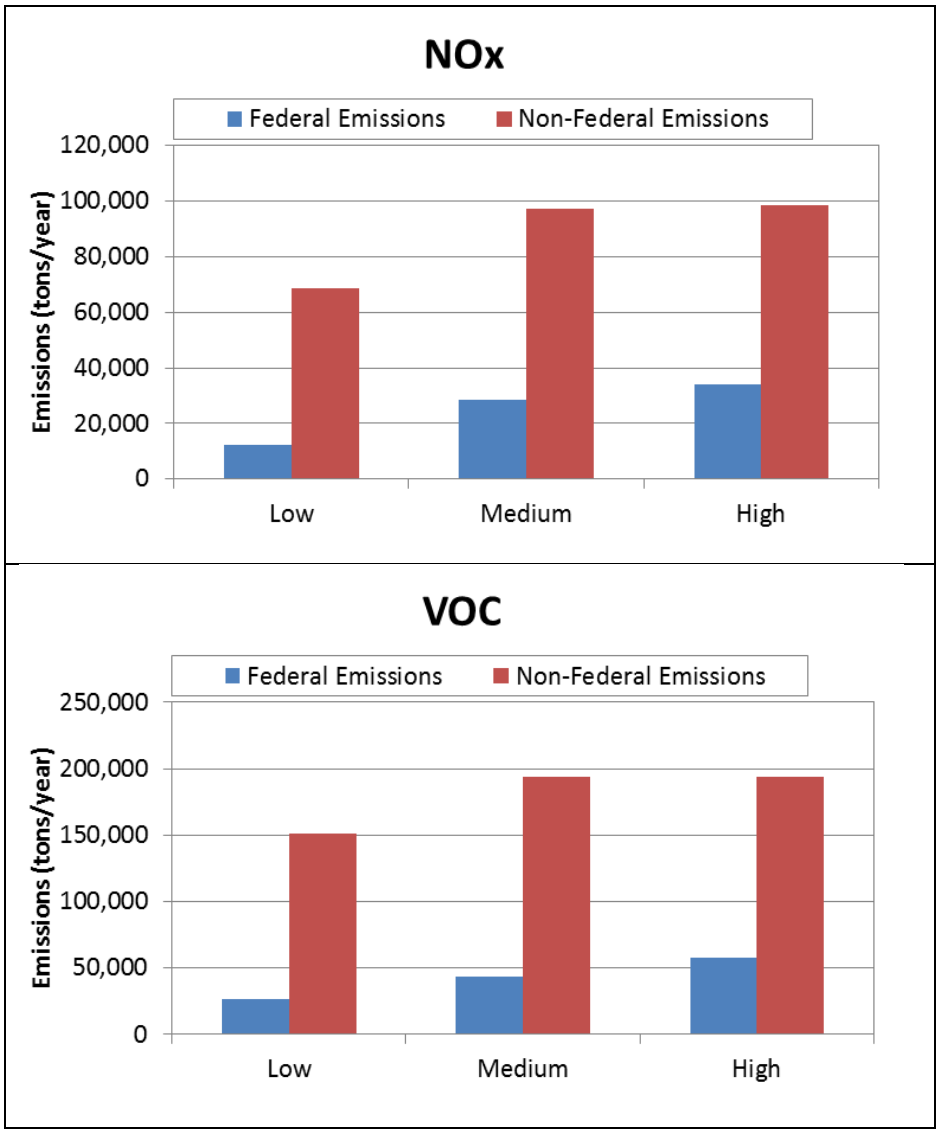

Figure 3-3. By scenario 2025 emissions from oil and gas development across Colorado BLM Planning Areas, SUIT land, and Mancos Shale for NOx (top panel) and VOC (bottom panel).

3.3.2 2025 High, Low and Medium Development Scenarios Emissions

The CARMMS air quality modeling results for the 2025 High, Low and Medium Development Scenarios are presented in Chapter 5. In this section we summarize the emissions for the Colorado BLM Planning Areas, SUIT land shale development, and Mancos Shale by scenario for 2025 emission scenarios. Table 3-3 displays NO_X and VOC O&G 2015 and 2025 emissions (and percent change 2015 to 2025) by planning area for each scenario stratified by Federal and non-Federal lands. We note that the first year of O&G activity for the Mancos and RGFO Area 2 emissions is 2016 and for the SUIT Supplemental EIS for Shale Formation Oil and Gas Plan of Development is 2018. Emissions are estimated to be negligible from Mancos, RGFO Area 2, and

SUIT in 2015. We also note that the 2025 emissions include new emissions and some existing emissions that have declined. Summary spreadsheets (not shown here) also include emissions stratified by upstream versus midstream, provide emissions per well, and all associated well-site equipment input factors and O&G activity assumptions. Generally, medium scenario federal emission magnitudes are smaller than the high scenario and greater than the low scenario federal emissions for each field office. The exception is medium scenario NOx emissions from O&G shale development on SUIT land which are smaller than low scenario emissions as a result of the application of medium scenario control assumptions to the SEIS for Shale Formation Oil and Gas Plan of Development emissions inventory (Ramboll Environ, 2016).

Table 3-3. Summary of oil and gas NO_X and VOC emissions within the Colorado BLM Planning Areas, SUIT land, and Mancos Shale for the 2015 current year and 2025 High Development Scenarios (2025 emissions include both existing and new O&G sources).

2015	NO_X Emissions (TPY)			VOC Emissions (TPY)		
BLM Area	**Federal**	**non-Fed**	**Total**	**Federal**	**non-Fed**	**Total**
RGFO - Area 1	449	36,731	37,180	1,618	84,277	85,894
RGFO - Area 2	0	0	0	0	0	0
RGFO - Area 3	406	8,589	8,996	3,730	41,194	44,924
RGFO - Area 4	100	3,743	3,843	286	5,060	5,346
CRVFO (No Roan)	1,960	1,748	3,708	7,251	6,532	13,782
Roan (CRVFO)	1,734	936	2,670	2,890	1,620	4,509
GJFO	1,331	1,927	3,259	1,500	2,437	3,938
KFO	72	18	90	103	29	132
LSFO	671	174	846	862	237	1,099
TRFO	628	4,612	5,241	499	2,651	3,150
UFO	53	19	72	49	18	66
WRFO	2,963	402	3,364	6,952	945	7,897
Mancos[1]	NA	NA	NA	NA	NA	NA
SUIT[2]	NA	NA	NA	NA	NA	NA
2025 High Scenario	**NO_X Emissions (TPY)**			**VOC Emissions (TPY)**		
BLM Area	**Federal**	**non-Fed**	**Total**	**Federal**	**non-Fed**	**Total**
RGFO - Area 1	1,144	55,427	56,571	2,427	111,807	114,234
RGFO - Area 2	94	67	161	253	183	437
RGFO - Area 3	2,077	13,152	15,229	6,452	41,889	48,341
RGFO - Area 4	293	4,055	4,348	877	8,735	9,612
CRVFO (No Roan)	2,483	3,037	5,520	7,368	8,459	15,828
Roan (CRVFO)	2,636	3,054	5,690	4,175	4,388	8,562
GJFO	5,682	7,389	13,071	5,282	7,180	12,462
KFO	274	203	477	173	97	270
LSFO	2,226	1,489	3,715	2,411	1,355	3,767
TRFO	1,261	4,412	5,673	715	2,528	3,244
UFO	501	865	1,366	393	663	1,056
WRFO	12,066	1,677	13,743	20,952	2,864	23,816
Mancos	3,184	1,364	4,548	6,469	2,772	9,242
SUIT	NA	2,383	2,383	NA	1,008	1,008
Difference	**NO_X Emissions (TPY)**			**VOC Emissions (TPY)**		
BLM Area	**Federal**	**non-Fed**	**Total**	**Federal**	**non-Fed**	**Total**
RGFO - Area 1	155%	51%	52%	50%	33%	33%
RGFO - Area 2	No 2015 Emissions					
RGFO - Area 3	411%	53%	69%	73%	2%	8%
RGFO - Area 4	193%	8%	13%	206%	73%	80%
CRVFO (No Roan)	27%	74%	49%	2%	30%	15%
Roan (CRVFO)	52%	226%	113%	44%	171%	90%
GJFO	327%	283%	301%	252%	195%	216%
KFO	284%	1027%	433%	68%	235%	104%
LSFO	232%	754%	339%	180%	471%	243%
TRFO	101%	-4%	8%	43%	-5%	3%
UFO	844%	4529%	1805%	710%	3687%	1499%
WRFO	307%	318%	308%	201%	203%	202%

[1] Mancos Shale O&G activity in 2015 is assumed negligible

[2] O&G activity on SUIT land in 2015 is included in TRFO emission estimates.

Table 3-3a. Summary of oil and gas NO_X and VOC emissions within the Colorado BLM Planning Areas, SUIT land, and Mancos Shale for the 2025 Medium Development scenario (2025 emissions include both existing and new O&G sources).

2025 Medium Scenario	NO_X Emissions (TPY)			VOC Emissions (TPY)		
BLM Area	**Federal**	**non-Fed**	**Total**	**Federal**	**non-Fed**	**Total**
RGFO - Area 1	764	55,427	56,191	1,472	111,807	113,279
RGFO - Area 2	62	67	130	99	183	282
RGFO - Area 3	1,506	13,152	14,658	3,384	41,889	45,273
RGFO - Area 4	267	4,055	4,321	441	8,735	9,177
CRVFO (No Roan)	2,259	3,037	5,296	6,290	8,459	14,749
Roan (CRVFO)	2,390	3,054	5,444	3,579	4,388	7,967
GJFO	4,787	7,389	12,176	4,036	7,180	11,216
KFO	240	203	442	149	97	246
LSFO	1,949	1,489	3,438	1,893	1,355	3,248
TRFO	1,146	4,412	5,559	659	2,528	3,187
UFO	369	865	1,235	260	663	923
WRFO	10,828	1,677	12,505	18,083	2,864	20,947
Mancos	1,811	1,364	3,175	2,751	2,772	5,523
SUIT	0	1,115	1,115	0	718	718
Difference from 2015	**NO_X Emissions (TPY)**			**VOC Emissions (TPY)**		
BLM Area	**Federal**	**non-Fed**	**Total**	**Federal**	**non-Fed**	**Total**
RGFO - Area 1	70%	51%	51%	-9%	33%	32%
RGFO - Area 2	No 2015 Emissions					
RGFO - Area 3	271%	53%	63%	-9%	2%	1%
RGFO - Area 4	166%	8%	12%	54%	73%	72%
CRVFO (No Roan)	15%	74%	43%	-13%	30%	7%
Roan (CRVFO)	38%	226%	104%	24%	171%	77%
GJFO	260%	283%	274%	169%	195%	185%
KFO	235%	1027%	394%	44%	235%	86%
LSFO	190%	754%	307%	120%	471%	196%
TRFO	82%	-4%	6%	32%	-5%	1%
UFO	597%	4529%	1621%	435%	3687%	1297%
WRFO	265%	318%	272%	160%	203%	165%

Table 3-3b. Summary of oil and gas NO_X and VOC emissions within the Colorado BLM Planning Areas, SUIT land, and Mancos Shale for the 2025 Low Development scenario (2025 emissions include both existing and new O&G sources).

2025 Low Scenario	NO_X Emissions (TPY)			VOC Emissions (TPY)		
BLM Area	**Federal**	**non-Fed**	**Total**	**Federal**	**non-Fed**	**Total**
RGFO - Area 1	472	40,322	40,795	1,363	87,837	89,199
RGFO - Area 2	0	0	0	0	0	0
RGFO - Area 3	615	12,044	12,659	2,862	39,162	42,024
RGFO - Area 4	100	3,358	3,458	396	7,000	7,396
CRVFO (No Roan)	2,140	2,278	4,418	6,639	6,848	13,487
Roan (CRVFO)	1,867	926	2,793	3,201	1,693	4,894
GJFO	1,080	2,892	3,971	1,234	3,136	4,370
KFO	86	70	155	93	46	139
LSFO	632	435	1,068	727	426	1,153
TRFO	566	3,996	4,563	404	2,342	2,746
UFO	48	39	87	45	35	80
WRFO	3,155	549	3,704	6,754	1,058	7,813
Mancos	1,592	682	2,274	3,235	1,386	4,621
SUIT	0	1,191	1,191	0	504	504
Difference from 2015	**NO_X Emissions (TPY)**			**VOC Emissions (TPY)**		
BLM Area	**Federal**	**non-Fed**	**Total**	**Federal**	**non-Fed**	**Total**
RGFO - Area 1	5%	10%	10%	-16%	4%	4%
RGFO - Area 2	No 2015 Emissions					
RGFO - Area 3	51%	40%	41%	-23%	-5%	-6%
RGFO - Area 4	0%	-10%	-10%	38%	38%	38%
CRVFO (No Roan)	9%	30%	19%	-8%	5%	-2%
Roan (CRVFO)	8%	-1%	5%	11%	5%	9%
GJFO	-19%	50%	22%	-18%	29%	11%
KFO	20%	288%	74%	-10%	59%	5%
LSFO	-6%	150%	26%	-16%	79%	5%
TRFO	-10%	-13%	-13%	-19%	-12%	-13%
UFO	-9%	108%	21%	-7%	99%	21%
WRFO	6%	37%	10%	-3%	12%	-1%

Figure 3-4 shows the wide range of emissions splits by Federal and non-Federal well types for each planning area. RGFO Area 1 and SUIT have the highest percent of emissions from non-Federal O&G activity and WRFO has the highest percent of emissions from Federal O&G activity.

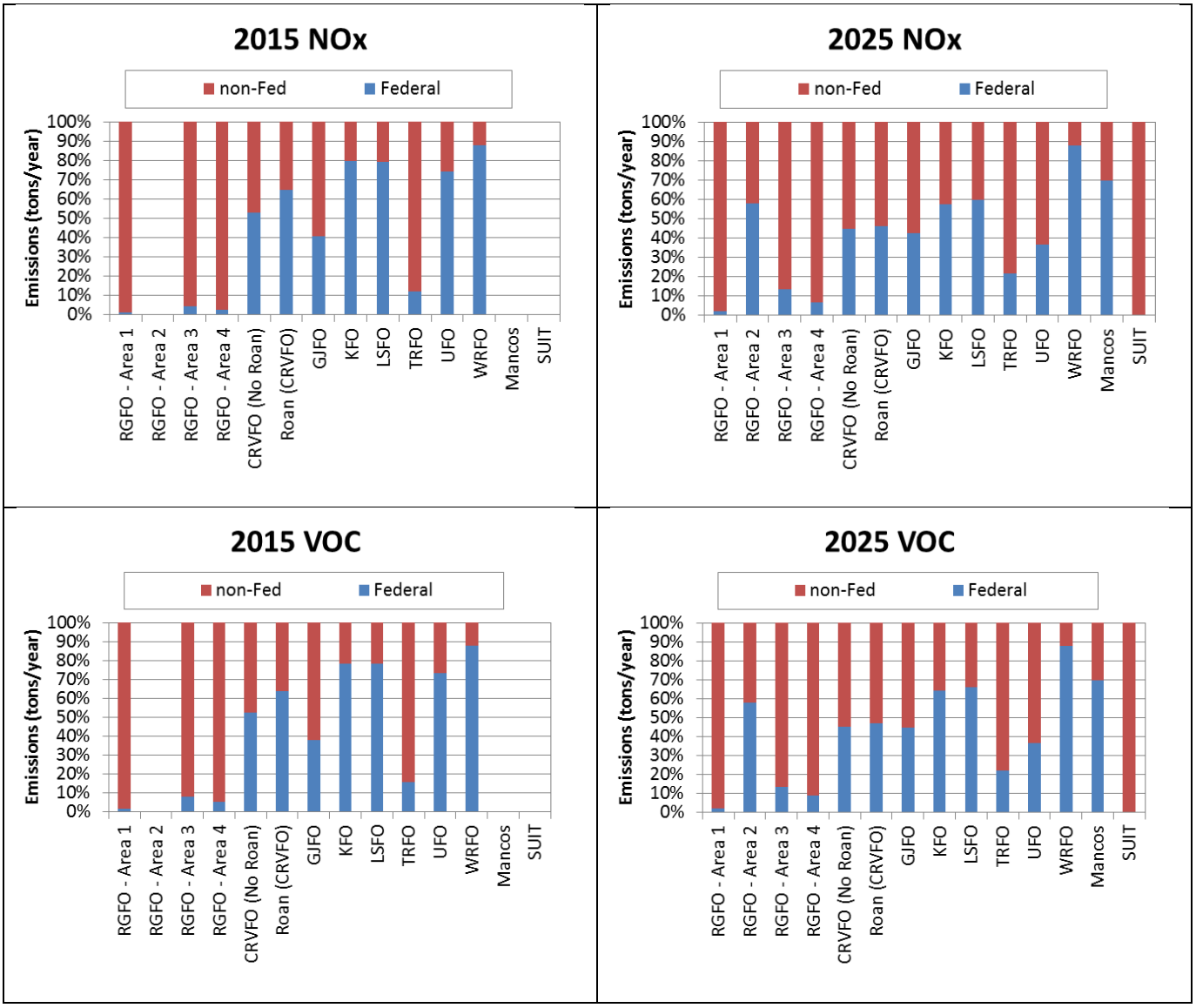

Figure 3-4. NO_X and VOC emission contributions from O&G development by planning area for the 2015 current (left) and 2025 High Development Scenario (right) emissions scenarios.

3.4 Other Anthropogenic Emissions

Other anthropogenic emissions (i.e., non O&G and BLM authorized mining sources) for the 2025 future year were taken from IWDW-WAQS 2025 Future Year Platform (see Section 3.6.2 for details).

3.5 Emissions that Remain at 2011 Levels

The following emission categories from the 2011 Base Case emissions scenario (see Section 2.3) were assumed to remain unchanged for the 2025 future year emission scenarios:

- Biogenic emissions;
- Wildfires, Prescribed Burns and Agricultural Burning emissions;
- Lightning emissions;
- Sea Salt emissions;
- Windblown Dust emissions.

3.6 Future Year Emissions Modeling

3.6.1 Future Year Emissions Modeling Procedures

The 2025 future year emissions were processed using the SMOKE emissions model and each source category for which separate ozone and particulate matter contributions are needed was processed in a separate stream in the SMOKE emissions modeling. This resulted in many different streams of SMOKE emissions processing for the three 2025 emission scenarios to provide separate source groups so that the AQ/AQRV impacts can be isolated in the source apportionment modeling.

3.6.2 Non-Oil and Gas Future-Year Emissions Data

The 2025 inventory and ancillary emissions data for some of the inventory sectors were obtained directly from the WAQS IWDW year 2025 modeling platform, which in turn uses data from EPA's 2011v6.2 modeling platform. A summary of the 2025 WAQS (IWDW) modeling platform inventory is provided below and additional details are available from IWDW website[10] and EPA's Technical Support Document for the 2011v6.2 platform[11].

CEM Point: For Electric Generating Units (EGUs) with Continuous Emissions Monitors (CEMs), EPA developed the 2025 EGU-specific emissions based on the Integrated Planning Model (IPM®[12]) version 5.14 including controls from the Cross-State Air Pollution Rule (CSAPR), the Final Mercury and Air Toxics (MATS), Regional Haze Rule, and Cooling Water Intakes Rule. Revised 2025 EGU emissions for Colorado with updates on retirement/conversion of EGUs that are not accounted for in the 2025 EPA projections were obtained from the Colorado Department of Public Health and Environment (CDPHE) and implemented in SMOKE processing.

[10] http://vibe.cira.colostate.edu/wiki/wiki/7112/waqs-2011b-platform-future-year-emissions
[11] https://www.epa.gov/sites/production/files/2015-10/documents/2011v6_2_2017_2025_emismod_tsd_aug2015.pdf
[12] https://www.epa.gov/airmarkets/power-sector-modeling

EGUs within Colorado and New Mexico were separated into coal and oil/gas EGUs in SMOKE processing to address the indirect effects of coal and oil/gas EGU projects.

Non-CEM Point: Projection factors and percent reductions reflect emissions reductions due to national and local rules, control programs, plant closures, consent decrees and settlement. Annual Energy Outlook (AEO) fuel volume projections were used for projections for corn ethanol and biodiesel plants. Terminal area forecast (TAF) data were used for aircraft for projection in landing/takeoff activity.

Nonpoint/Area: Agricultural sector projection factors for livestock estimates based on expected changes in animal population from 2005 Department of Agriculture data, updated based on personal communication with EPA experts in July 2012. Fugitive dust projection factors for dust categories related to livestock estimates based on expected changes in animal population and AEO-based vehicle miles travelled (VMT) growth for paved and unpaved roads. Residential wood combustion projections based on growth in lower-emitting stoves and a reduction in higher emitting stoves. Portable Fuel Container (PFC) projection factors reflecting impact of the final Mobile Source Air Toxics (MSAT 2) rule and the Renewable Fuel Standard (RFS2). Upstream impacts from AEO fuel volume, including cellulosic ethanol plants are also reflected.

Off-road Mobile: Other than for California and Texas, this sector uses data from a run of NMIM that utilized NONROAD2008a, using future-year equipment population estimates and control programs to the year 2025 and using national level inputs. Final controls from the final locomotive-marine and small spark ignition rules are included. California and Texas-specific data were provided by California Air Resources Board (CARB) and Texas Commission on Environmental Quality (TCEQ), respectively.

Aircraft/locomotive/marine: Projection factors for Category 1 and Category 2 commercial marine and locomotives reflect final locomotive-marine controls.

Offshore shipping: Base-year 2011 emissions grown and controlled to 2025, incorporating controls based on Emissions Control Area (ECA) and International Marine Organization (IMO) global NO_X and SO_2 controls.

On-road Mobile, not including refueling: MOVES2014-based emissions factors for year 2025 were developed using the same representative counties, state-supplied data, meteorology, and procedures that were used to produce the 2011 emission factors. California-specific data were provided by CARB. Other than California, this sector includes all non-refueling on-road mobile emissions (exhaust, evaporative, evaporative permeation, brake wear and tire wear modes).

On-road Refueling: Uses the same projection and processing approach as the on-road sector with an additional step that replaced gasoline refuelling estimates with Colorado submitted point emissions for some counties.

Natural Emissions: Biogenic, wildfires, prescribed burns, agricultural burning, lightning, and wind-blown dust emissions are held constant at 2011 levels.

We note that the cumulative effect of emissions from downstream combustion of oil and gas extracted in Colorado is accounted in one or more of the emissions sectors described above. In addition, the cumulative effect of combustion occurring outside the modeling domain is represented through the boundary conditions.

Most of the ancillary data (spatial/temporal/chemical) were held unchanged from the WAQS 2025 modeling platform, which were taken directly from the EPA 2011v6.2 modeling platform. The pre-merged emissions files for sectors listed above were obtained from WAQS 2025 modeling platform and "windowed" to prepare CAMx-ready emissions for the CARMMS 2.0 12/4km domain for year 2025 modeling.

3.6.3 Oil and Gas Future-Year Emissions Data

Emissions inventories for oil and gas sources in Colorado were prepared as described in Section 3.1. For oil and gas sources within the BLM planning areas, emissions were divided into existing and RFD (new) source categories to facilitate CAMx source apportionment processing. The RFD sources were further divided into oil and gas development on the BLM-authorized (Federal) and other (non-Federal) lands. For the Southern Ute Indian Tribe (SUIT) emissions for year 2025, we leveraged the inventory/calculator developed for the programmatic SUIT SEIS by Ramboll Environ (2016).

For processing oil and gas emissions, we developed ancillary data (spatial/temporal/chemical) specific to planning areas. The area-specific spatial allocation profiles were developed from the data provided by BLM and chemical speciation profiles were prepared from the gas composition available in the emission calculator. Table 3-4 provides a list of speciation and gridding profiles developed by planning areas. The conventional (CG) and CBM gas speciation profile are assigned to source categories associated with the respective well type.

Table 3-4. Source of VOC speciation profile and spatial surrogates used for gridding oil and gas emissions in the federal planning areas in Colorado.

Source Region	Speciation Profiles	Gridding Profiles
Colorado River Valley, without Roan	CRV{CG}	CRVFO {CG}{Fed,non-Fed}
Grand Junction FO	GJ {CBM,CG,SG}	GJFO {CG,CBM}{Fed,non-Fed}
Kremmling FO	K {CBM,CG,CO}	KFO shapefile
Little Snake FO	LS {CG,CO}	CRVFO {CG}{Fed,non-Fed}
Roan Plateau	CRV{CG}	CRVFO_Roan_Plateau.
Tres Rios FO	TR {CBM,CG,CO,SHL}	TRFO {CG,CBM}{Fed,non-Fed}
Uncompahgre FO	U {CBM,CG}	UFO {CG,CBM}{Fed,non-Fed}
White River FO	WR {CG,CO}	WRVFO {CG}{Fed,non-Fed}
Pawnee National Grasslands	DJ{FLA ,VNT}	RGFO {CG}{Fed}
Royal Gorge FO Area1	DJ{FLA ,VNT}	RGFO {CG}{Fed,non-Fed}
Royal Gorge FO Area2	DJ{FLA ,VNT}	RGFO {CG}{Fed,non-Fed}
Royal Gorge FO Area3	DJ{FLA ,VNT}	RGFO {CG}{Fed,non-Fed}
Royal Gorge FO Area4	DJ{FLA ,VNT}	RGFO {CG}{Fed,non-Fed}

For spatial allocation, gridding profiles were developed for each well type (i.e., conventional, CBM) and land type (Federal, non-Federal) combination.

3.6.4 Mining Future-Year Emissions Data

For mining sources, emissions were estimated for coal and uranium mines on Federal lands in the western Colorado BLM Planning Areas. The emissions for mines on Federal lands were estimated based on the CDPHE APEN database and available EISs and EAs. The mining emissions not on federal lands were obtained from the 2025 EPA/WAQS inventory. EPA default chemical speciation profiles were used in the SMOKE emissions modeling for mining except that the EPA mining $PM_{2.5}$ speciation profile was adjusted as described in Section 3.7.1 of the CARMMS1.5 report.

The estimated coal mining sources were consolidated with the 2025 EPA/WAQS inventory to avoid potential double counting and modeled as "point". The western Colorado uranium mining emissions were modeled as "area" and spatially allocated using spatial surrogates developed from the data provided by BLM in a shapefile format.

3.7 Emissions Modeling Results

The CARMMS 2.0 CAMx source apportionment modeling used 23 emission source categories plus three combined O&G source groups as well as total anthropogenic and all emissions within the 12/4 km CARMMS 2.0 domain (see Section 4).

Table 3-5 lists the total NO_X, VOC, SO_2 and $PM_{2.5}$ and PM_{10} emissions for these source categories/groups as applied in the CARMMS 2.0 2025 High Development Scenario source apportionment simulation. These emissions were obtained from the SMOKE scenario reports created by the Smkreport processor for each day of the annual simulation and summed to obtain total annual emissions.

When considering new Federal O&G within the 14 BLM Planning Areas and the 2025 High Development Scenario (Table 3-5), the WRFO has the highest NO_X emissions (10,185 tons per year, TPY) followed by GJFO (4,703 TPY), FFO (3,184 TPY) and SUIT (2,383 TPY). Total 2025 O&G NO_X emissions in the 14 BLM Planning Areas is 132,491 TPY that is split into 22 percent new Federal (29,281 TPY), 35 percent new non-Federal (46,443 TPY) and 43 percent existing O&G emissions (56,767 TPY). Outside the 14 BLM Planning Areas, there is an additional 149,661 TPY O&G NO_X emissions for a total 2025 High Development Scenario O&G NO_X emissions across the entire 4 km CARMMS domain of 282,152 TPY that represents 38 percent of the total anthropogenic and 31 percent of the total (anthropogenic plus natural) NO_X emissions in the 4 km domain.

Total O&G VOC emissions in the 4 km CARMMS domain for the 2025 High Development Scenario are 633,801 TPY that represents 70 percent of the total anthropogenic and 21 percent of the total anthropogenic plus natural VOC emissions across the domain. Natural VOC emissions represent 70 percent of the annual VOC emissions across the 4 km CARMMS domain. Note that biogenic emissions are highly day-specific with higher emissions under warmer

temperatures and higher light intensity. Thus, the contributions of biogenic VOC emissions to the total annual VOC emissions (70 percent) would be expected to be lower on cooler and higher on warmer days. Also note that the VOC emissions in Table 3-5 were obtained from the Carbon Bond chemical mechanism species that will be different than the VOC species input into the SMOKE emissions modeling system (for example, includes ethane and excludes nonreactive carbon in VOCs).

With one exception, SO_2 emissions from Federal O&G within the 14 BLM Planning Areas are fairly low (< 20 TPY). The exception is the WRFO Planning Area where the 1,173 TPY SO_2 emissions represent 95 percent of the 1,240 TPY SO_2 emissions from all 14 BLM Planning Areas combined in the 2025 High Development Scenario. A majority of the 2025 SO_2 emissions in the WRFO Planning Area come from two gas plants: the Enterprise Gas Proc – Meeker Gas Plant and the Williams Field – Willow Creek Gas Plant. These gas plant emissions were based on the CDPHE 2008 Air Pollution Emission Notice (APEN) database grown to 2025 using the change in gas production between 2008 and 2025 for the 2025 High, Low and Medium Development Scenarios. Total O&G SO_2 emissions across the CARMMS domain is 6,960 TPY that is primarily (74 percent) due to O&G from outside the 14 BLM Planning Areas, these areas in the 4 km CARMMS domain outside the 14 BLM Planning Areas includes the Uinta Basin where sour gas reserves occur.

Total $PM_{2.5}$ emissions from O&G in the 14 BLM Planning Areas and the 2025 High Development Scenario is 12,977 TPY of which 16 percent is due to new Federal O&G and the rest approximately split equally between new non-Federal and existing O&G. Mining within the 14 BLM Planning Areas contributes 1,148 TPY. By far the largest contribution of primary $PM_{2.5}$ emissions is the other (non O&G and mining) anthropogenic emissions category that contributes 59 percent of the region-wide total with natural emissions (mostly due to wildfires) contributing most of the rest (37 percent).

Table 3-6 and Table 3-7 are like Table 3-5 but for the 2025 Low and Medium Development Scenario, respectively. The three scenarios only differ in emissions from the new O&G and mining activities from the 14 BLM planning areas; emissions from other source categories do not vary across scenarios.

With the revisions made to the Mancos Shale Low Development Scenario inventory in the current study (CARMMS 2.0), the 2025 emissions from new Federal sources in the FFO are 50% (data not shown here) lower than in the High Development Scenario for all pollutants. The total new Federal O&G NO_X emissions across the 14 BLM Planning Areas for the low scenario (6,649 TPY) are 77% lower than the high scenario (29,281 TPY). Similar reductions are seen for the other species (-76 to -87 percent). Note that for the 2025 Low Development Scenario, there are no emissions from RGFO #2. The annual emissions for the 2025 Medium Development Scenario are shown in Table 3-7. Total O&G NO_X emissions across the 14 BLM Planning Areas for the 2025 Medium Development Scenario are 22,138 TPY that is 24% (data not shown here) lower than the 2025 High Development Scenario. Similarly, 2025 Medium Development Scenario O&G VOC emissions across the 14 BLM Planning Areas are 37% lower than the 2025 High Development Scenario.

Table 3-5. Total emissions (tons per year) for each Source Category and combinations of Source Categories for the 2025 High Development Scenario from the SMOKE scenario reports.

CARMMS 2.0 2025 High Development Scenario in 12km Domain (tpy)						
Group Number	**Group Description**	**NOx**	**VOC**	**SO2**	**PM2.5**	**PM10**
A	Natural (Biogenic + Fires + ltnox)	182,455	2,116,579	16,182	159,801	998,775
B	LSFO	1,767	1,839	30	112	644
C	WRFO	10,185	16,109	1,173	575	1,199
D	CRVFO except Roan Plateau	1,188	2,404	3	65	209
E	RPPA	1,838	2,207	2	74	182
F	GJFO	4,703	4,066	15	234	1,120
G	UFO	464	358	1	30	113
H	TRFO	578	261	3	31	195
I	KFO	211	90	0	9	43
J	RGFO #1	749	1,182	2	127	894
K	RGFO #2	94	252	0	16	107
L	RGFO #3	1,725	4,217	2	251	1,715
M	RGFO #4	212	527	0	19	98
N	SUIT	2,383	1,004	4	177	411
O	FFO	3,184	6,459	5	327	1,900
P	New O&G from non-Fed BLM PAs	46,443	72,963	274	5,796	37,881
Q	Existing O&G from BLM PAs	56,767	136,746	281	5,134	19,683
R	Mining from BLM PAs	3,297	37	18	1,148	4,146
S	All O&G outside BLM PAs	149,661	383,115	5,164	4,821	4,827
X (= sum of B - M)	Total New Federal O&G in Colorado	23,714	33,514	1,231	1,543	6,518
sum of B - O	14 BLM PAs new Fed O&G	29,281	40,977	1,240	2,047	8,829
sum of B - Q	14 PAs Total O&G	132,491	250,686	1,796	12,977	66,393
sum of B - Q + S	Total O&G	282,152	633,801	6,960	17,798	71,220
T+U+V+W*	Other Anthropogenic Emissions	453,277	269,604	160,751	256,287	1,540,740
	Total Anthropogenic Emissions	738,725	903,443	167,729	275,233	1,616,106
	Total All emissions	921,181	3,020,022	183,911	435,034	2,614,882

Table 3-6. Total emissions (tons per year) for each Source Category and combinations of Source Categories for the 2025 Low Development Scenario from the SMOKE scenario reports.

CARMMS 2.0 2025 Low Development Scenario in 12km Domain (tpy)						
Group Number	**Group Description**	**NOx**	**VOC**	**SO2**	**PM2.5**	**PM10**
A	Natural (Biogenic + Fires + ltnox)	182,455	2,116,579	16,182	159,801	998,775
B	LSFO	182	172	4	8	46
C	WRFO	1,275	2,016	147	72	150
D	CRVFO except Roan Plateau	811	1,649	2	44	144
E	RPPA	879	1,120	1	37	95
F	GJFO	234	199	1	7	19
G	UFO	12	11	0	1	3
H	TRFO	89	40	1	3	17
I	KFO	23	10	0	1	5
J	RGFO #1	78	123	0	13	90
K	RGFO #2	0	0	0	0	0
L	RGFO #3	263	641	0	38	260
M	RGFO #4	19	47	0	2	9
N	SUIT	1,191	502	2	89	205
O	FFO	1,592	3,229	3	163	950
P	New O&G from non-Fed BLM PAs	17,718	31,186	67	2,344	15,515
Q	Existing O&G from BLM PAs	56,767	136,746	281	5,134	19,683
R	Mining from BLM PAs	3,244	32	18	943	3,888
S	All O&G outside BLM PAs	149,661	383,115	5,164	4,821	4,827
X (= sum of B - M)	Total New Federal O&G in Colorado	3,866	6,027	156	226	837
sum of B - O	14 BLM PAs new Fed O&G	6,649	9,758	160	478	1,993
sum of B - Q	14 PAs Total O&G	81,135	177,690	509	7,955	37,191
sum of B - Q + S	Total O&G	230,795	560,805	5,673	12,776	42,018
T+U+V+W	Other Anthropogenic Emissions	453,277	269,604	160,751	256,287	1,540,740
	Total Anthropogenic Emissions	687,316	830,442	166,442	270,006	1,586,646
	Total All emissions	869,771	2,947,021	182,624	429,807	2,585,421

Table 3-7. Total emissions (tons per year) for each Source Category and combinations of Source Categories for the 2025 Medium Development Scenario from the SMOKE scenario reports.

CARMMS 2.0 2025 Medium Development Scenario in 12km Domain (tpy)						
Group Number	**Group Description**	**NOx**	**VOC**	**SO2**	**PM2.5**	**PM10**
A	Natural (Biogenic + Fires + ltnox)	182,455	2,116,579	16,182	159,801	998,775
B	LSFO	1,490	1,324	29	67	275
C	WRFO	8,947	13,254	1,173	503	765
D	CRVFO except Roan Plateau	964	1,332	3	50	113
E	RPPA	1,592	1,614	2	61	107
F	GJFO	3,808	2,825	15	151	521
G	UFO	333	225	1	19	53
H	TRFO	464	205	3	17	87
I	KFO	177	66	0	6	24
J	RGFO #1	370	231	1	57	365
K	RGFO #2	62	98	0	8	45
L	RGFO #3	1,155	1,161	1	130	718
M	RGFO #4	185	92	0	14	59
N	SUIT	781	482	3	71	175
O	FFO	1,811	2,745	5	167	726
P	New O&G from non-Fed BLM PAs	46,443	72,963	274	5,796	37,881
Q	Existing O&G from BLM PAs	56,767	136,746	281	5,134	19,683
R	Mining from BLM PAs	3,271	36	18	1,130	4,104
S	All O&G outside BLM PAs	149,661	383,115	5,164	4,821	4,827
X (= sum of B - M)	Total New Federal O&G in Colorado	19,546	22,427	1,229	1,084	3,134
sum of B - O	14 BLM PAs new Fed O&G	22,138	25,654	1,237	1,322	4,034
sum of B - Q	14 PAs Total O&G	125,348	235,363	1,792	12,252	61,598
sum of B - Q + S	Total O&G	275,009	618,478	6,956	17,073	66,425
T+U+V+W	Other Anthropogenic Emissions	453,277	269,604	160,751	256,287	1,540,740
	Total Anthropogenic Emissions	731,557	888,118	167,726	274,490	1,611,269
	Total All emissions	914,012	3,004,697	183,908	434,291	2,610,045

Figure 3-5 to Figure 3-11 displays spatial maps of NO_X, VOC and $PM_{2.5}$ emissions across the 4 km CARMMS domain by different source types for the 2025 High, Medium and Low Development Scenarios. The spatial maps for the Medium and Low Development Scenarios have the same locations as the High Development Scenario just with lower intensity. Figure 3-5 displays the total new Federal O&G emissions across the Colorado BLM Planning Areas and Figure 3-6 shows the total new non-Federal O&G emissions across all the 14 BLM Planning Areas. Most of the new Federal O&G emissions are located in the western Colorado Planning Areas (e.g. Roan Plateau and the surrounding areas) while the new non-Federal O&G emissions are mainly located in the eastern Colorado Planning Areas (e.g. RGFO #1).

Figure 3-7 and Figure 3-8 displays the spatial distribution of NO_x, VOC and $PM_{2.5}$ emissions from existing O&G activities within and outside the 14 CO/NM BLM Planning Areas, respectively, which do not vary across different scenarios. In addition to the familiar Basins within the 14 CO/NM Planning Areas (Denver-Julesburg, Piceance and North and South San Juan), the Uinta Basin is clearly evident along with O&G emissions in eastern Utah. Spatial distribution of mining

emissions within the BLM Planning Areas is shown in Figure 3-9, which consists of mainly isolated grid cells. Figure 3-10 and Figure 3-11 displays the other (remainder) anthropogenic emissions and natural emissions, respectively. Roadways and the major urban areas of Denver, Salt Lake City, Colorado Springs and Albuquerque are clearly evident in the other anthropogenic emissions NO_X and VOC maps. Whereas the spatial maps of other anthropogenic $PM_{2.5}$ emissions is more reflective of agricultural sources. Natural VOC emissions are dominated by forested areas, whereas the natural NO_X emissions are higher in agricultural areas and the locations of fires in 2011[13]. For example, the Las Conchas Fire started in Santa Fe National Forest on June 26, 2011, resulted in substantial emissions in Los Alamos County.

[13] https://en.wikipedia.org/wiki/Las_Conchas_Fire

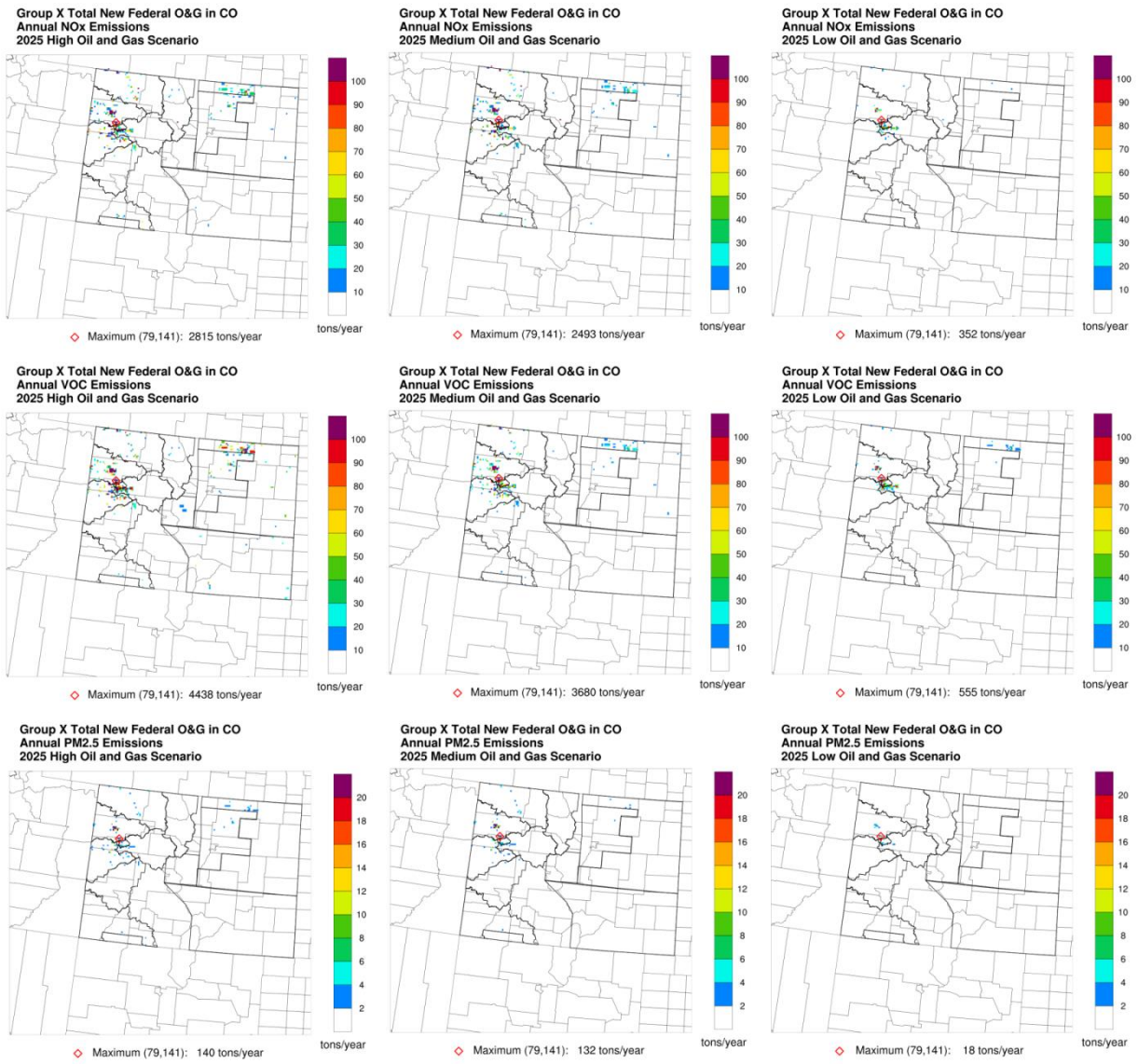

Figure 3-5. Spatial distribution of total new Federal oil and gas NOX (top row), VOC (middle row) and PM2.5 (bottom row) emissions (tons per year) for the 14 BLM Planning Areas in the 2025 High (left column), Medium (middle column) and Low (right column) Development Scenario.

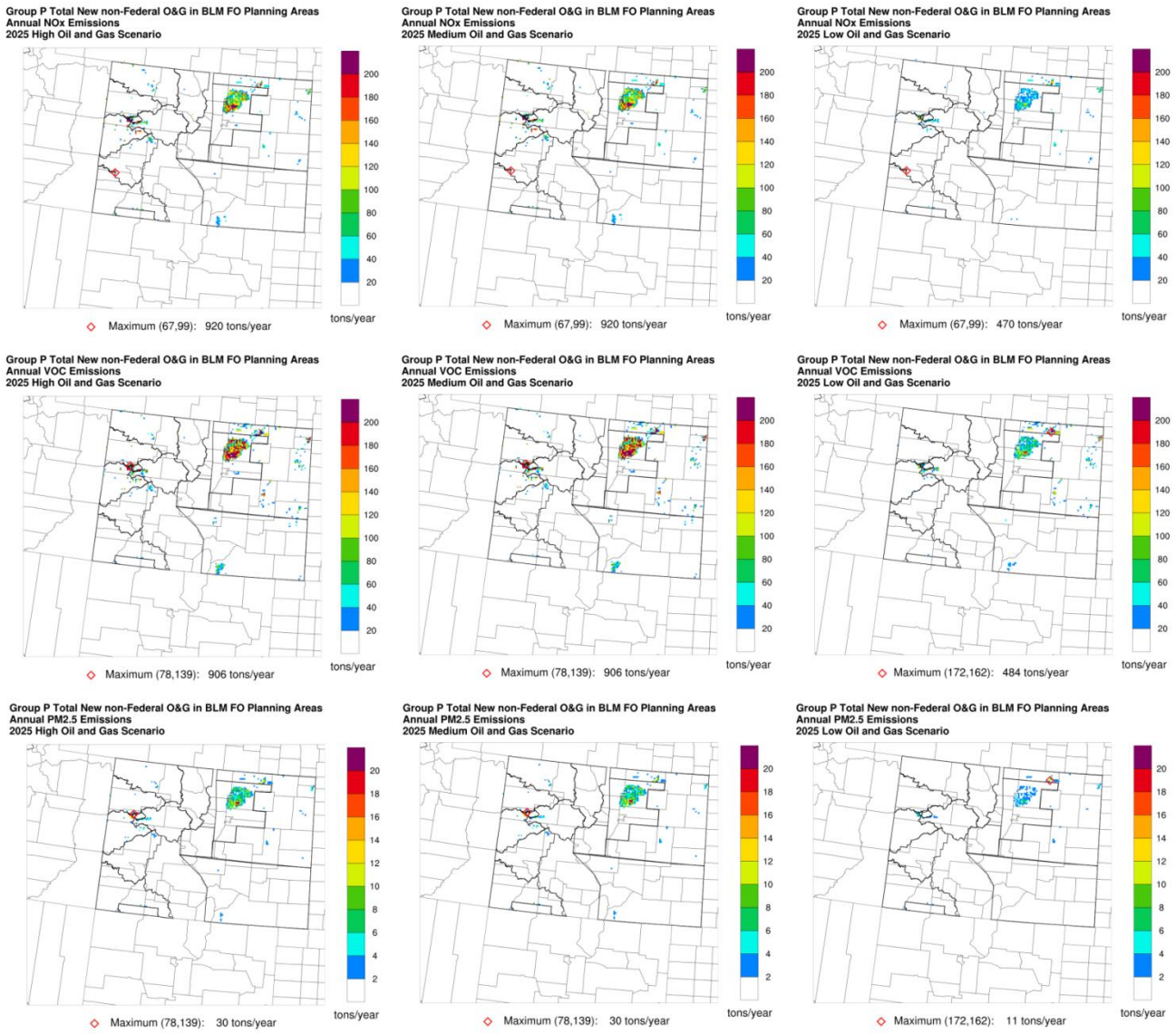

Figure 3-6. Spatial distribution of total new non-Federal oil and gas NOX (top row), VOC (middle row) and PM2.5 (bottom row) emissions (tons per year) for the BLM Planning Areas in the 2025 High (left column), Medium (middle column) and Low (right column) Development Scenario.

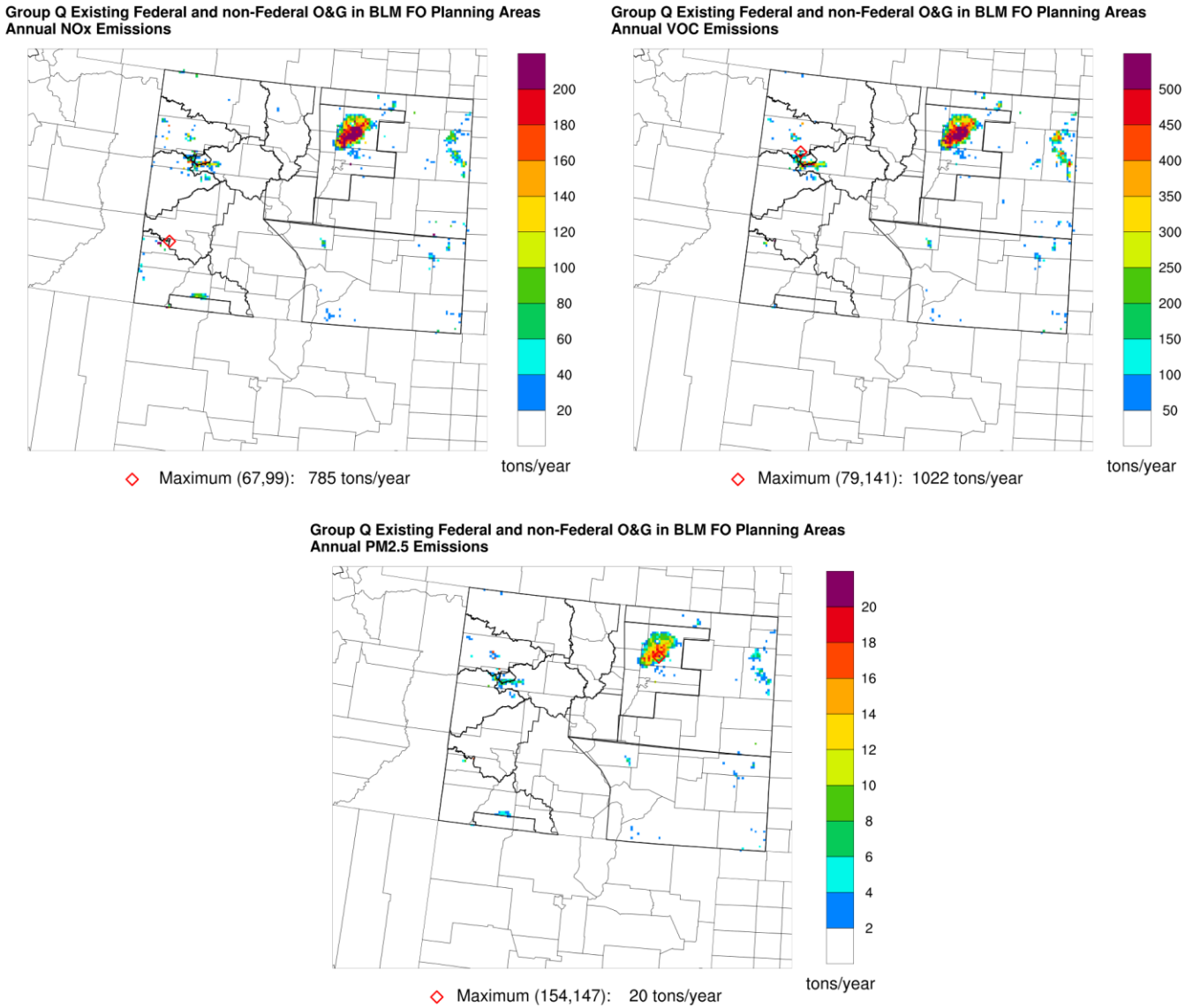

Figure 3-7. Spatial distribution of existing Federal and non-Federal oil and gas NOX (top left), VOC (top right) and PM2.5 (bottom) emissions (tons per year) for the BLM Planning Areas.

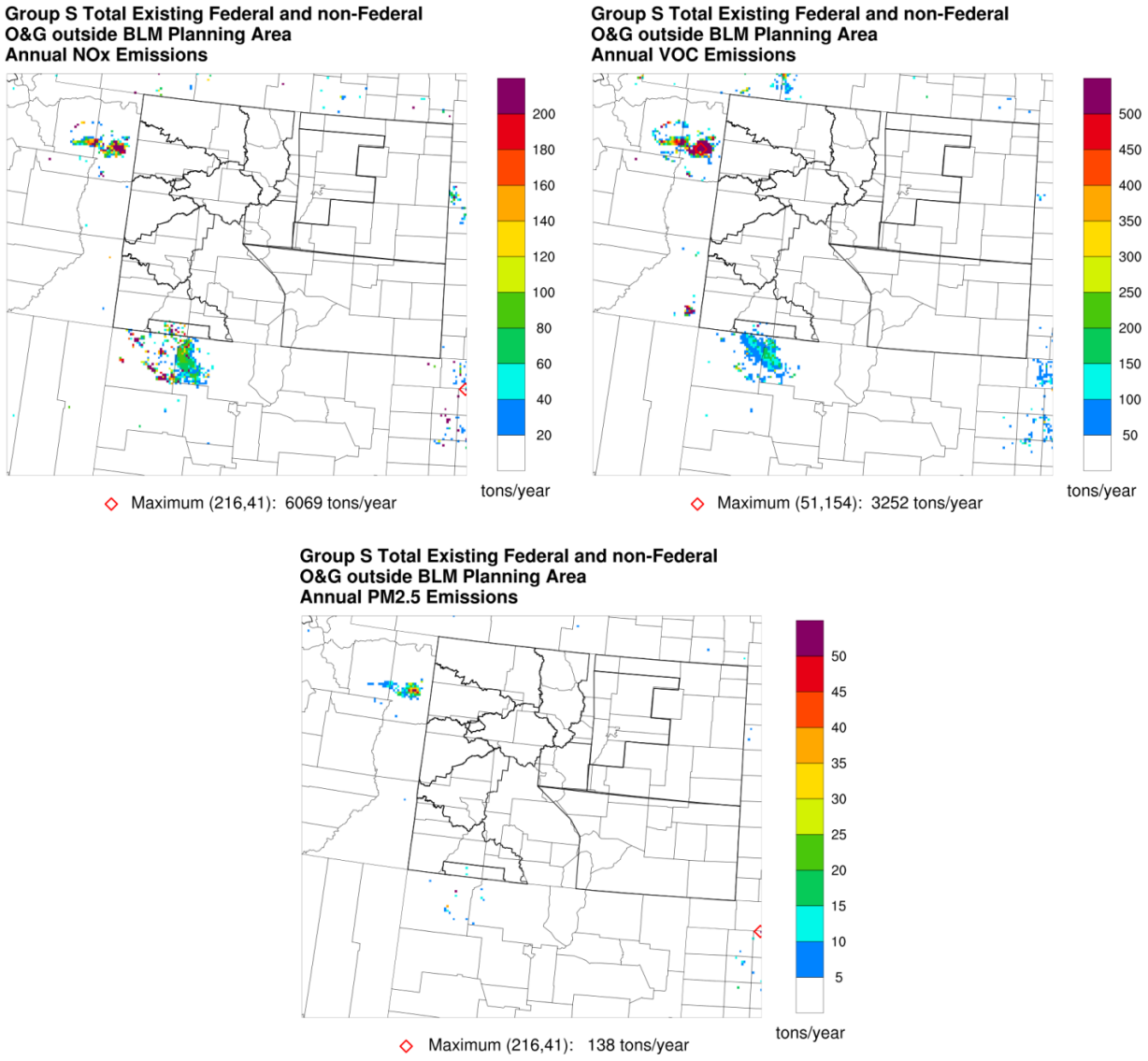

Figure 3-8. Spatial distribution of Total Existing Federal and non-Federal oil and gas NOX (top left), VOC (top right) and PM2.5 (bottom) emissions (tons per year) outside the BLM Planning Areas.

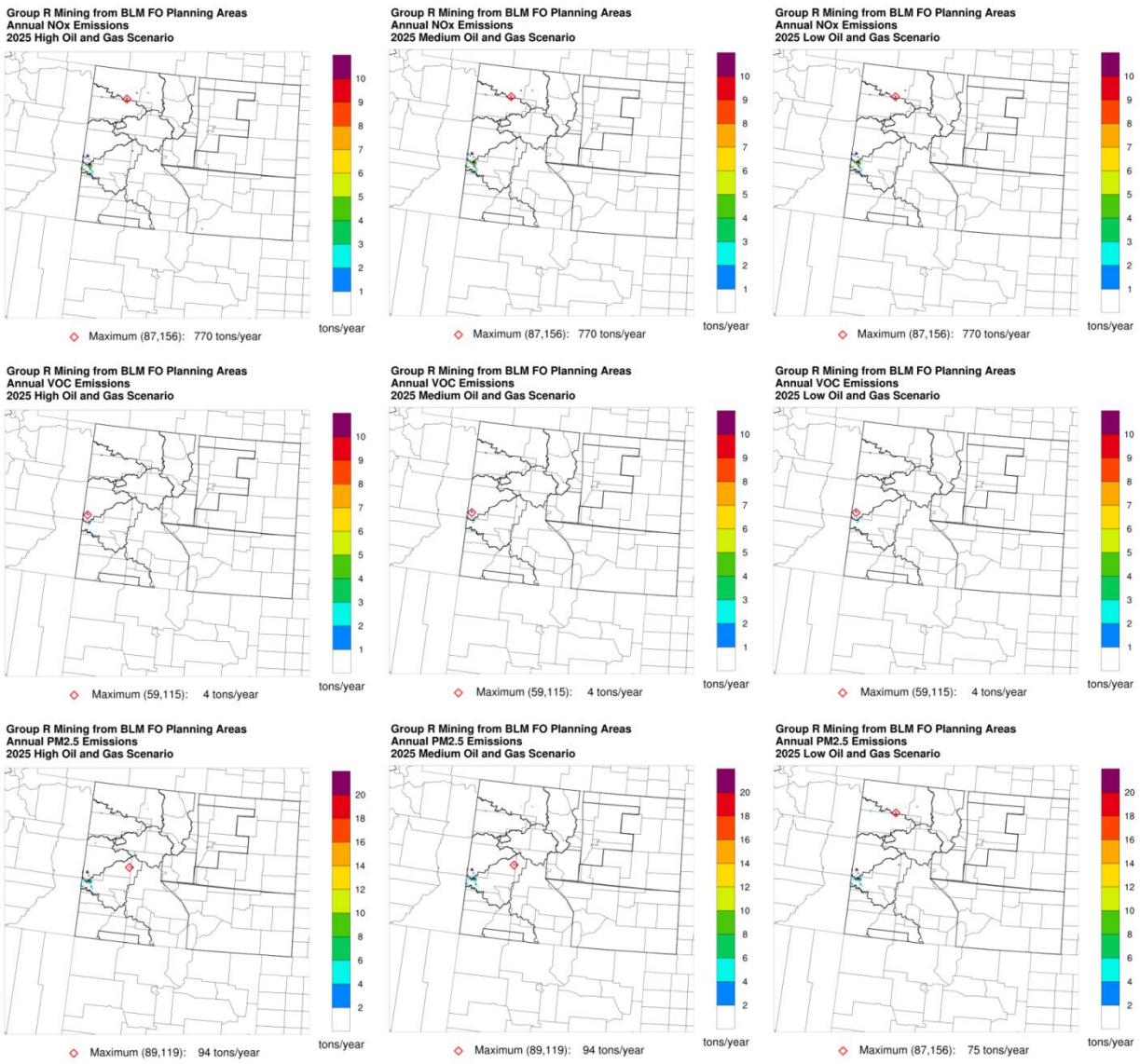

Figure 3-9. Spatial distribution of mining NOX (top row), VOC (middle row) and $PM_{2.5}$ (bottom row) emissions (tons per year) for the BLM Planning Areas in the 2025 High (left column), Medium (middle column) and Low (right column) Development Scenario.

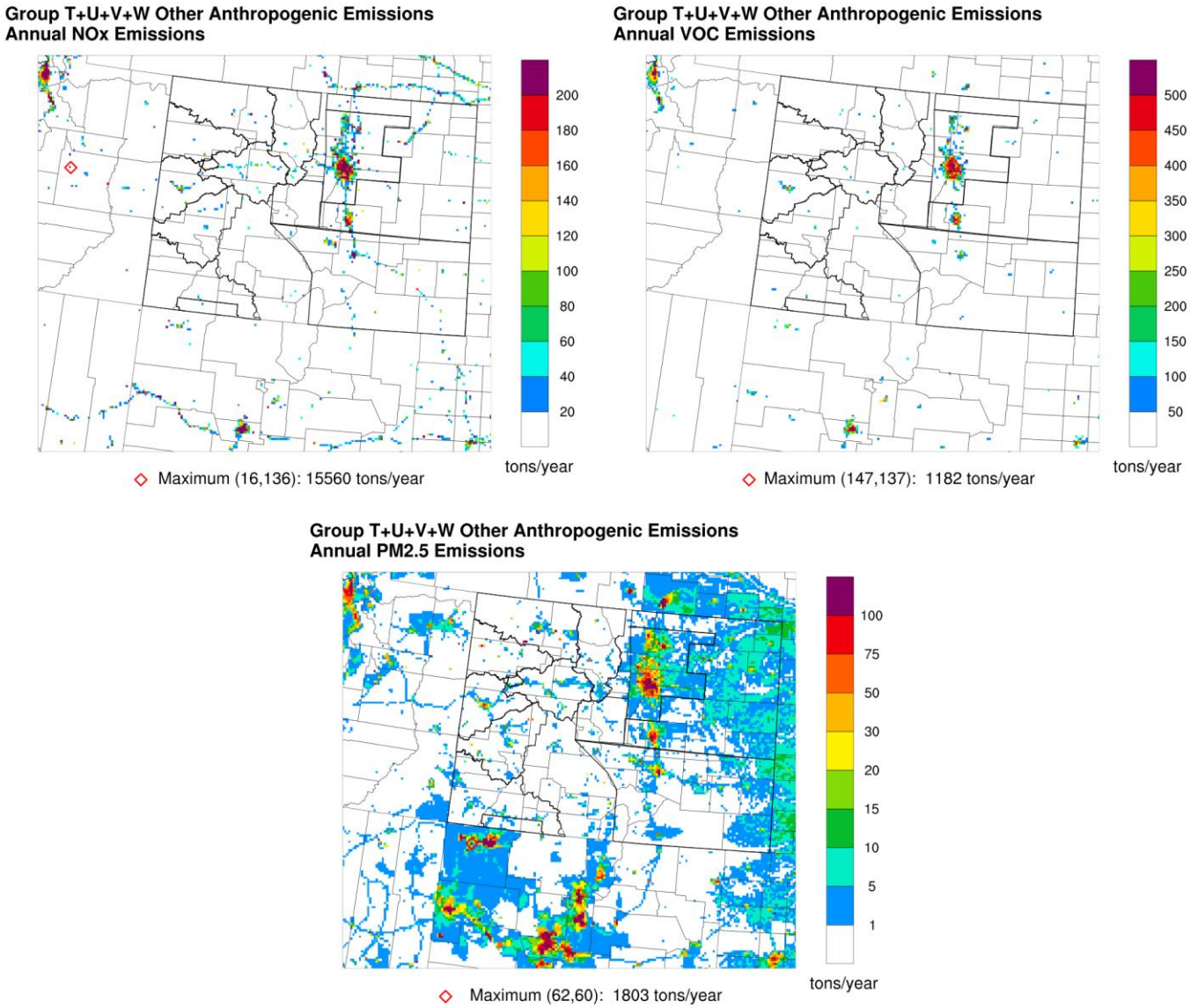

Figure 3-10. Spatial distribution of other anthropogenic NOX (top left), VOC (top right) and $PM_{2.5}$ (bottom) emissions (tons per year) for the CARMMS 4km domain.

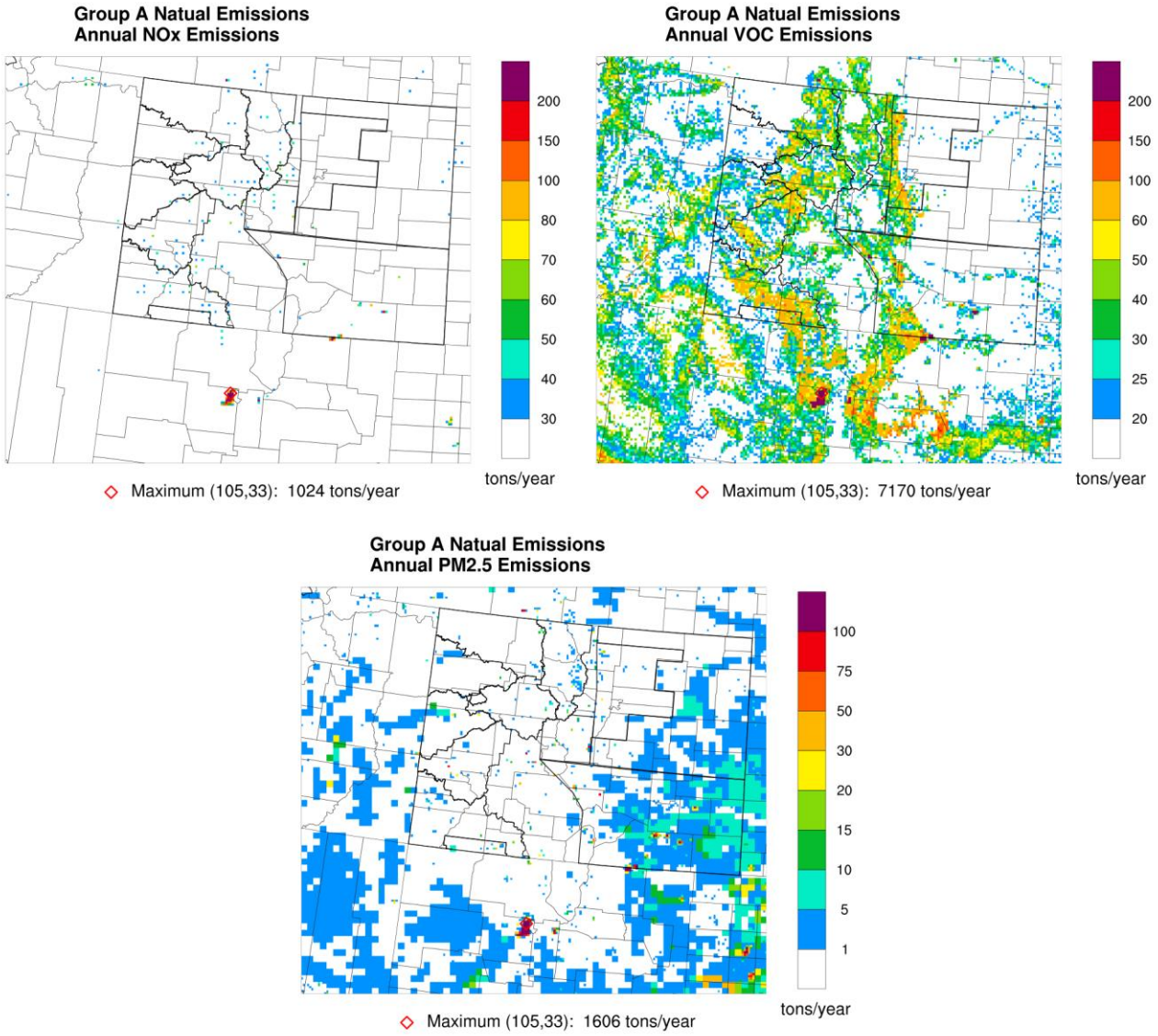

Figure 3-11. Spatial distribution of natural NOX (top left), VOC (top right) and $PM_{2.5}$ (bottom) emissions (tons per year) for the CARMMS 4km domain.

4.0 FUTURE YEAR MODELING AND ANALYSIS APPROACH

The CAMx source apportionment tool was used to obtain separate contributions of BLM authorized oil and gas development on Federal lands within 13 Colorado BLM planning areas and the BLM NMFFO Planning Area (i.e., the 14 BLM Planning Areas) to air quality (AQ) and air quality related value (AQRV) impacts associated with the 2025 High, Low and Medium Development Scenarios. Emphasis is laid on 14 Colorado BLM Planning Areas while contributions of other source groups are also analyzed. The following sections describe the approach of the CARMMS 2.0 2025 CAMx source apportionment modeling and analysis. The results are presented in Chapter 5.

4.1 CARMMS Source Apportionment Modeling Approach

The CAMx Anthropogenic Precursor Culpability Assessment (APCA) version of the Ozone Source Apportionment Technology (OSAT) and the Particulate Source Apportionment Technology (PSAT) were used to obtain separate AQ and AQRV contributions due to BLM-authorized new oil and gas development on Federal lands for each of the 13 Colorado BLM Planning Areas and the BLM NMFFO Planning Area (i.e., the 14 BLM Planning Areas). The source apportionment modeling also obtained contributions from new oil and gas emissions on non-Federal lands, existing oil and gas emissions, and mining within the combined 14 BLM Planning Areas, oil and gas emissions within the 12 km CARMMS 2.0 domain outside the 14 BLM Planning Areas, remainder anthropogenic emissions and natural emissions (i.e., biogenic sources, fires, lightning, windblown dust and sea salt), as well as coal-fired and oil/gas-fired EGUs.

4.1.1 Overview of Source Apportionment Tools

The CAMx OSAT/APCA ozone and PSAT PM source apportionment tools use reactive tracers that are released from each Source Group for which contributions are desired. These reactive tracers operate in parallel to the host photochemical grid model accessing the model's transport, dispersion, chemistry and deposition algorithms. For example, the OSAT/APCA ozone source apportionment tools represents each Source Group's ozone contributions using four reactive tracers that represent the Source Groups VOC emissions (V), NO_X emissions (N) and ozone attributed to the Source Group that is formed under more VOC-limited (O3V) and NO_X-limited (O3N) conditions. At each time step and in each grid cell, ozone formed is allocated to the Source Groups based on the Source Groups relative contribution of VOC or more NO_X emissions to the total VOC or NO_X concentrations after determination of whether ozone formation is more VOC-limited or more NO_X-limited. The APCA ozone source apportionment tool differs from OSAT in that it recognizes that some precursor emissions are not controllable so redirects ozone formed from the uncontrollable to the controllable Source Group. For example, when ozone is formed under VOC-limited conditions due to the interaction between biogenic VOC and anthropogenic NO_X emissions, a case OSAT would assign the ozone formed to the biogenic emissions Source Group, APCA redirects the ozone formed to the anthropogenic emissions Source Group recognizing that biogenic VOC emissions are not controllable and without the anthropogenic NO_X the ozone would not have been generated. In a CAMx APCA source apportionment run, the first Source Category specified in the run is assumed to be the uncontrollable Source Group (typically natural emissions) and ozone will only be allocated to natural emissions when it is due to natural VOC and NO_X emissions interacting with each other

(e.g., ozone formed due to reactions between biogenic VOC and biogenic NOx). For the CARMMS 2.0 modeling, the natural emissions Source Group included biogenic, fires (wildfires, prescribed burns and agricultural burning), lightning, windblown dust and sea salt emissions. Although one could argue that emissions from prescribed burns and agricultural burning are not natural, emissions from wildfires dominate the fire emissions especially within the CARMMS 2.0 12 km domain.

For the CAMx PSAT PM source apportionment tool, there are several families of PM source apportionment tracers that can be run separately or together that track the different components of PM. Each of these families has a different number of reactive tracers to track the pathway from the PM precursor emissions to the ultimate PM compounds. The five different families of PSAT source apportionment are as follows (number of tracers in parenthesis): Sulfate-SO4 (2); Nitrate/Ammonium-NO3/NH4 (7); Primary PM (6); Secondary Organic Aerosol-SOA (20) and Mercury-Hg (3). For CARMMS, we used the SO4, NO3/NH4 and Primary PM PSAT families of tracers so that 15 total reactive tracers are needed to track PM contribution for each Source Group. The Hg PSAT family was not used because mercury is not a focus of CARMMS and O&G sources typically have negligible Hg emissions. There are five SOA precursors treated in CAMx: toluene and xylene (aromatics), isoprene, terpene and sesquiterpene with biogenic sources contributing a majority of the SOA. O&G VOC emissions are dominated by light VOCs that do not form any SOA. We examined the speciation of the O&G emissions and found the five VOC species that are SOA precursors account for approximately 0.1 percent of the O&G VOC emissions. Thus, O&G emission VOCs would have a negligible contribution to SOA so the SOA family of PSAT source apportionment tracers was not used. The CARMMS annual source apportionment runs take over a month to complete and use of the SOA PSAT family would have more than doubled the number of tracers. Thus, SOA is not included in the $PM_{2.5}$ and visibility impacts associated with Source Groups A through V that are based on the PSAT source apportionment modeling results. But SOA is included in the $PM_{2.5}$ and visibility impacts of total emissions from the 2025 and 2011 emission scenarios.

4.1.2 CARMMS Source Apportionment Configuration

The APCA version of the OSAT and the SO4, NO3/NH4 and Primary PM (i.e., no SOA) families of PSAT source apportionment was used to track the AQ/AQRV contributions of new O&G development on Federal lands in 14 separate BLM Planning Areas (Figure 4-1) for the 2025 High, Low and Medium Development Scenarios using the CARMMS 2.0 2011 12/4 km modeling platform. In total, in CARMMS 2.0, the 2025 CAMx source apportionment modeling tracked AQ/AQRV contributions for 23 (A-W) separate Source Categories in the order listed in Table 4-1. In addition, contributions from 11 (X-A8) additional combined source groups were obtained by combining separate individual source groups from CAMx source apportionment modeling (Table 4-2), to disclose impacts from a few categories of sources, such as the total contribution from new federal O&G in Colorado (X).

In addition to the CAMx source apportionment tool, another alternative approach, i.e., the so-called Bruce-Force approach, was also taken to calculate the total AQ/AQRV impact from new federal O&G in Colorado. Specifically, a “zero-out” CAMx simulation was conducted using emissions input that excluded the emissions from new O&G emissions in the 12 BLM planning

areas in Colorado (areas 2-13 in Table 4-1), to simulate the total concentrations without the emissions from new federal O&G in CO; the difference between the 2025 total concentrations the total concentrations without the emissions from new federal O&G in CO was used to represent the contribution from new federal O&G in CO. The result is presented as a source group X1 (Table 4-2), which is equivalent to source group X but by using a different approach. Note that Table 4-1 has unique source groups applied in CAMx; additional groups (for example, all oil and gas) may be generated through combinations of these groups.

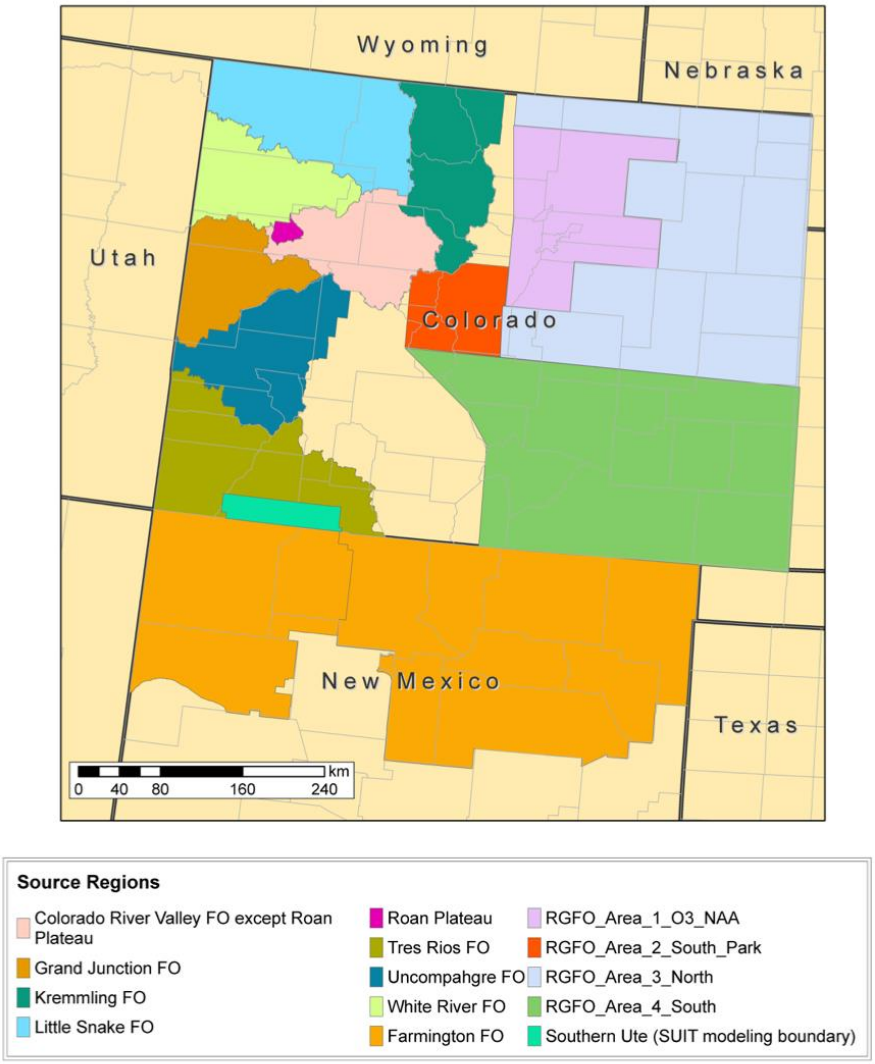

Figure 4-1. Colorado BLM planning areas and New Mexico planning area (the 14 BLM Planning Areas) where separate contributions of new O&G development on Federal lands were obtained for 2025 source apportionment modeling.

Table 4-1. Ordering of the 23 Source Categories used in the CAMx 2025 source apportionment modeling in CARMMS 2.0.

Reported Source Category	Definition	CAMx source group(s)
A	Natural emissions (combined biogenic, fires, lightning, sea salt and windblown dust)	1
B	Little Snake FO	2
C	White River FO	3
D	Colorado River Valley FO (CRVFO)	4
E	Roan Plateau Planning area portion of CRVFO	5
F	Grand Junction FO	6
G	Uncompahgre FO	7
H	Tres Rios FO	8
I	Kremmling FO	9
J	RGFO #1 (all area within the Denver / Front Range Ozone NAA; future Federal O&G)	10
K	RGFO #2 (all area outside the Denver / Front Range Ozone NAA and within the approximate northern half of the RGFO; future Federal O&G)	11
L	RGFO #3 (South Park area; future Federal O&G)	12
M	RGFO #4 (approximately the southern half of RGFO outside the other source apportionment areas; future Federal O&G)	13
N	Southern Ute Indian Tribe Supplemental Environmental Impact Statement for Shale Formation Oil and Gas Plan of Development (SUIT; all wells assumed non-federal)	14
O	New Mexico Farmington Field Office (NMFFO) (future Federal O&G)	15
P	Combined future non-Federal O&G from BLM Field Office Planning Areas in CO and NMFFO	16
Q	Combined Existing O&G from BLM Planning Areas in CO (federal and non-Federal O&G)	17
R	Mining from BLM Planning Areas	18
S	All O&G in 12 km domain outside the BLM Planning Areas of CO and NMFFO (existing and new; non-federal and federal)	19
T	Remaining anthropogenic emissions (on-road and non-road mobile, non-EGU point and area sources everywhere in 12 km domain)	20
U	Coal EGU Colorado + New Mexico	21
V	Oil/Gas EGU Colorado + New Mexico	22
W	All Other EGUs in 12 km domain	23

4.2 Post-Processing of the CAMx 2025 Source Apportionment Modeling Results

The CAMx 2025 total concentrations results were post-processed for comparison to the applicable ambient air quality standards as listed in Table 4-3. Gas-phase species were converted from parts per million (ppm) to µg/m^3 using the conversion factor recommended in the Colorado Department of Health and Environment (CDPHE) air permit modeling guidance[14]. The incremental AQ and AQRV impacts due to each of the 35 Source Groups listed in Table 4-1 and Table 4-2 were reported in CARMMS 2.0.

Table 4-2. Combined Source apportionment post-processing source Groups with separate AQ/AQRV impacts at Class I and sensitive Class II areas disclosed for the 2025 emission scenarios in CARMMS 2.0.

Reported Source Category	Definition	CAMx source group(s)
X	Total new federal O&G in CO	Sum of 2 - 13
Y	New total CRVFO	4 + 5
Z	New total RGFO	10+11+12+13
A1	All new O&G in CO plus new non-federal FFO	X + 14 + 16
A2	New federal O&G + new Mining in CO (R in CARMMS 1.5)	X + 18
A3	New federal O&G + new non-federal O&G + Mining in CO (S in CARMMS 1.5; approximate as it also includes new non-fed FFO)	A1 + 18
A4	All EGUs in CO and NM	21 + 22
A5	2025 BC	BC tracer
A6	2025 Total	2025 Core model output
A7	2011 Total	2011 Core model output
X1	Total new federal O& G in CO using Brute-Force zero-out run	Difference between A7 and zero-out run

The 35 Source Groups listed in Table 4-1 and Table 4-2 consist of the following sources:

(A) Natural emissions (biogenic, fires, lightning, WBD and sea salt).

(B-O) New Federal O&G from each of the 14 BLM Planning Areas as shown in Figure 4-1.

(O) New Federal O&G from the New Mexico Farmington Field Office.

(P) Combined future non-Federal O&G from 14 BLM Field Office Planning Areas.

(Q) Combined existing O&G from BLM Planning Areas.

(R) Combined mining emissions from BLM Planning Areas.

[14] C [ppm] = C [µg/m^3] / (40.9 x MW), where MW = molecular weight in g/mole. This formula assumes 1 atmosphere pressure and 298 K temperature. http://www.colorado.gov/airquality/permits/guide.pdf

(S)	All O&G in 12 km domain outside the BLM Planning Areas of CO and NMFFO
(T)	Remaining anthropogenic emissions (on-road and non-road mobile, non-EGU point and area sources everywhere in 12 km domain).
(U-W)	Coal (U) and O&G (V) EGUs in Colorado and New Mexico, and all other EGUs in the 12 km domain (W).
(X)	Total new Federal O&G in Colorado.
(Y)	Total emissions from Colorado River Valley FO (CRVFO)
(Z)	Total emissions from RGFO (#1 - #4)
(A1)	All new O&G in CO plus new non-federal FFO (doesn't include new fed FFO), i.e., New federal O&G in CO + New SUIT shale + New state/private (non-fed) O&G in Colorado and FFO.
(A2)	New federal O&G and new Mining in CO.
(A3)	Total emissions from new federal O&G, new non-federal O&G and new Mining in CO (this is approximate as it also includes new non-fed FFO).
(A4)	All EGUs in CO and NM.
(A5)	Contributions from 2025 boundary conditions (BC), i.e., sources outside the 12 km domain.
(A6)	All emissions from the 2025 CAMx simulation (total concentrations).
(A7)	All emissions from the 2011 CAMx simulation (total concentrations).
(X1)	Total new federal O& G in CO using Brute-Force zero-out run (calculated as the difference between 2025 CAMx total concentrations and the zero-out run for each of the High, Low and Medium scenarios). It is equivalent to X but by using a different modeling approach.

Table 4-3 shows the national and state ambient air quality standards and PSD concentration increments that are used in the air quality impact assessment.

Table 4-3. Applicable National and State Ambient Air Quality Standards and PSD concentration increments (bold indicates units in which standard was defined, conversion to ppm/ppb following CDPHE modeling guidance).

Pollutant/Averaging Time	NAAQS	CAAQS[13]	NMAAQS[14]	PSD Class I Increment[1]	PSD Class II Increment[1]
CO					
1-hour[2]	**35 ppm** 40,000 µg/m^3	--	**13.1 ppm** 1,100 µg/m^3	--	--
8-hour[2]	**9 ppm** 10,000 µg/m^3	--	**8.7 ppm** 10,000 µg/m^3	--	--
NO_2					
1-hour[3]	**100 ppb** 188 µg/m^3	--	--	--	--
24-hour	--	--	**0.10 ppm** 1,953 µg/m^3	--	--
Annual[4]	**53 ppb** 100 µg/m^3	--	**0.05 ppm** 98 µg/m^3	2.5 µg/m^3	25 µg/m^3
O_3					
8-hour[5]	**0.070 ppm** 137 µg/m^3	--	--	--	--
PM_{10}					
24-hour[6]	**150 µg/m^3**	--	--	8 µg/m^3	30 µg/m^3
Annual[7]	--	--	--	4 µg/m^3	17 µg/m^3
$PM_{2.5}$					
24-hour[8]	**35 µg/m^3**	--	--	2 µg/m^3	9 µg/m^3
Annual[9]	**12 µg/m^3**	--	--	1 µg/m^3	4 µg/m^3
SO_2					
1-hour[10]	**75 ppb** 196 µg/m^3	--	--		
3-hour[11]	**0.5 ppm** 1,300 µg/m^3	**700 µg/m^3**	--	25 µg/m^3	512 µg/m^3
24-hour[12]	--	--	**0.10 ppm** 262 µg/m^3	5 µg/m^3	91 µg/m^3
Annual[4]	--	--	**0.02 ppm** 52 µg/m^3	2 µg/m^3	20 µg/m^3

1. The PSD demonstrations serve information purposes only and do not constitute a regulatory PSD increment consumption analysis.
2. No more than one exceedance per calendar year; for NMAAQS - No more than one exceedance per consecutive 12 months
3. 98th percentile, averaged over 3 year; for NMAAQS - not to be exceeded more than once over any 12 consecutive months
4. Annual mean not to be exceeded; for NMAAQS - arithmetic average over any four consecutive quarters not to be exceeded
5. Fourth-highest daily maximum 8-hour ozone concentrations in a year, averaged over 3 years
6. Not to be exceeded more than once per calendar year on average over 3 years.
7. 3 year average of the arithmetic means over a calendar year
8. 98th percentile, averaged over 3 years
9. Annual mean, averaged over 3 years, NAAQS promulgated December 14, 2012
10. 99th percentile of daily maximum 1-hour concentrations in a year, averaged over 3 years
11. No more than one exceedance per calendar year (secondary NAAQS) and no more than one exceedance in 12 consecutive months (CAAQS)
12. For areas in New Mexico not within 3.5 miles of the Chino Mines Company
13. http://www.colorado.gov/cs/Satellite/CDPHE-Main/CBON/1251601911433
14. http://www.nmcpr.state.nm.us/nmac/parts/title20/20.002.0003.htm

4.3 Class I and Sensitive Class II Areas for Analysis

The AQ/AQRV impacts due to O&G development on Federal lands within the Colorado BLM Planning Areas were assessed for the Class I areas and sensitive Class II areas identified in CARMMS 1.0/1.5 (Ramboll Environ and Kleinfelder, 2016a, Parker and Morris, 2014) within the CARMMS 2.0 12/4 km modeling domain. GIS analysis was performed to determine the grid cell definition of the identified Class I/II areas within the CARMMS 2.0 12/4 km modeling domain. Sensitive lakes in the region were also identified.

4.3.1 Final Class I and Sensitive Class II Areas

The Class I areas where air quality and AQRV impacts were calculated within the 12/4 km CARMMS 2.0 modeling domain are displayed in Figure 4-2 and listed in Table 4-4. The sensitive Class II areas used in the CARMMS post-processing are displayed in Figures 4-3a – 4-3c and listed in Table 4-5. Note that several of the Class I areas are portions of a sensitive Class II area. In total, the CARMMS modeling results were post-processed using 26 and 58 Class I and sensitive Class II areas, respectively. Details on how the sensitive Class II areas were defined are provided in Parker and Morris (2014). Note that the Colorado side of Dinosaur National Monument is considered PSD Class I for just SO_2. Sensitive lakes in the region where acid neutralizing capacity (ANC) calculations are made are listed in Table 4-6.

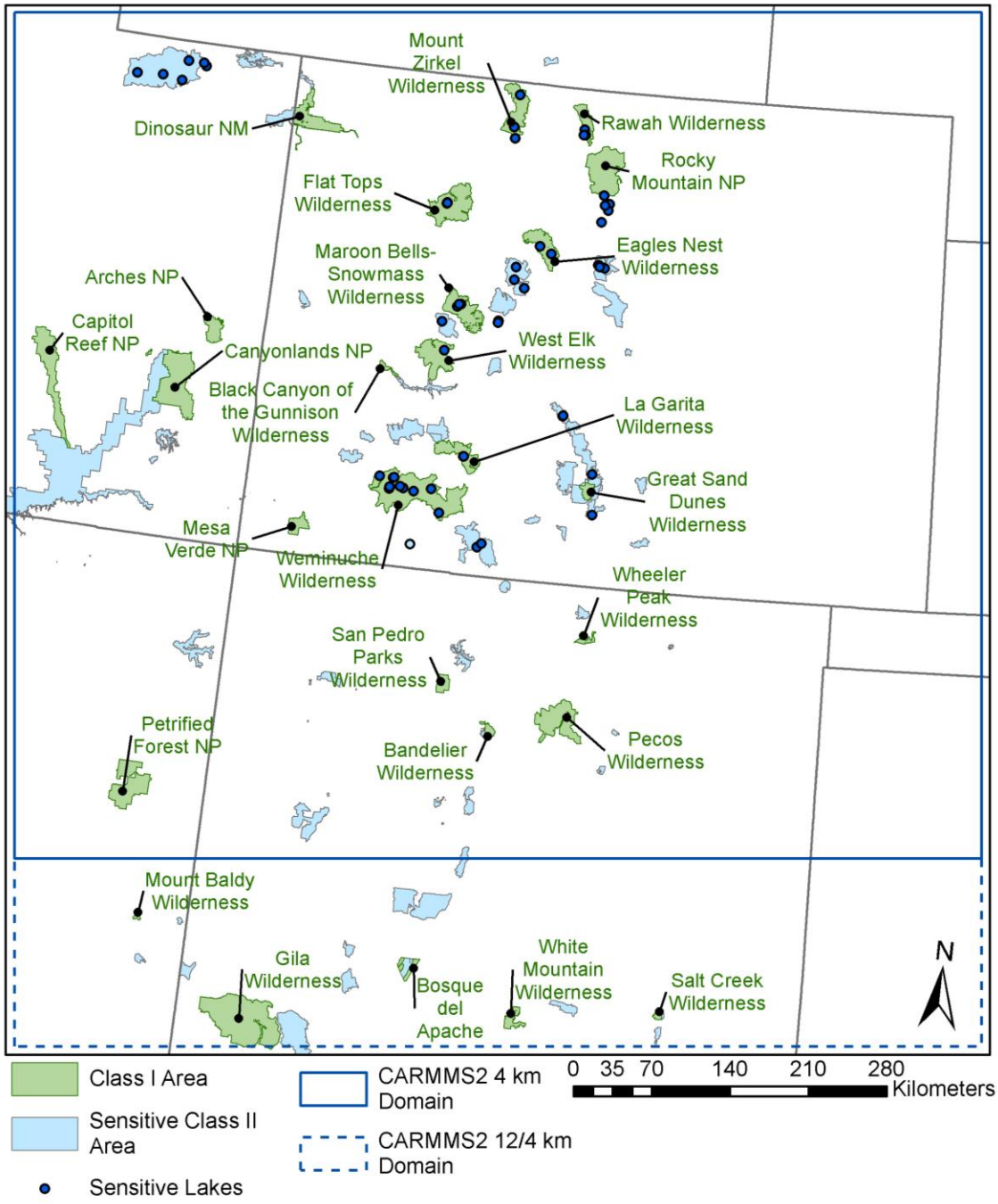

Figure 4-2. Locations of Class I (light green) and sensitive Class II (light blue) areas where air quality and AQRV impacts were assessed as well as sensitive lakes (black dots) with ANC calculations. Class I areas are labeled, while sensitive Class II areas and sensitive lakes are not.

Table 4-4. List of Class I Areas for Impact Analysis.

Class I	State	Owner
Arches NP	UT	NPS
Bandelier Wilderness	NM	NPS
Black Canyon of the Gunnison Wilderness	CO	NPS
Bosque del Apache	NM	FWS
Canyonlands NP	UT	NPS
Capitol Reef NP	UT	NPS
Dinosaur NM[1]	CO	NPS
Eagles Nest Wilderness	CO	USFS
Flat Tops Wilderness	CO	USFS
Gila Wilderness	NM	USFS
Great Sand Dunes Wilderness	CO	NPS
La Garita Wilderness	CO	USFS
Maroon Bells-Snowmass Wilderness	CO	USFS
Mesa Verde NP	CO	NPS
Mount Baldy Wilderness	AZ	USFS
Mount Zirkel Wilderness	CO	USFS
Pecos Wilderness	NM	USFS
Petrified Forest NP	AZ	NPS
Rawah Wilderness	CO	USFS
Rocky Mountain NP	CO	NPS
Salt Creek Wilderness	NM	FWS
San Pedro Parks Wilderness	NM	USFS
Weminuche Wilderness	CO	USFS
West Elk Wilderness	CO	USFS
Wheeler Peak Wilderness	NM	USFS
White Mountain Wilderness	NM	USFS

1. The Colorado side of Dinosaur NM is PSD Class I for SO_2

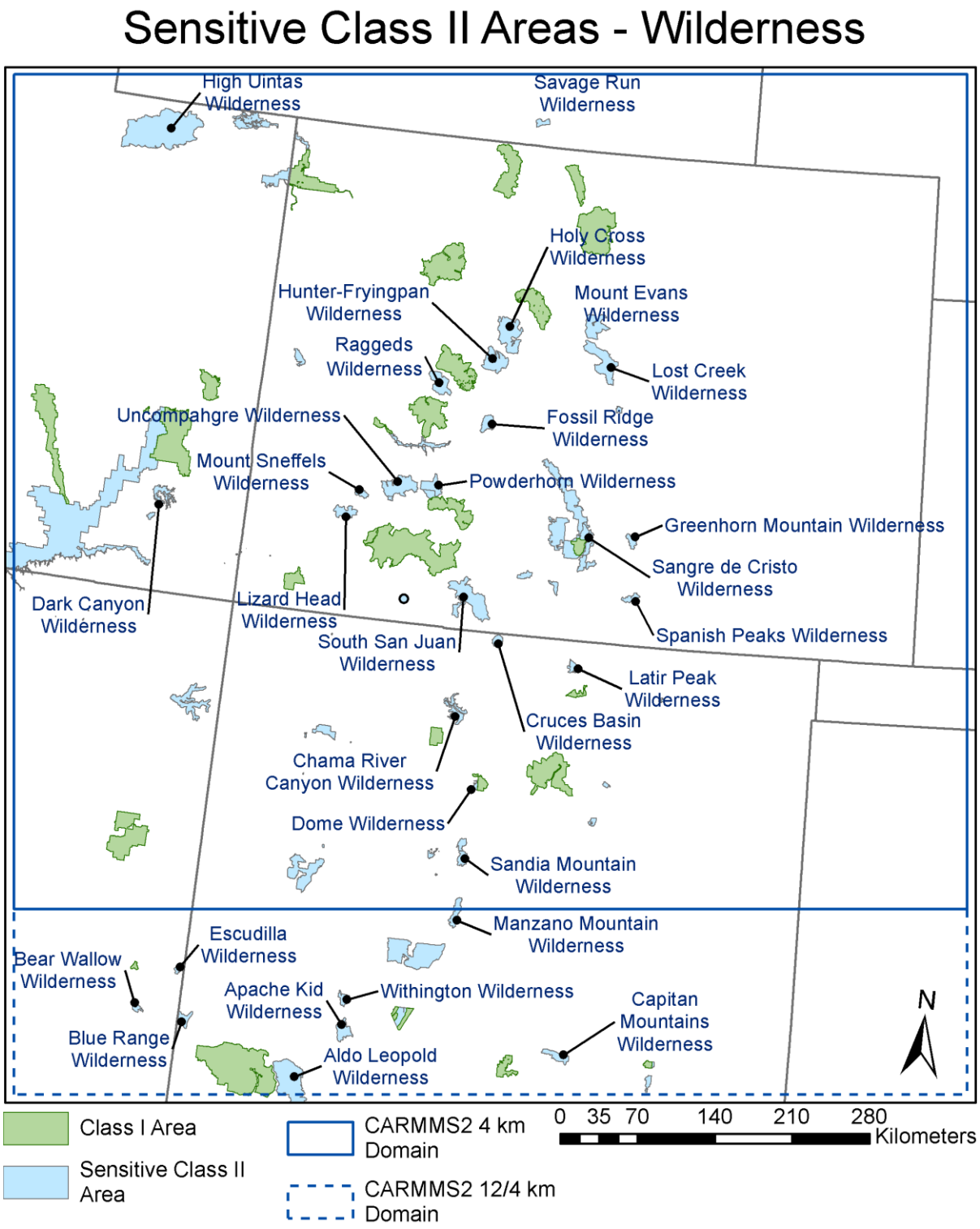

Figure 4-3a. Sensitive Class II wilderness areas for the CARMMS analysis labeled. Class I areas and non-wilderness sensitive Class II areas unlabeled.

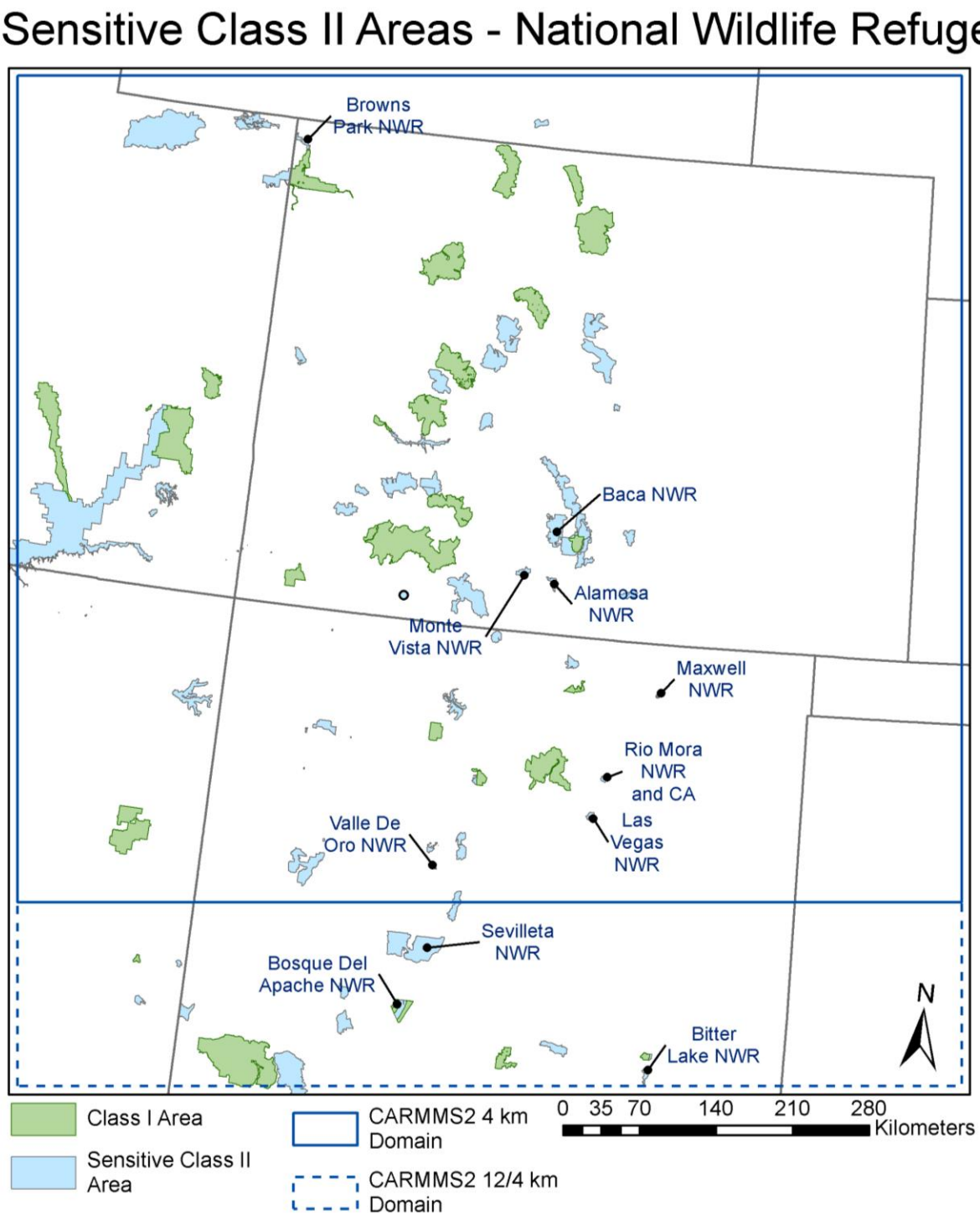

Figure 4-3b. National Wildlife Refuge sensitive Class II areas for the CARMMS analysis labeled. Class I area and non-National-Wildlife-Refuge Class II areas displayed but not labeled.

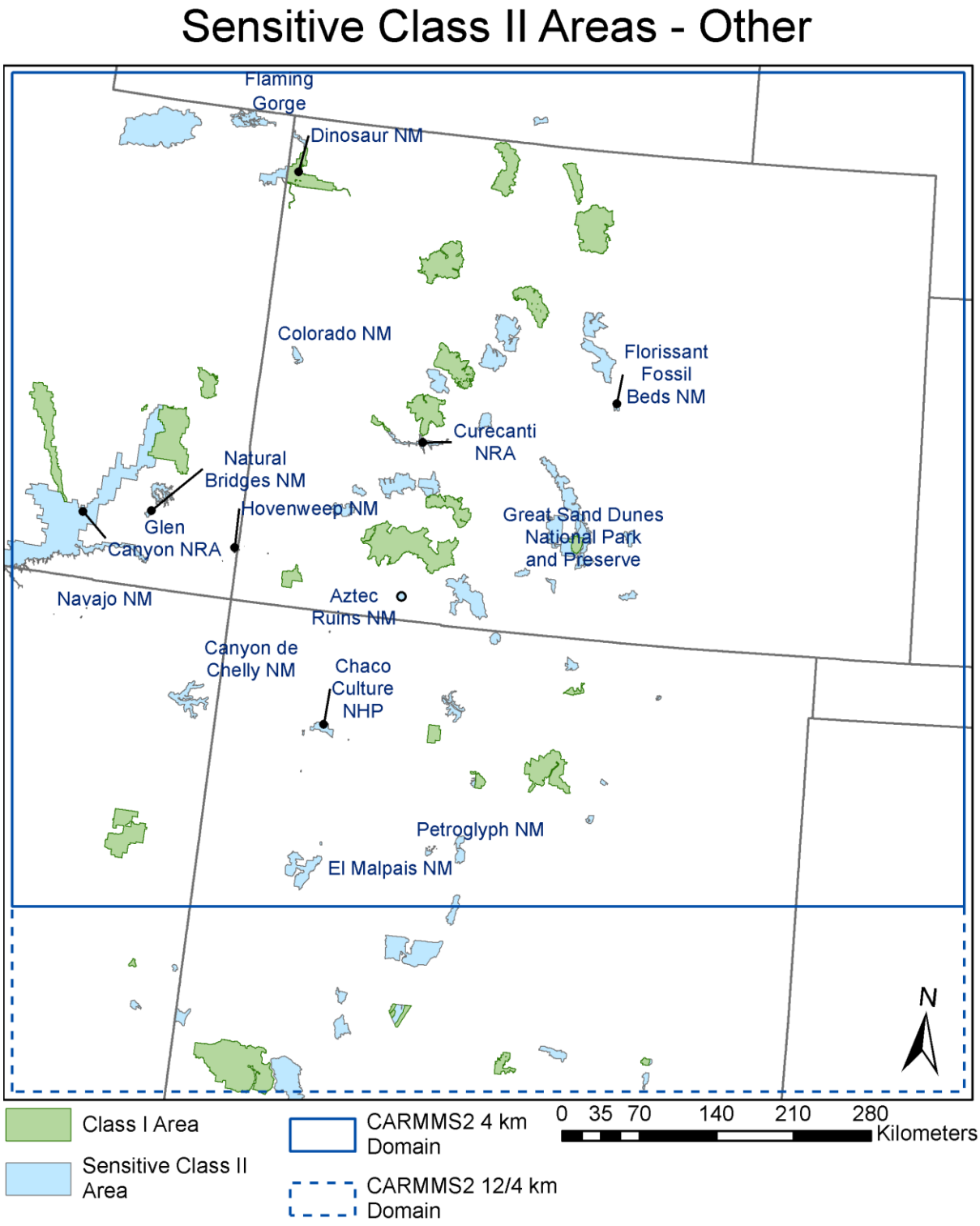

Figure 4-3c. Other sensitive Class II areas for the CARMMS analysis labeled. Class I areas and Class II areas shown in Figure 4-3a and Figure 4-3b are also shown but not labeled.

Table 4-5. Sensitive Class II areas where air quality and AQRV impacts were assessed.

Class II	State	Owner
Alamosa National Wildlife Refuge	CO	FWS
Aldo Leopold Wilderness	NM	USFS
Apache Kid Wilderness	NM	USFS
Aztec Ruins NM	NM	NPS
Baca National Wildlife Refuge	CO	FWS
Bear Wallow Wilderness	AZ	USFS
Bitter Lake National Wildlife Refuge	NM	FWS
Blue Range Wilderness	NM	USFS
Bosque Del Apache National Wildlife Refuge	NM	FWS
Browns Park National Wildlife Refuge	CO	FWS
Canyon de Chelly NM	AZ	NPS
Capitan Mountains Wilderness	NM	USFS
Chaco Culture NHP	NM	NPS
Chama River Canyon Wilderness	NM	USFS
Chimney Rock NM	CO	USFS
Colorado NM	CO	NPS
Cruces Basin Wilderness	NM	USFS
Curecanti NRA	CO	NPS
Dark Canyon Wilderness	UT	USFS
Dinosaur NM	CO	NPS
Dome Wilderness	NM	USFS
El Malpais NM	NM	NPS
Escudilla Wilderness	AZ	USFS
Flaming Gorge	UT	USFS
Florissant Fossil Beds NM	CO	NPS
Fossil Ridge Wilderness	CO	USFS
Glen Canyon NRA	UT	NPS
Great Sand Dunes National Park	CO	NPS
Great Sand Dunes National Preserve	CO	NPS
Greenhorn Mountain Wilderness	CO	USFS
High Uintas Wilderness	UT	USFS
Holy Cross Wilderness	CO	USFS
Hovenweep NM	CO	NPS
Hunter-Fryingpan Wilderness	CO	USFS
Las Vegas National Wildlife Refuge	NM	FWS
Latir Peak Wilderness	NM	USFS
Lizard Head Wilderness	CO	USFS
Lost Creek Wilderness	CO	USFS

Class II	State	Owner
Manzano Mountain Wilderness	NM	USFS
Maxwell National Wildlife Refuge	NM	FWS
Monte Vista National Wildlife Refuge	CO	FWS
Mount Evans Wilderness	CO	USFS
Mount Sneffels Wilderness	CO	USFS
Natural Bridges NM	UT	NPS
Navajo NM	AZ	NPS
Petroglyph NM	NM	NPS
Powderhorn Wilderness	CO	USFS
Raggeds Wilderness	CO	USFS
Rio Mora National Wildlife Refuge and Conservation Area	NM	FWS
Sandia Mountain Wilderness	NM	USFS
Sangre de Cristo Wilderness	CO	USFS
Savage Run Wilderness	WY	USFS
Sevilleta National Wildlife Refuge	NM	FWS
South San Juan Wilderness	CO	USFS
Spanish Peaks Wilderness	CO	USFS
Uncompahgre Wilderness	CO	USFS
Valle De Oro National Wildlife Refuge	NM	FWS
Withington Wilderness	NM	USFS

Table 4-6. Sensitive lakes where ANC calculations were made.

Lake	National Forest	Wilderness Area
Brooklyn Lake	White River	Collegiate Peaks
Tabor Lake	White River	Collegiate Peaks
Booth Lake	White River	Eagles Nest
Upper Willow Lake	White River	Eagles Nest
Ned Wilson Lake	White River	Flat Tops
Upper Ned Wilson Lake	White River	Flat Tops
Lower NWL Packtrail Pothole	White River	Flat Tops
Upper NWL Packtrail Pothole	White River	Flat Tops
Walk Up Lake	Ashley	--
Bluebell Lake	Ashley	High Uintas
Dean Lake	Ashley	High Uintas
No Name (Utah, Duchesne – 4D2-039)	Ashley	High Uintas
Upper Coffin Lake	Ashley	High Uintas
Fish Lake	Wasatch-Cache	High Uintas
Blodgett Lake, Colorado	White River	Holy Cross
Upper Turquoise Lake	White River	Holy Cross
Upper West Tennessee Lake	San Isabel	Holy Cross
Blue Lake (Colorado; Boulder – 4E1-040)	Arapaho and Roosevelt	Indian Peaks
Crater Lake	Arapaho and Roosevelt	Indian Peaks
King Lake (Colorado; Grand – 4E1-049)	Arapaho and Roosevelt	Indian Peaks
No Name Lake (Colorado; Boulder – 4E1-055)	Arapaho and Roosevelt	Indian Peaks
Upper Lake	Arapaho and Roosevelt	Indian Peaks
Small Lake Above U-Shaped Lake	Rio Grande	La Garita
U-Shaped Lake	Rio Grande	La Garita
Avalanche Lake	White River	Maroon Bells
Capitol Lake	White River	Maroon Bells
Moon Lake (Upper)	White River	Maroon Bells
Upper Middle Beartrack Lake	Arapaho and Roosevelt	Mount Evans
Abyss Lake	Pike and San Isabel	Mount Evans
Frozen Lake	Pike and San Isabel	Mount Evans
North Lake	Pike and San Isabel	Mount Evans
South Lake	Pike and San Isabel	Mount Evans
Lake Elbert	Medicine Bow-Routt	Mount Zirkel
Seven Lakes (LG East)	Medicine Bow-Routt	Mount Zirkel

Lake	National Forest	Wilderness Area

Summit Lake	Medicine Bow-Routt	Mount Zirkel
Deep Creek Lake	Gunnison	Raggeds
Island Lake	Arapaho and Roosevelt	Rawah
Kelly Lake	Arapaho and Roosevelt	Rawah
Rawah Lake #4	Arapaho and Roosevelt	Rawah
Crater Lake (Sangre de Cristo)	Rio Grande	Sangre de Cristo
Lower Stout Lake	San Isabel	Sangre de Cristo
Upper Little Sand Creek Lake	San Isabel	Sangre de Cristo
Upper Stout Lake	San Isabel	Sangre de Cristo
Glacier Lake (Colorado)	San Juan-Rio Grande	South San Juan
Lake South of Blue Lakes	San Juan-Rio Grande	South San Juan
Big Eldorado Lake	San Juan-Rio Grande	Weminuche
Four Mile Pothole	San Juan-Rio Grande	Weminuche
Lake Due South of Ute Lake	San Juan-Rio Grande	Weminuche
Little Eldorado	San Juan-Rio Grande	Weminuche
Little Granite Lake	San Juan-Rio Grande	Weminuche
Lower Sunlight Lake	San Juan-Rio Grande	Weminuche
Middle Ute Lake	San Juan-Rio Grande	Weminuche
Small Pond Above Trout Lake	San Juan-Rio Grande	Weminuche
Upper Grizzly Lake	San Juan-Rio Grande	Weminuche
Upper Sunlight Lake	San Juan-Rio Grande	Weminuche
West Snowdon Lake	San Juan-Rio Grande	Weminuche
White Dome Lake	San Juan-Rio Grande	Weminuche
South Golden Lake	Grand Mesa, Uncompahgre and Gunnison	West Elk

4.3.2 Class I and Sensitive Class II Area Grid Cell Assignments

Determining the grid cells that represent the Class I/II areas was achieved with Graphical Information System (GIS) software, and was performed by intersecting the CAMx model grid cells with GIS shapefiles that define the Class I/II boundaries. Different GIS tools are available to perform the intersection that assigns a Class I/II designation to each grid cell, and different input shapefiles defining the boundaries are also available.

To generate the grid cells for the final analysis, we used official Class I boundary shapefiles that are available for download from the NPS website[15]. The GIS tool "spatial join" was used to assign a Class I/II area to each CAMx grid cell if any part of the Class I/II area intersects the grid cell. Then, a cell area threshold was applied to remove those grid cells in which in the Class I/II area made up less than 5% of the total cell area. However, the threshold was only applied if the Class I/II area would still be represented by other grid cells. In other words, the threshold was

[15] http://www.nature.nps.gov/air/maps/classiloc.cfm

not applied to areas whose geographical extent was too small to comprise more than 5% of any grid cell, such as the Aztec Ruins NM. In addition, for the final processing, attention was paid to grid cells that cover more than one Class I/II area, in those cases, a particular grid cell was used twice to represent 2 different neighboring Class I/II areas.

4.4 Ambient Concentration Analysis using Absolute Modeling Results

Modeled concentrations predicted by the CAMx due to all sources were compared against national and state standards (NAAQS, CAAQS and NMAAQS) throughout the 4 km modeling domain. When exceedances of the ozone or $PM_{2.5}$ NAAQS are estimated, the APCA and PSAT source apportionment results was used to determine the contribution of emissions from each of the Source Groups to determine the major cause of the modeled exceedance. The incremental air quality concentration contribution due to emissions from oil and gas on Federal lands at Class I and sensitive Class II areas for each BLM planning area were compared to applicable PSD increments (see Table 4-3). The PSD demonstrations are for information only and are not regulatory PSD Increment consumption analyses, which would be completed as necessary by the relevant state or other agency.

4.5 Ambient Concentration Analysis using Relative Modeling Results

EPA's modeling guidance recommends using the PGM modeling results in a relative fashion when comparing future year modeling results to the ozone and $PM_{2.5}$ NAAQS (EPA, 2007). The relative change in the PGM concentrations between the current and future year simulations are used to scale the observed current year ozone or $PM_{2.5}$ Base Design Value (DVB) to obtain a projected future year Design Value (DVF). The model derived scaling factors are called Relative Response Factors (RRFs) and are based on the ratio of future year to current year modeling results:

$$DVF = DVB \times RRF$$

EPA's PGM modeling guidance provides recommended procedures for calculating DVBs and RRFs (EPA, 2007) that have been implemented in EPA's Modeled Attainment Test Software (MATS[16]; Abt, 2012). The MATS projection tool was used with the CAMx 2011 Base Case and 2025 High, Low and Medium Development Scenarios modeling results to project future year ozone DVFs that were compared to the NAAQS. MATS also has a capability of projecting $PM_{2.5}$ DVFs but there is much less observed $PM_{2.5}$ data in the region so such projections would be extremely limited, so MATS was not used for $PM_{2.5}$. The MATS default settings for making future year ozone projections were used that includes using a DVB based on an average of three-years of Design Values (DVs) centered on the Base Case modeling year (2011) and constructing RRFs using at least 10 days of modeling results. As the Base Case year is 2011, then this means using a DVB based on DVs from the following 3-year periods, 2009-2011, 2010-2012 and 2011-2013.

4.6 Visibility Analysis

Visibility impacts were calculated for new oil and gas and mining emissions on Federal lands within each BLM Planning Areas as well as for cumulative emissions sources. The approach used the incremental concentrations as quantified by the CAMx PSAT tool simulation of oil and gas and mining activities within each BLM planning area. Changes in light extinction from CAMx

[16] http://www.epa.gov/ttn/scram/modelingapps_mats.htm

model concentration increments due to emissions from oil and gas and other activity emissions were calculated for each day at grid cells that intersect Class I and sensitive Class II areas within the 12/4 km modeling domain (see Section 4.3.2). The FLAG (2010) procedures were used in the incremental BLM planning area-specific visibility assessment analysis.

The visibility evaluation metric used in this analysis is based on the Haze Index which is measured in deciview (dv) units and is defined as follows:

$$HI = 10 \times \ln[b_{ext}/10]$$

b_{ext} is the atmospheric light extinction measured in inverse megameters (Mm^{-1}) and is calculated primarily from atmospheric concentrations of particulates. A more intuitive measure of haze is visual range (VR), which is defined as the distance at which a large black object just disappears from view, and is measured in km. Visual range is related to b_{ext} by the formula VR = 3912 / b_{ext}. Visual range will not be used as a threshold in the analysis, but could be back-calculated from extinction to give a more easily understood visibility metric.

The incremental concentrations due to BLM planning area emissions were added to background concentrations in the extinction equation (b_{ext}) and the difference between the Haze Index with added BLM planning area concentrations to the Haze Index based solely on background concentrations is calculated. This quantity is the change in Haze Index, which is referred to as "delta deciview" (Δdv) :

$$\Delta dv = 10 \times \ln[b_{ext(BLM+background)}/10] - 10 \times \ln[b_{ext(background)}/10]$$

$$\Delta dv = 10 \times \ln[b_{ext(BLM+background)}/b_{ext(background)}]$$

Here $b_{ext(BLM+background)}$ refers to atmospheric light extinction due to oil and gas and other activities in each BLM planning area plus background concentrations, and $b_{ext(background)}$ refers to atmospheric light extinction due to background concentrations only.

For each individual BLM Planning Area, the estimated visibility degradation at the Class I areas and sensitive Class II areas due to new O&G emissions on Federal lands are presented in terms of the number of days that exceed a threshold change in deciview (Δdv) relative to background conditions. In the next section we describe the method for calculating the extinction, b_{ext}.

4.6.1 IMPROVE Reconstructed Mass Extinction Equations

The FLAG (2010) procedures for evaluating visibility impacts at Class I areas use the revised IMPROVE reconstructed mass extinction equation to convert PM species in μgm^{-3} to light extinction (b_{ext}) in inverse megameters (Mm^{-1}) as follows:

$$b_{ext} = b_{SO4} + b_{NO3} + b_{EC} + b_{OCM} + b_{Soil} + b_{PMC} + b_{SeaSalt} + b_{Rayleigh} + b_{NO2}$$

where

$$b_{SO4} = 2.2 \times f_S(RH) \times [\text{Small Sulfate}] + 4.8 \times f_L(RH) \times [\text{Large Sulfate}]$$

$$b_{NO3} = 2.4 \times f_S(RH) \times [\text{Small Nitrate}] + 5.1 \times f_L(RH) \times [\text{Large Nitrate}]$$

$$b_{OCM} = 2.8 \times [\text{Small Organic Mass}] + 6.1 \times [\text{Large Organic Mass}]$$

$$b_{EC} = 10 \times [\text{Elemental Carbon}]$$

$$b_{Soil} = 1 \times [\text{Fine Soil}]$$

$$b_{CM} = 0.6 \times [\text{Coarse Mass}]$$

$$b_{SeaSalt} = 1.7 \times f_{SS}(RH) \times [\text{Sea Salt}]$$

$$b_{Rayleigh} = \text{Rayleigh Scattering (Site-specific)}$$

$$b_{NO2} = 0.33 \times [NO_2 \text{ (ppb)}] \text{ {or as: } } 0.1755 \times [NO_2 \text{ } (\mu g/m^3)]\}.$$

f(RH) are relative humidity adjustment factors that account for the fact that sulfate, nitrate and sea salt aerosols are hygroscopic and are more effective at scattering radiation at higher relative humidity. FLAG (2010) recommends using monthly average f(RH) values rather than the hourly averages recommended in the previous FLAG (2000) guidance document in order to moderate the effects of extreme weather events on the visibility results.

The revised IMPROVE equation treats "large sulfate" and "small sulfate" separately because large and small aerosols affect an incoming beam of light differently. However, the IMPROVE measurements do not separately measure large and small sulfate; they measure only the total $PM_{2.5}$ sulfate. Similarly, CAMx writes out a single concentration of particulate sulfate for each grid cell. Part of the definition of the new IMPROVE equation is a procedure for calculating the large and small sulfate contributions based on the magnitude of the model output sulfate concentrations; the procedure is documented in FLAG (2010). The sulfate concentration magnitude is used as a surrogate for distinguishing between large and small sulfate concentrations. For a given grid cell, the large and small sulfate contributions are calculated from the model output sulfate (which is the "Total Sulfate" referred to in the FLAG (2010) guidance) as:

For Total Sulfate < 20 $\mu g/m^3$:

$$[\text{Large Sulfate}] = ([\text{Total Sulfate}] / 20\ \mu g/m^3) \times [\text{Total Sulfate}]$$

For Total Sulfate ≥ 20 $\mu g/m^3$:

$$[\text{Large Sulfate}] = [\text{Total Sulfate}]$$

For all values of Total Sulfate:

$$[\text{Small Sulfate}] = [\text{Total Sulfate}] - [\text{Large Sulfate}]$$

The procedure is identical for nitrate and organic mass. Sulfate, nitrate and organic mass concentrations for the western U.S. are expected to be mainly in the small fraction.

The PSAT source apportionment algorithm does not separately track NO_2 concentrations but instead tracks total reactive nitrogen (RGN) that consistent mainly of NO plus NO_2. Thus for each hour and each grid cell representing a Class I/II area, a Source Group's incremental PSAT RGN contribution is converted to NO_2 by multiplying by the total (all emissions) CAMx model NO_2/RGN concentration ratio, which is then used in the IMPROVE visibility equation.

Although sodium and particulate chloride are treated in the CAMx core model, these species are not carried in the CAMx PSAT tool; neglecting sea salt in the visibility calculations in the 4 km CARMMS impact assessment domains does not compromise the accuracy of the analysis as IMPROVE measurements show that sea salt concentrations are negligible in this inland area and there would be no sea salt associated with any of the O&G emissions.

Predicted daily average modeled concentrations due to each BLM planning area for grid cells containing Class I and sensitive Class II area receptors were processed using the revised IMPROVE reconstructed mass extinction equation FLAG (2010) to obtain changes in b_{ext} at each sensitive receptor area which are then converted to deciview and reported.

The FLAG (2010) method was used to estimate the visibility impacts from each Colorado and northern New Mexico BLM Planning Area. This method used the revised IMPROVE equation together with annual average natural conditions (see Table 6 in FLAG, 2010) and monthly relative humidity factors for each Class I area (see Tables 7-9 in FLAG, 2010). The Δdv was calculated for each grid cell that overlaps a Class I or sensitive Class II area for each day of the annual CAMx run. The highest Δdv across all grid cells overlapping a Class I or sensitive Class II area was selected to represent the daily value at that Class I/II area. Visibility impacts due to new O&G emissions on Federal lands within each BLM Planning Areas that are more than 0.5 and 1.0 dv are reported.

4.6.2 Cumulative Visibility

The cumulative visibility impacts due to the development of oil and gas and other (e.g., mining) activities on all BLM Planning Areas were assessed following the recommendations from the FWS and NPS that was outlined in their February 10, 2012 letter to the Wyoming Department of Environmental Quality on recommended cumulative visibility method for the Continental Divide-Creston gas infill development EIS (FWS and NPS, 2012) and subsequent conversations with the FLMs. This approach is based on an abbreviated regional haze rule method that estimates the future year visibility at Class I and sensitive Class II areas for the average of the Worst 20% (W20%) and Best 20% (B20%) visibility days with and without the effects of the cumulative emissions on visibility impairment. The cumulative visibility impacts used CAMx model output from the 2011 Base Case and 2025 emissions scenarios in conjunction with monitoring data to produce cumulative visibility impacts at each Class I area in the CARMMS domain. EPA's Modeled Attainment Test Software (MATS[17]) was used to make the 2025 visibility projections for the W20% and B20% days. The basic steps in the recommended cumulative visibility method are as follows (FWS and NPS, 2012):

[17] http://www.epa.gov/ttn/scram/modelingapps_mats.htm

5. Calculate the observed average 2011 current year cumulative visibility impact using the Haze Index (HI, in deciviews) at each Class I or associated sensitive Class II area to determine the 20% of days with the worst and 20% of days with the best visibility. The intent is to incorporate 5 years of monitoring data surrounding the 2011 Base Case year, which would include 2009-2013. MATS uses the IMPROVE data associated with each Class I area and modeling results at the location of the IMPROVE monitoring site.

2. Estimate the relative response factors (RRFs) for each component of $PM_{2.5}$ and for coarse mass (CM) corresponding to the new IMPROVE visibility algorithm using the CAMx 2011 and 2025 model output.

3. Using the RRFs and ambient data, calculate 2025 future-year daily concentration data for the B20% and W20% days using the CAMx 2011 Base Case and 2025 standard model concentration estimates and PSAT source apportionment modeling results two ways:

4. 2025 Total Emissions: Use total 2025 High, Low and Medium Development Scenario CAMx concentration results due to all emissions;

5. 2025 No Cumulative Emissions: Use PSAT source apportionment results to eliminate contributions of PM concentrations associated with combined emission scenarios corresponding to Source Groups X, A1, A2, A3, A4, and X1 in Table 4-2.

6. Use the information in step 3 to calculate the average 2025 visibility for the 20% Best and 20% Worst visibility days and the 2025 emissions.

7. Assess the average differences in cumulative visibility impacts for the four combined scenarios and also compare with the current observed Baseline visibility conditions.

4.7 Sulfur and Nitrogen Deposition

CAMx-predicted wet and dry fluxes of sulfur- and nitrogen-containing species were processed to estimate total annual sulfur (S) and nitrogen (N) deposition values at each Class I and sensitive Class II area as well as at each acid sensitive lake. The Maximum annual S and N deposition values from any grid cell that intersects a Class I or sensitive Class II receptor area was used to represent deposition for that area, in addition to the Average annual deposition values of all grid cells that intersect a Class I or sensitive Class II receptor area. Maximum and Average predicted S and N deposition impacts were estimated separately for each BLM planning area and together across all BLM planning areas using the Source Groups in Table 4-2c.

Nitrogen deposition impacts were calculated by taking the sum of the nitrogen contained in the fluxes of all nitrogen species modeled by the CAMx PSAT source apportionment tool. CAMx species used in the nitrogen deposition flux calculation are: reactive gaseous nitrate species, RGN (NO, NO_2, NO_3 radical, HONO, N_2O_5), TPN (PAN, PANX, PNA), organic nitrates (NTR), particulate nitrate formed from primary emissions plus secondarily formed particulate nitrate (NO_3), gaseous nitric acid (HNO_3), gaseous ammonia (NH_3) and particulate ammonium (NH_4).

CAMx species used in the sulfur deposition calculation are primarily sulfur dioxide emissions (SO_2) and particulate sulfate ion from primary emissions plus secondarily formed sulfate (SO_4).

FLAG (2010) recommends that applicable sources assess impacts of nitrogen and sulfur deposition at Class I areas. This guidance recognizes the importance of establishing critical deposition loading values ("Critical Loads") for each specific Class I area as these Critical Loads are completely dependent on local atmospheric, aquatic and terrestrial conditions and chemistry. Critical Load thresholds are essentially a level of atmospheric pollutant deposition below which negative ecosystem effects are not likely to occur. FLAG (2010) does not include any Critical Load levels for specific Class I areas and refers to site-specific critical load information on FLM websites for each area of concern. This guidance does, however recommend the use of deposition analysis thresholds (DATs[18]) developed by the National Park Service and the Fish and Wildlife Service. The DATs represent screening level values for nitrogen and sulfur deposition for individual projects with deposition impacts below the DATS considered negligible. Note that DATs are Project-level thresholds. DAT have been established for both nitrogen and sulfur deposition and in western Class I areas they are 0.005 kilograms per hectare per year (kg/ha-yr) for both nitrogen and sulfur deposition. As a screening analysis, results for oil and gas and mining activities for each BLM planning area, which is Source Groups A through P were separately compared to the DATs. Comparison of deposition impacts from combined Source Groups to the DAT is not appropriate.

For the combined Source Groups and total 2011 and 2025 emissions Source Groups W and X, the annual nitrogen and sulfur deposition were compared against Critical Load values established for the Rocky Mountain region to assess total deposition impacts. The NPS has provided recent information on nitrogen critical load values applicable for Wyoming and Colorado Class I and sensitive Class II areas (NPS, 2014). For Class I and sensitive Class II areas in Wyoming a critical load value of 2.2 kg/ha-yr for nitrogen deposition (estimated from a wet deposition critical load value of 1.4 kg N/ha-yr) is applicable, based on research conducted by Saros et. al.(2010) in the eastern Sierra Nevada and Greater Yellowstone ecosystems. This is a critical load value that is protective of high elevation surface waters. For Colorado Class I and sensitive Class II areas (with the exception of Dinosaur National Monument) a critical load value 2.3 kg N/ha-yr is applicable for total nitrogen deposition, based on research conducted by Jill Baron (Baron 2006) that estimated 1.5 kg/ha-yr as a critical loading value for wet nitrogen deposition for high-elevation lakes in Rocky Mountain National Park, Colorado. For Dinosaur National Monument, which is an arid region, a nitrogen deposition critical load value is based on research conducted by Pardo et al. (2011) which concluded that the cumulative critical load necessary to protect shrublands and lichen communities in Dinosaur NM is 3 kg N/ha/year.

For sulfur deposition, the critical load threshold published by Fox et al. (Fox 1989) for total sulfur deposition of 5 kg/ha-yr, for the Bob Marshall Wilderness Area in Montana and Bridger Wilderness Area in Wyoming, was used as critical load threshold for each of the Class I and sensitive Class II areas.

[18] http://www.nature.nps.gov/air/Pubs/pdf/flag/nsDATGuidance.pdf

In summary, we will compare the total annual sulfur and nitrogen deposition amounts for the cumulative Source Groups Q through X to the following Critical Load values:

Nitrogen

- Wyoming – 2.2 kg/ha-yr
- Colorado – 2.3 kg/ha-yr, except for Dinosaur Monument that will use 3.0 kg/ha-yr

Sulfur

- 5.0 kg/ha-yr – all areas

4.8 Acid Neutralizing Capacity

In addition to calculation of total deposition fluxes, an additional analysis was performed to assess the change in water chemistry associated with atmospheric deposition from BLM oil and gas and mining activities and cumulative sources for each of the sensitive lakes listed in Table 4-5. This analysis assesses the change in the acid neutralizing capacity (ANC) of sensitive lakes. An estimate of potential changes in ANC was made by following the procedure developed by the USFS Rocky Mountain Region (USFS, 2000). Predicted changes in ANC are compared with the threshold (10 percent change in ANC for lakes with background ANC values greater than 25 micro equivalents per liter [µeq/L], and no more than a 1 µeq/L change in ANC for lakes with background ANC values equal to or less than 25 µeq/L). A list of sensitive lakes was obtained from the USFS (Table 4-5). The most recent lake chemistry background ANC data was obtained from the VIEWS website for each of the sensitive lakes in the 12/4 km CARMMS 2.0 modeling domain.

4.9 W126 Cumulative Ozone Exposure Index

Vegetation response to ozone as a stress to growth is correlated not only with absolute amount of ozone but also with the amount of time exposed during daytime photosynthesis. To quantify this stress, several ozone exposure metrics have been proposed as another secondary standard of ozone. These are Sum of ozone greater than 60 ppb (SUM60), Accumulated Ozone exposure over a Threshold of 40 ppb (AOT40), and Cumulative peak-weighted index (W126), and all of three metrics has the same unit of ppm-hours. Among them, W126 is reported as representing most realistically the vegetation's response to ozone using a sigmoidal weight function to ozone concentration.

There is no official threshold set by US EPA for the ozone exposure metrics while Canada and the United Nations Economic Commission for Europe (UN/ECE) have set thresholds for SUM60 and AOT40, respectively. EPA was taking comments on the annual W126 in the range of 13-17 ppm-hours and was also seeking comment on defining a target protection level of the annual W126 value as low as 7 to 13 ppm-hours. Clean Air Scientific Advisory Committee (CASAC) recommends the annual W126 level be within 7 to 15 ppm-hours.

To calculate W126, three steps as follows were taken:

1. Calculate daily W126 for 12 hour from 8 AM to 8 PM based on Local Standard Time.

2. Sum the daily W126 for consecutive 3 months from starting month of ozone season, April chosen in this project. Thus, the first 3-month sum includes April, May, and July. Continue getting the 3-month sum of daily W126 until the ending month of the 3 month becomes the end of ozone season, October selected in this project. Thus, the last 3-month sum includes August, September, and October.

3. Find maximum among the five three-month sums, and this is annual W126.

The official annual W126 based on observation is the average of three years. However, the CAMx run is conducted only for one year so only one year is used in this project.

5.0 2025 MODELING RESULTS

In this Chapter we present the CARMMS modeling results for the 2025 High, Low and Medium Development Scenarios following the procedures given in Chapter 4 using examples from the 35 Source Groups listed in Table 4-1 and Table 4-2. Electronic attachments are provided that contain modeling results for all of the Source Groups with summaries provided in this Chapter. In this Chapter we present results for:

(X, X1) Total new O&G on Federal lands in BLM planning areas in CO, by CAMx source apportionment modeling (X) and Brute-Force approach (X1)

and one or more of the following Source Groups:

(C) New O&G on Federal lands within the BLM White River Field Office Planning Area;

(D) New O&G on Federal lands within the BLM Colorado River Valley Field Office (CRVFO) Planning Area;

(J) New O&G on Federal lands within the BLM RGFO #1 (all area within the Denver / Front Range Ozone NAA) Planning Area;

(P) Combined future O&G from non-Federal lands within the BLM Field Office Planning Areas;

(Q) Combined existing Federal and non-Federal O&G from BLM Planning Areas;

(S) All O&G (existing and new on Federal and non-Federal lands) in 12 km domain outside the BLM Planning Areas;

(T) Remaining anthropogenic emissions (on-road and non-road mobile, non-EGU point and area sources everywhere in 12 km domain);

(A1) All new O&G in CO plus new non-federal FFO;

(A2) New federal O&G + new Mining in CO;

(A3) New federal O&G + new non-federal O&G + Mining in CO;

(A4) All EGUs in CO and NM.

The contributions from the rest of the Source Groups are provided in the interactive electronic attachments.

5.1 PSD Pollutant Concentration Impacts at Class I and Sensitive Class II Areas

Attachment A-1, A-2 and A-3 are three Excel spreadsheets that contain the contributions of emissions from each Source Group listed in Table 4-1 and Table 4-2 to pollutant concentrations at the 27 Class I (Table 4-4) and 58 sensitive Class II (Table 4-5) areas for the 2025 High, Low and Medium Development Scenarios, respectively. Results are presented for each PSD pollutant and averaging time given in Table 4-3. Attachment A contains two pivot table sheets:

The first pivot table sheet is "Summary" that lists the impacts of a user selected Source Group to all PSD pollutants across all Class I/II areas. It is controlled by selecting the Source Group in cell B1 and whether contributions of the maximum receptor or average across all receptors in a Class I/II area is desired in cell B2; we always select the "Maximum" option. If a concentration at a Class I or sensitive Class II area is above the, respectively, PSD Class I or II Increments, the cell is shaded yellow.

The second pivot table sheet is "MaxImpact" and for a user-selected PSD pollutant it lists the maximum concentration impact at any Class I and sensitive Class II area due to emissions from each Source Group along with the percentage the concentration is of the PSD Increment and the Class I and II area where the maximum occurs. The pivot table is controlled by selecting the pollutant and averaging time in cell B1 and whether maximum or average concentrations across the Class I/II area is desired in cell B2.

The sheet "Readme" has a brief explanation of the sheets in the spreadsheet and maps for the locations of the Class I and sensitive Class II areas.

The PSD incremental concentrations are reported for informational purposes only and the analyses presented in this section are not a comprehensive PSD increment consumption assessment; that assessment must be performed by the appropriate state or federal agency.

5.1.1 Maximum PSD Concentration Impacts at any Class I or II Area

EPA has defined PSD Concentrations Increments for Class I and II areas for 8 different pollutant concentration/averaging time combinations (see Table 4-3). In this section we present the "Maximum" PSD concentration impacts at Class I and sensitive Class II areas due to each of the relevant 35 Source Groups from Table 4-1 and Table 4-2 (i.e., from the MaxImpact sheet in Attachments A-1 and A-2). The modeled impacts are based on the CAMx PSAT source apportionment contributions (or Brute-Force modeling analysis results for Source Group X1). For short-term averaging times (i.e., not annual), the highest second high concentration at each Class I/II area is selected for comparison with the PSD increment.

5.1.1.1 Annual NO_2 PSD Concentrations

The maximum contribution to annual NO_2 concentrations at any Class I or sensitive Class II area due to emissions from the 35 Source Groups for the 2025 High, Low and Medium Development Scenarios are shown in Table 5-1, which was obtained from the MaxImpact sheet in Attachments A-1, A-2 and A-3. The Class I and II PSD Increments for annual NO_2 are 2.5 and 25 $\mu g/m^3$, respectively. The annual NO_2 contributions from each of the individual BLM Planning Areas in Colorado and northern New Mexico (i.e., Source Groups B through O) are all below the

annual NO_2 PSD Increment in all Class I and sensitive Class II areas for all three 2025 emission scenarios. The BLM Planning Area with the highest annual NO_2 concentration contribution to any Class I area is the BLM Colorado White River Field Office Planning Area whose annual NO_2 concentration contribution at Dinosaur National Monument (NM) for the 2025 High Development Scenarios is 0.50 $\mu g/m^3$, which represents 20% of the Class I area Increment. The mitigation in the 2025 Medium Development Scenario reduces this impact by 13% to 0.432 $\mu g/m^3$; this represents 17% of the PSD Class I area annual NO_2 increment. The corresponding White River FO annual NO_2 impact for the Low Development Scenario is 0.06 $\mu g/m^3$; this represents 2% of the Class I increment. The maximum annual NO_2 contribution at any Class I area from any other of the 14 BLM Planning Areas are not greater than 3% of the Class I area NO_2 PSD Increment.

The highest annual NO_2 concentration at any sensitive Class II area due to new O&G emissions on Federal lands in any of the 14 BLM Planning Areas in the High Development Scenario is due the New Mexico Farmington Field Office (NMFFO) with a 1.7 $\mu g/m^3$ annual NO_2 concentration at the Aztec Ruins Class II area that represents 7% of the PSD Class II area Increment. This value drops to 0.95 $\mu g/m^3$ and 0.83 $\mu g/m^3$ in the Medium and Low Development Scenarios, respectively.

The maximum annual NO_2 contribution due to all new O&G and mining on Federal lands within the 13 Colorado BLM Planning Areas combined (i.e., Source Group X) for the High, Low and Medium Development Scenarios are, respectively, 0.54, 0.06 and 0.47 $\mu g/m^3$ at Mesa Verde National Park, which represents 22%, 3% and 19% of the NO_2 PSD Class I increment and is primarily due to Federal O&G emissions from the White River FO Planning Area as discussed above. The corresponding estimates using Brute-Force approach (X1) are 0.59 (24%), 0.07 (3%), 0.51 (21%) $\mu g/m^3$, slightly above the CAMx source apportionment estimtes.

For the Combined Source Group that represents all new O&G on both Federal and non-Federal lands and mining within the 13 CO BLM Planning Areas (Source Group A3, approximate as it also includes new non-fed FFO), the maximum NO_2 contribution are 0.64, 0.1 and 0.56 $\mu g/m^3$ for the High, Low and Medium Development Scenarios, respectively, which are all well below the annual NO_2 PSD Class I Increment (2.5 $\mu g/m^3$). The maximum contribution from Source Group A3 to annual NO_2 at any sensitive Class II area in all scenarios is at the Aztec Ruins Class II area: 1.28 $\mu g/m^3$ for the High Scenario, 0.62 $\mu g/m^3$ in the Low Scenario and 0.93 $\mu g/m^3$ in the Medium Development Scenario, all of which are below the Class II area annual NO_2 PSD Increment.

The contributions of the defined coal and oil/gas EGU source groups are all below the annual PSD Class I and Class II Increments.

Table 5-1. Maximum annual NO_2 concentration at any Class I or sensitive Class II area due to the different Source Groups for the 2025 High Development Scenario.

Choose	NO2, Annual	µg/m3							
Across grid cells	Maximum								

Group	Group Name	PSD Class I Increment	Max @ any Class I area	Percent of PSD Class I Increment	Class I Area where Max occurred	PSD Class II Increment	Max @ any Class II area	Percent of PSD Class II Increment	Class II Area where Max occurred
A	Natural emissions	2.5	5.562	222.5%	Bandelier	25	4.281	17.1%	Bear_Wallow
B	Little Snake FO	2.5	0.019	0.7%	Dinosaur_CO	25	0.025	0.1%	Dinosaur_all
C	White River FO	2.5	0.497	19.9%	Dinosaur_CO	25	0.735	2.9%	Dinosaur_all
D	Colorado River Valley FO (CRVFO)	2.5	0.019	0.8%	Flat_Tops	25	0.010	0.0%	Holy_Cross
E	Roan Plateau Planning area portion of CRVFO	2.5	0.032	1.3%	Flat_Tops	25	0.013	0.1%	Colorado
F	Grand Junction FO	2.5	0.063	2.5%	Arches	25	0.103	0.4%	Colorado
G	Uncompahgre FO	2.5	0.060	2.4%	Maroon_Bells	25	0.076	0.3%	Raggeds
H	Tres Rios FO	2.5	0.010	0.4%	Weminuche	25	0.032	0.1%	South_San_Juan
I	Kremmling FO	2.5	0.034	1.3%	Eagles_Nest	25	0.005	0.0%	Savage_Run
J	RGFO #1	2.5	0.001	0.0%	Rocky_Mountain	25	0.001	0.0%	Lost_Creek
K	RGFO #2	2.5	0.000	0.0%	Eagles_Nest	25	0.012	0.0%	Lost_Creek
L	RGFO #3	2.5	0.001	0.0%	Rocky_Mountain	25	0.001	0.0%	Lost_Creek
M	RGFO #4	2.5	0.001	0.0%	Great_Sand_Dunes	25	0.005	0.0%	Spanish_Peaks
N	Southern Ute Indian Tribe	2.5	0.050	2.0%	Mesa_Verde	25	0.511	2.0%	Aztec_Ruins
O	New Mexico Farmington Field Office	2.5	0.033	1.3%	Mesa_Verde	25	1.674	6.7%	Aztec_Ruins
P	Combined future non-Federal O&G from BLM Planning Areas	2.5	0.219	8.7%	Maroon_Bells	25	0.850	3.4%	Raggeds
Q	Combined Existing O&G from BLM Planning Areas	2.5	0.133	5.3%	Dinosaur_CO	25	0.361	1.4%	Hovenweep
R	Mining from BLM Planning Areas	2.5	0.048	1.9%	Mount_Zirkel	25	0.029	0.1%	Dinosaur_all
S	All O&G in 12 km domain outside of the BLM Planning Areas	2.5	3.981	159.2%	Salt_Creek	25	5.080	20.3%	Aztec_Ruins
T	Remaining anthropogenic emissions	2.5	4.155	166.2%	Petrified_Forest	25	6.752	27.0%	Petroglyph
U	Coal EGU Colorado + New Mexico	2.5	0.291	11.7%	Mount_Zirkel	25	0.331	1.3%	Aztec_Ruins
V	Oil/Gas EGU Colorado + New Mexico	2.5	0.005	0.2%	Great_Sand_Dunes	25	0.027	0.1%	Alamosa_NWR
W	All Other EGUs in 12 km domain	2.5	0.553	22.1%	Dinosaur_CO	25	1.544	6.2%	Glen_Canyon
X	Total new federal O&G in CO	2.5	0.542	21.7%	Dinosaur_CO	25	0.807	3.2%	Dinosaur_all
Y	New total CRVFO	2.5	0.051	2.0%	Flat_Tops	25	0.021	0.1%	Holy_Cross
Z	New total RGFO	2.5	0.002	0.1%	Rocky_Mountain	25	0.013	0.1%	Lost_Creek
A1	All new O&G in CO plus new non-federal FFO1	2.5	0.621	24.8%	Dinosaur_CO	25	1.282	5.1%	Aztec_Ruins
A2	New federal O&G + new Mining in CO	2.5	0.557	22.3%	Dinosaur_CO	25	0.833	3.3%	Dinosaur_all
A3	New federal O&G + new non-federal O&G + Mining in CO	2.5	0.636	25.5%	Dinosaur_CO	25	1.283	5.1%	Aztec_Ruins
A4	All EGUs in CO and NM	2.5	0.292	11.7%	Mount_Zirkel	25	0.334	1.3%	Aztec_Ruins
A5	2025 BC	2.5	0.625	25.0%	Salt_Creek	25	0.794	3.2%	Bitter_Lake_NWR
A6	2025 Total	2.5	6.097	243.9%	Bandelier	25	9.901	39.6%	Aztec_Ruins
A7	2011 Total	2.5	7.986	319.5%	Petrified_Forest	25	23.059	92.2%	Aztec_Ruins
X1	Total new federal O&G in CO (X) using Brute-Force zero-out run	2.5	0.590	23.6%	Dinosaur_CO	25	0.861	3.4%	Dinosaur_all

Note that the thresholds shown are project-level thresholds. The comparisons shown above are for informational purposes only.

Table 5-1a. Maximum annual NO_2 concentration at any Class I or sensitive Class II area due to the different Source Groups for the 2025 Low Development Scenario.

NO2, Annual	µg/m3							
Maximum								

Group Name	PSD Class I Increment	Max @ any Class I area	Percent of PSD Class I Increment	Class I Area where Max occurred	PSD Class II Increment	Max @ any Class II area	Percent of PSD Class II Increment	Class II Area where Max occurred
Natural emissions	2.5	5.562	222.5%	Bandelier	25	4.281	17.1%	Bear_Wallow
Little Snake FO	2.5	0.002	0.1%	Dinosaur_CO	25	0.003	0.0%	Dinosaur_all
White River FO	2.5	0.057	2.3%	Dinosaur_CO	25	0.085	0.3%	Dinosaur_all
Colorado River Valley FO (CRVFO)	2.5	0.013	0.5%	Flat_Tops	25	0.007	0.0%	Holy_Cross
Roan Plateau Planning area portion of CRVFO	2.5	0.015	0.6%	Flat_Tops	25	0.006	0.0%	Colorado
Grand Junction FO	2.5	0.003	0.1%	Arches	25	0.004	0.0%	Colorado
Uncompahgre FO	2.5	0.001	0.0%	Maroon_Bells	25	0.002	0.0%	Raggeds
Tres Rios FO	2.5	0.002	0.1%	Weminuche	25	0.003	0.0%	Chimney_Rock
Kremmling FO	2.5	0.004	0.2%	Eagles_Nest	25	0.001	0.0%	Savage_Run
RGFO #1	2.5	0.000	0.0%	Rocky_Mountain	25	0.000	0.0%	Lost_Creek
RGFO #2	2.5	0.000	0.0%	Mesa_Verde	25	0.000	0.0%	Manzano_Mountain
RGFO #3	2.5	0.000	0.0%	Rocky_Mountain	25	0.000	0.0%	Lost_Creek
RGFO #4	2.5	0.000	0.0%	Great_Sand_Dunes	25	0.000	0.0%	Spanish_Peaks
Southern Ute Indian Tribe	2.5	0.024	1.0%	Mesa_Verde	25	0.249	1.0%	Aztec_Ruins
New Mexico Farmington Field Office	2.5	0.016	0.7%	Mesa_Verde	25	0.828	3.3%	Aztec_Ruins
Combined future non-Federal O&G from BLM Planning Areas	2.5	0.040	1.6%	Flat_Tops	25	0.374	1.5%	Aztec_Ruins
Combined Existing O&G from BLM Planning Areas	2.5	0.122	4.9%	Dinosaur_CO	25	0.362	1.4%	Hovenweep
Mining from BLM Planning Areas	2.5	0.047	1.9%	Mount_Zirkel	25	0.028	0.1%	Dinosaur_all
All O&G in 12 km domain outside of the BLM Planning Areas	2.5	3.981	159.2%	Salt_Creek	25	5.022	20.1%	Aztec_Ruins
Remaining anthropogenic emissions	2.5	4.156	166.2%	Petrified_Forest	25	6.751	27.0%	Petroglyph
Coal EGU Colorado + New Mexico	2.5	0.290	11.6%	Mount_Zirkel	25	0.330	1.3%	Aztec_Ruins
Oil/Gas EGU Colorado + New Mexico	2.5	0.005	0.2%	Great_Sand_Dunes	25	0.027	0.1%	Alamosa_NWR
All Other EGUs in 12 km domain	2.5	0.553	22.1%	Dinosaur_CO	25	1.545	6.2%	Glen_Canyon
Total new federal O&G in CO	2.5	0.064	2.6%	Dinosaur_CO	25	0.098	0.4%	Dinosaur_all
New total CRVFO	2.5	0.027	1.1%	Flat_Tops	25	0.012	0.0%	Holy_Cross
New total RGFO	2.5	0.000	0.0%	Rocky_Mountain	25	0.000	0.0%	Spanish_Peaks
All new O&G in CO plus new non-federal FFO1	2.5	0.081	3.2%	Dinosaur_CO	25	0.622	2.5%	Aztec_Ruins
New federal O&G + new Mining in CO	2.5	0.079	3.1%	Dinosaur_CO	25	0.124	0.5%	Dinosaur_all
New federal O&G + new non-federal O&G + Mining in CO	2.5	0.101	4.0%	Flat_Tops	25	0.623	2.5%	Aztec_Ruins
All EGUs in CO and NM	2.5	0.290	11.6%	Mount_Zirkel	25	0.333	1.3%	Aztec_Ruins
2025 BC	2.5	0.625	25.0%	Salt_Creek	25	0.794	3.2%	Bitter_Lake_NWR
2025 Total	2.5	6.088	243.5%	Bandelier	25	8.330	33.3%	Aztec_Ruins
2011 Total	2.5	7.986	319.5%	Petrified_Forest	25	23.059	92.2%	Aztec_Ruins
Total new federal O&G in CO (X) using Brute-Force zero-out run	2.5	0.073	2.9%	Dinosaur_CO	25	0.107	0.4%	Dinosaur_all

Note that the thresholds shown are project-level thresholds. The comparisons shown above are for informational purposes only.

Table 5-1b. Maximum annual NO_2 concentration at any Class I or sensitive Class II area due to the different Source Groups for the 2025 Medium Development Scenario.

Choose	NO2, Annual	µg/m3							
Across grid cells	Maximum								

Group	Group Name	PSD Class I Increment	Max @ any Class I area	Percent of PSD Class I Increment	Class I Area where Max occurred	PSD Class II Increment	Max @ any Class II area	Percent of PSD Class II Increment	Class II Area where Max occurred
A	Natural emissions	2.5	5.562	222.5%	Bandelier	25	4.281	17.1%	Bear_Wallow
B	Little Snake FO	2.5	0.016	0.7%	Dinosaur_CO	25	0.021	0.1%	Dinosaur_all
C	White River FO	2.5	0.432	17.3%	Dinosaur_CO	25	0.639	2.6%	Dinosaur_all
D	Colorado River Valley FO (CRVFO)	2.5	0.015	0.6%	Flat_Tops	25	0.008	0.0%	Holy_Cross
E	Roan Plateau Planning area portion of CRVFO	2.5	0.028	1.1%	Flat_Tops	25	0.011	0.0%	Colorado
F	Grand Junction FO	2.5	0.052	2.1%	Arches	25	0.084	0.3%	Colorado
G	Uncompahgre FO	2.5	0.042	1.7%	Maroon_Bells	25	0.052	0.2%	Raggeds
H	Tres Rios FO	2.5	0.007	0.3%	Weminuche	25	0.017	0.1%	South_San_Juan
I	Kremmling FO	2.5	0.034	1.3%	Eagles_Nest	25	0.004	0.0%	Mount_Evans
J	RGFO #1	2.5	0.001	0.0%	Rocky_Mountain	25	0.000	0.0%	Lost_Creek
K	RGFO #2	2.5	0.000	0.0%	Eagles_Nest	25	0.008	0.0%	Lost_Creek
L	RGFO #3	2.5	0.001	0.0%	Rocky_Mountain	25	0.001	0.0%	Lost_Creek
M	RGFO #4	2.5	0.000	0.0%	Great_Sand_Dunes	25	0.004	0.0%	Spanish_Peaks
N	Southern Ute Indian Tribe	2.5	0.016	0.6%	Mesa_Verde	25	0.164	0.7%	Aztec_Ruins
O	New Mexico Farmington Field Office	2.5	0.019	0.7%	Mesa_Verde	25	0.947	3.8%	Aztec_Ruins
P	Combined future non-Federal O&G from BLM Planning Areas	2.5	0.220	8.8%	Maroon_Bells	25	0.850	3.4%	Raggeds
Q	Combined Existing O&G from BLM Planning Areas	2.5	0.132	5.3%	Dinosaur_CO	25	0.361	1.4%	Hovenweep
R	Mining from BLM Planning Areas	2.5	0.048	1.9%	Mount_Zirkel	25	0.029	0.1%	Dinosaur_all
S	All O&G in 12 km domain outside of the BLM Planning Areas	2.5	3.981	159.2%	Salt_Creek	25	5.046	20.2%	Aztec_Ruins
T	Remaining anthropogenic emissions	2.5	4.155	166.2%	Petrified_Forest	25	6.752	27.0%	Petroglyph
U	Coal EGU Colorado + New Mexico	2.5	0.291	11.7%	Mount_Zirkel	25	0.330	1.3%	Aztec_Ruins
V	Oil/Gas EGU Colorado + New Mexico	2.5	0.005	0.2%	Great_Sand_Dunes	25	0.027	0.1%	Alamosa_NWR
W	All Other EGUs in 12 km domain	2.5	0.553	22.1%	Dinosaur_CO	25	1.544	6.2%	Glen_Canyon
X	Total new federal O&G in CO	2.5	0.469	18.8%	Dinosaur_CO	25	0.698	2.8%	Dinosaur_all
Y	New total CRVFO	2.5	0.043	1.7%	Flat_Tops	25	0.018	0.1%	Holy_Cross
Z	New total RGFO	2.5	0.001	0.1%	Rocky_Mountain	25	0.009	0.0%	Lost_Creek
A1	All new O&G in CO plus new non-federal FFO1	2.5	0.548	21.9%	Dinosaur_CO	25	0.930	3.7%	Aztec_Ruins
A2	New federal O&G + new Mining in CO	2.5	0.485	19.4%	Dinosaur_CO	25	0.724	2.9%	Dinosaur_all
A3	New federal O&G + new non-federal O&G + Mining in CO	2.5	0.563	22.5%	Dinosaur_CO	25	0.931	3.7%	Aztec_Ruins
A4	All EGUs in CO and NM	2.5	0.292	11.7%	Mount_Zirkel	25	0.333	1.3%	Aztec_Ruins
A5	2025 BC	2.5	0.625	25.0%	Salt_Creek	25	0.794	3.2%	Bitter_Lake_NWR
A6	2025 Total	2.5	6.093	243.7%	Bandelier	25	8.783	35.1%	Aztec_Ruins
A7	2011 Total	2.5	7.986	319.5%	Petrified_Forest	25	23.059	92.2%	Aztec_Ruins
X1	Total new federal O&G in CO (X) using Brute-Force zero-out run	2.5	0.513	20.5%	Dinosaur_CO	25	0.746	3.0%	Dinosaur_all

Note that the thresholds shown are project-level thresholds. The comparisons shown above are for informational purposes only.

5.1.1.2 SO_2 PSD Concentrations

Tables 5-2 through 5-4 presents the comparison of the maximum annual, 24-hour and 3-hour SO_2 concentrations, respectively, at Class I/II areas with the PSD SO_2 increments for the 35 Source Groups. Note that the Colorado portion of the Dinosaur National Monument is Class I for SO_2 only, so it is included in the Class I area grouping in these tables. Note that PSD Increments are not applicable for Natural or Total emissions or for cumulative EGU emissions in the modeling domain. None of the rest Source Groups exceed the annual, 24-hour and 3-hour PSD Class I Increment at any Class I/II area in any of the scenarios. The contributions of the 14 BLM Planning Areas to SO_2 concentrations at Class I/II areas are extremely small, mostly much less than 1% of the PSD Increments, except for the Federal O&G from the White River Field Office (WRFO) Planning Area, which has by far the largest contribution to annual, 24-hour and 3-hour SO_2 concentrations at any Class I area. The maximum contributions from the White River Field Office (WRFO) Planning Area to the maximum annual, 24-hour and 3-hour SO_2 concentrations for the 2025 High Development Scenario are 3%, 6%, and 3% of the PSD Increment for the High and Medium Development Scenarios (the mitigation in the Medium Development Scenario did not address SO_2 emissions) and less than 1% of the PSD Increment for the Low Development Scenarios, which all occur at the Colorado portion of Dinosaur National Monument.

Table 5-2. Maximum annual SO_2 concentration at any Class I or sensitive Class II area due to the different Source Groups for the 2025 High Development Scenario.

Choose	SO2, Annual	µg/m3							
Across grid cells	Maximum								
Group	**Group Name**	**PSD Class I Increment**	**Max @ any Class I area**	**Percent of PSD Class I Increment**	**Class I Area where Max occurred**	**PSD Class II Increment**	**Max @ any Class II area**	**Percent of PSD Class II Increment**	**Class II Area where Max occurred**
A	Natural emissions	2	2.726	136.3%	Bandelier	20	2.002	10.0%	Bear_Wallow
B	Little Snake FO	2	0.001	0.0%	Mount_Zirkel	20	0.001	0.0%	Dinosaur_all
C	White River FO	2	0.068	3.4%	Dinosaur_CO	20	0.099	0.5%	Dinosaur_all
D	Colorado River Valley FO (CRVFO)	2	0.000	0.0%	Flat_Tops	20	0.000	0.0%	Dinosaur_all
E	Roan Plateau Planning area portion of CRVFO	2	0.000	0.0%	Flat_Tops	20	0.000	0.0%	Colorado
F	Grand Junction FO	2	0.000	0.0%	Arches	20	0.000	0.0%	Colorado
G	Uncompahgre FO	2	0.000	0.0%	Maroon_Bells	20	0.000	0.0%	Raggeds
H	Tres Rios FO	2	0.000	0.0%	Mesa_Verde	20	0.001	0.0%	Hovenweep
I	Kremmling FO	2	0.000	0.0%	Rawah	20	0.000	0.0%	Savage_Run
J	RGFO #1	2	0.000	0.0%	Rocky_Mountain	20	0.000	0.0%	Lost_Creek
K	RGFO #2	2	0.000	0.0%	Eagles_Nest	20	0.000	0.0%	Lost_Creek
L	RGFO #3	2	0.000	0.0%	Rocky_Mountain	20	0.000	0.0%	Lost_Creek
M	RGFO #4	2	0.000	0.0%	Great_Sand_Dunes	20	0.000	0.0%	Spanish_Peaks
N	Southern Ute Indian Tribe	2	0.000	0.0%	Mesa_Verde	20	0.001	0.0%	Aztec_Ruins
O	New Mexico Farmington Field Office	2	0.000	0.0%	Mesa_Verde	20	0.003	0.0%	Aztec_Ruins
P	Combined future non-Federal O&G from BLM Planning Areas	2	0.004	0.2%	Dinosaur_CO	20	0.008	0.0%	Dinosaur_all
Q	Combined Existing O&G from BLM Planning Areas	2	0.014	0.7%	Dinosaur_CO	20	0.019	0.1%	Dinosaur_all
R	Mining from BLM Planning Areas	2	0.000	0.0%	Mount_Zirkel	20	0.000	0.0%	Raggeds
S	All O&G in 12 km domain outside of the BLM Planning Areas	2	0.015	0.8%	Mesa_Verde	20	0.082	0.4%	Aztec_Ruins
T	Remaining anthropogenic emissions	2	0.038	1.9%	Dinosaur_CO	20	0.423	2.1%	Sandia_Mountain
U	Coal EGU Colorado + New Mexico	2	0.280	14.0%	Mount_Zirkel	20	0.144	0.7%	Aztec_Ruins
V	Oil/Gas EGU Colorado + New Mexico	2	0.001	0.0%	Bandelier	20	0.006	0.0%	Petroglyph
W	All Other EGUs in 12 km domain	2	0.305	15.2%	Petrified_Forest	20	0.880	4.4%	Glen_Canyon
X	Total new federal O&G in CO	2	0.069	3.4%	Dinosaur_CO	20	0.100	0.5%	Dinosaur_all
Y	New total CRVFO	2	0.000	0.0%	Flat_Tops	20	0.000	0.0%	Dinosaur_all
Z	New total RGFO	2	0.000	0.0%	Rocky_Mountain	20	0.000	0.0%	Lost_Creek
A1	All new O&G in CO plus new non-federal FFO1	2	0.073	3.7%	Dinosaur_CO	20	0.108	0.5%	Dinosaur_all
A2	New federal O&G + new Mining in CO	2	0.069	3.4%	Dinosaur_CO	20	0.100	0.5%	Dinosaur_all
A3	New federal O&G + new non-federal O&G + Mining in CO	2	0.073	3.7%	Dinosaur_CO	20	0.108	0.5%	Dinosaur_all
A4	All EGUs in CO and NM	2	0.280	14.0%	Mount_Zirkel	20	0.144	0.7%	Aztec_Ruins
A5	2025 BC	2	0.493	24.7%	Salt_Creek	20	0.572	2.9%	Bitter_Lake_NWR
A6	2025 Total	2	2.888	144.4%	Bandelier	20	2.270	11.3%	Bear_Wallow
A7	2011 Total	2	2.986	149.3%	Bandelier	20	2.502	12.5%	Bear_Wallow
X1	Total new federal O&G in CO (X) using Brute-Force zero-out run	2	0.073	3.6%	Dinosaur_CO	20	0.104	0.5%	Dinosaur_all

Note that the thresholds shown are project-level thresholds. The comparisons shown above are for informational purposes only.

Table 5-2a. Maximum annual SO_2 concentration at any Class I or sensitive Class II area due to the different Source Groups for the 2025 Low Development Scenario.

SO2, Annual	µg/m3							
Maximum								

Group Name	PSD Class I Increment	Max @ any Class I area	Percent of PSD Class I Increment	Class I Area where Max occurred	PSD Class II Increment	Max @ any Class II area	Percent of PSD Class II Increment	Class II Area where Max occurred
Natural emissions	2	2.726	136.3%	Bandelier	20	2.002	10.0%	Bear_Wallow
Little Snake FO	2	0.000	0.0%	Mount_Zirkel	20	0.000	0.0%	Dinosaur_all
White River FO	2	0.008	0.4%	Dinosaur_CO	20	0.012	0.1%	Dinosaur_all
Colorado River Valley FO (CRVFO)	2	0.000	0.0%	Flat_Tops	20	0.000	0.0%	Dinosaur_all
Roan Plateau Planning area portion of CRVFO	2	0.000	0.0%	Flat_Tops	20	0.000	0.0%	Colorado
Grand Junction FO	2	0.000	0.0%	Flat_Tops	20	0.000	0.0%	Colorado
Uncompahgre FO	2	0.000	0.0%	Maroon_Bells	20	0.000	0.0%	Raggeds
Tres Rios FO	2	0.000	0.0%	Mesa_Verde	20	0.000	0.0%	Hovenweep
Kremmling FO	2	0.000	0.0%	Rawah	20	0.000	0.0%	Savage_Run
RGFO #1	2	0.000	0.0%	Rocky_Mountain	20	0.000	0.0%	Lost_Creek
RGFO #2	2	0.000	0.0%	Mount_Zirkel	20	0.000	0.0%	Manzano_Mountain
RGFO #3	2	0.000	0.0%	Rocky_Mountain	20	0.000	0.0%	Lost_Creek
RGFO #4	2	0.000	0.0%	Great_Sand_Dunes	20	0.000	0.0%	Spanish_Peaks
Southern Ute Indian Tribe	2	0.000	0.0%	Mesa_Verde	20	0.000	0.0%	Aztec_Ruins
New Mexico Farmington Field Office	2	0.000	0.0%	Mesa_Verde	20	0.001	0.0%	Aztec_Ruins
Combined future non-Federal O&G from BLM Planning Areas	2	0.001	0.0%	Dinosaur_CO	20	0.003	0.0%	Hovenweep
Combined Existing O&G from BLM Planning Areas	2	0.013	0.7%	Dinosaur_CO	20	0.019	0.1%	Dinosaur_all
Mining from BLM Planning Areas	2	0.000	0.0%	Mount_Zirkel	20	0.000	0.0%	Dinosaur_all
All O&G in 12 km domain outside of the BLM Planning Areas	2	0.015	0.8%	Mesa_Verde	20	0.082	0.4%	Aztec_Ruins
Remaining anthropogenic emissions	2	0.038	1.9%	Dinosaur_CO	20	0.423	2.1%	Sandia_Mountain
Coal EGU Colorado + New Mexico	2	0.280	14.0%	Mount_Zirkel	20	0.144	0.7%	Aztec_Ruins
Oil/Gas EGU Colorado + New Mexico	2	0.001	0.0%	Bandelier	20	0.006	0.0%	Petroglyph
All Other EGUs in 12 km domain	2	0.305	15.2%	Petrified_Forest	20	0.880	4.4%	Glen_Canyon
Total new federal O&G in CO	2	0.008	0.4%	Dinosaur_CO	20	0.012	0.1%	Dinosaur_all
New total CRVFO	2	0.000	0.0%	Flat_Tops	20	0.000	0.0%	Dinosaur_all
New total RGFO	2	0.000	0.0%	Rocky_Mountain	20	0.000	0.0%	Spanish_Peaks
All new O&G in CO plus new non-federal FFO1	2	0.009	0.5%	Dinosaur_CO	20	0.014	0.1%	Dinosaur_all
New federal O&G + new Mining in CO	2	0.008	0.4%	Dinosaur_CO	20	0.012	0.1%	Dinosaur_all
New federal O&G + new non-federal O&G + Mining in CO	2	0.009	0.5%	Dinosaur_CO	20	0.014	0.1%	Dinosaur_all
All EGUs in CO and NM	2	0.280	14.0%	Mount_Zirkel	20	0.144	0.7%	Aztec_Ruins
2025 BC	2	0.493	24.7%	Salt_Creek	20	0.572	2.9%	Bitter_Lake_NWR
2025 Total	2	2.887	144.4%	Bandelier	20	2.270	11.3%	Bear_Wallow
2011 Total	2	2.986	149.3%	Bandelier	20	2.502	12.5%	Bear_Wallow
Total new federal O&G in CO (X) using Brute-Force zero-out run	2	0.009	0.5%	Dinosaur_CO	20	0.013	0.1%	Dinosaur_all

Note that the thresholds shown are project-level thresholds. The comparisons shown above are for informational purposes only.

Table 5-2b. Maximum annual SO_2 concentration at any Class I or sensitive Class II area due to the different Source Groups for the 2025 Medium Development Scenario.

Choose	SO2, Annual	µg/m3							
Across grid cells	Maximum								

Group	Group Name	PSD Class I Increment	Max @ any Class I area	Percent of PSD Class I Increment	Class I Area where Max occurred	PSD Class II Increment	Max @ any Class II area	Percent of PSD Class II Increment	Class II Area where Max occurred
A	Natural emissions	2	2.726	136.3%	Bandelier	20	2.002	10.0%	Bear_Wallow
B	Little Snake FO	2	0.001	0.0%	Mount_Zirkel	20	0.001	0.0%	Dinosaur_all
C	White River FO	2	0.068	3.4%	Dinosaur_CO	20	0.099	0.5%	Dinosaur_all
D	Colorado River Valley FO (CRVFO)	2	0.000	0.0%	Flat_Tops	20	0.000	0.0%	Dinosaur_all
E	Roan Plateau Planning area portion of CRVFO	2	0.000	0.0%	Flat_Tops	20	0.000	0.0%	Colorado
F	Grand Junction FO	2	0.000	0.0%	Arches	20	0.000	0.0%	Colorado
G	Uncompahgre FO	2	0.000	0.0%	Maroon_Bells	20	0.000	0.0%	Raggeds
H	Tres Rios FO	2	0.000	0.0%	Mesa_Verde	20	0.001	0.0%	Hovenweep
I	Kremmling FO	2	0.000	0.0%	Rawah	20	0.000	0.0%	Savage_Run
J	RGFO #1	2	0.000	0.0%	Rocky_Mountain	20	0.000	0.0%	Lost_Creek
K	RGFO #2	2	0.000	0.0%	Eagles_Nest	20	0.000	0.0%	Lost_Creek
L	RGFO #3	2	0.000	0.0%	Rocky_Mountain	20	0.000	0.0%	Lost_Creek
M	RGFO #4	2	0.000	0.0%	Great_Sand_Dunes	20	0.000	0.0%	Spanish_Peaks
N	Southern Ute Indian Tribe	2	0.000	0.0%	Mesa_Verde	20	0.001	0.0%	Aztec_Ruins
O	New Mexico Farmington Field Office	2	0.000	0.0%	Mesa_Verde	20	0.003	0.0%	Aztec_Ruins
P	Combined future non-Federal O&G from BLM Planning Areas	2	0.004	0.2%	Dinosaur_CO	20	0.008	0.0%	Dinosaur_all
Q	Combined Existing O&G from BLM Planning Areas	2	0.014	0.7%	Dinosaur_CO	20	0.019	0.1%	Dinosaur_all
R	Mining from BLM Planning Areas	2	0.000	0.0%	Mount_Zirkel	20	0.000	0.0%	Raggeds
S	All O&G in 12 km domain outside of the BLM Planning Areas	2	0.015	0.8%	Mesa_Verde	20	0.082	0.4%	Aztec_Ruins
T	Remaining anthropogenic emissions	2	0.038	1.9%	Dinosaur_CO	20	0.423	2.1%	Sandia_Mountain
U	Coal EGU Colorado + New Mexico	2	0.280	14.0%	Mount_Zirkel	20	0.144	0.7%	Aztec_Ruins
V	Oil/Gas EGU Colorado + New Mexico	2	0.001	0.0%	Bandelier	20	0.006	0.0%	Petroglyph
W	All Other EGUs in 12 km domain	2	0.305	15.2%	Petrified_Forest	20	0.880	4.4%	Glen_Canyon
X	Total new federal O&G in CO	2	0.069	3.4%	Dinosaur_CO	20	0.100	0.5%	Dinosaur_all
Y	New total CRVFO	2	0.000	0.0%	Flat_Tops	20	0.000	0.0%	Dinosaur_all
Z	New total RGFO	2	0.000	0.0%	Rocky_Mountain	20	0.000	0.0%	Lost_Creek
A1	All new O&G in CO plus new non-federal FFO1	2	0.073	3.7%	Dinosaur_CO	20	0.108	0.5%	Dinosaur_all
A2	New federal O&G + new Mining in CO	2	0.069	3.4%	Dinosaur_CO	20	0.100	0.5%	Dinosaur_all
A3	New federal O&G + new non-federal O&G + Mining in CO	2	0.073	3.7%	Dinosaur_CO	20	0.108	0.5%	Dinosaur_all
A4	All EGUs in CO and NM	2	0.280	14.0%	Mount_Zirkel	20	0.144	0.7%	Aztec_Ruins
A5	2025 BC	2	0.493	24.7%	Salt_Creek	20	0.572	2.9%	Bitter_Lake_NWR
A6	2025 Total	2	2.888	144.4%	Bandelier	20	2.270	11.3%	Bear_Wallow
A7	2011 Total	2	2.986	149.3%	Bandelier	20	2.502	12.5%	Bear_Wallow
X1	Total new federal O&G in CO (X) using Brute-Force zero-out run	2	0.073	3.6%	Dinosaur_CO	20	0.104	0.5%	Dinosaur_all

Table 5-3. Maximum 24-hour SO_2 concentration at any Class I or sensitive Class II area due to the different Source Groups for the 2025 High Development Scenario.

Choose	SO2, 24-hour	µg/m3							
Across grid cells	Maximum								

Group	Group Name	PSD Class I Increment	Max @ any Class I area	Percent of PSD Class I Increment	Class I Area where Max occurred	PSD Class II Increment	Max @ any Class II area	Percent of PSD Class II Increment	Class II Area where Max occurred
A	Natural emissions	5	210.991	4219.8%	Bandelier	91	108.145	118.8%	Bear_Wallow
B	Little Snake FO	5	0.003	0.1%	Flat_Tops	91	0.005	0.0%	Dinosaur_all
C	White River FO	5	0.297	5.9%	Dinosaur_CO	91	0.489	0.5%	Dinosaur_all
D	Colorado River Valley FO (CRVFO)	5	0.000	0.0%	Flat_Tops	91	0.000	0.0%	Dinosaur_all
E	Roan Plateau Planning area portion of CRVFO	5	0.000	0.0%	Flat_Tops	91	0.000	0.0%	Colorado
F	Grand Junction FO	5	0.002	0.0%	Arches	91	0.002	0.0%	Colorado
G	Uncompahgre FO	5	0.001	0.0%	Maroon_Bells	91	0.001	0.0%	Raggeds
H	Tres Rios FO	5	0.001	0.0%	Mesa_Verde	91	0.007	0.0%	Hovenweep
I	Kremmling FO	5	0.000	0.0%	Rawah	91	0.000	0.0%	Savage_Run
J	RGFO #1	5	0.000	0.0%	Rocky_Mountain	91	0.000	0.0%	Lost_Creek
K	RGFO #2	5	0.000	0.0%	Eagles_Nest	91	0.000	0.0%	Lost_Creek
L	RGFO #3	5	0.000	0.0%	Rocky_Mountain	91	0.000	0.0%	Lost_Creek
M	RGFO #4	5	0.000	0.0%	Wheeler_Peak	91	0.000	0.0%	Spanish_Peaks
N	Southern Ute Indian Tribe	5	0.001	0.0%	Mesa_Verde	91	0.003	0.0%	Aztec_Ruins
O	New Mexico Farmington Field Office	5	0.001	0.0%	Mesa_Verde	91	0.008	0.0%	Aztec_Ruins
P	Combined future non-Federal O&G from BLM Planning Areas	5	0.024	0.5%	Flat_Tops	91	0.038	0.0%	Dinosaur_all
Q	Combined Existing O&G from BLM Planning Areas	5	0.065	1.3%	Dinosaur_CO	91	0.111	0.1%	Dinosaur_all
R	Mining from BLM Planning Areas	5	0.002	0.0%	Dinosaur_CO	91	0.004	0.0%	Dinosaur_all
S	All O&G in 12 km domain outside of the BLM Planning Areas	5	0.104	2.1%	Mesa_Verde	91	0.525	0.6%	Aztec_Ruins
T	Remaining anthropogenic emissions	5	0.244	4.9%	Gila	91	1.438	1.6%	Sandia_Mountain
U	Coal EGU Colorado + New Mexico	5	1.131	22.6%	Mount_Zirkel	91	1.262	1.4%	Aztec_Ruins
V	Oil/Gas EGU Colorado + New Mexico	5	0.006	0.1%	Bandelier	91	0.045	0.0%	Valle_De_Oro_NWR
W	All Other EGUs in 12 km domain	5	2.460	49.2%	Petrified_Forest	91	8.527	9.4%	Glen_Canyon
X	Total new federal O&G in CO	5	0.299	6.0%	Dinosaur_CO	91	0.491	0.5%	Dinosaur_all
Y	New total CRVFO	5	0.000	0.0%	Flat_Tops	91	0.001	0.0%	Colorado
Z	New total RGFO	5	0.000	0.0%	Rocky_Mountain	91	0.000	0.0%	Lost_Creek
A1	All new O&G in CO plus new non-federal FFO1	5	0.307	6.1%	Dinosaur_CO	91	0.529	0.6%	Dinosaur_all
A2	New federal O&G + new Mining in CO	5	0.299	6.0%	Dinosaur_CO	91	0.491	0.5%	Dinosaur_all
A3	New federal O&G + new non-federal O&G + Mining in CO	5	0.307	6.1%	Dinosaur_CO	91	0.529	0.6%	Dinosaur_all
A4	All EGUs in CO and NM	5	1.131	22.6%	Mount_Zirkel	91	1.262	1.4%	Aztec_Ruins
A5	2025 BC	5	2.809	56.2%	Salt_Creek	91	2.909	3.2%	Bitter_Lake_NWR
A6	2025 Total	5	211.072	4221.4%	Bandelier	91	108.266	119.0%	Bear_Wallow
A7	2011 Total	5	211.109	4222.2%	Bandelier	91	108.726	119.5%	Bear_Wallow
X1	Total new federal O&G in CO (X) using Brute-Force zero-out run	5	0.322	6.4%	Dinosaur_CO	91	0.521	0.6%	Dinosaur_all

Note that the thresholds shown are project-level thresholds. The comparisons shown above are for informational purposes only.

Table 5-3a. Maximum 24-hour SO_2 concentration at any Class I or sensitive Class II area due to the different Source Groups for the 2025 Low Development Scenario.

SO2, 24-hour	µg/m3							
Maximum								

Group Name	PSD Class I Increment	Max @ any Class I area	Percent of PSD Class I Increment	Class I Area where Max occurred	PSD Class II Increment	Max @ any Class II area	Percent of PSD Class II Increment	Class II Area where Max occurred
Natural emissions	5	210.991	4219.8%	Bandelier	91	108.145	118.8%	Bear_Wallow
Little Snake FO	5	0.000	0.0%	Dinosaur_CO	91	0.001	0.0%	Dinosaur_all
White River FO	5	0.034	0.7%	Dinosaur_CO	91	0.058	0.1%	Dinosaur_all
Colorado River Valley FO (CRVFO)	5	0.000	0.0%	Flat_Tops	91	0.000	0.0%	Dinosaur_all
Roan Plateau Planning area portion of CRVFO	5	0.000	0.0%	Flat_Tops	91	0.000	0.0%	Colorado
Grand Junction FO	5	0.000	0.0%	Arches	91	0.000	0.0%	Colorado
Uncompahgre FO	5	0.000	0.0%	Maroon_Bells	91	0.000	0.0%	Raggeds
Tres Rios FO	5	0.000	0.0%	Mesa_Verde	91	0.001	0.0%	Hovenweep
Kremmling FO	5	0.000	0.0%	Rawah	91	0.000	0.0%	Savage_Run
RGFO #1	5	0.000	0.0%	Rocky_Mountain	91	0.000	0.0%	Lost_Creek
RGFO #2	5	0.000	0.0%	Mount_Zirkel	91	0.000	0.0%	Manzano_Mountain
RGFO #3	5	0.000	0.0%	Rocky_Mountain	91	0.000	0.0%	Lost_Creek
RGFO #4	5	0.000	0.0%	Great_Sand_Dunes	91	0.000	0.0%	Spanish_Peaks
Southern Ute Indian Tribe	5	0.000	0.0%	Mesa_Verde	91	0.001	0.0%	Aztec_Ruins
New Mexico Farmington Field Office	5	0.000	0.0%	Mesa_Verde	91	0.004	0.0%	Aztec_Ruins
Combined future non-Federal O&G from BLM Planning Areas	5	0.004	0.1%	Flat_Tops	91	0.013	0.0%	Hovenweep
Combined Existing O&G from BLM Planning Areas	5	0.061	1.2%	Dinosaur_CO	91	0.107	0.1%	Dinosaur_all
Mining from BLM Planning Areas	5	0.002	0.0%	Dinosaur_CO	91	0.004	0.0%	Dinosaur_all
All O&G in 12 km domain outside of the BLM Planning Areas	5	0.104	2.1%	Mesa_Verde	91	0.525	0.6%	Aztec_Ruins
Remaining anthropogenic emissions	5	0.244	4.9%	Gila	91	1.438	1.6%	Sandia_Mountain
Coal EGU Colorado + New Mexico	5	1.133	22.7%	Mount_Zirkel	91	1.262	1.4%	Aztec_Ruins
Oil/Gas EGU Colorado + New Mexico	5	0.006	0.1%	Bandelier	91	0.045	0.0%	Valle_De_Oro_NWR
All Other EGUs in 12 km domain	5	2.460	49.2%	Petrified_Forest	91	8.527	9.4%	Glen_Canyon
Total new federal O&G in CO	5	0.034	0.7%	Dinosaur_CO	91	0.058	0.1%	Dinosaur_all
New total CRVFO	5	0.000	0.0%	Flat_Tops	91	0.000	0.0%	Colorado
New total RGFO	5	0.000	0.0%	Rocky_Mountain	91	0.000	0.0%	Lost_Creek
All new O&G in CO plus new non-federal FFO1	5	0.036	0.7%	Dinosaur_CO	91	0.065	0.1%	Dinosaur_all
New federal O&G + new Mining in CO	5	0.035	0.7%	Dinosaur_CO	91	0.058	0.1%	Dinosaur_all
New federal O&G + new non-federal O&G + Mining in CO	5	0.036	0.7%	Dinosaur_CO	91	0.065	0.1%	Dinosaur_all
All EGUs in CO and NM	5	1.133	22.7%	Mount_Zirkel	91	1.262	1.4%	Aztec_Ruins
2025 BC	5	2.809	56.2%	Salt_Creek	91	2.909	3.2%	Bitter_Lake_NWR
2025 Total	5	211.072	4221.4%	Bandelier	91	108.266	119.0%	Bear_Wallow
2011 Total	5	211.109	4222.2%	Bandelier	91	108.726	119.5%	Bear_Wallow
Total new federal O&G in CO (X) using Brute-Force zero-out run	5	0.040	0.8%	Dinosaur_CO	91	0.066	0.1%	Dinosaur_all

Note that the thresholds shown are project-level thresholds. The comparisons shown above are for informational purposes only.

Table 5-3b. Maximum 24-hour SO_2 concentration at any Class I or sensitive Class II area due to the different Source Groups for the 2025 Medium Development Scenario.

Choose	SO2, 24-hour	µg/m3							
Across grid cells	Maximum								

Group	Group Name	PSD Class I Increment	Max @ any Class I area	Percent of PSD Class I Increment	Class I Area where Max occurred	PSD Class II Increment	Max @ any Class II area	Percent of PSD Class II Increment	Class II Area where Max occurred
A	Natural emissions	5	210.991	4219.8%	Bandelier	91	108.145	118.8%	Bear_Wallow
B	Little Snake FO	5	0.003	0.1%	Flat_Tops	91	0.005	0.0%	Dinosaur_all
C	White River FO	5	0.297	5.9%	Dinosaur_CO	91	0.489	0.5%	Dinosaur_all
D	Colorado River Valley FO (CRVFO)	5	0.000	0.0%	Flat_Tops	91	0.000	0.0%	Dinosaur_all
E	Roan Plateau Planning area portion of CRVFO	5	0.000	0.0%	Flat_Tops	91	0.000	0.0%	Colorado
F	Grand Junction FO	5	0.002	0.0%	Arches	91	0.002	0.0%	Colorado
G	Uncompahgre FO	5	0.001	0.0%	Maroon_Bells	91	0.001	0.0%	Raggeds
H	Tres Rios FO	5	0.001	0.0%	Mesa_Verde	91	0.007	0.0%	Hovenweep
I	Kremmling FO	5	0.000	0.0%	Rawah	91	0.000	0.0%	Savage_Run
J	RGFO #1	5	0.000	0.0%	Rocky_Mountain	91	0.000	0.0%	Lost_Creek
K	RGFO #2	5	0.000	0.0%	Eagles_Nest	91	0.000	0.0%	Lost_Creek
L	RGFO #3	5	0.000	0.0%	Rocky_Mountain	91	0.000	0.0%	Lost_Creek
M	RGFO #4	5	0.000	0.0%	Wheeler_Peak	91	0.000	0.0%	Spanish_Peaks
N	Southern Ute Indian Tribe	5	0.001	0.0%	Mesa_Verde	91	0.002	0.0%	Aztec_Ruins
O	New Mexico Farmington Field Office	5	0.001	0.0%	Mesa_Verde	91	0.008	0.0%	Aztec_Ruins
P	Combined future non-Federal O&G from BLM Planning Areas	5	0.024	0.5%	Flat_Tops	91	0.038	0.0%	Dinosaur_all
Q	Combined Existing O&G from BLM Planning Areas	5	0.065	1.3%	Dinosaur_CO	91	0.111	0.1%	Dinosaur_all
R	Mining from BLM Planning Areas	5	0.002	0.0%	Dinosaur_CO	91	0.004	0.0%	Dinosaur_all
S	All O&G in 12 km domain outside of the BLM Planning Areas	5	0.104	2.1%	Mesa_Verde	91	0.525	0.6%	Aztec_Ruins
T	Remaining anthropogenic emissions	5	0.244	4.9%	Gila	91	1.438	1.6%	Sandia_Mountain
U	Coal EGU Colorado + New Mexico	5	1.131	22.6%	Mount_Zirkel	91	1.262	1.4%	Aztec_Ruins
V	Oil/Gas EGU Colorado + New Mexico	5	0.006	0.1%	Bandelier	91	0.045	0.0%	Valle_De_Oro_NWR
W	All Other EGUs in 12 km domain	5	2.460	49.2%	Petrified_Forest	91	8.527	9.4%	Glen_Canyon
X	Total new federal O&G in CO	5	0.299	6.0%	Dinosaur_CO	91	0.491	0.5%	Dinosaur_all
Y	New total CRVFO	5	0.000	0.0%	Flat_Tops	91	0.001	0.0%	Colorado
Z	New total RGFO	5	0.000	0.0%	Rocky_Mountain	91	0.000	0.0%	Lost_Creek
A1	All new O&G in CO plus new non-federal FFO1	5	0.306	6.1%	Dinosaur_CO	91	0.529	0.6%	Dinosaur_all
A2	New federal O&G + new Mining in CO	5	0.299	6.0%	Dinosaur_CO	91	0.491	0.5%	Dinosaur_all
A3	New federal O&G + new non-federal O&G + Mining in CO	5	0.307	6.1%	Dinosaur_CO	91	0.529	0.6%	Dinosaur_all
A4	All EGUs in CO and NM	5	1.131	22.6%	Mount_Zirkel	91	1.262	1.4%	Aztec_Ruins
A5	2025 BC	5	2.809	56.2%	Salt_Creek	91	2.909	3.2%	Bitter_Lake_NWR
A6	2025 Total	5	211.072	4221.4%	Bandelier	91	108.266	119.0%	Bear_Wallow
A7	2011 Total	5	211.109	4222.2%	Bandelier	91	108.726	119.5%	Bear_Wallow
X1	Total new federal O&G in CO (X) using Brute-Force zero-out run	5	0.321	6.4%	Dinosaur_CO	91	0.521	0.6%	Dinosaur_all

Note that the thresholds shown are project-level thresholds. The comparisons shown above are for informational purposes only.

Table 5-4. Maximum 3-hour SO_2 concentration at any Class I or sensitive Class II area due to the different Source Groups for the 2025 High Development Scenario.

Choose	SO2, 3-hour	µg/m3							
Across grid cells	Maximum								

Group	Group Name	PSD Class I Increment	Max @ any Class I area	Percent of PSD Class I Increment	Class I Area where Max occurred	PSD Class II Increment	Max @ any Class II area	Percent of PSD Class II Increment	Class II Area where Max occurred
A	Natural emissions	25	587.662	2350.6%	Bandelier	512	337.323	65.9%	Dome
B	Little Snake FO	25	0.007	0.0%	Dinosaur_CO	512	0.013	0.0%	Dinosaur_all
C	White River FO	25	0.842	3.4%	Dinosaur_CO	512	0.842	0.2%	Dinosaur_all
D	Colorado River Valley FO (CRVFO)	25	0.001	0.0%	Dinosaur_CO	512	0.001	0.0%	Dinosaur_all
E	Roan Plateau Planning area portion of CRVFO	25	0.001	0.0%	Flat_Tops	512	0.001	0.0%	Colorado
F	Grand Junction FO	25	0.003	0.0%	Arches	512	0.004	0.0%	Colorado
G	Uncompahgre FO	25	0.002	0.0%	Maroon_Bells	512	0.001	0.0%	Raggeds
H	Tres Rios FO	25	0.003	0.0%	Mesa_Verde	512	0.011	0.0%	Hovenweep
I	Kremmling FO	25	0.000	0.0%	Rawah	512	0.000	0.0%	Savage_Run
J	RGFO #1	25	0.000	0.0%	Rocky_Mountain	512	0.000	0.0%	Mount_Evans
K	RGFO #2	25	0.000	0.0%	Eagles_Nest	512	0.000	0.0%	Lost_Creek
L	RGFO #3	25	0.000	0.0%	Rocky_Mountain	512	0.000	0.0%	Florissant_Fossi
M	RGFO #4	25	0.000	0.0%	Wheeler_Peak	512	0.000	0.0%	Spanish_Peaks
N	Southern Ute Indian Tribe	25	0.002	0.0%	Weminuche	512	0.006	0.0%	Aztec_Ruins
O	New Mexico Farmington Field Office	25	0.002	0.0%	Mesa_Verde	512	0.013	0.0%	Aztec_Ruins
P	Combined future non-Federal O&G from BLM Planning Areas	25	0.070	0.3%	Flat_Tops	512	0.081	0.0%	Dinosaur_all
Q	Combined Existing O&G from BLM Planning Areas	25	0.165	0.7%	Dinosaur_CO	512	0.174	0.0%	Dinosaur_all
R	Mining from BLM Planning Areas	25	0.006	0.0%	Mount_Zirkel	512	0.007	0.0%	Dinosaur_all
S	All O&G in 12 km domain outside of the BLM Planning Areas	25	0.409	1.6%	Mesa_Verde	512	1.162	0.2%	Aztec_Ruins
T	Remaining anthropogenic emissions	25	1.217	4.9%	Dinosaur_CO	512	3.640	0.7%	Sandia_Mountain
U	Coal EGU Colorado + New Mexico	25	2.478	9.9%	Mount_Zirkel	512	3.861	0.8%	Aztec_Ruins
V	Oil/Gas EGU Colorado + New Mexico	25	0.017	0.1%	Bandelier	512	0.107	0.0%	Valle_De_Oro_NWR
W	All Other EGUs in 12 km domain	25	7.459	29.8%	Petrified_Forest	512	14.048	2.7%	Glen_Canyon
X	Total new federal O&G in CO	25	0.843	3.4%	Dinosaur_CO	512	0.843	0.2%	Dinosaur_all
Y	New total CRVFO	25	0.001	0.0%	Flat_Tops	512	0.001	0.0%	Dinosaur_all
Z	New total RGFO	25	0.000	0.0%	Rocky_Mountain	512	0.000	0.0%	Lost_Creek
A1	All new O&G in CO plus new non-federal FFO1	25	0.910	3.6%	Dinosaur_CO	512	0.910	0.2%	Dinosaur_all
A2	New federal O&G + new Mining in CO	25	0.843	3.4%	Dinosaur_CO	512	0.843	0.2%	Dinosaur_all
A3	New federal O&G + new non-federal O&G + Mining in CO	25	0.911	3.6%	Dinosaur_CO	512	0.911	0.2%	Dinosaur_all
A4	All EGUs in CO and NM	25	2.478	9.9%	Mount_Zirkel	512	3.861	0.8%	Aztec_Ruins
A5	2025 BC	25	7.584	30.3%	Salt_Creek	512	8.896	1.7%	Bitter_Lake_NWR
A6	2025 Total	25	587.878	2351.5%	Bandelier	512	337.436	65.9%	Dome
A7	2011 Total	25	587.900	2351.6%	Bandelier	512	338.092	66.0%	Dome
X1	Total new federal O&G in CO (X) using Brute-Force zero-out run	25	0.889	3.6%	Dinosaur_CO	512	0.889	0.2%	Dinosaur_all

Note that the thresholds shown are project-level thresholds. The comparisons shown above are for informational purposes only.

Table 5-4a. Maximum 3-hour SO_2 concentration at any Class I or sensitive Class II area due to the different Source Groups for the 2025 Low Development Scenario.

SO2, 3-hour	µg/m3							
Maximum								

Group Name	PSD Class I Increment	Max @ any Class I area	Percent of PSD Class I Increment	Class I Area where Max occurred	PSD Class II Increment	Max @ any Class II area	Percent of PSD Class II Increment	Class II Area where Max occurred
Natural emissions	25	587.662	2350.6%	Bandelier	512	337.323	65.9%	Dome
Little Snake FO	25	0.001	0.0%	Dinosaur_CO	512	0.002	0.0%	Dinosaur_all
White River FO	25	0.100	0.4%	Dinosaur_CO	512	0.100	0.0%	Dinosaur_all
Colorado River Valley FO (CRVFO)	25	0.000	0.0%	Dinosaur_CO	512	0.001	0.0%	Dinosaur_all
Roan Plateau Planning area portion of CRVFO	25	0.000	0.0%	Flat_Tops	512	0.000	0.0%	Colorado
Grand Junction FO	25	0.000	0.0%	Flat_Tops	512	0.000	0.0%	Colorado
Uncompahgre FO	25	0.000	0.0%	Maroon_Bells	512	0.000	0.0%	Raggeds
Tres Rios FO	25	0.001	0.0%	Mesa_Verde	512	0.002	0.0%	Hovenweep
Kremmling FO	25	0.000	0.0%	Rawah	512	0.000	0.0%	Savage_Run
RGFO #1	25	0.000	0.0%	Rocky_Mountain	512	0.000	0.0%	Mount_Evans
RGFO #2	25	0.000	0.0%	Mount_Zirkel	512	0.000	0.0%	Manzano_Mountain
RGFO #3	25	0.000	0.0%	Rocky_Mountain	512	0.000	0.0%	Florissant_Fossi
RGFO #4	25	0.000	0.0%	Wheeler_Peak	512	0.000	0.0%	Spanish_Peaks
Southern Ute Indian Tribe	25	0.001	0.0%	Weminuche	512	0.003	0.0%	Aztec_Ruins
New Mexico Farmington Field Office	25	0.001	0.0%	Mesa_Verde	512	0.007	0.0%	Aztec_Ruins
Combined future non-Federal O&G from BLM Planning Areas	25	0.012	0.0%	Flat_Tops	512	0.022	0.0%	Hovenweep
Combined Existing O&G from BLM Planning Areas	25	0.159	0.6%	Dinosaur_CO	512	0.171	0.0%	Dinosaur_all
Mining from BLM Planning Areas	25	0.006	0.0%	Mount_Zirkel	512	0.007	0.0%	Dinosaur_all
All O&G in 12 km domain outside of the BLM Planning Areas	25	0.409	1.6%	Mesa_Verde	512	1.163	0.2%	Aztec_Ruins
Remaining anthropogenic emissions	25	1.218	4.9%	Dinosaur_CO	512	3.640	0.7%	Sandia_Mountain
Coal EGU Colorado + New Mexico	25	2.487	9.9%	Mount_Zirkel	512	3.861	0.8%	Aztec_Ruins
Oil/Gas EGU Colorado + New Mexico	25	0.017	0.1%	Bandelier	512	0.107	0.0%	Valle_De_Oro_NWR
All Other EGUs in 12 km domain	25	7.459	29.8%	Petrified_Forest	512	14.048	2.7%	Glen_Canyon
Total new federal O&G in CO	25	0.101	0.4%	Dinosaur_CO	512	0.101	0.0%	Dinosaur_all
New total CRVFO	25	0.001	0.0%	Flat_Tops	512	0.001	0.0%	Dinosaur_all
New total RGFO	25	0.000	0.0%	Rocky_Mountain	512	0.000	0.0%	Lost_Creek
All new O&G in CO plus new non-federal FFO1	25	0.112	0.4%	Dinosaur_CO	512	0.112	0.0%	Dinosaur_all
New federal O&G + new Mining in CO	25	0.101	0.4%	Dinosaur_CO	512	0.101	0.0%	Dinosaur_all
New federal O&G + new non-federal O&G + Mining in CO	25	0.112	0.4%	Dinosaur_CO	512	0.112	0.0%	Dinosaur_all
All EGUs in CO and NM	25	2.487	9.9%	Mount_Zirkel	512	3.861	0.8%	Aztec_Ruins
2025 BC	25	7.584	30.3%	Salt_Creek	512	8.896	1.7%	Bitter_Lake_NWR
2025 Total	25	587.878	2351.5%	Bandelier	512	337.436	65.9%	Dome
2011 Total	25	587.900	2351.6%	Bandelier	512	338.092	66.0%	Dome
Total new federal O&G in CO (X) using Brute-Force zero-out run	25	0.114	0.5%	Dinosaur_CO	512	0.114	0.0%	Dinosaur_all

Note that the thresholds shown are project-level thresholds. The comparisons shown above are for informational purposes only.

Table 5-4b. Maximum 3-hour SO_2 concentration at any Class I or sensitive Class II area due to the different Source Groups for the 2025 Medium Development Scenario.

Choose	SO2, 3-hour	µg/m3							
Across grid cells	Maximum								

Group	Group Name	PSD Class I Increment	Max @ any Class I area	Percent of PSD Class I Increment	Class I Area where Max occurred	PSD Class II Increment	Max @ any Class II area	Percent of PSD Class II Increment	Class II Area where Max occurred
A	Natural emissions	25	587.662	2350.6%	Bandelier	512	337.323	65.9%	Dome
B	Little Snake FO	25	0.007	0.0%	Dinosaur_CO	512	0.013	0.0%	Dinosaur_all
C	White River FO	25	0.842	3.4%	Dinosaur_CO	512	0.842	0.2%	Dinosaur_all
D	Colorado River Valley FO (CRVFO)	25	0.001	0.0%	Dinosaur_CO	512	0.001	0.0%	Dinosaur_all
E	Roan Plateau Planning area portion of CRVFO	25	0.001	0.0%	Flat_Tops	512	0.001	0.0%	Colorado
F	Grand Junction FO	25	0.003	0.0%	Arches	512	0.004	0.0%	Colorado
G	Uncompahgre FO	25	0.002	0.0%	Maroon_Bells	512	0.001	0.0%	Raggeds
H	Tres Rios FO	25	0.003	0.0%	Mesa_Verde	512	0.011	0.0%	Hovenweep
I	Kremmling FO	25	0.000	0.0%	Rawah	512	0.000	0.0%	Savage_Run
J	RGFO #1	25	0.000	0.0%	Rocky_Mountain	512	0.000	0.0%	Mount_Evans
K	RGFO #2	25	0.000	0.0%	Eagles_Nest	512	0.000	0.0%	Lost_Creek
L	RGFO #3	25	0.000	0.0%	Rocky_Mountain	512	0.000	0.0%	Florissant_Fossi
M	RGFO #4	25	0.000	0.0%	Wheeler_Peak	512	0.000	0.0%	Spanish_Peaks
N	Southern Ute Indian Tribe	25	0.002	0.0%	Weminuche	512	0.004	0.0%	Aztec_Ruins
O	New Mexico Farmington Field Office	25	0.002	0.0%	Mesa_Verde	512	0.012	0.0%	Aztec_Ruins
P	Combined future non-Federal O&G from BLM Planning Areas	25	0.070	0.3%	Flat_Tops	512	0.081	0.0%	Dinosaur_all
Q	Combined Existing O&G from BLM Planning Areas	25	0.165	0.7%	Dinosaur_CO	512	0.174	0.0%	Dinosaur_all
R	Mining from BLM Planning Areas	25	0.006	0.0%	Mount_Zirkel	512	0.007	0.0%	Dinosaur_all
S	All O&G in 12 km domain outside of the BLM Planning Areas	25	0.409	1.6%	Mesa_Verde	512	1.162	0.2%	Aztec_Ruins
T	Remaining anthropogenic emissions	25	1.217	4.9%	Dinosaur_CO	512	3.640	0.7%	Sandia_Mountain
U	Coal EGU Colorado + New Mexico	25	2.478	9.9%	Mount_Zirkel	512	3.861	0.8%	Aztec_Ruins
V	Oil/Gas EGU Colorado + New Mexico	25	0.017	0.1%	Bandelier	512	0.107	0.0%	Valle_De_Oro_NWR
W	All Other EGUs in 12 km domain	25	7.459	29.8%	Petrified_Forest	512	14.048	2.7%	Glen_Canyon
X	Total new federal O&G in CO	25	0.843	3.4%	Dinosaur_CO	512	0.843	0.2%	Dinosaur_all
Y	New total CRVFO	25	0.001	0.0%	Flat_Tops	512	0.001	0.0%	Dinosaur_all
Z	New total RGFO	25	0.000	0.0%	Rocky_Mountain	512	0.000	0.0%	Lost_Creek
A1	All new O&G in CO plus new non-federal FFO1	25	0.910	3.6%	Dinosaur_CO	512	0.910	0.2%	Dinosaur_all
A2	New federal O&G + new Mining in CO	25	0.843	3.4%	Dinosaur_CO	512	0.843	0.2%	Dinosaur_all
A3	New federal O&G + new non-federal O&G + Mining in CO	25	0.910	3.6%	Dinosaur_CO	512	0.910	0.2%	Dinosaur_all
A4	All EGUs in CO and NM	25	2.478	9.9%	Mount_Zirkel	512	3.861	0.8%	Aztec_Ruins
A5	2025 BC	25	7.584	30.3%	Salt_Creek	512	8.896	1.7%	Bitter_Lake_NWR
A6	2025 Total	25	587.878	2351.5%	Bandelier	512	337.436	65.9%	Dome
A7	2011 Total	25	587.900	2351.6%	Bandelier	512	338.092	66.0%	Dome
X1	Total new federal O&G in CO (X) using Brute-Force zero-out run	25	0.889	3.6%	Dinosaur_CO	512	0.889	0.2%	Dinosaur_all

Note that the thresholds shown are project-level thresholds. The comparisons shown above are for informational purposes only.

5.1.1.3 $PM_{2.5}$ PSD Concentrations

Tables 5-5 and 5-6 display the maximum annual and 24-hour $PM_{2.5}$ concentrations due the Source Groups at any Class I and II area and presents a comparison with the PSD $PM_{2.5}$ Increments for the 2025 High, Low and Medium Development Scenarios. $PM_{2.5}$ concentrations due to emissions from Federal O&G within any of the 14 BLM Planning Areas do not come close to exceeding any of the PSD $PM_{2.5}$ Increments. The BLM Planning Area with the largest Federal O&G $PM_{2.5}$ contribution at any Class I area is again the White River FO Planning Area that contributes $PM_{2.5}$ concentrations of 4 and 12 percent for the High, 4 and 10 percent for the Medium and 0.5 and 2 percent for the Low Development Scenarios to the annual and 24-hour $PM_{2.5}$ Class I PSD Increments at the Dinosaur NM Class I area.

The maximum contributions at any Class I area to annual $PM_{2.5}$ due to all Federal O&G and mining in the 13 Colorado BLM Planning Areas (Source Group X and X1 are very similar with the latter being slightly higher) are, respectively, 0.05, 0.04, and 0.006 $\mu g/m^3$ that represents 5%, 4%, and less than 1% of the Class I area increment for the High, Medium and Low Development Scenarios. The maximum contributions at any Class I area to 24-hour $PM_{2.5}$ due to all Federal O&G and mining in the 13 Colorado BLM Planning Areas (Source Group X is slightly higher than X1) are, respectively, 0.2, 0.2, and 0.04 $\mu g/m^3$ for the High, Medium and Low Development Scenarios, representing 11%, 9%, and 2% of the Class I area increment.

Extremely high maximum annual and 24-hour $PM_{2.5}$ contributions are seen due to natural wildfire emissions that occurred in 2011 (Source Group A), which are also reflected in the total 2025 (A6) and 2011 (A7) Source Groups for which the PSD Increments are not applicable.

Table 5-5. Maximum Annual $PM_{2.5}$ concentration at any Class I or sensitive Class II area due to the different Source Groups for the 2025 High Development Scenario.

Choose	PM2.5, Annual	µg/m3							
Across grid cells	Maximum								

Group	Group Name	PSD Class I Increment	Max @ any Class I area	Percent of PSD Class I Increment	Class I Area where Max occurred	PSD Class II Increment	Max @ any Class II area	Percent of PSD Class II Increment	Class II Area where Max occurred
A	Natural emissions	1	7.833	783.3%	Bandelier	4	6.155	153.9%	Bear_Wallow
B	Little Snake FO	1	0.004	0.4%	Mount_Zirkel	4	0.003	0.1%	Dinosaur_all
C	White River FO	1	0.042	4.2%	Dinosaur_CO	4	0.063	1.6%	Dinosaur_all
D	Colorado River Valley FO (CRVFO)	1	0.002	0.2%	Flat_Tops	4	0.001	0.0%	Holy_Cross
E	Roan Plateau Planning area portion of CRVFO	1	0.002	0.2%	Flat_Tops	4	0.002	0.0%	Colorado
F	Grand Junction FO	1	0.009	0.9%	Arches	4	0.014	0.4%	Colorado
G	Uncompahgre FO	1	0.005	0.5%	Maroon_Bells	4	0.006	0.2%	Raggeds
H	Tres Rios FO	1	0.002	0.2%	Weminuche	4	0.004	0.1%	South_San_Juan
I	Kremmling FO	1	0.002	0.2%	Rawah	4	0.001	0.0%	Savage_Run
J	RGFO #1	1	0.001	0.1%	Rocky_Mountain	4	0.000	0.0%	Lost_Creek
K	RGFO #2	1	0.000	0.0%	Eagles_Nest	4	0.002	0.1%	Lost_Creek
L	RGFO #3	1	0.001	0.1%	Rocky_Mountain	4	0.000	0.0%	Lost_Creek
M	RGFO #4	1	0.000	0.0%	Great_Sand_Dunes	4	0.001	0.0%	Greenhorn_Mounta
N	Southern Ute Indian Tribe	1	0.006	0.6%	Mesa_Verde	4	0.045	1.1%	Aztec_Ruins
O	New Mexico Farmington Field Office	1	0.006	0.6%	Mesa_Verde	4	0.183	4.6%	Aztec_Ruins
P	Combined future non-Federal O&G from BLM Planning Areas	1	0.029	2.9%	Rocky_Mountain	4	0.085	2.1%	Aztec_Ruins
Q	Combined Existing O&G from BLM Planning Areas	1	0.029	2.9%	Rocky_Mountain	4	0.020	0.5%	Dinosaur_all
R	Mining from BLM Planning Areas	1	0.040	4.0%	West_Elk	4	0.060	1.5%	Raggeds
S	All O&G in 12 km domain outside of the BLM Planning Areas	1	0.140	14.0%	Salt_Creek	4	0.413	10.3%	Dinosaur_all
T	Remaining anthropogenic emissions	1	1.941	194.1%	Bandelier	4	10.173	254.3%	Valle_De_Oro_NWR
U	Coal EGU Colorado + New Mexico	1	0.129	12.9%	Mount_Zirkel	4	0.101	2.5%	Aztec_Ruins
V	Oil/Gas EGU Colorado + New Mexico	1	0.000	0.0%	Great_Sand_Dunes	4	0.002	0.0%	Alamosa_NWR
W	All Other EGUs in 12 km domain	1	0.207	20.7%	Petrified_Forest	4	0.331	8.3%	Glen_Canyon
X	Total new federal O&G in CO	1	0.045	4.5%	Dinosaur_CO	4	0.069	1.7%	Dinosaur_all
Y	New total CRVFO	1	0.004	0.4%	Flat_Tops	4	0.003	0.1%	Colorado
Z	New total RGFO	1	0.001	0.1%	Rocky_Mountain	4	0.002	0.1%	Lost_Creek
A1	All new O&G in CO plus new non-federal FFO1	1	0.052	5.2%	Dinosaur_CO	4	0.134	3.4%	Aztec_Ruins
A2	New federal O&G + new Mining in CO	1	0.052	5.2%	Dinosaur_CO	4	0.078	1.9%	Dinosaur_all
A3	New federal O&G + new non-federal O&G + Mining in CO	1	0.061	6.1%	Maroon_Bells	4	0.137	3.4%	Aztec_Ruins
A4	All EGUs in CO and NM	1	0.129	12.9%	Mount_Zirkel	4	0.101	2.5%	Aztec_Ruins
A5	2025 BC	1	1.785	178.5%	Salt_Creek	4	2.311	57.8%	Bitter_Lake_NWR
A6	2025 Total	1	9.724	972.4%	Bandelier	4	12.140	303.5%	Valle_De_Oro_NWR
A7	2011 Total	1	9.781	978.1%	Bandelier	4	11.197	279.9%	Valle_De_Oro_NWR
X1	Total new federal O&G in CO (X) using Brute-Force zero-out run	1	0.050	5.0%	Dinosaur_CO	4	0.069	1.7%	Dinosaur_all

Note that the thresholds shown are project-level thresholds. The comparisons shown above are for informational purposes only.

Table 5-5a. Maximum Annual $PM_{2.5}$ concentration at any Class I or sensitive Class II area due to the different Source Groups for the 2025 Low Development Scenario.

Choose	PM2.5, Annual	µg/m3							
Across grid cells	Maximum								

Group	Group Name	PSD Class I Increment	Max @ any Class I area	Percent of PSD Class I Increment	Class I Area where Max occurred	PSD Class II Increment	Max @ any Class II area	Percent of PSD Class II Increment	Class II Area where Max occurred
A	Natural emissions	1	7.833	783.3%	Bandelier	4	6.155	153.9%	Bear_Wallow
B	Little Snake FO	1	0.000	0.0%	Mount_Zirkel	4	0.000	0.0%	Dinosaur_all
C	White River FO	1	0.005	0.5%	Dinosaur_CO	4	0.008	0.2%	Dinosaur_all
D	Colorado River Valley FO (CRVFO)	1	0.001	0.1%	Flat_Tops	4	0.001	0.0%	Holy_Cross
E	Roan Plateau Planning area portion of CRVFO	1	0.001	0.1%	Flat_Tops	4	0.001	0.0%	Colorado
F	Grand Junction FO	1	0.000	0.0%	Arches	4	0.000	0.0%	Colorado
G	Uncompahgre FO	1	0.000	0.0%	Maroon_Bells	4	0.000	0.0%	Raggeds
H	Tres Rios FO	1	0.000	0.0%	Weminuche	4	0.000	0.0%	Chimney_Rock
I	Kremmling FO	1	0.000	0.0%	Rawah	4	0.000	0.0%	Savage_Run
J	RGFO #1	1	0.000	0.0%	Rocky_Mountain	4	0.000	0.0%	Lost_Creek
K	RGFO #2	1	0.000	0.0%	Mesa_Verde	4	0.000	0.0%	Sandia_Mountain
L	RGFO #3	1	0.000	0.0%	Rocky_Mountain	4	0.000	0.0%	Lost_Creek
M	RGFO #4	1	0.000	0.0%	Great_Sand_Dunes	4	0.000	0.0%	Greenhorn_Mounta
N	Southern Ute Indian Tribe	1	0.003	0.3%	Mesa_Verde	4	0.023	0.6%	Aztec_Ruins
O	New Mexico Farmington Field Office	1	0.003	0.3%	Mesa_Verde	4	0.092	2.3%	Aztec_Ruins
P	Combined future non-Federal O&G from BLM Planning Areas	1	0.010	1.0%	Rocky_Mountain	4	0.042	1.1%	Aztec_Ruins
Q	Combined Existing O&G from BLM Planning Areas	1	0.029	2.9%	Rocky_Mountain	4	0.021	0.5%	Dinosaur_all
R	Mining from BLM Planning Areas	1	0.024	2.4%	West_Elk	4	0.035	0.9%	Raggeds
S	All O&G in 12 km domain outside of the BLM Planning Areas	1	0.140	14.0%	Salt_Creek	4	0.415	10.4%	Dinosaur_all
T	Remaining anthropogenic emissions	1	1.941	194.1%	Bandelier	4	10.171	254.3%	Valle_De_Oro_NWR
U	Coal EGU Colorado + New Mexico	1	0.130	13.0%	Mount_Zirkel	4	0.102	2.5%	Aztec_Ruins
V	Oil/Gas EGU Colorado + New Mexico	1	0.000	0.0%	Great_Sand_Dunes	4	0.002	0.0%	Alamosa_NWR
W	All Other EGUs in 12 km domain	1	0.207	20.7%	Petrified_Forest	4	0.331	8.3%	Glen_Canyon
X	Total new federal O&G in CO	1	0.006	0.6%	Dinosaur_CO	4	0.010	0.2%	Dinosaur_all
Y	New total CRVFO	1	0.002	0.2%	Flat_Tops	4	0.002	0.0%	Colorado
Z	New total RGFO	1	0.000	0.0%	Rocky_Mountain	4	0.000	0.0%	Lost_Creek
A1	All new O&G in CO plus new non-federal FFO1	1	0.011	1.1%	Rocky_Mountain	4	0.066	1.6%	Aztec_Ruins
A2	New federal O&G + new Mining in CO	1	0.025	2.5%	West_Elk	4	0.036	0.9%	Raggeds
A3	New federal O&G + new non-federal O&G + Mining in CO	1	0.027	2.7%	West_Elk	4	0.069	1.7%	Aztec_Ruins
A4	All EGUs in CO and NM	1	0.130	13.0%	Mount_Zirkel	4	0.102	2.5%	Aztec_Ruins
A5	2025 BC	1	1.785	178.5%	Salt_Creek	4	2.311	57.8%	Bitter_Lake_NWR
A6	2025 Total	1	9.720	972.0%	Bandelier	4	12.132	303.3%	Valle_De_Oro_NWR
A7	2011 Total	1	9.781	978.1%	Bandelier	4	11.197	279.9%	Valle_De_Oro_NWR
X1	Total new federal O&G in CO (X) using Brute-Force zero-out run	1	0.007	0.7%	Dinosaur_CO	4	0.010	0.2%	Dinosaur_all

Note that the thresholds shown are project-level thresholds. The comparisons shown above are for informational purposes only.

Table 5-5b. Maximum Annual $PM_{2.5}$ concentration at any Class I or sensitive Class II area due to the different Source Groups for the 2025 Medium Development Scenario.

Choose	PM2.5, Annual	µg/m3							
Across grid cells	Maximum								

Group	Group Name	PSD Class I Increment	Max @ any Class I area	Percent of PSD Class I Increment	Class I Area where Max occurred	PSD Class II Increment	Max @ any Class II area	Percent of PSD Class II Increment	Class II Area where Max occurred
A	Natural emissions	1	7.833	783.3%	Bandelier	4	6.155	153.9%	Bear_Wallow
B	Little Snake FO	1	0.002	0.2%	Mount_Zirkel	4	0.002	0.0%	Dinosaur_all
C	White River FO	1	0.037	3.7%	Dinosaur_CO	4	0.056	1.4%	Dinosaur_all
D	Colorado River Valley FO (CRVFO)	1	0.001	0.1%	Flat_Tops	4	0.001	0.0%	Holy_Cross
E	Roan Plateau Planning area portion of CRVFO	1	0.002	0.2%	Flat_Tops	4	0.002	0.0%	Colorado
F	Grand Junction FO	1	0.006	0.6%	Arches	4	0.010	0.2%	Colorado
G	Uncompahgre FO	1	0.004	0.4%	Maroon_Bells	4	0.004	0.1%	Raggeds
H	Tres Rios FO	1	0.001	0.1%	Weminuche	4	0.002	0.0%	Chimney_Rock
I	Kremmling FO	1	0.001	0.1%	Rawah	4	0.000	0.0%	Savage_Run
J	RGFO #1	1	0.000	0.0%	Rocky_Mountain	4	0.000	0.0%	Lost_Creek
K	RGFO #2	1	0.000	0.0%	Eagles_Nest	4	0.001	0.0%	Lost_Creek
L	RGFO #3	1	0.000	0.0%	Rocky_Mountain	4	0.000	0.0%	Lost_Creek
M	RGFO #4	1	0.000	0.0%	Great_Sand_Dunes	4	0.000	0.0%	Greenhorn_Mounta
N	Southern Ute Indian Tribe	1	0.002	0.2%	Mesa_Verde	4	0.018	0.4%	Aztec_Ruins
O	New Mexico Farmington Field Office	1	0.003	0.3%	Mesa_Verde	4	0.095	2.4%	Aztec_Ruins
P	Combined future non-Federal O&G from BLM Planning Areas	1	0.029	2.9%	Rocky_Mountain	4	0.085	2.1%	Aztec_Ruins
Q	Combined Existing O&G from BLM Planning Areas	1	0.029	2.9%	Rocky_Mountain	4	0.020	0.5%	Dinosaur_all
R	Mining from BLM Planning Areas	1	0.040	4.0%	West_Elk	4	0.060	1.5%	Raggeds
S	All O&G in 12 km domain outside of the BLM Planning Areas	1	0.140	14.0%	Salt_Creek	4	0.414	10.3%	Dinosaur_all
T	Remaining anthropogenic emissions	1	1.941	194.1%	Bandelier	4	10.173	254.3%	Valle_De_Oro_NWR
U	Coal EGU Colorado + New Mexico	1	0.129	12.9%	Mount_Zirkel	4	0.101	2.5%	Aztec_Ruins
V	Oil/Gas EGU Colorado + New Mexico	1	0.000	0.0%	Great_Sand_Dunes	4	0.002	0.0%	Alamosa_NWR
W	All Other EGUs in 12 km domain	1	0.207	20.7%	Petrified_Forest	4	0.331	8.3%	Glen_Canyon
X	Total new federal O&G in CO	1	0.039	3.9%	Dinosaur_CO	4	0.060	1.5%	Dinosaur_all
Y	New total CRVFO	1	0.003	0.3%	Flat_Tops	4	0.002	0.1%	Colorado
Z	New total RGFO	1	0.001	0.1%	Rocky_Mountain	4	0.001	0.0%	Lost_Creek
A1	All new O&G in CO plus new non-federal FFO1	1	0.046	4.6%	Dinosaur_CO	4	0.106	2.7%	Aztec_Ruins
A2	New federal O&G + new Mining in CO	1	0.046	4.6%	Dinosaur_CO	4	0.069	1.7%	Dinosaur_all
A3	New federal O&G + new non-federal O&G + Mining in CO	1	0.057	5.7%	Maroon_Bells	4	0.109	2.7%	Aztec_Ruins
A4	All EGUs in CO and NM	1	0.129	12.9%	Mount_Zirkel	4	0.102	2.5%	Aztec_Ruins
A5	2025 BC	1	1.785	178.5%	Salt_Creek	4	2.311	57.8%	Bitter_Lake_NWR
A6	2025 Total	1	9.722	972.2%	Bandelier	4	12.137	303.4%	Valle_De_Oro_NWR
A7	2011 Total	1	9.781	978.1%	Bandelier	4	11.197	279.9%	Valle_De_Oro_NWR
X1	Total new federal O&G in CO (X) using Brute-Force zero-out run	1	0.044	4.4%	Dinosaur_CO	4	0.060	1.5%	Dinosaur_all

Note that the thresholds shown are project-level thresholds. The comparisons shown above are for informational purposes only.

Table 5-6. Maximum 24-Hour $PM_{2.5}$ concentration at any Class I or sensitive Class II area due to the different Source Groups for the 2025 High Development Scenario.

Choose	PM2.5, 24-hour	µg/m3							
Across grid cells	Maximum								

Group	Group Name	PSD Class I Increment	Max @ any Class I area	Percent of PSD Class I Increment	Class I Area where Max occurred	PSD Class II Increment	Max @ any Class II area	Percent of PSD Class II Increment	Class II Area where Max occurred
A	Natural emissions	2	593.477	29673.8%	Bandelier	9	332.517	3694.6%	Bear_Wallow
B	Little Snake FO	2	0.027	1.3%	Dinosaur_CO	9	0.036	0.4%	Dinosaur_all
C	White River FO	2	0.229	11.5%	Dinosaur_CO	9	0.385	4.3%	Dinosaur_all
D	Colorado River Valley FO (CRVFO)	2	0.010	0.5%	Maroon_Bells	9	0.017	0.2%	Colorado
E	Roan Plateau Planning area portion of CRVFO	2	0.016	0.8%	Black_Canyon	9	0.035	0.4%	Colorado
F	Grand Junction FO	2	0.084	4.2%	Arches	9	0.146	1.6%	Colorado
G	Uncompahgre FO	2	0.021	1.1%	Maroon_Bells	9	0.020	0.2%	Raggeds
H	Tres Rios FO	2	0.009	0.5%	Weminuche	9	0.022	0.2%	South_San_Juan
I	Kremmling FO	2	0.007	0.3%	Rawah	9	0.005	0.1%	Savage_Run
J	RGFO #1	2	0.008	0.4%	Rocky_Mountain	9	0.009	0.1%	Lost_Creek
K	RGFO #2	2	0.001	0.1%	Eagles_Nest	9	0.011	0.1%	Florissant_Fossi
L	RGFO #3	2	0.012	0.6%	Rocky_Mountain	9	0.009	0.1%	Mount_Evans
M	RGFO #4	2	0.001	0.0%	Great_Sand_Dunes	9	0.002	0.0%	Greenhorn_Mounta
N	Southern Ute Indian Tribe	2	0.050	2.5%	Mesa_Verde	9	0.188	2.1%	Aztec_Ruins
O	New Mexico Farmington Field Office	2	0.063	3.2%	Mesa_Verde	9	0.595	6.6%	Aztec_Ruins
P	Combined future non-Federal O&G from BLM Planning Areas	2	0.402	20.1%	Rocky_Mountain	9	0.378	4.2%	Lost_Creek
Q	Combined Existing O&G from BLM Planning Areas	2	0.487	24.4%	Rocky_Mountain	9	0.428	4.8%	Lost_Creek
R	Mining from BLM Planning Areas	2	0.148	7.4%	West_Elk	9	0.258	2.9%	Raggeds
S	All O&G in 12 km domain outside of the BLM Planning Areas	2	0.716	35.8%	Dinosaur_CO	9	3.055	33.9%	Dinosaur_all
T	Remaining anthropogenic emissions	2	7.557	377.9%	Bandelier	9	36.244	402.7%	Valle_De_Oro_NWR
U	Coal EGU Colorado + New Mexico	2	0.690	34.5%	Mount_Zirkel	9	0.791	8.8%	Aztec_Ruins
V	Oil/Gas EGU Colorado + New Mexico	2	0.013	0.6%	Great_Sand_Dunes	9	0.028	0.3%	Alamosa_NWR
W	All Other EGUs in 12 km domain	2	2.535	126.8%	Petrified_Forest	9	3.013	33.5%	Glen_Canyon
X	Total new federal O&G in CO	2	0.231	11.5%	Dinosaur_CO	9	0.391	4.3%	Dinosaur_all
Y	New total CRVFO	2	0.025	1.2%	Black_Canyon	9	0.050	0.6%	Colorado
Z	New total RGFO	2	0.024	1.2%	Rocky_Mountain	9	0.019	0.2%	Lost_Creek
A1	All new O&G in CO plus new non-federal FFO1	2	0.423	21.2%	Rocky_Mountain	9	0.530	5.9%	Colorado
A2	New federal O&G + new Mining in CO	2	0.250	12.5%	Dinosaur_CO	9	0.410	4.6%	Dinosaur_all
A3	New federal O&G + new non-federal O&G + Mining in CO	2	0.425	21.2%	Rocky_Mountain	9	0.544	6.0%	Colorado
A4	All EGUs in CO and NM	2	0.690	34.5%	Mount_Zirkel	9	0.793	8.8%	Aztec_Ruins
A5	2025 BC	2	7.825	391.2%	Salt_Creek	9	11.962	132.9%	Capitan_Mountain
A6	2025 Total	2	608.768	30438.4%	Bandelier	9	342.197	3802.2%	Bear_Wallow
A7	2011 Total	2	609.031	30451.6%	Bandelier	9	342.838	3809.3%	Bear_Wallow
X1	Total new federal O&G in CO (X) using Brute-Force zero-out run	2	0.212	10.6%	Black_Canyon	9	0.359	4.0%	Dinosaur_all

Note that the thresholds shown are project-level thresholds. The comparisons shown above are for informational purposes only.

Table 5-6a. Maximum 24-Hour $PM_{2.5}$ concentration at any Class I or sensitive Class II area due to the different Source Groups for the 2025 Low Development Scenario.

Choose	PM2.5, 24-hour	µg/m3							
Across grid cells	Maximum								

Group	Group Name	PSD Class I Increment	Max @ any Class I area	Percent of PSD Class I Increment	Class I Area where Max occurred	PSD Class II Increment	Max @ any Class II area	Percent of PSD Class II Increment	Class II Area where Max occurred
A	Natural emissions	2	593.477	29673.8%	Bandelier	9	332.517	3694.6%	Bear_Wallow
B	Little Snake FO	2	0.002	0.1%	Dinosaur_CO	9	0.003	0.0%	Dinosaur_all
C	White River FO	2	0.038	1.9%	Dinosaur_CO	9	0.063	0.7%	Dinosaur_all
D	Colorado River Valley FO (CRVFO)	2	0.007	0.3%	Maroon_Bells	9	0.012	0.1%	Colorado
E	Roan Plateau Planning area portion of CRVFO	2	0.009	0.5%	Black_Canyon	9	0.018	0.2%	Colorado
F	Grand Junction FO	2	0.004	0.2%	Arches	9	0.006	0.1%	Colorado
G	Uncompahgre FO	2	0.000	0.0%	Maroon_Bells	9	0.001	0.0%	Raggeds
H	Tres Rios FO	2	0.001	0.1%	Weminuche	9	0.002	0.0%	Aztec_Ruins
I	Kremmling FO	2	0.001	0.0%	Rawah	9	0.000	0.0%	Savage_Run
J	RGFO #1	2	0.001	0.0%	Rocky_Mountain	9	0.001	0.0%	Lost_Creek
K	RGFO #2	2	0.000	0.0%	Bandelier	9	0.000	0.0%	Aztec_Ruins
L	RGFO #3	2	0.002	0.1%	Rocky_Mountain	9	0.001	0.0%	Mount_Evans
M	RGFO #4	2	0.000	0.0%	Great_Sand_Dunes	9	0.000	0.0%	Greenhorn_Mounta
N	Southern Ute Indian Tribe	2	0.026	1.3%	Mesa_Verde	9	0.099	1.1%	Aztec_Ruins
O	New Mexico Farmington Field Office	2	0.032	1.6%	Mesa_Verde	9	0.306	3.4%	Aztec_Ruins
P	Combined future non-Federal O&G from BLM Planning Areas	2	0.153	7.6%	Rocky_Mountain	9	0.144	1.6%	Lost_Creek
Q	Combined Existing O&G from BLM Planning Areas	2	0.531	26.5%	Rocky_Mountain	9	0.472	5.2%	Lost_Creek
R	Mining from BLM Planning Areas	2	0.101	5.0%	Dinosaur_CO	9	0.153	1.7%	Dinosaur_all
S	All O&G in 12 km domain outside of the BLM Planning Areas	2	0.716	35.8%	Dinosaur_CO	9	3.061	34.0%	Dinosaur_all
T	Remaining anthropogenic emissions	2	7.556	377.8%	Bandelier	9	36.235	402.6%	Valle_De_Oro_NWR
U	Coal EGU Colorado + New Mexico	2	0.700	35.0%	Mount_Zirkel	9	0.807	9.0%	Aztec_Ruins
V	Oil/Gas EGU Colorado + New Mexico	2	0.013	0.6%	Great_Sand_Dunes	9	0.027	0.3%	Alamosa_NWR
W	All Other EGUs in 12 km domain	2	2.535	126.7%	Petrified_Forest	9	3.014	33.5%	Glen_Canyon
X	Total new federal O&G in CO	2	0.038	1.9%	Dinosaur_CO	9	0.065	0.7%	Dinosaur_all
Y	New total CRVFO	2	0.016	0.8%	Black_Canyon	9	0.030	0.3%	Colorado
Z	New total RGFO	2	0.003	0.2%	Rocky_Mountain	9	0.002	0.0%	Lost_Creek
A1	All new O&G in CO plus new non-federal FFO1	2	0.157	7.9%	Rocky_Mountain	9	0.229	2.5%	Aztec_Ruins
A2	New federal O&G + new Mining in CO	2	0.112	5.6%	Dinosaur_CO	9	0.170	1.9%	Dinosaur_all
A3	New federal O&G + new non-federal O&G + Mining in CO	2	0.158	7.9%	Rocky_Mountain	9	0.246	2.7%	Aztec_Ruins
A4	All EGUs in CO and NM	2	0.700	35.0%	Mount_Zirkel	9	0.809	9.0%	Aztec_Ruins
A5	2025 BC	2	7.824	391.2%	Salt_Creek	9	11.962	132.9%	Capitan_Mountain
A6	2025 Total	2	608.767	30438.3%	Bandelier	9	342.197	3802.2%	Bear_Wallow
A7	2011 Total	2	609.031	30451.6%	Bandelier	9	342.838	3809.3%	Bear_Wallow
X1	Total new federal O&G in CO (X) using Brute-Force zero-out run	2	0.044	2.2%	Black_Canyon	9	0.061	0.7%	Colorado

Note that the thresholds shown are project-level thresholds. The comparisons shown above are for informational purposes only.

Table 5-6b. Maximum 24-Hour $PM_{2.5}$ concentration at any Class I or sensitive Class II area due to the different Source Groups for the 2025 Medium Development Scenario.

Choose	PM2.5, 24-hour	µg/m3							
Across grid cells	Maximum								

Group	Group Name	PSD Class I Increment	Max @ any Class I area	Percent of PSD Class I Increment	Class I Area where Max occurred	PSD Class II Increment	Max @ any Class II area	Percent of PSD Class II Increment	Class II Area where Max occurred
A	Natural emissions	2	593.477	29673.8%	Bandelier	9	332.517	3694.6%	Bear_Wallow
B	Little Snake FO	2	0.016	0.8%	Dinosaur_CO	9	0.026	0.3%	Dinosaur_all
C	White River FO	2	0.206	10.3%	Dinosaur_CO	9	0.351	3.9%	Dinosaur_all
D	Colorado River Valley FO (CRVFO)	2	0.008	0.4%	Maroon_Bells	9	0.014	0.2%	Colorado
E	Roan Plateau Planning area portion of CRVFO	2	0.014	0.7%	Black_Canyon	9	0.030	0.3%	Colorado
F	Grand Junction FO	2	0.065	3.2%	Arches	9	0.112	1.2%	Colorado
G	Uncompahgre FO	2	0.014	0.7%	Maroon_Bells	9	0.013	0.1%	Raggeds
H	Tres Rios FO	2	0.005	0.3%	Weminuche	9	0.011	0.1%	South_San_Juan
I	Kremmling FO	2	0.004	0.2%	Rawah	9	0.003	0.0%	Savage_Run
J	RGFO #1	2	0.004	0.2%	Rocky_Mountain	9	0.004	0.0%	Lost_Creek
K	RGFO #2	2	0.001	0.0%	Eagles_Nest	9	0.006	0.1%	Florissant_Fossi
L	RGFO #3	2	0.007	0.4%	Rocky_Mountain	9	0.006	0.1%	Mount_Evans
M	RGFO #4	2	0.001	0.0%	Great_Sand_Dunes	9	0.001	0.0%	Greenhorn_Mounta
N	Southern Ute Indian Tribe	2	0.020	1.0%	Mesa_Verde	9	0.074	0.8%	Aztec_Ruins
O	New Mexico Farmington Field Office	2	0.033	1.6%	Mesa_Verde	9	0.316	3.5%	Aztec_Ruins
P	Combined future non-Federal O&G from BLM Planning Areas	2	0.403	20.1%	Rocky_Mountain	9	0.379	4.2%	Lost_Creek
Q	Combined Existing O&G from BLM Planning Areas	2	0.488	24.4%	Rocky_Mountain	9	0.429	4.8%	Lost_Creek
R	Mining from BLM Planning Areas	2	0.148	7.4%	West_Elk	9	0.258	2.9%	Raggeds
S	All O&G in 12 km domain outside of the BLM Planning Areas	2	0.716	35.8%	Dinosaur_CO	9	3.055	33.9%	Dinosaur_all
T	Remaining anthropogenic emissions	2	7.557	377.8%	Bandelier	9	36.240	402.7%	Valle_De_Oro_NWR
U	Coal EGU Colorado + New Mexico	2	0.691	34.5%	Mount_Zirkel	9	0.802	8.9%	Aztec_Ruins
V	Oil/Gas EGU Colorado + New Mexico	2	0.013	0.6%	Great_Sand_Dunes	9	0.027	0.3%	Alamosa_NWR
W	All Other EGUs in 12 km domain	2	2.535	126.8%	Petrified_Forest	9	3.013	33.5%	Glen_Canyon
X	Total new federal O&G in CO	2	0.207	10.3%	Dinosaur_CO	9	0.356	4.0%	Dinosaur_all
Y	New total CRVFO	2	0.021	1.0%	Black_Canyon	9	0.042	0.5%	Colorado
Z	New total RGFO	2	0.013	0.7%	Rocky_Mountain	9	0.010	0.1%	Florissant_Fossi
A1	All new O&G in CO plus new non-federal FFO1	2	0.418	20.9%	Rocky_Mountain	9	0.483	5.4%	Colorado
A2	New federal O&G + new Mining in CO	2	0.227	11.3%	Dinosaur_CO	9	0.375	4.2%	Dinosaur_all
A3	New federal O&G + new non-federal O&G + Mining in CO	2	0.419	21.0%	Rocky_Mountain	9	0.496	5.5%	Colorado
A4	All EGUs in CO and NM	2	0.691	34.5%	Mount_Zirkel	9	0.804	8.9%	Aztec_Ruins
A5	2025 BC	2	7.825	391.2%	Salt_Creek	9	11.962	132.9%	Capitan_Mountain
A6	2025 Total	2	608.767	30438.4%	Bandelier	9	342.197	3802.2%	Bear_Wallow
A7	2011 Total	2	609.031	30451.6%	Bandelier	9	342.838	3809.3%	Bear_Wallow
X1	Total new federal O&G in CO (X) using Brute-Force zero-out run	2	0.179	9.0%	Dinosaur_CO	9	0.316	3.5%	Dinosaur_all

Note that the thresholds shown are project-level thresholds. The comparisons shown above are for informational purposes only.

5.1.1.4 PM_{10} PSD Concentrations

The results of the comparisons against the PM_{10} PSD increments is very similar to $PM_{2.5}$ with none of the Source Groups, except Natural Emissions (Source Group A) that are also included in the total 2025 and 2011 Source Groups, showing any exceedances of the annual or 24-hour PM_{10} PSD increment (Tables 5-7 and 5-8). Wildfires within the Natural Emissions Source Group can produce very high PM concentrations.

Of the BLM Planning Areas, Federal O&G from the White River FO has the largest annual and 24-hour PM_{10} concentrations at any Class I area with maximum values that of 1.5% and 4% for the High, 1% and 3% for the Medium Development Scenarios as a fraction of the PSD PM_{10} increment. For the Low Development Scenario, New Mexico Farmington FO (NMFFO) has the largest annual and 24-hour PM_{10} at any Class I area with maximum values of 0.3% and 1% of the PSD PM_{10} increment. The combined Source Groups, i.e., X, X1, A1-A3 PM_{10} impacts at any Class I area are 18% or less of the PM_{10} PSD increments.

Table 5-7. Maximum Annual PM_{10} concentration at any Class I or sensitive Class II area due to the different Source Groups for the 2025 High Development Scenario.

Choose	PM10, Annual	µg/m3							
Across grid cells	Maximum								

Group	Group Name	PSD Class I Increment	Max @ any Class I area	Percent of PSD Class I Increment	Class I Area where Max occurred	PSD Class II Increment	Max @ any Class II area	Percent of PSD Class II Increment	Class II Area where Max occurred
A	Natural emissions	4	9.282	232.0%	Bandelier	17	9.167	53.9%	Sevilleta_NWR
B	Little Snake FO	4	0.012	0.3%	Mount_Zirkel	17	0.007	0.0%	Dinosaur_all
C	White River FO	4	0.060	1.5%	Dinosaur_CO	17	0.094	0.6%	Dinosaur_all
D	Colorado River Valley FO (CRVFO)	4	0.004	0.1%	Flat_Tops	17	0.002	0.0%	Holy_Cross
E	Roan Plateau Planning area portion of CRVFO	4	0.004	0.1%	Flat_Tops	17	0.003	0.0%	Colorado
F	Grand Junction FO	4	0.021	0.5%	Arches	17	0.036	0.2%	Colorado
G	Uncompahgre FO	4	0.017	0.4%	Maroon_Bells	17	0.020	0.1%	Raggeds
H	Tres Rios FO	4	0.007	0.2%	Weminuche	17	0.020	0.1%	South_San_Juan
I	Kremmling FO	4	0.006	0.1%	Rawah	17	0.002	0.0%	Savage_Run
J	RGFO #1	4	0.002	0.0%	Rocky_Mountain	17	0.001	0.0%	Lost_Creek
K	RGFO #2	4	0.000	0.0%	Eagles_Nest	17	0.010	0.1%	Lost_Creek
L	RGFO #3	4	0.002	0.0%	Rocky_Mountain	17	0.001	0.0%	Lost_Creek
M	RGFO #4	4	0.000	0.0%	Great_Sand_Dunes	17	0.002	0.0%	Greenhorn_Mounta
N	Southern Ute Indian Tribe	4	0.010	0.3%	Mesa_Verde	17	0.075	0.4%	Aztec_Ruins
O	New Mexico Farmington Field Office	4	0.022	0.6%	Mesa_Verde	17	0.828	4.9%	Aztec_Ruins
P	Combined future non-Federal O&G from BLM Planning Areas	4	0.098	2.4%	Rocky_Mountain	17	0.372	2.2%	Aztec_Ruins
Q	Combined Existing O&G from BLM Planning Areas	4	0.060	1.5%	Rocky_Mountain	17	0.041	0.2%	Aztec_Ruins
R	Mining from BLM Planning Areas	4	0.066	1.7%	Mount_Zirkel	17	0.063	0.4%	Raggeds
S	All O&G in 12 km domain outside of the BLM Planning Areas	4	0.140	3.5%	Salt_Creek	17	0.413	2.4%	Dinosaur_all
T	Remaining anthropogenic emissions	4	12.158	304.0%	Bandelier	17	66.573	391.6%	Valle_De_Oro_NWR
U	Coal EGU Colorado + New Mexico	4	0.141	3.5%	Mount_Zirkel	17	0.118	0.7%	Aztec_Ruins
V	Oil/Gas EGU Colorado + New Mexico	4	0.000	0.0%	Great_Sand_Dunes	17	0.002	0.0%	Alamosa_NWR
W	All Other EGUs in 12 km domain	4	0.237	5.9%	Petrified_Forest	17	0.424	2.5%	Glen_Canyon
X	Total new federal O&G in CO	4	0.069	1.7%	Dinosaur_CO	17	0.109	0.6%	Dinosaur_all
Y	New total CRVFO	4	0.007	0.2%	Flat_Tops	17	0.005	0.0%	Colorado
Z	New total RGFO	4	0.004	0.1%	Rocky_Mountain	17	0.010	0.1%	Lost_Creek
A1	All new O&G in CO plus new non-federal FFO1	4	0.110	2.7%	Rocky_Mountain	17	0.458	2.7%	Aztec_Ruins
A2	New federal O&G + new Mining in CO	4	0.098	2.4%	Dinosaur_CO	17	0.149	0.9%	Dinosaur_all
A3	New federal O&G + new non-federal O&G + Mining in CO	4	0.128	3.2%	Mount_Zirkel	17	0.464	2.7%	Aztec_Ruins
A4	All EGUs in CO and NM	4	0.141	3.5%	Mount_Zirkel	17	0.118	0.7%	Aztec_Ruins
A5	2025 BC	4	4.304	107.6%	Salt_Creek	17	7.917	46.6%	Bitter_Lake_NWR
A6	2025 Total	4	16.212	405.3%	Bandelier	17	70.901	417.1%	Valle_De_Oro_NWR
A7	2011 Total	4	13.893	347.3%	Bandelier	17	58.983	347.0%	Valle_De_Oro_NWR
X1	Total new federal O&G in CO (X) using Brute-Force zero-out run	4	0.077	1.9%	Dinosaur_CO	17	0.111	0.7%	Dinosaur_all

Note that the thresholds shown are project-level thresholds. The comparisons shown above are for informational purposes only.

Table 5-7a. Maximum Annual PM_{10} concentration at any Class I or sensitive Class II area due to the different Source Groups for the 2025 Low Development Scenario.

Choose	PM10, Annual	µg/m3							
Across grid cells	Maximum								

Group	Group Name	PSD Class I Increment	Max @ any Class I area	Percent of PSD Class I Increment	Class I Area where Max occurred	PSD Class II Increment	Max @ any Class II area	Percent of PSD Class II Increment	Class II Area where Max occurred
A	Natural emissions	4	9.281	232.0%	Bandelier	17	9.167	53.9%	Sevilleta_NWR
B	Little Snake FO	4	0.001	0.0%	Mount_Zirkel	17	0.001	0.0%	Dinosaur_all
C	White River FO	4	0.008	0.2%	Dinosaur_CO	17	0.012	0.1%	Dinosaur_all
D	Colorado River Valley FO (CRVFO)	4	0.003	0.1%	Flat_Tops	17	0.002	0.0%	Holy_Cross
E	Roan Plateau Planning area portion of CRVFO	4	0.002	0.0%	Flat_Tops	17	0.001	0.0%	Colorado
F	Grand Junction FO	4	0.000	0.0%	Arches	17	0.001	0.0%	Colorado
G	Uncompahgre FO	4	0.000	0.0%	Maroon_Bells	17	0.001	0.0%	Raggeds
H	Tres Rios FO	4	0.001	0.0%	Weminuche	17	0.002	0.0%	Chimney_Rock
I	Kremmling FO	4	0.001	0.0%	Rawah	17	0.000	0.0%	Savage_Run
J	RGFO #1	4	0.000	0.0%	Rocky_Mountain	17	0.000	0.0%	Lost_Creek
K	RGFO #2	4	0.000	0.0%	Mesa_Verde	17	0.000	0.0%	Sandia_Mountain
L	RGFO #3	4	0.000	0.0%	Rocky_Mountain	17	0.000	0.0%	Lost_Creek
M	RGFO #4	4	0.000	0.0%	Great_Sand_Dunes	17	0.000	0.0%	Greenhorn_Mounta
N	Southern Ute Indian Tribe	4	0.005	0.1%	Mesa_Verde	17	0.038	0.2%	Aztec_Ruins
O	New Mexico Farmington Field Office	4	0.011	0.3%	Mesa_Verde	17	0.416	2.4%	Aztec_Ruins
P	Combined future non-Federal O&G from BLM Planning Areas	4	0.035	0.9%	Rocky_Mountain	17	0.187	1.1%	Aztec_Ruins
Q	Combined Existing O&G from BLM Planning Areas	4	0.061	1.5%	Rocky_Mountain	17	0.041	0.2%	Aztec_Ruins
R	Mining from BLM Planning Areas	4	0.064	1.6%	Mount_Zirkel	17	0.041	0.2%	Dinosaur_all
S	All O&G in 12 km domain outside of the BLM Planning Areas	4	0.140	3.5%	Salt_Creek	17	0.415	2.4%	Dinosaur_all
T	Remaining anthropogenic emissions	4	12.159	304.0%	Bandelier	17	66.572	391.6%	Valle_De_Oro_NWR
U	Coal EGU Colorado + New Mexico	4	0.142	3.5%	Mount_Zirkel	17	0.119	0.7%	Aztec_Ruins
V	Oil/Gas EGU Colorado + New Mexico	4	0.000	0.0%	Great_Sand_Dunes	17	0.002	0.0%	Alamosa_NWR
W	All Other EGUs in 12 km domain	4	0.237	5.9%	Petrified_Forest	17	0.424	2.5%	Glen_Canyon
X	Total new federal O&G in CO	4	0.009	0.2%	Dinosaur_CO	17	0.014	0.1%	Dinosaur_all
Y	New total CRVFO	4	0.004	0.1%	Flat_Tops	17	0.003	0.0%	Colorado
Z	New total RGFO	4	0.000	0.0%	Rocky_Mountain	17	0.000	0.0%	Greenhorn_Mounta
A1	All new O&G in CO plus new non-federal FFO1	4	0.037	0.9%	Rocky_Mountain	17	0.226	1.3%	Aztec_Ruins
A2	New federal O&G + new Mining in CO	4	0.068	1.7%	Mount_Zirkel	17	0.054	0.3%	Dinosaur_all
A3	New federal O&G + new non-federal O&G + Mining in CO	4	0.076	1.9%	Mount_Zirkel	17	0.231	1.4%	Aztec_Ruins
A4	All EGUs in CO and NM	4	0.142	3.5%	Mount_Zirkel	17	0.119	0.7%	Aztec_Ruins
A5	2025 BC	4	4.304	107.6%	Salt_Creek	17	7.917	46.6%	Bitter_Lake_NWR
A6	2025 Total	4	16.201	405.0%	Bandelier	17	70.890	417.0%	Valle_De_Oro_NWR
A7	2011 Total	4	13.893	347.3%	Bandelier	17	58.983	347.0%	Valle_De_Oro_NWR
X1	Total new federal O&G in CO (X) using Brute-Force zero-out run	4	0.010	0.3%	Dinosaur_CO	17	0.015	0.1%	Dinosaur_all

Note that the thresholds shown are project-level thresholds. The comparisons shown above are for informational purposes only.

Table 5-7b. Maximum Annual PM_{10} concentration at any Class I or sensitive Class II area due to the different Source Groups for the 2025 Medium Development Scenario.

Choose	PM10, Annual	µg/m3							
Across grid cells	Maximum								

Group	Group Name	PSD Class I Increment	Max @ any Class I area	Percent of PSD Class I Increment	Class I Area where Max occurred	PSD Class II Increment	Max @ any Class II area	Percent of PSD Class II Increment	Class II Area where Max occurred
A	Natural emissions	4	9.282	232.0%	Bandelier	17	9.167	53.9%	Sevilleta_NWR
B	Little Snake FO	4	0.005	0.1%	Mount_Zirkel	17	0.004	0.0%	Dinosaur_all
C	White River FO	4	0.045	1.1%	Dinosaur_CO	17	0.069	0.4%	Dinosaur_all
D	Colorado River Valley FO (CRVFO)	4	0.002	0.1%	Flat_Tops	17	0.002	0.0%	Holy_Cross
E	Roan Plateau Planning area portion of CRVFO	4	0.002	0.1%	Flat_Tops	17	0.002	0.0%	Colorado
F	Grand Junction FO	4	0.011	0.3%	Arches	17	0.019	0.1%	Colorado
G	Uncompahgre FO	4	0.009	0.2%	Maroon_Bells	17	0.010	0.1%	Raggeds
H	Tres Rios FO	4	0.003	0.1%	Weminuche	17	0.009	0.1%	South_San_Juan
I	Kremmling FO	4	0.003	0.1%	Rawah	17	0.001	0.0%	Savage_Run
J	RGFO #1	4	0.001	0.0%	Rocky_Mountain	17	0.000	0.0%	Lost_Creek
K	RGFO #2	4	0.000	0.0%	Eagles_Nest	17	0.004	0.0%	Lost_Creek
L	RGFO #3	4	0.001	0.0%	Rocky_Mountain	17	0.000	0.0%	Lost_Creek
M	RGFO #4	4	0.000	0.0%	Great_Sand_Dunes	17	0.001	0.0%	Greenhorn_Mounta
N	Southern Ute Indian Tribe	4	0.004	0.1%	Mesa_Verde	17	0.031	0.2%	Aztec_Ruins
O	New Mexico Farmington Field Office	4	0.009	0.2%	Mesa_Verde	17	0.324	1.9%	Aztec_Ruins
P	Combined future non-Federal O&G from BLM Planning Areas	4	0.098	2.4%	Rocky_Mountain	17	0.373	2.2%	Aztec_Ruins
Q	Combined Existing O&G from BLM Planning Areas	4	0.060	1.5%	Rocky_Mountain	17	0.041	0.2%	Aztec_Ruins
R	Mining from BLM Planning Areas	4	0.066	1.6%	Mount_Zirkel	17	0.063	0.4%	Raggeds
S	All O&G in 12 km domain outside of the BLM Planning Areas	4	0.140	3.5%	Salt_Creek	17	0.414	2.4%	Dinosaur_all
T	Remaining anthropogenic emissions	4	12.159	304.0%	Bandelier	17	66.573	391.6%	Valle_De_Oro_NWR
U	Coal EGU Colorado + New Mexico	4	0.141	3.5%	Mount_Zirkel	17	0.119	0.7%	Aztec_Ruins
V	Oil/Gas EGU Colorado + New Mexico	4	0.000	0.0%	Great_Sand_Dunes	17	0.002	0.0%	Alamosa_NWR
W	All Other EGUs in 12 km domain	4	0.237	5.9%	Petrified_Forest	17	0.424	2.5%	Glen_Canyon
X	Total new federal O&G in CO	4	0.049	1.2%	Dinosaur_CO	17	0.077	0.5%	Dinosaur_all
Y	New total CRVFO	4	0.005	0.1%	Flat_Tops	17	0.003	0.0%	Colorado
Z	New total RGFO	4	0.002	0.0%	Rocky_Mountain	17	0.005	0.0%	Lost_Creek
A1	All new O&G in CO plus new non-federal FFO1	4	0.105	2.6%	Rocky_Mountain	17	0.411	2.4%	Aztec_Ruins
A2	New federal O&G + new Mining in CO	4	0.084	2.1%	Mount_Zirkel	17	0.115	0.7%	Dinosaur_all
A3	New federal O&G + new non-federal O&G + Mining in CO	4	0.116	2.9%	Mount_Zirkel	17	0.416	2.4%	Aztec_Ruins
A4	All EGUs in CO and NM	4	0.141	3.5%	Mount_Zirkel	17	0.119	0.7%	Aztec_Ruins
A5	2025 BC	4	4.304	107.6%	Salt_Creek	17	7.917	46.6%	Bitter_Lake_NWR
A6	2025 Total	4	16.205	405.1%	Bandelier	17	70.897	417.0%	Valle_De_Oro_NWR
A7	2011 Total	4	13.893	347.3%	Bandelier	17	58.983	347.0%	Valle_De_Oro_NWR
X1	Total new federal O&G in CO (X) using Brute-Force zero-out run	4	0.055	1.4%	Dinosaur_CO	17	0.078	0.5%	Dinosaur_all

Note that the thresholds shown are project-level thresholds. The comparisons shown above are for informational purposes only.

Table 5-8. Maximum 24-Hour PM_{10} concentration at any Class I or sensitive Class II area due to the different Source Groups for the 2025 High Development Scenario.

Choose	PM10, 24-hour	µg/m3							
Across grid cells	Maximum								

Group	Group Name	PSD Class I Increment	Max @ any Class I area	Percent of PSD Class I Increment	Class I Area where Max occurred	PSD Class II Increment	Max @ any Class II area	Percent of PSD Class II Increment	Class II Area where Max occurred
A	Natural emissions	8	674.493	8431.2%	Bandelier	30	372.753	1242.5%	Bear_Wallow
B	Little Snake FO	8	0.076	0.9%	Dinosaur_CO	30	0.109	0.4%	Dinosaur_all
C	White River FO	8	0.294	3.7%	Dinosaur_CO	30	0.531	1.8%	Dinosaur_all
D	Colorado River Valley FO (CRVFO)	8	0.016	0.2%	Flat_Tops	30	0.023	0.1%	Colorado
E	Roan Plateau Planning area portion of CRVFO	8	0.020	0.2%	Black_Canyon	30	0.040	0.1%	Colorado
F	Grand Junction FO	8	0.152	1.9%	Arches	30	0.218	0.7%	Colorado
G	Uncompahgre FO	8	0.059	0.7%	Maroon_Bells	30	0.055	0.2%	Raggeds
H	Tres Rios FO	8	0.037	0.5%	Weminuche	30	0.091	0.3%	South_San_Juan
I	Kremmling FO	8	0.017	0.2%	Rawah	30	0.010	0.0%	Savage_Run
J	RGFO #1	8	0.029	0.4%	Rocky_Mountain	30	0.020	0.1%	Lost_Creek
K	RGFO #2	8	0.004	0.1%	Eagles_Nest	30	0.033	0.1%	Lost_Creek
L	RGFO #3	8	0.032	0.4%	Rocky_Mountain	30	0.020	0.1%	Lost_Creek
M	RGFO #4	8	0.003	0.0%	Great_Sand_Dunes	30	0.008	0.0%	Greenhorn_Mounta
N	Southern Ute Indian Tribe	8	0.082	1.0%	Mesa_Verde	30	0.276	0.9%	Aztec_Ruins
O	New Mexico Farmington Field Office	8	0.186	2.3%	Mesa_Verde	30	2.129	7.1%	Aztec_Ruins
P	Combined future non-Federal O&G from BLM Planning Areas	8	1.413	17.7%	Rocky_Mountain	30	0.952	3.2%	Aztec_Ruins
Q	Combined Existing O&G from BLM Planning Areas	8	0.825	10.3%	Rocky_Mountain	30	0.649	2.2%	Lost_Creek
R	Mining from BLM Planning Areas	8	0.375	4.7%	Dinosaur_CO	30	0.558	1.9%	Dinosaur_all
S	All O&G in 12 km domain outside of the BLM Planning Areas	8	0.716	8.9%	Dinosaur_CO	30	3.055	10.2%	Dinosaur_all
T	Remaining anthropogenic emissions	8	43.280	541.0%	Bandelier	30	234.660	782.2%	Aztec_Ruins
U	Coal EGU Colorado + New Mexico	8	0.740	9.3%	Mount_Zirkel	30	0.888	3.0%	Aztec_Ruins
V	Oil/Gas EGU Colorado + New Mexico	8	0.013	0.2%	Great_Sand_Dunes	30	0.029	0.1%	Alamosa_NWR
W	All Other EGUs in 12 km domain	8	2.894	36.2%	Petrified_Forest	30	3.797	12.7%	Glen_Canyon
X	Total new federal O&G in CO	8	0.296	3.7%	Dinosaur_CO	30	0.539	1.8%	Dinosaur_all
Y	New total CRVFO	8	0.029	0.4%	Black_Canyon	30	0.060	0.2%	Colorado
Z	New total RGFO	8	0.055	0.7%	Rocky_Mountain	30	0.042	0.1%	Lost_Creek
A1	All new O&G in CO plus new non-federal FFO1	8	1.464	18.3%	Rocky_Mountain	30	1.217	4.1%	Aztec_Ruins
A2	New federal O&G + new Mining in CO	8	0.521	6.5%	Dinosaur_CO	30	0.803	2.7%	Dinosaur_all
A3	New federal O&G + new non-federal O&G + Mining in CO	8	1.469	18.4%	Rocky_Mountain	30	1.239	4.1%	Aztec_Ruins
A4	All EGUs in CO and NM	8	0.740	9.3%	Mount_Zirkel	30	0.890	3.0%	Aztec_Ruins
A5	2025 BC	8	16.773	209.7%	Salt_Creek	30	22.605	75.3%	Bitter_Lake_NWR
A6	2025 Total	8	692.086	8651.1%	Bandelier	30	383.645	1278.8%	Bear_Wallow
A7	2011 Total	8	692.117	8651.5%	Bandelier	30	384.256	1280.9%	Bear_Wallow
X1	Total new federal O&G in CO (X) using Brute-Force zero-out run	8	0.285	3.6%	Dinosaur_CO	30	0.502	1.7%	Dinosaur_all

Note that the thresholds shown are project-level thresholds. The comparisons shown above are for informational purposes only.

Table 5-8a. Maximum 24-Hour PM_{10} concentration at any Class I or sensitive Class II area due to the different Source Groups for the 2025 Low Development Scenario.

Choose	PM10, 24-hour	µg/m3							
Across grid cells	Maximum								

Group	Group Name	PSD Class I Increment	Max @ any Class I area	Percent of PSD Class I Increment	Class I Area where Max occurred	PSD Class II Increment	Max @ any Class II area	Percent of PSD Class II Increment	Class II Area where Max occurred
A	Natural emissions	8	674.487	8431.1%	Bandelier	30	372.753	1242.5%	Bear_Wallow
B	Little Snake FO	8	0.005	0.1%	Dinosaur_CO	30	0.008	0.0%	Dinosaur_all
C	White River FO	8	0.043	0.5%	Dinosaur_CO	30	0.072	0.2%	Dinosaur_all
D	Colorado River Valley FO (CRVFO)	8	0.011	0.1%	Maroon_Bells	30	0.016	0.1%	Colorado
E	Roan Plateau Planning area portion of CRVFO	8	0.011	0.1%	Black_Canyon	30	0.021	0.1%	Colorado
F	Grand Junction FO	8	0.004	0.1%	Arches	30	0.007	0.0%	Colorado
G	Uncompahgre FO	8	0.001	0.0%	Maroon_Bells	30	0.001	0.0%	Raggeds
H	Tres Rios FO	8	0.006	0.1%	Weminuche	30	0.005	0.0%	Chimney_Rock
I	Kremmling FO	8	0.002	0.0%	Rawah	30	0.001	0.0%	Savage_Run
J	RGFO #1	8	0.003	0.0%	Rocky_Mountain	30	0.002	0.0%	Lost_Creek
K	RGFO #2	8	0.000	0.0%	Bandelier	30	0.000	0.0%	Aztec_Ruins
L	RGFO #3	8	0.005	0.1%	Rocky_Mountain	30	0.003	0.0%	Lost_Creek
M	RGFO #4	8	0.000	0.0%	Great_Sand_Dunes	30	0.001	0.0%	Greenhorn_Mounta
N	Southern Ute Indian Tribe	8	0.041	0.5%	Mesa_Verde	30	0.144	0.5%	Aztec_Ruins
O	New Mexico Farmington Field Office	8	0.094	1.2%	Mesa_Verde	30	1.076	3.6%	Aztec_Ruins
P	Combined future non-Federal O&G from BLM Planning Areas	8	0.500	6.3%	Rocky_Mountain	30	0.482	1.6%	Aztec_Ruins
Q	Combined Existing O&G from BLM Planning Areas	8	0.865	10.8%	Rocky_Mountain	30	0.687	2.3%	Lost_Creek
R	Mining from BLM Planning Areas	8	0.378	4.7%	Dinosaur_CO	30	0.562	1.9%	Dinosaur_all
S	All O&G in 12 km domain outside of the BLM Planning Areas	8	0.716	9.0%	Dinosaur_CO	30	3.061	10.2%	Dinosaur_all
T	Remaining anthropogenic emissions	8	43.318	541.5%	Bandelier	30	234.725	782.4%	Aztec_Ruins
U	Coal EGU Colorado + New Mexico	8	0.750	9.4%	Mount_Zirkel	30	0.904	3.0%	Aztec_Ruins
V	Oil/Gas EGU Colorado + New Mexico	8	0.013	0.2%	Great_Sand_Dunes	30	0.029	0.1%	Alamosa_NWR
W	All Other EGUs in 12 km domain	8	2.894	36.2%	Petrified_Forest	30	3.797	12.7%	Glen_Canyon
X	Total new federal O&G in CO	8	0.044	0.5%	Dinosaur_CO	30	0.074	0.2%	Dinosaur_all
Y	New total CRVFO	8	0.019	0.2%	Black_Canyon	30	0.036	0.1%	Colorado
Z	New total RGFO	8	0.007	0.1%	Rocky_Mountain	30	0.005	0.0%	Lost_Creek
A1	All new O&G in CO plus new non-federal FFO1	8	0.506	6.3%	Rocky_Mountain	30	0.609	2.0%	Aztec_Ruins
A2	New federal O&G + new Mining in CO	8	0.395	4.9%	Dinosaur_CO	30	0.589	2.0%	Dinosaur_all
A3	New federal O&G + new non-federal O&G + Mining in CO	8	0.511	6.4%	Rocky_Mountain	30	0.631	2.1%	Aztec_Ruins
A4	All EGUs in CO and NM	8	0.750	9.4%	Mount_Zirkel	30	0.906	3.0%	Aztec_Ruins
A5	2025 BC	8	16.771	209.6%	Salt_Creek	30	22.605	75.3%	Bitter_Lake_NWR
A6	2025 Total	8	692.079	8651.0%	Bandelier	30	383.645	1278.8%	Bear_Wallow
A7	2011 Total	8	692.117	8651.5%	Bandelier	30	384.256	1280.9%	Bear_Wallow
X1	Total new federal O&G in CO (X) using Brute-Force zero-out run	8	0.053	0.7%	Black_Canyon	30	0.081	0.3%	Dinosaur_all

Note that the thresholds shown are project-level thresholds. The comparisons shown above are for informational purposes only.

Table 5-8b. Maximum 24-Hour PM_{10} concentration at any Class I or sensitive Class II area due to the different Source Groups for the 2025 Medium Development Scenario.

Choose	PM10, 24-hour	µg/m3							
Across grid cells	Maximum								

Group	Group Name	PSD Class I Increment	Max @ any Class I area	Percent of PSD Class I Increment	Class I Area where Max occurred	PSD Class II Increment	Max @ any Class II area	Percent of PSD Class II Increment	Class II Area where Max occurred
A	Natural emissions	8	674.486	8431.1%	Bandelier	30	372.753	1242.5%	Bear_Wallow
B	Little Snake FO	8	0.034	0.4%	Dinosaur_CO	30	0.047	0.2%	Dinosaur_all
C	White River FO	8	0.233	2.9%	Dinosaur_CO	30	0.384	1.3%	Dinosaur_all
D	Colorado River Valley FO (CRVFO)	8	0.010	0.1%	Maroon_Bells	30	0.016	0.1%	Colorado
E	Roan Plateau Planning area portion of CRVFO	8	0.015	0.2%	Black_Canyon	30	0.032	0.1%	Colorado
F	Grand Junction FO	8	0.092	1.1%	Arches	30	0.143	0.5%	Colorado
G	Uncompahgre FO	8	0.030	0.4%	Maroon_Bells	30	0.029	0.1%	Raggeds
H	Tres Rios FO	8	0.017	0.2%	Weminuche	30	0.040	0.1%	South_San_Juan
I	Kremmling FO	8	0.010	0.1%	Rawah	30	0.006	0.0%	Savage_Run
J	RGFO #1	8	0.012	0.1%	Rocky_Mountain	30	0.008	0.0%	Lost_Creek
K	RGFO #2	8	0.002	0.0%	Eagles_Nest	30	0.014	0.0%	Lost_Creek
L	RGFO #3	8	0.015	0.2%	Rocky_Mountain	30	0.010	0.0%	Lost_Creek
M	RGFO #4	8	0.002	0.0%	Great_Sand_Dunes	30	0.005	0.0%	Greenhorn_Mounta
N	Southern Ute Indian Tribe	8	0.034	0.4%	Mesa_Verde	30	0.113	0.4%	Aztec_Ruins
O	New Mexico Farmington Field Office	8	0.076	0.9%	Mesa_Verde	30	0.862	2.9%	Aztec_Ruins
P	Combined future non-Federal O&G from BLM Planning Areas	8	1.412	17.7%	Rocky_Mountain	30	0.959	3.2%	Aztec_Ruins
Q	Combined Existing O&G from BLM Planning Areas	8	0.826	10.3%	Rocky_Mountain	30	0.650	2.2%	Lost_Creek
R	Mining from BLM Planning Areas	8	0.375	4.7%	Dinosaur_CO	30	0.557	1.9%	Dinosaur_all
S	All O&G in 12 km domain outside of the BLM Planning Areas	8	0.716	8.9%	Dinosaur_CO	30	3.055	10.2%	Dinosaur_all
T	Remaining anthropogenic emissions	8	43.305	541.3%	Bandelier	30	234.709	782.4%	Aztec_Ruins
U	Coal EGU Colorado + New Mexico	8	0.741	9.3%	Mount_Zirkel	30	0.899	3.0%	Aztec_Ruins
V	Oil/Gas EGU Colorado + New Mexico	8	0.013	0.2%	Great_Sand_Dunes	30	0.029	0.1%	Alamosa_NWR
W	All Other EGUs in 12 km domain	8	2.894	36.2%	Petrified_Forest	30	3.797	12.7%	Glen_Canyon
X	Total new federal O&G in CO	8	0.234	2.9%	Dinosaur_CO	30	0.391	1.3%	Dinosaur_all
Y	New total CRVFO	8	0.023	0.3%	Black_Canyon	30	0.047	0.2%	Colorado
Z	New total RGFO	8	0.025	0.3%	Rocky_Mountain	30	0.020	0.1%	Lost_Creek
A1	All new O&G in CO plus new non-federal FFO1	8	1.435	17.9%	Rocky_Mountain	30	1.071	3.6%	Aztec_Ruins
A2	New federal O&G + new Mining in CO	8	0.468	5.9%	Dinosaur_CO	30	0.713	2.4%	Dinosaur_all
A3	New federal O&G + new non-federal O&G + Mining in CO	8	1.440	18.0%	Rocky_Mountain	30	1.093	3.6%	Aztec_Ruins
A4	All EGUs in CO and NM	8	0.741	9.3%	Mount_Zirkel	30	0.901	3.0%	Aztec_Ruins
A5	2025 BC	8	16.773	209.7%	Salt_Creek	30	22.605	75.3%	Bitter_Lake_NWR
A6	2025 Total	8	692.079	8651.0%	Bandelier	30	383.645	1278.8%	Bear_Wallow
A7	2011 Total	8	692.117	8651.5%	Bandelier	30	384.256	1280.9%	Bear_Wallow
X1	Total new federal O&G in CO (X) using Brute-Force zero-out run	8	0.212	2.7%	Dinosaur_CO	30	0.377	1.3%	Dinosaur_all

Note that the thresholds shown are project-level thresholds. The comparisons shown above are for informational purposes only.

5.1.2 PSD Concentration across All Class I and Sensitive Class II Areas

In this section we present examples of the contributions of PSD pollutant concentrations across all PSD Class I and sensitive Class II areas for several of the individual and combined Planning Area Source Groups. The tables below were obtained from the "Summary" sheet of Attachments A-1, A-2 and A-3 Excel spreadsheet that contains results for all of the Source Groups.

5.1.2.1 Individual BLM Planning Area PSD Contributions

All of the PSD pollutant concentrations at Class I areas due to new O&G on Federal lands within each of the 14 BLM other Planning Areas are well below the Class I and II PSD concentration increments. Tables of concentrations contributions at all of the Class I and sensitive Class II areas from each of the 35 Source Groups and the High and Low Development Scenarios can be found in Attachments A-1, A-2 and A-3. Table 5-9 display the contributions of new oil and gas emissions on Federal lands to PSD pollutant concentrations at all Class I and sensitive Class II areas in the CARMMS 12/4 km domain for three BLM Field Office Planning Areas, i.e., White River Field Office (WRFO), Colorado River Valley Field Office (CRVFO), and the RGFO #1 Planning Area.

Table 5-9. Contributions of new oil and gas emissions on Federal lands within the White River Field Office Planning Area (Source Group C) to PSD pollutant concentrations at Class I and sensitive Class II areas for the 2025 High Development Scenario.

Group	C	White River FO
Across grid cells	Maximum	Max

			Pollutant	NO_2 (µg/m³)	PM_{10} (µg/m³)		$PM_{2.5}$ (µg/m³)		SO_2 (µg/m³)			
			Averaging Time	Annual[3]	24-hour[2]	Annual[3]	24-hour[4]	Annual[3]	3-hour[2]	24-hour[2]	Annual[3]	
Class I	State	Owner		PSD Class I Increment[1]								ShortName
				2.5	8	4	2	1	25	5	2	
Arches NP	UT	NPS		0.018	0.076	0.005	0.066	0.004	0.092	0.050	0.005	CI_Arches
Bandelier Wilderness	NM	NPS		0.001	0.007	0.001	0.006	0.000	0.009	0.005	0.000	CI_Bandelier
Black Canyon of the Gunnison Wilderness	CO	NPS		0.022	0.096	0.007	0.084	0.006	0.097	0.061	0.005	CI_Black_Canyon
Bosque del Apache	NM	FWS		0.000	0.006	0.000	0.005	0.000	0.007	0.003	0.000	CI_Bosque
Canyonlands NP	UT	NPS		0.011	0.071	0.003	0.061	0.002	0.072	0.045	0.004	CI_Canyonlands
Capitol Reef NP	UT	NPS		0.001	0.017	0.001	0.015	0.001	0.034	0.013	0.001	CI_Capitol_Reef
Dinosaur NM	CO	NPS		0.497	0.294	0.060	0.229	0.042	0.842	0.297	0.068	CI_Dinosaur_CO
Eagles Nest Wilderness	CO	USFS		0.017	0.032	0.005	0.030	0.004	0.071	0.034	0.004	CI_Eagles_Nest
Flat Tops Wilderness	CO	USFS		0.098	0.095	0.018	0.079	0.013	0.371	0.124	0.021	CI_Flat_Tops
Gila Wilderness	NM	USFS		0.000	0.003	0.000	0.002	0.000	0.006	0.002	0.000	CI_Gila
Great Sand Dunes Wilderness-nps	CO	NPS		0.002	0.023	0.002	0.021	0.001	0.019	0.009	0.001	CI_Great_Sand_Dunes
La Garita Wilderness	CO	USFS		0.004	0.026	0.002	0.022	0.001	0.047	0.020	0.001	CI_La_Garita
Maroon Bells-Snowmass Wilderness	CO	USFS		0.020	0.039	0.005	0.034	0.004	0.102	0.046	0.005	CI_Maroon_Bells
Mesa Verde NP	CO	NPS		0.003	0.027	0.001	0.025	0.001	0.036	0.017	0.001	CI_Mesa_Verde
Mount Baldy Wilderness	AZ	USFS		0.000	0.005	0.000	0.004	0.000	0.007	0.002	0.000	CI_Mount_Baldy
Mount Zirkel Wilderness	CO	USFS		0.055	0.066	0.012	0.055	0.009	0.132	0.066	0.013	CI_Mount_Zirkel
Pecos Wilderness	NM	USFS		0.001	0.006	0.001	0.006	0.000	0.011	0.004	0.000	CI_Pecos
Petrified Forest NP	AZ	NPS		0.001	0.019	0.001	0.017	0.000	0.012	0.007	0.000	CI_Petrified_Forest
Rawah Wilderness	CO	USFS		0.022	0.048	0.007	0.044	0.005	0.101	0.032	0.006	CI_Rawah
Rocky Mountain NP	CO	NPS		0.017	0.036	0.005	0.033	0.004	0.103	0.027	0.005	CI_Rocky_Mountain
Salt Creek Wilderness	NM	FWS		0.000	0.003	0.000	0.002	0.000	0.006	0.002	0.000	CI_Salt_Creek
San Pedro Parks Wilderness	NM	USFS		0.001	0.011	0.001	0.009	0.000	0.013	0.006	0.000	CI_San_Pedro
Weminuche Wilderness	CO	USFS		0.003	0.022	0.001	0.018	0.001	0.039	0.014	0.001	CI_Weminuche
West Elk Wilderness	CO	USFS		0.012	0.052	0.004	0.046	0.003	0.099	0.039	0.003	CI_West_Elk
Wheeler Peak Wilderness	NM	USFS		0.001	0.007	0.001	0.007	0.001	0.013	0.006	0.001	CI_Wheeler_Peak
White Mountain Wilderness	NM	USFS		0.000	0.004	0.000	0.003	0.000	0.008	0.003	0.000	CI_White_Mountain
Class II	State	Owner		PSD Class II Increment[1]								ShortName
				25	30	17	9	4	512	91	20	
Alamosa National Wildlife Refuge	CO	FWS		0.002	0.028	0.002	0.027	0.002	0.021	0.010	0.001	CII_Alamosa_NWR
Aldo Leopold Wilderness	NM	USFS		0.000	0.002	0.000	0.002	0.000	0.007	0.003	0.000	CII_Aldo_Leopold
Apache Kid Wilderness	NM	USFS		0.000	0.005	0.000	0.004	0.000	0.006	0.003	0.000	CII_Apache_Kid
Aztec Ruins NM	NM	NPS		0.002	0.014	0.001	0.012	0.001	0.019	0.008	0.001	CII_Aztec_Ruins
Baca National Wildlife Refuge	CO	FWS		0.003	0.034	0.002	0.032	0.002	0.023	0.011	0.001	CII_Baca_NWR
Bear Wallow Wilderness	AZ	USFS		0.000	0.003	0.000	0.002	0.000	0.005	0.003	0.000	CII_Bear_Wallow
Bitter Lake National Wildlife Refuge	NM	FWS		0.000	0.003	0.000	0.002	0.000	0.006	0.002	0.000	CII_Bitter_Lake_NWR
Blue Range Wilderness	NM	USFS		0.000	0.003	0.000	0.002	0.000	0.005	0.002	0.000	CII_Blue_Range
Bosque Del Apache National Wildlife Refuge	NM	FWS		0.000	0.006	0.000	0.005	0.000	0.007	0.003	0.000	CII_Bosque_NWR
Browns Park National Wildlife Refuge	CO	FWS		0.019	0.040	0.004	0.029	0.003	0.222	0.044	0.004	CII_Browns_Park_NWR
Canyon de Chelly NM	AZ	NPS		0.002	0.018	0.001	0.017	0.001	0.026	0.013	0.001	CII_Canyon_de_Chelly
Capitan Mountains Wilderness	NM	USFS		0.000	0.005	0.000	0.004	0.000	0.008	0.003	0.000	CII_Capitan_Mountain
Chaco Culture NHP	NM	NPS		0.001	0.012	0.001	0.010	0.001	0.022	0.010	0.001	CII_Chaco_Culture
Chama River Canyon Wilderness	NM	USFS		0.001	0.009	0.001	0.008	0.001	0.014	0.007	0.001	CII_Chama_River_Cany
Chimney Rock NM	CO	USFS		0.002	0.012	0.001	0.010	0.001	0.020	0.009	0.001	CII_Chimney_Rock
Colorado NM	CO	NPS		0.047	0.136	0.010	0.122	0.008	0.225	0.095	0.010	CII_Colorado
Cruces Basin Wilderness	NM	USFS		0.001	0.008	0.001	0.007	0.001	0.019	0.008	0.001	CII_Cruces_Basin
Curecanti NRA	CO	NPS		0.015	0.065	0.006	0.060	0.005	0.073	0.040	0.004	CII_Curecanti
Dark Canyon Wilderness	UT	USFS		0.005	0.038	0.002	0.031	0.001	0.057	0.031	0.001	CII_Dark_Canyon
Dinosaur NM	CO	NPS		0.735	0.531	0.094	0.385	0.063	0.842	0.489	0.099	CII_Dinosaur_all
Dome Wilderness	NM	USFS		0.001	0.006	0.001	0.005	0.000	0.008	0.004	0.000	CII_Dome
El Malpais NM	NM	NPS		0.001	0.010	0.001	0.008	0.000	0.016	0.007	0.000	CII_El_Malpais
Escudilla Wilderness	AZ	USFS		0.000	0.004	0.000	0.004	0.000	0.006	0.003	0.000	CII_Escudilla
Flaming Gorge	UT	USFS		0.003	0.016	0.001	0.012	0.001	0.065	0.017	0.001	CII_Flaming_Gorge
Florissant Fossil Beds NM	CO	NPS		0.005	0.012	0.002	0.010	0.001	0.036	0.016	0.001	CII_Florissant_Fossi
Fossil Ridge Wilderness	CO	USFS		0.006	0.022	0.002	0.019	0.002	0.055	0.021	0.002	CII_Fossil_Ridge
Glen Canyon NRA	UT	NPS		0.008	0.050	0.003	0.040	0.002	0.066	0.035	0.003	CII_Glen_Canyon
Great Sand Dunes National Park	CO	NPS		0.002	0.028	0.002	0.027	0.002	0.020	0.010	0.001	CII_Great_Sand_Park
Great Sand Dunes National Preserve	CO	NPS		0.002	0.014	0.001	0.012	0.001	0.020	0.010	0.001	CII_Great_Sand_Prese
Greenhorn Mountain Wilderness	CO	USFS		0.002	0.010	0.001	0.009	0.001	0.020	0.011	0.001	CII_Greenhorn_Mounta
High Uintas Wilderness	UT	USFS		0.001	0.010	0.000	0.009	0.000	0.025	0.008	0.000	CII_High_Uintas
Holy Cross Wilderness	CO	USFS		0.018	0.037	0.005	0.033	0.004	0.087	0.035	0.004	CII_Holy_Cross
Hovenweep NM	CO	NPS		0.005	0.019	0.002	0.016	0.001	0.038	0.017	0.001	CII_Hovenweep
Hunter-Fryingpan Wilderness	CO	USFS		0.015	0.037	0.004	0.032	0.003	0.095	0.033	0.004	CII_Hunter_Fryingpan
Las Vegas National Wildlife Refuge	NM	FWS		0.001	0.005	0.001	0.005	0.000	0.007	0.003	0.000	CII_Las_Vegas_NWR
Latir Peak Wilderness	NM	USFS		0.001	0.009	0.001	0.008	0.001	0.013	0.006	0.001	CII_Latir_Peak
Lizard Head Wilderness	CO	USFS		0.005	0.025	0.002	0.021	0.001	0.050	0.023	0.001	CII_Lizard_Head
Lost Creek Wilderness	CO	USFS		0.008	0.019	0.003	0.016	0.002	0.046	0.019	0.002	CII_Lost_Creek
Manzano Mountain Wilderness	NM	USFS		0.001	0.023	0.001	0.018	0.001	0.022	0.010	0.001	CII_Manzano_Mountain
Maxwell National Wildlife Refuge	NM	FWS		0.001	0.007	0.001	0.006	0.001	0.011	0.004	0.000	CII_Maxwell_NWR
Monte Vista National Wildlife Refuge	CO	FWS		0.002	0.027	0.002	0.026	0.002	0.026	0.009	0.001	CII_Monte_Vista_NWR
Mount Evans Wilderness	CO	USFS		0.008	0.020	0.003	0.014	0.002	0.045	0.018	0.002	CII_Mount_Evans
Mount Sneffels Wilderness	CO	USFS		0.007	0.034	0.002	0.028	0.002	0.063	0.027	0.002	CII_Mount_Sneffels
Natural Bridges NM	UT	NPS		0.004	0.022	0.001	0.019	0.001	0.049	0.022	0.001	CII_Natural_Bridges
Navajo NM	AZ	NPS		0.002	0.016	0.001	0.013	0.000	0.024	0.018	0.001	CII_Navajo
Petroglyph NM	NM	NPS		0.001	0.011	0.001	0.009	0.001	0.011	0.006	0.000	CII_Petroglyph
Powderhorn Wilderness	CO	USFS		0.006	0.028	0.002	0.025	0.002	0.051	0.026	0.002	CII_Powderhorn
Raggeds Wilderness	CO	USFS		0.015	0.037	0.004	0.032	0.003	0.094	0.032	0.004	CII_Raggeds
Rio Mora National Wildlife Refuge and Conservation Area	NM	FWS		0.001	0.005	0.001	0.004	0.000	0.008	0.004	0.000	CII_Rio_Mora_NWR_and
Sandia Mountain Wilderness	NM	USFS		0.001	0.011	0.001	0.010	0.001	0.016	0.005	0.000	CII_Sandia_Mountain
Sangre de Cristo Wilderness	CO	USFS		0.004	0.017	0.001	0.015	0.001	0.034	0.013	0.001	CII_Sangre_de_Cristo
Savage Run Wilderness	WY	USFS		0.021	0.037	0.007	0.032	0.006	0.053	0.026	0.005	CII_Savage_Run
Sevilleta National Wildlife Refuge	NM	FWS		0.000	0.010	0.000	0.009	0.000	0.011	0.004	0.000	CII_Sevilleta_NWR
South San Juan Wilderness	CO	USFS		0.002	0.012	0.001	0.010	0.001	0.023	0.010	0.001	CII_South_San_Juan
Spanish Peaks Wilderness	CO	USFS		0.001	0.009	0.001	0.008	0.001	0.015	0.007	0.001	CII_Spanish_Peaks
Uncompahgre Wilderness	CO	USFS		0.008	0.047	0.003	0.039	0.003	0.065	0.029	0.002	CII_Uncompahgre
Valle De Oro National Wildlife Refuge	NM	FWS		0.001	0.015	0.001	0.013	0.001	0.011	0.005	0.000	CII_Valle_De_Oro_NWR
Withington Wilderness	NM	USFS		0.000	0.005	0.000	0.004	0.000	0.006	0.003	0.000	CII_Withington

Note that the thresholds shown are project-level thresholds. The comparisons shown above are for informational purposes only.

Table 5-9a. Contributions of new oil and gas emissions on Federal lands within the Colorado River Valley Field Office Planning Area to PSD pollutant concentrations at Class I and sensitive Class II areas for the 2025 High Development Scenario.

Group	D	Colorado River Valley FO (CRVFO)
Across grid cells	Maximum	Max

		Pollutant	NO_2 (µg/m³)	PM_{10} (µg/m³)		$PM_{2.5}$ (µg/m³)		SO_2 (µg/m³)			
		Averaging Time	Annual[3]	24-hour[2]	Annual[3]	24-hour[4]	Annual[3]	3-hour[2]	24-hour[2]	Annual[3]	
Class I	State	Owner	PSD Class I Increment[1]								ShortName
			2.5	8	4	2	1	25	5	2	
Arches NP	UT	NPS	0.003	0.012	0.001	0.008	0.000	0.000	0.000	0.000	CI_Arches
Bandelier Wilderness	NM	NPS	0.000	0.002	0.000	0.001	0.000	0.000	0.000	0.000	CI_Bandelier
Black Canyon of the Gunnison Wilderness	CO	NPS	0.003	0.011	0.001	0.009	0.001	0.000	0.000	0.000	CI_Black_Canyon
Bosque del Apache	NM	FWS	0.000	0.001	0.000	0.000	0.000	0.000	0.000	0.000	CI_Bosque
Canyonlands NP	UT	NPS	0.001	0.007	0.000	0.004	0.000	0.000	0.000	0.000	CI_Canyonlands
Capitol Reef NP	UT	NPS	0.000	0.002	0.000	0.001	0.000	0.000	0.000	0.000	CI_Capitol_Reef
Dinosaur NM	CO	NPS	0.003	0.004	0.000	0.002	0.000	0.001	0.000	0.000	CI_Dinosaur_CO
Eagles Nest Wilderness	CO	USFS	0.010	0.012	0.002	0.007	0.001	0.000	0.000	0.000	CI_Eagles_Nest
Flat Tops Wilderness	CO	USFS	0.019	0.016	0.004	0.007	0.002	0.001	0.000	0.000	CI_Flat_Tops
Gila Wilderness	NM	USFS	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	CI_Gila
Great Sand Dunes Wilderness-nps	CO	NPS	0.001	0.004	0.000	0.003	0.000	0.000	0.000	0.000	CI_Great_Sand_Dunes
La Garita Wilderness	CO	USFS	0.001	0.004	0.000	0.003	0.000	0.000	0.000	0.000	CI_La_Garita
Maroon Bells-Snowmass Wilderness	CO	USFS	0.011	0.015	0.003	0.010	0.001	0.000	0.000	0.000	CI_Maroon_Bells
Mesa Verde NP	CO	NPS	0.000	0.004	0.000	0.003	0.000	0.000	0.000	0.000	CI_Mesa_Verde
Mount Baldy Wilderness	AZ	USFS	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	CI_Mount_Baldy
Mount Zirkel Wilderness	CO	USFS	0.003	0.005	0.001	0.003	0.000	0.000	0.000	0.000	CI_Mount_Zirkel
Pecos Wilderness	NM	USFS	0.000	0.002	0.000	0.001	0.000	0.000	0.000	0.000	CI_Pecos
Petrified Forest NP	AZ	NPS	0.000	0.001	0.000	0.001	0.000	0.000	0.000	0.000	CI_Petrified_Forest
Rawah Wilderness	CO	USFS	0.002	0.003	0.001	0.002	0.000	0.000	0.000	0.000	CI_Rawah
Rocky Mountain NP	CO	NPS	0.004	0.007	0.001	0.006	0.001	0.000	0.000	0.000	CI_Rocky_Mountain
Salt Creek Wilderness	NM	FWS	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	CI_Salt_Creek
San Pedro Parks Wilderness	NM	USFS	0.000	0.001	0.000	0.001	0.000	0.000	0.000	0.000	CI_San_Pedro
Weminuche Wilderness	CO	USFS	0.000	0.002	0.000	0.002	0.000	0.000	0.000	0.000	CI_Weminuche
West Elk Wilderness	CO	USFS	0.004	0.010	0.001	0.007	0.001	0.000	0.000	0.000	CI_West_Elk
Wheeler Peak Wilderness	NM	USFS	0.000	0.002	0.000	0.002	0.000	0.000	0.000	0.000	CI_Wheeler_Peak
White Mountain Wilderness	NM	USFS	0.000	0.001	0.000	0.000	0.000	0.000	0.000	0.000	CI_White_Mountain
Class II	State	Owner	PSD Class II Increment[1]								ShortName
			25	30	17	9	4	512	91	20	
Alamosa National Wildlife Refuge	CO	FWS	0.001	0.006	0.000	0.005	0.000	0.000	0.000	0.000	CII_Alamosa_NWR
Aldo Leopold Wilderness	NM	USFS	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	CII_Aldo_Leopold
Apache Kid Wilderness	NM	USFS	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	CII_Apache_Kid
Aztec Ruins NM	NM	NPS	0.000	0.002	0.000	0.002	0.000	0.000	0.000	0.000	CII_Aztec_Ruins
Baca National Wildlife Refuge	CO	FWS	0.001	0.007	0.000	0.006	0.000	0.000	0.000	0.000	CII_Baca_NWR
Bear Wallow Wilderness	AZ	USFS	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	CII_Bear_Wallow
Bitter Lake National Wildlife Refuge	NM	FWS	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	CII_Bitter_Lake_NWR
Blue Range Wilderness	NM	USFS	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	CII_Blue_Range
Bosque Del Apache National Wildlife Refuge	NM	FWS	0.000	0.001	0.000	0.000	0.000	0.000	0.000	0.000	CII_Bosque_NWR
Browns Park National Wildlife Refuge	CO	FWS	0.000	0.001	0.000	0.001	0.000	0.000	0.000	0.000	CII_Browns_Park_NWR
Canyon de Chelly NM	AZ	NPS	0.000	0.003	0.000	0.003	0.000	0.000	0.000	0.000	CII_Canyon_de_Chelly
Capitan Mountains Wilderness	NM	USFS	0.000	0.001	0.000	0.000	0.000	0.000	0.000	0.000	CII_Capitan_Mountain
Chaco Culture NHP	NM	NPS	0.000	0.002	0.000	0.001	0.000	0.000	0.000	0.000	CII_Chaco_Culture
Chama River Canyon Wilderness	NM	USFS	0.000	0.001	0.000	0.001	0.000	0.000	0.000	0.000	CII_Chama_River_Cany
Chimney Rock NM	CO	USFS	0.000	0.002	0.000	0.001	0.000	0.000	0.000	0.000	CII_Chimney_Rock
Colorado NM	CO	NPS	0.007	0.023	0.002	0.017	0.001	0.001	0.000	0.000	CII_Colorado
Cruces Basin Wilderness	NM	USFS	0.000	0.002	0.000	0.002	0.000	0.000	0.000	0.000	CII_Cruces_Basin
Curecanti NRA	CO	NPS	0.002	0.008	0.001	0.006	0.001	0.000	0.000	0.000	CII_Curecanti
Dark Canyon Wilderness	UT	USFS	0.000	0.004	0.000	0.002	0.000	0.000	0.000	0.000	CII_Dark_Canyon
Dinosaur NM	CO	NPS	0.006	0.007	0.001	0.004	0.000	0.001	0.000	0.000	CII_Dinosaur_all
Dome Wilderness	NM	USFS	0.000	0.001	0.000	0.001	0.000	0.000	0.000	0.000	CII_Dome
El Malpais NM	NM	NPS	0.000	0.001	0.000	0.001	0.000	0.000	0.000	0.000	CII_El_Malpais
Escudilla Wilderness	AZ	USFS	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	CII_Escudilla
Flaming Gorge	UT	USFS	0.000	0.001	0.000	0.000	0.000	0.000	0.000	0.000	CII_Flaming_Gorge
Florissant Fossil Beds NM	CO	NPS	0.002	0.004	0.000	0.003	0.000	0.000	0.000	0.000	CII_Florissant_Fossi
Fossil Ridge Wilderness	CO	USFS	0.002	0.005	0.001	0.003	0.000	0.000	0.000	0.000	CII_Fossil_Ridge
Glen Canyon NRA	UT	NPS	0.001	0.007	0.000	0.004	0.000	0.000	0.000	0.000	CII_Glen_Canyon
Great Sand Dunes National Park	CO	NPS	0.001	0.006	0.000	0.005	0.000	0.000	0.000	0.000	CII_Great_Sand_Park
Great Sand Dunes National Preserve	CO	NPS	0.001	0.003	0.000	0.002	0.000	0.000	0.000	0.000	CII_Great_Sand_Prese
Greenhorn Mountain Wilderness	CO	USFS	0.001	0.002	0.000	0.001	0.000	0.000	0.000	0.000	CII_Greenhorn_Mounta
High Uintas Wilderness	UT	USFS	0.000	0.001	0.000	0.000	0.000	0.000	0.000	0.000	CII_High_Uintas
Holy Cross Wilderness	CO	USFS	0.010	0.013	0.002	0.008	0.001	0.000	0.000	0.000	CII_Holy_Cross
Hovenweep NM	CO	NPS	0.001	0.004	0.000	0.002	0.000	0.000	0.000	0.000	CII_Hovenweep
Hunter-Fryingpan Wilderness	CO	USFS	0.008	0.012	0.002	0.007	0.001	0.000	0.000	0.000	CII_Hunter_Fryingpan
Las Vegas National Wildlife Refuge	NM	FWS	0.000	0.001	0.000	0.001	0.000	0.000	0.000	0.000	CII_Las_Vegas_NWR
Latir Peak Wilderness	NM	USFS	0.000	0.002	0.000	0.002	0.000	0.000	0.000	0.000	CII_Latir_Peak
Lizard Head Wilderness	CO	USFS	0.001	0.003	0.000	0.002	0.000	0.000	0.000	0.000	CII_Lizard_Head
Lost Creek Wilderness	CO	USFS	0.003	0.005	0.001	0.003	0.000	0.000	0.000	0.000	CII_Lost_Creek
Manzano Mountain Wilderness	NM	USFS	0.000	0.003	0.000	0.002	0.000	0.000	0.000	0.000	CII_Manzano_Mountain
Maxwell National Wildlife Refuge	NM	FWS	0.000	0.001	0.000	0.001	0.000	0.000	0.000	0.000	CII_Maxwell_NWR
Monte Vista National Wildlife Refuge	CO	FWS	0.000	0.005	0.000	0.005	0.000	0.000	0.000	0.000	CII_Monte_Vista_NWR
Mount Evans Wilderness	CO	USFS	0.003	0.005	0.001	0.004	0.000	0.000	0.000	0.000	CII_Mount_Evans
Mount Sneffels Wilderness	CO	USFS	0.001	0.003	0.000	0.002	0.000	0.000	0.000	0.000	CII_Mount_Sneffels
Natural Bridges NM	UT	NPS	0.000	0.003	0.000	0.001	0.000	0.000	0.000	0.000	CII_Natural_Bridges
Navajo NM	AZ	NPS	0.000	0.002	0.000	0.001	0.000	0.000	0.000	0.000	CII_Navajo
Petroglyph NM	NM	NPS	0.000	0.002	0.000	0.001	0.000	0.000	0.000	0.000	CII_Petroglyph
Powderhorn Wilderness	CO	USFS	0.001	0.005	0.000	0.004	0.000	0.000	0.000	0.000	CII_Powderhorn
Raggeds Wilderness	CO	USFS	0.006	0.009	0.001	0.007	0.001	0.000	0.000	0.000	CII_Raggeds
Rio Mora National Wildlife Refuge and Conservation Area	NM	FWS	0.000	0.001	0.000	0.001	0.000	0.000	0.000	0.000	CII_Rio_Mora_NWR_and
Sandia Mountain Wilderness	NM	USFS	0.000	0.002	0.000	0.002	0.000	0.000	0.000	0.000	CII_Sandia_Mountain
Sangre de Cristo Wilderness	CO	USFS	0.001	0.003	0.000	0.002	0.000	0.000	0.000	0.000	CII_Sangre_de_Cristo
Savage Run Wilderness	WY	USFS	0.001	0.003	0.000	0.002	0.000	0.000	0.000	0.000	CII_Savage_Run
Sevilleta National Wildlife Refuge	NM	FWS	0.000	0.001	0.000	0.001	0.000	0.000	0.000	0.000	CII_Sevilleta_NWR
South San Juan Wilderness	CO	USFS	0.000	0.002	0.000	0.001	0.000	0.000	0.000	0.000	CII_South_San_Juan
Spanish Peaks Wilderness	CO	USFS	0.000	0.002	0.000	0.001	0.000	0.000	0.000	0.000	CII_Spanish_Peaks
Uncompahgre Wilderness	CO	USFS	0.001	0.004	0.000	0.003	0.000	0.000	0.000	0.000	CII_Uncompahgre
Valle De Oro National Wildlife Refuge	NM	FWS	0.000	0.002	0.000	0.002	0.000	0.000	0.000	0.000	CII_Valle_De_Oro_NWR
Withington Wilderness	NM	USFS	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	CII_Withington

Note that the thresholds shown are project-level thresholds. The comparisons shown above are for informational purposes only.

Table 5-9b. Contributions of new oil and gas emissions on Federal lands within the RGFO #1 Field Office Planning Area to PSD pollutant concentrations at Class I and sensitive Class II areas for the 2025 High Development Scenario.

Group	J	RGFO #1
Across grid cells	Maximum	Max

			Pollutant	NO_2 ($\mu g/m^3$)	PM_{10} ($\mu g/m^3$)		$PM_{2.5}$ ($\mu g/m^3$)		SO_2 ($\mu g/m^3$)			
			Averaging Time	Annual[3]	24-hour[2]	Annual[3]	24-hour[4]	Annual[3]	3-hour[2]	24-hour[2]	Annual[3]	
Class I	State	Owner	PSD Class I Increment[1]									ShortName
				2.5	8	4	2	1	25	5	2	
Arches NP	UT	NPS		0.000	0.001	0.000	0.000	0.000	0.000	0.000	0.000	CI_Arches
Bandelier Wilderness	NM	NPS		0.000	0.002	0.000	0.000	0.000	0.000	0.000	0.000	CI_Bandelier
Black Canyon of the Gunnison Wilderness	CO	NPS		0.000	0.002	0.000	0.001	0.000	0.000	0.000	0.000	CI_Black_Canyon
Bosque del Apache	NM	FWS		0.000	0.001	0.000	0.000	0.000	0.000	0.000	0.000	CI_Bosque
Canyonlands NP	UT	NPS		0.000	0.001	0.000	0.000	0.000	0.000	0.000	0.000	CI_Canyonlands
Capitol Reef NP	UT	NPS		0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	CI_Capitol_Reef
Dinosaur NM	CO	NPS		0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	CI_Dinosaur_CO
Eagles Nest Wilderness	CO	USFS		0.000	0.004	0.000	0.002	0.000	0.000	0.000	0.000	CI_Eagles_Nest
Flat Tops Wilderness	CO	USFS		0.000	0.002	0.000	0.001	0.000	0.000	0.000	0.000	CI_Flat_Tops
Gila Wilderness	NM	USFS		0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	CI_Gila
Great Sand Dunes Wilderness-nps	CO	NPS		0.000	0.003	0.000	0.002	0.000	0.000	0.000	0.000	CI_Great_Sand_Dunes
La Garita Wilderness	CO	USFS		0.000	0.002	0.000	0.001	0.000	0.000	0.000	0.000	CI_La_Garita
Maroon Bells-Snowmass Wilderness	CO	USFS		0.000	0.002	0.000	0.001	0.000	0.000	0.000	0.000	CI_Maroon_Bells
Mesa Verde NP	CO	NPS		0.000	0.001	0.000	0.000	0.000	0.000	0.000	0.000	CI_Mesa_Verde
Mount Baldy Wilderness	AZ	USFS		0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	CI_Mount_Baldy
Mount Zirkel Wilderness	CO	USFS		0.000	0.005	0.000	0.001	0.000	0.000	0.000	0.000	CI_Mount_Zirkel
Pecos Wilderness	NM	USFS		0.000	0.002	0.000	0.001	0.000	0.000	0.000	0.000	CI_Pecos
Petrified Forest NP	AZ	NPS		0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	CI_Petrified_Forest
Rawah Wilderness	CO	USFS		0.000	0.010	0.000	0.003	0.000	0.000	0.000	0.000	CI_Rawah
Rocky Mountain NP	CO	NPS		0.001	0.029	0.002	0.008	0.001	0.000	0.000	0.000	CI_Rocky_Mountain
Salt Creek Wilderness	NM	FWS		0.000	0.002	0.000	0.000	0.000	0.000	0.000	0.000	CI_Salt_Creek
San Pedro Parks Wilderness	NM	USFS		0.000	0.001	0.000	0.000	0.000	0.000	0.000	0.000	CI_San_Pedro
Weminuche Wilderness	CO	USFS		0.000	0.002	0.000	0.001	0.000	0.000	0.000	0.000	CI_Weminuche
West Elk Wilderness	CO	USFS		0.000	0.003	0.000	0.001	0.000	0.000	0.000	0.000	CI_West_Elk
Wheeler Peak Wilderness	NM	USFS		0.000	0.002	0.000	0.001	0.000	0.000	0.000	0.000	CI_Wheeler_Peak
White Mountain Wilderness	NM	USFS		0.000	0.001	0.000	0.000	0.000	0.000	0.000	0.000	CI_White_Mountain
Class II	State	Owner	PSD Class II Increment[1]									ShortName
				25	30	17	9	4	512	91	20	
Alamosa National Wildlife Refuge	CO	FWS		0.000	0.003	0.000	0.001	0.000	0.000	0.000	0.000	CII_Alamosa_NWR
Aldo Leopold Wilderness	NM	USFS		0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	CII_Aldo_Leopold
Apache Kid Wilderness	NM	USFS		0.000	0.001	0.000	0.000	0.000	0.000	0.000	0.000	CII_Apache_Kid
Aztec Ruins NM	NM	NPS		0.000	0.001	0.000	0.000	0.000	0.000	0.000	0.000	CII_Aztec_Ruins
Baca National Wildlife Refuge	CO	FWS		0.000	0.004	0.000	0.002	0.000	0.000	0.000	0.000	CII_Baca_NWR
Bear Wallow Wilderness	AZ	USFS		0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	CII_Bear_Wallow
Bitter Lake National Wildlife Refuge	NM	FWS		0.000	0.002	0.000	0.000	0.000	0.000	0.000	0.000	CII_Bitter_Lake_NWR
Blue Range Wilderness	NM	USFS		0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	CII_Blue_Range
Bosque Del Apache National Wildlife Refuge	NM	FWS		0.000	0.001	0.000	0.000	0.000	0.000	0.000	0.000	CII_Bosque_NWR
Browns Park National Wildlife Refuge	CO	FWS		0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	CII_Browns_Park_NWR
Canyon de Chelly NM	AZ	NPS		0.000	0.001	0.000	0.000	0.000	0.000	0.000	0.000	CII_Canyon_de_Chelly
Capitan Mountains Wilderness	NM	USFS		0.000	0.001	0.000	0.000	0.000	0.000	0.000	0.000	CII_Capitan_Mountain
Chaco Culture NHP	NM	NPS		0.000	0.001	0.000	0.000	0.000	0.000	0.000	0.000	CII_Chaco_Culture
Chama River Canyon Wilderness	NM	USFS		0.000	0.001	0.000	0.000	0.000	0.000	0.000	0.000	CII_Chama_River_Cany
Chimney Rock NM	CO	USFS		0.000	0.001	0.000	0.000	0.000	0.000	0.000	0.000	CII_Chimney_Rock
Colorado NM	CO	NPS		0.000	0.001	0.000	0.000	0.000	0.000	0.000	0.000	CII_Colorado
Cruces Basin Wilderness	NM	USFS		0.000	0.002	0.000	0.001	0.000	0.000	0.000	0.000	CII_Cruces_Basin
Curecanti NRA	CO	NPS		0.000	0.002	0.000	0.001	0.000	0.000	0.000	0.000	CII_Curecanti
Dark Canyon Wilderness	UT	USFS		0.000	0.001	0.000	0.000	0.000	0.000	0.000	0.000	CII_Dark_Canyon
Dinosaur NM	CO	NPS		0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	CII_Dinosaur_all
Dome Wilderness	NM	USFS		0.000	0.001	0.000	0.000	0.000	0.000	0.000	0.000	CII_Dome
El Malpais NM	NM	NPS		0.000	0.001	0.000	0.000	0.000	0.000	0.000	0.000	CII_El_Malpais
Escudilla Wilderness	AZ	USFS		0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	CII_Escudilla
Flaming Gorge	UT	USFS		0.000	0.001	0.000	0.000	0.000	0.000	0.000	0.000	CII_Flaming_Gorge
Florissant Fossil Beds NM	CO	NPS		0.001	0.013	0.001	0.006	0.000	0.000	0.000	0.000	CII_Florissant_Fossi
Fossil Ridge Wilderness	CO	USFS		0.000	0.003	0.000	0.001	0.000	0.000	0.000	0.000	CII_Fossil_Ridge
Glen Canyon NRA	UT	NPS		0.000	0.001	0.000	0.000	0.000	0.000	0.000	0.000	CII_Glen_Canyon
Great Sand Dunes National Park	CO	NPS		0.000	0.003	0.000	0.002	0.000	0.000	0.000	0.000	CII_Great_Sand_Park
Great Sand Dunes National Preserve	CO	NPS		0.000	0.004	0.000	0.002	0.000	0.000	0.000	0.000	CII_Great_Sand_Prese
Greenhorn Mountain Wilderness	CO	USFS		0.000	0.007	0.000	0.003	0.000	0.000	0.000	0.000	CII_Greenhorn_Mounta
High Uintas Wilderness	UT	USFS		0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	CII_High_Uintas
Holy Cross Wilderness	CO	USFS		0.000	0.004	0.000	0.002	0.000	0.000	0.000	0.000	CII_Holy_Cross
Hovenweep NM	CO	NPS		0.000	0.001	0.000	0.000	0.000	0.000	0.000	0.000	CII_Hovenweep
Hunter-Fryingpan Wilderness	CO	USFS		0.000	0.004	0.000	0.002	0.000	0.000	0.000	0.000	CII_Hunter_Fryingpan
Las Vegas National Wildlife Refuge	NM	FWS		0.000	0.003	0.000	0.001	0.000	0.000	0.000	0.000	CII_Las_Vegas_NWR
Latir Peak Wilderness	NM	USFS		0.000	0.002	0.000	0.001	0.000	0.000	0.000	0.000	CII_Latir_Peak
Lizard Head Wilderness	CO	USFS		0.000	0.001	0.000	0.000	0.000	0.000	0.000	0.000	CII_Lizard_Head
Lost Creek Wilderness	CO	USFS		0.001	0.020	0.001	0.009	0.000	0.000	0.000	0.000	CII_Lost_Creek
Manzano Mountain Wilderness	NM	USFS		0.000	0.003	0.000	0.001	0.000	0.000	0.000	0.000	CII_Manzano_Mountain
Maxwell National Wildlife Refuge	NM	FWS		0.000	0.005	0.000	0.002	0.000	0.000	0.000	0.000	CII_Maxwell_NWR
Monte Vista National Wildlife Refuge	CO	FWS		0.000	0.003	0.000	0.001	0.000	0.000	0.000	0.000	CII_Monte_Vista_NWR
Mount Evans Wilderness	CO	USFS		0.001	0.019	0.001	0.009	0.000	0.000	0.000	0.000	CII_Mount_Evans
Mount Sneffels Wilderness	CO	USFS		0.000	0.001	0.000	0.000	0.000	0.000	0.000	0.000	CII_Mount_Sneffels
Natural Bridges NM	UT	NPS		0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	CII_Natural_Bridges
Navajo NM	AZ	NPS		0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	CII_Navajo
Petroglyph NM	NM	NPS		0.000	0.002	0.000	0.001	0.000	0.000	0.000	0.000	CII_Petroglyph
Powderhorn Wilderness	CO	USFS		0.000	0.002	0.000	0.001	0.000	0.000	0.000	0.000	CII_Powderhorn
Raggeds Wilderness	CO	USFS		0.000	0.002	0.000	0.001	0.000	0.000	0.000	0.000	CII_Raggeds
Rio Mora National Wildlife Refuge and Conservation Area	NM	FWS		0.000	0.003	0.000	0.001	0.000	0.000	0.000	0.000	CII_Rio_Mora_NWR_and
Sandia Mountain Wilderness	NM	USFS		0.000	0.002	0.000	0.001	0.000	0.000	0.000	0.000	CII_Sandia_Mountain
Sangre de Cristo Wilderness	CO	USFS		0.000	0.006	0.000	0.003	0.000	0.000	0.000	0.000	CII_Sangre_de_Cristo
Savage Run Wilderness	WY	USFS		0.000	0.006	0.000	0.002	0.000	0.000	0.000	0.000	CII_Savage_Run
Sevilleta National Wildlife Refuge	NM	FWS		0.000	0.001	0.000	0.000	0.000	0.000	0.000	0.000	CII_Sevilleta_NWR
South San Juan Wilderness	CO	USFS		0.000	0.002	0.000	0.001	0.000	0.000	0.000	0.000	CII_South_San_Juan
Spanish Peaks Wilderness	CO	USFS		0.000	0.010	0.000	0.004	0.000	0.000	0.000	0.000	CII_Spanish_Peaks
Uncompahgre Wilderness	CO	USFS		0.000	0.001	0.000	0.001	0.000	0.000	0.000	0.000	CII_Uncompahgre
Valle De Oro National Wildlife Refuge	NM	FWS		0.000	0.001	0.000	0.001	0.000	0.000	0.000	0.000	CII_Valle_De_Oro_NWR
Withington Wilderness	NM	USFS		0.000	0.001	0.000	0.000	0.000	0.000	0.000	0.000	CII_Withington

Note that the thresholds shown are project-level thresholds. The comparisons shown above are for informational purposes only.

5.1.2.2 Combined BLM Planning Area PSD Contributions

Below we examine the contributions of emissions to concentrations at Class I areas for three of the combination Source Groups: (X) new Federal O&G within the 13 Colorado BLM Planning

Areas; (A2) new Federal O&G and mining within Colorado; and (A3) New federal O&G, new non-federal O&G and mining in Colorado. Results for the other Source Groups as well as results for the sensitive Class II areas are contained in Attachments A-1, A-2 and A-3.

The PSD contributions of Source Group X are below the Class I and Class II PSD increments at all Class I and sensitive Class II areas, respectively, for all PSD pollutants and averaging times and the 2025 High, Low and Medium Scenarios (Table 5-10). As a percentage of a PSD increment, the largest contribution at any Class I area due to Source Group X is 22% (0.54 $\mu g/m^3$), 2% (0.06 $\mu g/m^3$) and 19% (0.47 $\mu g/m^3$) of the 2.5 $\mu g/m^3$ annual NO_2 PSD Class I increment for the High, Low and Medium Development Scenarios, respectively, and occurs at the Dinosaur National Monument. These NO_2 impacts are primarily (92%) due to new Federal O&G emissions from the TRFO Planning Area.

The PSD pollutant concentrations contributions for the 2025 High and Low Development Scenarios are shown in Table 5-11 for Source Group A2 which is the Contributions of new oil and gas and mining on Federal lands within Colorado.

The contributions of new Federal O&G, new non-federal O&G and mining in Colorado (Source Group A3) to PSD pollutants at Class I areas for the three 2025 emission scenarios are shown in Table 5-12. Again, New federal O&G, new non-federal O&G and mining in Colorado produces PSD pollutant concentrations at all Class I and sensitive Class II areas that are all below the PSD Class I and II area increments.

Table 5-10. Contributions of new Federal oil and gas development on Federal lands in Colorado to PSD pollutant concentrations at Class I and sensitive Class II areas (Source Group X) for the 2025 High Development Scenario.

Group	X	Total new federal O&G in CO
Across grid cells	Maximum	Max

			Pollutant	NO_2 ($\mu g/m^3$)	PM_{10} ($\mu g/m^3$)		$PM_{2.5}$ ($\mu g/m^3$)		SO_2 ($\mu g/m^3$)			
			Averaging Time	Annual[3]	24-hour[2]	Annual[3]	24-hour[4]	Annual[3]	3-hour[2]	24-hour[2]	Annual[3]	
Class I	State	Owner		PSD Class I Increment[1]								ShortName
				2.5	8	4	2	1	25	5	2	
Arches NP	UT	NPS		0.091	0.215	0.029	0.141	0.014	0.095	0.052	0.005	CI_Arches
Bandelier Wilderness	NM	NPS		0.003	0.018	0.002	0.013	0.001	0.009	0.005	0.000	CI_Bandelier
Black Canyon of the Gunnison Wilderness	CO	NPS		0.058	0.221	0.022	0.163	0.014	0.100	0.064	0.005	CI_Black_Canyon
Bosque del Apache	NM	FWS		0.001	0.013	0.001	0.007	0.000	0.007	0.004	0.000	CI_Bosque
Canyonlands NP	UT	NPS		0.030	0.170	0.012	0.123	0.006	0.074	0.046	0.004	CI_Canyonlands
Capitol Reef NP	UT	NPS		0.003	0.038	0.002	0.026	0.001	0.036	0.014	0.001	CI_Capitol_Reef
Dinosaur NM	CO	NPS		0.542	0.296	0.069	0.231	0.045	0.843	0.299	0.069	CI_Dinosaur_CO
Eagles Nest Wilderness	CO	USFS		0.077	0.074	0.017	0.058	0.010	0.072	0.035	0.004	CI_Eagles_Nest
Flat Tops Wilderness	CO	USFS		0.180	0.113	0.037	0.087	0.020	0.372	0.125	0.021	CI_Flat_Tops
Gila Wilderness	NM	USFS		0.000	0.006	0.000	0.004	0.000	0.006	0.002	0.000	CI_Gila
Great Sand Dunes Wilderness-nps	CO	NPS		0.009	0.055	0.005	0.046	0.003	0.019	0.009	0.001	CI_Great_Sand_Dunes
La Garita Wilderness	CO	USFS		0.012	0.050	0.005	0.037	0.003	0.049	0.021	0.001	CI_La_Garita
Maroon Bells-Snowmass Wilderness	CO	USFS		0.109	0.111	0.029	0.066	0.012	0.104	0.048	0.005	CI_Maroon_Bells
Mesa Verde NP	CO	NPS		0.013	0.060	0.006	0.045	0.003	0.038	0.018	0.001	CI_Mesa_Verde
Mount Baldy Wilderness	AZ	USFS		0.000	0.009	0.000	0.005	0.000	0.007	0.003	0.000	CI_Mount_Baldy
Mount Zirkel Wilderness	CO	USFS		0.091	0.115	0.030	0.075	0.015	0.136	0.069	0.014	CI_Mount_Zirkel
Pecos Wilderness	NM	USFS		0.003	0.018	0.002	0.014	0.001	0.011	0.004	0.000	CI_Pecos
Petrified Forest NP	AZ	NPS		0.002	0.033	0.001	0.024	0.001	0.013	0.007	0.000	CI_Petrified_Forest
Rawah Wilderness	CO	USFS		0.053	0.088	0.021	0.067	0.010	0.103	0.033	0.006	CI_Rawah
Rocky Mountain NP	CO	NPS		0.039	0.073	0.014	0.063	0.008	0.105	0.028	0.005	CI_Rocky_Mountain
Salt Creek Wilderness	NM	FWS		0.001	0.008	0.001	0.004	0.000	0.006	0.002	0.000	CI_Salt_Creek
San Pedro Parks Wilderness	NM	USFS		0.003	0.024	0.002	0.014	0.001	0.014	0.007	0.001	CI_San_Pedro
Weminuche Wilderness	CO	USFS		0.014	0.043	0.009	0.028	0.003	0.039	0.015	0.001	CI_Weminuche
West Elk Wilderness	CO	USFS		0.051	0.124	0.015	0.089	0.008	0.100	0.040	0.003	CI_West_Elk
Wheeler Peak Wilderness	NM	USFS		0.004	0.020	0.003	0.014	0.001	0.013	0.006	0.001	CI_Wheeler_Peak
White Mountain Wilderness	NM	USFS		0.001	0.008	0.001	0.005	0.000	0.009	0.003	0.000	CI_White_Mountain
Class II	State	Owner		PSD Class II Increment[1]								ShortName
				25	30	17	9	4	512	91	20	
Alamosa National Wildlife Refuge	CO	FWS		0.007	0.058	0.006	0.053	0.004	0.022	0.010	0.001	CII_Alamosa_NWR
Aldo Leopold Wilderness	NM	USFS		0.000	0.005	0.000	0.003	0.000	0.007	0.003	0.000	CII_Aldo_Leopold
Apache Kid Wilderness	NM	USFS		0.000	0.009	0.000	0.006	0.000	0.006	0.003	0.000	CII_Apache_Kid
Aztec Ruins NM	NM	NPS		0.026	0.051	0.013	0.029	0.005	0.020	0.009	0.001	CII_Aztec_Ruins
Baca National Wildlife Refuge	CO	FWS		0.009	0.065	0.007	0.060	0.004	0.024	0.011	0.001	CII_Baca_NWR
Bear Wallow Wilderness	AZ	USFS		0.000	0.006	0.000	0.003	0.000	0.006	0.003	0.000	CII_Bear_Wallow
Bitter Lake National Wildlife Refuge	NM	FWS		0.001	0.010	0.001	0.005	0.000	0.007	0.002	0.000	CII_Bitter_Lake_NWR
Blue Range Wilderness	NM	USFS		0.000	0.005	0.000	0.003	0.000	0.005	0.003	0.000	CII_Blue_Range
Bosque Del Apache National Wildlife Refuge	NM	FWS		0.001	0.013	0.001	0.007	0.000	0.007	0.004	0.000	CII_Bosque_NWR
Browns Park National Wildlife Refuge	CO	FWS		0.032	0.048	0.006	0.034	0.003	0.224	0.045	0.004	CII_Browns_Park_NWR
Canyon de Chelly NM	AZ	NPS		0.003	0.045	0.002	0.036	0.002	0.027	0.014	0.001	CII_Canyon_de_Chelly
Capitan Mountains Wilderness	NM	USFS		0.001	0.010	0.001	0.006	0.000	0.008	0.003	0.000	CII_Capitan_Mountain
Chaco Culture NHP	NM	NPS		0.003	0.031	0.002	0.025	0.001	0.023	0.011	0.001	CII_Chaco_Culture
Chama River Canyon Wilderness	NM	USFS		0.005	0.022	0.003	0.013	0.001	0.014	0.007	0.001	CII_Chama_River_Cany
Chimney Rock NM	CO	USFS		0.029	0.044	0.016	0.018	0.005	0.021	0.009	0.001	CII_Chimney_Rock
Colorado NM	CO	NPS		0.173	0.386	0.052	0.296	0.026	0.234	0.099	0.010	CII_Colorado
Cruces Basin Wilderness	NM	USFS		0.006	0.026	0.005	0.016	0.002	0.019	0.008	0.001	CII_Cruces_Basin
Curecanti NRA	CO	NPS		0.039	0.162	0.016	0.118	0.010	0.076	0.041	0.004	CII_Curecanti
Dark Canyon Wilderness	UT	USFS		0.010	0.073	0.004	0.052	0.002	0.058	0.032	0.002	CII_Dark_Canyon
Dinosaur NM	CO	NPS		0.807	0.539	0.109	0.391	0.069	0.843	0.491	0.100	CII_Dinosaur_all
Dome Wilderness	NM	USFS		0.002	0.017	0.002	0.011	0.001	0.009	0.005	0.000	CII_Dome
El Malpais NM	NM	NPS		0.002	0.028	0.002	0.018	0.001	0.017	0.007	0.000	CII_El_Malpais
Escudilla Wilderness	AZ	USFS		0.000	0.008	0.000	0.005	0.000	0.007	0.003	0.000	CII_Escudilla
Flaming Gorge	UT	USFS		0.005	0.022	0.002	0.014	0.001	0.066	0.017	0.001	CII_Flaming_Gorge
Florissant Fossil Beds NM	CO	NPS		0.022	0.054	0.012	0.030	0.005	0.036	0.017	0.001	CII_Florissant_Fossi
Fossil Ridge Wilderness	CO	USFS		0.023	0.054	0.008	0.038	0.004	0.056	0.021	0.002	CII_Fossil_Ridge
Glen Canyon NRA	UT	NPS		0.022	0.123	0.010	0.075	0.005	0.068	0.037	0.003	CII_Glen_Canyon
Great Sand Dunes National Park	CO	NPS		0.009	0.062	0.006	0.053	0.004	0.020	0.010	0.001	CII_Great_Sand_Park
Great Sand Dunes National Preserve	CO	NPS		0.009	0.030	0.005	0.022	0.002	0.020	0.010	0.001	CII_Great_Sand_Prese
Greenhorn Mountain Wilderness	CO	USFS		0.010	0.028	0.006	0.015	0.002	0.021	0.011	0.001	CII_Greenhorn_Mounta
High Uintas Wilderness	UT	USFS		0.001	0.019	0.001	0.012	0.000	0.025	0.008	0.000	CII_High_Uintas
Holy Cross Wilderness	CO	USFS		0.062	0.096	0.017	0.073	0.009	0.088	0.036	0.005	CII_Holy_Cross
Hovenweep NM	CO	NPS		0.015	0.050	0.005	0.037	0.003	0.039	0.020	0.003	CII_Hovenweep
Hunter-Fryingpan Wilderness	CO	USFS		0.051	0.082	0.014	0.069	0.008	0.096	0.033	0.004	CII_Hunter_Fryingpan
Las Vegas National Wildlife Refuge	NM	FWS		0.002	0.017	0.002	0.014	0.001	0.007	0.003	0.000	CII_Las_Vegas_NWR
Latir Peak Wilderness	NM	USFS		0.005	0.023	0.003	0.018	0.002	0.013	0.007	0.001	CII_Latir_Peak
Lizard Head Wilderness	CO	USFS		0.016	0.048	0.005	0.035	0.003	0.052	0.024	0.001	CII_Lizard_Head
Lost Creek Wilderness	CO	USFS		0.037	0.050	0.017	0.029	0.007	0.047	0.019	0.002	CII_Lost_Creek
Manzano Mountain Wilderness	NM	USFS		0.003	0.051	0.003	0.034	0.002	0.023	0.010	0.001	CII_Manzano_Mountain
Maxwell National Wildlife Refuge	NM	FWS		0.005	0.021	0.003	0.012	0.001	0.011	0.004	0.000	CII_Maxwell_NWR
Monte Vista National Wildlife Refuge	CO	FWS		0.007	0.055	0.006	0.050	0.004	0.027	0.009	0.001	CII_Monte_Vista_NWR
Mount Evans Wilderness	CO	USFS		0.032	0.046	0.011	0.035	0.006	0.046	0.018	0.002	CII_Mount_Evans
Mount Sneffels Wilderness	CO	USFS		0.020	0.069	0.007	0.046	0.004	0.066	0.028	0.002	CII_Mount_Sneffels
Natural Bridges NM	UT	NPS		0.008	0.049	0.003	0.032	0.002	0.052	0.023	0.001	CII_Natural_Bridges
Navajo NM	AZ	NPS		0.003	0.036	0.002	0.021	0.001	0.025	0.018	0.001	CII_Navajo
Petroglyph NM	NM	NPS		0.002	0.028	0.002	0.021	0.001	0.012	0.006	0.000	CII_Petroglyph
Powderhorn Wilderness	CO	USFS		0.016	0.062	0.006	0.048	0.004	0.053	0.027	0.002	CII_Powderhorn
Raggeds Wilderness	CO	USFS		0.122	0.122	0.032	0.071	0.013	0.096	0.033	0.004	CII_Raggeds
Rio Mora National Wildlife Refuge and Conservation Area	NM	FWS		0.002	0.014	0.002	0.010	0.001	0.008	0.004	0.000	CII_Rio_Mora_NWR_and
Sandia Mountain Wilderness	NM	USFS		0.002	0.032	0.002	0.023	0.002	0.016	0.005	0.000	CII_Sandia_Mountain
Sangre de Cristo Wilderness	CO	USFS		0.013	0.040	0.005	0.031	0.003	0.035	0.014	0.001	CII_Sangre_de_Cristo
Savage Run Wilderness	WY	USFS		0.040	0.055	0.016	0.043	0.009	0.055	0.027	0.005	CII_Savage_Run
Sevilleta National Wildlife Refuge	NM	FWS		0.001	0.022	0.001	0.017	0.001	0.012	0.005	0.000	CII_Sevilleta_NWR
South San Juan Wilderness	CO	USFS		0.036	0.107	0.022	0.025	0.005	0.023	0.010	0.001	CII_South_San_Juan
Spanish Peaks Wilderness	CO	USFS		0.009	0.028	0.004	0.017	0.002	0.015	0.008	0.001	CII_Spanish_Peaks
Uncompahgre Wilderness	CO	USFS		0.020	0.096	0.008	0.067	0.005	0.067	0.030	0.002	CII_Uncompahgre
Valle De Oro National Wildlife Refuge	NM	FWS		0.002	0.032	0.003	0.027	0.002	0.012	0.005	0.000	CII_Valle_De_Oro_NWR
Withington Wilderness	NM	USFS		0.000	0.009	0.000	0.005	0.000	0.006	0.003	0.000	CII_Withington

Note that the thresholds shown are project-level thresholds. The comparisons shown above are for informational purposes only.

Table 5-10a. Contributions of new Federal oil and gas development on Federal lands in Colorado to PSD pollutant concentrations at Class I and sensitive Class II areas (Source Group X) for the 2025 Low Development Scenario.

Group	X	Total new federal O&G in CO
Across grid cells	Maximum	Max

		Pollutant	NO_2 ($\mu g/m^3$)	PM_{10} ($\mu g/m^3$)		$PM_{2.5}$ ($\mu g/m^3$)		SO_2 ($\mu g/m^3$)			
		Averaging Time	Annual[3]	24-hour[2]	Annual[3]	24-hour[4]	Annual[3]	3-hour[2]	24-hour[2]	Annual[3]	
Class I	State	Owner	PSD Class I Increment[1]								ShortName
			2.5	8	4	2	1	25	5	2	
Arches NP	UT	NPS	0.009	0.032	0.002	0.026	0.001	0.011	0.006	0.001	CI_Arches
Bandelier Wilderness	NM	NPS	0.000	0.003	0.000	0.002	0.000	0.001	0.001	0.000	CI_Bandelier
Black Canyon of the Gunnison Wilderness	CO	NPS	0.008	0.035	0.003	0.030	0.002	0.012	0.007	0.001	CI_Black_Canyon
Bosque del Apache	NM	FWS	0.000	0.002	0.000	0.001	0.000	0.001	0.000	0.000	CI_Bosque
Canyonlands NP	UT	NPS	0.004	0.024	0.001	0.021	0.001	0.008	0.006	0.000	CI_Canyonlands
Capitol Reef NP	UT	NPS	0.000	0.006	0.000	0.004	0.000	0.005	0.002	0.000	CI_Capitol_Reef
Dinosaur NM	CO	NPS	0.064	0.044	0.009	0.038	0.006	0.101	0.034	0.008	CI_Dinosaur_CO
Eagles Nest Wilderness	CO	USFS	0.016	0.018	0.004	0.014	0.002	0.008	0.004	0.001	CI_Eagles_Nest
Flat Tops Wilderness	CO	USFS	0.040	0.022	0.007	0.017	0.004	0.041	0.015	0.003	CI_Flat_Tops
Gila Wilderness	NM	USFS	0.000	0.001	0.000	0.001	0.000	0.001	0.000	0.000	CI_Gila
Great Sand Dunes Wilderness-nps	CO	NPS	0.002	0.008	0.001	0.007	0.000	0.002	0.001	0.000	CI_Great_Sand_Dunes
La Garita Wilderness	CO	USFS	0.002	0.008	0.001	0.007	0.000	0.006	0.002	0.000	CI_La_Garita
Maroon Bells-Snowmass Wilderness	CO	USFS	0.017	0.020	0.004	0.016	0.002	0.012	0.006	0.001	CI_Maroon_Bells
Mesa Verde NP	CO	NPS	0.002	0.010	0.001	0.008	0.000	0.005	0.002	0.000	CI_Mesa_Verde
Mount Baldy Wilderness	AZ	USFS	0.000	0.001	0.000	0.001	0.000	0.001	0.000	0.000	CI_Mount_Baldy
Mount Zirkel Wilderness	CO	USFS	0.013	0.014	0.004	0.010	0.002	0.017	0.009	0.002	CI_Mount_Zirkel
Pecos Wilderness	NM	USFS	0.000	0.003	0.000	0.002	0.000	0.001	0.001	0.000	CI_Pecos
Petrified Forest NP	AZ	NPS	0.000	0.004	0.000	0.003	0.000	0.002	0.001	0.000	CI_Petrified_Forest
Rawah Wilderness	CO	USFS	0.007	0.010	0.003	0.008	0.001	0.012	0.004	0.001	CI_Rawah
Rocky Mountain NP	CO	NPS	0.008	0.013	0.002	0.011	0.001	0.013	0.003	0.001	CI_Rocky_Mountain
Salt Creek Wilderness	NM	FWS	0.000	0.001	0.000	0.001	0.000	0.001	0.000	0.000	CI_Salt_Creek
San Pedro Parks Wilderness	NM	USFS	0.000	0.003	0.000	0.002	0.000	0.002	0.001	0.000	CI_San_Pedro
Weminuche Wilderness	CO	USFS	0.002	0.007	0.001	0.005	0.000	0.005	0.002	0.000	CI_Weminuche
West Elk Wilderness	CO	USFS	0.007	0.018	0.002	0.015	0.001	0.012	0.005	0.000	CI_West_Elk
Wheeler Peak Wilderness	NM	USFS	0.001	0.003	0.000	0.003	0.000	0.002	0.001	0.000	CI_Wheeler_Peak
White Mountain Wilderness	NM	USFS	0.000	0.001	0.000	0.001	0.000	0.001	0.000	0.000	CI_White_Mountain
Class II	State	Owner	PSD Class II Increment[1]								ShortName
			25	30	17	9	4	512	91	20	
Alamosa National Wildlife Refuge	CO	FWS	0.001	0.010	0.001	0.010	0.001	0.003	0.001	0.000	CII_Alamosa_NWR
Aldo Leopold Wilderness	NM	USFS	0.000	0.001	0.000	0.000	0.000	0.001	0.000	0.000	CII_Aldo_Leopold
Apache Kid Wilderness	NM	USFS	0.000	0.001	0.000	0.001	0.000	0.001	0.000	0.000	CII_Apache_Kid
Aztec Ruins NM	NM	NPS	0.003	0.007	0.001	0.004	0.001	0.002	0.001	0.000	CII_Aztec_Ruins
Baca National Wildlife Refuge	CO	FWS	0.002	0.012	0.001	0.011	0.001	0.003	0.001	0.000	CII_Baca_NWR
Bear Wallow Wilderness	AZ	USFS	0.000	0.001	0.000	0.000	0.000	0.001	0.000	0.000	CII_Bear_Wallow
Bitter Lake National Wildlife Refuge	NM	FWS	0.000	0.001	0.000	0.001	0.000	0.001	0.000	0.000	CII_Bitter_Lake_NWR
Blue Range Wilderness	NM	USFS	0.000	0.001	0.000	0.000	0.000	0.001	0.000	0.000	CII_Blue_Range
Bosque Del Apache National Wildlife Refuge	NM	FWS	0.000	0.002	0.000	0.001	0.000	0.001	0.000	0.000	CII_Bosque_NWR
Browns Park National Wildlife Refuge	CO	FWS	0.004	0.006	0.001	0.004	0.000	0.025	0.005	0.000	CII_Browns_Park_NWR
Canyon de Chelly NM	AZ	NPS	0.001	0.007	0.000	0.006	0.000	0.004	0.002	0.000	CII_Canyon_de_Chelly
Capitan Mountains Wilderness	NM	USFS	0.000	0.002	0.000	0.001	0.000	0.001	0.000	0.000	CII_Capitan_Mountain
Chaco Culture NHP	NM	NPS	0.000	0.005	0.000	0.004	0.000	0.003	0.001	0.000	CII_Chaco_Culture
Chama River Canyon Wilderness	NM	USFS	0.001	0.003	0.000	0.002	0.000	0.002	0.001	0.000	CII_Chama_River_Cany
Chimney Rock NM	CO	USFS	0.003	0.006	0.002	0.003	0.001	0.003	0.001	0.000	CII_Chimney_Rock
Colorado NM	CO	NPS	0.021	0.060	0.005	0.051	0.003	0.029	0.011	0.001	CII_Colorado
Cruces Basin Wilderness	NM	USFS	0.001	0.003	0.000	0.002	0.000	0.002	0.001	0.000	CII_Cruces_Basin
Curecanti NRA	CO	NPS	0.006	0.024	0.002	0.021	0.002	0.009	0.005	0.000	CII_Curecanti
Dark Canyon Wilderness	UT	USFS	0.001	0.011	0.000	0.008	0.000	0.007	0.004	0.000	CII_Dark_Canyon
Dinosaur NM	CO	NPS	0.098	0.074	0.014	0.065	0.010	0.101	0.058	0.012	CII_Dinosaur_all
Dome Wilderness	NM	USFS	0.000	0.002	0.000	0.002	0.000	0.001	0.001	0.000	CII_Dome
El Malpais NM	NM	NPS	0.000	0.003	0.000	0.002	0.000	0.002	0.001	0.000	CII_El_Malpais
Escudilla Wilderness	AZ	USFS	0.000	0.001	0.000	0.001	0.000	0.001	0.000	0.000	CII_Escudilla
Flaming Gorge	UT	USFS	0.001	0.003	0.000	0.002	0.000	0.008	0.002	0.000	CII_Flaming_Gorge
Florissant Fossil Beds NM	CO	NPS	0.003	0.007	0.001	0.004	0.001	0.005	0.002	0.000	CII_Florissant_Fossi
Fossil Ridge Wilderness	CO	USFS	0.004	0.009	0.001	0.007	0.001	0.007	0.003	0.000	CII_Fossil_Ridge
Glen Canyon NRA	UT	NPS	0.003	0.020	0.001	0.014	0.001	0.007	0.005	0.000	CII_Glen_Canyon
Great Sand Dunes National Park	CO	NPS	0.002	0.010	0.001	0.009	0.001	0.003	0.001	0.000	CII_Great_Sand_Park
Great Sand Dunes National Preserve	CO	NPS	0.001	0.006	0.001	0.004	0.000	0.003	0.001	0.000	CII_Great_Sand_Prese
Greenhorn Mountain Wilderness	CO	USFS	0.001	0.004	0.001	0.003	0.000	0.003	0.001	0.000	CII_Greenhorn_Mounta
High Uintas Wilderness	UT	USFS	0.000	0.002	0.000	0.002	0.000	0.003	0.001	0.000	CII_High_Uintas
Holy Cross Wilderness	CO	USFS	0.015	0.021	0.003	0.017	0.002	0.011	0.005	0.001	CII_Holy_Cross
Hovenweep NM	CO	NPS	0.003	0.008	0.001	0.006	0.000	0.004	0.003	0.000	CII_Hovenweep
Hunter-Fryingpan Wilderness	CO	USFS	0.012	0.019	0.003	0.017	0.002	0.011	0.004	0.000	CII_Hunter_Fryingpan
Las Vegas National Wildlife Refuge	NM	FWS	0.000	0.003	0.000	0.002	0.000	0.001	0.000	0.000	CII_Las_Vegas_NWR
Latir Peak Wilderness	NM	USFS	0.001	0.004	0.000	0.003	0.000	0.002	0.001	0.000	CII_Latir_Peak
Lizard Head Wilderness	CO	USFS	0.003	0.008	0.001	0.006	0.000	0.006	0.003	0.000	CII_Lizard_Head
Lost Creek Wilderness	CO	USFS	0.006	0.008	0.001	0.006	0.001	0.006	0.002	0.000	CII_Lost_Creek
Manzano Mountain Wilderness	NM	USFS	0.001	0.008	0.000	0.006	0.000	0.003	0.001	0.000	CII_Manzano_Mountain
Maxwell National Wildlife Refuge	NM	FWS	0.001	0.003	0.000	0.002	0.000	0.001	0.001	0.000	CII_Maxwell_NWR
Monte Vista National Wildlife Refuge	CO	FWS	0.001	0.010	0.001	0.009	0.001	0.003	0.001	0.000	CII_Monte_Vista_NWR
Mount Evans Wilderness	CO	USFS	0.006	0.010	0.002	0.008	0.001	0.006	0.002	0.000	CII_Mount_Evans
Mount Sneffels Wilderness	CO	USFS	0.003	0.010	0.001	0.008	0.001	0.008	0.003	0.000	CII_Mount_Sneffels
Natural Bridges NM	UT	NPS	0.001	0.007	0.000	0.005	0.000	0.007	0.003	0.000	CII_Natural_Bridges
Navajo NM	AZ	NPS	0.001	0.005	0.000	0.003	0.000	0.003	0.002	0.000	CII_Navajo
Petroglyph NM	NM	NPS	0.000	0.004	0.000	0.003	0.000	0.001	0.001	0.000	CII_Petroglyph
Powderhorn Wilderness	CO	USFS	0.002	0.010	0.001	0.008	0.001	0.006	0.003	0.000	CII_Powderhorn
Raggeds Wilderness	CO	USFS	0.012	0.018	0.003	0.013	0.002	0.011	0.004	0.000	CII_Raggeds
Rio Mora National Wildlife Refuge and Conservation Area	NM	FWS	0.000	0.002	0.000	0.001	0.000	0.001	0.000	0.000	CII_Rio_Mora_NWR_and
Sandia Mountain Wilderness	NM	USFS	0.000	0.005	0.000	0.004	0.000	0.002	0.001	0.000	CII_Sandia_Mountain
Sangre de Cristo Wilderness	CO	USFS	0.002	0.006	0.001	0.005	0.000	0.004	0.002	0.000	CII_Sangre_de_Cristo
Savage Run Wilderness	WY	USFS	0.006	0.008	0.002	0.006	0.001	0.006	0.003	0.001	CII_Savage_Run
Sevilleta National Wildlife Refuge	NM	FWS	0.000	0.003	0.000	0.003	0.000	0.001	0.001	0.000	CII_Sevilleta_NWR
South San Juan Wilderness	CO	USFS	0.002	0.004	0.001	0.003	0.000	0.003	0.001	0.000	CII_South_San_Juan
Spanish Peaks Wilderness	CO	USFS	0.001	0.004	0.001	0.003	0.000	0.002	0.001	0.000	CII_Spanish_Peaks
Uncompahgre Wilderness	CO	USFS	0.003	0.015	0.001	0.012	0.001	0.008	0.004	0.000	CII_Uncompahgre
Valle De Oro National Wildlife Refuge	NM	FWS	0.000	0.005	0.000	0.004	0.000	0.001	0.001	0.000	CII_Valle_De_Oro_NWR
Withington Wilderness	NM	USFS	0.000	0.001	0.000	0.001	0.000	0.001	0.000	0.000	CII_Withington

Note that the thresholds shown are project-level thresholds. The comparisons shown above are for informational purposes only.

Table 5-10b. Contributions of new Federal oil and gas development on Federal lands in Colorado to PSD pollutant concentrations at Class I and sensitive Class II areas (Source Group X) for the 2025 Medium Development Scenario.

Group	X	Total new federal O&G in CO
Across grid cells	Maximum	Max

			Pollutant	NO_2 ($\mu g/m^3$)	PM_{10} ($\mu g/m^3$)		$PM_{2.5}$ ($\mu g/m^3$)		SO_2 ($\mu g/m^3$)			
			Averaging Time	Annual[3]	24-hour[2]	Annual[3]	24-hour[4]	Annual[3]	3-hour[2]	24-hour[2]	Annual[3]	
Class I	State	Owner		PSD Class I Increment[1]								ShortName
				2.5	8	4	2	1	25	5	2	
Arches NP	UT	NPS		0.076	0.143	0.017	0.117	0.010	0.095	0.052	0.005	CI_Arches
Bandelier Wilderness	NM	NPS		0.002	0.013	0.001	0.011	0.001	0.009	0.005	0.000	CI_Bandelier
Black Canyon of the Gunnison Wilderness	CO	NPS		0.048	0.161	0.014	0.137	0.011	0.100	0.064	0.005	CI_Black_Canyon
Bosque del Apache	NM	FWS		0.001	0.009	0.000	0.006	0.000	0.007	0.004	0.000	CI_Bosque
Canyonlands NP	UT	NPS		0.026	0.125	0.007	0.102	0.004	0.073	0.046	0.004	CI_Canyonlands
Capitol Reef NP	UT	NPS		0.003	0.026	0.001	0.023	0.001	0.036	0.014	0.001	CI_Capitol_Reef
Dinosaur NM	CO	NPS		0.469	0.234	0.049	0.207	0.039	0.843	0.299	0.069	CI_Dinosaur_CO
Eagles Nest Wilderness	CO	USFS		0.070	0.056	0.011	0.049	0.008	0.072	0.035	0.004	CI_Eagles_Nest
Flat Tops Wilderness	CO	USFS		0.155	0.090	0.024	0.079	0.017	0.372	0.125	0.021	CI_Flat_Tops
Gila Wilderness	NM	USFS		0.000	0.004	0.000	0.003	0.000	0.006	0.002	0.000	CI_Gila
Great Sand Dunes Wilderness-nps	CO	NPS		0.007	0.042	0.003	0.038	0.002	0.019	0.009	0.001	CI_Great_Sand_Dunes
La Garita Wilderness	CO	USFS		0.010	0.037	0.003	0.032	0.002	0.048	0.020	0.001	CI_La_Garita
Maroon Bells-Snowmass Wilderness	CO	USFS		0.084	0.072	0.016	0.056	0.009	0.103	0.048	0.005	CI_Maroon_Bells
Mesa Verde NP	CO	NPS		0.011	0.046	0.003	0.038	0.002	0.038	0.018	0.001	CI_Mesa_Verde
Mount Baldy Wilderness	AZ	USFS		0.000	0.006	0.000	0.005	0.000	0.007	0.003	0.000	CI_Mount_Baldy
Mount Zirkel Wilderness	CO	USFS		0.077	0.079	0.018	0.064	0.012	0.136	0.069	0.014	CI_Mount_Zirkel
Pecos Wilderness	NM	USFS		0.002	0.013	0.001	0.011	0.001	0.011	0.004	0.000	CI_Pecos
Petrified Forest NP	AZ	NPS		0.002	0.025	0.001	0.021	0.001	0.013	0.007	0.000	CI_Petrified_Forest
Rawah Wilderness	CO	USFS		0.041	0.067	0.013	0.057	0.008	0.103	0.033	0.006	CI_Rawah
Rocky Mountain NP	CO	NPS		0.033	0.058	0.009	0.053	0.007	0.105	0.028	0.005	CI_Rocky_Mountain
Salt Creek Wilderness	NM	FWS		0.001	0.005	0.000	0.004	0.000	0.006	0.002	0.000	CI_Salt_Creek
San Pedro Parks Wilderness	NM	USFS		0.003	0.016	0.001	0.012	0.001	0.014	0.007	0.001	CI_San_Pedro
Weminuche Wilderness	CO	USFS		0.011	0.029	0.005	0.024	0.002	0.039	0.015	0.001	CI_Weminuche
West Elk Wilderness	CO	USFS		0.041	0.089	0.009	0.075	0.006	0.100	0.040	0.003	CI_West_Elk
Wheeler Peak Wilderness	NM	USFS		0.003	0.014	0.002	0.012	0.001	0.013	0.006	0.001	CI_Wheeler_Peak
White Mountain Wilderness	NM	USFS		0.000	0.005	0.000	0.004	0.000	0.009	0.003	0.000	CI_White_Mountain
Class II	State	Owner		PSD Class II Increment[1]								ShortName
				25	30	17	9	4	512	91	20	
Alamosa National Wildlife Refuge	CO	FWS		0.006	0.046	0.004	0.044	0.003	0.022	0.010	0.001	CII_Alamosa_NWR
Aldo Leopold Wilderness	NM	USFS		0.000	0.003	0.000	0.002	0.000	0.007	0.003	0.000	CII_Aldo_Leopold
Apache Kid Wilderness	NM	USFS		0.000	0.007	0.000	0.005	0.000	0.006	0.003	0.000	CII_Apache_Kid
Aztec Ruins NM	NM	NPS		0.019	0.031	0.007	0.022	0.003	0.020	0.009	0.001	CII_Aztec_Ruins
Baca National Wildlife Refuge	CO	FWS		0.008	0.052	0.004	0.050	0.003	0.024	0.011	0.001	CII_Baca_NWR
Bear Wallow Wilderness	AZ	USFS		0.000	0.004	0.000	0.003	0.000	0.006	0.003	0.000	CII_Bear_Wallow
Bitter Lake National Wildlife Refuge	NM	FWS		0.001	0.005	0.000	0.004	0.000	0.006	0.002	0.000	CII_Bitter_Lake_NWR
Blue Range Wilderness	NM	USFS		0.000	0.003	0.000	0.003	0.000	0.005	0.003	0.000	CII_Blue_Range
Bosque Del Apache National Wildlife Refuge	NM	FWS		0.001	0.009	0.000	0.006	0.000	0.007	0.004	0.000	CII_Bosque_NWR
Browns Park National Wildlife Refuge	CO	FWS		0.028	0.035	0.004	0.029	0.003	0.224	0.045	0.004	CII_Browns_Park_NWR
Canyon de Chelly NM	AZ	NPS		0.003	0.034	0.002	0.030	0.001	0.027	0.014	0.001	CII_Canyon_de_Chelly
Capitan Mountains Wilderness	NM	USFS		0.000	0.007	0.000	0.006	0.000	0.008	0.003	0.000	CII_Capitan_Mountain
Chaco Culture NHP	NM	NPS		0.002	0.023	0.001	0.021	0.001	0.023	0.010	0.001	CII_Chaco_Culture
Chama River Canyon Wilderness	NM	USFS		0.004	0.014	0.002	0.011	0.001	0.014	0.007	0.001	CII_Chama_River_Cany
Chimney Rock NM	CO	USFS		0.019	0.024	0.008	0.013	0.003	0.021	0.009	0.001	CII_Chimney_Rock
Colorado NM	CO	NPS		0.144	0.284	0.030	0.246	0.020	0.233	0.099	0.010	CII_Colorado
Cruces Basin Wilderness	NM	USFS		0.004	0.018	0.002	0.012	0.001	0.019	0.008	0.001	CII_Cruces_Basin
Curecanti NRA	CO	NPS		0.032	0.115	0.011	0.098	0.008	0.075	0.041	0.004	CII_Curecanti
Dark Canyon Wilderness	UT	USFS		0.009	0.053	0.003	0.044	0.002	0.058	0.032	0.002	CII_Dark_Canyon
Dinosaur NM	CO	NPS		0.698	0.391	0.077	0.356	0.060	0.843	0.491	0.100	CII_Dinosaur_all
Dome Wilderness	NM	USFS		0.002	0.012	0.001	0.009	0.001	0.009	0.005	0.000	CII_Dome
El Malpais NM	NM	NPS		0.002	0.019	0.001	0.015	0.001	0.016	0.007	0.000	CII_El_Malpais
Escudilla Wilderness	AZ	USFS		0.000	0.006	0.000	0.005	0.000	0.007	0.003	0.000	CII_Escudilla
Flaming Gorge	UT	USFS		0.005	0.015	0.001	0.012	0.001	0.066	0.017	0.001	CII_Flaming_Gorge
Florissant Fossil Beds NM	CO	NPS		0.017	0.031	0.007	0.022	0.004	0.036	0.017	0.001	CII_Florissant_Fossi
Fossil Ridge Wilderness	CO	USFS		0.019	0.038	0.005	0.032	0.003	0.056	0.021	0.002	CII_Fossil_Ridge
Glen Canyon NRA	UT	NPS		0.019	0.082	0.006	0.062	0.004	0.068	0.037	0.003	CII_Glen_Canyon
Great Sand Dunes National Park	CO	NPS		0.007	0.047	0.004	0.044	0.003	0.020	0.010	0.001	CII_Great_Sand_Park
Great Sand Dunes National Preserve	CO	NPS		0.007	0.022	0.003	0.019	0.002	0.020	0.010	0.001	CII_Great_Sand_Prese
Greenhorn Mountain Wilderness	CO	USFS		0.008	0.017	0.003	0.013	0.002	0.021	0.011	0.001	CII_Greenhorn_Mounta
High Uintas Wilderness	UT	USFS		0.001	0.014	0.000	0.011	0.000	0.025	0.008	0.000	CII_High_Uintas
Holy Cross Wilderness	CO	USFS		0.052	0.070	0.010	0.063	0.007	0.088	0.036	0.005	CII_Holy_Cross
Hovenweep NM	CO	NPS		0.013	0.036	0.003	0.031	0.002	0.039	0.020	0.003	CII_Hovenweep
Hunter-Fryingpan Wilderness	CO	USFS		0.043	0.064	0.009	0.060	0.007	0.096	0.033	0.004	CII_Hunter_Fryingpan
Las Vegas National Wildlife Refuge	NM	FWS		0.002	0.013	0.001	0.011	0.001	0.007	0.003	0.000	CII_Las_Vegas_NWR
Latir Peak Wilderness	NM	USFS		0.004	0.017	0.002	0.015	0.001	0.013	0.007	0.001	CII_Latir_Peak
Lizard Head Wilderness	CO	USFS		0.014	0.035	0.003	0.029	0.002	0.051	0.024	0.001	CII_Lizard_Head
Lost Creek Wilderness	CO	USFS		0.029	0.031	0.009	0.025	0.005	0.047	0.019	0.002	CII_Lost_Creek
Manzano Mountain Wilderness	NM	USFS		0.003	0.036	0.002	0.028	0.001	0.023	0.010	0.001	CII_Manzano_Mountain
Maxwell National Wildlife Refuge	NM	FWS		0.004	0.012	0.002	0.010	0.001	0.011	0.004	0.000	CII_Maxwell_NWR
Monte Vista National Wildlife Refuge	CO	FWS		0.006	0.043	0.004	0.042	0.003	0.027	0.009	0.001	CII_Monte_Vista_NWR
Mount Evans Wilderness	CO	USFS		0.026	0.034	0.006	0.029	0.005	0.046	0.018	0.002	CII_Mount_Evans
Mount Sneffels Wilderness	CO	USFS		0.018	0.049	0.004	0.039	0.003	0.065	0.028	0.002	CII_Mount_Sneffels
Natural Bridges NM	UT	NPS		0.007	0.034	0.002	0.027	0.001	0.051	0.023	0.001	CII_Natural_Bridges
Navajo NM	AZ	NPS		0.003	0.024	0.001	0.017	0.001	0.025	0.018	0.001	CII_Navajo
Petroglyph NM	NM	NPS		0.002	0.020	0.002	0.017	0.001	0.012	0.006	0.000	CII_Petroglyph
Powderhorn Wilderness	CO	USFS		0.013	0.046	0.004	0.040	0.003	0.053	0.027	0.002	CII_Powderhorn
Raggeds Wilderness	CO	USFS		0.092	0.078	0.018	0.057	0.009	0.095	0.033	0.004	CII_Raggeds
Rio Mora National Wildlife Refuge and Conservation Area	NM	FWS		0.002	0.009	0.001	0.008	0.001	0.008	0.004	0.000	CII_Rio_Mora_NWR_and
Sandia Mountain Wilderness	NM	USFS		0.002	0.023	0.002	0.019	0.001	0.016	0.005	0.000	CII_Sandia_Mountain
Sangre de Cristo Wilderness	CO	USFS		0.010	0.030	0.003	0.026	0.002	0.035	0.014	0.001	CII_Sangre_de_Cristo
Savage Run Wilderness	WY	USFS		0.033	0.042	0.010	0.037	0.008	0.055	0.027	0.005	CII_Savage_Run
Sevilleta National Wildlife Refuge	NM	FWS		0.001	0.016	0.001	0.014	0.001	0.012	0.004	0.000	CII_Sevilleta_NWR
South San Juan Wilderness	CO	USFS		0.020	0.047	0.010	0.014	0.003	0.023	0.010	0.001	CII_South_San_Juan
Spanish Peaks Wilderness	CO	USFS		0.008	0.017	0.003	0.013	0.001	0.015	0.008	0.001	CII_Spanish_Peaks
Uncompahgre Wilderness	CO	USFS		0.017	0.068	0.006	0.058	0.004	0.067	0.030	0.002	CII_Uncompahgre
Valle De Oro National Wildlife Refuge	NM	FWS		0.002	0.024	0.002	0.023	0.002	0.012	0.005	0.000	CII_Valle_De_Oro_NWR
Withington Wilderness	NM	USFS		0.000	0.006	0.000	0.005	0.000	0.006	0.003	0.000	CII_Withington

Note that the thresholds shown are project-level thresholds. The comparisons shown above are for informational purposes only.

Table 5-11. Contributions of new oil and gas and mining on Federal lands within the 13 Colorado BLM Planning Areas to PSD pollutant concentrations at Class I areas (Source Group A2) for the 2025 High Development Scenario.

Group	A2	New federal O&G + new Mining in CO
Across grid cells	Maximum	Max

			Pollutant	NO_2 (µg/m^3)	PM_{10} (µg/m^3)		PM_{25} (µg/m^3)		SO_2 (µg/m^3)			
			Averaging Time	Annual[3]	24-hour[2]	Annual[3]	24-hour[4]	Annual[3]	3-hour[2]	24-hour[2]	Annual[3]	
Class I	State	Owner		PSD Class I Increment[1]								ShortName
				2.5	8	4	2	1	25	5	2	
Arches NP	UT	NPS		0.096	0.235	0.039	0.164	0.021	0.095	0.052	0.005	CI_Arches
Bandelier Wilderness	NM	NPS		0.003	0.038	0.004	0.024	0.002	0.009	0.005	0.000	CI_Bandelier
Black Canyon of the Gunnison Wilderness	CO	NPS		0.062	0.267	0.038	0.203	0.027	0.100	0.064	0.005	CI_Black_Canyon
Bosque del Apache	NM	FWS		0.001	0.020	0.001	0.013	0.001	0.007	0.004	0.000	CI_Bosque
Canyonlands NP	UT	NPS		0.033	0.192	0.016	0.137	0.009	0.074	0.046	0.004	CI_Canyonlands
Capitol Reef NP	UT	NPS		0.003	0.045	0.003	0.033	0.002	0.036	0.014	0.001	CI_Capitol_Reef
Dinosaur NM	CO	NPS		0.557	0.521	0.098	0.250	0.052	0.843	0.299	0.069	CI_Dinosaur_CO
Eagles Nest Wilderness	CO	USFS		0.082	0.119	0.029	0.067	0.015	0.072	0.035	0.005	CI_Eagles_Nest
Flat Tops Wilderness	CO	USFS		0.209	0.332	0.071	0.092	0.028	0.372	0.125	0.021	CI_Flat_Tops
Gila Wilderness	NM	USFS		0.000	0.011	0.000	0.006	0.000	0.006	0.002	0.000	CI_Gila
Great Sand Dunes Wilderness-nps	CO	NPS		0.010	0.068	0.009	0.056	0.006	0.019	0.009	0.001	CI_Great_Sand_Dunes
La Garita Wilderness	CO	USFS		0.013	0.074	0.009	0.051	0.006	0.049	0.021	0.001	CI_La_Garita
Maroon Bells-Snowmass Wilderness	CO	USFS		0.116	0.210	0.061	0.148	0.040	0.104	0.048	0.005	CI_Maroon_Bells
Mesa Verde NP	CO	NPS		0.015	0.105	0.019	0.075	0.007	0.039	0.018	0.001	CI_Mesa_Verde
Mount Baldy Wilderness	AZ	USFS		0.000	0.015	0.001	0.008	0.000	0.007	0.003	0.000	CI_Mount_Baldy
Mount Zirkel Wilderness	CO	USFS		0.138	0.423	0.096	0.136	0.028	0.137	0.070	0.014	CI_Mount_Zirkel
Pecos Wilderness	NM	USFS		0.003	0.031	0.004	0.019	0.002	0.011	0.004	0.000	CI_Pecos
Petrified Forest NP	AZ	NPS		0.002	0.048	0.002	0.035	0.002	0.013	0.007	0.000	CI_Petrified_Forest
Rawah Wilderness	CO	USFS		0.067	0.181	0.042	0.087	0.015	0.103	0.033	0.006	CI_Rawah
Rocky Mountain NP	CO	NPS		0.048	0.132	0.030	0.071	0.013	0.106	0.028	0.005	CI_Rocky_Mountain
Salt Creek Wilderness	NM	FWS		0.001	0.015	0.001	0.007	0.001	0.006	0.002	0.000	CI_Salt_Creek
San Pedro Parks Wilderness	NM	USFS		0.004	0.044	0.004	0.024	0.002	0.014	0.007	0.001	CI_San_Pedro
Weminuche Wilderness	CO	USFS		0.015	0.056	0.011	0.037	0.004	0.039	0.015	0.001	CI_Weminuche
West Elk Wilderness	CO	USFS		0.060	0.210	0.057	0.179	0.047	0.101	0.040	0.003	CI_West_Elk
Wheeler Peak Wilderness	NM	USFS		0.004	0.038	0.005	0.023	0.003	0.013	0.006	0.001	CI_Wheeler_Peak
White Mountain Wilderness	NM	USFS		0.001	0.017	0.001	0.009	0.001	0.009	0.003	0.000	CI_White_Mountain

Note that the thresholds shown are project-level thresholds. The comparisons shown above are for informational purposes only.

Table 5-11a. Contributions of new oil and gas and mining on Federal lands within the 13 Colorado BLM Planning Areas to PSD pollutant concentrations at Class I areas (Source Group A2) for the 2025 Low Development Scenario.

Group	A2	New federal O&G + new Mining in CO
Across grid cells	Maximum	Max

			Pollutant	NO_2 (µg/m^3)	PM_{10} (µg/m^3)		PM_{25} (µg/m^3)		SO_2 (µg/m^3)			
			Averaging Time	Annual[3]	24-hour[2]	Annual[3]	24-hour[4]	Annual[3]	3-hour[2]	24-hour[2]	Annual[3]	
Class I	State	Owner		PSD Class I Increment[1]								ShortName
				2.5	8	4	2	1	25	5	2	
Arches NP	UT	NPS		0.013	0.062	0.011	0.044	0.007	0.011	0.006	0.001	CI_Arches
Bandelier Wilderness	NM	NPS		0.001	0.017	0.002	0.011	0.001	0.001	0.001	0.000	CI_Bandelier
Black Canyon of the Gunnison Wilderness	CO	NPS		0.012	0.093	0.015	0.069	0.011	0.012	0.007	0.001	CI_Black_Canyon
Bosque del Apache	NM	FWS		0.000	0.011	0.001	0.007	0.000	0.001	0.000	0.000	CI_Bosque
Canyonlands NP	UT	NPS		0.006	0.053	0.006	0.042	0.004	0.009	0.006	0.000	CI_Canyonlands
Capitol Reef NP	UT	NPS		0.001	0.017	0.001	0.015	0.001	0.005	0.002	0.000	CI_Capitol_Reef
Dinosaur NM	CO	NPS		0.079	0.395	0.036	0.112	0.012	0.101	0.035	0.008	CI_Dinosaur_CO
Eagles Nest Wilderness	CO	USFS		0.021	0.073	0.014	0.024	0.006	0.008	0.005	0.001	CI_Eagles_Nest
Flat Tops Wilderness	CO	USFS		0.066	0.282	0.040	0.058	0.011	0.041	0.015	0.003	CI_Flat_Tops
Gila Wilderness	NM	USFS		0.000	0.005	0.000	0.003	0.000	0.001	0.000	0.000	CI_Gila
Great Sand Dunes Wilderness-nps	CO	NPS		0.002	0.035	0.004	0.018	0.002	0.002	0.001	0.000	CI_Great_Sand_Dunes
La Garita Wilderness	CO	USFS		0.003	0.030	0.004	0.019	0.003	0.006	0.002	0.000	CI_La_Garita
Maroon Bells-Snowmass Wilderness	CO	USFS		0.022	0.084	0.023	0.068	0.019	0.012	0.006	0.001	CI_Maroon_Bells
Mesa Verde NP	CO	NPS		0.004	0.061	0.013	0.038	0.005	0.005	0.002	0.000	CI_Mesa_Verde
Mount Baldy Wilderness	AZ	USFS		0.000	0.006	0.000	0.004	0.000	0.001	0.000	0.000	CI_Mount_Baldy
Mount Zirkel Wilderness	CO	USFS		0.060	0.322	0.068	0.074	0.014	0.018	0.010	0.002	CI_Mount_Zirkel
Pecos Wilderness	NM	USFS		0.001	0.017	0.002	0.008	0.001	0.001	0.001	0.000	CI_Pecos
Petrified Forest NP	AZ	NPS		0.001	0.023	0.001	0.016	0.001	0.002	0.001	0.000	CI_Petrified_Forest
Rawah Wilderness	CO	USFS		0.022	0.113	0.024	0.031	0.006	0.013	0.004	0.001	CI_Rawah
Rocky Mountain NP	CO	NPS		0.017	0.096	0.018	0.033	0.006	0.014	0.004	0.001	CI_Rocky_Mountain
Salt Creek Wilderness	NM	FWS		0.000	0.008	0.001	0.004	0.000	0.001	0.000	0.000	CI_Salt_Creek
San Pedro Parks Wilderness	NM	USFS		0.001	0.022	0.002	0.011	0.001	0.002	0.001	0.000	CI_San_Pedro
Weminuche Wilderness	CO	USFS		0.003	0.023	0.003	0.014	0.002	0.005	0.002	0.000	CI_Weminuche
West Elk Wilderness	CO	USFS		0.013	0.106	0.028	0.088	0.025	0.012	0.005	0.001	CI_West_Elk
Wheeler Peak Wilderness	NM	USFS		0.001	0.022	0.002	0.010	0.001	0.002	0.001	0.000	CI_Wheeler_Peak
White Mountain Wilderness	NM	USFS		0.000	0.009	0.001	0.004	0.000	0.001	0.000	0.000	CI_White_Mountain

Note that the thresholds shown are project-level thresholds. The comparisons shown above are for informational purposes only.

Table 5-11b. Contributions of new oil and gas and mining on Federal lands within the 13 Colorado BLM Planning Areas to PSD pollutant concentrations at Class I areas (Source Group A2) for the 2025 Medium Development Scenario.

Group	A2	New federal O&G + new Mining in CO
Across grid cells	Maximum	Max

		Pollutant	NO_2 (µg/m^3)	PM_{10} (µg/m^3)		PM_{25} (µg/m^3)		SO_2 (µg/m^3)			
		Averaging Time	Annual[3]	24-hour[2]	Annual[3]	24-hour[4]	Annual[3]	3-hour[2]	24-hour[2]	Annual[3]	
Class I	State	Owner	PSD Class I Increment[1]								ShortName
			2.5	8	4	2	1	25	5	2	
Arches NP	UT	NPS	0.080	0.170	0.025	0.138	0.017	0.095	0.052	0.005	CI_Arches
Bandelier Wilderness	NM	NPS	0.002	0.031	0.003	0.022	0.002	0.009	0.005	0.000	CI_Bandelier
Black Canyon of the Gunnison Wilderness	CO	NPS	0.052	0.209	0.030	0.177	0.024	0.100	0.064	0.005	CI_Black_Canyon
Bosque del Apache	NM	FWS	0.001	0.017	0.001	0.012	0.001	0.007	0.004	0.000	CI_Bosque
Canyonlands NP	UT	NPS	0.028	0.144	0.011	0.115	0.007	0.074	0.046	0.004	CI_Canyonlands
Capitol Reef NP	UT	NPS	0.003	0.034	0.002	0.028	0.001	0.036	0.014	0.001	CI_Capitol_Reef
Dinosaur NM	CO	NPS	0.485	0.468	0.077	0.227	0.046	0.843	0.299	0.069	CI_Dinosaur_CO
Eagles Nest Wilderness	CO	USFS	0.075	0.096	0.022	0.059	0.013	0.072	0.035	0.005	CI_Eagles_Nest
Flat Tops Wilderness	CO	USFS	0.184	0.321	0.058	0.084	0.025	0.372	0.125	0.021	CI_Flat_Tops
Gila Wilderness	NM	USFS	0.000	0.009	0.000	0.006	0.000	0.006	0.002	0.000	CI_Gila
Great Sand Dunes Wilderness-nps	CO	NPS	0.008	0.057	0.007	0.050	0.005	0.019	0.009	0.001	CI_Great_Sand_Dunes
La Garita Wilderness	CO	USFS	0.011	0.062	0.007	0.045	0.005	0.048	0.020	0.001	CI_La_Garita
Maroon Bells-Snowmass Wilderness	CO	USFS	0.090	0.163	0.048	0.134	0.037	0.103	0.048	0.005	CI_Maroon_Bells
Mesa Verde NP	CO	NPS	0.013	0.086	0.016	0.068	0.007	0.039	0.018	0.001	CI_Mesa_Verde
Mount Baldy Wilderness	AZ	USFS	0.000	0.012	0.000	0.007	0.000	0.007	0.003	0.000	CI_Mount_Baldy
Mount Zirkel Wilderness	CO	USFS	0.124	0.386	0.084	0.124	0.025	0.137	0.069	0.014	CI_Mount_Zirkel
Pecos Wilderness	NM	USFS	0.002	0.026	0.003	0.017	0.002	0.011	0.004	0.000	CI_Pecos
Petrified Forest NP	AZ	NPS	0.002	0.039	0.002	0.032	0.001	0.013	0.007	0.000	CI_Petrified_Forest
Rawah Wilderness	CO	USFS	0.056	0.158	0.035	0.077	0.013	0.103	0.033	0.006	CI_Rawah
Rocky Mountain NP	CO	NPS	0.042	0.116	0.025	0.062	0.012	0.106	0.028	0.005	CI_Rocky_Mountain
Salt Creek Wilderness	NM	FWS	0.001	0.012	0.001	0.006	0.001	0.006	0.002	0.000	CI_Salt_Creek
San Pedro Parks Wilderness	NM	USFS	0.003	0.036	0.003	0.022	0.002	0.014	0.007	0.001	CI_San_Pedro
Weminuche Wilderness	CO	USFS	0.011	0.046	0.007	0.033	0.004	0.039	0.015	0.001	CI_Weminuche
West Elk Wilderness	CO	USFS	0.050	0.182	0.051	0.167	0.045	0.100	0.040	0.003	CI_West_Elk
Wheeler Peak Wilderness	NM	USFS	0.004	0.031	0.004	0.021	0.002	0.013	0.006	0.001	CI_Wheeler_Peak
White Mountain Wilderness	NM	USFS	0.001	0.014	0.001	0.008	0.001	0.009	0.003	0.000	CI_White_Mountain

Note that the thresholds shown are project-level thresholds. The comparisons shown above are for informational purposes only.

Table 5-12. Contributions of new oil and gas and mining on Federal lands and new oil and gas on non-Federal lands within Colorado to PSD pollutant concentrations at Class I and sensitive Class II areas (Source Group A3, was T in 1.5) for the 2025 High Development Scenario.

Group	A3	New federal O&G + new non-federal O&G + Mining in CO
Across grid cells	Maximum	Max

		Pollutant	NO_2 (µg/m^3)	PM_{10} (µg/m^3)		PM_{25} (µg/m^3)		SO_2 (µg/m^3)			
		Averaging Time	Annual[3]	24-hour[2]	Annual[3]	24-hour[4]	Annual[3]	3-hour[2]	24-hour[2]	Annual[3]	ShortName
Class I	State	Owner	PSD Class I Increment[1]								
			2.5	8	4	2	1	25	5	2	
Arches NP	UT	NPS	0.172	0.375	0.055	0.263	0.031	0.117	0.062	0.007	CI_Arches
Bandelier Wilderness	NM	NPS	0.016	0.096	0.015	0.057	0.006	0.011	0.006	0.001	CI_Bandelier
Black Canyon of the Gunnison Wilderness	CO	NPS	0.123	0.463	0.061	0.339	0.038	0.121	0.077	0.006	CI_Black_Canyon
Bosque del Apache	NM	FWS	0.002	0.049	0.004	0.023	0.002	0.009	0.004	0.000	CI_Bosque
Canyonlands NP	UT	NPS	0.059	0.298	0.024	0.222	0.013	0.089	0.056	0.005	CI_Canyonlands
Capitol Reef NP	UT	NPS	0.006	0.075	0.005	0.051	0.003	0.042	0.018	0.001	CI_Capitol_Reef
Dinosaur NM	CO	NPS	0.636	0.598	0.111	0.265	0.059	0.911	0.307	0.073	CI_Dinosaur_CO
Eagles Nest Wilderness	CO	USFS	0.162	0.217	0.050	0.144	0.025	0.082	0.041	0.006	CI_Eagles_Nest
Flat Tops Wilderness	CO	USFS	0.343	0.367	0.098	0.133	0.041	0.426	0.145	0.025	CI_Flat_Tops
Gila Wilderness	NM	USFS	0.001	0.022	0.001	0.012	0.001	0.007	0.003	0.000	CI_Gila
Great Sand Dunes Wilderness-nps	CO	NPS	0.028	0.177	0.022	0.100	0.011	0.024	0.011	0.001	CI_Great_Sand_Dunes
La Garita Wilderness	CO	USFS	0.030	0.134	0.017	0.075	0.009	0.057	0.024	0.002	CI_La_Garita
Maroon Bells-Snowmass Wilderness	CO	USFS	0.333	0.333	0.120	0.216	0.061	0.123	0.054	0.006	CI_Maroon_Bells
Mesa Verde NP	CO	NPS	0.101	0.272	0.047	0.129	0.019	0.048	0.022	0.002	CI_Mesa_Verde
Mount Baldy Wilderness	AZ	USFS	0.001	0.034	0.001	0.015	0.001	0.009	0.003	0.000	CI_Mount_Baldy
Mount Zirkel Wilderness	CO	USFS	0.196	0.515	0.128	0.170	0.039	0.159	0.080	0.017	CI_Mount_Zirkel
Pecos Wilderness	NM	USFS	0.014	0.095	0.012	0.049	0.005	0.013	0.005	0.001	CI_Pecos
Petrified Forest NP	AZ	NPS	0.004	0.071	0.004	0.053	0.002	0.015	0.009	0.000	CI_Petrified_Forest
Rawah Wilderness	CO	USFS	0.106	0.533	0.068	0.126	0.024	0.118	0.039	0.007	CI_Rawah
Rocky Mountain NP	CO	NPS	0.109	1.469	0.120	0.425	0.038	0.117	0.032	0.006	CI_Rocky_Mountain
Salt Creek Wilderness	NM	FWS	0.003	0.068	0.005	0.020	0.002	0.007	0.003	0.000	CI_Salt_Creek
San Pedro Parks Wilderness	NM	USFS	0.021	0.092	0.013	0.042	0.006	0.016	0.008	0.001	CI_San_Pedro
Weminuche Wilderness	CO	USFS	0.082	0.213	0.039	0.089	0.014	0.043	0.018	0.001	CI_Weminuche
West Elk Wilderness	CO	USFS	0.132	0.326	0.078	0.230	0.056	0.112	0.048	0.004	CI_West_Elk
Wheeler Peak Wilderness	NM	USFS	0.016	0.102	0.013	0.046	0.006	0.015	0.007	0.001	CI_Wheeler_Peak
White Mountain Wilderness	NM	USFS	0.002	0.054	0.003	0.017	0.001	0.010	0.004	0.000	CI_White_Mountain
Class II	State	Owner	PSD Class II Increment[1]								ShortName
			25	30	17	9	4	512	91	20	
Alamosa National Wildlife Refuge	CO	FWS	0.027	0.161	0.025	0.127	0.015	0.026	0.013	0.001	CII_Alamosa_NWR
Aldo Leopold Wilderness	NM	USFS	0.001	0.022	0.001	0.010	0.001	0.008	0.003	0.000	CII_Aldo_Leopold
Apache Kid Wilderness	NM	USFS	0.001	0.033	0.002	0.015	0.001	0.008	0.003	0.000	CII_Apache_Kid
Aztec Ruins NM	NM	NPS	1.283	1.239	0.464	0.468	0.137	0.026	0.014	0.003	CII_Aztec_Ruins
Baca National Wildlife Refuge	CO	FWS	0.028	0.179	0.025	0.133	0.015	0.028	0.014	0.001	CII_Baca_NWR
Bear Wallow Wilderness	AZ	USFS	0.001	0.022	0.001	0.012	0.000	0.007	0.003	0.000	CII_Bear_Wallow
Bitter Lake National Wildlife Refuge	NM	FWS	0.003	0.068	0.005	0.020	0.002	0.008	0.003	0.000	CII_Bitter_Lake_NWR
Blue Range Wilderness	NM	USFS	0.001	0.032	0.001	0.014	0.001	0.005	0.003	0.000	CII_Blue_Range
Bosque Del Apache National Wildlife Refuge	NM	FWS	0.002	0.049	0.004	0.023	0.002	0.009	0.004	0.000	CII_Bosque_NWR
Browns Park National Wildlife Refuge	CO	FWS	0.046	0.153	0.013	0.053	0.006	0.252	0.050	0.004	CII_Browns_Park_NWR
Canyon de Chelly NM	AZ	NPS	0.008	0.140	0.007	0.081	0.004	0.032	0.016	0.001	CII_Canyon_de_Chelly
Capitan Mountains Wilderness	NM	USFS	0.002	0.062	0.004	0.020	0.002	0.010	0.003	0.000	CII_Capitan_Mountain
Chaco Culture NHP	NM	NPS	0.013	0.099	0.009	0.076	0.005	0.028	0.013	0.001	CII_Chaco_Culture
Chama River Canyon Wilderness	NM	USFS	0.052	0.190	0.028	0.080	0.011	0.018	0.009	0.001	CII_Chama_River_Cany
Chimney Rock NM	CO	USFS	0.440	0.506	0.164	0.190	0.052	0.025	0.013	0.002	CII_Chimney_Rock
Colorado NM	CO	NPS	0.332	0.722	0.109	0.544	0.059	0.270	0.118	0.013	CII_Colorado
Cruces Basin Wilderness	NM	USFS	0.037	0.117	0.023	0.053	0.009	0.023	0.010	0.001	CII_Cruces_Basin
Curecanti NRA	CO	NPS	0.083	0.311	0.043	0.224	0.028	0.090	0.050	0.005	CII_Curecanti
Dark Canyon Wilderness	UT	USFS	0.022	0.211	0.011	0.111	0.005	0.066	0.038	0.002	CII_Dark_Canyon
Dinosaur NM	CO	NPS	0.974	0.927	0.173	0.461	0.090	0.911	0.529	0.108	CII_Dinosaur_all
Dome Wilderness	NM	USFS	0.013	0.081	0.011	0.053	0.005	0.010	0.006	0.001	CII_Dome
El Malpais NM	NM	NPS	0.007	0.078	0.006	0.048	0.003	0.020	0.009	0.001	CII_El_Malpais
Escudilla Wilderness	AZ	USFS	0.001	0.036	0.001	0.014	0.001	0.008	0.004	0.000	CII_Escudilla
Flaming Gorge	UT	USFS	0.008	0.062	0.004	0.024	0.002	0.074	0.019	0.001	CII_Flaming_Gorge
Florissant Fossil Beds NM	CO	NPS	0.074	0.586	0.056	0.254	0.023	0.040	0.021	0.002	CII_Florissant_Fossi
Fossil Ridge Wilderness	CO	USFS	0.057	0.163	0.030	0.093	0.018	0.062	0.025	0.002	CII_Fossil_Ridge
Glen Canyon NRA	UT	NPS	0.042	0.226	0.020	0.141	0.011	0.081	0.047	0.004	CII_Glen_Canyon
Great Sand Dunes National Park	CO	NPS	0.028	0.177	0.022	0.118	0.012	0.025	0.012	0.001	CII_Great_Sand_Park
Great Sand Dunes National Preserve	CO	NPS	0.027	0.209	0.021	0.092	0.010	0.024	0.012	0.001	CII_Great_Sand_Prese
Greenhorn Mountain Wilderness	CO	USFS	0.030	0.348	0.029	0.125	0.010	0.024	0.013	0.001	CII_Greenhorn_Mounta
High Uintas Wilderness	UT	USFS	0.001	0.047	0.002	0.023	0.001	0.029	0.009	0.000	CII_High_Uintas
Holy Cross Wilderness	CO	USFS	0.134	0.215	0.048	0.141	0.024	0.104	0.045	0.006	CII_Holy_Cross
Hovenweep NM	CO	NPS	0.058	0.153	0.024	0.101	0.013	0.052	0.033	0.009	CII_Hovenweep
Hunter-Fryingpan Wilderness	CO	USFS	0.114	0.201	0.044	0.119	0.024	0.105	0.038	0.005	CII_Hunter_Fryingpan
Las Vegas National Wildlife Refuge	NM	FWS	0.011	0.114	0.013	0.051	0.006	0.008	0.004	0.000	CII_Las_Vegas_NWR
Latir Peak Wilderness	NM	USFS	0.018	0.095	0.015	0.051	0.006	0.015	0.008	0.001	CII_Latir_Peak
Lizard Head Wilderness	CO	USFS	0.049	0.150	0.016	0.101	0.009	0.062	0.028	0.002	CII_Lizard_Head
Lost Creek Wilderness	CO	USFS	0.089	0.895	0.070	0.403	0.025	0.053	0.021	0.003	CII_Lost_Creek
Manzano Mountain Wilderness	NM	USFS	0.013	0.155	0.016	0.082	0.007	0.028	0.013	0.001	CII_Manzano_Mountain
Maxwell National Wildlife Refuge	NM	FWS	0.031	0.162	0.023	0.090	0.009	0.014	0.005	0.001	CII_Maxwell_NWR
Monte Vista National Wildlife Refuge	CO	FWS	0.030	0.155	0.024	0.115	0.015	0.031	0.011	0.001	CII_Monte_Vista_NWR
Mount Evans Wilderness	CO	USFS	0.088	0.822	0.067	0.354	0.024	0.053	0.020	0.003	CII_Mount_Evans
Mount Sneffels Wilderness	CO	USFS	0.055	0.181	0.019	0.128	0.011	0.079	0.033	0.002	CII_Mount_Sneffels
Natural Bridges NM	UT	NPS	0.020	0.161	0.010	0.072	0.005	0.062	0.028	0.002	CII_Natural_Bridges
Navajo NM	AZ	NPS	0.007	0.117	0.005	0.046	0.002	0.029	0.022	0.001	CII_Navajo
Petroglyph NM	NM	NPS	0.009	0.108	0.011	0.073	0.006	0.014	0.008	0.001	CII_Petroglyph
Powderhorn Wilderness	CO	USFS	0.037	0.134	0.019	0.087	0.011	0.062	0.031	0.002	CII_Powderhorn
Raggeds Wilderness	CO	USFS	0.934	0.564	0.251	0.315	0.102	0.103	0.040	0.006	CII_Raggeds
Rio Mora National Wildlife Refuge and Conservation Area	NM	FWS	0.013	0.108	0.013	0.041	0.005	0.010	0.005	0.000	CII_Rio_Mora_NWR_and
Sandia Mountain Wilderness	NM	USFS	0.009	0.104	0.011	0.073	0.006	0.019	0.007	0.001	CII_Sandia_Mountain
Sangre de Cristo Wilderness	CO	USFS	0.036	0.286	0.024	0.125	0.011	0.042	0.018	0.002	CII_Sangre_de_Cristo
Savage Run Wilderness	WY	USFS	0.075	0.295	0.049	0.100	0.019	0.065	0.032	0.006	CII_Savage_Run
Sevilleta National Wildlife Refuge	NM	FWS	0.005	0.079	0.007	0.055	0.004	0.014	0.005	0.000	CII_Sevilleta_NWR
South San Juan Wilderness	CO	USFS	0.109	0.258	0.057	0.102	0.018	0.028	0.012	0.001	CII_South_San_Juan
Spanish Peaks Wilderness	CO	USFS	0.084	0.355	0.050	0.173	0.015	0.018	0.009	0.001	CII_Spanish_Peaks
Uncompahgre Wilderness	CO	USFS	0.046	0.201	0.022	0.154	0.014	0.078	0.034	0.003	CII_Uncompahgre
Valle De Oro National Wildlife Refuge	NM	FWS	0.009	0.115	0.012	0.087	0.008	0.014	0.007	0.001	CII_Valle_De_Oro_NWR
Withington Wilderness	NM	USFS	0.001	0.038	0.002	0.019	0.001	0.008	0.004	0.000	CII_Withington

Note that the thresholds shown are project-level thresholds. The comparisons shown above are for informational purposes only.

Table 5-12a. Contributions of new oil and gas and mining on Federal lands and new oil and gas on non-Federal lands within Colorado to PSD pollutant concentrations at Class I and sensitive Class II areas (Source Group A3) for the 2025 Low Development Scenario.

Group	A3	New federal O&G + new non-federal O&G + Mining in CO
Across grid cells	Maximum	Max

			Pollutant	NO_2 (µg/m^3)	PM_{10} (µg/m^3)		PM_{25} (µg/m^3)		SO_2 (µg/m^3)			
			Averaging Time	Annual[3]	24-hour[2]	Annual[3]	24-hour[4]	Annual[3]	3-hour[2]	24-hour[2]	Annual[3]	
Class I	State	Owner		PSD Class I Increment[1]								ShortName
				2.5	8	4	2	1	25	5	2	
Arches NP	UT	NPS		0.030	0.092	0.014	0.070	0.010	0.015	0.008	0.001	CI_Arches
Bandelier Wilderness	NM	NPS		0.007	0.043	0.007	0.025	0.003	0.002	0.001	0.000	CI_Bandelier
Black Canyon of the Gunnison Wilderness	CO	NPS		0.027	0.138	0.019	0.095	0.014	0.015	0.010	0.001	CI_Black_Canyon
Bosque del Apache	NM	FWS		0.001	0.022	0.002	0.010	0.001	0.001	0.001	0.000	CI_Bosque
Canyonlands NP	UT	NPS		0.013	0.087	0.008	0.054	0.005	0.011	0.008	0.001	CI_Canyonlands
Capitol Reef NP	UT	NPS		0.002	0.025	0.002	0.017	0.001	0.006	0.002	0.000	CI_Capitol_Reef
Dinosaur NM	CO	NPS		0.096	0.414	0.039	0.119	0.014	0.112	0.036	0.009	CI_Dinosaur_CO
Eagles Nest Wilderness	CO	USFS		0.040	0.077	0.019	0.050	0.009	0.011	0.006	0.001	CI_Eagles_Nest
Flat Tops Wilderness	CO	USFS		0.101	0.299	0.047	0.063	0.015	0.050	0.019	0.004	CI_Flat_Tops
Gila Wilderness	NM	USFS		0.000	0.009	0.000	0.005	0.000	0.001	0.000	0.000	CI_Gila
Great Sand Dunes Wilderness-nps	CO	NPS		0.009	0.062	0.008	0.031	0.004	0.003	0.002	0.000	CI_Great_Sand_Dunes
La Garita Wilderness	CO	USFS		0.009	0.049	0.006	0.025	0.004	0.007	0.003	0.000	CI_La_Garita
Maroon Bells-Snowmass Wilderness	CO	USFS		0.044	0.102	0.028	0.071	0.021	0.015	0.007	0.001	CI_Maroon_Bells
Mesa Verde NP	CO	NPS		0.045	0.140	0.027	0.064	0.010	0.008	0.004	0.001	CI_Mesa_Verde
Mount Baldy Wilderness	AZ	USFS		0.000	0.013	0.000	0.006	0.000	0.001	0.000	0.000	CI_Mount_Baldy
Mount Zirkel Wilderness	CO	USFS		0.074	0.342	0.076	0.084	0.017	0.021	0.012	0.003	CI_Mount_Zirkel
Pecos Wilderness	NM	USFS		0.006	0.044	0.006	0.021	0.002	0.002	0.001	0.000	CI_Pecos
Petrified Forest NP	AZ	NPS		0.001	0.030	0.002	0.024	0.001	0.002	0.001	0.000	CI_Petrified_Forest
Rawah Wilderness	CO	USFS		0.033	0.188	0.032	0.044	0.009	0.015	0.005	0.001	CI_Rawah
Rocky Mountain NP	CO	NPS		0.036	0.511	0.046	0.158	0.014	0.016	0.004	0.001	CI_Rocky_Mountain
Salt Creek Wilderness	NM	FWS		0.001	0.028	0.002	0.009	0.001	0.001	0.000	0.000	CI_Salt_Creek
San Pedro Parks Wilderness	NM	USFS		0.009	0.042	0.006	0.019	0.003	0.002	0.001	0.000	CI_San_Pedro
Weminuche Wilderness	CO	USFS		0.036	0.100	0.017	0.045	0.007	0.005	0.002	0.000	CI_Weminuche
West Elk Wilderness	CO	USFS		0.026	0.122	0.032	0.095	0.027	0.014	0.006	0.001	CI_West_Elk
Wheeler Peak Wilderness	NM	USFS		0.006	0.038	0.006	0.017	0.002	0.002	0.001	0.000	CI_Wheeler_Peak
White Mountain Wilderness	NM	USFS		0.001	0.021	0.001	0.007	0.001	0.001	0.001	0.000	CI_White_Mountain
Class II	State	Owner		PSD Class II Increment[1]								ShortName
				25	30	17	9	4	512	91	20	
Alamosa National Wildlife Refuge	CO	FWS		0.009	0.057	0.009	0.034	0.006	0.004	0.002	0.000	CII_Alamosa_NWR
Aldo Leopold Wilderness	NM	USFS		0.000	0.010	0.001	0.005	0.000	0.001	0.000	0.000	CII_Aldo_Leopold
Apache Kid Wilderness	NM	USFS		0.000	0.013	0.001	0.006	0.000	0.001	0.000	0.000	CII_Apache_Kid
Aztec Ruins NM	NM	NPS		0.623	0.631	0.231	0.246	0.069	0.007	0.004	0.001	CII_Aztec_Ruins
Baca National Wildlife Refuge	CO	FWS		0.009	0.063	0.009	0.042	0.005	0.004	0.002	0.000	CII_Baca_NWR
Bear Wallow Wilderness	AZ	USFS		0.000	0.009	0.000	0.005	0.000	0.001	0.000	0.000	CII_Bear_Wallow
Bitter Lake National Wildlife Refuge	NM	FWS		0.001	0.028	0.002	0.009	0.001	0.001	0.000	0.000	CII_Bitter_Lake_NWR
Blue Range Wilderness	NM	USFS		0.000	0.010	0.000	0.006	0.000	0.001	0.000	0.000	CII_Blue_Range
Bosque Del Apache National Wildlife Refuge	NM	FWS		0.001	0.022	0.002	0.010	0.001	0.001	0.001	0.000	CII_Bosque_NWR
Browns Park National Wildlife Refuge	CO	FWS		0.009	0.099	0.006	0.022	0.002	0.029	0.006	0.001	CII_Browns_Park_NWR
Canyon de Chelly NM	AZ	NPS		0.002	0.062	0.003	0.041	0.002	0.005	0.002	0.000	CII_Canyon_de_Chelly
Capitan Mountains Wilderness	NM	USFS		0.001	0.025	0.002	0.008	0.001	0.001	0.001	0.000	CII_Capitan_Mountain
Chaco Culture NHP	NM	NPS		0.005	0.044	0.004	0.032	0.003	0.004	0.002	0.000	CII_Chaco_Culture
Chama River Canyon Wilderness	NM	USFS		0.024	0.091	0.013	0.040	0.006	0.003	0.002	0.000	CII_Chama_River_Cany
Chimney Rock NM	CO	USFS		0.210	0.250	0.080	0.095	0.026	0.004	0.003	0.001	CII_Chimney_Rock
Colorado NM	CO	NPS		0.063	0.198	0.028	0.125	0.019	0.037	0.015	0.002	CII_Colorado
Cruces Basin Wilderness	NM	USFS		0.015	0.054	0.010	0.022	0.004	0.003	0.002	0.000	CII_Cruces_Basin
Curecanti NRA	CO	NPS		0.020	0.099	0.014	0.076	0.010	0.012	0.007	0.001	CII_Curecanti
Dark Canyon Wilderness	UT	USFS		0.006	0.078	0.004	0.040	0.002	0.009	0.005	0.000	CII_Dark_Canyon
Dinosaur NM	CO	NPS		0.155	0.618	0.060	0.181	0.021	0.112	0.065	0.014	CII_Dinosaur_all
Dome Wilderness	NM	USFS		0.005	0.036	0.005	0.023	0.002	0.002	0.001	0.000	CII_Dome
El Malpais NM	NM	NPS		0.002	0.031	0.003	0.019	0.002	0.003	0.001	0.000	CII_El_Malpais
Escudilla Wilderness	AZ	USFS		0.000	0.014	0.001	0.007	0.000	0.001	0.001	0.000	CII_Escudilla
Flaming Gorge	UT	USFS		0.002	0.029	0.002	0.008	0.001	0.009	0.002	0.000	CII_Flaming_Gorge
Florissant Fossil Beds NM	CO	NPS		0.020	0.209	0.017	0.095	0.007	0.006	0.003	0.000	CII_Florissant_Fossi
Fossil Ridge Wilderness	CO	USFS		0.014	0.057	0.011	0.033	0.008	0.008	0.003	0.000	CII_Fossil_Ridge
Glen Canyon NRA	UT	NPS		0.009	0.071	0.006	0.042	0.003	0.010	0.006	0.001	CII_Glen_Canyon
Great Sand Dunes National Park	CO	NPS		0.009	0.062	0.008	0.035	0.005	0.003	0.002	0.000	CII_Great_Sand_Park
Great Sand Dunes National Preserve	CO	NPS		0.009	0.075	0.008	0.034	0.004	0.003	0.002	0.000	CII_Great_Sand_Prese
Greenhorn Mountain Wilderness	CO	USFS		0.010	0.124	0.011	0.046	0.004	0.003	0.002	0.000	CII_Greenhorn_Mounta
High Uintas Wilderness	UT	USFS		0.000	0.023	0.001	0.008	0.000	0.004	0.001	0.000	CII_High_Uintas
Holy Cross Wilderness	CO	USFS		0.037	0.076	0.018	0.041	0.009	0.013	0.007	0.001	CII_Holy_Cross
Hovenweep NM	CO	NPS		0.023	0.064	0.012	0.051	0.007	0.023	0.015	0.004	CII_Hovenweep
Hunter-Fryingpan Wilderness	CO	USFS		0.030	0.068	0.016	0.035	0.009	0.013	0.005	0.001	CII_Hunter_Fryingpan
Las Vegas National Wildlife Refuge	NM	FWS		0.004	0.041	0.005	0.018	0.002	0.001	0.001	0.000	CII_Las_Vegas_NWR
Latir Peak Wilderness	NM	USFS		0.006	0.036	0.006	0.017	0.003	0.002	0.001	0.000	CII_Latir_Peak
Lizard Head Wilderness	CO	USFS		0.018	0.059	0.007	0.043	0.005	0.008	0.004	0.000	CII_Lizard_Head
Lost Creek Wilderness	CO	USFS		0.025	0.312	0.024	0.150	0.009	0.008	0.003	0.000	CII_Lost_Creek
Manzano Mountain Wilderness	NM	USFS		0.005	0.065	0.007	0.041	0.004	0.004	0.002	0.000	CII_Manzano_Mountain
Maxwell National Wildlife Refuge	NM	FWS		0.011	0.062	0.009	0.032	0.004	0.002	0.001	0.000	CII_Maxwell_NWR
Monte Vista National Wildlife Refuge	CO	FWS		0.011	0.055	0.009	0.034	0.005	0.004	0.002	0.000	CII_Monte_Vista_NWR
Mount Evans Wilderness	CO	USFS		0.026	0.289	0.024	0.131	0.009	0.007	0.003	0.000	CII_Mount_Evans
Mount Sneffels Wilderness	CO	USFS		0.019	0.079	0.008	0.047	0.005	0.011	0.004	0.000	CII_Mount_Sneffels
Natural Bridges NM	UT	NPS		0.006	0.060	0.004	0.027	0.002	0.009	0.004	0.000	CII_Natural_Bridges
Navajo NM	AZ	NPS		0.002	0.050	0.002	0.020	0.001	0.004	0.003	0.000	CII_Navajo
Petroglyph NM	NM	NPS		0.004	0.048	0.005	0.032	0.003	0.002	0.001	0.000	CII_Petroglyph
Powderhorn Wilderness	CO	USFS		0.010	0.046	0.007	0.033	0.005	0.008	0.004	0.000	CII_Powderhorn
Raggeds Wilderness	CO	USFS		0.061	0.163	0.046	0.150	0.038	0.013	0.005	0.001	CII_Raggeds
Rio Mora National Wildlife Refuge and Conservation Area	NM	FWS		0.005	0.041	0.005	0.016	0.002	0.001	0.001	0.000	CII_Rio_Mora_NWR_and
Sandia Mountain Wilderness	NM	USFS		0.004	0.041	0.005	0.030	0.003	0.003	0.001	0.000	CII_Sandia_Mountain
Sangre de Cristo Wilderness	CO	USFS		0.010	0.102	0.009	0.048	0.005	0.005	0.002	0.000	CII_Sangre_de_Cristo
Savage Run Wilderness	WY	USFS		0.022	0.101	0.023	0.037	0.007	0.008	0.005	0.001	CII_Savage_Run
Sevilleta National Wildlife Refuge	NM	FWS		0.002	0.035	0.003	0.024	0.002	0.002	0.001	0.000	CII_Sevilleta_NWR
South San Juan Wilderness	CO	USFS		0.039	0.099	0.020	0.044	0.007	0.004	0.002	0.000	CII_South_San_Juan
Spanish Peaks Wilderness	CO	USFS		0.032	0.132	0.019	0.064	0.006	0.002	0.001	0.000	CII_Spanish_Peaks
Uncompahgre Wilderness	CO	USFS		0.013	0.062	0.008	0.044	0.005	0.010	0.004	0.000	CII_Uncompahgre
Valle De Oro National Wildlife Refuge	NM	FWS		0.003	0.051	0.005	0.040	0.003	0.002	0.001	0.000	CII_Valle_De_Oro_NWR
Withington Wilderness	NM	USFS		0.000	0.014	0.001	0.007	0.000	0.001	0.001	0.000	CII_Withington

Note that the thresholds shown are project-level thresholds. The comparisons shown above are for informational purposes only.

Table 5-12b. Contributions of new oil and gas and mining on Federal lands and new oil and gas on non-Federal lands within Colorado to PSD pollutant concentrations at Class I and sensitive Class II areas (Source Group A3) for the 2025 Medium Development Scenario.

Group	A3	New federal O&G + new non-federal O&G + Mining in CO
Across grid cells	Maximum	Max

			Pollutant	NO_2 (µg/m^3)	PM_{10} (µg/m^3)		PM_{25} (µg/m^3)		SO_2 (µg/m^3)			
			Averaging Time	Annual[3]	24-hour[2]	Annual[3]	24-hour[4]	Annual[3]	3-hour[2]	24-hour[2]	Annual[3]	
Class I	**State**	**Owner**		PSD Class I Increment[1]								**ShortName**
				2.5	8	4	2	1	25	5	2	
Arches NP	UT	NPS		0.156	0.313	0.042	0.237	0.026	0.117	0.062	0.007	CI_Arches
Bandelier Wilderness	NM	NPS		0.012	0.078	0.013	0.046	0.005	0.011	0.006	0.001	CI_Bandelier
Black Canyon of the Gunnison Wilderness	CO	NPS		0.112	0.417	0.052	0.311	0.035	0.121	0.076	0.006	CI_Black_Canyon
Bosque del Apache	NM	FWS		0.002	0.043	0.003	0.020	0.002	0.009	0.004	0.000	CI_Bosque
Canyonlands NP	UT	NPS		0.053	0.251	0.019	0.201	0.011	0.089	0.056	0.005	CI_Canyonlands
Capitol Reef NP	UT	NPS		0.006	0.060	0.004	0.046	0.002	0.042	0.018	0.001	CI_Capitol_Reef
Dinosaur NM	CO	NPS		0.563	0.545	0.090	0.242	0.053	0.910	0.307	0.073	CI_Dinosaur_CO
Eagles Nest Wilderness	CO	USFS		0.155	0.194	0.043	0.141	0.023	0.082	0.041	0.006	CI_Eagles_Nest
Flat Tops Wilderness	CO	USFS		0.317	0.355	0.085	0.124	0.037	0.426	0.145	0.025	CI_Flat_Tops
Gila Wilderness	NM	USFS		0.001	0.020	0.001	0.011	0.000	0.007	0.003	0.000	CI_Gila
Great Sand Dunes Wilderness-nps	CO	NPS		0.024	0.171	0.019	0.092	0.010	0.024	0.011	0.001	CI_Great_Sand_Dunes
La Garita Wilderness	CO	USFS		0.026	0.122	0.015	0.070	0.008	0.057	0.024	0.002	CI_La_Garita
Maroon Bells-Snowmass Wilderness	CO	USFS		0.307	0.304	0.107	0.210	0.057	0.123	0.054	0.006	CI_Maroon_Bells
Mesa Verde NP	CO	NPS		0.064	0.209	0.038	0.105	0.015	0.048	0.022	0.002	CI_Mesa_Verde
Mount Baldy Wilderness	AZ	USFS		0.001	0.031	0.001	0.014	0.001	0.009	0.003	0.000	CI_Mount_Baldy
Mount Zirkel Wilderness	CO	USFS		0.182	0.475	0.116	0.159	0.036	0.159	0.080	0.017	CI_Mount_Zirkel
Pecos Wilderness	NM	USFS		0.011	0.077	0.011	0.040	0.004	0.013	0.005	0.001	CI_Pecos
Petrified Forest NP	AZ	NPS		0.004	0.062	0.003	0.049	0.002	0.015	0.009	0.000	CI_Petrified_Forest
Rawah Wilderness	CO	USFS		0.094	0.522	0.060	0.124	0.022	0.117	0.038	0.007	CI_Rawah
Rocky Mountain NP	CO	NPS		0.105	1.440	0.115	0.419	0.037	0.117	0.032	0.006	CI_Rocky_Mountain
Salt Creek Wilderness	NM	FWS		0.003	0.066	0.004	0.019	0.002	0.007	0.003	0.000	CI_Salt_Creek
San Pedro Parks Wilderness	NM	USFS		0.016	0.076	0.011	0.036	0.005	0.016	0.008	0.001	CI_San_Pedro
Weminuche Wilderness	CO	USFS		0.054	0.156	0.030	0.067	0.011	0.043	0.018	0.001	CI_Weminuche
West Elk Wilderness	CO	USFS		0.121	0.298	0.072	0.219	0.054	0.112	0.048	0.004	CI_West_Elk
Wheeler Peak Wilderness	NM	USFS		0.014	0.095	0.012	0.043	0.005	0.015	0.007	0.001	CI_Wheeler_Peak
White Mountain Wilderness	NM	USFS		0.002	0.051	0.003	0.015	0.001	0.010	0.004	0.000	CI_White_Mountain
Class II	**State**	**Owner**		PSD Class II Increment[1]								**ShortName**
				25	30	17	9	4	512	91	20	
Alamosa National Wildlife Refuge	CO	FWS		0.022	0.144	0.022	0.111	0.013	0.026	0.013	0.001	CII_Alamosa_NWR
Aldo Leopold Wilderness	NM	USFS		0.001	0.021	0.001	0.009	0.001	0.008	0.003	0.000	CII_Aldo_Leopold
Apache Kid Wilderness	NM	USFS		0.001	0.031	0.002	0.013	0.001	0.008	0.003	0.000	CII_Apache_Kid
Aztec Ruins NM	NM	NPS		0.931	1.093	0.416	0.368	0.109	0.025	0.014	0.003	CII_Aztec_Ruins
Baca National Wildlife Refuge	CO	FWS		0.025	0.174	0.022	0.124	0.013	0.028	0.014	0.001	CII_Baca_NWR
Bear Wallow Wilderness	AZ	USFS		0.001	0.020	0.001	0.011	0.000	0.007	0.003	0.000	CII_Bear_Wallow
Bitter Lake National Wildlife Refuge	NM	FWS		0.003	0.066	0.004	0.019	0.002	0.008	0.003	0.000	CII_Bitter_Lake_NWR
Blue Range Wilderness	NM	USFS		0.001	0.027	0.001	0.013	0.001	0.005	0.003	0.000	CII_Blue_Range
Bosque Del Apache National Wildlife Refuge	NM	FWS		0.002	0.043	0.003	0.020	0.002	0.009	0.004	0.000	CII_Bosque_NWR
Browns Park National Wildlife Refuge	CO	FWS		0.042	0.137	0.011	0.047	0.005	0.251	0.050	0.004	CII_Browns_Park_NWR
Canyon de Chelly NM	AZ	NPS		0.007	0.111	0.006	0.073	0.004	0.032	0.016	0.001	CII_Canyon_de_Chelly
Capitan Mountains Wilderness	NM	USFS		0.002	0.058	0.004	0.019	0.002	0.010	0.003	0.000	CII_Capitan_Mountain
Chaco Culture NHP	NM	NPS		0.010	0.088	0.008	0.064	0.004	0.027	0.013	0.001	CII_Chaco_Culture
Chama River Canyon Wilderness	NM	USFS		0.040	0.162	0.024	0.065	0.009	0.018	0.009	0.001	CII_Chama_River_Cany
Chimney Rock NM	CO	USFS		0.287	0.398	0.135	0.136	0.039	0.025	0.013	0.002	CII_Chimney_Rock
Colorado NM	CO	NPS		0.301	0.621	0.087	0.496	0.053	0.270	0.117	0.013	CII_Colorado
Cruces Basin Wilderness	NM	USFS		0.026	0.112	0.019	0.049	0.007	0.023	0.010	0.001	CII_Cruces_Basin
Curecanti NRA	CO	NPS		0.076	0.277	0.037	0.208	0.026	0.090	0.050	0.005	CII_Curecanti
Dark Canyon Wilderness	UT	USFS		0.019	0.189	0.009	0.103	0.005	0.066	0.038	0.002	CII_Dark_Canyon
Dinosaur NM	CO	NPS		0.864	0.836	0.139	0.430	0.081	0.910	0.529	0.108	CII_Dinosaur_all
Dome Wilderness	NM	USFS		0.010	0.065	0.009	0.042	0.004	0.010	0.006	0.001	CII_Dome
El Malpais NM	NM	NPS		0.006	0.066	0.005	0.045	0.003	0.020	0.009	0.001	CII_El_Malpais
Escudilla Wilderness	AZ	USFS		0.001	0.033	0.001	0.013	0.001	0.008	0.004	0.000	CII_Escudilla
Flaming Gorge	UT	USFS		0.008	0.054	0.003	0.022	0.002	0.074	0.019	0.001	CII_Flaming_Gorge
Florissant Fossil Beds NM	CO	NPS		0.068	0.574	0.050	0.248	0.021	0.040	0.021	0.002	CII_Florissant_Fossi
Fossil Ridge Wilderness	CO	USFS		0.053	0.157	0.027	0.090	0.017	0.062	0.025	0.002	CII_Fossil_Ridge
Glen Canyon NRA	UT	NPS		0.038	0.185	0.016	0.127	0.009	0.081	0.047	0.004	CII_Glen_Canyon
Great Sand Dunes National Park	CO	NPS		0.024	0.171	0.020	0.108	0.011	0.025	0.012	0.001	CII_Great_Sand_Park
Great Sand Dunes National Preserve	CO	NPS		0.024	0.202	0.019	0.089	0.009	0.024	0.012	0.001	CII_Great_Sand_Prese
Greenhorn Mountain Wilderness	CO	USFS		0.027	0.340	0.027	0.121	0.010	0.024	0.013	0.001	CII_Greenhorn_Mounta
High Uintas Wilderness	UT	USFS		0.001	0.042	0.001	0.021	0.001	0.029	0.009	0.000	CII_High_Uintas
Holy Cross Wilderness	CO	USFS		0.124	0.183	0.041	0.132	0.022	0.104	0.045	0.006	CII_Holy_Cross
Hovenweep NM	CO	NPS		0.048	0.129	0.020	0.086	0.011	0.052	0.033	0.009	CII_Hovenweep
Hunter-Fryingpan Wilderness	CO	USFS		0.105	0.181	0.038	0.111	0.023	0.105	0.038	0.005	CII_Hunter_Fryingpan
Las Vegas National Wildlife Refuge	NM	FWS		0.010	0.107	0.012	0.047	0.005	0.008	0.004	0.000	CII_Las_Vegas_NWR
Latir Peak Wilderness	NM	USFS		0.015	0.087	0.013	0.047	0.006	0.015	0.008	0.001	CII_Latir_Peak
Lizard Head Wilderness	CO	USFS		0.045	0.137	0.014	0.095	0.009	0.062	0.028	0.002	CII_Lizard_Head
Lost Creek Wilderness	CO	USFS		0.081	0.876	0.065	0.396	0.024	0.053	0.021	0.003	CII_Lost_Creek
Manzano Mountain Wilderness	NM	USFS		0.011	0.142	0.014	0.074	0.007	0.028	0.013	0.001	CII_Manzano_Mountain
Maxwell National Wildlife Refuge	NM	FWS		0.030	0.154	0.021	0.087	0.008	0.014	0.005	0.001	CII_Maxwell_NWR
Monte Vista National Wildlife Refuge	CO	FWS		0.022	0.135	0.020	0.104	0.013	0.031	0.011	0.001	CII_Monte_Vista_NWR
Mount Evans Wilderness	CO	USFS		0.083	0.803	0.063	0.345	0.023	0.053	0.020	0.003	CII_Mount_Evans
Mount Sneffels Wilderness	CO	USFS		0.050	0.165	0.017	0.122	0.010	0.079	0.033	0.002	CII_Mount_Sneffels
Natural Bridges NM	UT	NPS		0.016	0.144	0.008	0.066	0.004	0.062	0.028	0.002	CII_Natural_Bridges
Navajo NM	AZ	NPS		0.006	0.102	0.004	0.043	0.002	0.029	0.022	0.001	CII_Navajo
Petroglyph NM	NM	NPS		0.007	0.088	0.009	0.060	0.005	0.014	0.008	0.001	CII_Petroglyph
Powderhorn Wilderness	CO	USFS		0.033	0.128	0.017	0.081	0.010	0.062	0.031	0.002	CII_Powderhorn
Raggeds Wilderness	CO	USFS		0.918	0.545	0.243	0.312	0.100	0.103	0.040	0.006	CII_Raggeds
Rio Mora National Wildlife Refuge and Conservation Area	NM	FWS		0.011	0.102	0.012	0.039	0.005	0.010	0.005	0.000	CII_Rio_Mora_NWR_and
Sandia Mountain Wilderness	NM	USFS		0.008	0.089	0.010	0.064	0.005	0.019	0.007	0.001	CII_Sandia_Mountain
Sangre de Cristo Wilderness	CO	USFS		0.033	0.280	0.022	0.121	0.011	0.042	0.018	0.002	CII_Sangre_de_Cristo
Savage Run Wilderness	WY	USFS		0.068	0.293	0.044	0.096	0.018	0.065	0.032	0.006	CII_Savage_Run
Sevilleta National Wildlife Refuge	NM	FWS		0.004	0.071	0.006	0.046	0.003	0.014	0.005	0.000	CII_Sevilleta_NWR
South San Juan Wilderness	CO	USFS		0.071	0.185	0.042	0.074	0.013	0.028	0.012	0.001	CII_South_San_Juan
Spanish Peaks Wilderness	CO	USFS		0.081	0.341	0.046	0.167	0.014	0.018	0.009	0.001	CII_Spanish_Peaks
Uncompahgre Wilderness	CO	USFS		0.041	0.182	0.019	0.143	0.013	0.078	0.034	0.003	CII_Uncompahgre
Valle De Oro National Wildlife Refuge	NM	FWS		0.007	0.101	0.010	0.072	0.007	0.014	0.007	0.001	CII_Valle_De_Oro_NWR
Withington Wilderness	NM	USFS		0.001	0.036	0.002	0.018	0.001	0.008	0.004	0.000	CII_Withington

Note that the thresholds shown are project-level thresholds. The comparisons shown above are for informational purposes only.

5.2 Visibility Impacts at Class I/II Areas using FLAG (2010)

Attachments B-1, B-2 and B-3 are interactive Excel spreadsheets that contain the visibility impacts at Class I and sensitive Class II areas due to emissions from the 35 Source Groups using the FLAG (2010) procedures as described in Section 4.6. There are four interactive sheets in Attachment B:

> "Table1" shows maximum change in (delta) visibility (Δdv), the day of maximum Δdv and number of days that Δdv exceed the 0.5 and 1.0 dv thresholds for all Class I/II areas and a user selected Source Group that is controlled in cell B1.
>
> "Table2" shows the temporal distribution (i.e., maximum and minimum and 98th, 80th and 20th percentiles) of Δdv by user selected Source Group (controlled by cell B1) for all Class I and II areas.
>
> "Table3" shows maximum (or 98th, 80th, 20th or minimum controlled by cell B1) impact of Δdv from all Source Groups across all Class I, all Class II and combined all Class I and II areas.
>
> "Table4" shows the maximum number of days that Δdv is greater than the 0.5 and 1.0 dv thresholds at any Class I or II area for all 32 Source Groups.
>
> "Table 5" shows the number of days that Δdv is greater than the 0.5 and 1.0 dv thresholds and the maximum Δdv at each Class I and sensitive Class II area for a user-selected Source Group controlled by cell B1.

Additional information describing the Attachment B-1 and B-2 spreadsheets are contained in sheets "Readme" and "Ref."

5.2.1 Maximum Visibility Impacts at any Class I Area for all Source Groups

Table 5-13 displays the Class I and II areas where the maximum number of days Δdv exceeds the 0.5 and 1.0 thresholds occurred for each of the Source Groups in the 2025 High Development Scenario. Tables 5-14 and 5-15 show the same information for the 2025 Low and Medium Development Scenarios, respectively. These Tables were obtained from "Table4" in Attachments B-1, B-2 and B-3. The maximum Δdv impact at any Class I and II area due to each the Source Groups for the 2025 High, Low and Medium Development Scenarios are shown in Table 5-16.

Of the 14 BLM Colorado and New Mexico Planning Areas (Source Groups B through O) plus the total CRFO (Source Group Y) and RGFO (Source Group Z) Planning Areas, only WRFO has Federal O&G with Δdv visibility impacts at any Class I area that exceed the 0.5 dv threshold for the 2025 High Development Scenario (Table 5-13). WRFO has 41 days of Δdv > 0.5 and 4 days with Δdv > 1.0 (Table 5-13) and maximum Δdv of 1.555 at Dinosaur Class I Area (Table 5-16).

The individual Source Groups B through O of O&G emissions in BLM Planning Areas have no days with Δdv > 0.5 at any Class I area for the 2025 Low Development Scenario (Table 5-14). The maximum Δdv at any Class I area for Federal O&G within an individual BLM Planning Area

and the 2025 Low Development Scenario is 0.12 from WRFO at Dinosaur Class I Area (Table 5-16a).

Results for the 2025 Medium Development Scenario are similar but lower than the High Development Scenario with WRFO having 32 days with Δdv > 0.5 at any Class I area and 1 day with Δdv > 1.0 at any Class I area (Table 5-15).

When looking at the 2025 High Development Scenario visibility impacts at Sensitive Class II areas, four of the 14 BLM Planning Areas (Source Groups B through O) have maximum Δdv that exceeds the 0.5 threshold: WRFO, GJFO, SUIT and NMFFO (Tables 5-13a and 5-16).

- WRFO with 83 days of Δdv > 0.5 and 25 days with Δdv > 1.0 and maximum Δdv of 2.56 at Dinosaur National Monument.
- GJFO with 6 days of Δdv > 0.5 and 1 days with Δdv > 1.0 and maximum Δdv of 1.23 at Colorado National Monument.
- SUIT with 17 days of Δdv > 0.5 and 1 days with Δdv > 1.0 and maximum Δdv of 1.16 at Aztec Ruins National Monument.
- NMFFO with 261 days of Δdv > 0.5 and 80 days with Δdv > 1.0 and maximum Δdv of 2.66 at Aztec Ruins National Monument.

For the 2025 Low Development Scenario, there are three BLM Planning Areas that have visibility impacts greater than 0.5 dv at any Class II area.

- WRFO has 1 days of Δdv > 0.5 and 0 days with Δdv > 1.0 and a maximum Δdv of 0.51 at Dinosaur National Monument.
- SUIT has 1 days of Δdv > 0.5 and 0 days with Δdv > 1.0 and a maximum Δdv of 0.65 at Aztec Ruins National Monument.
- NMFFO has 82 days of Δdv > 0.5 and 6 days with Δdv > 1.0 and a maximum Δdv of 1.49 at Aztec Ruins National Monument.

New O&G development on BLM Planning Areas result in exceedances of the 0.5 dv visibility threshold at Class II areas for the 2025 Medium Development Scenario for the same four BLM Planning Areas as seen for the 2025 High Development Scenarios only with lower number of days (Tables 5-15a and 5-16b).

- WRFO with 69 days of Δdv > 0.5 and 21 days with Δdv > 1.0 and maximum Δdv of 2.39 at Dinosaur National Monument.
- GJFO with 4 days of Δdv > 0.5 and 1 days with Δdv > 1.0 and maximum Δdv of 1.06 at Colorado National Monument.

- SUIT with 0 days of Δdv > 0.5 and 0 days with Δdv > 1.0 and maximum Δdv of 0.45 at Aztec Ruins National Monument.

- NMFFO with 84 days of Δdv > 0.5 and 9 days with Δdv > 1.0 and maximum Δdv of 1.55 at Aztec Ruins National Monument.

Not surprisingly, when looking at visibility impacts using the FLAG (2010) approach at Class I/II areas due to O&G emissions across combined BLM Planning Areas there are greater visibility impacts than for any individual BLM Planning Area. The FLMs have developed a Cumulative Visibility approach using the regional haze Worst 20 percent days (W20%) and Best 20 percent days (B20%) regional haze rule metric that is used to assess the visibility impacts for these combined Source Groups that is discussed in Section 5.3. The combined Source Group visibility impacts at Class I/II areas using the FLAG (2010) method in Figures 5-13 through 5-15 are provided for information only.

Table 5-13. Class I area where each of the Source Groups have the maximum number of days that Δdv exceeds the 0.5 and 1.0 dv thresholds for the High Development Scenario.

Source Group	Group Name	>0.5		>1.0	
		Max # of Day @ Class I	Class I (Max Occurs)	Max # of Day @ Class I	Class I (Max Occurs)
A	Natural emissions	213	CI_Bosque	175	CI_Bosque
B	Little Snake FO	0	NA	0	NA
C	White River FO	41	CI_Dinosaur_CO	4	CI_Dinosaur_CO
D	Colorado River Valley FO (CRVFO)	0	NA	0	NA
E	Roan Plateau Planning area portion of CRVFO	0	NA	0	NA
F	Grand Junction FO	0	NA	0	NA
G	Uncompahgre FO	0	NA	0	NA
H	Tres Rios FO	0	NA	0	NA
I	Kremmling FO	0	NA	0	NA
J	RGFO #1	0	NA	0	NA
K	RGFO #2	0	NA	0	NA
L	RGFO #3	0	NA	0	NA
M	RGFO #4	0	NA	0	NA
N	Southern Ute Indian Tribe	0	NA	0	NA
O	New Mexico Farmington Field Office	0	NA	0	NA
P	Combined future non-Federal O&G from BLM Planning Areas	18	CI_Rocky_Mountain	8	CI_Rocky_Mountain
Q	Combined Existing O&G from BLM Planning Areas	21	CI_Rocky_Mountain	10	CI_Rocky_Mountain
R	Mining from BLM Planning Areas	1	CI_Flat_Tops	0	NA
S	All O&G in 12 km domain outside of the BLM Planning Areas	317	CI_Salt_Creek	52	CI_Salt_Creek
T	Remaining anthropogenic emissions	364	CI_Bandelier	364	CI_Bandelier
U	Coal EGU Colorado + New Mexico	103	CI_Mount_Zirkel	25	CI_Mount_Zirkel
V	Oil/Gas EGU Colorado + New Mexico	0	NA	0	NA
W	All Other EGUs in 12 km domain	135	CI_Petrified_Forest	56	CI_Petrified_Forest
X	Total new federal O&G in CO	44	CI_Dinosaur_CO	4	CI_Dinosaur_CO
Y	New total CRVFO	0	NA	0	NA
Z	New total RGFO	0	NA	0	NA
A1	All new O&G in CO plus new non-federal FFO1	57	CI_Dinosaur_CO	10	CI_Black_Canyon
A2	New federal O&G + new Mining in CO	50	CI_Dinosaur_CO	5	CI_Dinosaur_CO
A3	New federal O&G + new non-federal O&G + Mining in CO	66	CI_Dinosaur_CO	11	CI_Black_Canyon
A4	All EGUs in CO and NM	103	CI_Mount_Zirkel	25	CI_Mount_Zirkel
A5	2025 BC	364	CI_Bosque	364	CI_White_Mountain
A6	2025 Total	364	CI_Arches	364	CI_Arches
A7	2011 Total	364	CI_Arches	364	CI_Arches
X1	Total new federal O&G in CO (X) using Brute-Force zero-out run	51	CI_Dinosaur_CO	1	CI_Dinosaur_CO

Note that the thresholds shown are project-level thresholds. The comparisons shown above are for informational purposes only.

Table 5-13a. Sensitive Class II area where each of the Source Groups has the maximum number of days that Δdv exceeds the 0.5 and 1.0 dv thresholds for the High Development Scenario.

Source Group	Group Name	>0.5		>1.0	
		Max # of Day @ Class II	Class II (Max Occurs)	Max # of Day @ Class II	Class II (Max Occurs)
A	Natural emissions	228	CII_Glen_Canyon	179	CII_Glen_Canyon
B	Little Snake FO	0	NA	0	NA
C	White River FO	83	CII_Dinosaur_all	25	CII_Dinosaur_all
D	Colorado River Valley FO (CRVFO)	0	NA	0	NA
E	Roan Plateau Planning area portion of CRVFO	0	NA	0	NA
F	Grand Junction FO	6	CII_Colorado	1	CII_Colorado
G	Uncompahgre FO	0	NA	0	NA
H	Tres Rios FO	0	NA	0	NA
I	Kremmling FO	0	NA	0	NA
J	RGFO #1	0	NA	0	NA
K	RGFO #2	0	NA	0	NA
L	RGFO #3	0	NA	0	NA
M	RGFO #4	0	NA	0	NA
N	Southern Ute Indian Tribe	17	CII_Aztec_Ruins	1	CII_Aztec_Ruins
O	New Mexico Farmington Field Office	261	CII_Aztec_Ruins	80	CII_Aztec_Ruins
P	Combined future non-Federal O&G from BLM Planning Areas	71	CII_Aztec_Ruins	6	CII_Lost_Creek
Q	Combined Existing O&G from BLM Planning Areas	19	CII_Lost_Creek	8	CII_Lost_Creek
R	Mining from BLM Planning Areas	2	CII_Dinosaur_all	0	NA
S	All O&G in 12 km domain outside of the BLM Planning Areas	333	CII_Aztec_Ruins	166	CII_Aztec_Ruins
T	Remaining anthropogenic emissions	364	CII_Alamosa_NWR	364	CII_Aztec_Ruins
U	Coal EGU Colorado + New Mexico	52	CII_Aztec_Ruins	28	CII_Aztec_Ruins
V	Oil/Gas EGU Colorado + New Mexico	0	NA	0	NA
W	All Other EGUs in 12 km domain	196	CII_Glen_Canyon	104	CII_Glen_Canyon
X	Total new federal O&G in CO	89	CII_Dinosaur_all	32	CII_Dinosaur_all
Y	New total CRVFO	1	CII_Colorado	0	NA
Z	New total RGFO	0	NA	0	NA
A1	All new O&G in CO plus new non-federal FFO1	152	CII_Aztec_Ruins	43	CII_Dinosaur_all
A2	New federal O&G + new Mining in CO	103	CII_Dinosaur_all	37	CII_Dinosaur_all
A3	New federal O&G + new non-federal O&G + Mining in CO	156	CII_Aztec_Ruins	47	CII_Dinosaur_all
A4	All EGUs in CO and NM	53	CII_Aztec_Ruins	29	CII_Aztec_Ruins
A5	2025 BC	364	CII_Alamosa_NWR	364	CII_Las_Vegas_NWR
A6	2025 Total	364	CII_Alamosa_NWR	364	CII_Alamosa_NWR
A7	2011 Total	364	CII_Alamosa_NWR	364	CII_Alamosa_NWR
X1	Total new federal O&G in CO (X) using Brute-Force zero-out run	100	CII_Dinosaur_all	28	CII_Dinosaur_all

Note that the thresholds shown are project-level thresholds. The comparisons shown above are for informational purposes only.

Table 5-14. Class I area where each of the Source Groups have the maximum number of days that Δdv exceeds the 0.5 and 1.0 dv thresholds for the Low Development Scenario.

Source Group	Group Name	>0.5		>1.0	
		Max # of Day @ Class I	Class I (Max Occurs)	Max # of Day @ Class I	Class I (Max Occurs)
A	Natural emissions	213	CI_Bosque	175	CI_Bosque
B	Little Snake FO	0	NA	0	NA
C	White River FO	0	NA	0	NA
D	Colorado River Valley FO (CRVFO)	0	NA	0	NA
E	Roan Plateau Planning area portion of CRVFO	0	NA	0	NA
F	Grand Junction FO	0	NA	0	NA
G	Uncompahgre FO	0	NA	0	NA
H	Tres Rios FO	0	NA	0	NA
I	Kremmling FO	0	NA	0	NA
J	RGFO #1	0	NA	0	NA
K	RGFO #2	0	NA	0	NA
L	RGFO #3	0	NA	0	NA
M	RGFO #4	0	NA	0	NA
N	Southern Ute Indian Tribe	0	NA	0	NA
O	New Mexico Farmington Field Office	0	NA	0	NA
P	Combined future non-Federal O&G from BLM Planning Areas	3	CI_Rocky_Mountain	1	CI_Rocky_Mountain
Q	Combined Existing O&G from BLM Planning Areas	22	CI_Rocky_Mountain	11	CI_Rocky_Mountain
R	Mining from BLM Planning Areas	1	CI_Flat_Tops	0	NA
S	All O&G in 12 km domain outside of the BLM Planning Areas	317	CI_Salt_Creek	52	CI_Salt_Creek
T	Remaining anthropogenic emissions	364	CI_Bandelier	364	CI_Bandelier
U	Coal EGU Colorado + New Mexico	105	CI_Mount_Zirkel	29	CI_Mount_Zirkel
V	Oil/Gas EGU Colorado + New Mexico	0	NA	0	NA
W	All Other EGUs in 12 km domain	135	CI_Petrified_Forest	56	CI_Petrified_Forest
X	Total new federal O&G in CO	0	NA	0	NA
Y	New total CRVFO	0	NA	0	NA
Z	New total RGFO	0	NA	0	NA
A1	All new O&G in CO plus new non-federal FFO1	3	CI_Rocky_Mountain	1	CI_Rocky_Mountain
A2	New federal O&G + new Mining in CO	1	CI_Flat_Tops	0	NA
A3	New federal O&G + new non-federal O&G + Mining in CO	5	CI_Rocky_Mountain	1	CI_Rocky_Mountain
A4	All EGUs in CO and NM	105	CI_Mount_Zirkel	29	CI_Mount_Zirkel
A5	2025 BC	364	CI_Bosque	364	CI_White_Mountain
A6	2025 Total	364	CI_Arches	364	CI_Arches
A7	2011 Total	364	CI_Arches	364	CI_Arches
X1	Total new federal O&G in CO (X) using Brute-Force zero-out run	0	NA	0	NA

Note that the thresholds shown are project-level thresholds. The comparisons shown above are for informational purposes only.

Table 5-14a. Sensitive Class II area where each of the Source Groups has the maximum number of days that Δdv exceeds the 0.5 and 1.0 dv thresholds for the Low Development Scenario.

Source Group	Group Name	>0.5		>1.0	
		Max # of Day @ Class II	Class II (Max Occurs)	Max # of Day @ Class II	Class II (Max Occurs)
A	Natural emissions	228	CII_Glen_Canyon	179	CII_Glen_Canyon
B	Little Snake FO	0	NA	0	NA
C	White River FO	1	CII_Dinosaur_all	0	NA
D	Colorado River Valley FO (CRVFO)	0	NA	0	NA
E	Roan Plateau Planning area portion of CRVFO	0	NA	0	NA
F	Grand Junction FO	0	NA	0	NA
G	Uncompahgre FO	0	NA	0	NA
H	Tres Rios FO	0	NA	0	NA
I	Kremmling FO	0	NA	0	NA
J	RGFO #1	0	NA	0	NA
K	RGFO #2	0	NA	0	NA
L	RGFO #3	0	NA	0	NA
M	RGFO #4	0	NA	0	NA
N	Southern Ute Indian Tribe	1	CII_Aztec_Ruins	0	NA
O	New Mexico Farmington Field Office	82	CII_Aztec_Ruins	6	CII_Aztec_Ruins
P	Combined future non-Federal O&G from BLM Planning Areas	6	CII_Aztec_Ruins	0	NA
Q	Combined Existing O&G from BLM Planning Areas	19	CII_Lost_Creek	9	CII_Lost_Creek
R	Mining from BLM Planning Areas	2	CII_Dinosaur_all	0	NA
S	All O&G in 12 km domain outside of the BLM Planning Areas	332	CII_Aztec_Ruins	163	CII_Aztec_Ruins
T	Remaining anthropogenic emissions	364	CII_Alamosa_NWR	364	CII_Aztec_Ruins
U	Coal EGU Colorado + New Mexico	53	CII_Aztec_Ruins	30	CII_Aztec_Ruins
V	Oil/Gas EGU Colorado + New Mexico	0	NA	0	NA
W	All Other EGUs in 12 km domain	196	CII_Glen_Canyon	104	CII_Glen_Canyon
X	Total new federal O&G in CO	1	CII_Dinosaur_all	0	NA
Y	New total CRVFO	0	NA	0	NA
Z	New total RGFO	0	NA	0	NA
A1	All new O&G in CO plus new non-federal FFO1	42	CII_Aztec_Ruins	1	CII_Aztec_Ruins
A2	New federal O&G + new Mining in CO	4	CII_Dinosaur_all	0	NA
A3	New federal O&G + new non-federal O&G + Mining in CO	42	CII_Aztec_Ruins	1	CII_Aztec_Ruins
A4	All EGUs in CO and NM	53	CII_Aztec_Ruins	30	CII_Aztec_Ruins
A5	2025 BC	364	CII_Alamosa_NWR	364	CII_Las_Vegas_NWR
A6	2025 Total	364	CII_Alamosa_NWR	364	CII_Alamosa_NWR
A7	2011 Total	364	CII_Alamosa_NWR	364	CII_Alamosa_NWR
X1	Total new federal O&G in CO (X) using Brute-Force zero-out run	0	NA	0	NA

Note that the thresholds shown are project-level thresholds. The comparisons shown above are for informational purposes only.

Table 5-15. Class I area where each of the Source Groups have the maximum number of days that Δdv exceeds the 0.5 and 1.0 dv thresholds for the Medium Development Scenario.

Source Group	Group Name	>0.5		>1.0	
		Max # of Day @ Class I	Class I (Max Occurs)	Max # of Day @ Class I	Class I (Max Occurs)
A	Natural emissions	213	CI_Bosque	175	CI_Bosque
B	Little Snake FO	0	NA	0	NA
C	White River FO	32	CI_Dinosaur_CO	3	CI_Dinosaur_CO
D	Colorado River Valley FO (CRVFO)	0	NA	0	NA
E	Roan Plateau Planning area portion of CRVFO	0	NA	0	NA
F	Grand Junction FO	0	NA	0	NA
G	Uncompahgre FO	0	NA	0	NA
H	Tres Rios FO	0	NA	0	NA
I	Kremmling FO	0	NA	0	NA
J	RGFO #1	0	NA	0	NA
K	RGFO #2	0	NA	0	NA
L	RGFO #3	0	NA	0	NA
M	RGFO #4	0	NA	0	NA
N	Southern Ute Indian Tribe	0	NA	0	NA
O	New Mexico Farmington Field Office	0	NA	0	NA
P	Combined future non-Federal O&G from BLM Planning Areas	18	CI_Rocky_Mountain	8	CI_Rocky_Mountain
Q	Combined Existing O&G from BLM Planning Areas	21	CI_Rocky_Mountain	10	CI_Rocky_Mountain
R	Mining from BLM Planning Areas	1	CI_Flat_Tops	0	NA
S	All O&G in 12 km domain outside of the BLM Planning Areas	317	CI_Salt_Creek	52	CI_Salt_Creek
T	Remaining anthropogenic emissions	364	CI_Bandelier	364	CI_Bandelier
U	Coal EGU Colorado + New Mexico	104	CI_Mount_Zirkel	25	CI_Mount_Zirkel
V	Oil/Gas EGU Colorado + New Mexico	0	NA	0	NA
W	All Other EGUs in 12 km domain	135	CI_Petrified_Forest	56	CI_Petrified_Forest
X	Total new federal O&G in CO	36	CI_Dinosaur_CO	3	CI_Dinosaur_CO
Y	New total CRVFO	0	NA	0	NA
Z	New total RGFO	0	NA	0	NA
A1	All new O&G in CO plus new non-federal FFO1	48	CI_Dinosaur_CO	8	CI_Black_Canyon
A2	New federal O&G + new Mining in CO	39	CI_Dinosaur_CO	4	CI_Dinosaur_CO
A3	New federal O&G + new non-federal O&G + Mining in CO	55	CI_Dinosaur_CO	9	CI_Black_Canyon
A4	All EGUs in CO and NM	104	CI_Mount_Zirkel	25	CI_Mount_Zirkel
A5	2025 BC	364	CI_Bosque	364	CI_White_Mountain
A6	2025 Total	364	CI_Arches	364	CI_Arches
A7	2011 Total	364	CI_Arches	364	CI_Arches
X1	Total new federal O&G in CO (X) using Brute-Force zero-out run	40	CI_Dinosaur_CO	1	CI_Dinosaur_CO

Note that the thresholds shown are project-level thresholds. The comparisons shown above are for informational purposes only.

Table 5-15a. Sensitive Class II area where each of the Source Groups has the maximum number of days that Δdv exceeds the 0.5 and 1.0 dv thresholds for the Medium Development Scenario.

Source Group	Group Name	>0.5		>1.0	
		Max # of Day @ Class II	Class II (Max Occurs)	Max # of Day @ Class II	Class II (Max Occurs)
A	Natural emissions	228	CII_Glen_Canyon	179	CII_Glen_Canyon
B	Little Snake FO	0	NA	0	NA
C	White River FO	69	CII_Dinosaur_all	21	CII_Dinosaur_all
D	Colorado River Valley FO (CRVFO)	0	NA	0	NA
E	Roan Plateau Planning area portion of CRVFO	0	NA	0	NA
F	Grand Junction FO	4	CII_Colorado	1	CII_Colorado
G	Uncompahgre FO	0	NA	0	NA
H	Tres Rios FO	0	NA	0	NA
I	Kremmling FO	0	NA	0	NA
J	RGFO #1	0	NA	0	NA
K	RGFO #2	0	NA	0	NA
L	RGFO #3	0	NA	0	NA
M	RGFO #4	0	NA	0	NA
N	Southern Ute Indian Tribe	0	NA	0	NA
O	New Mexico Farmington Field Office	84	CII_Aztec_Ruins	9	CII_Aztec_Ruins
P	Combined future non-Federal O&G from BLM Planning Areas	74	CII_Aztec_Ruins	6	CII_Lost_Creek
Q	Combined Existing O&G from BLM Planning Areas	19	CII_Lost_Creek	8	CII_Lost_Creek
R	Mining from BLM Planning Areas	2	CII_Dinosaur_all	0	NA
S	All O&G in 12 km domain outside of the BLM Planning Areas	332	CII_Aztec_Ruins	166	CII_Aztec_Ruins
T	Remaining anthropogenic emissions	364	CII_Alamosa_NWR	364	CII_Aztec_Ruins
U	Coal EGU Colorado + New Mexico	53	CII_Aztec_Ruins	29	CII_Aztec_Ruins
V	Oil/Gas EGU Colorado + New Mexico	0	NA	0	NA
W	All Other EGUs in 12 km domain	196	CII_Glen_Canyon	104	CII_Glen_Canyon
X	Total new federal O&G in CO	76	CII_Dinosaur_all	24	CII_Dinosaur_all
Y	New total CRVFO	0	NA	0	NA
Z	New total RGFO	0	NA	0	NA
A1	All new O&G in CO plus new non-federal FFO1	104	CII_Aztec_Ruins	34	CII_Dinosaur_all
A2	New federal O&G + new Mining in CO	84	CII_Dinosaur_all	28	CII_Dinosaur_all
A3	New federal O&G + new non-federal O&G + Mining in CO	110	CII_Dinosaur_all	38	CII_Dinosaur_all
A4	All EGUs in CO and NM	53	CII_Aztec_Ruins	29	CII_Aztec_Ruins
A5	2025 BC	364	CII_Alamosa_NWR	364	CII_Las_Vegas_NWR
A6	2025 Total	364	CII_Alamosa_NWR	364	CII_Alamosa_NWR
A7	2011 Total	364	CII_Alamosa_NWR	364	CII_Alamosa_NWR
X1	Total new federal O&G in CO (X) using Brute-Force zero-out run	77	CII_Dinosaur_all	19	CII_Dinosaur_all

Note that the thresholds shown are project-level thresholds. The comparisons shown above are for informational purposes only.

Table 5-16. Maximum Δdv impact at any Class I and sensitive Class II area due to each of the Source Groups for the 2025 High Development Scenario.

Temporal Rank	Max						
Maximum Impact from Source Group Across Class I&II							
Source Group	Group Name	Max dv @ Class I	Class I (Max Occurs)	Max dv @ Class II	Class II (Max Occurs)	Max dv @ Class I&II	Class I&II (Max Occurs)
A	Natural emissions	58.12318	CI_Bandelier	55.97628	CII_Dome	58.12318	CI_Bandelier
B	Little Snake FO	0.24487	CI_Mount_Zirkel	0.20386	CII_Dinosaur_all	0.24487	CI_Mount_Zirkel
C	White River FO	1.55539	CI_Dinosaur_CO	2.55756	CII_Dinosaur_all	2.55756	CII_Dinosaur_all
D	Colorado River Valley FO (CRVFO)	0.06157	CI_Eagles_Nest	0.18077	CII_Colorado	0.18077	CII_Colorado
E	Roan Plateau Planning area portion of CRVFO	0.10545	CI_Black_Canyon	0.33485	CII_Colorado	0.33485	CII_Colorado
F	Grand Junction FO	0.49049	CI_Arches	1.29879	CII_Colorado	1.29879	CII_Colorado
G	Uncompahgre FO	0.13009	CI_Maroon_Bells	0.13785	CII_Raggeds	0.13785	CII_Raggeds
H	Tres Rios FO	0.04072	CI_Weminuche	0.08860	CII_South_San_Juan	0.08860	CII_South_San_Juan
I	Kremmling FO	0.04023	CI_Rawah	0.02588	CII_Savage_Run	0.04023	CI_Rawah
J	RGFO #1	0.06664	CI_Rocky_Mountain	0.04864	CII_Lost_Creek	0.06664	CI_Rocky_Mountain
K	RGFO #2	0.00594	CI_Eagles_Nest	0.04769	CII_Florissant_Fossi	0.04769	CII_Florissant_Fossi
L	RGFO #3	0.11767	CI_Rocky_Mountain	0.08173	CII_Florissant_Fossi	0.11767	CI_Rocky_Mountain
M	RGFO #4	0.00794	CI_Pecos	0.01570	CII_Spanish_Peaks	0.01570	CII_Spanish_Peaks
N	Southern Ute Indian Tribe	0.37417	CI_Mesa_Verde	1.15756	CII_Aztec_Ruins	1.15756	CII_Aztec_Ruins
O	New Mexico Farmington Field Office	0.39291	CI_Mesa_Verde	2.66071	CII_Aztec_Ruins	2.66071	CII_Aztec_Ruins
P	Combined future non-Federal O&G from BLM Planning Areas	2.67040	CI_Rocky_Mountain	2.18267	CII_Colorado	2.67040	CI_Rocky_Mountain
Q	Combined Existing O&G from BLM Planning Areas	3.17753	CI_Rocky_Mountain	2.09625	CII_Lost_Creek	3.17753	CI_Rocky_Mountain
R	Mining from BLM Planning Areas	0.60337	CI_Flat_Tops	0.64416	CII_Dinosaur_all	0.64416	CII_Dinosaur_all
S	All O&G in 12 km domain outside of the BLM Planning Areas	2.38262	CI_Dinosaur_CO	8.84438	CII_Dinosaur_all	8.84438	CII_Dinosaur_all
T	Remaining anthropogenic emissions	12.46957	CI_Bandelier	26.46216	CII_Aztec_Ruins	26.46216	CII_Aztec_Ruins
U	Coal EGU Colorado + New Mexico	2.98052	CI_Mount_Zirkel	2.34453	CII_Aztec_Ruins	2.98052	CI_Mount_Zirkel
V	Oil/Gas EGU Colorado + New Mexico	0.07997	CI_Great_Sand_Dunes	0.18050	CII_Alamosa_NWR	0.18050	CII_Alamosa_NWR
W	All Other EGUs in 12 km domain	9.26874	CI_Petrified_Forest	7.81540	CII_Dinosaur_all	9.26874	CI_Petrified_Forest
X	Total new federal O&G in CO	1.56529	CI_Dinosaur_CO	2.56658	CII_Dinosaur_all	2.56658	CII_Dinosaur_all
Y	New total CRVFO	0.16599	CI_Black_Canyon	0.51036	CII_Colorado	0.51036	CII_Colorado
Z	New total RGFO	0.13977	CI_Rocky_Mountain	0.12031	CII_Florissant_Fossi	0.13977	CI_Rocky_Mountain
A1	All new O&G in CO plus new non-federal FFO1	2.85059	CI_Rocky_Mountain	4.29199	CII_Colorado	4.29199	CII_Colorado
A2	New federal O&G + new Mining in CO	1.60012	CI_Dinosaur_CO	2.63004	CII_Dinosaur_all	2.63004	CII_Dinosaur_all
A3	New federal O&G + new non-federal O&G + Mining in CO	2.86057	CI_Rocky_Mountain	4.35070	CII_Colorado	4.35070	CII_Colorado
A4	All EGUs in CO and NM	2.98057	CI_Mount_Zirkel	2.35349	CII_Aztec_Ruins	2.98057	CI_Mount_Zirkel
A5	2025 BC	14.85337	CI_Salt_Creek	18.59945	CII_Capitan_Mountain	18.59945	CII_Capitan_Mountain
A6	2025 Total	58.21085	CI_Bandelier	56.10798	CII_Dome	58.21085	CI_Bandelier
A7	2011 Total	58.21498	CI_Bandelier	56.11617	CII_Dome	58.21498	CI_Bandelier
X1	Total new federal O&G in CO (X) using Brute-Force zero-out ru	1.38047	CI_Dinosaur_CO	1.95620	CII_Colorado	1.95620	CII_Colorado

Note that the thresholds shown are project-level thresholds. The comparisons shown above are for informational purposes only.

Table 5-16a. Maximum Δdv impact at any Class I and sensitive Class II area due to each of the Source Groups for the 2025 Low Development Scenario.

Temporal Rank	Max

Maximum Impact from Source Group Across Class I&II							
Source Group	Group Name	Max dv @ Class I	Class I (Max Occurs)	Max dv @ Class II	Class II (Max Occurs)	Max dv @ Class I&II	Class I&II (Max Occurs)
A	Natural emissions	58.12318	CI_Bandelier	55.97628	CII_Dome	58.12318	CI_Bandelier
B	Little Snake FO	0.02567	CI_Mount_Zirkel	0.02056	CII_Dinosaur_all	0.02567	CI_Mount_Zirkel
C	White River FO	0.24643	CI_Dinosaur_CO	0.51130	CII_Dinosaur_all	0.51130	CII_Dinosaur_all
D	Colorado River Valley FO (CRVFO)	0.04896	CI_Eagles_Nest	0.13319	CII_Colorado	0.13319	CII_Colorado
E	Roan Plateau Planning area portion of CRVFO	0.05607	CI_Black_Canyon	0.17521	CII_Colorado	0.17521	CII_Colorado
F	Grand Junction FO	0.02492	CI_Arches	0.06882	CII_Colorado	0.06882	CII_Colorado
G	Uncompahgre FO	0.00243	CI_Maroon_Bells	0.00395	CII_Raggeds	0.00395	CII_Raggeds
H	Tres Rios FO	0.00606	CI_Weminuche	0.01028	CII_Mount_Sneffels	0.01028	CII_Mount_Sneffels
I	Kremmling FO	0.00488	CI_Eagles_Nest	0.00278	CII_Savage_Run	0.00488	CI_Eagles_Nest
J	RGFO #1	0.00752	CI_Rocky_Mountain	0.00544	CII_Lost_Creek	0.00752	CI_Rocky_Mountain
K	RGFO #2	0.00004	CI_Mesa_Verde	0.00004	CII_Sandia_Mountain	0.00004	CI_Mesa_Verde
L	RGFO #3	0.01840	CI_Rocky_Mountain	0.01303	CII_Florissant_Fossi	0.01840	CI_Rocky_Mountain
M	RGFO #4	0.00070	CI_Pecos	0.00141	CII_Spanish_Peaks	0.00141	CII_Spanish_Peaks
N	Southern Ute Indian Tribe	0.19363	CI_Mesa_Verde	0.64767	CII_Aztec_Ruins	0.64767	CII_Aztec_Ruins
O	New Mexico Farmington Field Office	0.20245	CI_Mesa_Verde	1.49245	CII_Aztec_Ruins	1.49245	CII_Aztec_Ruins
P	Combined future non-Federal O&G from BLM Planning Areas	1.12089	CI_Rocky_Mountain	0.73815	CII_Lost_Creek	1.12089	CI_Rocky_Mountain
Q	Combined Existing O&G from BLM Planning Areas	3.46660	CI_Rocky_Mountain	2.27472	CII_Lost_Creek	3.46660	CI_Rocky_Mountain
R	Mining from BLM Planning Areas	0.64309	CI_Flat_Tops	0.67416	CII_Dinosaur_all	0.67416	CII_Dinosaur_all
S	All O&G in 12 km domain outside of the BLM Planning Areas	2.38749	CI_Dinosaur_CO	8.85961	CII_Dinosaur_all	8.85961	CII_Dinosaur_all
T	Remaining anthropogenic emissions	12.46955	CI_Bandelier	26.46481	CII_Aztec_Ruins	26.46481	CII_Aztec_Ruins
U	Coal EGU Colorado + New Mexico	3.08427	CI_Mount_Zirkel	2.41708	CII_Aztec_Ruins	3.08427	CI_Mount_Zirkel
V	Oil/Gas EGU Colorado + New Mexico	0.07973	CI_Great_Sand_Dunes	0.17800	CII_Alamosa_NWR	0.17800	CII_Alamosa_NWR
W	All Other EGUs in 12 km domain	9.31865	CI_Petrified_Forest	7.88451	CII_Dinosaur_all	9.31865	CI_Petrified_Forest
X	Total new federal O&G in CO	0.25007	CI_Dinosaur_CO	0.51266	CII_Dinosaur_all	0.51266	CII_Dinosaur_all
Y	New total CRVFO	0.10122	CI_Black_Canyon	0.30636	CII_Colorado	0.30636	CII_Colorado
Z	New total RGFO	0.02073	CI_Rocky_Mountain	0.01692	CII_Florissant_Fossi	0.02073	CI_Rocky_Mountain
A1	All new O&G in CO plus new non-federal FFO1	1.15678	CI_Rocky_Mountain	1.29872	CII_Aztec_Ruins	1.29872	CII_Aztec_Ruins
A2	New federal O&G + new Mining in CO	0.72906	CI_Flat_Tops	0.74014	CII_Dinosaur_all	0.74014	CII_Dinosaur_all
A3	New federal O&G + new non-federal O&G + Mining in CO	1.16808	CI_Rocky_Mountain	1.32055	CII_Aztec_Ruins	1.32055	CII_Aztec_Ruins
A4	All EGUs in CO and NM	3.08432	CI_Mount_Zirkel	2.42647	CII_Aztec_Ruins	3.08432	CI_Mount_Zirkel
A5	2025 BC	14.85337	CI_Salt_Creek	18.59945	CII_Capitan_Mountain	18.59945	CII_Capitan_Mountain
A6	2025 Total	58.21085	CI_Bandelier	56.10798	CII_Dome	58.21085	CI_Bandelier
A7	2011 Total	58.21498	CI_Bandelier	56.11617	CII_Dome	58.21498	CI_Bandelier
X1	Total new federal O&G in CO (X) using Brute-Force zero-out ru	0.26548	CI_Dinosaur_CO	0.47955	CII_Colorado	0.47955	CII_Colorado

Note that the thresholds shown are project-level thresholds. The comparisons shown above are for informational purposes only.

Table 5-16b. Maximum Δdv impact at any Class I and sensitive Class II area due to each of the Source Groups for the 2025 Medium Development Scenario.

Temporal Rank	Max

Maximum Impact from Source Group Across Class I&II							
Source Group	Group Name	Max dv @ Class I	Class I (Max Occurs)	Max dv @ Class II	Class II (Max Occurs)	Max dv @ Class I&II	Class I&II (Max Occurs)
A	Natural emissions	58.12318	CI_Bandelier	55.97628	CII_Dome	58.12318	CI_Bandelier
B	Little Snake FO	0.19881	CI_Mount_Zirkel	0.15606	CII_Dinosaur_all	0.19881	CI_Mount_Zirkel
C	White River FO	1.44872	CI_Dinosaur_CO	2.38869	CII_Dinosaur_all	2.38869	CII_Dinosaur_all
D	Colorado River Valley FO (CRVFO)	0.05027	CI_Eagles_Nest	0.14900	CII_Colorado	0.14900	CII_Colorado
E	Roan Plateau Planning area portion of CRVFO	0.09275	CI_Black_Canyon	0.29365	CII_Colorado	0.29365	CII_Colorado
F	Grand Junction FO	0.39723	CI_Arches	1.05957	CII_Colorado	1.05957	CII_Colorado
G	Uncompahgre FO	0.08499	CI_Maroon_Bells	0.09611	CII_Raggeds	0.09611	CII_Raggeds
H	Tres Rios FO	0.02357	CI_Weminuche	0.04395	CII_Aztec_Ruins	0.04395	CII_Aztec_Ruins
I	Kremmling FO	0.03406	CI_Eagles_Nest	0.01715	CII_Savage_Run	0.03406	CI_Eagles_Nest
J	RGFO #1	0.03226	CI_Rocky_Mountain	0.02350	CII_Lost_Creek	0.03226	CI_Rocky_Mountain
K	RGFO #2	0.00344	CI_Eagles_Nest	0.02850	CII_Florissant_Fossi	0.02850	CII_Florissant_Fossi
L	RGFO #3	0.07554	CI_Rocky_Mountain	0.05278	CII_Florissant_Fossi	0.07554	CI_Rocky_Mountain
M	RGFO #4	0.00717	CI_Pecos	0.01317	CII_Spanish_Peaks	0.01317	CII_Spanish_Peaks
N	Southern Ute Indian Tribe	0.14062	CI_Mesa_Verde	0.44999	CII_Aztec_Ruins	0.44999	CII_Aztec_Ruins
O	New Mexico Farmington Field Office	0.21445	CI_Mesa_Verde	1.54887	CII_Aztec_Ruins	1.54887	CII_Aztec_Ruins
P	Combined future non-Federal O&G from BLM Planning Areas	2.67523	CI_Rocky_Mountain	2.20612	CII_Colorado	2.67523	CI_Rocky_Mountain
Q	Combined Existing O&G from BLM Planning Areas	3.18388	CI_Rocky_Mountain	2.10119	CII_Lost_Creek	3.18388	CI_Rocky_Mountain
R	Mining from BLM Planning Areas	0.60727	CI_Flat_Tops	0.64818	CII_Dinosaur_all	0.64818	CII_Dinosaur_all
S	All O&G in 12 km domain outside of the BLM Planning Areas	2.38513	CI_Dinosaur_CO	8.84576	CII_Dinosaur_all	8.84576	CII_Dinosaur_all
T	Remaining anthropogenic emissions	12.46956	CI_Bandelier	26.46347	CII_Aztec_Ruins	26.46347	CII_Aztec_Ruins
U	Coal EGU Colorado + New Mexico	2.98964	CI_Mount_Zirkel	2.39410	CII_Aztec_Ruins	2.98964	CI_Mount_Zirkel
V	Oil/Gas EGU Colorado + New Mexico	0.07990	CI_Great_Sand_Dunes	0.18020	CII_Alamosa_NWR	0.18020	CII_Alamosa_NWR
W	All Other EGUs in 12 km domain	9.27293	CI_Petrified_Forest	7.82069	CII_Dinosaur_all	9.27293	CI_Petrified_Forest
X	Total new federal O&G in CO	1.45681	CI_Dinosaur_CO	2.39703	CII_Dinosaur_all	2.39703	CII_Dinosaur_all
Y	New total CRVFO	0.14257	CI_Black_Canyon	0.43884	CII_Colorado	0.43884	CII_Colorado
Z	New total RGFO	0.08628	CI_Rocky_Mountain	0.07246	CII_Florissant_Fossi	0.08628	CI_Rocky_Mountain
A1	All new O&G in CO plus new non-federal FFO1	2.80397	CI_Rocky_Mountain	4.01727	CII_Colorado	4.01727	CII_Colorado
A2	New federal O&G + new Mining in CO	1.49047	CI_Dinosaur_CO	2.45972	CII_Dinosaur_all	2.45972	CII_Dinosaur_all
A3	New federal O&G + new non-federal O&G + Mining in CO	2.81387	CI_Rocky_Mountain	4.05676	CII_Colorado	4.05676	CII_Colorado
A4	All EGUs in CO and NM	2.98969	CI_Mount_Zirkel	2.40335	CII_Aztec_Ruins	2.98969	CI_Mount_Zirkel
A5	2025 BC	14.85337	CI_Salt_Creek	18.59945	CII_Capitan_Mountain	18.59945	CII_Capitan_Mountain
A6	2025 Total	58.21085	CI_Bandelier	56.10798	CII_Dome	58.21085	CI_Bandelier
A7	2011 Total	58.21498	CI_Bandelier	56.11617	CII_Dome	58.21498	CI_Bandelier
X1	Total new federal O&G in CO (X) using Brute-Force zero-out ru	1.27632	CI_Dinosaur_CO	1.70056	CII_Dinosaur_all	1.70056	CII_Dinosaur_all

Note that the thresholds shown are project-level thresholds. The comparisons shown above are for informational purposes only.

5.2.2 Individual Planning Area Contributions to Visibility Impairment at Class I and II Areas using FLAG (2010)

In this section, we present the visibility impacts at Class I areas due to Federal O&G in five BLM Planning Areas: WRFO, GJFO, SUIT, NMFFO, CRVFO and the 2025 High, Low and Medium Development Scenarios. The first four BLM Planning Areas were selected because they were the ones that had Δdv impacts of greater than 0.5 at any Class I or II area (see Table 5-16), whereas CRVFO was selected as one of our example Planning Areas. Tables 5-17 through 5-21 display the maximum Δdv and number of days Δdv exceeds the 0.5 and 1.0 thresholds for all Class I areas due to emissions from Federal O&G development within the WRFO, GJFO, SUIT, NMFFO and CRVFO Planning Areas, respectively. These Tables were obtained from sheet "Table1" in Attachments B-1, B-2 and B-3. The visibility results for the 2025 High, Low and Medium Development Scenario and these five BLM Planning Areas are summarized as follows, results for the other Source Groups and for sensitive Class II areas can be found in Attachments B-1, B-2 and B-3:

Federal O&G from the WRFO Planning Area and the 2025 High Development Scenario result in 4 days and 41 days at Dinosaur NM with Δdv > 1.0 and Δdv > 0.5, respectively, and maximum Δdv of 1.56 at this Class I Area (Table 5-17). The mitigation in the 2025 Medium Development Scenario reduces these values to 3 and 32 days with Δdv > 1.0 and Δdv > 0.5, and 0.479 maximum Δdv at Dinosaur NM (Table 5-17b). For the 2025 Low Development Scenario, new Federal O&G from the WRFO Planning Area cause no days with Δdv > 0.5 and maximum Δdv of 0.25 at Dinosaur NM (Table 5-17a).

For the 2025 High, Medium and Low Development Scenarios, there are no days with Δdv > 0.5 at any Class I area due to new Federal O&G emissions within the GJFO Planning area; the maximum Δdv are 0.49, 0.40, and 0.02 for the 2025 High, Medium and Low Development Scenarios, all being found at the Arches National Park (Table 5-18).

There are no days with Δdv > 0.5 at any Class I area due to Federal O&G emissions from SUIT for all three 2025 emission scenarios (Table 5-20). However, as shown in Attachments B-1, B-2 and B-3, there are 17, 0 and 0 days with Δdv > 0.5 and 1, 0 and 0 days with Δdv > 1.0 at the Aztec Ruins sensitive Class II area for the 2025 High, Low and Medium Development Scenarios, respectively.

There are no days with Δdv > 0.5 at any Class I area due to Federal O&G emissions from the NMFFO Mancos Shale Development area for all three 2025 emission scenarios (Table 5-20). However, as shown in Attachments B-1, B-2 and B-3, there are 261, 84 and 82 days with Δdv > 0.5 and 80, 9 and 6 days with Δdv > 1.0 at the Aztec Ruins sensitive Class II area for the 2025 High, Low and Medium Development Scenarios, respectively.

New Federal O&G from the CRVFO Planning Area has no days with Δdv > 0.5 at any Class I area for all three 2025 emissions scenarios (Table 5-21). The maximum Δdv impact due to new Federal O&G development in the CRVFO Planning Area is 0.06, 0.05 and 0.05 at Eagles Nest Wilderness for the 2025 High, Low and Medium Development Scenarios, respectively (Table 5-21).

Table 5-17. Maximum Δdv and number of days Δdv exceeds 0.5 and 1.0 for each Class I area due to emissions from Federal O&G within the WRFO Planning Area (2025 High Development Scenario).

White River FO					
Site Name	Class I&II Name	Δdv	Date	Number of Day	
				> 1.0	> 0.5
Class I					
CI_Arches	Arches NP	0.44296	1/15/2011	0	0
CI_Bandelier	Bandelier Wilderness	0.03853	1/25/2011	0	0
CI_Black_Canyon	Black Canyon of the Gunnison Wilderness	0.49847	12/4/2011	0	0
CI_Bosque	Bosque del Apache	0.03356	12/21/2011	0	0
CI_Canyonlands	Canyonlands NP	0.35160	1/15/2011	0	0
CI_Capitol_Reef	Capitol Reef NP	0.08079	12/17/2011	0	0
CI_Dinosaur_CO	Dinosaur NM	1.55539	12/15/2011	4	41
CI_Eagles_Nest	Eagles Nest Wilderness	0.24712	3/4/2011	0	0
CI_Flat_Tops	Flat Tops Wilderness	0.45796	5/21/2011	0	0
CI_Gila	Gila Wilderness	0.01282	11/9/2011	0	0
CI_Great_Sand_Dunes	Great Sand Dunes Wilderness-nps	0.15913	12/15/2011	0	0
CI_La_Garita	La Garita Wilderness	0.13313	2/6/2011	0	0
CI_Maroon_Bells	Maroon Bells-Snowmass Wilderness	0.20753	2/5/2011	0	0
CI_Mesa_Verde	Mesa Verde NP	0.14282	12/21/2011	0	0
CI_Mount_Baldy	Mount Baldy Wilderness	0.05133	12/20/2011	0	0
CI_Mount_Zirkel	Mount Zirkel Wilderness	0.33903	11/30/2011	0	0
CI_Pecos	Pecos Wilderness	0.04151	12/21/2011	0	0
CI_Petrified_Forest	Petrified Forest NP	0.13913	12/21/2011	0	0
CI_Rawah	Rawah Wilderness	0.25201	3/3/2011	0	0
CI_Rocky_Mountain	Rocky Mountain NP	0.22761	3/4/2011	0	0
CI_Salt_Creek	Salt Creek Wilderness	0.01035	12/22/2011	0	0
CI_San_Pedro	San Pedro Parks Wilderness	0.07829	12/21/2011	0	0
CI_Weminuche	Weminuche Wilderness	0.14808	2/6/2011	0	0
CI_West_Elk	West Elk Wilderness	0.27742	1/10/2011	0	0
CI_Wheeler_Peak	Wheeler Peak Wilderness	0.04456	2/5/2011	0	0
CI_White_Mountain	White Mountain Wilderness	0.01486	11/8/2011	0	0

Note that the thresholds shown are project-level thresholds. The comparisons shown above are for informational purposes only.

Table 5-17a. Maximum Δdv and number of days Δdv exceeds 0.5 and 1.0 for each Class I area due to emissions from Federal O&G within the WRFO Planning Area (2025 Low Development Scenario).

White River FO					
Site Name	Class I&II Name	Δdv	Date	Number of Day	
				> 1.0	> 0.5
Class I					
CI_Arches	Arches NP	0.06481	1/15/2011	0	0
CI_Bandelier	Bandelier Wilderness	0.00458	1/25/2011	0	0
CI_Black_Canyon	Black Canyon of the Gunnison Wilderness	0.06566	12/4/2011	0	0
CI_Bosque	Bosque del Apache	0.00422	12/21/2011	0	0
CI_Canyonlands	Canyonlands NP	0.05173	1/15/2011	0	0
CI_Capitol_Reef	Capitol Reef NP	0.01106	12/17/2011	0	0
CI_Dinosaur_CO	Dinosaur NM	0.24643	12/15/2011	0	0
CI_Eagles_Nest	Eagles Nest Wilderness	0.03483	3/4/2011	0	0
CI_Flat_Tops	Flat Tops Wilderness	0.06955	4/25/2011	0	0
CI_Gila	Gila Wilderness	0.00162	11/9/2011	0	0
CI_Great_Sand_Dunes	Great Sand Dunes Wilderness-nps	0.01995	12/15/2011	0	0
CI_La_Garita	La Garita Wilderness	0.01827	2/6/2011	0	0
CI_Maroon_Bells	Maroon Bells-Snowmass Wilderness	0.02749	2/5/2011	0	0
CI_Mesa_Verde	Mesa Verde NP	0.01889	12/21/2011	0	0
CI_Mount_Baldy	Mount Baldy Wilderness	0.00659	12/20/2011	0	0
CI_Mount_Zirkel	Mount Zirkel Wilderness	0.04198	1/16/2011	0	0
CI_Pecos	Pecos Wilderness	0.00521	12/21/2011	0	0
CI_Petrified_Forest	Petrified Forest NP	0.01730	12/21/2011	0	0
CI_Rawah	Rawah Wilderness	0.03208	3/3/2011	0	0
CI_Rocky_Mountain	Rocky Mountain NP	0.02729	3/4/2011	0	0
CI_Salt_Creek	Salt Creek Wilderness	0.00128	12/22/2011	0	0
CI_San_Pedro	San Pedro Parks Wilderness	0.00959	12/21/2011	0	0
CI_Weminuche	Weminuche Wilderness	0.01997	2/6/2011	0	0
CI_West_Elk	West Elk Wilderness	0.04135	1/10/2011	0	0
CI_Wheeler_Peak	Wheeler Peak Wilderness	0.00563	2/5/2011	0	0
CI_White_Mountain	White Mountain Wilderness	0.00187	11/8/2011	0	0

Note that the thresholds shown are project-level thresholds. The comparisons shown above are for informational purposes only.

Table 5-17b. Maximum Δdv and number of days Δdv exceeds 0.5 and 1.0 for each Class I area due to emissions from Federal O&G within the WRFO Planning Area (2025 Medium Development Scenario).

White River FO					
Site Name	Class I&II Name	Δdv	Date	Number of Day	
				> 1.0	> 0.5
Class I					
CI_Arches	Arches NP	0.40531	1/15/2011	0	0
CI_Bandelier	Bandelier Wilderness	0.03441	1/25/2011	0	0
CI_Black_Canyon	Black Canyon of the Gunnison Wilderness	0.45218	12/4/2011	0	0
CI_Bosque	Bosque del Apache	0.03308	12/21/2011	0	0
CI_Canyonlands	Canyonlands NP	0.32168	1/15/2011	0	0
CI_Capitol_Reef	Capitol Reef NP	0.07446	12/17/2011	0	0
CI_Dinosaur_CO	Dinosaur NM	1.44872	12/15/2011	3	32
CI_Eagles_Nest	Eagles Nest Wilderness	0.22777	3/4/2011	0	0
CI_Flat_Tops	Flat Tops Wilderness	0.42486	5/21/2011	0	0
CI_Gila	Gila Wilderness	0.01233	11/9/2011	0	0
CI_Great_Sand_Dunes	Great Sand Dunes Wilderness-nps	0.14398	12/15/2011	0	0
CI_La_Garita	La Garita Wilderness	0.12342	2/6/2011	0	0
CI_Maroon_Bells	Maroon Bells-Snowmass Wilderness	0.19172	2/5/2011	0	0
CI_Mesa_Verde	Mesa Verde NP	0.13045	12/21/2011	0	0
CI_Mount_Baldy	Mount Baldy Wilderness	0.04884	12/20/2011	0	0
CI_Mount_Zirkel	Mount Zirkel Wilderness	0.30167	11/30/2011	0	0
CI_Pecos	Pecos Wilderness	0.03976	12/21/2011	0	0
CI_Petrified_Forest	Petrified Forest NP	0.13206	12/21/2011	0	0
CI_Rawah	Rawah Wilderness	0.22854	3/3/2011	0	0
CI_Rocky_Mountain	Rocky Mountain NP	0.20590	3/4/2011	0	0
CI_Salt_Creek	Salt Creek Wilderness	0.00993	12/22/2011	0	0
CI_San_Pedro	San Pedro Parks Wilderness	0.07336	12/21/2011	0	0
CI_Weminuche	Weminuche Wilderness	0.13769	2/6/2011	0	0
CI_West_Elk	West Elk Wilderness	0.25345	1/10/2011	0	0
CI_Wheeler_Peak	Wheeler Peak Wilderness	0.04046	2/5/2011	0	0
CI_White_Mountain	White Mountain Wilderness	0.01411	11/8/2011	0	0

Note that the thresholds shown are project-level thresholds. The comparisons shown above are for informational purposes only.

Table 5-18. Maximum Δdv and number of days Δdv exceeds 0.5 and 1.0 for each Class I area due to emissions from Federal O&G within the GJFO Planning Area (2025 High Development Scenario).

Grand Junction FO					
Site Name	Class I&II Name	Δdv	Date	Number of Day	
				> 1.0	> 0.5
Class I					
CI_Arches	Arches NP	0.49049	1/7/2011	0	0
CI_Bandelier	Bandelier Wilderness	0.02292	1/25/2011	0	0
CI_Black_Canyon	Black Canyon of the Gunnison Wilderness	0.35160	12/4/2011	0	0
CI_Bosque	Bosque del Apache	0.00686	12/10/2011	0	0
CI_Canyonlands	Canyonlands NP	0.27358	1/15/2011	0	0
CI_Capitol_Reef	Capitol Reef NP	0.06600	12/11/2011	0	0
CI_Dinosaur_CO	Dinosaur NM	0.06202	12/11/2011	0	0
CI_Eagles_Nest	Eagles Nest Wilderness	0.11975	1/4/2011	0	0
CI_Flat_Tops	Flat Tops Wilderness	0.12848	1/4/2011	0	0
CI_Gila	Gila Wilderness	0.00750	12/20/2011	0	0
CI_Great_Sand_Dunes	Great Sand Dunes Wilderness-nps	0.05774	12/15/2011	0	0
CI_La_Garita	La Garita Wilderness	0.04771	11/8/2011	0	0
CI_Maroon_Bells	Maroon Bells-Snowmass Wilderness	0.16332	12/21/2011	0	0
CI_Mesa_Verde	Mesa Verde NP	0.06359	1/15/2011	0	0
CI_Mount_Baldy	Mount Baldy Wilderness	0.01184	12/20/2011	0	0
CI_Mount_Zirkel	Mount Zirkel Wilderness	0.11997	11/30/2011	0	0
CI_Pecos	Pecos Wilderness	0.02458	1/24/2011	0	0
CI_Petrified_Forest	Petrified Forest NP	0.03307	1/16/2011	0	0
CI_Rawah	Rawah Wilderness	0.04692	3/17/2011	0	0
CI_Rocky_Mountain	Rocky Mountain NP	0.08593	3/3/2011	0	0
CI_Salt_Creek	Salt Creek Wilderness	0.00209	11/8/2011	0	0
CI_San_Pedro	San Pedro Parks Wilderness	0.02374	12/21/2011	0	0
CI_Weminuche	Weminuche Wilderness	0.05067	2/6/2011	0	0
CI_West_Elk	West Elk Wilderness	0.20790	1/10/2011	0	0
CI_Wheeler_Peak	Wheeler Peak Wilderness	0.02599	1/24/2011	0	0
CI_White_Mountain	White Mountain Wilderness	0.00412	12/6/2011	0	0

Note that the thresholds shown are project-level thresholds. The comparisons shown above are for informational purposes only.

Table 5-18a. Maximum Δdv and number of days Δdv exceeds 0.5 and 1.0 for each Class I area due to emissions from Federal O&G within the GJFO Planning Area (2025 Low Development Scenario).

Grand Junction FO					
Site Name	Class I&II Name	Δdv	Date	Number of Day > 1.0	Number of Day > 0.5
Class I					
CI_Arches	Arches NP	0.02492	1/7/2011	0	0
CI_Bandelier	Bandelier Wilderness	0.00107	1/25/2011	0	0
CI_Black_Canyon	Black Canyon of the Gunnison Wilderness	0.01631	12/4/2011	0	0
CI_Bosque	Bosque del Apache	0.00028	12/10/2011	0	0
CI_Canyonlands	Canyonlands NP	0.01556	1/15/2011	0	0
CI_Capitol_Reef	Capitol Reef NP	0.00251	12/11/2011	0	0
CI_Dinosaur_CO	Dinosaur NM	0.00297	12/11/2011	0	0
CI_Eagles_Nest	Eagles Nest Wilderness	0.00656	3/4/2011	0	0
CI_Flat_Tops	Flat Tops Wilderness	0.00677	1/4/2011	0	0
CI_Gila	Gila Wilderness	0.00032	12/20/2011	0	0
CI_Great_Sand_Dunes	Great Sand Dunes Wilderness-nps	0.00276	12/15/2011	0	0
CI_La_Garita	La Garita Wilderness	0.00257	11/8/2011	0	0
CI_Maroon_Bells	Maroon Bells-Snowmass Wilderness	0.00982	12/21/2011	0	0
CI_Mesa_Verde	Mesa Verde NP	0.00333	12/6/2011	0	0
CI_Mount_Baldy	Mount Baldy Wilderness	0.00052	12/20/2011	0	0
CI_Mount_Zirkel	Mount Zirkel Wilderness	0.00509	11/30/2011	0	0
CI_Pecos	Pecos Wilderness	0.00124	1/24/2011	0	0
CI_Petrified_Forest	Petrified Forest NP	0.00148	1/16/2011	0	0
CI_Rawah	Rawah Wilderness	0.00222	3/3/2011	0	0
CI_Rocky_Mountain	Rocky Mountain NP	0.00397	3/3/2011	0	0
CI_Salt_Creek	Salt Creek Wilderness	0.00009	12/9/2011	0	0
CI_San_Pedro	San Pedro Parks Wilderness	0.00104	12/21/2011	0	0
CI_Weminuche	Weminuche Wilderness	0.00258	2/6/2011	0	0
CI_West_Elk	West Elk Wilderness	0.01032	1/10/2011	0	0
CI_Wheeler_Peak	Wheeler Peak Wilderness	0.00130	1/24/2011	0	0
CI_White_Mountain	White Mountain Wilderness	0.00018	12/6/2011	0	0

Note that the thresholds shown are project-level thresholds. The comparisons shown above are for informational purposes only.

Table 5-18b. Maximum Δdv and number of days Δdv exceeds 0.5 and 1.0 for each Class I area due to emissions from Federal O&G within the GJFO Planning Area (2025 Medium Development Scenario).

Grand Junction FO					
Site Name	Class I&II Name	Δdv	Date	Number of Day > 1.0	Number of Day > 0.5
Class I					
CI_Arches	Arches NP	0.39723	1/7/2011	0	0
CI_Bandelier	Bandelier Wilderness	0.01816	1/25/2011	0	0
CI_Black_Canyon	Black Canyon of the Gunnison Wilderness	0.27636	12/4/2011	0	0
CI_Bosque	Bosque del Apache	0.00525	12/10/2011	0	0
CI_Canyonlands	Canyonlands NP	0.22332	1/15/2011	0	0
CI_Capitol_Reef	Capitol Reef NP	0.05181	12/11/2011	0	0
CI_Dinosaur_CO	Dinosaur NM	0.04686	12/11/2011	0	0
CI_Eagles_Nest	Eagles Nest Wilderness	0.09537	1/4/2011	0	0
CI_Flat_Tops	Flat Tops Wilderness	0.10132	1/4/2011	0	0
CI_Gila	Gila Wilderness	0.00574	12/20/2011	0	0
CI_Great_Sand_Dunes	Great Sand Dunes Wilderness-nps	0.04597	12/15/2011	0	0
CI_La_Garita	La Garita Wilderness	0.03777	11/8/2011	0	0
CI_Maroon_Bells	Maroon Bells-Snowmass Wilderness	0.13131	12/21/2011	0	0
CI_Mesa_Verde	Mesa Verde NP	0.05058	1/15/2011	0	0
CI_Mount_Baldy	Mount Baldy Wilderness	0.00909	12/20/2011	0	0
CI_Mount_Zirkel	Mount Zirkel Wilderness	0.09363	11/30/2011	0	0
CI_Pecos	Pecos Wilderness	0.01971	1/24/2011	0	0
CI_Petrified_Forest	Petrified Forest NP	0.02627	1/16/2011	0	0
CI_Rawah	Rawah Wilderness	0.03729	3/17/2011	0	0
CI_Rocky_Mountain	Rocky Mountain NP	0.06880	3/3/2011	0	0
CI_Salt_Creek	Salt Creek Wilderness	0.00155	12/9/2011	0	0
CI_San_Pedro	San Pedro Parks Wilderness	0.01825	12/21/2011	0	0
CI_Weminuche	Weminuche Wilderness	0.03989	2/6/2011	0	0
CI_West_Elk	West Elk Wilderness	0.16266	1/10/2011	0	0
CI_Wheeler_Peak	Wheeler Peak Wilderness	0.02077	1/24/2011	0	0
CI_White_Mountain	White Mountain Wilderness	0.00311	12/6/2011	0	0

Note that the thresholds shown are project-level thresholds. The comparisons shown above are for informational purposes only.

Table 5-19. Maximum Δdv and number of days Δdv exceeds 0.5 and 1.0 for each Class I area due to emissions within the SUIT Planning Area (2025 High Development Scenario).

Southern Ute Indian Tribe					
				Number of Day	
Site Name	Class I & II Name	Ddv	Date	>1.0	>0.5
Class I					
CI_Arches	Arches NP	0.01974	12/12/11	0	0
CI_Bandelier	Bandelier Wilderness	0.07148	2/10/11	0	0
CI_Black_Canyon	Black Canyon of the Gunnison Wilderness	0.02663	12/3/11	0	0
CI_Bosque	Bosque del Apache	0.02183	12/24/11	0	0
CI_Canyonlands	Canyonlands NP	0.02606	12/11/11	0	0
CI_Capitol_Reef	Capitol Reef NP	0.02557	12/11/11	0	0
CI_Dinosaur_CO	Dinosaur NM	0.01294	12/13/11	0	0
CI_Eagles_Nest	Eagles Nest Wilderness	0.01280	12/11/11	0	0
CI_Flat_Tops	Flat Tops Wilderness	0.00775	12/11/11	0	0
CI_Gila	Gila Wilderness	0.00923	12/24/11	0	0
CI_Great_Sand_Dunes	Great Sand Dunes Wilderness-nps	0.04215	12/30/11	0	0
CI_La_Garita	La Garita Wilderness	0.03718	3/18/11	0	0
CI_Maroon_Bells	Maroon Bells-Snowmass Wilderness	0.02195	3/19/11	0	0
CI_Mesa_Verde	Mesa Verde NP	0.37417	12/10/11	0	0
CI_Mount_Baldy	Mount Baldy Wilderness	0.00557	12/6/11	0	0
CI_Mount_Zirkel	Mount Zirkel Wilderness	0.00768	12/12/11	0	0
CI_Pecos	Pecos Wilderness	0.05397	2/5/11	0	0
CI_Petrified_Forest	Petrified Forest NP	0.01645	12/19/11	0	0
CI_Rawah	Rawah Wilderness	0.00414	11/7/11	0	0
CI_Rocky_Mountain	Rocky Mountain NP	0.01193	12/12/11	0	0
CI_Salt_Creek	Salt Creek Wilderness	0.00424	2/11/11	0	0
CI_San_Pedro	San Pedro Parks Wilderness	0.04135	1/23/11	0	0
CI_Weminuche	Weminuche Wilderness	0.18872	12/22/11	0	0
CI_West_Elk	West Elk Wilderness	0.02830	12/11/11	0	0
CI_Wheeler_Peak	Wheeler Peak Wilderness	0.02236	1/17/11	0	0
CI_White_Mountain	White Mountain Wilderness	0.00521	2/6/11	0	0

Note that the thresholds shown are project-level thresholds. The comparisons shown above are for informational purposes only.

Table 5-19a. Maximum Δdv and number of days Δdv exceeds 0.5 and 1.0 for each Class I area due to emissions within the SUIT Planning Area (2025 Low Development Scenario).

Southern Ute Indian Tribe					
				Number of Day	
Site Name	Class I & II Name	Ddv	Date	>1.0	>0.5
Class I					
CI_Arches	Arches NP	0.00969	12/12/11	0	0
CI_Bandelier	Bandelier Wilderness	0.03581	2/10/11	0	0
CI_Black_Canyon	Black Canyon of the Gunnison Wilderness	0.01314	12/3/11	0	0
CI_Bosque	Bosque del Apache	0.01079	12/24/11	0	0
CI_Canyonlands	Canyonlands NP	0.01262	12/11/11	0	0
CI_Capitol_Reef	Capitol Reef NP	0.01277	12/11/11	0	0
CI_Dinosaur_CO	Dinosaur NM	0.00638	12/13/11	0	0
CI_Eagles_Nest	Eagles Nest Wilderness	0.00632	12/11/11	0	0
CI_Flat_Tops	Flat Tops Wilderness	0.00389	12/11/11	0	0
CI_Gila	Gila Wilderness	0.00451	12/24/11	0	0
CI_Great_Sand_Dunes	Great Sand Dunes Wilderness-nps	0.02097	12/30/11	0	0
CI_La_Garita	La Garita Wilderness	0.01865	3/18/11	0	0
CI_Maroon_Bells	Maroon Bells-Snowmass Wilderness	0.01100	3/19/11	0	0
CI_Mesa_Verde	Mesa Verde NP	0.19363	12/10/11	0	0
CI_Mount_Baldy	Mount Baldy Wilderness	0.00283	12/6/11	0	0
CI_Mount_Zirkel	Mount Zirkel Wilderness	0.00380	12/12/11	0	0
CI_Pecos	Pecos Wilderness	0.02772	2/5/11	0	0
CI_Petrified_Forest	Petrified Forest NP	0.00809	12/19/11	0	0
CI_Rawah	Rawah Wilderness	0.00204	11/7/11	0	0
CI_Rocky_Mountain	Rocky Mountain NP	0.00580	12/12/11	0	0
CI_Salt_Creek	Salt Creek Wilderness	0.00211	2/11/11	0	0
CI_San_Pedro	San Pedro Parks Wilderness	0.02114	1/23/11	0	0
CI_Weminuche	Weminuche Wilderness	0.10049	12/22/11	0	0
CI_West_Elk	West Elk Wilderness	0.01442	12/11/11	0	0
CI_Wheeler_Peak	Wheeler Peak Wilderness	0.01142	1/4/11	0	0
CI_White_Mountain	White Mountain Wilderness	0.00265	2/6/11	0	0

Note that the thresholds shown are project-level thresholds. The comparisons shown above are for informational purposes only.

Table 5-19b. Maximum Δdv and number of days Δdv exceeds 0.5 and 1.0 for each Class I area due to emissions within the SUIT Planning Area (2025 Medium Development Scenario).

Southern Ute Indian Tribe					
				Number of Day	
Site Name	Class I & II Name	D dv	Date	>1.0	>0.5
Class I					
CI_Arches	Arches NP	0.00700	12/12/11	0	0
CI_Bandelier	Bandelier Wilderness	0.02405	2/10/11	0	0
CI_Black_Canyon	Black Canyon of the Gunnison Wilderness	0.00872	12/3/11	0	0
CI_Bosque	Bosque del Apache	0.00737	12/25/11	0	0
CI_Canyonlands	Canyonlands NP	0.00959	12/11/11	0	0
CI_Capitol_Reef	Capitol Reef NP	0.01012	12/11/11	0	0
CI_Dinosaur_CO	Dinosaur NM	0.00437	12/13/11	0	0
CI_Eagles_Nest	Eagles Nest Wilderness	0.00434	12/11/11	0	0
CI_Flat_Tops	Flat Tops Wilderness	0.00276	12/11/11	0	0
CI_Gila	Gila Wilderness	0.00315	12/24/11	0	0
CI_Great_Sand_Dunes	Great Sand Dunes Wilderness-nps	0.01409	12/30/11	0	0
CI_La_Garita	La Garita Wilderness	0.01278	3/18/11	0	0
CI_Maroon_Bells	Maroon Bells-Snowmass Wilderness	0.00745	3/19/11	0	0
CI_Mesa_Verde	Mesa Verde NP	0.14062	12/10/11	0	0
CI_Mount_Baldy	Mount Baldy Wilderness	0.00184	12/6/11	0	0
CI_Mount_Zirkel	Mount Zirkel Wilderness	0.00267	12/12/11	0	0
CI_Pecos	Pecos Wilderness	0.01849	2/5/11	0	0
CI_Petrified_Forest	Petrified Forest NP	0.00540	12/19/11	0	0
CI_Rawah	Rawah Wilderness	0.00142	11/7/11	0	0
CI_Rocky_Mountain	Rocky Mountain NP	0.00398	12/12/11	0	0
CI_Salt_Creek	Salt Creek Wilderness	0.00168	2/11/11	0	0
CI_San_Pedro	San Pedro Parks Wilderness	0.01450	1/16/11	0	0
CI_Weminuche	Weminuche Wilderness	0.07005	12/22/11	0	0
CI_West_Elk	West Elk Wilderness	0.00986	12/11/11	0	0
CI_Wheeler_Peak	Wheeler Peak Wilderness	0.00802	1/4/11	0	0
CI_White_Mountain	White Mountain Wilderness	0.00191	1/16/11	0	0

Note that the thresholds shown are project-level thresholds. The comparisons shown above are for informational purposes only.

Table 5-20. Maximum Δdv and number of days Δdv exceeds 0.5 and 1.0 for each Class I area due to emissions from Federal O&G within the NMFFO Planning Area (2025 High Development Scenario).

New Mexico Farmington Field Office					
Site Name	Class I&II Name	Δdv	Date	Number of Day > 1.0	Number of Day > 0.5
Class I					
CI_Arches	Arches NP	0.03212	12/12/2011	0	0
CI_Bandelier	Bandelier Wilderness	0.11158	2/10/2011	0	0
CI_Black_Canyon	Black Canyon of the Gunnison Wilderness	0.03077	12/3/2011	0	0
CI_Bosque	Bosque del Apache	0.04811	12/24/2011	0	0
CI_Canyonlands	Canyonlands NP	0.04789	12/11/2011	0	0
CI_Capitol_Reef	Capitol Reef NP	0.07101	12/11/2011	0	0
CI_Dinosaur_CO	Dinosaur NM	0.01952	12/13/2011	0	0
CI_Eagles_Nest	Eagles Nest Wilderness	0.01554	12/11/2011	0	0
CI_Flat_Tops	Flat Tops Wilderness	0.01127	12/11/2011	0	0
CI_Gila	Gila Wilderness	0.01674	12/24/2011	0	0
CI_Great_Sand_Dunes	Great Sand Dunes Wilderness-nps	0.05551	12/30/2011	0	0
CI_La_Garita	La Garita Wilderness	0.04206	11/19/2011	0	0
CI_Maroon_Bells	Maroon Bells-Snowmass Wilderness	0.02339	3/19/2011	0	0
CI_Mesa_Verde	Mesa Verde NP	0.39291	12/10/2011	0	0
CI_Mount_Baldy	Mount Baldy Wilderness	0.00888	2/3/2011	0	0
CI_Mount_Zirkel	Mount Zirkel Wilderness	0.01098	12/12/2011	0	0
CI_Pecos	Pecos Wilderness	0.13243	12/21/2011	0	0
CI_Petrified_Forest	Petrified Forest NP	0.02546	1/27/2011	0	0
CI_Rawah	Rawah Wilderness	0.00586	12/12/2011	0	0
CI_Rocky_Mountain	Rocky Mountain NP	0.01433	12/12/2011	0	0
CI_Salt_Creek	Salt Creek Wilderness	0.00962	2/11/2011	0	0
CI_San_Pedro	San Pedro Parks Wilderness	0.10555	2/3/2011	0	0
CI_Weminuche	Weminuche Wilderness	0.18961	12/22/2011	0	0
CI_West_Elk	West Elk Wilderness	0.02615	12/11/2011	0	0
CI_Wheeler_Peak	Wheeler Peak Wilderness	0.03934	12/29/2011	0	0
CI_White_Mountain	White Mountain Wilderness	0.01089	1/16/2011	0	0

Note that the thresholds shown are project-level thresholds. The comparisons shown above are for informational purposes only.

Table 5-20a. Maximum Δdv and number of days Δdv exceeds 0.5 and 1.0 for each Class I area due to emissions from Federal O&G within the NMFFO Planning Area (2025 Low Development Scenario).

New Mexico Farmington Field Office					
Site Name	Class I&II Name	Δdv	Date	Number of Day > 1.0	Number of Day > 0.5
Class I					
CI_Arches	Arches NP	0.01569	12/12/2011	0	0
CI_Bandelier	Bandelier Wilderness	0.05591	2/10/2011	0	0
CI_Black_Canyon	Black Canyon of the Gunnison Wilderness	0.01520	12/3/2011	0	0
CI_Bosque	Bosque del Apache	0.02396	12/24/2011	0	0
CI_Canyonlands	Canyonlands NP	0.02351	12/11/2011	0	0
CI_Capitol_Reef	Capitol Reef NP	0.03559	12/11/2011	0	0
CI_Dinosaur_CO	Dinosaur NM	0.00966	12/13/2011	0	0
CI_Eagles_Nest	Eagles Nest Wilderness	0.00774	12/11/2011	0	0
CI_Flat_Tops	Flat Tops Wilderness	0.00561	12/11/2011	0	0
CI_Gila	Gila Wilderness	0.00826	12/24/2011	0	0
CI_Great_Sand_Dunes	Great Sand Dunes Wilderness-nps	0.02764	12/30/2011	0	0
CI_La_Garita	La Garita Wilderness	0.02117	11/19/2011	0	0
CI_Maroon_Bells	Maroon Bells-Snowmass Wilderness	0.01169	3/19/2011	0	0
CI_Mesa_Verde	Mesa Verde NP	0.20245	12/10/2011	0	0
CI_Mount_Baldy	Mount Baldy Wilderness	0.00448	2/3/2011	0	0
CI_Mount_Zirkel	Mount Zirkel Wilderness	0.00547	12/12/2011	0	0
CI_Pecos	Pecos Wilderness	0.06774	12/21/2011	0	0
CI_Petrified_Forest	Petrified Forest NP	0.01275	1/27/2011	0	0
CI_Rawah	Rawah Wilderness	0.00287	12/12/2011	0	0
CI_Rocky_Mountain	Rocky Mountain NP	0.00701	12/12/2011	0	0
CI_Salt_Creek	Salt Creek Wilderness	0.00481	2/11/2011	0	0
CI_San_Pedro	San Pedro Parks Wilderness	0.05316	2/3/2011	0	0
CI_Weminuche	Weminuche Wilderness	0.09989	12/22/2011	0	0
CI_West_Elk	West Elk Wilderness	0.01323	12/11/2011	0	0
CI_Wheeler_Peak	Wheeler Peak Wilderness	0.01969	12/29/2011	0	0
CI_White_Mountain	White Mountain Wilderness	0.00546	1/16/2011	0	0

Note that the thresholds shown are project-level thresholds. The comparisons shown above are for informational purposes only.

Table 5-20b. Maximum Δdv and number of days Δdv exceeds 0.5 and 1.0 for each Class I area due to emissions from Federal O&G within the NMFFO Planning Area (2025 Medium Development Scenario).

New Mexico Farmington Field Office					
Site Name	Class I&II Name	Δdv	Date	Number of Day	
				> 1.0	> 0.5
Class I					
CI_Arches	Arches NP	0.01720	12/12/2011	0	0
CI_Bandelier	Bandelier Wilderness	0.06174	2/10/2011	0	0
CI_Black_Canyon	Black Canyon of the Gunnison Wilderness	0.01719	12/3/2011	0	0
CI_Bosque	Bosque del Apache	0.02654	12/24/2011	0	0
CI_Canyonlands	Canyonlands NP	0.02483	12/11/2011	0	0
CI_Capitol_Reef	Capitol Reef NP	0.03675	12/11/2011	0	0
CI_Dinosaur_CO	Dinosaur NM	0.01072	12/13/2011	0	0
CI_Eagles_Nest	Eagles Nest Wilderness	0.00851	12/11/2011	0	0
CI_Flat_Tops	Flat Tops Wilderness	0.00586	12/11/2011	0	0
CI_Gila	Gila Wilderness	0.00911	12/24/2011	0	0
CI_Great_Sand_Dunes	Great Sand Dunes Wilderness-nps	0.03105	12/30/2011	0	0
CI_La_Garita	La Garita Wilderness	0.02248	11/19/2011	0	0
CI_Maroon_Bells	Maroon Bells-Snowmass Wilderness	0.01284	3/19/2011	0	0
CI_Mesa_Verde	Mesa Verde NP	0.21445	12/10/2011	0	0
CI_Mount_Baldy	Mount Baldy Wilderness	0.00474	2/3/2011	0	0
CI_Mount_Zirkel	Mount Zirkel Wilderness	0.00596	12/12/2011	0	0
CI_Pecos	Pecos Wilderness	0.06977	12/21/2011	0	0
CI_Petrified_Forest	Petrified Forest NP	0.01435	12/19/2011	0	0
CI_Rawah	Rawah Wilderness	0.00307	12/12/2011	0	0
CI_Rocky_Mountain	Rocky Mountain NP	0.00794	12/12/2011	0	0
CI_Salt_Creek	Salt Creek Wilderness	0.00482	2/11/2011	0	0
CI_San_Pedro	San Pedro Parks Wilderness	0.05498	2/3/2011	0	0
CI_Weminuche	Weminuche Wilderness	0.10689	12/22/2011	0	0
CI_West_Elk	West Elk Wilderness	0.01439	12/11/2011	0	0
CI_Wheeler_Peak	Wheeler Peak Wilderness	0.02011	12/29/2011	0	0
CI_White_Mountain	White Mountain Wilderness	0.00556	1/16/2011	0	0

Note that the thresholds shown are project-level thresholds. The comparisons shown above are for informational purposes only.

Table 5-21. Maximum Δdv and number of days Δdv exceeds 0.5 and 1.0 for each Class I area due to emissions from Federal O&G within the CRVFO Planning Area (2025 High Development Scenario).

Colorado River Valley FO (CRVFO)					
Site Name	Class I&II Name	D dv	Date	Number of Day	
				>1.0	>0.5
Class I					
CI_Arches	Arches NP	0.04065	12/17/11	0	0
CI_Bandelier	Bandelier Wilderness	0.00704	1/25/11	0	0
CI_Black_Canyon	Black Canyon of the Gunnison Wilderness	0.06111	1/26/11	0	0
CI_Bosque	Bosque del Apache	0.00110	12/10/11	0	0
CI_Canyonlands	Canyonlands NP	0.03851	12/17/11	0	0
CI_Capitol_Reef	Capitol Reef NP	0.00903	12/18/11	0	0
CI_Dinosaur_CO	Dinosaur NM	0.01203	12/11/11	0	0
CI_Eagles_Nest	Eagles Nest Wilderness	0.06157	3/4/11	0	0
CI_Flat_Tops	Flat Tops Wilderness	0.05548	1/4/11	0	0
CI_Gila	Gila Wilderness	0.00136	12/20/11	0	0
CI_Great_Sand_Dunes	Great Sand Dunes Wilderness-nps	0.02143	12/6/11	0	0
CI_La_Garita	La Garita Wilderness	0.01943	1/15/11	0	0
CI_Maroon_Bells	Maroon Bells-Snowmass Wilderness	0.05860	12/21/11	0	0
CI_Mesa_Verde	Mesa Verde NP	0.01450	12/21/11	0	0
CI_Mount_Baldy	Mount Baldy Wilderness	0.00240	12/20/11	0	0
CI_Mount_Zirkel	Mount Zirkel Wilderness	0.02070	11/30/11	0	0
CI_Pecos	Pecos Wilderness	0.00754	1/15/11	0	0
CI_Petrified_Forest	Petrified Forest NP	0.00732	12/21/11	0	0
CI_Rawah	Rawah Wilderness	0.01147	3/17/11	0	0
CI_Rocky_Mountain	Rocky Mountain NP	0.03220	3/3/11	0	0
CI_Salt_Creek	Salt Creek Wilderness	0.00063	12/9/11	0	0
CI_San_Pedro	San Pedro Parks Wilderness	0.00601	12/21/11	0	0
CI_Weminuche	Weminuche Wilderness	0.01391	1/15/11	0	0
CI_West_Elk	West Elk Wilderness	0.04635	11/8/11	0	0
CI_Wheeler_Peak	Wheeler Peak Wilderness	0.00964	1/15/11	0	0
CI_White_Mountain	White Mountain Wilderness	0.00090	12/6/11	0	0

Note that the thresholds shown are project-level thresholds. The comparisons shown above are for informational purposes only.

Table 5-21a. Maximum Δdv and number of days Δdv exceeds 0.5 and 1.0 for each Class I area due to emissions from Federal O&G within the CRVFO Planning Area (2025 Low Development Scenario).

Colorado River Valley FO (CRVFO)					
Site Name	Class I & II Name	D dv	Date	Number of Day	
				>1.0	>0.5
Class I					
CI_Arches	Arches NP	0.03457	12/18/11	0	0
CI_Bandelier	Bandelier Wilderness	0.00459	1/25/11	0	0
CI_Black_Canyon	Black Canyon of the Gunnison Wilderness	0.04538	1/26/11	0	0
CI_Bosque	Bosque del Apache	0.00070	12/10/11	0	0
CI_Canyonlands	Canyonlands NP	0.03050	12/17/11	0	0
CI_Capitol_Reef	Capitol Reef NP	0.00555	12/18/11	0	0
CI_Dinosaur_CO	Dinosaur NM	0.00903	12/11/11	0	0
CI_Eagles_Nest	Eagles Nest Wilderness	0.04896	3/4/11	0	0
CI_Flat_Tops	Flat Tops Wilderness	0.04305	1/4/11	0	0
CI_Gila	Gila Wilderness	0.00091	12/20/11	0	0
CI_Great_Sand_Dunes	Great Sand Dunes Wilderness-nps	0.01502	12/6/11	0	0
CI_La_Garita	La Garita Wilderness	0.01454	1/15/11	0	0
CI_Maroon_Bells	Maroon Bells-Snowmass Wilderness	0.04766	12/21/11	0	0
CI_Mesa_Verde	Mesa Verde NP	0.01057	12/21/11	0	0
CI_Mount_Baldy	Mount Baldy Wilderness	0.00159	12/20/11	0	0
CI_Mount_Zirkel	Mount Zirkel Wilderness	0.01276	11/30/11	0	0
CI_Pecos	Pecos Wilderness	0.00531	1/15/11	0	0
CI_Petrified_Forest	Petrified Forest NP	0.00481	12/21/11	0	0
CI_Rawah	Rawah Wilderness	0.00766	3/17/11	0	0
CI_Rocky_Mountain	Rocky Mountain NP	0.02067	3/3/11	0	0
CI_Salt_Creek	Salt Creek Wilderness	0.00041	12/9/11	0	0
CI_San_Pedro	San Pedro Parks Wilderness	0.00398	12/21/11	0	0
CI_Weminuche	Weminuche Wilderness	0.01003	1/15/11	0	0
CI_West_Elk	West Elk Wilderness	0.03314	11/8/11	0	0
CI_Wheeler_Peak	Wheeler Peak Wilderness	0.00681	1/15/11	0	0
CI_White_Mountain	White Mountain Wilderness	0.00061	12/6/11	0	0

Note that the thresholds shown are project-level thresholds. The comparisons shown above are for informational purposes only.

Table 5-21b. Maximum Δdv and number of days Δdv exceeds 0.5 and 1.0 for each Class I area due to emissions from Federal O&G within the CRVFO Planning Area (2025 Medium Development Scenario).

Colorado River Valley FO (CRVFO)					
Site Name	Class I & II Name	D dv	Date	Number of Day	
				>1.0	>0.5
Class I					
CI_Arches	Arches NP	0.03321	12/17/11	0	0
CI_Bandelier	Bandelier Wilderness	0.00566	1/25/11	0	0
CI_Black_Canyon	Black Canyon of the Gunnison Wilderness	0.05023	1/26/11	0	0
CI_Bosque	Bosque del Apache	0.00089	12/10/11	0	0
CI_Canyonlands	Canyonlands NP	0.03117	12/17/11	0	0
CI_Capitol_Reef	Capitol Reef NP	0.00724	12/18/11	0	0
CI_Dinosaur_CO	Dinosaur NM	0.00983	12/11/11	0	0
CI_Eagles_Nest	Eagles Nest Wilderness	0.05027	3/4/11	0	0
CI_Flat_Tops	Flat Tops Wilderness	0.04490	1/4/11	0	0
CI_Gila	Gila Wilderness	0.00109	12/20/11	0	0
CI_Great_Sand_Dunes	Great Sand Dunes Wilderness-nps	0.01739	12/6/11	0	0
CI_La_Garita	La Garita Wilderness	0.01595	1/15/11	0	0
CI_Maroon_Bells	Maroon Bells-Snowmass Wilderness	0.04767	12/21/11	0	0
CI_Mesa_Verde	Mesa Verde NP	0.01183	12/21/11	0	0
CI_Mount_Baldy	Mount Baldy Wilderness	0.00193	12/20/11	0	0
CI_Mount_Zirkel	Mount Zirkel Wilderness	0.01679	11/30/11	0	0
CI_Pecos	Pecos Wilderness	0.00614	1/15/11	0	0
CI_Petrified_Forest	Petrified Forest NP	0.00592	12/21/11	0	0
CI_Rawah	Rawah Wilderness	0.00931	3/17/11	0	0
CI_Rocky_Mountain	Rocky Mountain NP	0.02575	3/3/11	0	0
CI_Salt_Creek	Salt Creek Wilderness	0.00051	12/9/11	0	0
CI_San_Pedro	San Pedro Parks Wilderness	0.00486	12/21/11	0	0
CI_Weminuche	Weminuche Wilderness	0.01140	1/15/11	0	0
CI_West_Elk	West Elk Wilderness	0.03771	11/8/11	0	0
CI_Wheeler_Peak	Wheeler Peak Wilderness	0.00783	1/15/11	0	0
CI_White_Mountain	White Mountain Wilderness	0.00072	12/6/11	0	0

Note that the thresholds shown are project-level thresholds. The comparisons shown above are for informational purposes only.

5.3 Cumulative Visibility Impacts at Class I Areas

The visibility impacts due to new oil and gas emissions from combined BLM Planning Areas were examined following the procedures provided by the FWS and NPS (FWS and NPS, 2012) and described in Section 4.6.2. These procedures use EPA's Modeled Attainment Test Software (MATS) to project current year observed visibility impairment for the observed best 20 percent (B20%) and worst 20 percent (W20%) visibility days to the future year using the CAMx 2011 Base Case and 2025 High, Low and Medium Development Scenarios modeling results with and without emissions from each of the combined emission Source Groups. The cumulative visibility analysis was conducted for the following four combined Source Groups:

Source Group X: Total new O&G on Federal lands in BLM planning areas in CO, by CAMx source apportionment modeling;

Source Group X1: Total new O&G on Federal lands in BLM planning areas in CO, by the Brute-Force "zero-out" approach.

Source Group A2: New federal O&G and new Mining in CO;

Source Group A3: New federal and non-federal O&G and new Mining in CO;

Attachments C-1, C-2 and C-3 contain the 2011 observed and 2025 projected visibility for the W20% and B20% days at Class I and sensitive Class II areas for the High, Low and Medium

Development Scenarios, respectively, with and without each of the combined Source Groups. Tables 5-22 through 5-27 from Attachments C-1, C-2 and C-3 display the cumulative visibility results at Class I areas for the 2025 High, Low and Medium Development Scenarios, the four combined emission Source Groups listed above and the W20% and B20% days. MATS uses observed PM species concentrations and monthly average relative humidity from IMPROVE monitoring sites to calculate daily visibility impairment from which the W20% and B20% visibility days metrics are determined. Not all Class I areas have a co-located IMPROVE monitoring site. Thus, IMPROVE observations were mapped to nearby Class I areas that did not include an IMPROVE monitor. In Tables 5-22 through 5-27, the Class I area of interest is shown in the first column and the IMPROVE site used to represent observed visibility at the Class I area is shown in the third column. For example, the IMPROVE data from Canyonlands National Park was used to represent observed visibility for both the Canyonlands and Arches National Parks. The MATS includes the IMPROVE site to Class I area mappings. However, MATS does not include mappings between IMPROVE sites and sensitive Class II areas. Thus, we assigned an IMPROVE monitoring site to each sensitive Class II area based mainly on proximity so that MATS could calculate cumulative visibility impacts for the W20%/B20% days at sensitive Class II areas. Tables 5-22 through 5-26 include cumulative visibility impacts for just the Class I areas, the results for the sensitive Class II areas are included in Attachments C-1, C-2 and C-3.

Table 5-22 displays the observed W20% visibility metric for the current year (2011) and the projected W20% metric for the 2025 High Development Scenario with and without each of the four combined Source Groups with differences in the W20% visibility metric shown in Table 5-22a. Source Groups A1, A4 are also included in these tables as well as in Attachments C-1, C-2 and C-3, although our discussions are focused on X, X1, A2, and A3.

From the 2011 current year to the 2025 High Development Scenario future year, the W20% visibility metric is estimated to improve at 22 and degrade at 4 of the 26 Class I areas. The biggest improvement in W20% visibility between 2011 and 2025 High Scenario is a reduction of 0.68 dv that occurs both at Canyonlands National Park and Petrified Forest National Park, where visibility goes from 11.92 dv in 2011 to 11.24 dv in the 2025 High Development Scenario. The two Class I areas with degradation are Capitol Reef National Park (0.03 dv increase), Rocky Mountain National Park (0.09 dv increase), Salt Creek (0.11 dv increase), and White Mountain Wilderness (0.03 dv increase).

There are even more improvements in the W20% visibility between 2011 and 2025 for the Low Development Scenario (Table 5-23). Again the Class I area with the biggest improvement between 2011 and 2025 Low Scenario is a reduction of 0.68 dv at Canyonlands National Park and Petrified Forest National Park. 24 of the 26 Class I areas see W20% visibility improvements between 2011 and 2025 Low Scenario with Capitol Reef National Park and Salt Creek showing W20% visibility degradation by 0.03 dv and 0.11 dv, respectively. The results for the 2025 Medium Development Scenario are similar to the High Development Scenario, with 22 of 26 Class I areas showing improvements in the W20% visibility metric with the largest improvement (0.68 dv decrease) at Canyonlands National Park and Petrified Forest National Park (Table 5-24).

The Source Group X (new Federal O&G in Colorado) contribution to 2025 W20% visibility ranges from a minimum of zero to maximums of 0.24 dv (High), 0.04 dv (Low) and 0.20 dv (Medium) dv

(Tables 5-22a, 5-23a and 5-24a). The largest contribution of X occurs at the Arches National Park for all three Development Scenarios. The Source Group X1 shows same or slightly lower contribution using the Brute-Force approach. The biggest difference is seen in the Arches National Park, where X1 is lower than X by 0.11 dv.

The contributions from New federal O&G and new Mining in CO combined (Source Group A2) are slightly higher than Source Group X, as expected, by including impact from Mining. The Source Group A2 has contributions to 2025 W20% visibility ranging from 0 to maximums of 0.25, 0.06, and 0.21 dv (Medium), respectively, all of which are found at Arches National Park. The contributions of New federal and non-federal O&G and new Mining in CO (Source Group A3) increase further when non-federal O&G contribution is included, with contributions to 2025 W20% visibility ranging from 0 to maximums of 0.50 dv, 0.18 dv and 0.49 dv for the High, Low and Medium Development Scenarios, respectively, all of which are seen at Rocky Mountain National Park.

The results for the B20% visibility days and High, Low and Medium Development Scenarios are shown in Tables 5-25 through 5-27. Between 2011 and 2025 the B20% visibility improves for all but one Class I areas for all three 2025 emission scenarios. The only one Class I area with degraded visibility is Salt Creek, where reduction of 0.01 dv of visibility is seen for all three emission scenarios. The largest improvement in B20% visibility for the High, Low and Medium Development Scenarios are 0.46, 0.47 and 0.46 dv, respectively, all found at Canyonlands National Park and Pecos Wilderness. The Source Groups' X, X1, A2 and A3 contributions to the B20% visibility range from zero to 0.05, 0.04, 0.08, 0.10 dv for the High Development Scenario, zero to 0.01, 0.01, 0.04, and 0.05 dv with the 2025 Low Development Scenario, and zero to 0.04, 0.0.03, 0.07 and 0.09 dv for the Medium Development Scenario, respectively.

Table 5-22. Cumulative visibility results for W20% visibility days at Class I areas for current year (2011) and 2025 High Development Scenario using all emissions and without Source Groups X, A1, A2, A3, A4, and X1.

Class I Name	State	IMPROVE Site	2011 Base	2025 High	2025 High w/o X	2025 High w/o A1	2025 High w/o A2	2025 High w/o A3	2025 High w/o A4	2025 High w/o X1
Arches NP	UT	CANY1	10.83	10.63	10.39	10.21	10.38	10.19	10.61	10.50
Mount Baldy Wilderness	AZ	BALD1	10.53	9.98	9.98	9.98	9.98	9.98	9.98	9.98
Bandelier NM	NM	BAND1	11.92	11.85	11.85	11.83	11.85	11.83	11.83	11.85
Black Canyon of the Gunnison NM	CO	WEMI1	9.77	9.55	9.55	9.52	9.54	9.52	9.53	9.55
Bosque del Apache	NM	BOAP1	14.02	13.56	13.56	13.55	13.56	13.55	13.55	13.56
Canyonlands NP	AZ	PEFO1	11.92	11.24	11.24	11.24	11.24	11.24	11.24	11.24
Capitol Reef NP	NM	WHIT1	14.19	14.22	14.22	14.22	14.22	14.22	14.22	14.22
Eagles Nest Wilderness	CO	WHRI1	8.47	8.24	8.21	8.16	8.19	8.13	8.18	8.22
Flat Tops Wilderness	CO	WHRI1	8.47	8.24	8.21	8.16	8.19	8.13	8.18	8.22
Gila Wilderness	NM	GICL1	11.19	10.85	10.85	10.85	10.85	10.85	10.85	10.85
Great Sand Dunes NM	CO	GRSA1	11.57	11.43	11.42	11.38	11.42	11.37	11.37	11.42
La Garita Wilderness	CO	WEMI1	9.77	9.55	9.55	9.52	9.54	9.52	9.53	9.55
Maroon Bells-Snowmass Wilderness	CO	WHRI1	8.47	8.24	8.21	8.16	8.19	8.13	8.18	8.22
Mesa Verde NP	CO	MEVE1	11.22	11.18	11.17	11.12	11.16	11.12	11.12	11.17
Mount Zirkel Wilderness	CO	MOZI1	9.13	8.97	8.91	8.84	8.87	8.80	8.82	8.92
Pecos Wilderness	NM	WHPE1	9.90	9.68	9.68	9.67	9.68	9.67	9.67	9.68
Petrified Forest NP	AZ	PEFO1	11.92	11.24	11.24	11.24	11.24	11.24	11.24	11.24
Rawah Wilderness	CO	MOZI1	9.13	8.97	8.91	8.84	8.87	8.80	8.82	8.92
Rocky Mountain NP	CO	ROMO1	11.84	11.93	11.89	11.44	11.88	11.43	11.85	11.90
Salt Creek	NM	SACR1	17.42	17.53	17.53	17.53	17.53	17.53	17.53	17.53
San Pedro Parks Wilderness	NM	SAPE1	9.86	9.56	9.56	9.56	9.56	9.56	9.55	9.56
West Elk Wilderness	CO	WHRI1	8.47	8.24	8.21	8.16	8.19	8.13	8.18	8.22
Weminuche Wilderness	CO	WEMI1	9.77	9.55	9.55	9.52	9.54	9.52	9.53	9.55
Wheeler Peak Wilderness	NM	WHPE1	9.90	9.68	9.68	9.67	9.68	9.67	9.67	9.68
White Mountain Wilderness	NM	WHIT1	14.19	14.22	14.22	14.22	14.22	14.22	14.22	14.22
Dinosaur NM	CO	MOZI1	9.13	8.97	8.91	8.84	8.87	8.80	8.82	8.92

Table 5-22a. Differences in cumulative visibility results for W20% visibility days at Class I areas between current year (2011) and 2025 High Development Scenario (2011-2025) and contributions of Source Groups X, A1, A2, A3, A4, and X1 to 2025 W20% day's visibility.

Class I Name	State	IMPROVE Site	2025 High Improvement from 2011	Contribution from X	Contribution from A1	Contribution from A2	Contribution from A3	Contribution from A4	Contribution from X1
Arches NP	UT	CANY1	0.20	0.24	0.42	0.25	0.44	0.02	0.13
Mount Baldy Wilderness	AZ	BALD1	0.55	0.00	0.00	0.00	0.00	0.00	0.00
Bandelier NM	NM	BAND1	0.07	0.00	0.02	0.00	0.02	0.02	0.00
Black Canyon of the Gunnison NM	CO	WEMI1	0.22	0.00	0.03	0.01	0.03	0.02	0.00
Bosque del Apache	NM	BOAP1	0.46	0.00	0.01	0.00	0.01	0.01	0.00
Canyonlands NP	AZ	PEFO1	0.68	0.00	0.00	0.00	0.00	0.00	0.00
Capitol Reef NP	NM	WHIT1	-0.03	0.00	0.00	0.00	0.00	0.00	0.00
Eagles Nest Wilderness	CO	WHRI1	0.23	0.03	0.08	0.05	0.11	0.06	0.02
Flat Tops Wilderness	CO	WHRI1	0.23	0.03	0.08	0.05	0.11	0.06	0.02
Gila Wilderness	NM	GICL1	0.34	0.00	0.00	0.00	0.00	0.00	0.00
Great Sand Dunes NM	CO	GRSA1	0.14	0.01	0.05	0.01	0.06	0.06	0.01
La Garita Wilderness	CO	WEMI1	0.22	0.00	0.03	0.01	0.03	0.02	0.00
Maroon Bells-Snowmass Wilderness	CO	WHRI1	0.23	0.03	0.08	0.05	0.11	0.06	0.02
Mesa Verde NP	CO	MEVE1	0.04	0.01	0.06	0.02	0.06	0.06	0.01
Mount Zirkel Wilderness	CO	MOZI1	0.16	0.06	0.13	0.10	0.17	0.15	0.05
Pecos Wilderness	NM	WHPE1	0.22	0.00	0.01	0.00	0.01	0.01	0.00
Petrified Forest NP	AZ	PEFO1	0.68	0.00	0.00	0.00	0.00	0.00	0.00
Rawah Wilderness	CO	MOZI1	0.16	0.06	0.13	0.10	0.17	0.15	0.05
Rocky Mountain NP	CO	ROMO1	-0.09	0.04	0.49	0.05	0.50	0.08	0.03
Salt Creek	NM	SACR1	-0.11	0.00	0.00	0.00	0.00	0.00	0.00
San Pedro Parks Wilderness	NM	SAPE1	0.30	0.00	0.00	0.00	0.00	0.01	0.00
West Elk Wilderness	CO	WHRI1	0.23	0.03	0.08	0.05	0.11	0.06	0.02
Weminuche Wilderness	CO	WEMI1	0.22	0.00	0.03	0.01	0.03	0.02	0.00
Wheeler Peak Wilderness	NM	WHPE1	0.22	0.00	0.01	0.00	0.01	0.01	0.00
White Mountain Wilderness	NM	WHIT1	-0.03	0.00	0.00	0.00	0.00	0.00	0.00
Dinosaur NM	CO	MOZI1	0.16	0.06	0.13	0.10	0.17	0.15	0.05

Table 5-23. Cumulative visibility results for W20% visibility days at Class I areas for current year (2011) and 2025 Low Development Scenario using all emissions and without Source Groups X, A1, A2, A3, A4, and X1.

Class I Name	State	IMPROVE Site	2011 Base	2025 Low	2025 Low w/o X	2025 Low w/o A1	2025 Low w/o A2	2025 Low w/o A3	2025 Low w/o A4	2025 Low w/o X1
Arches NP	UT	CANY1	10.83	10.41	10.37	10.31	10.35	10.30	10.38	10.37
Mount Baldy Wilderness	AZ	BALD1	10.53	9.98	9.98	9.98	9.98	9.98	9.98	9.98
Bandelier NM	NM	BAND1	11.92	11.84	11.84	11.83	11.84	11.83	11.82	11.84
Black Canyon of the Gunnison NM	CO	WEMI1	9.77	9.53	9.53	9.51	9.52	9.51	9.50	9.53
Bosque del Apache	NM	BOAP1	14.02	13.55	13.55	13.55	13.55	13.55	13.54	13.55
Canyonlands NP	AZ	PEFO1	11.92	11.24	11.24	11.24	11.24	11.24	11.24	11.24
Capitol Reef NP	NM	WHIT1	14.19	14.22	14.22	14.22	14.22	14.22	14.22	14.22
Eagles Nest Wilderness	CO	WHRI1	8.47	8.19	8.18	8.16	8.17	8.15	8.13	8.18
Flat Tops Wilderness	CO	WHRI1	8.47	8.19	8.18	8.16	8.17	8.15	8.13	8.18
Gila Wilderness	NM	GICL1	11.19	10.85	10.85	10.85	10.85	10.85	10.85	10.85
Great Sand Dunes NM	CO	GRSA1	11.57	11.40	11.40	11.38	11.40	11.38	11.34	11.40
La Garita Wilderness	CO	WEMI1	9.77	9.53	9.53	9.51	9.52	9.51	9.50	9.53
Maroon Bells-Snowmass Wilderness	CO	WHRI1	8.47	8.19	8.18	8.16	8.17	8.15	8.13	8.18
Mesa Verde NP	CO	MEVE1	11.22	11.13	11.13	11.11	11.13	11.10	11.08	11.13
Mount Zirkel Wilderness	CO	MOZI1	9.13	8.86	8.85	8.83	8.81	8.79	8.71	8.85
Pecos Wilderness	NM	WHPE1	9.90	9.67	9.67	9.67	9.67	9.67	9.67	9.67
Petrified Forest NP	AZ	PEFO1	11.92	11.24	11.24	11.24	11.24	11.24	11.24	11.24
Rawah Wilderness	CO	MOZI1	9.13	8.86	8.85	8.83	8.81	8.79	8.71	8.85
Rocky Mountain NP	CO	ROMO1	11.84	11.63	11.62	11.46	11.61	11.45	11.54	11.63
Salt Creek	NM	SACR1	17.42	17.53	17.53	17.53	17.53	17.53	17.53	17.53
San Pedro Parks Wilderness	NM	SAPE1	9.86	9.56	9.56	9.56	9.56	9.56	9.55	9.56
West Elk Wilderness	CO	WHRI1	8.47	8.19	8.18	8.16	8.17	8.15	8.13	8.18
Weminuche Wilderness	CO	WEMI1	9.77	9.53	9.53	9.51	9.52	9.51	9.50	9.53
Wheeler Peak Wilderness	NM	WHPE1	9.90	9.67	9.67	9.67	9.67	9.67	9.67	9.67
White Mountain Wilderness	NM	WHIT1	14.19	14.22	14.22	14.22	14.22	14.22	14.22	14.22
Dinosaur NM	CO	MOZI1	9.13	8.86	8.85	8.83	8.81	8.79	8.71	8.85

Table 5-23a. Differences in cumulative visibility results for W20% visibility days at Class I areas between current year (2011) and 2025 Low Development Scenario (2011-2025) and contributions of Source Groups X, A1, A2, A3, A4, and X1 to 2025 W20% day's visibility.

Class I Name	State	IMPROVE Site	2025 Low Improvement from 2011	Contribution from X	Contribution from A1	Contribution from A2	Contribution from A3	Contribution from A4	Contribution from X1
Arches NP	UT	CANY1	0.42	0.04	0.10	0.06	0.11	0.03	0.04
Mount Baldy Wilderness	AZ	BALD1	0.55	0.00	0.00	0.00	0.00	0.00	0.00
Bandelier NM	NM	BAND1	0.08	0.00	0.01	0.00	0.01	0.02	0.00
Black Canyon of the Gunnison NM	CO	WEMI1	0.24	0.00	0.02	0.01	0.02	0.03	0.00
Bosque del Apache	NM	BOAP1	0.47	0.00	0.00	0.00	0.00	0.01	0.00
Canyonlands NP	AZ	PEFO1	0.68	0.00	0.00	0.00	0.00	0.00	0.00
Capitol Reef NP	NM	WHIT1	-0.03	0.00	0.00	0.00	0.00	0.00	0.00
Eagles Nest Wilderness	CO	WHRI1	0.28	0.01	0.03	0.02	0.04	0.06	0.01
Flat Tops Wilderness	CO	WHRI1	0.28	0.01	0.03	0.02	0.04	0.06	0.01
Gila Wilderness	NM	GICL1	0.34	0.00	0.00	0.00	0.00	0.00	0.00
Great Sand Dunes NM	CO	GRSA1	0.17	0.00	0.02	0.00	0.02	0.06	0.00
La Garita Wilderness	CO	WEMI1	0.24	0.00	0.02	0.01	0.02	0.03	0.00
Maroon Bells-Snowmass Wilderness	CO	WHRI1	0.28	0.01	0.03	0.02	0.04	0.06	0.01
Mesa Verde NP	CO	MEVE1	0.09	0.00	0.02	0.00	0.03	0.05	0.00
Mount Zirkel Wilderness	CO	MOZI1	0.27	0.01	0.03	0.05	0.07	0.15	0.01
Pecos Wilderness	NM	WHPE1	0.23	0.00	0.00	0.00	0.00	0.00	0.00
Petrified Forest NP	AZ	PEFO1	0.68	0.00	0.00	0.00	0.00	0.00	0.00
Rawah Wilderness	CO	MOZI1	0.27	0.01	0.03	0.05	0.07	0.15	0.01
Rocky Mountain NP	CO	ROMO1	0.21	0.01	0.17	0.02	0.18	0.09	0.00
Salt Creek	NM	SACR1	-0.11	0.00	0.00	0.00	0.00	0.00	0.00
San Pedro Parks Wilderness	NM	SAPE1	0.30	0.00	0.00	0.00	0.00	0.01	0.00
West Elk Wilderness	CO	WHRI1	0.28	0.01	0.03	0.02	0.04	0.06	0.01
Weminuche Wilderness	CO	WEMI1	0.24	0.00	0.02	0.01	0.02	0.03	0.00
Wheeler Peak Wilderness	NM	WHPE1	0.23	0.00	0.00	0.00	0.00	0.00	0.00
White Mountain Wilderness	NM	WHIT1	-0.03	0.00	0.00	0.00	0.00	0.00	0.00
Dinosaur NM	CO	MOZI1	0.27	0.01	0.03	0.05	0.07	0.15	0.01

Table 5-24. Cumulative visibility results for W20% visibility days at Class I areas for current year (2011) and 2025 Medium Development Scenario using all emissions and without Source Groups X, A1, A2, A3, A4, and X1.

Class I Name	State	IMPROVE Site	2011 Base	2025 Medium	2025 Medium w/o X	2025 Medium w/o A1	2025 Medium w/o A2	2025 Medium w/o A3	2025 Medium w/o A4	2025 Medium w/o X1
Arches NP	UT	CANY1	10.83	10.60	10.40	10.22	10.39	10.20	10.58	10.50
Mount Baldy Wilderness	AZ	BALD1	10.53	9.98	9.98	9.98	9.98	9.98	9.98	9.98
Bandelier NM	NM	BAND1	11.92	11.85	11.84	11.83	11.84	11.83	11.83	11.84
Black Canyon of the Gunnison NM	CO	WEMI1	9.77	9.54	9.53	9.51	9.53	9.51	9.51	9.53
Bosque del Apache	NM	BOAP1	14.02	13.56	13.55	13.55	13.55	13.55	13.55	13.55
Canyonlands NP	AZ	PEFO1	11.92	11.24	11.24	11.24	11.24	11.24	11.24	11.24
Capitol Reef NP	NM	WHIT1	14.19	14.22	14.22	14.22	14.22	14.22	14.22	14.22
Eagles Nest Wilderness	CO	WHRI1	8.47	8.23	8.21	8.16	8.19	8.13	8.17	8.21
Flat Tops Wilderness	CO	WHRI1	8.47	8.23	8.21	8.16	8.19	8.13	8.17	8.21
Gila Wilderness	NM	GICL1	11.19	10.85	10.85	10.85	10.85	10.85	10.85	10.85
Great Sand Dunes NM	CO	GRSA1	11.57	11.42	11.42	11.37	11.42	11.37	11.37	11.42
La Garita Wilderness	CO	WEMI1	9.77	9.54	9.53	9.51	9.53	9.51	9.51	9.53
Maroon Bells-Snowmass Wilderness	CO	WHRI1	8.47	8.23	8.21	8.16	8.19	8.13	8.17	8.21
Mesa Verde NP	CO	MEVE1	11.22	11.15	11.14	11.11	11.14	11.10	11.10	11.14
Mount Zirkel Wilderness	CO	MOZI1	9.13	8.95	8.91	8.84	8.87	8.79	8.80	8.91
Pecos Wilderness	NM	WHPE1	9.90	9.68	9.68	9.67	9.68	9.67	9.67	9.68
Petrified Forest NP	AZ	PEFO1	11.92	11.24	11.24	11.24	11.24	11.24	11.24	11.24
Rawah Wilderness	CO	MOZI1	9.13	8.95	8.91	8.84	8.87	8.79	8.80	8.91
Rocky Mountain NP	CO	ROMO1	11.84	11.92	11.89	11.44	11.88	11.43	11.83	11.90
Salt Creek	NM	SACR1	17.42	17.53	17.53	17.53	17.53	17.53	17.53	17.53
San Pedro Parks Wilderness	NM	SAPE1	9.86	9.56	9.56	9.56	9.56	9.56	9.55	9.56
West Elk Wilderness	CO	WHRI1	8.47	8.23	8.21	8.16	8.19	8.13	8.17	8.21
Weminuche Wilderness	CO	WEMI1	9.77	9.54	9.53	9.51	9.53	9.51	9.51	9.53
Wheeler Peak Wilderness	NM	WHPE1	9.90	9.68	9.68	9.67	9.68	9.67	9.67	9.68
White Mountain Wilderness	NM	WHIT1	14.19	14.22	14.22	14.22	14.22	14.22	14.22	14.22
Dinosaur NM	CO	MOZI1	9.13	8.95	8.91	8.84	8.87	8.79	8.80	8.91

Table 5-24a. Differences in cumulative visibility results for W20% visibility days at Class I areas between current year (2011) and 2025 Medium Development Scenario (2011-2025) and contributions of Source Groups X, A1, A2, A3, A4, and X1 to 2025 W20% day's visibility.

Class I Name	State	IMPROVE Site	2025 Medium Improvement from 2011	Contribution from X	Contribution from A1	Contribution from A2	Contribution from A3	Contribution from A4	Contribution from X1
Arches NP	UT	CANY1	0.23	0.20	0.38	0.21	0.40	0.02	0.10
Mount Baldy Wilderness	AZ	BALD1	0.55	0.00	0.00	0.00	0.00	0.00	0.00
Bandelier NM	NM	BAND1	0.07	0.01	0.02	0.01	0.02	0.02	0.01
Black Canyon of the Gunnison NM	CO	WEMI1	0.23	0.01	0.03	0.01	0.03	0.03	0.01
Bosque del Apache	NM	BOAP1	0.46	0.01	0.01	0.01	0.01	0.01	0.01
Canyonlands NP	AZ	PEFO1	0.68	0.00	0.00	0.00	0.00	0.00	0.00
Capitol Reef NP	NM	WHIT1	-0.03	0.00	0.00	0.00	0.00	0.00	0.00
Eagles Nest Wilderness	CO	WHRI1	0.24	0.02	0.07	0.04	0.10	0.06	0.02
Flat Tops Wilderness	CO	WHRI1	0.24	0.02	0.07	0.04	0.10	0.06	0.02
Gila Wilderness	NM	GICL1	0.34	0.00	0.00	0.00	0.00	0.00	0.00
Great Sand Dunes NM	CO	GRSA1	0.15	0.00	0.05	0.00	0.05	0.05	0.00
La Garita Wilderness	CO	WEMI1	0.23	0.01	0.03	0.01	0.03	0.03	0.01
Maroon Bells-Snowmass Wilderness	CO	WHRI1	0.24	0.02	0.07	0.04	0.10	0.06	0.02
Mesa Verde NP	CO	MEVE1	0.07	0.01	0.04	0.01	0.05	0.05	0.01
Mount Zirkel Wilderness	CO	MOZI1	0.18	0.04	0.11	0.08	0.16	0.15	0.04
Pecos Wilderness	NM	WHPE1	0.22	0.00	0.01	0.00	0.01	0.01	0.00
Petrified Forest NP	AZ	PEFO1	0.68	0.00	0.00	0.00	0.00	0.00	0.00
Rawah Wilderness	CO	MOZI1	0.18	0.04	0.11	0.08	0.16	0.15	0.04
Rocky Mountain NP	CO	ROMO1	-0.08	0.03	0.48	0.04	0.49	0.09	0.02
Salt Creek	NM	SACR1	-0.11	0.00	0.00	0.00	0.00	0.00	0.00
San Pedro Parks Wilderness	NM	SAPE1	0.30	0.00	0.00	0.00	0.00	0.01	0.00
West Elk Wilderness	CO	WHRI1	0.24	0.02	0.07	0.04	0.10	0.06	0.02
Weminuche Wilderness	CO	WEMI1	0.23	0.01	0.03	0.01	0.03	0.03	0.01
Wheeler Peak Wilderness	NM	WHPE1	0.22	0.00	0.01	0.00	0.01	0.01	0.00
White Mountain Wilderness	NM	WHIT1	-0.03	0.00	0.00	0.00	0.00	0.00	0.00
Dinosaur NM	CO	MOZI1	0.18	0.04	0.11	0.08	0.16	0.15	0.04

Table 5-25. Cumulative visibility results for B20% visibility days at Class I areas for current year (2011) and 2025High Development Scenario using all emissions and without Source Groups X, A1, A2, A3, A4, and X1.

Class I Name	State	IMPROVE Site	2011 Base	2025 High	2025 High w/o X	2025 High w/o A1	2025 High w/o A2	2025 High w/o A3	2025 High w/o A4	2025 High w/o X1
Arches NP	UT	CANY1	3.06	2.91	2.88	2.86	2.87	2.85	2.89	2.88
Mount Baldy Wilderness	AZ	BALD1	2.73	2.56	2.56	2.56	2.56	2.56	2.56	2.56
Bandelier NM	NM	BAND1	3.99	3.81	3.81	3.80	3.81	3.80	3.78	3.81
Black Canyon of the Gunnison NM	CO	WEMI1	2.06	1.89	1.87	1.85	1.86	1.85	1.88	1.87
Bosque del Apache	NM	BOAP1	5.72	5.50	5.49	5.49	5.49	5.49	5.48	5.49
Canyonlands NP	AZ	PEFO1	4.08	3.62	3.61	3.60	3.61	3.60	3.61	3.62
Capitol Reef NP	NM	WHIT1	3.34	3.25	3.25	3.25	3.25	3.25	3.24	3.25
Eagles Nest Wilderness	CO	WHRI1	0.51	0.32	0.28	0.24	0.26	0.22	0.30	0.29
Flat Tops Wilderness	CO	WHRI1	0.51	0.32	0.28	0.24	0.26	0.22	0.30	0.29
Galiuro Wilderness	NM	GICL1	2.46	2.41	2.41	2.41	2.41	2.41	2.41	2.41
Great Sand Dunes NM	CO	GRSA1	3.81	3.69	3.67	3.64	3.66	3.63	3.67	3.67
La Garita Wilderness	CO	WEMI1	2.06	1.89	1.87	1.85	1.86	1.85	1.88	1.87
Maroon Bells-Snowmass Wilderness	CO	WHRI1	0.51	0.32	0.28	0.24	0.26	0.22	0.30	0.29
Mesa Verde NP	CO	MEVE1	2.97	2.78	2.76	2.72	2.75	2.71	2.75	2.75
Mount Zirkel Wilderness	CO	MOZI1	0.89	0.81	0.76	0.74	0.73	0.71	0.61	0.77
Pecos Wilderness	AZ	PEFO1	4.08	3.62	3.61	3.60	3.61	3.60	3.61	3.62
Petrified Forest NP	NM	WHPE1	1.09	1.08	1.07	1.05	1.06	1.05	1.06	1.07
Rawah Wilderness	CO	MOZI1	0.89	0.81	0.76	0.74	0.73	0.71	0.61	0.77
Rocky Mountain NP	CO	ROMO1	1.61	1.47	1.46	1.41	1.45	1.40	1.42	1.46
Salt Creek	NM	SACR1	7.37	7.38	7.38	7.38	7.38	7.38	7.37	7.38
San Pedro Parks Wilderness	NM	SAPE1	1.42	1.33	1.32	1.31	1.32	1.30	1.28	1.32
West Elk Wilderness	CO	WHRI1	0.51	0.32	0.28	0.24	0.26	0.22	0.30	0.29
Weminuche Wilderness	CO	WEMI1	2.06	1.89	1.87	1.85	1.86	1.85	1.88	1.87
Wheeler Peak Wilderness	NM	WHPE1	1.09	1.08	1.07	1.05	1.06	1.05	1.06	1.07
White Mountain Wilderness	NM	WHIT1	3.34	3.25	3.25	3.25	3.25	3.25	3.24	3.25
Dinosaur NM	CO	MOZI1	0.89	0.81	0.76	0.74	0.73	0.71	0.61	0.77

Table 5-25a. Differences in cumulative visibility results for B20% visibility days at Class I areas between current year (2011) and 2025 High Development Scenario (2011-2025) and contributions of Source Groups X, A1, A2, A3, A4, and X1 to 2025 B20% day's visibility.

Class I Name	State	IMPROVE Site	2025 High Improvement from 2011	Contribution from X	Contribution from A1	Contribution from A2	Contribution from A3	Contribution from A4	Contribution from X1
Arches NP	UT	CANY1	0.15	0.03	0.05	0.04	0.06	0.02	0.03
Mount Baldy Wilderness	AZ	BALD1	0.17	0.00	0.00	0.00	0.00	0.00	0.00
Bandelier NM	NM	BAND1	0.18	0.00	0.01	0.00	0.01	0.03	0.00
Black Canyon of the Gunnison NM	CO	WEMI1	0.17	0.02	0.04	0.03	0.04	0.01	0.02
Bosque del Apache	NM	BOAP1	0.22	0.01	0.01	0.01	0.01	0.02	0.01
Canyonlands NP	AZ	PEFO1	0.46	0.01	0.02	0.01	0.02	0.01	0.00
Capitol Reef NP	NM	WHIT1	0.09	0.00	0.00	0.00	0.00	0.01	0.00
Eagles Nest Wilderness	CO	WHRI1	0.19	0.04	0.08	0.06	0.10	0.02	0.03
Flat Tops Wilderness	CO	WHRI1	0.19	0.04	0.08	0.06	0.10	0.02	0.03
Galiuro Wilderness	NM	GICL1	0.05	0.00	0.00	0.00	0.00	0.00	0.00
Great Sand Dunes NM	CO	GRSA1	0.12	0.02	0.05	0.03	0.06	0.02	0.02
La Garita Wilderness	CO	WEMI1	0.17	0.02	0.04	0.03	0.04	0.01	0.02
Maroon Bells-Snowmass Wilderness	CO	WHRI1	0.19	0.04	0.08	0.06	0.10	0.02	0.03
Mesa Verde NP	CO	MEVE1	0.19	0.02	0.06	0.03	0.07	0.03	0.03
Mount Zirkel Wilderness	CO	MOZI1	0.08	0.05	0.07	0.08	0.10	0.20	0.04
Pecos Wilderness	AZ	PEFO1	0.46	0.01	0.02	0.01	0.02	0.01	0.00
Petrified Forest NP	NM	WHPE1	0.01	0.01	0.03	0.02	0.03	0.02	0.01
Rawah Wilderness	CO	MOZI1	0.08	0.05	0.07	0.08	0.10	0.20	0.04
Rocky Mountain NP	CO	ROMO1	0.14	0.01	0.06	0.02	0.07	0.05	0.01
Salt Creek	NM	SACR1	-0.01	0.00	0.00	0.00	0.00	0.01	0.00
San Pedro Parks Wilderness	NM	SAPE1	0.09	0.01	0.02	0.01	0.03	0.05	0.01
West Elk Wilderness	CO	WHRI1	0.19	0.04	0.08	0.06	0.10	0.02	0.03
Weminuche Wilderness	CO	WEMI1	0.17	0.02	0.04	0.03	0.04	0.01	0.02
Wheeler Peak Wilderness	NM	WHPE1	0.01	0.01	0.03	0.02	0.03	0.02	0.01
White Mountain Wilderness	NM	WHIT1	0.01	0.00	0.00	0.00	0.00	0.01	0.00
Dinosaur NM	CO	MOZI1	0.01	0.00	0.00	0.08	0.10	0.20	0.04

Table 5-26. Cumulative visibility results for B20% visibility days at Class I areas for current year (2011) and 2025 Low Development Scenario using all emissions and without Source Groups X, A1, A2, A3, A4, and X1.

Class I Name	State	IMPROVE Site	2011 Base	2025 Low	2025 Low w/o X	2025 Low w/o A1	2025 Low w/o A2	2025 Low w/o A3	2025 Low w/o A4	2025 Low w/o X1
Arches NP	UT	CANY1	3.06	2.87	2.87	2.86	2.86	2.86	2.86	2.87
Mount Baldy Wilderness	AZ	BALD1	2.73	2.56	2.56	2.56	2.56	2.56	2.56	2.56
Bandelier NM	NM	BAND1	3.99	3.80	3.80	3.80	3.80	3.80	3.77	3.80
Black Canyon of the Gunnison NM	CO	WEMI1	2.06	1.86	1.86	1.85	1.85	1.85	1.85	1.86
Bosque del Apache	NM	BOAP1	5.72	5.49	5.49	5.49	5.49	5.49	5.48	5.49
Canyonlands NP	AZ	PEFO1	4.08	3.61	3.61	3.61	3.61	3.61	3.61	3.61
Capitol Reef NP	NM	WHIT1	3.34	3.25	3.25	3.25	3.25	3.24	3.24	3.25
Eagles Nest Wilderness	CO	WHRI1	0.51	0.26	0.25	0.24	0.24	0.23	0.25	0.25
Flat Tops Wilderness	CO	WHRI1	0.51	0.26	0.25	0.24	0.24	0.23	0.25	0.25
Galiuro Wilderness	NM	GICL1	2.46	2.41	2.41	2.41	2.41	2.41	2.40	2.41
Great Sand Dunes NM	CO	GRSA1	3.81	3.64	3.64	3.63	3.63	3.62	3.62	3.64
La Garita Wilderness	CO	WEMI1	2.06	1.86	1.86	1.85	1.85	1.85	1.85	1.86
Maroon Bells-Snowmass Wilderness	CO	WHRI1	0.51	0.26	0.25	0.24	0.24	0.23	0.25	0.25
Mesa Verde NP	CO	MEVE1	2.97	2.72	2.71	2.70	2.70	2.69	2.69	2.71
Mount Zirkel Wilderness	CO	MOZI1	0.89	0.76	0.75	0.74	0.72	0.71	0.55	0.75
Pecos Wilderness	AZ	PEFO1	4.08	3.61	3.61	3.61	3.61	3.61	3.61	3.61
Petrified Forest NP	NM	WHPE1	1.09	1.06	1.05	1.05	1.05	1.05	1.04	1.05
Rawah Wilderness	CO	MOZI1	0.89	0.76	0.75	0.74	0.72	0.71	0.55	0.75
Rocky Mountain NP	CO	ROMO1	1.61	1.43	1.43	1.41	1.42	1.40	1.38	1.43
Salt Creek	NM	SACR1	7.37	7.38	7.38	7.38	7.38	7.38	7.37	7.38
San Pedro Parks Wilderness	NM	SAPE1	1.42	1.31	1.31	1.30	1.31	1.30	1.26	1.31
West Elk Wilderness	CO	WHRI1	0.51	0.26	0.25	0.24	0.24	0.23	0.25	0.25
Weminuche Wilderness	CO	WEMI1	2.06	1.86	1.86	1.85	1.85	1.85	1.85	1.86
Wheeler Peak Wilderness	NM	WHPE1	1.09	1.06	1.05	1.05	1.05	1.05	1.04	1.05
White Mountain Wilderness	NM	WHIT1	3.34	3.25	3.25	3.25	3.25	3.24	3.24	3.25
Dinosaur NM	CO	MOZI1	0.89	0.76	0.75	0.74	0.72	0.71	0.55	0.75

Table 5-26a. Differences in cumulative visibility results for B20% visibility days at Class I areas between current year (2011) and 2025 Low Development Scenario (2011-2025) and contributions of Source Groups X, A1, A2, A3, A4, and X1 to 2025 B20% day's visibility.

Class I Name	State	IMPROVE Site	2025 Low Improvement from 2011	Contribution from X	Contribution from A1	Contribution from A2	Contribution from A3	Contribution from A4	Contribution from X1
Arches NP	UT	CANY1	0.19	0.00	0.01	0.01	0.01	0.01	0.00
Mount Baldy Wilderness	AZ	BALD1	0.17	0.00	0.00	0.00	0.00	0.00	0.00
Bandelier NM	NM	BAND1	0.19	0.00	0.00	0.00	0.00	0.03	0.00
Black Canyon of the Gunnison NM	CO	WEMI1	0.20	0.00	0.01	0.01	0.01	0.01	0.00
Bosque del Apache	NM	BOAP1	0.23	0.00	0.00	0.00	0.00	0.01	0.00
Canyonlands NP	AZ	PEFO1	0.47	0.00	0.00	0.00	0.00	0.00	0.00
Capitol Reef NP	NM	WHIT1	0.09	0.00	0.00	0.00	0.01	0.01	0.00
Eagles Nest Wilderness	CO	WHRI1	0.25	0.01	0.02	0.02	0.03	0.01	0.01
Flat Tops Wilderness	CO	WHRI1	0.25	0.01	0.02	0.02	0.03	0.01	0.01
Galiuro Wilderness	NM	GICL1	0.05	0.00	0.00	0.00	0.00	0.01	0.00
Great Sand Dunes NM	CO	GRSA1	0.17	0.00	0.01	0.01	0.02	0.02	0.00
La Garita Wilderness	CO	WEMI1	0.20	0.00	0.01	0.01	0.01	0.01	0.00
Maroon Bells-Snowmass Wilderness	CO	WHRI1	0.25	0.01	0.02	0.02	0.03	0.01	0.01
Mesa Verde NP	CO	MEVE1	0.25	0.01	0.02	0.02	0.03	0.03	0.01
Mount Zirkel Wilderness	CO	MOZI1	0.13	0.01	0.02	0.04	0.05	0.21	0.01
Pecos Wilderness	AZ	PEFO1	0.47	0.00	0.00	0.00	0.00	0.00	0.00
Petrified Forest NP	NM	WHPE1	0.03	0.01	0.01	0.01	0.01	0.02	0.01
Rawah Wilderness	CO	MOZI1	0.13	0.01	0.02	0.04	0.05	0.21	0.01
Rocky Mountain NP	CO	ROMO1	0.18	0.00	0.02	0.01	0.03	0.05	0.00
Salt Creek	NM	SACR1	-0.01	0.00	0.00	0.00	0.00	0.01	0.00
San Pedro Parks Wilderness	NM	SAPE1	0.11	0.00	0.01	0.00	0.01	0.05	0.00
West Elk Wilderness	CO	WHRI1	0.25	0.01	0.02	0.02	0.03	0.01	0.01
Weminuche Wilderness	CO	WEMI1	0.20	0.00	0.01	0.01	0.01	0.01	0.00
Wheeler Peak Wilderness	NM	WHPE1	0.03	0.01	0.01	0.01	0.01	0.02	0.01
White Mountain Wilderness	NM	WHIT1	0.01	0.00	0.00	0.00	0.01	0.01	0.00
Dinosaur NM	CO	MOZI1	0.01	0.00	0.00	0.04	0.05	0.21	0.01

Table 5-27. Cumulative visibility results for B20% visibility days at Class I areas for current year (2011) and 2025 Medium Development Scenario using all emissions and without Source Groups X, A1, A2, A3, A4, and X1.

Class I Name	State	IMPROVE Site	2011 Base	2025 Medium	2025 Medium w/o X	2025 Medium w/o A1	2025 Medium w/o A2	2025 Medium w/o A3	2025 Medium w/o A4	2025 Medium w/o X1
Arches NP	UT	CANY1	3.06	2.90	2.88	2.86	2.87	2.85	2.88	2.88
Mount Baldy Wilderness	AZ	BALD1	2.73	2.56	2.56	2.56	2.56	2.56	2.56	2.56
Bandelier NM	NM	BAND1	3.99	3.81	3.81	3.80	3.81	3.80	3.78	3.81
Black Canyon of the Gunnison NM	CO	WEMI1	2.06	1.88	1.87	1.85	1.86	1.84	1.87	1.87
Bosque del Apache	NM	BOAP1	5.72	5.49	5.49	5.49	5.49	5.49	5.48	5.49
Canyonlands NP	AZ	PEFO1	4.08	3.62	3.61	3.60	3.61	3.60	3.61	3.61
Capitol Reef NP	NM	WHIT1	3.34	3.25	3.25	3.25	3.25	3.24	3.24	3.25
Eagles Nest Wilderness	CO	WHRI1	0.51	0.31	0.28	0.24	0.26	0.23	0.30	0.29
Flat Tops Wilderness	CO	WHRI1	0.51	0.31	0.28	0.24	0.26	0.23	0.30	0.29
Galiuro Wilderness	NM	GICL1	2.46	2.41	2.41	2.41	2.41	2.41	2.40	2.41
Great Sand Dunes NM	CO	GRSA1	3.81	3.68	3.66	3.63	3.65	3.62	3.66	3.66
La Garita Wilderness	CO	WEMI1	2.06	1.88	1.87	1.85	1.86	1.84	1.87	1.87
Maroon Bells-Snowmass Wilderness	CO	WHRI1	0.51	0.31	0.28	0.24	0.26	0.23	0.30	0.29
Mesa Verde NP	CO	MEVE1	2.97	2.75	2.74	2.71	2.73	2.70	2.73	2.73
Mount Zirkel Wilderness	CO	MOZI1	0.89	0.80	0.76	0.74	0.73	0.71	0.60	0.77
Pecos Wilderness	AZ	PEFO1	4.08	3.62	3.61	3.60	3.61	3.60	3.61	3.61
Petrified Forest NP	NM	WHPE1	1.09	1.07	1.06	1.05	1.06	1.05	1.06	1.06
Rawah Wilderness	CO	MOZI1	0.89	0.80	0.76	0.74	0.73	0.71	0.60	0.77
Rocky Mountain NP	CO	ROMO1	1.61	1.47	1.46	1.41	1.45	1.40	1.42	1.46
Salt Creek	NM	SACR1	7.37	7.38	7.38	7.38	7.38	7.38	7.37	7.38
San Pedro Parks Wilderness	NM	SAPE1	1.42	1.32	1.32	1.30	1.31	1.30	1.27	1.32
West Elk Wilderness	CO	WHRI1	0.51	0.31	0.28	0.24	0.26	0.23	0.30	0.29
Weminuche Wilderness	CO	WEMI1	2.06	1.88	1.87	1.85	1.86	1.84	1.87	1.87
Wheeler Peak Wilderness	NM	WHPE1	1.09	1.07	1.06	1.05	1.06	1.05	1.06	1.06
White Mountain Wilderness	NM	WHIT1	3.34	3.25	3.25	3.25	3.25	3.24	3.24	3.25
Dinosaur NM	CO	MOZI1	0.89	0.80	0.76	0.74	0.73	0.71	0.60	0.77

Table 5-27a. Differences in cumulative visibility results for B20% visibility days at Class I areas between current year (2011) and 2025 Medium Development Scenario (2011-2025) and contributions of Source Groups X, A1, A2, A3, A4, and X1 to 2025 B20% day's visibility.

Class I Name	State	IMPROVE Site	2025 Medium Improvement from 2011	Contribution from X	Contribution from A1	Contribution from A2	Contribution from A3	Contribution from A4	Contribution from X1
Arches NP	UT	CANY1	0.16	0.02	0.04	0.03	0.05	0.02	0.02
Mount Baldy Wilderness	AZ	BALD1	0.17	0.00	0.00	0.00	0.00	0.00	0.00
Bandelier NM	NM	BAND1	0.18	0.00	0.01	0.00	0.01	0.03	0.00
Black Canyon of the Gunnison NM	CO	WEMI1	0.18	0.01	0.03	0.02	0.04	0.01	0.01
Bosque del Apache	NM	BOAP1	0.23	0.00	0.00	0.00	0.00	0.01	0.00
Canyonlands NP	AZ	PEFO1	0.46	0.01	0.02	0.01	0.02	0.01	0.01
Capitol Reef NP	NM	WHIT1	0.09	0.00	0.00	0.00	0.01	0.01	0.00
Eagles Nest Wilderness	CO	WHRI1	0.20	0.03	0.07	0.05	0.08	0.01	0.02
Flat Tops Wilderness	CO	WHRI1	0.20	0.03	0.07	0.05	0.08	0.01	0.02
Galiuro Wilderness	NM	GICL1	0.05	0.00	0.00	0.00	0.00	0.01	0.00
Great Sand Dunes NM	CO	GRSA1	0.13	0.02	0.05	0.03	0.06	0.02	0.02
La Garita Wilderness	CO	WEMI1	0.18	0.01	0.03	0.02	0.04	0.01	0.01
Maroon Bells-Snowmass Wilderness	CO	WHRI1	0.20	0.03	0.07	0.05	0.08	0.01	0.02
Mesa Verde NP	CO	MEVE1	0.22	0.01	0.04	0.02	0.05	0.02	0.02
Mount Zirkel Wilderness	CO	MOZI1	0.09	0.04	0.06	0.07	0.09	0.20	0.03
Pecos Wilderness	AZ	PEFO1	0.46	0.01	0.02	0.01	0.02	0.01	0.01
Petrified Forest NP	NM	WHPE1	0.02	0.01	0.02	0.01	0.02	0.01	0.01
Rawah Wilderness	CO	MOZI1	0.09	0.04	0.06	0.07	0.09	0.20	0.03
Rocky Mountain NP	CO	ROMO1	0.14	0.01	0.06	0.02	0.07	0.05	0.01
Salt Creek	NM	SACR1	-0.01	0.00	0.00	0.00	0.00	0.01	0.00
San Pedro Parks Wilderness	NM	SAPE1	0.10	0.00	0.02	0.01	0.02	0.05	0.00
West Elk Wilderness	CO	WHRI1	0.20	0.03	0.07	0.05	0.08	0.01	0.02
Weminuche Wilderness	CO	WEMI1	0.18	0.01	0.03	0.02	0.04	0.01	0.01
Wheeler Peak Wilderness	NM	WHPE1	0.02	0.01	0.02	0.01	0.02	0.01	0.01
White Mountain Wilderness	NM	WHIT1	0.01	0.00	0.00	0.00	0.01	0.01	0.00
Dinosaur NM	CO	MOZI1	0.01	0.00	0.00	0.07	0.09	0.20	0.03

5.4 Sulfur and Nitrogen Deposition at Class I and Sensitive Class II Areas

Attachments D-1, D-2 and D-3 are interactive Excel spreadsheets that display Maximum and Average sulfur and nitrogen deposition due to emissions from each of the 34 Source Groups shown in Table 4-1 and Table 4-2. As for the PSD concentrations Attachment A spreadsheet, there is a "Summary" sheet that displays the sulfur and nitrogen deposition across all Class I and sensitive Class II areas for a user selected Source Group that is controlled by a drop down menu in cell B5. And a "MaxImpact" sheet that gives the highest sulfur or nitrogen deposition that occurred at any Class I area or sensitive Class II area that is controlled by cell B3 to select Sulfur or Nitrogen and cell B4 to select either Maximum or Average. Here Maximum represents the maximum deposition in any grid cell covering the Class I/II area, whereas Average provides the average of deposition across all grid cells covering a Class I/II area. Although the convention in the past has been to report the Maximum deposition in any receptor in a Class I/II area, since deposition relates to the total amount deposited across an entire watershed, the Average metric is probably a more relevant parameter for evaluating potential environment effects. Both Maximum and Average deposition metrics are reported.

For the deposition impacts associated with Federal O&G within each of the individual BLM Planning Areas (i.e., Source Groups B through O), the sulfur and nitrogen deposition amounts are compared against the 0.005 kg/ha-yr Deposition Analysis Threshold (DAT) for the western United States. The DAT is a screening threshold such that if a Project's deposition amount is below the DAT its deposition impact is considered insignificant. The deposition due to the total emissions, that is Source Groups A6 (2025) and A7 (2011), are compared against the Critical Load Values, which for nitrogen is 2.2 kg/ha-yr in Wyoming and 2.3 kg/ha-yr in Colorado except for 3.0 kg/ha-yr for Dinosaur NM. The Critical Load of atmospheric deposition for sulfur in this analysis is 5.0 kg/ha-yr everywhere.

5.4.1 Highest Deposition Impacts at Class I/II Areas

Tables 5-29 through 5-31 display the highest Maximum and Average nitrogen and sulfur deposition in any Class I or sensitive Class II area due to emissions from each of the 34 Source Groups for the 2025 High, Low and Medium Development Scenarios, respectively. As examples, the results for a number of selected Source Groups, including F (GJFO), J (RGFO #1), X, A4, and X1, are summarized in Tables 5-28 and 5-28a. Note that DATs are Project-level thresholds and thus, Planning Area-level exceedances are less relevant than Project-level exceedances.

5.4.1.1 Individual BLM Planning Area Comparison to DATs

Individual BLM Planning Area (i.e., Source Groups B through O) annual nitrogen and sulfur deposition are compared against the 0.005 kg/ha-yr western U.S. DAT. All deposition flux values reported below have units of kg/ha-yr.

The two BLM Planning Areas with Federal O&G typically having the highest annual nitrogen deposition impact are WRFO with maximum deposition fluxes of 0.135 and average values of 0.075 for the High Scenario, maximum values of 0.119 and average values of 0.065 ad 0.028 for the Medium Scenario, and maximum values of 0.017 and average values of 0.009 for the Low Development Scenario (Tables 5-29 through 5-31).

The annual sulfur deposition from new Federal O&G in the BLM Planning Areas tends to be much lower than seen for the nitrogen deposition, so results for just the 2025 High Development Scenario and maximum sulfur deposition metric are presented in Table 5-32 with the other results provided in Attachments D-1, D-2 and D-3. The only individual BLM Planning Area whose new Federal O&G emissions results in its sulfur deposition exceeding the DAT is the WRFO with a maximum of 0.021 kg/ha-yr in the High Development Scenario. The maximum (0.020 kg/ha-yr) and average (0.014 kg/ha-yr) sulfur deposition due to WRFO for the 2025 Medium Development Scenario are also above the DAT. However, the highest WRFO sulfur deposition for the maximum (0.003 kg/ha-yr) and average (0.002 kg/ha-yr) values in the 2025 Low Development Scenario are below the DAT. The sulfur deposition results for all the other individual BLM Planning areas are below the DAT.

Table 5-28. Highest average nitrogen deposition (kg/ha-yr) at any Class I or sensitive Class II area due to selected Source Groups, including F (GJFO), J (RGFO #1), X, A4, and X1 for the 2025 High, Low and Medium Development Scenarios.

		Source Group (kg/ha-yr)				
		GJFO	RGFO #1	X	A4	X1
2025 High Development Scenario						
Class I	Area	Flat Tops	Rocky Mountain	Eagles Nest	Mount Zirkel	Flat Tops
	Avg	0.035	0.0007	0.0826	0.3176	0.1507
Sensitive Class II	Area	Colorado NM	Lost Creek	Holy Cross	Manzano Mountain	Colorado NM
	Avg	0.0373	0.0009	0.0809	0.0724	0.0785
2025 Low Development Scenario						
Class I	Area	Flat Tops	Rocky Mountain	Eagles Nest	Mount Zirkel	Flat Tops
	Avg	0.0017	0.0001	0.0229	0.3173	0.0309
Sensitive Class II	Area	Colorado NM	Lost Creek	Holy Cross	Manzano Mountain	Holy Cross
	Avg	0.0016	0.0001	0.0208	0.0724	0.0166
2025 Medium Development Scenario						
Class I	Area	Flat Tops	Rocky Mountain	Eagles Nest	Mount Zirkel	Flat Tops
	Avg	0.0284	0.0003	0.0704	0.3177	0.1286
Sensitive Class II	Area	Colorado NM	Lost Creek	Holy Cross	Manzano Mountain	Colorado NM
	Avg	0.0299	0.0004	0.0692	0.0724	0.066

Table 5-28a. Highest average sulfur deposition (kg/ha-yr) at any Class I or sensitive Class II area due to selected Source Groups, including F (GJFO), J (RGFO #1), X, A4, and X1 for the 2025 High, Low and Medium Development Scenarios.

		Source Group (kg/ha-yr)				
		GJFO	RGFO #1	X	A4	X1
2025 High Development Scenario						
Class I	Area	Flat Tops	Rocky Mountain	Mount Zirkel	Mount Zirkel	Flat Tops
	Avg	0.0003	0	0.0124	0.2838	0.0145
Sensitive Class II	Area	Holy Cross	Mount Evans	Dinosaur all	Savage Run	Holy Cross
	Avg	0.0002	0	0.0065	0.0307	0.0051
2025 Low Development Scenario						
Class I	Area	Flat Tops	Rocky Mountain	Mount Zirkel	Mount Zirkel	Flat Tops
	Avg	0	0	0.0016	0.2838	0.0019
Sensitive Class II	Area	Holy Cross	Mount Evans	Dinosaur all	Savage Run	Holy Cross
	Avg	0	0	0.0008	0.0307	0.0007
2025 Medium Development Scenario						
Class I	Area	Flat Tops	Rocky Mountain	Mount Zirkel	Mount Zirkel	Flat Tops
	Avg	0.0003	0	0.0123	0.2838	0.0144
Sensitive Class II	Area	Holy Cross	Mount Evans	Dinosaur all	Savage Run	Holy Cross
	Avg	0.0002	0	0.0065	0.0307	0.005

Table 5-29. Highest nitrogen deposition at any Class I area or sensitive Class II area for each of the 34 Source Groups and the 2025 High Development Scenario using the Maximum deposition in any receptor in the Class I/II area.

Choose	Nitrogen
Across grid cells	Maximum

Group	Group Name	Max @ any Class I area	Class I Area where Max occurred	Max @ any Class II area	Class II Area where Max occurred
A	Natural emissions	5.4402	Bandelier	2.1061	Escudilla
B	Little Snake FO	0.0189	Mount_Zirkel	0.0125	Dinosaur_all
C	White River FO	0.1353	Dinosaur_CO	0.3492	Dinosaur_all
D	Colorado River Valley FO (CRVFO)	0.0202	Flat_Tops	0.0124	Holy_Cross
E	Roan Plateau Planning area portion of CRVFO	0.0351	Flat_Tops	0.0152	Holy_Cross
F	Grand Junction FO	0.0517	Flat_Tops	0.0503	Colorado
G	Uncompahgre FO	0.0216	Maroon_Bells	0.0243	Raggeds
H	Tres Rios FO	0.0062	Weminuche	0.0133	South_San_Juan
I	Kremmling FO	0.0070	Rawah	0.0026	Mount_Evans
J	RGFO #1	0.0021	Rocky_Mountain	0.0015	Lost_Creek
K	RGFO #2	0.0003	Eagles_Nest	0.0037	Lost_Creek
L	RGFO #3	0.0023	Rocky_Mountain	0.0017	Lost_Creek
M	RGFO #4	0.0005	Great_Sand_Dunes	0.0025	Spanish_Peaks
N	Southern Ute Indian Tribe	0.0396	Mesa_Verde	0.0871	Chimney_Rock
O	New Mexico Farmington Field Office	0.0345	Mesa_Verde	0.1413	Aztec_Ruins
P	Combined future non-Federal O&G from BLM Planning Areas	0.1685	Flat_Tops	0.1537	Raggeds
Q	Combined Existing O&G from BLM Planning Areas	0.1692	Rocky_Mountain	0.1229	Lost_Creek
R	Mining from BLM Planning Areas	0.0581	Mount_Zirkel	0.0173	Savage_Run
S	All O&G in 12 km domain outside of the BLM Planning Areas	0.6956	Dinosaur_CO	1.0192	Aztec_Ruins
T	Remaining anthropogenic emissions	1.1702	Gila	4.5435	Valle_De_Oro_NWR
U	Coal EGU Colorado + New Mexico	0.2722	Mount_Zirkel	0.1785	Aztec_Ruins
V	Oil/Gas EGU Colorado + New Mexico	0.0058	Rocky_Mountain	0.0068	Sandia_Mountain
W	All Other EGUs in 12 km domain	0.4179	Dinosaur_CO	0.6926	Glen_Canyon
X	Total new federal O&G in CO	0.1509	Eagles_Nest	1.3096	Dinosaur_all
Y	New total CRVFO	0.0605	Eagles_Nest	0.0467	Holy_Cross
Z	New total RGFO	0.0003	Rocky_Mountain	0.0022	Lost_Creek
A1	All new O&G in CO plus new non-federal FFO1	0.3054	Eagles_Nest	1.3977	Dinosaur_all
A2	New federal O&G + new Mining in CO	0.1988	Mount_Zirkel	1.3113	Dinosaur_all
A3	New federal O&G + new non-federal O&G + Mining in CO	0.3230	Eagles_Nest	1.3995	Dinosaur_all
A4	All EGUs in CO and NM	0.5078	Mount_Zirkel	0.1156	Sandia_Mountain
A5	2025 BC	2.0280	Gila	2.6579	Manzano_Mountain
A6	2025 Total	7.0526	Bandelier	5.7340	Valle_De_Oro_NWR
A7	2011 Total	7.5294	Bandelier	6.5629	Valle_De_Oro_NWR
X1	Total new federal O&G in CO (X) using Brute-Force zero-out run	0.2162	Flat_Tops	0.3945	Dinosaur_all

Table 5-29a. Highest nitrogen deposition at any Class I area or sensitive Class II area for each of the 34 Source Groups and the 2025 High Development Scenario using the Average deposition in any receptor in the Class I/II area.

Choose	Nitrogen				
Across grid cells	Average				

Group	Group Name	Max @ any Class I area	Class I Area where Max occurred	Max @ any Class II area	Class II Area where Max occurred
A	Natural emissions	1.5245	Bandelier	2.1061	Escudilla
B	Little Snake FO	0.0149	Mount_Zirkel	0.0082	Savage_Run
C	White River FO	0.0745	Mount_Zirkel	0.0428	Dinosaur_all
D	Colorado River Valley FO (CRVFO)	0.0123	Flat_Tops	0.0087	Holy_Cross
E	Roan Plateau Planning area portion of CRVFO	0.0211	Flat_Tops	0.0110	Holy_Cross
F	Grand Junction FO	0.0350	Flat_Tops	0.0373	Colorado
G	Uncompahgre FO	0.0088	Maroon_Bells	0.0112	Raggeds
H	Tres Rios FO	0.0041	Mesa_Verde	0.0072	South_San_Juan
I	Kremmling FO	0.0044	Rawah	0.0016	Mount_Evans
J	RGFO #1	0.0007	Rocky_Mountain	0.0009	Lost_Creek
K	RGFO #2	0.0002	Eagles_Nest	0.0027	Lost_Creek
L	RGFO #3	0.0009	Rocky_Mountain	0.0010	Lost_Creek
M	RGFO #4	0.0003	Great_Sand_Dunes	0.0016	Spanish_Peaks
N	Southern Ute Indian Tribe	0.0297	Mesa_Verde	0.0871	Chimney_Rock
O	New Mexico Farmington Field Office	0.0271	Mesa_Verde	0.1376	Aztec_Ruins
P	Combined future non-Federal O&G from BLM Planning Areas	0.1123	Flat_Tops	0.0813	Raggeds
Q	Combined Existing O&G from BLM Planning Areas	0.0858	Flat_Tops	0.0828	Lost_Creek
R	Mining from BLM Planning Areas	0.0416	Mount_Zirkel	0.0146	Savage_Run
S	All O&G in 12 km domain outside of the BLM Planning Areas	0.4343	Dinosaur_CO	0.9523	Aztec_Ruins
T	Remaining anthropogenic emissions	0.6441	Black_Canyon	4.5435	Valle_De_Oro_NWR
U	Coal EGU Colorado + New Mexico	0.1823	Mount_Zirkel	0.1590	Aztec_Ruins
V	Oil/Gas EGU Colorado + New Mexico	0.0023	Rocky_Mountain	0.0058	Valle_De_Oro_NWR
W	All Other EGUs in 12 km domain	0.2735	Dinosaur_CO	0.2815	Dinosaur_all
X	Total new federal O&G in CO	0.0826	Eagles_Nest	0.0809	Holy_Cross
Y	New total CRVFO	0.0329	Eagles_Nest	0.0277	Holy_Cross
Z	New total RGFO	0.0001	Rocky_Mountain	0.0012	Florissant_Fossi
A1	All new O&G in CO plus new non-federal FFO1	0.1683	Eagles_Nest	0.1573	Holy_Cross
A2	New federal O&G + new Mining in CO	0.1359	Mount_Zirkel	0.0827	Holy_Cross
A3	New federal O&G + new non-federal O&G + Mining in CO	0.1751	Eagles_Nest	0.1592	Holy_Cross
A4	All EGUs in CO and NM	0.3176	Mount_Zirkel	0.0724	Manzano_Mountain
A5	2025 BC	1.6967	Salt_Creek	2.2325	Manzano_Mountain
A6	2025 Total	2.9486	Bandelier	5.7340	Valle_De_Oro_NWR
A7	2011 Total	3.4372	Bandelier	6.5629	Valle_De_Oro_NWR
X1	Total new federal O&G in CO (X) using Brute-Force zero-out run	0.1507	Flat_Tops	0.0785	Colorado

Table 5-30. Highest nitrogen deposition at any Class I area or sensitive Class II area for each of the 34 Source Groups and the 2025 Low Development Scenario using the Maximum deposition in any receptor in the Class I/II area.

Choose	Nitrogen				
Across grid cells	Maximum				

Group	Group Name	Max @ any Class I area	Class I Area where Max occurred	Max @ any Class II area	Class II Area where Max occurred
A	Natural emissions	5.4407	Bandelier	2.1061	Escudilla
B	Little Snake FO	0.0017	Mount_Zirkel	0.0013	Dinosaur_all
C	White River FO	0.0166	Dinosaur_CO	0.0444	Dinosaur_all
D	Colorado River Valley FO (CRVFO)	0.0133	Flat_Tops	0.0081	Holy_Cross
E	Roan Plateau Planning area portion of CRVFO	0.0160	Flat_Tops	0.0069	Holy_Cross
F	Grand Junction FO	0.0025	Flat_Tops	0.0022	Colorado
G	Uncompahgre FO	0.0005	Maroon_Bells	0.0007	Raggeds
H	Tres Rios FO	0.0009	Weminuche	0.0013	Mount_Sneffels
I	Kremmling FO	0.0007	Rawah	0.0003	Mount_Evans
J	RGFO #1	0.0002	Rocky_Mountain	0.0002	Lost_Creek
K	RGFO #2	0.0000	San_Pedro	0.0000	Manzano_Mountain
L	RGFO #3	0.0004	Rocky_Mountain	0.0003	Lost_Creek
M	RGFO #4	0.0000	Great_Sand_Dunes	0.0002	Spanish_Peaks
N	Southern Ute Indian Tribe	0.0197	Mesa_Verde	0.0436	Chimney_Rock
O	New Mexico Farmington Field Office	0.0172	Mesa_Verde	0.0712	Aztec_Ruins
P	Combined future non-Federal O&G from BLM Planning Areas	0.0461	Rocky_Mountain	0.0363	Aztec_Ruins
Q	Combined Existing O&G from BLM Planning Areas	0.1695	Rocky_Mountain	0.1228	Lost_Creek
R	Mining from BLM Planning Areas	0.0565	Mount_Zirkel	0.0169	Savage_Run
S	All O&G in 12 km domain outside of the BLM Planning Areas	0.6938	Dinosaur_CO	1.0232	Aztec_Ruins
T	Remaining anthropogenic emissions	1.1702	Gila	4.5445	Valle_De_Oro_NWR
U	Coal EGU Colorado + New Mexico	0.2677	Mount_Zirkel	0.1785	Aztec_Ruins
V	Oil/Gas EGU Colorado + New Mexico	0.0058	Rocky_Mountain	0.0068	Sandia_Mountain
W	All Other EGUs in 12 km domain	0.4167	Dinosaur_CO	0.6924	Glen_Canyon
X	Total new federal O&G in CO	0.0418	Eagles_Nest	0.1688	Dinosaur_all
Y	New total CRVFO	0.0337	Eagles_Nest	0.0261	Holy_Cross
Z	New total RGFO	0.0000	Rocky_Mountain	0.0001	Spanish_Peaks
A1	All new O&G in CO plus new non-federal FFO1	0.0863	Eagles_Nest	0.1889	Dinosaur_all
A2	New federal O&G + new Mining in CO	0.1027	Mount_Zirkel	0.1703	Dinosaur_all
A3	New federal O&G + new non-federal O&G + Mining in CO	0.1170	Mount_Zirkel	0.1904	Dinosaur_all
A4	All EGUs in CO and NM	0.5046	Mount_Zirkel	0.1157	Sandia_Mountain
A5	2025 BC	2.0280	Gila	2.6581	Manzano_Mountain
A6	2025 Total	7.0361	Bandelier	5.7279	Valle_De_Oro_NWR
A7	2011 Total	7.5294	Bandelier	6.5629	Valle_De_Oro_NWR
X1	Total new federal O&G in CO (X) using Brute-Force zero-out run	0.0482	Flat_Tops	0.0547	Dinosaur_all

Table 5-30a. Highest nitrogen deposition at any Class I area or sensitive Class II area for each of the 34 Source Groups and the 2025 Low Development Scenario using the Average deposition in any receptor in the Class I/II area.

Choose	Nitrogen
Across grid cells	Average

Group	Group Name	Max @ any Class I area	Class I Area where Max occurred	Max @ any Class II area	Class II Area where Max occurred
A	Natural emissions	1.5245	Bandelier	2.1061	Escudilla
B	Little Snake FO	0.0014	Mount_Zirkel	0.0008	Savage_Run
C	White River FO	0.0090	Mount_Zirkel	0.0052	Dinosaur_all
D	Colorado River Valley FO (CRVFO)	0.0081	Flat_Tops	0.0057	Holy_Cross
E	Roan Plateau Planning area portion of CRVFO	0.0096	Flat_Tops	0.0050	Holy_Cross
F	Grand Junction FO	0.0017	Flat_Tops	0.0016	Colorado
G	Uncompahgre FO	0.0002	Maroon_Bells	0.0003	Raggeds
H	Tres Rios FO	0.0007	Black_Canyon	0.0009	Mount_Sneffels
I	Kremmling FO	0.0005	Rawah	0.0002	Mount_Evans
J	RGFO #1	0.0001	Rocky_Mountain	0.0001	Lost_Creek
K	RGFO #2	0.0000	San_Pedro	0.0000	Manzano_Mountain
L	RGFO #3	0.0001	Rocky_Mountain	0.0002	Lost_Creek
M	RGFO #4	0.0000	Great_Sand_Dunes	0.0001	Spanish_Peaks
N	Southern Ute Indian Tribe	0.0148	Mesa_Verde	0.0436	Chimney_Rock
O	New Mexico Farmington Field Office	0.0134	Mesa_Verde	0.0694	Aztec_Ruins
P	Combined future non-Federal O&G from BLM Planning Areas	0.0298	Flat_Tops	0.0349	Aztec_Ruins
Q	Combined Existing O&G from BLM Planning Areas	0.0826	Flat_Tops	0.0823	Lost_Creek
R	Mining from BLM Planning Areas	0.0408	Mount_Zirkel	0.0143	Savage_Run
S	All O&G in 12 km domain outside of the BLM Planning Areas	0.4333	Dinosaur_CO	0.9564	Aztec_Ruins
T	Remaining anthropogenic emissions	0.6453	Black_Canyon	4.5445	Valle_De_Oro_NWR
U	Coal EGU Colorado + New Mexico	0.1794	Mount_Zirkel	0.1591	Aztec_Ruins
V	Oil/Gas EGU Colorado + New Mexico	0.0023	Rocky_Mountain	0.0058	Valle_De_Oro_NWR
W	All Other EGUs in 12 km domain	0.2729	Dinosaur_CO	0.2808	Dinosaur_all
X	Total new federal O&G in CO	0.0229	Eagles_Nest	0.0208	Holy_Cross
Y	New total CRVFO	0.0185	Eagles_Nest	0.0158	Holy_Cross
Z	New total RGFO	0.0000	Rocky_Mountain	0.0000	Maxwell_NWR
A1	All new O&G in CO plus new non-federal FFO1	0.0477	Eagles_Nest	0.0541	Chimney_Rock
A2	New federal O&G + new Mining in CO	0.0686	Mount_Zirkel	0.0232	Mount_Evans
A3	New federal O&G + new non-federal O&G + Mining in CO	0.0780	Mount_Zirkel	0.0545	Chimney_Rock
A4	All EGUs in CO and NM	0.3173	Mount_Zirkel	0.0724	Manzano_Mountain
A5	2025 BC	1.6968	Salt_Creek	2.2327	Manzano_Mountain
A6	2025 Total	2.9315	Bandelier	5.7279	Valle_De_Oro_NWR
A7	2011 Total	3.4372	Bandelier	6.5629	Valle_De_Oro_NWR
X1	Total new federal O&G in CO (X) using Brute-Force zero-out run	0.0309	Flat_Tops	0.0166	Holy_Cross

Table 5-31. Highest nitrogen deposition at any Class I area or sensitive Class II area for each of the 34 Source Groups and the 2025 Medium Development Scenario using the Maximum deposition in any receptor in the Class I/II area.

Choose	Nitrogen				
Across grid cells	Maximum				

Group	Group Name	Max @ any Class I area	Class I Area where Max occurred	Max @ any Class II area	Class II Area where Max occurred
A	Natural emissions	5.4404	Bandelier	2.1061	Escudilla
B	Little Snake FO	0.0146	Mount_Zirkel	0.0107	Dinosaur_all
C	White River FO	0.1189	Dinosaur_CO	0.3074	Dinosaur_all
D	Colorado River Valley FO (CRVFO)	0.0163	Flat_Tops	0.0100	Holy_Cross
E	Roan Plateau Planning area portion of CRVFO	0.0305	Flat_Tops	0.0134	Holy_Cross
F	Grand Junction FO	0.0420	Flat_Tops	0.0403	Colorado
G	Uncompahgre FO	0.0152	Maroon_Bells	0.0171	Raggeds
H	Tres Rios FO	0.0044	Weminuche	0.0073	South_San_Juan
I	Kremmling FO	0.0046	Rawah	0.0026	Mount_Evans
J	RGFO #1	0.0010	Rocky_Mountain	0.0008	Lost_Creek
K	RGFO #2	0.0002	Eagles_Nest	0.0025	Lost_Creek
L	RGFO #3	0.0016	Rocky_Mountain	0.0012	Lost_Creek
M	RGFO #4	0.0004	Great_Sand_Dunes	0.0023	Spanish_Peaks
N	Southern Ute Indian Tribe	0.0129	Mesa_Verde	0.0284	Chimney_Rock
O	New Mexico Farmington Field Office	0.0195	Mesa_Verde	0.0807	Aztec_Ruins
P	Combined future non-Federal O&G from BLM Planning Areas	0.1681	Flat_Tops	0.1533	Raggeds
Q	Combined Existing O&G from BLM Planning Areas	0.1692	Rocky_Mountain	0.1229	Lost_Creek
R	Mining from BLM Planning Areas	0.0579	Mount_Zirkel	0.0172	Savage_Run
S	All O&G in 12 km domain outside of the BLM Planning Areas	0.6953	Dinosaur_CO	1.0210	Aztec_Ruins
T	Remaining anthropogenic emissions	1.1702	Gila	4.5438	Valle_De_Oro_NWR
U	Coal EGU Colorado + New Mexico	0.2719	Mount_Zirkel	0.1785	Aztec_Ruins
V	Oil/Gas EGU Colorado + New Mexico	0.0058	Rocky_Mountain	0.0068	Sandia_Mountain
W	All Other EGUs in 12 km domain	0.4177	Dinosaur_CO	0.6926	Glen_Canyon
X	Total new federal O&G in CO	0.1285	Eagles_Nest	1.1489	Dinosaur_all
Y	New total CRVFO	0.0514	Eagles_Nest	0.0399	Holy_Cross
Z	New total RGFO	0.0002	Rocky_Mountain	0.0015	Lost_Creek
A1	All new O&G in CO plus new non-federal FFO1	0.2829	Eagles_Nest	1.2372	Dinosaur_all
A2	New federal O&G + new Mining in CO	0.1824	Mount_Zirkel	1.1505	Dinosaur_all
A3	New federal O&G + new non-federal O&G + Mining in CO	0.3005	Eagles_Nest	1.2388	Dinosaur_all
A4	All EGUs in CO and NM	0.5076	Mount_Zirkel	0.1157	Sandia_Mountain
A5	2025 BC	2.0280	Gila	2.6580	Manzano_Mountain
A6	2025 Total	7.0459	Bandelier	5.7320	Valle_De_Oro_NWR
A7	2011 Total	7.5294	Bandelier	6.5629	Valle_De_Oro_NWR
X1	Total new federal O&G in CO (X) using Brute-Force zero-out run	0.1847	Flat_Tops	0.3447	Dinosaur_all

Table 5-31a. Highest nitrogen deposition at any Class I area or sensitive Class II area for each of the 34 Source Groups and the 2025 Medium Development Scenario using the Average deposition in any receptor in the Class I/II area.

Choose	Nitrogen
Across grid cells	Average

Group	Group Name	Max @ any Class I area	Class I Area where Max occurred	Max @ any Class II area	Class II Area where Max occurred
A	Natural emissions	1.5245	Bandelier	2.1061	Escudilla
B	Little Snake FO	0.0118	Mount_Zirkel	0.0067	Savage_Run
C	White River FO	0.0654	Mount_Zirkel	0.0373	Dinosaur_all
D	Colorado River Valley FO (CRVFO)	0.0099	Flat_Tops	0.0070	Holy_Cross
E	Roan Plateau Planning area portion of CRVFO	0.0183	Flat_Tops	0.0096	Holy_Cross
F	Grand Junction FO	0.0284	Flat_Tops	0.0299	Colorado
G	Uncompahgre FO	0.0063	Maroon_Bells	0.0079	Raggeds
H	Tres Rios FO	0.0032	Mesa_Verde	0.0046	Chimney_Rock
I	Kremmling FO	0.0030	Rawah	0.0015	Mount_Evans
J	RGFO #1	0.0003	Rocky_Mountain	0.0004	Lost_Creek
K	RGFO #2	0.0001	Eagles_Nest	0.0018	Lost_Creek
L	RGFO #3	0.0006	Rocky_Mountain	0.0007	Lost_Creek
M	RGFO #4	0.0002	Great_Sand_Dunes	0.0014	Spanish_Peaks
N	Southern Ute Indian Tribe	0.0097	Mesa_Verde	0.0284	Chimney_Rock
O	New Mexico Farmington Field Office	0.0153	Mesa_Verde	0.0786	Aztec_Ruins
P	Combined future non-Federal O&G from BLM Planning Areas	0.1120	Flat_Tops	0.0811	Raggeds
Q	Combined Existing O&G from BLM Planning Areas	0.0856	Flat_Tops	0.0828	Lost_Creek
R	Mining from BLM Planning Areas	0.0415	Mount_Zirkel	0.0146	Savage_Run
S	All O&G in 12 km domain outside of the BLM Planning Areas	0.4342	Dinosaur_CO	0.9545	Aztec_Ruins
T	Remaining anthropogenic emissions	0.6442	Black_Canyon	4.5438	Valle_De_Oro_NWR
U	Coal EGU Colorado + New Mexico	0.1821	Mount_Zirkel	0.1590	Aztec_Ruins
V	Oil/Gas EGU Colorado + New Mexico	0.0023	Rocky_Mountain	0.0058	Valle_De_Oro_NWR
W	All Other EGUs in 12 km domain	0.2735	Dinosaur_CO	0.2815	Dinosaur_all
X	Total new federal O&G in CO	0.0704	Eagles_Nest	0.0692	Holy_Cross
Y	New total CRVFO	0.0280	Eagles_Nest	0.0237	Holy_Cross
Z	New total RGFO	0.0001	Rocky_Mountain	0.0008	Florissant_Fossi
A1	All new O&G in CO plus new non-federal FFO1	0.1561	Eagles_Nest	0.1458	Holy_Cross
A2	New federal O&G + new Mining in CO	0.1248	Mount_Zirkel	0.0711	Holy_Cross
A3	New federal O&G + new non-federal O&G + Mining in CO	0.1640	Mount_Zirkel	0.1476	Holy_Cross
A4	All EGUs in CO and NM	0.3177	Mount_Zirkel	0.0724	Manzano_Mountain
A5	2025 BC	1.6968	Salt_Creek	2.2326	Manzano_Mountain
A6	2025 Total	2.9417	Bandelier	5.7320	Valle_De_Oro_NWR
A7	2011 Total	3.4372	Bandelier	6.5629	Valle_De_Oro_NWR
X1	Total new federal O&G in CO (X) using Brute-Force zero-out run	0.1286	Flat_Tops	0.0660	Colorado

Table 5-32. Highest sulfur deposition at any Class I area or sensitive Class II area for each of the 34 Source Groups and the 2025 High Development Scenario using the Maximum deposition in any receptor in the Class I/II area.

Choose	Sulfur				
Across grid cells	Maximum				

Group	Group Name	Max @ any Class I area	Class I Area where Max occurred	Max @ any Class II area	Class II Area where Max occurred
A	Natural emissions	0.6435	Bandelier	0.3260	Bear_Wallow
B	Little Snake FO	0.0008	Mount_Zirkel	0.0003	Savage_Run
C	White River FO	0.0205	Flat_Tops	0.0528	Dinosaur_all
D	Colorado River Valley FO (CRVFO)	0.0002	Flat_Tops	0.0001	Holy_Cross
E	Roan Plateau Planning area portion of CRVFO	0.0002	Flat_Tops	0.0001	Holy_Cross
F	Grand Junction FO	0.0005	Flat_Tops	0.0003	Holy_Cross
G	Uncompahgre FO	0.0004	Maroon_Bells	0.0004	Raggeds
H	Tres Rios FO	0.0001	Weminuche	0.0003	Hovenweep
I	Kremmling FO	0.0001	Rawah	0.0000	Savage_Run
J	RGFO #1	0.0000	Rocky_Mountain	0.0000	Lost_Creek
K	RGFO #2	0.0000	Eagles_Nest	0.0001	Lost_Creek
L	RGFO #3	0.0000	Rocky_Mountain	0.0000	Lost_Creek
M	RGFO #4	0.0000	Great_Sand_Dunes	0.0000	Spanish_Peaks
N	Southern Ute Indian Tribe	0.0006	Weminuche	0.0008	Aztec_Ruins
O	New Mexico Farmington Field Office	0.0006	Weminuche	0.0017	Aztec_Ruins
P	Combined future non-Federal O&G from BLM Planning Areas	0.0044	Flat_Tops	0.0045	Dinosaur_all
Q	Combined Existing O&G from BLM Planning Areas	0.0041	Rocky_Mountain	0.0103	Dinosaur_all
R	Mining from BLM Planning Areas	0.0005	Mount_Zirkel	0.0003	Colorado
S	All O&G in 12 km domain outside of the BLM Planning Areas	0.0100	Dinosaur_CO	0.0245	Aztec_Ruins
T	Remaining anthropogenic emissions	0.0449	Mount_Zirkel	0.1838	Sandia_Mountain
U	Coal EGU Colorado + New Mexico	0.2346	Mount_Zirkel	0.0629	Lost_Creek
V	Oil/Gas EGU Colorado + New Mexico	0.0002	Bandelier	0.0020	Sandia_Mountain
W	All Other EGUs in 12 km domain	0.1246	Petrified_Forest	0.3345	Glen_Canyon
X	Total new federal O&G in CO	0.0189	Mount_Zirkel	0.2349	Dinosaur_all
Y	New total CRVFO	0.0003	Eagles_Nest	0.0003	Holy_Cross
Z	New total RGFO	0.0000	Rocky_Mountain	0.0000	Lost_Creek
A1	All new O&G in CO plus new non-federal FFO1	0.0222	Mount_Zirkel	0.2443	Dinosaur_all
A2	New federal O&G + new Mining in CO	0.0196	Mount_Zirkel	0.2350	Dinosaur_all
A3	New federal O&G + new non-federal O&G + Mining in CO	0.0229	Mount_Zirkel	0.2444	Dinosaur_all
A4	All EGUs in CO and NM	0.5516	Mount_Zirkel	0.0492	Sandia_Mountain
A5	2025 BC	1.2052	Gila	1.1197	Aldo_Leopold
A6	2025 Total	1.3161	Gila	1.2150	Aldo_Leopold
A7	2011 Total	1.6593	Gila	1.5407	Aldo_Leopold
X1	Total new federal O&G in CO (X) using Brute-Force zero-out run	0.0214	Flat_Tops	0.0559	Dinosaur_all

5.4.1.2 Comparisons Against Critical Loads

In this section we compare the total sulfur and nitrogen deposition from all sources in the 2011 Base Case and 2025 High, Low and Medium Development Scenarios with Critical Loads of atmospheric deposition. It is unclear what the sulfur and nitrogen for the combined Source Groups (P-X1) should be compared against given that the DAT and Critical Load LOCs were designed for single Projects and total emissions, respectively. The total nitrogen and sulfur deposition amounts for the combined Source Groups P through X1 are much lower than the Critical Load values (Attachments D-1, D-2 and D-3).

Tables 5-33 and 5-34 display the total nitrogen and sulfur deposition, respectively, at Class I areas for the 2025 High, Low and Medium Development Scenarios, the 2011 Base Case, the differences between the three 2025 scenarios and the 2011 Base Case (2025 minus 2011) and the difference between the three 2025 scenarios and the natural emissions (Source Group A). As seen in Table 5-29, the Class I area with the highest Maximum nitrogen deposition (due to all sources combined) in the 2025 High Development Scenario is the Bandelier Class I area in New

Mexico with a value of 7.05 kg/ha-yr that is over 3 times the nitrogen Critical Load (2.3 kg/ha-yr). However, most (6.44 position kg/ha-yr) of this is due to natural emissions (Source Group A in Table 5-29) and when natural emission contributions are removed the value at Bandelier for the 2025 scenarios (1.60-1.61 kg/ha-yr) drops below the nitrogen Critical Load (2.3 kg/ha-yr) (Table 5-33). After removing natural emission contributions the Maximum nitrogen deposition exceeds the 2.3 kg/ha-yr Critical Load at 6, 6, and 4 of the 26 Class I areas with the highest value of 2.96, 2.73 and 2.93 kg/ha-yr at the Mount Zirkel Wilderness Area and the 2025 High, Low and Medium Development Scenarios, respectively. When examining the Average annual nitrogen deposition across Class I areas, 2, 1, and 2 of the Class I areas exceed the 2.3 kg/ha-yr nitrogen Critical Load for the 2025 High, Low and Medium emission scenarios, respectively.

With no exception, all 26 Class I areas exhibit a reduction in annual nitrogen deposition from 2011 to 2025 with the largest reduction occurring at Mount Zirkel Wilderness (-0.67, -0.90 and 0.70 kg/ha-yr for 2025 High, Low and Medium emission scenarios, respectively) and the second largest reduction occurring at Mesa Verde NP (-0.66, -0.73, and -0.70 kg/ha-yr for 2025 High, Low and Medium emission scenarios, respectively).

The total sulfur deposition at all of the Class I areas for the 2011 and three 2025 emission scenarios are all well below the sulfur Critical Load of 5 kg/ha-yr (Table 5-34). Sulfur deposition is reduced by 10% to 65% across the Class I areas between the 2011 and 2025 High emissions scenarios. The highest sulfur deposition at any Class I area for the three 2025 emission scenarios is 1.32 kg/ha-yr at Gila Wilderness that is approximately a factor of 4 below the sulfur deposition Critical Load (5.0 kg/ha-yr) (Table 5-34).

Additional results, including those for sensitive Class II areas and all Source Groups, are found in Attachments D-1, D-2 and D-3.

Table 5-33. Total annual nitrogen deposition at Class I areas for the 2025 High Development Scenario, 2011 Base Case, their differences (2025 High minus 2011) and 2025 High Development Scenario without the contributions of natural emissions (e.g., wildfires).

	2025 High		2011 Base		2025 High - 2011		2025 High - Natual	
	N-Max	N-Avg	N-Max	N-Avg	N-Max	N-Avg	N-Max	N-Avg
Class I Area	(kgN/ha)	(kgN/ha)	(kgN/ha)	(kgN/ha)	(kgN/ha)	(kgN/ha)	(kgN/ha)	(kgN/ha)
Arches NP	1.47	1.34	1.75	1.62	-0.28	-0.28	1.41	1.29
Bandelier Wilderness	7.05	2.95	7.53	3.44	-0.48	-0.49	1.61	1.42
Black Canyon of the Gunnison Wilderness	2.41	1.95	2.70	2.20	-0.28	-0.26	2.32	1.86
Bosque del Apache	1.61	1.39	1.93	1.70	-0.33	-0.31	1.54	1.33
Canyonlands NP	1.45	1.19	1.85	1.48	-0.40	-0.29	1.39	1.15
Capitol Reef NP	2.15	1.29	2.46	1.56	-0.31	-0.27	2.11	1.26
Dinosaur NM	2.62	1.82	2.83	1.94	-0.22	-0.13	2.55	1.77
Eagles Nest Wilderness	2.27	1.85	2.66	2.23	-0.39	-0.38	2.18	1.77
Flat Tops Wilderness	2.32	1.96	2.57	2.15	-0.25	-0.19	2.22	1.89
Gila Wilderness	2.75	1.95	3.03	2.22	-0.29	-0.27	1.61	1.71
Great Sand Dunes Wilderness-nps	1.90	1.53	2.22	1.81	-0.32	-0.29	1.77	1.42
La Garita Wilderness	1.58	1.28	1.92	1.55	-0.34	-0.27	1.48	1.19
Maroon Bells-Snowmass Wilderness	2.18	1.76	2.51	2.02	-0.34	-0.26	2.08	1.68
Mesa Verde NP	2.27	2.02	2.93	2.61	-0.66	-0.59	2.16	1.93
Mount Baldy Wilderness	1.91	1.91	2.25	2.25	-0.34	-0.34	1.57	1.57
Mount Zirkel Wilderness	3.11	2.46	3.78	2.99	-0.67	-0.52	2.96	2.38
Pecos Wilderness	4.01	1.99	4.52	2.46	-0.52	-0.47	1.64	1.65
Petrified Forest NP	2.19	1.71	2.72	2.26	-0.53	-0.55	2.13	1.66
Rawah Wilderness	2.59	2.15	3.10	2.56	-0.51	-0.42	2.49	2.06
Rocky Mountain NP	2.48	2.02	3.04	2.47	-0.55	-0.44	2.36	1.93
Salt Creek Wilderness	2.42	2.36	2.57	2.55	-0.15	-0.19	2.38	2.32
San Pedro Parks Wilderness	2.02	1.89	2.51	2.34	-0.48	-0.45	1.84	1.73
Weminuche Wilderness	2.10	1.62	2.60	2.01	-0.50	-0.38	1.99	1.53
West Elk Wilderness	1.97	1.57	2.31	1.83	-0.34	-0.26	1.88	1.49
Wheeler Peak Wilderness	2.16	1.94	2.69	2.41	-0.52	-0.47	1.92	1.72
White Mountain Wilderness	1.88	1.72	2.19	2.02	-0.31	-0.30	1.83	1.68

Note that the thresholds shown are project-level thresholds. The comparisons shown above are for informational purposes only.

Table 5-33a. Total annual nitrogen deposition at Class I areas for the 2025 Low Development Scenario, 2011 Base Case, their differences (2025 Low minus 2011) and 2025 Low Development Scenario without the contributions of natural emissions (e.g., wildfires).

	2025 Low		2011 Base		2025 Low - 2011		2025 Low - Natual	
	N-Max	N-Avg	N-Max	N-Avg	N-Max	N-Avg	N-Max	N-Avg
Class I Area	(kgN/ha)	(kgN/ha)	(kgN/ha)	(kgN/ha)	(kgN/ha)	(kgN/ha)	(kgN/ha)	(kgN/ha)
Arches NP	1.36	1.26	1.75	1.62	-0.39	-0.36	1.31	1.21
Bandelier Wilderness	7.04	2.93	7.53	3.44	-0.49	-0.51	1.60	1.41
Black Canyon of the Gunnison Wilderness	2.29	1.85	2.70	2.20	-0.40	-0.35	2.20	1.77
Bosque del Apache	1.60	1.39	1.93	1.70	-0.33	-0.31	1.53	1.32
Canyonlands NP	1.43	1.16	1.85	1.48	-0.42	-0.32	1.37	1.12
Capitol Reef NP	2.15	1.28	2.46	1.56	-0.31	-0.27	2.11	1.25
Dinosaur NM	2.57	1.76	2.83	1.94	-0.26	-0.18	2.51	1.71
Eagles Nest Wilderness	2.10	1.72	2.66	2.23	-0.56	-0.51	2.01	1.64
Flat Tops Wilderness	2.09	1.75	2.57	2.15	-0.49	-0.40	1.99	1.68
Gila Wilderness	2.75	1.95	3.03	2.22	-0.29	-0.28	1.61	1.71
Great Sand Dunes Wilderness-nps	1.87	1.49	2.22	1.81	-0.35	-0.32	1.74	1.39
La Garita Wilderness	1.54	1.24	1.92	1.55	-0.38	-0.31	1.43	1.16
Maroon Bells-Snowmass Wilderness	2.05	1.65	2.51	2.02	-0.46	-0.37	1.96	1.57
Mesa Verde NP	2.20	1.96	2.93	2.61	-0.73	-0.65	2.09	1.87
Mount Baldy Wilderness	1.91	1.91	2.25	2.25	-0.34	-0.34	1.57	1.57
Mount Zirkel Wilderness	2.88	2.29	3.78	2.99	-0.90	-0.70	2.73	2.21
Pecos Wilderness	3.99	1.97	4.52	2.46	-0.54	-0.49	1.61	1.63
Petrified Forest NP	2.19	1.71	2.72	2.26	-0.53	-0.55	2.13	1.65
Rawah Wilderness	2.42	2.01	3.10	2.56	-0.68	-0.55	2.33	1.93
Rocky Mountain NP	2.33	1.90	3.04	2.47	-0.71	-0.56	2.20	1.81
Salt Creek Wilderness	2.42	2.36	2.57	2.55	-0.15	-0.20	2.38	2.32
San Pedro Parks Wilderness	2.00	1.87	2.51	2.34	-0.50	-0.47	1.82	1.71
Weminuche Wilderness	2.03	1.58	2.60	2.01	-0.57	-0.42	1.92	1.49
West Elk Wilderness	1.88	1.49	2.31	1.83	-0.43	-0.33	1.79	1.42
Wheeler Peak Wilderness	2.13	1.91	2.69	2.41	-0.55	-0.50	1.89	1.70
White Mountain Wilderness	1.87	1.71	2.19	2.02	-0.31	-0.31	1.83	1.67

Note that the thresholds shown are project-level thresholds. The comparisons shown above are for informational purposes only.

Table 5-33b. Total annual nitrogen deposition at Class I areas for the 2025 Medium Development Scenario, 2011 Base Case, their differences (2025 Medium minus 2011) and 2025 Medium Development Scenario without the contributions of natural emissions (e.g., wildfires).

	2025 Med		2011 Base		2025 Med - 2011		2025 Med - Natual	
	N-Max	N-Avg	N-Max	N-Avg	N-Max	N-Avg	N-Max	N-Avg
Class I Area	(kgN/ha)	(kgN/ha)	(kgN/ha)	(kgN/ha)	(kgN/ha)	(kgN/ha)	(kgN/ha)	(kgN/ha)
Arches NP	1.46	1.33	1.75	1.62	-0.29	-0.29	1.40	1.28
Bandelier Wilderness	7.05	2.94	7.53	3.44	-0.48	-0.50	1.61	1.42
Black Canyon of the Gunnison Wilderness	2.40	1.93	2.70	2.20	-0.30	-0.27	2.31	1.85
Bosque del Apache	1.61	1.39	1.93	1.70	-0.33	-0.31	1.53	1.32
Canyonlands NP	1.45	1.19	1.85	1.48	-0.41	-0.29	1.39	1.14
Capitol Reef NP	2.15	1.29	2.46	1.56	-0.31	-0.27	2.11	1.26
Dinosaur NM	2.61	1.81	2.83	1.94	-0.22	-0.13	2.55	1.76
Eagles Nest Wilderness	2.25	1.83	2.66	2.23	-0.41	-0.39	2.16	1.75
Flat Tops Wilderness	2.29	1.94	2.57	2.15	-0.29	-0.22	2.19	1.87
Gila Wilderness	2.75	1.95	3.03	2.22	-0.29	-0.28	1.61	1.71
Great Sand Dunes Wilderness-nps	1.89	1.52	2.22	1.81	-0.33	-0.30	1.76	1.41
La Garita Wilderness	1.57	1.27	1.92	1.55	-0.35	-0.28	1.46	1.18
Maroon Bells-Snowmass Wilderness	2.16	1.75	2.51	2.02	-0.35	-0.28	2.07	1.66
Mesa Verde NP	2.23	1.99	2.93	2.61	-0.70	-0.62	2.12	1.89
Mount Baldy Wilderness	1.91	1.91	2.25	2.25	-0.34	-0.34	1.57	1.57
Mount Zirkel Wilderness	3.08	2.44	3.78	2.99	-0.70	-0.55	2.93	2.36
Pecos Wilderness	4.00	1.98	4.52	2.46	-0.53	-0.48	1.63	1.64
Petrified Forest NP	2.19	1.71	2.72	2.26	-0.53	-0.55	2.13	1.66
Rawah Wilderness	2.57	2.13	3.10	2.56	-0.53	-0.43	2.47	2.05
Rocky Mountain NP	2.47	2.01	3.04	2.47	-0.57	-0.46	2.34	1.92
Salt Creek Wilderness	2.42	2.36	2.57	2.55	-0.15	-0.19	2.38	2.32
San Pedro Parks Wilderness	2.01	1.89	2.51	2.34	-0.49	-0.46	1.83	1.72
Weminuche Wilderness	2.06	1.60	2.60	2.01	-0.54	-0.40	1.95	1.51
West Elk Wilderness	1.96	1.56	2.31	1.83	-0.35	-0.27	1.86	1.48
Wheeler Peak Wilderness	2.15	1.93	2.69	2.41	-0.53	-0.48	1.91	1.71
White Mountain Wilderness	1.88	1.72	2.19	2.02	-0.31	-0.31	1.83	1.68

Note that the thresholds shown are project-level thresholds. The comparisons shown above are for informational purposes only.

Table 5-34. Total annual sulfur deposition at Class I areas for the 2025 High Development Scenario, 2011 Base Case, their differences (2025 High minus 2011) and 2025 High Development Scenario without the contributions of natural emissions (e.g., wildfires).

	2025 High		2011 Base		2025 High - 2011		2025 High - Natual	
	S-Max	S-Avg	S-Max	S-Avg	S-Max	S-Avg	S-Max	S-Avg
Class I Area	(kgS/ha)	(kgS/ha)	(kgS/ha)	(kgS/ha)	(kgS/ha)	(kgS/ha)	(kgS/ha)	(kgS/ha)
Arches NP	0.23	0.20	0.31	0.26	-0.07	-0.06	0.23	0.20
Bandelier Wilderness	1.02	0.44	1.13	0.52	-0.11	-0.08	0.38	0.27
Black Canyon of the Gunnison Wilderness	0.32	0.28	0.41	0.36	-0.09	-0.08	0.32	0.28
Bosque del Apache	0.43	0.34	0.56	0.44	-0.13	-0.11	0.43	0.34
Canyonlands NP	0.32	0.20	0.41	0.26	-0.09	-0.06	0.32	0.20
Capitol Reef NP	0.32	0.21	0.39	0.26	-0.07	-0.05	0.31	0.21
Dinosaur NM	0.42	0.31	0.54	0.41	-0.12	-0.09	0.42	0.31
Eagles Nest Wilderness	0.83	0.55	0.99	0.68	-0.16	-0.12	0.83	0.55
Flat Tops Wilderness	0.84	0.65	1.04	0.79	-0.19	-0.14	0.84	0.65
Gila Wilderness	1.32	0.70	1.66	0.92	-0.34	-0.22	1.22	0.68
Great Sand Dunes Wilderness-nps	0.42	0.32	0.53	0.41	-0.11	-0.09	0.42	0.32
La Garita Wilderness	0.62	0.47	0.75	0.58	-0.14	-0.11	0.60	0.46
Maroon Bells-Snowmass Wilderness	0.90	0.67	1.07	0.79	-0.17	-0.13	0.89	0.66
Mesa Verde NP	0.48	0.41	0.63	0.54	-0.15	-0.13	0.47	0.41
Mount Baldy Wilderness	0.73	0.73	0.99	0.99	-0.26	-0.26	0.69	0.69
Mount Zirkel Wilderness	1.27	0.92	1.58	1.16	-0.31	-0.25	1.26	0.91
Pecos Wilderness	0.81	0.53	1.02	0.67	-0.21	-0.13	0.60	0.50
Petrified Forest NP	0.33	0.28	0.54	0.45	-0.21	-0.17	0.33	0.28
Rawah Wilderness	0.91	0.67	1.13	0.85	-0.23	-0.18	0.90	0.66
Rocky Mountain NP	0.85	0.63	1.07	0.82	-0.22	-0.19	0.83	0.62
Salt Creek Wilderness	0.48	0.45	0.56	0.53	-0.09	-0.08	0.48	0.45
San Pedro Parks Wilderness	0.64	0.53	0.80	0.68	-0.16	-0.14	0.62	0.52
Weminuche Wilderness	0.96	0.67	1.16	0.82	-0.21	-0.15	0.95	0.66
West Elk Wilderness	0.75	0.52	0.89	0.63	-0.14	-0.10	0.75	0.52
Wheeler Peak Wilderness	0.82	0.69	1.01	0.85	-0.19	-0.17	0.78	0.66
White Mountain Wilderness	0.54	0.40	0.67	0.49	-0.13	-0.09	0.54	0.40

Note that the thresholds shown are project-level thresholds. The comparisons shown above are for informational purposes only.

Table 5-34a. Total annual sulfur deposition at Class I areas for the 2025 Low Development Scenario, 2011 Base Case, their differences (2025 Low minus 2011) and 2025 Low Development Scenario without the contributions of natural emissions (e.g., wildfires).

	2025 Low		2011 Base		2025 Low - 2011		2025 Low - Natual	
	S-Max	S-Avg	S-Max	S-Avg	S-Max	S-Avg	S-Max	S-Avg
Class I Area	(kgS/ha)	(kgS/ha)	(kgS/ha)	(kgS/ha)	(kgS/ha)	(kgS/ha)	(kgS/ha)	(kgS/ha)
Arches NP	0.23	0.20	0.31	0.26	-0.08	-0.06	0.23	0.20
Bandelier Wilderness	1.02	0.44	1.13	0.52	-0.11	-0.08	0.38	0.27
Black Canyon of the Gunnison Wilderness	0.32	0.28	0.41	0.36	-0.09	-0.08	0.31	0.28
Bosque del Apache	0.43	0.34	0.56	0.44	-0.13	-0.11	0.43	0.33
Canyonlands NP	0.32	0.20	0.41	0.26	-0.09	-0.06	0.32	0.20
Capitol Reef NP	0.32	0.21	0.39	0.26	-0.07	-0.05	0.31	0.21
Dinosaur NM	0.42	0.31	0.54	0.41	-0.13	-0.10	0.42	0.31
Eagles Nest Wilderness	0.82	0.55	0.99	0.68	-0.17	-0.13	0.82	0.55
Flat Tops Wilderness	0.83	0.64	1.04	0.79	-0.21	-0.15	0.82	0.63
Gila Wilderness	1.32	0.70	1.66	0.92	-0.34	-0.22	1.22	0.68
Great Sand Dunes Wilderness-nps	0.42	0.32	0.53	0.41	-0.11	-0.09	0.41	0.32
La Garita Wilderness	0.61	0.47	0.75	0.58	-0.14	-0.11	0.60	0.46
Maroon Bells-Snowmass Wilderness	0.90	0.66	1.07	0.79	-0.17	-0.13	0.89	0.66
Mesa Verde NP	0.48	0.41	0.63	0.54	-0.15	-0.13	0.47	0.40
Mount Baldy Wilderness	0.73	0.73	0.99	0.99	-0.26	-0.26	0.69	0.69
Mount Zirkel Wilderness	1.25	0.90	1.58	1.16	-0.32	-0.26	1.25	0.90
Pecos Wilderness	0.81	0.53	1.02	0.67	-0.21	-0.14	0.60	0.50
Petrified Forest NP	0.33	0.28	0.54	0.45	-0.21	-0.17	0.33	0.28
Rawah Wilderness	0.90	0.66	1.13	0.85	-0.24	-0.19	0.89	0.66
Rocky Mountain NP	0.84	0.62	1.07	0.82	-0.23	-0.19	0.83	0.62
Salt Creek Wilderness	0.48	0.45	0.56	0.53	-0.09	-0.08	0.48	0.45
San Pedro Parks Wilderness	0.64	0.53	0.80	0.68	-0.16	-0.14	0.62	0.52
Weminuche Wilderness	0.96	0.67	1.16	0.82	-0.21	-0.15	0.95	0.66
West Elk Wilderness	0.75	0.52	0.89	0.63	-0.14	-0.11	0.74	0.52
Wheeler Peak Wilderness	0.82	0.69	1.01	0.85	-0.19	-0.17	0.78	0.66
White Mountain Wilderness	0.54	0.40	0.67	0.49	-0.13	-0.09	0.54	0.40

Note that the thresholds shown are project-level thresholds. The comparisons shown above are for informational purposes only.

Table 5-34b. Total annual sulfur deposition at Class I areas for the 2025 Medium Development Scenario, 2011 Base Case, their differences (2025 Medium minus 2011) and 2025 Medium Development Scenario without the contributions of natural emissions (e.g., wildfires).

	2025 Med		2011 Base		2025 Med - 2011		2025 Med - Natual	
	S-Max	S-Avg	S-Max	S-Avg	S-Max	S-Avg	S-Max	S-Avg
Class I Area	(kgS/ha)	(kgS/ha)	(kgS/ha)	(kgS/ha)	(kgS/ha)	(kgS/ha)	(kgS/ha)	(kgS/ha)
Arches NP	0.23	0.20	0.31	0.26	-0.07	-0.06	0.23	0.20
Bandelier Wilderness	1.02	0.44	1.13	0.52	-0.11	-0.08	0.38	0.27
Black Canyon of the Gunnison Wilderness	0.32	0.28	0.41	0.36	-0.09	-0.08	0.32	0.28
Bosque del Apache	0.43	0.34	0.56	0.44	-0.13	-0.11	0.43	0.34
Canyonlands NP	0.32	0.20	0.41	0.26	-0.09	-0.06	0.32	0.20
Capitol Reef NP	0.32	0.21	0.39	0.26	-0.07	-0.05	0.31	0.21
Dinosaur NM	0.42	0.31	0.54	0.41	-0.12	-0.09	0.42	0.31
Eagles Nest Wilderness	0.83	0.55	0.99	0.68	-0.16	-0.12	0.83	0.55
Flat Tops Wilderness	0.84	0.65	1.04	0.79	-0.19	-0.14	0.84	0.65
Gila Wilderness	1.32	0.70	1.66	0.92	-0.34	-0.22	1.22	0.68
Great Sand Dunes Wilderness-nps	0.42	0.32	0.53	0.41	-0.11	-0.09	0.42	0.32
La Garita Wilderness	0.62	0.47	0.75	0.58	-0.14	-0.11	0.60	0.46
Maroon Bells-Snowmass Wilderness	0.90	0.67	1.07	0.79	-0.17	-0.13	0.89	0.66
Mesa Verde NP	0.48	0.41	0.63	0.54	-0.15	-0.13	0.47	0.40
Mount Baldy Wilderness	0.73	0.73	0.99	0.99	-0.26	-0.26	0.69	0.69
Mount Zirkel Wilderness	1.27	0.92	1.58	1.16	-0.31	-0.25	1.26	0.91
Pecos Wilderness	0.81	0.53	1.02	0.67	-0.21	-0.13	0.60	0.50
Petrified Forest NP	0.33	0.28	0.54	0.45	-0.21	-0.17	0.33	0.28
Rawah Wilderness	0.91	0.67	1.13	0.85	-0.23	-0.18	0.90	0.66
Rocky Mountain NP	0.85	0.63	1.07	0.82	-0.22	-0.19	0.83	0.62
Salt Creek Wilderness	0.48	0.45	0.56	0.53	-0.09	-0.08	0.48	0.45
San Pedro Parks Wilderness	0.64	0.53	0.80	0.68	-0.16	-0.14	0.62	0.52
Weminuche Wilderness	0.96	0.67	1.16	0.82	-0.21	-0.15	0.95	0.66
West Elk Wilderness	0.75	0.52	0.89	0.63	-0.14	-0.10	0.75	0.52
Wheeler Peak Wilderness	0.82	0.69	1.01	0.85	-0.19	-0.17	0.78	0.66
White Mountain Wilderness	0.54	0.40	0.67	0.49	-0.13	-0.09	0.54	0.40

Note that the thresholds shown are project-level thresholds. The comparisons shown above are for informational purposes only.

5.5 Acid Neutralizing Capacity (ANC) at Sensitive Lakes

Acid Neutralizing Capacity (ANC) at sensitive lakes was calculated for each Source Group following the procedures given in Section 4.8. For a Project, the USFS ANC Level of Acceptable Change (LAC) threshold is no change greater than 10% for lakes with base ANC > 25 µeq/l and no change greater than 1 µeq/l for lakes with base ANC values < 25 µeq/l. Attachments E-1, E-2 and E-3 are interactive Excel spreadsheet that displays the change in ANC at the sensitive lakes due to emissions from each of the 34 Source Groups and the High, Low and Medium Development Scenarios, respectively. The Source Group to be displayed is controlled by cell B3 with the resultant change in ANC (Delta ANC) shown as a percent in Column N and as µeq/l in Column O with an indication of whether it is below the USFS LAC value given in Column P. Although ANC is presented for each Source Group, the ANC results for the Source Groups with existing sources are not meaningful since their effects are contained within both the 10 percentile baseline lake acidity as well as the incremental acidity added to the baseline.

5.5.1 ANC Calculations for Individual BLM Planning Areas

For new Federal O&G from each of the 14 BLM Planning Areas (Source Groups B through O) the change in ANC were below the USFS LAC significance thresholds at all of the sensitive lakes. For example, Table 5-35 displays ANC results from Attachment E-1 (2025 High Development Scenario) for the WRFO, CRVFO, GJFO, RGFO #1 Planning Areas (Source Groups C, D, F, and J). Note that Attachment D contains more information on the sensitive lakes than presented in Table 5-35 including the lake chemistry parameters. For new Federal O&G from the WRFO Planning Area and the 2025 High Scenario, the maximum change in ANC at any sensitive lake is 6.5% at the Upper Ned Wilson Lake in the White River National Forest. This change is below both of the USFS LAC values (Table 5-35). For new Federal O&G within the CRVFO Planning Area and the 2025 High Scenario, the maximum change in ANC at any sensitive lake is 0.88% at the Upper Ned Wilson Lake in the White River National Forest, which is below the USFS LAC thresholds (Table 5-35a). New Federal O&G development within the GJFO results in ANC impacts that are all below the threshold in the High Development Scenario with the maximum ANC change of 2.58% at the Upper Ned Wilson Lake in the White River National Forest. New Federal O&G development within the RGFO #1 Planning Area has almost no effect on acidification at the sensitive lakes with maximum change in ANC values of 0.03% (Table 5-35b). ANC results for the other BLM Planning Areas and the 2025 Low and Medium Development Scenario are contained in Attachments E-1, E-2 and E-3.

Table 5-35. ANC calculations at sensitive lakes for new Federal oil and gas development within the BLM White River Field Office Planning Area (Source Group C) and the 2025 High Development Scenario.

Lake	National Forest	Wilderness Area	State	Latitude (Deg N)	Longitude (Deg W)	Elevation (m)	10th Percentile Lowest ANC Value (µeq/L)	Total S Dep (kg-S/ha-yr)	Total N Dep (kg-N/ha-yr)	PPT (m)	Delta ANC (%)	Delta ANC (< eq/L)	USFS LAC Threshold	Below Threshold?	2025 High Predicted 10th Percentile Lowest ANC
Brooklyn Lake	White River	Collegiate Peaks	CO	39.0495	-106.6569	3737	101.7	0.0004	0.0020	1.162	0.02%	0.0217	<10%	yes	101.7
Tabor Lake	White River	Collegiate Peaks	CO	39.0628	-106.6564	3746	112.4	0.0004	0.0020	1.182	0.02%	0.0207	<10%	yes	112.4
Booth Lake	White River	Eagles Nest	CO	39.6886	-106.3050	3493	86.8	0.0007	0.0036	1.223	0.04%	0.0375	<10%	yes	86.7
Upper Willow Lake	White River	Eagles Nest	CO	39.6458	-106.1747	3469	134.1	0.0006	0.0029	1.143	0.02%	0.0324	<10%	yes	134.1
Ned Wilson Lake	White River	Flat Tops	CO	39.9614	-107.3239	3385	39.0	0.0020	0.0096	1.180	0.26%	0.1028	<10%	yes	38.9
Upper Ned Wilson Lake	White River	Flat Tops	CO	39.9628	-107.3236	3386	12.9	0.0020	0.0096	1.180	0.80%	0.1028	<1(µeq/L)	yes	12.8
Lower NWLI Packtrail Pothole	White River	Flat Tops	CO	39.9682	-107.3241	3379	29.7	0.0020	0.0096	1.180	0.35%	0.1028	<10%	yes	29.5
Upper NWLI Packtrail Pothole	White River	Flat Tops	CO	39.9656	-107.3238	3380	48.7	0.0020	0.0096	1.180	0.21%	0.1028	<10%	yes	48.6
Walk Up Lake	Ashley	--	UT	40.8110	-110.0383	---	55.2	0.0000	0.0003	1.011	0.01%	0.0035	<10%	yes	55.2
Bluebell Lake	Ashley	High Uintas	UT	40.6970	-110.4822	3322	55.5	0.0000	0.0001	0.943	0.00%	0.0018	<10%	yes	55.5
Dean Lake	Ashley	High Uintas	UT	40.6785	-110.7616	3275	48.9	0.0000	0.0001	1.024	0.00%	0.0015	<10%	yes	48.9
No Name (Utah; Duchesne 002-039)	Ashley	High Uintas	UT	40.6710	-110.2758	3302	67.0	0.0001	0.0003	0.845	0.01%	0.0043	<10%	yes	67.0
Upper Griffin Lake	Ashley	High Uintas	UT	40.8342	-110.2383	3361	64.9	0.0000	0.0002	1.047	0.00%	0.0024	<10%	yes	64.8
Fish Lake	Wasatch-Cache	High Uintas	UT	40.8361	-110.0676	---	105.8	0.0000	0.0003	1.062	0.00%	0.0031	<10%	yes	105.8
Blodgett Lake, Colorado	White River	Holy Cross	CO	39.4062	-106.5352	3558	47.7	0.0007	0.0032	1.159	0.07%	0.0353	<10%	yes	47.6
Upper Turquoise Lake	White River	Holy Cross	CO	39.5098	-106.5332	3450	104.0	0.0006	0.0035	1.121	0.04%	0.0388	<10%	yes	104.0
Upper West Tennessee Lake	San Isabel	Holy Cross	CO	39.3445	-106.4250	3649	114.2	0.0006	0.0028	1.161	0.03%	0.0308	<10%	yes	114.2
Blue Lake (Colorado; Boulder 002-040)	Arapaho and Roosevelt	Indian Peaks	CO	40.0876	-105.6169	3446	19.3	0.0007	0.0042	1.348	0.20%	0.0388	<1(µeq/L)	yes	19.2
Crater Lake	Arapaho and Roosevelt	Indian Peaks	CO	40.0755	-105.6639	3141	53.1	0.0007	0.0035	1.241	0.07%	0.0350	<10%	yes	53.1
King Lake (Colorado; Grand 002-049)	Arapaho and Roosevelt	Indian Peaks	CO	39.9441	-105.6858	3486	52.3	0.0008	0.0040	1.237	0.08%	0.0405	<10%	yes	52.2
No Name Lake (Colorado; Boulder 002-055)	Arapaho and Roosevelt	Indian Peaks	CO	40.0375	-105.6269	3422	25.6	0.0009	0.0045	1.449	0.15%	0.0386	<10%	yes	25.6
Upper Lake	Arapaho and Roosevelt	Indian Peaks	CO	40.1545	-105.6805	3271	69.0	0.0008	0.0042	1.225	0.06%	0.0427	<10%	yes	68.9
Small Lake Above U-Shaped Lake	Rio Grande	La Garita	CO	37.9436	-106.8639	3932	59.9	0.0001	0.0006	0.816	0.01%	0.0089	<10%	yes	59.9
U-Shaped Lake	Rio Grande	La Garita	CO	37.9422	-106.8606	3566	81.4	0.0001	0.0006	0.816	0.01%	0.0089	<10%	yes	81.4
Avalanche Lake	White River	Maroon Bells	CO	39.1439	-107.0998	3260	158.8	0.0005	0.0022	1.337	0.01%	0.0205	<10%	yes	158.8
Capitol Lake	White River	Maroon Bells	CO	39.1630	-107.0820	3530	154.4	0.0005	0.0022	1.434	0.01%	0.0193	<10%	yes	154.4
Moon Lake (Upper)	White River	Maroon Bells	CO	39.1644	-107.0589	3578	53.0	0.0005	0.0022	1.434	0.04%	0.0193	<10%	yes	53.0
Upper Middle Beartrack Lake	Arapaho and Roosevelt	Mount Evans	CO	39.5711	-105.6067	3542	50.9	0.0004	0.0022	1.018	0.05%	0.0265	<10%	yes	50.9
Abyss Lake	Pike and San Isabel	Mount Evans	CO	39.5858	-105.6592	3856	81.1	0.0004	0.0022	1.118	0.03%	0.0249	<10%	yes	81.1
Frozen Lake	Pike and San Isabel	Mount Evans	CO	39.5775	-105.6583	3944	93.3	0.0004	0.0022	1.118	0.03%	0.0249	<10%	yes	93.2
North Lake	Pike and San Isabel	Mount Evans	CO	39.5914	-105.6733	3420	80.9	0.0004	0.0022	1.118	0.03%	0.0249	<10%	yes	80.9
South Lake	Pike and San Isabel	Mount Evans	CO	39.5903	-105.6714	3432	66.7	0.0004	0.0022	1.118	0.04%	0.0249	<10%	yes	66.7
Lake Elbert	Medicine Bow-Routt	Mount Zirkel	CO	40.6342	-106.7069	3289	56.6	0.0019	0.0115	1.694	0.15%	0.0829	<10%	yes	56.5
Seven Lakes (LGI East)	Medicine Bow-Routt	Mount Zirkel	CO	40.8958	-106.6819	3273	36.2	0.0016	0.0097	1.576	0.21%	0.0754	<10%	yes	36.2
Summit Lake	Medicine Bow-Routt	Mount Zirkel	CO	40.5453	-106.6819	3146	48.0	0.0018	0.0113	1.523	0.19%	0.0904	<10%	yes	47.9
Deep Creek Lake	Gunnison	Raggeds	CO	39.0089	-107.2400	3359	20.6	0.0003	0.0018	0.836	0.13%	0.0272	<1(µeq/L)	yes	20.6
Island Lake	Arapaho and Roosevelt	Rawah	CO	40.6272	-105.9411	3392	71.0	0.0010	0.0061	1.204	0.09%	0.0615	<10%	yes	71.0
Kelly Lake	Arapaho and Roosevelt	Rawah	CO	40.6256	-105.9594	3293	179.9	0.0010	0.0061	1.204	0.03%	0.0615	<10%	yes	179.8
Rawah Lake #4	Arapaho and Roosevelt	Rawah	CO	40.6711	-105.9578	3497	41.3	0.0010	0.0066	1.246	0.15%	0.0638	<10%	yes	41.2
Crater Lake (Sangre de Cristo)	Rio Grande	Sangre de Cristo	CO	37.5756	-105.4951	3871	162.9	0.0001	0.0008	0.959	0.01%	0.0097	<10%	yes	162.9
Lower Stout Lake	San Isabel	Sangre de Cristo	CO	38.3528	-105.8892	3585	145.2	0.0001	0.0008	0.646	0.01%	0.0150	<10%	yes	145.2
Upper Little Sand Creek Lake	San Isabel	Sangre de Cristo	CO	37.9039	-105.5356	3773	129.5	0.0001	0.0006	0.803	0.01%	0.0090	<10%	yes	129.5
Upper Stout Lake	San Isabel	Sangre de Cristo	CO	38.3503	-105.8908	3609	76.3	0.0001	0.0008	0.646	0.02%	0.0150	<10%	yes	76.3
Glacier Lake (Colorado)	San Juan-Rio Grande	South San Juan	CO	37.2594	-106.5879	3639	63.4	0.0000	0.0003	1.071	0.00%	0.0030	<10%	yes	63.4
Lake South of Blue Lakes	San Juan-Rio Grande	South San Juan	CO	37.2243	-106.6307	3615	16.9	0.0000	0.0003	1.084	0.02%	0.0034	<1(µeq/L)	yes	16.9
Big Eldorado Lake	San Juan-Rio Grande	Weminuche	CO	37.7133	-107.5433	3811	19.6	0.0001	0.0006	1.159	0.03%	0.0060	<1(µeq/L)	yes	19.6
Four Mile Pothole	San Juan-Rio Grande	Weminuche	CO	37.4684	-107.0525	---	123.4	0.0001	0.0005	0.902	0.01%	0.0063	<10%	yes	123.4
Lake Dues South of Ute Lake	San Juan-Rio Grande	Weminuche	CO	37.6361	-107.4428	---	13.2	0.0001	0.0004	1.106	0.04%	0.0049	<1(µeq/L)	yes	13.2
Little Eldorado	San Juan-Rio Grande	Weminuche	CO	37.7133	-107.5458	3812	-3.3	0.0001	0.0006	1.159	0.18%	0.0060	<1(µeq/L)	yes	-3.3
Little Granite Lake	San Juan-Rio Grande	Weminuche	CO	37.6205	-107.3317	3304	80.7	0.0001	0.0005	1.034	0.01%	0.0062	<10%	yes	80.7
Lower Sunlight Lake	San Juan-Rio Grande	Weminuche	CO	37.6331	-107.5830	3668	80.9	0.0001	0.0005	1.136	0.01%	0.0057	<10%	yes	80.9
Middle Ute Lake	San Juan-Rio Grande	Weminuche	CO	37.6483	-107.4752	3644	42.8	0.0001	0.0004	1.110	0.01%	0.0045	<10%	yes	42.8
Small Pond Above Trout Lake	San Juan-Rio Grande	Weminuche	CO	37.6519	-107.1564	3562	25.5	0.0001	0.0005	1.027	0.02%	0.0057	<10%	yes	25.5
Upper Grizzly Lake	San Juan-Rio Grande	Weminuche	CO	37.6200	-107.5836	3993	29.9	0.0001	0.0005	1.199	0.02%	0.0054	<10%	yes	29.9
Upper Sunlight Lake	San Juan-Rio Grande	Weminuche	CO	37.6278	-107.5797	3824	28.0	0.0001	0.0005	1.199	0.02%	0.0054	<10%	yes	28.0
West Snowdon Lake	San Juan-Rio Grande	Weminuche	CO	37.7103	-107.6935	3652	39.4	0.0001	0.0005	0.914	0.02%	0.0061	<10%	yes	39.3
White Dome Lake	San Juan-Rio Grande	Weminuche	CO	37.7089	-107.5525	3822	2.1	0.0001	0.0006	1.159	0.29%	0.0060	<1(µeq/L)	yes	2.1
South Golden Lake	Grand Mesa, Uncompahgre and Gunnison	West Elk	CO	38.7776	-107.1828	3371	111.4	0.0003	0.0017	0.861	0.02%	0.0243	<10%	yes	111.4

Note that the thresholds shown are project-level thresholds. The comparisons shown above are for informational purposes only.

Table 5-35a. ANC calculations at sensitive lakes for new Federal oil and gas development within the BLM Colorado River Valley Field Office (CRVFO) Planning Area (Source Group F) and the 2025 High Development Scenario.

Lake	National Forest	Wilderness Area	State	Latitude (Deg N)	Longitude (Deg W)	Elevation (m)	10th Percentile Lowest ANC Value (µeq/L)	Total S Dep (kg-S/ha-yr)	Total N Dep (kg-N/ha-yr)	PPT (m)	Delta ANC (%)	Delta ANC (< eq/L)	USFS LAC Threshold	Below Threshold?	2025 High Predicted 10th Percentile Lowest ANC
Brooklyn Lake	White River	Collegiate Peaks	CO	39.0495	-106.6569	3737	101.7	0.0001	0.0051	1.162	0.05%	0.0476	<10%	yes	101.6
Tabor Lake	White River	Collegiate Peaks	CO	39.0628	-106.6564	3746	112.4	0.0001	0.0050	1.182	0.04%	0.0457	<10%	yes	112.4
Booth Lake	White River	Eagles Nest	CO	39.6886	-106.3050	3493	86.8	0.0001	0.0112	1.223	0.11%	0.0988	<10%	yes	86.7
Upper Willow Lake	White River	Eagles Nest	CO	39.6458	-106.1747	3469	134.1	0.0001	0.0086	1.143	0.06%	0.0814	<10%	yes	134.0
Ned Wilson Lake	White River	Flat Tops	CO	39.9614	-107.3239	3385	39.0	0.0001	0.0125	1.180	0.29%	0.1139	<10%	yes	38.9
Upper Ned Wilson Lake	White River	Flat Tops	CO	39.9628	-107.3236	3386	12.9	0.0001	0.0125	1.180	0.88%	0.1139	<1(µeq/L)	yes	12.8
Lower NW Packtrail Pothole	White River	Flat Tops	CO	39.9682	-107.3241	3379	29.7	0.0001	0.0125	1.180	0.38%	0.1139	<10%	yes	29.5
Upper NW Packtrail Pothole	White River	Flat Tops	CO	39.9656	-107.3238	3380	48.7	0.0001	0.0125	1.180	0.23%	0.1139	<10%	yes	48.6
Walk Up Lake	Ashley	--	UT	40.8110	-110.0383	---	55.2	0.0000	0.0001	1.011	0.00%	0.0011	<10%	yes	55.2
Bluebell Lake	Ashley	High Uintas	UT	40.6970	-110.4822	3322	55.5	0.0000	0.0001	0.943	0.00%	0.0007	<10%	yes	55.5
Dean Lake	Ashley	High Uintas	UT	40.6785	-110.7616	3275	48.9	0.0000	0.0001	1.024	0.00%	0.0006	<10%	yes	48.9
No Name (Utah; Duchesne 02-039)	Ashley	High Uintas	UT	40.6710	-110.2758	3302	67.0	0.0000	0.0001	0.845	0.00%	0.0014	<10%	yes	67.0
Upper Griffin Lake	Ashley	High Uintas	UT	40.8342	-110.2383	3361	64.9	0.0000	0.0001	1.047	0.00%	0.0009	<10%	yes	64.8
Fish Lake	Wasatch-Cache	High Uintas	UT	40.8361	-110.0676	---	105.8	0.0000	0.0001	1.062	0.00%	0.0011	<10%	yes	105.8
Blodgett Lake, Colorado	White River	Holy Cross	CO	39.4062	-106.5352	3558	47.7	0.0001	0.0096	1.159	0.19%	0.0890	<10%	yes	47.6
Upper Turquoise Lake	White River	Holy Cross	CO	39.5098	-106.5332	3450	104.0	0.0001	0.0108	1.121	0.10%	0.1038	<10%	yes	103.9
Upper West Tennessee Lake	San Isabel	Holy Cross	CO	39.3445	-106.4250	3649	114.2	0.0001	0.0080	1.161	0.07%	0.0744	<10%	yes	114.1
Blue Lake (Colorado; Boulder 01-040)	Arapaho and Roosevelt	Indian Peaks	CO	40.0876	-105.6169	3446	19.3	0.0001	0.0075	1.348	0.31%	0.0597	<1(µeq/L)	yes	19.2
Crater Lake	Arapaho and Roosevelt	Indian Peaks	CO	40.0755	-105.6639	3141	53.1	0.0001	0.0061	1.241	0.10%	0.0533	<10%	yes	53.1
King Lake (Colorado; Grand 01-049)	Arapaho and Roosevelt	Indian Peaks	CO	39.9441	-105.6858	3486	52.3	0.0001	0.0077	1.237	0.13%	0.0672	<10%	yes	52.2
No Name Lake (Colorado; Boulder 01-055)	Arapaho and Roosevelt	Indian Peaks	CO	40.0375	-105.6269	3422	25.6	0.0001	0.0081	1.449	0.24%	0.0605	<10%	yes	25.6
Upper Lake	Arapaho and Roosevelt	Indian Peaks	CO	40.1545	-105.6805	3271	69.0	0.0001	0.0068	1.225	0.09%	0.0599	<10%	yes	68.9
Small Lake Above U-Shaped Lake	Rio Grande	La Garita	CO	37.9436	-106.8639	3932	59.9	0.0000	0.0008	0.816	0.02%	0.0112	<10%	yes	59.9
U-Shaped Lake	Rio Grande	La Garita	CO	37.9422	-106.8606	3566	81.4	0.0000	0.0008	0.816	0.01%	0.0112	<10%	yes	81.3
Avalanche Lake	White River	Maroon Bells	CO	39.1439	-107.0998	3260	158.8	0.0001	0.0060	1.337	0.03%	0.0481	<10%	yes	158.8
Capitol Lake	White River	Maroon Bells	CO	39.1630	-107.0820	3530	154.4	0.0001	0.0060	1.434	0.03%	0.0454	<10%	yes	154.4
Moon Lake (Upper)	White River	Maroon Bells	CO	39.1644	-107.0589	3578	53.0	0.0001	0.0060	1.434	0.09%	0.0454	<10%	yes	52.9
Upper Middle Beartrack Lake	Arapaho and Roosevelt	Mount Evans	CO	39.5711	-105.6067	3542	50.9	0.0000	0.0049	1.018	0.10%	0.0516	<10%	yes	50.8
Abyss Lake	Pike and San Isabel	Mount Evans	CO	39.5858	-105.6592	3856	81.1	0.0001	0.0051	1.118	0.06%	0.0487	<10%	yes	81.1
Frozen Lake	Pike and San Isabel	Mount Evans	CO	39.5775	-105.6583	3944	93.3	0.0001	0.0051	1.118	0.05%	0.0487	<10%	yes	93.2
North Lake	Pike and San Isabel	Mount Evans	CO	39.5914	-105.6733	3420	80.9	0.0001	0.0051	1.118	0.06%	0.0487	<10%	yes	80.9
South Lake	Pike and San Isabel	Mount Evans	CO	39.5903	-105.6714	3432	66.7	0.0001	0.0051	1.118	0.07%	0.0487	<10%	yes	66.7
Lake Elbert	Medicine Bow-Routt	Mount Zirkel	CO	40.6342	-106.7069	3289	56.6	0.0001	0.0057	1.694	0.06%	0.0364	<10%	yes	56.5
Seven Lakes (LGI East)	Medicine Bow-Routt	Mount Zirkel	CO	40.8958	-106.6819	3273	36.2	0.0001	0.0047	1.576	0.09%	0.0320	<10%	yes	36.2
Summit Lake	Medicine Bow-Routt	Mount Zirkel	CO	40.5453	-106.6819	3146	48.0	0.0001	0.0060	1.523	0.09%	0.0422	<10%	yes	48.0
Deep Creek Lake	Gunnison	Raggeds	CO	39.0089	-107.2400	3359	20.6	0.0000	0.0042	0.836	0.26%	0.0535	<1(µeq/L)	yes	20.5
Island Lake	Arapaho and Roosevelt	Rawah	CO	40.6272	-105.9411	3392	71.0	0.0000	0.0044	1.204	0.06%	0.0393	<10%	yes	71.0
Kelly Lake	Arapaho and Roosevelt	Rawah	CO	40.6256	-105.9594	3293	179.9	0.0000	0.0044	1.204	0.02%	0.0393	<10%	yes	179.8
Rawah Lake #4	Arapaho and Roosevelt	Rawah	CO	40.6711	-105.9578	3497	41.3	0.0001	0.0047	1.246	0.10%	0.0402	<10%	yes	41.2
Crater Lake (Sangre de Cristo)	Rio Grande	Sangre de Cristo	CO	37.5756	-105.4951	3871	162.9	0.0000	0.0013	0.959	0.01%	0.0141	<10%	yes	162.9
Lower Stout Lake	San Isabel	Sangre de Cristo	CO	38.3528	-105.8892	3585	145.2	0.0000	0.0014	0.646	0.02%	0.0234	<10%	yes	145.2
Upper Little Sand Creek Lake	San Isabel	Sangre de Cristo	CO	37.9039	-105.5356	3773	129.5	0.0000	0.0009	0.803	0.01%	0.0126	<10%	yes	129.5
Upper Stout Lake	San Isabel	Sangre de Cristo	CO	38.3503	-105.8908	3609	76.3	0.0000	0.0014	0.646	0.03%	0.0234	<10%	yes	76.3
Glacier Lake (Colorado)	San Juan-Rio Grande	South San Juan	CO	37.2594	-106.5879	3639	63.4	0.0000	0.0003	1.071	0.01%	0.0035	<10%	yes	63.4
Lake South bf Blue Lakes	San Juan-Rio Grande	South San Juan	CO	37.2243	-106.6307	3615	16.9	0.0000	0.0004	1.084	0.02%	0.0038	<1(µeq/L)	yes	16.9
Big Eldorado Lake	San Juan-Rio Grande	Weminuche	CO	37.7133	-107.5433	3811	19.6	0.0000	0.0006	1.159	0.03%	0.0057	<1(µeq/L)	yes	19.6
Four Mile Pothole	San Juan-Rio Grande	Weminuche	CO	37.4684	-107.0525	---	123.4	0.0000	0.0006	0.902	0.01%	0.0066	<10%	yes	123.4
Lake Dues South bf Ute Lake	San Juan-Rio Grande	Weminuche	CO	37.6361	-107.4428	---	13.2	0.0000	0.0005	1.106	0.04%	0.0048	<1(µeq/L)	yes	13.2
Little Eldorado	San Juan-Rio Grande	Weminuche	CO	37.7133	-107.5458	3812	-3.3	0.0000	0.0006	1.159	0.17%	0.0057	<1(µeq/L)	yes	-3.3
Little Granite Lake	San Juan-Rio Grande	Weminuche	CO	37.6205	-107.3317	3304	80.7	0.0000	0.0006	1.034	0.01%	0.0064	<10%	yes	80.7
Lower Sunlight Lake	San Juan-Rio Grande	Weminuche	CO	37.6331	-107.5830	3668	80.9	0.0000	0.0006	1.136	0.01%	0.0055	<10%	yes	80.9
Middle Ute Lake	San Juan-Rio Grande	Weminuche	CO	37.6483	-107.4752	3644	42.8	0.0000	0.0005	1.110	0.01%	0.0044	<10%	yes	42.8
Small Pond Above Trout Lake	San Juan-Rio Grande	Weminuche	CO	37.6519	-107.1564	3562	25.5	0.0000	0.0006	1.027	0.02%	0.0062	<10%	yes	25.5
Upper Grizzly Lake	San Juan-Rio Grande	Weminuche	CO	37.6200	-107.5836	3993	29.9	0.0000	0.0006	1.199	0.02%	0.0051	<10%	yes	29.9
Upper Sunlight Lake	San Juan-Rio Grande	Weminuche	CO	37.6278	-107.5797	3824	28.0	0.0000	0.0006	1.199	0.02%	0.0051	<10%	yes	28.0
West Snowdon Lake	San Juan-Rio Grande	Weminuche	CO	37.7103	-107.6935	3652	39.4	0.0000	0.0005	0.914	0.02%	0.0060	<10%	yes	39.3
White Dome Lake	San Juan-Rio Grande	Weminuche	CO	37.7089	-107.5525	3822	2.1	0.0000	0.0006	1.159	0.28%	0.0057	<1(µeq/L)	yes	2.1
South Golden Lake	Grand Mesa, Uncompahgre and Gunnison	West Elk	CO	38.7776	-107.1828	3371	111.4	0.0000	0.0033	0.861	0.04%	0.0411	<10%	yes	111.4

Note that the thresholds shown are project-level thresholds. The comparisons shown above are for informational purposes only.

Table 5-35b. ANC calculations at sensitive lakes for new Federal oil and gas development within the BLM Grand Junction Field Office Planning Area (Source Group F) and the 2025 High Development Scenario.

Lake	National Forest	Wilderness Area	State	Latitude (Deg N)	Longitude (Deg W)	Elevation (m)	10th Percentile Lowest ANC Value (µeq/L)	Total S Dep (kg-S/ha-yr)	Total N Dep (kg-N/ha-yr)	PPT (m)	Delta ANC (%)*	Delta ANC (µeq/L)*	USFS LAC Threshold	Below Threshold?	2025 Hi Predicted 10th Percentile Lowest ANC Value (µeq/L)
Brooklyn Lake	White River	Collegiate Peaks	CO	39.0495	-106.6569	3737	101.7	0.0002	0.0150	1.162	0.14%	0.1388	<10%	yes	101.5
Tabor Lake	White River	Collegiate Peaks	CO	39.0628	-106.6564	3746	112.4	0.0001	0.0146	1.182	0.12%	0.1330	<10%	yes	112.3
Booth Lake	White River	Eagles Nest	CO	39.6986	-106.3050	3493	86.8	0.0003	0.0270	1.223	0.27%	0.2371	<10%	yes	86.5
Upper Willow Lake	White River	Eagles Nest	CO	39.6458	-106.1747	3469	134.1	0.0002	0.0215	1.143	0.15%	0.2025	<10%	yes	133.9
Ned Wilson Lake	White River	Flat Tops	CO	39.9614	-107.3239	3385	39.0	0.0004	0.0364	1.180	0.85%	0.3322	<10%	yes	38.7
Upper Ned Wilson Lake	White River	Flat Tops	CO	39.9628	-107.3236	3386	12.9	0.0004	0.0364	1.180	2.58%	0.3322	<1(µeq/L)	yes	12.5
Lower NWL Packtrail Pothole	White River	Flat Tops	CO	39.9682	-107.3241	3379	29.7	0.0004	0.0364	1.180	1.12%	0.3322	<10%	yes	29.3
Upper NWL Packtrail Pothole	White River	Flat Tops	CO	39.9656	-107.3238	3380	48.7	0.0004	0.0364	1.180	0.68%	0.3322	<10%	yes	48.4
Walk Up Lake	Ashley	--	UT	40.8110	-110.0383	---	55.2	0.0000	0.0008	1.011	0.02%	0.0085	<10%	yes	55.2
Bluebell Lake	Ashley	High Uintas	UT	40.6970	-110.4822	3322	55.5	0.0000	0.0005	0.943	0.01%	0.0051	<10%	yes	55.5
Dean Lake	Ashley	High Uintas	UT	40.6785	-110.7616	3275	48.9	0.0000	0.0004	1.024	0.01%	0.0044	<10%	yes	48.9
No Name (Utah, Duchesne - 4D2-039)	Ashley	High Uintas	UT	40.6710	-110.2758	3302	67.0	0.0000	0.0008	0.845	0.01%	0.0099	<10%	yes	67.0
Upper Coffin Lake	Ashley	High Uintas	UT	40.8342	-110.2383	3361	64.9	0.0000	0.0006	1.047	0.01%	0.0062	<10%	yes	64.8
Fish Lake	Wasatch-Cache	High Uintas	UT	40.8361	-110.0676	---	105.8	0.0000	0.0008	1.062	0.01%	0.0079	<10%	yes	105.8
Blodgett Lake, Colorado	White River	Holy Cross	CO	39.4062	-106.5352	3558	47.7	0.0003	0.0252	1.159	0.49%	0.2336	<10%	yes	47.4
Upper Turquoise Lake	White River	Holy Cross	CO	39.5098	-106.5332	3450	104.0	0.0003	0.0259	1.121	0.24%	0.2489	<10%	yes	103.8
Upper West Tennessee Lake	San Isabel	Holy Cross	CO	39.3445	-106.4250	3649	114.2	0.0002	0.0216	1.161	0.18%	0.2005	<10%	yes	114.0
Blue Lake (Colorado; Boulder - 4E1-040)	Arapaho and Roosevelt	Indian Peaks	CO	40.0876	-105.6169	3446	19.3	0.0002	0.0209	1.348	0.86%	0.1662	<1(µeq/L)	yes	19.1
Crater Lake	Arapaho and Roosevelt	Indian Peaks	CO	40.0755	-105.6639	3141	53.1	0.0002	0.0172	1.241	0.28%	0.1489	<10%	yes	53.0
King Lake (Colorado; Grand - 4E1-049)	Arapaho and Roosevelt	Indian Peaks	CO	39.9441	-105.6858	3486	52.3	0.0002	0.0211	1.237	0.35%	0.1832	<10%	yes	52.1
No Name Lake (Colorado; Boulder - 4E1-055)	Arapaho and Roosevelt	Indian Peaks	CO	40.0375	-105.6269	3422	25.6	0.0002	0.0225	1.449	0.65%	0.1674	<10%	yes	25.5
Upper Lake	Arapaho and Roosevelt	Indian Peaks	CO	40.1545	-105.6805	3271	69.0	0.0002	0.0195	1.225	0.25%	0.1711	<10%	yes	68.8
Small Lake Above U-Shaped Lake	Rio Grande	La Garita	CO	37.9436	-106.8639	3932	59.9	0.0000	0.0040	0.816	0.09%	0.0526	<10%	yes	59.8
U-Shaped Lake	Rio Grande	La Garita	CO	37.9422	-106.8606	3566	81.4	0.0000	0.0040	0.816	0.06%	0.0526	<10%	yes	81.3
Avalanche Lake	White River	Maroon Bells	CO	39.1439	-107.0998	3260	158.8	0.0003	0.0218	1.337	0.11%	0.1756	<10%	yes	158.6
Capitol Lake	White River	Maroon Bells	CO	39.1630	-107.0820	3530	154.4	0.0003	0.0212	1.434	0.10%	0.1594	<10%	yes	154.2
Moon Lake (Upper)	White River	Maroon Bells	CO	39.1644	-107.0589	3578	53.0	0.0003	0.0212	1.434	0.30%	0.1594	<10%	yes	52.8
Upper Middle Beartrack Lake	Arapaho and Roosevelt	Mount Evans	CO	39.5711	-105.6067	3542	50.9	0.0001	0.0133	1.018	0.28%	0.1406	<10%	yes	50.8
Abyss Lake	Pike and San Isabel	Mount Evans	CO	39.5858	-105.6592	3856	81.1	0.0001	0.0137	1.118	0.16%	0.1313	<10%	yes	81.0
Frozen Lake	Pike and San Isabel	Mount Evans	CO	39.5775	-105.6583	3944	93.3	0.0001	0.0137	1.118	0.14%	0.1313	<10%	yes	93.1
North Lake	Pike and San Isabel	Mount Evans	CO	39.5914	-105.6733	3420	80.9	0.0001	0.0137	1.118	0.16%	0.1313	<10%	yes	80.8
South Lake	Pike and San Isabel	Mount Evans	CO	39.5903	-105.6714	3432	66.7	0.0001	0.0137	1.118	0.20%	0.1313	<10%	yes	66.6
Lake Elbert	Medicine Bow-Routt	Mount Zirkel	CO	40.6342	-106.7069	3289	56.6	0.0003	0.0237	1.694	0.27%	0.1503	<10%	yes	56.4
Seven Lakes (LG East)	Medicine Bow-Routt	Mount Zirkel	CO	40.8958	-106.6819	3273	36.2	0.0002	0.0198	1.576	0.37%	0.1355	<10%	yes	36.1
Summit Lake	Medicine Bow-Routt	Mount Zirkel	CO	40.5453	-106.6819	3146	48.0	0.0002	0.0237	1.523	0.35%	0.1674	<10%	yes	47.8
Deep Creek Lake	Gunnison	Raggeds	CO	39.0089	-107.2400	3359	20.6	0.0002	0.0159	0.836	0.99%	0.2045	<1(µeq/L)	yes	20.4
Island Lake	Arapaho and Roosevelt	Rawah	CO	40.6272	-105.9411	3392	71.0	0.0002	0.0159	1.204	0.20%	0.1422	<10%	yes	70.9
Kelly Lake	Arapaho and Roosevelt	Rawah	CO	40.6256	-105.9594	3293	179.9	0.0002	0.0159	1.204	0.08%	0.1422	<10%	yes	179.7
Rawah Lake #4	Arapaho and Roosevelt	Rawah	CO	40.6711	-105.9578	3497	41.3	0.0002	0.0170	1.246	0.36%	0.1469	<10%	yes	41.1
Crater Lake (Sangre de Cristo)	Rio Grande	Sangre de Cristo	CO	37.5756	-105.4951	3871	162.9	0.0000	0.0049	0.959	0.03%	0.0550	<10%	yes	162.9
Lower Stout Lake	San Isabel	Sangre de Cristo	CO	38.3528	-105.8892	3585	145.2	0.0000	0.0058	0.646	0.07%	0.0959	<10%	yes	145.1
Upper Little Sand Creek Lake	San Isabel	Sangre de Cristo	CO	37.9039	-105.5356	3773	129.5	0.0000	0.0038	0.803	0.04%	0.0514	<10%	yes	129.4
Upper Stout Lake	San Isabel	Sangre de Cristo	CO	38.3503	-105.8908	3609	76.3	0.0000	0.0058	0.646	0.13%	0.0959	<10%	yes	76.2
Glacier Lake (Colorado)	San Juan-Rio Grande	South San Juan	CO	37.2594	-106.5879	3639	63.4	0.0000	0.0016	1.071	0.03%	0.0160	<10%	yes	63.4
Lake South of Blue Lakes	San Juan-Rio Grande	South San Juan	CO	37.2243	-106.6307	3615	16.9	0.0000	0.0018	1.084	0.11%	0.0181	<1(µeq/L)	yes	16.9
Big Eldorado Lake	San Juan-Rio Grande	Weminuche	CO	37.7133	-107.5433	3811	19.6	0.0000	0.0036	1.159	0.17%	0.0338	<1(µeq/L)	yes	19.6
Four Mile Pothole	San Juan-Rio Grande	Weminuche	CO	37.4684	-107.0525	---	123.4	0.0000	0.0029	0.902	0.03%	0.0341	<10%	yes	123.4
Lake Due South of Ute Lake	San Juan-Rio Grande	Weminuche	CO	37.6361	-107.4428	---	13.2	0.0000	0.0028	1.106	0.21%	0.0273	<1(µeq/L)	yes	13.1
Little Eldorado	San Juan-Rio Grande	Weminuche	CO	37.7133	-107.5458	3812	-3.3	0.0000	0.0036	1.159	1.02%	0.0338	<1(µeq/L)	yes	-3.3
Little Granite Lake	San Juan-Rio Grande	Weminuche	CO	37.6205	-107.3317	3304	80.7	0.0000	0.0033	1.034	0.04%	0.0347	<10%	yes	80.7
Lower Sunlight Lake	San Juan-Rio Grande	Weminuche	CO	37.6331	-107.5830	3668	80.9	0.0000	0.0034	1.136	0.04%	0.0322	<10%	yes	80.8
Middle Ute Lake	San Juan-Rio Grande	Weminuche	CO	37.6483	-107.4752	3644	42.8	0.0000	0.0026	1.110	0.06%	0.0255	<10%	yes	42.8
Small Pond Above Trout Lake	San Juan-Rio Grande	Weminuche	CO	37.6519	-107.1564	3562	25.5	0.0000	0.0031	1.027	0.13%	0.0322	<10%	yes	25.4
Upper Grizzly Lake	San Juan-Rio Grande	Weminuche	CO	37.6200	-107.5836	3993	29.9	0.0000	0.0033	1.199	0.10%	0.0298	<10%	yes	29.9
Upper Sunlight Lake	San Juan-Rio Grande	Weminuche	CO	37.6278	-107.5797	3824	28.0	0.0000	0.0033	1.199	0.11%	0.0298	<10%	yes	28.0
West Snowdon Lake	San Juan-Rio Grande	Weminuche	CO	37.7103	-107.6935	3652	39.4	0.0000	0.0029	0.914	0.09%	0.0341	<10%	yes	39.3
White Dome Lake	San Juan-Rio Grande	Weminuche	CO	37.7089	-107.5525	3822	2.1	0.0000	0.0036	1.159	1.64%	0.0338	<1(µeq/L)	yes	2.0
South Golden Lake	Grand Mesa, Uncompahgre and Gunnison	West Elk	CO	38.7776	-107.1828	3371	111.4	0.0001	0.0136	0.861	0.15%	0.1695	<10%	yes	111.2

Note that the thresholds shown are project-level thresholds. The comparisons shown above are for informational purposes only.

Table 5-35c. ANC calculations at sensitive lakes for new Federal oil and gas development within the BLM RGFO #1 Planning Area (Source Group J) and the 2025 High Development Scenario.

Lake	National Forest	Wilderness Area	State	Latitude (Deg N)	Longitude (Deg W)	Elevation (m)	10th Percentile Lowest ANC Value (µeq/L)	Total S Dep (kg-S/ha-yr)	Total N Dep (kg-N/ha-yr)	PPT (m)	Delta ANC (%)	Delta ANC (< eq/L)	USFS LAC Threshold	Below Threshold?	2025 High Predicted 10th Percentile Lowest ANC
Brooklyn Lake	White River	Collegiate Peaks	CO	39.0495	-106.6569	3737	101.7	0.0000	0.0001	1.162	0.00%	0.0009	<10%	yes	101.7
Tabor Lake	White River	Collegiate Peaks	CO	39.0628	-106.6564	3746	112.4	0.0000	0.0001	1.182	0.00%	0.0009	<10%	yes	112.4
Booth Lake	White River	Eagles Nest	CO	39.6986	-106.3050	3493	86.8	0.0000	0.0001	1.223	0.00%	0.0009	<10%	yes	86.8
Upper Willow Lake	White River	Eagles Nest	CO	39.6458	-106.1747	3469	134.1	0.0000	0.0001	1.143	0.00%	0.0014	<10%	yes	134.1
Ned Wilson Lake	White River	Flat Tops	CO	39.9614	-107.3239	3385	39.0	0.0000	0.0000	1.180	0.00%	0.0003	<10%	yes	39.0
Upper Ned Wilson Lake	White River	Flat Tops	CO	39.9628	-107.3236	3386	12.9	0.0000	0.0000	1.180	0.00%	0.0003	<1(µeq/L)	yes	12.9
Lower NWU Packtrail Pothole	White River	Flat Tops	CO	39.9682	-107.3241	3379	29.7	0.0000	0.0000	1.180	0.00%	0.0003	<10%	yes	29.6
Upper NWU Packtrail Pothole	White River	Flat Tops	CO	39.9656	-107.3238	3380	48.7	0.0000	0.0000	1.180	0.00%	0.0003	<10%	yes	48.7
Walk Up Lake	Ashley	--	UT	40.8110	-110.0383	---	55.2	0.0000	0.0000	1.011	0.00%	0.0001	<10%	yes	55.2
Bluebell Lake	Ashley	High Uintas	UT	40.6970	-110.4822	3322	55.5	0.0000	0.0000	0.943	0.00%	0.0001	<10%	yes	55.5
Dean Lake	Ashley	High Uintas	UT	40.6785	-110.7616	3275	48.9	0.0000	0.0000	1.024	0.00%	0.0000	<10%	yes	48.9
No Name (Utah; Duchesne 02-039)	Ashley	High Uintas	UT	40.6710	-110.2758	3302	67.0	0.0000	0.0000	0.845	0.00%	0.0001	<10%	yes	67.0
Upper Griffin Lake	Ashley	High Uintas	UT	40.8342	-110.2383	3361	64.9	0.0000	0.0000	1.047	0.00%	0.0001	<10%	yes	64.8
Fish Lake	Wasatch-Cache	High Uintas	UT	40.8361	-110.0676	---	105.8	0.0000	0.0000	1.062	0.00%	0.0001	<10%	yes	105.8
Blodgett Lake, Colorado	White River	Holy Cross	CO	39.4062	-106.5352	3558	47.7	0.0000	0.0001	1.159	0.00%	0.0008	<10%	yes	47.7
Upper Turquoise Lake	White River	Holy Cross	CO	39.5098	-106.5332	3450	104.0	0.0000	0.0001	1.121	0.00%	0.0011	<10%	yes	104.0
Upper West Tennessee Lake	San Isabel	Holy Cross	CO	39.3445	-106.4250	3649	114.2	0.0000	0.0001	1.161	0.00%	0.0011	<10%	yes	114.2
Blue Lake (Colorado; Boulder E1-040)	Arapaho and Roosevelt	Indian Peaks	CO	40.0876	-105.6169	3446	19.3	0.0000	0.0007	1.348	0.03%	0.0052	<1(µeq/L)	yes	19.2
Crater Lake	Arapaho and Roosevelt	Indian Peaks	CO	40.0755	-105.6639	3141	53.1	0.0000	0.0006	1.241	0.01%	0.0052	<10%	yes	53.1
King Lake (Colorado; Grand E1-049)	Arapaho and Roosevelt	Indian Peaks	CO	39.9441	-105.6858	3486	52.3	0.0000	0.0008	1.237	0.01%	0.0070	<10%	yes	52.3
No Name Lake (Colorado; Boulder E1-055)	Arapaho and Roosevelt	Indian Peaks	CO	40.0375	-105.6269	3422	25.6	0.0000	0.0008	1.449	0.02%	0.0058	<10%	yes	25.6
Upper Lake	Arapaho and Roosevelt	Indian Peaks	CO	40.1545	-105.6805	3271	69.0	0.0000	0.0005	1.225	0.01%	0.0042	<10%	yes	69.0
Small Lake Above U-Shaped Lake	Rio Grande	La Garita	CO	37.9436	-106.8639	3932	59.9	0.0000	0.0000	0.816	0.00%	0.0006	<10%	yes	59.9
U-Shaped Lake	Rio Grande	La Garita	CO	37.9422	-106.8606	3566	81.4	0.0000	0.0000	0.816	0.00%	0.0006	<10%	yes	81.4
Avalanche Lake	White River	Maroon Bells	CO	39.1439	-107.0998	3260	158.8	0.0000	0.0001	1.337	0.00%	0.0005	<10%	yes	158.8
Capitol Lake	White River	Maroon Bells	CO	39.1630	-107.0820	3530	154.4	0.0000	0.0001	1.434	0.00%	0.0005	<10%	yes	154.4
Moon Lake (Upper)	White River	Maroon Bells	CO	39.1644	-107.0589	3578	53.0	0.0000	0.0001	1.434	0.00%	0.0005	<10%	yes	53.0
Upper Middle Beartrack Lake	Arapaho and Roosevelt	Mount Evans	CO	39.5711	-105.6067	3542	50.9	0.0000	0.0006	1.018	0.01%	0.0068	<10%	yes	50.9
Abyss Lake	Pike and San Isabel	Mount Evans	CO	39.5858	-105.6592	3856	81.1	0.0000	0.0005	1.118	0.01%	0.0045	<10%	yes	81.1
Frozen Lake	Pike and San Isabel	Mount Evans	CO	39.5775	-105.6583	3944	93.3	0.0000	0.0005	1.118	0.00%	0.0045	<10%	yes	93.3
North Lake	Pike and San Isabel	Mount Evans	CO	39.5914	-105.6733	3420	80.9	0.0000	0.0005	1.118	0.01%	0.0045	<10%	yes	80.9
South Lake	Pike and San Isabel	Mount Evans	CO	39.5903	-105.6714	3432	66.7	0.0000	0.0005	1.118	0.01%	0.0045	<10%	yes	66.7
Lake Elbert	Medicine Bow-Routt	Mount Zirkel	CO	40.6342	-106.7069	3289	56.6	0.0000	0.0001	1.694	0.00%	0.0005	<10%	yes	56.6
Seven Lakes (LGI East)	Medicine Bow-Routt	Mount Zirkel	CO	40.8958	-106.6819	3273	36.2	0.0000	0.0001	1.576	0.00%	0.0006	<10%	yes	36.2
Summit Lake	Medicine Bow-Routt	Mount Zirkel	CO	40.5453	-106.6819	3146	48.0	0.0000	0.0001	1.523	0.00%	0.0006	<10%	yes	48.0
Deep Creek Lake	Gunnison	Raggeds	CO	39.0089	-107.2400	3359	20.6	0.0000	0.0001	0.836	0.00%	0.0007	<1(µeq/L)	yes	20.6
Island Lake	Arapaho and Roosevelt	Rawah	CO	40.6272	-105.9411	3392	71.0	0.0000	0.0003	1.204	0.00%	0.0023	<10%	yes	71.0
Kelly Lake	Arapaho and Roosevelt	Rawah	CO	40.6256	-105.9594	3293	179.9	0.0000	0.0003	1.204	0.00%	0.0023	<10%	yes	179.8
Rawah Lake #4	Arapaho and Roosevelt	Rawah	CO	40.6711	-105.9578	3497	41.3	0.0000	0.0003	1.246	0.01%	0.0024	<10%	yes	41.3
Crater Lake (Sangre Bel Cristo)	Rio Grande	Sangre Bel Cristo	CO	37.5756	-105.4951	3871	162.9	0.0000	0.0002	0.959	0.00%	0.0024	<10%	yes	162.9
Lower Stout Lake	San Isabel	Sangre Bel Cristo	CO	38.3528	-105.8892	3585	145.2	0.0000	0.0004	0.646	0.00%	0.0062	<10%	yes	145.2
Upper Little Sand Creek Lake	San Isabel	Sangre Bel Cristo	CO	37.9039	-105.5356	3773	129.5	0.0000	0.0002	0.803	0.00%	0.0032	<10%	yes	129.5
Upper Stout Lake	San Isabel	Sangre Bel Cristo	CO	38.3503	-105.8908	3609	76.3	0.0000	0.0004	0.646	0.01%	0.0062	<10%	yes	76.3
Glacier Lake (Colorado)	San Juan-Rio Grande	South San Juan	CO	37.2594	-106.5879	3639	63.4	0.0000	0.0000	1.071	0.00%	0.0005	<10%	yes	63.4
Lake South bf Blue Lakes	San Juan-Rio Grande	South San Juan	CO	37.2243	-106.6307	3615	16.9	0.0000	0.0001	1.084	0.00%	0.0005	<1(µeq/L)	yes	16.9
Big Eldorado Lake	San Juan-Rio Grande	Weminuche	CO	37.7133	-107.5433	3811	19.6	0.0000	0.0000	1.159	0.00%	0.0002	<1(µeq/L)	yes	19.6
Four Mile Pothole	San Juan-Rio Grande	Weminuche	CO	37.4684	-107.0525	---	123.4	0.0000	0.0000	0.902	0.00%	0.0005	<10%	yes	123.4
Lake Dues South bf Ute Lake	San Juan-Rio Grande	Weminuche	CO	37.6361	-107.4428	---	13.2	0.0000	0.0000	1.106	0.00%	0.0002	<1(µeq/L)	yes	13.2
Little Eldorado	San Juan-Rio Grande	Weminuche	CO	37.7133	-107.5458	3812	-3.3	0.0000	0.0000	1.159	0.01%	0.0002	<1(µeq/L)	yes	-3.3
Little Granite Lake	San Juan-Rio Grande	Weminuche	CO	37.6205	-107.3317	3304	80.7	0.0000	0.0000	1.034	0.00%	0.0004	<10%	yes	80.7
Lower Sunlight Lake	San Juan-Rio Grande	Weminuche	CO	37.6331	-107.5830	3668	80.9	0.0000	0.0000	1.136	0.00%	0.0002	<10%	yes	80.9
Middle Ute Lake	San Juan-Rio Grande	Weminuche	CO	37.6483	-107.4752	3644	42.8	0.0000	0.0000	1.110	0.00%	0.0002	<10%	yes	42.8
Small Pond Above Trout Lake	San Juan-Rio Grande	Weminuche	CO	37.6519	-107.1564	3562	25.5	0.0000	0.0000	1.027	0.00%	0.0004	<10%	yes	25.5
Upper Grizzly Lake	San Juan-Rio Grande	Weminuche	CO	37.6200	-107.5836	3993	29.9	0.0000	0.0000	1.199	0.00%	0.0002	<10%	yes	29.9
Upper Sunlight Lake	San Juan-Rio Grande	Weminuche	CO	37.6278	-107.5797	3824	28.0	0.0000	0.0000	1.199	0.00%	0.0002	<10%	yes	28.0
West Snowdon Lake	San Juan-Rio Grande	Weminuche	CO	37.7103	-107.6935	3652	39.4	0.0000	0.0000	0.914	0.00%	0.0002	<10%	yes	39.3
White Dome Lake	San Juan-Rio Grande	Weminuche	CO	37.7089	-107.5525	3822	2.1	0.0000	0.0000	1.159	0.01%	0.0002	<1(µeq/L)	yes	2.1
South Golden Lake	Grand Mesa, Uncompahgre and Gunnison	West Elk	CO	38.7776	-107.1828	3371	111.4	0.0000	0.0001	0.861	0.00%	0.0009	<10%	yes	111.4

Note that the thresholds shown are project-level thresholds. The comparisons shown above are for informational purposes only.

5.5.2 ANC Calculations for Combined BLM Planning Areas

The Attachment E-1, E-2 and E-3 spreadsheets also contain ANC calculations for the combined BLM Planning Area Source Groups P through X1 of new emission sources. Below we provide results for new Federal oil and gas development and mining within the 13 Colorado BLM Planning Areas (Source Group A2) and the Source Group A3 that represents new Federal and new non-Federal oil and gas development and mining within the 13 Colorado Planning Areas.

Table 5-36 displays the ANC results at the 58 sensitive lakes for the combined new Federal O&G and mining within the 13 Colorado BLM Planning Areas (Source Group A2) and the 2025 High, Low and Medium Development Scenarios. For all the lakes, the maximum percent change in ANC is always below the USFS LAC 10% threshold for all three 2025 emission scenarios.

The ANC results for new Federal and new non-Federal oil and gas development and mining within the 13 Colorado Planning Areas (Source Group A3) and the 2025 High, Low and Medium Emissions Scenario are shown in Tables 5-37 and 5-38. For the lakes that have base ANC values > 25 µeq/l the maximum percent change in ANC is always below the USFS LAC 10% threshold for all three 2025 emission scenarios. However, for the 3 lakes with base ANC < 25 µeq/l, three have changes in ANC greater than the 1 µeq/l USFS LAC threshold for the 2025 High Development Scenario (Table 5-37): Upper Ned Wilson Lake (1.1 µeq/l); Blue Lake (1.2 µeq/l) and Deep Creek Lake (3.4 µeq/l). The mitigation in the 2025 Medium Development scenario is not sufficient to reduce the change in ANC value at the three lakes to below the 1 µeq/l LAC threshold. Upper Ned Wilson (1.03 µeq/l), Blue Lake (1.2 µeq/l) and Deep Creek (3.3 µeq/l) remain above the LAC threshold (Table 5-38). For these same three lakes the change in ANC values are all below the 1 µeq/l USFS LAC threshold for the 2025 Low Development Scenario (Table 5-38).

Note that the USFS ANC LAC thresholds were developed for evaluating potential lake acidification for individual Projects, not for quasi-cumulative emission source groups of new O&G development across an entire state as in Source Groups A2 and A3. In addition, the USFS ANC LAC thresholds were developed for evaluating potential lake acidification for individual Projects (i.e. new emissions since baseline lake chemistry data was monitored), not for cumulative emissions scenarios that include all existing O&G since the baseline ANC values that are used in the ANC calculations would already account for impacts from existing emissions sources.

Table 5-36. ANC calculations at sensitive lakes for new Federal oil and gas development and mining within the 13 Colorado BLM Planning Areas (Source Group A2) and 2025 High Development Scenario.

Lake	National Forest	Wilderness Area	State	Latitude (Deg N)	Longitude (Deg W)	Elevation (m)	10th Percentile Lowest ANC Value (μeq/L)	Total S Dep (kg-S/ha-yr)	Total N Dep (kg-N/ha-yr)	PPT (m)	Delta ANC (%)*	Delta ANC (μeq/L)*	USFS LAC Threshold	Below Threshold?	2025 Hi Predicted 10th Percentile Lowest ANC Value (μeq/L)
Brooklyn Lake	White River	Collegiate Peaks	CO	39.0495	-106.6569	3737	101.7	0.0065	0.0965	1.162	0.92%	0.9371	<10%	yes	100.7
Tabor Lake	White River	Collegiate Peaks	CO	39.0628	-106.6564	3746	112.4	0.0031	0.0514	1.182	0.43%	0.4876	<10%	yes	111.9
Booth Lake	White River	Eagles Nest	CO	39.6986	-106.3050	3493	86.8	0.0030	0.0865	1.223	0.89%	0.7766	<10%	yes	86.0
Upper Willow Lake	White River	Eagles Nest	CO	39.6458	-106.1747	3469	134.1	0.0065	0.1153	1.143	0.84%	1.1287	<10%	yes	133.0
Ned Wilson Lake	White River	Flat Tops	CO	39.9614	-107.3239	3385	39.0	0.0057	0.0575	1.180	1.45%	0.5643	<10%	yes	38.4
Upper Ned Wilson Lake	White River	Flat Tops	CO	39.9628	-107.3236	3386	12.9	0.0057	0.0575	1.180	4.38%	0.5643	<1(μeq/L)	yes	12.3
Lower NWL Packtrail Pothole	White River	Flat Tops	CO	39.9682	-107.3241	3379	29.7	0.0057	0.0575	1.180	1.90%	0.5643	<10%	yes	29.1
Upper NWL Packtrail Pothole	White River	Flat Tops	CO	39.9656	-107.3238	3380	48.7	0.0057	0.0575	1.180	1.16%	0.5643	<10%	yes	48.1
Walk Up Lake	Ashley	--	UT	40.8110	-110.0383	---	55.2	0.0000	0.0000	1.011	0.00%	0.0000	<10%	yes	55.2
Bluebell Lake	Ashley	High Uintas	UT	40.6970	-110.4822	3322	55.5	0.0000	0.0000	0.943	0.00%	0.0000	<10%	yes	55.5
Dean Lake	Ashley	High Uintas	UT	40.6785	-110.7616	3275	48.9	0.0000	0.0000	1.024	0.00%	0.0000	<10%	yes	48.9
No Name (Utah, Duchesne - 4D2-039)	Ashley	High Uintas	UT	40.6710	-110.2758	3302	67.0	0.0000	0.0001	0.845	0.00%	0.0009	<10%	yes	67.0
Upper Coffin Lake	Ashley	High Uintas	UT	40.8342	-110.2383	3361	64.9	0.0000	0.0000	1.047	0.00%	0.0000	<10%	yes	64.8
Fish Lake	Wasatch-Cache	High Uintas	UT	40.8361	-110.0676	---	105.8	0.0000	0.0000	1.062	0.00%	0.0000	<10%	yes	105.8
Blodgett Lake, Colorado	White River	Holy Cross	CO	39.4062	-106.5352	3558	47.7	0.0068	0.1064	1.159	2.17%	1.0336	<10%	yes	46.6
Upper Turquoise Lake	White River	Holy Cross	CO	39.5098	-106.5332	3450	104.0	0.0092	0.1187	1.121	1.16%	1.2056	<10%	yes	102.8
Upper West Tennessee Lake	San Isabel	Holy Cross	CO	39.3445	-106.4250	3649	114.2	0.0091	0.1257	1.161	1.07%	1.2276	<10%	yes	113.0
Blue Lake (Colorado; Boulder - 4E1-040)	Arapaho and Roosevelt	Indian Peaks	CO	40.0876	-105.6169	3446	19.3	0.0039	0.0925	1.348	3.94%	0.7582	<1(μeq/L)	yes	18.5
Crater Lake	Arapaho and Roosevelt	Indian Peaks	CO	40.0755	-105.6639	3141	53.1	0.0021	0.0596	1.241	0.99%	0.5276	<10%	yes	52.6
King Lake (Colorado; Grand - 4E1-049)	Arapaho and Roosevelt	Indian Peaks	CO	39.9441	-105.6858	3486	52.3	0.0045	0.1139	1.237	1.94%	1.0156	<10%	yes	51.2
No Name Lake (Colorado; Boulder - 4E1-055)	Arapaho and Roosevelt	Indian Peaks	CO	40.0375	-105.6269	3422	25.6	0.0047	0.1098	1.449	3.27%	0.8383	<10%	yes	24.8
Upper Lake	Arapaho and Roosevelt	Indian Peaks	CO	40.1545	-105.6805	3271	69.0	0.0032	0.0703	1.225	0.92%	0.6363	<10%	yes	68.3
Small Lake Above U-Shaped Lake	Rio Grande	La Garita	CO	37.9436	-106.8639	3932	59.9	0.0000	0.0016	0.816	0.04%	0.0210	<10%	yes	59.9
U-Shaped Lake	Rio Grande	La Garita	CO	37.9422	-106.8606	3566	81.4	0.0000	0.0016	0.816	0.03%	0.0210	<10%	yes	81.3
Avalanche Lake	White River	Maroon Bells	CO	39.1439	-107.0998	3260	158.8	0.0027	0.0539	1.337	0.28%	0.4489	<10%	yes	158.4
Capitol Lake	White River	Maroon Bells	CO	39.1630	-107.0820	3530	154.4	0.0058	0.0932	1.434	0.47%	0.7305	<10%	yes	153.7
Moon Lake (Upper)	White River	Maroon Bells	CO	39.1644	-107.0589	3578	53.0	0.0058	0.0932	1.434	1.38%	0.7305	<10%	yes	52.2
Upper Middle Beartrack Lake	Arapaho and Roosevelt	Mount Evans	CO	39.5711	-105.6067	3542	50.9	0.0031	0.0658	1.018	1.41%	0.7179	<10%	yes	50.2
Abyss Lake	Pike and San Isabel	Mount Evans	CO	39.5858	-105.6592	3856	81.1	0.0039	0.0765	1.118	0.94%	0.7629	<10%	yes	80.3
Frozen Lake	Pike and San Isabel	Mount Evans	CO	39.5775	-105.6583	3944	93.3	0.0039	0.0765	1.118	0.82%	0.7629	<10%	yes	92.5
North Lake	Pike and San Isabel	Mount Evans	CO	39.5914	-105.6733	3420	80.9	0.0039	0.0765	1.118	0.94%	0.7629	<10%	yes	80.2
South Lake	Pike and San Isabel	Mount Evans	CO	39.5903	-105.6714	3432	66.7	0.0039	0.0765	1.118	1.14%	0.7629	<10%	yes	66.0
Lake Elbert	Medicine Bow-Routt	Mount Zirkel	CO	40.6342	-106.7069	3289	56.6	0.0176	0.1857	1.694	2.24%	1.2657	<10%	yes	55.3
Seven Lakes (LG East)	Medicine Bow-Routt	Mount Zirkel	CO	40.8958	-106.6819	3273	36.2	0.0170	0.1626	1.576	3.31%	1.2006	<10%	yes	35.0
Summit Lake	Medicine Bow-Routt	Mount Zirkel	CO	40.5453	-106.6819	3146	48.0	0.0186	0.1756	1.523	2.80%	1.3432	<10%	yes	46.7
Deep Creek Lake	Gunnison	Raggeds	CO	39.0089	-107.2400	3359	20.6	0.0042	0.0622	0.836	4.07%	0.8393	<1(μeq/L)	yes	19.8
Island Lake	Arapaho and Roosevelt	Rawah	CO	40.6272	-105.9411	3392	71.0	0.0056	0.0733	1.204	0.97%	0.6915	<10%	yes	70.3
Kelly Lake	Arapaho and Roosevelt	Rawah	CO	40.6256	-105.9594	3293	179.9	0.0056	0.0733	1.204	0.38%	0.6915	<10%	yes	179.2
Rawah Lake #4	Arapaho and Roosevelt	Rawah	CO	40.6711	-105.9578	3497	41.3	0.0064	0.0811	1.246	1.80%	0.7417	<10%	yes	40.5
Crater Lake (Sangre de Cristo)	Rio Grande	Sangre de Cristo	CO	37.5756	-105.4951	3871	162.9	0.0028	0.0407	0.959	0.29%	0.4790	<10%	yes	162.4
Lower Stout Lake	San Isabel	Sangre de Cristo	CO	38.3528	-105.8892	3585	145.2	0.0029	0.0387	0.646	0.47%	0.6804	<10%	yes	144.5
Upper Little Sand Creek Lake	San Isabel	Sangre de Cristo	CO	37.9039	-105.5356	3773	129.5	0.0026	0.0341	0.803	0.37%	0.4822	<10%	yes	129.0
Upper Stout Lake	San Isabel	Sangre de Cristo	CO	38.3503	-105.8908	3609	76.3	0.0029	0.0387	0.646	0.89%	0.6804	<10%	yes	75.7
Glacier Lake (Colorado)	San Juan-Rio Grande	South San Juan	CO	37.2594	-106.5879	3639	63.4	0.0002	0.0090	1.071	0.14%	0.0913	<10%	yes	63.3
Lake South of Blue Lakes	San Juan-Rio Grande	South San Juan	CO	37.2243	-106.6307	3615	16.9	0.0002	0.0091	1.084	0.54%	0.0913	<1(μeq/L)	yes	16.8
Big Eldorado Lake	San Juan-Rio Grande	Weminuche	CO	37.7133	-107.5433	3811	19.6	0.0003	0.0066	1.159	0.32%	0.0632	<1(μeq/L)	yes	19.6
Four Mile Pothole	San Juan-Rio Grande	Weminuche	CO	37.4684	-107.0525	---	123.4	0.0001	0.0033	0.902	0.03%	0.0397	<10%	yes	123.4
Lake Due South of Ute Lake	San Juan-Rio Grande	Weminuche	CO	37.6361	-107.4428	---	13.2	0.0002	0.0048	1.106	0.37%	0.0481	<1(μeq/L)	yes	13.1
Little Eldorado	San Juan-Rio Grande	Weminuche	CO	37.7133	-107.5458	3812	-3.3	0.0003	0.0066	1.159	1.92%	0.0632	<1(μeq/L)	yes	-3.4
Little Granite Lake	San Juan-Rio Grande	Weminuche	CO	37.6205	-107.3317	3304	80.7	0.0003	0.0056	1.034	0.08%	0.0608	<10%	yes	80.7
Lower Sunlight Lake	San Juan-Rio Grande	Weminuche	CO	37.6331	-107.5830	3668	80.9	0.0002	0.0057	1.136	0.07%	0.0555	<10%	yes	80.8
Middle Ute Lake	San Juan-Rio Grande	Weminuche	CO	37.6483	-107.4752	3644	42.8	0.0002	0.0041	1.110	0.10%	0.0408	<10%	yes	42.7
Small Pond Above Trout Lake	San Juan-Rio Grande	Weminuche	CO	37.6519	-107.1564	3562	25.5	0.0001	0.0022	1.027	0.09%	0.0238	<10%	yes	25.5
Upper Grizzly Lake	San Juan-Rio Grande	Weminuche	CO	37.6200	-107.5836	3993	29.9	0.0003	0.0071	1.199	0.22%	0.0649	<10%	yes	29.8
Upper Sunlight Lake	San Juan-Rio Grande	Weminuche	CO	37.6278	-107.5797	3824	28.0	0.0003	0.0071	1.199	0.23%	0.0649	<10%	yes	27.9
West Snowdon Lake	San Juan-Rio Grande	Weminuche	CO	37.7103	-107.6935	3652	39.4	0.0002	0.0030	0.914	0.09%	0.0370	<10%	yes	39.3
White Dome Lake	San Juan-Rio Grande	Weminuche	CO	37.7089	-107.5525	3822	2.1	0.0003	0.0066	1.159	3.07%	0.0632	<1(μeq/L)	yes	2.0
South Golden Lake	Grand Mesa, Uncompahgre and Gunnison	West Elk	CO	38.7776	-107.1828	3371	111.4	0.0022	0.0394	0.861	0.46%	0.5117	<10%	yes	110.9

Note that the thresholds shown are project-level thresholds. The comparisons shown above are for informational purposes only.

Table 5-36a. ANC calculations at sensitive lakes for new Federal oil and gas development and mining within the 13 Colorado BLM Planning Areas (Source Group A2) and 2025 Low Development Scenario.

Lake	National Forest	Wilderness Area	State	Latitude (Deg N)	Longitude (Deg W)	Elevation (m)	10th Percentile Lowest ANC Value (μeq/L)	Total S Dep (kg-S/ha-yr)	Total N Dep (kg-N/ha-yr)	PPT (m)	Delta ANC (%)*	Delta ANC (μeq/L)*	USFS LAC Threshold	Below Threshold?	2025 Hi Predicted 10th Percentile Lowest ANC Value (μeq/L)
Brooklyn Lake	White River	Collegiate Peaks	CO	39.0495	-106.6569	3737	101.7	0.0008	0.0207	1.162	0.19%	0.1966	<10%	yes	101.5
Tabor Lake	White River	Collegiate Peaks	CO	39.0628	-106.6564	3746	112.4	0.0004	0.0110	1.182	0.09%	0.1025	<10%	yes	112.3
Booth Lake	White River	Eagles Nest	CO	39.6986	-106.3050	3493	86.8	0.0004	0.0283	1.223	0.29%	0.2504	<10%	yes	86.5
Upper Willow Lake	White River	Eagles Nest	CO	39.6458	-106.1747	3469	134.1	0.0009	0.0376	1.143	0.27%	0.3579	<10%	yes	133.7
Ned Wilson Lake	White River	Flat Tops	CO	39.9614	-107.3239	3385	39.0	0.0008	0.0166	1.180	0.40%	0.1562	<10%	yes	38.8
Upper Ned Wilson Lake	White River	Flat Tops	CO	39.9628	-107.3236	3386	12.9	0.0008	0.0166	1.180	1.21%	0.1562	<1(μeq/L)	yes	12.7
Lower NWL Packtrail Pothole	White River	Flat Tops	CO	39.9682	-107.3241	3379	29.7	0.0008	0.0166	1.180	0.53%	0.1562	<10%	yes	29.5
Upper NWL Packtrail Pothole	White River	Flat Tops	CO	39.9656	-107.3238	3380	48.7	0.0008	0.0166	1.180	0.32%	0.1562	<10%	yes	48.5
Walk Up Lake	Ashley	--	UT	40.8110	-110.0383	---	55.2	0.0000	0.0000	1.011	0.00%	0.0000	<10%	yes	55.2
Bluebell Lake	Ashley	High Uintas	UT	40.6970	-110.4822	3322	55.5	0.0000	0.0000	0.943	0.00%	0.0000	<10%	yes	55.5
Dean Lake	Ashley	High Uintas	UT	40.6785	-110.7616	3275	48.9	0.0000	0.0000	1.024	0.00%	0.0000	<10%	yes	48.9
No Name (Utah, Duchesne - 4D2-039)	Ashley	High Uintas	UT	40.6710	-110.2758	3302	67.0	0.0000	0.0000	0.845	0.00%	0.0001	<10%	yes	67.0
Upper Coffin Lake	Ashley	High Uintas	UT	40.8342	-110.2383	3361	64.9	0.0000	0.0000	1.047	0.00%	0.0000	<10%	yes	64.8
Fish Lake	Wasatch-Cache	High Uintas	UT	40.8361	-110.0676	---	105.8	0.0000	0.0000	1.062	0.00%	0.0000	<10%	yes	105.8
Blodgett Lake, Colorado	White River	Holy Cross	CO	39.4062	-106.5352	3558	47.7	0.0009	0.0290	1.159	0.58%	0.2745	<10%	yes	47.4
Upper Turquoise Lake	White River	Holy Cross	CO	39.5098	-106.5332	3450	104.0	0.0012	0.0337	1.121	0.32%	0.3311	<10%	yes	103.7
Upper West Tennessee Lake	San Isabel	Holy Cross	CO	39.3445	-106.4250	3649	114.2	0.0012	0.0327	1.161	0.27%	0.3097	<10%	yes	113.9
Blue Lake (Colorado; Boulder - 4E1-040)	Arapaho and Roosevelt	Indian Peaks	CO	40.0876	-105.6169	3446	19.3	0.0007	0.0406	1.348	1.69%	0.3258	<1(μeq/L)	yes	18.9
Crater Lake	Arapaho and Roosevelt	Indian Peaks	CO	40.0755	-105.6639	3141	53.1	0.0004	0.0242	1.241	0.40%	0.2110	<10%	yes	52.9
King Lake (Colorado; Grand - 4E1-049)	Arapaho and Roosevelt	Indian Peaks	CO	39.9441	-105.6858	3486	52.3	0.0008	0.0501	1.237	0.84%	0.4373	<10%	yes	51.8
No Name Lake (Colorado; Boulder - 4E1-055)	Arapaho and Roosevelt	Indian Peaks	CO	40.0375	-105.6269	3422	25.6	0.0008	0.0494	1.449	1.44%	0.3692	<10%	yes	25.3
Upper Lake	Arapaho and Roosevelt	Indian Peaks	CO	40.1545	-105.6805	3271	69.0	0.0006	0.0308	1.225	0.39%	0.2721	<10%	yes	68.7
Small Lake Above U-Shaped Lake	Rio Grande	La Garita	CO	37.9436	-106.8639	3932	59.9	0.0000	0.0004	0.816	0.01%	0.0060	<10%	yes	59.9
U-Shaped Lake	Rio Grande	La Garita	CO	37.9422	-106.8606	3566	81.4	0.0000	0.0004	0.816	0.01%	0.0060	<10%	yes	81.4
Avalanche Lake	White River	Maroon Bells	CO	39.1439	-107.0998	3260	158.8	0.0003	0.0079	1.337	0.04%	0.0650	<10%	yes	158.7
Capitol Lake	White River	Maroon Bells	CO	39.1630	-107.0820	3530	154.4	0.0007	0.0149	1.434	0.07%	0.1151	<10%	yes	154.3
Moon Lake (Upper)	White River	Maroon Bells	CO	39.1644	-107.0589	3578	53.0	0.0007	0.0149	1.434	0.22%	0.1151	<10%	yes	52.9
Upper Middle Beartrack Lake	Arapaho and Roosevelt	Mount Evans	CO	39.5711	-105.6067	3542	50.9	0.0005	0.0236	1.018	0.49%	0.2511	<10%	yes	50.6
Abyss Lake	Pike and San Isabel	Mount Evans	CO	39.5858	-105.6592	3856	81.1	0.0006	0.0276	1.118	0.33%	0.2678	<10%	yes	80.8
Frozen Lake	Pike and San Isabel	Mount Evans	CO	39.5775	-105.6583	3944	93.3	0.0006	0.0276	1.118	0.29%	0.2678	<10%	yes	93.0
North Lake	Pike and San Isabel	Mount Evans	CO	39.5914	-105.6733	3420	80.9	0.0006	0.0276	1.118	0.33%	0.2678	<10%	yes	80.7
South Lake	Pike and San Isabel	Mount Evans	CO	39.5903	-105.6714	3432	66.7	0.0006	0.0276	1.118	0.40%	0.2678	<10%	yes	66.5
Lake Elbert	Medicine Bow-Routt	Mount Zirkel	CO	40.6342	-106.7069	3289	56.6	0.0027	0.0957	1.694	1.09%	0.6169	<10%	yes	56.0
Seven Lakes (LG East)	Medicine Bow-Routt	Mount Zirkel	CO	40.8958	-106.6819	3273	36.2	0.0027	0.0827	1.576	1.59%	0.5753	<10%	yes	35.7
Summit Lake	Medicine Bow-Routt	Mount Zirkel	CO	40.5453	-106.6819	3146	48.0	0.0031	0.0869	1.523	1.31%	0.6270	<10%	yes	47.4
Deep Creek Lake	Gunnison	Raggeds	CO	39.0089	-107.2400	3359	20.6	0.0005	0.0093	0.836	0.60%	0.1245	<1(μeq/L)	yes	20.5
Island Lake	Arapaho and Roosevelt	Rawah	CO	40.6272	-105.9411	3392	71.0	0.0009	0.0325	1.204	0.41%	0.2942	<10%	yes	70.7
Kelly Lake	Arapaho and Roosevelt	Rawah	CO	40.6256	-105.9594	3293	179.9	0.0009	0.0325	1.204	0.16%	0.2942	<10%	yes	179.6
Rawah Lake #4	Arapaho and Roosevelt	Rawah	CO	40.6711	-105.9578	3497	41.3	0.0010	0.0367	1.246	0.78%	0.3215	<10%	yes	41.0
Crater Lake (Sangre de Cristo)	Rio Grande	Sangre de Cristo	CO	37.5756	-105.4951	3871	162.9	0.0004	0.0067	0.959	0.05%	0.0780	<10%	yes	162.8
Lower Stout Lake	San Isabel	Sangre de Cristo	CO	38.3528	-105.8892	3585	145.2	0.0004	0.0062	0.646	0.07%	0.1073	<10%	yes	145.1
Upper Little Sand Creek Lake	San Isabel	Sangre de Cristo	CO	37.9039	-105.5356	3773	129.5	0.0003	0.0055	0.803	0.06%	0.0775	<10%	yes	129.4
Upper Stout Lake	San Isabel	Sangre de Cristo	CO	38.3503	-105.8908	3609	76.3	0.0004	0.0062	0.646	0.14%	0.1073	<10%	yes	76.2
Glacier Lake (Colorado)	San Juan-Rio Grande	South San Juan	CO	37.2594	-106.5879	3639	63.4	0.0000	0.0012	1.071	0.02%	0.0121	<10%	yes	63.4
Lake South of Blue Lakes	San Juan-Rio Grande	South San Juan	CO	37.2243	-106.6307	3615	16.9	0.0000	0.0011	1.084	0.07%	0.0113	<1(μeq/L)	yes	16.9
Big Eldorado Lake	San Juan-Rio Grande	Weminuche	CO	37.7133	-107.5433	3811	19.6	0.0001	0.0020	1.159	0.10%	0.0194	<1(μeq/L)	yes	19.6
Four Mile Pothole	San Juan-Rio Grande	Weminuche	CO	37.4684	-107.0525	---	123.4	0.0000	0.0006	0.902	0.01%	0.0072	<10%	yes	123.4
Lake Due South of Ute Lake	San Juan-Rio Grande	Weminuche	CO	37.6361	-107.4428	---	13.2	0.0001	0.0015	1.106	0.11%	0.0150	<1(μeq/L)	yes	13.1
Little Eldorado	San Juan-Rio Grande	Weminuche	CO	37.7133	-107.5458	3812	-3.3	0.0001	0.0020	1.159	0.59%	0.0194	<1(μeq/L)	yes	-3.3
Little Granite Lake	San Juan-Rio Grande	Weminuche	CO	37.6205	-107.3317	3304	80.7	0.0001	0.0016	1.034	0.02%	0.0178	<10%	yes	80.7
Lower Sunlight Lake	San Juan-Rio Grande	Weminuche	CO	37.6331	-107.5830	3668	80.9	0.0001	0.0017	1.136	0.02%	0.0170	<10%	yes	80.8
Middle Ute Lake	San Juan-Rio Grande	Weminuche	CO	37.6483	-107.4752	3644	42.8	0.0001	0.0013	1.110	0.03%	0.0132	<10%	yes	42.8
Small Pond Above Trout Lake	San Juan-Rio Grande	Weminuche	CO	37.6519	-107.1564	3562	25.5	0.0000	0.0006	1.027	0.03%	0.0066	<10%	yes	25.5
Upper Grizzly Lake	San Juan-Rio Grande	Weminuche	CO	37.6200	-107.5836	3993	29.9	0.0001	0.0021	1.199	0.07%	0.0199	<10%	yes	29.9
Upper Sunlight Lake	San Juan-Rio Grande	Weminuche	CO	37.6278	-107.5797	3824	28.0	0.0001	0.0021	1.199	0.07%	0.0199	<10%	yes	28.0
West Snowdon Lake	San Juan-Rio Grande	Weminuche	CO	37.7103	-107.6935	3652	39.4	0.0001	0.0010	0.914	0.03%	0.0120	<10%	yes	39.3
White Dome Lake	San Juan-Rio Grande	Weminuche	CO	37.7089	-107.5525	3822	2.1	0.0001	0.0020	1.159	0.94%	0.0194	<1(μeq/L)	yes	2.0
South Golden Lake	Grand Mesa, Uncompahgre and Gunnison	West Elk	CO	38.7776	-107.1828	3371	111.4	0.0003	0.0046	0.861	0.05%	0.0604	<10%	yes	111.3

Note that the thresholds shown are project-level thresholds. The comparisons shown above are for informational purposes only.

Table 5-36b. ANC calculations at sensitive lakes for new Federal oil and gas development and mining within the 13 Colorado BLM Planning Areas (Source Group A2) and 2025 Medium Development Scenario.

Lake	National Forest	Wilderness Area	State	Latitude (Deg N)	Longitude (Deg W)	Elevation (m)	10th Percentile Lowest ANC Value (μeq/L)	Total S Dep (kg-S/ha-yr)	Total N Dep (kg-N/ha-yr)	PPT (m)	Delta ANC (%)*	Delta ANC (μeq/L)*	USFS LAC Threshold	Below Threshold?	2025 Hi Predicted 10th Percentile Lowest ANC Value (μeq/L)
Brooklyn Lake	White River	Collegiate Peaks	CO	39.0495	-106.6569	3737	101.7	0.0065	0.0821	1.162	0.79%	0.8050	<10%	yes	100.9
Tabor Lake	White River	Collegiate Peaks	CO	39.0628	-106.6564	3746	112.4	0.0030	0.0435	1.182	0.37%	0.4157	<10%	yes	112.0
Booth Lake	White River	Eagles Nest	CO	39.6986	-106.3050	3493	86.8	0.0030	0.0743	1.223	0.77%	0.6701	<10%	yes	86.1
Upper Willow Lake	White River	Eagles Nest	CO	39.6458	-106.1747	3469	134.1	0.0064	0.1002	1.143	0.74%	0.9865	<10%	yes	133.1
Ned Wilson Lake	White River	Flat Tops	CO	39.9614	-107.3239	3385	39.0	0.0056	0.0501	1.180	1.27%	0.4972	<10%	yes	38.5
Upper Ned Wilson Lake	White River	Flat Tops	CO	39.9628	-107.3236	3386	12.9	0.0056	0.0501	1.180	3.86%	0.4972	<1(μeq/L)	yes	12.4
Lower NWL Packtrail Pothole	White River	Flat Tops	CO	39.9682	-107.3241	3379	29.7	0.0056	0.0501	1.180	1.68%	0.4972	<10%	yes	29.2
Upper NWL Packtrail Pothole	White River	Flat Tops	CO	39.9656	-107.3238	3380	48.7	0.0056	0.0501	1.180	1.02%	0.4972	<10%	yes	48.2
Walk Up Lake	Ashley	--	UT	40.8110	-110.0383	---	55.2	0.0000	0.0000	1.011	0.00%	0.0000	<10%	yes	55.2
Bluebell Lake	Ashley	High Uintas	UT	40.6970	-110.4822	3322	55.5	0.0000	0.0000	0.943	0.00%	0.0000	<10%	yes	55.5
Dean Lake	Ashley	High Uintas	UT	40.6785	-110.7616	3275	48.9	0.0000	0.0000	1.024	0.00%	0.0000	<10%	yes	48.9
No Name (Utah, Duchesne - 4D2-039)	Ashley	High Uintas	UT	40.6710	-110.2758	3302	67.0	0.0000	0.0001	0.845	0.00%	0.0008	<10%	yes	67.0
Upper Coffin Lake	Ashley	High Uintas	UT	40.8342	-110.2383	3361	64.9	0.0000	0.0000	1.047	0.00%	0.0000	<10%	yes	64.8
Fish Lake	Wasatch-Cache	High Uintas	UT	40.8361	-110.0676	---	105.8	0.0000	0.0000	1.062	0.00%	0.0000	<10%	yes	105.8
Blodgett Lake, Colorado	White River	Holy Cross	CO	39.4062	-106.5352	3558	47.7	0.0067	0.0913	1.159	1.88%	0.8944	<10%	yes	46.8
Upper Turquoise Lake	White River	Holy Cross	CO	39.5098	-106.5332	3450	104.0	0.0091	0.1022	1.121	1.01%	1.0482	<10%	yes	103.0
Upper West Tennessee Lake	San Isabel	Holy Cross	CO	39.3445	-106.4250	3649	114.2	0.0090	0.1082	1.161	0.93%	1.0657	<10%	yes	113.1
Blue Lake (Colorado; Boulder - 4E1-040)	Arapaho and Roosevelt	Indian Peaks	CO	40.0876	-105.6169	3446	19.3	0.0038	0.0822	1.348	3.51%	0.6761	<1(μeq/L)	yes	18.6
Crater Lake	Arapaho and Roosevelt	Indian Peaks	CO	40.0755	-105.6639	3141	53.1	0.0021	0.0525	1.241	0.88%	0.4664	<10%	yes	52.7
King Lake (Colorado; Grand - 4E1-049)	Arapaho and Roosevelt	Indian Peaks	CO	39.9441	-105.6858	3486	52.3	0.0044	0.1012	1.237	1.73%	0.9056	<10%	yes	51.4
No Name Lake (Colorado; Boulder - 4E1-055)	Arapaho and Roosevelt	Indian Peaks	CO	40.0375	-105.6269	3422	25.6	0.0047	0.0976	1.449	2.92%	0.7485	<10%	yes	24.9
Upper Lake	Arapaho and Roosevelt	Indian Peaks	CO	40.1545	-105.6805	3271	69.0	0.0032	0.0627	1.225	0.83%	0.5697	<10%	yes	68.4
Small Lake Above U-Shaped Lake	Rio Grande	La Garita	CO	37.9436	-106.8639	3932	59.9	0.0000	0.0014	0.816	0.03%	0.0191	<10%	yes	59.9
U-Shaped Lake	Rio Grande	La Garita	CO	37.9422	-106.8606	3566	81.4	0.0000	0.0014	0.816	0.02%	0.0191	<10%	yes	81.3
Avalanche Lake	White River	Maroon Bells	CO	39.1439	-107.0998	3260	158.8	0.0026	0.0442	1.337	0.23%	0.3712	<10%	yes	158.4
Capitol Lake	White River	Maroon Bells	CO	39.1630	-107.0820	3530	154.4	0.0057	0.0774	1.434	0.40%	0.6122	<10%	yes	153.8
Moon Lake (Upper)	White River	Maroon Bells	CO	39.1644	-107.0589	3578	53.0	0.0057	0.0774	1.434	1.16%	0.6122	<10%	yes	52.4
Upper Middle Beartrack Lake	Arapaho and Roosevelt	Mount Evans	CO	39.5711	-105.6067	3542	50.9	0.0030	0.0579	1.018	1.25%	0.6341	<10%	yes	50.3
Abyss Lake	Pike and San Isabel	Mount Evans	CO	39.5858	-105.6592	3856	81.1	0.0039	0.0674	1.118	0.83%	0.6757	<10%	yes	80.4
Frozen Lake	Pike and San Isabel	Mount Evans	CO	39.5775	-105.6583	3944	93.3	0.0039	0.0674	1.118	0.72%	0.6757	<10%	yes	92.6
North Lake	Pike and San Isabel	Mount Evans	CO	39.5914	-105.6733	3420	80.9	0.0039	0.0674	1.118	0.83%	0.6757	<10%	yes	80.3
South Lake	Pike and San Isabel	Mount Evans	CO	39.5903	-105.6714	3432	66.7	0.0039	0.0674	1.118	1.01%	0.6757	<10%	yes	66.1
Lake Elbert	Medicine Bow-Routt	Mount Zirkel	CO	40.6342	-106.7069	3289	56.6	0.0176	0.1707	1.694	2.07%	1.1707	<10%	yes	55.4
Seven Lakes (LG East)	Medicine Bow-Routt	Mount Zirkel	CO	40.8958	-106.6819	3273	36.2	0.0169	0.1494	1.576	3.06%	1.1104	<10%	yes	35.1
Summit Lake	Medicine Bow-Routt	Mount Zirkel	CO	40.5453	-106.6819	3146	48.0	0.0185	0.1600	1.523	2.57%	1.2338	<10%	yes	46.8
Deep Creek Lake	Gunnison	Raggeds	CO	39.0089	-107.2400	3359	20.6	0.0041	0.0506	0.836	3.36%	0.6912	<1(μeq/L)	yes	19.9
Island Lake	Arapaho and Roosevelt	Rawah	CO	40.6272	-105.9411	3392	71.0	0.0055	0.0660	1.204	0.88%	0.6270	<10%	yes	70.4
Kelly Lake	Arapaho and Roosevelt	Rawah	CO	40.6256	-105.9594	3293	179.9	0.0055	0.0660	1.204	0.35%	0.6270	<10%	yes	179.2
Rawah Lake #4	Arapaho and Roosevelt	Rawah	CO	40.6711	-105.9578	3497	41.3	0.0063	0.0731	1.246	1.63%	0.6729	<10%	yes	40.6
Crater Lake (Sangre de Cristo)	Rio Grande	Sangre de Cristo	CO	37.5756	-105.4951	3871	162.9	0.0027	0.0343	0.959	0.25%	0.4079	<10%	yes	162.5
Lower Stout Lake	San Isabel	Sangre de Cristo	CO	38.3528	-105.8892	3585	145.2	0.0028	0.0325	0.646	0.40%	0.5764	<10%	yes	144.6
Upper Little Sand Creek Lake	San Isabel	Sangre de Cristo	CO	37.9039	-105.5356	3773	129.5	0.0025	0.0286	0.803	0.32%	0.4094	<10%	yes	129.1
Upper Stout Lake	San Isabel	Sangre de Cristo	CO	38.3503	-105.8908	3609	76.3	0.0028	0.0325	0.646	0.76%	0.5764	<10%	yes	75.8
Glacier Lake (Colorado)	San Juan-Rio Grande	South San Juan	CO	37.2594	-106.5879	3639	63.4	0.0002	0.0061	1.071	0.10%	0.0625	<10%	yes	63.3
Lake South of Blue Lakes	San Juan-Rio Grande	South San Juan	CO	37.2243	-106.6307	3615	16.9	0.0002	0.0061	1.084	0.36%	0.0614	<1(μeq/L)	yes	16.8
Big Eldorado Lake	San Juan-Rio Grande	Weminuche	CO	37.7133	-107.5433	3811	19.6	0.0003	0.0060	1.159	0.30%	0.0580	<1(μeq/L)	yes	19.6
Four Mile Pothole	San Juan-Rio Grande	Weminuche	CO	37.4684	-107.0525	---	123.4	0.0001	0.0024	0.902	0.02%	0.0294	<10%	yes	123.4
Lake Due South of Ute Lake	San Juan-Rio Grande	Weminuche	CO	37.6361	-107.4428	---	13.2	0.0002	0.0044	1.106	0.34%	0.0442	<1(μeq/L)	yes	13.1
Little Eldorado	San Juan-Rio Grande	Weminuche	CO	37.7133	-107.5458	3812	-3.3	0.0003	0.0060	1.159	1.76%	0.0580	<1(μeq/L)	yes	-3.4
Little Granite Lake	San Juan-Rio Grande	Weminuche	CO	37.6205	-107.3317	3304	80.7	0.0003	0.0051	1.034	0.07%	0.0550	<10%	yes	80.7
Lower Sunlight Lake	San Juan-Rio Grande	Weminuche	CO	37.6331	-107.5830	3668	80.9	0.0002	0.0053	1.136	0.06%	0.0515	<10%	yes	80.8
Middle Ute Lake	San Juan-Rio Grande	Weminuche	CO	37.6483	-107.4752	3644	42.8	0.0002	0.0037	1.110	0.09%	0.0376	<10%	yes	42.7
Small Pond Above Trout Lake	San Juan-Rio Grande	Weminuche	CO	37.6519	-107.1564	3562	25.5	0.0001	0.0020	1.027	0.08%	0.0214	<10%	yes	25.5
Upper Grizzly Lake	San Juan-Rio Grande	Weminuche	CO	37.6200	-107.5836	3993	29.9	0.0003	0.0065	1.199	0.20%	0.0599	<10%	yes	29.8
Upper Sunlight Lake	San Juan-Rio Grande	Weminuche	CO	37.6278	-107.5797	3824	28.0	0.0003	0.0065	1.199	0.21%	0.0599	<10%	yes	27.9
West Snowdon Lake	San Juan-Rio Grande	Weminuche	CO	37.7103	-107.6935	3652	39.4	0.0001	0.0028	0.914	0.09%	0.0343	<10%	yes	39.3
White Dome Lake	San Juan-Rio Grande	Weminuche	CO	37.7089	-107.5525	3822	2.1	0.0003	0.0060	1.159	2.82%	0.0580	<1(μeq/L)	yes	2.0
South Golden Lake	Grand Mesa, Uncompahgre and Gunnison	West Elk	CO	38.7776	-107.1828	3371	111.4	0.0021	0.0320	0.861	0.38%	0.4195	<10%	yes	111.0

Note that the thresholds shown are project-level thresholds. The comparisons shown above are for informational purposes only.

Table 5-37. ANC calculations at sensitive lakes for new Federal and new non-Federal oil and gas development and mining within the 13 Colorado Planning Areas (Source Group A3) and the 2025 High Development Scenario.

Lake	National Forest	Wilderness Area	State	Latitude (Deg N)	Longitude (Deg W)	Elevation (m)	10th Percentile Lowest ANC Value (μeq/L)	Total S Dep (kg-S/ha-yr)	Total N Dep (kg-N/ha-yr)	PPT (m)	Delta ANC (%)*	Delta ANC (μeq/L)*	USFS LAC Threshold	Below Threshold?	2025 Hi Predicted 10th Percentile Lowest ANC Value (μeq/L)
Brooklyn Lake	White River	Collegiate Peaks	CO	39.0495	-106.6569	3737	101.7	0.0079	0.1838	1.162	1.72%	1.7489	<10%	yes	99.9
Tabor Lake	White River	Collegiate Peaks	CO	39.0628	-106.6564	3746	112.4	0.0037	0.1014	1.182	0.84%	0.9436	<10%	yes	111.5
Booth Lake	White River	Eagles Nest	CO	39.6986	-106.3050	3493	86.8	0.0040	0.1758	1.223	1.80%	1.5620	<10%	yes	85.2
Upper Willow Lake	White River	Eagles Nest	CO	39.6458	-106.1747	3469	134.1	0.0080	0.2148	1.143	1.54%	2.0691	<10%	yes	132.0
Ned Wilson Lake	White River	Flat Tops	CO	39.9614	-107.3239	3385	39.0	0.0076	0.1142	1.180	2.80%	1.0916	<10%	yes	37.9
Upper Ned Wilson Lake	White River	Flat Tops	CO	39.9628	-107.3236	3386	12.9	0.0076	0.1142	1.180	8.48%	1.0916	<1(μeq/L)	no	11.8
Lower NWL Packtrail Pothole	White River	Flat Tops	CO	39.9682	-107.3241	3379	29.7	0.0076	0.1142	1.180	3.68%	1.0916	<10%	yes	28.6
Upper NWL Packtrail Pothole	White River	Flat Tops	CO	39.9656	-107.3238	3380	48.7	0.0076	0.1142	1.180	2.24%	1.0916	<10%	yes	47.6
Walk Up Lake	Ashley	--	UT	40.8110	-110.0383	---	55.2	0.0000	0.0000	1.011	0.00%	0.0000	<10%	yes	55.2
Bluebell Lake	Ashley	High Uintas	UT	40.6970	-110.4822	3322	55.5	0.0000	0.0000	0.943	0.00%	0.0000	<10%	yes	55.5
Dean Lake	Ashley	High Uintas	UT	40.6785	-110.7616	3275	48.9	0.0000	0.0000	1.024	0.00%	0.0000	<10%	yes	48.9
No Name (Utah, Duchesne - 4D2-039)	Ashley	High Uintas	UT	40.6710	-110.2758	3302	67.0	0.0000	0.0001	0.845	0.00%	0.0012	<10%	yes	67.0
Upper Coffin Lake	Ashley	High Uintas	UT	40.8342	-110.2383	3361	64.9	0.0000	0.0000	1.047	0.00%	0.0000	<10%	yes	64.8
Fish Lake	Wasatch-Cache	High Uintas	UT	40.8361	-110.0676	---	105.8	0.0000	0.0000	1.062	0.00%	0.0000	<10%	yes	105.8
Blodgett Lake, Colorado	White River	Holy Cross	CO	39.4062	-106.5352	3558	47.7	0.0082	0.2071	1.159	4.14%	1.9723	<10%	yes	45.7
Upper Turquoise Lake	White River	Holy Cross	CO	39.5098	-106.5332	3450	104.0	0.0112	0.2254	1.121	2.15%	2.2373	<10%	yes	101.8
Upper West Tennessee Lake	San Isabel	Holy Cross	CO	39.3445	-106.4250	3649	114.2	0.0109	0.2333	1.161	1.95%	2.2298	<10%	yes	112.0
Blue Lake (Colorado; Boulder - 4E1-040)	Arapaho and Roosevelt	Indian Peaks	CO	40.0876	-105.6169	3446	19.3	0.0051	0.1531	1.348	6.47%	1.2461	<1(μeq/L)	no	18.0
Crater Lake	Arapaho and Roosevelt	Indian Peaks	CO	40.0755	-105.6639	3141	53.1	0.0030	0.1051	1.241	1.74%	0.9250	<10%	yes	52.2
King Lake (Colorado; Grand - 4E1-049)	Arapaho and Roosevelt	Indian Peaks	CO	39.9441	-105.6858	3486	52.3	0.0059	0.1918	1.237	3.25%	1.6976	<10%	yes	50.6
No Name Lake (Colorado; Boulder - 4E1-055)	Arapaho and Roosevelt	Indian Peaks	CO	40.0375	-105.6269	3422	25.6	0.0063	0.1824	1.449	5.40%	1.3823	<10%	yes	24.2
Upper Lake	Arapaho and Roosevelt	Indian Peaks	CO	40.1545	-105.6805	3271	69.0	0.0041	0.1130	1.225	1.47%	1.0153	<10%	yes	68.0
Small Lake Above U-Shaped Lake	Rio Grande	La Garita	CO	37.9436	-106.8639	3932	59.9	0.0001	0.0037	0.816	0.08%	0.0489	<10%	yes	59.9
U-Shaped Lake	Rio Grande	La Garita	CO	37.9422	-106.8606	3566	81.4	0.0001	0.0037	0.816	0.06%	0.0489	<10%	yes	81.3
Avalanche Lake	White River	Maroon Bells	CO	39.1439	-107.0998	3260	158.8	0.0036	0.1174	1.337	0.61%	0.9614	<10%	yes	157.8
Capitol Lake	White River	Maroon Bells	CO	39.1630	-107.0820	3530	154.4	0.0075	0.1970	1.434	0.98%	1.5135	<10%	yes	152.9
Moon Lake (Upper)	White River	Maroon Bells	CO	39.1644	-107.0589	3578	53.0	0.0075	0.1970	1.434	2.86%	1.5135	<10%	yes	51.5
Upper Middle Beartrack Lake	Arapaho and Roosevelt	Mount Evans	CO	39.5711	-105.6067	3542	50.9	0.0039	0.1209	1.018	2.56%	1.3026	<10%	yes	49.6
Abyss Lake	Pike and San Isabel	Mount Evans	CO	39.5858	-105.6592	3856	81.1	0.0049	0.1388	1.118	1.68%	1.3648	<10%	yes	79.7
Frozen Lake	Pike and San Isabel	Mount Evans	CO	39.5775	-105.6583	3944	93.3	0.0049	0.1388	1.118	1.46%	1.3648	<10%	yes	91.9
North Lake	Pike and San Isabel	Mount Evans	CO	39.5914	-105.6733	3420	80.9	0.0049	0.1388	1.118	1.69%	1.3648	<10%	yes	79.6
South Lake	Pike and San Isabel	Mount Evans	CO	39.5903	-105.6714	3432	66.7	0.0049	0.1388	1.118	2.04%	1.3648	<10%	yes	65.4
Lake Elbert	Medicine Bow-Routt	Mount Zirkel	CO	40.6342	-106.7069	3289	56.6	0.0205	0.2378	1.694	2.84%	1.6090	<10%	yes	55.0
Seven Lakes (LG East)	Medicine Bow-Routt	Mount Zirkel	CO	40.8958	-106.6819	3273	36.2	0.0196	0.2081	1.576	4.21%	1.5241	<10%	yes	34.7
Summit Lake	Medicine Bow-Routt	Mount Zirkel	CO	40.5453	-106.6819	3146	48.0	0.0219	0.2350	1.523	3.71%	1.7794	<10%	yes	46.2
Deep Creek Lake	Gunnison	Raggeds	CO	39.0089	-107.2400	3359	20.6	0.0072	0.2630	0.836	16.68%	3.4362	<1(μeq/L)	no	17.2
Island Lake	Arapaho and Roosevelt	Rawah	CO	40.6272	-105.9411	3392	71.0	0.0066	0.1005	1.204	1.32%	0.9405	<10%	yes	70.1
Kelly Lake	Arapaho and Roosevelt	Rawah	CO	40.6256	-105.9594	3293	179.9	0.0066	0.1005	1.204	0.52%	0.9405	<10%	yes	178.9
Rawah Lake #4	Arapaho and Roosevelt	Rawah	CO	40.6711	-105.9578	3497	41.3	0.0075	0.1105	1.246	2.43%	1.0026	<10%	yes	40.3
Crater Lake (Sangre de Cristo)	Rio Grande	Sangre de Cristo	CO	37.5756	-105.4951	3871	162.9	0.0036	0.0798	0.959	0.57%	0.9223	<10%	yes	162.0
Lower Stout Lake	San Isabel	Sangre de Cristo	CO	38.3528	-105.8892	3585	145.2	0.0037	0.0745	0.646	0.88%	1.2814	<10%	yes	143.9
Upper Little Sand Creek Lake	San Isabel	Sangre de Cristo	CO	37.9039	-105.5356	3773	129.5	0.0033	0.0656	0.803	0.70%	0.9097	<10%	yes	128.6
Upper Stout Lake	San Isabel	Sangre de Cristo	CO	38.3503	-105.8908	3609	76.3	0.0037	0.0745	0.646	1.68%	1.2814	<10%	yes	75.1
Glacier Lake (Colorado)	San Juan-Rio Grande	South San Juan	CO	37.2594	-106.5879	3639	63.4	0.0005	0.0425	1.071	0.67%	0.4279	<10%	yes	63.0
Lake South of Blue Lakes	San Juan-Rio Grande	South San Juan	CO	37.2243	-106.6307	3615	16.9	0.0006	0.0503	1.084	2.96%	0.4996	<1(μeq/L)	yes	16.4
Big Eldorado Lake	San Juan-Rio Grande	Weminuche	CO	37.7133	-107.5433	3811	19.6	0.0004	0.0149	1.159	0.71%	0.1397	<1(μeq/L)	yes	19.5
Four Mile Pothole	San Juan-Rio Grande	Weminuche	CO	37.4684	-107.0525	---	123.4	0.0001	0.0120	0.902	0.12%	0.1431	<10%	yes	123.2
Lake Due South of Ute Lake	San Juan-Rio Grande	Weminuche	CO	37.6361	-107.4428	---	13.2	0.0003	0.0106	1.106	0.80%	0.1046	<1(μeq/L)	yes	13.1
Little Eldorado	San Juan-Rio Grande	Weminuche	CO	37.7133	-107.5458	3812	-3.3	0.0004	0.0149	1.159	4.23%	0.1397	<1(μeq/L)	yes	-3.4
Little Granite Lake	San Juan-Rio Grande	Weminuche	CO	37.6205	-107.3317	3304	80.7	0.0004	0.0117	1.034	0.15%	0.1239	<10%	yes	80.6
Lower Sunlight Lake	San Juan-Rio Grande	Weminuche	CO	37.6331	-107.5830	3668	80.9	0.0003	0.0136	1.136	0.16%	0.1303	<10%	yes	80.7
Middle Ute Lake	San Juan-Rio Grande	Weminuche	CO	37.6483	-107.4752	3644	42.8	0.0002	0.0090	1.110	0.21%	0.0888	<10%	yes	42.7
Small Pond Above Trout Lake	San Juan-Rio Grande	Weminuche	CO	37.6519	-107.1564	3562	25.5	0.0001	0.0052	1.027	0.22%	0.0550	<10%	yes	25.4
Upper Grizzly Lake	San Juan-Rio Grande	Weminuche	CO	37.6200	-107.5836	3993	29.9	0.0003	0.0162	1.199	0.49%	0.1466	<10%	yes	29.7
Upper Sunlight Lake	San Juan-Rio Grande	Weminuche	CO	37.6278	-107.5797	3824	28.0	0.0003	0.0162	1.199	0.52%	0.1466	<10%	yes	27.9
West Snowdon Lake	San Juan-Rio Grande	Weminuche	CO	37.7103	-107.6935	3652	39.4	0.0002	0.0071	0.914	0.21%	0.0842	<10%	yes	39.3
White Dome Lake	San Juan-Rio Grande	Weminuche	CO	37.7089	-107.5525	3822	2.1	0.0004	0.0149	1.159	6.78%	0.1397	<1(μeq/L)	yes	1.9
South Golden Lake	Grand Mesa, Uncompahgre and Gunnison	West Elk	CO	38.7776	-107.1828	3371	111.4	0.0031	0.0779	0.861	0.90%	0.9988	<10%	yes	110.4

Note that the thresholds shown are project-level thresholds. The comparisons shown above are for informational purposes only.

Table 5-38. ANC calculations at sensitive lakes for new Federal and new non-Federal oil and gas development and mining within the 13 Colorado Planning Areas (Source Group A3) and the 2025 Low Development Scenario.

Lake	National Forest	Wilderness Area	State	Latitude (Deg N)	Longitude (Deg W)	Elevation (m)	10th Percentile Lowest ANC Value (µeq/L)	Total S Dep (kg-S/ha-yr)	Total N Dep (kg-N/ha-yr)	PPT (m)	Delta ANC (%)*	Delta ANC (µeq/L)*	USFS LAC Threshold	Below Threshold?	2025 Hi Predicted 10th Percentile Lowest ANC Value (µeq/L)
Brooklyn Lake	White River	Collegiate Peaks	CO	39.0495	-106.6569	3737	101.7	0.0011	0.0406	1.162	0.37%	0.3809	<10%	yes	101.3
Tabor Lake	White River	Collegiate Peaks	CO	39.0628	-106.6564	3746	112.4	0.0005	0.0223	1.182	0.18%	0.2047	<10%	yes	112.2
Booth Lake	White River	Eagles Nest	CO	39.6986	-106.3050	3493	86.8	0.0006	0.0542	1.223	0.55%	0.4776	<10%	yes	86.3
Upper Willow Lake	White River	Eagles Nest	CO	39.6458	-106.1747	3469	134.1	0.0013	0.0666	1.143	0.47%	0.6318	<10%	yes	133.5
Ned Wilson Lake	White River	Flat Tops	CO	39.9614	-107.3239	3385	39.0	0.0012	0.0343	1.180	0.82%	0.3201	<10%	yes	38.7
Upper Ned Wilson Lake	White River	Flat Tops	CO	39.9628	-107.3236	3386	12.9	0.0012	0.0343	1.180	2.49%	0.3201	<1(µeq/L)	yes	12.6
Lower NWL Packtrail Pothole	White River	Flat Tops	CO	39.9682	-107.3241	3379	29.7	0.0012	0.0343	1.180	1.08%	0.3201	<10%	yes	29.3
Upper NWL Packtrail Pothole	White River	Flat Tops	CO	39.9656	-107.3238	3380	48.7	0.0012	0.0343	1.180	0.66%	0.3201	<10%	yes	48.4
Walk Up Lake	Ashley	--	UT	40.8110	-110.0383	---	55.2	0.0000	0.0000	1.011	0.00%	0.0000	<10%	yes	55.2
Bluebell Lake	Ashley	High Uintas	UT	40.6970	-110.4822	3322	55.5	0.0000	0.0000	0.943	0.00%	0.0000	<10%	yes	55.5
Dean Lake	Ashley	High Uintas	UT	40.6785	-110.7616	3275	48.9	0.0000	0.0000	1.024	0.00%	0.0000	<10%	yes	48.9
No Name (Utah, Duchesne - 4D2-039)	Ashley	High Uintas	UT	40.6710	-110.2758	3302	67.0	0.0000	0.0000	0.845	0.00%	0.0002	<10%	yes	67.0
Upper Coffin Lake	Ashley	High Uintas	UT	40.8342	-110.2383	3361	64.9	0.0000	0.0000	1.047	0.00%	0.0000	<10%	yes	64.8
Fish Lake	Wasatch-Cache	High Uintas	UT	40.8361	-110.0676	---	105.8	0.0000	0.0000	1.062	0.00%	0.0000	<10%	yes	105.8
Blodgett Lake, Colorado	White River	Holy Cross	CO	39.4062	-106.5352	3558	47.7	0.0012	0.0570	1.159	1.12%	0.5348	<10%	yes	47.1
Upper Turquoise Lake	White River	Holy Cross	CO	39.5098	-106.5332	3450	104.0	0.0017	0.0644	1.121	0.60%	0.6269	<10%	yes	103.4
Upper West Tennessee Lake	San Isabel	Holy Cross	CO	39.3445	-106.4250	3649	114.2	0.0016	0.0618	1.161	0.51%	0.5806	<10%	yes	113.6
Blue Lake (Colorado; Boulder - 4E1-040)	Arapaho and Roosevelt	Indian Peaks	CO	40.0876	-105.6169	3446	19.3	0.0010	0.0573	1.348	2.39%	0.4594	<1(µeq/L)	yes	18.8
Crater Lake	Arapaho and Roosevelt	Indian Peaks	CO	40.0755	-105.6639	3141	53.1	0.0006	0.0369	1.241	0.60%	0.3212	<10%	yes	52.8
King Lake (Colorado; Grand - 4E1-049)	Arapaho and Roosevelt	Indian Peaks	CO	39.9441	-105.6858	3486	52.3	0.0011	0.0714	1.237	1.19%	0.6241	<10%	yes	51.6
No Name Lake (Colorado; Boulder - 4E1-055)	Arapaho and Roosevelt	Indian Peaks	CO	40.0375	-105.6269	3422	25.6	0.0012	0.0695	1.449	2.03%	0.5189	<10%	yes	25.1
Upper Lake	Arapaho and Roosevelt	Indian Peaks	CO	40.1545	-105.6805	3271	69.0	0.0008	0.0426	1.225	0.55%	0.3766	<10%	yes	68.6
Small Lake Above U-Shaped Lake	Rio Grande	La Garita	CO	37.9436	-106.8639	3932	59.9	0.0000	0.0014	0.816	0.03%	0.0180	<10%	yes	59.9
U-Shaped Lake	Rio Grande	La Garita	CO	37.9422	-106.8606	3566	81.4	0.0000	0.0014	0.816	0.02%	0.0180	<10%	yes	81.3
Avalanche Lake	White River	Maroon Bells	CO	39.1439	-107.0998	3260	158.8	0.0005	0.0176	1.337	0.09%	0.1437	<10%	yes	158.7
Capitol Lake	White River	Maroon Bells	CO	39.1630	-107.0820	3530	154.4	0.0010	0.0320	1.434	0.16%	0.2447	<10%	yes	154.2
Moon Lake (Upper)	White River	Maroon Bells	CO	39.1644	-107.0589	3578	53.0	0.0010	0.0320	1.434	0.46%	0.2447	<10%	yes	52.7
Upper Middle Beartrack Lake	Arapaho and Roosevelt	Mount Evans	CO	39.5711	-105.6067	3542	50.9	0.0007	0.0399	1.018	0.83%	0.4240	<10%	yes	50.5
Abyss Lake	Pike and San Isabel	Mount Evans	CO	39.5858	-105.6592	3856	81.1	0.0008	0.0460	1.118	0.55%	0.4450	<10%	yes	80.7
Frozen Lake	Pike and San Isabel	Mount Evans	CO	39.5775	-105.6583	3944	93.3	0.0008	0.0460	1.118	0.48%	0.4450	<10%	yes	92.8
North Lake	Pike and San Isabel	Mount Evans	CO	39.5914	-105.6733	3420	80.9	0.0008	0.0460	1.118	0.55%	0.4450	<10%	yes	80.5
South Lake	Pike and San Isabel	Mount Evans	CO	39.5903	-105.6714	3432	66.7	0.0008	0.0460	1.118	0.67%	0.4450	<10%	yes	66.3
Lake Elbert	Medicine Bow-Routt	Mount Zirkel	CO	40.6342	-106.7069	3289	56.6	0.0033	0.1085	1.694	1.24%	0.7005	<10%	yes	55.9
Seven Lakes (LG East)	Medicine Bow-Routt	Mount Zirkel	CO	40.8958	-106.6819	3273	36.2	0.0032	0.0933	1.576	1.79%	0.6504	<10%	yes	35.6
Summit Lake	Medicine Bow-Routt	Mount Zirkel	CO	40.5453	-106.6819	3146	48.0	0.0037	0.1015	1.523	1.53%	0.7332	<10%	yes	47.3
Deep Creek Lake	Gunnison	Raggeds	CO	39.0089	-107.2400	3359	20.6	0.0008	0.0264	0.836	1.68%	0.3460	<1(µeq/L)	yes	20.3
Island Lake	Arapaho and Roosevelt	Rawah	CO	40.6272	-105.9411	3392	71.0	0.0011	0.0397	1.204	0.51%	0.3598	<10%	yes	70.7
Kelly Lake	Arapaho and Roosevelt	Rawah	CO	40.6256	-105.9594	3293	179.9	0.0011	0.0397	1.204	0.20%	0.3598	<10%	yes	179.5
Rawah Lake #4	Arapaho and Roosevelt	Rawah	CO	40.6711	-105.9578	3497	41.3	0.0012	0.0444	1.246	0.94%	0.3894	<10%	yes	40.9
Crater Lake (Sangre de Cristo)	Rio Grande	Sangre de Cristo	CO	37.5756	-105.4951	3871	162.9	0.0006	0.0171	0.959	0.12%	0.1952	<10%	yes	162.7
Lower Stout Lake	San Isabel	Sangre de Cristo	CO	38.3528	-105.8892	3585	145.2	0.0005	0.0141	0.646	0.17%	0.2398	<10%	yes	145.0
Upper Little Sand Creek Lake	San Isabel	Sangre de Cristo	CO	37.9039	-105.5356	3773	129.5	0.0005	0.0132	0.803	0.14%	0.1811	<10%	yes	129.3
Upper Stout Lake	San Isabel	Sangre de Cristo	CO	38.3503	-105.8908	3609	76.3	0.0005	0.0141	0.646	0.31%	0.2398	<10%	yes	76.1
Glacier Lake (Colorado)	San Juan-Rio Grande	South San Juan	CO	37.2594	-106.5879	3639	63.4	0.0002	0.0178	1.071	0.28%	0.1784	<10%	yes	63.2
Lake South of Blue Lakes	San Juan-Rio Grande	South San Juan	CO	37.2243	-106.6307	3615	16.9	0.0002	0.0217	1.084	1.27%	0.2154	<1(µeq/L)	yes	16.7
Big Eldorado Lake	San Juan-Rio Grande	Weminuche	CO	37.7133	-107.5433	3811	19.6	0.0001	0.0056	1.159	0.27%	0.0525	<1(µeq/L)	yes	19.6
Four Mile Pothole	San Juan-Rio Grande	Weminuche	CO	37.4684	-107.0525	---	123.4	0.0001	0.0049	0.902	0.05%	0.0583	<10%	yes	123.3
Lake Due South of Ute Lake	San Juan-Rio Grande	Weminuche	CO	37.6361	-107.4428	---	13.2	0.0001	0.0040	1.106	0.30%	0.0393	<1(µeq/L)	yes	13.1
Little Eldorado	San Juan-Rio Grande	Weminuche	CO	37.7133	-107.5458	3812	-3.3	0.0001	0.0056	1.159	1.59%	0.0525	<1(µeq/L)	yes	-3.4
Little Granite Lake	San Juan-Rio Grande	Weminuche	CO	37.6205	-107.3317	3304	80.7	0.0001	0.0041	1.034	0.05%	0.0435	<10%	yes	80.7
Lower Sunlight Lake	San Juan-Rio Grande	Weminuche	CO	37.6331	-107.5830	3668	80.9	0.0001	0.0052	1.136	0.06%	0.0499	<10%	yes	80.8
Middle Ute Lake	San Juan-Rio Grande	Weminuche	CO	37.6483	-107.4752	3644	42.8	0.0001	0.0035	1.110	0.08%	0.0340	<10%	yes	42.7
Small Pond Above Trout Lake	San Juan-Rio Grande	Weminuche	CO	37.6519	-107.1564	3562	25.5	0.0000	0.0019	1.027	0.08%	0.0203	<10%	yes	25.5
Upper Grizzly Lake	San Juan-Rio Grande	Weminuche	CO	37.6200	-107.5836	3993	29.9	0.0001	0.0061	1.199	0.18%	0.0552	<10%	yes	29.8
Upper Sunlight Lake	San Juan-Rio Grande	Weminuche	CO	37.6278	-107.5797	3824	28.0	0.0001	0.0061	1.199	0.20%	0.0552	<10%	yes	27.9
West Snowdon Lake	San Juan-Rio Grande	Weminuche	CO	37.7103	-107.6935	3652	39.4	0.0001	0.0028	0.914	0.08%	0.0328	<10%	yes	39.3
White Dome Lake	San Juan-Rio Grande	Weminuche	CO	37.7089	-107.5525	3822	2.1	0.0001	0.0056	1.159	2.55%	0.0525	<1(µeq/L)	yes	2.0
South Golden Lake	Grand Mesa, Uncompahgre and Gunnison	West Elk	CO	38.7776	-107.1828	3371	111.4	0.0005	0.0128	0.861	0.15%	0.1640	<10%	yes	111.2

Note that the thresholds shown are project-level thresholds. The comparisons shown above are for informational purposes only.

Table 5-38a. ANC calculations at sensitive lakes for new Federal and new non-Federal oil and gas development and mining within the 13 Colorado Planning Areas (Source Group A3) and the 2025 Medium Development Scenario.

Lake	National Forest	Wilderness Area	State	Latitude (Deg N)	Longitude (Deg W)	Elevation (m)	10th Percentile Lowest ANC Value (μeq/L)	Total S Dep (kg-S/ha-yr)	Total N Dep (kg-N/ha-yr)	PPT (m)	Delta ANC (%)*	Delta ANC (μeq/L)*	USFS LAC Threshold	Below Threshold?	2025 Hi Predicted 10th Percentile Lowest ANC Value (μeq/L)
Brooklyn Lake	White River	Collegiate Peaks	CO	39.0495	-106.6569	3737	101.7	0.0079	0.1694	1.162	1.59%	1.6170	<10%	yes	100.1
Tabor Lake	White River	Collegiate Peaks	CO	39.0628	-106.6564	3746	112.4	0.0037	0.0935	1.182	0.78%	0.8726	<10%	yes	111.5
Booth Lake	White River	Eagles Nest	CO	39.6986	-106.3050	3493	86.8	0.0039	0.1638	1.223	1.68%	1.4569	<10%	yes	85.3
Upper Willow Lake	White River	Eagles Nest	CO	39.6458	-106.1747	3469	134.1	0.0080	0.1996	1.143	1.44%	1.9268	<10%	yes	132.2
Ned Wilson Lake	White River	Flat Tops	CO	39.9614	-107.3239	3385	39.0	0.0075	0.1073	1.180	2.64%	1.0292	<10%	yes	38.0
Upper Ned Wilson Lake	White River	Flat Tops	CO	39.9628	-107.3236	3386	12.9	0.0075	0.1073	1.180	7.99%	1.0292	<1(μeq/L)	no	11.9
Lower NWL Packtrail Pothole	White River	Flat Tops	CO	39.9682	-107.3241	3379	29.7	0.0075	0.1073	1.180	3.47%	1.0292	<10%	yes	28.6
Upper NWL Packtrail Pothole	White River	Flat Tops	CO	39.9656	-107.3238	3380	48.7	0.0075	0.1073	1.180	2.11%	1.0292	<10%	yes	47.7
Walk Up Lake	Ashley	--	UT	40.8110	-110.0383	---	55.2	0.0000	0.0000	1.011	0.00%	0.0000	<10%	yes	55.2
Bluebell Lake	Ashley	High Uintas	UT	40.6970	-110.4822	3322	55.5	0.0000	0.0000	0.943	0.00%	0.0000	<10%	yes	55.5
Dean Lake	Ashley	High Uintas	UT	40.6785	-110.7616	3275	48.9	0.0000	0.0000	1.024	0.00%	0.0000	<10%	yes	48.9
No Name (Utah, Duchesne - 4D2-039)	Ashley	High Uintas	UT	40.6710	-110.2758	3302	67.0	0.0000	0.0001	0.845	0.00%	0.0011	<10%	yes	67.0
Upper Coffin Lake	Ashley	High Uintas	UT	40.8342	-110.2383	3361	64.9	0.0000	0.0000	1.047	0.00%	0.0000	<10%	yes	64.8
Fish Lake	Wasatch-Cache	High Uintas	UT	40.8361	-110.0676	---	105.8	0.0000	0.0000	1.062	0.00%	0.0000	<10%	yes	105.8
Blodgett Lake, Colorado	White River	Holy Cross	CO	39.4062	-106.5352	3558	47.7	0.0082	0.1923	1.159	3.85%	1.8353	<10%	yes	45.8
Upper Turquoise Lake	White River	Holy Cross	CO	39.5098	-106.5332	3450	104.0	0.0111	0.2091	1.121	2.00%	2.0813	<10%	yes	101.9
Upper West Tennessee Lake	San Isabel	Holy Cross	CO	39.3445	-106.4250	3649	114.2	0.0108	0.2158	1.161	1.81%	2.0685	<10%	yes	112.1
Blue Lake (Colorado; Boulder - 4E1-040)	Arapaho and Roosevelt	Indian Peaks	CO	40.0876	-105.6169	3446	19.3	0.0051	0.1427	1.348	6.04%	1.1634	<1(μeq/L)	no	18.1
Crater Lake	Arapaho and Roosevelt	Indian Peaks	CO	40.0755	-105.6639	3141	53.1	0.0029	0.0979	1.241	1.62%	0.8634	<10%	yes	52.3
King Lake (Colorado; Grand - 4E1-049)	Arapaho and Roosevelt	Indian Peaks	CO	39.9441	-105.6858	3486	52.3	0.0059	0.1789	1.237	3.04%	1.5862	<10%	yes	50.7
No Name Lake (Colorado; Boulder - 4E1-055)	Arapaho and Roosevelt	Indian Peaks	CO	40.0375	-105.6269	3422	25.6	0.0062	0.1701	1.449	5.04%	1.2918	<10%	yes	24.3
Upper Lake	Arapaho and Roosevelt	Indian Peaks	CO	40.1545	-105.6805	3271	69.0	0.0041	0.1054	1.225	1.38%	0.9488	<10%	yes	68.0
Small Lake Above U-Shaped Lake	Rio Grande	La Garita	CO	37.9436	-106.8639	3932	59.9	0.0001	0.0035	0.816	0.08%	0.0470	<10%	yes	59.9
U-Shaped Lake	Rio Grande	La Garita	CO	37.9422	-106.8606	3566	81.4	0.0001	0.0035	0.816	0.06%	0.0470	<10%	yes	81.3
Avalanche Lake	White River	Maroon Bells	CO	39.1439	-107.0998	3260	158.8	0.0035	0.1081	1.337	0.56%	0.8870	<10%	yes	157.9
Capitol Lake	White River	Maroon Bells	CO	39.1630	-107.0820	3530	154.4	0.0074	0.1815	1.434	0.91%	1.3974	<10%	yes	153.0
Moon Lake (Upper)	White River	Maroon Bells	CO	39.1644	-107.0589	3578	53.0	0.0074	0.1815	1.434	2.64%	1.3974	<10%	yes	51.6
Upper Middle Beartrack Lake	Arapaho and Roosevelt	Mount Evans	CO	39.5711	-105.6067	3542	50.9	0.0038	0.1130	1.018	2.40%	1.2194	<10%	yes	49.7
Abyss Lake	Pike and San Isabel	Mount Evans	CO	39.5858	-105.6592	3856	81.1	0.0049	0.1297	1.118	1.58%	1.2778	<10%	yes	79.8
Frozen Lake	Pike and San Isabel	Mount Evans	CO	39.5775	-105.6583	3944	93.3	0.0049	0.1297	1.118	1.37%	1.2778	<10%	yes	92.0
North Lake	Pike and San Isabel	Mount Evans	CO	39.5914	-105.6733	3420	80.9	0.0049	0.1297	1.118	1.58%	1.2778	<10%	yes	79.7
South Lake	Pike and San Isabel	Mount Evans	CO	39.5903	-105.6714	3432	66.7	0.0049	0.1297	1.118	1.91%	1.2778	<10%	yes	65.5
Lake Elbert	Medicine Bow-Routt	Mount Zirkel	CO	40.6342	-106.7069	3289	56.6	0.0205	0.2228	1.694	2.68%	1.5146	<10%	yes	55.1
Seven Lakes (LG East)	Medicine Bow-Routt	Mount Zirkel	CO	40.8958	-106.6819	3273	36.2	0.0195	0.1949	1.576	3.96%	1.4341	<10%	yes	34.8
Summit Lake	Medicine Bow-Routt	Mount Zirkel	CO	40.5453	-106.6819	3146	48.0	0.0218	0.2195	1.523	3.48%	1.6705	<10%	yes	46.3
Deep Creek Lake	Gunnison	Raggeds	CO	39.0089	-107.2400	3359	20.6	0.0072	0.2505	0.836	15.90%	3.2763	<1(μeq/L)	no	17.3
Island Lake	Arapaho and Roosevelt	Rawah	CO	40.6272	-105.9411	3392	71.0	0.0065	0.0933	1.204	1.23%	0.8770	<10%	yes	70.1
Kelly Lake	Arapaho and Roosevelt	Rawah	CO	40.6256	-105.9594	3293	179.9	0.0065	0.0933	1.204	0.49%	0.8770	<10%	yes	179.0
Rawah Lake #4	Arapaho and Roosevelt	Rawah	CO	40.6711	-105.9578	3497	41.3	0.0075	0.1026	1.246	2.26%	0.9347	<10%	yes	40.4
Crater Lake (Sangre de Cristo)	Rio Grande	Sangre de Cristo	CO	37.5756	-105.4951	3871	162.9	0.0036	0.0729	0.959	0.52%	0.8450	<10%	yes	162.1
Lower Stout Lake	San Isabel	Sangre de Cristo	CO	38.3528	-105.8892	3585	145.2	0.0036	0.0680	0.646	0.81%	1.1744	<10%	yes	144.0
Upper Little Sand Creek Lake	San Isabel	Sangre de Cristo	CO	37.9039	-105.5356	3773	129.5	0.0033	0.0600	0.803	0.64%	0.8352	<10%	yes	128.7
Upper Stout Lake	San Isabel	Sangre de Cristo	CO	38.3503	-105.8908	3609	76.3	0.0036	0.0680	0.646	1.54%	1.1744	<10%	yes	75.2
Glacier Lake (Colorado)	San Juan-Rio Grande	South San Juan	CO	37.2594	-106.5879	3639	63.4	0.0004	0.0268	1.071	0.43%	0.2701	<10%	yes	63.1
Lake South of Blue Lakes	San Juan-Rio Grande	South San Juan	CO	37.2243	-106.6307	3615	16.9	0.0004	0.0305	1.084	1.79%	0.3032	<1(μeq/L)	yes	16.6
Big Eldorado Lake	San Juan-Rio Grande	Weminuche	CO	37.7133	-107.5433	3811	19.6	0.0004	0.0143	1.159	0.68%	0.1345	<1(μeq/L)	yes	19.5
Four Mile Pothole	San Juan-Rio Grande	Weminuche	CO	37.4684	-107.0525	---	123.4	0.0001	0.0086	0.902	0.08%	0.1029	<10%	yes	123.3
Lake Due South of Ute Lake	San Juan-Rio Grande	Weminuche	CO	37.6361	-107.4428	---	13.2	0.0003	0.0102	1.106	0.76%	0.1006	<1(μeq/L)	yes	13.1
Little Eldorado	San Juan-Rio Grande	Weminuche	CO	37.7133	-107.5458	3812	-3.3	0.0004	0.0143	1.159	4.08%	0.1345	<1(μeq/L)	yes	-3.4
Little Granite Lake	San Juan-Rio Grande	Weminuche	CO	37.6205	-107.3317	3304	80.7	0.0004	0.0111	1.034	0.15%	0.1178	<10%	yes	80.6
Lower Sunlight Lake	San Juan-Rio Grande	Weminuche	CO	37.6331	-107.5830	3668	80.9	0.0003	0.0132	1.136	0.16%	0.1261	<10%	yes	80.7
Middle Ute Lake	San Juan-Rio Grande	Weminuche	CO	37.6483	-107.4752	3644	42.8	0.0002	0.0087	1.110	0.20%	0.0855	<10%	yes	42.7
Small Pond Above Trout Lake	San Juan-Rio Grande	Weminuche	CO	37.6519	-107.1564	3562	25.5	0.0001	0.0048	1.027	0.20%	0.0511	<10%	yes	25.4
Upper Grizzly Lake	San Juan-Rio Grande	Weminuche	CO	37.6200	-107.5836	3993	29.9	0.0003	0.0156	1.199	0.47%	0.1413	<10%	yes	29.7
Upper Sunlight Lake	San Juan-Rio Grande	Weminuche	CO	37.6278	-107.5797	3824	28.0	0.0003	0.0156	1.199	0.50%	0.1413	<10%	yes	27.9
West Snowdon Lake	San Juan-Rio Grande	Weminuche	CO	37.7103	-107.6935	3652	39.4	0.0002	0.0068	0.914	0.21%	0.0815	<10%	yes	39.3
White Dome Lake	San Juan-Rio Grande	Weminuche	CO	37.7089	-107.5525	3822	2.1	0.0004	0.0143	1.159	6.53%	0.1345	<1(μeq/L)	yes	1.9
South Golden Lake	Grand Mesa, Uncompahgre and Gunnison	West Elk	CO	38.7776	-107.1828	3371	111.4	0.0031	0.0703	0.861	0.81%	0.9039	<10%	yes	110.5

Note that the thresholds shown are project-level thresholds. The comparisons shown above are for informational purposes only.

5.6 2025 NAAQS Comparisons

In this section we compare the CAMx 2025 High, Low and Medium Development Scenario modeling results with the National Ambient Air Quality Standard (NAAQS). For the ozone NAAQS analysis, the results are analyzed using both the absolute CAMx 2025 modeling results as well as using the CAMx 2011 and 2025 modeling results in a relative fashion to scale the observed DVB to project future year 2025 DVF as recommended by EPA (2007) and described in Section 4.5.

5.6.1 Ozone NAAQS Analysis using Relative Modeling Results

EPA's Model Attainment Test Software (MATS) was used to make future year ozone DVF projections using the CAMx 2011 Base Case and 2025 High and Low Development Scenario modeling results. MATS was also used to make ozone DVF projections for the 2025 High and Low Development Scenario removing the contributions of six of the combined Source Groups X, A1, A2, A3, A4, and X1. MATS was used to make 2025 ozone DVF projections at the monitoring sites as well as throughout the CARMMS modeling domain using the MATS Unmonitored Area Analysis (UAA) procedures.

5.6.1.1 Ozone Design Value Projections at Monitoring Sites

The results of the 2025 ozone DVF projections at the monitoring sites are given in Attachments F-1, F-2 and F-3 and shown in Table 5-39. The maximum DVB (based on 2009-2013 observations) is 80.7 ppb at the CO_Douglas_0004 monitor in Douglas, CO, which is projected to be reduced to 74.5, 73.5 and 74.4 ppb for the 2025 High, Low and Medium Development Scenarios, respectively. There are 26 (out of 55) monitoring sites in the CARMMS 12/4 km domain with DVB above the ozone NAAQS (i.e., DVB ≥ 71 ppb). We note that 71 ppb is used for comparison rather than 70 ppb because EPA recommends rounding 8-hr ozone design values to the tenths digit until the last step in the MATS calculation when the final base or future design value is truncated to the nearest ppb. We also note that the ozone NAAQS is based on a 3-year average while the DVB is based on a 5-year observational period. Because DVBs are available here from the MATS analysis, they are compared to the NAAQS as they provide a measure of the severity of ozone concentrations in the base time period (here 2009-2013). The number of sites with DVF above the NAAQS is reduced to8, 6, and 8 in the 2025 High, Low, and Medium emission scenarios, respectively. Removing the contributions due to new O&G (Source Group X) or new O&G and mining (Source Group A2) on Federal lands within the 13 Colorado BLM Planning Areas reduces the 2025 DVF at Douglas, CO to 73.9(or 73.8), 73.4(or 73.3) and 73.9(or 73.9) ppb for the High, Low and Medium Development Scenarios, respectively; all these values are still above the ozone NAAQS (71.0 ppb or higher). When emissions from new non-Federal O&G within the 13 Colorado Planning Areas are also removed (Source Group A3), the projected 2025 DVFs at Douglas, CO are 72.1, 72.6 and 72.2 ppb for the High, Low and Medium Development Scenarios, all still above the NAAQS. The maximum reduction in 2025 DVFs due to the removal of Source Group X at any monitor is 3.0 ppb at Garfield, CO (CO_Garfield_0012) in the High Development Scenario. The corresponding maximum reductions by removing Source Group X in the Low and Medium Scenarios are 1.2 and 2.6 ppb, respectively. The maximum reduction in 2025 DVF due to the removal of Source Group X, X1, A2, A3 in the High Development Scenario are, respectively, 3.3, 2.2, 3.4, and 7.2 ppb at the Garfield

(CO_Garfield_0012) monitoring site. Compared to the results with Source Group X, removing X1 (equivalent to X but with Brute-Force approach) shows slightly less reduction of DVF.

Table 5-39. Current year ozone Base Design Values (DVB) and projected 2025 future year ozone Design Values (DVF) for the 2025 High Development Scenario and without Source Group X, X1, A1, A2, A3 and A4.

CID	Name	Lat	Long	State	County	DVB	DVF							Contribution from					
							2025 High	2025 High w/o X	2025 High w/o X1	2025 High w/o A1	2025 High w/o A2	2025 High w/o A3	2025 High w/o A4	Group X	Group X1	Group A1	Group A2	Group A3	Group A4
040170119	AZ_Navajo_0119	34.82251	-109.89249	Arizona	Navajo	68.7	65.0	64.9	64.9	64.9	64.9	64.9	64.9	0.0	0.0	0.0	0.0	0.0	0.0
080013001	CO_Adams_3001	39.838119	-104.94984	Colorado	Adams	73.5	69.9	69.5	69.7	67.3	69.5	67.3	69.0	0.4	0.2	2.6	0.4	2.6	0.9
080050002	CO_Arapahoe_0002	39.567887	-104.957193	Colorado	Arapahoe	76.7	71.7	71.3	71.4	69.7	71.2	69.6	70.9	0.5	0.3	2.1	0.5	2.1	0.9
080050006	CO_Arapahoe_0006	39.638522	-104.569335	Colorado	Arapahoe	72.7	66.5	66.2	66.3	65.1	66.2	65.0	66.0	0.3	0.2	1.4	0.3	1.5	0.5
080130011	CO_Boulder_0011	39.957212	-105.238458	Colorado	Boulder	74.7	69.7	69.3	69.4	66.7	69.3	66.7	68.8	0.4	0.2	2.9	0.4	3.0	0.8
080310014	CO_Denver_0014	39.751761	-105.030681	Colorado	Denver	71.0	69.0	68.6	68.7	66.5	68.5	66.5	68.1	0.4	0.3	2.5	0.5	2.6	0.9
080310025	CO_Denver_0025	39.704005	-104.998113	Colorado	Denver	65.0	63.5	63.1	63.3	61.4	63.1	61.4	62.8	0.4	0.2	2.1	0.4	2.2	0.7
080350004	CO_Douglas_0004	39.534488	-105.070358	Colorado	Douglas	80.7	74.5	73.9	74.1	72.2	73.8	72.1	73.6	0.6	0.4	2.3	0.6	2.3	0.9
080410013	CO_El Paso_0013	38.958341	-104.817215	Colorado	El Paso	71.0	65.3	65.1	65.2	64.7	65.1	64.7	63.2	0.2	0.2	0.7	0.2	0.7	2.2
080410016	CO_El Paso_0016	38.853097	-104.901289	Colorado	El Paso	72.7	67.1	66.8	66.9	66.1	66.7	66.0	65.0	0.3	0.2	1.0	0.4	1.1	2.1
080450012	CO_Garfield_0012	39.54182	-107.784125	Colorado	Garfield	65.0	63.8	60.5	61.6	56.6	60.5	56.6	63.5	3.3	2.2	7.2	3.4	7.2	0.3
080590002	CO_Jefferson_0002	39.800333	-105.099973	Colorado	Jefferson	74.0	71.2	70.8	70.9	68.5	70.8	68.5	70.3	0.4	0.2	2.6	0.4	2.7	0.9
080590005	CO_Jefferson_0005	39.638781	-105.13948	Colorado	Jefferson	75.7	70.3	69.8	70.0	67.9	69.7	67.9	69.3	0.5	0.3	2.4	0.6	2.5	1.0
080590006	CO_Jefferson_0006	39.912799	-105.188587	Colorado	Jefferson	80.3	75.3	74.9	75.0	72.0	74.8	72.0	74.4	0.4	0.3	3.3	0.5	3.3	0.9
080590011	CO_Jefferson_0011	39.743724	-105.177989	Colorado	Jefferson	78.7	73.8	73.3	73.5	71.2	73.2	71.2	72.6	0.5	0.3	2.6	0.6	2.7	1.2
080590013	CO_Jefferson_0013	39.541515	-105.29841	Colorado	Jefferson	74.5	67.7	67.2	67.3	65.6	67.1	65.5	66.7	0.5	0.3	2.1	0.6	2.2	0.9
080671004	CO_La Plata_1004	37.30389	-107.484167	Colorado	La Plata	72.7	70.0	69.9	70.0	69.3	69.9	69.3	69.8	0.1	0.0	0.7	0.1	0.7	0.2
080677001	CO_La Plata_7001	37.13678	-107.62863	Colorado	La Plata	68.7	65.1	65.0	65.0	64.0	65.0	64.0	64.8	0.0	0.0	1.1	0.0	1.1	0.3
080690007	CO_Larimer_0007	40.27813	-105.54564	Colorado	Larimer	75.7	70.2	69.8	69.9	67.1	69.8	67.1	69.5	0.4	0.2	3.1	0.4	3.1	0.7
080690011	CO_Larimer_0011	40.592543	-105.141122	Colorado	Larimer	78.0	75.2	74.8	74.9	70.2	74.7	70.1	74.4	0.4	0.2	5.0	0.4	5.1	0.7
080690012	CO_Larimer_0012	40.642103	-105.275029	Colorado	Larimer	71.0	67.7	67.3	67.5	63.5	67.3	63.5	67.0	0.3	0.2	4.2	0.4	4.2	0.7
080691004	CO_Larimer_1004	40.57747	-105.07892	Colorado	Larimer	68.7	66.5	66.1	66.3	62.0	66.1	62.0	65.8	0.3	0.2	4.4	0.4	4.5	0.7
080770020	CO_Mesa_0020	39.130575	-108.313835	Colorado	Mesa	67.0	64.8	63.7	64.2	62.6	63.6	62.5	64.6	1.1	0.6	2.2	1.1	2.3	0.1
080830006	CO_Montezuma_0006	37.350054	-108.592334	Colorado	Montezuma	67.3	64.4	64.4	64.4	64.1	64.4	64.1	63.7	0.1	0.0	0.4	0.1	0.4	0.8
080830101	CO_Montezuma_0101	37.1984	-108.49046	Colorado	Montezuma	68.3	65.3	65.2	65.3	64.7	65.2	64.7	64.6	0.1	0.1	0.6	0.1	0.6	0.8
081030005	CO_Rio Blanco_0005	40.038889	-107.8475	Colorado	Rio Blanco	63.0	61.7	60.0	60.4	59.0	59.9	58.9	61.5	1.8	1.3	2.8	1.8	2.8	0.2
081030006	CO_Rio Blanco_0006	40.086944	-108.761389	Colorado	Rio Blanco	77.0	74.7	74.2	74.4	73.9	74.2	73.9	74.5	0.5	0.3	0.8	0.5	0.8	0.1
081230009	CO_Weld_0009	40.386368	-104.73744	Colorado	Weld	74.7	72.2	71.9	72.0	67.6	71.9	67.5	71.6	0.3	0.2	4.6	0.3	4.7	0.6
350010023	NM_Bernalillo_0023	35.1343	-106.5852	New Mexico	Bernalillo	68.0	65.6	65.6	65.6	65.6	65.6	65.6	65.5	0.0	0.0	0.0	0.0	0.0	0.2
350010024	NM_Bernalillo_0024	35.0631	-106.578785	New Mexico	Bernalillo	69.3	66.1	66.0	66.0	66.0	66.0	66.0	65.8	0.0	0.0	0.0	0.0	0.0	0.2
350010027	NM_Bernalillo_0027	35.1539	-106.69715	New Mexico	Bernalillo	70.0	67.2	67.2	67.2	67.2	67.2	67.2	67.1	0.0	0.0	0.0	0.0	0.0	0.1
350010029	NM_Bernalillo_0029	35.01708	-106.65739	New Mexico	Bernalillo	68.7	65.2	65.2	65.2	65.2	65.2	65.2	65.0	0.0	0.0	0.0	0.0	0.0	0.2
350010032	NM_Bernalillo_0032	35.06407	-106.76151	New Mexico	Bernalillo	70.0	67.2	67.2	67.2	67.2	67.2	67.2	67.0	0.0	0.0	0.0	0.0	0.0	0.2
350011012	NM_Bernalillo_1012	35.1852	-106.50815	New Mexico	Bernalillo	72.0	68.5	68.5	68.5	68.4	68.4	68.4	68.3	0.0	0.0	0.0	0.0	0.0	0.2
350011013	NM_Bernalillo_1013	35.19324	-106.613815	New Mexico	Bernalillo	68.7	65.9	65.8	65.8	65.8	65.8	65.8	65.7	0.0	0.0	0.0	0.0	0.0	0.2
350431001	NM_Sandoval_1001	35.299444	-106.548333	New Mexico	Sandoval	61.7	59.3	59.3	59.3	59.3	59.3	59.3	59.2	0.0	0.0	0.0	0.0	0.0	0.1
350439004	NM_Sandoval_9004	35.615278	-106.724444	New Mexico	Sandoval	62.0	60.1	60.1	60.1	60.0	60.1	60.0	59.9	0.0	0.0	0.0	0.0	0.0	0.1
350450009	NM_San Juan_0009	36.742222	-107.976944	New Mexico	San Juan	65.3	62.8	62.7	62.7	62.3	62.7	62.3	62.0	0.1	0.0	0.5	0.1	0.5	0.7
350450018	NM_San Juan_0018	36.80973	-107.65158	New Mexico	San Juan	71.0	68.0	68.0	68.0	67.5	68.0	67.5	67.3	0.0	0.0	0.6	0.1	0.6	0.7
350451005	NM_San Juan_1005	36.796667	-108.4725	New Mexico	San Juan	66.0	63.4	63.4	63.4	63.1	63.4	63.1	61.8	0.0	0.0	0.3	0.0	0.3	1.7
350490021	NM_Santa Fe_0021	35.61975	-106.07968	New Mexico	Santa Fe	64.3	62.2	62.2	62.2	62.2	62.2	62.2	62.1	0.0	0.0	0.0	0.0	0.0	0.1
350610008	NM_Valencia_0008	34.8147	-106.7396	New Mexico	Valencia	68.5	66.6	66.6	66.6	66.6	66.6	66.6	66.5	0.0	0.0	0.0	0.0	0.0	0.1
483819991	TX_Randall_9991	34.8803	-101.6649	Texas	Randall	73.0	69.7	69.7	69.7	69.7	69.7	69.7	69.7	0.0	0.0	0.0	0.0	0.0	0.0
490071003	UT_Carbon_1003	39.60996	-110.800749	Utah	Carbon	69.0	65.9	65.9	65.9	65.9	65.9	65.9	65.9	0.0	0.0	0.0	0.0	0.0	0.1
490110004	UT_Davis_0004	40.902967	-111.884467	Utah	Davis	69.3	65.0	65.0	65.0	65.0	65.0	65.0	65.0	0.0	0.0	0.0	0.0	0.0	0.0
490131001	UT_Duchesne_1001	40.208652	-110.841056	Utah	Duchesne	68.0	64.1	64.1	64.1	64.1	64.1	64.1	64.1	0.0	0.0	0.0	0.0	0.0	0.0
490352004	UT_Salt Lake_2004	40.736389	-112.210278	Utah	Salt Lake	74.0	69.4	69.3	69.3	69.3	69.3	69.3	69.3	0.0	0.0	0.0	0.0	0.0	0.0
490353006	UT_Salt Lake_3006	40.736389	-111.872222	Utah	Salt Lake	75.0	70.4	70.4	70.4	70.4	70.4	70.4	70.4	0.0	0.0	0.0	0.0	0.0	0.0
490370101	UT_San Juan_0101	38.45832	-109.82126	Utah	San Juan	68.7	65.8	65.6	65.7	65.4	65.6	65.4	65.5	0.2	0.1	0.4	0.2	0.4	0.2
490450003	UT_Tooele_0003	40.543309	-112.299618	Utah	Tooele	72.0	67.4	67.4	67.4	67.3	67.4	67.3	67.4	0.1	0.0	0.1	0.1	0.1	0.0
490490002	UT_Utah_0002	40.253611	-111.663056	Utah	Utah	70.0	66.4	66.4	66.4	66.4	66.4	66.4	66.4	0.0	0.0	0.0	0.0	0.0	0.0
490495010	UT_Utah_5010	40.136336	-111.660502	Utah	Utah	69.3	65.4	65.4	65.4	65.4	65.4	65.4	65.4	0.0	0.0	0.0	0.0	0.0	0.0
490570002	UT_Weber_0002	41.206321	-111.975524	Utah	Weber	71.7	67.3	67.3	67.3	67.3	67.3	67.3	67.3	0.0	0.0	0.0	0.0	0.0	0.0
560070100	WY_Carbon_0100	41.386944	-107.616667	Wyoming	Carbon	63.0	60.5	60.0	60.2	59.7	59.9	59.7	60.3	0.6	0.4	0.8	0.6	0.9	0.2
560210100	WY_Laramie_0100	41.182227	-104.778334	Wyoming	Laramie	68.0	66.3	66.1	66.2	64.6	66.0	64.6	65.7	0.3	0.2	1.7	0.3	1.7	0.6

Table 5-39a. Current year ozone Base Design Values (DVB) and projected 2025 future year ozone Design Values (DVF) for the 2025 Low Development Scenario and without Source Group X, X1, A1, A2, A3 and A4.

CID	Name	Lat	Long	State	County	DVB	DVF							Contribution from					
							2025 Low	2025 Low w/o X	2025 Low w/o X1	2025 Low w/o A1	2025 Low w/o A2	2025 Low w/o A3	2025 Low w/o A4	Group X	Group X1	Group A1	Group A2	Group A3	Group A4
040170119	AZ_Navajo_0119	34.82251	-109.89249	Arizona	Navajo	68.7	64.9	64.9	64.9	64.9	64.9	64.9	64.9	0.0	0.0	0.0	0.0	0.0	0.0
080013001	CO_Adams_3001	39.838119	-104.94984	Colorado	Adams	73.5	68.8	68.8	68.8	67.9	68.7	67.8	68.0	0.1	0.0	0.9	0.1	1.0	0.9
080050002	CO_Arapahoe_0002	39.567887	-104.957193	Colorado	Arapahoe	76.7	70.8	70.7	70.7	70.1	70.6	70.0	69.9	0.1	0.1	0.7	0.2	0.8	0.9
080050006	CO_Arapahoe_0006	39.638522	-104.569335	Colorado	Arapahoe	72.7	65.9	65.8	65.8	65.4	65.8	65.4	65.3	0.1	0.0	0.5	0.1	0.5	0.5
080130011	CO_Boulder_0011	39.957212	-105.238458	Colorado	Boulder	74.7	68.6	68.5	68.5	67.5	68.5	67.4	67.7	0.1	0.0	1.1	0.1	1.1	0.9
080310014	CO_Denver_0014	39.751761	-105.030681	Colorado	Denver	71.0	67.9	67.8	67.9	67.1	67.8	67.0	67.0	0.1	0.0	0.9	0.1	0.9	0.9
080310025	CO_Denver_0025	39.704005	-104.998113	Colorado	Denver	65.0	62.6	62.6	62.6	61.9	62.5	61.8	61.9	0.1	0.0	0.7	0.1	0.8	0.7
080350004	CO_Douglas_0004	39.534488	-105.070358	Colorado	Douglas	80.7	73.5	73.4	73.4	72.7	73.3	72.6	72.5	0.1	0.1	0.7	0.2	0.8	0.9
080410013	CO_El Paso_0013	38.958341	-104.817215	Colorado	El Paso	71.0	65.0	64.9	65.0	64.8	64.9	64.7	62.8	0.0	0.0	0.2	0.1	0.3	2.2
080410016	CO_El Paso_0016	38.853097	-104.901289	Colorado	El Paso	72.7	66.6	66.5	66.5	66.2	66.4	66.2	64.4	0.1	0.0	0.3	0.1	0.4	2.1
080450012	CO_Garfield_0012	39.54182	-107.784125	Colorado	Garfield	65.0	60.3	58.9	59.3	57.4	58.9	57.3	60.0	1.4	1.0	2.9	1.4	2.9	0.3
080590002	CO_Jefferson_0002	39.800333	-105.099973	Colorado	Jefferson	74.0	70.0	69.9	69.9	69.1	69.9	69.0	69.1	0.1	0.0	0.9	0.1	1.0	0.9
080590005	CO_Jefferson_0005	39.638781	-105.13948	Colorado	Jefferson	75.7	69.2	69.1	69.2	68.4	69.1	68.4	68.2	0.1	0.1	0.8	0.2	0.9	1.1
080590006	CO_Jefferson_0006	39.912799	-105.188587	Colorado	Jefferson	80.3	74.1	74.1	74.1	73.0	74.0	72.9	73.2	0.1	0.0	1.2	0.1	1.3	1.0
080590011	CO_Jefferson_0011	39.743724	-105.177989	Colorado	Jefferson	78.7	72.8	72.7	72.7	71.9	72.6	71.8	71.5	0.1	0.1	0.9	0.2	1.0	1.2
080590013	CO_Jefferson_0013	39.541515	-105.29841	Colorado	Jefferson	74.5	66.7	66.6	66.6	66.0	66.5	65.9	65.7	0.1	0.1	0.7	0.2	0.8	1.0
080671004	CO_La Plata_1004	37.30389	-107.484167	Colorado	La Plata	72.7	69.6	69.6	69.6	69.2	69.6	69.2	69.4	0.0	0.0	0.3	0.0	0.3	0.2
080677001	CO_La Plata_7001	37.13678	-107.62863	Colorado	La Plata	68.7	64.5	64.5	64.5	63.9	64.5	63.9	64.2	0.0	0.0	0.6	0.0	0.6	0.3
080690007	CO_Larimer_0007	40.27813	-105.54564	Colorado	Larimer	75.7	68.8	68.8	68.8	67.7	68.7	67.7	68.1	0.1	0.0	1.1	0.1	1.2	0.7
080690011	CO_Larimer_0011	40.592543	-105.141122	Colorado	Larimer	78.0	73.3	73.3	73.3	71.4	73.2	71.4	72.5	0.1	0.0	1.9	0.1	2.0	0.8
080690012	CO_Larimer_0012	40.642103	-105.275029	Colorado	Larimer	71.0	65.9	65.8	65.9	64.3	65.8	64.3	65.1	0.1	0.0	1.5	0.1	1.6	0.7
080691004	CO_Larimer_1004	40.57747	-105.07892	Colorado	Larimer	68.7	64.9	64.8	64.9	63.2	64.8	63.2	64.2	0.1	0.0	1.7	0.1	1.7	0.7
080770020	CO_Mesa_0020	39.130575	-108.313835	Colorado	Mesa	67.0	63.7	63.4	63.5	63.0	63.3	62.9	63.5	0.3	0.2	0.7	0.4	0.8	0.1
080830006	CO_Montezuma_0006	37.350054	-108.592334	Colorado	Montezuma	67.3	64.2	64.2	64.2	64.0	64.2	64.0	63.5	0.0	0.0	0.2	0.0	0.2	0.8
080830101	CO_Montezuma_0101	37.1984	-108.49046	Colorado	Montezuma	68.3	65.0	64.9	65.0	64.7	64.9	64.7	64.2	0.0	0.0	0.3	0.0	0.3	0.8
081030005	CO_Rio Blanco_0005	40.038889	-107.8475	Colorado	Rio Blanco	63.0	60.0	59.6	59.7	59.2	59.5	59.2	59.8	0.4	0.3	0.8	0.4	0.8	0.2
081030006	CO_Rio Blanco_0006	40.086944	-108.761389	Colorado	Rio Blanco	77.0	74.3	74.2	74.2	74.1	74.2	74.1	74.1	0.1	0.0	0.2	0.1	0.2	0.1
081230009	CO_Weld_0009	40.386368	-104.73744	Colorado	Weld	74.7	71.1	71.0	71.0	69.2	71.0	69.2	70.5	0.1	0.0	1.8	0.1	1.9	0.6
350010023	NM_Bernalillo_0023	35.1343	-106.5852	New Mexico	Bernalillo	68.0	65.6	65.6	65.6	65.6	65.6	65.6	65.5	0.0	0.0	0.0	0.0	0.0	0.2
350010024	NM_Bernalillo_0024	35.0631	-106.578785	New Mexico	Bernalillo	69.3	66.0	66.0	66.0	66.0	66.0	66.0	65.8	0.0	0.0	0.0	0.0	0.0	0.2
350010027	NM_Bernalillo_0027	35.1539	-106.69715	New Mexico	Bernalillo	70.0	67.2	67.2	67.2	67.2	67.2	67.2	67.1	0.0	0.0	0.0	0.0	0.0	0.1
350010029	NM_Bernalillo_0029	35.01708	-106.65739	New Mexico	Bernalillo	68.7	65.2	65.2	65.2	65.2	65.2	65.2	65.0	0.0	0.0	0.0	0.0	0.0	0.2
350010032	NM_Bernalillo_0032	35.06407	-106.76151	New Mexico	Bernalillo	70.0	67.2	67.2	67.2	67.2	67.2	67.2	67.0	0.0	0.0	0.0	0.0	0.0	0.2
350011012	NM_Bernalillo_1012	35.1852	-106.50815	New Mexico	Bernalillo	72.0	68.4	68.4	68.4	68.4	68.4	68.4	68.3	0.0	0.0	0.0	0.0	0.0	0.2
350011013	NM_Bernalillo_1013	35.19324	-106.613815	New Mexico	Bernalillo	68.7	65.8	65.8	65.8	65.8	65.8	65.8	65.6	0.0	0.0	0.0	0.0	0.0	0.2
350431001	NM_Sandoval_1001	35.299444	-106.548333	New Mexico	Sandoval	61.7	59.3	59.3	59.3	59.3	59.3	59.3	59.2	0.0	0.0	0.0	0.0	0.0	0.1
350439004	NM_Sandoval_9004	35.615278	-106.724444	New Mexico	Sandoval	62.0	60.0	60.0	60.1	60.0	60.0	60.0	59.9	0.0	0.0	0.0	0.0	0.0	0.1
350450009	NM_San Juan_0009	36.742222	-107.976944	New Mexico	San Juan	65.3	62.4	62.4	62.4	62.2	62.4	62.2	61.7	0.0	0.0	0.2	0.0	0.2	0.7
350450018	NM_San Juan_0018	36.80973	-107.65158	New Mexico	San Juan	71.0	67.5	67.5	67.5	67.3	67.5	67.3	66.8	0.0	0.0	0.3	0.0	0.3	0.7
350451005	NM_San Juan_1005	36.796667	-108.4725	New Mexico	San Juan	66.0	63.2	63.2	63.2	63.1	63.2	63.1	61.5	0.0	0.0	0.2	0.0	0.2	1.7
350490021	NM_Santa Fe_0021	35.61975	-106.07968	New Mexico	Santa Fe	64.3	62.2	62.2	62.2	62.2	62.2	62.2	62.1	0.0	0.0	0.0	0.0	0.0	0.1
350610008	NM_Valencia_0008	34.8147	-106.7396	New Mexico	Valencia	68.5	66.6	66.6	66.6	66.6	66.6	66.6	66.5	0.0	0.0	0.0	0.0	0.0	0.1
483819991	TX_Randall_9991	34.8803	-101.6649	Texas	Randall	73.0	69.7	69.7	69.7	69.7	69.7	69.7	69.7	0.0	0.0	0.0	0.0	0.0	0.0
490071003	UT_Carbon_1003	39.60996	-110.800749	Utah	Carbon	69.0	65.9	65.9	65.9	65.9	65.9	65.9	65.9	0.0	0.0	0.0	0.0	0.0	0.1
490110004	UT_Davis_0004	40.902967	-111.884467	Utah	Davis	69.3	65.0	65.0	65.0	65.0	65.0	65.0	65.0	0.0	0.0	0.0	0.0	0.0	0.0
490131001	UT_Duchesne_1001	40.208652	-110.841056	Utah	Duchesne	68.0	64.1	64.1	64.1	64.1	64.1	64.1	64.1	0.0	0.0	0.0	0.0	0.0	0.0
490352004	UT_Salt Lake_2004	40.736389	-112.210278	Utah	Salt Lake	74.0	69.3	69.3	69.3	69.3	69.3	69.3	69.3	0.0	0.0	0.0	0.0	0.0	0.0
490353006	UT_Salt Lake_3006	40.736389	-111.872222	Utah	Salt Lake	75.0	70.4	70.4	70.4	70.4	70.4	70.4	70.4	0.0	0.0	0.0	0.0	0.0	0.0
490370101	UT_San Juan_0101	38.45832	-109.82126	Utah	San Juan	68.7	65.5	65.5	65.5	65.4	65.5	65.4	65.3	0.0	0.0	0.1	0.0	0.1	0.2
490450003	UT_Tooele_0003	40.543309	-112.299618	Utah	Tooele	72.0	67.4	67.4	67.4	67.4	67.4	67.4	67.4	0.0	0.0	0.0	0.0	0.0	0.0
490490002	UT_Utah_0002	40.253611	-111.663056	Utah	Utah	70.0	66.4	66.4	66.4	66.4	66.4	66.4	66.3	0.0	0.0	0.0	0.0	0.0	0.0
490495010	UT_Utah_5010	40.136336	-111.660502	Utah	Utah	69.3	65.4	65.4	65.4	65.4	65.4	65.4	65.4	0.0	0.0	0.0	0.0	0.0	0.0
490570002	UT_Weber_0002	41.206321	-111.975524	Utah	Weber	71.7	67.3	67.3	67.3	67.3	67.3	67.3	67.3	0.0	0.0	0.0	0.0	0.0	0.0
560070100	WY_Carbon_0100	41.386944	-107.616667	Wyoming	Carbon	63.0	60.1	60.0	60.0	59.9	59.9	59.9	59.9	0.1	0.1	0.2	0.2	0.2	0.2
560210100	WY_Laramie_0100	41.182227	-104.778334	Wyoming	Laramie	68.0	65.5	65.5	65.5	64.9	65.4	64.9	64.9	0.0	0.0	0.6	0.1	0.7	0.6

Table 5-39b. Current year ozone Base Design Values (DVB) and projected 2025 future year ozone Design Values (DVF) for the 2025 Medium Development Scenario and without Source Group X, X1, A1, A2, A3 and A4.

CID	Name	Lat	Long	State	County	DVB	DVF							Contribution from					
							2025 Med	2025 Med w/o X	2025 Med w/o X1	2025 Med w/o A1	2025 Med w/o A2	2025 Med w/o A3	2025 Med w/o A4	Group X	Group X1	Group A1	Group A2	Group A3	Group A4
040170119	AZ_Navajo_0119	34.82251	-109.89249	Arizona	Navajo	68.7	65.0	64.9	64.9	64.9	64.9	64.9	64.9	0.0	0.0	0.0	0.0	0.0	0.0
080013001	CO_Adams_3001	39.838119	-104.94984	Colorado	Adams	73.5	69.8	69.5	69.6	67.3	69.5	67.3	69.0	0.3	0.2	2.5	0.3	2.6	0.9
080050002	CO_Arapahoe_0002	39.567887	-104.957193	Colorado	Arapahoe	76.7	71.6	71.3	71.4	69.7	71.2	69.6	70.8	0.4	0.3	2.0	0.4	2.0	0.9
080050006	CO_Arapahoe_0006	39.638522	-104.569335	Colorado	Arapahoe	72.7	66.4	66.2	66.3	65.1	66.2	65.0	65.9	0.2	0.2	1.4	0.3	1.4	0.5
080130011	CO_Boulder_0011	39.957212	-105.238458	Colorado	Boulder	74.7	69.6	69.3	69.4	66.8	69.3	66.7	68.8	0.3	0.2	2.8	0.3	2.9	0.8
080310014	CO_Denver_0014	39.751761	-105.030681	Colorado	Denver	71.0	68.9	68.6	68.7	66.5	68.5	66.5	68.1	0.3	0.2	2.4	0.4	2.5	0.9
080310025	CO_Denver_0025	39.704005	-104.998113	Colorado	Denver	65.0	63.4	63.1	63.3	61.4	63.1	61.4	62.7	0.3	0.2	2.0	0.3	2.1	0.7
080350004	CO_Douglas_0004	39.534488	-105.070358	Colorado	Douglas	80.7	74.4	73.9	74.1	72.2	73.9	72.2	73.5	0.5	0.3	2.1	0.5	2.2	0.9
080410013	CO_El Paso_0013	38.958341	-104.817215	Colorado	El Paso	71.0	65.3	65.1	65.2	64.7	65.1	64.6	63.1	0.2	0.1	0.6	0.2	0.6	2.2
080410016	CO_El Paso_0016	38.853097	-104.901289	Colorado	El Paso	72.7	67.0	66.8	66.8	66.1	66.7	66.0	64.9	0.3	0.2	1.0	0.3	1.0	2.1
080450012	CO_Garfield_0012	39.54182	-107.784125	Colorado	Garfield	65.0	63.4	60.6	61.5	56.7	60.6	56.6	63.2	2.8	1.9	6.8	2.9	6.8	0.3
080590002	CO_Jefferson_0002	39.800333	-105.099973	Colorado	Jefferson	74.0	71.1	70.8	70.9	68.6	70.8	68.5	70.2	0.3	0.2	2.5	0.3	2.6	0.9
080590005	CO_Jefferson_0005	39.638781	-105.13948	Colorado	Jefferson	75.7	70.2	69.8	70.0	68.0	69.7	67.9	69.2	0.4	0.3	2.3	0.5	2.4	1.0
080590006	CO_Jefferson_0006	39.912799	-105.188587	Colorado	Jefferson	80.3	75.2	74.9	75.0	72.0	74.8	72.0	74.3	0.3	0.2	3.2	0.4	3.2	0.9
080590011	CO_Jefferson_0011	39.743724	-105.177989	Colorado	Jefferson	78.7	73.7	73.3	73.5	71.2	73.3	71.2	72.5	0.4	0.3	2.5	0.5	2.6	1.2
080590013	CO_Jefferson_0013	39.541515	-105.29841	Colorado	Jefferson	74.5	67.6	67.2	67.3	65.6	67.1	65.5	66.6	0.4	0.3	2.0	0.5	2.1	0.9
080671004	CO_La Plata_1004	37.30389	-107.484167	Colorado	La Plata	72.7	69.7	69.6	69.6	69.2	69.6	69.2	69.5	0.1	0.0	0.5	0.1	0.5	0.2
080677001	CO_La Plata_7001	37.13678	-107.62863	Colorado	La Plata	68.7	64.6	64.6	64.6	63.9	64.5	63.9	64.3	0.0	0.0	0.7	0.0	0.7	0.3
080690007	CO_Larimer_0007	40.27813	-105.54564	Colorado	Larimer	75.7	70.1	69.8	69.9	67.1	69.8	67.1	69.4	0.3	0.2	3.0	0.3	3.0	0.7
080690011	CO_Larimer_0011	40.592543	-105.141122	Colorado	Larimer	78.0	75.1	74.8	74.9	70.2	74.8	70.1	74.3	0.3	0.2	4.9	0.3	5.0	0.7
080690012	CO_Larimer_0012	40.642103	-105.275029	Colorado	Larimer	71.0	67.6	67.3	67.4	63.5	67.3	63.5	66.9	0.3	0.2	4.1	0.3	4.1	0.7
080691004	CO_Larimer_1004	40.57747	-105.07892	Colorado	Larimer	68.7	66.4	66.2	66.2	62.1	66.1	62.0	65.7	0.2	0.2	4.3	0.3	4.4	0.7
080770020	CO_Mesa_0020	39.130575	-108.313835	Colorado	Mesa	67.0	64.6	63.7	64.1	62.6	63.7	62.5	64.5	0.9	0.5	2.1	1.0	2.1	0.1
080830006	CO_Montezuma_0006	37.350054	-108.592334	Colorado	Montezuma	67.3	64.3	64.2	64.3	64.0	64.2	64.0	63.5	0.0	0.0	0.3	0.0	0.3	0.8
080830101	CO_Montezuma_0101	37.1984	-108.49046	Colorado	Montezuma	68.3	65.1	65.0	65.0	64.7	65.0	64.6	64.3	0.1	0.1	0.4	0.1	0.4	0.8
081030005	CO_Rio Blanco_0005	40.038889	-107.8475	Colorado	Rio Blanco	63.0	61.5	60.0	60.4	59.0	59.9	58.9	61.3	1.5	1.1	2.6	1.6	2.6	0.2
081030006	CO_Rio Blanco_0006	40.086944	-108.761389	Colorado	Rio Blanco	77.0	74.6	74.2	74.4	73.9	74.2	73.9	74.5	0.4	0.2	0.7	0.5	0.7	0.1
081230009	CO_Weld_0009	40.386368	-104.73744	Colorado	Weld	74.7	72.1	71.9	72.0	67.6	71.9	67.5	71.6	0.2	0.1	4.6	0.2	4.6	0.6
350010023	NM_Bernalillo_0023	35.1343	-106.5852	New Mexico	Bernalillo	68.0	65.6	65.6	65.6	65.6	65.6	65.6	65.5	0.0	0.0	0.0	0.0	0.0	0.2
350010024	NM_Bernalillo_0024	35.0631	-106.578785	New Mexico	Bernalillo	69.3	66.0	66.0	66.0	66.0	66.0	66.0	65.8	0.0	0.0	0.0	0.0	0.0	0.2
350010027	NM_Bernalillo_0027	35.1539	-106.69715	New Mexico	Bernalillo	70.0	67.2	67.2	67.2	67.2	67.2	67.2	67.1	0.0	0.0	0.0	0.0	0.0	0.1
350010029	NM_Bernalillo_0029	35.01708	-106.65739	New Mexico	Bernalillo	68.7	65.2	65.2	65.2	65.2	65.2	65.2	65.0	0.0	0.0	0.0	0.0	0.0	0.2
350010032	NM_Bernalillo_0032	35.06407	-106.76151	New Mexico	Bernalillo	70.0	67.2	67.2	67.2	67.2	67.2	67.2	67.0	0.0	0.0	0.0	0.0	0.0	0.2
350011012	NM_Bernalillo_1012	35.1852	-106.50815	New Mexico	Bernalillo	72.0	68.4	68.4	68.4	68.4	68.4	68.4	68.3	0.0	0.0	0.0	0.0	0.0	0.2
350011013	NM_Bernalillo_1013	35.19324	-106.613815	New Mexico	Bernalillo	68.7	65.8	65.8	65.8	65.8	65.8	65.8	65.7	0.0	0.0	0.0	0.0	0.0	0.2
350431001	NM_Sandoval_1001	35.299444	-106.548333	New Mexico	Sandoval	61.7	59.3	59.3	59.3	59.3	59.3	59.3	59.2	0.0	0.0	0.0	0.0	0.0	0.1
350439004	NM_Sandoval_9004	35.615278	-106.724444	New Mexico	Sandoval	62.0	60.1	60.1	60.1	60.0	60.1	60.0	59.9	0.0	0.0	0.0	0.0	0.0	0.1
350450009	NM_San Juan_0009	36.742222	-107.976944	New Mexico	San Juan	65.3	62.5	62.4	62.5	62.1	62.4	62.1	61.7	0.0	0.0	0.3	0.0	0.4	0.7
350450018	NM_San Juan_0018	36.80973	-107.65158	New Mexico	San Juan	71.0	67.7	67.6	67.6	67.2	67.6	67.2	66.9	0.0	0.0	0.5	0.0	0.5	0.7
350451005	NM_San Juan_1005	36.796667	-108.4725	New Mexico	San Juan	66.0	63.3	63.2	63.2	63.0	63.2	63.0	61.6	0.0	0.0	0.2	0.0	0.2	1.7
350490021	NM_Santa Fe_0021	35.61975	-106.07968	New Mexico	Santa Fe	64.3	62.2	62.2	62.2	62.2	62.2	62.2	62.1	0.0	0.0	0.0	0.0	0.0	0.1
350610008	NM_Valencia_0008	34.8147	-106.7396	New Mexico	Valencia	68.5	66.6	66.6	66.6	66.6	66.6	66.6	66.5	0.0	0.0	0.0	0.0	0.0	0.1
483819991	TX_Randall_9991	34.8803	-101.6649	Texas	Randall	73.0	69.7	69.7	69.7	69.7	69.7	69.7	69.7	0.0	0.0	0.0	0.0	0.0	0.0
490071003	UT_Carbon_1003	39.60996	-110.800749	Utah	Carbon	69.0	65.9	65.9	65.9	65.9	65.9	65.9	65.9	0.0	0.0	0.0	0.0	0.0	0.1
490110004	UT_Davis_0004	40.902967	-111.884467	Utah	Davis	69.3	65.0	65.0	65.0	65.0	65.0	65.0	65.0	0.0	0.0	0.0	0.0	0.0	0.0
490131001	UT_Duchesne_1001	40.208652	-110.841056	Utah	Duchesne	68.0	64.1	64.1	64.1	64.1	64.1	64.1	64.1	0.0	0.0	0.0	0.0	0.0	0.0
490352004	UT_Salt Lake_2004	40.736389	-112.210278	Utah	Salt Lake	74.0	69.4	69.3	69.3	69.3	69.3	69.3	69.3	0.0	0.0	0.0	0.0	0.0	0.0
490353006	UT_Salt Lake_3006	40.736389	-111.872222	Utah	Salt Lake	75.0	70.4	70.4	70.4	70.4	70.4	70.4	70.4	0.0	0.0	0.0	0.0	0.0	0.0
490370101	UT_San Juan_0101	38.45832	-109.82126	Utah	San Juan	68.7	65.7	65.6	65.6	65.4	65.6	65.4	65.5	0.2	0.1	0.4	0.2	0.4	0.2
490450003	UT_Tooele_0003	40.543309	-112.299618	Utah	Tooele	72.0	67.4	67.4	67.4	67.3	67.4	67.3	67.4	0.0	0.0	0.1	0.1	0.1	0.0
490490002	UT_Utah_0002	40.253611	-111.663056	Utah	Utah	70.0	66.4	66.4	66.4	66.4	66.4	66.4	66.4	0.0	0.0	0.0	0.0	0.0	0.0
490495010	UT_Utah_5010	40.136336	-111.660502	Utah	Utah	69.3	65.4	65.4	65.4	65.4	65.4	65.4	65.4	0.0	0.0	0.0	0.0	0.0	0.0
490570002	UT_Weber_0002	41.206321	-111.975524	Utah	Weber	71.7	67.3	67.3	67.3	67.3	67.3	67.3	67.3	0.0	0.0	0.0	0.0	0.0	0.0
560070100	WY_Carbon_0100	41.386944	-107.616667	Wyoming	Carbon	63.0	60.5	60.0	60.2	59.7	59.9	59.7	60.3	0.5	0.3	0.7	0.6	0.8	0.2
560210100	WY_Laramie_0100	41.182227	-104.778334	Wyoming	Laramie	68.0	66.3	66.1	66.2	64.6	66.0	64.6	65.7	0.2	0.1	1.6	0.2	1.7	0.6

5.6.1.2 Ozone Design Value Projection Unmonitored Area Analysis

MATS was used to perform an unmonitored area analysis (UAA) of the 2025 ozone DVF projections for the 2025 High, Low and Medium Development Scenarios and the 2025 results without the contributions from the combined Source Groups X, X1, A1, A2, A3, and A4. The MATS UAA interpolates the current year observed ozone DVBs across the CARMMS 12/4 km domain and then makes 2025 ozone DVF projections throughout the domain using the relative change in the CAMx 2011 and 2025 modeling results in each 12/4 km grid cell. Figure 5-1 displays the spatial distribution of the MATS UAA derived 2011 ozone DVBs and 2025 ozone DVFs and their differences for the three 2025 emission scenarios. The color scheme for the spatial plots has a cut-point at 71.0 ppb so tiles that are yellow or warmer indicate exceedances of the 0.070 ppm ozone NAAQS.

The current year DVBs indicate areas of ozone exceedances in and around Denver, places in Utah, Arizona, New Mexico, and Texas, with a maximum DVB of 109.6 ppb next to the AZ/NM boarder that is found to be caused by wild fire emissions (Figure 5-1, top left). For the 2025 High, Low and Medium Development Scenarios the areas of 2025 ozone DVF exceedances are substantially reduced, while the natural wild fire emissions lead to 108.8 ppb of maximum DVF for all three scenarios near the AZ/NM boarder (top right in Figures 5-1a, 5-1b and 5-1c). The 2025 DVF – 2011 DVB difference plots (Figure 5-1, bottom) shows largest ozone reductions with the largest reduction in the Denver metropolitan area.

The 2025 UAA ozone DVF without Source Group A2 (Federal O&G and mining in 13 CO BLM Planning Areas) results in reduction in the DVFs in northern and northeastern CO, with the highest reductions of 3.4, 1.5, 2.9 ppb in the CRVFO Planning Area in the County of Garfield (Figure 5-2a, top panels) in the High, Low and Medium Development Scenarios. The areas exceeding the NAAQS do not show notable changes when impact from Federal O&G and mining in CO is excluded.

Removing both Federal O&G and mining and non-Federal O&G (Source Group A3) in CO results in more reductions in the 2025 DVFs, especially in northeastern CO and Weld County in the greater Denver area (Figures 5-2a, 5-3a and 5-4a, bottom panels). The largest reductions are 7.3 ppb (High Scenario), 3.1 ppb (Low Scenario) and 6.8 ppb (Medium Scenario) in the CRVFO Planning Area in Garfield County.

Figures 5-2b, 5-3b and 5-4b show the 2025 UAA ozone DVF without Source Group X and X1, which represent new Federal O&G in CO with Source Apportionment modeling and Brute Force approach, respectively. Overall, removing X or X1 does not lead to a substantial change in NAAQS ozone exceedance areas, while removing X1 has slightly less impact than removing X. The maximum impact of new Federal O&G in CO is 3.3, 1.4 and 2.8 ppb for the 2025 High, Low and Medium Development Scenarios, respectively, with X, and 2.4, 1.0, and 2.0 ppb, respectively, with X1.

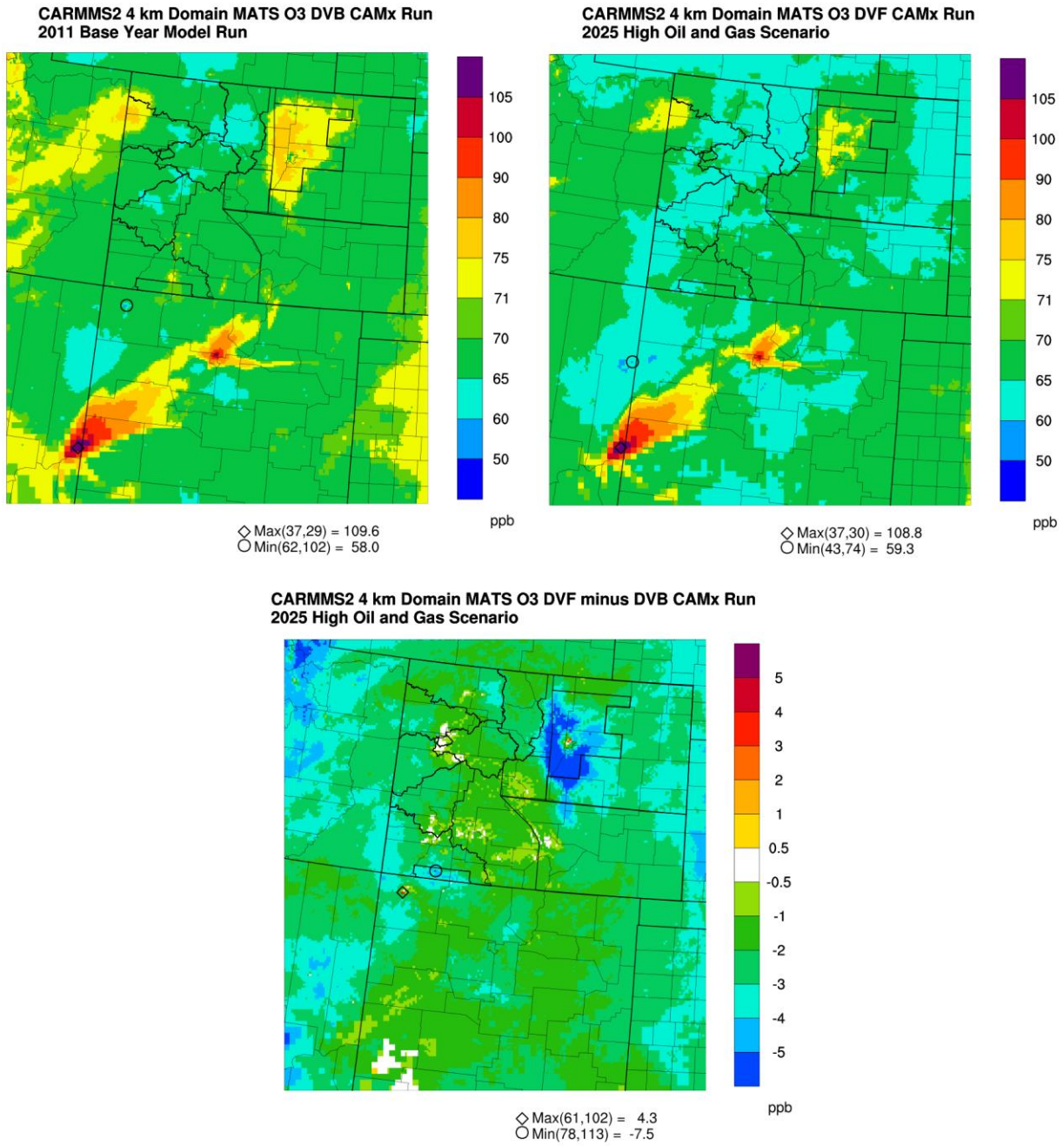

Figure 5-1a. 2011-centered ozone DVB (top left), 2025 High Development Scenario ozone DVF (top right) and their differences (2025 High – 2011) (bottom) calculated using MATS.

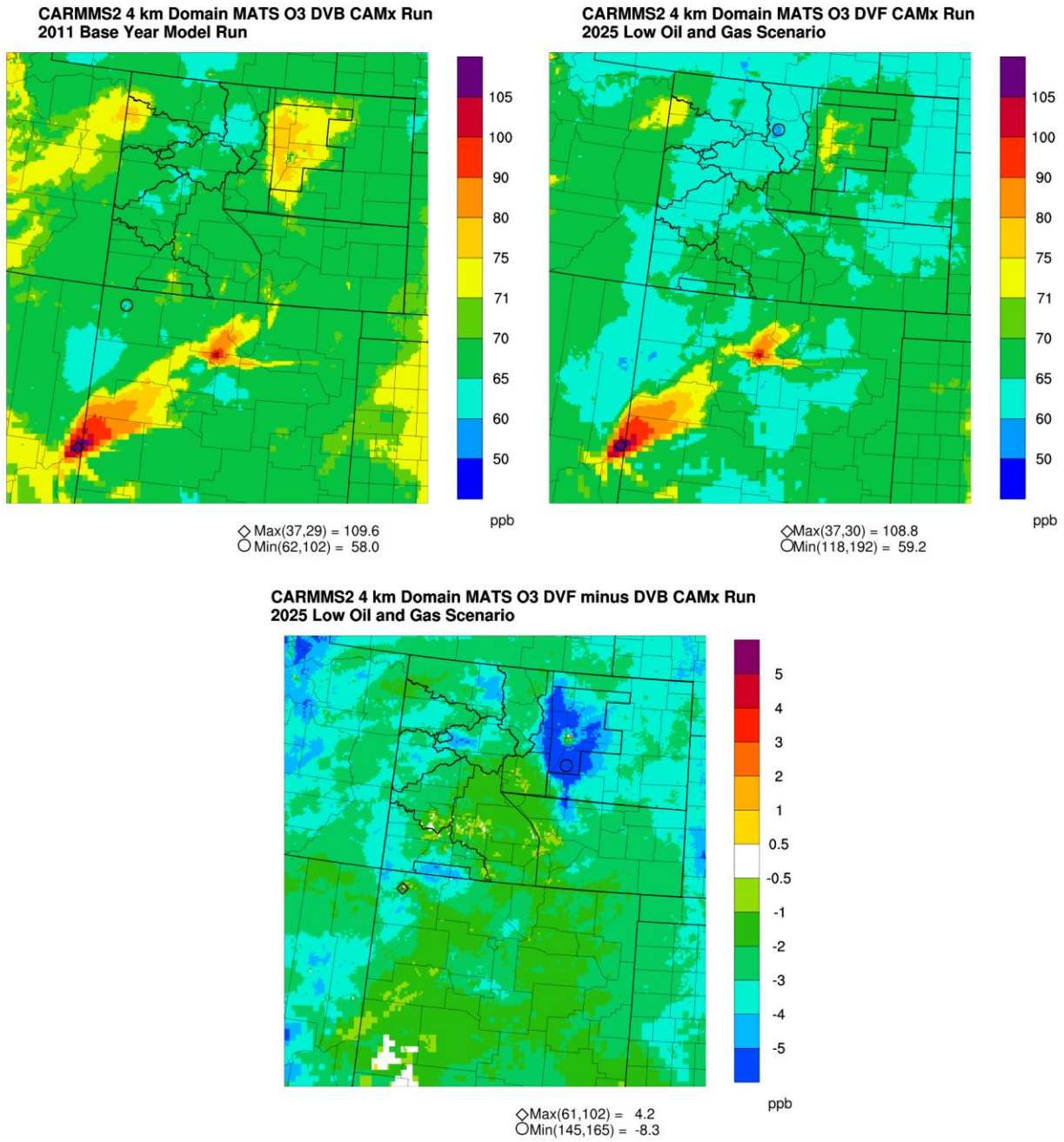

Figure 5-1b. 2011-centered ozone DVB (top left), 2025 Low Development Scenario ozone DVF (top right) and their differences (2025 Low – 2011) (bottom) calculated using MATS.

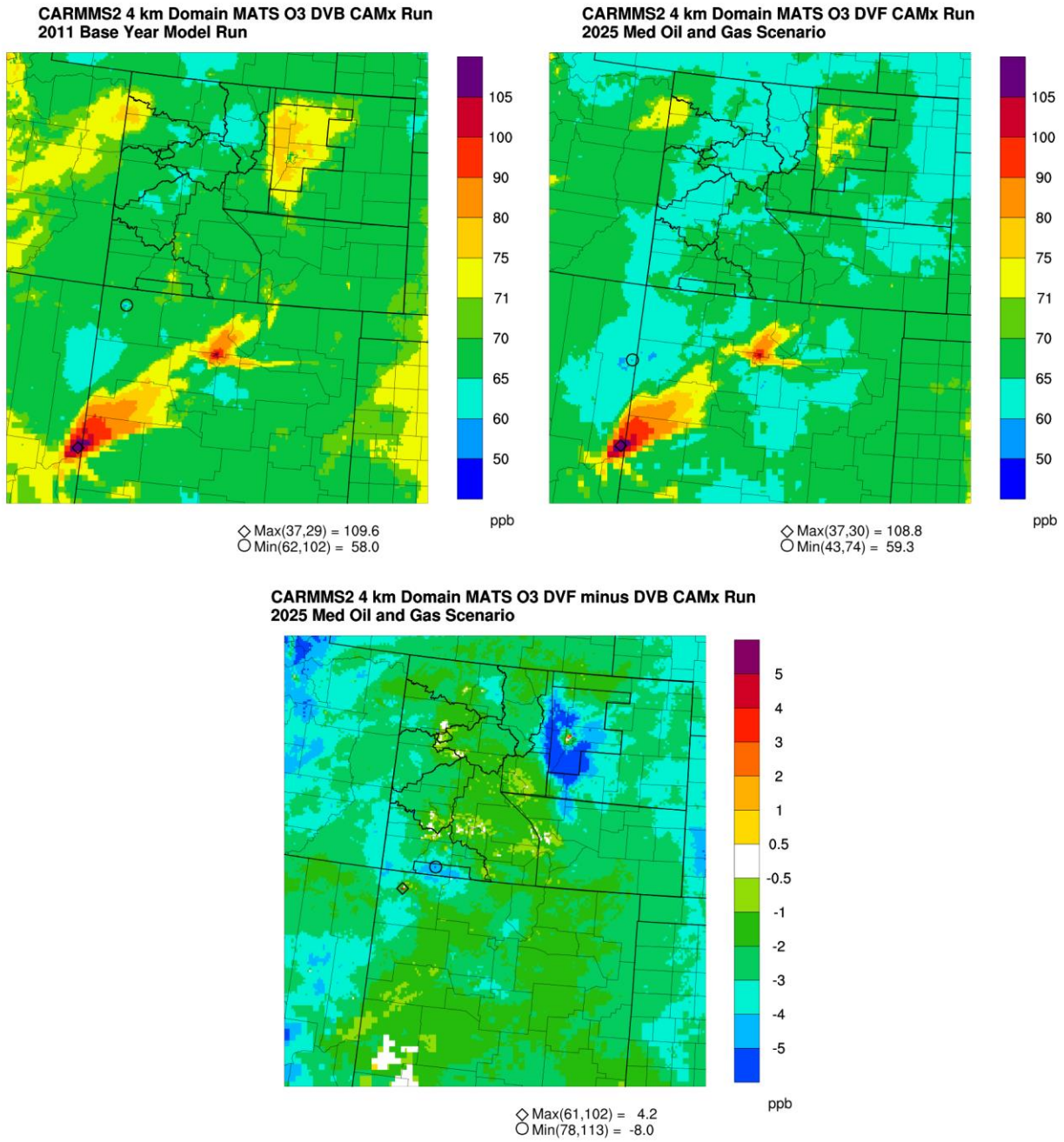

Figure 5-1c. 2011-centered ozone DVB (top left), 2025 Medium Development Scenario ozone DVF (top right) and their differences (2025 Medium – 2011) (bottom) calculated using MATS.

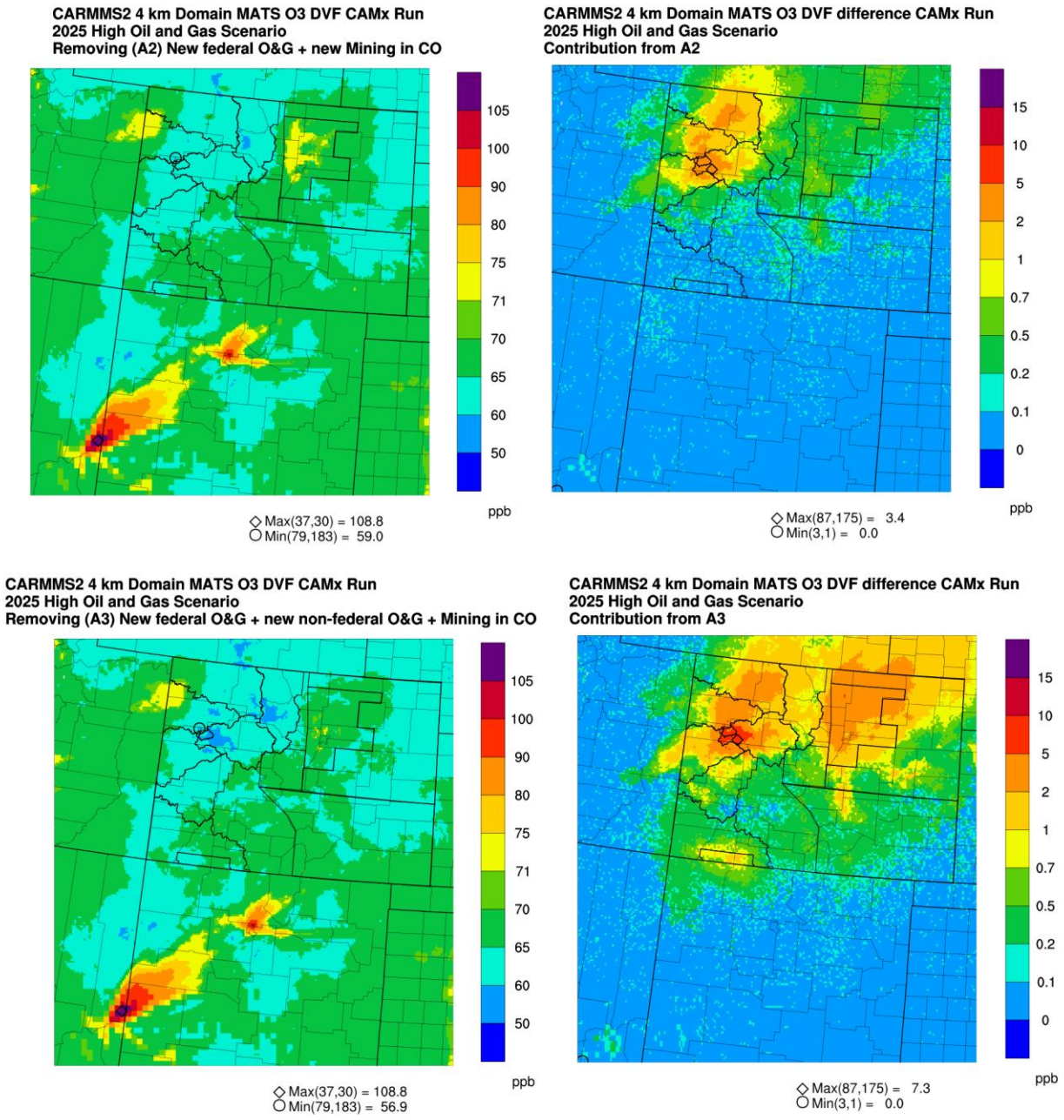

Figure 5-2a. 2025 projected ozone DVF 2025 Unmonitored Area Analysis for Source Group A2 (top) and A3 (bottom) showing 2025 DVF without each Source Group (left) and difference in DVFs with 2025 High Development Scenario (right).

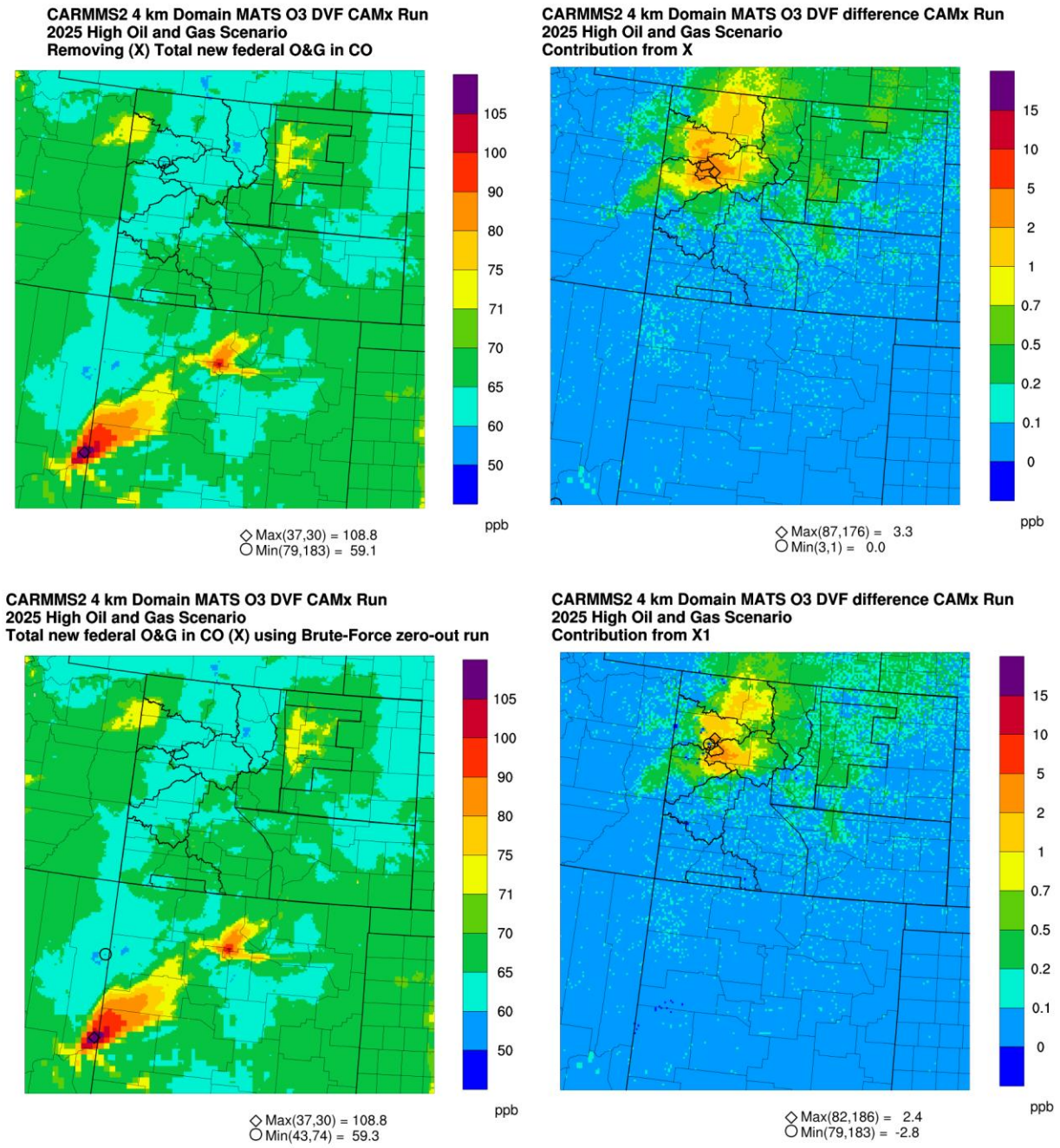

Figure 5-2b. 2025 projected ozone DVF 2025 Unmonitored Area Analysis for Source Group X (top) and X1 (bottom) showing 2025 DVF without each Source Group (left) and difference in DVFs with 2025 High Development Scenario (right).

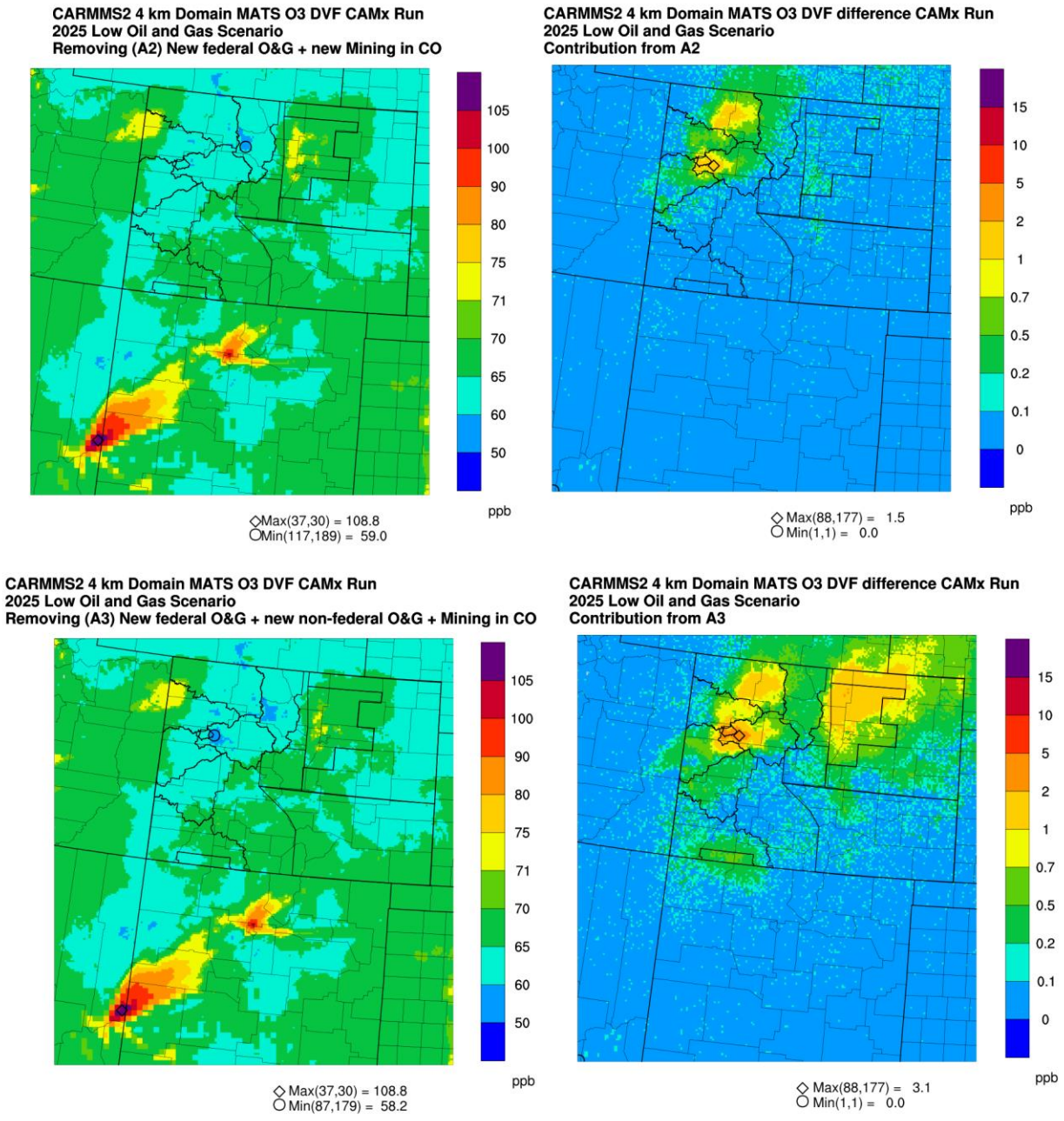

Figure 5-3a. 2025 projected ozone DVF 2025 Unmonitored Area Analysis for Source Group A2 (top) and A3 (bottom) showing 2025 DVF without each Source Group (left) and difference in DVFs with 2025 Low Development Scenario (right).

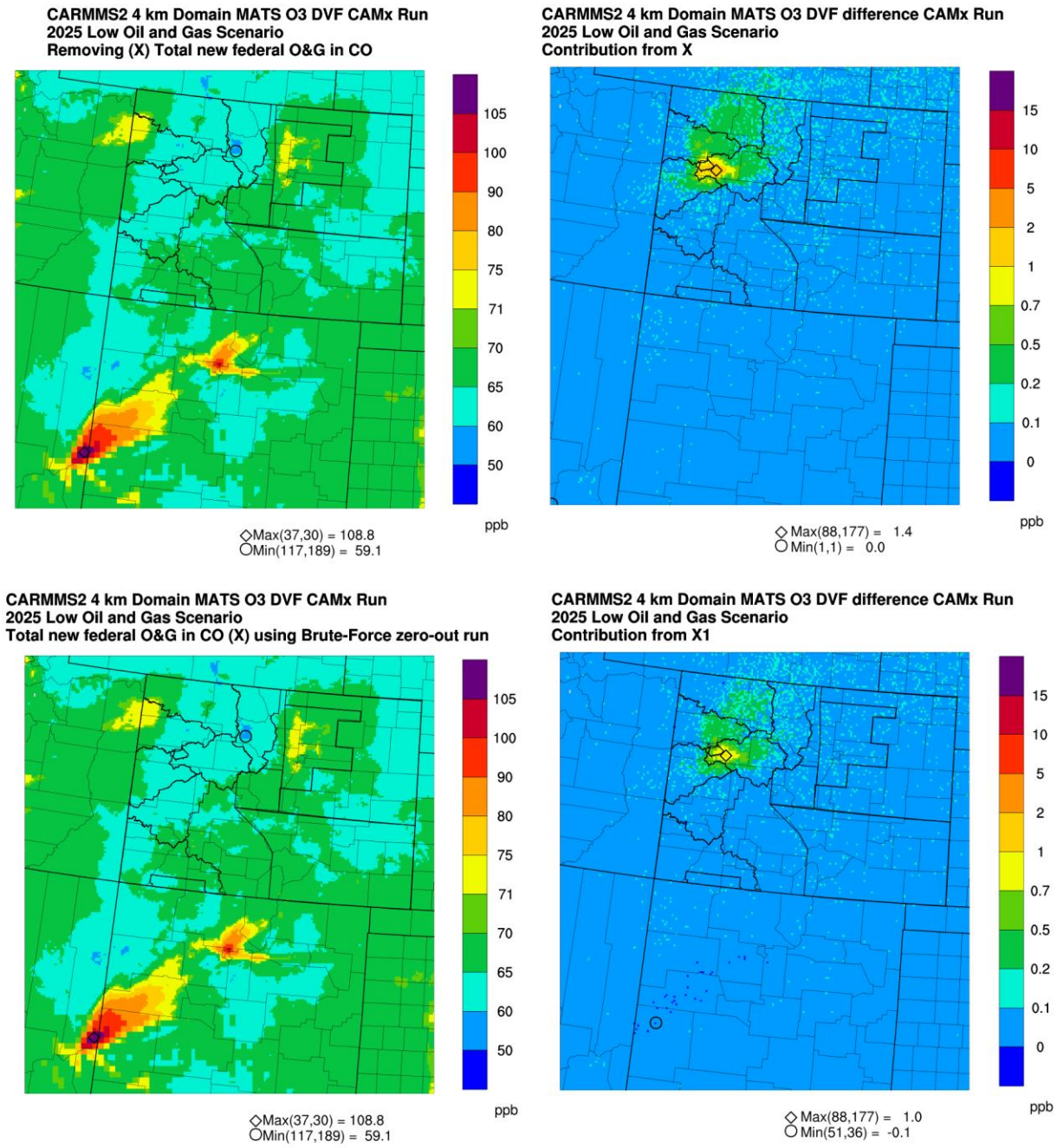

Figure 5-3b. 2025 projected ozone DVF 2025 Unmonitored Area Analysis for Source Group X (top) and X1 (bottom) showing 2025 DVF without each Source Group (left) and difference in DVFs with 2025 Low Development Scenario (right).

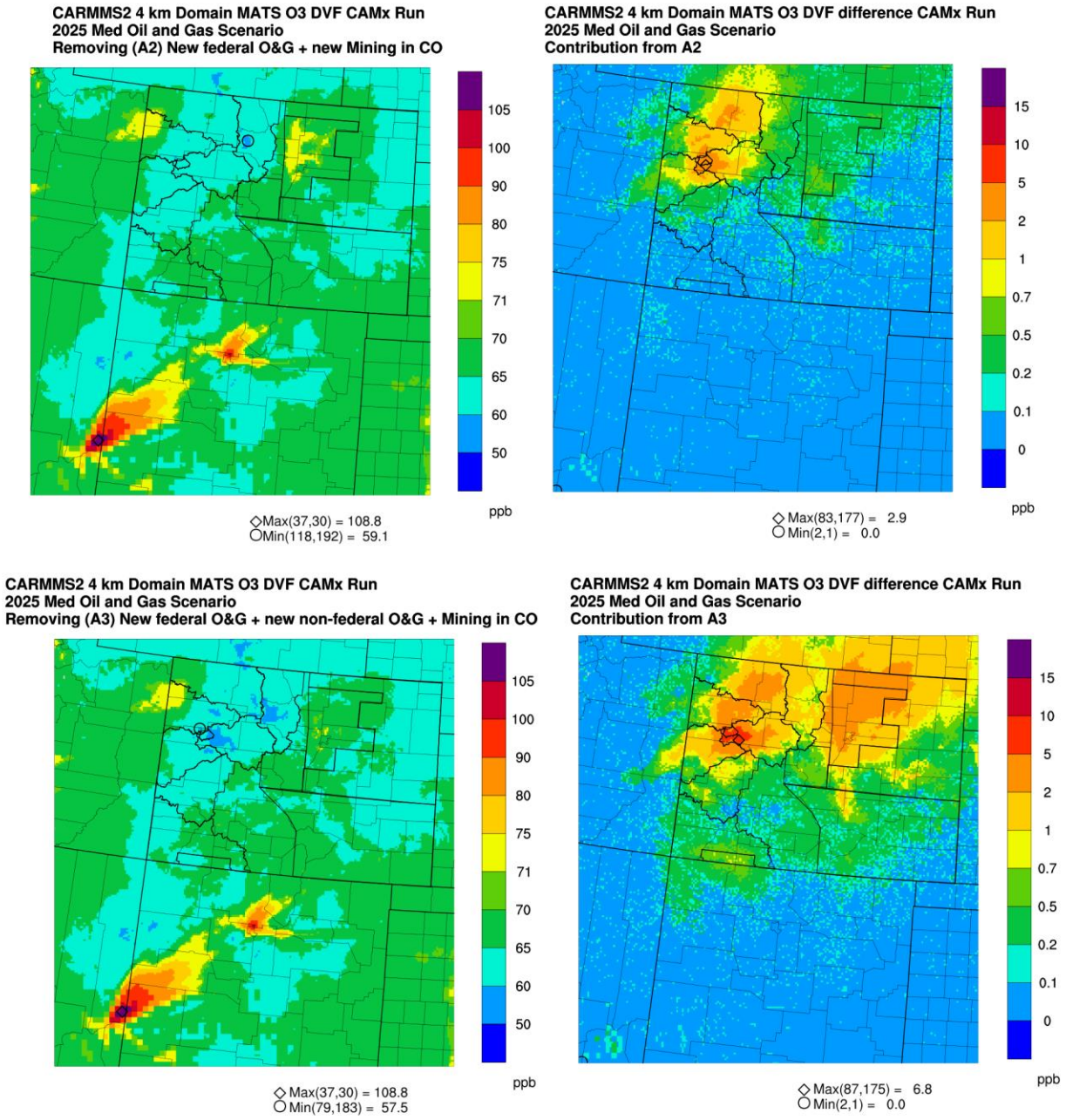

Figure 5-4a. 2025 projected ozone DVF 2025 Unmonitored Area Analysis for Source Group A2 (top) and A3 (bottom) showing 2025 DVF without each Source Group (left) and difference in DVFs with 2025 Medium Development Scenario (right).

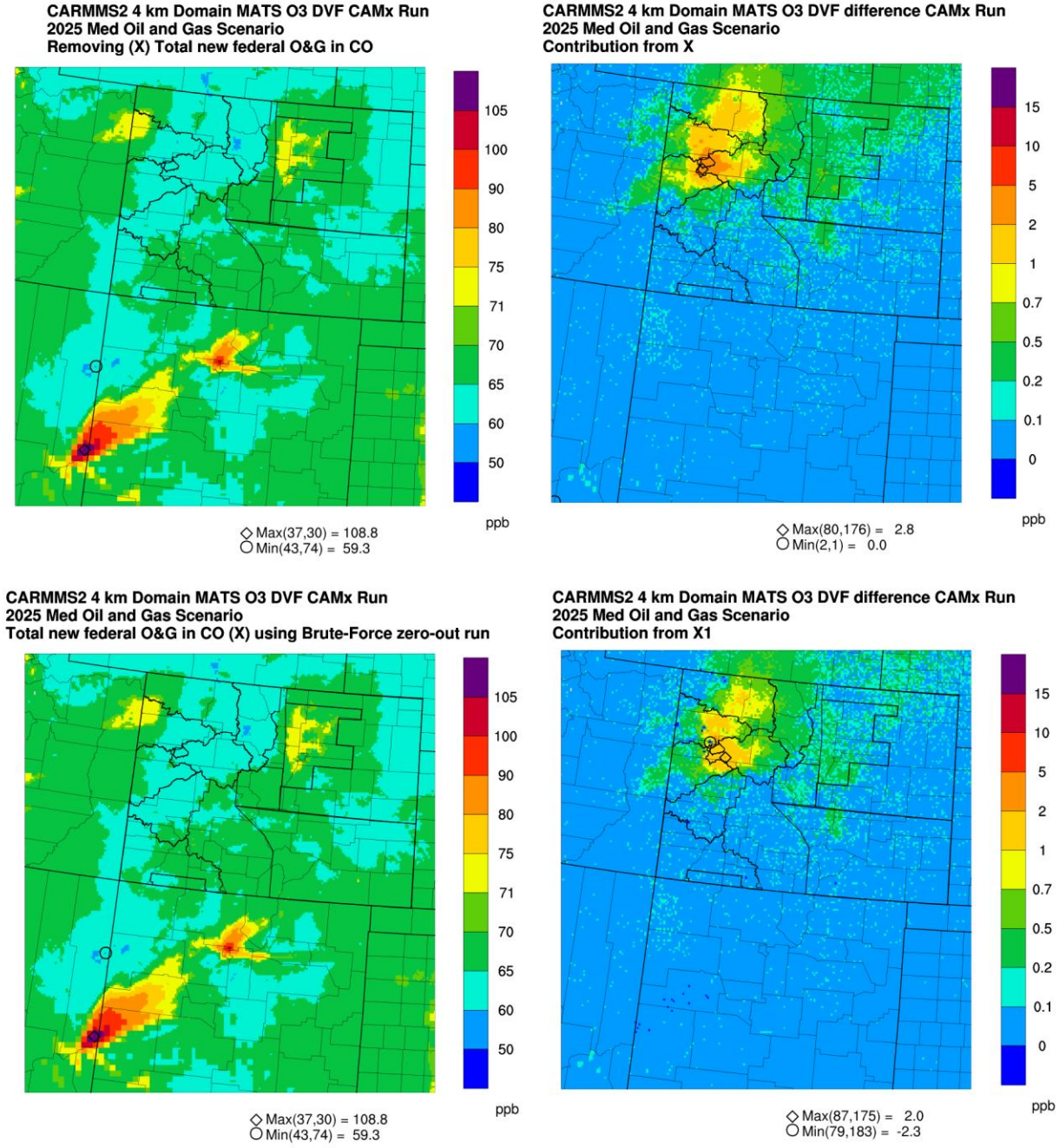

Figure 5-4b. 2025 projected ozone DVF 2025 Unmonitored Area Analysis for Source Group X (top) and X1 (bottom) showing 2025 DVF without each Source Group (left) and difference in DVFs with 2025 Medium Development Scenario (right).

5.6.2 Ozone NAAQS Analysis using the Absolute Modeling Results

The CAMx source apportionment absolute modeling results in the 2025 High, Low and Medium Development Scenarios are analyzed and compared to the NAAQS in this section. The ozone NAAQS is defined as the three-year average of the 4th highest daily maximum 8-hour (DMAX8) ozone concentration. Since CARMMS 2.0 only uses one year of modeling results (2011 meteorological year), the 2025 4th highest DMAX8 ozone concentration is used as a pseudo-NAAQS comparison metric. The contribution of each Source Group to total modeled ozone at each grid cell of the 12/4 km modeling domain is obtained as the ozone concentration from each Source Group at the time when the 4th highest DMAX8 ozone concentration occurred. The contribution of each Source Group to modeled 2025 4th high DMAX8 ozone greater than the NAAQS (i.e., 71.0 ppb or greater) is also analyzed.

5.6.2.1 Contributions of Source Groups to 4th High DMAX8 Ozone

Figure 5-5 displays the 4th highest DMAX8 ozone for the 2011 Base Case and the 2025 High, Low and Medium Development Scenarios and their differences, and the 4th highest DMAX8 ozone for the 2025 scenario with the ozone contributions from natural emissions removed (Source Group A). This last display was generated to determine whether exceedances of the NAAQS could have been primarily due to natural emissions. The color scale in Figure 5-5 has a sharp contrast from green to yellow when an exceedance of the ozone NAAQS occurs (i.e., 71.0 ppb or higher).

For the 2011 Base Case, there are vast regions where the modeled 2025 4th high DMAX8 ozone exceeds the NAAQS (Figure 5-5, top left) in the domain, while natural fires lead to the highest ozone along NM/AZ boarder and near Los Alamos of NM.

In the 2025 High, Low and Medium Development Scenarios, the areas of ozone exceedances decrease from the Base Case. The 2025 – 2011 ozone differences (Figure 5-5, bottom left) show decreases in almost all areas, with largest reductions of -8.3, -9.2, and -8.4 ppb for the High, Low and Medium Scenarios, respectively. The largest increase of ozone of 5.3 ppb is found in the Moffat County of NM in all three scenarios. The contribution of natural emissions to the modeled 4th highest daily maximum 8-hour ozone concentrations (Figure 5-5, bottom right) confirms the extraordinary contribution from natural wild fires, with a maximum contribution at 61.3 ppb.

Attachment I is a zipped file that contains spatial maps of concentrations including total concentrations and the contributions of each of the Source Groups to the 4th highest DMAX8 ozone and other pollutants from the 2025 High, Low and Medium Development Scenarios CAMx source apportionment modeling. Figure 5-6 displays example spatial maps of contributions to the 4th highest DMAX8 ozone concentrations for CRVFO, White River FO, GJFO, RGFO #1, new Federal O&G in CO (Source Group X), new Federal O&G and Mining in CO (Source Group A2), new Federal O&G, new non-Federal O&G, and new mining in Colorado (Source Group A3), new Federal O&G in CO with Brute Force approach (X1) for the 2025 High, Low and Medium Development Scenarios that were extracted out of Attachment I.

The maximum ozone contributions to the 4th highest DMAX8 ozone for each of the Source Groups are given in Table 5-40. Note that these are maximum Source Group contributions to

the 4th highest DMAX8 ozone and could occur when the total ozone is less or greater than the ozone NAAQS. Section 5.6.2.2 discusses the Source Group contributions only when the total 4th high DMAX8 ozone exceeds the ozone NAAQS. Ozone contributions due to Federal O&G development in the White River Field Office Planning Area are centered on the WRFO area where a maximum ozone contribution of 7.1 ppb occurs for the 2025 High Development Scenario (Table 5-40 and Figure 5-6a, top left). The mitigation in the 2025 Medium Development Scenario reduces this maximum GJFO ozone contribution by -7% to 6.5 ppb. There are much lower 4th high DMAX8 ozone contributions due to WRFO in the 2025 Low Development Scenario (Figure 5-6a, top right) with a maximum contribution of only 1.0 ppb.

Lower 4th high DMAX8 ozone contributions are seen for CRVFO new Federal O&G with highest ozone contributions of 0.4, 0.1 and 0.3, ppb respectively, for the 2025 High, Low and Medium Development Scenarios occurring in the northeast corner of the CRVFO Planning Area (Figure 5-6b).

Ozone contributions due to new Federal O&G within the GJFO area have maximum values of 3.8, 0.2, and 3.2 ppb in the 2025 High, Low and Medium Development Scenarios, respectively (Figure 5-6c).

New Federal O&G emissions in the RGFO #1 Planning Area have peak contributions of 0.4, 0.1 and 0.2 ppb respectively, to fourth highest daily maximum 8-hour ozone from in the 2025 High, Low and Medium Development Scenarios.

The maximum ozone contribution due to Federal O&G throughout the 13 CO Planning areas (Source Group X) for the 2025 High, Low and Medium Development Scenarios are, respectively, 8.7, 2.3 and 7.9 ppb and occur in the White River FO (Table 5-40 and Figure 5-6e). The compartments estimated by X1 (Figure 5-6h) are 6.7, 1.6, and 6.0 ppb, respectively.

Contributions to fourth highest daily maximum 8-hour ozone due to emissions from new Federal O&G and Mining in CO (A2) are shown in Figure 5-6f, and are similar to those by Source Group X (without Mining) in Figure 5-6e, with maximum contributions at 8.7, 3.3, and 7.9 ppb for the 2025 High, Low and Medium Scenarios, respectively. The contributions from new Federal O&G and Mining in CO together with new non-Federal O&G are higher, with maximum contributions at 14.2, 4.8, 13.4 ppb, for the 2025 High, Low, and Medium Scenarios, respectively.

Table 5-40. Maximum contribution to the 4th highest DMAX8 ozone (ppb) for each of the Source Groups and the 2025 High, Low and Medium Development Scenarios.

Source Group	High	Low	Med
A. Natural emissions	61.3	61.3	61.3
B. Little Snake FO	1.0	0.1	0.9
C. White River FO	7.1	1.0	6.5
D. Colorado River Valley FO (CRVFO)	1.3	1.0	1.1
E. Roan Plateau Planning area portion of CRVFO	1.6	1.2	1.7
F. Grand Junction FO	3.8	0.2	3.2
G. Uncompahgre FO	0.8	0.0	0.6
H. Tres Rios FO	0.2	0.0	0.2
I. Kremmling FO	0.1	0.0	0.1
J. RGFO #1	0.4	0.1	0.2
K. RGFO #2	0.1	0.0	0.0
L. RGFO #3	0.6	0.1	0.4
M. RGFO #4	0.1	0.0	0.1
N. Southern Ute Indian Tribe	0.8	0.5	0.3
O. New Mexico Farmington Field Office	1.7	0.9	1.0
P. Combined future non-Federal O&G from BLM Planning Areas	7.2	3.1	7.2
Q. Combined Existing O&G from BLM Planning Areas	12.8	14.5	12.8
R. Mining from BLM Planning Areas	2.7	3.3	2.8
S. All O&G in 12 km domain outside of the BLM Planning Areas	21.8	21.8	21.8
T. Remaining anthropogenic emissions	19.2	19.2	19.2
U. Coal EGU Colorado + New Mexico	10.5	10.8	10.5
V. Oil/Gas EGU Colorado + New Mexico	0.9	1.2	0.9
W. All Other EGUs in 12 km domain	10.1	10.1	10.1
X. Total new federal O&G in CO	8.7	2.3	7.9
Y. New total CRVFO	2.4	1.9	2.2
Z. New total RGFO	0.8	0.1	0.5
A1. All new O&G in CO plus new non-federal FFO1	14.1	4.7	13.3
A2. New federal O&G + new Mining in CO	8.7	3.3	7.9
A3. New federal O&G + new non-federal O&G + Mining in CO	14.2	4.8	13.4
A4. All EGUs in CO and NM	10.5	10.9	10.5
A5. 2025 BC	81.1	81.1	81.1
A6. 2025 Total	119.7	119.7	119.7
A7. 2011 Total	122.0	122.0	122.0
X1. Total new federal O&G in CO (X) using Brute-Force zero-out run	6.7	1.6	6.0

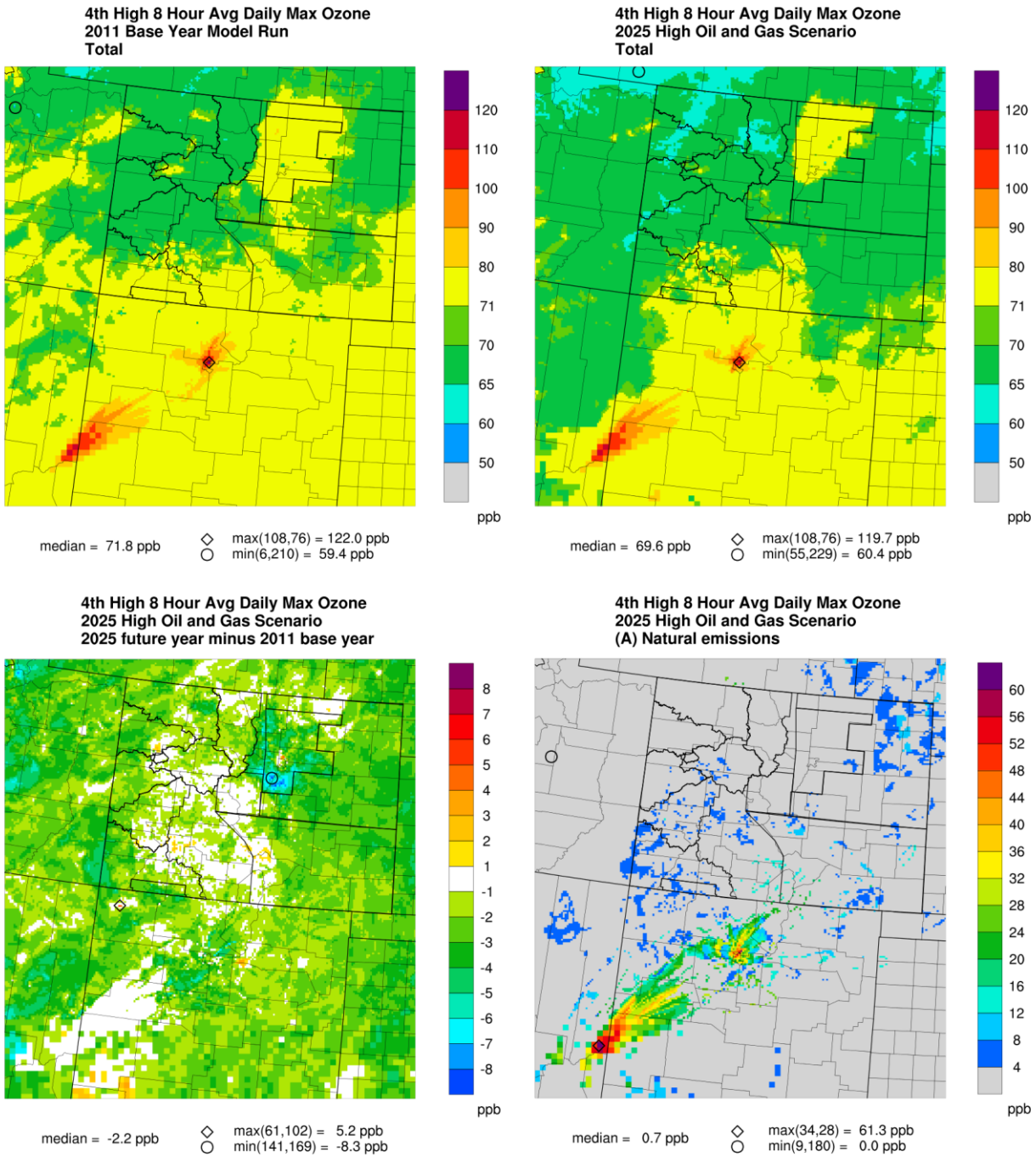

Figure 5-5a. Fourth highest daily maximum 8-hour ozone concentrations for the 2011 Base Case (top left), 2025 High Development Scenario (top right), 2025 High minus 2011 differences (bottom left) and Natural Emissions (bottom right).

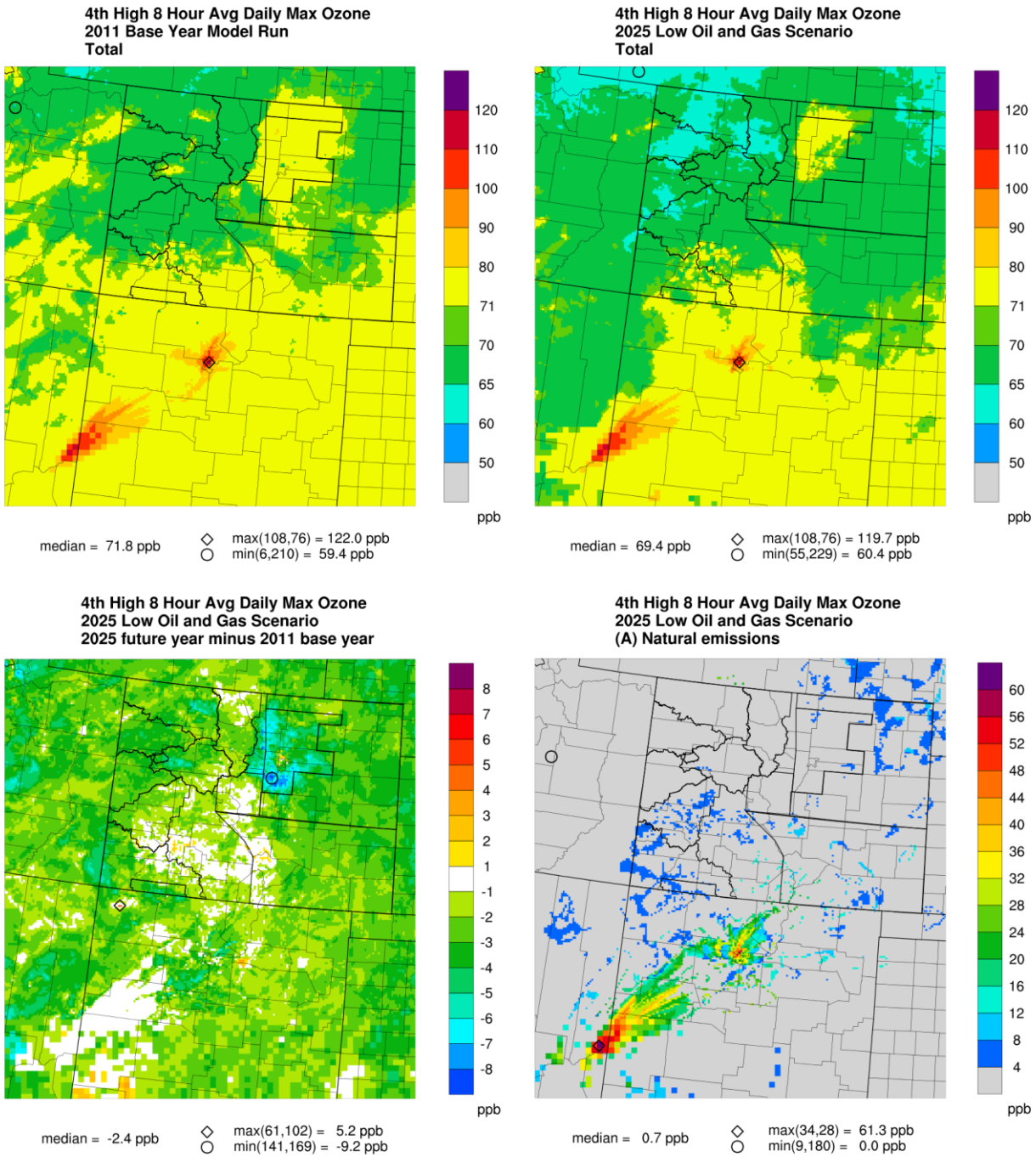

Figure 5-5b. Fourth highest daily maximum 8-hour ozone concentrations for the 2011 Base Case (top left), 2025 Low Development Scenario (top right), 2025 Low minus 2011 differences (bottom left) and Natural Emissions (bottom right).

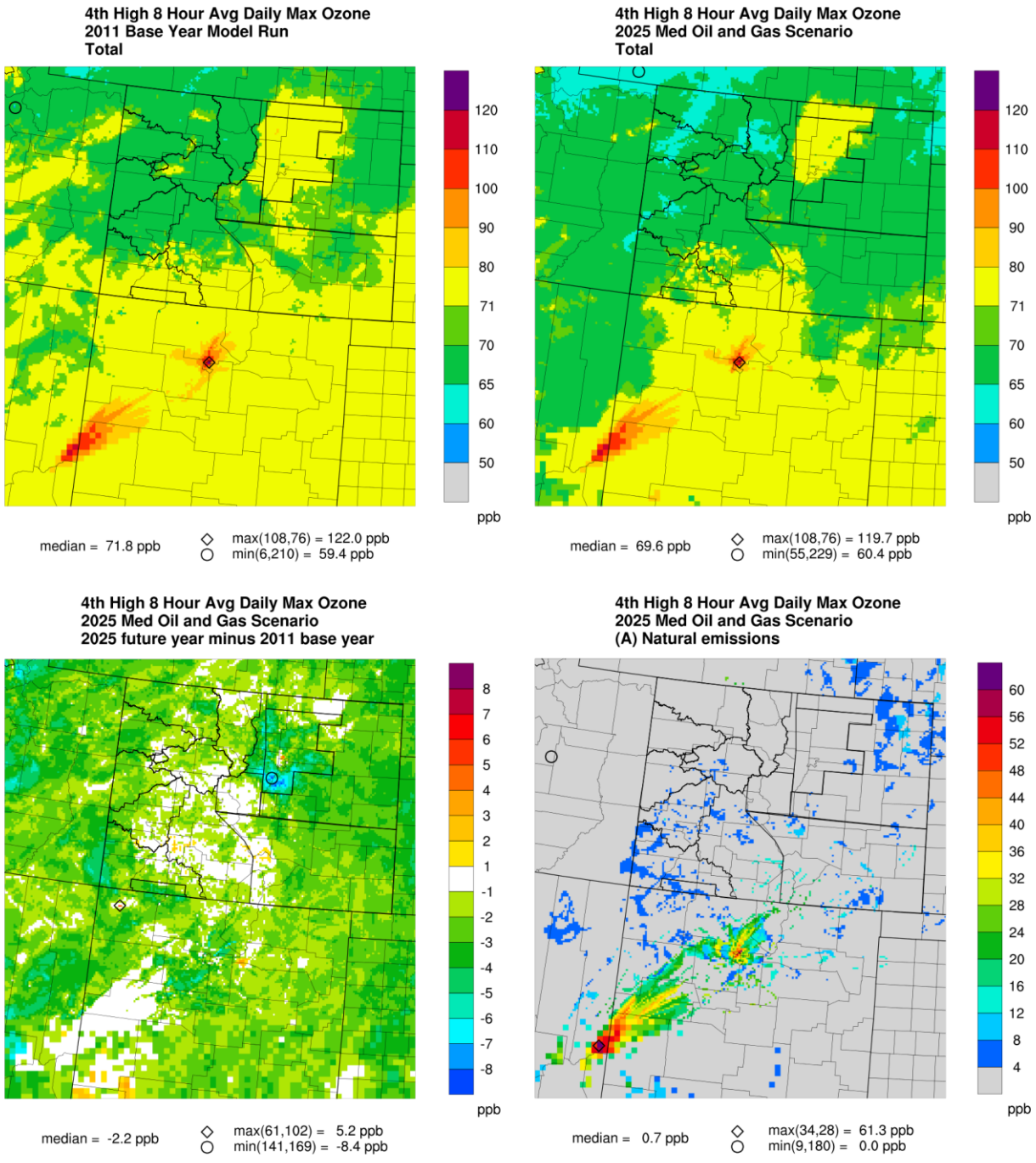

Figure 5-5c. Fourth highest daily maximum 8-hour ozone concentrations for the 2011 Base Case (top left), 2025 Medium Development Scenario (top right), 2025 Medium minus 2011 differences (bottom left) and Natural Emissions (bottom right).

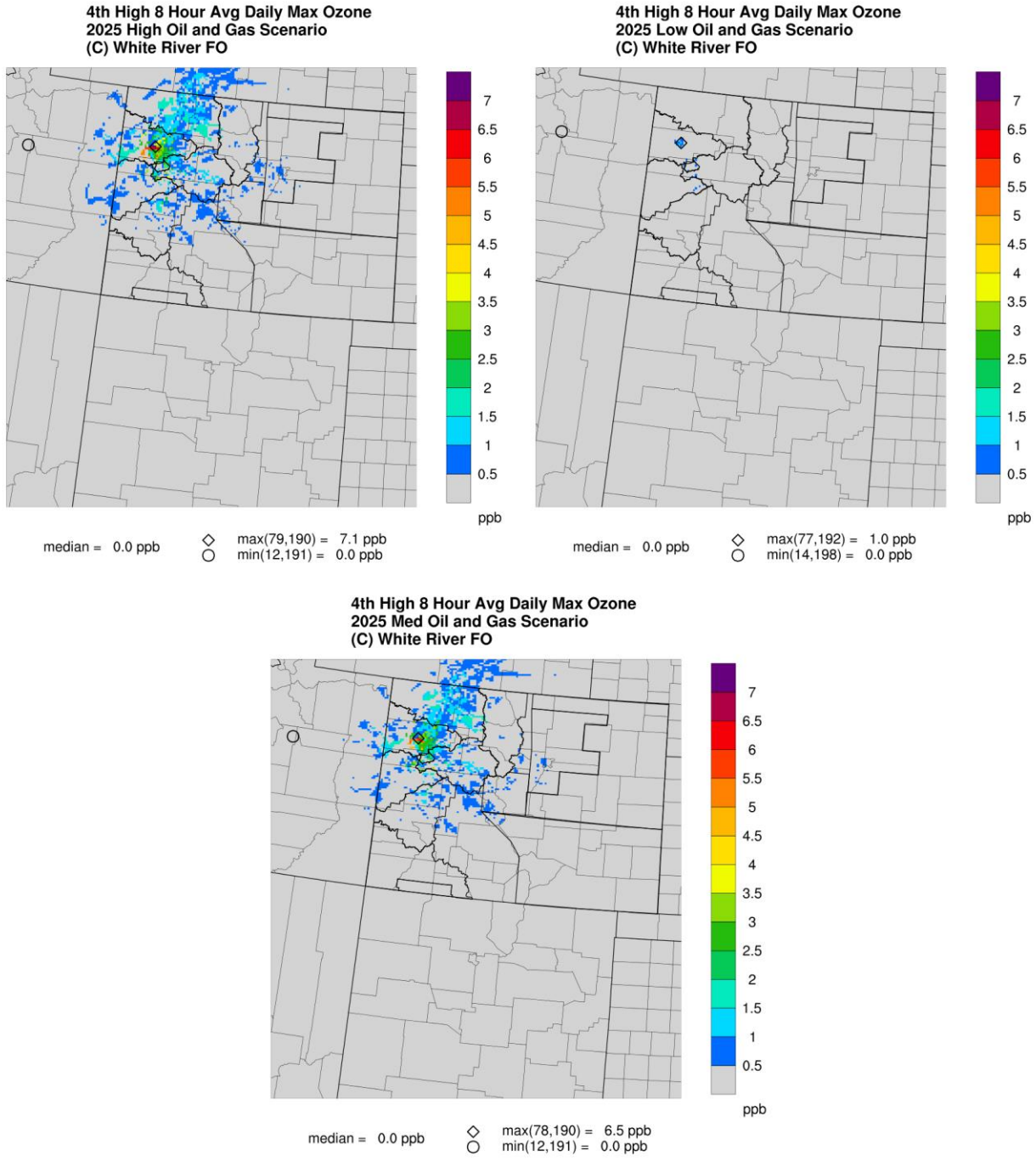

Figure 5-6a. Contributions to fourth highest daily maximum 8-hour ozone due to emissions from new Federal O&G within White River FO (Source Group C) for the 2025 High (top left), Low (top right) and Medium (bottom) Development Scenarios.

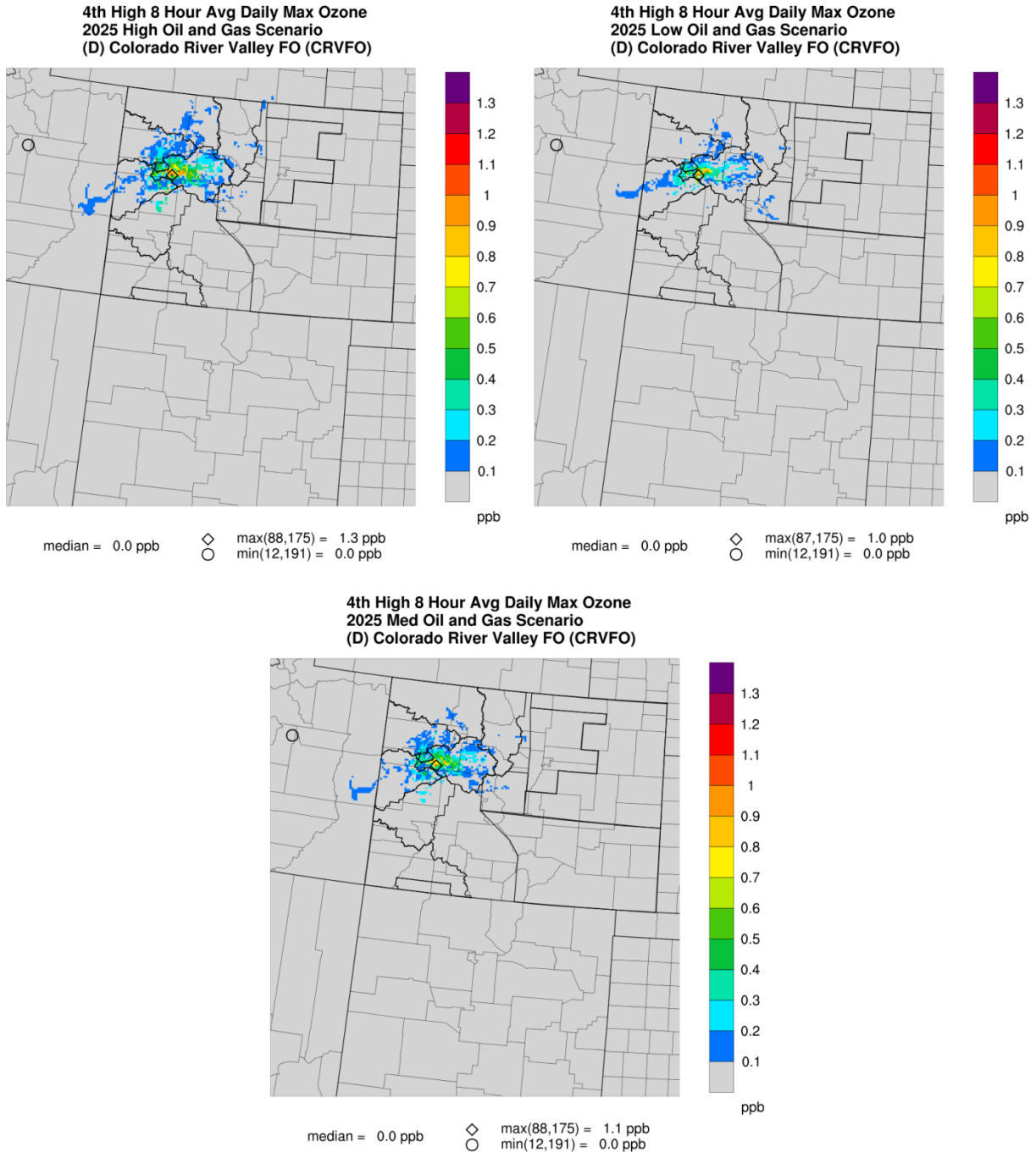

Figure 5-6b. Contributions to fourth highest daily maximum 8-hour ozone due to emissions from new Federal O&G within the CRVFO (Source Group D) for the 2025 High (top left), Low (top right) and Medium (bottom) Development Scenarios.

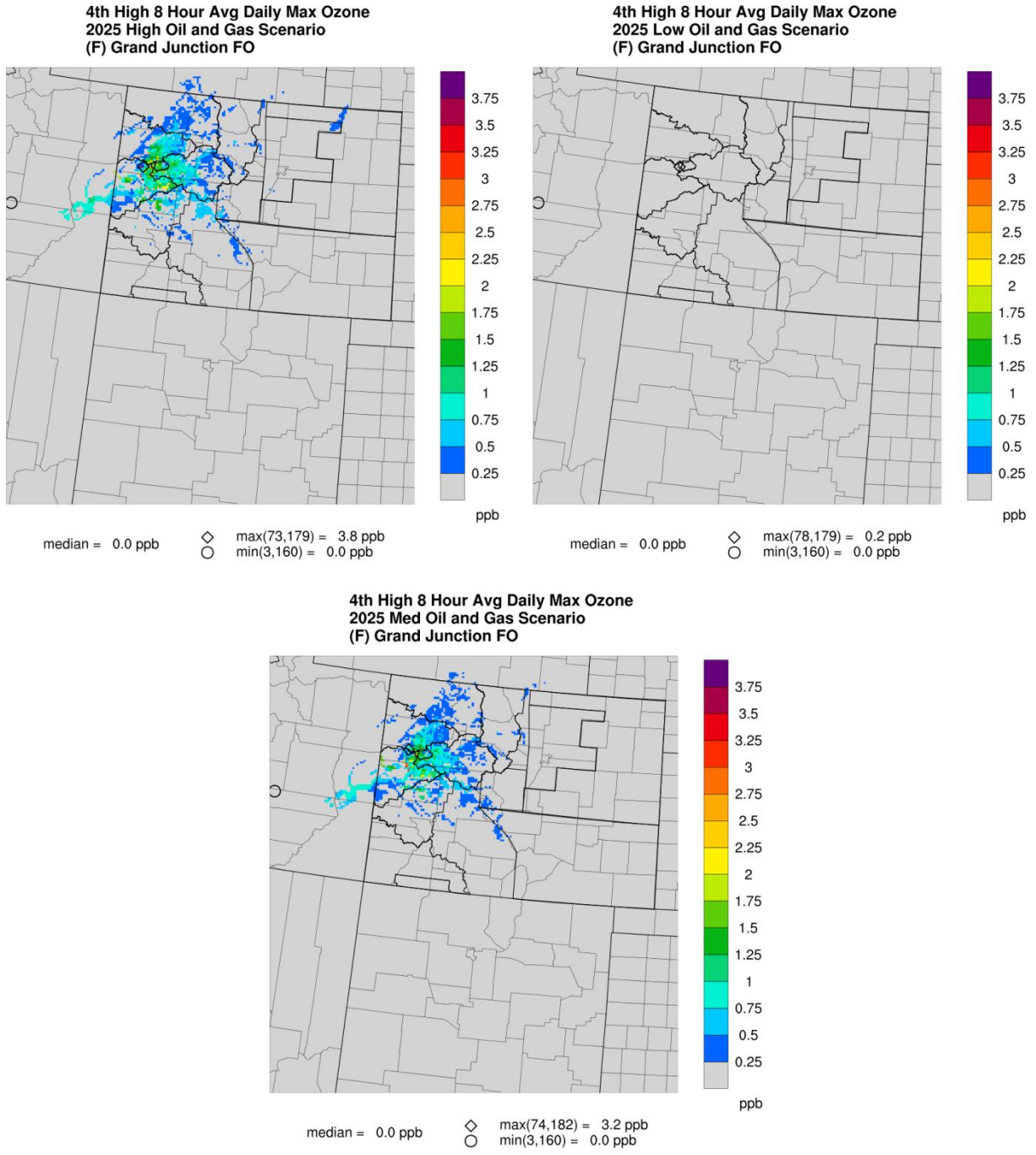

Figure 5-6c. Contributions to fourth highest daily maximum 8-hour ozone due to emissions from new Federal O&G within the GJFO (Source Group F) for the 2025 High (top left), Low (top right) and Medium (bottom) Development Scenarios.

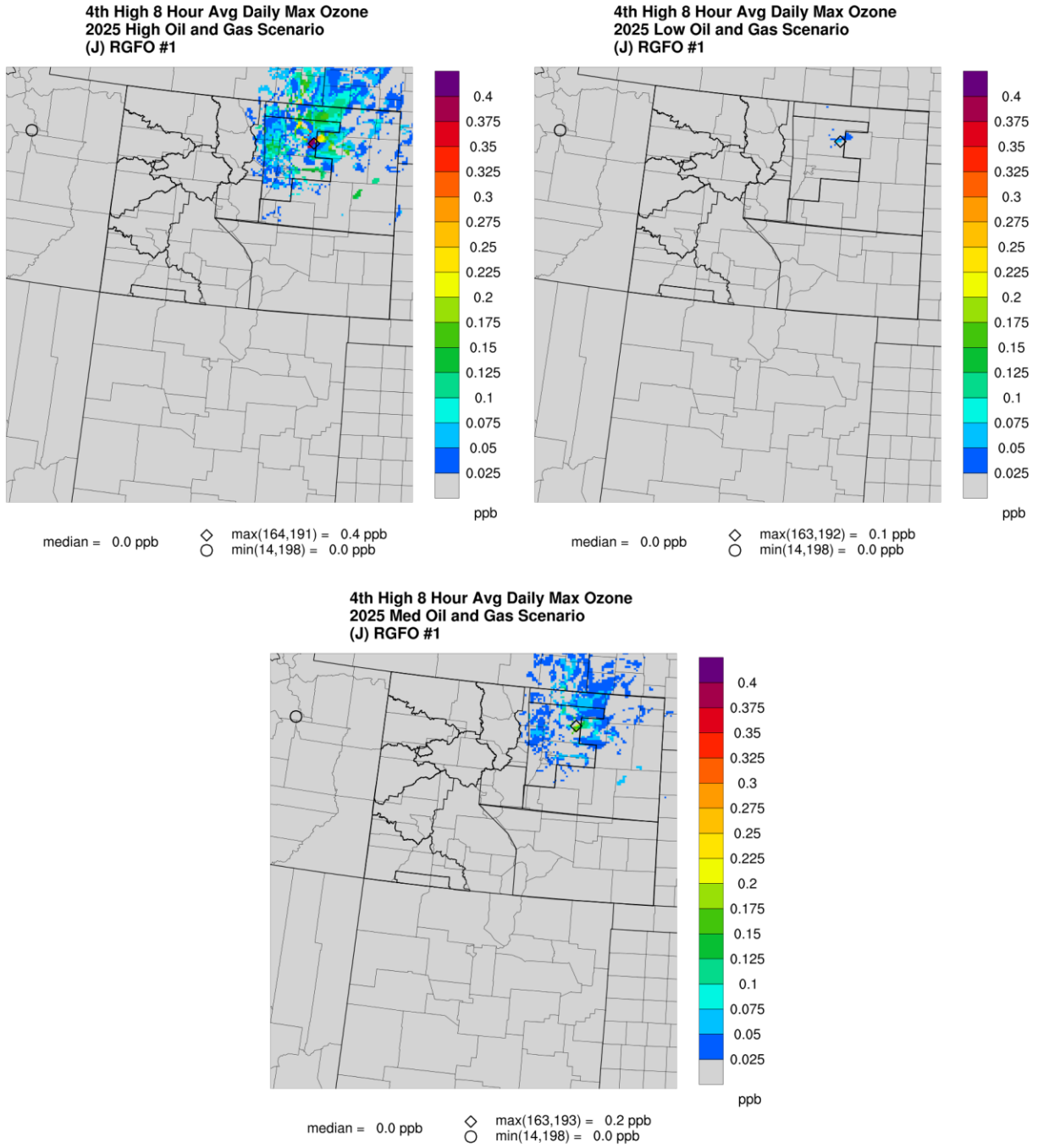

Figure 5-6d. Contributions to fourth highest daily maximum 8-hour ozone due to emissions from RGFO #1 (Source Group J) for the 2025 High (top left), Low (top right) and Medium (bottom) Development Scenarios.

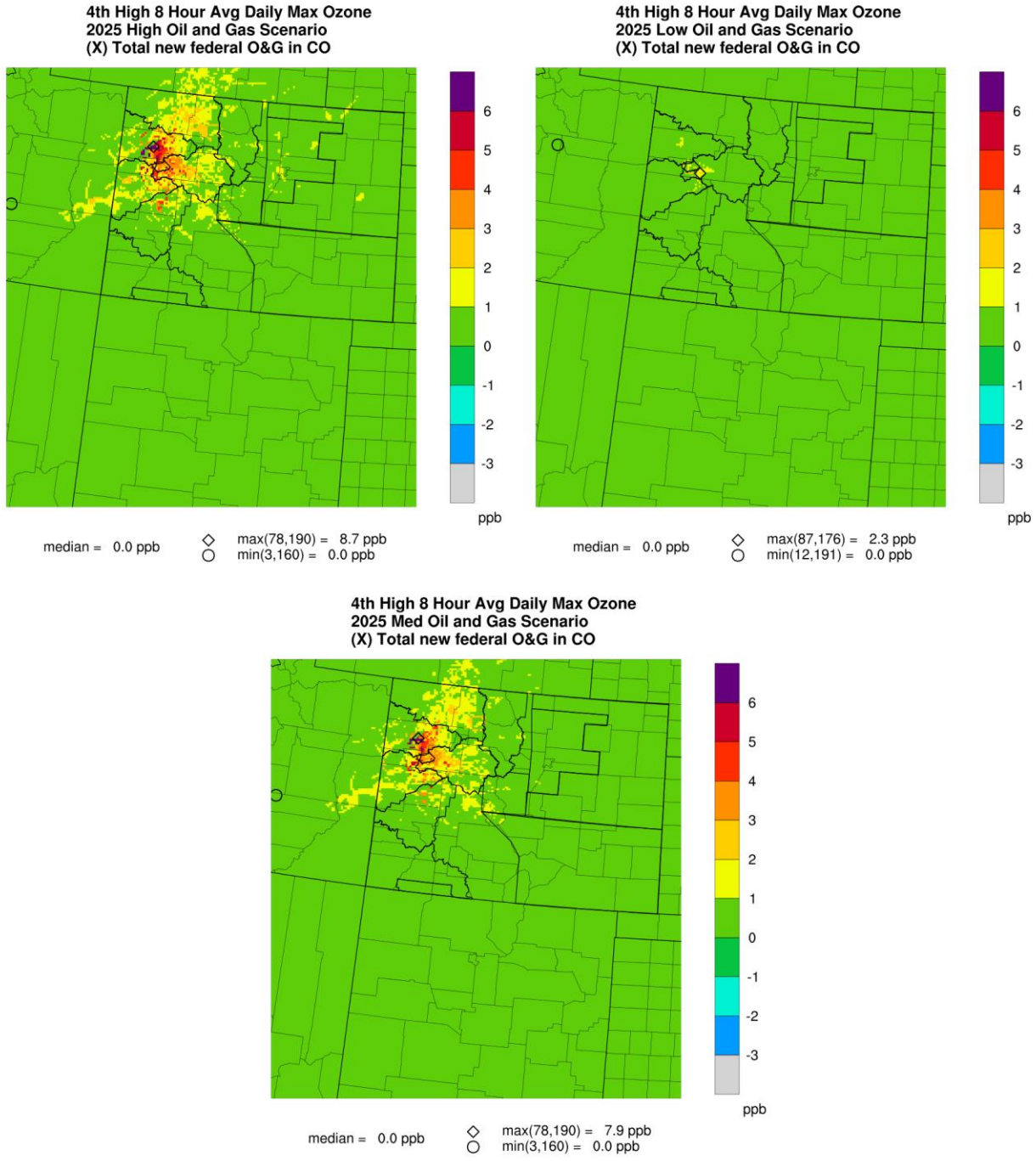

Figure 5-6e. Contributions to fourth highest daily maximum 8-hour ozone due to emissions from new Federal O&G in CO (Source Group X) for the 2025 High (top left), Low (top right) and Medium (bottom) Development Scenarios.

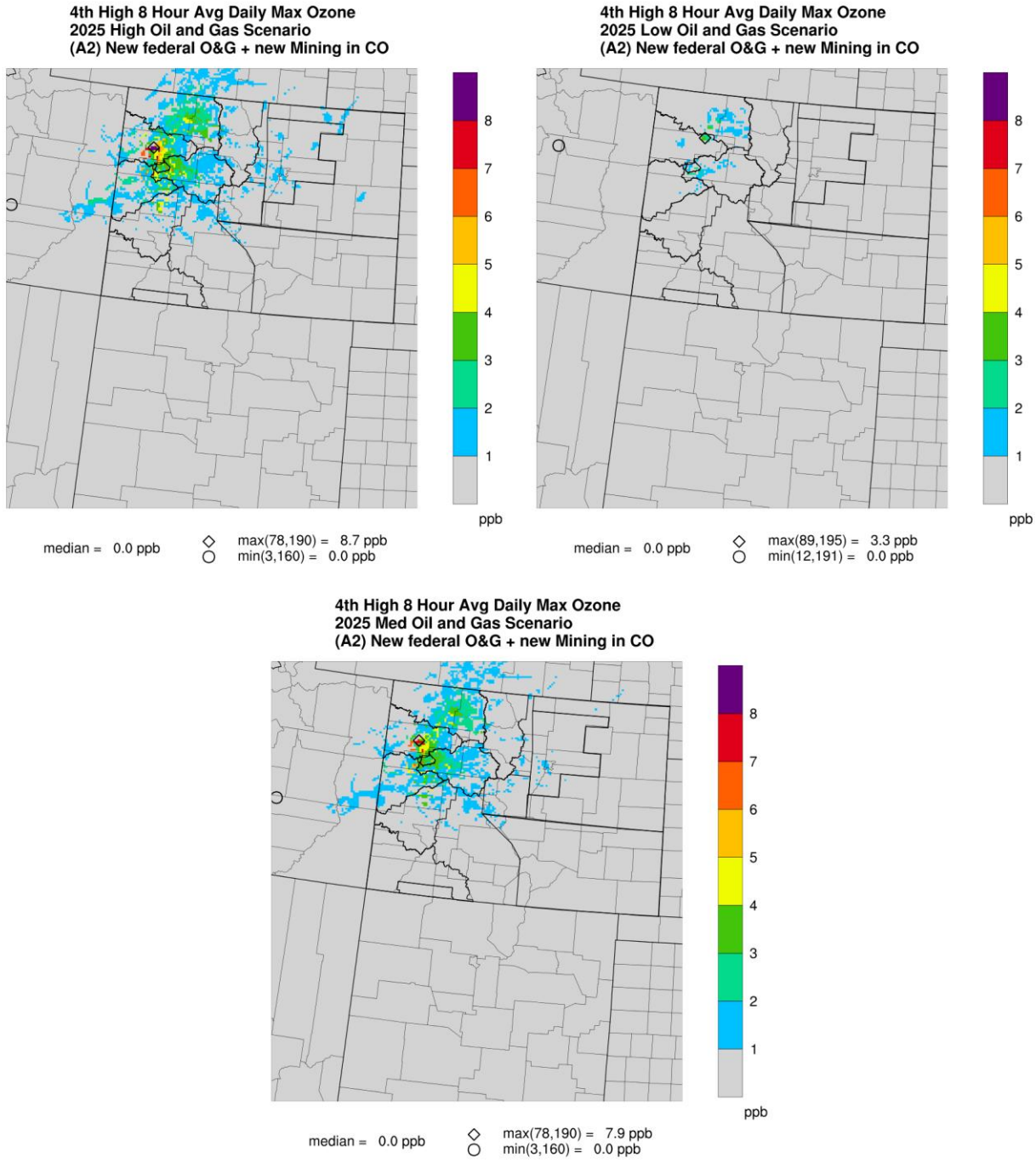

Figure 5-6f. Contributions to fourth highest daily maximum 8-hour ozone due to emissions from new Federal O&G and Mining in CO (Source Group A2) for the 2025 High (top left), Low (top right) and Medium (bottom) Development Scenarios.

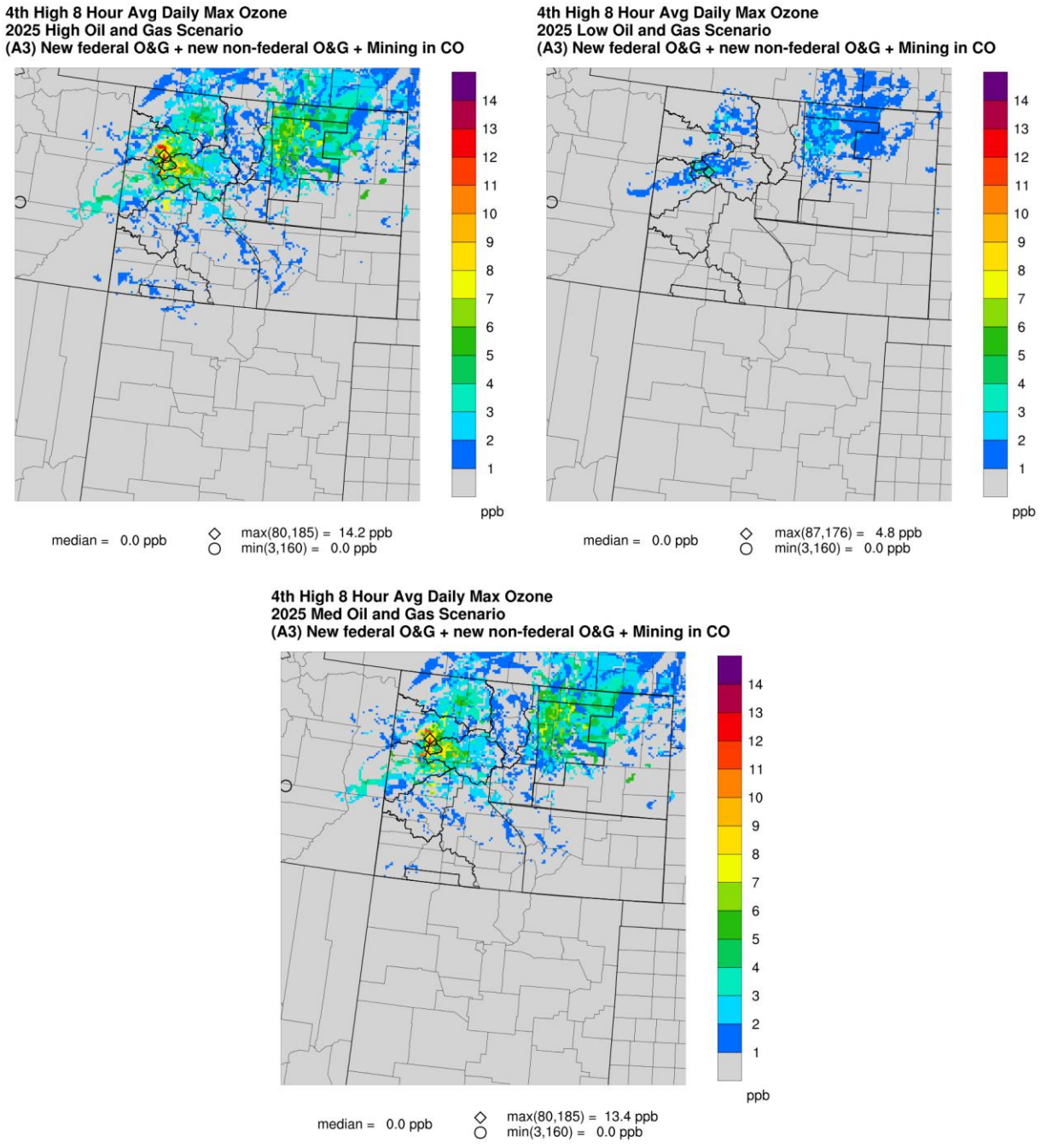

Figure 5-6g. Contributions to fourth highest daily maximum 8-hour ozone due to emissions from new Federal O&G, new non-Federal O&G, and new mining in Colorado (Source Group A3) for the 2025 High (top left), Low (top right) and Medium (bottom) Development Scenarios.

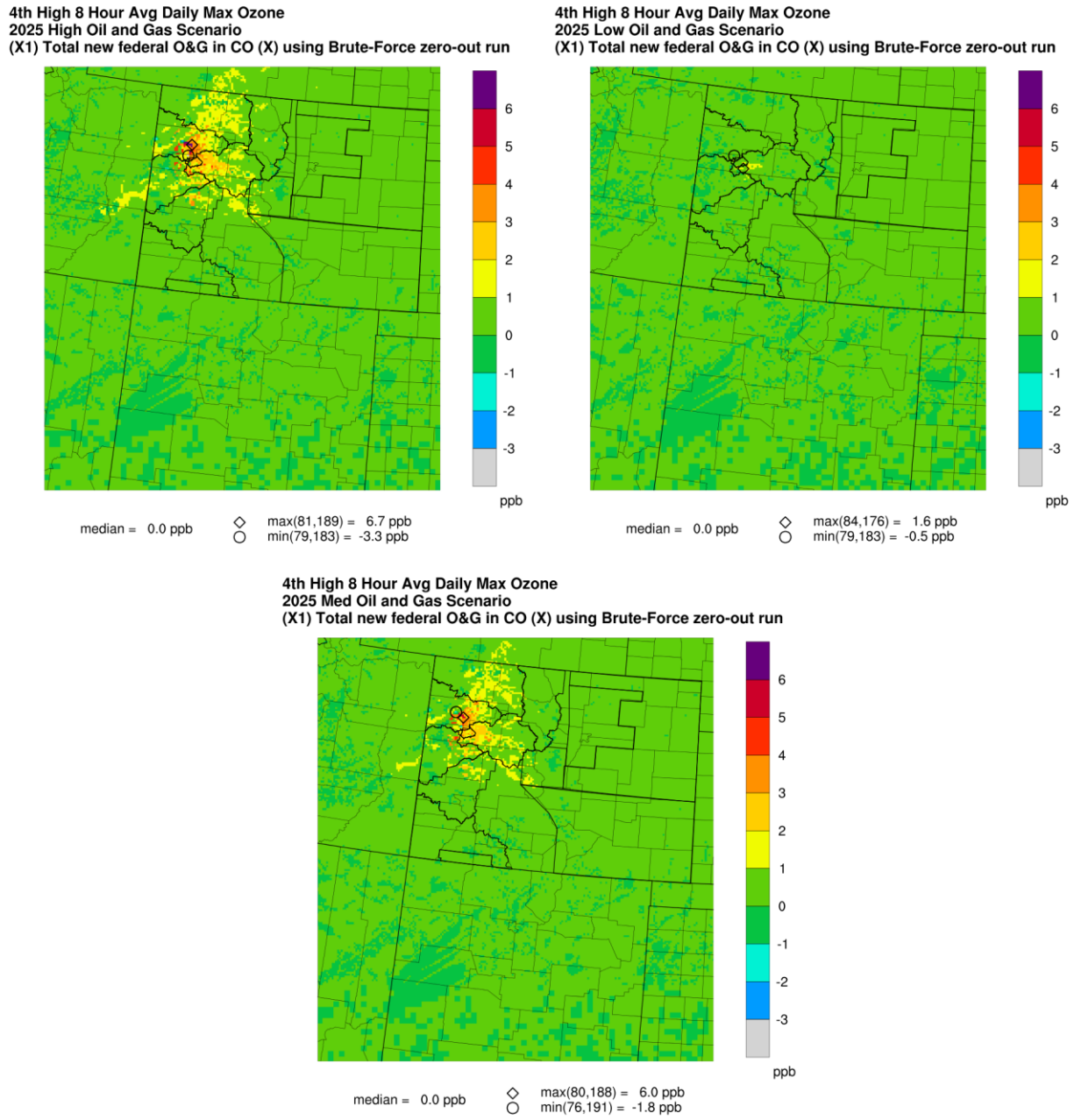

Figure 5-6h. Contributions to fourth highest daily maximum 8-hour ozone due to emissions from new Federal O&G in CO (Source Group X1) for the 2025 High (top left), Low (top right) and Medium (bottom) Development Scenarios.

5.6.2.2 Source Group Absolute Contributions to Ozone Exceedances

The contributions of each Source Group to 4th highest DMAX8 ozone above the current ozone NAAQS (71.0 ppb and higher) for the 2025 High, Low and Medium Development Scenarios are contained in Attachments G-1, G-2 and G-3, respectively. The Attachment G interactive Excel spreadsheet contains two sheets: "StatTable" that displays the maximum ozone contribution for each Source Group to modeled 2025 DMAX8 ozone greater than the NAAQS. Table 5-41 from StatTable in Attachment G lists the maximum ozone contribution to any modeled 2025 4th high DMAX8 ozone greater than the NAAQS. The White River FO is the individual BLM Planning Area with the largest contribution to 2025 modeled exceedances of the ozone NAAQS of 1.5 ppb for the High, 0.1 ppb for the Low and 0.8 ppb for the Medium Development Scenarios when the 2025 total ozone was 71.1, 71.2 and 71.1 ppb, respectively.

The highest contribution to 2025 DMAX8 ozone for all Federal O&G and mining within the 13 Colorado BLM Planning Areas (Source Group X) is 4.5, 0.3 and 1.0 ppb for the 2025 High, Low and Medium Development Scenarios, respectively, while the Brute-Force compartments (X1) are 2.9, 0.3, and 0.7 ppb, respectively. The contribution of new Federal and non-Federal O&G and Federal mining within Colorado (Source Group A2) to 2025 DMAX8 ozone exceedances are 4.6, 0.5 and 1.2 ppb for the High, Low and Medium Development Scenarios, respectively.

Figure 5-7 shows the contribution from new Federal O&G in (X) and new Federal O&G and mining in CO (A2) as a function of the 2025 4th high DMAX8 ozone at all grid cells that exceed NAAQS in the domain that came from the "Scatter" sheet in Attachments G-1, G-2 and G-3. This figure shows that the excessive ozone concentrations above NAAQS do not correlate with the contribution of X or A2. As a matter of fact, the cases with highest 4th high DMAX8 are associated with relatively very low contributions from these two source groups. For the 2025 High O&G Development Scenario, for both X and A2, there are only 4 cases when the contribution is much higher than 1 ppb.

Table 5-41. Maximum ozone contribution by Source Group to total modeled 2025 4th high DMAX8 ozone greater than the NAAQS for the 2025 High Development Scenario.

Group	Name	Max		
		Max Contribution (ppb)	Corresponding 4th MDA8	% Max Contribution
A	Natural emissions	61.2777	112.8	54.34%
B	Little Snake FO	0.1066	71.6	0.15%
C	White River FO	1.5162	71.1	2.13%
D	Colorado River Valley FO (CRVFO)	0.9341	71.1	1.31%
E	Roan Plateau Planning area portion of CRVFO	1.1023	71.1	1.55%
F	Grand Junction FO	1.2137	71.0	1.71%
G	Uncompahgre FO	0.0666	71.7	0.09%
H	Tres Rios FO	0.1072	71.9	0.15%
I	Kremmling FO	0.0389	71.1	0.05%
J	RGFO #1	0.4163	71.8	0.58%
K	RGFO #2	0.0183	73.8	0.02%
L	RGFO #3	0.3881	71.8	0.54%
M	RGFO #4	0.0258	72.4	0.04%
N	Southern Ute Indian Tribe	0.7968	71.8	1.11%
O	New Mexico Farmington Field Office	1.4391	71.7	2.01%
P	Combined future non-Federal O&G from BLM Planning Areas	7.1819	75.7	9.49%
Q	Combined Existing O&G from BLM Planning Areas	12.8180	75.3	17.03%
R	Mining from BLM Planning Areas	0.2071	72.6	0.29%
S	All O&G in 12 km domain outside of the BLM Planning Areas	20.7460	71.8	28.90%
T	Remaining anthropogenic emissions	17.6720	73.2	24.15%
U	Coal EGU Colorado + New Mexico	3.2005	72.4	4.42%
V	Oil/Gas EGU Colorado + New Mexico	0.5792	73.7	0.79%
W	All Other EGUs in 12 km domain	8.6937	71.4	12.18%
X	Total new federal O&G in CO	4.4792	71.1	6.30%
Y	New total CRVFO	1.9683	71.1	2.77%
Z	New total RGFO	0.7578	71.0	1.07%
A1	All new O&G in CO plus new non-federal FFO1	9.3085	71.1	13.10%
A2	New federal O&G + new Mining in CO	4.5710	71.1	6.43%
A3	New federal O&G + new non-federal O&G + Mining in CO	9.3906	71.1	13.22%
A4	All EGUs in CO and NM	3.6329	71.3	5.09%
A5	2025 BC	81.1423	81.6	99.38%
A6	2025 Total	119.6734	119.7	100.00%
A7	2011 Total	122.0480	119.7	101.98%
X1	Total new federal O&G in CO (X) using Brute-Force zero-out run	2.8862	71.1	4.06%

Table 5-41a. Maximum ozone contribution by Source Group to total modeled 2025 4th high DMAX8 ozone greater than the NAAQS for the 2025 Low Development Scenario.

Group	Name	Max		
		Max Contribution (ppb)	Corresponding 4th MDA8	% Max Contribution
A	Natural emissions	61.2777	112.8	54.34%
B	Little Snake FO	0.0212	71.1	0.03%
C	White River FO	0.1241	71.2	0.17%
D	Colorado River Valley FO (CRVFO)	0.1061	71.1	0.15%
E	Roan Plateau Planning area portion of CRVFO	0.1047	71.1	0.15%
F	Grand Junction FO	0.0175	71.9	0.02%
G	Uncompahgre FO	0.0020	71.1	0.00%
H	Tres Rios FO	0.0163	71.7	0.02%
I	Kremmling FO	0.0038	71.9	0.01%
J	RGFO #1	0.0534	71.6	0.07%
K	RGFO #2	0.0000	72.9	0.00%
L	RGFO #3	0.0673	71.7	0.09%
M	RGFO #4	0.0024	72.1	0.00%
N	Southern Ute Indian Tribe	0.5070	72.4	0.70%
O	New Mexico Farmington Field Office	0.6111	72.6	0.84%
P	Combined future non-Federal O&G from BLM Planning Areas	3.0520	73.4	4.16%
Q	Combined Existing O&G from BLM Planning Areas	14.5489	73.4	19.82%
R	Mining from BLM Planning Areas	0.2139	72.2	0.30%
S	All O&G in 12 km domain outside of the BLM Planning Areas	20.7676	71.6	29.02%
T	Remaining anthropogenic emissions	17.8013	72.1	24.67%
U	Coal EGU Colorado + New Mexico	3.3139	72.5	4.57%
V	Oil/Gas EGU Colorado + New Mexico	0.5894	72.8	0.81%
W	All Other EGUs in 12 km domain	8.6900	71.3	12.18%
X	Total new federal O&G in CO	0.3283	71.1	0.46%
Y	New total CRVFO	0.2108	71.1	0.30%
Z	New total RGFO	0.0966	71.6	0.13%
A1	All new O&G in CO plus new non-federal FFO1	3.2189	71.6	4.50%
A2	New federal O&G + new Mining in CO	0.4714	71.1	0.66%
A3	New federal O&G + new non-federal O&G + Mining in CO	3.3199	71.6	4.64%
A4	All EGUs in CO and NM	3.3464	72.5	4.62%
A5	2025 BC	81.1477	81.6	99.40%
A6	2025 Total	119.6520	119.7	100.00%
A7	2011 Total	122.0480	119.7	102.00%
X1	Total new federal O&G in CO (X) using Brute-Force zero-out run	0.2867	71.1	0.40%

Table 5-41b. Maximum ozone contribution by Source Group to total modeled 2025 4th high DMAX8 ozone greater than the NAAQS for the 2025 Medium Development Scenario.

Group	Name	Max		
		Max Contribution (ppb)	Corresponding 4th MDA8	% Max Contribution
A	Natural emissions	61.2777	112.8	54.34%
B	Little Snake FO	0.0888	71.5	0.12%
C	White River FO	0.8279	71.1	1.16%
D	Colorado River Valley FO (CRVFO)	0.0627	71.9	0.09%
E	Roan Plateau Planning area portion of CRVFO	0.0941	71.1	0.13%
F	Grand Junction FO	0.2642	71.2	0.37%
G	Uncompahgre FO	0.0481	71.6	0.07%
H	Tres Rios FO	0.0774	71.9	0.11%
I	Kremmling FO	0.0366	71.0	0.05%
J	RGFO #1	0.2001	73.1	0.27%
K	RGFO #2	0.0120	73.8	0.02%
L	RGFO #3	0.2652	71.6	0.37%
M	RGFO #4	0.0233	72.3	0.03%
N	Southern Ute Indian Tribe	0.3069	72.0	0.43%
O	New Mexico Farmington Field Office	0.6562	72.8	0.90%
P	Combined future non-Federal O&G from BLM Planning Areas	7.2023	76.0	9.48%
Q	Combined Existing O&G from BLM Planning Areas	12.8454	75.1	17.09%
R	Mining from BLM Planning Areas	0.2079	72.5	0.29%
S	All O&G in 12 km domain outside of the BLM Planning Areas	20.7490	71.8	28.92%
T	Remaining anthropogenic emissions	17.6708	73.1	24.17%
U	Coal EGU Colorado + New Mexico	3.3043	72.5	4.56%
V	Oil/Gas EGU Colorado + New Mexico	0.5789	73.6	0.79%
W	All Other EGUs in 12 km domain	8.6894	71.3	12.18%
X	Total new federal O&G in CO	0.9896	72.7	1.36%
Y	New total CRVFO	0.1568	71.9	0.22%
Z	New total RGFO	0.3830	71.5	0.54%
A1	All new O&G in CO plus new non-federal FFO1	7.7481	76.0	10.20%
A2	New federal O&G + new Mining in CO	1.1712	72.7	1.61%
A3	New federal O&G + new non-federal O&G + Mining in CO	7.8636	76.0	10.35%
A4	All EGUs in CO and NM	3.6389	71.2	5.11%
A5	2025 BC	81.1463	81.6	99.40%
A6	2025 Total	119.6666	119.7	100.00%
A7	2011 Total	122.0480	119.7	101.99%
X1	Total new federal O&G in CO (X) using Brute-Force zero-out run	0.6720	71.1	0.95%

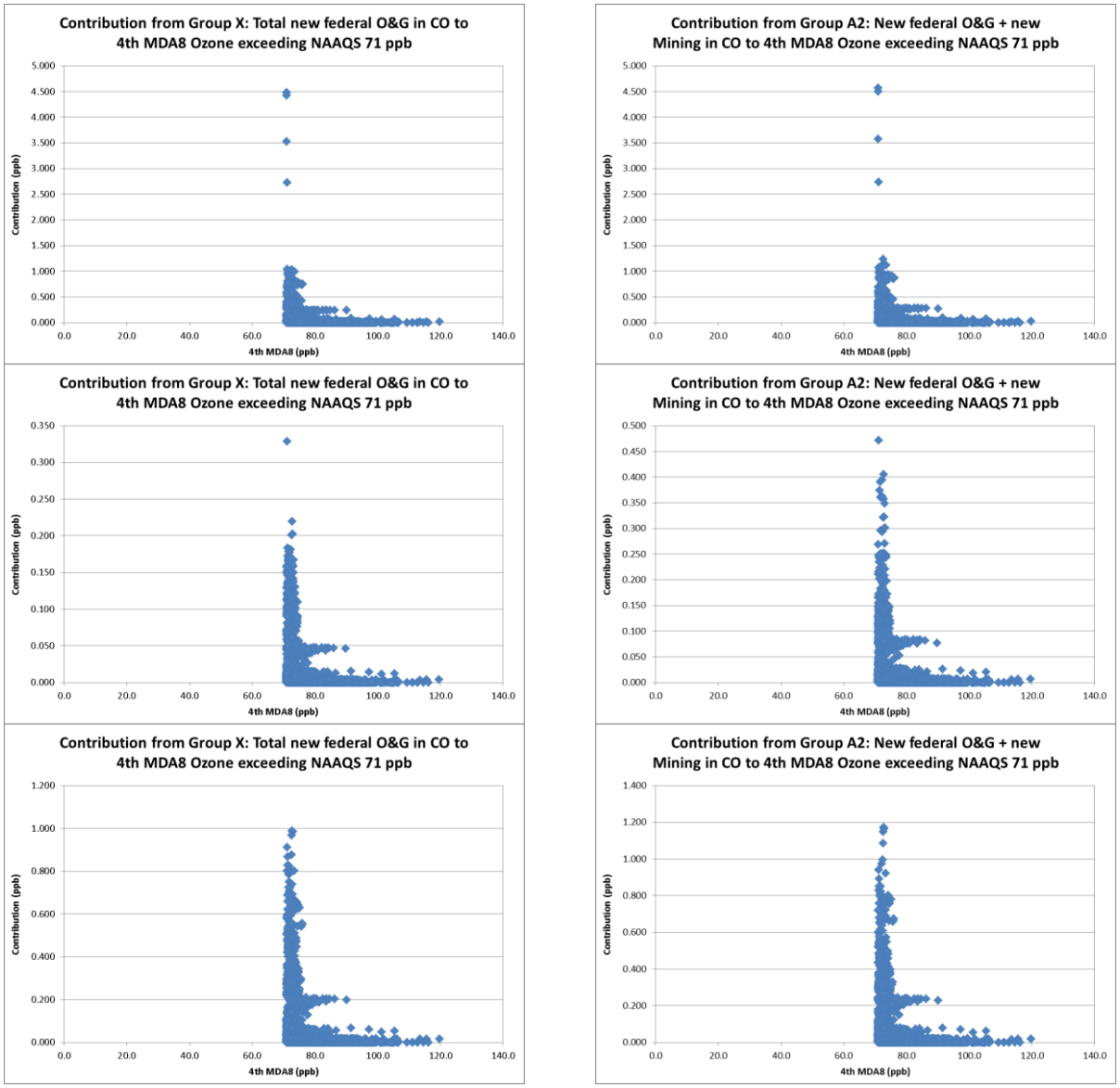

Figure 5-7. Contributions of Federal O&G from new Federal O&G (Source Group X; left) and new Federal O&G and mining in CO (Source Group A2; right) to modeled fourth highest daily maximum 8-hour ozone concentrations greater than the NAAQS for the 2025 High (top), Low (middle) and Medium (bottom) Development Scenarios.

5.6.3 $PM_{2.5}$ NAAQS Analysis

There are two $PM_{2.5}$ NAAQS, one for a 24-hour averaging time that is expressed as a three-year average of the 98th percentile value in a year with a threshold of 35 µg/m^3 and an annual average over three-years with a threshold of 12 µg/m^3. With a complete year of modeling results, the 98th percentile corresponds to the 8th highest daily $PM_{2.5}$ concentration in a year.

5.6.3.1 24-Hour $PM_{2.5}$ NAAQS Analyses

Figure 5-8 displays the 8th highest 24-hour $PM_{2.5}$ concentrations for the 2011 Base Case and 2025 emission scenarios and their differences and the contributions of Natural Emissions to the 8th highest 24-hour $PM_{2.5}$ concentration. The maximum 8th high 24-hour $PM_{2.5}$ in 2011 (421.3 µg/m^3) and 2025 High, Low and Medium Development Scenarios (420.9 µg/m^3) far exceed the 35 µg/m^3 NAAQS (Figure 5-8, top panels). This high value occurs on the AZ/NM boarder and is largely due to emissions from wildfires (406.5 µg/m^3), as shown from the map of contribution by Natural Emissions (Figure 5-8, bottom right). The greater Denver area shows exceedance in 2011 Base case and all three 2025 Scenarios. The maps of difference between 2015 Scenarios and 2011 Base case (Figure 5-8, bottom left) show decrease of $PM_{2.5}$ concentrations in a majority of places in the domain and increase in many places, including Denver, eastern Utah, and central and northwestern New Mexico.

Figures 5-9 through 5-11 show the contribution of new Federal O&G in CO to 8th high 24-hour $PM_{2.5}$ in 2025 High, Low and Medium Scenarios. The maximum contribution is 6.3, 0.9 and 5.6 µg/m^3 for the High, Low and Medium Scenarios, respectively, all of which occur in the White River Field Office Planning Area, while the maximum is found in a different place for the Medium Scenario than the High and Low Scenarios.

Figure 5-12 displays the contributions of Federal O&G from the WRFO (top left), CRVFO (top right), GJFO (bottom left), and RGFO #1 Planning Areas to the 8th highest 24-hour $PM_{2.5}$ concentrations for the 2025 High Development Scenario. Results for the 2025 Low and Medium Development Scenario are lower and can be found in Attachment I. The maximum contribution to 8th highest 24-hour $PM_{2.5}$ concentration due to emissions from new Federal O&G in these four Source Groups in the High Development Scenario are 6.3 µg/m^3 (WRFO), 0.3 µg/m^3 (CRVFO), 2.6 µg/m^3 (GJFO) and 1.3 µg/m^3 (RGFO #1) (Table 5-42).

Figure 5-13a shows the contributions of new Federal O&G and mining in CO (Source Group A2) to $PM_{2.5}$ concentrations in the three 2025 Development Scenarios. The peak 8th highest daily $PM_{2.5}$ concentrations are 6.3, 4.2 and 5.6 µg/m^3 in the 2025 High, Low and Medium Development Scenarios, respectively. Figure 5-13b presents the contributions of new Federal and non-Federal O&G and mining in CO (Source Group A3) for the 2025 High, Low and Medium Development Scenarios. The peak 8th highest daily $PM_{2.5}$ concentrations are 17.6, 6.1 and 17.5 µg/m^3 in the 2025 High, Low and Medium Development Scenarios, respectively. Comparing Figure 5-13a and Figure 5-13b suggests that these peaks near Denver are to a large extent due to contribution from non-Federal O&G. The year 2025 minus year 2011 impacts difference plots (bottom left of Figures 5-8a, 5-8b and 5-8c) in conjunction with plots for Source Groups A2 and A3 indicate relatively large increases in 24-hour $PM_{2.5}$ concentrations primarily due to new non-Federal oil and gas in the RGFO #1.

Table 5-42 summarizes the maximum contribution to the 8th highest 24-hour $PM_{2.5}$ concentrations for all of the Source Groups and the 2025 High, Low and Medium Development Scenarios. For most BLM Planning Areas, the contribution of Federal O&G to the 8th highest 24-hour $PM_{2.5}$ concentrations is small, around or less than 1 $\mu g/m^3$. The top 6 contributors for the High Development Scenario are White River FO (6.3 $\mu g/m^3$), Southern Ute Indian Tribe (2.9 $\mu g/m^3$), Grand Junction FO (2.6 $\mu g/m^3$), Little Snake FO (1.3 $\mu g/m^3$), RGFO #1 (1.3 $\mu g/m^3$), and RGFO #3 (1.3 $\mu g/m^3$), which are also the largest contributors for the Low and Medium Scenarios.

Table 5-42. Maximum contribution to the 8th high 24-hour $PM_{2.5}$ concentrations ($\mu g/m^3$) for each of the Source Groups and the 2025 High, Low and Medium Development Scenarios.

Source Group	High	Low	Med
A. Natural emissions	406.5	406.5	406.5
B. Little Snake FO	1.3	0.1	0.5
C. White River FO	6.3	0.9	5.5
D. Colorado River Valley FO (CRVFO)	0.3	0.2	0.3
E. Roan Plateau Planning area portion of CRVFO	0.8	0.3	0.5
F. Grand Junction FO	2.6	0.0	0.9
G. Uncompahgre FO	0.2	0.0	0.2
H. Tres Rios FO	0.4	0.1	0.2
I. Kremmling FO	0.1	0.0	0.1
J. RGFO #1	1.3	0.1	0.6
K. RGFO #2	0.1	0.0	0.1
L. RGFO #3	1.3	0.2	0.7
M. RGFO #4	0.1	0.0	0.1
N. Southern Ute Indian Tribe	2.9	1.5	1.2
O. New Mexico Farmington Field Office	0.8	0.4	0.4
P. Combined future non-Federal O&G from BLM Planning Areas	17.4	6.1	17.4
Q. Combined Existing O&G from BLM Planning Areas	14.6	16.4	14.6
R. Mining from BLM Planning Areas	5.4	4.2	5.4
S. All O&G in 12 km domain outside of the BLM Planning Areas	19.0	19.0	19.0
T. Remaining anthropogenic emissions	86.7	86.9	86.7
U. Coal EGU Colorado + New Mexico	3.3	3.3	3.3
V. Oil/Gas EGU Colorado + New Mexico	0.1	0.1	0.1
W. All Other EGUs in 12 km domain	5.6	5.6	5.6
X. Total new federal O&G in CO	6.3	0.9	5.6
Y. New total CRVFO	1.0	0.5	0.6
Z. New total RGFO	1.4	0.3	0.7
A1. All new O&G in CO plus new non-federal FFO1	17.6	6.1	17.5
A2. New federal O&G + new Mining in CO	6.3	4.2	5.6
A3. New federal O&G + new non-federal O&G + Mining in CO	17.6	6.1	17.5
A4. All EGUs in CO and NM	3.3	3.3	3.3
A5. 2025 BC	14.0	14.0	14.0
A6. 2025 Total	420.9	420.9	420.9
A7. 2011 Total	421.3	421.3	421.3
X1. Total new federal O&G in CO (X) using Brute-Force zero-out run	6.5	0.9	5.7

Table 5-42a. Maximum contribution to the annual $PM_{2.5}$ concentrations ($\mu g/m^3$) for each of the Source Groups and the 2025 High, Low and Medium Development Scenarios.

Source Group	High	Low	Med
A. Natural emissions	17.4	17.4	17.4
B. Little Snake FO	0.6	0.0	0.3
C. White River FO	3.4	0.4	2.8
D. Colorado River Valley FO (CRVFO)	0.2	0.1	0.2
E. Roan Plateau Planning area portion of CRVFO	0.4	0.2	0.3
F. Grand Junction FO	1.2	0.0	0.6
G. Uncompahgre FO	0.2	0.0	0.1
H. Tres Rios FO	0.2	0.0	0.1
I. Kremmling FO	0.1	0.0	0.1
J. RGFO #1	0.6	0.1	0.3
K. RGFO #2	0.1	0.0	0.0
L. RGFO #3	0.6	0.1	0.3
M. RGFO #4	0.1	0.0	0.0
N. Southern Ute Indian Tribe	1.4	0.7	0.6
O. New Mexico Farmington Field Office	0.3	0.1	0.1
P. Combined future non-Federal O&G from BLM Planning Areas	7.2	2.5	7.2
Q. Combined Existing O&G from BLM Planning Areas	5.6	5.7	5.6
R. Mining from BLM Planning Areas	2.9	1.6	2.9
S. All O&G in 12 km domain outside of the BLM Planning Areas	8.1	8.1	8.1
T. Remaining anthropogenic emissions	18.9	18.9	18.9
U. Coal EGU Colorado + New Mexico	0.6	0.6	0.6
V. Oil/Gas EGU Colorado + New Mexico	0.0	0.0	0.0
W. All Other EGUs in 12 km domain	1.2	1.2	1.2
X. Total new federal O&G in CO	3.5	0.4	2.9
Y. New total CRVFO	0.5	0.3	0.4
Z. New total RGFO	0.6	0.1	0.3
A1. All new O&G in CO plus new non-federal FFO1	7.3	2.5	7.3
A2. New federal O&G + new Mining in CO	3.5	1.6	2.9
A3. New federal O&G + new non-federal O&G + Mining in CO	7.3	2.5	7.3
A4. All EGUs in CO and NM	0.6	0.6	0.6
A5. 2025 BC	3.1	3.1	3.1
A6. 2025 Total	21.1	20.9	21.0
A7. 2011 Total	23.5	23.5	23.5
X1. Total new federal O&G in CO (X) using Brute-Force zero-out run	3.6	0.5	2.9

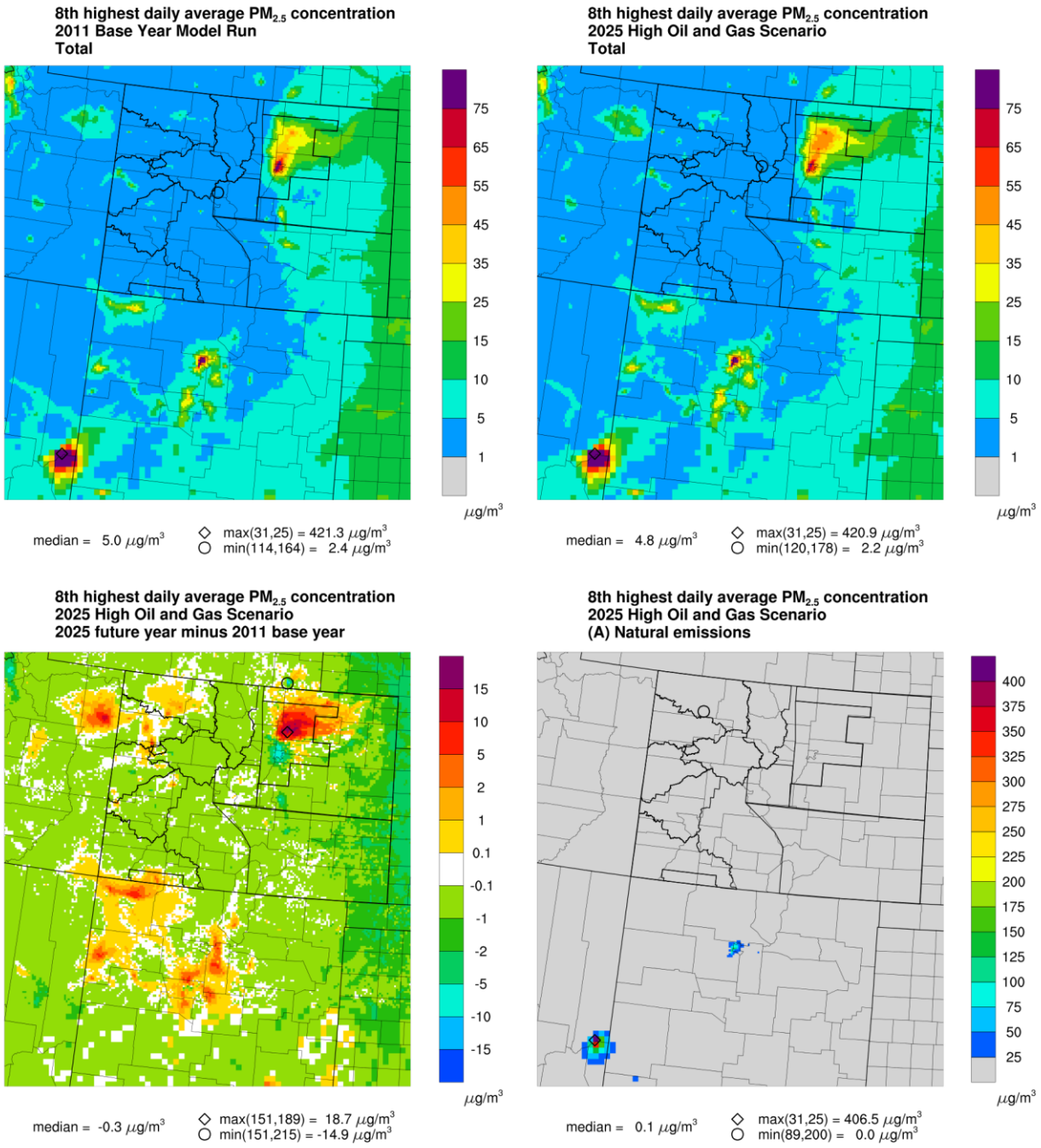

Figure 5-8a. Eighth highest 24-hour $PM_{2.5}$ concentrations for the 2011 Base Case (top left), 2025 High Development Scenario (top right), 2025 High minus 2011 differences (bottom left) and Natural Emissions (bottom right).

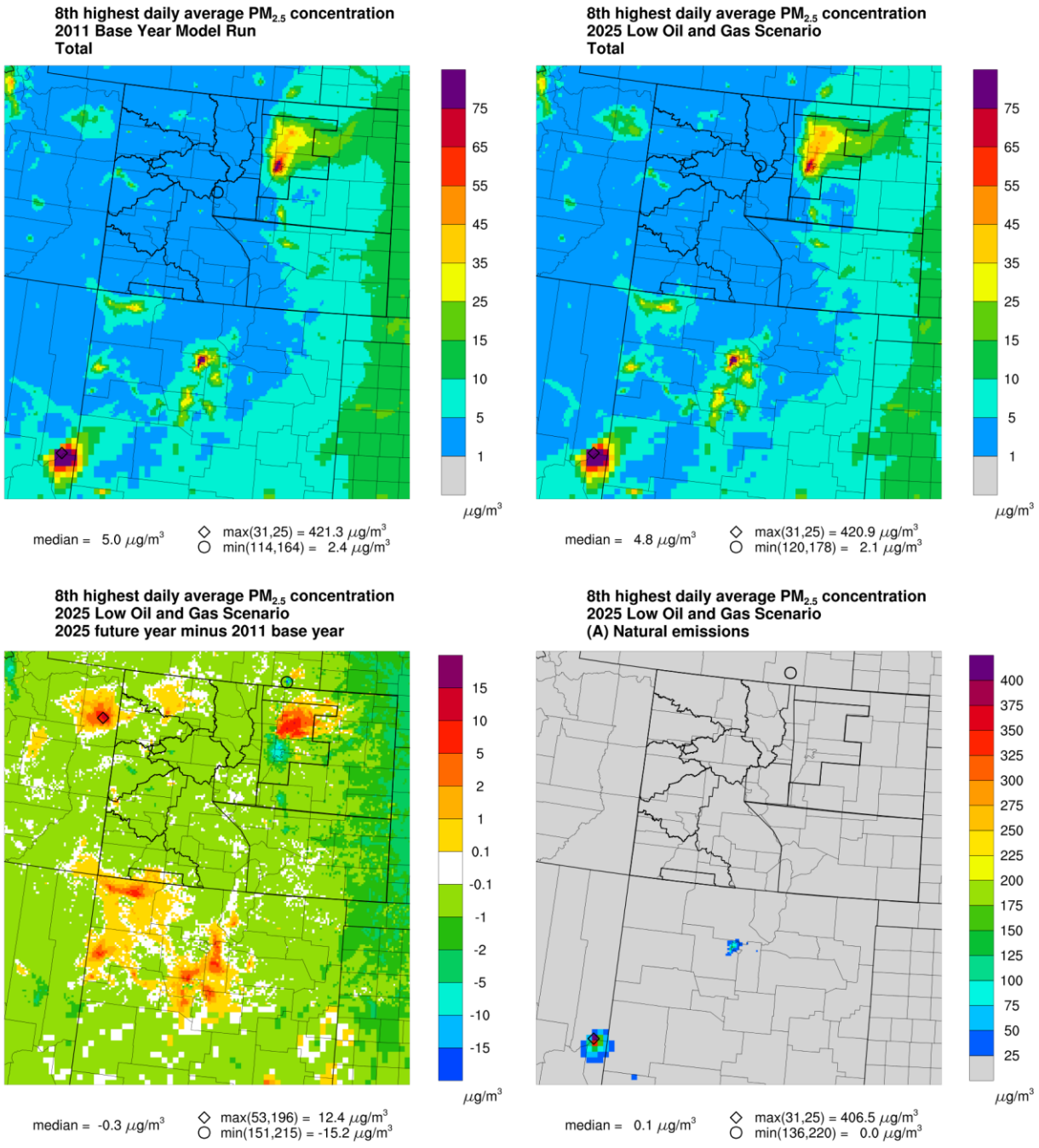

Figure 5-8b. Eighth highest 24-hour $PM_{2.5}$ concentrations for the 2011 Base Case (top left), 2025 Low Development Scenario (top right), 2025 Low minus 2011 differences (bottom left) and Natural Emissions (bottom right).

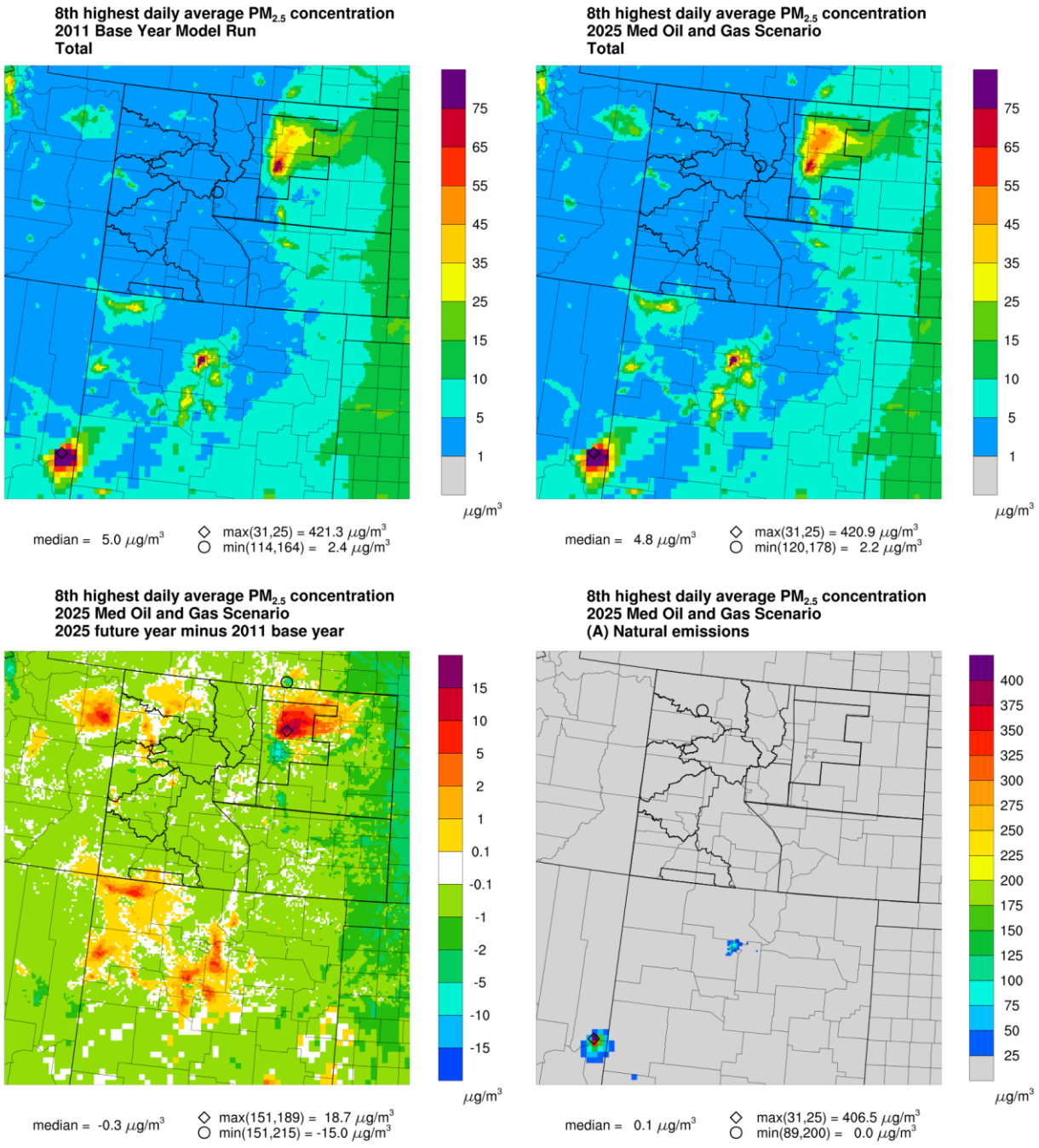

Figure 5-8c. Eighth highest 24-hour $PM_{2.5}$ concentrations for the 2011 Base Case (top left), 2025 Medium Development Scenario (top right), 2025 Medium minus 2011 differences (bottom left) and Natural Emissions (bottom right).

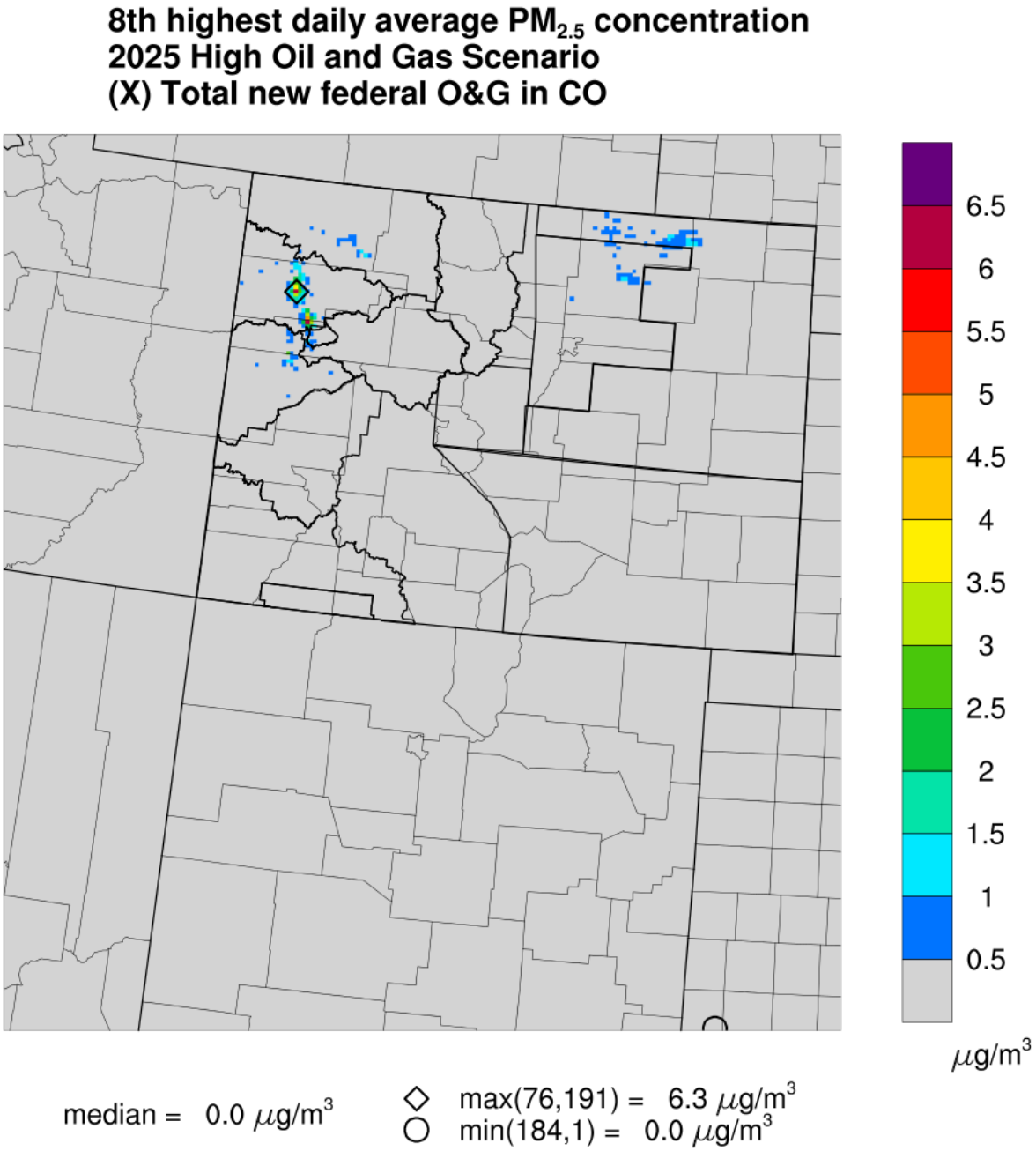

Figure 5-9. Contribution to 8th highest daily $PM_{2.5}$ concentrations due to emissions from new Federal O&G in CO (Source Group X) for the 2025 High Development Scenario.

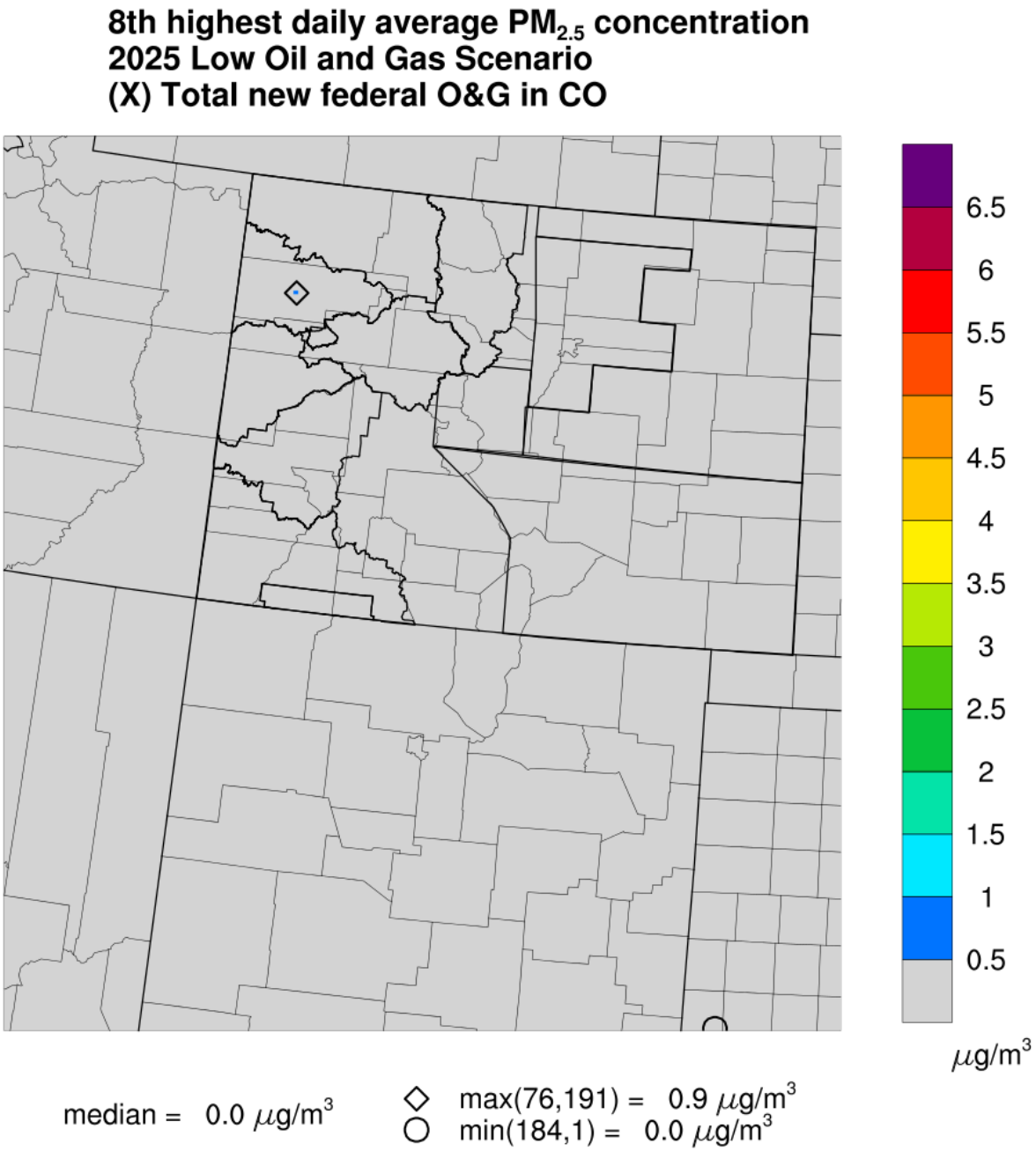

Figure 5-10. Contribution to 8th highest daily $PM_{2.5}$ concentrations due to emissions from new Federal O&G in CO (Source Group X) for the 2025 Low Development Scenario.

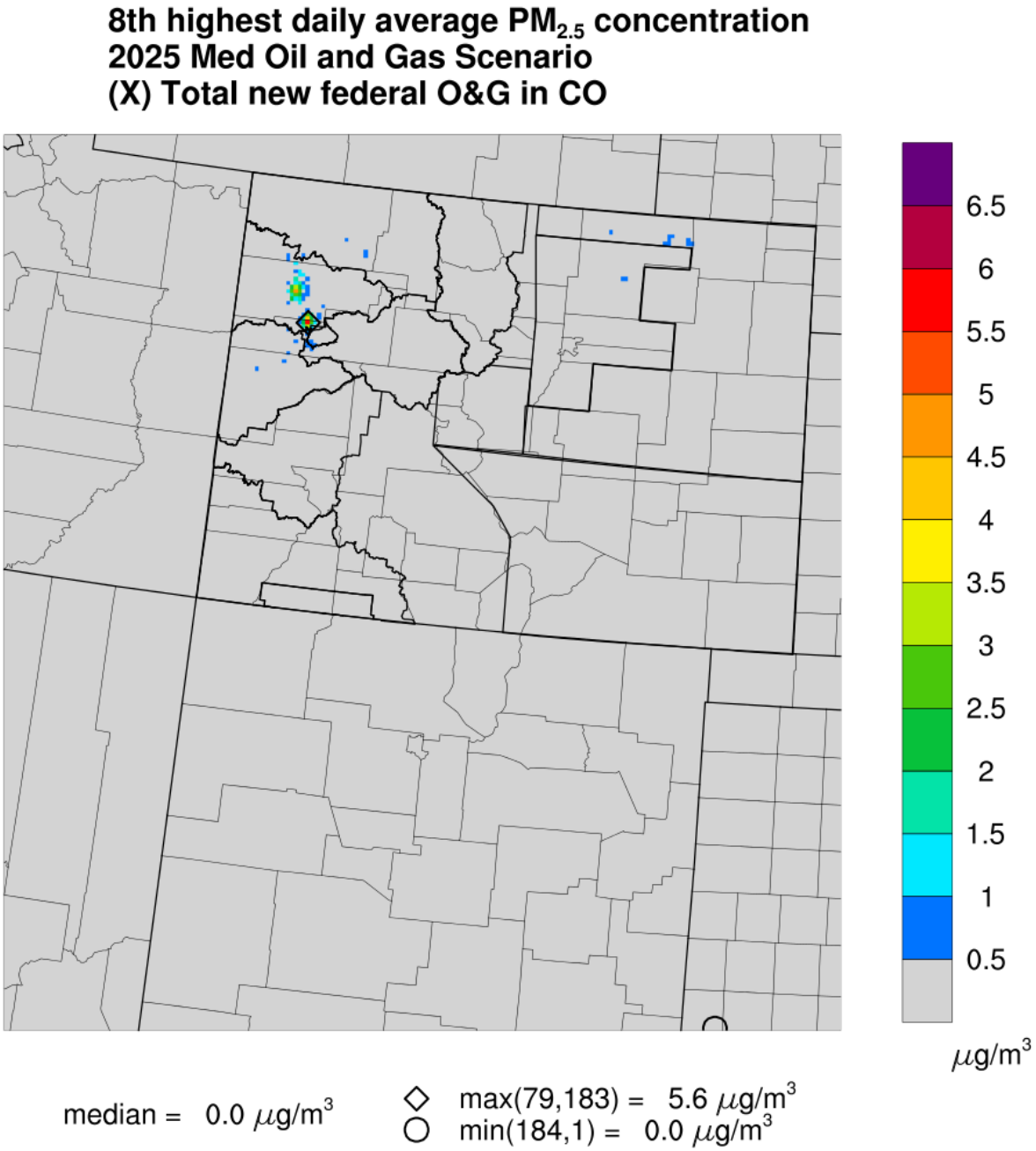

Figure 5-11. Contribution to 8th highest daily $PM_{2.5}$ concentrations due to emissions from new Federal O&G in CO (Source Group X) for the 2025 Medium Development Scenario.

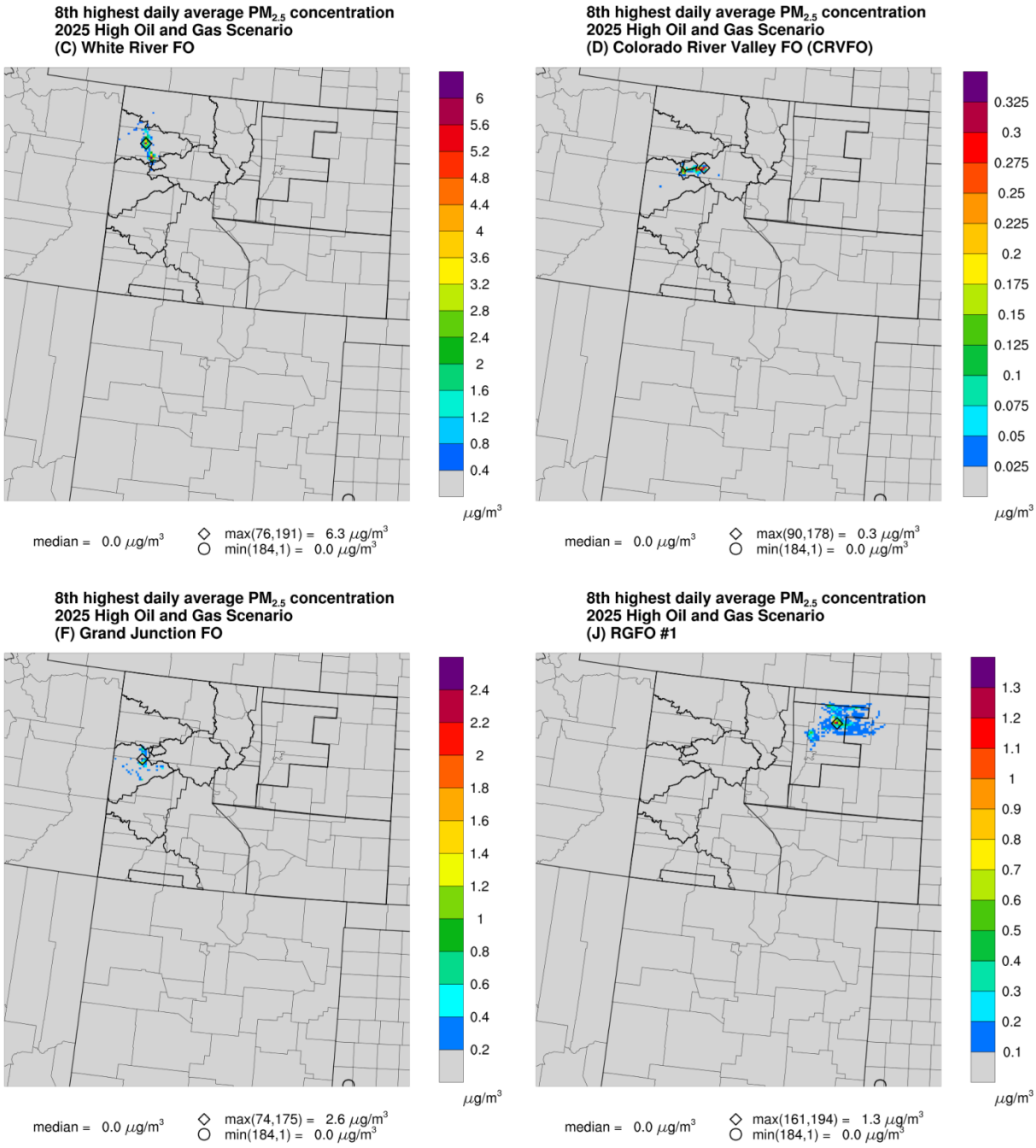

Figure 5-12. Contribution to 8th highest daily $PM_{2.5}$ concentrations due to emissions from new Federal O&G within the WRFO (top left), CRVFO (top right), GJFO (bottom left), and RGFO #1 (bottom right) Planning Areas for the 2025 High Development Scenario.

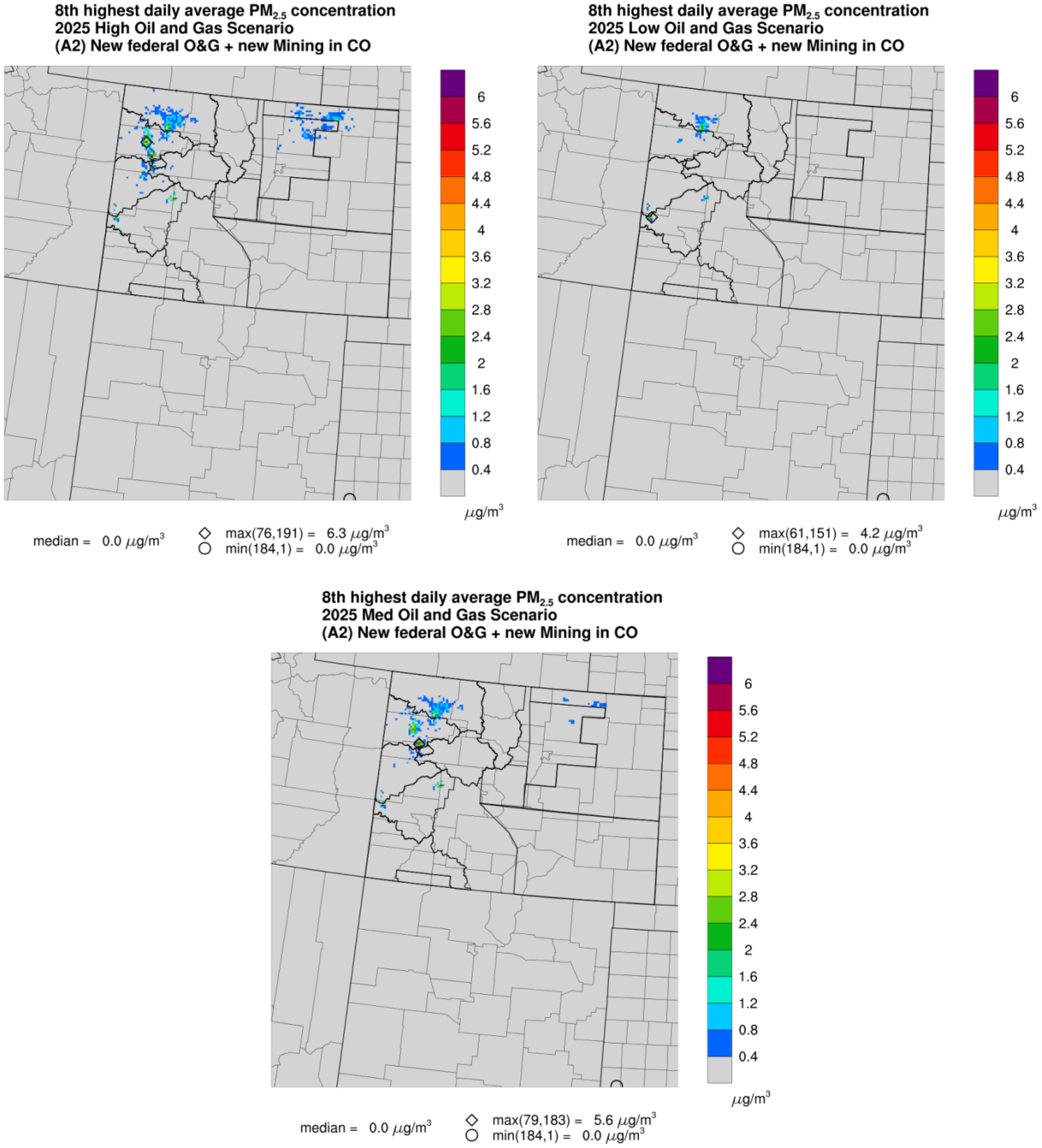

Figure 5-13a. Contribution to 8th highest daily $PM_{2.5}$ concentration from new Federal O&G and mining in CO (source group A2) for the 2025 High (top left), Low (top right) and Medium (bottom) Development Scenarios.

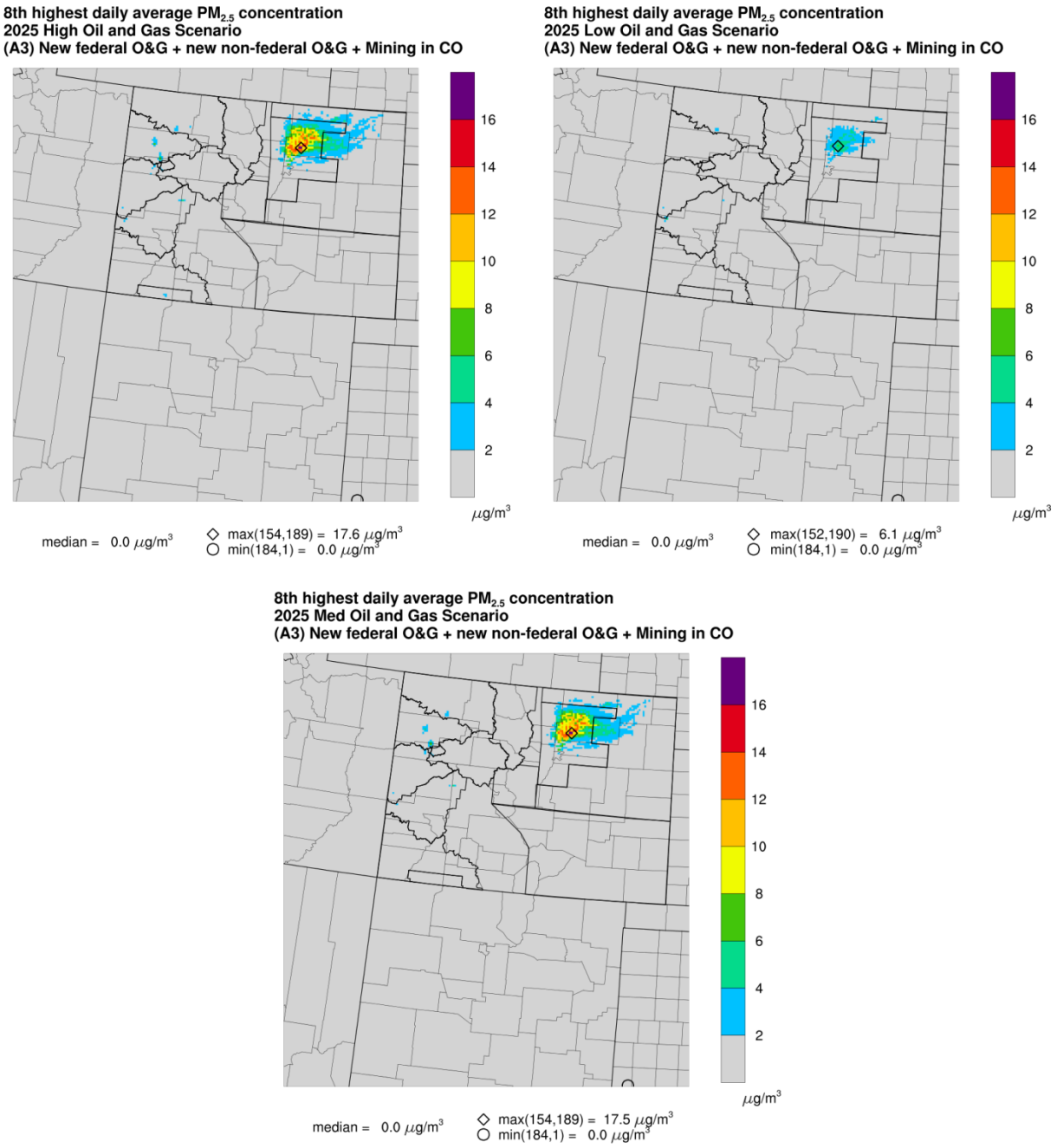

Figure 5-13b. Contribution to 8th highest daily $PM_{2.5}$ concentration from new Federal O&G, new non-Federal O&G, and mining in CO (source group A3) for the 2025 High (top left), Low (top right) and Medium (bottom) Development Scenarios.

5.6.3.2 Annual $PM_{2.5}$ NAAQS Analysis

Figure 5-14 displays the annual average $PM_{2.5}$ concentrations for the 2011 Base Case and 2025 emissions scenarios and their differences and the annual average $PM_{2.5}$ concentrations due to Natural Emissions. The highest annual average $PM_{2.5}$ concentration is about 23.5 $\mu g/m^3$ for the 2011 Base Case, and 21.1, 20.9, and 21.0 $\mu g/m^3$ in the 2025 High, Low, and Medium Development Scenarios. Compared to the year of 2011, annual $PM_{2.5}$ concentrations drop in the majority of places in the domain, and increases in a number of places, including in the RGFO #1 Planning Area near Denver, where about 10 $\mu g/m^3$of increase in annual $PM_{2.5}$ occurs for the High and Medium Development Scenarios.

The maximum contribution of each Source Group to annual $PM_{2.5}$ concentrations for the 2025 High and Low Development Scenarios are shown in Table 5-42a. The 6 Planning Areas with highest contributions are White River FO (3.4 $\mu g/m^3$), Southern Ute Indian Tribe (1.4 $\mu g/m^3$), Grand Junction FO (1.2 $\mu g/m^3$), Little Snake FO (0.6 $\mu g/m^3$), RGFO #1 (0.6 $\mu g/m^3$), and RGFO #3 (0.6 $\mu g/m^3$).

Figure 5-15a shows the contributions of new Federal O&G emissions (Source Group X) in Colorado to annual average $PM_{2.5}$ concentrations in the three 2025 scenarios. The spatial peaks of the annual average $PM_{2.5}$ concentrations are 3.5, 0.4 and 2.9 $\mu g/m^3$ in the 2025 High, Low and Medium Development Scenarios, respectively.

Figure 5-15b displays the contributions from the WRFO (top left), CRVFO (top right), GJFO (bottom left), and RGFO #1 (bottom right) Planning Areas to annual average $PM_{2.5}$ concentrations in the 2025 High Development Scenario. The maximum contributions for these 4 Source Groups are 3.4, 0.2, 1.2, and 0.6 $\mu g/m^3$, respectively, with each of them occurring within its corresponding Planning Area.

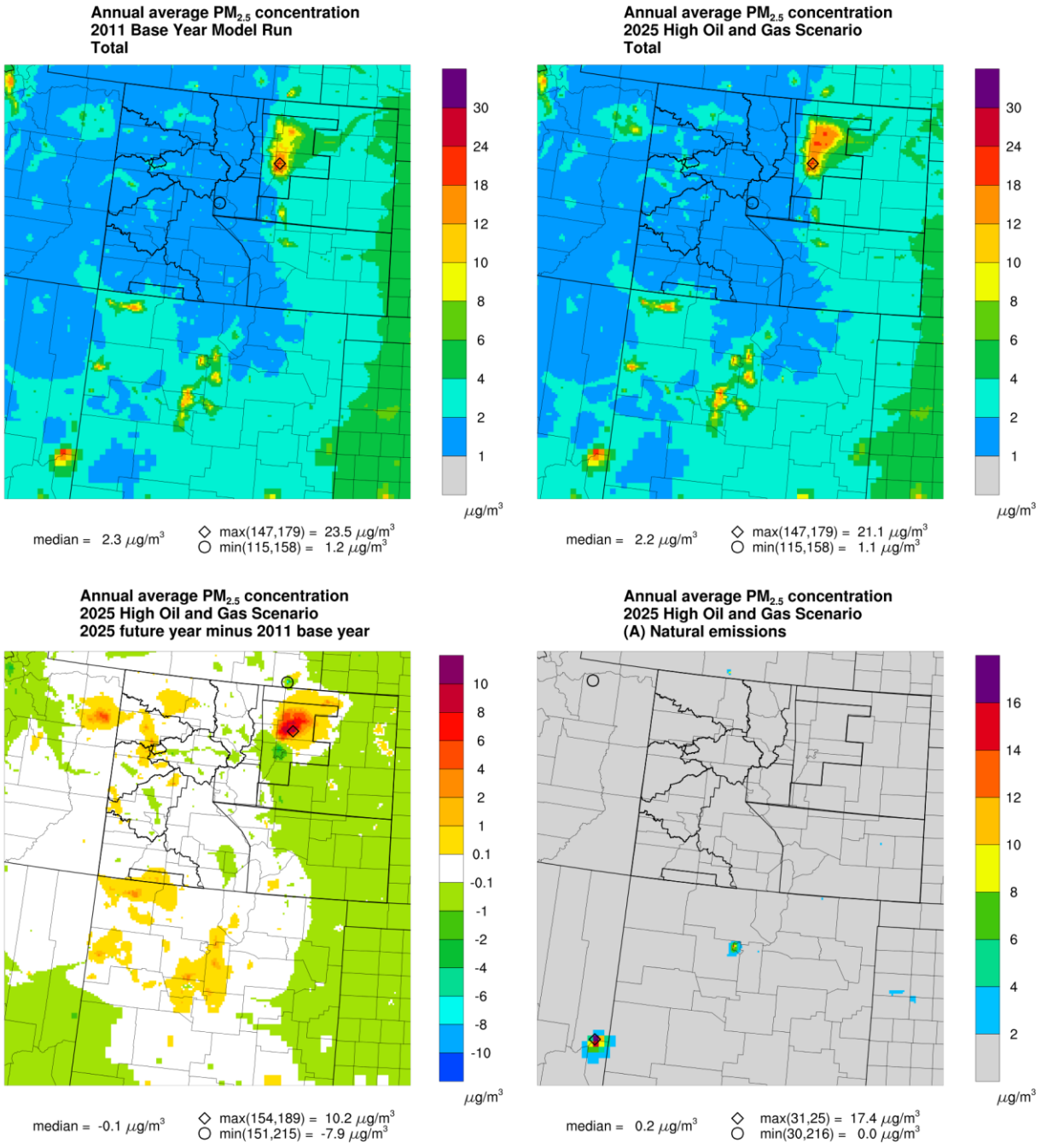

Figure 5-14a. Annual average $PM_{2.5}$ concentrations for the 2011 Base Case (top left), 2025 High Development Scenario (top right), 2025 High minus 2011 differences (bottom left) and Natural Emissions (bottom right).

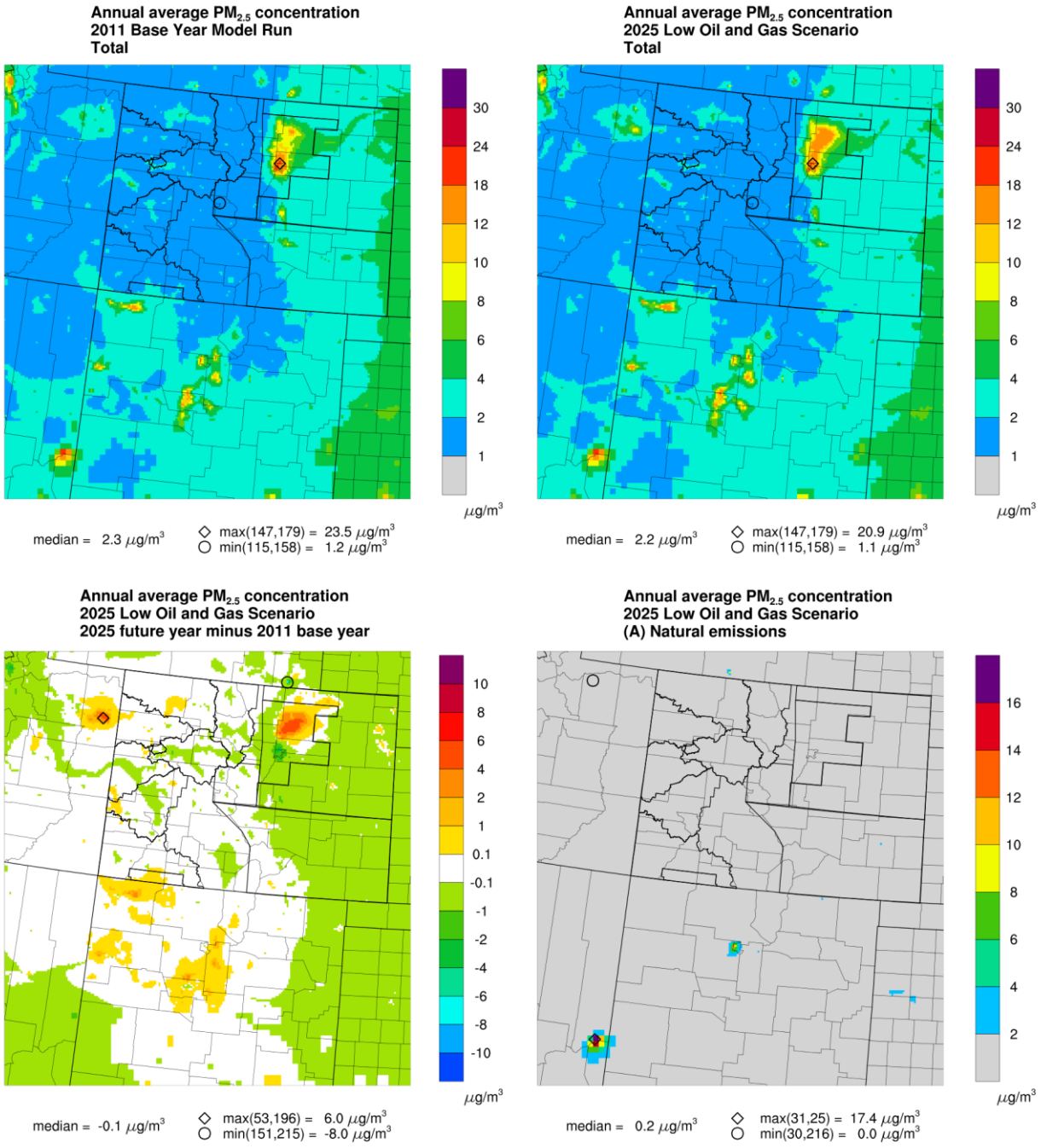

Figure 5-14b. Annual average $PM_{2.5}$ concentrations for the 2011 Base Case (top left), 2025 Low Development Scenario (top right), 2025 Low minus 2011 differences (bottom left) and Natural Emissions (bottom right).

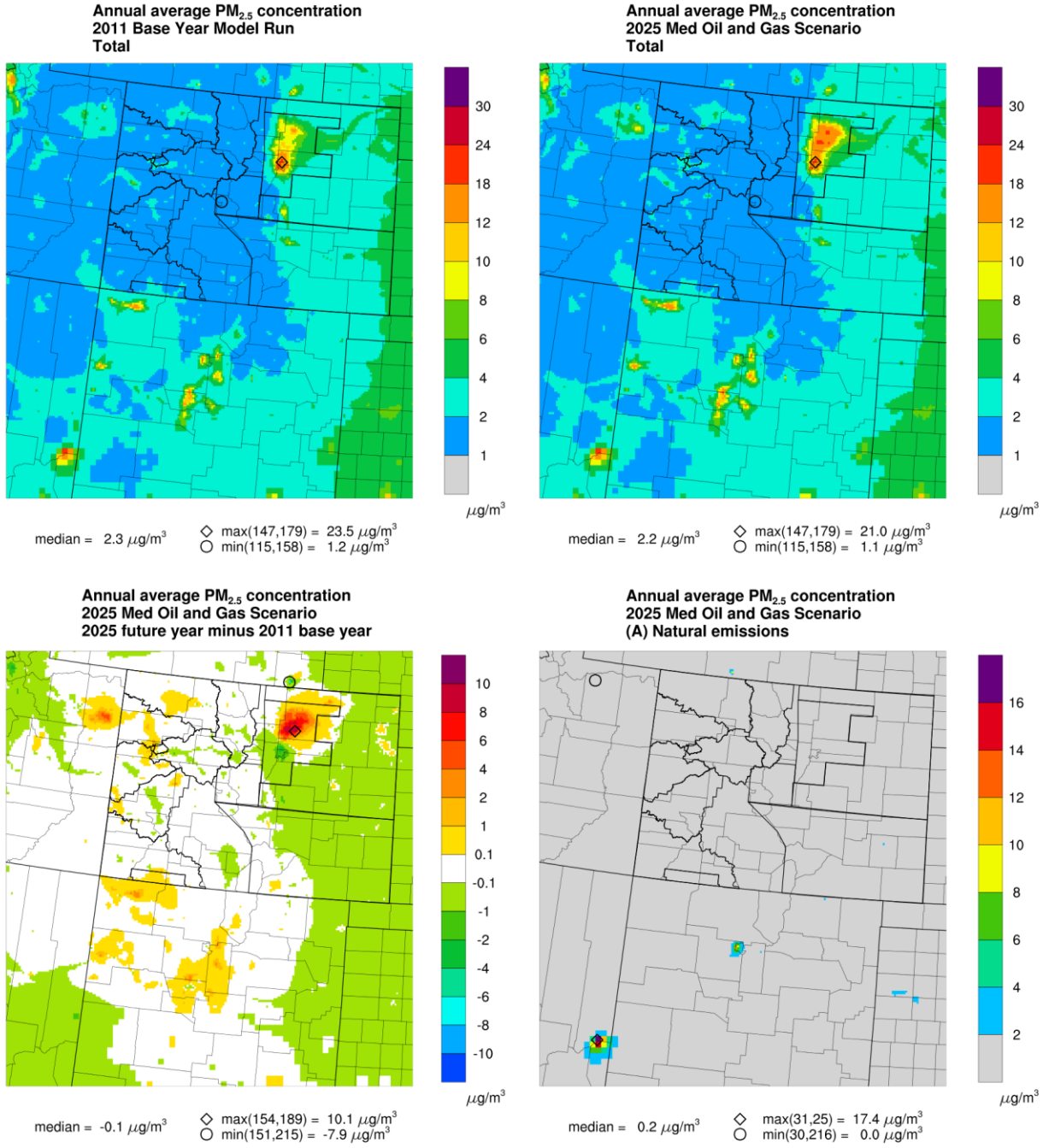

Figure 5-14c. Annual average $PM_{2.5}$ concentrations for the 2011 Base Case (top left), 2025 Medium Development Scenario (top right), 2025 Medium minus 2011 differences (bottom left) and Natural Emissions (bottom right).

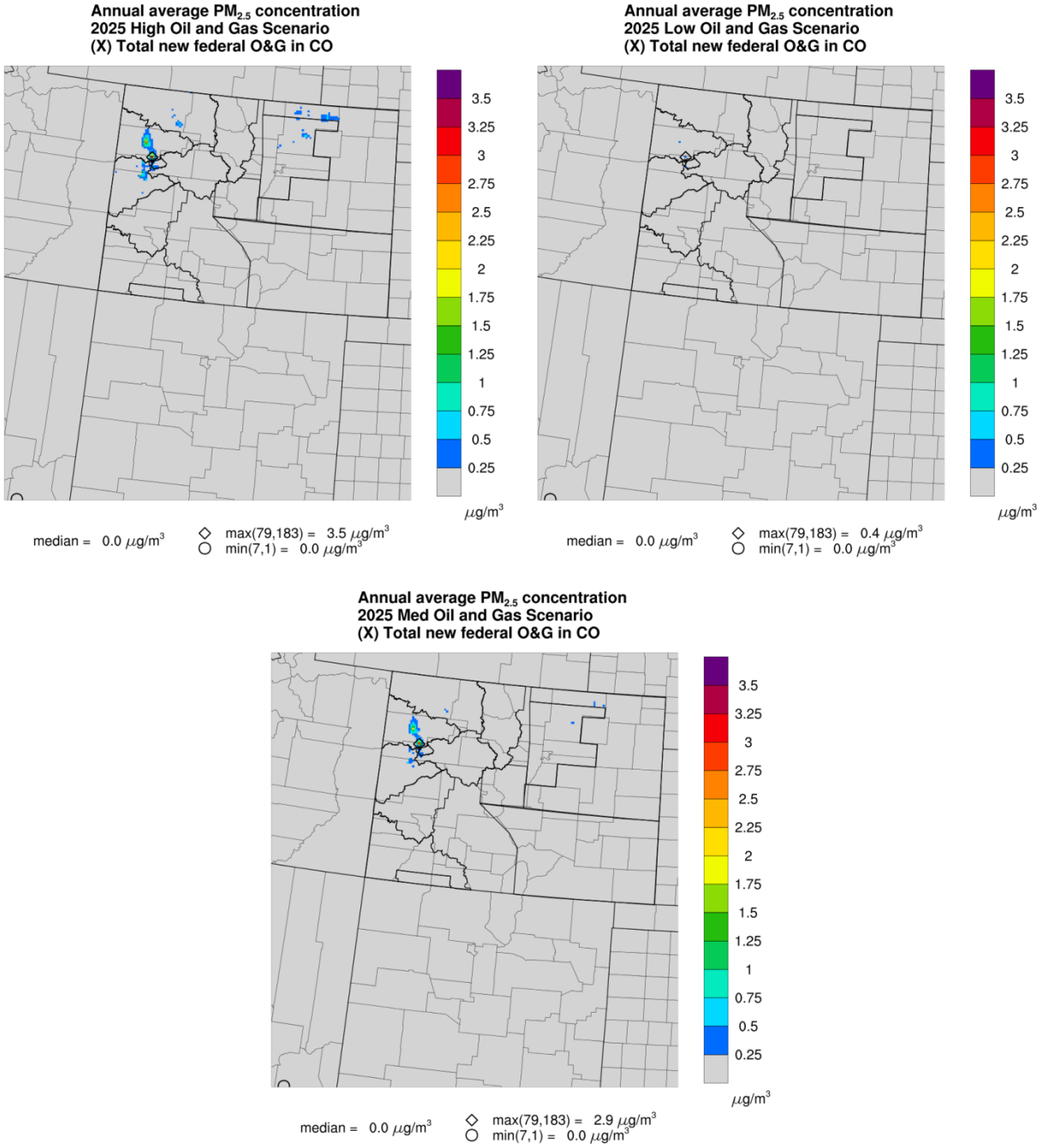

Figure 5-15a. Contribution to annual average $PM_{2.5}$ from new Federal O&G in CO (source group X) for the 2025 High (top left), Low (top right) and Medium (bottom) Development Scenarios.

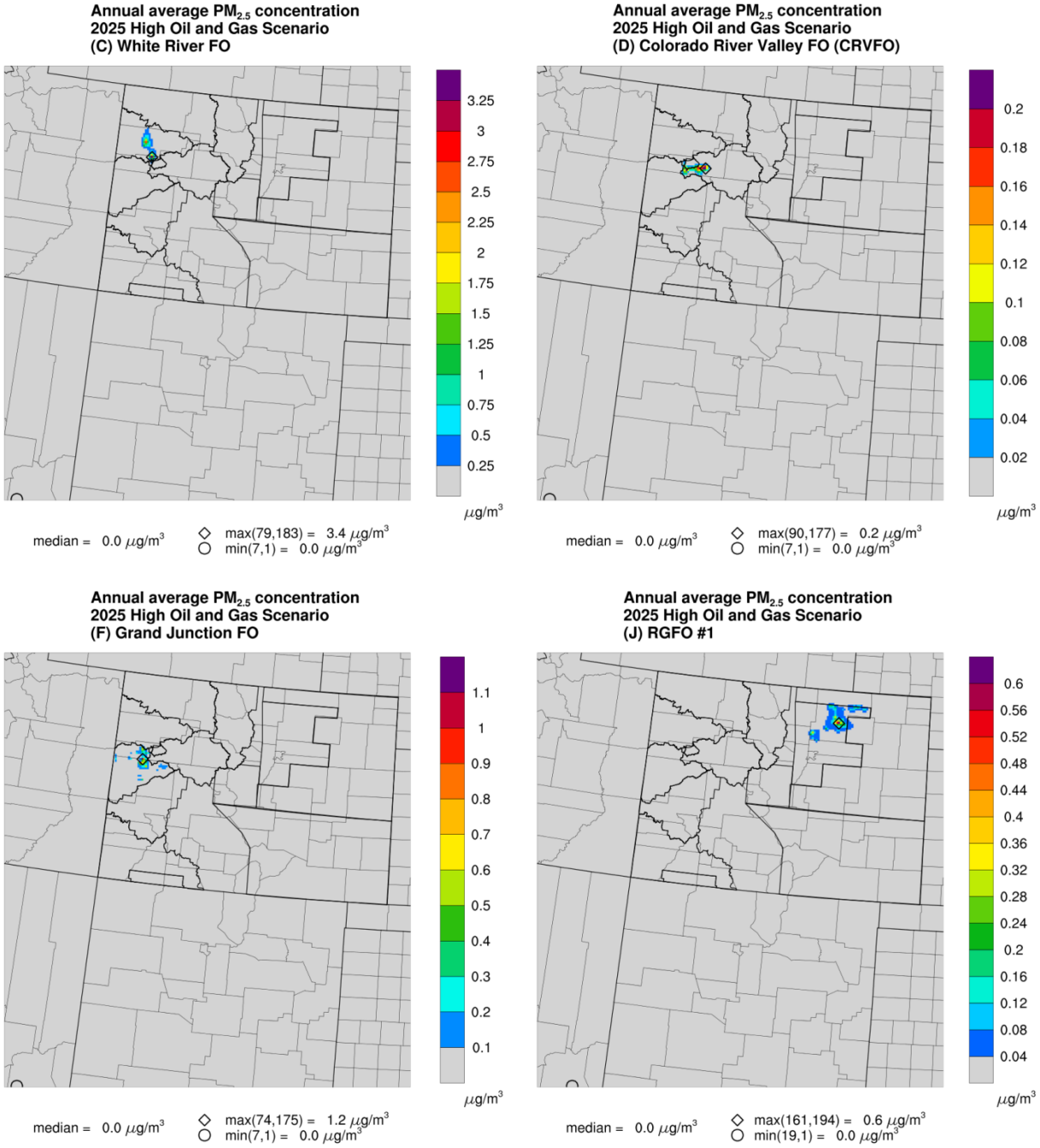

Figure 5-15b. Contribution to annual $PM_{2.5}$ concentrations due to emissions from new Federal O&G within the WRFO (top left), CRVFO (top right), GJFO (bottom left), and RGFO #1 (bottom right) Planning Areas for the 2025 High Development Scenario.

5.6.4 PM_{10} NAAQS Analysis

Figures 5-16, 5-17a and 5-17b display the 2025 High Development Scenario modeling results for 24-hour PM_{10} that can be compared to the 150 µg/m^3 24-hour PM_{10} NAAQS. Much of the discussion on 24-hour $PM_{2.5}$ also holds for 24-hour PM_{10}, although there appear to be more exceedances of the 24-hour PM_{10} NAAQS. Extremely large highest second high PM_{10} concentrations occur in the 2011 and 2025 emissions scenarios that exceed 1,000 µg/m^3 (Figure 5-16, top panels), which are largely due to natural emissions from wild fires near the AZ/NM boarder.

Figure 5-17a shows the contributions of new Federal O&G emissions CO (Source Group X) to PM_{10} concentrations in the three 2025 scenarios. The spatial peaks of the 2nd highest 24-hour PM_{10} concentrations are 19.7, 2.0 and 11.4 µg/m^3 in the 2025 High, Low and Medium Development Scenarios, respectively.

Figure 5-17b displays the contributions from the WRFO (top left), CRVFO (top right), GJFO (bottom left), and RGFO #1 (bottom right) Planning Areas to 2nd highest daily PM_{10} concentrations in the 2025 High Development Scenario. The maximum contributions for these 4 Source Groups are 19.6, 1.3, 15.4, and 9.0 µg/m^3, respectively, with each of them occurring within its corresponding Planning Area.

The contributions of all of the Source Groups and all three 2025 emission scenarios to 24-hour PM_{10} concentrations can be found in Attachment I.

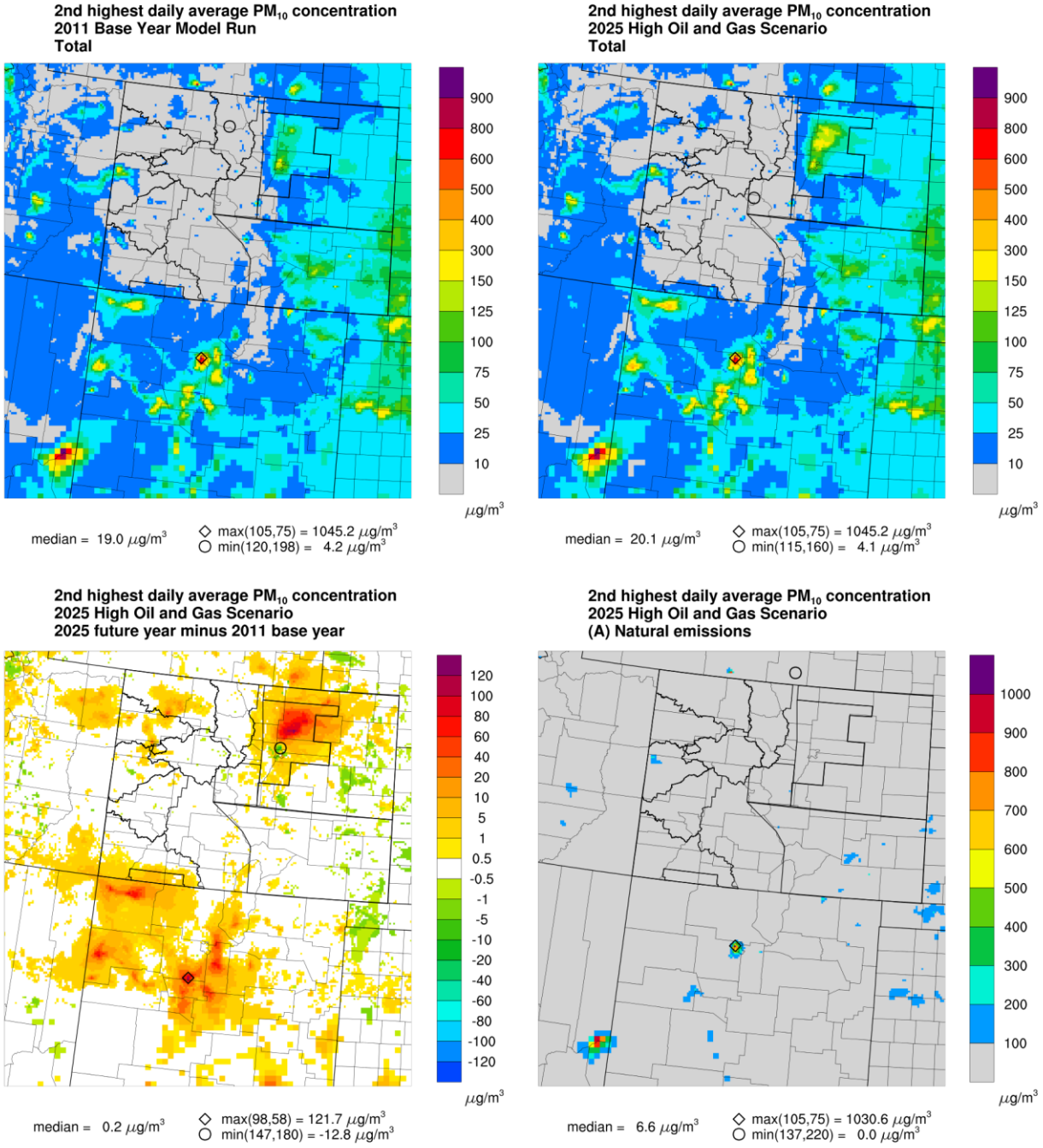

Figure 5-16. Second highest 24-hour average PM_{10} concentrations for the 2011 Base Case (top left), 2025 High Development Scenario (top right), 2025 minus 2011 differences (bottom left) and Natural Emissions (bottom right).

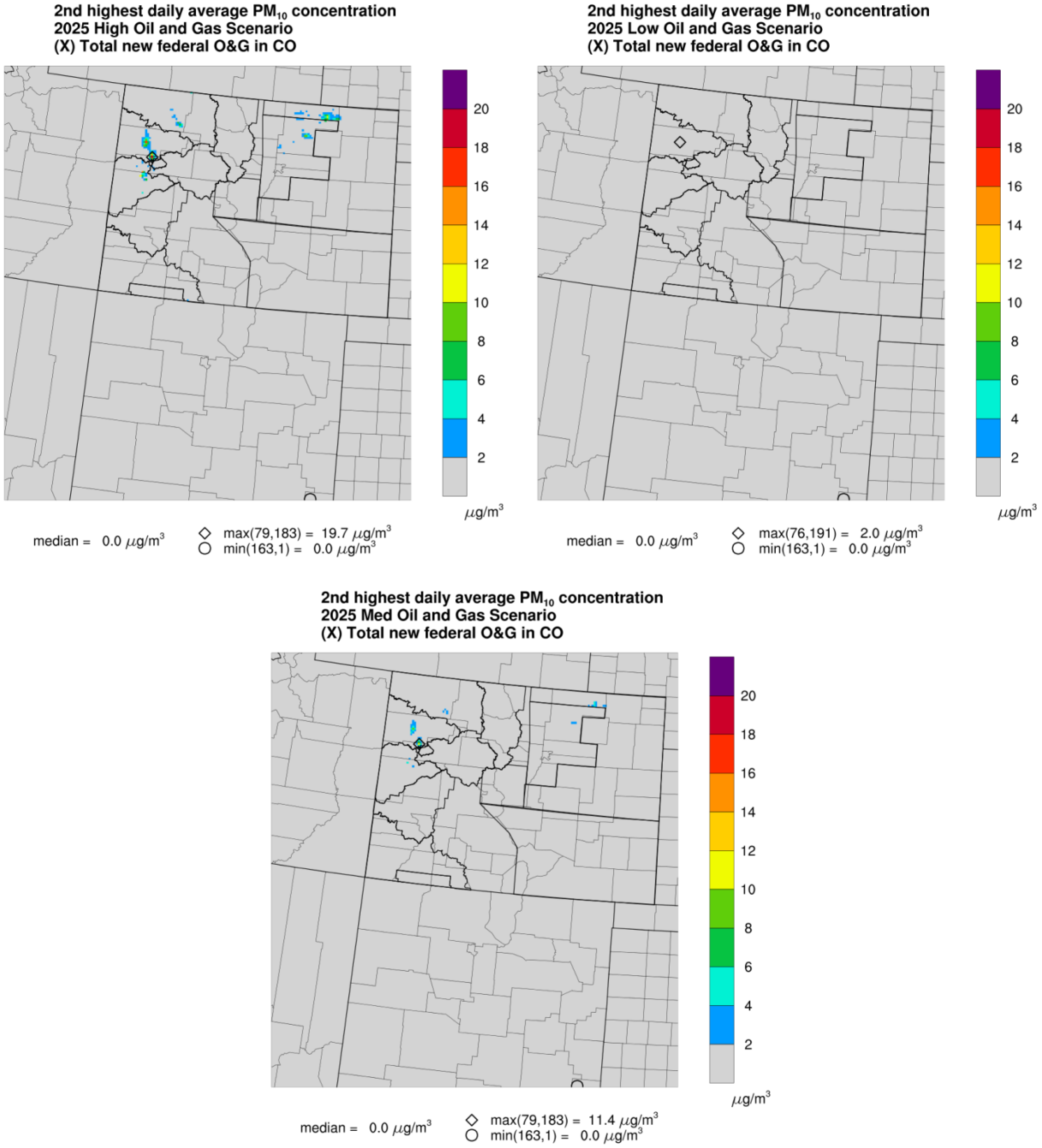

Figure 5-17a. Contribution to second highest 24-hour average PM_{10} concentrations from new Federal O&G in CO (source group X) for the 2025 High (top left), Low (top right) and Medium (bottom) Development Scenarios.

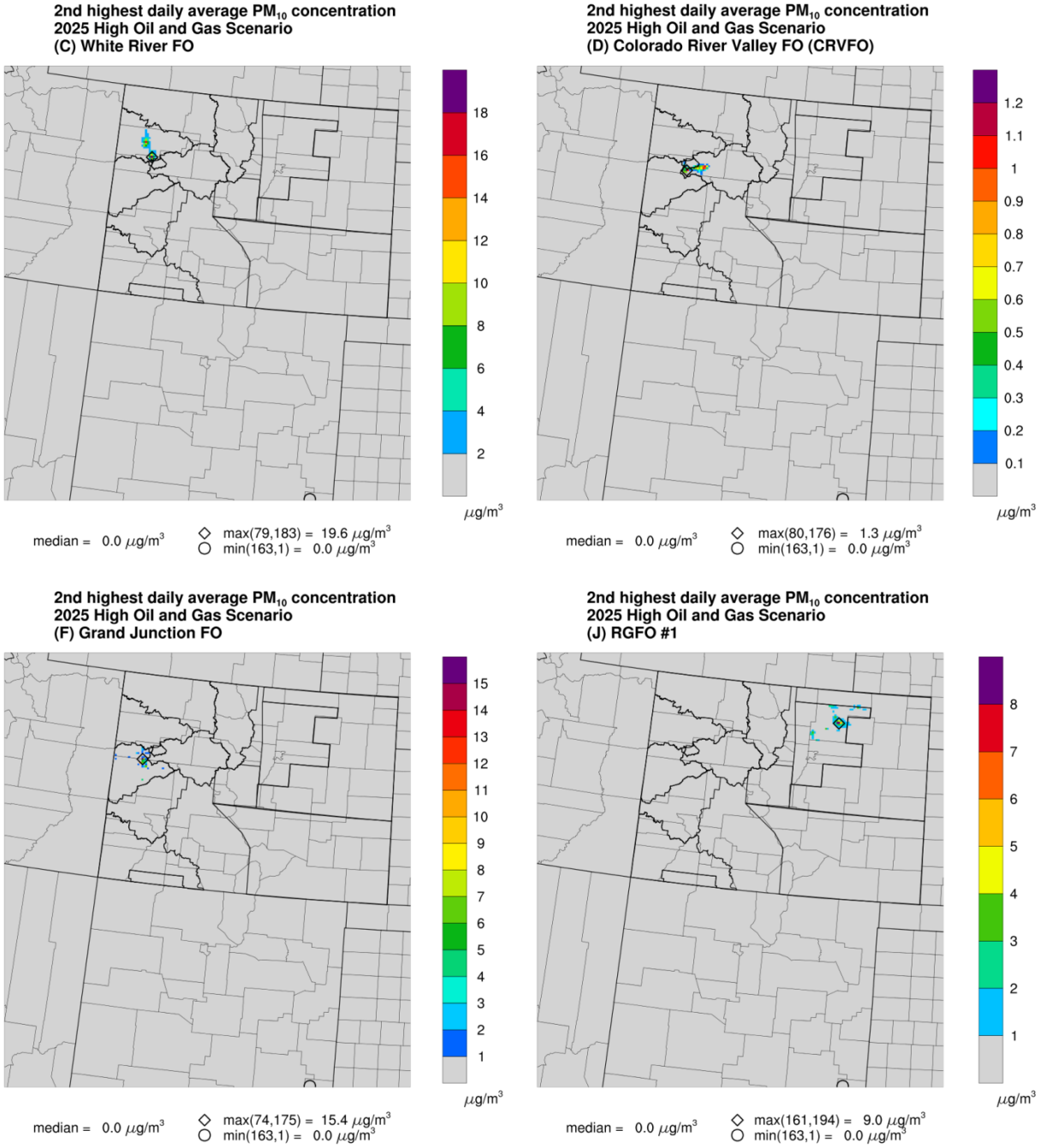

Figure 5-17b. Contribution to 2nd highest daily PM_{10} concentrations due to emissions from new Federal O&G within the WRFO (top left), CRVFO (top right), GJFO (bottom left), and RGFO #1 (bottom right) Planning Areas for the 2025 High Development Scenario.

5.6.5 SO_2 NAAQS Analysis

The 2011 Base Case and 2025 High Development Scenario, their differences and contributions of Natural Emissions to 1-hour, 3-hour and annual SO_2 concentrations are shown in Figures 5-18 through 5-21, respectively. The 1-hour SO_2 NAAQS is 75 ppb and it is exceeded when the colors in Figure 5-18 are yellow or hotter. Natural emissions from wild fires are the primary cause for the two exceeding areas in Arizona and New Mexico. 1-hour SO_2 is overall below 30 ppb in most places and shows reduction from the 2011 base year to the 2025 High Development Scenario. Similarly, as shown in Figures 5-19 through 5-22, 3-hour, 24-hour and annual average SO_2 are all well below the corresponding NAAQS/CAAQS/NMAAQS, with the exception of small areas affected by extreme wild fires, and all of them show a reduction from the 2011 base year to the 2025 High Development Scenario.

As an example, Figure 5-22 shows contribution to fourth highest daily maximum hourly SO_2 concentrations due to emissions from new Federal O&G and mining in CO (Source Group A2) (left) and new Federal O&G and mining and non-Federal O&G in CO (Source Group A3) (right). The contributions from both A2 and A3 Source Groups are relatively small with a maximum of 2.8 ppb in the White River FO. Spatial maps showing the SO_2 contributions from all other Source Groups and 2025 emission scenarios are given in Attachment I.

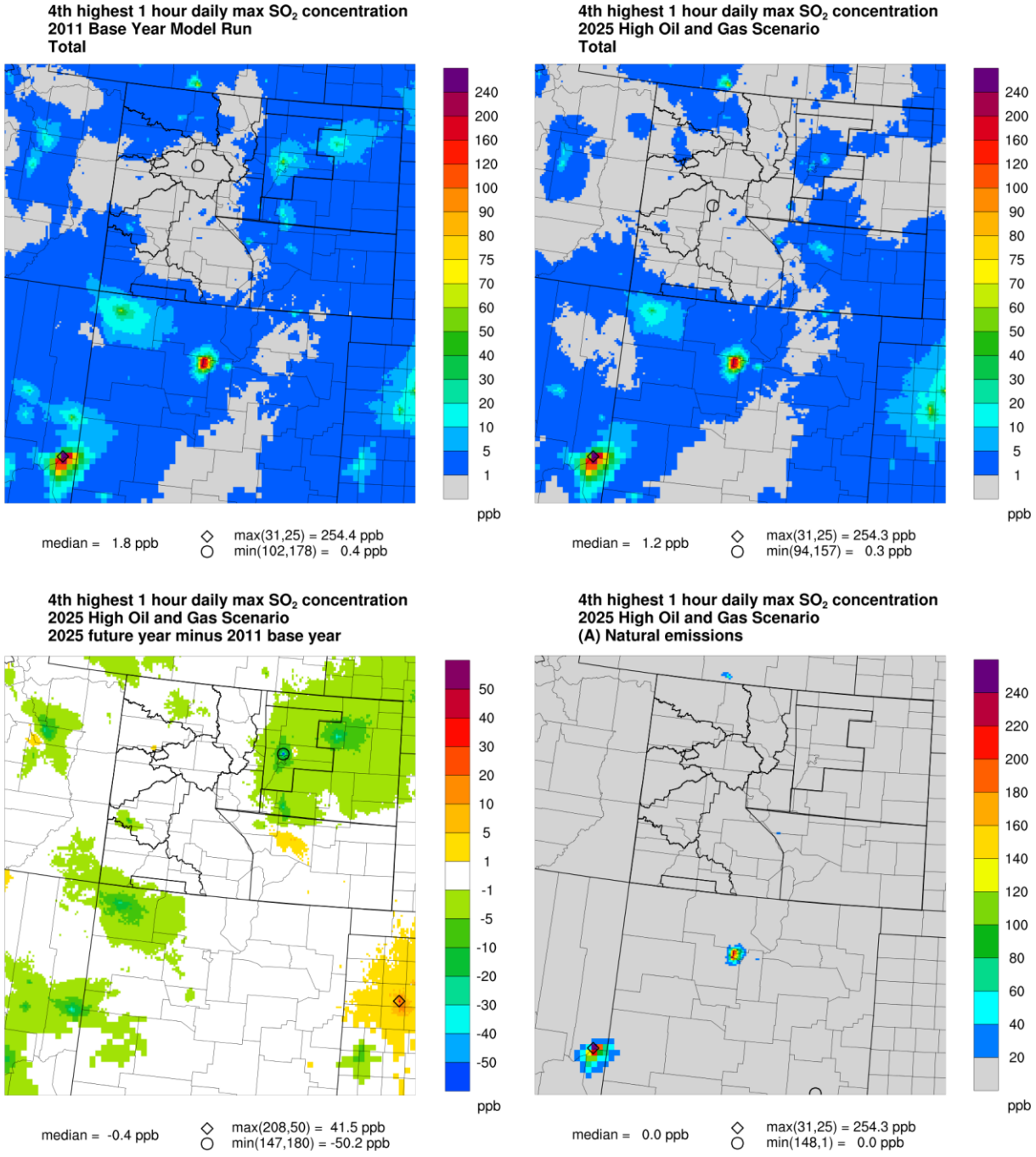

Figure 5-18. Fourth highest (99th percentile) daily maximum 1-hour average SO_2 concentrations for the 2011 Base Case (top left), 2025 High Development Scenario (top right), 2025 minus 2011 differences (bottom left) and Natural Emissions (bottom right).

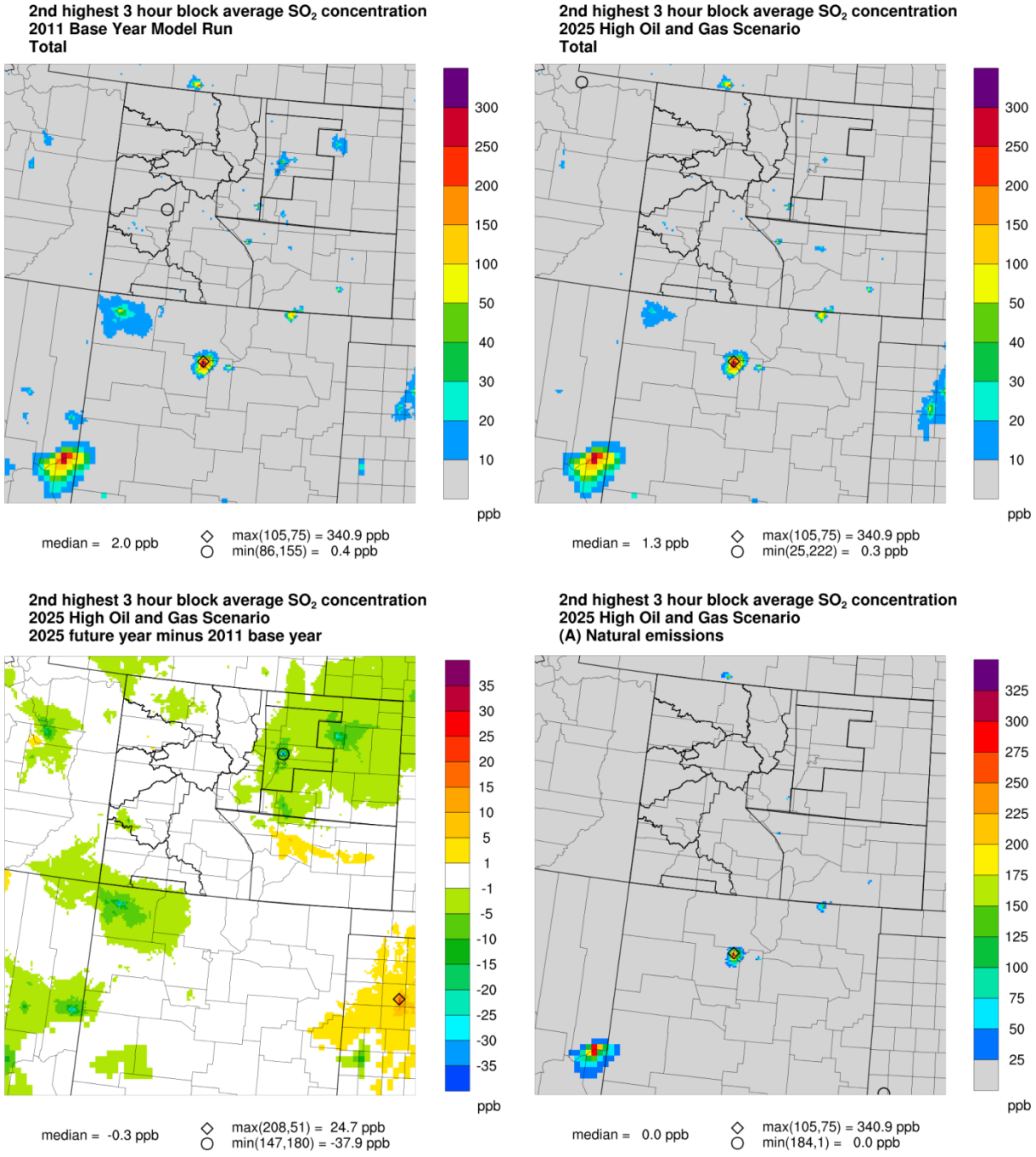

Figure 5-19. Second highest 3-hour average SO_2 concentrations for the 2011 Base Case (top left), 2025 High Development Scenario (top right), 2025 minus 2011 differences (bottom left) and Natural Emissions (bottom right).

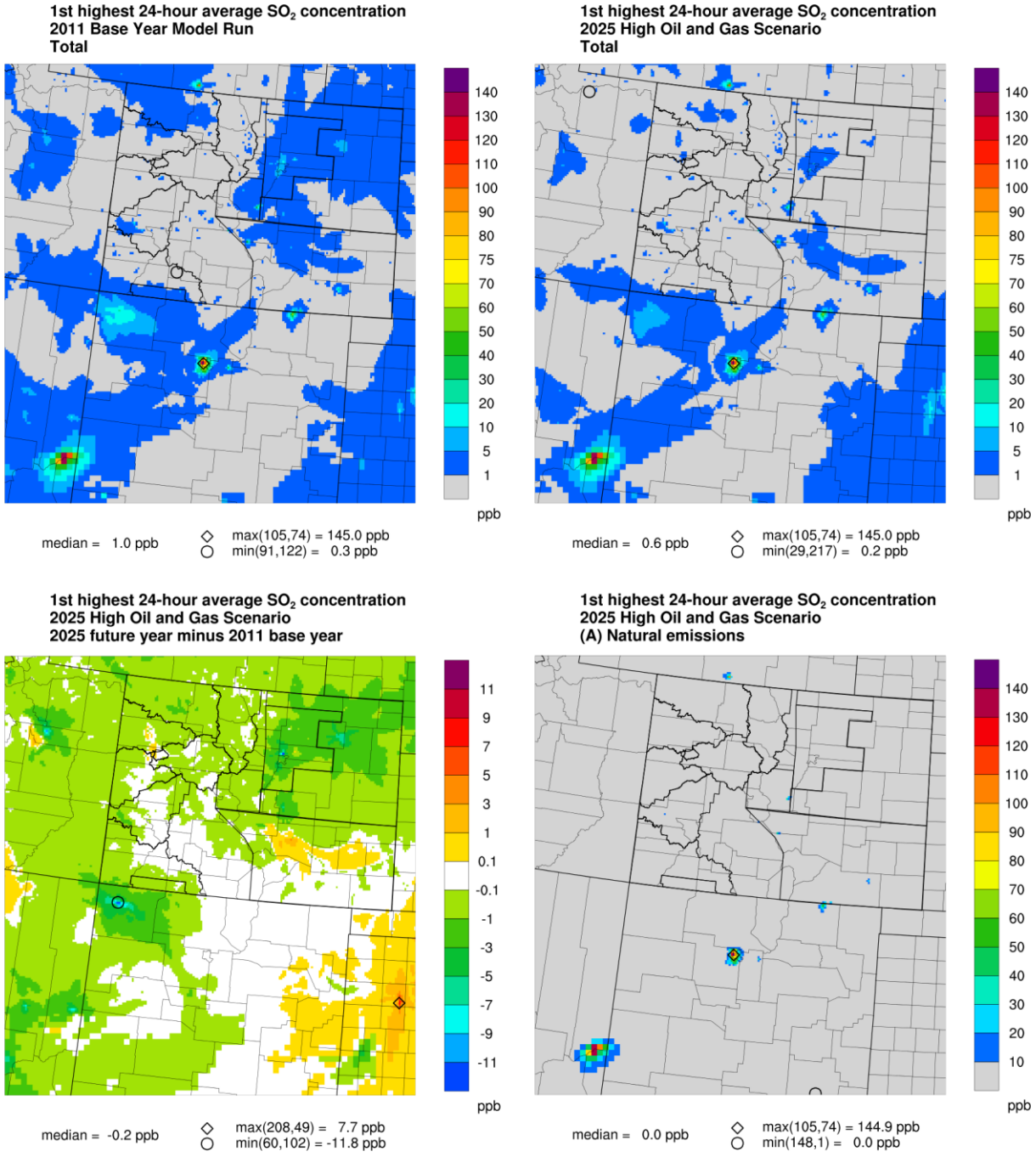

Figure 5-20. 24-hour average SO_2 concentrations for the 2011 Base Case (top left), 2025 High Development Scenario (top right), 2025 minus 2011 differences (bottom left) and Natural Emissions (bottom right).

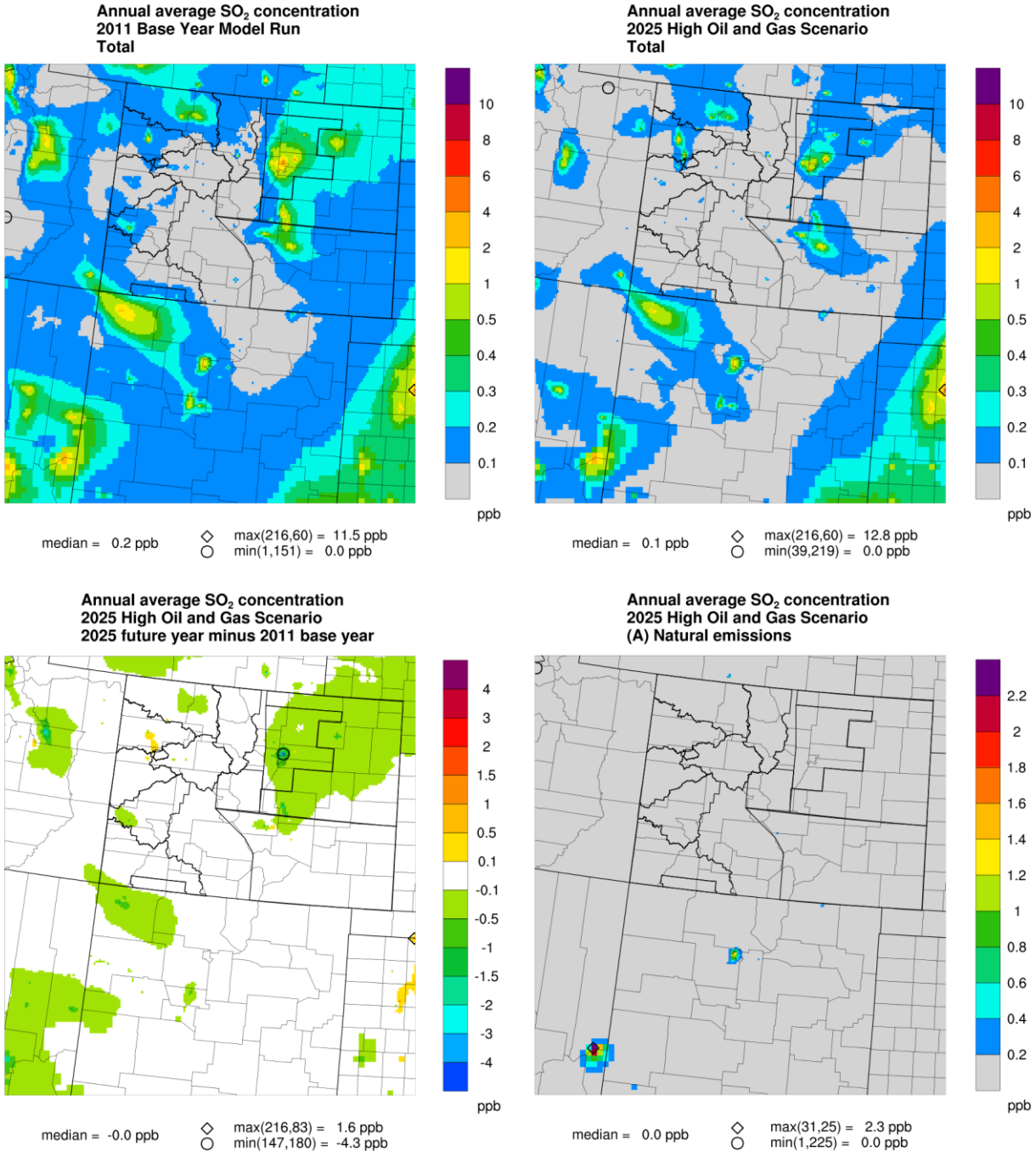

Figure 5-21. Annual average SO_2 concentrations for the 2011 Base Case (top left), 2025 High Development Scenario (top right), 2025 minus 2011 differences (bottom left) and Natural Emissions (bottom right).

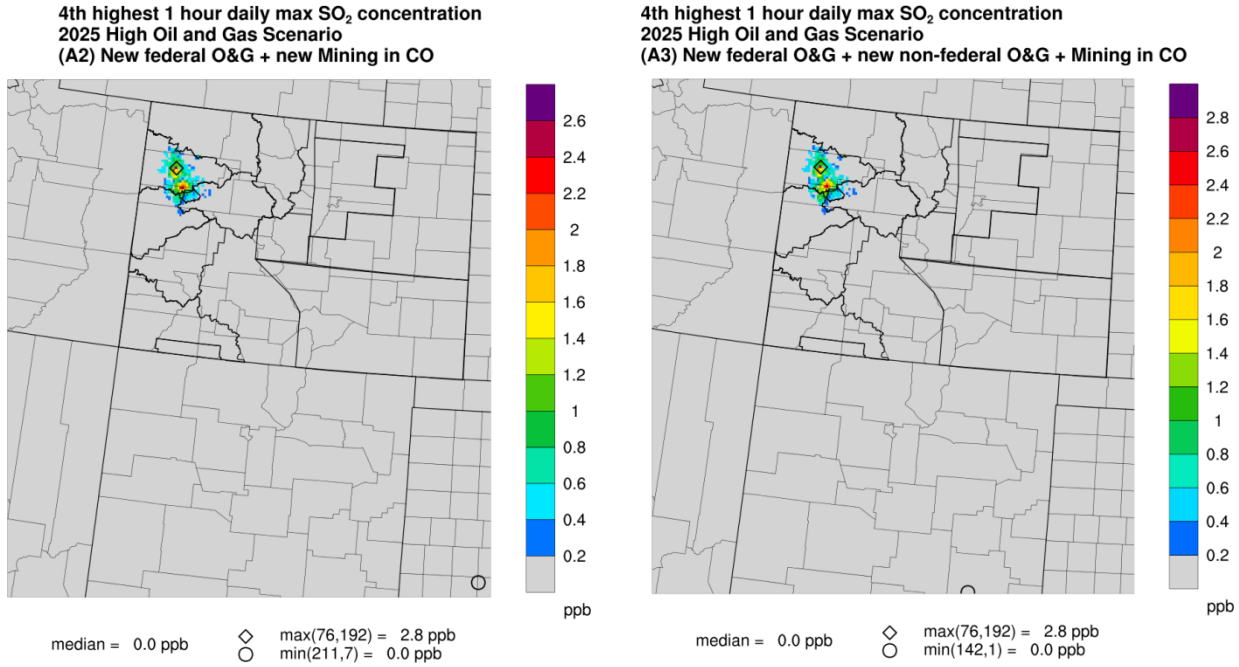

Figure 5-22. Contribution to fourth highest daily maximum hourly SO_2 concentrations due to emissions from new Federal O&G and mining in CO (Source Group A2) (left) and new Federal O&G and mining and non-Federal O&G in CO (Source Group A3) (right).

5.6.6 NO_2 NAAQS Analysis

Figure 5-23a displays spatial maps of the 98th percentile daily maximum 1-hour NO_2 concentrations for the 2011 Base Case and 2025 High, Low and Medium Development Scenarios with the differences in NO_2 concentrations between the 2025 emissions scenarios and the 2011 Base Case shown in Figure 5-23b. The 1-hour NO_2 NAAQS is 188 µg/m^3 (100 ppb) and the tile plots in Figure 5-23a have a cut-point at 100 ppb. In all four scenarios, the highest 1-hour NO_2 concentration occurs near the AZ/NM border that is above the NAAQS. This NO_2 exceedance is due to wildfires and is present in the 2011 Base Case and 2025 scenarios since wildfires were assumed to be unchanged.

The differences in 1-hour NO_2 concentrations between the 2011 and 2025 emission scenarios (Figure 5-23b) indicate increases in RGFO #1, WRFO, GJFO, and Uncompahgre FO, large increases in northern, as well as eastern Arizona and New Mexico. The largest increases are 64.1, 54.2, and 64.0 ppb for the High, Low, Medium Scenarios, respectively, all of which are on the southern border of Uncompahgre FO.

Figure 5-23d-f show the contributions from new Federal O&G in CO (source group X), new Federal O&G and mining in CO (source group A2), new Federal O&G, new non-Federal O&G and mining in CO (source group A3), and all EGUs in CO and NM (source group A4) to the 98th percentile daily maximum 1-hour NO_2 concentrations for each of the High, Low and Medium Development Scenarios, respectively. Source Group X has maximum contributions for the High, Medium and Low Development Scenarios of 64.2, 11.3 and 61.3 ppb, respectively, all of which occur near the southern border of WRFO. The maximum contributions from Source Group A2 are 64.2, 40.3, and 61.3 ppb for the three scenarios, while the maximum contributions from Source Group A3 are 65.4, 40.3, and 61.3 ppb for the three scenarios. The maximum contributions from all EGUs in CO and NA are 18.3 ppb for all three scenarios, while the slightly different value of 18.4 ppb for the Low Development Scenario is due to different chemistry among different emission scenarios.

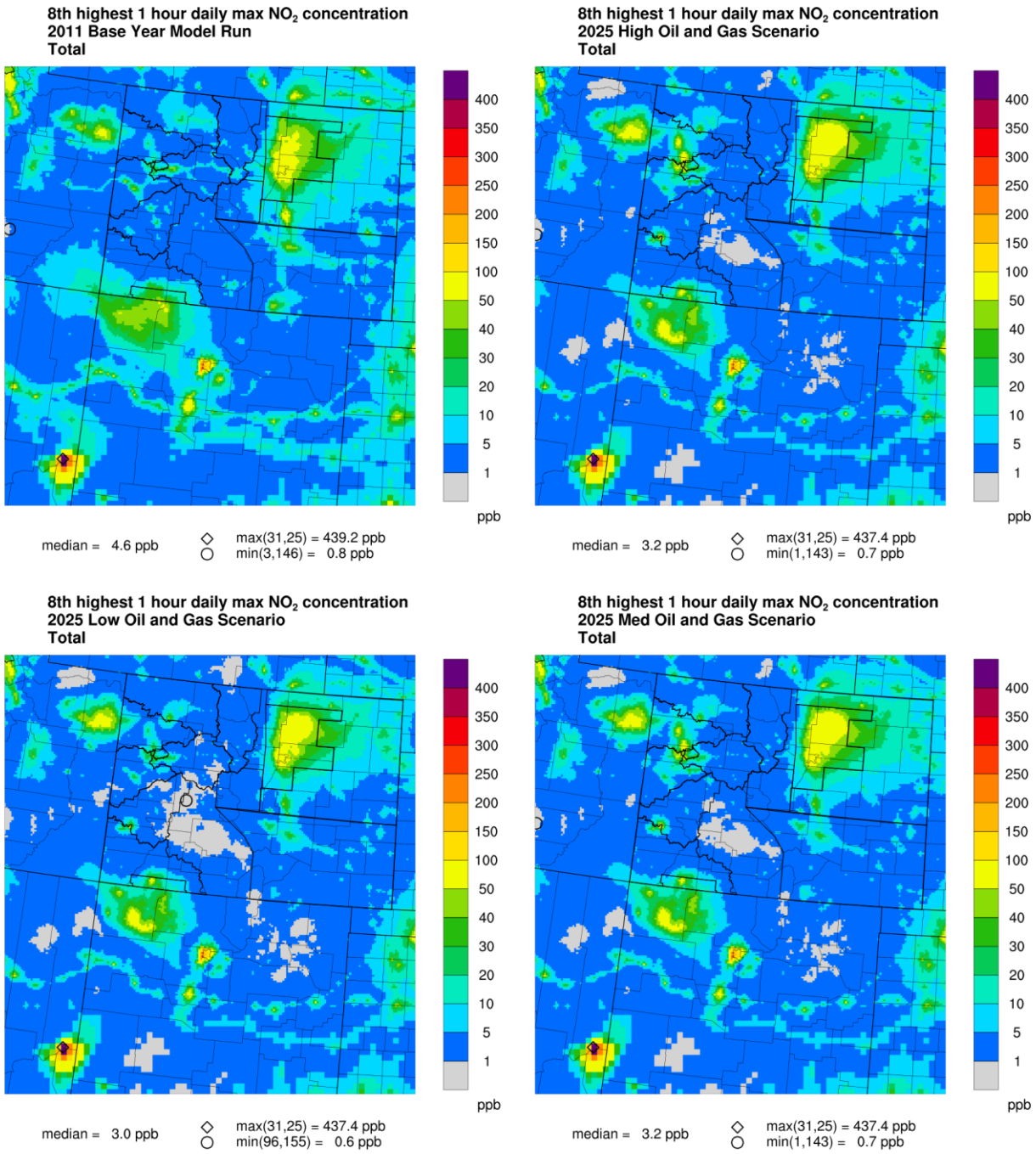

Figure 5-23a. Eighth highest (98th percentile) daily maximum 1-hour average NO_2 concentrations for the 2011 Base Case (top left), 2025 High Development Scenario (top right), 2025 Low Development Scenario (bottom left) and 2025 Medium Development Scenario (bottom right).

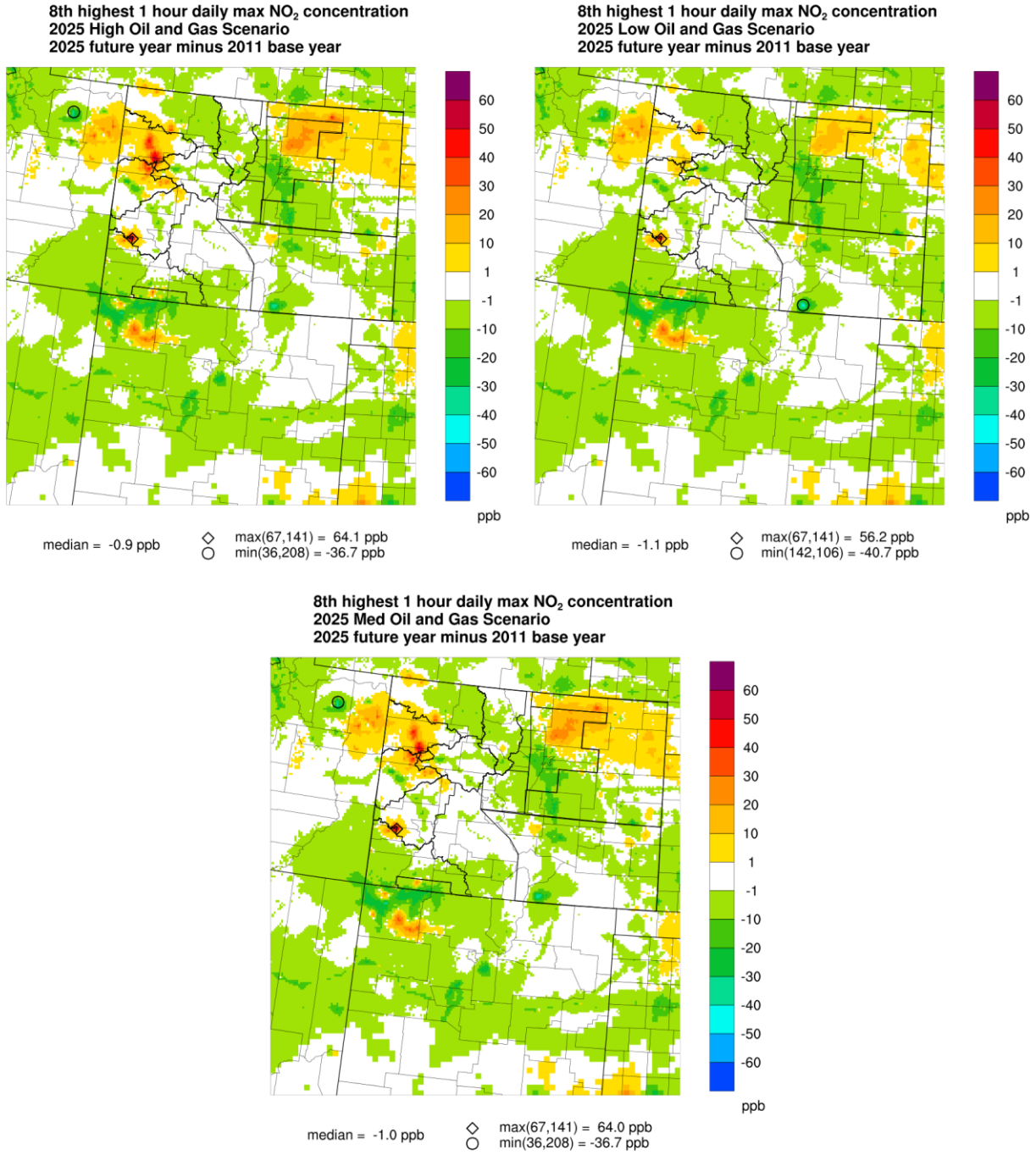

Figure 5-23b. Differences in eighth highest (98th percentile) daily maximum 1-hour average NO_2 concentrations between the 2025 emission scenarios and the 2011 Base Case for the 2025 High (top left), Low (top right) and Medium (bottom) Development Scenarios.

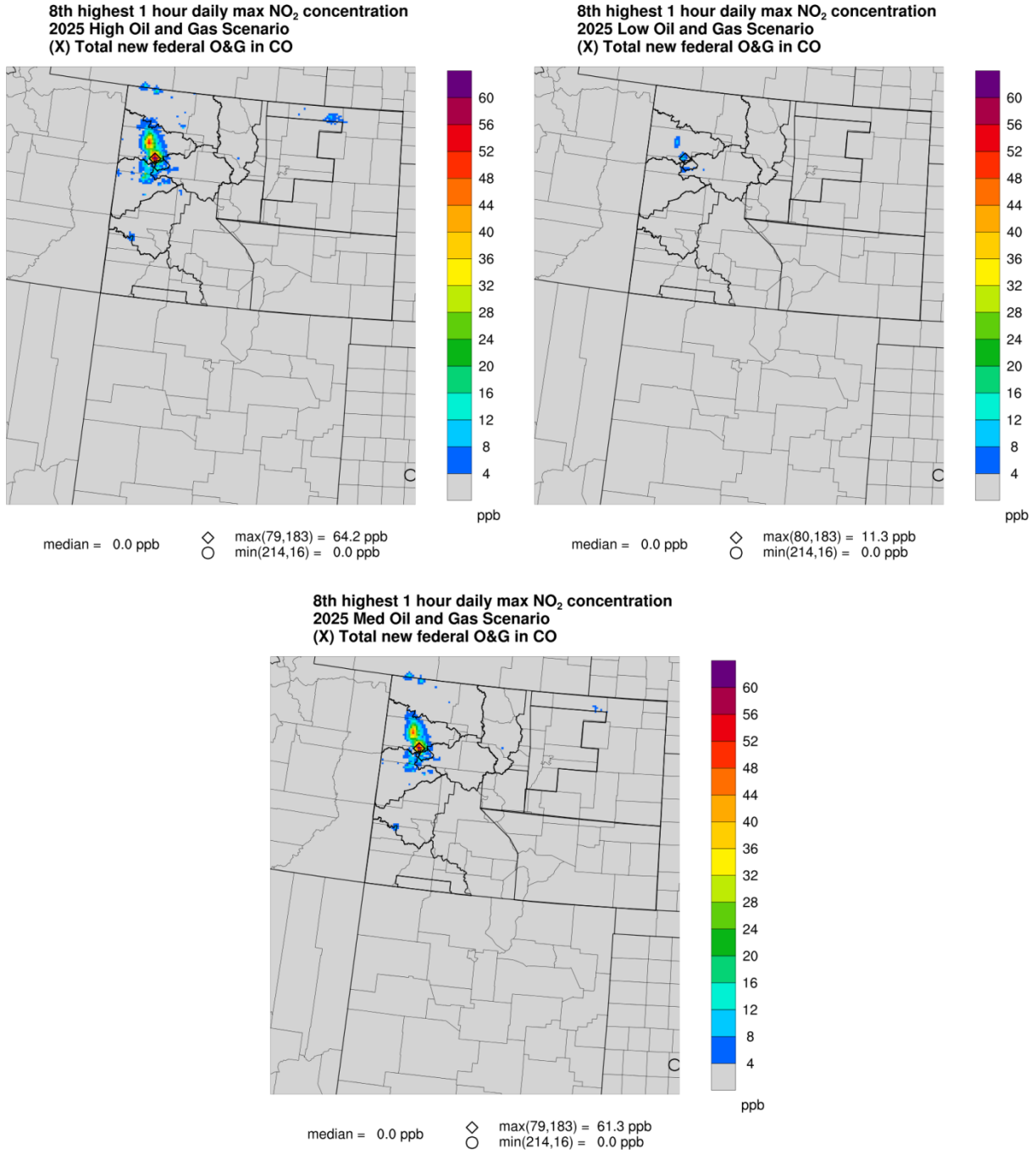

Figure 5-23c. Contributions from new Federal O&G in CO (source group X) to the eighth highest (98th percentile) daily maximum 1-hour average NO_2 concentrations in the 2025 High (top left), Low (top right) and Medium (bottom) Development Scenarios.

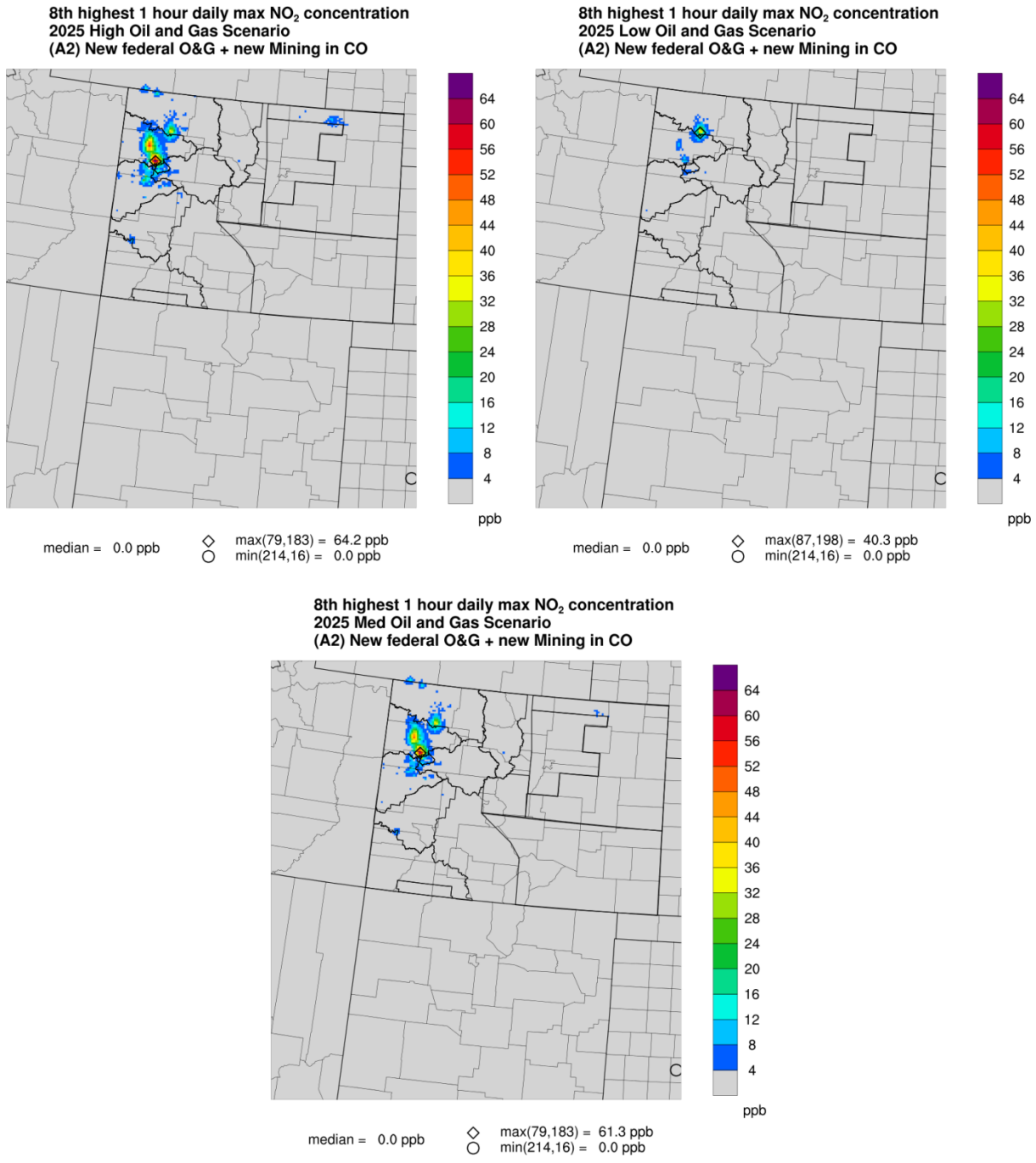

Figure 5-23d. Contributions from new Federal O&G and mining in CO (source group A2) to the eighth highest (98th percentile) daily maximum 1-hour average NO_2 concentrations in the 2025 High (top left), Low (top right) and Medium (bottom) Development Scenarios.

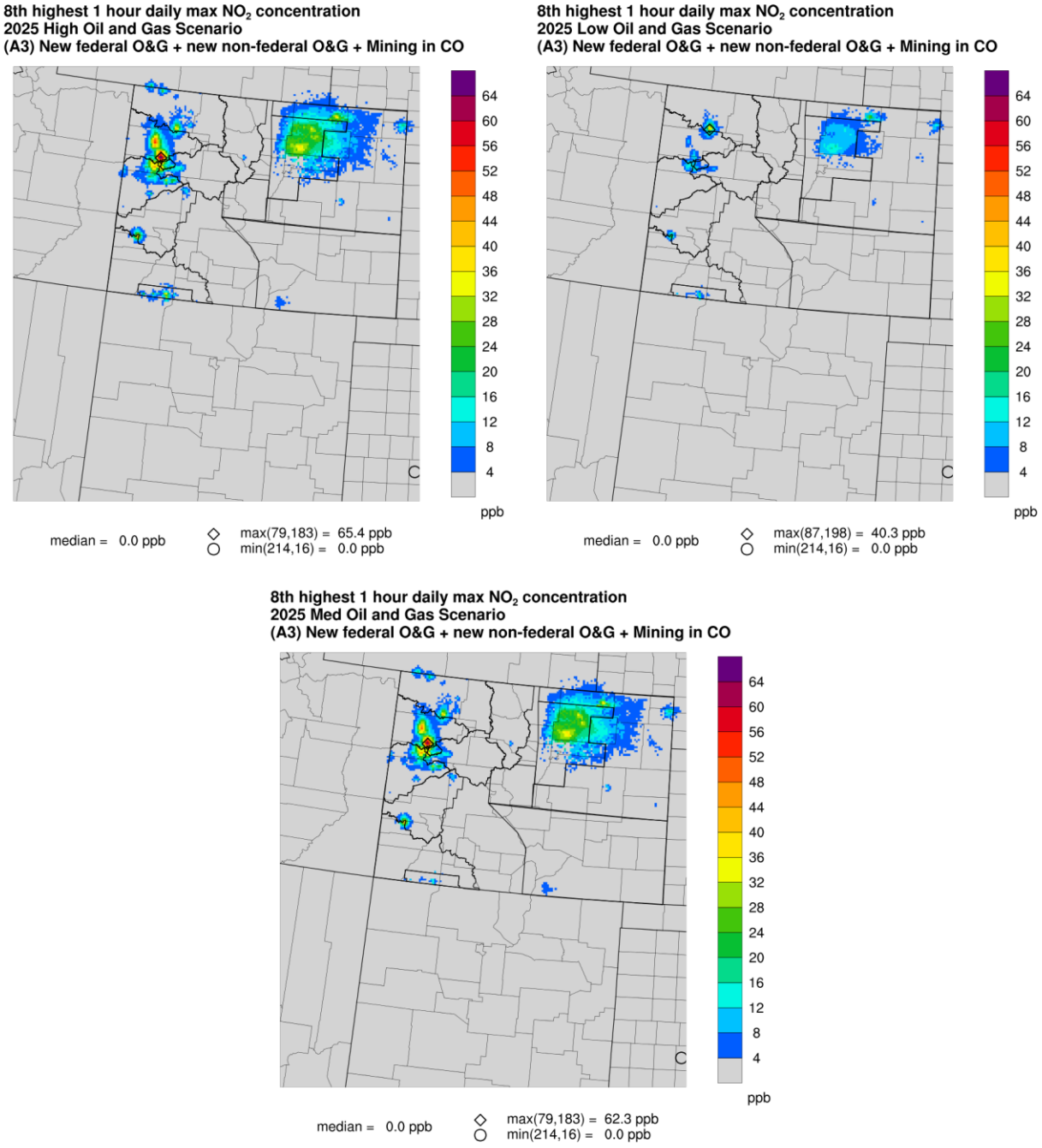

Figure 5-23e. Contributions from new Federal O&G, new non-Federal O&G and mining in CO (source group A3) to the eighth highest (98th percentile) daily maximum 1-hour average NO_2 concentrations in the 2025 High (top left), Low (top right) and Medium (bottom) Development Scenarios.

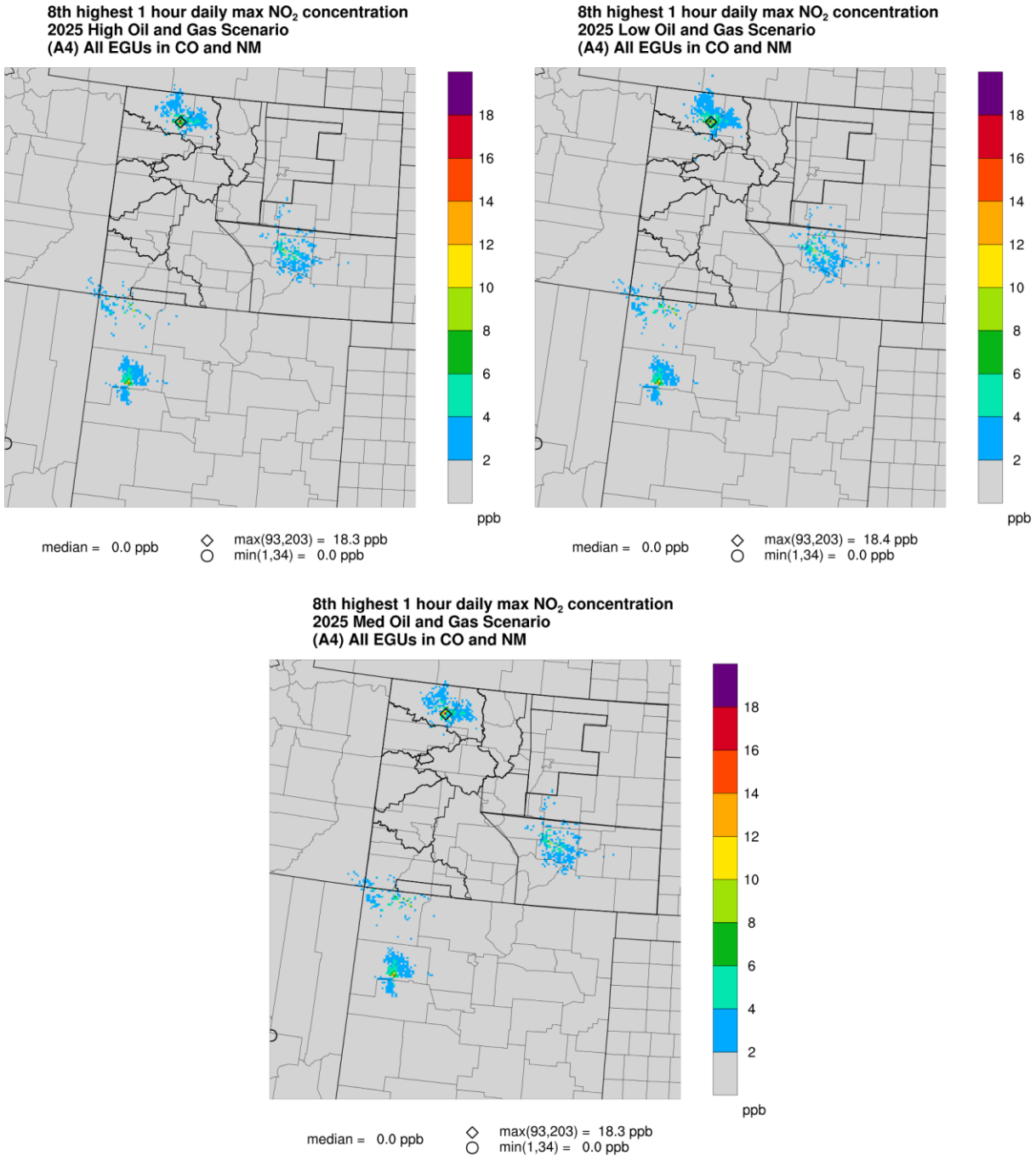

Figure 5-23f.Contributions from all EGUs in CO and NM (source group A4) to the eighth highest (98th percentile) daily maximum 1-hour average NO_2 concentrations in the 2025 High (top left), Low (top right) and Medium (bottom) Development Scenarios.

5.7 W126 Cumulative Ozone Exposure Index

Figure 5-24 shows spatial maps of W126 Cumulative Ozone Exposure Index for 2011 Base Year (upper left), 2025 High Development Scenario (upper right), and their difference (lower left). The annual W126 index ranges from 4 to 35 ppm-hours for the 2011 Base Year, and ranges from 7 to 32 ppm-hours for the 2025 High Scenario. The maximum W126 is seen in New Mexico for both the 2011 Base Year and the 2025 High Scenario. Reduction of W126 from 2011 to 2025 is seen over most areas within the 12/4 km domain except at some locations near Denver and in northwestern New Mexico. Annual W126 index for the 2025 Low and Medium Scenarios has very similar spatial pattern to the 2025 High Scenario, and show similar reduction compared to the 2011 Base Year.

Figure 5-25 shows contribution from total new Federal O&G in Colorado to W126 Cumulative Ozone Exposure Index (Source Group X) in the 2025 High, Low and Medium Development Scenarios. The contribution of new Federal O&G in Colorado is very small for all three scenarios with spatial maximums of 0.82, 0.24, and 0.71 ppb, respectively. The maximum contribution from Source Group X to W126 within the 12/4 km domain occurs in the White River FO for the High and Medium Scenarios, and occurs in the CRVFO for the Low Scenario.

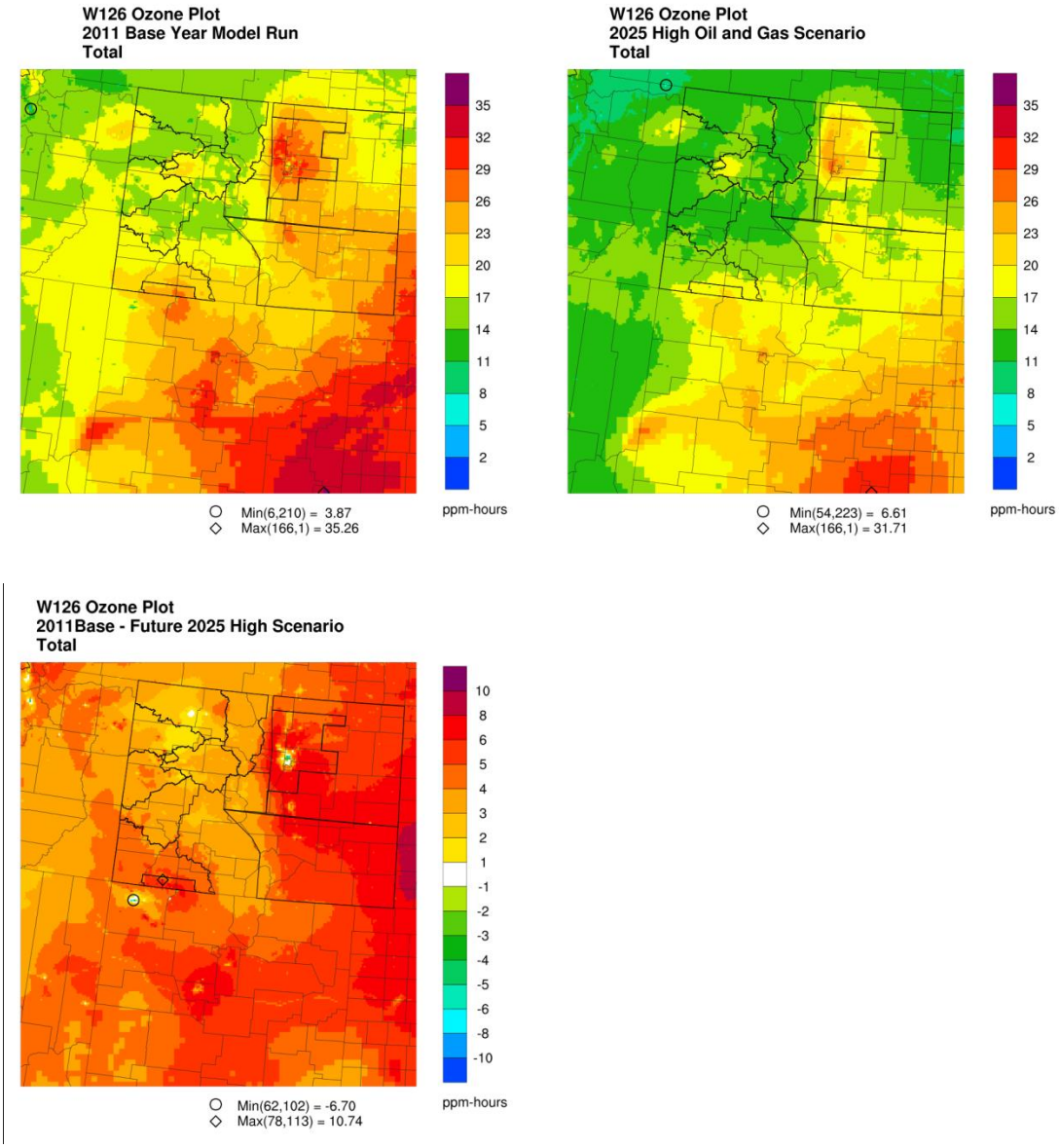

Figure 5-24. W126 Cumulative Ozone Exposure Index for 2011 Base Year (upper left), 2025 High Development Scenario (upper right), and their difference (lower left).

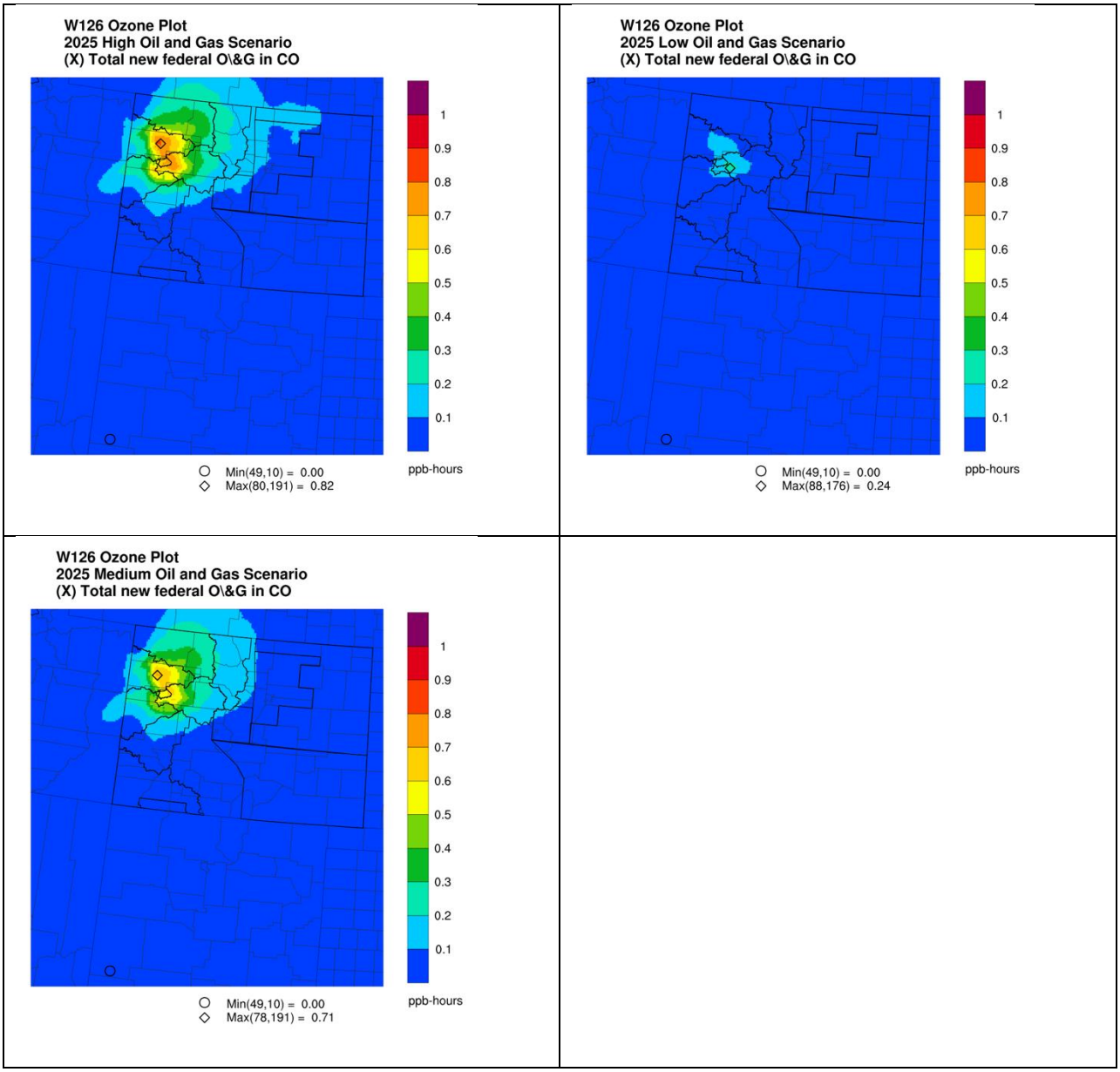

Figure 5-25. Contribution from total new Federal O&G in Colorado to W126 Cumulative Ozone Exposure Index (Source Group X) in the 2025 High, Low and Medium Development Scenarios.

6.0 ACRONYMS

ACHD	Allegheny County Health Department
AES	Applied Envirosolutions
AMET	Atmospheric Model Evaluation Tool
APCA	Anthropogenic Precursor Culpability Assessment
APU	Auxiliary Power Units
ARMS	Air Resource Management Study
AQ	Air Quality
AQRV	Air Quality Related Value
AQS	Air Quality System
BC	Boundary Condition
BLM	Bureau of Land Management
CAFOS	Concentrated Animal Feeding Operations
CAMD	Clean Air Markets Division
CAMx	Comprehensive Air-quality Model with extensions
CAPS	Criteria Air Pollutants
CARMMS	Colorado Air Resource Management Modeling Study
CASTNet	Clean Air Status and Trends Network
CAVR	Clean Air Visibility Rule
CB05	Carbon Bond mechanism version 5
CD-C	Continental Divide-Creston
CDPHE	Colorado Department of Health and Environment
CEM	Continuous Emissions Monitor
CENRAP	Central Regional Air Planning Association
CMAQ	Community Multiscale Air Quality modeling system
CMU	Carnegie Mellon University
ConCEPT	Consolidated Community Emissions Processing Tool
CONUS	Continental United States
COSO	BLM Colorado State Office
CRVFO	Colorado River Valley Field Office
CPC	Center for Prediction of Climate
CSAPR	Cross State Air Pollution Rule
CSN	Chemical Speciation Network
DDM	Decoupled Direct Method
DEASCO3	Deterministic and Empirical Assessment of Smoke's Contribution to Ozone
Dv	deciview
ECA	Emissions Control Area
EGU	Electrical Generating Units
EIS	Environmental Impact Statement
EM	Emissions Model
EMS	Emissions Modeling System
EPA	Environmental Protection Agency
EPS	Emissions Processing System
ERG	Eastern Research Group
ESRL	Earth Systems Research Laboratory
FB	Fractional Bias
FE	Fractional Error

FFO	New Mexico BLM Farmington Field Office
FINN	Fire Inventory from NCAR
FLM	Federal Land Manager
FRM	Federal Reference Method
FWS	Fish and Wildlife Service
GCM	Global Chemistry Model
GEOS-Chem	Goddard Earth Observing System (GEOS) global chemistry model
GJFO	Grand Junction Field Office
GSE	Ground Support Equipment
IAD	Impact Assessment Domain
IMPROVE	Interagency Monitoring of Protected Visual Environments
IMWD	Inter-Mountains West Processing Domain
IPAMS	Independent Petroleum Association of the Mountain States
JSFP	Joint Science Fire Program
FO	Kremmling Field Office
LCP	Lambert Conformal Projection
LTO	Landing and Takeoff Operations
LSFO	Little Snake Field Office
LSM	Land Surface Model
MADIS	Meteorological Assimilation Data Ingest System
MATS	Modeled Attainment Test Software
MEGAN	Model of Emissions of Gases and Aerosols in Nature
MM	Meteorological Model
MM5	Version 5 of the Mesoscale Model
MNGE	Mean Normalized Gross Error
MNB	Mean Normalized Bias
MOVES	Motor Vehicle Emissions Simulator
MOZART	Model for Ozone And Related chemical Tracers
NAAQS	National Ambient Air Quality Standard
NADP	National Acid Deposition Program
NCAR	National Center for Atmospheric Research
NCDC	National Climatic Data Center
NDBC	National Data Buoy Center
NEI	National Emissions Inventory
NEPA	National Environmental Policy Act
NMB	Normalized Mean Bias
NME	Normalized Mean Error
NMED	New Mexico Environmental Department
NMFFO	New Mexico Farmington Field Office
NMIM	National Mobile Inventory Model
NMSO	BLM New Mexico State Office
NOAA	National Oceanic and Atmospheric Administration
NPRI	National Pollutant Release Inventory
NPS	National Park Service
NSPS	New Source Performance Standard
NSR	New Source Review
O&G	Oil and Gas
OA	Organic Aerosol
OSAT	Ozone Source Apportionment Technology

PAVE	Package for Analysis and Visualization
PBL	Planetary Boundary Layer
PGM	Photochemical Grid Model
PiG	Plume-in-Grid
PM	Particulate Matter
PPM	Piecewise Parabolic Method
PSAT	Particulate Source Apportionment Technology
PSD	Prevention of Significant Deterioration
QA	Quality Assurance
QC	Quality Control
RAQC	Regional Air Quality Council
RGFO	Royal Gorge Field Office
RMC	Regional Modeling Center
RMNP	Rocky Mountain National Park
RMP	Resource Management Plan
ROMANS	Rocky Mountain Atmospheric Nitrogen and Sulfur Study
SCC	Source Classification Code
SIP	State Implementation Plan
SMOKE	Sparse Matrix Kernel Emissions modeling system
SOA	Secondary Organic Aerosol
TCEQ	Texas Commission on Environmental Quality
TRFO	Tres Rios Field Office
UAM	Urban Airshed Model
UCR	University of California at Riverside
UFO	Uncompahgre Field Office
UNC	University of North Carolina
UPA	Unpaired Peak Accuracy
USFS	United States Forest Service
USFS-PG	United State Forest Service Pawnee Grasslands
UTSO	BLM Utah State Office
VERDI	Visualization Environment for Rich Data Interpretation
VISTAS	Visibility Improvements for States and Tribal Associations in the Southeast
VMT	Vehicle Miles Traveled
WBD	Wind Blown Dust model
WEA	Western Energy Alliance
WESTUS	Western United States
WRAP	Western Regional Air Partnership
WRFO	White River Field Office
WGA	Western Governors' Association
WRF	Weather Research Forecasting model

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Appendix A: CARMMS 2.0 CAMx Model Performance Evaluation of 2011 Base Case

September 2, 2016

MEMORANDUM

To: Forrest Cook and Chad Meister: BLM Colorado State Office
From: Zhen Liu, Krish Vijayaraghavan and Ralph Morris: Ramboll Environ
CC: Russ Erbes, Dustin Collins and Michele Steyskal: Kleinfelder

Subject: CARMMS 2.0 CAMx Model Performance Evaluation of 2011 Base Case

1. Introduction

The Colorado Air Resources Management Modeling Study (CARMMS 2.0) uses data from the modeling platform of Western Air Quality Study (WAQS) from the Intermountain West Data Warehouse (IWDW) for the 2011 base year and 2025 future year air quality modeling. Following the CARMMS 2.0 work plan (Ramboll Environ, 2016), the air quality modeling for the 2011 base year has been conducted using the Comprehensive Air Quality Model with Extensions (CAMx) photochemical grid model (PGM). The results from the base year modeling will be used in conjunction with the future year modeling results to assess the Air Quality (AQ) and Air Quality Related Value (AQRV) impacts associated with BLM-authorized new Federal mineral development within Colorado as well as other cumulative emission sources.

Commented [KV1]: We are intentionally not mentioning New Mexico because the focus of the MPE is on Colorado and the focus of CARMMS is on Colorado.

The CARMMS 2.0 approach for the 2011 base year air quality modeling was designed to leverage the WAQS-IWDW year 2011b modeling platform to the largest extent possible. As emphasized in comments from EPA on the presentation of the CARMMS 2.0 work plan (EPA, 2016), the purpose of the WAQS-IWDW project *was to more efficiently conduct air quality analyses to accommodate the needs of the Cooperators for air quality planning, including NEPA analyses. One component of accomplishing this goal includes the WAQS-IWDW using its resources to complete a Base Case platform that uses the most current data and tools, and provide a comprehensive MPE. This results in (1) agreement among regulatory and authorizing agencies on air quality analysis techniques, (2) consistency among data and analytical assumptions, and (3) streamlining a process for air quality analyses. The resources from the study are also intended to prevent projects from needing to generate (a) model input data for Base Case period; (b) No-Action scenario for future model simulation; and (c) MPEs. This results in reducing the uncertainty, time, and expense of starting an air quality analysis. Therefore, the EPA would prefer that the BLM use the WAQS-IWDW model platform as-is, and consider taking the resources saved from not re-generating the Base Case, Future Case, and MPE towards sustaining the WAQS-IWDW.*

Indeed, this approach has led to very efficient preparation of input data for the CARMMS 2.0 2011 base year modeling as it uses data extensively from the WAQS-IWDW. Also, the WAQS modeling has already gone through a comprehensive MPE (UNC and Ramboll Environ, 2016). Thus, a comprehensive MPE for CARMMS 2.0 modeling results is not required. However, due to a few changes made in the CARMMS 2.0 modeling compared to the WAQS platform as discussed below, an abbreviated MPE has been conducted to check for equivalency with the WAQS results.

There are two main differences between CARMMS 2.0 and the WAQS-IWDW modeling platform, namely the modeling domain and the CAMx model version. It is not computationally practical to run the WAQS-IWDW modeling platform as is for CARMMS, so a subset of the domain is selected for CARMMS 2.0 (Figure 2-1) to reduce the computational burden of the CAMx source apportionment runs for the three 2025 future year cases for the high, medium and low oil and gas scenarios. CARMMS 2.0 uses CAMx version 6.20 while WAQS applied version 6.10. Through test runs, we confirmed that the change in CAMx version from 6.10 to 6.20 does not introduce notable changes in the modeling results for ozone and $PM_{2.5}$ in this domain.

The rest of this document is organized as follows. The configuration of the CARMMS 2.0 base year 2011 modeling is described in Section 2. Section 3 describes the procedures for the CARMMS 2.0 MPE. The results of the MPE are presented in Section 4, and the conclusions are provided in Section 5.

2. CARMMS 2.0 Modeling Approach and Configuration

A 12/4 km two-way nested domain (Figure 2-1) for CARMMS 2.0 modeling was defined to ensure that (1) the spatial extent was the same as that in CARMMS 1.0, (2) the modeling domain covers all relevant areas for assessing the AQ and AQRV impacts associated with BLM-authorized new Federal mineral development within Colorado and other cumulative emission sources, and that (3) input data can be used from the IWDW WAQS 2011 modeling platform to the largest extent possible. The spatial extent of the CARMMS 2.0 domain is the same as that in CARMMS 1.0 except that 2.0 uses a nested 12 km/ 4 km domain. The CARMMS 2.0 domain is defined to be smaller than the WAQS domain to reduce the computational complexity of the CAMx source apportionment runs and because the focus here is on Colorado.

Input data for emissions, meteorological fields and initial and boundary conditions for CARMMS 2.0 2011 base year modeling were prepared using data from the WAQS 2011b platform archived by IWDW. Specifically, the merged emission files for the 12 and 4 km WAQS air quality domains from the IWDW database were “windowed” to prepare CAMx-ready emissions for the CARMMS 2.0 12/4 km domain for Year 2011 modeling. Prior to CARMMS 2.0, an error was found in the lightning NOx emissions used in WAQS 2011b modeling; this error was fixed in the merged point source emission files used for CARMMS 2.0 modeling. Meteorological inputs and land use files for the CARMMS 12 km and 4 km modeling domains were windowed from the CAMx-ready WRFCAMx inputs used for WAQS 12 km and 4 km domains, respectively. Initial and

boundary conditions for the CARMMS 2.0 12 km domain were extracted from 3-D modeling outputs from WAQS 2011b 12 km domain modeling.

CAMx version 6.20 with the CB6r2 photochemical mechanism was used in CARMMS 2.0 modeling, whereas WAQS 2011b modeling used CAMx version 6.10 with the CB6r2 photochemical mechanism. This minor change in model version was verified through test runs on the CARMMS 2.0 domain to not introduce notable differences in the modeling results for ozone and $PM_{2.5}$.

To summarize, the CARMMS 2.0 base year 2011 modeling bears high consistency with the IWDW WAQS 2011b platform, with the only known differences being (1) the model version, (2) the lightning NOx point source emissions, and (3) the difference in model resolution for areas to the north and west of the CARMMS 4 km domain, which were simulated at 12 km resolution in CARMMS 2.0 and at 4 km resolution in WAQS.

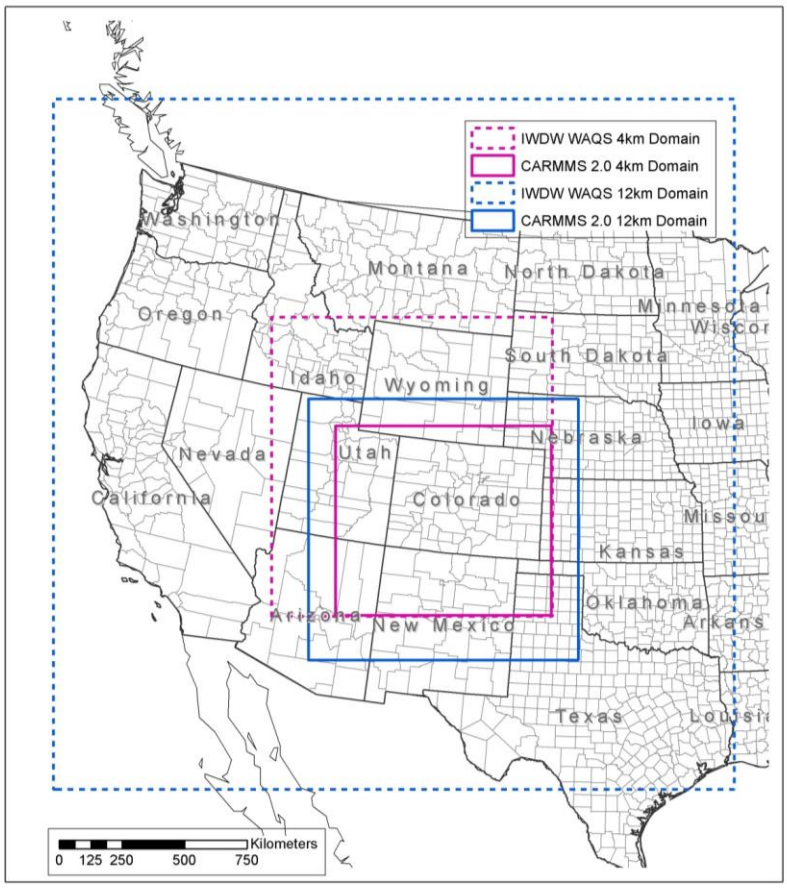

Figure 2-1. IWDW WAQS 2011 12 km (dashed blue) and 4 km (dashed pink) domains, and CARMMS 2.0 12 km (solid blue) and 4 km (solid pink) air quality modeling domains.

3. Model Performance Evaluation Procedures

An abbreviated MPE was conducted for CARMMS 2.0 2011 modeling results. In contrast to the comprehensive MPE that was conducted for the WAQS-IWDW 2011b platform, the scope and procedures of the MPE for CARMMS 2.0 were specifically designed to verify the consistency of CARMMS 2011 MPE results with WAQS 2011b modeling results. This is in keeping with EPA's recommendation to use the WAQS platform as much as possible.

Modeled daily maximum 8-hour (MDA8) O_3 corresponding to observed O_3 greater than 60 ppb (following EPA guidance (2014)) and daily 24-hour average $PM_{2.5}$ and its components from the

CARMMS 2.0 modeling were compared with WAQS 2011b modeling results and observed data in the state of Colorado. Observational data from AQS and CASTNET networks were used for the performance evaluation of O_3, and for $PM_{2.5}$ mass and components data from the IMPROVE network were used. IMPROVE data were used for the $PM_{2.5}$ mass and components evaluation because these stations are generally located at Class I area sites that correspond to National Parks and Wilderness Areas and a key focus of CARMMS is to study AQ and AQRV impacts at Class I and sensitive Class II areas. Figure 4-1 shows the locations of AQS, CASTNET, and IMPROVE sites within the boundaries of state of Colorado (shown in green). Because the purpose of this MPE is only to demonstrate equivalency with WAQS results and because the focus of CARMMS is on Colorado, we restricted the MPE to the stations within Colorado. Hourly model outputs of O_3 and $PM_{2.5}$ components from the grid cells where monitoring stations are present were extracted from the 4 km domain of CARMMS 2.0 2011 modeling and the 4 km domain of WAQS 2011b modeling.

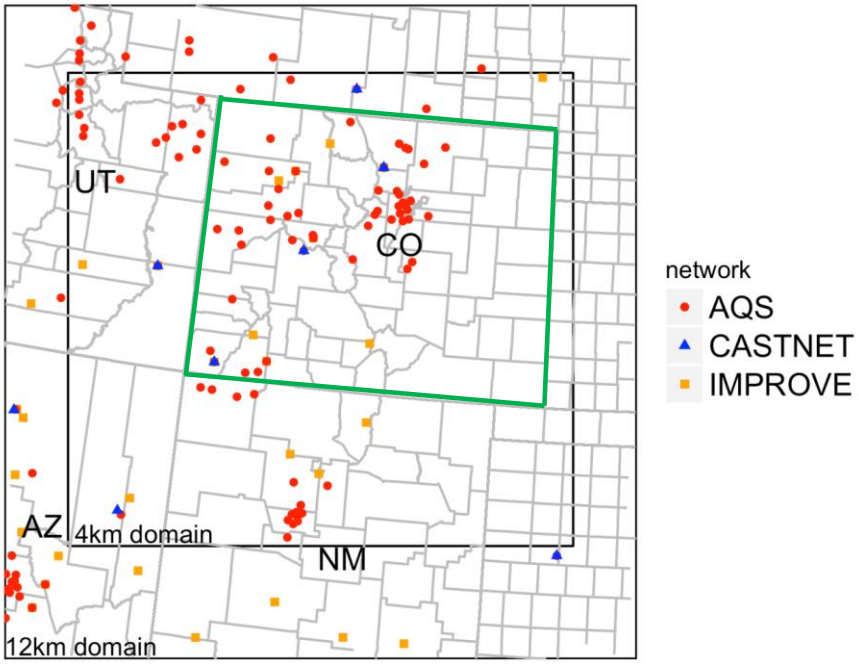

Figure 4-1. Locations of sites from AQS, CASTNET, and IMPROVE networks within the CARMMS 2.0 domain. The boundaries of State of Colorado are highlighted in green, encompassing the sites that are used for the MPE comparison between CARMMS 2.0 and WAQS 2011b.

As recommended for use in the MPE for WAQS modeling platform (WAQS, 2015), the Atmospheric Model Evaluation Tool (AMET) was used to generate model-data pairs and

calculate five key statistical metrics, including normalized mean bias (NMB), normalized mean error (NME), fractional bias (FB), and fractional error (FE), and correlation coefficient (r). The definitions of these metrics are listed in Table 4-1. MPE metrics were calculated for all the sites within the state of Colorado on a quarterly and annual basis, for both CARMMS 2.0 2011 and WAQS 2011b modeling results, and compared against goals and criteria listed in Table 4-2. The same criteria and goals were also used in the MPE for the WAQS 2011b modelling platform. We note that while there are no bright-line goals or criteria, these goals and criteria have been used historically and are useful to assess model performance.

Table 4-1. Definition of model performance evaluation statistical measures used in model performance evaluation.

Statistical Measure	Mathematical Expression	Notes
Correlation Coefficient (r)	$\frac{\sum_{i=1}^{N}[(P_i - \bar{P}) \times (O_i - \bar{O})]}{\sqrt{\sum_{i=1}^{N}(P_i - \bar{P})^2 \times \sum_{i=1}^{N}(O_i - \bar{O})^2}}$	P_i = prediction at time and location i; O_i = observation at time and location i; $\bar{P}$ = arithmetic average of P_i, i=1,2,…, N; $\bar{O}$ = arithmetic average of O_i, i=1,2,…,N
Normalized Mean Error (NME)	$\frac{\sum_{i=1}^{N}\lvert P_i - O_i\rvert}{\sum_{i=1}^{N} O_i}$	Reported as %
Fractional Error (FE)	$\frac{2}{N}\sum_{i=1}^{N}\left\lvert\frac{P_i - O_i}{P_i + O_i}\right\rvert$	Reported as % and bounded by 0% to 200%
Normalized Mean Bias (NMB)	$\frac{\sum_{i=1}^{N}(P_i - O_i)}{\sum_{i=1}^{N} O_i}$	Reported as %
Fractional Bias (FB)	$\frac{2}{N}\sum_{i=1}^{N}\left(\frac{P_i - O_i}{P_i + O_i}\right)$	Reported as %, bounded by -200% to +200%

Table 4-2. Ozone and PM model performance goals and criteria for bias and error (source: UNC and Ramboll Environ, 2015).

Normalized Mean Bias	Normalized Mean Error	Comment
≤±15%	≤35%	Ozone model performance Goal from the 1991 guidance that would be considered very good model performance for PM species (EPA, 1991).
≤±30%	≤50%	PM model performance Goal, considered good PM performance.
≤±60%	≤75%	PM model performance Criteria, considered average PM performance.

		Exceeding this level of performance for PM species with significant mass may be cause for concern.

4. Results and discussion

Table 5-1 shows statistical metrics calculated for MDA8 O_3 (with a 60 ppb cutoff) from CARMMS 2.0 2011 and WAQS 2011b modeling. Overall, the difference in model bias and error between CARMMS 2.0 and WAQS 2011b is very small (within 1%), except for results in Quarters 1 and 4 that have few data points (n <50). Both CARMMS 2.0 and WAQS 2011b show negative model bias (NMB and FB), indicating that they both tend to underestimate MDA8 O_3 at concentrations greater than 60 ppb of observed O_3, while CARMMS 2.0 is slightly lower than WAQS 2011b. In terms of error (NME and FE), CARMMS 2.0 is slightly worse than WAQS 2011b when the comparison focuses on days with concentrations greater than 60 ppb of observed O_3. When compared against the goals and criteria in Table 4-2, WAQS 2011b meets the goals for both bias (≤±15%) and error (≤35%) for O_3 in Table 4-2 in all the metrics calculated on quarterly or annual basis. CARMMS 2.0 meets the goal for bias and error in all but one case; the fractional bias (FB) is slightly higher at 17.4% in the first quarter of 2011 at CASTNET sites. The correlation coefficients calculated for the two sets of modeling results are very close, while the lack of correlation (r is typically < 0.5) is likely due to omitting large portion of variability with the 60 ppb cutoff applied.

Time series of observed versus modeled O_3 from CARMMS and WAQS were compared at all AQS and CASTNET sites in Colorado. These show that WAQS 2011b and CARMMS 2.0 simulate very similar day-to-day variability of O_3, while the two are more different in colder than in warmer months (see discussion below; time series plots at sites that are not discussed below are provided separately in an attachment). It is also seen that the CARMMS 2.0 modeling performance is often better at concentrations lower than the 60 ppb cutoff. CARMMS 2.0 performance is better on an annual basis than WAQS 2011b at the majority of AQS and CASTNET sites, while only at 3 out of all AQS sites and 1 out of 4 CASTNET sites is CARMMS 2.0 worse in both bias and error than WAQS 2011b.

Figure 5-1 and Figure 5-2 show time series plots at two AQS sites (Welby and Manitou), with the former being an example of a site where WAQS performance is slightly better than CARMMS 2.0, and the latter being an example where CARMMS 2.0 is better than WAQS. Figure 5-3 and Figure 5-4 show results from two CASTNET sites (Rocky Mountain National Park and Gothic), which show slightly worse and better performance by CARMMS 2.0 in comparison to WAQS 2011b, respectively (see statistical metrics embedded in the time series figures).

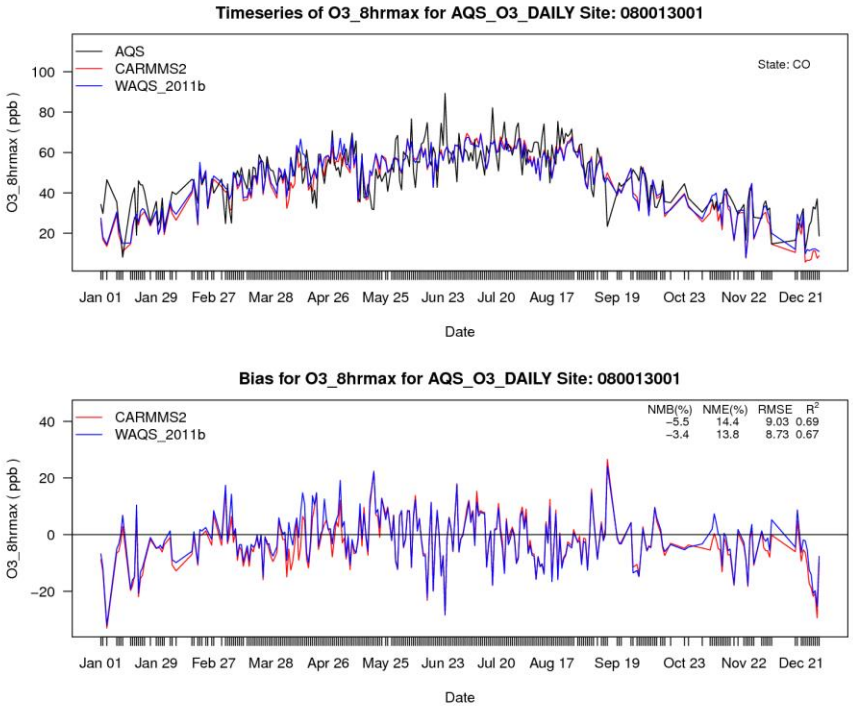

Figure 5-1. Time series plot of observed versus modeled MDA8 O3 (upper panel) and of model biases (lower panel) at the AQS Welby (080013001) site in the Denver area.

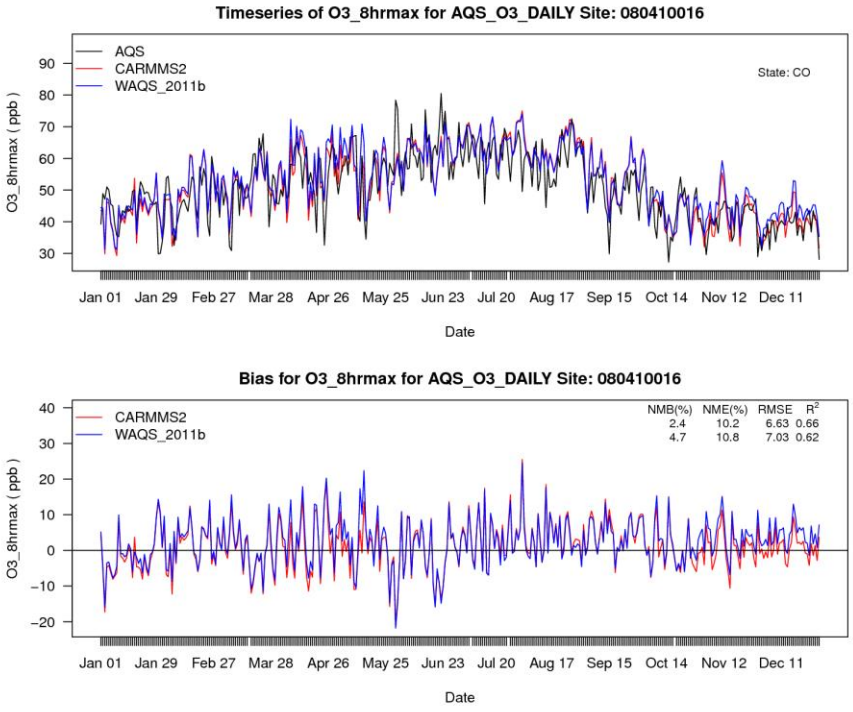

Figure 5-2. Time series plot of observed versus modeled MDA8 O3 (upper panel) and of model biases (lower panel) at the AQS Manitou (080410016) site in the Colorado Springs region .

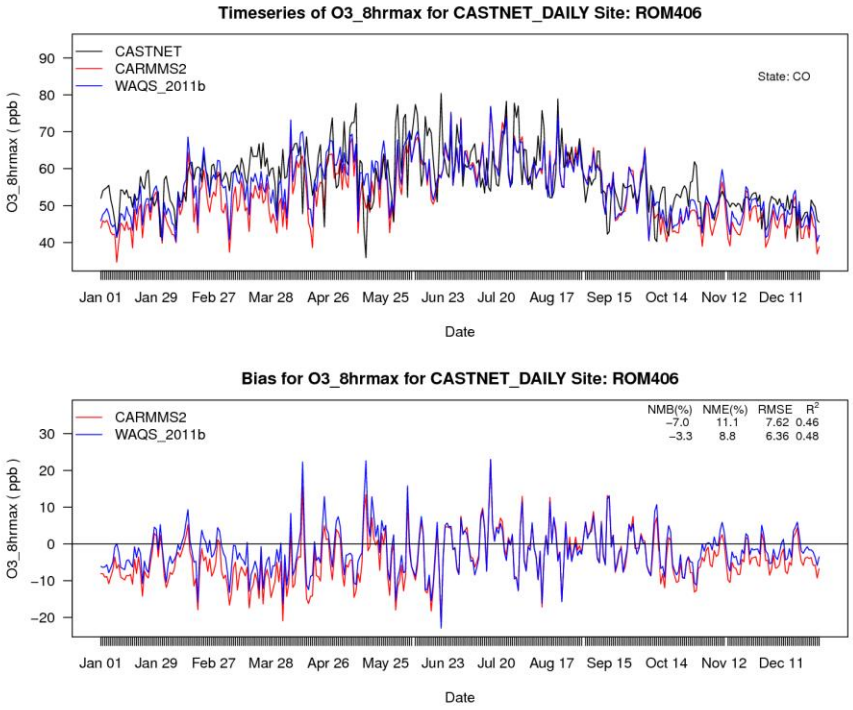

Figure 5-3. Time series plot of observed versus modeled MDA8 O3 (upper panel) and of model biases (lower panel) at the CASTNET Rocky Mountain National Park (ROM406) site in Larimer County in Colorado .

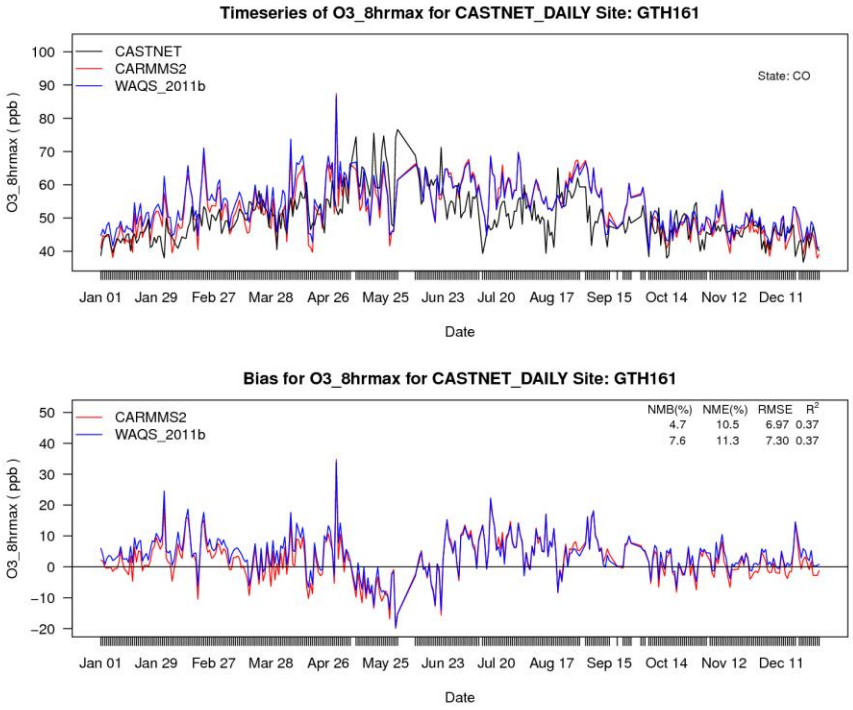

Figure 5-4. Time series plot of observed versus modeled MDA8 O3 (upper panel) and of model biases (lower panel) at the AQS Gothic (GTH161) site in Gunnison County in Colorado.

Table 5-2 presents a comparison of model performance of CARMMS 2.0 and WAQS 2011b for $PM_{2.5}$ total mass concentrations at IMPROVE sites within Colorado. As in the case of O_3, the difference between CARMMS 2.0 and WAQS is very small in terms of both bias and error (difference < 1%), except for in the first quarter of 2011 when both show very small bias and error (< 3%). Both modeling results show marked underestimation of $PM_{2.5}$ compared to observations in the summer months. Time series plots show that the two modeling results track each other very well at all sites, with very similar MPE statistics on an individual site basis.

Figure 5-5 shows the time series plot at the Weminuche (WEMI1) site of the IMPROVE network, as an example with CARMMS 2.0 having slightly worse bias and error than WAQS, while Figure 5-6 shows another opposite example with CARMMS 2.0 being slightly better. In general, the CARMMS and WAQS results have very similar temporal trends with differences hardly discernible. $PM_{2.5}$ time series plots for all IMPROVE sites in Colorado are provided separately in an attachment. Again, the temporal trends are similar for WAQS and CARMMS at all sites.

Comparing those metrics calculated in Table 5-2 against to the goals and criteria in Table 4-2 suggests that, for most of the instances, CARMMS 2.0 and WAQS simultaneously meets or miss the goals or criteria. On an annual basis, both CARMMS 2.0 and WAQS meet the criteria for bias (≤±60%) and error (≤75%). When considering the goals, CARMMS 2.0 meets the goal for NMB and FB, while WAQS misses (FB = 30.2%) the goal for FB (≤±30%); both meet the goal for error (≤50%) with NME but miss the goal with FE. When considering metrics calculated on a quarterly basis, CARMMS and WAQS are always consistent in either meeting or missing the goals or criteria.

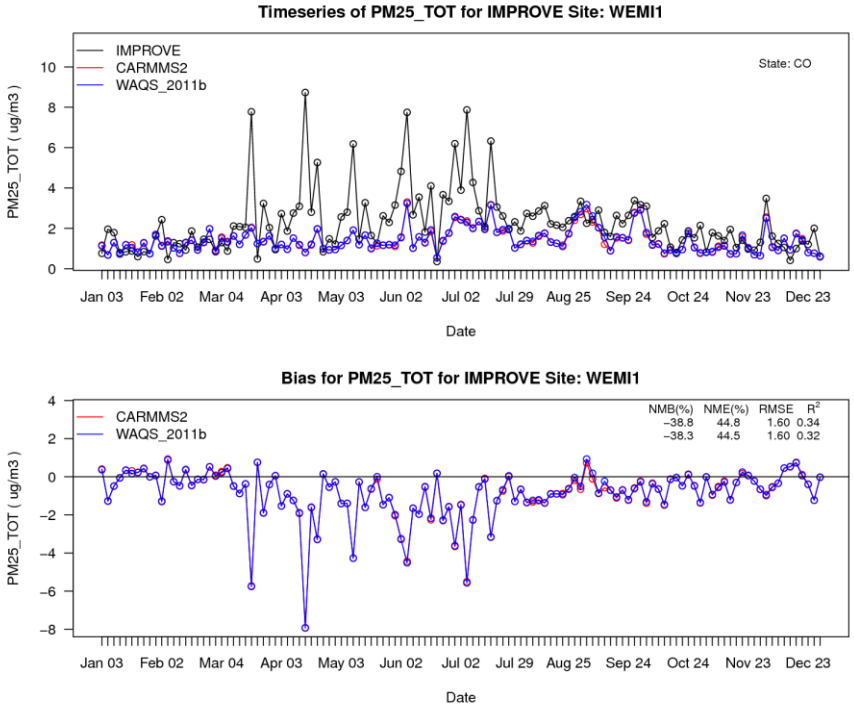

Figure 5-5. Time series plot of observed versus modeled 24-hour $PM_{2.5}$ (upper panel) and the model biases (lower panel) at the Weminuche (WEMI1) IMPROVE site.

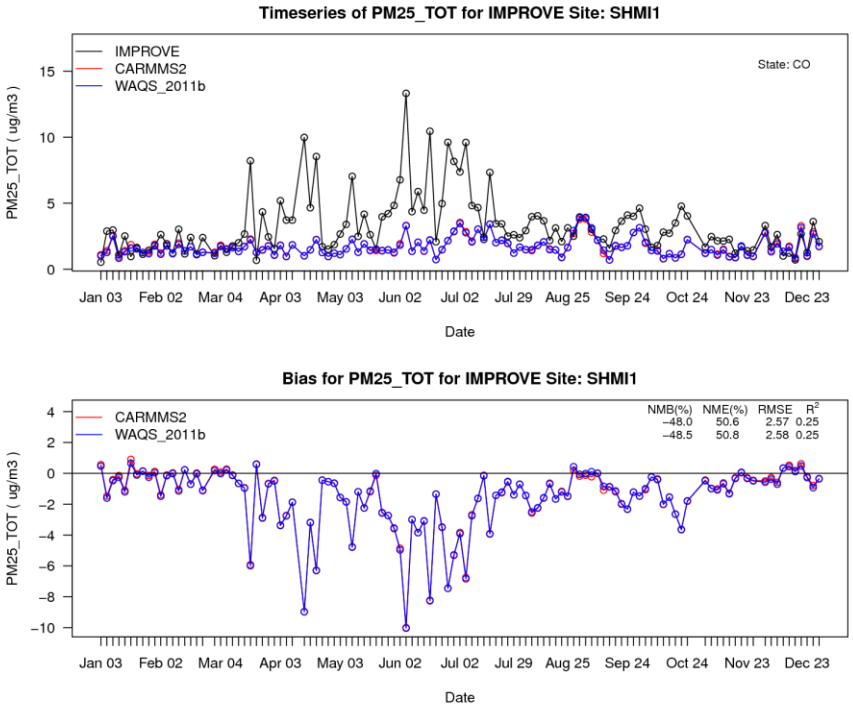

Figure 5-6. Time series plot of observed versus modeled 24-hour $PM_{2.5}$ (upper panel) and the model biases (lower panel) at the Shamrock Mine (SHMI1) IMPROVE site.

Table 5-3 through Table 5-8 show the MPE statistics calculated for $PM_{2.5}$ components, SO4, NO3, OC, EC, NH4, and other $PM_{2.5}$ components (OPM25) using IMPROVE speciated measurements. Similar to the results for total $PM_{2.5}$ mass concentrations, CARMMS 2.0 and WAQS show very similar performance for these individual components. When considering the annual normalized or fractional bias, CARMMS performs slightly better than WAQS for $PM_{2.5}$ mass, SO4, OC and EC. When considering other statistics and/or species, CARMMS performs slightly worse. Time series plots showing model performances at individual sites are provided separately in an attachment.

Table 5-1. Comparison of WAQS 2011b and CARMMS 2.0 model performance for MDA8 O_3 with 60 ppb cutoff.

Period	Network	#Obs	Mean obs	NMB (%)		NME (%)		FB (%)		FE (%)		Correlation Coeff	
				CARMMS2	WAQS	CARMMS2	WAQS	CARMMS2	WAQS	CARMMS2	WAQS	CARMMS2	WAQS
Q1	AQS	43	62.4	-13.0	-7.4	13.0	7.4	-14.6	-10.5	14.9	11.0	-0.1	-0.1
	CASTNET	22	62.3	-14.5	-8.6	14.5	8.6	-17.4	-10.3	17.4	10.6	0.3	0.2
Q2	AQS	514	66.6	-8.2	-6.8	9.2	8.8	-8.2	-6.9	10.6	10.2	0.4	0.3
	CASTNET	131	66.1	-9.8	-7.2	9.8	8.0	-10.1	-7.5	11.4	9.9	0.3	0.3
Q3	AQS	738	66.7	0.6	-0.5	6.9	6.8	0.2	-1.0	7.8	7.7	0.3	0.3
	CASTNET	87	65.3	-2.2	-3.1	5.7	6.3	-1.5	-2.5	7.5	7.5	0.3	0.3
Q4	AQS	4	63.3	-9.4	-8.2	11.0	8.6	-11.0	-9.6	12.5	9.9	1.0	1.0
	CASTNET	4	62.3	-9.7	-8.5	13.6	11.4	-9.9	-8.3	13.6	11.2	0.7	0.7
Annual	**AQS**	**1299**	**66.5**	**-3.3**	**-3.3**	**7.8**	**7.4**	**-3.7**	**-3.7**	**9.2**	**8.8**	**0.3**	**0.3**
	CASTNET	**244**	**65.4**	**-6.7**	**-5.4**	**8.7**	**7.3**	**-7.7**	**-5.9**	**10.6**	**9.1**	**0.3**	**0.3**

Table 5-2. Comparison of WAQS 2011b and CARMMS 2.0 model performance for 24-hour average $PM_{2.5}$.

Period	Network	#Obs	Mean obs	NMB (%)		NME (%)		FB (%)		FE (%)		Correlation Coeff	
				CARMMS2	WAQS	CARMMS2	WAQS	CARMMS2	WAQS	CARMMS2	WAQS	CARMMS2	WAQS
Q1	IMPROVE	204	1.7	2.24	-0.578	37.1	35.9	2.78	0.485	44.7	44.5	0.4	0.41
Q2	IMPROVE	201	4	-54.9	-54.6	56.4	56.3	-70.1	-70	76.8	76.6	0.6	0.6
Q3	IMPROVE	208	3.1	-33.4	-32.7	34.4	33.8	-40.5	-39.2	43.7	43.4	0.59	0.55
Q4	IMPROVE	203	1.65	-12.8	-14.2	33	32.9	-10.4	-12.5	41.3	40.7	0.42	0.45
Annual	**IMPROVE**	**816**	**2.61**	**-26.7**	**-26.8**	**32.8**	**31.1**	**-29.5**	**-30.2**	**51.5**	**51.2**	**0.49**	**0.5**

Table 5-3. Comparison of WAQS 2011b and CARMMS 2.0 model performance for 24-hour average $PM_{2.5}$ SO4.

Period	Network	#Obs	Mean obs	NMB (%)		NME (%)		FB (%)		FE (%)		Correlation Coeff	
				CARMMS2	WAQS	CARMMS2	WAQS	CARMMS2	WAQS	CARMMS2	WAQS	CARMMS2	WAQS
Q1	IMPROVE	202	0.294	91.4	96	97.5	101	59	60.9	68.3	69.6	0.39	0.39
Q2	IMPROVE	181	0.528	-4.97	-4.52	31.3	30.1	-1.49	0.176	38.2	38.2	0.21	0.21
Q3	IMPROVE	202	0.532	-4.71	-3.87	24.2	24.4	2.87	4.39	28.9	28.7	0.45	0.44
Q4	IMPROVE	200	0.333	46.2	47.7	57.2	58	35.3	36.3	50	50.1	0.39	0.4
Annual	**IMPROVE**	**785**	**0.419**	**26.9**	**28.9**	**44.7**	**45.5**	**24.6**	**26.1**	**46.6**	**46.9**	**0.36**	**0.36**

Table 5-4. Comparison of WAQS 2011b and CARMMS 2.0 model performance for 24-hour average $PM_{2.5}$ NO3.

Period	Network	#Obs	Mean obs	NMB (%)		NME (%)		FB (%)		FE (%)		Correlation Coeff	
				CARMMS2	WAQS	CARMMS2	WAQS	CARMMS2	WAQS	CARMMS2	WAQS	CARMMS2	WAQS
Q1	IMPROVE	202	0.159	-57.9	-55.9	90.5	92	-69.8	-69	121	121	0.21	0.19
Q2	IMPROVE	181	0.151	-87.2	-83.1	88.1	85.6	-156	-153	161	159	0.32	0.32
Q3	IMPROVE	202	0.0738	-99.6	-99.7	100	99.7	-193	-193	194	194	0.44	0.45
Q4	IMPROVE	200	0.103	-60.8	-56.9	88.1	88.3	-90.6	-87.7	127	125	0.51	0.52
Annual	**IMPROVE**	**785**	**0.121**	**-72.9**	**-72.5**	**86.1**	**86.6**	**-127**	**-125**	**151**	**150**	**0.36**	**0.35**

Table 5-5. Comparison of WAQS 2011b and CARMMS 2.0 model performance for 24-hour average $PM_{2.5}$ OC.

Period	Network	#Obs	Mean obs	NMB (%)		NME (%)		FB (%)		FE (%)		Correlation Coeff	
				CARMMS2	WAQS	CARMMS2	WAQS	CARMMS2	WAQS	CARMMS2	WAQS	CARMMS2	WAQS
Q1	IMPROVE	194	0.256	-0.304	-6.43	41.5	39.9	4.15	-7.19	53.5	55.2	0.21	0.18
Q2	IMPROVE	202	0.562	-25.6	-29.2	35.4	36.5	-29.6	-33.5	54.5	55.1	0.83	0.83
Q3	IMPROVE	213	0.638	-13.5	-12.5	32.8	32.8	-17.6	-16.7	42.5	42.9	0.44	0.39
Q4	IMPROVE	200	0.27	-12.5	-19.5	45.9	45.3	-4.82	-14.8	60.6	61.1	0.18	0.2
Annual	**IMPROVE**	**809**	**0.437**	**-14.3**	**-17.5**	**36.9**	**35.9**	**-12.2**	**-18.1**	**52.6**	**53.4**	**0.63**	**0.62**

Table 5-6. Comparison of WAQS 2011b and CARMMS 2.0 model performance for 24-hour average $PM_{2.5}$ EC.

Period	Network	#Obs	Mean obs	NMB (%)		NME (%)		FB (%)		FE (%)		Correlation Coeff	
				CARMMS2	WAQS	CARMMS2	WAQS	CARMMS2	WAQS	CARMMS2	WAQS	CARMMS2	WAQS
Q1	IMPROVE	201	0.0498	58.6	56.3	76.9	76.6	39.1	36.4	65.2	64.9	0.26	0.24
Q2	IMPROVE	203	0.0788	10.4	9.8	43.1	43.3	11	11.2	48.1	48.3	0.75	0.74
Q3	IMPROVE	213	0.0852	-19.4	-19	32.8	34	-24.5	-22.8	44.4	44	0.58	0.57
Q4	IMPROVE	202	0.0628	18.7	17.1	48.1	46.9	17.4	15.9	56.3	55.7	0.17	0.18
Annual	**IMPROVE**	**819**	**0.0694**	**7.8**	**8.0**	**47.2**	**46.3**	**10.1**	**9.58**	**53.3**	**53**	**0.62**	**0.63**

Table 5-7. Comparison of WAQS 2011b and CARMMS 2.0 model performance for 24-hour average $PM_{2.5}$ NH4.

Period	Network	#Obs	Mean obs	NMB (%)		NME (%)		FB (%)		FE (%)		Correlation Coeff	
				CARMMS2	WAQS	CARMMS2	WAQS	CARMMS2	WAQS	CARMMS2	WAQS	CARMMS2	WAQS
Q1	IMPROVE	202	0.156	-1.3	0.237	35.9	37.7	-8.1	-6.67	45.3	46	0.42	0.41
Q2	IMPROVE	181	0.242	-34	-32.5	36.6	36.1	-31.4	-29.6	46.7	45.9	0.28	0.27
Q3	IMPROVE	202	0.221	-19.1	-17.6	29.5	28.8	-16.3	-14.7	33.3	32.5	0.43	0.43
Q4	IMPROVE	200	0.155	0.465	0.0709	29.6	29.5	-3.16	-2.33	39.5	39	0.49	0.5
Annual	**IMPROVE**	**785**	**0.192**	**-13.0**	**-12.3**	**30.6**	**30.2**	**-14.3**	**-12.9**	**41.1**	**40.7**	**0.41**	**0.41**

Table 5-8. Comparison of WAQS 2011b and CARMMS 2.0 model performance for 24-hour average $PM_{2.5}$ OtherPM25.

Period	Network	#Obs	Mean obs	NMB (%)		NME (%)		FB (%)		FE (%)		Correlation Coeff	
				CARMMS2	WAQS	CARMMS2	WAQS	CARMMS2	WAQS	CARMMS2	WAQS	CARMMS2	WAQS
Q1	IMPROVE	168	0.714	-21.9	-19.4	76.6	75.7	-21.4	-20.6	86.1	85	0.19	0.2
Q2	IMPROVE	175	1.96	-79	-78.8	79	78.8	-116	-115	129	128	0.33	0.33
Q3	IMPROVE	195	1.05	-73.2	-72	73.2	72	-112	-111	115	113	0.38	0.39
Q4	IMPROVE	180	0.604	-47.4	-48.6	53.3	53.3	-51.5	-50.5	81.3	80.5	0.31	0.31
Annual	**IMPROVE**	**718**	**1.08**	**-64.9**	**-63.9**	**67.2**	**66.6**	**-76.4**	**-75.5**	**103**	**102**	**0.23**	**0.23**

5. Conclusion

In conclusion, results from the abbreviated CARMMS 2.0 MPE show that the modified modeling platform for CARMMS 2.0 shows approximately equivalent model performance with the WAQS-IWDW 2011b modeling platform and also meets relevant goals and/or criteria for ozone and $PM_{2.5}$ in general. The extensive use of modeling data from WAQS-IWDW has significantly improved the efficiency of CARMMS 2.0 air quality modeling for the 2011 base year; the CARMMS 2.0 2025 future year modeling will continue to leverage the data and resources provided by WAQS-IWDW.

References

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Appendix B: CARMMS 2.0 Oil and Gas Emission Calculator Documentation

August 4, 2016

MEMORANDUM

To: Forrest Cook and Chad Meister, BLM Colorado State Office
From: John Grant, Rajashi Parikh, Krish Vijayaraghavan: Ramboll Environ
Russ Erbes, Michele Steyskal, Kaitlin Meszaros, Dustin Collins: Kleinfelder

Subject: CARMMS 2.0 Oil and Gas Emission Calculator Documentation

1.0 INTRODUCTION

1.1 Scope and Goals

The purpose of this document is to explain the emissions calculation procedures used in the oil and gas emission calculators developed for the Colorado Air Resource Management Modeling Study (CARMMS) 2.0. For CARMMS 2.0, we developed a new set of emissions calculators for the Royal Gorge Field Office (RGFO) and updated existing emissions calculators for Western Colorado Field Offices for CARMMS 1.0 (ENVIRON et al.; 2015) and the Mancos Shale for CARMMS 1.5 (Ramboll Environ and Kleinfelder, 2016).

The RGFO is divided into four separate planning areas, with three planning areas containing mostly conventional oil and gas well development and one planning area containing mostly coal bed methane gas well development. One of the conventional oil and gas well areas (RGFO Area 1, see Figure 1-1) is also a non-attainment area for ozone. For the RGFO calculators, we used an emission calculator template similar to the existing calculators developed in CARMMS 1.0 and CARMMS 1.5 for consistency across field offices. Source data used in the RGFO calculcators were based on RGFO specific operations and equipment currently in the field. Similarly, the on-the-books regulations used for emission controls also took into account RGFO specific considerations, such as regulations specific to the non-attainment area. The RGFO calculators, for all four of the RGFO planning areas, estimate emissions for 2015 to 2025 using current decline curve data and the most recent version of MOVES2014a (Motor Vehicle Emission Simulator version 2014a; EPA, 2015) to create on-road vehicle and off-road equipment emission factors. The RGFO has both conventional oil and conventional gas wells; however, operations at RGFO oil and gas wells are similar so they were combined into one calculator.

The Western Colorado Field Offices CARMMS 1.0 emission calculators and the Mancos Shale CARMMS 1.5 emission calculators were updated to estimate emissions for the 2015 to 2025 period, including updates to emission controls required by on-the-books regulations. We also updated well decline curves and updated on-road vehicle and off-road equipment emission factors using the latest version of MOVES2014a. The Tres Rios Field Office emission calculators were modified to exclude future oil and gas activity on Southern Ute Indian Tribe land because

emissions from future oil and gas activity on Southern Ute Indian Tribe land are estimated based on the Supplemental Environmental Impact Statement for Shale Formation Oil and Gas Plan of Development emissions inventory (Ramboll Environ, 2016).

The refined emission calculators are used to develop the 2025 emissions inventories for Colorado and New Mexico Bureau of Land Management (BLM) planning areas (see Figure 1-1) and the Mancos Shale (see Figure 1-2).

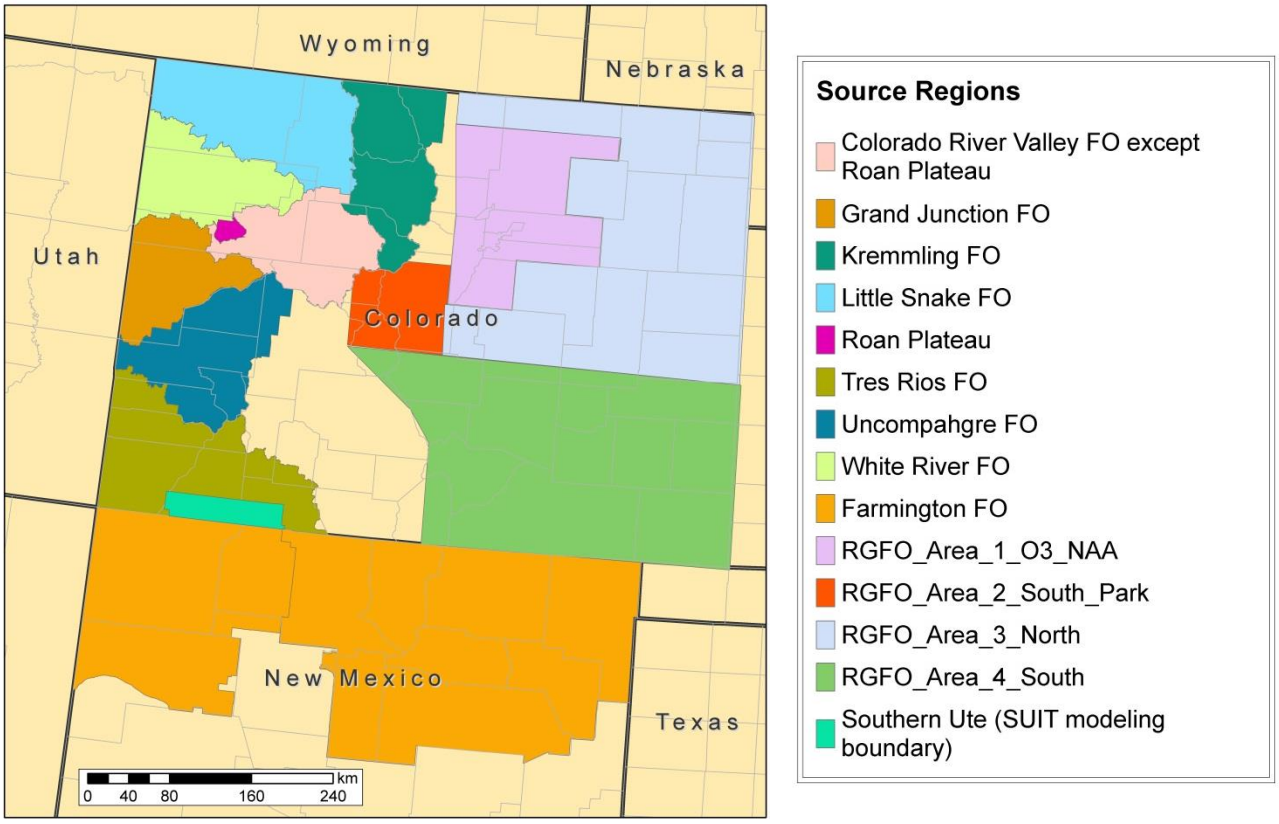

Figure 1-1. Colorado Field Office Planning Areas.

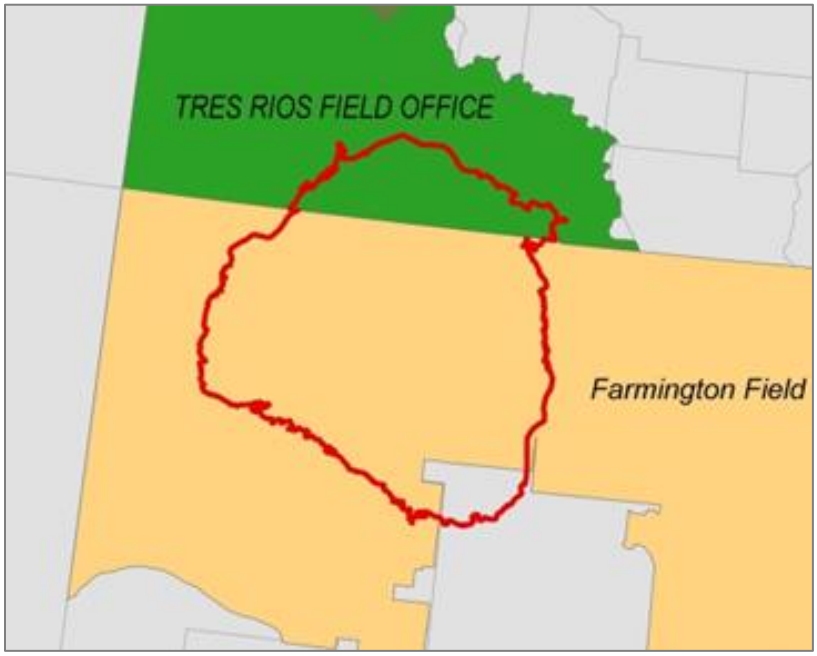

Figure 1-2. Mancos Shale development area (in red outline with Tres Rios and Farmington Field Offices).

1.2 Overview of Calculators

Emission calculators have been developed for this study for each of the following areas and well types.

- Royal Gorge Field Office
  - Conventional oil and gas
  - Coalbed methane (natural gas) (CBM)
- Western Colorado Field Offices
  - Conventional gas
  - Conventional oil
  - Shale gas
  - Coalbed methane (natural gas) (CBM)
- Mancos Shale
  - Shale gas
  - Shale oil

For each well type a separate, self-contained emission calculator spreadsheet contains all of the inputs and calculations need to generate wellsite emissions.

Additionally, a calculator has been developed to estimate midstream emissions for each planning area. The midstream emission calculator draws upon Colorado Department of Public Health (CDPHE) Air Pollutant Emission Notice (APEN) emissions for base year emission estimates (CDPHE, 2016). APEN data only through calendar year 2014 were available at the time that the emission calculators were developed, thus calendar year 2014 data were used to represent the base year (2015). Future year midstream emission projections are dependent on the change in oil and gas production in a given planning area which can be updated based on linkages to the by well type emission calculators.

1.2.1 Pollutants

The emission calculators include estimates of emissions of criteria air pollutants (CAPs), greenhouse gases (GHGs), and hazardous air pollutants (HAPs) as follows:

- Criteria Pollutants
  - Carbon monoxide (CO)
  - Nitrogen oxides (NO_X)
  - Particulate matter less than or equal to 10 microns in diameter (PM_{10})
  - Particulate matter less than or equal to 2.5 microns in diameter ($PM_{2.5}$)
  - Sulfur dioxide (SO_2)
  - Volatile Organic Compounds (VOCs)
- Greenhouse Gases
  - Carbon dioxide (CO_2)
  - Methane (CH_4)
  - Nitrous oxide (N_2O)
- Hazardous Air Pollutants (HAPs)

While lead (Pb) is a criteria pollutant, emissions of lead in the BLM western Colorado planning areas are expected to be extremely low and are therefore not included in this analysis.

HAP emissions were estimated for each emissions source. For oil and gas emissions sources, HAP emissions from venting and combustion source categories were estimated for formaldehyde, n-hexane, benzene, toluene, ethylbenzene, and xylenes (BTEX).

Anthropogenic greenhouse gas emission inventories typically include carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), and fluorinated gases. Fluorinated gases are not expected to be emitted in appreciable quantities by any category considered in this emission inventory and were therefore not included in this analysis.

1.2.2 Temporal

The calculators estimate annual emissions associated with oil and gas exploration. Base year emissions are estimated for 2015 with annual emission forecasts to 2025.

2.0 CALCULATOR DEVELOPMENT

2.1 Calculator Inputs

The emission calculator for each well type allows for specification of the following inputs. Appendices A through H present gas composition, equipment configuration, and gas venting activity inputs for each area and well type inclusive of on-the-books regulations. Base year oil and gas activity and well decline estimates are available in the individual spreadsheet calculators.

- Gas composition
- Equipment configurations (e.g. drill rigs, fracing rigs)
- Gas venting activity (e.g. completions, blowdowns)
- Base year oil and gas activity (gas production, oil production, spud counts, active well counts)
- Well decline estimates

The midstream emission calculator includes estimates of base year 2015 gas plant and compressor station emissions taken from CDPHE APEN data. Base year midstream emissions are projected to future years based upon the gas production in each planning area. Appendix I shows base year 2015 midstream emissions by field office and facility as reported in APEN data.

2.2 Emission Calculations

Emission calculations for all emission-generating activities were developed based on typical oil and gas emission inventory methodology. Emissions are generated in three main phases of oil and gas systems:

- Emissions from Well Construction and Development

- Emissions from the Production Phase (occurring at-or-nearby the well pad)
- Emissions from Midstream Sources (Central Gas Compression and Processing)

Methods used to estimate emissions from each source category are explained in Section 2.2.1. For each source category, emissions for the base year were estimated. Emissions were then forecasted to future years, accounting for activity growth and for applicable sources emissions controls.

The methodologies described here are used consistently in each of the calculators; however the input data of each calculator was selected to best reflect the operational characteristics by area (RGFO, Western Colorado, and New Mexico) and well type (oil, gas, CBNG, shale gas and shale oil).

2.2.1 Emissions from Well pad Construction and Development

Emissions from well pad construction and development include those generated by equipment, vehicles and activities related to well pad construction, access roads construction, pipeline construction, wellbore drilling and well completions. Table 2-1 includes the emission sources identified for the well pad construction and development phase. Pollutant emissions are initially estimated on a per surrogate basis and later scaled with the projected surrogate estimate to obtain area-wide annual emissions from each source.

Table 2-1. Construction source categories and scaling surrogates.

Equipment Source Category	Emissions units per event	Scaling Surrogate
Well Pad, Access Road, and Pipeline Construction Equipment	tons/new pad	New pads per year
Well Pad, Access Road and Pipeline Construction Traffic	tons/new pad	New pads per year
Drilling Equipment and Completion Equipment	tons/spud	Spuds per year
Fracing Equipment	tons/spud	Spuds per year
Refracing Equipment	tons/well	Active wells per year
Drilling and Well Completion Traffic	tons/spud	Spuds per year
Rig Hauling and Rig Moving Traffic	tons/pad	New pads per year
Well Pad, Access Road and Pipeline Construction Wind Erosion	tons/new pad	New pads per year
Well Completion Venting	tons/spud	Spuds per year

2.2.1.1 Well Pad, Access Road, and Pipeline Construction Equipment

This category refers to emissions associated with off-road engines used during construction of well pads, access roads and pipelines and is also inclusive of well pad reclamation activity. Detailed data for each engine type such as horsepower rating, hours of operation, fuel type, engine technology and load factors were derived from the literature. The EPA MOVES2014a model (USEPA, 2015) was used to compile emission factors for each equipment type. The N_2O emissions factor was obtained from the 2009 API O&G GHG Methodologies Compendium,

Tables 4-13 and 4-17 (API, 2009). Engines were classified in three types as activity data and emissions factors vary by utility: well pad construction equipment, access road construction equipment and pipeline construction equipment.

Emissions on a per event (new well pads) basis for an engine type for which data was provided were estimated according to Equation 1:

$$E_{engine\ k,i} = \frac{EF_i \times HP \times LF \times t_{event} \times n}{907{,}185} \qquad \text{Equation (1)}$$

where:

E_{engine} are emissions of pollutant *i* from an engine type k [ton/pad]
EF_i is the emissions factor of pollutant *i* [g/hp-hr]
HP is the horsepower of the engine k [hp]
LF is the load factor of the engine k
t_{event} is the number of hours the engine is used [hr/pad]
907,185 is the mass unit conversion [g/ton]
n is the number of type-k engines

2.2.1.1.1 Area-Wide Annual Emissions from Source Category

Annual emissions from well pad construction equipment by pollutant were estimated from the sum of engine emissions from each of the construction engine types ($E_{engineTOTAL,i} = \sum E_{engine\ k,i}$) according to Equation 2:

$$E_{well\ pad\ equip,\ i} = E_{engineTOTAL,i} \times S_{well\ pad} \qquad \text{Equation (2)}$$

where:

$E_{well\ pad\ equip}$ are annual emissions of pollutant i from well pad construction and development equipment [ton/yr]
$E_{engineTOTAL,i}$ is sum of all engine emissions per event [ton/pad]
$S_{well\ pad}$ is the scaling surrogate for well pad construction [new pads/yr]

2.2.1.2 Well Pad, Access Road and Pipeline Construction Traffic

This category refers to the exhaust emissions from light-duty and heavy-duty vehicle traffic during well pad, access road and pipeline construction. Emission factors were developed using the MOVES2014a model (USEPA, 2015). For each field office, by project year, representative county emissions factors were developed. The emission factors were prepared for two vehicle classes, heavy duty trucks (source type combination short-haul truck) and pick-up trucks (source type light commercial truck). MOVES2014a emissions factors were modeled to include exhaust running, idle and start, brake wear, tire wear, and evaporative processes. The representative county for each field office and annual average per mile emission factors by county, year and vehicle type are summarized in Appendix J.

Emissions from two distinct fleet types were estimated in this source category dependent on the vehicle destination/use: (1) well pad and access road construction vehicles and (2) pipeline

construction vehicles. Annual vehicle miles traveled (VMT) to well site were available for each vehicle class (light duty and heavy duty) within each fleet type (well pad and access road, and pipeline construction), thus exhaust emissions for each of four vehicle groups were calculated using the MOVES2014a emission factors on a grams per mile basis, as shown in Equation 3.

$$E_{traffic,\ i} = \frac{EF_i \times N_{trips} \times D}{907185} \qquad \text{Equation (3)}$$

where:

$E_{traffic,\ i}$ is traffic exhaust emissions for pollutant i per well pad [ton/pad]
EF_i is the average emission factor of pollutant i [g/mile]
N_{trips} is the annual number of round trips per activity [trips/pad]
D is the round trip distance [miles/trip]
907185 is the mass conversion [g/ton]

2.2.1.2.1 Area-Wide Annual Emissions from Source Category

Annual emissions for well pad, pipeline and access road construction traffic by pollutant were propagated with the appropriate scaling surrogate according to Equation 4:

$$E_{well\ pad\ traffic,\ i} = E_{traffic,\ i} \times S_{well\ pad} \qquad \text{Equation (4)}$$

where:

$E_{well\ pad\ traffic,\ i}$ is the annual exhaust emissions of pollutant i from well pad, pipeline and access road construction traffic [ton/yr]
$E_{traffic,\ i}$ are the emissions of pollutant i per new well pad [ton/wellpad]
$S_{well\ pad}$ is the scaling surrogate for well pad and access road construction traffic [new pads/yr]

2.2.1.3 Drilling, Completion and Hydraulic Fracturing Equipment

This section refers to emissions associated with off-road engines used during drilling and completion activities. Detailed data for each engine type per source category such as horsepower rating, hours of operation, fuel type, engine technology and load factors was derived from the literature. Emissions for four distinct engine groups were estimated: (1) drilling equipment, (2) completion equipment, (3) fracing equipment, and (4) refracing equipment. Emissions were estimated separately by engine type as inputs and surrogates (see Table 2-1) varied by type; however the same methodology delineated by Equations 5 and 6 was used in all calculations.

For drilling, completion and hydraulic fracturing equipment, the EPA Tier 2 Federal Diesel Engine Standard emission rates were applied for NO_X, VOC, CO, PM_{10} and $PM_{2.5}$ emissions. The N_2O emissions factor was obtained from the 2009 API O&G GHG Methodologies Compendium, Tables 4-13 and 4-17 (API, 2009). Emissions on a per event (spuds or active wells) basis for an engine type were estimated according to Equation 5:

$$E_{engine\ k,i} = \frac{EF_i \times HP \times LF \times t_{event} \times n}{907{,}185} \qquad \text{Equation (5)}$$

where:

E_{engine} are exhaust emissions of pollutant *i* from an engine type k [ton/event]
EF_i is the emissions factor of pollutant *i* [g/hp-hr]
HP is the horsepower of the engine k [hp]
LF is the load factor of the engine k
t_{event} is the number of hours engine k is used [hr/event]
907,185 is the mass unit conversion [g/ton]
n is the number of type-k engines

2.2.1.3.1 Area-Wide Annual Emissions from Source Category

Annual equipment emissions by pollutant were estimated separately for each of the four engine groups and scaled with the appropriate scaling surrogate according to Equation 6:

$$E_{D\&C\ equipment,\ i} = E_{engineTOTAL,i} \times S_{event} \qquad \text{Equation (6)}$$

where:

$E_{D\&C\ equipment,i}$ is annual emissions of pollutant i from completion/drilling equipment [ton/yr]
$E_{engineTOTAL,i}$ is sum of all engine emissions per event [ton/event]
S_{event} is the scaling surrogate for completion/drilling operations [event/yr] according to Table 2-1.

2.2.1.4 Drilling and Well Completion Traffic

This section refers to on-road emissions from light-duty and heavy-duty vehicle traffic during drilling and completion operations. Methodology to estimate traffic emissions from these source categories was similar to that of source category *Well Pad, Access Road and Pipeline Construction Traffic.* However, emissions for *Drilling Traffic* and *Completion Traffic* were calculated separately since activity inputs and surrogates varied by source category. Input data to estimate the annual vehicle miles traveled (VMT) per activity was derived from the literature for each vehicle class (light duty and heavy duty) within each fleet. Fleets were defined by the vehicle destination or utility, which vary by the type of oil and gas development (conventional and CBNG versus shale). These are shown in Table 2-2 below. Annual average emission factors from EPA's MOVES2014a model as described in Section 2.2.1.2 were applied.

Table 2-2. Vehicle fleets used during drilling and completion.

Vehicle Use/Destination	Vehicle Class		Fleet group ID
	Type	Class	
Drilling Traffic	Semi Trucks	Heavy Duty Truck	1
	Pickup Trucks	Light Duty Truck	2
Rig Move Drilling Traffic	Semi Trucks	Heavy Duty Truck	3
Rig Hauling	Semi Trucks	Heavy Duty Truck	4
Well Completion & Testing	Semi Trucks	Heavy Duty Truck	5
	Pickup Trucks	Light Duty Truck	6

Exhaust emissions for each of the fleet groups were calculated using the appropriate MOVES2014a emission factors on a grams per mile basis, as shown in Equation 7:

$$E_{traffic,\ i} = \frac{EF_i \times N_{trips} \times D}{907185} \qquad \text{Equation (7)}$$

where:

$E_{traffic,\ i}$ is the traffic emissions for pollutant i per spud [tons/spud]
EF_i is the average emission factor of pollutant i [g/mile]
N_{trips} is the annual number of round trips per activity [trips/spud]
D is the round trip distance [miles/trip]
907185 is the mass unit conversion [g/ton]

Given that emissions from the vehicle fleets are based on the same surrogate (spuds), total emissions from drilling and completion traffic will be the sum of emissions per spud from each fleet (calculated with Equation 7), as shown in Equation 8:

$$E_{traffic,D\&C,\ i} = \sum_{fleet=1}^{7} \left(E_{traffic,\ i}\right)_{fleet} \qquad \text{Equation (8)}$$

where

$E_{traffic,D\&C,\ i}$ is the total drilling and completions emissions of pollutant i per spud [ton/spud]
$E_{traffic,\ i}$ is the traffic emissions for pollutant i per spud for a vehicle fleet [tons/spud]

2.2.1.4.1 Area-Wide Annual Emissions from Source Category

Annual emissions for drilling/completion traffic by pollutant were propagated with the appropriate scaling surrogate (spuds per year) according to Equation 9:

$$E_{traffic,\ i} = E_{traffic,D\&C,\ i} \times S_{spud} \qquad \text{Equation (9)}$$

where:

$E_{category\ traffic,\ i}$ are annual emissions of pollutant i from drilling/completion traffic [ton/yr]
$E_{traffic,D\&C,\ i}$ is the total drilling and completions emissions of pollutant i per spud [ton/spud]
S_{spud} is the scaling surrogate for drilling/completion traffic [spuds/yr]

2.2.1.5 Construction Equipment Fugitive Dust

Fugitive dust emissions from disturbed land by well pad construction and reclamation equipment were estimated based on AP-42 Chapter 13 Section 13.2.3 guidance for estimating emissions from Heavy Construction Operations (USEPA, 1995a). A construction fugitive dust emission factor for total suspended particles (TSP) is available in the AP-42 guidance (1.2 tons-TSP/acre/month of activity).

Total suspended particle emissions from wellpad construction equipment on a per wellpad basis are estimated based on Equation 10:

$$E_{equip.dust,TSP} = EF \times A \times t \times \frac{(1-C)}{30} \quad \text{Equation (10)}$$

where:

$E_{equip,dust,TSP}$ is the TSP emissions from construction equipment fugitive dust [tons/wellpad]
A is the average number of acres disturbed per wellpad [acres/wellpad]
t is the number of construction days per wellpad [days]
C is the control efficiency
30 is the conversion factor for days/month

Conversion factors for TSP to particulate matter PM_{10} (EPA, 2006b) and from PM_{10} to $PM_{2.5}$ (Midwest Research Institute, 2006) were used to estimate other fugitive dust pollutant emissions (PM_{10} and $PM_{2.5}$). A control efficiency of 50% was assumed for well pad construction watering control.

2.2.1.5.1 Area-Wide Annual Emissions from Source Category

Annual emissions for construction equipment fugitive dust, by pollutant i, were propagated with the appropriate scaling surrogate (wellpads per year) according to Equation 11:

$$E_{equip,dust,i_{TOTAL}} = E_{equip.dust,i} \times S_{new\ pads} \quad \text{Equation (11)}$$

where:

$E_{equip,dust,i_{TOTAL}}$ is the annual dust emissions of pollutant i from construction equipment [ton/yr]
$E_{equip.dust,i}$ is the fugitive dust emissions of pollutant i from construction equipment per pad [tons/wellpad]
$S_{new\ pads}$ is the scaling surrogate for construction equipment fugitive dust [new pads/yr]

2.2.1.6 Fugitive Dust Emissions from Construction, Drilling and Completion Support Vehicles

Fugitive dust emissions from vehicle travel on unpaved roads were estimated based on the AP-42 technical guidance in Section 13.2.2.1 Unpaved Roads (USEPA, 2006a). Road dust emission factors for vehicles traveling on unpaved surfaces at industrial sites can be estimated with Equation 12.

$$EF_i = k\left(\frac{s}{12}\right)^a \left(\frac{W}{3}\right)^b \quad \text{Equation (12)}$$

where:

EF is the size-specific particulate emissions factor for pollutant i (lb/mile)
s is the surface material silt content (%)
W is the mean vehicle weight (tons)
k, a, b are empirical constants according to Table 2-3.

Table 2-3. Empirical constants by pollutant to estimate road dust emissions factor.

Parameter	PM_{10}	$PM_{2.5}$
k	1.5	0.15
a	0.9	0.9
b	0.45	0.45

Because the emissions factor is a function of vehicle weight, individual emissions factor for heavy duty vehicles and light duty vehicles were derived with Equation 12. To account for natural mitigation of road dust emissions due to annual precipitation and from watering control, Equation 13 was applied:

$$EF_{mitigated} = EF_i \times \frac{365-P}{365} \times \frac{100-CE}{100} \qquad \text{Equation (13)}$$

where:

$EF_{mitigated}$ is the annual average emission factor for uncontrolled conditions including natural mitigation [lb/mile]
EF_i is the size-specific emission factor [lb/mile]
P is number of precipitation days (>0.01" rainfall) at the site
CE is the control efficiency for watering in unpaved roads; CE =50%

Emissions were estimated for all types of vehicles involved in construction, drilling and completion activities. The vehicle groups were classified according to their vehicle class and utility, and literature data was collected to estimate annual vehicle miles traveled per activity (or event), which varied by vehicle groups and by the type of oil and gas development (conventional oil, conventional gas, CBNG, and shale). The vehicle fleets used in each type of development are shown in Table 2-4.

Table 2-4. Vehicles groups related to fugitive road dust emissions in well construction and development.

Vehicle group ID	Utility/destination	Vehicle Class	Event (surrogate)
1	Well Pad Access Road Construction	Heavy Duty Truck	New pads
2		Light Duty Truck	
3	Pipeline Construction	Heavy Duty Truck	
4		Light Duty Truck	
5	Drilling Traffic	Heavy Duty Truck	Spuds
6		Light Duty Truck	
7	Rig Move Drilling Traffic	Heavy Duty Truck	New pads
8		Light Duty Truck	
9	Rig Hauling	Heavy Duty Truck	
10	Well Completion & Testing	Heavy Duty Truck	Spuds
11		Light Duty Truck	
12	Fuel Haul Truck	Heavy Duty Truck	Spuds

Fugitive dust road emissions were calculated using the mitigated emissions factor ($EF_{mitigated}$) from Equation 13, along with the vehicle miles traveled for each vehicle group as shown in Equation 14.

$$E_{traffic,\ i} = \frac{EF_{mitigated} \times N_{trips} \times D}{2000} \qquad \text{Equation (14)}$$

where:

$E_{traffic,\ i}$ is the traffic fugitive dust emissions for pollutant i per event [ton/event]

$EF_{mitigated}$ is the average emission factor of pollutant i for fugitive dust emissions [lb/mile]

N_{trips} is the annual number of round trips per activity [trips/event]
D is the round trip distance [miles/trip]
2000 is the mass conversion [lb/ton]

2.2.1.6.1 Area-Wide Annual Emissions from Source Category

Annual emissions for road fugitive dust from construction/drilling/completion traffic were propagated with the appropriate scaling surrogate according to Equation 15:

$$E_{dust,traffic,\ i} = E_{traffic,\ i} \times S_{event} \qquad \text{Equation (15)}$$

where:

$E_{dust,traffic,\ i}$ are annual emissions of pollutant i for road fugitive dust from construction/drilling/completion traffic [ton/yr]
$E_{traffic,\ i}$ are the emissions of pollutant i per event (spuds or new pads) [ton/event]
S_{event} is the scaling surrogate for the vehicle group [event/yr]

2.2.1.7 Construction Wind Erosion

Wind erosion dust emissions associated with well pad construction, and road, pipeline construction operations, and well pad reclamation activity were estimated based on AP-42 guidance for the estimation of emissions from industrial wind erosion (USEPA, 2006b). Wind erosion emissions per well pad were estimated based on Equation 16:

$$E_{dust,i} = \frac{P \times A \times r}{907{,}185} \qquad \text{Equation (16)}$$

where:

$E_{dust,\ i}$ are dust emissions for pollutant i from construction wind erosion [ton/pad]
P is the erosion potential [g/m^2]
A is the well pad construction area [m^2/pad]
r is the particle size multiplier for PM_{10} or $PM_{2.5}$
907,185 is a mass unit conversion [g/ton]

The erosions potential is a function of the wind friction velocity, as shown in equation 17 and 18:

$$P = 58 \times (u* - u_t)^2 + 25(u* - u_t) \quad \text{Equation (17)}$$

where:

$u*$ is the friction velocity (m/s)

u_t is the threshold friction velocity (m/s)

$$P = 0 \qquad for \qquad (u* \le u_t) \quad \text{Equation (18)}$$

Friction velocity estimates (u*) were made by multiplying the average annual fastest wind speed by 0.053 per AP-42 guidance (USEPA, 2006b). Particle size multipliers of 0.5 and 0.075 were assumed for PM_{10} and $PM_{2.5}$ respectively per AP-42 guidance.

2.2.1.7.1 Area-Wide Annual Emissions from Source Category

The annual construction dust wind erosion emissions were scaled by multiplying per well pad emissions by the scaling surrogate (new pads) according to Equation 19:

$$E_{wind\ erosion\ total,\ i} = E_{dust,\ i} \times S_{well\ pad} \quad \text{Equation (19)}$$

where:

$E_{dust\ erosion\ total,i}$ are the annual emissions of pollutant *i* from construction dust wind erosion [ton/yr]

$E_{dust,\ i}$ are the dust emissions of pollutant i per well pad [ton/pad]

$S_{well\ pad}$ is the scaling surrogate for construction dust wind erosion [pad/yr]

2.2.1.8 Well Completion Venting

This section describes emissions from well completion venting. The calculation methodology for estimating venting emissions from a single completion event is shown below in Equation 20:

$$E_{completion,i} = \left[\frac{P \times Q_{completion}}{\frac{R}{MW_{gas}} \times T \times 3.5 \times 10^{-5}}\right] \times \frac{f_i}{907185} \times (1 - 0.95F_{flare} - F_{green}) \quad \text{Equation (20)}$$

where:

$E_{completion,i}$ is the uncontrolled emissions of pollutant *i* from a single completion event [ton/event]

P is atmospheric pressure [1 atm]

$Q_{completion}$ is the volume of gas generated per completion [MCF/event]

R is the universal gas constant [0.082 L-atm/mol-K]

MW_{gas} is the molecular weight of the gas [g/mol]

T is the atmospheric temperature [298 K]

f_i is the mass fraction of pollutant *i* in the completion venting gas

F_{green} is the fraction of completions that were controlled by green completion techniques

F_{flare} is the fraction of completions controlled by flare
0.95 is the control efficiency of the flare

2.2.1.8.1 Extrapolation to Area-Wide Annual Emissions

Annual emissions are obtained by scaling-up emissions per event by the number of spuds for a particular year. The total emissions from completion venting are estimated following Equation 21:

$$E_{completion,TOTAL,i} = E_{completion,i} \times S_{spuds} \quad \text{Equation (21)}$$

where:

$E_{completion,TOTAL}$ are the annual emissions for pollutant i from completion venting [tons/year]
$E_{completion,i}$ are the completion emissions from a single completion event [tons/event], event=spuds
S_{spuds} is the scaling surrogate for completion venting in a particular year [spuds/year]

2.2.1.9 Well Completion Flaring

This section describes the methodology for estimating flaring emissions from completion venting as described in Equation 22. It was assumed the efficiency of the flare was 95 percent.

$$E_{flare,completion} = \left(\frac{EF_i \times Q_{completion} \times F_{flared} \times HV}{1000} \right) \Big/ 2000 \quad \text{Equation (22)}$$

where:

$E_{flare,completion}$ is the area-wide flaring emissions of pollutant i for well completions [ton/event]
EF_i is the flaring emissions factor for pollutant *i* [lb/MMBtu]
$Q_{completion}$ is the volume of gas generated per completion [MCF/event]
HV is the local heating value of the gas [BTU/SCF]
F_{flared} is the fraction of well completions with flares

2.2.1.9.1 Extrapolation to Area-Wide Annual Emissions

Annual area-wide flaring emissions for well completions are scaled-up using the total number of spuds per year as shown in Equation 23:

$$E_{heater,TOTAL,i} = E_{heater,i} \times S_{TOTAL} \quad \text{Equation (23)}$$

where:

$E_{heater,TOTAL}$ is the annual emissions from well completion flaring for pollutant i [[ton/yr]
E_{heater} is the emissions from well completion flaring for pollutant i per event [ton/event]
S_{TOTAL} is the total number of spuds for a particular year [spuds]. The number of well completions is assumed equal to the spuds count for the year.

2.2.2 Emissions from the Production Phase

Emissions from the Production phase include those generated by equipment, vehicles and activities related to oil and gas production at well sites after a well has been completed. Pollutant emissions are initially estimated on a per event basis and later scaled with the projected number of events per year (scaling surrogate) to obtain Area-wide annual emissions from each source.

2.2.2.1 Well Workovers Equipment

This category refers to emissions associated with off-road engines used during well workovers. Detailed data for a typical workover engine such as horsepower rating, hours of operation, fuel type, engine technology and load factor was derived from the literature. EPA off-road diesel engine emission standards are the basis of workover engine emission rates. The N_2O emissions factor was obtained from the 2009 API O&G GHG Methodologies Compendium, Tables 4-13 and 4-17 (API, 2009).

Emissions on a per well basis for a workover engine were estimated according to Equation 24:

$$E_{engine,\ i} = f \times \frac{EF_i \times HP \times LF \times t \times n}{907{,}185} \qquad \text{Equation (24)}$$

where:

E_{engine} are emissions of pollutant *i* from a workover engine [ton/well]
EF_i is the emissions factor of pollutant *i* [g/hp-hr]
HP is the horsepower of the engine [hp]
LF is the load factor of the engine
t is the number of hours of use per day [hr/day]
907,185 is the mass unit conversion [g/ton]
n is the number of operating days per well [days/well]
f is the well workover frequency per year

2.2.2.1.1 Area-Wide Annual Emissions from Source Category

Annual emissions from well workover equipment by pollutant were estimated according to Equation 25:

$$E_{WO-equip,\ i} = E_{engine\ i} \times S_{wells} \qquad \text{Equation (25)}$$

where:

$E_{WO\text{- }equip,\ i}$ are annual emissions of pollutant i from workover equipment [ton/yr]
$E_{engine,\ i}$ is emissions of pollutant i from workover equipment per well [ton/well]
$S_{well\ pad}$ is the scaling surrogate for workovers [active wells/yr]

2.2.2.2 Production Traffic (Well workovers, Road Maintenance, Well Pad Reclamation and Production)

This section describes the estimation of exhaust emissions from light-duty and heavy-duty vehicle traffic used for Well Workovers, Maintenance, Well Pad Reclamation and Production. This excludes traffic from tank loading and compressor stations maintenance. Vehicle classes within the four source categories are shown in Table 2-5. Emissions from these vehicle fleets were first estimated on a per well basis and later on scaled to annual Area-wide emissions with the scaling surrogate, active wells per year.

Table 2-5. Vehicle fleets comprising production traffic.

Vehicle fleets ID	Utility (source category)	Vehicle Class	Event (surrogate)
1	Well Workover Commuting Vehicles	Light Duty Truck	Active Wells
2		Heavy Duty Truck	
3	Road Maintenance	Light Duty Truck	
4	Road and Well Pad Reclamation	Light Duty Truck	

Emission factors were developed using the MOVES2014a model as described in Section 2.2.1.2 above.

Exhaust emissions for the five vehicle groups were estimated as shown in Equation 26.

$$E_{fleet,traffic,\ i} = \frac{EF_i \times N_{trips} \times D}{907185} \qquad \text{Equation (26)}$$

where:

$E_{fleet,traffic,\ i}$ is the fleet's traffic emissions for pollutant i per well [tons/well]
EF_i is the average emission factor of pollutant i [g/mile]
N_{trips} is the annual number of round trips per activity [trips/well]
D is the round trip distance [miles/trip]
907185 is the mass unit conversion [g/ton]

2.2.2.2.1 Area-Wide Annual Emissions from Source Category

Annual emissions for each category (fleet) of production traffic were propagated with the appropriate scaling surrogate (active wells per year) according to Equation 27:

$$E_{fleet,TOTAL,i} = E_{fleet,traffic,,\ i} \times S_{wells} \qquad \text{Equation (27)}$$

where:

$E_{fleet,TOTAL,\ i}$ are annual emissions of pollutant i from a production fleet [ton/yr]
$E_{fleet,traffic,\ i}$ is the emissions of pollutant i per well for a production traffic fleet [ton/well]
S_{wells} is the scaling surrogate for the source category [active wells/yr]

2.2.2.3 Fugitive Dust Emissions from Production Traffic (Well Workovers, Road Maintenance, Well Pad Reclamation and Other Production)

Fugitive dust emissions from vehicle travel on unpaved roads were estimated based on the AP-42 technical guidance Section 13.2.2.1 Unpaved Roads (EPA, 2006a). Road dust emission factors for vehicles traveling on unpaved surfaces at industrial sites can be estimated with Equation 28.

$$EF_i = k\left(\frac{s}{12}\right)^a\left(\frac{W}{3}\right)^b \qquad \text{Equation (28)}$$

Where:

EF is the size-specific particulate emissions factor for pollutant i (lb/mile)
s is the surface material silt content (%)
W is the mean vehicle weight (tons)
k, a, b are empirical constants according to Table 2-6.

Table 2-6. Empirical constants by pollutant to estimate road dust emissions factor.

Parameter	PM_{10}	$PM_{2.5}$
k	1.5	0.15
a	0.9	0.9
b	0.45	0.45

Because the emissions factor is a function of vehicle weight, individual emissions factor for heavy duty vehicles and light duty vehicles were calculated with Equation 28. To account for natural mitigation of road dust emissions due to annual precipitation and from watering control, Equation 29 was applied:

$$EF_{mitigated} = EF_i \times \frac{365-P}{365} \times \frac{100-CE}{100} \qquad \text{Equation (29)}$$

Where:

$EF_{mitigated}$ is the annual average emission factor for uncontrolled conditions including natural mitigation [lb/mile]
EF_i is the size-specific emission factor [lb/mile]
P is number of precipitation days (>0.01" rainfall) at the site
CE is the control efficiency for watering in unpaved roads

Vehicle fleets comprising production traffic are shown in Table 2-5. Fugitive dust emissions from these vehicle fleets were first estimated on a per well basis and later scaled to annual Area-wide emissions with the scaling surrogate, active wells per year.

Fugitive dust road emissions per well were calculated using the mitigated emissions factor ($EF_{mitigated}$) from Equation 29, along with the vehicle miles traveled for each vehicle group. This is shown in Equation 30

$$E_{fleet,traffic,\ i} = \frac{EF_{mitigated} \times N_{trips} \times D}{2000}$$ Equation (30)

where:

$E_{fleet,traffic,\ i}$ is the traffic fugitive dust emissions for pollutant i per well [ton/well]
$EF_{mitigated}$ is the average emission factor of pollutant i for fugitive dust emissions [lb/mile]
N_{trips} is the annual number of round trips per activity [trips/well]
D is the round trip distance [miles/trip]
2000 is the mass conversion [lb/ton]

2.2.2.3.1 Area-Wide Annual Emissions from Source Category

Annual fugitive dust emissions for each category (fleet) of Production Traffic were propagated with the appropriate scaling surrogate (active wells per year) according to Equation 31:

$$E_{fleet,TOTAL,i} = E_{fleet,traffic,,\ i} \times S_{wells}$$ Equation (31)

where:

$E_{fleet,TOTAL,\ i}$ are annual fugitive dust emissions of pollutant i from a production fleet [ton/yr]
$E_{fleet,traffic,\ i}$ is the fugitive dust emissions of pollutant i per well for a production traffic fleet [ton/well]
S_{wells} is the scaling surrogate for the source category [active wells/yr]

2.2.2.4 Blowdown venting

This section refers to the estimation of emissions from venting during well blowdowns. The calculation methodology for estimating emissions from a single blowdown event is shown below in Equation 32:

$$E_{blowdown,i} = \left(\frac{P \times (V_{vented})}{\left(R / MW_{gas} \right) \times T \times 3.5 \times 10^{-5}} \right) \times \frac{f_i}{907185}$$ Equation (32)

where:

$E_{blowdown,i}$ is the emissions of pollutant *i* from a single blowdown event [ton/event]
P is atmospheric pressure [1 atm]
V_{vented} is the volume of vented gas per blowdown (uncontrolled) [MCF/event]
R is the universal gas constant [0.082 L-atm/mol-K]
MW_{gas} is the molecular weight of the gas [g/mol]
T is the atmospheric temperature [298 K]
f_i is the mass fraction of pollutant *i* in the vented gas

2.2.2.4.1 Area-Wide Annual Emissions from Source Category

The total emissions from all annual blowdowns events occurring are estimated with Equation 33:

$$E_{blowdown,TOTAL} = E_{blowdown,i} \times N_{blowdown} \times S_{wells} \quad \text{Equation (33)}$$

where:

$E_{blowdown,TOTAL}$ are the total annual emissions from blowdowns [tons/yr]
$E_{blowdown,i}$ are the blowdown emissions from a single blowdown event [tons/event]
$N_{blowdown}$ is the frequency of blowdowns per well per year [events/yr-well]
S_{wells} is the total number of active wells for a particular year [wells]

2.2.2.5 Well Recompletion Venting

This section describes emissions from well recompletion venting. The calculation methodology for estimating venting emissions from a single recompletion event is shown below in Equation 34:

$$E_{recompletion,i} = \left[\frac{P \times Q_{recompletion}}{\frac{R}{MW_{gas}} \times T \times 3.5 \times 10^{-5}}\right] \times \frac{f_i}{907185} \quad \text{Equation (34)}$$

where:

$E_{recompletion,i}$ is the uncontrolled emissions of pollutant *i* from a single recompletion event [ton/event]
P is atmospheric pressure [1 atm]
$Q_{recompletion}$ is the volume of gas generated per recompletion [MCF/event]
R is the universal gas constant [0.082 L-atm/mol-K]
MW_{gas} is the molecular weight of the gas [g/mol]
T is the atmospheric temperature [298 K]
f_i is the mass fraction of pollutant *i* in the recompletion venting gas

2.2.2.5.1 Extrapolation to Annual Area-Wide Emissions

Annual emissions are obtained by scaling-up emissions per event with the total number of recompletion events in a particular year. The total emissions from recompletion venting are estimated following Equation 35:

$$E_{recompletion,TOTAL,i} = E_{recompletion,i} \times f \times S_{well\ count} \quad \text{Equation (35)}$$

where:

$E_{completion,TOTAL}$ are the annual emissions for pollutant i from recompletion venting [tons/year]
$E_{completion,i}$ are the venting emissions from a single recompletion event [tons/event]
f is the frequency of recompletion events per well per year [events/yr-well]

$S_{well\ count}$ is the scaling surrogate for recompletion venting in a particular year [active wells]

2.2.2.6 Wellhead Fugitives

This source category refers to fugitive emissions or *leaks* from well equipment such as pump seals, valves, connectors, flanges, etc. Fugitive emissions were estimated for three main streams identified: gas service stream, liquids service stream and high oil stream. VOC, CO_2 and CH_4 emissions per stream were estimated using device-specific TOC emission factors for oil and gas production (USEPA, 1995b) and equipment counts. Because Colorado has a state-wide Leak Detection and Repair (LDAR) program that operators are required to implement by 2015, TOC emission factors for < 10,000 ppm from Table 2-8 of the EPA reference were used (USEPA, 1995b). Input data was obtained from the literature, or average field data for the RGFO, on total device counts per well by type of equipment and by the type of service to which the equipment applies – gas, liquids and high oil.

Fugitive VOC emissions for an individual device in a given stream (gas, liquids, and high oil) were estimated according to Equation 36:

$$E_{fugitiveVOC,k} = EF_{TOC} \times N \times t_{annual} \times Y \qquad \text{Equation (36)}$$

where:

$E_{fugitive\ VOC,\ k}$ is the fugitive VOC emissions for a given device k [ton/yr-well]
EF_{TOC} is the emission factor of TOC [kg/hr/device]
N is the total number of devices type-k for a given stream per well [devices/well]
Y is the ratio of VOC to TOC in the vented gas

Total VOC fugitive emissions for a given stream are equal to the sum of all fugitive emissions from devices in that stream per Equation 37:

$$E_{fugitiveVOC,stream} = \sum E_{fugitiveVOC,\ k} \qquad \text{Equation (37)}$$

where:

$E_{fugitive\ VOC,stream}$ is the total fugitive VOC emissions in a given stream per well [ton/yr-well]

CO_2 and CH_4 fugitive emissions per stream were estimated according to Equations 38 and 39:

$$E_{fugitiveCH4,stream} = E_{fugitiveVOC,stream} \times \frac{weight\ fraction_{CH4}}{weight\ fraction_{VOC}} \qquad \text{Equation (38)}$$

$$E_{fugitiveCO2,stream} = E_{fugitiveVOC,stream} \times \frac{weight\ fraction_{CO2}}{weight\ fraction_{VOC}} \qquad \text{Equation (39)}$$

where:

$E_{fugitive\ CO2,stream}$ is the total fugitive CO_2 emissions in a given stream per well [ton/yr-well]
$E_{fugitive\ CH4,stream}$ is the total fugitive CH_4 emissions in a given stream per well [ton/yr-well]

Weight fractions per pollutant were based on gas compositions. For gas and well streams, sales gas composition was used. For condensate stream, fugitive-post flash compositions were used.

2.2.2.6.1 Area-Wide Annual Emissions from Source Category

Fugitive emissions were propagated annually according to Equation 40 using the scaling surrogate, active well counts:

$$E_{fugitive,\ i} = E_{fugitive\ i,stream} \times S_{well\ count} \qquad \text{Equation (40)}$$

where:

$E_{fugitive,\ i}$ are the annual fugitive emissions for pollutant i in a given stream [ton/yr]
$E_{fugitive\ I,\ stream}$ are fugitive emissions of pollutant i in a stream per well [ton/yr-well]
$S_{well\ count}$ is the number of active wells for a particular year [active wells]

2.2.2.7 Pneumatic Devices

Emissions for pneumatic devices will vary by the bleed rate of the device. The methodology for estimating the emissions from a mix of pneumatic devices i (liquid level controllers, pressure controllers, etc.) for a single typical well is shown in Equation 41:

$$E_{pneumatic\,j} = \frac{f_j}{907185}\left(\sum_i \dot{V}_i \times N_i \times t_{annual}\right) \times \frac{P}{\left(\left(R/MW_{gas}\right) \times T \times 3.5 \times 10^{-5}\right)} \qquad \text{Equation (41)}$$

where:

$E_{pneumatic,j}$ is the total emissions of pollutant *j* from all pneumatic devices for a typical well [ton/year/well]
$\dot{V}_i$ is the volumetric bleed rate from device *i* [MCF/hr/device]
N_i is the average number of devices *i* found in a well [devices/well]
t_{annual} is the number of hours per year that devices were operating [8760 hr/yr]
P is the atmospheric pressure [1 atm]
R is the universal gas constant [0.082 L-atm/mol-K]
MW_{gas} is the molecular weight of the gas [g/mol]
T is the atmospheric temperature [298 K]
f_j is the mass fraction of pollutant *j* in the vented gas

2.2.2.7.1 Extrapolation to Area-Wide Annual Emissions

Annual emissions from pneumatic devices were estimated according to Equation 42:

$$E_{pneumatic\,TOTAL,\,j} = E_{pneumatic\,j} \times N_{well} \qquad \text{Equation (42)}$$

where:

$E_{pneumatic,TOTAL,j}$ is the total annual emissions of pollutant *j* from pneumatic devices [ton/yr]
$E_{pneumatic,j}$ is the pneumatic device emissions of pollutant *j* for a single typical well [ton/yr/well]
N_{well} is the total number of active wells in the basin [wells]

2.2.2.8 Pneumatic Pumps

To estimate emissions from pneumatic pumps, literature data indicating the average rate of gas consumption per gallon of chemical injected and the annual chemical throughput for a single pump was applied. Emissions per well from pneumatic pumps were estimated as shown in Equation 43:

$$E_{pump,i} = \frac{N_{CIP} \times V_{vented,gas} \times t_{pump} \times MW_i \times R \times Y_i}{2000} \quad \text{Equation (43)}$$

where:

$E_{pump,\ i}$ is the pneumatic pump emissions for pollutant i per well [ton/yr-well]
$V_{vented,TOTAL}$ is the average gas venting rate per pump [SCF/pump/hr]
N_{CIP} is the number of gas-actuated pneumatic pumps per well [pump/well]
t_{pump} is the annual hours of operation of a pump [hrs/yr]
MW_i is the molecular weight of pollutant i [lb/lb-mol]
R is the universal gas constant [lb-mol/391.9scf]
Y_i is the molar fraction of pollutant i in pneumatic pump vented gas
2000 is the mass unit conversion [lb/ton]

2.2.2.8.1 Area-Wide Annual Emissions from Source Category

To estimate area-wide annual emissions from pneumatic pumps the scaling surrogate, active wells, was used according to Equation 44

$$E_{pneumaticpumps,\ i} = E_{pump,\ i} \times S_{well\ count} \quad \text{Equation (44)}$$

where:

$E_{pneumaticpumps,\ i}$ are the annual emissions for pollutant i from pneumatic pumps [ton/yr]
$E_{pump,\ i}$ is the emissions from all pneumatic pumps per well [ton/yr-well]
$S_{well\ count}$ is the number of active wells for a particular year [wells]

2.2.2.9 Water Injection Pumps

This category refers to exhaust emissions associated with diesel combustion in water injection pump engines. Detailed data for each engine type such as horsepower rating, hours of operation, fuel type, engine technology and load factors was derived from the literature. The EPA MOVES2014a model (USEPA, 2015) was used to compile emission factors. The N_2O emissions factor was obtained from the 2009 API O&G GHG Methodologies Compendium, Tables 4-13 and 4-17 (API, 2009).

Emissions on a per well basis for a water injection pump were estimated according to Equation 45:

$$E_{engine,i} = \frac{EF_i \times HP \times LF \times t_{event} \times n}{907{,}185} \quad \text{Equation (45)}$$

where:

E_{engine} are per-well emissions of pollutant *i* from water injection pumps [ton/well]
EF_i is the emissions factor of pollutant *i* [g/hp-hr]
HP is the horsepower of the pump [hp]
LF is the load factor of the pump
t_{event} is the number of hours the engine is used annually [hrs/unit]
907,185 is the mass unit conversion [g/ton]
n is the number of water injection pumps per well [units/well]

2.2.2.9.1 Area-Wide Annual Emissions from Source Category

Annual emissions from water injection pumps for pollutant i were estimated according to Equation 46:

$$E_{water\ pumps,\ i} = E_{engine,\ i} \times S_{well} \quad \text{Equation (46)}$$

where:

$E_{well\ pad\ equip}$ are annual emissions of pollutant i from water injection pumps [ton/yr]
$E_{engine,\ i}$ is engine emissions per well [ton/well]
S_{well} is the scaling surrogate for water injection pumps [active wells/yr]

2.2.2.10 Miscellaneous Engines

This category refers to exhaust emissions associated with miscellaneous engines at well sites. Detailed data for miscellaneous engines such as horsepower rating, hours of operation, fuel type, engine technology and load factors was derived from the literature. The EPA MOVES2014a model (USEPA, 2015) was used to compile emission factors. The N_2O emissions factor was obtained from the 2009 API O&G GHG Methodologies Compendium, Tables 4-13 and 4-17 (API, 2009). For the RGFO conventional oil and gas well planning area calculators, the miscellaneous engines were diesel engines that were assumed to meet EPA Tier 2 emission standards.

Emissions on a per well basis for miscellaneous engines were estimated according to Equation 47:

$$E_{engine,i} = \frac{EF_i \times HP \times LF \times t_{event} \times n}{907{,}185} \times f \quad \text{Equation (47)}$$

where:

E_{engine} are per-well emissions of pollutant *i* from miscellaneous engines [ton/well]
EF_i is the emissions factor of pollutant *i* [g/hp-hr]

HP is the horsepower of the pump [hp]
LF is the load factor of the pump
t_{event} is the number of hours the engine is used [hrs/unit]
f is the fraction of wells served by a miscellaneous engine
907,185 is the mass unit conversion [g/ton]
n is the number of engines per well [units/well]

2.2.2.10.1 Area-Wide Annual Emissions from Source Category

Annual emissions from miscellaneous engines for pollutant i were estimated according to Equation 48:

$$E_{water\ pumps,\ i} = E_{engine,\ i} \times S_{well} \qquad \text{Equation (48)}$$

where:

$E_{well\ pad\ equip}$ are annual emissions of pollutant i from miscellaneous engines [ton/yr]
$E_{engine,\ i}$ is engine emissions per well [ton/well]
S_{well} is the scaling surrogate for miscellaneous engines [active wells/yr]

2.2.2.11 Compressor Station Maintenance Traffic Exhaust

This section describes the estimation of exhaust emissions from light-duty vehicles (pickup trucks) used for compressor maintenance at compressor stations. Emission factors were developed using the MOVES2014a model (USEPA, 2015) as described in Section 2.2.1.2. The total vehicle miles travelled annually from maintenance visits to a single compressor station were obtained from the literature, or from mapping average distances.

Exhaust emissions for this fleet were estimated as shown in Equation 49.

$$E_{fleet,traffic,\ i} = \frac{EF_i \times VMT_{CS}}{907185} \qquad \text{Equation (49)}$$

where:

$E_{fleet,traffic,\ i}$ is the fleet's traffic emissions for pollutant i per well [tons/station]
EF_i is the average emission factor for light duty vehicles of pollutant i [g/mile]
VMT_{CS} is the annual miles travelled for maintenance compressor station [miles/station]
907185 is the mass unit conversion [g/ton]

2.2.2.11.1 Area-Wide Annual Emissions from Source Category

Annual emissions for the compressor maintenance fleet were propagated with the scaling surrogate "total count of active compressor stations" according to Equation 50:

$$E_{fleet,TOTAL,i} = E_{fleet,traffic,,\ i} \times S_{CS} \qquad \text{Equation (50)}$$

where:

$E_{fleet,TOTAL,\ i}$ are annual emissions of pollutant i from compressor station maintenance traffic [ton/yr]

$E_{fleet,traffic,\ i}$ is the emissions of pollutant i per station for the fleet [ton/station]
S_{CS} is the scaling surrogate for the source category [number of active compressor stations per year]

2.2.2.12 Fugitive Dust Emissions from Compressor Station Maintenance Traffic

Road dust emission factors for light duty vehicles traveling on unpaved surfaces to and from compressor stations were estimated with the same methodology as in Section 2.2.1.2.6 using Equations 28 and 29. Fugitive dust road emissions per station (visited) were calculated using the mitigated emissions factor ($EF_{mitigated}$) from Equation 29, along with the annual vehicle miles traveled per compressor station. This is shown in Equation 51.

$$E_{fleet,traffic,\ i} = \frac{EF_{mitigated} \times VMT}{2000} \qquad \text{Equation (51)}$$

where:

$E_{fleet,traffic,\ i}$ is the traffic fugitive dust emissions for pollutant i per station [ton/station]
$EF_{mitigated}$ is the average emission factor of pollutant i for fugitive dust emissions [lb/mile]
VMT is the annual miles travelled for maintenance compressor station [miles/station]
2000 is the mass conversion [lb/ton]

2.2.2.12.1 Area-Wide Annual Emissions from Source Category

Annual fugitive dust emissions for compressor station maintenance traffic were propagated with the "total number of compressor stations" according to Equation 52:

$$E_{fleet,TOTAL,i} = E_{fleet,traffic,,\ i} \times S_{CS} \qquad \text{Equation (52)}$$

where:

$E_{fleet,TOTAL,\ i}$ are annual fugitive dust emissions of pollutant i from compressor station maintenance traffic [ton/yr]
$E_{fleet,traffic,\ i}$ is the emissions of pollutant i per station for the fleet [ton/station]
S_{CS} is the scaling surrogate for the source category [number of active compressor stations per year]

2.2.2.13 Condensate Tanks Flashing

Condensate tank emissions were calculated differently for conventional oil and gas developments and for shale gas developments.

An uncontrolled VOC emissions factor applicable to Garfield, Mesa, Rio Blanco, and Moffat Counties (CDPHE, 2014) was used to estimate emissions for condensate tanks in conventional gas, shale gas and coalbed (natural gas) methane developments on a per barrel basis. The published emissions factor was 10 lbs VOC/bbl [0.005 tons/bbl]; for Western Colorado field office planning areas outside of those counties the emission factor of 11.3 lbs VOC/bbl [0.008

tons/bbl] can be used (CDPHE, 2014). For conventional oil developments, the emissions factor of 1.6 lbs VOC/bbl was used based on BLM (2013). For the RGFO conventional oil and gas well planning areas, an average uncontrolled emission factor of 6.565 lbs VOC/bbl [0.003 tons/bbl] was used to estimate emissions for condensate tanks (BLM, 2016a). For the RGFO conventional oil and gas well planning areas, emissions from produced water tanks were also included due to the amount of produced water being generated in these areas. An uncontrolled emission factor of 0.0865 lbs VOC/bbl was used to estimate emissions from produced water tanks (BLM, 2016a). For the RGFO CBM well planning area produced water tanks, the published uncontrolled emission factor of 0.262 lbs VOC/bbl was used (CDPHE, 2014). The VOC emissions factor was multiplied by the annual condensate production from each type of well to propagate VOC emissions to the Planning Area level for each year. For the produced water tanks, a ratio of condensate or oil to water prodution was used to propagate VOC emissions in the RGFO conventional oil and gas well planning areas, and in the RGFO CBM well planning area, the annual water production was used directly to calculate emissions from produced water tanks. Similar to the methodology for conventional oil and gas sources, CO_2 and CH_4 total emissions were then calculated using the weight fraction ratios from local flash gas composition analyses using Equations 53 and 54.

$$E_{tanks,CH4} = E_{tanks,VOC} \times \frac{weight\ fraction_{CH4}}{weight\ fraction_{VOC}} \quad \text{Equation (53)}$$

$$E_{tanks,CO2} = E_{tanks,VOC} \times \frac{weight\ fraction_{CO2}}{weight\ fraction_{VOC}} \quad \text{Equation (54)}$$

where:

$E_{tanks,VOC}$ is the total annual condensate tanks emissions from APENS database [tons/yr]
$E_{tanks,CO2}$ is the total condensate tank CO_2 emissions [tons/yr]
$E_{tanks,CH4}$ is the total condensate CH_4 emissions [tons/yr]
Weight fractions of each pollutant in flash gas

2.2.2.14 Loading Emissions from Condensate or Oil Tanks

This section describes emissions from truck loading of condensate or crude oil from tanks. The loading loss rate is estimated following Equation 55:

$$L = 12.46 \times \left(\frac{S \times V \times M}{T} \right) \quad \text{Equation (55)}$$

where:

L is the loading loss rate [lb/1000gal]
S is the saturation factor taken from AP-42 default values based on operating mode. The operating mode for loading assumed was submerged loading: dedicated normal service.
V is the true vapor pressure of the liquid loaded [psia]
M is the molecular weight of the vapor [lb/lb-mole]
T is the temperature of the bulk liquid [^{o}R], T=540 R

VOC tank loading emissions are then estimated by Equation 56:

$$E_{loading,\ VOC} = L\ \times Y_{voc} \times \frac{42}{2000} \qquad \text{Equation (56)}$$

where:

$E_{loading}$ are the VOC tank loading emissions [ton/bbl]
L is the loading loss rate [lb/1000gal]
Y_{VOC} is the weight fraction of VOC in the vapor in the liquid loaded
42 is a unit conversion [gal/bbl]
2000 is a unit conversion [lbs/ton]

CO_2 and CH_4 emissions are calculated based on Equations 57-58:

$$E_{loading,CH4} = E_{loading,VOC} \times \frac{weight\ fraction_{CH4}}{weight\ fraction_{VOC}} \qquad \text{Equation (57)}$$

$$E_{loading,CO2} = E_{loading,VOC} \times \frac{weight\ fraction_{CO2}}{weight\ fraction_{VOC}} \qquad \text{Equation (58)}$$

where:

$E_{loading,CO2}$ is the total loading CO_2 emissions per barrel of liquid [ton/bbl]
$E_{loadingCH4}$ is the total loading CH_4 emissions per barrel of liquid [ton/bbl]
Weight fractions of each pollutant in the vapor losses from the liquid loaded

For emissions from produced water loading in the RGFO planning areas, the condensate or oil emission factor for loading was scaled by a ratio of the produced water flashing emission factor to the condensate or oil flashing emission factor.

2.2.2.14.1 Area-Wide Annual Emissions from Source Category

Annual emissions per pollutant i from condensate loading were scaled by annual condensate production per Equation 59:

$$E_{tank\ loadout,\ i} = E_{loading,\ i} \times S_{bbl\ condensate} \qquad \text{Equation (59)}$$

where:

$E_{tank\ loadout,\ i}$ is the total condensate loading emissions for pollutant i from tank load-out [ton/yr]
$E_{loading,\ i}$ is the condensate loading emissions for pollutant i from per barrel [ton/bbl]
$S_{bbl\ condensate}$ is the total annual of barrels condensate [bbl/yr]

2.2.2.15 Condensate, Crude Oil and Produced Water Hauling Traffic Exhaust

This section describes the estimation of exhaust emissions from heavy-duty vehicles (haul trucks) used for produced condensate hauling from the well site. Emission factors were developed using the MOVES2014a model (EPA, 2015) as described in Section 2.2.1.2. The total round trip distance for each hauling trip was derived from the literature. A hauling volume of

per truck of 200 barrels of condensate or crude oil, hence the number of round trips per barrel was estimated (1/200).

Exhaust emissions for condensate and crude oil hauling fleet were estimated as shown in Equation 60a.

$$E_{fleet,traffic,\ i} = \frac{EF_i \times N_{trips} \times D}{907185} \quad \text{Equation (60a)}$$

where:

$E_{fleet,traffic,\ i}$ is the hauling traffic exhaust emissions for pollutant i per barrel [ton/bbl]
EF_i is the average emission factor of pollutant i for heavy duty vehicles [g/mile]
N_{trips} is the annual number of round trips per barrel [trips/bbl]. N=1/200
D is the round trip distance [miles/trip]
907185 is the mass conversion [g/ton]

2.2.2.15.1 Area-Wide Annual Emissions from Condensate or Crude Oil Hauling

Annual emissions for the condensate and crude oil hauling fleet were propagated with the annual condensate or crude oil production according to Equation 61a:

$$E_{fleet,TOTAL,i} = E_{fleet,traffic,,\ i} \times S_{bbl,condensate} \quad \text{Equation (61a)}$$

where:

$E_{fleet,TOTAL,\ i}$ are annual emissions of pollutant i from condensate hauling traffic [ton/yr]
$E_{fleet,traffic,\ i}$ is the emissions of pollutant i per barrel for the hauling fleet [ton/bbl]
$S_{bbl,condensate}$ is the scaling surrogate for the source category [barrels of condensate produced per year]

2.2.2.15.2 Produced water hauling exhaust emissions

Produced water refers to the water produced with the gas once the well has been completed and is under operation. This water is typically hauled from the well site storage tanks with water trucks or sent via pipeline to injection wells. It was assumed that produced water truck capacity is 130 bbl and that 50 percent of the water is hauled out. For the all planning areas in the RGFO, the calculated annual produced water rates per well based on the decline curves, rather than an average value, were used to the number of trips from produced water trucking. It was assumed that produced water truck capacity is 130 bbl and the amount of water hauled out was dependent on the specific RGFO planning area.

Exhaust emissions for produced water hauling fleet were estimated as shown in Equation 60b:

$$E_{fleet,traffic,\ i} = \frac{EF_i \times N_{trips} \times D}{907185} \quad \text{Equation (60b)}$$

where:

$E_{fleet,traffic,\ i}$ is the produced water hauling exhaust emissions for pollutant i per well [ton/well]
EF_i is the average emission factor of pollutant i for heavy duty vehicles [g/mile]
N_{trips} is the annual number of round trips per well [trips/well]
D is the round trip distance [miles/trip]
907185 is the mass conversion [g/ton]

2.2.2.15.2.1 Area-Wide Annual Emissions from Produced Water Hauling

Annual emissions for the produced water hauling fleet were propagated to the planning area according to Equation 61b:

$$E_{fleet,TOTAL,i} = E_{fleet,traffic,\ i} \times S_{active\ wells} \quad \text{Equation (61b)}$$

where:

$E_{fleet,TOTAL,\ i}$ are annual emissions of pollutant i from produced water hauling traffic [ton/yr]
$E_{fleet,traffic,\ i}$ is the emissions of pollutant i per well for the hauling fleet [ton/well]
$S_{active\ wells}$ is the scaling surrogate for the source category, active wells per year [wells/yr]

2.2.2.15.3 Fugitive Dust Emissions from Condensate and Produced Water Hauling Traffic

Road dust emission factors for heavy duty vehicles traveling on unpaved surfaces for condensate hauling and produced water hauling were estimated with the same methodology as in Section 2.2.1.2.6 using Equations 28 and 29. Because the number of trips for both of these activities is based on different surrogates as shown in Section 2.2.1.2.15, fugitive dust road emissions of each fleet were calculated using the mitigated emissions factor ($EF_{mitigated}$) from Equation 29. This is shown in Equation 62.

$$E_{fleet,traffic,\ i} = \frac{EF_{mitigated} \times D \times N_{trips}}{2000} \quad \text{Equation (62)}$$

where:

$E_{fleet,traffic,\ i}$ is the traffic fugitive dust emissions for pollutant i per (1) barrel of condensate [ton/bbl] for condensate hauling or (2) well [ton/well] for produced water hauling
$EF_{mitigated}$ is the average emission factor of pollutant i for fugitive dust emissions [lb/mile]
N_{trips} is the annual number of round trips per (1) barrel of condensate hauled [trips/bbl] for condensate hauling or (2) well [trips/well] for produced water hauling
D is the round trip distance per hauling trip [miles/trip]
2000 is the mass conversion [lb/ton]

2.2.2.15.3.1 Area-Wide Annual Emissions from Condensate and Produced Water Hauling Traffic

Annual fugitive dust emissions for condensate hauling were propagated with the annual condensate production according to Equation 63:

$$E_{fleet,TOTAL,i} = E_{fleet,traffic,\ i} \times S_{bbl,condensate\ or\ active\ wells} \quad \text{Equation (63)}$$

where:

$E_{fleet,TOTAL,\ i}$ are annual fugitive dust emissions of pollutant i from condensate hauling traffic [ton/yr]

$E_{fleet,traffic,\ \ i}$ is the dust emissions of pollutant i per barrel for the hauling fleet [ton/surrogate]

$S_{bbl,condensate\ or\ active\ wells}$ is the scaling surrogate for the source category

2.2.2.16 Heaters

This section describes the methodology for estimating emissions from heaters and reboilers. Heater emissions are a function of the properties of the local produced gas used as a fuel. Emissions factors for external combustion of natural gas were obtained from AP-42 Section 1.4 Natural Gas Combustion (USEPA, 1995a). Emissions per well from heaters and reboilers can be estimated individually using Equation 64.

$$E_{heater,i} = N_{heaters} \times \frac{EF_i \times Q_{heater} \times t_{annual}}{\left(HV_{local} \times 2000\right)} \qquad \text{Equation (64)}$$

where:

$E_{heater,i}$ is the per well emissions for pollutant from a given heater [ton/well-yr]

EF_i is the heater emission factor for a given pollutant i [lb/MM SCF]

Q_{heater} is the heater MMBTU/hr rating [$MMBTU_{rated}$/hr]

HV_{local} is the local natural gas heating value [BTU_{local}/SCF]

t_{annual} is the annual hours of operation [hr/yr]

$N_{heaters}$ is the number of heaters per well

2.2.2.16.1 Area-Wide Annual Emissions from heaters

Annual emissions for heaters and reboilers are estimated with Equation 65 using the scaling surrogate active wells.

$$E_{heater,TOTAL,i} = E_{heater,i} \times W_{TOTAL} \qquad \text{Equation (65)}$$

where:

$E_{heater,TOTAL}$ is the total emissions of pollutant i for a given heater type in the Project [ton/yr]

E_{heater} is the per well annual emissions from a given heater type for pollutant i [ton/well-yr]

W_{TOTAL} is the total number of wells for a particular year [wells]

2.2.2.17 Dehydrator Emissions

This section describes the methodology to estimate emissions from dehydrator still vents. Uncontrolled emission factors per unit of gas production for emissions of VOC, CH_4 and CO_2 were derived from the literature for the various well types. Total emissions were propagated using the gas production by well type, assuming 100 percent of the gas undergoes well site dehydration. This was done applying Equation 66.

$$E_{dehyTOTAL,i,j} = EF_{dehy,i} \times S_{gas\ production,j}$$ Equation (66)

where:

$E_{dehy,TOTAL,,I,j}$ are the total area-wide emissions from dehydrators still vents for pollutant i in year j [tons/yr]

$EF_{dehy,i}$ is the dehydrator still vent emissions rate [tons/MCF]

$S_{gas\ production}$ is the annual gas production in year j [MCF/yr]

2.2.3 Midstream sources

Midstream sources include gathering and treating emissions associated with facilities such as compressor stations and gas plants. Midstream emissions are taken from the 2014 APEN (Air Pollutant Emission Notice) emissions database provided by CDPHE (CDPHE, 2016). CDPHE provided APEN emissions for all oil and gas related emission sources covered by the following SCC and SIC codes:

- All of the SCCs 202002*, 310*, 404003* (where * indicates all sub-SCCs for the SCC)
- And only those with the following SICs: 13*, 492*, 4612

BLM field office planning area designation was assigned according to the latitude and longitude of each source. The APEN oil and gas emissions database includes both well site and midstream sources. Midstream sources were identified for inclusion in the calculator based on the facility name and the suite of equipment included at a given facility. Appendix I includes a table of emissions by facility for each field office area.

Emissions were available in the APEN emissions database for the pollutants VOCs, CO, NO_X, PM_{10} and SO_2 in tons per year. Emissions for CH_4 and CO_2 were calculated using the vented gas speciation according to Equations 67 and 68 for the following sources.

- Glycol Dehydrator
- Natural Gas Processing Facilities, Gas Sweeting: Amine Process
- Condensate Tanks
- Natural Gas Processing Facilities, Flanges and Connections

$$E_{source,CH4} = E_{tanks,VOC} \times \frac{weight\ fraction_{CH4}}{weight\ fraction_{VOC}}$$ Equation (67)

$$E_{sourceCO2} = E_{tanks,VOC} \times \frac{weight\ fraction_{CO2}}{weight\ fraction_{VOC}}$$ Equation (68)

where:

$E_{source,VOC}$ is the total annual emissions from APENS database *a source* [tons/yr]

$E_{source,CO2}$ is the total CO_2 emissions from *a source* [tons/yr]

$E_{source,CH4}$ is the total CH_4 emissions from *a source* [tons/yr]

Weight fractions of each pollutant in the vented gas

For combustion sources such as compressor engines, process heaters and flares, emissions for CH_4, N_2O and CO_2 were estimated using the ratios of each greenhouse gas to NOx of emissions factors from AP-42.

Emissions in future years were estimated by multiplying 2015 emissions by the ratio of gas production in a given future year to gas production in 2015.

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APPENDIX A

Royal Gorge Field Office Conventional Oil and Gas Well Calculator Inputs by Source Category

NOTE: All input parameters are derived from the data source listed unless noted otherwise. Green shaded data is from (BLM 2016a and BLM 2016b)

Gas Analysis & Venting	Speciated Sales Gas Analysis	
Gas Component	Mole Fraction (%)	BLM provided data
Methane C1	62.841	
Ethane C2	15.809	
Nitrogen	0.624	
Water	0.000	
Carbon Dioxide	2.280	
Nitrous Oxide	0.000	
Hydrogen Sulfide	0.000	
Propane C3	9.249	
i-Butane i-C4	1.331	
n-Butane n-C4	3.670	
i-Pentane iC5	0.709	
n-Pentane nC5	0.875	
Hexanes C6	0.319	
Heptanes C7	0.173	
Octanes+	0.063	
Benzene	0.035	
Ethylbenzene	0.004	
n-Hexane n-C6	0.178	
Toluene	0.030	
2,2,4-Trimethylpentane	0.008	
Xylenes	0.011	
High Heating Value (Btu/scf)	1,465	

Average number of spuds per pad	
Base Year	6
Future Wells	10

Cn_HEq_Exh Construction/Drilling/Completion Equipment

Construction Equipment

Construction Site	Equipment Type	Capacity (hp)	# of Units	Avg. Load Factor (%)	# of Operating Hours/Day	# of Operating Days/Well Pad	Equipment Category	HP Range
Well Pad	Construction Equipment	227	7	48	13	9	Other Construction Equipment	300
Well Pad Access Road	Construction Equipment	227	7	48	13	3	Other Construction Equipment	300
Pipeline	Construction Equipment	227	4	48	13	2	Other Construction Equipment	300

Construction Site	Equipment Type	2015 Emission Factors (g/hp-hr)								
		VOC	CO	NO_x	PM_{10}	$PM_{2.5}$	SO_2	CO_2	CH_4	N_2O[a]
Well Pad	Construction Equipment	0.25	0.81	2.56	0.16	0.15	0.003	539.00	0.016	0.005
Well Pad Access Road	Construction Equipment	0.25	0.81	2.56	0.16	0.15	0.003	539.00	0.016	0.005
Pipeline	Construction Equipment	0.25	0.81	2.56	0.16	0.15	0.003	539.00	0.016	0.005

Emission Factor Source: EPA MOVES2014a diesel fuel construction equipment for Weld County

[a]N2O factor source: 2009 API O&G GHG Methodologies Compendium, Tables 4-13 and 4-17. 130,500 Btu/gallon, 2545 Btu/hp-hr.

Drilling

Construction Site	Equipment Type	Capacity (hp)	# of Units	Avg. Load Factor (%)	# of Operating Hours/Day	# of Operating Days/activity	NONROAD SCC	Tier Level	HP Range for Efs
Rig-up, Drilling, and Rig-down	Drilling Equipment - Avg	1152	3	51	24	8	2270010010	Tier 2	750-1200

Construction Site	Equipment Type	Tier Emission Factors (g/hp-hr)									
		Year	VOC	CO	NO_x	PM_{10}	$PM_{2.5}$	SO_2	CO_2	CH_4	N2O[a]
Rig-up, Drilling, and Rig-down	Drilling Equipment - Avg	Base year	0.26	2.61	4.53	0.15	0.15	0.11	530	0.004	0.002

Source: EPA Federal Tier Standards

[a]N2O factor source: 2009 API O&G GHG Methodologies Compendium, Tables 4-13 and 4-17. 130,500 Btu/gallon, 2545 Btu/hp-hr.

Completion/Fracing

Equipment Type	Capacity (hp)	# of Units	Avg. Load Factor (%)	# of Operating Hours/Day	# of Operating Days/activity	NONROAD SCC	Tier Level	HP Range
Completion Rig Equipment	1650	1	50	20	4	2270010010	Tier 2	>1200
Completion Nonroad Equipment	2000	5	60	18	6	2270010010	Tier 2	>1200
Completion Offroad Equipment	140	3	44	18	6	2270010010	Other Construction Equipment	175

Equipment Type	Capacity (hp)	Base Year Tier Emission Factors (g/hp-hr)								
		VOC	CO	NO_x	PM_{10}	$PM_{2.5}$	SO_2	CO_2	CH_4	N_2O[a]
Completion Rig Equipment	1650	0.26	2.61	4.53	0.15	0.15	0.11	523	0.004	0.002
Completion Nonroad Equipment	2000	0.26	2.61	4.53	0.15	0.15	0.11	523	0.004	0.002
Completion Offroad Equipment	140	0.25	0.81	2.56	0.16	0.15	0.003	539.00	0.016	0.005

Source: EPA Federal Tier Standards for rig and nonroad engines, EPA MOVES2014a diesel fuel construction equipment for Weld County for completion offroad equipment

[a]N2O factor source: 2009 API O&G GHG Methodologies Compendium, Tables 4-13 and 4-17. 130,500 Btu/gallon, 2545 Btu/hp-hr.

Fracing frequency per spud	1
Refracing Frequency per Year	0.05

Cn_CV_Exh	Construction Traffic Exhaust

Well Pad and Access Road Construction Traffic

Construction Site Destination	Vehicle		Round Trip Distance (miles)	# of Round Trips/Well Pad/ Year
	Type	Class		
Construction Traffic	Semi Trucks	Combination Short-haul Truck	19	18
	Pickup Trucks	Passenger Truck	23	70

Drilling/Completion/Fracing Traffic

Construction Site Destination	Vehicle		Round Trip Distance (miles)	# of Round Trips/activity/ Year
	Type	Class		
Drilling Traffic	Semi Trucks	Combination Short-haul Truck	23	82
	Pickup Trucks	Passenger Truck	24	215
Well Completion & Testing	Semi Trucks	Combination Short-haul Truck	23	307
	Pickup Trucks	Passenger Truck	22	95

Cn_HEq_FDust	Construction Traffic Dust

Area Disturbed for Oil Wells	Avg. Disturbed Acres per wellpad*	Construction Days
Well Pad	6.67	9
Well Pad Access Road and Pipeline Construction	1.64	3

*includes reclamation activity

Road and Pipeline Construction, (Pipeline Percentage of Acreage)	6%

Ops_Well WO Workovers

Equipment

Activity	Equipment Type	Capacity (hp)	# of Operating Hours/Day	# of Operating Days/Well	Load Factor	Well Workover Frequency per Year	NONROAD SCC	Tier Level	HP Range for EFs
Well Workover	Workover Equipment	1500	13	2	50	0.45	2270010010	Tier 2	750-1200

Tier Emission Factors (g/hp-hr)								
VOC	CO	NO_x	PM_{10}	$PM_{2.5}$	SO_2	CO_2	CH_4	N2O[a]
0.26	2.61	4.53	0.15	0.15	0.11	530	0.004	0.002

Source: EPA Federal Tier Standards

[a]N2O factor source: 2009 API O&G GHG Methodologies Compendium, Tables 4-13 and 4-17. 130,500 Btu/gallon, 2545 Btu/hp-hr.

Traffic

Activity	Vehicle		Round Trip Distance (miles)	# of Round Trips/Well/ Year
	Type	Class		
Well Workover	WO Rig	Combination Short-haul Truck	27	4
	Haul Truck	Combination Short-haul Truck	27	12
	Pickup Truck	Passenger Truck	19	20

blowdown Blowdown Venting

Type	Control Efficiency (%)	Volume of gas vented per blowdown Uncontrolled (MCF)	Frequency of Blowdown per well per year
Blowdown	0%	10.92	2.0

well completion	Completion Venting
Type	**Total volume of gas during completion (mcf)**
All completions	650

Recompletion	Recompletion Venting		
Type	**Control Efficiency (%)**	**Volume of gas vented per well per recompletion Uncontrolled (MCF)**	**No. of recompletion per well per year**
Recompletion	97%	650	1%

Data updated from White River Air Quality Technical Support Document, URS, 2012

well workover	Workover Flaring	
Type	**Control Efficiency (%)**	**Volume of gas during workover (MCF)**
Workover	98%	11

Compressor_Venting	Compressor Venting			
Type	**Control Efficiency (%)**	**Volume of gas vented per start-up or shutdown Uncontrolled (MCF)**	**Frequency of Start-up per well per year**	**Frequency of Shutdown per well per year**
Compressor Shutdown	0%	0.095	8	8

Wellhead Fugitives — Wellhead Fugitive Devices, Pneumatic Devices, and Pneumatic Pumps

Fugitive Devices

component	Ave. # in Gas Service	Ave. # in Liquid service	Ave. # in High Oil service	Ave. # in Water/Oil Service
valves	38	33	0	12
pump seals	1	0	0	0
others	14	5	0	2
connectors	177	199	0	30
flanges	19	15	0	8
open-ended lines	7	3	0	5

Pneumatic Pumps

Type	Gallons/yr/pump	SCF/Gallon	Number of Pump
Pneumatic Pumps	91	118	0

Pneumatic Devices

Device	Number of Devices / well	Bleed Rate (cfh)
Maximum Pneumatic Devices	2	6.0

WaterInjection_Pumps_Exh — Water Injection Pumps

WaterInjection_Pumps_Exh	Capacity (hp)	# of Units per well	Avg. Load Factor (%)	# of Operating Hours	Equipment Category	2015 Emission Factors (g/hp-hr)								
						VOC[a]	CO[a]	NOx[a]	PM10[b]	PM2.5[b]	SO2[b]	CO2[c]	CH4[c]	N2O[c]
Water Injection Pumps	0	0.00	47	0	Pumps	0.70	2.00	1.00	0.04	0.04	0.0023	451.01	0.009	0.0009

[a] Source: assume pumps will comply with NSPS 40 CFR part 60 subpart JJJJ (same rates as Colorado Regulation 7)

[b] Source: EPA, AP-42 Section 3.2 Natural Gas Fired Reciprocating Engines assuming fuel consumption of 8,500 Btu/hp-hr

[c] EPA Mandatory GHG Reporting, Part 98, Subpart C, Tables C-1 and C-2.

Misc_Engines_Exh Miscellaneous Engines

Misc_Engines_Exh	Capacity (hp)	# of Units per Well	Fraction of wells to be served by Miscellaneous engine	Avg. Load Factor (%)	# of Operating Hours/Well	Equipment Category
Misc. Engines	165	0.33	1.00	49	60	Misc. Engines

Misc_Engines_Exh		HP Range	2015 Emission Factors (g/hp-hr)								
			VOC[a]	CO[a]	NOx[a]	PM10[b]	PM2.5[b]	SO2[b]	CO2[c]	CH4[c]	N2O[c]
Misc. Engines	Tier 2	100-175	0.26	3.73	4.68	0.22	0.22	0.11	530.25	0.004	0.002

Source: EPA Federal Tier Standards

[a]N2O factor source: 2009 API O&G GHG Methodologies Compendium, Tables 4-13 and 4-17. 130,500 Btu/gallon, 2545 Btu/hp-hr.

Condensate Tanks & Traffic	Condensate Tanks
Type	***Base Year Assumptions***
Condensate	1. All Condensate Throughput Sent Tanks
	2. Average Condensate Truck Haulout of 200 bbl/load
Produced Water	3. All Water Throughput Sent Tanks
	4. Average Water Truck Haulout of 130 bbl/load

Uncontrolled VOC Emission Factors for Condensate Tanks

Condensate Tanks Emission Factor	6.565	lb/bbl
Produced Water	0.0865	lb/bbl

Flash Gas Weight Fractions

CO2 Fraction in Flash Gas	%wt	0.2
CH4 Fraction in Flash Gas	%wt	3
VOC Fraction in Flash Gas	%wt	88
VOC Molecular weight in Flash gas	lb/lb-mol	56
High Heating Value	Btu/scf	2,529

Condensate Truck Load-out

True vapor pressure of liquid loaded, pounds per square inch absolute (psia)	5.2
Mode of Operation	submerged loading: dedicated normal service

Produced Water and Condensate Truck Traffic

Construction Site Destination	Vehicle		Avg. Vehicle Speed (mph)	Round Trip Distance (miles)	# of Round Trips/Year/well
	Type	Class			
Produced Condensate Hauling	Haul Truck (200 bbl)	Combination Short-haul Truck	22	27	20.00
Water Hauling	Haul Truck (130 bbl)	Combination Short-haul Truck	22	27	11.00

Ops_RoadMaint Maintenance Traffic

Activity	Vehicle		Total Miles Traveled Per Well	Avg. Vehicle Speed (mph)
	Type	Class		
Road and Pad Maintenance	Pickup Truck	Passenger Truck	19	22

Compressor_Engines Compressor Engines

Type of Compressors / Pumps	Rate (Hp)	# Units per Well	Annual Compression (Hp)	Operating Hours/Year
Wellhead Compressor Engines	75	1	13.1	8,760
Lateral Compressor Engines	253	0.17	24.6	8,760

Annual compression calculation includes provided load factors.

comp_main_Traffic Compressor Station Traffic

	Exisitng	
Number of Compressor Stations on BLM Lands	1	
Number of Compressor Stations on Non-BLM Lands	44	Colorado APENS data

Activity	Vehicle Type	Avg. Vehicle Speed (mph)	Total Miles Traveled per Compressor Station
Compressor Maintenance	Pickup Truck	22	55

Mileage is distance from farthest compressor station to Greeley, CO.

Reclaim-RdsWells Well Pad Reclamation

Activity	Vehicle Type	Avg. Vehicle Speed (mph)	Total Miles Traveled per Well
Road and Well Pad Reclamation	Pickup Truck	22	19

Others Traffic Other Traffic

Activity	Vehicle		Avg. Vehicle Speed (mph)
	Type	Class	
Road and Well Pad Reclamation	Fuel Haul Truck	Combination Short-haul Truck	22

Heaters and Flaring Heaters

Wellsite Heaters	Heater Rating (MMBtu/hr)	Fraction of the year heating	hr/yr	No.of Units per Well
Separator Heaters	1.00	1.00	8760	1
Other Heaters	1.25	0.60	5240	0.17

Ops Dehy Dehydrators

Land Designation	Uncontrolled VOC Emissions (tons/mscf)	Uncontrolled CH4 Emissions (tons/mscf)	Uncontrolled CO2 Emissions (tons/mscf)
Total	0.00E+00	0.00E+00	0.00E+00

APPENDIX B

Royal Gorge Field Office Coalbed (Natural Gas) Methane Well Calculator Inputs by Source Category

NOTE: All input parameters are derived from the data source listed unless noted otherwise. Green shaded data is from (BLM 2016a and BLM 2016b)

Gas Analysis & Venting	Speciated Sales Gas Analysis	
Gas Component	Mole Fraction (%)	BLM provided data
Methane C1	99.115	
Ethane C2	0.014	
Nitrogen	0.400	
Water	0.000	
Carbon Dioxide	0.460	
Nitrous Oxide	0.000	
Hydrogen Sulfide	0.000	
Propane C3	0.001	
i-Butane i-C4	0.000	
n-Butane n-C4	0.000	
i-Pentane iC5	0.000	
n-Pentane nC5	0.000	
Hexanes C6	0.000	
Heptanes C7	0.000	
Octanes+	0.000	
Benzene	0.000	
Ethylbenzene	0.000	
n-Hexane n-C6	0.000	
Toluene	0.000	
2,2,4-Trimethylpentane	0.000	
Xylenes	0.000	
AP-42 Standard Heating Value (Btu/scf)	1,020	

Average number of spuds per pad	
Base Year	1
Future Wells	1

Cn_HEq_Exh Construction/Drilling/Completion Equipment

Construction Equipment

Construction Site	Equipment Type	Capacity (hp)	# of Units	Avg. Load Factor (%)	# of Operating Hours/Day	# of Operating Days/Well Pad	Equipment Category	HP Range
Well Pad	Construction Equipment	153	3	59	10	9	Other Construction Equipment	175
Well Pad Access Road	Construction Equipment	153	3	59	12	5	Other Construction Equipment	175
Pipeline	Construction Equipment	153	3	59	10	9	Other Construction Equipment	175

Construction Site	Equipment Type	2015 Emission Factors (g/hp-hr)								
		VOC	CO	NO_x	PM_{10}	$PM_{2.5}$	SO_2	CO_2	CH_4	N_2O[a]
Well Pad	Construction Equipment	0.20	0.63	1.95	0.12	0.12	0.003	535.87	0.02	0.005
Well Pad Access Road	Construction Equipment	0.20	0.63	1.95	0.12	0.12	0.003	535.87	0.02	0.005
Pipeline	Construction Equipment	0.20	0.63	1.95	0.12	0.12	0.003	535.87	0.02	0.005

Emission Factor Source: EPA MOVES2014a diesel fuel construction equipment for Las Animas County

[a]N2O factor source: 2009 API O&G GHG Methodologies Compendium, Tables 4-13 and 4-17. 130,500 Btu/gallon, 2545 Btu/hp-hr.

Drilling

Construction Site	Equipment Type	Capacity (hp)	# of Units	Avg. Load Factor (%)	# of Operating Hours/Day	# of Operating Days/activity	NONROAD SCC	Tier Level	HP Range for Efs
Spud, Drill Rigs, and Nonroad Engines	Drilling Equipment - Avg	350	5	42	24	5	2270010010	Tier 2	300-600

Construction Site	Equipment Type	Tier Emission Factors (g/hp-hr)									
		Year	VOC	CO	NO_x	PM_{10}	$PM_{2.5}$	SO_2	CO_2	CH_4	N2O[a]
Spud, Drill Rigs, and Nonroad Engines	Drilling Equipment - Avg	Base year	0.26	2.61	4.53	0.15	0.15	0.11	530	0.004	0.002

Source: EPA Federal Tier Standards

[a]N2O factor source: 2009 API O&G GHG Methodologies Compendium, Tables 4-13 and 4-17. 130,500 Btu/gallon, 2545 Btu/hp-hr.

Completion/Fracing

Equipment Type	Capacity (hp)	# of Units	Avg. Load Factor (%)	# of Operating Hours/Day	# of Operating Days/activity	NONROAD SCC	Tier Level	HP Range
Completion Equipment	1000	1	42	12	3	2270010010	Tier 2	300-600
Completion Frac Pump Equipment	1500	0	59	0	0	2270010010	Tier 2	>1200
Completion Frac Misc. Equipment	158	0	42	0	0	2270010010	Tier 2	100-175

Equipment Type	Capacity (hp)	Base Year Tier Emission Factors (g/hp-hr)								
		VOC	CO	NO_x	PM_{10}	$PM_{2.5}$	SO_2	CO_2	CH_4	N_2O[a]
Completion Equipment	400	0.26	2.61	4.53	0.15	0.15	0.11	523	0.004	0.002
Completion Frac Pump Equipment	1500	0.26	2.61	4.53	0.15	0.15	0.11	523	0.004	0.002
Completion Frac Misc. Equipment	158	0.26	3.73	4.68	0.22	0.22	0.11	520	0.004	0.002

Source: EPA Federal Tier Standards

[a]N2O factor source: 2009 API O&G GHG Methodologies Compendium, Tables 4-13 and 4-17. 130,500 Btu/gallon, 2545 Btu/hp-hr.

Fracing frequency per spud	0
Refracing Frequency per Year	0

Cn_CV_Exh	Construction Traffic Exhaust

Well Pad and Access Road Construction Traffic

Construction Site Destination	Vehicle		Round Trip Distance (miles)	# of Round Trips/Well Pad/ Year
	Type	Class		
Construction Traffic	Semi Trucks	Combination Short-haul Truck	40	21
	Pickup Trucks	Passenger Truck	40	100

Drilling/Completion/Fracing Traffic

Construction Site Destination	Vehicle		Round Trip Distance (miles)	# of Round Trips/activity/ Year
	Type	Class		
Drilling Traffic	Semi Trucks	Combination Short-haul Truck	40	78
	Pickup Trucks	Passenger Truck	40	84
Well Completion & Testing	Semi Trucks	Combination Short-haul Truck	60	102
	Pickup Trucks	Passenger Truck	60	84

Cn_HEq_FDust	Construction Traffic Dust

Area Disturbed for Oil Wells	Avg. Disturbed Acres per wellpad*	Construction Days
Well Pad	12.36	9
Well Pad Access Road and Pipeline Construction	241.37	14

*includes reclamation activity

Road and Pipeline Construction, (Pipeline Percentage of Acreage)	6%

Ops_Well WO Workovers

Equipment

Activity	Equipment Type	Capacity (hp)	# of Operating Hours/Day	# of Operating Days/Well	Load Factor	Well Workover Frequency per Year	NONROAD SCC	Tier Level	HP Range for EFs
Well Workover	Workover Equipment	400	10	2	43	0.08	2270010010	Tier 2	300-600

Tier Emission Factors (g/hp-hr)								
VOC	CO	NO_x	PM_{10}	$PM_{2.5}$	SO_2	CO_2	CH_4	N2O[a]
0.26	2.61	4.53	0.15	0.15	0.11	530	0.004	0.002

Source: EPA Federal Tier Standards

[a]N2O factor source: 2009 API O&G GHG Methodologies Compendium, Tables 4-13 and 4-17. 130,500 Btu/gallon, 2545 Btu/hp-hr.

Traffic

Activity	Vehicle		Round Trip Distance (miles)	# of Round Trips/Well/ Year
	Type	Class		
Well Workover	WO Rig	Combination Short-haul Truck	20	1
	Haul Truck	Combination Short-haul Truck	20	1
	Pickup Truck	Passenger Truck	20	1

blowdown Blowdown Venting

Type	Control Efficiency (%)	Volume of gas vented per blowdown Uncontrolled (MCF)	Frequency of Blowdown per well per year
Blowdown	0%	72.44	1.0

well completion	Completion Venting
Type	**Total volume of gas during completion (mcf)**
All completions	43

Recompletion	Recompletion Venting		
Type	**Control Efficiency (%)**	**Volume of gas vented per well per recompletion Uncontrolled (MCF)**	**No. of recompletion per well per year**
Recompletion	95%	14	1%

Data updated from White River Air Quality Technical Support Document, URS, 2012

well workover	Workover Flaring	
Type	**Control Efficiency (%)**	**Volume of gas during workover (MCF)**
Workover	0%	5

Compressor_Venting	Compressor Venting			
Type	**Control Efficiency (%)**	**Volume of gas vented per start-up or shutdown Uncontrolled (MCF)**	**Frequency of Start-up per well per year**	**Frequency of Shutdown per well per year**
Compressor Shutdown	0%	0.000	0	0

Wellhead Fugitives — Wellhead Fugitive Devices, Pneumatic Devices, and Pneumatic Pumps

Fugitive Devices

component	Ave. # in Gas Service	Ave. # in Liquid service	Ave. # in High Oil service	Ave. # in Water/Oil Service
valves	59	0	0	0
pump seals	0	0	0	0
others	3	0	0	0
connectors	193	0	0	0
flanges	0	0	0	0
open-ended lines	8	0	0	0

Pneumatic Pumps

Type	Gallons/yr/pump	SCF/Gallon	Number of Pump
Pneumatic Pumps	91	118	0

Pneumatic Devices

Device	Number of Devices / well	Bleed Rate (cfh)
Maximum Pneumatic Devices	1	6.0

WaterInjection_Pumps_Exh — Water Injection Pumps

WaterInjection_Pumps_Exh	Capacity (hp)	# of Units per well	Avg. Load Factor (%)	# of Operating Hours	Equipment Category	2015 Emission Factors (g/hp-hr)								
						VOC[a]	CO[a]	NOx[a]	PM10[b]	PM2.5[b]	SO2[b]	CO2[c]	CH4[c]	N2O[c]
Water Injection Pumps	34	1	47	8760	Pumps	0.71	4.85	2.13	0.04	0.04	0.0023	451.01	0.009	0.00009

[a] Source: assume pumping engines will comply with NSPS 40 CFR part 60 subpart JJJJ with 75% of HC+NOx rate being 75% NOx and 25% HC

[b] Source: EPA, AP-42 Section 3.2 Natural Gas Fired Reciprocating Engines assuming fuel consumption of 8,500 Btu/hp-hr

[c] EPA Mandatory GHG Reporting, Part 98, Subpart C, Tables C-1 and C-2.

Misc_Engines_Exh Miscellaneous Engines

Misc_Engines_Exh	Capacity (hp)	# of Units per Well	Fraction of wells to be served by Miscellaneous engine	Avg. Load Factor (%)	# of Operating Hours/Well	Equipment Category
Misc. Engines	0	0.00	0.00	0	0	Misc. Engines

Misc_Engines_Exh		HP Range	2015 Emission Factors (g/hp-hr)								
			VOC[a]	CO[a]	NOx[a]	PM10[b]	PM2.5[b]	SO2[b]	CO2[c]	CH4[c]	N2O[c]
Misc. Engines	N/A	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----

Condensate Tanks & Traffic	Condensate Tanks
Type	***Base Year Assumptions***
Condensate	1. All Condensate Throughput Sent Tanks
	2. Average Condensate Truck Haulout of 200 bbl/load
Produced Water	3. All Water Throughput Sent Tanks
	4. Any produced water will be piped offsite instead of trucked.

Uncontrolled VOC Emission Factors for Condensate Tanks

Condensate Tanks Emission Factor	11.8	lb/bbl
Produced Water	0.262	lb/bbl

Flash Gas Weight Fractions

CO2 Fraction in Flash Gas	%wt	52
CH4 Fraction in Flash Gas	%wt	0.2
VOC Fraction in Flash Gas	%wt	45
VOC Molecular weight in Flash gas	lb/lb-mol	49
High Heating Value	Btu/scf	2,000

Condensate Truck Load-out

True vapor pressure of liquid loaded, pounds per square inch absolute (psia)	4.3
Molecular Weight	68
Mode of Operation	submerged loading: dedicated normal service

Produced Water and Condensate Truck Traffic

Construction Site Destination	Vehicle		Avg. Vehicle Speed (mph)	Round Trip Distance (miles)	# of Round Trips/Year/well
	Type	Class			
Produced Condensate Hauling	Haul Truck (200 bbl)	Combination Short-haul Truck	30	5	0.00
Water Hauling	Haul Truck (130 bbl)	Combination Short-haul Truck	30	5	0.00

Ops_RoadMaint Maintenance Traffic

Activity	Vehicle		Total Miles Traveled Per Well	Avg. Vehicle Speed (mph)
	Type	Class		
Road and Pad Maintenance	Pickup Truck	Passenger Truck	1200	30

Compressor_Engines Compressor Engines

Type of Compressors / Pumps	Rate (Hp)	# Units per Well	Annual Compression (Hp)	Operating Hours/Year
Wellhead Compressor Engines	38	1.00	38.0	8,760
Lateral Compressor Engines	0	1.00	0.0	8,760

Annual compression calculation includes provided load factors.

comp_main_Traffic Compressor Station Traffic

	Exisitng	
Number of Compressor Stations on BLM Lands	1	
Number of Compressor Stations on Non-BLM Lands	28	Colorado APENS data

Activity	Vehicle Type	Avg. Vehicle Speed (mph)	Total Miles Traveled per Compressor Station
Compressor Maintenance	Pickup Truck	30	8

Mileage is distance from farthest compressor station to Greeley, CO.

Reclaim-RdsWells Well Pad Reclamation

Activity	Vehicle Type	Avg. Vehicle Speed (mph)	Total Miles Traveled per Well
Road and Well Pad Reclamation	Pickup Truck	30	0.7

Others Traffic Other Traffic

Activity	Vehicle		Avg. Vehicle Speed (mph)
	Type	Class	
Road and Well Pad Reclamation	Fuel Haul Truck	Combination Short-haul Truck	0

Heaters and Flaring Heaters

Wellsite Heaters	Heater Rating (MMBtu/hr)	Fraction of the year heating	hr/yr	No.of Units per Well
Separator Heaters	0.50	0.30	8760	1
Reboilers	0.50	1.00	8760	0.07

Ops Dehy Dehydrators

Land Designation	Uncontrolled VOC Emissions (tons/mscf)	Uncontrolled CH4 Emissions (tons/mscf)	Uncontrolled CO2 Emissions (tons/mscf)
Total	1.28E-07	1.08E-05	1.37E-07

APPENDIX C

Western Colorado Field Offices Conventional Gas Well Calculator Inputs by Source Category

Note: Yellow highlights indicate that inputs were obtained from the Uncompahgre Field Office Air Quality Technical Support Document, ENVIRON, 2012. All inputs taken from other sources are noted.

Gas Analysis & Venting	Speciated Sales Gas Analysis
Gas Component	**Mole Fraction (%)**
Methane C1	81.012
Ethane C2	4.334
Nitrogen	6.718
Water	0.000
Carbon Dioxide	5.380
Nitrous Oxide	0.000
Hydrogen Sulfide	0.000
Propane C3	1.437
i-Butane i-C4	0.288
n-Butane n-C4	0.329
i-Pentane iC5	0.154
n-Pentane nC5	0.104
Hexanes C6	0.111
Heptanes C7	0.037
Octanes+	0.017
Benzene	0.004
Ethylbenzene	0.000
n-Hexane n-C6	0.068
Toluene	0.003
2,2,4-Trimethylpentane	0.001
Xylenes	0.002

Cn_HEq_Exh Construction/Drilling/Completion Equipment

Construction Equipment

Construction Site	Equipment Type	Capacity (hp)	# of Units	Avg. Load Factor (%)	# of Operating Hours/Day	# of Operating Days/Well Pad	Equipment Category	HP Range
Well Pad	Construction Equipment	250	4	42	10	13	Other Construction Equipment	300
Well Pad Access Road	Construction Equipment	250	4	42	10	10	Other Construction Equipment	300
Pipeline	Construction Equipment	250	2	42	10	2	Other Construction Equipment	300

Construction Site	Equipment Type	2015 Emission Factors (g/hp-hr)								
		VOC	CO	NO_x	PM_{10}	$PM_{2.5}$	SO_2	CO_2	CH_4	N_2O[a]
Well Pad	Construction Equipment	0.24	0.86	2.63	0.16	0.16	0.003	536.14	0.02	0.02
Well Pad Access Road	Construction Equipment	0.24	0.86	2.63	0.16	0.16	0.003	536.14	0.02	0.02
Pipeline	Construction Equipment	0.24	0.86	2.63	0.16	0.16	0.003	536.14	0.02	0.02

Source: EPA MOVES2014a

[a]N2O factor source: 2009 API O&G GHG Methodologies Compendium, Tables 4-13 and 4-17. 130,500 Btu/gallon, 2545 Btu/hp-hr.

Drilling

Construction Site	Equipment Type	Capacity (hp)	# of Units	Avg. Load Factor (%)	# of Operating Hours/Day	# of Operating Days/activity	NONROAD SCC	Tier Level	HP Range for Efs
Rig-up, Drilling, and Rig-down	Drilling Equipment - Avg	2469	2	40	24	17	2270010010	Tier 2	>1200

Construction Site	Equipment Type	Tier Emission Factors (g/hp-hr)									
		Year	VOC	CO	NO_x	PM_{10}	$PM_{2.5}$	SO_2	CO_2	CH_4	N2O[a]
Rig-up, Drilling, and Rig-down	Drilling Equipment - Avg	Base year	0.26	2.61	4.53	0.15	0.15	0.11	530	0.004	0.002
		Future years	0.22	2.61	3.76	0.10	0.10	0.11	530	0.003	0.002

Source: EPA Federal Tier Standards

[a]N2O factor source: 2009 API O&G GHG Methodologies Compendium, Tables 4-13 and 4-17. 130,500 Btu/gallon, 2545 Btu/hp-hr.

Completion/Fracing

Equipment Type	Capacity (hp)	# of Units	Avg. Load Factor (%)	# of Operating Hours/Day	# of Operating Days/activity	NONROAD SCC	Tier Level	HP Range
Completion Equipment	1230	1	40	7	1	2270010010	Tier 2	>1200
Fracing Equipment	12000	1	85	24	1	2270010010	Tier 2	>1200
Refracing Equipment	1500	4	97	1	3	2270010010	Tier 2	>1200

Grand Junction Field Office Air Quality Technical Support Document, ENVIRON, 2012

Data updated from White River Air Quality Technical Support Document, URS, 2012 (Fracing Equipment), and from Uncompahgre Field Office Air Quality Technical Support Document, ENVIRON, 2012 (Completion)

Equipment Type	Capacity (hp)	Year	Tier Emission Factors (g/hp-hr)								
			VOC	CO	NO_x	PM_{10}	$PM_{2.5}$	SO_2	CO_2	CH_4	N_2O[a]
Completion Equipment	1230	Base Year	0.26	2.61	4.53	0.15	0.15	0.11	523	0.004	0.002
		Future Years	0.22	2.61	3.76	0.10	0.10	0.11	523	0.003	0.002
Fracing Equipment	12000	Base Year	0.26	2.61	4.53	0.15	0.15	0.11	523	0.004	0.002
		Future Years	0.22	2.61	3.76	0.10	0.10	0.11	523	0.003	0.002
Refracing Equipment	1500	All Years	0.26	2.61	4.53	0.15	0.15	0.11	523	0.004	0.002

Source: EPA Federal Tier Standards

[a]N2O factor source: 2009 API O&G GHG Methodologies Compendium, Tables 4-13 and 4-17. 130,500 Btu/gallon, 2545 Btu/hp-hr.

Fracing frequency per spud	1
Refracing Frequency per Year per Well	0.05

Cn_CV_Exh Construction Traffic Exhaust

Well Pad and Access Road Construction Traffic

Construction Site Destination	Vehicle		Round Trip Distance (miles)	# of Round Trips/Well Pad/ Year
	Type	Class		
Well Pad and Access Road Construction Traffic	Semi Trucks	HDDV	4	80
	Pickup Trucks	LDDT	4	30
Pipeline Construction	Semi Trucks	HDDV	5	16
	Pickup Trucks	LDDT	5	18

Drilling/Completion/Fracing Traffic

Construction Site Destination	Vehicle		Round Trip Distance (miles)	# of Round Trips/activity/ Year
	Type	Class		
Drilling Traffic	Semi Trucks	HDDV	4	136
	Pickup Trucks	LDDT	5	136
Rig Hauling	Semi Trucks	HDDV	5	1
Rig Move Drilling Traffic	Semi Trucks	HDDV	5	90
	Pickup Trucks	LDDT	5	42
Well Completion & Testing	Semi Trucks	HDDV	5	84
	Pickup Trucks	LDDT	5	74

Ops_Well WO Workovers

Construction Equipment

Activity	Equipment Type	Capacity (hp)	# of Operating Hours/Day	# of Operating Days/Well	Load Factor	Well Workover Frequency per Year	NONROAD SCC
Well Workover	Workover Equipment	638	9	6	43	0.08	2270010010

Tier Level	HP Range for Efs	Tier Emission Factors (g/hp-hr)								
		VOC	CO	NO_x	PM_{10}	$PM_{2.5}$	SO_2	CO_2	CH_4	N2O[a]
Tier 2	600-750	0.26	2.61	4.53	0.15	0.15	0.11	530	0.004	0.002

Traffic

Activity	Vehicle		Round Trip Distance (miles)	# of Round Trips/Well/ Year
	Type	Class		
Well Workover	WO Rig	HDDV	4	4
	Haul Truck	HDDV	4	12
	Pickup Truck	LDDT	4	20

blowdown — Blowdown Venting

Type	Control Efficiency (%)	Volume of gas vented per blowdown Uncontrolled (MCF)	Frequency of Blowdown per well per year
Blowdown	0%	0.75	3.0

Data updated from White River Air Quality Technical Support Document, URS, 2012

well completion — Completion Venting

Type	Total volume of gas during completion (mcf)
All completions	1,000

Data updated from White River Air Quality Technical Support Document, URS, 2012

Recompletion — Recompletion Venting

Type	Control Efficiency (%)	Volume of gas vented per well per recompletion Uncontrolled (MCF)	No. of recompletion per well per year
Recompletion	0%	1000	1%

Data updated from White River Air Quality Technical Support Document, URS, 2012

Compressor_Venting Compressor Venting

Type	Control Efficiency (%)	Volume of gas vented per start-up or shutdown Uncontrolled (MCF)	Frequency of Start-up per well per year	Frequency of Shutdown per well per year
Compressor Shutdown	0%	10	1	1

Wellhead Fugitives Wellhead Fugitive Devices, Pneumatic Devices, and Pneumatic Pumps

Fugitive Devices

component	Ave. # in Gas Service	Ave. # in Liquid service	Ave. # in High Oil service	Ave. # in Water/Oil Service
valves	49	14	0	3
pump seals	2	1	0	0
others	46	0	0	0
connectors	0	0	0	0
flanges	13	8	0	1
open-ended lines	6	2	0	0

Pneumatic Pumps

Type	Gallons/yr/pump	SCF/Gallon	Number of Pump
Pneumatic Pumps	91	118	1

Pneumatic Devices*

Device	Number of Devices / well	Low-Bleed Rate (cfh)
Liquid level controller	2	6
Pressure controller	1	6
Valve controllers	2.0	6
Liquid level controller	0.1	6

Data updated from Colorado River Valley Air Quality Technical Support Document, URS, 2012

*Assumed that all devices are low-bleed in the base year and that in future years 90% of devices are low-bleed and 10% of devices are no bleed.

WaterInjection_Pumps_Exh Water Injection Pumps

Type	Capacity (hp)	# of Units per well	Avg. Load Factor (%)	# of Operating Hours	Equipment Category	2015 Emission Factors (g/hp-hr)								
						VOC	CO	NO_x	PM_{10}	$PM_{2.5}$	SO_2	CO_2	CH_4	N_2O[a]
Water Injection Pumps	347	0.06	47	2920	Pumps	0.70	2.00	1.00	0.04	0.04	0.001	134.94	0.0025	0.0003

Source: EPA MOVES2014a

[a]N2O factor source: 2009 API O&G GHG Methodologies Compendium, Tables 4-13 and 4-17. 130,500 Btu/gallon, 2545 Btu/hp-hr.

Misc_Engines_Exh Miscellaneous Engines

Construction Site	Capacity (hp)	# of Units per Well	Fraction of wells to be served by Miscellaneous engine	Avg. Load Factor (%)	# of Operating Hours/Well	Equipment Category
Misc. Engines	118	1	1	50	4380	Misc. Engines

HP Range	2015 Emission Factors (g/hp-hr)								
	VOC	CO	NO_x	PM_{10}	$PM_{2.5}$	SO_2	CO_2	CH_4	N_2O[a]
175	0.21	0.60	2.16	0.15	0.15	0.003	530.45	0.02	0.02

Source: EPA MOVES2014a

[a]N2O factor source: 2009 API O&G GHG Methodologies Compendium, Tables 4-13 and 4-17. 130,500 Btu/gallon, 2545 Btu/hp-hr.

Condensate Tanks & Traffic	Condensate Tanks
Type	***Base Year Assumptions***
Condensate	1. All Condensate Throughput Sent Tanks
	2. Average Condensate Truck Haulout of 200 bbl/load
Produced Water	3. 50% of produced water hauled by truck.
	4. Average Water Truck Haulout of 130 bbl/load
	5. Based on water production estimates by well type and planning area from the IHS Energy database provided by BLM staff.

Uncontrolled VOC Emission Factors for Condensate Tanks

Applicable to Garfield, Mesa, Rio Blanco, Moffat Counties*	10	lb/bbl
Applicable to all other Western Colorado Field Office Counties*	11.8	lb/bbl

*CDPHE, 2014. Stationary Sources Program / Air Pollution Control Division, PS Memo 14-03: Oil & Gas Industry Crude Oil, Condensate and Produced Water Atmospheric Storage Tanks Regulatory Definitions and Permitting Guidance for General Permit GP08. https://www.colorado.gov/pacific/sites/default/files/AP_Memo-14-03-GP08-Guidance.pdf

Flash Gas Weight Fractions

CO2 Fraction in Flash Gas	%wt	2
CH4 Fraction in Flash Gas	%wt	9
VOC Fraction in Flash Gas	%wt	58
VOC Molecular weight in Flash gas	lb/lb-mol	36

Condensate Truck Load-out

True vapor pressure of liquid loaded, pounds per square inch absolute (psia)	5.2
Mode of Operation	submerged loading: dedicated normal service

Produced Water and Condensate Truck Traffic

Construction Site Destination	Vehicle		Avg. Vehicle Speed (mph)	Round Trip Distance (miles)	Condensate (Round Trips/BBL) OR Water (Round Trips/Year/well)
	Type	Class			
Produced Condensate Hauling	Haul Truck (200 bbl)	HDDV	25	4	0.005
Water Hauling	Haul Truck (130 bbl)	HDDV	25	20	2.6

Based on 50% of the water production being hauled. BLM Coalbed Methane Emissions Calculator. Received from BLM March 2012

Ops_RoadMaint Maintenance Traffic

Activity	Vehicle		Total Miles Traveled Per Well	Avg. Vehicle Speed (mph)
	Type	Class		
Road Maintenance	Pickup Truck	LDDV	18	35

Compressor_Engines Compressor Engines

Type of Compressors / Pumps	Rate (Hp)	# Units per Well	Annual Compression (Hp)	Operating Hours/Year
Wellhead Compressor Engines	45	0.1	4	6,778
Lateral Compressor Engines	212	0.02	5	8,760

comp_main_Traffic — Compressor Station Traffic

Activity	Vehicle Type	Avg. Vehicle Speed (mph)	Total Miles Traveled per Compressor Station
Compressor Maintenance	Pickup Truck	35	855

Reclaim-RdsWells — Well Pad Reclamation

Activity	Vehicle Type	Avg. Vehicle Speed (mph)	Total Miles Traveled per Well
Road and Well Pad Reclamation	Pickup Truck	35	1,110

Others Traffic — Other Traffic

Activity	Vehicle Type	Avg. Vehicle Speed (mph)	Round Trip Distance (miles)	# of Round Trips/Year/well
Fuel Hauling	HDDV	25	7	0.6

Heaters and Flaring — Heaters

Wellsite Heaters	Heater Rating (MMBtu/hr)	Fraction of the year heating	hr/yr	No.of Units per Well
Heaters	0.83	0.57	4964	1
Reboilers	0.67	0.53	4599	1

Ops Dehy	Dehydrators	
Uncontrolled VOC Emissions (tons/mscf)	**Uncontrolled CH4 Emissions (tons/mscf)**	**Uncontrolled CO2 Emissions (tons/mscf)**
2.51E-06	4.03E-06	3.15E-07

Data updated from White River Air Quality Technical Support Document, URS, 2012

APPENDIX D

Western Colorado Field Offices Shale Gas Well Calculator Inputs by Source Category

Note: Yellow highlights indicate that inputs were obtained from the Uncompahgre Field Office Air Quality Technical Support Document, ENVIRON, 2012. All inputs except those from the Bull Mountain Emission Inventory are noted. Green highlights indicate that inputs were obtained from the data from Bull Mountain Emission Inventory Aug, 2013

Gas Analysis & Venting	Speciated Sales Gas Analysis
Gas Component	Mole Fraction (%)
Methane C1	90.150
Ethane C2	1.960
Nitrogen	0.160
Water	0.000
Carbon Dioxide	6.660
Nitrous Oxide	0.000
Hydrogen Sulfide	0.000
Propane C3	0.520
i-Butane i-C4	0.120
n-Butane n-C4	0.100
i-Pentane iC5	0.060
n-Pentane nC5	0.030
Hexanes+ C6+	0.128
Heptanes C7	0.000
Octanes+	0.000
Benzene	0.036
Ethylbenzene	0.002
n-Hexane n-C6	0.000
Toluene	0.047
2,2,4-Trimethylpentane	0.000
Xylenes	0.017
Helium	0.010
O2	0.000

*The full gas composition did not include BTEX and n-hexane components. These were included by adding separately provided BTEX and n-hexane mole fractions to the composition above and subtracting the corresponding mole fractions from the hexanes+ component.

Cn_HEq_Exh	Construction/Drilling/Completion Equipment

Construction Equipment

Construction Site	Equipment Type	Capacity (hp)	# of Units	Avg. Load Factor (%)	# of Operating Hours/Day	# of Operating Days/Well Pad**	HP Range
Well Pad	Haul Truck	250	3	40	8	13	300
	Trackhoe	250	1	40	8	13	300
	Dozer	250	2	40	8	13	300
	Grader	250	1	40	8	13	300
	Compactor	250	1	40	8	13	300
	Water Truck	250	1	40	8	13	300
Well Pad Access Road	Dozer	250	2	40	8	10	300
	Grader	250	1	40	8	10	300
	Trackhoe	250	1	40	8	10	300
	Haul Truck	250	3	40	8	10	300
Pipeline	Dozer	250	1	40	10	10	300
	Grader	250	1	40	10	10	300
	Trackhoe	250	1	40	10	10	300
	Bending Mach	250	1	40	10	10	300
	Sideboom	250	1	40	10	10	300
	Utility Tractor	250	1	40	10	10	300

**Includes pad reclamation associated activity

Construction Site	Equipment Type	2015 Emission Factors (g/hp-hr)								
		VOC	CO	NO_x	PM_{10}	$PM_{2.5}$	SO_2	CO_2	CH_4	N_2O^a
Well Pad	For all Construction Equipment	0.24	0.86	2.63	0.16	0.16	0.003	536.14	0.02	0.02
Well Pad Access Road	For all Construction Equipment	0.24	0.86	2.63	0.16	0.16	0.003	536.14	0.02	0.02
Pipeline	For all Construction Equipment	0.24	0.86	2.63	0.16	0.16	0.003	536.14	0.02	0.02

Source: EPA MOVES2014a

[a]N2O factor source: 2009 API O&G GHG Methodologies Compendium, Tables 4-13 and 4-17. 130,500 Btu/gallon, 2545 Btu/hp-hr.

Drilling

Construction Site	Equipment Type	Capacity (hp)	# of Units	Avg. Load Factor (%)	# of Operating Hours/Day	# of Operating Days/activity	NONROAD SCC	Tier Level	HP Range for Efs
Rig-up, Drilling, and Rig-down	Drilling Equipment - Avg	1200	1	40	24	35	2270010010	Tier 2	>1200

Construction Site	Equipment Type	Tier Emission Factors (g/hp-hr)								
		VOC	CO	NO_x	PM_{10}	$PM_{2.5}$	SO_2	CO_2	CH_4	N2O
Rig-up, Drilling, and Rig-down	Drilling Equipment - Avg	0.26	2.61	4.53	0.15	0.15	0.11	530	0.004	0.002
Source: EPA Federal Tier Standards [a]N2O factor source: 2009 API O&G GHG Methodologies Compendium, Tables 4-13 and 4-17. 130,500 Btu/gallon, 2545 Btu/hp-hr.										

Completion/Fracing

Equipment Type	Capacity (hp)	# of Units	Avg. Load Factor (%)	# of Operating Hours/Day	# of Operating Days/activity	NONROAD SCC	Tier Level	HP Range
Completion Equipment	1230	1	40	7	1	2270010010	Tier 2	>1200
Fracing Equipment	12000	1	85	24	1	2270010010	Tier 2	>1200
Refracing Equipment	1500	4	97	1	3	2270010010	Tier 2	>1200

Grand Junction Field Office Air Quality Technical Support Document, ENVIRON, 2012

Data updated from White River Air Quality Technical Support Document, URS, 2012 (Fracing Equipment), and from Uncompahgre Field Office Air Quality Technical Support Document, ENVIRON, 2012 (Completion)

Equipment Type	Capacity (hp)	Tier Emission Factors (g/hp-hr)								
		VOC	CO	NO_x	PM_{10}	$PM_{2.5}$	SO_2	CO_2	CH_4	N_2O[a]
Completion Equipment	1230	0.26	2.61	4.53	0.15	0.15	0.11	523	0.004	0.002
Fracing Equipment	12000	0.26	2.61	4.53	0.15	0.15	0.11	523	0.004	0.002
Refracing Equipment	1500	0.26	2.61	4.53	0.15	0.15	0.11	523	0.004	0.002
Source: EPA Federal Tier Standards [a]N2O factor source: 2009 API O&G GHG Methodologies Compendium, Tables 4-13 and 4-17. 130,500 Btu/gallon, 2545 Btu/hp-hr.										

Fracing frequency per spud	1
Refracing Frequency per Year per Well	0.25

Cn_CV_Exh Construction Traffic Exhaust

Well Pad and Access Road Construction Traffic

Construction Site Destination	Vehicle		Round Trip Distance (miles)	# of Round Trips/Well Pad/ Year
	Type	Class		
Well Pad and Access Road Construction Traffic	Semi Trucks	HDDV	16	164
	Pickup Trucks	LDDT	16	40
Pipeline Construction	Semi Trucks	HDDV	16	35
	Pickup Trucks	LDDT	16	48

Drilling/Completion/Fracing Traffic

Construction Site Destination	Vehicle		Round Trip Distance (miles)	# of Round Trips/activity/ Year
	Type	Class		
Drilling Traffic	Semi Trucks	HDDV	16	917
	Pickup Trucks	LDDT	16	274
Rig Hauling	Semi Trucks	HDDV	16	1
Rig Move Drilling Traffic	Semi Trucks	HDDV	16	90
	Pickup Trucks	LDDT	16	42
Well Completion & Testing	Semi Trucks	HDDV	16	84
	Pickup Trucks	LDDT	16	74

Cn_HEq_FDust Construction Traffic Dust

Area Disturbed for Oil Wells	Avg. Disturbed Acres per wellpad	Construction Days
Well Pad	3.75	15
Well Pad Access Road and Pipeline Construction	1.8	8

Road and Pipeline Construction, (Pipeline Percentage of Acreage)	6%

Ops_Well WO Workovers

Construction Equipment

Activity	Equipment Type	Capacity (hp)	# of Operating Hours/Day	# of Operating Days/Well	Load Factor	Well Workover Frequency per Year	NONROAD SCC
Well Workover	Workover Equipment	500	10	7	43	0.5	2270010010

Tier Level	HP Range for Efs	Tier Emission Factors (g/hp-hr)								
		VOC	CO	NO_x	PM_{10}	$PM_{2.5}$	SO_2	CO_2	CH_4	N2O[a]
Tier 2	600-750	0.26	2.61	4.53	0.15	0.15	0.11	530	0.004	0.002

Traffic

Activity	Vehicle		Round Trip Distance (miles)	# of Round Trips/Well/ Year
	Type	Class		
Well Workover	WO Rig	HDDV	4.1	0.6
	Haul Truck	HDDV	4.1	1.3
	Pickup Truck	LDDT	4.1	6.4

blowdown	Blowdown Venting		
Type	**Control Efficiency (%)**	**Volume of gas vented per blowdown Uncontrolled (MCF)**	**Frequency of Blowdown per well per year**
Blowdown	0%	0.81	3.4

Data updated from White River Air Quality Technical Support Document, URS, 2012

well completion	Completion Venting
Type	**Total volume of gas during completion (mcf)**
All completions	1,000

Recompletion	Recompletion Venting		
Type	**Control Efficiency (%)**	**Volume of gas vented per well per recompletion Uncontrolled (MCF)**	**No. of recompletion per well per year**
Recompletion	0%	30	50%

Compressor_Venting	Compressor Venting			
Type	**Control Efficiency (%)**	**Volume of gas vented per start-up or shutdown Uncontrolled (MCF)**	**Frequency of Start-up per well per year**	**Frequency of Shutdown per well per year**
Compressor Shutdown	0%	10	1	1

Wellhead Fugitives	Wellhead Fugitive Devices, Pneumatic Devices, and Pneumatic Pumps			
Fugitive Devices				
component	**Ave. # in Gas Service**	**Ave. # in Liquid service**	**Ave. # in High Oil service**	**Ave. # in Water/Oil Service**
valves	49	14	0	3
pump seals	2	1	0	0
others	46	0	0	0
connectors	0	0	0	0
flanges	13	8	0	1
open-ended lines	6	2	0	0

Pneumatic Pumps

Type	Gallons/yr/pump	SCF/Gallon	Number of Pump
Pneumatic Pumps	91	118	1

Pneumatic Devices

Device	Number of Devices / well	Lo-Bleed Rate (cfh)
Liquid level controller	2	6
Pressure controller	1	6
Valve controllers	2.0	6
Liquid level controller	0.1	6
	Data updated from Colorado River Valley Air Quality Technical Support Document, URS, 2012	

WaterInjection_Pumps_Exh Water Injection Pumps

Type	Capacity (hp)	# of Units per well	Avg. Load Factor (%)	# of Operating Hours	Equipment Category	2015 Emission Factors (g/hp-hr)								
						VOC	CO	NO_x	PM_{10}	$PM_{2.5}$	SO_2	CO_2	CH_4	N_2O[a]
Water Injection Pumps	347	0.09	47	2920	Pumps	0.70	2.00	1.00	0.04	0.04	0.001	134.94	0.003	0.0003

Source: Source: EPA MOVES2014a

[a]N2O factor source: 2009 API O&G GHG Methodologies Compendium, Tables 4-13 and 4-17. 130,500 Btu/gallon, 2545 Btu/hp-hr.

Misc_Engines_Exh	Miscellaneous Engines					
Construction Site	**Capacity (hp)**	**# of Units per Well**	**Fraction of wells to be served by Miscellaneous engine**	**Avg. Load Factor (%)**	**# of Operating Hours/Well**	**Equipment Category**
Misc. Engines (wellsite water pumps)	19	1	1	47%	8760	Misc. Engines

HP Range	**2015 Emission Factors (g/hp-hr)**								
	VOC	**CO**	**NO_x**	**PM_{10}**	**$PM_{2.5}$**	**SO_2**	**CO_2**	**CH_4**	**N_2O[a]**
25	0.27	1.68	8.16	0.04	0.04	0.00	557.28	0.01	0.00

Source: Emission factors for NOx and VOC from EPA Nonroad Spark-Ignition Engines 19 kW and Below - Exhaust Emission Standards, Phase 2, Class II Engine. Emission factors for CO, PM10 and PM2.5 and HAPs from AP-42, Volume I, Fifth Edition, Table 3.2-1.

Emission factors for CO2, CH4, and N2O from Tables C-1 and C-2 of 40 CFR Part 98, Mandatory Reporting of Greenhouse Gases; Final Rule.

Condensate Tanks & Traffic	Condensate Tanks
Type	***Base Year Assumptions***
Condensate	1. All Condensate Throughput Sent Tanks
	2. Average Condensate Truck Haulout of 200 bbl/load
Produced Water	3. 50% of produced water hauled by truck.
	4. Average Water Truck Haulout of 130 bbl/load
	5. Based on water production estimates by well type and planning area from the IHS Energy database provided by BLM staff.

Uncontrolled VOC Emission Factors for Condensate Tanks

	11.8	lb/bbl

source: CDPHE, 2014. Stationary Sources Program / Air Pollution Control Division, PS Memo 14-03: Oil & Gas Industry Crude Oil, Condensate and Produced Water Atmospheric Storage Tanks Regulatory Definitions and Permitting Guidance for General Permit GP08. https://www.colorado.gov/pacific/sites/default/files/AP_Memo-14-03-GP08-Guidance.pdf

Flash Gas Weight Fractions

CO2 Fraction in Flash Gas	%wt	2
CH4 Fraction in Flash Gas	%wt	9
VOC Fraction in Flash Gas	%wt	58
VOC Molecular weight in Flash gas	lb/lb-mol	36

Condensate Truck Load-out

True vapor pressure of liquid loaded, pounds per square inch absolute (psia)	5.2
Mode of Operation	submerged loading: dedicated normal service

Produced Water and Condensate Truck Traffic

Construction Site Destination	Vehicle		Avg. Vehicle Speed (mph)	Round Trip Distance (miles)	# of Round Trips/BBL
	Type	Class			
Produced Condensate Hauling	Haul Truck (200 bbl)	HDDV	15	4	0.005
Water Hauling	Haul Truck (130 bbl)	HDDV	15	4	0.008
	Based on 50% of the water production being hauled. BLM Coalbed Methane Emissions Calculator. Received from BLM March 2012				

Ops_RoadMaint Maintenance Traffic

Activity	Vehicle		Total Miles Traveled Per Well	Avg. Vehicle Speed (mph)
	Type	Class		
Road Maintenance	Pickup Truck	LDDV	18	15

Compressor_Engines Compressor Engines

Type of Compressors / Pumps	Rate (Hp)	# Units per Well	Annual Compression (Hp)	Operating Hours/Year
Wellhead Compressor Engines	45	1	4	6,778
Lateral Compressor Engines	212	0.02	5	8,760

Input data from BLM, 2016b

comp_main_ Traffic Compressor Station Traffic

Activity	Vehicle Type	Avg. Vehicle Speed (mph)	Total Miles Traveled per Compressor Station
Compressor Maintenance	Pickup Truck	35	107

Reclaim-RdsWells Well Pad Reclamation

Activity	Vehicle Type	Avg. Vehicle Speed (mph)	Total Miles Traveled per Well
Road and Well Pad Reclamation	Pickup Truck	35	416

Others Traffic Other Traffic

Activity	Vehicle Type	Avg. Vehicle Speed (mph)	Round Trip Distance (miles)	# of Round Trips/Year/well
Fuel Hauling	HDDV	25	7	0.6

Heaters and Flaring Heaters

Wellsite Heaters	Heater Rating (MMBtu/hr)	Fraction of the year heating	hr/yr	No.of Units per Well
Heaters	0.23	0.17	1460	3
Reboilers	0.25	0.50	4380	1

The Bull Mountain Emission Inventory estimated emissions from one separator heater with 0.125 mmbtu/hr heater rating,4380 hours /year and 4 tank heaters with 0.25 mmbtu/hr heater rating and 730 hours/year. For this project, weighted average of separator heater and tank heaters data were used to estimate heater emissions.

Ops Dehy	Dehydrators	
Uncontrolled VOC Emissions (tons/mscf)	**Uncontrolled CH4 Emissions (tons/mscf)**	**Uncontrolled CO2 Emissions (tons/mscf)**
4.66E-08	5.10E-06	4.35E-07

APPENDIX E

Western Colorado Field Offices Coalbed (Natural Gas) Methane Well Calculator Inputs by Source Category

Note: Yellow highlights indicate that inputs were obtained from theBLM Coalbed Methane Emissions Calculator. Received from BLM March 2012. All inputs taken from other sources are noted.

Gas Analysis & Venting	Speciated Sales Gas Analysis
Gas Component	**Mole Fraction (%)**
Methane C1	97.913
Ethane C2	0.000
Nitrogen	1.173
Water	0.000
Carbon Dioxide	0.851
Nitrous Oxide	0.000
Hydrogen Sulfide	0.000
Propane C3	0.063
i-Butane i-C4	0.000
n-Butane n-C4	0.000
i-Pentane iC5	0.000
n-Pentane nC5	0.000
Hexanes C6	0.000
Heptanes C7	0.000
Octanes+	0.000
Benzene	0.000
Ethylbenzene	0.000
n-Hexane n-C6	0.000
Toluene	0.000
2,2,4-Trimethylpentane	0.000
Xylenes	0.000

Cn_HEq_Exh Construction/Drilling/Completion Equipment

Construction Equipment

Construction Site	Equipment Type	Capacity (hp)	# of Units	Avg. Load Factor (%)	# of Operating Hours/Day	# of Operating Days/Well Pad	Equipment Category	HP Range
Well Pad	Construction Equipment	200	2	80	12	3	Other Construction Equipment	300
Well Pad Access Road	Construction Equipment	200	1	80	4	1	Other Construction Equipment	300
Pipeline	Construction Equipment	200	2	80	10	2	Other Construction Equipment	300

Construction Site	Equipment Type	2015 Emission Factors (g/hp-hr)								
		VOC	CO	NO_x	PM_{10}	$PM_{2.5}$	SO_2	CO_2	CH_4	N_2O[a]
Well Pad	Construction Equipment	0.24	0.86	2.63	0.16	0.16	0.00	536.14	0.02	0.02
Well Pad Access Road	Construction Equipment	0.24	0.86	2.63	0.16	0.16	0.00	536.14	0.02	0.02
Pipeline	Construction Equipment	0.24	0.86	2.63	0.16	0.16	0.00	536.14	0.02	0.02

Source: EPA MOVES2014a

[a]N2O factor source: 2009 API O&G GHG Methodologies Compendium, Tables 4-13 and 4-17. 130,500 Btu/gallon, 2545 Btu/hp-hr.

Drilling

Construction Site	Equipment Type	Capacity (hp)	# of Units	Avg. Load Factor (%)	# of Operating Hours/Day	# of Operating Days/activity	NONROAD SCC	Tier Level	HP Range for Efs
Rig-up, Drilling, and Rig-down	Drilling Equipment - Avg	400	3	77	24	3	2270010010	Tier 2	300-600

Construction Site	Equipment Type	Tier Emission Factors (g/hp-hr)								
		VOC	CO	NO_x	PM_{10}	$PM_{2.5}$	SO_2	CO_2	CH_4	N2O[a]
Rig-up, Drilling, and Rig-down	Drilling Equipment - Avg	0.26	2.61	4.53	0.15	0.15	0.11	530	0.004	0.002

Source: EPA Federal Tier Standards

[a]N2O factor source: 2009 API O&G GHG Methodologies Compendium, Tables 4-13 and 4-17. 130,500 Btu/gallon, 2545 Btu/hp-hr.

Completion/Fracing

Equipment Type	Capacity (hp)	# of Units	Avg. Load Factor (%)	# of Operating Hours/Day	# of Operating Days/activity	NONROAD SCC	Tier Level	HP Range
Completion Equipment	1000	1	50	10	5	2270010010	Tier 2	300-600
Fracing Equipment	-	-	-	-	-	-	-	-
Refracing Equipment	-	-	-	-	-	-	-	-

Input data from BLM, 2016b

Equipment Type	Capacity (hp)	Tier Emission Factors (g/hp-hr)								
		VOC	CO	NO_x	PM_{10}	$PM_{2.5}$	SO_2	CO_2	CH_4	N_2O[a]
Completion Equipment	400	0.26	2.61	4.53	0.15	0.15	0.11	523	0.004	0.002
Fracing Equipment	-	-	-	-	-	-	-	-	-	-
Refracing Equipment	-	-	-	-	-	-	-	-	-	-

Source: EPA Federal Tier Standards

[a]N2O factor source: 2009 API O&G GHG Methodologies Compendium, Tables 4-13 and 4-17. 130,500 Btu/gallon, 2545 Btu/hp-hr.

Fracing frequency per spud	-
Refracing Frequency per Year per Well	-

Cn_CV_Exh Construction Traffic Exhaust

Well Pad and Access Road Construction Traffic

Construction Site Destination	Vehicle		Round Trip Distance (miles)	# of Round Trips/Well Pad/ Year
	Type	Class		
Well Pad and Access Road Construction Traffic	Semi Trucks	HDDV	20	3
	Pickup Trucks	LDDT	20	3
Pipeline Construction	Semi Trucks	HDDV	20	8
	Pickup Trucks	LDDT	20	8

Drilling/Completion/Fracing Traffic

Construction Site Destination	Vehicle		Round Trip Distance (miles)	# of Round Trips/activity/ Year
	Type	Class		
Drilling Traffic	Semi Trucks	HDDV	20	2
	Pickup Trucks	LDDT	20	20
Rig Hauling	Semi Trucks	HDDV	20	12
Rig Move Drilling Traffic	Semi Trucks	HDDV	20	1
	Pickup Trucks	LDDT	20	16
Well Completion & Testing	Semi Trucks	HDDV	20	36
	Pickup Trucks	LDDT	20	12

Cn_HEq_FDust Construction Traffic Dust

Area Disturbed for Oil Wells	Avg. Disturbed Acres per wellpad	Construction Days
Well Pad	6.00	2.50
Well Pad Access Road and Pipeline Construction	4.9	2.17

Road and Pipeline Construction, (Pipeline Percentage of Acreage)	6%

Data from Uncompahgre Field Office Air Quality Technical Support Document, ENVIRON, 2012

Ops_Well WO Workovers

Construction Equipment

Activity	Equipment Type	Capacity (hp)	# of Operating Hours/Day	# of Operating Days/Well	Load Factor	Well Workover Frequency per Year	NONROAD SCC
Well Workover	Workover Equipment	400	10	2	43	0.08	2270010010

Data from Uncompahgre Field Office Air Quality Technical Support Document, ENVIRON, 2012

Tier Level	HP Range for Efs	Tier Emission Factors (g/hp-hr)								
		VOC	CO	NO_x	PM_{10}	$PM_{2.5}$	SO_2	CO_2	CH_4	$N2O^a$
Tier 2	600-750	0.26	2.61	4.53	0.15	0.15	0.11	530	0.004	0.002

Traffic

Activity	Vehicle		Round Trip Distance (miles)	# of Round Trips/Well/ Year
	Type	Class		
Well Workover	WO Rig	HDDV	20	1
	Haul Truck	HDDV	20	1
	Pickup Truck	LDDT	20	2

blowdown Blowdown Venting

Type	Control Efficiency (%)	Volume of gas vented per blowdown Uncontrolled (MCF)	Frequency of Blowdown per well per year
Blowdown	0%	200	2.0

Data updated from White River Air Quality Technical Support Document, URS, 2012

well completion	Completion Venting
Type	**Total volume of gas during completion (mcf)**
All completions	1,000

Data updated from White River Air Quality Technical Support Document, URS, 2012

Recompletion	Recompletion Venting		
Type	**Control Efficiency (%)**	**Volume of gas vented per well per recompletion Uncontrolled (MCF)**	**No. of recompletion per well per year**
Recompletion	0%	1000	1%

Data updated from White River Air Quality Technical Support Document, URS, 2012

Compressor_Venting	Compressor Venting			
Type	**Control Efficiency (%)**	**Volume of gas vented per start-up or shutdown Uncontrolled (MCF)**	**Frequency of Start-up per well per year**	**Frequency of Shutdown per well per year**
Compressor Shutdown	0%	10	1	1

Data from Uncompahgre Field Office Air Quality Technical Support Document, ENVIRON, 2012

Wellhead Fugitives	Wellhead Fugitive Devices, Pneumatic Devices, and Pneumatic Pumps

Fugitive Devices

component	Ave. # in Gas Service	Ave. # in Liquid service	Ave. # in High Oil service	Ave. # in Water/Oil Service
valves	59	0	0	0
pump seals	0	0	0	0
others	3	0	0	0
connectors	193	0	0	0
flanges	0	0	0	0
open-ended lines	8	0	0	0

Input data from BLM, 2016b

Pneumatic Pumps

Type	Gallons/yr/pump	SCF/Gallon	Number of Pump
Pneumatic Pumps	-	-	-

Pneumatic Devices

Device	Number of Devices / well	Lo-Bleed Rate (cfh)
Liquid level controller	5	6
Transducer	5	6

WaterInjection_Pumps_Exh Water Injection Pumps

Type	Capacity (hp)	# of Units per well	Avg. Load Factor (%)	# of Operating Hours	Equipment Category	2015 Emission Factors (g/hp-hr)								
						NOxa	PM10b	SO2b	COa	VOCa	PM2.5b	CO2c	CH4c	N2Oc
Water Injection Pumps	34	1	47	8760	Pumps	0.70	2.00	1.00	0.04	0.04	0.001	134.94	0.003	0.0003

a Source: assume compressors will comply with NSPS 40 CFR part 60 subpart JJJJ (same rates as Colorado Regulation 7)
b Source: EPA, AP-42 Section 3.2 Natural Gas Fired Reciprocating Engines
c EPA Mandatory GHG Reporting, Part 98, Subpart C, Tables C-1 and C-2.

Produced Water and Condensate Truck Traffic

Construction Site Destination	Vehicle		Avg. Vehicle Speed (mph)	Round Trip Distance (miles)	# of Round Trips/BBL
	Type	Class			
Water Hauling	Haul Truck (130 bbl)	HDDV	35	20	0.008

Assumed 50% of the water production is hauled.

Ops_RoadMaint Maintenance Traffic

Activity	Vehicle		Total Miles Traveled Per Well	Avg. Vehicle Speed (mph)
	Type	Class		
Road Maintenance	Pickup Truck	LDDV	1	35

comp_main_Traffic Compressor Station Traffic

Activity	Vehicle Type	Avg. Vehicle Speed (mph)	Total Miles Traveled per Compressor Station
Compressor Maintenance	Pickup Truck	35	2,920

Reclaim-RdsWells Well Pad Reclamation

Activity	Vehicle Type	Avg. Vehicle Speed (mph)	Total Miles Traveled per Well
Road and Well Pad Reclamation	Pickup Truck	35	28

Others Traffic Other Traffic

Activity	Vehicle Type	Avg. Vehicle Speed (mph)	Round Trip Distance (miles)	# of Round Trips/Year/well
Fuel Hauling	HDDV	25	14	1.0

Heaters and Flaring	Heaters			
Wellsite Heaters	**Heater Rating (MMBtu/hr)**	**Fraction of the year heating**	**hr/yr**	**No.of Units per Well**
Heaters	0.50	0.30	8760	1
Reboilers	3.00	0.30	8760	0.002

Data from Uncompahgre Field Office Air Quality Technical Support Document, ENVIRON, 2012

Ops Dehy	Dehydrators	
Uncontrolled VOC Emissions (tons/mscf)	**Uncontrolled CH4 Emissions (tons/mscf)**	**Uncontrolled CO2 Emissions (tons/mscf)**
1.26E-07	1.60E-05	0.00E+00

APPENDIX F

Western Colorado Field Offices Conventional Oil Well Calculator Inputs by Source Category

Note: Yellow highlights indicate that inputs were obtained from the Uncompahgre Field Office Air Quality Technical Support Document, ENVIRON, 2012. All inputs taken from other sources are noted.

Gas Analysis & Venting	Speciated Sales Gas Analysis
Gas Component	**Mole Fraction (%)**
Methane C1	81.012
Ethane C2	4.334
Nitrogen	6.718
Water	0.000
Carbon Dioxide	5.380
Nitrous Oxide	0.000
Hydrogen Sulfide	0.000
Propane C3	1.437
i-Butane i-C4	0.288
n-Butane n-C4	0.329
i-Pentane iC5	0.154
n-Pentane nC5	0.104
Hexanes C6	0.111
Heptanes C7	0.037
Octanes+	0.017
Benzene	0.004
Ethylbenzene	0.000
n-Hexane n-C6	0.068
Toluene	0.003
2,2,4-Trimethylpentane	0.001
Xylenes	0.002

Cn_HEq_Exh Construction/Drilling/Completion Equipment

Construction Equipment

Construction Site	Equipment Type	Capacity (hp)	# of Units	Avg. Load Factor (%)	# of Operating Hours/Day	# of Operating Days/Well Pad	Equipment Category	HP Range
Well Pad	Construction Equipment	250	4	42	10	13	Other Construction Equipment	300
Well Pad Access Road	Construction Equipment	250	4	42	10	10	Other Construction Equipment	300
Pipeline	Construction Equipment	250	2	42	10	2	Other Construction Equipment	300

Construction Site	Equipment Type	2015 Emission Factors (g/hp-hr)								
		VOC	CO	NO_x	PM_{10}	$PM_{2.5}$	SO_2	CO_2	CH_4	N_2O[a]
Well Pad	Construction Equipment	0.24	0.86	2.63	0.16	0.16	0.00	536.14	0.02	0.02
Well Pad Access Road	Construction Equipment	0.24	0.86	2.63	0.16	0.16	0.00	536.14	0.02	0.02
Pipeline	Construction Equipment	0.24	0.86	2.63	0.16	0.16	0.00	536.14	0.02	0.02

Source: EPA MOVES2014a

[a]N2O factor source: 2009 API O&G GHG Methodologies Compendium, Tables 4-13 and 4-17. 130,500 Btu/gallon, 2545 Btu/hp-hr.

Drilling

Construction Site	Equipment Type	Capacity (hp)	# of Units	Avg. Load Factor (%)	# of Operating Hours/Day	# of Operating Days/activity	NONROAD SCC	Tier Level	HP Range for Efs
Rig-up, Drilling, and Rig-down	Drilling Equipment - Avg	2469	2	40	24	17	2270010010	Tier 2	>1200

Construction Site	Equipment Type	Tier Emission Factors (g/hp-hr)								
		VOC	CO	NO_x	PM_{10}	$PM_{2.5}$	SO_2	CO_2	CH_4	N2O[a]
Rig-up, Drilling, and Rig-down	Drilling Equipment - Avg	0.26	2.61	4.53	0.15	0.15	0.11	530	0.004	0.002

Source: EPA Federal Tier Standards

[a]N2O factor source: 2009 API O&G GHG Methodologies Compendium, Tables 4-13 and 4-17. 130,500 Btu/gallon, 2545 Btu/hp-hr.

Completion/Fracing

Equipment Type	Capacity (hp)	# of Units	Avg. Load Factor (%)	# of Operating Hours/Day	# of Operating Days/activity	NONROAD SCC	Tier Level	HP Range
Completion Equipment	1230	1	40	7	1	2270010010	Tier 2	>1200
Fracing Equipment	12000	1	85	24	1	2270010010	Tier 2	>1200
Refracing Equipment	1500	4	97	1	3	2270010010	Tier 2	>1200

Grand Junction Field Office Air Quality Technical Support Document, ENVIRON, 2012
Data updated from White River Air Quality Technical Support Document, URS, 2012 (Fracing Equipment), and from Uncompahgre Field Office Air Quality Technical Support Document, ENVIRON, 2012 (Completion)

Equipment Type	Capacity (hp)	Tier Emission Factors (g/hp-hr)								
		VOC	CO	NO_x	PM_{10}	$PM_{2.5}$	SO_2	CO_2	CH_4	N_2O[a]
Completion Equipment	1230	0.26	2.61	4.53	0.15	0.15	0.11	523	0.004	0.002
Fracing Equipment	12000	0.26	2.61	4.53	0.15	0.15	0.11	523	0.004	0.002
Refracing Equipment	1500	0.26	2.61	4.53	0.15	0.15	0.11	523	0.004	0.002

Source: EPA Federal Tier Standards
[a]N2O factor source: 2009 API O&G GHG Methodologies Compendium, Tables 4-13 and 4-17. 130,500 Btu/gallon, 2545 Btu/hp-hr.

Fracing frequency per spud	1
Refracing Frequency per Year per Well	0.05

Cn_CV_Exh Construction Traffic Exhaust

Well Pad and Access Road Construction Traffic

Construction Site Destination	Vehicle		Round Trip Distance (miles)	# of Round Trips/Well Pad/ Year
	Type	Class		
Well Pad and Access Road Construction Traffic	Semi Trucks	HDDV	4	80
	Pickup Trucks	LDDT	4	30
Pipeline Construction	Semi Trucks	HDDV	5	16
	Pickup Trucks	LDDT	5	18

Drilling/Completion/Fracing Traffic

Construction Site Destination	Vehicle		Round Trip Distance (miles)	# of Round Trips/activity/ Year
	Type	Class		
Drilling Traffic	Semi Trucks	HDDV	4	136
	Pickup Trucks	LDDT	5	136
Rig Hauling	Semi Trucks	HDDV	5	1
Rig Move Drilling Traffic	Semi Trucks	HDDV	5	90
	Pickup Trucks	LDDT	5	42
Well Completion & Testing	Semi Trucks	HDDV	5	84
	Pickup Trucks	LDDT	5	74

Cn_HEq_FDust Construction Traffic Dust

Area Disturbed for Oil Wells	Avg. Disturbed Acres per wellpad	Construction Days
Well Pad	4.88	13
Well Pad Access Road and Pipeline Construction	9	10

Road and Pipeline Construction, (Pipeline Percentage of Acreage)	6%

Ops_Well WO Workovers

Construction Equipment

Activity	Equipment Type	Capacity (hp)	# of Operating Hours/Day	# of Operating Days/Well	Load Factor	Well Workover Frequency per Year	NONROAD SCC
Well Workover	Workover Equipment	638	9	6	43	0.08	2270010010

Tier Level	HP Range for Efs	Tier Emission Factors (g/hp-hr)								
		VOC	CO	NO_x	PM_{10}	$PM_{2.5}$	SO_2	CO_2	CH_4	$N2O^a$
Tier 2	600-750	0.26	2.61	4.53	0.15	0.15	0.11	530	0.004	0.002

Traffic

Activity	Vehicle		Round Trip Distance (miles)	# of Round Trips/Well/ Year
	Type	Class		
Well Workover	WO Rig	HDDV	4	4
	Haul Truck	HDDV	4	12
	Pickup Truck	LDDT	4	20

blowdown Blowdown Venting

Type	Control Efficiency (%)	Volume of gas vented per blowdown Uncontrolled (MCF)	Frequency of Blowdown per well per year
Blowdown	0%	0.75	3.0

Data updated from White River Air Quality Technical Support Document, URS, 2012

well completion	Completion Venting
Type	**Total volume of gas during completion (mcf)**
All completions	1,000

Data updated from White River Air Quality Technical Support Document, URS, 2012

Recompletion	Recompletion Venting		
Type	**Control Efficiency (%)**	**Volume of gas vented per well per recompletion Uncontrolled (MCF)**	**No. of recompletion per well per year**
Recompletion	0%	1000	1%

Data updated from White River Air Quality Technical Support Document, URS, 2012

Compressor_Venting	Compressor Venting			
Type	**Control Efficiency (%)**	**Volume of gas vented per start-up or shutdown Uncontrolled (MCF)**	**Frequency of Start-up per well per year**	**Frequency of Shutdown per well per year**
Compressor Shutdown	0%	10	1	1

Wellhead Fugitives	Wellhead Fugitive Devices, Pneumatic Devices, and Pneumatic Pumps

Fugitive Devices

component	Ave. # in Gas Service	Ave. # in Liquid service	Ave. # in High Oil service	Ave. # in Water/Oil Service
valves	38	33	0	12
pump seals	1	0	0	0
others	14	5	0	2
connectors	177	199	0	30
flanges	19	15	0	8
open-ended lines	7	3	0	5

Input data from BLM, 2016b

Pneumatic Pumps

Type	Gallons/yr/pump	SCF/Gallon	Number of Pump
Pneumatic Pumps	91	118	1

Pneumatic Devices

Device	Number of Devices / well	Lo-Bleed Rate (cfh)
Liquid level controller	2	6
Pressure controller	1	6
Valve controllers	2.0	6
Liquid level controller	0.1	6

Data updated from Colorado River Valley Air Quality Technical Support Document, URS, 2012

WaterInjection_Pumps_Exh Water Injection Pumps

Type	Capacity (hp)	# of Units per well	Avg. Load Factor (%)	# of Operating Hours	Equipment Category	2015 Emission Factors (g/hp-hr)								
						VOC	CO	NO_x	PM_{10}	$PM_{2.5}$	SO_2	CO_2	CH_4	N_2O[a]
Water Injection Pumps	347	0.06	47	2920	Pumps	0.70	2.00	1.00	0.04	0.04	0.001	134.94	0.003	0.0003

Source: EPA MOVES2014a

[a]N2O factor source: 2009 API O&G GHG Methodologies Compendium, Tables 4-13 and 4-17. 130,500 Btu/gallon, 2545 Btu/hp-hr.

Misc_Engines_Exh Miscellaneous Engines

Construction Site	Capacity (hp)	# of Units per Well	Fraction of wells to be served by Miscellaneous engine	Avg. Load Factor (%)	# of Operating Hours/Well	Equipment Category
Misc. Engines	139	1	0.41	47	2925	Misc. Engines

HP Range	2015 Emission Factors (g/hp-hr)								
	VOC	CO	NO_x	PM_{10}	$PM_{2.5}$	SO_2	CO_2	CH_4	N_2O[a]
175	0.21	0.60	2.16	0.15	0.15	0.003	530.45	0.02	0.02

Source: EPA MOVES2014a

[a]N2O factor source: 2009 API O&G GHG Methodologies Compendium, Tables 4-13 and 4-17. 130,500 Btu/gallon, 2545 Btu/hp-hr.

Condensate Tanks & Traffic	Crude Oil Tanks
Type	***Base Year Assumptions***
Condensate	1. All Crude Oil Throughput Sent Tanks
	2. Average Crude Oil Truck Haulout of 200 bbl/load
Produced Water	3. 50% of produced water hauled by truck.
	4. Average Water Truck Haulout of 130 bbl/load
	5. Based on water production estimates by well type and planning area from the IHS Energy database provided by BLM staff.

Uncontrolled VOC Emission Factors for Condensate Tanks

3.2	lb/bbl

source: CDPHE, 2014. Stationary Sources Program / Air Pollution Control Division, PS Memo 14-03: Oil & Gas Industry Crude Oil, Condensate and Produced Water Atmospheric Storage Tanks Regulatory Definitions and Permitting Guidance for General Permit GP08. https://www.colorado.gov/pacific/sites/default/files/AP_Memo-14-03-GP08-Guidance.pdf

Flash Gas Weight Fractions

CO2 Fraction in Flash Gas	%wt	2
CH4 Fraction in Flash Gas	%wt	9
VOC Fraction in Flash Gas	%wt	58
VOC Molecular weight in Flash gas	lb/lb-mol	36

Condensate Truck Load-out

True vapor pressure of liquid loaded, pounds per square inch absolute (psia)	5.2
Mode of Operation	submerged loading: dedicated normal service

Produced Water and Condensate Truck Traffic

Construction Site Destination	Vehicle		Avg. Vehicle Speed (mph)	Round Trip Distance (miles)	# of Round Trips/BBL
	Type	Class			
Produced Condensate Hauling	Haul Truck (200 bbl)	HDDV	25	4	0.005
Water Hauling	Haul Truck (130 bbl)	HDDV	25	20	0.008

Based on 50% of the water production being hauled. BLM Coalbed Methane Emissions Calculator. Received from BLM March 2012

Ops_RoadMaint Maintenance Traffic

Activity	Vehicle		Total Miles Traveled Per Well	Avg. Vehicle Speed (mph)
	Type	Class		
Road Maintenance	Pickup Truck	LDDV	18	35

Compressor_Engines Compressor Engines

Type of Compressors / Pumps	Rate (Hp)	# Units per Well	Annual Compression (Hp)	Operating Hours/Year
Wellhead Compressor Engines	45	0.1	4	6,778
Lateral Compressor Engines	212	0.02	5	8,760

comp_main_ Traffic Compressor Station Traffic

Activity	Vehicle Type	Avg. Vehicle Speed (mph)	Total Miles Traveled per Compressor Station
Compressor Maintenance	Pickup Truck	35	855

Reclaim-RdsWells Well Pad Reclamation

Activity	Vehicle Type	Avg. Vehicle Speed (mph)	Total Miles Traveled per Well
Road and Well Pad Reclamation	Pickup Truck	35	1,110

Others Traffic Other Traffic

Activity	Vehicle Type	Avg. Vehicle Speed (mph)	Round Trip Distance (miles)	# of Round Trips/Year/well
Fuel Hauling	HDDV	25	7	0.6

Heaters and Flaring Heaters

Wellsite Heaters	Heater Rating (MMBtu/hr)	Fraction of the year heating	hr/yr	No.of Units per Well
Heaters	0.83	0.57	4964	1
Reboilers	0.67	0.53	4599	1

Ops Dehy Dehydrators

Uncontrolled VOC Emissions (tons/mscf)	Uncontrolled CH4 Emissions (tons/mscf)	Uncontrolled CO2 Emissions (tons/mscf)
2.51E-06	4.03E-06	3.15E-07

Data updated from White River Air Quality Technical Support Document, URS, 2012

APPENDIX G

Mancos Shale Gas Well
Calculator Inputs by Source Category

Note: Yellow highlights indicate that inputs were obtained from the BLM inputs provided for the Mancos Shale.
Note: Green highlights indicate that inputs were obtained from TRFO shale gas calculator.

Gas Analysis & Venting	Speciated Sales Gas Analysis
Gas Component	Mole Fraction (%)
Methane C1	96.028
Ethane C2	0.270
Nitrogen	0.272
Water	0.000
Carbon Dioxide	3.420
Nitrous Oxide	0.000
Hydrogen Sulfide	0.000
Propane C3	0.001
i-Butane i-C4	0.000
n-Butane n-C4	0.000
i-Pentane iC5	0.000
n-Pentane nC5	0.000
Hexanes+ C6+	0.001
Heptanes C7	0.000
Octanes	0.000
Benzene	0.015
Ethylbenzene	0.000
n-Hexane n-C6	0.001
Toluene	0.005
2,2,4-Trimethylpentane	0.000
Xylenes	0.001
Helium	0.000
O2	0.000

Cn_HEq_Exh Construction/Drilling/Completion Equipment

Construction Equipment

Construction Site	Equipment Type	Capacity (hp)	# of Units	Avg. Load Factor (%)	# of Operating Hours/Day	# of Operating Days/Well Pad
Well Pad	Trackhoe	100	1	59	10	4
	Dozer	140	1	59	10	4
	Grader	250	1	59	10	4
Well Pad Access Road	Backhoe	100	1	59	10	4
	Dozer	140	1	59	10	4
	Grader	250	1	59	10	3
Pipeline	Backhoe	100	1	59	0	0
	Dozer	140	1	59	0	0
	Grader	250	1	59	10	3

Construction Site	Equipment Type	2015 Emission Factors (g/hp-hr)								
		VOC	CO	NO_x	PM_{10}	$PM_{2.5}$	SO_2	CO_2	CH_4	N_2O[a]
All Sites	100 HP Construction Equipment	0.34	2.86	3.24	0.39	0.38	0.00	595.17	0.02	0.02
All Sites	140 HP Construction Equipment	0.27	1.11	2.83	0.24	0.23	0.00	536.06	0.02	0.02
All Sites	250 HP Construction Equipment	0.24	0.86	2.63	0.16	0.16	0.00	536.14	0.02	0.02

Source: EPA MOVES2014a

[a]N2O factor source: 2009 API O&G GHG Methodologies Compendium, Tables 4-13 and 4-17. 130,500 Btu/gallon, 2545 Btu/hp-hr.

Drilling

Equipment Type	Capacity (hp)	# of Units	Avg. Load Factor (%)	Average # of Operating Hours/Day	# of Operating Days/activity
Main Deck	1468	4	50	24	24
Generators	150	1	75	24	24

Equipment Type	Tier Level	Tier Emission Factors (g/hp-hr)								
		VOC	CO	NO_x	PM_{10}	$PM_{2.5}$	SO_2	CO_2	CH_4	N2O[a]
Main Deck	Tier 2	0.26	2.61	4.53	0.15	0.15	0.11	530	0.004	0.002
Generators	Tier 2	0.26	3.73	4.68	0.22	0.22	0.11	530	0.004	0.002

Source: EPA Federal Tier Standards

[a]N2O factor source: 2009 API O&G GHG Methodologies Compendium, Tables 4-13 and 4-17. 130,500 Btu/gallon, 2545 Btu/hp-hr.

Completion/Fracing

Equipment Type	Capacity (hp)	# of Units	Avg. Load Factor (%)	# of Operating Hours/Day	# of Operating Days/activity	NONROAD SCC	Tier Level
Main Deck	600	1	80	24	0.3	2270010010	Tier 2
Auxiliary Pump	500	1	80	24	0.3	2270010010	Tier 2
Generators	400	1	75	24	0.3	2270010010	Tier 2
Main Deck	600	1	50	12	7.0	2270010010	Tier 2
Auxiliary Pump	225	1	80	12	3.0	2270010010	Tier 2
Power Swivel	150	1	75	12	3.0	2270010010	Tier 2
Field Generators for Pumps & Lighting	55	3	75	10	25.0	2270010010	Tier 2

Equipment Type	Capacity (hp)	Tier Emission Factors (g/hp-hr)								
		VOC	CO	NO_x	PM_{10}	$PM_{2.5}$	SO_2	CO_2	CH_4	N_2O[a]
Main Deck	600	0.26	2.61	4.53	0.15	0.15	0.11	523	0.004	0.002
Auxiliary Pump	500	0.26	2.61	4.53	0.15	0.15	0.11	523	0.004	0.002
Generators	400	0.26	2.61	4.53	0.15	0.15	0.11	523	0.004	0.002
Main Deck	600	0.26	2.61	4.53	0.15	0.15	0.11	523	0.004	0.002
Auxiliary Pump	225	0.26	2.61	4.68	0.15	0.15	0.11	523	0.004	0.002
Power Swivel	150	0.26	3.73	4.68	0.22	0.22	0.11	520	0.004	0.002
Field Generators for Pumps & Lighting	55	0.30	3.73	5.31	0.30	0.30	0.11	520	0.005	0.002

Source: EPA Federal Tier Standards

[a]N2O factor source: 2009 API O&G GHG Methodologies Compendium, Tables 4-13 and 4-17. 130,500 Btu/gallon, 2545 Btu/hp-hr.

Fracing frequency per spud	1
Refracing Frequency per Year per Well	0

Area Disturbed for Gas Wells	Avg. Disturbed Acres per wellpad*	Construction Days
Well Pad	4.90	4.00
Well Pad Access Road and Pipeline Construction	9.00	4.00

**includes frac pond, construction days are a weighted average based on acres disturbed*

Cn_CV_Exh Construction Traffic Exhaust

Well Pad and Access Road Construction Traffic

Construction Site Destination	Vehicle		Round Trip Distance (miles)	# of Round Trips/Well Pad/ Year
	Type	Class		
Well Pad and Access Road Construction Traffic	Semi Trucks	Heavy Duty Haul Trucks	144	11
	Pickup Trucks	Passenger Truck	144	48
Pipeline Construction	Semi Trucks	Heavy Duty Haul Trucks	144	1
	Pickup Trucks	Passenger Truck	144	15

Drilling/Completion/Fracing Traffic

Construction Site Destination	Vehicle		Round Trip Distance (miles)	# of Round Trips/activity/ Year
	Type	Class		
Drilling Traffic	Semi Trucks	Heavy Duty Haul Trucks	175	21
	Pickup Trucks	Passenger Truck	144	6
Rig Hauling	Semi Trucks	Combination Short-haul Truck	144	2
Well Completion & Testing	Semi Trucks	Combination Short-haul Truck	89	175
	Pickup Trucks	Passenger Truck	144	13

Ops_Well WO Workovers

Construction Equipment

Activity	Equipment Type	Average Capacity (hp)	# of Operating Hours/Day	No. of Engines	# of Operating Days/Well	Load Factor	Well Workover Frequency per Year
Well Workover	Workover Equipment	600	10	1	3	43	1

Tier Level	HP Range for Efs	Tier Emission Factors (g/hp-hr)								
		VOC	CO	NO_x	PM_{10}	$PM_{2.5}$	SO_2	CO_2	CH_4	N2O[a]
Tier 2	600-750	0.26	2.61	4.53	0.15	0.15	0.11	530	0.004	0.002

Traffic

Activity	Vehicle		Round Trip Distance (miles)	# of Round Trips/Well/ Year
	Type	Class		
Well Workover	WO Rig	Combination Short-haul Truck	144	1
	Haul Truck	Combination Short-haul Truck	144	1
	Pickup Truck	Passenger Truck	144	3

Blowdowns — Blowdown Venting

Type	Control Efficiency (%)	Volume of gas vented per blowdown Uncontrolled (MCF)	Frequency of Blowdown per well per year
Blowdown	0%	0.81	3.4

Well completions — Completion Venting

Type	Total volume of gas during completion (mcf)
All completions	700

Recompletions — Recompletion Venting

Type	Control Efficiency (%)	Volume of gas vented per well per recompletion Uncontrolled (MCF)	No. of recompletion per well per year
Recompletion	0%	30	0.5

Misc_Engines_Exh — Miscellaneous Engines

Construction Site	Capacity (hp)	# of Units per Well	Fraction of wells to be served by Miscellaneous engine	Avg. Load Factor (%)	# of Operating Hours/Well
Miscellaneous Engines	0	0	0	0	0

Wellhead Fugitives — Wellhead Fugitive Devices, Pneumatic Devices, and Pneumatic Pumps

Fugitive Devices

component	Ave. # in Gas Service	Ave. # in Liquid service	Ave. # in High Oil service	Ave. # in Water/Oil Service
valves	22	6	0	1
pump seals	20	10	0	0
others	0	0	0	0
connectors	15	15	0	0
flanges	18	11	0	1
open-ended lines	0	0	0	0

Pneumatic Pumps

Type	Gallons/yr/pump	SCF/Gallon	Number of Pump
Pneumatic Pumps	91	118	1

Pneumatic Devices

Device	Number of Devices / well	Lo-Bleed Rate (cfh)
Liquid level controller	2	6
Pressure controller	1	6
Valve controllers	2	6

Ops_RoadMaint — Maintenance Traffic

Activity	Vehicle		Total Miles Traveled Per Well	Avg. Vehicle Speed (mph)
	Type	Class		
Road Maintenance	Road Maintenance	Pickup Truck	18	35

Produced Water Truck Traffic

Construction Site Destination	Vehicle		Avg. Vehicle Speed (mph)	Round Trip Distance (miles)	Trips/Year/well
	Type	Class			
Water Hauling	Haul Truck	Combination Short-haul Truck	25	4	4

Compressor_Engines Compressor Engines

Type of Compressors / Pumps	Rate (Hp)	# Units per Well	Annual Compression (Hp)	Operating Hours/Year
Wellhead Compressor Engines	100	0.2	20	8,760
Lateral Compressor Engines	0	0	0	0

Reclamation Well Pad Reclamation

Activity	Vehicle Type	Avg. Vehicle Speed (mph)	Total Miles Traveled per Well
Road and Well Pad Reclamation	Pickup Truck	35	416

Others Traffic Other Traffic

Activity	Vehicle Type	Avg. Vehicle Speed (mph)	Round Trip Distance (miles)	# of Round Trips/Year/well
Fuel Haul Truck	Combination Short-haul Truck	25	7	0.6

Heaters and Flaring Heaters

Wellsite Heaters	Heater Rating (MMBtu/hr)	Annual Hours (hr/yr)	No. of Units per Well
Heaters	0.23	1460	1
Reboilers	0.38	4320	0.007

Ops Dehy Dehydrators

Uncontrolled VOC Emissions (tons/mscf)	Uncontrolled CH4 Emissions (tons/mscf)	Uncontrolled CO2 Emissions (tons/mscf)
2.13E-08	1.55E-05	4.35E-07

APPENDIX H

Mancos Shale Oil Well
Calculator Inputs by Source Category

Note: Yellow highlights indicate that inputs were obtained from the BLM inputs provided for the Mancos Shale.
Note: Green highlights indicate that inputs were obtained from TRFO conventional oil calculator.

Gas Analysis & Venting	Speciated Sales Gas Analysis
Gas Component	Mole Fraction (%)
Methane C1	88.972
Ethane C2	5.792
Nitrogen	0.094
Carbon Dioxide	2.528
Propane C3	1.365
i-Butane i-C4	0.370
n-Butane n-C4	0.261
i-Pentane iC5	0.155
n-Pentane nC5	0.102
Hexanes+ C6+	0.146
Heptanes C7	0.093
Octanes	0.065
Benzene	0.027
n-Hexane n-C6	0.146
Toluene	0.019
2,2,4-Trimethylpentane	0.000
Xylenes	0.011
Helium	0.000
O2	0.000

Cn_HEq_Exh Construction/Drilling/Completion Equipment

Construction Equipment

Construction Site	Equipment Type	Capacity (hp)	# of Units	Avg. Load Factor (%)	# of Operating Hours/Day	# of Operating Days/Well Pad
Well Pad	Trackhoe	100	1	59	10	4
	Dozer	140	1	59	10	4
	Grader	250	1	59	10	4
Well Pad Access Road	Backhoe	100	1	59	10	4
	Dozer	140	1	59	10	4
	Grader	250	1	59	10	3
Pipeline	Backhoe	100	1	59	0	0
	Dozer	140	1	59	0	0
	Grader	250	1	59	10	3

Construction Site	Equipment Type	2015 Emission Factors (g/hp-hr)								
		VOC	CO	NO_x	PM_{10}	$PM_{2.5}$	SO_2	CO_2	CH_4	N_2O[a]
All Sites	100 HP Construction Equipment	0.34	2.86	3.24	0.39	0.38	0.00	595.17	0.02	0.02
All Sites	140 HP Construction Equipment	0.27	1.11	2.83	0.24	0.23	0.00	536.06	0.02	0.02
All Sites	250 HP Construction Equipment	0.24	0.86	2.63	0.16	0.16	0.00	536.14	0.02	0.02

Source: EPA MOVES2014a

[a]N2O factor source: 2009 API O&G GHG Methodologies Compendium, Tables 4-13 and 4-17. 130,500 Btu/gallon, 2545 Btu/hp-hr.

Area Disturbed for Oil Wells	Avg. Disturbed Acres per wellpad*	Construction Days
Well Pad	4.9	4
Well Pad Access Road and Pipeline Construction	9	4

Drilling

Equipment Type	Capacity (hp)	# of Units	Avg. Load Factor (%)	Average # of Operating Hours/Day	# of Operating Days/activity
Vertical Drill Rig Engine	1000	1	42	24	4
Horizontal Drill Rig Engine	1000	1	59	24	8
Drill Rig Generator	350	1	42	24	12
Trailers Generator	150	1	42	24	12
Air Compressor	550	1	42	24	4
Air Compressor	550	1	42	24	4
Air Compressor Booster	650	1	42	24	4
Forklift	120	1	42	24	4
Aerial Lift	50	1	42	24	0.5
Frontend loader	150	1	42	24	0.5
Dozer	175	1	42	24	0.3

Equipment Type	Tier Level	Tier Emission Factors (g/hp-hr)								
		VOC	CO	NO_x	PM_{10}	$PM_{2.5}$	SO_2	CO_2	CH_4	N2O[a]
Vertical Drill Rig Engine	Tier 2	0.26	2.61	4.53	0.15	0.15	0.11	530	0.004	0.002
Horizontal Drill Rig Engine	Tier 2	0.26	2.61	4.53	0.15	0.15	0.11	530	0.004	0.002
Drill Rig Generator	Tier 2	0.26	2.61	4.53	0.15	0.15	0.11	530	0.004	0.002
Trailers Generator	Tier 2	0.26	3.73	4.68	0.22	0.22	0.11	530	0.004	0.002
Air Compressor	Tier 2	0.26	2.61	4.53	0.15	0.15	0.11	530	0.004	0.002
Air Compressor	Tier 2	0.26	2.61	4.53	0.15	0.15	0.11	530	0.004	0.002
Air Compressor Booster	Tier 2	0.26	2.61	4.53	0.15	0.15	0.11	530	0.004	0.002
Forklift	Tier 2	0.26	3.73	4.68	0.22	0.22	0.11	530	0.004	0.002
Aerial Lift	Tier 2	0.30	3.73	5.31	0.30	0.30	0.11	530	0.005	0.002
Frontend loader	Tier 2	0.26	3.73	4.68	0.22	0.22	0.11	530	0.004	0.002
Dozer	Tier 2	0.26	2.61	4.68	0.15	0.15	0.11	530	0.004	0.002

Source: EPA Federal Tier Standards

[a]N2O factor source: 2009 API O&G GHG Methodologies Compendium, Tables 4-13 and 4-17. 130,500 Btu/gallon, 2545 Btu/hp-hr.

Completion/Fracing

Equipment Type	Capacity (hp)	# of Units	Avg. Load Factor (%)	# of Operating Hours/Day	# of Operating Days/activity	NONROAD SCC	Tier Level
Frac Pump	1500	1	59	24	3	2270010010	Tier 2
Frac Pump	1500	1	59	24	3	2270010010	Tier 2
Frac Pump	1500	1	59	24	3	2270010010	Tier 2
Frac Pump	1500	1	59	24	3	2270010010	Tier 2
Frac Pump	1500	1	59	24	3	2270010010	Tier 2
Blenders	500	1	42	1	3	2270010010	Tier 2
Auxilary Pump	200	1	42	1	3	2270010010	Tier 2
Sand King	100	1	42	3	3	2270010010	Tier 2
Sand King	100	1	42	3	3	2270010010	Tier 2
Generator	150	1	42	24	3	2270010010	Tier 2

Equipment Type	Capacity (hp)	Tier Emission Factors (g/hp-hr)								
		VOC	CO	NO_x	PM_{10}	$PM_{2.5}$	SO_2	CO_2	CH_4	N_2O[a]
Frac Pump	1500	0.26	2.61	4.53	0.15	0.15	0.11	523	0.004	0.002
Frac Pump	1500	0.26	2.61	4.53	0.15	0.15	0.11	523	0.004	0.002
Frac Pump	1500	0.26	2.61	4.53	0.15	0.15	0.11	523	0.004	0.002
Frac Pump	1500	0.26	2.61	4.53	0.15	0.15	0.11	523	0.004	0.002
Frac Pump	1500	0.26	2.61	4.53	0.15	0.15	0.11	523	0.004	0.002
Blenders	500	0.26	2.61	4.53	0.15	0.15	0.11	523	0.004	0.002
Auxilary Pump	200	0.26	2.61	4.68	0.15	0.15	0.11	523	0.004	0.002
Sand King	100	0.30	3.73	5.31	0.30	0.30	0.11	520	0.005	0.002
Sand King	100	0.30	3.73	5.31	0.30	0.30	0.11	520	0.005	0.002
Generator	150	0.26	3.73	4.68	0.22	0.22	0.11	520	0.004	0.002

Source: EPA Federal Tier Standards

[a]N2O factor source: 2009 API O&G GHG Methodologies Compendium, Tables 4-13 and 4-17. 130,500 Btu/gallon, 2545 Btu/hp-hr.

Fracing frequency per spud	1
Refracing Frequency per Year per Well	0

Cn_CV_Exh Construction Traffic Exhaust

Well Pad and Access Road Construction Traffic

Construction Site Destination	Vehicle		Round Trip Distance (miles)	# of Round Trips/Well Pad/ Year
	Type	Class		
Well Pad and Access Road Construction Traffic	Semi Trucks	Heavy Duty Haul Trucks	40.0	15.0
	Pickup Trucks	Passenger Truck	40.0	32.0
Pipeline Construction	Semi Trucks	Heavy Duty Haul Trucks	40.0	6.0
	Pickup Trucks	Passenger Truck	40.0	0.0

Drilling/Completion/Fracing Traffic

Construction Site Destination	Vehicle		Round Trip Distance (miles)	# of Round Trips/activity/ Year
	Type	Class		
Drilling Traffic	Semi Trucks	Heavy Duty Haul Trucks	40	24
	Pickup Trucks	Passenger Truck	40	52
Conductor Set Traffic	Semi Trucks	Combination Short-haul Truck	40	1
	Pickup Trucks	Passenger Truck	40	5
Well Completion & Testing	Semi Trucks	Combination Short-haul Truck	40	32
	Pickup Trucks	Passenger Truck	40	60

Ops_Well WO Workovers

Construction Equipment

Activity	Equipment Type	Average Capacity (hp)	# of Operating Hours/Day	No. of Engines	# of Operating Days/Well	Load Factor	Well Workover Frequency per Year
Well Workover	Workover Equipment	504	9	3	2	42	1

Tier Level	HP Range for Efs	Tier Emission Factors (g/hp-hr)								
		VOC	CO	NO_x	PM_{10}	$PM_{2.5}$	SO_2	CO_2	CH_4	N2O[a]
Tier 2	300-600	0.26	2.61	4.53	0.15	0.15	0.11	530	0.004	0.002

Traffic

Activity	Vehicle	Round Trip Distance	# of Round

	Type	Class	(miles)	Trips/Well/ Year
Well Workover	WO Rig	Combination Short-haul Truck	0.0	0.0
	Haul Truck	Combination Short-haul Truck	40.0	6.0
	Pickup Truck	Passenger Truck	40.0	6.0

Blowdowns	Blowdown Venting		
Type	**Control Efficiency (%)**	**Volume of gas vented per blowdown Uncontrolled (MCF)**	**Frequency of Blowdown per well per year**
Blowdown	0%	0.75	3.0

Well completions	Completion Venting
Type	**Total volume of gas during completion (mcf)**
All completions	1,000

Recompletions	Recompletion Venting		
Type	**Control Efficiency (%)**	**Volume of gas vented per well per recompletion Uncontrolled (MCF)**	**No. of recompletion per well per year**
Recompletion	0%	5	1

Misc_Engines_Exh	Miscellaneous Engines				
Construction Site	**Capacity (hp)**	**# of Units per Well**	**Fraction of wells to be served by Miscellaneous engine**	**Avg. Load Factor (%)**	**# of Operating Hours/Well**
Pumpjack Engines	65	1	1.0	54	4368

HP Range	2015 Emission Factors (g/hp-hr)								
	VOC	CO	NO_x	PM_{10}	$PM_{2.5}$	SO_2	CO_2	CH_4	N_2O^a
75	0.44	4.80	2.80	0.18	0.18	0.00	424.16	0.01	0.001

source: NOx and CO from Subpart JJJJ, remaining pollutants from AP-42 rich burn 4-stroke engine emission rates

Wellhead Fugitives	Wellhead Fugitive Devices, Pneumatic Devices, and Pneumatic Pumps

Fugitive Devices

component	Ave. # in Gas Service	Ave. # in Liquid service	Ave. # in High Oil service	Ave. # in Water/Oil Service
valves	9	13	0	3
pump seals	0	0	0	0
others	0	0	0	0
connectors	19	19	0	0
flanges	10	30	0	4
open-ended lines	0	0	0	0

Pneumatic Pumps

Assumed no pneumatic pumps at oil wels

Pneumatic Devices

Device	Number of Devices / well	Lo-Bleed Rate (cfh)
Liquid level controller	2	6
Pressure controller	1	6
Valve controllers	2	6

Ops_RoadMaint Maintenance Traffic

Activity	Vehicle		Total Miles Traveled Per Well	Avg. Vehicle Speed (mph)
	Type	Class		
Road Maintenance	Road Maintenance	Combination Short-haul Truck	80	25

Oil Tanks & Traffic	Oil Tanks
Type	***Base Year Assumptions***
Oil	1. All Oil Throughput Sent Tanks
	2. Average Oil Truck Haul-out of 200 bbl/load
Produced Water	3. 50% of produced water hauled by truck.
	4. Average Water Truck Haulout of 130 bbl/load
	5. Based on water production estimates by well type and planning area from the IHS Energy database provided by BLM staff.

Uncontrolled VOC Emission Factors for Oil and Water Tanks

Oil Tank VOC Emission rate	2.7	lb/bbl
Water Tank VOC Emission rate*	0.26	lb/bbl

**CDPHE Oil and Gas Regulation No. 7 Guidance: An Overview of the Regulations. Table 1*

Flash Gas Weight Fractions

CO2 Fraction in Flash Gas	%wt	3
CH4 Fraction in Flash Gas	%wt	10
VOC Fraction in Flash Gas	%wt	62
VOC Molecular weight in Flash gas	lb/lb-mol	54

Oil Truck Load-out

True vapor pressure of liquid loaded, pounds per square inch absolute (psia)	2.3
Temperature of Loaded Liquid (ºR)	510
Mode of Operation	submerged loading: dedicated normal service

Produced Water and Oil Truck Traffic

Construction Site Destination	Vehicle		Avg. Vehicle Speed (mph)	Round Trip Distance (miles)
	Type	Class		
Produced Oil Hauling	Haul Truck	Combination Short-haul Truck	25	40
Water Hauling	Haul Truck	Combination Short-haul Truck	25	40

Compressor_Engines Compressor Engines

Type of Compressors / Pumps	Rate (Hp)	# Units per Well	Annual Compression (Hp)	Operating Hours/Year
Wellhead Compressor Engines	0	0	0	0
Lateral Compressor Engines	0	0	0	0

** no compressor engines are expected to be associated with shale oil wells*

Reclamation Well Pad Reclamation

Activity	Vehicle Type	Avg. Vehicle Speed (mph)	Total Miles Traveled per Well
Road and Well Pad Reclamation	Pickup Truck	35	416

Others Traffic Other Traffic

Activity	Vehicle Type	Avg. Vehicle Speed (mph)	Round Trip Distance (miles)	# of Round Trips/Year/well
Operations Traffic	Pickup Truck	35	40	50

Heaters and Flaring Heaters

Wellsite Heaters	Heater Rating (MMBtu/hr)	Annual Hours (hr/yr)	No. of Units per Well
Heaters	0.75	4368	1
Reboilers	0.00	0	0

Ops Dehy Dehydrators

Assumed no dehydrators at oil wells

APPENDIX I

Midstream Emissions by Field Office and Facility

Field Office	County	Facility Name	Base Year Emissions (tons/year)					
			NO_x	VOC	CO	PM_{10}	$PM_{2.5}$	SO_2
CRVFO (outside Roan Plat.)	Garfield	BARGATH LLC - CALLAHAN C.S.	103.75	47.20	36.03	2.360	2.360	0.130
CRVFO (outside Roan Plat.)	Garfield	BARGATH LLC - GRAND VALLEY	2.87	0.16	3.27	0.000	0.000	0.000
CRVFO (outside Roan Plat.)	Garfield	BARGATH LLC - JANGLES	68.00	30.68	22.80	1.550	1.550	0.093
CRVFO (outside Roan Plat.)	Garfield	BARGATH LLC - STARKEY GULCH CS	132.00	49.75	39.00	2.687	2.687	0.161
CRVFO (outside Roan Plat.)	Garfield	BARGATH LLC - UNA COMPRESSOR STATION	65.96	25.57	19.40	1.350	1.350	0.060
CRVFO (outside Roan Plat.)	Garfield	BARGATH, LLC - HYRUP PROD FACILITY	88.92	38.64	32.10	4.850	4.790	0.290
CRVFO (outside Roan Plat.)	Garfield	CAERUS PICEANCE - GARDEN GULCH C.S.	26.20	43.47	39.14	1.487	1.487	0.089
CRVFO (outside Roan Plat.)	Garfield	CAERUS PICEANCE - RULISON COMPR. STN	38.84	4.01	14.68	0.844	0.844	0.051
CRVFO (outside Roan Plat.)	Garfield	CAERUS PICEANCE - STARKEY C MASTER METER	0.00	1.52	0.00	0.000	0.000	0.000
CRVFO (outside Roan Plat.)	Garfield	ENCANA OIL & GAS - HIGH MESA COMP STATIO	0.00	200.12	0.00	0.000	0.000	0.000
CRVFO (outside Roan Plat.)	Garfield	ENCANA OIL & GAS - HUNTER MESA	0.00	110.16	0.00	0.000	0.000	0.000
CRVFO (outside Roan Plat.)	Garfield	ENTERPRISE PRODUCTS OP- JACKRABBIT CS	148.85	107.77	98.54	0.014	0.014	6.000
CRVFO (outside Roan Plat.)	Garfield	GRAND RIVER GATH - EAST MAMM CREEK CS	91.35	111.52	65.48	3.464	3.464	0.218
CRVFO (outside Roan Plat.)	Garfield	GRAND RIVER GATHERING - ORCHARD CS	32.54	28.57	14.23	0.808	0.808	0.040
CRVFO (outside Roan Plat.)	Garfield	GRAND RIVER GATHERING - PUMBA CS	98.35	122.76	140.49	3.564	3.564	0.214
CRVFO (outside Roan Plat.)	Garfield	RED ROCK GATHERING - HOLMES MESA CS	126.85	145.38	95.23	0.000	0.000	0.000
CRVFO (outside Roan Plat.)	Garfield	RED ROCK GATHERING- RIFLE BOULTON C.S.	0.00	12.17	0.00	0.000	0.000	0.000
CRVFO (outside Roan Plat.)	Garfield	SOURCEGAS DBA ROCKY MTN- CRYSTAL RIVER	24.25	13.61	30.62	0.572	0.572	0.024
CRVFO (outside Roan Plat.)	Garfield	URSA OPERATING - CASTLE SPRINGS C.S.	81.99	30.81	30.94	0.705	0.705	0.000
CRVFO (outside Roan Plat.)	Garfield	URSA OPERATING CO LLC - HUNTER MESA CS	33.62	50.18	65.41	1.652	1.652	0.000
CRVFO (outside Roan Plat.)	Garfield	VANGUARD OPE - BAILEY COMPRESSOR STATION	166.37	190.05	69.30	7.770	7.770	0.440
CRVFO (outside Roan Plat.)	Garfield	VANGUARD OPERTG- MAMM CREEK CS	182.59	59.31	194.75	9.980	9.980	0.550
CRVFO (outside Roan Plat.)	Garfield	WPX ENERGY - JOHNSON PRODUCTION FACILITY	0.00	1.11	0.00	0.000	0.000	0.000
CRVFO (outside Roan Plat.)	Mesa	DIVIDE CREEK-DIVIDE CREEK TREATMENT FAC	24.00	8.87	6.00	0.000	0.000	0.000
CRVFO (outside Roan Plat.)	Mesa	OXY USA - ALKALI CREEK C.S.	62.91	53.67	37.26	0.000	0.000	0.000
GJFO	Garfield	BARGATH LLC - CRAWFORD TRAIL	88.11	11.03	32.57	2.496	2.496	0.124
GJFO	Garfield	CHEVRON USA INC - PICEANCE BASIN CENTRAL	94.10	58.10	60.96	1.938	1.938	0.174
GJFO	Garfield	ENCANA O&G- HAY CANYON TREATING FACILITY	0.00	7.21	0.00	0.000	0.000	0.000

Field Office	County	Facility Name	Base Year Emissions (tons/year)					
			NO_x	VOC	CO	PM_{10}	$PM_{2.5}$	SO_2
GJFO	Garfield	ENCANA OIL & GAS - GASAWAY CS	25.42	35.28	50.49	0.608	0.608	0.000
GJFO	Garfield	NATIONAL FUEL CORP. - BAXTER FACILITY	18.50	2.90	4.40	0.081	0.081	0.005
GJFO	Garfield	OXY USA - CASCADE CREEK CENTRAL FACILITY	6.00	37.10	33.00	0.000	0.000	0.000
GJFO	Garfield	OXY USA WTP LP - CONN CREEK GAS	243.82	124.44	54.95	4.208	4.206	4.612
GJFO	Garfield	PUBLIC SERVICE CO- BAXTER COMPRESSOR STN	32.59	6.30	30.34	0.149	0.142	0.022
GJFO	Garfield	RED ROCK GATHERING - SOUTH CANYON C.S.	0.00	2.50	0.00	0.000	0.000	0.000
GJFO	Garfield	SOURCEGAS DBA ROCKY MTN -DEBEQUE C S	65.78	9.00	58.89	1.773	1.773	0.021
GJFO	Garfield	TRANSCOLORADO GAS - CONN CREEK	18.72	7.31	3.56	0.459	0.459	0.020
GJFO	Garfield	WPX ENERGY RKY MTN, LLC - TRAIL RIDGE CS	31.70	8.00	5.85	0.073	0.073	0.004
GJFO	Mesa	AXIA ENERGY - TAYLOR COMPRESSOR STATION	5.91	28.48	7.01	0.000	0.000	0.000
GJFO	Mesa	BADGER MIDSTREAM - BADGER WASH GAS PLANT	54.54	22.95	48.70	0.612	0.612	0.350
GJFO	Mesa	BLACK HILLS MIDSTREAM - HORSESHOE CANYON	35.30	39.03	26.50	0.570	0.570	0.035
GJFO	Mesa	COLLBRAN VALLEY GAS - ANDERSON GULCH	0.29	54.51	1.60	0.000	0.000	0.130
GJFO	Mesa	COLLBRAN VALLEY GAS GATHERING- CVG #2	30.27	16.63	7.23	1.268	1.268	0.073
GJFO	Mesa	ENCANA - PLATEAU CREEK	14.06	9.25	7.67	0.800	0.800	0.008
GJFO	Mesa	GOLDEN GATE/S.E.T.-GGP FRACTIONATION PLT	0.00	0.00	0.00	0.000	0.000	0.000
GJFO	Mesa	NATL FUEL CORP	22.07	7.55	8.85	0.307	0.307	0.015
GJFO	Mesa	OXY USA - BRUSH CREEK COMPRESSOR STATION	81.08	16.94	34.89	0.443	0.443	0.027
GJFO	Mesa	OXY USA INC. - East Plateau CS	77.67	33.66	48.93	1.772	1.772	0.106
GJFO	Mesa	PICEANCE ENERGY - BRUTON C.S.	28.96	22.97	27.66	0.123	0.123	0.000
GJFO	Mesa	PICEANCE ENERGY LLC - HAWXHURST RANCH	10.83	22.32	22.27	0.541	0.541	0.000
GJFO	Mesa	PICEANCE ENERGY, LLC - MVS CS	4.70	198.50	22.10	0.000	0.000	0.000
GJFO	Mesa	PUBLIC SERVICE CO - ASBURY STATION	30.87	11.63	49.92	0.130	0.130	0.008
GJFO	Mesa	PUBLIC SERVICE CO HUNTER CANYON STA	17.65	0.67	2.15	0.210	0.210	0.003
GJFO	Mesa	RED ROCK GATHERING - BAR X C.S.	12.20	18.50	14.20	0.376	0.376	0.023
GJFO	Mesa	RED ROCK GATHERING - DEBEQUE PROC FAC	102.69	207.78	89.48	0.280	0.130	0.240
GJFO	Mesa	RED ROCK GATHERING- PREMIER BAR X C.S.	73.32	7.82	5.09	1.340	1.340	0.020
GJFO	Mesa	SOURCEGAS DBA ROCKY MTN NG - COLLBRAN	84.97	32.18	26.37	0.200	0.200	0.000

Field Office	County	Facility Name	Base Year Emissions (tons/year)					
			NO_x	VOC	CO	PM_{10}	$PM_{2.5}$	SO_2
GJFO	Mesa	TRANSCOLORADO GAS TR CO - WHITEWATER CS	11.85	5.33	4.51	0.332	0.332	0.010
KFO	Grand	PUBLIC SERVICE CO- WILLIAMS FORK C.S.	6.70	0.22	0.40	0.003	0.003	0.000
LSFO	Moffat	AGAVE ENERGY - BIL HOL GULCH TREATING	8.58	32.79	17.16	0.040	0.040	0.000
LSFO	Moffat	ARGALI EXPLORATION COMPANY	45.59	0.98	3.27	0.080	0.080	0.005
LSFO	Moffat	CUSTOM ENERGY CONSTRUCTION INC BUCK PEAK	4.73	3.47	1.92	0.008	0.008	0.001
LSFO	Moffat	J W OPERATING CO - GREAT DIVIDE C.S.	10.76	1.13	4.85	0.000	0.000	0.000
LSFO	Moffat	MERIT ENERGY - SANDWASH C.S.	19.34	20.18	12.90	0.000	0.000	0.000
LSFO	Moffat	QEPM GATHERING - MUSSER FIELD CS	38.54	7.35	1.91	0.070	0.070	0.004
LSFO	Moffat	QEPM GATHERING I, LLC - EAST HIAWATHA CS	77.03	24.14	60.30	0.359	0.359	0.019
LSFO	Moffat	QEPM GATHERING I, LLC - LION C.S.	14.30	7.63	14.30	0.475	0.475	0.029
LSFO	Moffat	QEPM GATHERING I, LLC - SUGAR LOAF	5.80	17.93	10.20	0.166	0.166	0.010
LSFO	Moffat	QEPM GATHERING I, LLC - W HIAWATHA C. S.	32.76	29.36	15.09	0.380	0.380	0.000
LSFO	Moffat	QEPM GATHERING- POWDER WASH NORTHSIDE CS	4.14	13.42	0.23	0.000	0.000	0.000
LSFO	Moffat	QUESTAR - SKULL CREEK DEW POINT PLANT	73.07	20.56	18.53	0.500	0.500	0.011
LSFO	Moffat	ROCKIES EXPRESS PIPELINE - BIG HOLE CS	19.11	7.25	16.21	1.290	1.290	2.600
LSFO	Moffat	WYOMING INTERSTATE - SNAKE RIVER C.S.	7.24	0.25	8.84	0.478	0.478	0.232
LSFO	Rio Blanco	CHEVRON USA - WILSON CREEK GAS PLT	6.27	88.39	17.52	0.000	0.000	7.744
CRVFO (Roan Plat.)	Garfield	BARGATH - RABBIT BRUSH C.S.	107.70	18.57	23.05	3.612	3.562	0.188
CRVFO (Roan Plat.)	Garfield	BARGATH LLC - ANVIL POINTS CS	111.70	35.60	34.30	2.376	2.376	0.175
CRVFO (Roan Plat.)	Garfield	BARGATH LLC - CLOUGH CS	100.80	63.41	40.80	1.976	1.976	0.119
CRVFO (Roan Plat.)	Garfield	BARGATH LLC - COTTONWOOD POINT CS	132.70	35.90	33.00	2.324	2.324	0.139
CRVFO (Roan Plat.)	Garfield	BARGATH LLC - HAYBARN	0.00	0.00	0.00	0.000	0.873	0.000
CRVFO (Roan Plat.)	Garfield	BARGATH LLC - HAYES GULCH C.S.	115.11	38.39	34.04	2.345	2.345	0.141
CRVFO (Roan Plat.)	Garfield	BARGATH LLC - HEATH CS	176.12	64.53	51.94	3.596	3.596	0.222
CRVFO (Roan Plat.)	Garfield	BARGATH LLC - PARACHUTE	289.73	149.65	173.06	17.947	17.820	1.217
CRVFO (Roan Plat.)	Garfield	BARGATH LLC - RIFLE STATION	0.00	2.66	0.00	0.000	0.000	0.000
CRVFO (Roan Plat.)	Garfield	BARGATH LLC - RILEY CS	115.80	62.40	34.05	2.352	2.352	0.141
CRVFO (Roan Plat.)	Garfield	BARGATH LLC - ROAN CLIFFS GAS PLANT	0.10	0.30	0.70	0.000	0.000	0.000

Field Office	County	Facility Name	Base Year Emissions (tons/year)					
			NO_x	VOC	CO	PM_{10}	$PM_{2.5}$	SO_2
CRVFO (Roan Plat.)	Garfield	BARGATH LLC - RULISON CS	72.51	38.84	21.90	0.000	0.000	0.000
CRVFO (Roan Plat.)	Garfield	BARGATH LLC - SHARRARD CS	116.47	48.85	58.23	2.580	2.580	0.131
CRVFO (Roan Plat.)	Garfield	BARGATH LLC - WEBSTER HILL	66.87	11.20	11.70	2.113	2.113	0.127
CRVFO (Roan Plat.)	Garfield	BARGATH LLC - WHEELER GULCH CS	96.50	56.10	28.50	1.914	1.914	0.073
CRVFO (Roan Plat.)	Garfield	BARGATH, LLC - WASATCH COMPRESSOR YARD	66.70	49.59	29.90	1.162	1.162	0.070
CRVFO (Roan Plat.)	Garfield	ENCANA O&G - MIDDLE FORK C.S.	1.00	278.03	21.98	0.000	0.000	0.000
CRVFO (Roan Plat.)	Garfield	GRAND RIVER - RIFLE BOOSTER STATION	63.02	86.18	65.86	1.426	1.426	0.030
CRVFO (Roan Plat.)	Garfield	PUBLIC SERVICE CO - RIFLE GAS PLANT	12.09	14.95	3.11	0.381	0.381	0.006
CRVFO (Roan Plat.)	Garfield	RED ROCK GATHERING - RIFLE CLOUGH C.S.	187.20	97.54	122.98	3.741	3.741	0.203
CRVFO (Roan Plat.)	Garfield	RED ROCK GATHERING- ENTERPRISE INTERCON	0.06	0.30	0.14	0.000	0.000	0.000
CRVFO (Roan Plat.)	Garfield	WPX ENERGY - DOE COMPRESSOR STATION	33.10	12.90	3.70	0.095	0.095	0.006
CRVFO (Roan Plat.)	Garfield	WPX ENERGY - WEBSTER CS	10.46	2.10	10.46	0.000	0.000	0.000
TRFO	Archuleta	PUBLIC SERVICE CO - PAGOSA SPRINGS C.S.	0.77	0.22	0.77	0.000	0.000	0.000
TRFO	Dolores	MID-AMERICA PIPELINE CO DOVE CR STA	53.42	11.67	65.12	0.880	0.880	0.220
TRFO	Dolores	QEP ENERGY CO - SPARGO NO 2	23.45	0.18	23.45	0.049	0.049	0.003
TRFO	Dolores	TRANSCOLORADO GAS TRANS - DOLORES C.S.	14.46	7.15	0.69	0.433	0.433	0.025
TRFO	La Plata	BP AMERICA - PINON COMPRESSOR FACILITY	85.00	24.40	79.60	1.460	1.460	0.088
TRFO	Montezuma	KINDER MORGAN CO2 CO - HOVENWEEP CENTRAL	7.43	2.00	1.96	0.000	0.000	3.449
TRFO	Montezuma	KINDER MORGAN CO2 CO- YELLOW JACKET H102	9.00	2.07	1.96	0.000	0.000	17.000
TRFO	Montezuma	TRANSCOLORADO GAS TRANS - MANCOS CS	17.15	9.19	5.84	0.487	0.487	0.021
TRFO	San Miguel	PATARA MIDSTREAM - HAMILTON CREEK CS	27.10	49.70	11.20	0.130	0.130	0.008
UFO	Gunnison	GUNNISON ENERGY LLC - RAGGED MOUNTAIN CS	6.99	1.63	12.60	0.074	0.074	0.000
UFO	Montrose	TRANSCOLORADO GAS - OLATHE C.S.	10.05	0.45	9.25	0.252	0.252	0.110
UFO	Montrose	TRANSCOLORADO GAS TRANS - REDVALE CS	12.38	5.94	4.80	0.466	0.466	0.015
UFO	San Miguel	ROCKY MOUNTAIN NATURAL GAS - NORWOOD C.S	12.60	6.30	25.20	0.213	0.213	0.013
WRFO	Garfield	HUNTER RIDGE - CDP K22 496	26.50	30.54	53.55	0.000	0.000	0.000
WRFO	Garfield	HUNTER RIDGE ENERGY - STORY GULCH C.S.	167.02	261.63	75.97	0.407	0.407	18.343
WRFO	Rio Blanco	BARGATH LLC - RYAN GULCH GAS	168.61	64.20	25.22	3.025	3.025	0.181

Field Office	County	Facility Name	Base Year Emissions (tons/year)					
			NO_x	VOC	CO	PM_{10}	$PM_{2.5}$	SO_2
WRFO	Rio Blanco	BOPCO, LP - YELLOW CREEK BRIDGE PLT.	26.29	60.32	8.70	2.150	2.150	0.000
WRFO	Rio Blanco	CHEVRON - SAND UNIT WEST END WATER PLANT	0.00	1.47	0.00	0.000	0.000	0.000
WRFO	Rio Blanco	CHEVRON USA - SAND UNIT CO2/NGL PLANT	5.34	58.65	12.62	1.145	1.105	1.578
WRFO	Rio Blanco	COLORADO INTERSTATE GAS CO GREASEWOOD	44.94	0.44	16.08	1.130	1.130	0.520
WRFO	Rio Blanco	ENCANA - WRD FEDERAL 19-13 N BOOSTER ST.	1.69	0.02	2.74	0.000	0.000	0.000
WRFO	Rio Blanco	ENCANA O&G - W DOUGLAS CREEK C.S.	0.00	10.53	0.00	0.000	0.000	0.000
WRFO	Rio Blanco	ENCANA O&G (USA) INC - BULL FORK C.S.	39.76	50.20	12.20	0.000	0.000	0.001
WRFO	Rio Blanco	ENCANA O&G.- WEST DRAGON TRAIL C.S.	60.19	23.90	48.30	0.536	0.536	0.032
WRFO	Rio Blanco	ENCANA OIL - EAST DRAGON TRAIL CS	44.75	27.98	56.75	0.529	0.529	0.032
WRFO	Rio Blanco	ENCANA OIL & GAS - CORRAL CREEK C.S.	2.10	19.86	0.42	0.035	0.035	0.002
WRFO	Rio Blanco	ENCANA OIL & GAS - DRAGON TRAIL	216.62	103.18	102.16	9.746	9.746	0.172
WRFO	Rio Blanco	ENCANA OIL & GAS - PARK CANYON WEST C.S.	48.83	40.99	31.73	0.064	0.064	0.004
WRFO	Rio Blanco	ENCANA OIL & GAS (USA), INC. - CR 109 CS	2.81	1.03	2.53	0.040	0.040	0.002
WRFO	Rio Blanco	ENCANA OIL & GAS (USA), INC. - DRAGON TR	1.00	0.10	0.15	0.004	0.004	0.000
WRFO	Rio Blanco	ENCANA OIL & GAS DRAGON TRAIL #1042	1.00	0.10	2.00	0.004	0.004	0.000
WRFO	Rio Blanco	ENCANA OIL&GAS - HH 9149 AND HH 9132	1.84	1.36	3.10	0.000	0.000	0.000
WRFO	Rio Blanco	ENCANA OIL&GAS - M12 2104	1.84	2.87	3.10	0.000	0.000	0.000
WRFO	Rio Blanco	ENTERPRISE GAS PROC - MEEKER GAS PLANT	133.13	313.06	242.96	26.400	26.400	205.272
WRFO	Rio Blanco	ENTERPRISE GAS-PICEANCE DEV. PROJECT	101.41	149.65	117.00	4.544	4.544	21.828
WRFO	Rio Blanco	KOCH EXPLORATION - MEEKER GAS PLANT	38.06	73.98	75.37	1.792	1.792	0.141
WRFO	Rio Blanco	NORTHWEST PIPELINE CORP RANGELY STA	371.97	11.36	52.40	2.640	2.640	0.040
WRFO	Rio Blanco	PICEANCE ENERGY - STAKE SPRINGS BOOSTER	9.33	46.38	18.46	0.410	0.410	0.010
WRFO	Rio Blanco	PIONEER NATURAL RES-COLUMBINE SPRINGS	17.46	2.05	1.18	0.301	0.301	0.000
WRFO	Rio Blanco	PUBLIC SERVICE CO GREASEWOOD STATION	19.78	0.14	17.48	0.045	0.045	0.003
WRFO	Rio Blanco	QEPM GATHERING I, LLC - RABBIT MTN STA	12.80	11.89	19.20	0.187	0.187	0.012
WRFO	Rio Blanco	QUESTAR PIPELINE CO - GREASEWOOD GULCH	8.94	3.90	1.60	0.403	0.403	0.023
WRFO	Rio Blanco	RED ROCK GATHERING - CATHEDRAL C.S.	10.77	0.63	1.04	0.020	0.020	0.001
WRFO	Rio Blanco	RED ROCK GATHERING - FOUNDATION CREEK	64.91	70.80	44.93	0.580	0.580	0.030

Field Office	County	Facility Name	Base Year Emissions (tons/year)					
			NO_x	VOC	CO	PM_{10}	$PM_{2.5}$	SO_2
WRFO	Rio Blanco	RED ROCK GATHERING - GREASEWOOD	8.47	17.58	21.00	0.110	0.110	0.100
WRFO	Rio Blanco	RED ROCK GATHERING - N. DOUGLAS GAS PLT	56.07	77.65	68.15	0.320	0.301	0.089
WRFO	Rio Blanco	RED ROCK GATHERING- RANGELY NGL XFER STN	0.00	15.30	0.00	0.000	0.000	0.000
WRFO	Rio Blanco	RN INDUSTRIES - PICEANCE CREEK, RANGELY	12.36	787.69	5.53	0.450	0.450	0.860
WRFO	Rio Blanco	ROCKIES EXPRESS PIPELINE LLC - MEEKER	21.55	11.33	17.32	2.920	2.920	3.820
WRFO	Rio Blanco	ROCKY MOUNTAIN NAT GAS - PICEANCE	46.78	34.23	50.19	0.850	0.850	0.010
WRFO	Rio Blanco	ROCKY MOUNTAIN PIPELINE SYSTEM, LLC	0.00	3.00	0.00	0.000	0.000	0.000
WRFO	Rio Blanco	TRANSCOLORADO GAS TRANS - GREASEWOOD	0.18	0.01	0.02	0.000	0.000	0.000
WRFO	Rio Blanco	WEST TEXAS - PICEANCE CREEK GP	9.41	45.93	12.04	1.020	1.020	0.006
WRFO	Rio Blanco	WHITING OIL & GAS -JIMMY GULCH STATION	5.10	8.77	10.12	0.137	0.137	0.003
WRFO	Rio Blanco	WILLIAMS FIELD - WILLOW CREEK GAS PLANT	183.12	109.06	199.03	35.143	35.143	71.393
WRFO	Rio Blanco	XTO ENERGY, INC. - PICEANCE CREEK	89.96	91.71	90.02	7.115	6.790	7.849
RGFO - Area 1	Adams	WGR ASSET HOLDING CO - WATTENBERG PLANT	691.49	157.29	156.56	3.43	3.43	15.22
RGFO - Area 1	Adams	COLORADO INTERSTATE GAS CO WATKINS C.S.	398.50	32.62	96.20	11.45	11.45	0.15
RGFO - Area 1	Adams	KERR-MCGEE GATHERING - BRIGHTON CS	26.91	19.16	9.89	1.18	1.18	0.06
RGFO - Area 1	Adams	KERR-MCGEE GATHERING - RADAR CS	22.49	8.81	55.88	0.25	0.25	0.02
RGFO - Area 1	Arapahoe	KERR-MCGEE GATHERING - MITCHELL CS	33.60	12.28	22.00	0.08	0.08	0.00
RGFO - Area 1	Denver	KERR-MCGEE GATHERING - THIRD CREEK CS	6.52	6.63	1.32	0.09	0.09	0.01
RGFO - Area 1	Weld	DCP MIDSTREAM, LP - SPINDLE GAS PLANT	190.40	107.21	244.68	5.64	5.64	0.20
RGFO - Area 1	Weld	DCP MIDSTREAM, LP - ROGGEN NGPP	188.48	131.46	237.42	6.96	6.96	0.23
RGFO - Area 1	Weld	DCP MIDSTREAM, LP - SURREY C.S.	18.70	7.03	18.70	0.28	0.28	0.01
RGFO - Area 1	Weld	DCP MIDSTREAM, LP - WEST SPINDLE C.S.	16.41	7.43	27.90	0.46	0.46	0.01
RGFO - Area 1	Weld	DCP MIDSTREAM, LP - GREELEY GAS PLANT	148.14	107.89	164.23	3.44	3.44	0.06
RGFO - Area 1	Weld	DCP MIDSTREAM, LP- LUCERNE	131.68	82.86	199.68	6.63	6.63	4.24
RGFO - Area 1	Weld	DCP MIDSTREAM, LP - MIDPOINT C.S.	0.00	0.14	0.00	0.00	0.00	0.00
RGFO - Area 1	Weld	DCP MIDSTREAM - MARTHA (KIRKMEYER) C.S.	12.97	9.30	25.92	0.63	0.63	0.02
RGFO - Area 1	Weld	DCP MIDSTREAM, LP - MARLA C.S.	178.81	88.71	207.36	4.08	4.08	0.19
RGFO - Area 1	Weld	DCP MIDSTREAM LP - ENTERPRISE C.S.	107.88	116.14	125.36	4.54	4.54	0.26

Field Office	County	Facility Name	Base Year Emissions (tons/year)					
			NO_x	VOC	CO	PM_{10}	$PM_{2.5}$	SO_2
RGFO - Area 1	Weld	NOBLE ENERGY - STATE LARSON C. S.	15.50	0.20	1.00	0.03	0.03	0.00
RGFO - Area 1	Weld	KERR-MCGEE GATHERING - VOLLMAR C.S.	36.26	21.83	12.94	1.62	1.62	0.00
RGFO - Area 1	Weld	KERR-MCGEE GATHERING - HAMBERT C.S.	21.43	12.91	7.55	0.54	0.54	0.00
RGFO - Area 1	Weld	KERR-MCGEE GATHERING - FREDERICK CS	109.46	87.97	63.65	0.00	0.00	0.00
RGFO - Area 1	Weld	KERR-MCGEE GATHERING - DOUGAN C.S.	40.74	28.35	10.19	0.01	0.01	0.00
RGFO - Area 1	Weld	STERLING ENERGY - NEW RAYMER C.S.	15.63	3.64	14.70	0.00	0.00	0.00
RGFO - Area 1	Weld	ENCANA OIL & GAS - ARISTOCRAT CS	15.84	29.28	27.78	0.00	0.00	0.00
RGFO - Area 1	Weld	DCP MIDSTREAM, LP - PARKER & PA	5.02	1.11	5.02	0.07	0.07	0.00
RGFO - Area 1	Weld	NOBLE MIDSTREAM - LILLI GAS PROC. PLANT	68.36	83.49	33.99	1.16	1.16	0.06
RGFO - Area 1	Weld	DCP MIDSTREAM, LP - SOUTHFIELD C.S.	11.97	2.37	11.94	0.16	0.16	0.00
RGFO - Area 1	Weld	DCP MIDSTREAM, LP - MARILYN C.S.	25.60	8.73	18.20	0.48	0.48	0.02
RGFO - Area 1	Weld	DCP MIDSTREAM, LP - JODY C.S.	16.09	2.93	16.09	0.09	0.09	0.00
RGFO - Area 1	Weld	KERR-MCGEE - PLATTEVILLE CS	77.74	47.35	55.56	0.00	0.00	0.00
RGFO - Area 1	Weld	DCP MIDSTREAM, LP - PLATTEVILLE GPP	228.75	130.26	229.53	7.46	6.78	0.25
RGFO - Area 1	Weld	KERR-MCGEE GATHERING - IONE C.S.	29.20	23.88	55.54	0.53	0.53	0.02
RGFO - Area 1	Weld	DCP MIDSTREAM - CENTENNIAL PIG STATION	0.00	0.32	0.00	0.00	0.00	0.00
RGFO - Area 1	Weld	DCP MIDSTREAM, LP- REINICK	0.00	4.39	0.00	0.00	0.00	0.00
RGFO - Area 1	Weld	NOBLE MIDSTREAM - PLATTEVILLE STATION	9.66	65.57	8.24	0.00	0.00	0.00
RGFO - Area 1	Weld	DCP MIDSTREAM - LIBSACK C.S.	28.90	76.35	58.29	4.04	4.04	0.00
RGFO - Area 1	Weld	DCP MIDSTREAM - SULLIVAN C.S.	20.37	30.17	40.76	0.29	0.29	0.01
RGFO - Area 1	Weld	DCP MIDSTREAM - GODFREY BOTTOM C.S.	9.19	43.79	22.30	0.00	0.00	0.00
RGFO - Area 1	Weld	DCP MIDSTREAM - BERNHARDT C.S.	21.03	35.53	42.87	0.00	0.00	0.00
RGFO - Area 1	Weld	DCP MIDSTREAM - DCP O'CONNOR PLANT LLC	16.96	26.49	30.01	2.54	2.54	2.18
RGFO - Area 1	Weld	BBC - 17818_ANSCHUTZ 5-23H / ASBS CS	19.54	15.28	39.78	0.91	0.91	0.00
RGFO - Area 1	Weld	NOBLE MIDSTREAM - BRIGGSDALE	0.94	39.91	5.13	0.00	0.00	0.00
RGFO - Area 1	Weld	DCP MIDSTREAM, LP - WELLS RANCH CS	32.46	48.36	65.92	4.48	4.48	0.00
RGFO - Area 1	Weld	STERLING ENERGY - CENTENNIAL GAS PLANT	33.26	80.97	43.60	0.30	0.28	0.00
RGFO - Area 1	Weld	ROSE ROCK MIDSTREAM- WELLS RANCH STATION	0.00	11.54	0.00	0.00	0.00	0.00

Field Office	County	Facility Name	Base Year Emissions (tons/year)					
			NO_x	VOC	CO	PM_{10}	$PM_{2.5}$	SO_2
RGFO - Area 1	Weld	DCP MIDSTREAM, LP - SLW C.S.	16.02	25.18	36.20	2.06	2.06	0.00
RGFO - Area 1	Weld	DCP MIDSTREAM, LP - TROUDT C.S.	1.20	28.53	6.55	0.00	0.00	0.00
RGFO - Area 1	Weld	FOUNDATION ENERGY - OMB PIPELINE CS	6.37	3.68	4.87	0.00	0.00	0.00
RGFO - Area 1	Weld	DCP MIDSTREAM - 70 RANCH COMPR STATION	36.03	70.62	79.36	4.48	4.48	0.12
RGFO - Area 1	Weld	KERR-MCGEE GATHERING - TRI-TOWN C.S.	35.95	21.73	12.84	1.62	1.62	0.00
RGFO - Area 1	Weld	KERR-MCGEE GATHERING - MEAD C.S.	35.95	21.73	12.84	1.62	1.62	0.00
RGFO - Area 1	Weld	KERR-MCGEE GATHERING - ST. VRAIN C.S.	35.95	21.73	12.84	1.62	1.62	0.00
RGFO - Area 1	Weld	BILL BARRETT- BRONCO COMPRESSOR STATION	33.52	38.55	72.96	3.32	3.32	0.00
RGFO - Area 1	Weld	DCP MIDSTREAM - ROCKY TURBINE COMPR STN	36.90	96.08	47.20	4.20	4.20	2.20
RGFO - Area 1	Weld	PDC ENERGY-KNOX COMPRESSOR STATION	0.83	0.00	1.67	0.00	0.00	0.00
RGFO - Area 1	Weld	AKA ENERGY GROUP, LLC - WIEDEMAN C.S.	0.00	5.79	0.00	0.00	0.00	0.00
RGFO - Area 1	Weld	DCP MIDSTREAM - MOUNTAIN VIEW GAS PLANT	39.00	74.48	65.59	4.99	4.99	33.66
RGFO - Area 1	Weld	KERR-MCGEE - CANNON COMPRESSOR STATION	0.57	0.32	0.20	0.00	0.00	0.00
RGFO - Area 3	Cheyenne	COLORADO INTERSTATE GAS- KIT CARSON C.S.	348.75	12.00	115.45	5.22	5.22	0.11
RGFO - Area 3	Cheyenne	MULL DRILLING CO ARAPAHOE NW C.S.	32.99	19.80	66.20	0.00	0.00	0.00
RGFO - Area 3	Cheyenne	CITATION OIL - MOUNT PEARL GAS PLANT	82.33	26.87	58.79	0.89	0.89	0.05
RGFO - Area 3	Cheyenne	CITATION O & G - FRONTERA GAS PLANT	24.10	20.21	24.10	0.41	0.41	0.01
RGFO - Area 3	Cheyenne	CITATION OIL - ARAPAHOE GAS PLANT	17.20	5.23	22.04	0.32	0.32	0.00
RGFO - Area 3	Cheyenne	DCP MIDSTREAM, LP - N ARROWHEAD C.S.	6.83	8.69	4.36	0.11	0.11	0.01
RGFO - Area 3	Cheyenne	DCP MIDSTREAM, LP - N MAYFIELD C.S.	9.92	9.98	1.04	0.15	0.15	0.01
RGFO - Area 3	Cheyenne	DCP MIDSTREAM, LP - SE MT PEARL	7.29	20.15	14.14	0.00	0.00	0.00
RGFO - Area 3	Cheyenne	WILLIFORD ENERGY CO-RHOADES UNIT PLANT	0.00	18.66	0.00	0.00	0.00	0.00
RGFO - Area 3	Cheyenne	DCP MIDSTREAM, LP - LADDER CREEK C.S.	135.13	78.04	37.96	11.80	11.80	0.12
RGFO - Area 3	Cheyenne	DCP MIDSTREAM, LP - ARCHER C.S.	5.84	0.91	8.46	0.09	0.09	0.00
RGFO - Area 3	Cheyenne	DCP MIDSTREAM, LP - CHEYENNE WELLS C.S.	14.29	10.63	3.89	0.30	0.16	0.01
RGFO - Area 3	Cheyenne	DCP MIDSTREAM - W ARAPAHOE CS	21.45	27.00	24.67	0.25	0.25	0.01
RGFO - Area 3	Logan	TALLGRASS INTERSTATE GAS - TPC LOGAN CS	0.02	0.01	0.02	0.00	0.00	0.00
RGFO - Area 3	Logan	STERLING ENERGY INVESTMENTS - YENTER GP	113.65	258.26	125.25	2.38	2.38	0.30

Field Office	County	Facility Name	Base Year Emissions (tons/year)					
			NO_x	VOC	CO	PM_{10}	$PM_{2.5}$	SO_2
RGFO - Area 3	Morgan	WESTERN OPERATING CO - WIGGINS GAS PLANT	63.80	29.34	16.38	1.71	1.71	0.01
RGFO - Area 3	Morgan	Western Operating- Adena Compressor	3.12	0.02	3.12	0.13	0.13	0.00
RGFO - Area 3	Morgan	STERLING ENERGY - JACKSON LAKE GAS PLANT	0.00	18.44	0.00	0.00	0.00	0.00
RGFO - Area 3	Phillips	BLACK RAVEN - AMHERST CS	6.80	8.32	4.78	0.14	0.14	0.01
RGFO - Area 3	Phillips	OMIMEX PETRO- SMOKY HILLS COMPRESSOR STN	36.49	15.78	22.21	1.11	1.11	0.00
RGFO - Area 3	Washington	CIG (NIOBRARA)/HIGH PLAINS (AKRON) C.S.	29.96	13.01	42.52	1.16	1.16	0.01
RGFO - Area 3	Weld	WHITING OIL AND GAS - CEDAR VALLEY CS	13.01	1.45	0.94	0.03	0.03	0.00
RGFO - Area 3	Weld	MEADOWLARK MIDSTREAM CO - HEREFORD RANCH	14.60	125.43	29.58	0.66	0.66	0.05
RGFO - Area 3	Weld	MEADOWLARK MIDSTREAM - ANGUS COMPR STN	10.16	20.35	21.71	0.95	0.95	0.00
RGFO - Area 3	Weld	STERLING ENERGY INVESTMENTS - GROVER CS	24.04	27.86	51.33	2.28	2.28	0.00
RGFO - Area 3	Yuma	AUGUSTUS ENERGY RES - YGS YODEL C.S.	24.01	6.38	17.23	0.27	0.27	0.00
RGFO - Area 3	Yuma	FOUNDATION ENERGY - MILDRED C.S.	14.37	4.68	5.21	0.10	0.10	0.01
RGFO - Area 3	Yuma	FOUNDATION ENERGY - VERNON C.S.	9.34	28.38	6.09	0.03	0.03	0.01
RGFO - Area 3	Yuma	FOUNDATION ENERGY - NORTH WAVERLY C.S.	30.65	19.82	24.78	0.30	0.30	0.02
RGFO - Area 3	Yuma	FOUNDATION ENERGY - YODEL C.S.	0.00	9.57	0.00	0.00	0.00	0.00
RGFO - Area 3	Yuma	FOUNDATION ENERGY - YUMEX C.S.	35.03	14.74	25.00	0.66	0.66	0.04
RGFO - Area 3	Yuma	FOUNDATION ENERGY MGMT - WILTFANG C.S.	28.02	15.83	28.45	0.00	0.00	0.00
RGFO - Area 3	Yuma	BRANCH SYSTEMS, INC. - STATELINE CS	0.71	0.48	1.43	0.11	0.11	0.00
RGFO - Area 3	Yuma	CAERUS WASHCO - VERNON C S	3.92	4.60	8.13	0.14	0.14	0.00
RGFO - Area 3	Yuma	CAERUS WASHCO - NEWTON CS	7.72	3.06	7.72	0.15	0.15	0.01
RGFO - Area 3	Yuma	FOUNDATION ENERGY MGMT - DEVLIN C.S.	36.06	20.96	20.59	0.00	0.00	0.00
RGFO - Area 3	Yuma	FOUNDATION ENERGY - RIDGE ROAD C.S.	16.80	8.20	17.90	0.00	0.00	0.00
RGFO - Area 3	Yuma	FOUNDATION ENERGY - KORF C.S.	33.15	8.82	49.00	0.67	0.67	0.03
RGFO - Area 3	Yuma	FOUNDATION ENERGY - KELLER C.S.	19.40	11.13	31.20	0.00	0.00	0.00
RGFO - Area 4	Baca	SOVEREIGN OP. CO. - VILAS CS	1.22	0.05	3.76	0.00	0.00	0.00
RGFO - Area 4	Baca	MIDSTREAM ENERGY - SPELUNKER CS	10.00	2.20	8.50	0.00	0.00	0.01
RGFO - Area 4	Baca	SOVEREIGN OPER CO - EAST SIDE COMPRESSOR	1.22	0.05	3.76	0.00	0.00	0.00
RGFO - Area 4	Bent	COLORADO INTERSTATE GAS CO FLANK C.S.	46.52	37.63	56.12	0.88	0.88	0.03

Field Office	County	Facility Name	Base Year Emissions (tons/year)					
			NO_x	VOC	CO	PM_{10}	$PM_{2.5}$	SO_2
RGFO - Area 4	Bent	MERIT ENERGY - WAGON TRAIL COMPR STN	22.40	17.27	23.80	0.14	0.14	0.00
RGFO - Area 4	Kiowa	MERIT ENERGY CO - MCCLAVE C.S.	30.89	23.21	39.39	0.71	0.71	0.43
RGFO - Area 4	Las Animas	PIONEER NAT RES - BURRO CANYON CS	136.71	17.33	61.13	0.04	0.04	0.34
RGFO - Area 4	Las Animas	XTO ENERGY - APACHE CANYON 1 C.S.	55.28	28.31	24.22	0.01	0.01	0.10
RGFO - Area 4	Las Animas	PIONEER NAT RESOURCES - PRIMERO C.S.	84.00	15.20	57.60	1.33	1.33	0.08
RGFO - Area 4	Las Animas	PIONEER NAT RES - TAMBURELLI RANCH CS	115.07	15.05	53.58	1.03	1.03	0.28
RGFO - Area 4	Las Animas	PIONEER NAT RESOURCES - LORENCITO CS	35.36	6.23	20.08	0.03	0.03	0.06
RGFO - Area 4	Las Animas	COLORADO INTERSTATE GAS CO.-TRINIDAD CS	0.24	0.08	0.30	0.00	0.00	0.00
RGFO - Area 4	Las Animas	COLORADO INTERSTATE GAS CO. - KIM C.S.	4.02	1.56	3.76	2.30	2.30	0.14
RGFO - Area 4	Las Animas	XTO ENERGY - HILL RANCH 1 C.S.	51.50	50.65	29.96	2.10	2.10	0.12
RGFO - Area 4	Las Animas	PIONEER NAT RESOURCES - WET CANYON CS	16.95	7.02	8.14	0.01	0.01	0.04
RGFO - Area 4	Las Animas	PIONEER NATURAL RES- MAXWELL C.S.	47.54	6.61	28.07	0.02	0.02	0.14
RGFO - Area 4	Las Animas	XTO ENERGY - HILL RANCH 4 C.S.	63.78	15.49	22.64	0.17	0.17	0.07
RGFO - Area 4	Las Animas	XTO ENERGY - HILL RANCH 2 C.S.	58.44	19.48	5.29	1.32	1.32	0.00
RGFO - Area 4	Las Animas	XTO ENERGY - HILL RANCH 3 C.S.	60.60	14.40	19.04	0.16	0.16	0.10
RGFO - Area 4	Las Animas	XTO ENERGY - APACHE CANYON 2 C.S.	17.10	5.70	1.50	0.00	0.00	0.00
RGFO - Area 4	Las Animas	XTO ENERGY - APACHE CANYON 3 C.S.	36.55	7.56	4.63	0.01	0.01	0.05
RGFO - Area 4	Las Animas	XTO ENERGY - GOLDEN EAGLE 7 C.S.	33.26	11.08	2.88	0.77	0.77	0.05
RGFO - Area 4	Las Animas	XTO ENERGY - GOLDEN EAGLE 5 C.S.	34.33	7.47	3.28	0.00	0.00	0.00
RGFO - Area 4	Las Animas	XTO ENERGY - GOLDEN EAGLE 6 C.S.	34.39	11.36	3.02	0.00	0.00	0.00
RGFO - Area 4	Las Animas	XTO ENERGY - GOLDEN EAGLE 9 C.S.	39.12	1.29	5.34	0.00	0.00	0.00
RGFO - Area 4	Las Animas	XTO ENERGY - GOLDEN EAGLE 2 C.S.	32.83	1.29	5.35	0.00	0.00	0.00
RGFO - Area 4	Las Animas	XTO ENERGY - GOLDEN EAGLE 4 C.S.	39.04	1.34	5.35	0.00	0.00	0.00
RGFO - Area 4	Las Animas	XTO ENERGY - APACHE CANYON 7 C.S.	25.82	0.18	1.78	0.00	0.00	0.00
RGFO - Area 4	Prowers	BERRY ENERGY INC STATE 4-9 COMPRESSOR	9.45	0.43	0.17	0.03	0.03	0.00

APPENDIX J

EPA MOVES Emissions Factor by Field Office, County, and Year

Table J1. Field Office to Representative County On-road Emission Factor Cross-reference.

Field Office / Planning Area	County
Royal Gorge Field Office - Area 1	Weld County, CO
Royal Gorge Field Office - Area 2	Park County, CO
Royal Gorge Field Office - Area 3	Yuma County, CO
Royal Gorge Field Office - Area 4	Las Animas County, CO
Colorado River Valley	Garfield County, CO
Kremmling Field Office	Grand County, CO
Tres Rios Field Office	La Plata County, CO
Grand Junction Field Office	Mesa County, CO
Little Snake Field Office	Moffat County, CO
Uncompahgre Field Office	Montrose County, CO
White River Field Offices	Rio Blanco County, CO
Mancos Shale	Rio Arriba County, NM

Table J2. On-road Light Duty and Heavy Duty Truck Emisison Factors by Representative County and by Project Year.

County	Year	Vehicle Type	Emission Rates (grams/mile)								
			VOC	CO	NOx	PM10	PM2.5	SO2	CO2	CH4	N2O
Garfield County	2015	Heavy Duty	0.59	2.70	9.60	0.89	0.54	0.02	2064.96	0.05	0.003
Garfield County	2015	Light Duty	0.65	6.47	0.90	0.07	0.02	0.01	444.90	0.02	0.018
Grand County	2015	Heavy Duty	0.60	2.78	9.76	0.89	0.54	0.02	2066.89	0.06	0.004
Grand County	2015	Light Duty	0.63	6.51	0.90	0.07	0.02	0.01	446.15	0.02	0.017
La Plata County	2015	Heavy Duty	0.60	2.82	9.61	0.89	0.54	0.02	2067.15	0.06	0.004
La Plata County	2015	Light Duty	0.61	6.22	0.88	0.07	0.02	0.01	442.72	0.02	0.017
Las Animas County	2015	Heavy Duty	0.52	2.69	9.48	0.90	0.55	0.02	2098.93	0.05	0.003
Las Animas County	2015	Light Duty	0.71	7.63	1.01	0.06	0.02	0.01	456.69	0.03	0.020
Mesa County	2015	Heavy Duty	0.59	2.77	9.52	0.89	0.54	0.02	2066.07	0.06	0.004
Mesa County	2015	Light Duty	0.63	6.23	0.88	0.07	0.02	0.01	441.95	0.02	0.018
Moffat County	2015	Heavy Duty	0.60	2.82	9.60	0.89	0.54	0.02	2067.24	0.06	0.004
Moffat County	2015	Light Duty	0.62	6.33	0.88	0.07	0.02	0.01	444.02	0.02	0.017
Montrose County	2015	Heavy Duty	0.60	2.82	9.57	0.89	0.54	0.02	2067.00	0.06	0.004
Montrose County	2015	Light Duty	0.61	6.16	0.87	0.07	0.02	0.01	442.00	0.02	0.017
Park County	2015	Heavy Duty	0.54	2.79	9.69	0.90	0.55	0.02	2066.82	0.06	0.004
Park County	2015	Light Duty	0.59	6.43	0.89	0.06	0.02	0.01	445.29	0.02	0.017

County	Year	Vehicle Type	Emission Rates (grams/mile)								
			VOC	CO	NOx	PM10	PM2.5	SO2	CO2	CH4	N2O
Rio Arriba County	2015	Heavy Duty	0.60	2.81	9.61	0.89	0.54	0.02	2066.87	0.06	0.004
Rio Arriba County	2015	Light Duty	0.61	6.06	0.88	0.07	0.02	0.01	442.26	0.02	0.017
Rio Blanco County	2015	Heavy Duty	0.60	2.79	9.56	0.89	0.54	0.02	2066.59	0.06	0.004
Rio Blanco County	2015	Light Duty	0.61	6.20	0.87	0.07	0.02	0.01	442.61	0.02	0.017
Weld County	2015	Heavy Duty	0.53	2.74	9.44	0.90	0.55	0.02	2065.56	0.05	0.004
Weld County	2015	Light Duty	0.46	5.08	0.75	0.05	0.01	0.01	442.90	0.02	0.018
Yuma County	2015	Heavy Duty	0.53	2.79	9.43	0.90	0.55	0.02	2066.36	0.06	0.004
Yuma County	2015	Light Duty	0.56	6.08	0.86	0.05	0.01	0.01	441.09	0.02	0.017
Garfield County	2016	Heavy Duty	0.51	2.33	8.29	0.80	0.47	0.02	2052.96	0.06	0.003
Garfield County	2016	Light Duty	0.57	5.79	0.78	0.07	0.02	0.01	432.11	0.02	0.016
Grand County	2016	Heavy Duty	0.53	2.42	8.43	0.80	0.47	0.02	2054.83	0.06	0.004
Grand County	2016	Light Duty	0.55	5.84	0.78	0.07	0.02	0.01	433.35	0.02	0.015
La Plata County	2016	Heavy Duty	0.52	2.46	8.31	0.80	0.47	0.02	2055.08	0.06	0.004
La Plata County	2016	Light Duty	0.54	5.58	0.76	0.07	0.02	0.01	429.96	0.02	0.015
Las Animas County	2016	Heavy Duty	0.45	2.32	8.19	0.81	0.47	0.02	2086.84	0.06	0.003
Las Animas County	2016	Light Duty	0.62	6.83	0.88	0.06	0.02	0.01	443.76	0.02	0.018
Mesa County	2016	Heavy Duty	0.51	2.41	8.22	0.80	0.47	0.02	2054.03	0.06	0.004
Mesa County	2016	Light Duty	0.55	5.58	0.76	0.07	0.02	0.01	429.20	0.02	0.016
Moffat County	2016	Heavy Duty	0.52	2.45	8.29	0.80	0.47	0.02	2055.18	0.06	0.004
Moffat County	2016	Light Duty	0.54	5.67	0.76	0.07	0.02	0.01	431.25	0.02	0.015
Montrose County	2016	Heavy Duty	0.52	2.45	8.27	0.80	0.47	0.02	2054.94	0.06	0.004
Montrose County	2016	Light Duty	0.53	5.52	0.76	0.07	0.02	0.01	429.25	0.02	0.015
Park County	2016	Heavy Duty	0.46	2.42	8.37	0.81	0.47	0.02	2054.76	0.06	0.004
Park County	2016	Light Duty	0.52	5.77	0.77	0.06	0.02	0.01	432.50	0.02	0.015
Rio Arriba County	2016	Heavy Duty	0.52	2.44	8.30	0.80	0.47	0.02	2054.81	0.06	0.004
Rio Arriba County	2016	Light Duty	0.53	5.44	0.76	0.07	0.02	0.01	429.51	0.02	0.015
Rio Blanco County	2016	Heavy Duty	0.52	2.42	8.26	0.80	0.47	0.02	2054.54	0.06	0.004
Rio Blanco County	2016	Light Duty	0.53	5.55	0.75	0.07	0.02	0.01	429.85	0.02	0.015
Weld County	2016	Heavy Duty	0.45	2.37	8.16	0.81	0.47	0.02	2053.54	0.06	0.004
Weld County	2016	Light Duty	0.42	4.61	0.65	0.05	0.01	0.01	430.15	0.02	0.016
Yuma County	2016	Heavy Duty	0.45	2.42	8.15	0.81	0.47	0.02	2054.31	0.06	0.004
Yuma County	2016	Light Duty	0.50	5.45	0.74	0.05	0.01	0.01	428.36	0.02	0.015
Garfield County	2017	Heavy Duty	0.44	2.02	7.13	0.73	0.40	0.02	2034.36	0.06	0.003
Garfield County	2017	Light Duty	0.49	5.20	0.57	0.07	0.02	0.00	420.01	0.02	0.015
Grand County	2017	Heavy Duty	0.46	2.10	7.25	0.73	0.40	0.02	2036.18	0.07	0.004
Grand County	2017	Light Duty	0.47	5.24	0.56	0.07	0.02	0.00	421.23	0.02	0.013
La Plata County	2017	Heavy Duty	0.45	2.14	7.14	0.73	0.40	0.02	2036.42	0.06	0.004

County	Year	Vehicle Type	Emission Rates (grams/mile)								
			VOC	CO	NOx	PM10	PM2.5	SO2	CO2	CH4	N2O
La Plata County	2017	Light Duty	0.46	5.01	0.55	0.07	0.02	0.00	417.88	0.02	0.014
Las Animas County	2017	Heavy Duty	0.38	2.01	7.04	0.74	0.40	0.02	2068.05	0.06	0.003
Las Animas County	2017	Light Duty	0.54	6.12	0.64	0.05	0.02	0.00	431.24	0.02	0.016
Mesa County	2017	Heavy Duty	0.45	2.09	7.07	0.73	0.40	0.02	2035.40	0.06	0.004
Mesa County	2017	Light Duty	0.47	5.01	0.55	0.07	0.02	0.00	417.13	0.02	0.014
Moffat County	2017	Heavy Duty	0.46	2.14	7.13	0.73	0.40	0.02	2036.51	0.06	0.004
Moffat County	2017	Light Duty	0.47	5.09	0.55	0.07	0.02	0.00	419.15	0.02	0.014
Montrose County	2017	Heavy Duty	0.45	2.14	7.11	0.73	0.40	0.02	2036.28	0.06	0.004
Montrose County	2017	Light Duty	0.46	4.96	0.55	0.07	0.02	0.00	417.18	0.02	0.014
Park County	2017	Heavy Duty	0.39	2.10	7.20	0.74	0.40	0.02	2036.11	0.06	0.004
Park County	2017	Light Duty	0.45	5.18	0.56	0.05	0.02	0.00	420.39	0.02	0.013
Rio Arriba County	2017	Heavy Duty	0.45	2.13	7.14	0.73	0.40	0.02	2036.16	0.06	0.004
Rio Arriba County	2017	Light Duty	0.45	4.89	0.55	0.07	0.02	0.00	417.43	0.02	0.014
Rio Blanco County	2017	Heavy Duty	0.45	2.11	7.11	0.73	0.40	0.02	2035.89	0.06	0.004
Rio Blanco County	2017	Light Duty	0.46	4.99	0.55	0.07	0.02	0.00	417.77	0.02	0.014
Weld County	2017	Heavy Duty	0.38	2.06	7.02	0.74	0.40	0.02	2034.92	0.06	0.004
Weld County	2017	Light Duty	0.36	4.19	0.48	0.05	0.01	0.00	418.06	0.01	0.014
Yuma County	2017	Heavy Duty	0.39	2.11	7.01	0.74	0.40	0.02	2035.68	0.06	0.004
Yuma County	2017	Light Duty	0.42	4.90	0.53	0.05	0.01	0.00	416.30	0.02	0.013
Garfield County	2018	Heavy Duty	0.38	1.75	6.11	0.66	0.33	0.02	2016.97	0.06	0.003
Garfield County	2018	Light Duty	0.43	4.78	0.49	0.07	0.02	0.00	408.09	0.02	0.013
Grand County	2018	Heavy Duty	0.40	1.83	6.21	0.66	0.33	0.02	2018.73	0.07	0.004
Grand County	2018	Light Duty	0.42	4.81	0.48	0.07	0.02	0.00	409.29	0.02	0.012
La Plata County	2018	Heavy Duty	0.39	1.87	6.12	0.66	0.33	0.02	2018.96	0.07	0.004
La Plata County	2018	Light Duty	0.41	4.60	0.47	0.07	0.02	0.00	405.99	0.01	0.012
Las Animas County	2018	Heavy Duty	0.32	1.74	6.04	0.67	0.33	0.02	2050.48	0.06	0.003
Las Animas County	2018	Light Duty	0.48	5.59	0.55	0.05	0.02	0.00	418.79	0.02	0.014
Mesa County	2018	Heavy Duty	0.39	1.82	6.06	0.66	0.33	0.02	2017.98	0.06	0.004
Mesa County	2018	Light Duty	0.42	4.60	0.48	0.07	0.01	0.00	405.25	0.01	0.013
Moffat County	2018	Heavy Duty	0.40	1.87	6.11	0.66	0.33	0.02	2019.05	0.07	0.004
Moffat County	2018	Light Duty	0.41	4.68	0.48	0.07	0.02	0.00	407.25	0.02	0.012
Montrose County	2018	Heavy Duty	0.39	1.87	6.10	0.66	0.33	0.02	2018.82	0.07	0.004
Montrose County	2018	Light Duty	0.40	4.56	0.47	0.07	0.02	0.00	405.30	0.01	0.012
Park County	2018	Heavy Duty	0.34	1.83	6.17	0.67	0.33	0.02	2018.66	0.07	0.004
Park County	2018	Light Duty	0.40	4.76	0.48	0.05	0.02	0.00	408.47	0.02	0.012
Rio Arriba County	2018	Heavy Duty	0.39	1.86	6.12	0.66	0.33	0.02	2018.70	0.07	0.004
Rio Arriba County	2018	Light Duty	0.40	4.49	0.47	0.07	0.02	0.00	405.54	0.01	0.012

County	Year	Vehicle Type	Emission Rates (grams/mile)								
			VOC	CO	NOx	PM10	PM2.5	SO2	CO2	CH4	N2O
Rio Blanco County	2018	Heavy Duty	0.39	1.84	6.09	0.66	0.33	0.02	2018.46	0.07	0.004
Rio Blanco County	2018	Light Duty	0.40	4.58	0.47	0.07	0.02	0.00	405.88	0.01	0.012
Weld County	2018	Heavy Duty	0.32	1.79	6.01	0.67	0.33	0.02	2017.51	0.06	0.004
Weld County	2018	Light Duty	0.33	3.87	0.41	0.05	0.01	0.00	406.17	0.01	0.013
Yuma County	2018	Heavy Duty	0.33	1.84	6.00	0.67	0.33	0.02	2018.24	0.07	0.004
Yuma County	2018	Light Duty	0.38	4.50	0.46	0.05	0.01	0.00	404.43	0.01	0.012
Garfield County	2019	Heavy Duty	0.34	1.53	5.26	0.61	0.28	0.02	2001.29	0.07	0.003
Garfield County	2019	Light Duty	0.39	4.40	0.42	0.07	0.02	0.00	396.84	0.01	0.012
Grand County	2019	Heavy Duty	0.35	1.61	5.35	0.61	0.28	0.02	2002.98	0.07	0.004
Grand County	2019	Light Duty	0.38	4.43	0.42	0.07	0.02	0.00	398.03	0.02	0.011
La Plata County	2019	Heavy Duty	0.34	1.65	5.27	0.61	0.28	0.02	2003.22	0.07	0.004
La Plata County	2019	Light Duty	0.36	4.23	0.41	0.07	0.02	0.00	394.77	0.01	0.011
Las Animas County	2019	Heavy Duty	0.27	1.52	5.20	0.61	0.28	0.02	2034.62	0.07	0.003
Las Animas County	2019	Light Duty	0.42	5.12	0.47	0.05	0.01	0.00	406.98	0.02	0.013
Mesa County	2019	Heavy Duty	0.34	1.60	5.22	0.61	0.28	0.02	2002.27	0.07	0.004
Mesa County	2019	Light Duty	0.37	4.23	0.41	0.07	0.01	0.00	394.04	0.01	0.012
Moffat County	2019	Heavy Duty	0.35	1.64	5.26	0.61	0.28	0.02	2003.31	0.07	0.004
Moffat County	2019	Light Duty	0.37	4.31	0.41	0.07	0.02	0.00	396.01	0.01	0.011
Montrose County	2019	Heavy Duty	0.34	1.64	5.25	0.61	0.28	0.02	2003.09	0.07	0.004
Montrose County	2019	Light Duty	0.36	4.20	0.41	0.07	0.01	0.00	394.08	0.01	0.011
Park County	2019	Heavy Duty	0.29	1.61	5.31	0.62	0.28	0.02	2002.93	0.07	0.004
Park County	2019	Light Duty	0.36	4.38	0.42	0.05	0.01	0.00	397.21	0.02	0.011
Rio Arriba County	2019	Heavy Duty	0.34	1.63	5.27	0.61	0.28	0.02	2002.97	0.07	0.004
Rio Arriba County	2019	Light Duty	0.36	4.14	0.41	0.07	0.01	0.00	394.33	0.01	0.011
Rio Blanco County	2019	Heavy Duty	0.34	1.61	5.24	0.61	0.28	0.02	2002.72	0.07	0.004
Rio Blanco County	2019	Light Duty	0.36	4.22	0.41	0.07	0.02	0.00	394.66	0.01	0.011
Weld County	2019	Heavy Duty	0.27	1.57	5.18	0.62	0.28	0.02	2001.83	0.07	0.004
Weld County	2019	Light Duty	0.30	3.58	0.36	0.05	0.01	0.00	394.95	0.01	0.012
Yuma County	2019	Heavy Duty	0.28	1.61	5.17	0.62	0.28	0.02	2002.52	0.07	0.004
Yuma County	2019	Light Duty	0.34	4.14	0.40	0.05	0.01	0.00	393.23	0.01	0.011
Garfield County	2020	Heavy Duty	0.30	1.35	4.54	0.56	0.24	0.02	1987.14	0.07	0.003
Garfield County	2020	Light Duty	0.35	4.09	0.37	0.07	0.02	0.00	386.11	0.01	0.011
Grand County	2020	Heavy Duty	0.31	1.42	4.61	0.56	0.24	0.02	1988.79	0.07	0.004
Grand County	2020	Light Duty	0.34	4.12	0.37	0.07	0.02	0.00	387.29	0.01	0.010
La Plata County	2020	Heavy Duty	0.30	1.46	4.55	0.56	0.24	0.02	1989.02	0.07	0.004
La Plata County	2020	Light Duty	0.33	3.94	0.36	0.07	0.01	0.00	384.06	0.01	0.010
Las Animas County	2020	Heavy Duty	0.23	1.34	4.48	0.57	0.24	0.02	2020.29	0.07	0.003

County	Year	Vehicle Type	Emission Rates (grams/mile)								
			VOC	CO	NOx	PM10	PM2.5	SO2	CO2	CH4	N2O
Las Animas County	2020	Light Duty	0.38	4.73	0.41	0.05	0.01	0.00	395.63	0.02	0.012
Mesa County	2020	Heavy Duty	0.30	1.41	4.50	0.56	0.24	0.02	1988.09	0.07	0.004
Mesa County	2020	Light Duty	0.34	3.94	0.36	0.07	0.01	0.00	383.34	0.01	0.011
Moffat County	2020	Heavy Duty	0.31	1.45	4.54	0.56	0.24	0.02	1989.10	0.07	0.004
Moffat County	2020	Light Duty	0.33	4.00	0.36	0.07	0.02	0.00	385.29	0.01	0.010
Montrose County	2020	Heavy Duty	0.30	1.46	4.53	0.56	0.24	0.02	1988.89	0.07	0.004
Montrose County	2020	Light Duty	0.33	3.90	0.35	0.07	0.01	0.00	383.39	0.01	0.010
Park County	2020	Heavy Duty	0.25	1.42	4.58	0.57	0.24	0.02	1988.73	0.07	0.004
Park County	2020	Light Duty	0.32	4.07	0.36	0.05	0.01	0.00	386.48	0.01	0.010
Rio Arriba County	2020	Heavy Duty	0.30	1.45	4.54	0.56	0.24	0.02	1988.77	0.07	0.004
Rio Arriba County	2020	Light Duty	0.32	3.85	0.36	0.07	0.01	0.00	383.63	0.01	0.010
Rio Blanco County	2020	Heavy Duty	0.30	1.43	4.52	0.56	0.24	0.02	1988.54	0.07	0.004
Rio Blanco County	2020	Light Duty	0.33	3.92	0.35	0.07	0.01	0.00	383.95	0.01	0.010
Weld County	2020	Heavy Duty	0.24	1.38	4.46	0.57	0.24	0.02	1987.65	0.07	0.003
Weld County	2020	Light Duty	0.27	3.34	0.31	0.05	0.01	0.00	384.24	0.01	0.011
Yuma County	2020	Heavy Duty	0.24	1.43	4.46	0.57	0.24	0.02	1988.34	0.07	0.004
Yuma County	2020	Light Duty	0.31	3.85	0.35	0.05	0.01	0.00	382.54	0.01	0.010
Garfield County	2021	Heavy Duty	0.26	1.20	3.96	0.53	0.21	0.02	1974.81	0.07	0.003
Garfield County	2021	Light Duty	0.32	3.80	0.32	0.07	0.01	0.00	374.81	0.01	0.010
Grand County	2021	Heavy Duty	0.27	1.27	4.03	0.53	0.21	0.02	1976.42	0.07	0.004
Grand County	2021	Light Duty	0.31	3.83	0.32	0.07	0.02	0.00	375.98	0.01	0.009
La Plata County	2021	Heavy Duty	0.27	1.30	3.97	0.53	0.21	0.02	1976.64	0.07	0.004
La Plata County	2021	Light Duty	0.30	3.66	0.31	0.07	0.01	0.00	372.79	0.01	0.009
Las Animas County	2021	Heavy Duty	0.20	1.19	3.91	0.54	0.21	0.02	2007.81	0.07	0.003
Las Animas County	2021	Light Duty	0.34	4.36	0.36	0.05	0.01	0.00	383.72	0.01	0.011
Mesa County	2021	Heavy Duty	0.26	1.26	3.93	0.53	0.21	0.02	1975.74	0.07	0.004
Mesa County	2021	Light Duty	0.30	3.66	0.31	0.07	0.01	0.00	372.08	0.01	0.010
Moffat County	2021	Heavy Duty	0.27	1.30	3.96	0.53	0.21	0.02	1976.73	0.07	0.004
Moffat County	2021	Light Duty	0.30	3.72	0.32	0.07	0.02	0.00	374.00	0.01	0.009
Montrose County	2021	Heavy Duty	0.27	1.30	3.95	0.53	0.21	0.02	1976.52	0.07	0.004
Montrose County	2021	Light Duty	0.29	3.62	0.31	0.07	0.01	0.00	372.12	0.01	0.009
Park County	2021	Heavy Duty	0.21	1.27	4.00	0.54	0.21	0.02	1976.36	0.07	0.004
Park County	2021	Light Duty	0.29	3.79	0.32	0.05	0.01	0.00	375.18	0.01	0.009
Rio Arriba County	2021	Heavy Duty	0.27	1.29	3.97	0.53	0.21	0.02	1976.41	0.07	0.004
Rio Arriba County	2021	Light Duty	0.29	3.58	0.31	0.07	0.01	0.00	372.36	0.01	0.009
Rio Blanco County	2021	Heavy Duty	0.27	1.28	3.95	0.53	0.21	0.02	1976.18	0.07	0.004
Rio Blanco County	2021	Light Duty	0.29	3.64	0.31	0.07	0.01	0.00	372.69	0.01	0.009

County	Year	Vehicle Type	Emission Rates (grams/mile)								
			VOC	CO	NOx	PM10	PM2.5	SO2	CO2	CH4	N2O
Weld County	2021	Heavy Duty	0.20	1.23	3.90	0.54	0.21	0.02	1975.30	0.07	0.003
Weld County	2021	Light Duty	0.25	3.12	0.28	0.05	0.01	0.00	372.96	0.01	0.010
Yuma County	2021	Heavy Duty	0.20	1.27	3.89	0.54	0.21	0.02	1975.98	0.07	0.004
Yuma County	2021	Light Duty	0.28	3.58	0.30	0.05	0.01	0.00	371.28	0.01	0.009
Garfield County	2022	Heavy Duty	0.24	1.08	3.50	0.50	0.18	0.02	1964.23	0.07	0.003
Garfield County	2022	Light Duty	0.29	3.54	0.29	0.07	0.01	0.00	363.53	0.01	0.009
Grand County	2022	Heavy Duty	0.25	1.15	3.56	0.50	0.19	0.02	1965.81	0.08	0.004
Grand County	2022	Light Duty	0.28	3.57	0.28	0.07	0.02	0.00	364.67	0.01	0.009
La Plata County	2022	Heavy Duty	0.24	1.18	3.51	0.50	0.19	0.02	1966.02	0.07	0.004
La Plata County	2022	Light Duty	0.27	3.41	0.28	0.07	0.01	0.00	361.53	0.01	0.009
Las Animas County	2022	Heavy Duty	0.18	1.07	3.46	0.51	0.19	0.02	1997.09	0.07	0.003
Las Animas County	2022	Light Duty	0.31	4.04	0.31	0.05	0.01	0.00	371.88	0.01	0.010
Mesa County	2022	Heavy Duty	0.24	1.14	3.47	0.50	0.19	0.02	1965.14	0.07	0.004
Mesa County	2022	Light Duty	0.28	3.41	0.28	0.07	0.01	0.00	360.83	0.01	0.009
Moffat County	2022	Heavy Duty	0.25	1.18	3.50	0.50	0.19	0.02	1966.11	0.08	0.004
Moffat County	2022	Light Duty	0.28	3.47	0.28	0.07	0.01	0.00	362.73	0.01	0.009
Montrose County	2022	Heavy Duty	0.24	1.18	3.49	0.50	0.19	0.02	1965.89	0.07	0.004
Montrose County	2022	Light Duty	0.27	3.38	0.27	0.07	0.01	0.00	360.87	0.01	0.009
Park County	2022	Heavy Duty	0.19	1.15	3.53	0.51	0.19	0.02	1965.75	0.08	0.004
Park County	2022	Light Duty	0.27	3.53	0.28	0.05	0.01	0.00	363.89	0.01	0.009
Rio Arriba County	2022	Heavy Duty	0.24	1.17	3.50	0.50	0.19	0.02	1965.78	0.07	0.004
Rio Arriba County	2022	Light Duty	0.27	3.34	0.27	0.07	0.01	0.00	361.11	0.01	0.009
Rio Blanco County	2022	Heavy Duty	0.24	1.15	3.49	0.50	0.19	0.02	1965.57	0.07	0.004
Rio Blanco County	2022	Light Duty	0.27	3.40	0.27	0.07	0.01	0.00	361.43	0.01	0.009
Weld County	2022	Heavy Duty	0.18	1.11	3.44	0.51	0.19	0.02	1964.72	0.07	0.003
Weld County	2022	Light Duty	0.23	2.91	0.25	0.05	0.01	0.00	361.70	0.01	0.009
Yuma County	2022	Heavy Duty	0.18	1.15	3.44	0.51	0.19	0.02	1965.37	0.07	0.004
Yuma County	2022	Light Duty	0.25	3.34	0.27	0.05	0.01	0.00	360.05	0.01	0.009
Garfield County	2023	Heavy Duty	0.22	0.98	3.14	0.48	0.17	0.02	1955.21	0.07	0.003
Garfield County	2023	Light Duty	0.26	3.29	0.25	0.07	0.01	0.00	352.20	0.01	0.009
Grand County	2023	Heavy Duty	0.23	1.05	3.19	0.48	0.17	0.02	1956.75	0.08	0.004
Grand County	2023	Light Duty	0.26	3.33	0.25	0.07	0.02	0.00	353.33	0.01	0.008
La Plata County	2023	Heavy Duty	0.23	1.09	3.14	0.48	0.17	0.02	1956.97	0.07	0.004
La Plata County	2023	Light Duty	0.25	3.17	0.24	0.07	0.01	0.00	350.23	0.01	0.008
Las Animas County	2023	Heavy Duty	0.16	0.98	3.10	0.49	0.17	0.02	1987.95	0.07	0.003
Las Animas County	2023	Light Duty	0.28	3.74	0.27	0.05	0.01	0.00	360.03	0.01	0.009
Mesa County	2023	Heavy Duty	0.22	1.05	3.11	0.48	0.17	0.02	1956.10	0.07	0.004

County	Year	Vehicle Type	Emission Rates (grams/mile)								
			VOC	CO	NOx	PM10	PM2.5	SO2	CO2	CH4	N2O
Mesa County	2023	Light Duty	0.25	3.17	0.24	0.07	0.01	0.00	349.53	0.01	0.009
Moffat County	2023	Heavy Duty	0.23	1.08	3.14	0.48	0.17	0.02	1957.04	0.08	0.004
Moffat County	2023	Light Duty	0.25	3.23	0.25	0.07	0.01	0.00	351.41	0.01	0.008
Montrose County	2023	Heavy Duty	0.22	1.09	3.13	0.48	0.17	0.02	1956.85	0.07	0.004
Montrose County	2023	Light Duty	0.24	3.14	0.24	0.07	0.01	0.00	349.58	0.01	0.008
Park County	2023	Heavy Duty	0.17	1.06	3.16	0.49	0.17	0.02	1956.70	0.08	0.004
Park County	2023	Light Duty	0.25	3.29	0.25	0.05	0.01	0.00	352.55	0.01	0.008
Rio Arriba County	2023	Heavy Duty	0.22	1.08	3.14	0.48	0.17	0.02	1956.75	0.07	0.004
Rio Arriba County	2023	Light Duty	0.24	3.11	0.24	0.07	0.01	0.00	349.81	0.01	0.008
Rio Blanco County	2023	Heavy Duty	0.22	1.06	3.12	0.48	0.17	0.02	1956.53	0.07	0.004
Rio Blanco County	2023	Light Duty	0.24	3.16	0.24	0.07	0.01	0.00	350.12	0.01	0.008
Weld County	2023	Heavy Duty	0.16	1.02	3.08	0.49	0.17	0.02	1955.69	0.07	0.003
Weld County	2023	Light Duty	0.21	2.71	0.22	0.05	0.01	0.00	350.40	0.01	0.009
Yuma County	2023	Heavy Duty	0.16	1.06	3.08	0.49	0.17	0.02	1956.33	0.07	0.004
Yuma County	2023	Light Duty	0.23	3.10	0.24	0.05	0.01	0.00	348.76	0.01	0.008
Garfield County	2024	Heavy Duty	0.20	0.90	2.84	0.46	0.15	0.02	1947.58	0.07	0.003
Garfield County	2024	Light Duty	0.24	3.05	0.22	0.07	0.01	0.00	340.85	0.01	0.008
Grand County	2024	Heavy Duty	0.21	0.97	2.89	0.46	0.15	0.02	1949.10	0.08	0.004
Grand County	2024	Light Duty	0.24	3.09	0.22	0.07	0.01	0.00	341.97	0.01	0.008
La Plata County	2024	Heavy Duty	0.21	1.01	2.84	0.46	0.15	0.02	1949.31	0.08	0.004
La Plata County	2024	Light Duty	0.23	2.94	0.22	0.07	0.01	0.00	338.91	0.01	0.008
Las Animas County	2024	Heavy Duty	0.14	0.90	2.80	0.47	0.15	0.02	1980.21	0.07	0.003
Las Animas County	2024	Light Duty	0.26	3.45	0.24	0.05	0.01	0.00	348.18	0.01	0.009
Mesa County	2024	Heavy Duty	0.20	0.97	2.82	0.46	0.15	0.02	1948.46	0.07	0.004
Mesa County	2024	Light Duty	0.23	2.93	0.22	0.07	0.01	0.00	338.23	0.01	0.008
Moffat County	2024	Heavy Duty	0.21	1.00	2.84	0.46	0.15	0.02	1949.38	0.08	0.004
Moffat County	2024	Light Duty	0.23	2.99	0.22	0.07	0.01	0.00	340.07	0.01	0.008
Montrose County	2024	Heavy Duty	0.21	1.00	2.83	0.46	0.15	0.02	1949.19	0.08	0.004
Montrose County	2024	Light Duty	0.22	2.91	0.21	0.07	0.01	0.00	338.27	0.01	0.008
Park County	2024	Heavy Duty	0.15	0.97	2.87	0.47	0.15	0.02	1949.05	0.08	0.004
Park County	2024	Light Duty	0.23	3.05	0.22	0.05	0.01	0.00	341.20	0.01	0.008
Rio Arriba County	2024	Heavy Duty	0.21	0.99	2.84	0.46	0.15	0.02	1949.08	0.08	0.004
Rio Arriba County	2024	Light Duty	0.22	2.89	0.21	0.07	0.01	0.00	338.50	0.01	0.008
Rio Blanco County	2024	Heavy Duty	0.21	0.98	2.83	0.46	0.15	0.02	1948.87	0.08	0.004
Rio Blanco County	2024	Light Duty	0.22	2.93	0.21	0.07	0.01	0.00	338.81	0.01	0.008
Weld County	2024	Heavy Duty	0.14	0.94	2.79	0.47	0.15	0.02	1948.05	0.07	0.003
Weld County	2024	Light Duty	0.20	2.52	0.19	0.05	0.01	0.00	339.08	0.01	0.008

County	Year	Vehicle Type	Emission Rates (grams/mile)								
			VOC	CO	NOx	PM10	PM2.5	SO2	CO2	CH4	N2O
Yuma County	2024	Heavy Duty	0.15	0.98	2.79	0.47	0.15	0.02	1948.69	0.07	0.004
Yuma County	2024	Light Duty	0.21	2.88	0.21	0.05	0.01	0.00	337.47	0.01	0.008
Garfield County	2025	Heavy Duty	0.19	0.83	2.60	0.44	0.14	0.02	1940.96	0.07	0.003
Garfield County	2025	Light Duty	0.22	2.81	0.20	0.07	0.01	0.00	329.46	0.01	0.008
Grand County	2025	Heavy Duty	0.20	0.91	2.64	0.44	0.14	0.02	1942.47	0.08	0.004
Grand County	2025	Light Duty	0.22	2.85	0.20	0.07	0.01	0.00	330.56	0.01	0.007
La Plata County	2025	Heavy Duty	0.19	0.94	2.60	0.44	0.14	0.02	1942.67	0.08	0.004
La Plata County	2025	Light Duty	0.20	2.71	0.19	0.07	0.01	0.00	327.55	0.01	0.008
Las Animas County	2025	Heavy Duty	0.13	0.83	2.57	0.45	0.14	0.02	1973.48	0.07	0.003
Las Animas County	2025	Light Duty	0.23	3.16	0.21	0.05	0.01	0.00	336.33	0.01	0.008
Mesa County	2025	Heavy Duty	0.19	0.90	2.58	0.44	0.14	0.02	1941.82	0.07	0.004
Mesa County	2025	Light Duty	0.21	2.70	0.19	0.06	0.01	0.00	326.87	0.01	0.008
Moffat County	2025	Heavy Duty	0.20	0.93	2.60	0.44	0.14	0.02	1942.74	0.08	0.004
Moffat County	2025	Light Duty	0.21	2.76	0.19	0.07	0.01	0.00	328.69	0.01	0.008
Montrose County	2025	Heavy Duty	0.19	0.94	2.59	0.44	0.14	0.02	1942.55	0.08	0.004
Montrose County	2025	Light Duty	0.20	2.68	0.19	0.07	0.01	0.00	326.92	0.01	0.008
Park County	2025	Heavy Duty	0.14	0.91	2.62	0.45	0.14	0.02	1942.42	0.08	0.004
Park County	2025	Light Duty	0.21	2.81	0.20	0.05	0.01	0.00	329.81	0.01	0.007
Rio Arriba County	2025	Heavy Duty	0.19	0.93	2.60	0.44	0.14	0.02	1942.45	0.08	0.004
Rio Arriba County	2025	Light Duty	0.20	2.66	0.19	0.07	0.01	0.00	327.15	0.01	0.007
Rio Blanco County	2025	Heavy Duty	0.19	0.91	2.59	0.44	0.14	0.02	1942.23	0.08	0.004
Rio Blanco County	2025	Light Duty	0.20	2.70	0.19	0.07	0.01	0.00	327.45	0.01	0.007
Weld County	2025	Heavy Duty	0.13	0.87	2.56	0.45	0.14	0.02	1941.43	0.07	0.003
Weld County	2025	Light Duty	0.18	2.32	0.17	0.05	0.01	0.00	327.71	0.01	0.008
Yuma County	2025	Heavy Duty	0.13	0.91	2.55	0.45	0.14	0.02	1942.06	0.07	0.004
Yuma County	2025	Light Duty	0.19	2.65	0.18	0.05	0.01	0.00	326.12	0.01	0.007