BUREAU OF LAND MANAGEMENT –

COLORADO STATE OFFICE

2026 ANNUAL AIR QUALITY REPORT –

OIL AND GAS FOCUSED

Prepared November 2026



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1. Introduction

1.1 Purpose and Need

This report was prepared in accordance with Section V of the BLM Colorado Air Resource Protection Protocol (CARPP). The CARPP requires the BLM CO Air Resource Specialists (ARS) to annually assess whether the strategies defined within the protocol and implemented during project level authorizations for BLM managed activities that have the potential to significantly impact air resources (air quality and related values) are effective in meeting the stated goals and objectives outlined within each field office or planning area's applicable Resource Management Plan (RMP). The Federal Land Policy and Management Act of 1976 (FLPMA) and all Colorado RMPs require the BLM to comply with federal and state air quality regulations when authorizing federal actions. Some of the newer RMP revisions also contain specific management actions for meeting compliance and/or desired outcomes for regional air resources. The CARPP strategies provide a holistic approach for protecting air resources by implementing a "Deming Cycle" of planning, implementing, studying, and acting upon the results and insights gained throughout the cycle of planning studies, project authorizations, and subsequent data reviews, for which the Annual Report itself is a component.

The CARPP also requires the BLM to provide prescriptive model validation for the Colorado Air Resources Management Modeling Study (CARMMS). BLM Colorado initiated CARMMS to assess statewide impacts of projected oil, gas, and coal mining development scenarios. Specific validation measures include reviewing annual oil and gas development and production to determine which CARMMS scenario best approximates the current federal development track. In addition, BLM Colorado applies the same oil and gas trends analysis approach using the BLM Regional Modeling Study input and modeled predictions. Validation also requires a review of applicable air quality trends to ensure the model results can be adequately relied upon for future project authorizations. The validation process provides an opportunity for the BLM to assess whether specific air resource protection measures should be recommended for application on a regional or statewide basis to mitigate current or reasonably foreseeable cumulative impact concerns. Any mitigation recommendations may require additional analysis and/or interagency coordination (MOU) prior to implementation.

This report focuses exclusively on oil and gas authorizations, as BLM has determined that these activities have the greatest potential to impact air resources. For all other resources that BLM manages, BLM staff members conduct analyses for actions that have the potential to significantly impact air quality, in accordance with NEPA requirements, on a case-by-case basis. The following BLM Colorado Field Offices contain oil, gas, and/or coal resources for which the BLM has stewardship responsibilities. As such, the areas under the domain of the following field offices will be the focus of the report: Colorado River Valley (CRVFO), Grand Junction (GJFO), Kremmling (KFO), Little Snake (LSFO), Royal Gorge (RGFO), Tres Rios (TRFO), Uncompahgre (UFO), White River (WRFO).

1.2 NEPA Streamlining & Guidance

The Annual Report provides current information for each applicable Colorado Field Office or Planning Area that includes, but is not limited to, resource regulations, air quality trends, federal mineral rates of development and production, emissions inventory data, and detailed analysis. Consistent with CEQ regulation 40 CFR §1502.21, Incorporation by Reference (IBR), and mandates to reduce paperwork and

NEPA preparation time, the contents of this Annual Report should be incorporated by reference into subsequent BLM Colorado NEPA analyses. In doing so, future BLM Colorado NEPA analyses will include the affected environment and cumulative impacts analysis, including climate change, associated with the proposed action and alternatives for air related issues requiring detailed analysis or, to support the dismissal of such issues from further analysis.

This entire report is a resource to be incorporated by reference, but the following chapters have explicit connection to NEPA requirements:

Chapter 2. Air Quality Policy and Regulation describes and defines general and specific air quality regulations pertaining to BLM authorizations, as well as the authority for such laws; provides a basic overview of the science and issues associated with the various types of air pollutants (i.e. criteria, hazardous and greenhouse gases) and air quality related values, any applicable metrics for their analysis, and the contexts of such analysis relative to various geographic designations (e.g. attainment, non-attainment, Class I airsheds).

Chapter 3. Analysis Methods and Tools covers the basic science of air resources analysis; refers to the CARPP for project-specific analysis guidelines to be followed for the project-specific NEPA analysis; and outlines the analysis methods used within the Annual Report to track report year oil and gas development and production and compare to CARMMS scenarios. Additionally, this section includes a detailed description of the various tools BLM has at its disposal for providing appropriate air resources analysis. This section should be referenced to provide support for the methodology of analysis used in project-level NEPA.

Chapter 4. Affected Environment: Statewide Air Quality Conditions and Emissions provides current criteria pollutant monitoring data, air quality related values information, and geographically based national emissions inventory data. This chapter should be referenced to set the context for current statewide conditions in the NEPA air resources analysis.

Chapter 5. Affected Environment: Conditions and Trends by Field Office discusses and interprets the information in Chapter 4. Affected Environment: Statewide Air Quality Conditions and Emissions at the field office level and provides details about the current and trending pace of oil and gas development compared to CARMMS scenarios. This chapter should be referenced to establish the context for current field office conditions in NEPA air resources analysis and to describe the potential (i.e. projected) NEPA cumulative impacts at the field office scale.

Greenhouse gas (GHG) and climate information is not included in this air quality focused version of the annual report. The latest BLM Specialist Report on Annual Greenhouse Gas Emissions provides the most up-to-date GHG and climate information generated by the BLM for each State.

2. Air Quality Policy and Regulation

2.1 Introduction

Congress gave the Environmental Protection Agency (EPA) regulatory authority for cleaning up air pollution. The Clean Air Act (CAA) authorizes EPA to establish National Ambient Air Quality Standards (NAAQS) to protect public health and public welfare and to regulate emissions of hazardous air pollutants. The CAA also gives EPA the authority to limit emissions of air pollutants coming from sources like chemical plants, utilities, and steel mills.

The Colorado Department of Public Health and Environment (CDPHE) is responsible for ensuring that air in Colorado meets health and safety standards established under the CAA. To fulfil this responsibility, the CPDHE is required by the federal government to ensure compliance with the EPA's National Ambient Air Quality Standards (NAAQS) statewide. Additionally, the state ensures compliance with visibility standards through regional haze rules. The CPDHE enacts rules pertaining to air quality standards, develops plans to meet the federal standards, when necessary, issues preconstruction and operating permits to stationary sources, and ensures compliance with state and federal air quality rules.

EPA's Tribal Authority Rule gives Tribes the ability to develop air quality management programs, write rules to reduce air pollution and implement and enforce their rules in Indian Country. While state and local agencies are responsible for all CAA requirements, Tribes may develop and implement only those parts of the CAA that are appropriate for their lands.

While the EPA, State, and Tribes have regulatory authority to control air pollution emissions, it is the mission of the BLM to sustain the health, diversity, and productivity of the public lands for the use and enjoyment of present and future generations.

2.2 Federal Policy and Regulation

2.2.1 Clean Air Act

The CAA of 1963 [42 U.S.C. § 1857 et seq.], as amended and recodified [42 U.S.C. § 7401 et seq.] is the primary federal legislation and provides the framework for protecting and enhancing the quality of the Nation's air resources to promote the public health and welfare and the productive capacity of its population (Section 101(b)(1)). The Act focuses on reducing both criteria air pollutants and hazardous air pollutants. As required by the CAA, EPA has established NAAQS for criteria pollutants (Section 109 (a)(1)(A)). Compliance and enforcement of these federal requirements is delegated to applicable Tribal, State and local regulatory agencies (Sections 107(a), 301(d), 302). The CAA also allows these agencies to establish regulations which are more, but not less, stringent than the federal requirement (Section 116) (EPA, The Plain English Guide to The Clean Air Act, 2007). The BLM has no authority to determine how air quality standards will be achieved nor to determine area designations.

2.2.2 Federal Land Policy and Management Act

The Federal Land Policy and Management Act (FLPMA) of 1976 [43 U.S.C. §§ 1701-1785], often referred to as the BLM's "Organic Act," provides the majority of the BLM's legislated authority, direction policy, and basic management guidance. This Act outlines the BLM's role as a multiple use land management agency and provides for management of the public lands under principles of multiple use and sustained yield. The

Act directs public lands to be managed "in a manner that will protect the quality of scientific, scenic, historical, ecological, environmental, air and atmospheric, water resource, and archeological values" (Sec. 102. [43 U.S.C. 1701] (a) (8)). To meet this responsibility, the BLM is to require "compliance with applicable pollution control laws, including state and federal air, water, noise, or other pollution standards or implementation plans" (Sec. 202. [43 U.S.C. 1712] (a)(8)). This means that the BLM can reasonably rely on compliance with existing air pollution control regulations to ensure protection of regulatory air quality standards (e.g. NAAQS). In addition, BLM can reasonably rely on federal or delegated state air pollution control agencies to determine compliance with these regulations, and to enforce these regulatory air quality standards. FLPMA also gives the BLM authority to halt any BLM authorized activity that is found in violation of state or federal air quality regulations, thus ensuring that the BLM can provide compliance with applicable air quality standards, regulations, and implementation plans (Sec. 302. [43 U.S.C. 1732] (a)(c)).

2.2.3 National Environmental Policy Act

The National Environmental Policy Act (NEPA) of 1969 [42 U.S.C. 4321 et seq.]: NEPA ensures that information on the potential environmental and human impact of federal actions is available to public officials and citizens before decisions are made and before actions are taken. One of the purposes of the Act is to "promote efforts which will prevent or eliminate damage to the environment and biosphere," and to promote human health and welfare (Section 2). This Act requires that agencies prepare a detailed statement on the environmental impact of the proposed action for major federal actions expected to significantly affect the quality of the human environment (Section 102 (C)). In addition, agencies are required, to the fullest extent possible, to use a "systematic, interdisciplinary approach" in planning and decision-making processes that may have an impact on the environment (Section 102(A)).

2.3 Oil and Gas Regulations

Authority for regulating oil and gas activities in Colorado rests with four entities; 1) the Colorado Energy and Carbon Management Commission (ECMC), 2) the Colorado Department of Public Health and Environment (CDPHE), 3) the U.S. Environmental Protection Agency (EPA), and 4) Federal Land Management agencies (e.g. BLM, USFS). All emissions resulting from oil and gas exploration, development and production activities must comply with the rules and regulations established for applicable activities and sources as defined and enforced by the ECMC, CDPHE and EPA. Note that prior to July 1, 2023, the ECMC was the Colorado Oil and Gas Conservation Commission (COGCC).

The ECMC regulations that include an air quality component are the Series 300 (Drilling, Development, Production, and Abandonment) and 800 (Aesthetics and Noise Control) rules.

The CDPHE regulations that are most likely to have applicability for oil and gas operations are as follows:

- Regulation 1 - Emission Control for Particulate Matter, Smoke, Carbon Monoxide and Sulfur Oxides
    - III.D Fugitive Particulate Emissions
- Regulation 3 - Stationary Source Permitting and Air Pollutant Emission Notice Requirements
    - Part A - General Provisions Applicable to Air Pollution Emissions Notice Requirements
    - Part B - Construction Permits
- Regulation 6 - Standards of Performance for New Stationary Sources
    - Subpart A - General Provisions

    - Subpart OOOO - Standards of Performance for Crude Oil and Natural Gas Production, Transmission and Distribution
- Regulation 7 - Control of Ozone via Ozone Precursors and Control of Hydrocarbons via Oil and Gas Emissions
    - Part A - Applicability and General Provisions
    - Part B – Oil and Natural Gas Operations

The EPA rules that are most likely to have applicability to oil and gas operations are as follows:

- NSPS Subpart JJJJ - Standards of Performance for Stationary Spark Ignition Internal Combustion Engines
- NESHAP Subpart HH - National Emission Standard for Hazardous Air Pollutants from Oil and Natural Gas Production Facilities
- NESHAP Subpart ZZZZ - National Emission Standard for Hazardous Air Pollutants for Stationary Reciprocating Internal Combustion Engines
- NSPS OOOO Standards of Performance for Crude Oil and Natural Gas Production, Transmission and Distribution - The EPA is currently considering rulemaking to incorporate methane control requirements into NSPS Subpart OOOO, similar to how Colorado includes methane in its Regulation 7 definitions of volatile organic compounds.

Other EPA regulations would also indirectly affect overall emissions from the oil and gas industry, such as the non-road and on-road engine standards. Likewise, the National Highway Traffic Safety Administration (NHTSA) establishes the Corporate Average Fuel Economy (CAFE) requirements.

In addition to the above regulations, activities that involve federal mineral estate would also be required to comply with BLM land use stipulations (federal surface only) and permit-specific Conditions of Approval (COA) that would be determined by analysis at the time of permitting / authorization. The BLM makes land use allocations and stipulation decisions during RMP development. There are typically three types of stipulation for lands that are designated as available for future oil, gas, and coal exploration and development: they include No Surface Occupancy (NSO), Controlled Surface Use (CSU), and Timing Limitations (TL). Areas identified as NSO will be unavailable to placement of surface facilities such as oil and gas wells, will be avoidance areas for location of public utilities, and will be closed to new road construction. Areas identified as CSU will require proposals be authorized only according to the controls or constraints specified. Controls will be applicable to all surface use activities, such as oil and gas development and operation, mineral material sales, and public utility location.

The appropriateness and application of each is entirely dependent upon on-the-ground resources. Parcel lease documents typically have stipulations attached when exclusive mineral rights are transferred to an individual or organization after a lease sale. Any subsequent plans for exploration or development on the parcel must comply with the stipulation parameters. Additionally, when the BLM analyzes plans for subsequent exploration or development (as required by NEPA with data required by Onshore Oil and Gas Order No. 1), it may attach COAs to permits authorizing such activities as necessary to mitigate any significantly impacted resources, regardless of surface ownership status. The term COA refers to a site-specific requirement included in an approved permit or sundry notice that may limit or amend the specific actions proposed by the operator to minimize, mitigate, or prevent impacts to public lands or other resources. Both stipulations and COAs are subject to enforcement by the BLM.

2.4 Criteria Air Pollutants

The U.S. Environmental Protection Agency (EPA) has established National Ambient Air Quality Standards (NAAQS) for seven criteria air pollutants (CAPs), which include carbon monoxide (CO), nitrogen dioxide (NO_2), ozone (O_3), particulate matter (PM_{10} and $PM_{2.5}$), sulfur dioxide (SO_2), and lead (Pb). Exposure to air pollutant concentrations greater than the established NAAQS is shown to have a detrimental impact on human health and the environment. Thus, ambient air quality standards must not be violated in areas where the public has access. All criteria pollutants are directly emitted from a variety of source types, except for ground-level ozone and the secondary formation of condensable particulate matter (secondary $PM_{2.5}$). The Clean Air Act (CAA) established two types of NAAQS, primary and secondary. Primary standards set limits to protect public health, including the health of "sensitive" populations (e.g. asthmatics, children, the elderly, etc.), while secondary standards set limits to protect public welfare, including protection against decreased visibility and damage to animals, crops, vegetation, and buildings.

The EPA must review the NAAQS every five years to ensure that the latest science on health effects, risk assessment, and observable data such as hospital admissions are evaluated to determine whether NAAQS levels remain appropriate. Moreover, the EPA can revise any NAAQS if the data supports a revision. The Colorado Air Pollution Control Commission can establish state ambient air quality standards for any criteria pollutant. Any state standard must be at least as stringent as the federal standards. Table 1 lists the federal and Colorado ambient air quality standards. The EPA recently revised the primary annual $PM_{2.5}$ standard, lowering it from 12.0 $\mu g/m^3$ to 9.0 $\mu g/m^3$. This new standard was finalized on February 7, 2024, and aims to provide stronger public health protection based on the latest scientific evidence. The standard for the primary and secondary 24-hour $PM_{2.5}$, as well as the PM_{10} standards, remains unchanged

Ambient air quality (i.e. compliance with the NAAQS) is demonstrated by monitoring ground-level atmospheric air pollutant concentrations. The CDPHE monitors ambient air quality at several locations throughout the state and summarizes the data annually by air quality region to produce an annual report. There are currently eight air quality regions in Colorado that are designed to accurately reflect local air quality conditions. The reports are prepared to inform the public about air quality trends within each region and can be found on the CDPHE's Technical Services Program website. Similarly, several Federal Land Managers (FLMs) like the BLM, U.S. Forest Service (FS), and the National Park Service (NPS), also monitor for NAAQS and Air Quality Related Values (AQRVs) to meet Organic Act requirements.

Additional information on criteria pollutants, including emissions and modeling significance levels, can be found in the Colorado Modeling Guideline. The Guideline defines levels for emissions to suggest when modeling may be warranted, and when the results of such analysis could trigger the need for additional refined analysis. The Guidance defines Significant Impact Levels (SIL) for all criteria pollutants except for ozone and lead. Furthermore, the EPA also recently published SIL guidance for ozone and fine particulates applicable to Prevention of Significant Deterioration (PSD) permitting actions that regulatory agencies may choose to use when reviewing PSD modeling results on a case-by-case basis (more on PSD below). Both documents are informative about the NEPA process, although not directly applicable.

Table 1. Primary Criteria Pollutant NAAQS.

Pollutant	Primary/ Secondary	Averaging Time	Level*	Form
Carbon Monoxide (CO)	primary	8 hours	9 ppm	Not to be exceeded more than once per year
		1 hour	35 ppm	
Lead (Pb)	primary and secondary	Rolling 3-month average	0.15 µg/m^3	Not to be exceeded
Nitrogen Dioxide (NO_2)	primary	1 hour	100 ppb	98th percentile of 1-hour daily maximum concentrations, averaged over 3 years
	primary and secondary	1 year	53 ppb	Annual Mean
Ozone (O_3)	primary and secondary	8 hours	0.070 ppm	Annual fourth-highest daily maximum 8-hour concentration, averaged over 3 years
Fine Particulate Matter ($PM_{2.5}$)	primary	1 year	9.0 µg/m^3	Annual mean, averaged over 3 years
	secondary	1 year	15.0 µg/m^3	Annual mean, averaged over 3 years
	primary and secondary	24 hours	35 µg/m^3	98th percentile, averaged over 3 years
Coarse Particulate Matter (PM_{10})	primary and secondary	24 hours	150 µg/m^3	Not to be exceeded more than once per year on average over 3 years
Sulfur Dioxide (SO_2)	primary	1 hour	75 ppb	99th percentile of 1-hour daily maximum concentrations, averaged over 3 years
	Secondary	3 hours	0.5 ppm	Not to be exceeded more than once per year
* Units of measure for the standards are parts per million (ppm) by volume, parts per billion (ppb) by volume, and micrograms per cubic meter of air (µg/m^3).				

2.4.1 Carbon Monoxide

Carbon monoxide (CO) is a colorless, odorless gas emitted from combustion processes that can cause harmful health effects by reducing oxygen delivery to the body's organs (like the heart and brain) and tissues. At extremely high levels, CO can cause death (EPA, 2018). The largest sources of CO are cars, trucks and other vehicles or machinery that burn fossil fuels.

2.4.2 Nitrogen Oxides

Nitrogen oxides (NOx) are a group of highly reactive gases and include nitrogen dioxide (NO_2), nitrous acid, and nitric acid. While EPA's NAAQS cover this entire group of NO_x, NO_2 is the component of greatest interest and the indicator for the larger group of nitrogen oxides. NO_2 forms quickly from emissions from cars, trucks and buses, power plants, and off-road equipment. In addition to contributing to the formation of ground-level ozone, and fine particle pollution, NO_2 is linked with several adverse effects on the respiratory system (EPA, 2018).

2.4.3 Ozone

Ground-level ozone (O_3) is a secondary pollutant. It is formed by a chemical reaction between nitrogen oxides (NO_x) and volatile organic compounds (VOCs) in the presence of sunlight (photochemical oxidation). Precursor sources of NO_x and VOCs include motor vehicle exhaust, industrial emissions, gasoline vapors, vegetation emissions (i.e., terpenes), wood burning, and chemical solvents. Abundant solar radiation drives the photochemical process and creates ground-level ozone. Primary health effects from ozone exposure range from breathing difficulty to permanent lung damage. High concentrations of ground-level ozone contribute to plant and ecosystem damage.

While ozone is generally considered a summertime air pollutant, in certain parts of the country (e.g. Utah's Uinta Basin) it has become a wintertime issue due to highly concentrated precursor pollutants in low level

temperature inversions and additional photochemical reaction from snow reflecting solar radiation back into the atmosphere.

Ozone and its precursors are a regional air quality issue due to possible transport hundreds of miles from origination, thus maximum levels can occur at locations many miles downwind from the sources.

2.4.4 Particulate Matter (PM_{10} and $PM_{2.5}$)

Airborne particulate matter (PM) consists of tiny coarse-mode (PM_{10}) or fine-mode ($PM_{2.5}$) particles or aerosols combined with dust, dirt, smoke, and liquid droplets. $PM_{2.5}$ have diameters that are 2.5 micrometers or smaller and derive primarily from the incomplete combustion of fuel sources and secondarily formed aerosols. PM_{10} particles have diameters that are 10 micrometers or smaller and derive primarily from crushing, grinding, or abrasion of surfaces. Sources of particulate matter include industrial processes, power plants, vehicle exhaust, fugitive dust, construction activities, home heating, and fires. Many scientific studies have linked breathing PM to serious health problems, including aggravated asthma, increased respiratory symptoms, difficult or painful breathing, chronic bronchitis, decreased lung function, and premature death. Particulate matter is a major cause of reduced visibility. It can stain and damage stone and other materials, including culturally important objects, such as monuments and statues (EPA, 2018).

2.4.5 Sulfur Dioxide

Sulfur dioxide (SO_2) is one of a group of highly reactive gasses known as “oxides of sulfur.” The largest sources are from fossil fuel combustion at power plants (73%) and other industrial facilities (20%). Smaller sources of emissions include industrial processes such as extracting metal from ore, and the burning. High concentrations of SO_2 can cause adverse effects on the respiratory system (EPA, 2018).

2.4.6 Lead

Lead (Pb) is a metal found naturally in the environment as well as in manufactured products. The major sources of lead emissions have historically been from fuels in on-road motor vehicles (such as cars and trucks) and industrial sources. As a result of EPA's regulatory efforts to remove lead from gasoline, emissions of lead from the transportation sector declined by 95% between 1980 and 1999, and levels of lead in the air decreased by 94% during the same period. Major sources of lead emissions to the air today are ore and metals processing and piston-engine aircraft using aviation gasoline with lead (EPA, 2018).

2.4.7 Volatile Organic Compounds

VOCs are any compound of carbon, excluding carbon monoxide, carbon dioxide, carbonic acid, metallic carbides or carbonates and ammonium carbonate, which participates in atmospheric photochemical reactions, except those designated by EPA as having negligible photochemical reactivity (EPA, 2018). While there is no NAAQS for VOCs, they are regulated by the EPA to prevent the formation of ozone, a constituent of photochemical smog. In Colorado, VOCs originate largely from biological sources such as vegetation and soils, chemical solvents, gasoline vapors, and oil and gas production. Many VOCs are also hazardous air pollutants.

2.5 Hazardous Air Pollutants

Other common pollutants include Air Toxics, otherwise known as Hazardous Air Pollutants (HAPs). HAPs are chemicals or compounds that are known or suspected of causing cancer and other serious health effects, such as birth defects, developmental disorders, and compromises to immune and reproductive

systems, and may result from either chronic (i.e. long-term) and/or acute (i.e. short-term) exposure. CAA Sections 111 and 112 establish mechanisms for controlling HAPs from stationary sources, and the EPA is required to control emissions of 187 HAPs. Ambient air quality standards do not exist for HAPs; however, mass-based emissions limits and risk-based exposure thresholds are established as significance criteria to require Maximum Achievable Control Technologies (MACT) under the EPA promulgated National Emissions Standards for Hazardous Air Pollutants (NESHAPs) for 96 industrial source classes.

The primary air toxins of concern for BLM authorized activities are the BTEX compounds (i.e. benzene, toluene, ethyl-benzene, and xylene), formaldehyde, and n-hexane. For the purposes of NEPA disclosure, project level implementation, and mitigation thresholds, an upper limit of a one-in-a-million cancer risk for lifetime exposure (i.e. chronic) level is assessed. Chronic indicators, known as Reference Concentrations (RfC) are defined by the EPA as the daily inhalation concentrations at which no long-term adverse health impacts are expected, based on an annual average concentration in ambient air. Short-term (1-hour) HAPs concentrations will be compared to acute Reference Exposure Levels (RELs). RELs are defined as toxin concentrations below which no adverse health effects are expected. No RELs are available for ethylbenzene and n-hexane; instead, the available Immediately Dangerous to Life or Health (IDLH) divided by 10 (IDLH/10) values are used. These IDLH values are determined by the National Institute for Occupational Safety and Health (NIOSH) and were obtained from EPA's Air Toxics Database (EPA, 2011). These values are approximately comparable to mild effects levels for 1-hour exposures. A list of RELs for several HAPs is provided in Table 2**.**

In Colorado, an Air Pollutant Emission Notice must be filed for each emission point (individual or grouped) that has uncontrolled actual emissions equal to or greater than 250 pounds per year of any non-criteria reportable pollutant. The CDPHE maintains a list of reportable HAPs.

A recent study suggests that unconventional oil and gas development involving hydraulic fracturing (fracking) can create elevated particle radiation downwind (Longxiang, et al., 2020). Radioactive particles are EPA-regulated pollutants under the National Emission Standards for Hazardous Air Pollutants (NESHAP). While the study showed the potential for increased emissions of radioactive particles due to fracking it does not make a link between the emissions and potential dose or exposure to downwind populations. The EPA reports that average indoor radon activity concentrations at 1300 Bq/m3, and the study suggests hydraulic unconventional oil and gas development would cause a downwind increase of just 0.00014 Bq/m3. Elevated background radioactive concentrations due to unconventional oil and gas development are negligible relative to EPA's estimate of background radiation for indoor environments.

Table 2. Toxic Compound Thresholds.

Pollutant	**Reference Exposure Level (REL) (µg/m^3)**	**Reference Concentration (RfC) (µg/m^3)**
Benzene	1,300	30
Toluene	37,000	400
Ethylbenzene	350,000	1,000
Xylenes	22,000	100
n-Hexane	390,000	200
Formaldehyde	94	9.8

REL = 1hr average, RfC = annual average.

2.6 Airshed Classes and Prevention of Significant Deterioration

Overall air quality in a region is determined by monitoring ground-level pollutants and comparing their measured concentrations to the relevant design values for those pollutants. If the concentrations are below the standard, the area is in compliance with the NAAQS (National Ambient Air Quality Standards). However, areas designated as "nonattainment" are in violation of the standard.

In cases where a formal designation has not been made, two additional subcategories of attainment exist: Attainment/Unclassifiable and Attainment/Maintenance. Attainment/Unclassifiable is typically assigned to rural or natural areas where monitoring data is unavailable. On the other hand, Attainment/Maintenance is designated for areas that have previously violated the NAAQS but have since brought pollutant concentrations below the NAAQS design values.

Additionally, each geographical region is assigned a priority class (i.e., I, II, or III), which indicates the degree to which deterioration of existing air quality is permissible within that area under the Prevention of Significant Deterioration (PSD) permitting regulations. Class I areas are characterized by their special national or regional significance, such as natural, scenic, recreational, or historical value, and consequently, they allow only minimal degradation of air quality. In contrast, Class II areas permit reasonable industrial and economic growth. There are currently no Class III areas defined in the U.S. A list of the 12 Class I areas in Colorado is provided in Table 3.

Table 3. List of Class I areas in Colorado.

Class I Area	Acres	Nearest IMPROVE Monitor
Black Canyon of the Gunnison National Park	11,180	WEMI1
Eagles Nest Wilderness Area	133,910	WHRI1
Flat Tops Wilderness Area	235,230	WHRI1
Great Sand Dunes National Park	33,450	GRSA1
La Garita Wilderness Area	48,486	WEMI1
Maroon Bells-Snowmass Wilderness Area	71,060	WHRI1
Mesa Verde National Park	51,488	MEVE1
Mount Zirkel Wilderness Area	72,472	MOZI1
Rawah Wilderness Area	26,674	MOZI1
Rocky Mountain National Park	263,138	ROMO1
Weminuche Wilderness Area	400,907	WEMI1
West Elk Wilderness Area	61,412	WHRI1

Although the PSD rule is only applicable to major stationary sources of air pollution, a PSD increment analysis can provide a useful measure for estimating how a new source of pollution would impact regional air quality. A PSD increment is the amount of pollution allowed to increase in an area while preventing air quality in the airshed from deteriorating to the level set by the NAAQS. The NAAQS is a maximum allowable concentration ceiling, while a PSD increment is the maximum allowable increase in concentration allowed to occur above a baseline concentration for a pollutant within the PSD area boundary. The baseline concentration for a pollutant is defined as the ambient concentration existing at the time that the first complete PSD permit application affecting the boundary is submitted. PSD applicable sources are required to provide an analysis to ensure their emissions in conjunction with other applicable emissions increases and decreases within an area will not cause or contribute to a violation of

any applicable NAAQS or PSD increment. Significant deterioration occurs when the amount of new pollution exceeds the applicable PSD increment. An official PSD increment analysis is the sole responsibility of the CDPHE. Any subsequent analysis performed for NEPA purposes will be used for informational purposes only.

Table 4. Prevention of Significant Deterioration (PSD) Increments (µg/m^3).

Pollutant	Period	Class I	Class II
NO_2	Annual	2.5	25
SO_2	3-hour	25	512
	24-hour	5	91
	Annual	2	20
PM_{10}	24-hour	8	30
	Annual	4	17
$PM_{2.5}$	24-hour	2	9
	Annual	1	4

Source: 40 CFR 51.166(c)

2.7 Air Quality Related Values (AQRVs)

In addition to the NAAQS modeling required for PSD permitting, the PSD program requires an assessment of air pollution impacts to surface waters, soils, vegetation (e.g. deposition, ozone), and visibility. These metrics are commonly referred to as Air Quality Related Values (AQRVs). Measuring and characterizing potential impacts to AQRVs is important at federally mandated Class I lands, which include areas such as national parks, national wilderness areas, and national monuments. Class I areas are granted special air quality protections under Section 162(a) of the federal Clean Air Act (CAA), and the Federal Land Manager (FLM) for any such area is responsible for reviewing PSD actions compliance. AQRVs are routinely assessed by the BLM during NEPA analyses for actions / authorizations with the potential to impact such areas as required by FLPMA under Section 102 (a)(8).

2.7.1 Deposition

Atmospheric deposition is the process of removing pollutants from the atmosphere via mechanical and chemical processes. When air pollutants such as sulfur and nitrogen are deposited into ecosystems, they can cause acidification or enrichment of soils and surface waters. Atmospheric nitrogen and sulfur deposition may affect water chemistry, resulting in impacts to aquatic vegetation, invertebrate communities, amphibians, and fish. Deposition can also cause chemical changes in soils that alter soil microorganisms, plants, and trees. Although nitrogen is an essential plant nutrient, excess nitrogen from atmospheric deposition can stress ecosystems by favoring some plant species and inhibiting the growth of others. Two distinct methodologies measure these processes: wet and dry deposition monitors.

The National Atmospheric Deposition Program (NADP) is a conglomerate of various wet chemistry monitoring networks designed to measure wet atmospheric deposition and study its effects on the environment. The network currently operates about 250 sites, many since the early 1980s. The Clean Air Status and Trends Network (CASTNET) is a national air quality monitoring network designed to provide data to assess trends in air quality, dry atmospheric deposition, and ecological effects due to changes in

air pollutant emissions. CASTNET began collecting data in 1991 with the incorporation of 50 sites from the National Dry Deposition Network. CASTNET provides long-term monitoring of air quality in rural areas to determine trends in regional atmospheric nitrogen, sulfur and ozone concentrations and deposition fluxes of sulfur and nitrogen pollutants.

The FLMs use a deposition data analysis threshold (DAT) of 0.005 kg/ha-yr to determine the potential significance of any given project in the western U.S. as defined under the FLM Air Quality Related Values Work Group guidance (NPS, 2010). Cumulative thresholds, known as critical loads, have also been established for Colorado's Class I areas by the NPS and the USFS. Critical loads are deposition levels, often expressed as a range (i.e. minimum and maximum), below which significant ecosystem effects do not occur and are a property of the individual ecosystem's components (species) functionality. Colorado is primarily composed of three major level I ecoregions (Pardo, et al., 2011) (for which critical loads have been established: the Great Plains (lvl II - South Central Semi-Arid Prairies, 5 to 25 kg/ha-yr), the Northwestern Forested Mountains (lvl II - Western Cordillera, 1.5 to 17 kg/ha-yr), and the North American Deserts (lvl II - Cold Deserts, 3 to 8.4 kg/ha-yr). Critical loads are science-based; however FLMs may also identify a "target" load which can be higher or lower than a critical load based on ecosystem recovery goals, the desired level of resource protection to prevent future resource damage, economic considerations, and stakeholder input. The NPS maintains a list of critical loads for the National Parks and Monuments they manage. Setting a target load plays an important role in guiding policy, management decisions, and regulatory or voluntary measures such as emission reduction strategies for culpable air pollutant sources. Note that BLM-authorized actions do not significantly contribute to sulfur loading in the atmosphere or environment.

2.7.2 Visibility

2.7.2.1 Introduction to Visibility

Pollution in the atmosphere can impair scenic views by degrading the contrast, colors, and distance an observer can see. Visibility impairment results from the absorption and scatting of particles and gases present in the atmosphere. The absorption and scatting leads to a reduction in light from a scene reaching an observer, leading to a decrease in visual distance and diminished visual clarity of objects.

Visibility is often defined as the farthest distance at which an observer can distinguish a black object against the sky at the horizon. A common metric to quantify visibility is the Standard Visual Range (SVR), the maximum distance at which prominent high-contrast objects can be seen and identified under normal daylight conditions. It is used as a reference point for assessing visibility and is typically expressed in terms of miles or kilometers. The determination of SVR considers factors such as atmospheric conditions, lighting, and the size and contrast of the objects being observed. The purpose of establishing a SVR is to provide a consistent measure for evaluating visibility across different locations and situations. Average natural visual range conditions for Class I areas can be found in Table 10 of (NPS, 2010). Among Colorado park and wilderness locations, the natural visual range varies from about 160 miles at Great Sand Dunes National Park to 190 miles in the northern mountains. More information on visibility can be found in (Malm, 1999). An overview of visibility trends for the United States is provided in (Hand, Prenni, Copeland, Schichtel, & Malm, 2020).

2.7.2.2 Regional Haze

"Regional haze" is defined at 40 CFR 51.301 as "visibility impairment that is caused by the emission of air pollutants from numerous anthropogenic sources located over a wide geographic area. Such sources

include, but are not limited to, major and minor stationary sources, mobile sources, and area sources." Regional haze is a concern not only for its impact on visibility but also because fine particles can have adverse effects on human health and the environment. These particles can also contribute to respiratory problems and other health issues when inhaled. In addition, they can also have deleterious effects on ecosystems, air quality, and climate. In the 1977 CAA amendments, Congress set a national goal to remedy existing visibility impairment and to prevent future visibility degradation from manmade air pollution in Class I federal lands such as national parks and wilderness areas. To address this goal, the Regional Haze Rule (RHR) was finalized in 1999 and called on states to establish goals and reduce emissions to improve visibility in 156 mandatory Class I areas.

The primary cause of regional haze is light extinction by particulate matter (PM). For purposes of the Regional Haze Rule (RHR), light extinction is estimated from measurements of particulate matter and its chemical components (sulfate, nitrate, organic mass by carbon (OMC), light absorbing carbon, fine soil, sea salt, and coarse material), assumptions about relative humidity at the monitoring site, and the use of a commonly accepted algorithm. These estimates of light extinction are logarithmically transformed to deciviews (dv). A deciview (dv) is a unit of measurement to quantify human perception of visibility. It is derived from the natural logarithm of atmospheric light extinction coefficient. A one dv change is roughly the smallest perceptible change in visibility.

Visibility varies on a daily to seasonal basis and thus it is useful to characterize visibility by categories such as clearest and haziest days. Following the original *Guidance for Tracking Progress Under the Regional Haze Rule*, states demonstrated progress in meeting RHR goals based on the elimination of anthropogenic impairment on the 20% of days each year with the highest total haze, including natural and anthropogenic sources. However, in the western United States, these haziest days frequently include large amounts of haze from natural sources, chiefly wildfire smoke and windblown dust. Meeting the CAA goal of eliminating anthropogenic haze by focusing on days dominated by natural sources that are essentially uncontrollable is problematic. Accordingly, on August 20, 2019, the EPA issued *Guidance on Regional Haze State Implementation Plans for the Second Implementation Period* to assist states as they develop plans to address visibility impairment for the second implementation period under EPA's RHR.

The RHR revisions and guidance propose a new approach to track progress toward CAA goals, which is to select the 20% of days each year that have the highest *anthropogenic* impairment. These represent the days each year that have the largest apparent change in visibility from what would have existed with no anthropogenic haze. This creates a subset of days that are expected to be most sensitive to emissions control programs. The revision ensures that visibility tracking and RHR progress is based on anthropogenic rather than natural sources (i.e., dust or smoke).

In the original RHR guidance, states evaluated progress towards "natural conditions" by 2064. In the updated RHR guidance, new 2064 goals were established to calculate the Uniform Rate of Progress (URP), sometimes referred to as glidepath. Natural haze levels change from year to year, but the expectation is that the average amount of natural haze on the most impaired days will remain roughly constant over time. When averaged over many years, the natural contributions on the most impaired days are generally uniform temporally and spatially and provide reasonable default values for these 2064 endpoints. Fifteen-year averages of the natural haze levels on the 20% most impaired days are used to derive the 2064 endpoint estimates now used to assess RHR progress.

The recommended 2064 endpoints provide a consistent starting point for generating a URP to track progress within the updated impairment framework. As with the default natural conditions defined in the original RHR guidance, considerable uncertainty exists in these updated endpoints, especially at sites with significant, large natural sources nearby, such as those in Colorado. The 2064 endpoints do not yet reflect international anthropogenic contributions or prescribed fire but may in the future. More information about the EPA's impairment framework can be found at: http://vista.cira.colostate.edu/Improve/impairment/. The EPA's 2019 *Guidance on Regional Haze State Implementation Plans for the Second Implementation Period* provides a detailed explanation on how states can show progress towards the updated metrics.

2.7.2.3 Visibility Monitoring

To assess progress towards CAA goals, visibility monitoring is required in locations representative of the 156 visibility-protected federal Class I areas. To this end, the Interagency Monitoring of Protected Visual Environments (IMPROVE) was designated as the visibility monitoring network to carry out this responsibility. IMPROVE was initially established as a national visibility network in 1985 and consisted of 30 monitoring sites primarily located in national parks, 20 of which began operation in 1987. With the implementation of the RHR in 1999, the IMPROVE network expanded, and 110 monitoring sites were identified that were deemed representative of the regional haze conditions for 155 of the mandatory 156 Class I areas, the Bering Sea Wilderness being the exception. In addition to the 110 sites that are used to represent Class I areas, some IMPROVE protocol sites are in operation to provide expanded spatial coverage for the network. Protocol sites are separately sponsored by state, regional, tribal, and national organizations and use the same instrumentation, monitoring, and analysis protocols as IMPROVE. The use of identical samplers and analysis protocols by the same contractors ensures that data generated by IMPROVE and IMPROVE protocol sites can be treated as directly comparable. A list of Colorado Class I areas and the representative IMPROVE monitor is provided in Table 3. Visibility trends from Colorado IMPROVE sites are discussed in Section 4.6.1 Visibility of this report.

2.7.3 Ozone

Ozone affects sensitive vegetation and ecosystems, including forests, parks, wildlife refuges, and wilderness areas. Common effects on vegetation include reducing photosynthesis potential (i.e. slow plant growth), increasing risk of disease and damage from insects, amplifying harm from other pollutants and severe weather/drought, and causing visible damage to foliage under certain conditions. The effects of ozone on individual plants can have negative impacts on ecosystems, including loss of species diversity, changes to the specific assortment of plants present in a region, decreased habitat quality, and shifts in water and nutrient cycles.

Ozone impacts on trees, plants and ecosystems can be assessed using the "W126 index." The W126 is a seasonal weighted index designed to reflect the cumulative exposures that can damage plants and trees during the growing season, when daytime ozone concentrations are the highest and plant growth is most likely to be affected. The eight-hour primary ozone standard of 0.070 ppm is used to prevent the W126 exposure index from exceeding 17 ppm-hrs. The NPS published recommended benchmarks for the W126 metric based on information in the EPA's *Policy Assessment for the Review of the Ozone National Ambient Air Quality Standards* which outlines the use of the W126 metric for assessing plant response to ground-level ozone. The EPA assessment found that for W126 values less than 7 ppm-hrs, tree seedling biomass loss is under 2% per year in sensitive species; and for values greater than 13 ppm-hrs, tree seedling

biomass loss is 4–10% per year in sensitive species. The NPS uses this information to assess park conditions and trends and provides an explanation of air analysis methods.

2.8 Nonattainment and General Conformity

If a nonattainment designation takes effect for any criteria pollutant, the State of Colorado has three years to develop plans outlining how the area will attain and maintain the NAAQS by reducing air pollutant emissions that contribute to the violation. Further, any new major stationary source or major modification to a stationary source (as defined by the CAA and based on the severity of the violation in the area) that emits a nonattainment pollutant or precursor within the nonattainment area boundary would be required to offset the new or modified emissions from the source in a ratio greater than 1:1. Offset emissions or emissions credits (i.e. reductions from other sources) would need to be obtained from within the designated nonattainment area.

Section 176(c) of the CAA, 42 U.S.C. § 7506, prohibits federal entities from approving actions in nonattainment or maintenance areas that do not "conform" to the State Implementation Plan (SIP). The purpose of this conformity requirement is to ensure that federal activities: (1) do not interfere with the budgets in the SIPs, (2) do not cause or contribute to new violations of the NAAQS, and (3) do not impede the ability of regulators to attain or maintain the NAAQS. To implement CAA Section 176(c), the EPA issued the General Conformity Rule (40 C.F.R. Part 93, Subpart B), which applies to all federal actions not funded under U.S.C. Title 23 or the Federal Transit Act. BLM actions are not funded by U.S.C. Title 23 or the Federal Transit Act. The General Conformity Rule established emissions thresholds (40 C.F.R. 93.153) for use in evaluating the conformity of a project (40 C.F.R. 93.153(b)(1)). If the net emissions increase from reasonably foreseeable direct and indirect sources from the project or action are less than the defined thresholds, then no further conformity evaluation is required (40 C.F.R. 93.153(c)(1). If these emissions increases exceed any of the thresholds, a formal conformity determination would be required. The rule also identifies other actions to which the conformity requirements do not apply (40 C.F.R. 93.153(c)(2), (d), (e)), as well as actions that are "presumed to conform" with the applicable SIP (40 C.F.R. 93.153(f)-(i)). A formal conformity determination can entail air quality modeling studies, consultation with the EPA or State air quality agencies to obtain commitments to revise a SIP, or implementation measures to mitigate the air quality impacts (i.e. offset all of the reasonably foreseeable emissions for the action).

The BLM performs a General Conformity Applicability Analysis for each subject action when emissions are reasonably foreseeable such that they can be quantified to enable comparison to the triggering thresholds. For oil and gas projects, virtually all production-related stationary sources will receive a New Source Review (NSR) permit from the CDPHE to authorize operations. Under the Rule, these sources are exempt from applicability considerations. Typically, sources of this variety would include the following:

- Compression and Artificial Lift Pump Engines
- Tanks and Tank Batteries
- Components (e.g. flanges, valves, connectors)
- Pneumatic Devices

Other sources of emissions, such as drill rigs, completion and hydraulic fracturing equipment, on-road and off-road activity support vehicles, and other permit exempted equipment (e.g. separator and tank heaters)

are generally subject to the Rule and must be taken into consideration. The BLM makes subject to rule determinations for all emissions sources during project analyses, regardless of classification.

While working under a BLM-CDPHE Memorandum of Understanding (MOU), in late 2023, BLM provided CDPHE with a technical memo including levels of projected federal oil and gas development and production for future year 2026 (analysis year for the Denver – Front Range [DFR] "severe" ozone SIP) and BLM received a letter response from CDPHE describing that the projections look reasonable and confirmed that future federal oil and gas development and production are included in the State's ozone SIP inventories. It is estimated for the DFR ozone NAA SIP inventories that approximately 73 new federal wells will be developed each calendar year.

2.9 Emissions Data & Source Classifications

All emissions sources fall into two broad categories for regulatory purposes: stationary and mobile. Each are typically regulated according to their type and classification.

Stationary Sources: These sources include non-moving, fixed-site producers of pollution such as power plants, petro-chemical refineries, manufacturing facilities, and other industrial sites like oil and gas production pads and coal mines. Stationary facilities emit air pollutants via process vents or stacks (i.e. point sources) or by fugitive releases (i.e. emissions that do not pass through a process vent or stack). Stationary sources are also classified as either major or minor. A major source is one that emits, or has the potential to emit, a regulated air pollutant in quantities above a defined threshold. Stationary sources that are not major are considered minor or area sources. A stationary source that takes federally enforceable limits on production, consumption rates, or emissions to avoid major source status are called synthetic minors. The CDPHE Air Pollution Control Division (APCD) has authority under their EPA approved SIP to regulate and issue air permits for stationary sources of pollution in Colorado.

Mobile Sources: These sources include motor vehicles, engines, and equipment that can be moved from one location to another. Due to the large number and variety of these sources and their ability to move across traditional regulatory jurisdictions (i.e. state lines), mobile sources are regulated differently than stationary sources. In general, the EPA and other federal entities retain authority to set emissions standards for these sources depending on their type (i.e. on-road, off-road, and non-road), classification (e.g. light duty, heavy duty, horsepower rating, weight, fuel types, etc.), and the year of manufacture, or in some circumstances, their reconditioning. Mobile sources are not regulated by the state unless they are covered under an applicable SIP, usually as part of an on-road inspection and maintenance program.

2.9.1 Additional Resources

The CDPHE maintains an interactive map of Colorado that includes all designated air sheds (i.e. nonattainment, maintenance, and sensitive Class I and II areas), monitor locations, and a queryable interface that displays stationary source emissions for select pollutants within a given radius of a specified location. Readers are encouraged to explore the CDPHE's data to provide additional context for this report. Alternatively, these data, including historical monitoring data, are available from the EPA through an interactive map. The EPA also provides comprehensive information on Colorado nonattainment/maintenance status for each county for all CAPs.

3. Analysis Methods and Tools

3.1 Background

Air quality for any area is generally influenced by the amount of pollutants that are released within the vicinity and upwind of that area, and it can be highly dependent upon the contaminant's chemical and physical properties. Additionally, an area's terrain and weather (e.g. wind speed and direction, temperature, air pressure, rainfall, cloud cover) can have a direct influence on how pollutants accumulate, form, or disperse in their local and regional environments. Long-range transportation potential is another important consideration, as some pollutants can be dispersed over long distances and cause issues in areas far from their origin (e.g. ozone, secondary $PM_{2.5}$, mercury). Analysis indicators for air resources can be described in terms of pollutant classes and concentrations relative to various standards and metrics, which are described in 2.4 Criteria Air Pollutants and 2.5 Hazardous Air Pollutants of this report.

In general, BLM applies adaptive management when analyzing impacts from authorized activities with the potential to significantly affect air resources. These adaptive management principles include monitoring current conditions, predicting future impacts, and applying conditions of approval to account for any changing circumstances that may either result directly or cumulatively from the authorized action. This methodology allows the BLM to meet mission mandates and complete a timely and appropriate analysis that ensures activities approved by the BLM minimize potential adverse impacts to air quality, comply with NEPA, FLPMA, and applicable elements of the CAA. The remainder of this section introduces key concepts, studies, and tools used to provide analysis for BLM Colorado authorized activities and to produce the Annual Report.

3.2 Colorado Air Resource Management Modeling Study (CARMMS)

The CARMMS study is integral to BLM Colorado's adaptive management strategy for authorizing federal mineral development. CARMMS was developed to help the BLM understand the second element of the adaptive management strategy, which includes predicting future impacts. BLM Colorado provides for project-level authorization analyses, which can include near-field modeling tool assessments. In contrast, the CARMMS study utilizes the Comprehensive Air Quality Model with Extensions (CAMx) to provide a cumulative statewide assessment of potential air resource impacts. The model provides for a full suite of physicochemical state transformation modeling, which includes the ability to model ozone and secondary $PM_{2.5}$ formation and transport and represents the current state-of-the-science practice for NEPA and SIP compliance demonstrations. CAMx models nested domains at various resolutions over the entire CONUS that scale down to an area of interest. The model requires global variable inputs which includes the outermost boundary layer, gridded prognostic meteorological modeling with various horizontal and vertical scales, and cumulative gridded emissions modeling with applicable temporal variability that must include detailed pollutant speciation profiles.

The study was designed to take an iterative approach for predicting future impacts. The BLM acknowledges that all models have a "shelf life", where the inputs and assumptions used to develop the model are subject to change over time, including regional and localized developments. Relying on the model far into the future to provide for an appropriate analysis may not be technically sound. This approach provides for a more adaptive and defensive analysis posture versus a traditional one-off modeling approach performed for many discrete projects as was commonly done in the past.

For all CARMMS iterations, the BLM models three future development scenarios (i.e. low, medium, and high) out to the predefined projection year. Projections for oil and gas development are based on either the most recent Reasonably Foreseeable Development (RFD) document (i.e. high), or by projecting the current five-year average development pace forward for ten additional years (i.e. low). The medium scenario includes the same development intensities as the high but assumes restricted emissions for mitigation analyses. Both the high and low scenarios assume current development practices and controls specified by "on-the-books" regulations. Each field office's emissions are modeled using the CAMx source apportionment option. The method provides emissions tracking and enables the BLM to understand how the projected emissions from each field office incrementally contribute to regional air quality and air quality related value impacts. The differences in the impacts between the scenarios and the base year provide insight into how various emissions loading impacts the atmosphere on a relative basis. This insight is useful for making qualitative and quantitative comparisons with emissions levels at the current tracked pace of development, which is how the data are used in the report.

For coal resources, CARMMS provides a single source apportionment group for all Colorado mines that produce federal coal. The mining scenarios are based on each mine's maximum allowable emissions rate, usually tied to a production limit, which were estimated based on CDPHE Air Pollutant Emission Notice (APEN) data and any available NEPA documents prepared for previous mining authorizations. Production estimates were held static across the scenarios. The primary difference between the low and high scenario involved assumptions about the number of potential new mines that could come online and how existing mines might not be operational in the future model year.

BLM Colorado completed the first iteration of 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, and the results were published in January 2015. The 1.0 study included analysis of oil and natural gas development and mining emissions in the planning areas of individual BLM Colorado field offices and cumulative AQ and AQRV impacts due to non-Federal oil and gas and mining sources as well as other regional sources. Almost immediately upon completion, a second partial iteration of CARMMS (1.5) was run to capture updates to the Mancos Shale inventory and to consider the October 2015 change to the ozone NAAQS from 0.075 to 0.070 ppm. The results of the second iteration were published in March 2016. The CARMMS 1.5 results and data were used to produce the 2015 Annual Report.

To support newly revised RFD scenarios and ongoing RMP revision efforts, the BLM conducted the full second iteration of CARMMS (2.0) to answer the same air quality and AQRV questions for projected emissions scenarios out to 2025. For CARMMS 2.0, “new” oil and gas annual spud / completion and production level projections were made for each year 2016 through 2025. The 2.0 study leveraged the updated modeling platform derived from the Western Air Quality Study (WAQS) and the Intermountain West Data Warehouse (IWDW). A model performance evaluation (MPE) for CARMMS 2.0 can be found in Appendix A of the Report. As described in Appendix A for the CARMMS 2.0 Report, 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 Western Air Quality Study and meets relevant goals and/or criteria for ozone and PM2.5 in general.

3.3 BLM 2032 Regional Modeling Study

In 2023, a Rocky Mountain regional energy-focused air quality modeling study was completed for the BLM that predicted future year 2032 concentrations based on the EPA's 2016 v2 year 2032 future projections for non-oil, gas and coal related upstream / midstream operations, other anthropogenic (mobile, etc.) activities and natural (vegetation, etc.) emissions sources while the U.S. Energy Information Administration (EIA) Annual Energy Outlook (AEO) oil and gas projections were used with BLM fluid minerals specialists input to allocate new oil and gas development and production levels for each Rocky Mountain Region Basin. "New" federal and non-federal oil and gas projections for years 2020 through 2032 were modeled in addition to all existing (as of January 1, 2020) and other foreseeable emissions sources to predict circa 2032 air quality conditions for the Rocky Mountain Region. For the DJ Basin in northeast Colorado (RGFO), the "high supply" AEO scenario was modeled for both future oil and gas development and production, while for the Piceance Basin in northwest Colorado (includes CRVFO, GJFO, UFO and WRFO), the "high supply" AEO scenario was modeled for gas well development / production and the "low" supply scenario for oil well development / production. For the Green River Basin portion in Colorado (LSFO), the AEO "low" supply scenario was modeled for both future oil and natural gas. Likewise, for the North Park Basin (KFO), the AEO "low" supply scenario was modeled for both future oil and natural gas. For the San Juan Basin in southwest Colorado (TRFO), the "high supply" AEO scenario was modeled for gas well development / production and the "reference" case scenario for oil well development / production. Considering production for each future year (2020 – 2032) from existing oil and gas wells as of January 1, 2020, new well development rates were estimated for each year 2020 through 2032 based on the AEO projected future annual production levels; the number of new wells needed to produce oil and gas, when combined with projected oil and gas production levels associated with existing wells, would equal the production levels aligned with the AEO scenarios.

For 2032 Study, new federal oil and gas in Colorado was modeled in separate source groups (one source group for all western Colorado federal oil and gas and one source group for eastern Colorado federal oil and gas) using source apportionment technology to describe potential federal oil and gas contributions to cumulative air quality and related value conditions associated with new development that could be developed / operate in the land use planning areas. In addition, other oil and gas emissions source groups were modeled separately including existing federal and total non-federal oil and gas sources.

The CAMx modeling system used for the 2032 Regional Modeling Study has been previously evaluated (MPE) for a 2016 base case simulation as part of EPA's Good Neighbor ozone rule. Results for this MPE are available as an appendix to the EPA 2016v2 technical support document. As described in Appendix A of the EPA technical support document, the predictions from the 2016v2 modeling platform correspond closely to observed concentrations in terms of the magnitude, temporal fluctuations, and geographic differences for 8-hour daily maximum (MDA8) ozone. The EPA's document describes that the results of the MPE "provide confidence in the ability of the modeling platform to provide a reasonable projection of expected future year ozone concentrations and contributions.".

Similar to CARMMS, annual oil and gas development data are compared to levels modeled for the 2032 Study to validate the continuous use of modeled predictions for completing air quality assessments.

3.4 Annual Report

The Annual Report (this report) plays a key role in BLM Colorado's air resource analysis and adaptive management processes and essentially functions as the "check" and "act" portions of cycle, or the first and last elements of the strategy. The results of the report analysis provide an additional basis for developing authorization strategies that BLM Colorado can implement for subsequent tracking years, subject to management review and approval.

The Annual Report relies heavily on the CARMMS analysis and observed oil and gas production and development trends to drive adaptive management implementation. External data sources are incorporated to assess current air resource conditions or trends, and total mineral development throughout Colorado. Each year, the BLM collects and analyzes oil and gas development and production data from the Automated Fluid Minerals Support System (AFMSS), ECMC database, and Office of Natural Resources Revenue (ONRR) to determine the total number of new and active wells, as well as the production related values from these wells. The development metrics (i.e. spuds, active well counts, production volumes) are analyzed for each field office and compared to CARMMS high and low development scenarios. In general, spuds are a surrogate for construction related emissions, while active well counts and overall production volumes are surrogates for various production activity emissions.

BLM completed a Regional 2032 Air Quality Modeling Study in 2023 and similar to CARMMS utilizes CAMx source apportionment technology to distinctly predict potential future federal and non-federal oil and gas related air quality impacts (BLM, 2023). In addition to tracking actual oil and gas development and production trends with respect to those modeled for CARMMS, BLM is also tracking against the levels projected and modeled for the Regional Modeling Study and will disclose supplemental information in project-level NEPA analyses.

3.5 Project Level Authorizations

BLM Colorado provides analysis of project design features and recommends mitigation options as necessary to conform to Field Office RMP goals and objectives, which include compliance with federal and State air quality regulations. As such, individual project authorizations are not expected to contribute significantly to air quality impacts on their own. Project authorizations are handled on a case-by-case basis in accordance with the methods outlined in Appendix A of the CARPP. For all oil, gas, and coal development projects requiring NEPA, BLM staff are encouraged to incorporate the contents of this report by reference to describe the air resources affected environment, cumulative impacts, and climate change analysis.

In general, BLM Colorado requires an emissions inventory for each oil, gas, and coal project to utilize as the basis of analysis for any proposed action or alternatives developed for NEPA. Once an emissions inventory for a given project is complete, BLM staff can utilize the procedures below to complete any required analysis and incorporate the results into NEPA documents to disclose the direct, indirect, and cumulative environmental effects as appropriate. To facilitate the generation of the project emissions inventory, air resource specialists recommend proponents and staff utilize internally developed web tools available to support project analyses, including the Emissions Modeling and Impacts Tool (EMIT) discussed below.

3.5.1 Analysis Steps for an Individual Project

The ARS at the Colorado State Office can assist staff and proponents with the nuances of navigating and preparing an applicable and defensible NEPA analysis for air resources at any point in the analysis process, though the earlier, the better.

1. Evaluate the emissions inventories, including the underlying parameters, equipment specifications, and any assumptions to ensure they are reasonable and comprehensive to fully account for the emissions generating activities and sources for the proposed action and any alternatives (if applicable). Ensure that all stationary sources that will be subject to CDPHE permitting are clearly identified in the inventory. All oil and gas development projects should submit supplemental drilling and completions schedules (e.g. equipment set movements, spatial operational times) to aid in analysis scenario formulation.

2. Is the project in a Nonattainment or Maintenance Area? If "yes", then contact the state office Air Resource Specialist(s) to perform a General Conformity Applicability Analysis and prepare the remainder of the project level analysis to incorporate into the NEPA document.

3. Does the project have maximum annual emissions of any criteria pollutant more than 2 tons per year? If "no", then dismiss air quality as an issue for further analysis since the project has no potential to significantly impact air resources. The basis for this assertion is predicated on the Colorado Air Quality Control Regulation 3.II.D.I, which exempts sources from Air Pollutant Emission Notice (APEN) submissions at emissions rates (uncontrolled actual levels) of less than 2 tons per year for attainment areas and 1 ton per year (NOx and VOC) for ozone non-attainment areas. Colorado regulators have deemed these sources to be negligible in terms of potential air resource impacts. Thus, BLM Colorado shall consider these sources to be of a similar nature for NEPA purposes. NEPA practitioners should incorporate the following language into the issues considered but eliminated from detailed analysis sections of the authorizing NEPA document:

> ***An emissions inventory was prepared for the proposed action (and any applicable alternatives) and provides the rationale for dismissing air quality as an issue to be carried forward for further analysis. The resulting inventories indicate that project criteria pollutant emissions would be less than 2 tons per year (or 1 ton per year in the non-attainment area) for each applicable pollutant. BLM Colorado has adopted the Colorado Department of Public Health and Environment's Air Pollution Emissions Notice (APEN) thresholds as the basis for which the BLM would not consider additional analysis when emissions are below the threshold. Sources or activities that emit less than the applicable APEN threshold level of pollutant on an annual basis are considered negligible for their potential to impact air quality.***

4. Is the project a piece of a larger project level authorization (e.g. a master development plan) or similar to another project that has previous NEPA analysis? If "yes", then confirm that the project parameters (e.g. location, distance to receptors) and emissions profile of the piece or project is consistent with the previous analysis, and that the analysis itself reflects the current standards, thresholds, and any targets from applicable or subsequent NEPA decisions. Briefly describe how the actions are similar and how the emissions have been fully accounted

for in the referenced project. Then, tier to or incorporate by reference the analysis that describes the effects of the new piece or project.

5. Does the project have maximum annual emissions of any criteria pollutant in excess of the Colorado Modeling Guideline thresholds? If "no", then a qualitative or screening analysis may be sufficient to describe the environmental effects of the project. The Gridded Emissions Impact Tool and the EMIT can be utilized to complete the screening analysis. If "yes" to the question posed above, then a refined modeling analysis may be appropriate to describe the environmental effects of the project. Note that depending on the circumstances of the project like duration, number of sources, and distance to receptors or Class I areas, a screening analysis may still be appropriate for the project. Additionally, NEPA practitioners should consider the nature of the project in terms of the No Action scenario (proposed action will not be developed or implemented) or any Connected Actions. In Colorado, it is often the case that a project will co-develop federal and non-federal resources, such that the federal authorization alone may not be significant in terms of air resource impacts, meaning they could occur anyway without the federal approval. Project level analyses need to adequately evaluate complex project scenarios to fully account for and appropriately disclose any potential federal impacts. The Gridded Emissions Impact Tool (discussed below) and the EMIT can be utilized to complete the screening analysis. The EMIT also contains analysis tools that can be utilized to complete a refined analysis. The User's Guide and Technical Support Document (linked below) provides instructions for running a refined analysis, as well as information on the appropriateness of such an analysis that NEPA practitioners can incorporate by reference into the authorizing NEPA document for the project analysis.

Note that any previously completed and “final” NEPA analysis that is published online (i.e. EPlanning) for a project similar to the subject proposed action can be tiered to for completing a new project-level assessment. As described for number 4 above, confirm that the project parameters (e.g. location, distance to receptors) and emissions profile of the subject proposed action is consistent with the completed analysis for the similar project, and that the analysis itself reflects the current standards, thresholds, and any targets from applicable or subsequent NEPA decisions. In situations where a Determination of NEPA Adequacy (DNA) is being used, include description for the previously completed NEPA analysis in the list of documents being tiered to for the DNA and provide rationale for applicability describing potential impacts for the subject proposed action (include any mitigation that may be required consistent with previously completed analysis).

3.5.2 Gridded Emissions Impacts Tool

The Gridded Near-Field Assessment Tool was formulated based on the results of the CARMMS 2.0 modeling study. The tool determines how much new federal and non-federal oil and gas emissions were modeled in a "near-field project domain" (the 4km grid cell where the new proposed action would be located and the adjacent grid-cells) for all projected future CARMMS 2.0 emissions scenarios (i.e. low, medium, and high). In addition, for the near-field project domain, the tool provides a range of corresponding modeled concentrations of ambient nitrogen dioxide, ozone, and particulate matter (less than 10 and 2.5 microns in diameter) for each scenario, along with federal oil and gas-specific source apportionment concentrations that contribute to the ambient concentrations. These data are useful for determining the relative contribution of federal oil and gas emissions to the cumulative concentrations modeled within the grid cells. Concentration data are also available criteria pollutants of lesser concern

like carbon monoxide and sulfur dioxide. In addition to data specific to the project location, the tool also retrieves data for the modeled grid cell from each CARMMS scenario with the closest emissions greater than the project-specific emissions. The scenario with the lowest modeled impacts is used to represent the "project only" modeled emissions. These grid cells are the ones least influenced by neighboring grid cells, where higher neighboring emissions would influence adjacent cell concentrations beyond a project specific source estimate. They are used to determine the project's specific contribution to ambient air pollutant concentrations. There are a variety of factors that can affect the overall accuracy of this approach for describing project related impacts. However, as a screening assessment there is a high degree of conservatism in utilizing cumulative projected domain specific data to analyze project impacts, so long as the emissions are fully considered (levels high enough to proposed action and other foreseeable oil and gas development / operations were included in the modeling study). As a first-tier approach for analysis, this method provides a fast and reliable way to allocate CARMMS gridded emissions and impacts for project tracking assessments at the near-field scale.

3.5.3 Emissions Inventory Tool (EMIT)

The Emissions Inventory Tool (EMIT) is a web application designed to generate project specific emissions inventories and impacts analysis using a variety of estimation methods and regulatory tools. The EMIT is based on many years and iterations of emissions inventory tool development and NEPA analyses that have been widely used and accepted as regular practice. EMIT is primarily comprised of self-contained modules made up of sub-activities that logically group data entries to facilitate emissions estimates or the generation of analysis parameters. Modules exist for most authorized land management activities, and many of the sub-activities within each module allow users to populate form fields with default data sets. When feasible, default data were developed for specific geographical regions or another appropriate metric for the type of data being modeled. Many of the modules offer scalability to quickly allow users to model an individual project or an entire resource management plan. For a more detailed look at the EMIT application, please review the User's Guide and Technical Support Document.

4. Affected Environment: Statewide Air Quality Conditions and Emissions

In this chapter, air quality conditions and emissions throughout the state of Colorado are presented and serve as a foundation to characterize air quality at the field office level. Outdoor air quality data are available from the EPA here in an interactive web-based application.

4.1 National Emissions Inventory

The National Emissions Inventory (NEI) is a comprehensive and detailed estimate of air emissions of criteria pollutants, criteria precursors, and hazardous air pollutants. The NEI is released every three years based primarily upon data provided by State, Local, and Tribal air agencies for sources in their jurisdictions and supplemented by data developed by the EPA (EPA, 2026). The NEI includes emissions estimates for

Table 5. 2023 Colorado Statewide Criteria Air Pollutant Emissions (tpy) by Major Tier.

Source	NH_3	CO	NOx	PM_{10}	$PM_{2.5}$	SOx	VOC
Chemical & Allied Product Mfg	25	22	27	34	22	63	473
Fuel Comb. Elec. Util.	157	4,533	14,004	1,058	885	9,666	419
Fuel Comb. Industrial	22	20,348	22,771	899	861	455	5,885
Fuel Comb. Other	1,666	36,080	8,995	5,645	5,616	340	7,897
Highway Vehicles	3,105	278,113	36,123	2,647	1,311	169	20,669
Metals Processing	15	730	175	151	97	124	145
Miscellaneous	74,792	113,660	6,188	216,038	45,856	1,056	47,827
Natural Resources	16,866	56,649	13,456	0	0	0	351,701
Off-Highway	37	262,151	21,217	1,903	1,774	526	19,282
Other Industrial Processes	162	6,696	2,728	8,610	4,984	911	2,561
Petroleum & Related Industries	4	28,267	20,342	530	334	556	23,936
Solvent Utilization	6	30	25	112	106	7	46,800
Storage & Transport	4	248	158	1,420	609	2	8,403
Waste Disposal & Recycling	459	3,909	384	2,469	1,735	162	3,506
State Total	**97,321**	**811,435**	**146,594**	**241,517**	**64,191**	**14,037**	**539,504**
Oil and Gas % of State Total*	**< 0.1%**	**3.5%**	**13.9%**	**0.2%**	**0.5%**	**4.0%**	**4.4%**

*Oil and Gas = Petroleum and Related Industries ~ encompasses crude oil and natural gas production, refining, and exploration activities.

area, point, and mobile sources. Point sources include large industrial sources, usually with emissions over 100 tons per year, and New Source Performance Standard sources. Area emission sources are those that are too small or too numerous to be treated as point sources. Residential heating, agricultural dust, asphalt paving, solvent use, and oil and gas production are examples of area sources. Biogenic and event sources

such as wildfires are also considered area sources but reported separately. Mobile sources include emissions from both on-road and non-road vehicles that use gasoline, diesel, and other fuels. On-road sources include cars, light and heavy-duty trucks, and motorcycles. Non-road sources include lawn and garden equipment, locomotives, airplanes, recreation vehicles, marine vessels and commercial engines. Area sources are collected using local demographic information, energy and agricultural data, and submitted inventories. Mobile data is calculated using vehicle miles traveled and mobile emissions factors from the EPA. The most recent version of the NEI contains data for 2023 with and interactive report and data available at https://www.epa.gov/air-emissions-inventories/2023-nei-supporting-data-and-summaries.

4.2 Criteria Pollutant Emissions

Table 5 contains the 2023 CAP emissions data by sector for the State of Colorado. According to the 2023 NEI, Colorado crude oil and natural gas production, refining, and exploration activities are responsible for 13.9% of NO_x and 4.4% of VOC emissions statewide. (Table 5). The 2023 NEI CAP data by field office are presented in Table 6 to serve as context and comparison to potential project-level emissions associated with BLM actions.

Table 6. 2023 NEI Colorado Criteria Air Pollutant Emissions (tpy) by Field Office.

Field Office	NH_3	CO	NOx	PM_{10}	$PM_{2.5}$	SOx	VOC
CRVFO	1,464	33,964	9,570	5,132	2,080	180	36,095
GJFO	1,699	27,119	3,192	5,853	2,115	144	21,825
KFO	1,115	15,793	1,834	4,396	1,453	54	18,160
LSFO	1,722	13,134	7,937	7,108	1,680	3,725	23,854
RGFO	78,205	585,699	110,574	178,572	41,746	9,125	271,839
SLVFO	4,056	17,453	2,528	8,084	2,349	53	26,581
TRFO	3,671	79,565	4,906	21,135	8,628	464	84,454
UFO	4,162	32,300	3,588	9,531	3,549	149	42,123
WRFO	1,227	6,407	2,465	1,705	592	144	14,572
TOTAL	**97,321**	**811,435**	**146,594**	**241,517**	**64,191**	**14,037**	**539,504**

Table 7. 2023 NEI Colorado Oil and Gas Criteria Air Pollutant Emissions (tpy) by Field Office.

Field Office	CO	NOx	PM_{10}	$PM_{2.5}$	SOx	VOC
CRVFO	1,702	2,857	11	9	38	2,985
GJFO	59	69	2	0	6	188
KFO	76	92	5	5	4	304
LSFO	119	93	23	23	0	695
RGFO	22,366	15,783	477	293	388	18,100
TRFO	3,308	597	6	1	5	218
UFO	38	24	1	1	2	22
WRFO	587	819	2	1	112	1,423
TOTAL	**28,267**	**20,342**	**530**	**334**	**556**	**23,936**

Note: *Oil and Gas = Petroleum and Related Industries ~ encompasses crude oil and natural gas production, refining, and exploration activities. This Tier constitutes less than 5 tpy of NH_3 statewide.

In Table 7, 2023 NEI CAP information for by field office is provided for additional context and comparison to the emissions information presented in Table 5 and Table 6. Most of the oil and gas emissions recorded in the 2023 NEI occurred in four BLM Colorado field offices, CRVFO, RGFO, TRFO and WRFO (Table 7). These four field offices combined accounted for at least 90% of VOC, NOx, and particulate matter emissions from the Petroleum and Related Industries Tier in Colorado. Please note that Table 7 includes both federal and non-federal sources but excludes downstream emissions for activities including highway vehicles, fuel combustion for electric utility and industrial and off-highway equipment.

4.3 Hazardous Air Pollutants

HAPs, also known as toxic air pollutants, are known or suspected to cause cancer or other serious health effects. Common HAPs emitted in the oil and gas industry include benzene, toluene, ethyl benzene, mixed xylenes, formaldehyde, normal-hexane, acetaldehyde, and methanol. Air toxics are released naturally and through human activities. Additionally, mixing of various chemicals in the air can lead to the formation of certain air toxics. Wildfires produce air toxics, such as methanol, formaldehyde, and acetaldehyde, and the quantity of air toxics generated by wildfire fluctuates significantly from year to year. Natural sources (known as biogenic sources) of air toxics include plants and animals. For example, methanol, formaldehyde, and acetaldehyde are released from forests.

The 2023 NEI HAP emissions for each field office is provided in Table 8 and can be used to contextualize project level emissions. Overall, 4.2% of the 2023 NEI HAP emissions in Colorado were from oil and gas exploration and production. Similarly, wildfires made up approximately 4.1% of the total emissions (led by TRFO and followed by CRVFO and UFO with similar annual wildfire totals) while biogenic emissions constituted over 66% of the total Colorado air toxics emissions levels. Table 9 presents oil and gas emissions for each field office, including both federal and non-federal sources. Note that emissions for downstream / end-use activities including highway vehicles, fuel combustion for electric utility and industrial and off-highway equipment are not included in the oil and gas related emissions levels shown.

Table 8. 2023 NEI Colorado HAPs (tpy) by Field Office.

Field Office	Acetaldehyde	Benzene	Ethyl Benzene	Formaldehyde	Hexane	Methanol	Naphthalene	Toluene	Xylenes
CRVFO	537	108	30	937	61	2,092	36	227	136
GJFO	392	54	26	584	33	1,666	32	173	114
KFO	290	35	17	401	15	1,203	17	93	62
LSFO	413	28	9	587	19	2,259	10	69	38
RGFO	4,936	1,230	717	8,003	1,405	19,234	405	4,600	2,766
SLVFO	480	33	14	661	15	2,219	16	82	51
TRFO	1,380	166	54	2,253	50	5,313	122	327	226
UFO	700	70	23	1,008	32	2,986	41	157	92
WRFO	248	119	9	391	19	1,274	6	98	201
TOTAL	**9,376**	**1,843**	**899**	**14,825**	**1,649**	**38,246**	**685**	**5,825**	**3,687**

Table 9. 2023 NEI Colorado Oil and Gas HAPs (tpy) by Field Office.

Field Office	Acetaldehyde	Benzene	Ethyl Benzene	Formaldehyde	Hexane	Methanol	Naphthalene	Toluene	Xylenes
CRVFO	20.2	35.1	3.1	73.3	18.1	14.8	0.7	54.5	30.6
GJFO	0.1	2.2	0.3	0.8	1.4	0.5	0.0	4.7	4.7
KFO	0.2	0.2	0.0	0.6	0.1	0.0	0.0	0.4	0.2
LSFO	0.5	6.3	0.4	4.9	7.0	1.5	0.0	8.2	3.8
RGFO	247.1	158.6	17.0	1,249.5	481.1	60.9	10.0	164.1	99.5
SLVFO	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TRFO	1.9	4.1	0.4	11.8	1.5	0.6	0.0	5.1	2.8
UFO	0.1	0.0	0.1	0.7	0.1	7.4	0.1	0.2	0.6
WRFO	5.0	105.4	5.2	17.9	11.2	3.3	0.2	73.2	187.0
TOTAL	**275.0**	**312.0**	**26.5**	**1,359.4**	**520.6**	**89.0**	**11.1**	**310.3**	**329.3**
Oil and Gas % of State Total	**2.9%**	**16.9%**	**2.9%**	**9.2%**	**31.6%**	**0.2%**	**1.6%**	**5.3%**	**8.9%**

4.4 Air Quality Index

The Air Quality Index (AQI) is a standardized measurement used to communicate how clean or polluted the air is in a specific location. It is based on several major CAPs regulated by environmental, including ground-level ozone, particulate matter ($PM_{2.5}$ and PM_{10}), carbon monoxide, sulfur dioxide, and nitrogen dioxide. The AQI typically ranges from 0 to 500, with higher values indicating poorer air quality.

The AQI helps individuals and communities understand the potential health effects associated with different pollution levels, providing guidance on protective measures, especially for vulnerable populations, during periods of poor air quality. The EPA calculates a daily AQI based on local air monitoring data. The terms “Good”, “Moderate”, and “Unhealthy” help to interpret the AQI. When the AQI value is in the good range, pollutant concentrations are well below the NAAQS and air pollution poses little or no risk. Moderate AQI values occur when pollution is below but near the NAAQS and voluntary emission reduction measures are encouraged. The AQI is considered unhealthy when the NAAQS is exceeded, and major pollution sources are often required to implement mandatory emission reduction measures. Counties without AQI data usually have fewer air pollutant sources and are assumed to have good air quality.

Summary AQI data for Colorado from 2023 to 2025 were obtained from the EPA Air Quality Index Summary Report are provided in Table 10. Information for border counties in Utah (Uintah) and Wyoming (Sweetwater) is provided because they both have sizable fossil-fuel production and there is a marginal NAA for ozone within the Uinta Basin below 6,250 feet in elevation. The AQI data examined in this report can be obtained from the EPA Air Quality Index Summary Report. The data in Table 10 show that air quality varies considerably across the state, with the highest frequency of good AQI days in the rural and mountain

regions of the state, while the lowest frequency of good AQI days is found in the metro areas of the Front Range which are within the RGFO.

Table 10. AQI Index Summary Statistics by County.

2023-2025			Percentage of Days Rated			
County	**BLM Colorado Field Office**	**# Days with AQI**	**Good**	**Moderate**	**Unhealthy for Sensitive Groups**	**Unhealthy**
Adams	RGFO	1096	48%	49%	2%	0%
Alamosa	SLVFO	894	89%	11%	0%	0%
Arapahoe	RGFO	1096	59%	39%	2%	0%
Archuleta	TRFO	1095	91%	8%	0%	0%
Boulder	RGFO	1096	56%	42%	1%	0%
Chaffee	RGFO	430	48%	48%	3%	0%
Clear Creek	RGFO	1025	60%	38%	2%	0%
Delta	UFO	209	86%	14%	0%	0%
Denver	RGFO	1096	41%	56%	3%	0%
Douglas	RGFO	1092	60%	36%	4%	0%
El Paso	RGFO	1096	63%	35%	1%	0%
Fremont	RGFO	887	96%	4%	0%	0%
Garfield	CRVFO	1096	58%	41%	1%	0%
Gilpin	RGFO	1088	71%	28%	2%	0%
Grand	KFO	477	82%	18%	0%	0%
Gunnison	UFO	1093	69%	31%	0%	0%
Jackson	KFO	834	84%	16%	0%	0%
Jefferson	RGFO	1096	56%	38%	6%	1%
La Plata	TRFO	1096	64%	35%	0%	0%
Larimer	RGFO	1096	47%	49%	3%	0%
Mesa	GJFO	1096	64%	36%	1%	0%
Montezuma	TRFO	1096	75%	24%	0%	0%
Park	RGFO	795	55%	43%	2%	0%
Pitkin	CRVFO	743	95%	5%	0%	0%
Prowers	RGFO	1081	92%	8%	0%	0%
Pueblo	RGFO	1093	73%	26%	1%	0%
Rio Blanco	WRFO	731	70%	29%	1%	0%
Routt	LSFO	1083	97%	3%	0%	0%
San Juan	TRFO	307	99%	1%	0%	0%
San Miguel	TRFO	979	82%	18%	0%	0%
Weld	RGFO	1096	42%	55%	3%	0%
Sweetwater (Wyoming)	-	1096	70%	28%	2%	0%

Uintah (Utah)	-	1096	56%	40%	2%	2%

4.5 Air Quality Design Values

Design value is a statistic describing the air quality status of a given location relative to the NAAQS. Design values are computed and published annually by EPA with the most recently data available here and through an interactive map. As with AQI, counties without design value values typically have fewer air pollutant sources and good air quality.

The $PM_{2.5}$, NO_2, and O_3 design values for Colorado are presented in Table 11, Table 12, Table 13, Table 14 and Table 15. Design values for CO, SOx, and Pb are well below NAAQS. The design value for PM_{10} is expressed as the number of days per year with PM_{10} exceeding 150 µg/m^3. Across Colorado, this ranges from 0 days to several days per year. Ozone design values exceed the NAAQS in northern Front Range counties comprising the Denver Metro/North Front Range (DMNFR) ozone NAA. On October 7, 2022, the EPA finalized a rule that redesignated the Denver Metro/North Front Range (DMNFR) ozone nonattainment area from "serious" to "severe" for the 2008 ozone NAAQS. The rule went into effect on November 7, 2022, triggering a one-year period for affected facilities to evaluate and confirm compliance. With respect to the 2015 ozone NAAQS, on July 24, 2024, the EPA approved an update for Colorado's classification for ozone pollution. The update is based on air monitoring data collected between 2021 and 2023, and reclassifies the Denver metro/northern Front Range, including northern Weld County, from a "moderate" to a "serious'' nonattainment area. The most recent ozone design values for the other areas of Colorado with active ozone monitors (CRVFO, TRFO, GJFO, UFO and WRFO) range from about 90% to 96% of the NAAQS (Table 15).

Table 11. County-level Design Value History for the PM2.5 Annual NAAQS (9 µg/m^3).

County	Field Office	2019-2021	2020-2022	2021-2023	2022-2024	2023-2025
Adams	RGFO	N/A	N/A	8.5	7.4	7.6
Arapahoe	RGFO	6.4	6.1	5.9	5.3	5.2
Boulder	RGFO	8.4	8.1	7.3	6.5	6.8
Denver	RGFO	10.2	9.3	8.7	7.9	7.9
Douglas	RGFO	6.1	5.8	5.5	4.6	4.7
El Paso	RGFO	5.7	5.6	5.5	5.2	5.3
Larimer	RGFO	7.5	7.7	7.1	6.4	6.3
Mesa	GJFO	5.8	5.8	5.3	4.9	5.0
Pueblo	RGFO	N/A	N/A	N/A	5.4	5.0
Rio Blanco	WRFO	8.6	8.5	7.2	5.9	N/A
Weld	RGFO	9.5	8.8	8.1	7.1	7.8

Table 12. County-level Design Value History for the $PM_{2.5}$ 24-hour NAAQS (35 µg/m^3).

County	Field Office	2019-2021	2020-2022	2021-2023	2022-2024	2023-2025
Adams	RGFO	N/A	N/A	N/A	21	21
Arapahoe	RGFO	25	20	17	15	16
Boulder	RGFO	31	30	23	19	20
Denver	RGFO	32	29	24	20	20
Douglas	RGFO	28	25	19	14	15
El Paso	RGFO	18	18	15	14	14
Larimer	RGFO	32	31	22	19	18
Mesa	GJFO	18	18	14	13	13
Pueblo	RGFO	N/A	N/A	N/A	13	12
Rio Blanco	WRFO	20	21	16	13	N/A
Weld	RGFO	31	30	25	22	22

Table 13. County-level Design Value History for the NO_2 1-hour NAAQS (100 ppb).

County	Field Office	2019-2021	2020-2022	2021-2023	2022-2024	2023-2025
Adams	RGFO	58	56	56	55	53
Archuleta	TRFO	15	15	14	N/A	N/A
Denver	RGFO	70	68	66	63	60
Jefferson	RGFO	26	25	27	25	23
La Plata	TRFO	N/A	7	7	N/A	N/A
Rio Blanco	WRFO	24	20	N/A	N/A	N/A

Table 14. County-level Design Value History for the NO_2 Annual NAAQS (53 ppb).

County	Field Office	2021	2022	2023	2024	2025
Adams	RGFO	15	17	16	14	14
Archuleta	TRFO	3	2	2	N/A	N/A
Denver	RGFO	26	24	24	23	22
Jefferson	RGFO	3	3	3	3	3
La Plata	TRFO	5	4	4	3	3
Rio Blanco	WRFO	2	1	N/A	1	N/A
Weld	RGFO	6	8	7	6	6

Table 15. County-level Design Value History for the 2015 Ozone 8-Hour NAAQS (0.070 ppm).

County	Field Office	2019-2021	2020-2022	2021-2023	2022-2024	2023-2025
Adams	RGFO	0.072	0.077	0.074	0.076	0.074
Arapahoe	RGFO	0.080	0.080	0.077	0.073	0.074
Archuleta	TRFO	N/A	0.064	0.060	N/A	N/A
Boulder	RGFO	0.075	0.076	0.075	0.075	0.074
Denver	RGFO	0.075	0.077	0.075	0.075	0.075
Douglas	RGFO	0.083	0.083	0.081	0.080	0.079
El Paso	RGFO	0.073	0.074	0.071	0.073	0.073
Garfield	CRVFO	0.061	0.062	0.059	0.059	N/A
Gilpin	RGFO	0.074	0.076	0.075	0.074	0.072
Gunnison	UFO	0.065	0.065	0.065	0.066	0.067
Jefferson	RGFO	0.083	0.084	0.080	0.079	0.079
La Plata	TRFO	N/A	0.066	0.067	0.065	N/A
Larimer	RGFO	0.077	0.077	0.076	0.075	0.075
Mesa	GJFO	0.065	0.065	0.063	0.063	0.063
Montezuma	TRFO	0.066	0.066	0.064	0.064	0.064
Rio Blanco	WRFO	0.066	0.065	0.067	N/A	N/A
Weld	RGFO	0.071	0.077	0.074	0.073	0.073

* Shaded cells indicate levels above the NAAQS.

4.6 Air Quality Related Values

In this section, the most recent AQRV information on visibility and deposition is presented. For background information on each, including a description of the IMPROVE network, refer to Section 2.7 Air Quality Related Values (AQRVs) in this report.

4.6.1 Visibility

There are eight IMPROVE visibility monitoring locations within Colorado that have at least nine years of data (

Table 16). The IMPROVE monitors are used to assess current visibility and aerosol conditions in Class I areas; identify chemical species and emission sources responsible for anthropogenic visibility impairment; document long-term trends in visibility; and provide regional haze monitoring representing all visibility-protected federal Class I areas. A list of Class I areas in Colorado and representative IMPROVE monitors is provided in Table 3 of this report. Note that the Great Sand Dunes (GRSA1), Mesa Verde (MEVE1) and Weminuche Wilderness (WEMI1) locations were established at the beginning of the IMPROVE program, giving each the longest period of observation in the network at 37 years. The period of observation at the Rocky Mountain (ROMO1) is just two years shorter and 30 years of data are available from the Mount Zirkel (MOZI1) location. The relatively long period of observation and good geographic coverage of IMPROVE sites provides for a good assessment of Colorado visibility following CAA amendments of 1990.

Visibility trends for Colorado IMPROVE locations are presented in Figure 1 through Figure 8. At each location, there are annual visibility (dv) data for the haziest, clearest, and most impaired days. Following the most recent RHR guidance, progress towards CAA visibility goals is demonstrated by improvement on

the most impaired days. The haziest days are no longer used in a regulatory context but are provided for comparison to the new RHR metric, most impaired days. The CAA goal for the clearest days is simply no degradation from the 2000-2004 baseline clearest days. Nearly all sites in the network are meeting that requirement. However, there is no regulatory requirement for these locations to approach natural conditions on the clearest days. A summary of visibility trends (dv/year) for each location is presented in Table 17.

Table 16. List of IMPROVE Monitors in Colorado.

IMPROVE Site	Name	Field Office	Period of Record
FLTO1	Flat Tops	WRFO	2012 – 2020
GRSA1	Great Sand Dunes NP	SLVFO	1989 – present
MEVE1	Mesa Verde NP	TRFO	1989 – present
MOZI1	Mount Zirkel	KFO	1995 – present
ROMO1	Rocky Mountain NP	RGFO	1991 – present
SHMI1	Shamrock Mine	TRFO	2005 – present
WEMI1	Weminuche Wilderness	TRFO	1989 – present
WHRI1	White River NF	CRVFO	2001 – present

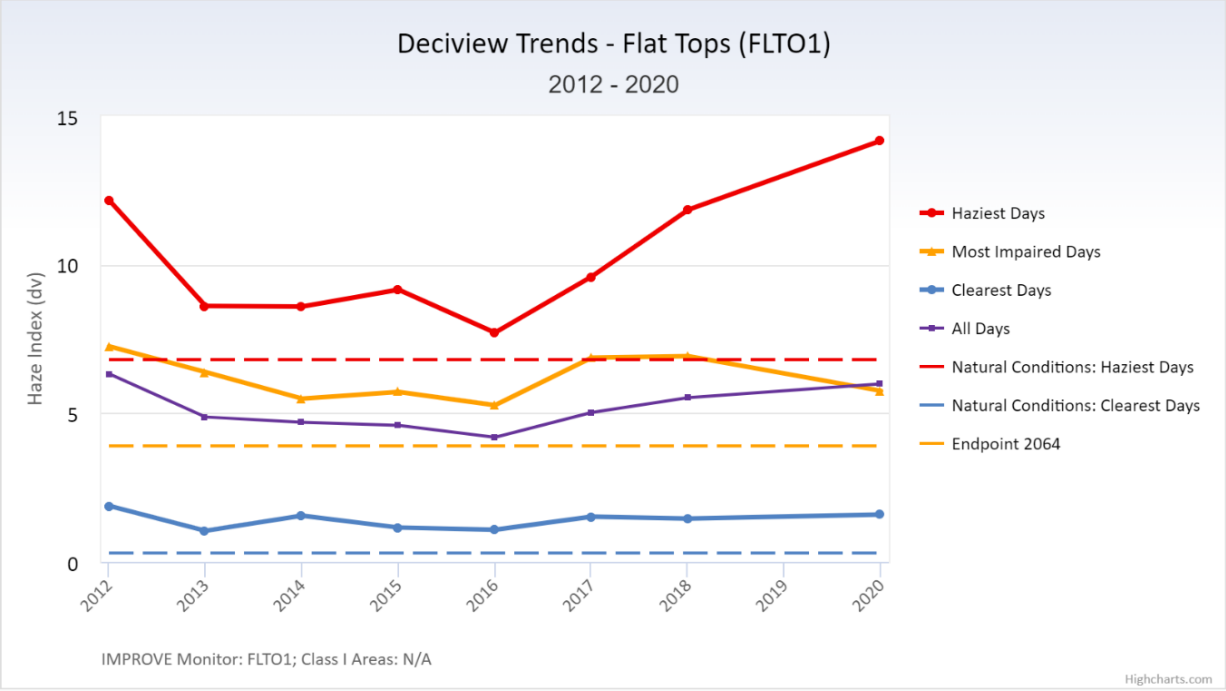


Figure 1. Visibility Trends at Flat Tops (FLTO1).

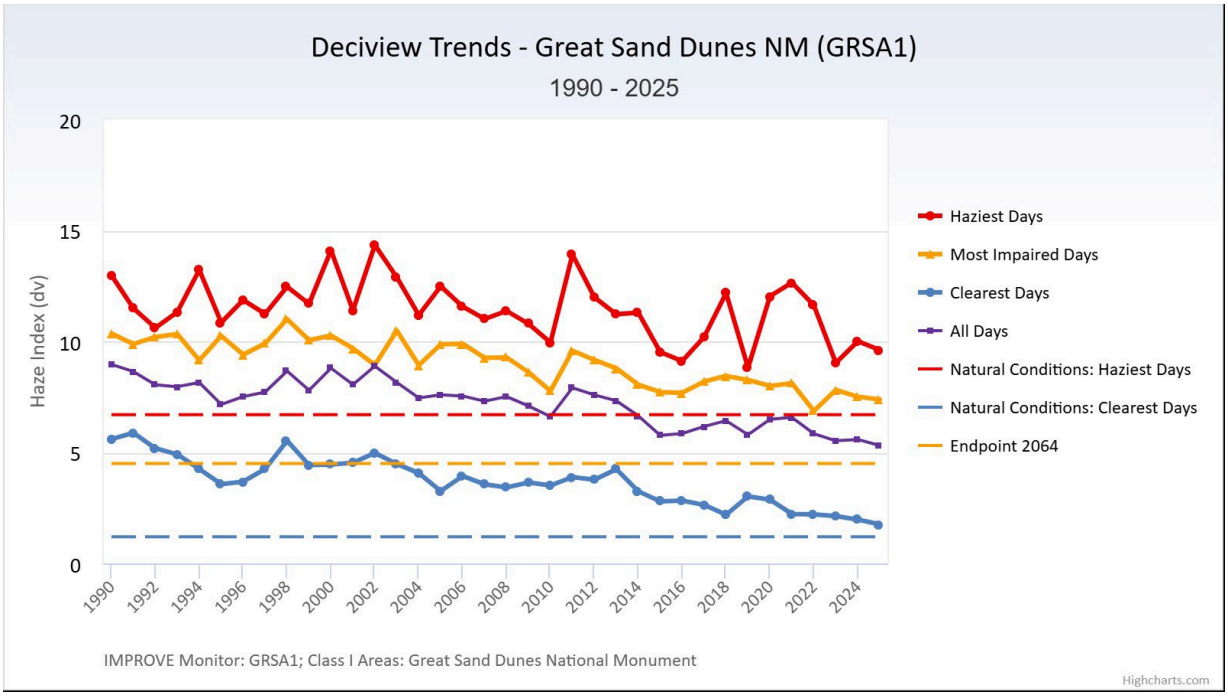


Figure 2. Visibility Trends at Great Sand Dunes NP (GRSA1).

The short period of record (2012-2020) at the Flat Tops (FLTO1) location precludes any determination of trends, but it still allows for an assessment of prevailing conditions in the WRFO and the mountains of western Colorado more broadly. As with most IMPROVE sites in the western United States, there is large interannual variability in the haziest days at the FLTO1 location (Figure 1) due to wildfire smoke. Observed visibility on the clearest days is only slightly above natural conditions and the low haze index for clearest and most impaired days reveals that background visibility at the FLTO1 location is good.

At the Great Sand Dunes (GRSA1) location (Figure 2) there has been a statistically significant trend towards improved visibility on the most impaired (anthropogenic)and clearest days. For both, the observed trend is -0.09 dv/year. The visibility trend for most impaired days at Great Sand Dunes demonstrates steady progress towards RHR 2064 endpoints.

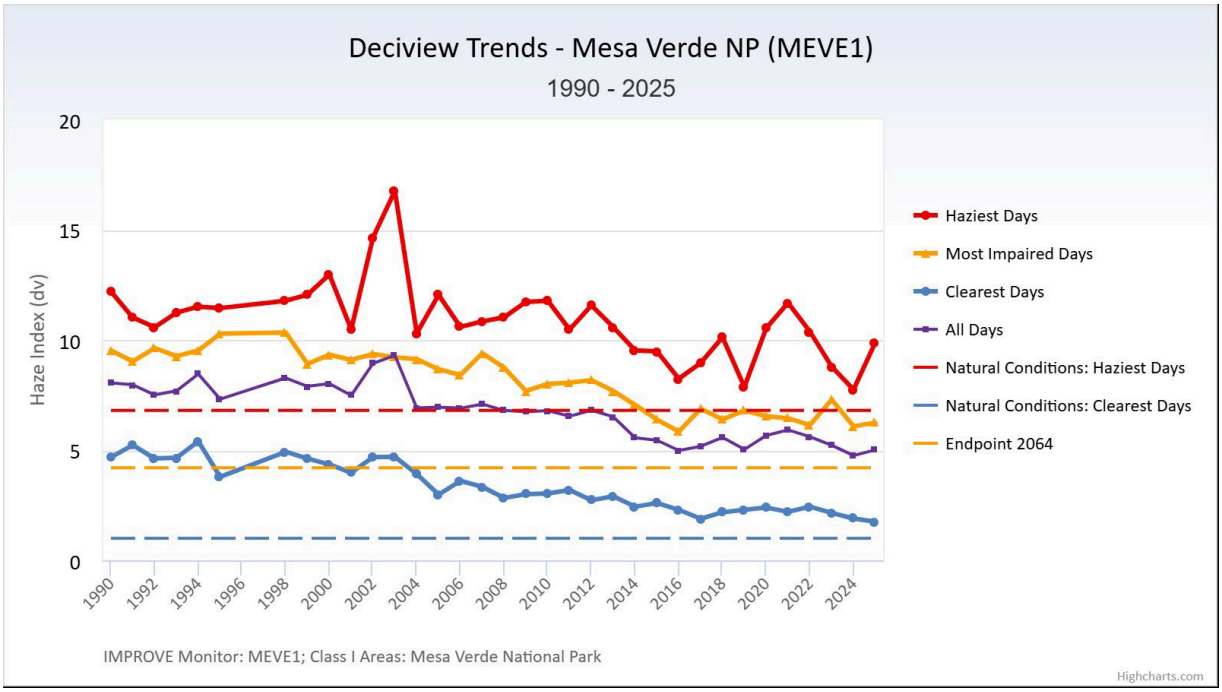


Figure 3. Visibility Trends at Mesa Verde NP (MEVI1).

There has been statistically significant improvement observed in each of the three haze categories at the Mesa Verde NP (Figure 3). Monitoring at Mesa Verde (MEVI1) extends back to 1989 making it among the longest established monitors within the IMPROVE network. Since 1989, the haze index on the most impaired days decreased by 0.12 dv/year, and the trend for most impaired days demonstrates progress towards the 2064 endpoint established in the latest RHR guidance. The trend for the clearest days indicates steady improvement towards natural conditions by 2064. Overall visibility at Mesa Verde NP is good, improving, and representative of prevailing conditions and trends in southwestern Colorado.

Visibility improved on the clearest and most impaired days at the Mount Zirkel (MOZI1) location, with a decrease of about 0.11 dv/year on the most impaired days. During the best visibility years, the clearest days approach natural conditions at MOZI1 location (Figure 4). Notably, the haze index on the clearest and most impaired days at MOZI1 is among the lowest in Colorado with only the WHRI site commonly observing lower haze indices. The trend for most impaired days at the MOZI1 site indicates improvement overall towards the 2064 endpoint set forth by the latest RHR guidance.

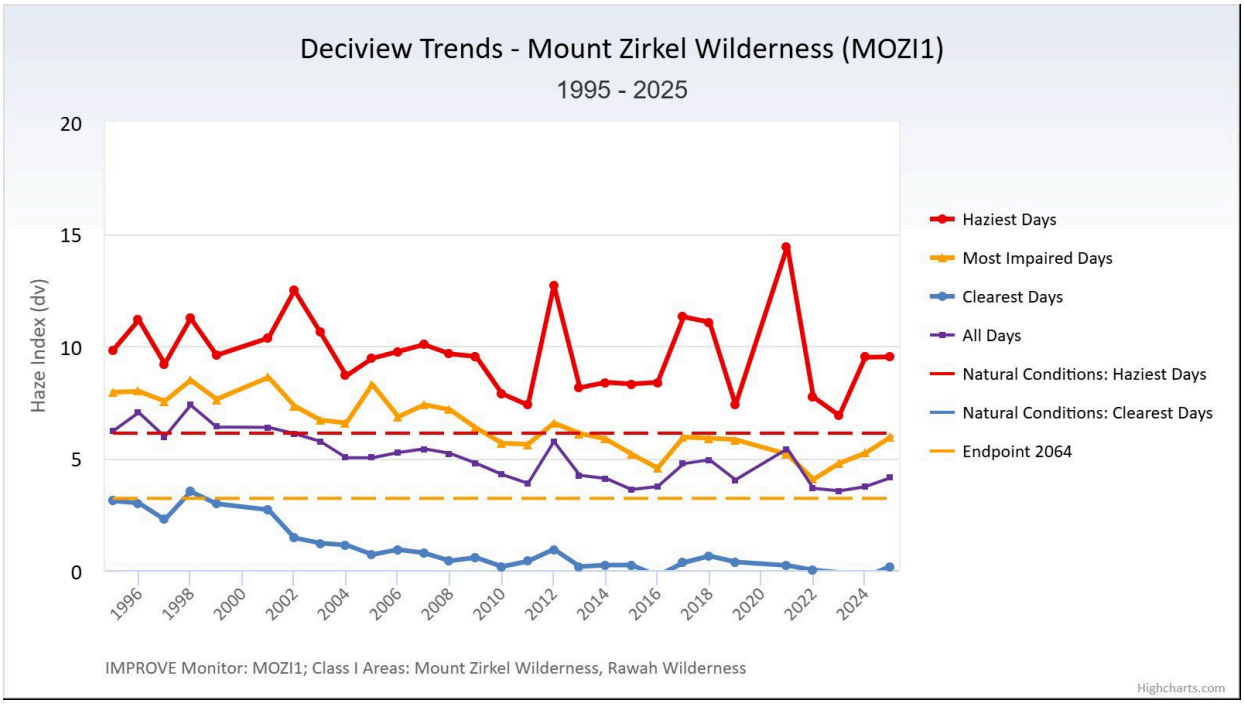


Figure 4. Visibility Trends at Mount Zirkel Wilderness (MOZI1).

At Rocky Mountain National Park (ROMO1), visibility monitoring has been conducted since 1991 with steady improvement on the clearest and most impaired days (Figure 5). The haze index for the most impaired days decreased by about 0.13 dv/year since 1991. Visibility on the haziest days improved slightly at the ROMO1 location, but this countered by the high wildfire smoke experienced in 2020 and 2021. Nevertheless, the long-term record at ROMO1 shows that overall visibility has improved with the visibility on the most impaired days demonstrating progress towards the 2064 endpoint established in the latest RHR guidance.

Over the past 20 years, visibility at the Shamrock Mine (SHMI1) location in southwestern Colorado has improved on the clearest, haziest and most impaired days (Figure 6). Note there is no data available for 2022 at SHMI1.

Visibility monitoring dates to 1989 at the Weminuche Wilderness (WEMI1) location making it one of the longest established IMPROVE monitors. Since 1989, the haze index for the most impaired days decreased by about 0.09 dv per year (Figure 7). Visibility on the clearest days is only slightly above natural conditions with some of the lowest haze index values within Colorado. The steady trend towards the 2064 endpoint for most impaired days demonstrates progress in meeting RHR visibility goals for the WEMI1 location.

The White River NF (WHRI1) IMPROVE monitor (Figure 8), which is broadly representative of the western Colorado mountains, shows improvement in visibility on the clearest and most impaired days dating back to 2001. Prevailing visibility at WHRI1 is generally the best in Colorado with only the MOZI1 site typically observing such low haze indices.

IMPROVE monitors across Colorado show a consistent pattern of statistically significant visibility improvement on both the clearest and most impaired days (Table 17). The trend of improved visibility on the most impaired days indicates solid progress toward RHR goals in Colorado's Class I areas. While wildfire

smoke episodes have contributed to some of the worst visibility conditions on record, the clearest days are now better than any observed in the period of record, and the most impaired days are moving toward the 2064 endpoint goal. This underscores the notable visibility gains achieved under the CAA and RHR, while highlighting the ongoing challenge of mitigating smoke impacts amid increasing wildfire activity.

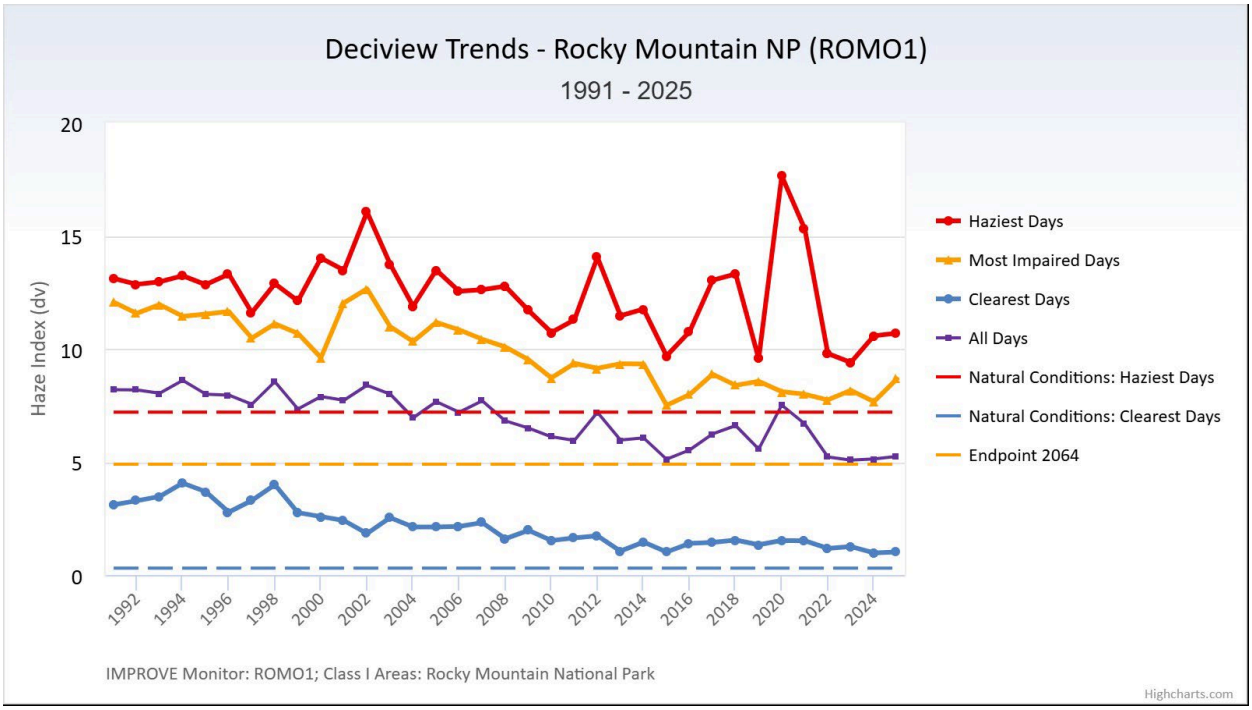


Figure 5. Visibility Trends at Rocky Mountain NP (ROMO1).

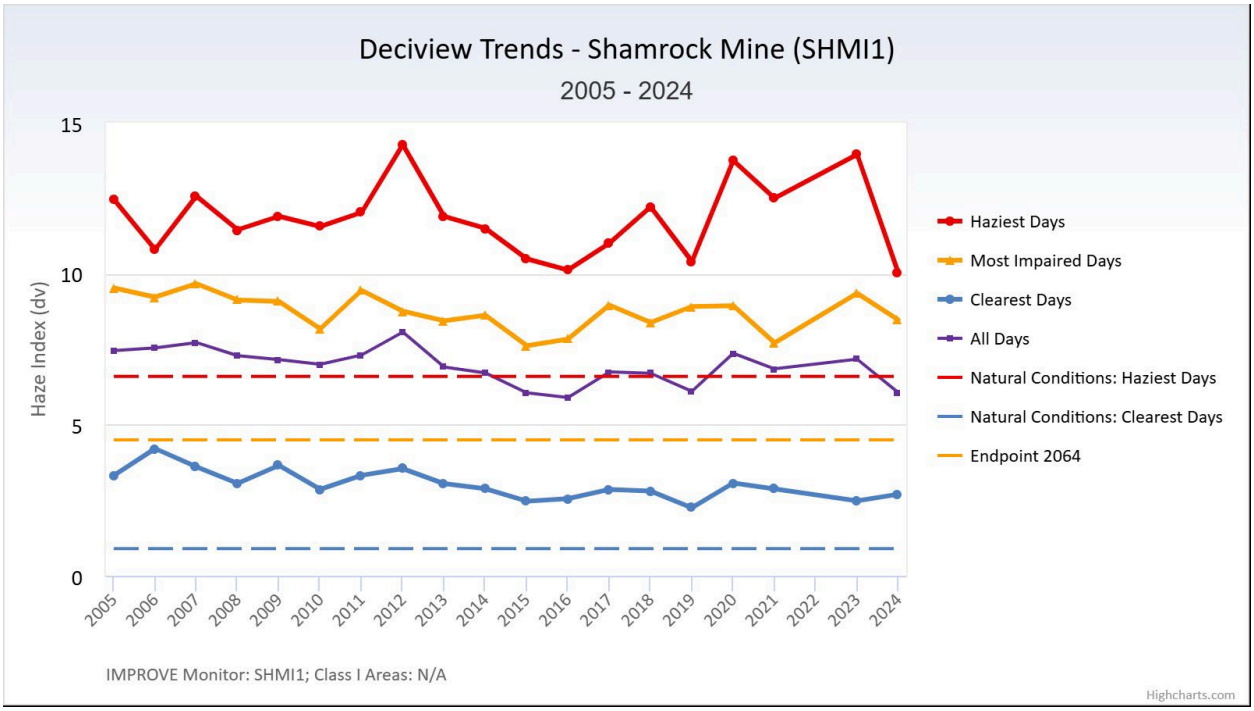


Figure 6. Visibility Trends at Shamrock Mine1 (SHMI1).

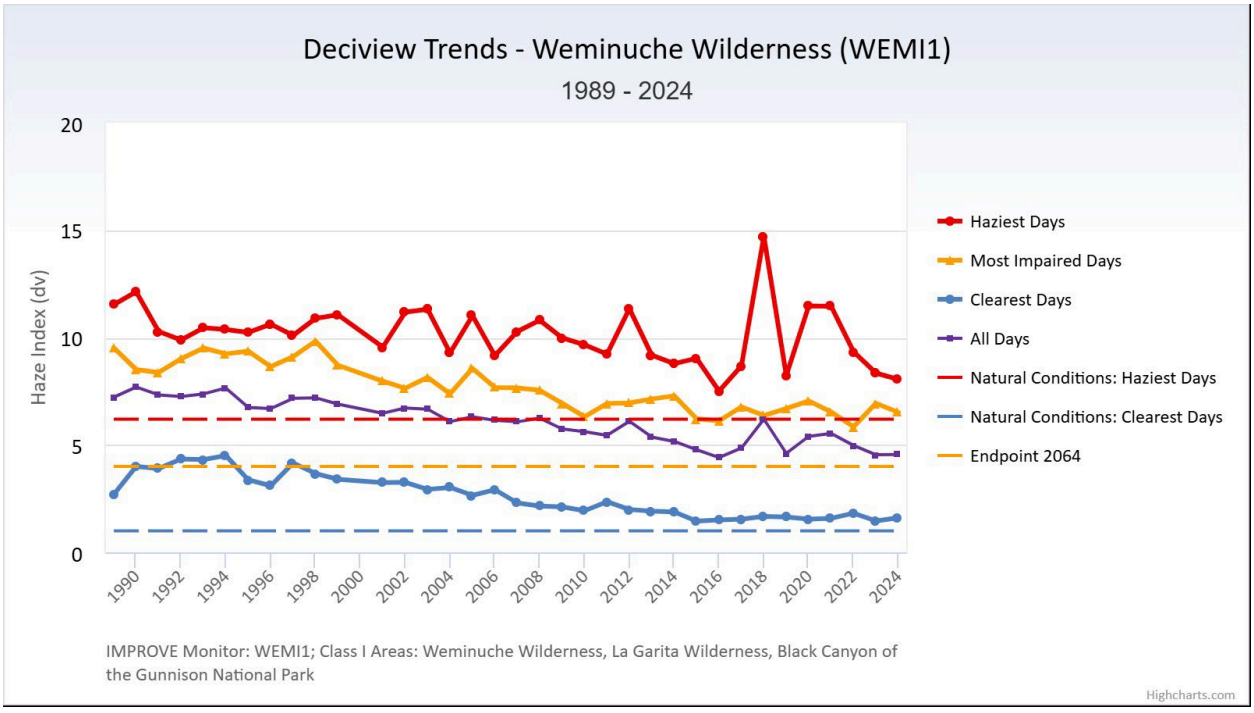


Figure 7. Visibility Trends at Weminuche Wilderness (WEMI1).

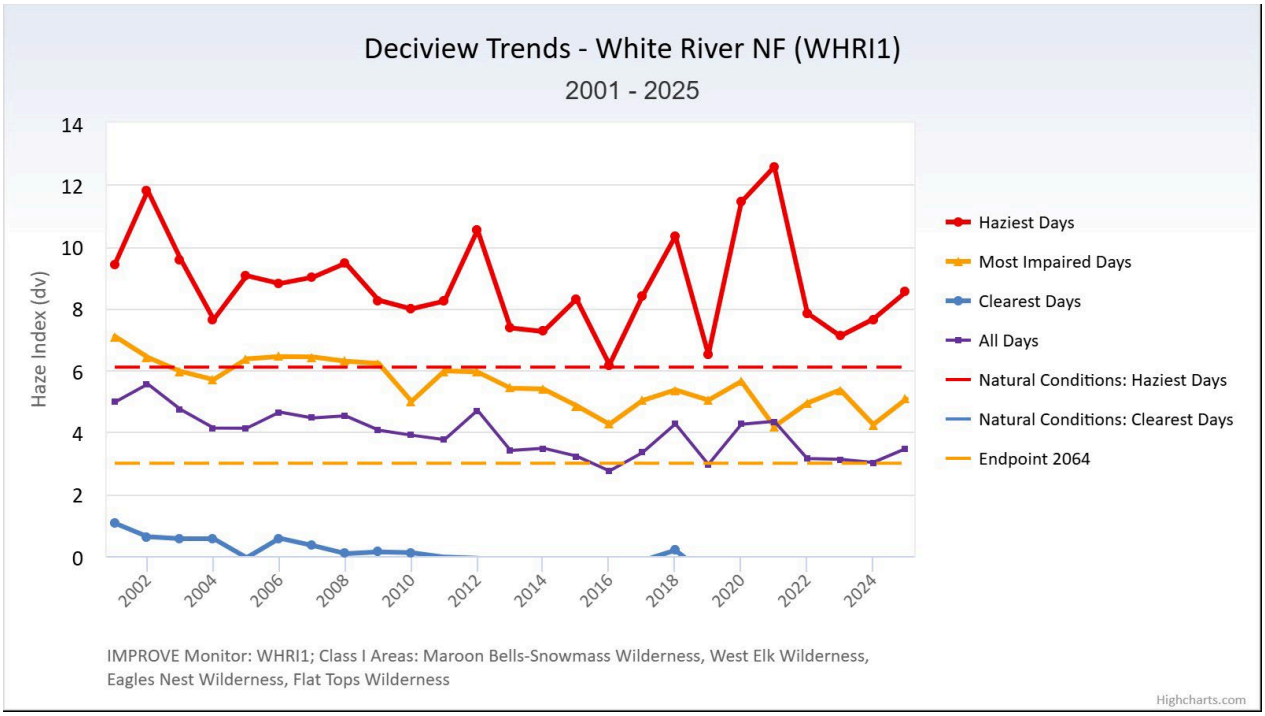


Figure 8. Visibility Trends at White River NF (WHRI1).

Table 17. Summary of Colorado Visibility Trends (dv/year).

IMPROVE Site	Period	Clearest Days	Most Impaired Days	Haziest Days
GRSA1	1989 – 2025	-0.094	-0.089	-0.060
FLTO1	2012 – 2020	+0.008	-0.066	+0.304
MEVE1	1989 – 2025	-0.092	-0.115	-0.070
MOZI1	1995 – 2025	-0.099	-0.113	-0.074
ROMO1	1991 – 2025	-0.071	-0.131	-0.076
SHMI1	2005 – 2024	-0.060	-0.055	-0.022
WEMI1	1989 – 2024	-0.086	-0.092	-0.064
WHRI1	2001 – 2025	-0.057	-0.085	-0.068

Source: Federal Land Manager Environmental Database Note: Data rounded to thousandths place.

4.6.2 Deposition and Park Conditions

Atmospheric deposition occurs when gaseous and particulate air pollutants are deposited on the ground, water bodies or vegetation. The pollutants may settle as dust or be washed from the atmosphere in rain, fog, or snow. When air pollutants such as sulfur and nitrogen are deposited into ecosystems, they may cause acidification, or enrichment of soils and surface waters. Atmospheric nitrogen and sulfur deposition may affect water chemistry, resulting in impacts to aquatic vegetation, invertebrate communities, amphibians, and fish. Deposition can also cause chemical changes in soils that alter soil microorganisms, plants, and trees. Excess nitrogen from atmospheric deposition can stress ecosystems by favoring some plant species and inhibiting the growth of others.

To assess deposition impacts, critical loads (also discussed in Section 2.7.1 Deposition) can be compared to observed deposition amounts. A "critical load" is the amount of pollution that leads to harmful changes in an ecosystem and is usually expressed as kilograms per hectare per year (kg N ha^{-1} yr^{-1}) of wet or total (wet and dry) deposition. Critical loads can be used to assess responses to nitrogen and sulfur deposition, including changes in aquatic and terrestrial plant diversity, soil nutrient levels, or fish health. Critical loads vary considerably because some ecosystem components are more sensitive than others. Epiphytic lichen will typically have low critical load values, as they are often the first thing to respond to increased pollution and they acquire all their nutrients from the atmosphere. On the other hand, many soils have high critical loads, because their structure helps them buffer the impacts of deposition, so they can sustain more cumulative deposition before they begin to change. When critical loads are exceeded, the environmental effects can cascade and impact ecosystem services. For the alpine environment of Rocky Mountain National Park, (Bowman, Murgel, Blett, & Porter, 2012) recommend N critical loads less than 10 kg N ha^{-1} yr^{-1} to prevent future acidification of soils and surface waters and less than 3 kg N ha^{-1} yr^{-1} for vegetation to protect natural plant communities and ecosystem services in the park.

The EPA's Clean Air Status and Trends Network (CASTNET) is a long-term environmental monitoring network with 95 sites located throughout the United States and Canada. CASTNET is managed and operated by the U.S. Environmental Protection Agency (EPA) in cooperation with the National Park Service (NPS); Bureau of Land Management, Wyoming State Office (BLM); and other federal, state, and local partners including six Native American tribes that operate CASTNET sites on tribal lands. The network was established under the 1991 CAA Amendments to assess the trends in acidic deposition due to emission reduction programs. CASTNET is the only network in the United States that provides a consistent, long-term data record of acidic dry deposition fluxes. CASTNET complements the National Atmospheric Deposition Program's (NADP's) National Trends Network (NTN). The NTN is considered the nation's primary source of wet deposition data and provides weekly wet deposition fluxes at more than 250 sites across the contiguous United States, Canada, Alaska, Puerto Rico, and the U.S. Virgin Islands. Nearly all CASTNET sites are collocated with or near an NTN site. Together, these two monitoring programs provide data necessary to estimate long-term temporal and spatial trends in total deposition (dry and wet) as well as ecosystem health.

As of October 2026, there are 18 active NTN sites in Colorado. In addition, there are four active CASTNET locations in Colorado: One each in Gothic (GTH161) and Mesa Verde NP (MEV405), and two in Rocky Mountain NP (ROM206, ROM406). Additional stations at Dinosaur National Monument (DIN431) and Canyonlands NP (CAN407) in Utah may be representative of conditions in western Colorado, while central Wyoming's Centennial (CNT169) site is just north of the Colorado border.

The NTN data show that nitrogen deposition in Colorado is generally low compared to the critical loads recommended by (Bowman, Murgel, Blett, & Porter, 2012) and as such, unlikely to result in widespread degradation to soil, vegetation, or water. However, some species and ecosystems are more sensitive to nitrogen deposition, thus conditions for individual ecosystem components may indicate potential ecosystem harm.

Trends in nitrogen deposition are difficult to evaluate due to incomplete data for many NTN sites (Table 18). At locations with consistent data, nitrogen deposition has generally remained stable over time. However, recent measurements at Alamosa, Las Animas Fish Hatchery, and Rocky Mountain National Park-

Beaver Meadows show a slight increase. In contrast, nitrogen deposition at Colorado's four active CASTNET stations has remained largely unchanged throughout the period of record.

The NPS also monitors and evaluates deposition and overall air quality to determine parks most at risk and where conditions are declining or improving. Park specific information can be found at the NPS Air Quality Conditions and Trends webpage. The NPS provides a rationale for each park's rating that considers a wide range of factors including ecosystem sensitivity to deposition, ozone risk to vegetation, visibility trends, etc. Accordingly, this information may be more holistic and indicative of AQRVs than strict quantitative metrics such as AQI or design values.

Table 18. Colorado National Trends Network (NTN) Sites.

Site ID	Site Name	County	Field Office	Start Year	2023 Nitrogen Deposition (kg ha^{-1})	2024 Nitrogen Deposition (kg ha^{-1})	2025 Nitrogen Deposition (kg ha^{-1})
CO00	Alamosa	Alamosa	SLVFO	1980	0.59	1.25	0.95
CO01	Las Animas Fish Hatchery	Bent	RGFO	1983	3.86	2.72*	2.90
CO02	Niwot Saddle	Boulder	RGFO	1984	2.27	2.02*	1.98*
CO08	Four Mile Park	Garfield	CRVFO	1987	1.22	1.70	0.92
CO10	Gothic	Gunnison	UFO	1999	0.76	1.46	0.82
CO19	Rocky Mountain National Park-Beaver Meadows	Larimer	RGFO	1980	2.03	1.66*	1.88*
CO21	Manitou	Teller	RGFO	1978	2.35	1.46	1.99
CO80	Akron 4E	Washington	RGFO	2022	3.94	4.07	4.17
CO81	Missile Site Park	Weld	RGFO	2020	5.02	3.84	4.17
CO90	Niwot Ridge-Southeast	Boulder	RGFO	2006	2.54	2.44*	2.33*
CO94	Sugarloaf	Boulder	RGFO	1986	2.45	2.10*	2.19*
CO97	Buffalo Pass - Summit Lake	Routt	LSFO	1984	1.59	2.34*	1.74*
CO98	Rocky Mountain National Park-Loch Vale	Larimer	RGFO	1983	2.21	2.70*	2.04
CO99	Mesa Verde National Park-Chapin Mesa	Montezuma	TRFO	1981	1.88	2.33	1.46

* Note: do not meet NADP's minimum criteria for data completeness (at least 75% of time period [year] is represented by valid samples).

5. Affected Environment: Conditions and Trends by Field Office

In this chapter, recent oil and gas development and production at the field office level is compared to CARMMS scenarios to evaluate whether model oil and gas activity is still representative and valid. Air quality conditions and trends discussed in Chapter 4. Affected Environment: Statewide Air Quality Conditions and Emissions are used to assess air quality and AQRVs at the field office level.

Please see Section VI – Oil and Gas Development Emissions Reduction Strategies and BMPs within the CARPP for management strategies and emissions controls that could be required because of project-level or broader-scale analyses. Depending on the state of current air quality conditions, how oil and gas is tracking, when new projects are proposed, and projected impacts for project-level and cumulative federal oil and gas impacts, any combination of the emissions controls listed in Section VI of CARPP might be required.

Federal oil and gas development and production data were obtained from the Automated Fluid Minerals Support System (AFMSS) and Office of Natural Resources Revenue (ONRR). Total (federal and non-federal) production and wells data were obtained from the report year ECMC production value, which contains both federal and non-federal sources. This information can be used to deduce the non-federal production component by subtracting the federal (ONRR) production from the ECMC (total) production. Federal spud counts were obtained from AFMSS and added to the previous year's federal active well count to determine the report year information, which provides a conservative estimate for federal active wells. The development metrics (i.e. spuds, production volumes) are analyzed for each field office and compared to CARMMS 2.0 high and low development scenarios and Regional Modeling Study levels. In general, spuds are a surrogate for construction / development related emissions, while overall oil and gas production volumes are surrogates for various production activity emissions. Federal annual production and spud / completion count data for each BLM Colorado Field Office are provided starting Section 5.2 below. Annual oil and gas development and production data for recent years at the State (Colorado, etc.), National and global levels can be found in the latest version of the BLM Annual GHG Report (BLM, 2026).

5.1 Estimated Report Year Oil and Gas Criteria Pollutant Emissions

The 2023 NEI oil and gas CAP emissions in Table 7 include federal and non-federal sources. To get a rough estimate of the federal portion of the CAP emissions from Table 7, the values can be scaled by the average of the federal portion of oil and gas production within each field office. For example, using State and Federal 2025 oil and gas production data, in the CRVFO, 35% of 2025 total oil production and 47% of 2025 total gas production was federal, and accordingly, the same percentage of annual CAPs emissions for the field office. Using this methodology, the annual estimated circa 2025 CAPs emissions levels related to 2025 Federal oil and gas exploration and production for each field office are presented in Table 19. They are provided for context and comparison to other pollution sources within the state and should be considered as approximate values. Overall, using this methodology, about 13% of Colorado oil and gas related NO_x emissions and about 15% of total Colorado oil and gas related VOC emissions are from federal oil and gas.

Table 19. Estimated 2025 Federal Oil and Gas CAP Emissions (tpy) by Field Office.

Field Office	CO	NOx	PM_{10}	$PM_{2.5}$	SOx	VOC
CRVFO	696	1,168	4	4	17	1,278
GJFO	20	23	1	0	2	66
KFO	30	36	2	2	2	125

LSFO	71	56	14	14	0	476
RGFO	573	404	12	7	9	430
TRFO	1,827	330	3	0	3	113
UFO	21	14	1	0	1	12
WRFO	411	574	1	1	87	1,066
BLM Colorado O&G TOTAL	**3,649**	**2,605**	**38**	**28**	**120**	**3,566**
% of State O&G Total	**13%**	**13%**	**7%**	**8%**	**22%**	**15%**

5.2 Colorado River Valley Field Office

The Colorado River Valley Field Office (CRVFO) is in the Northwest District within the west central portion of the state. CRVFO provides administrative management for approximately 567,000 surface acres of public land and roughly 750,000 acres of subsurface federal mineral estate within Garfield, Mesa, Eagle, Pitkin, Routt, and Rio Blanco counties. The major urban areas within the field office are located along the I-70 corridor from Vail Valley past Glenwood Springs and along State Highway 82 in Aspen Valley. The RMP providing direction for CRVFO management actions was finalized in 2015. A Supplemental EIS was recently completed for the CRVFO and GJFO. The need for the supplemental was to comply with the settlement agreements in litigation of the CRVFO RMP (Wilderness Workshop v. BLM, 16-cv-01822) and subsequent oil and gas leasing in both field offices (Wilderness Workshop v. BLM, 18-cv-00987). The purpose of supplemental EIS was to broaden the range of alternatives in the 2015 CRVFO and GJFO Approved RMPs with respect to the lands that are allocated as open or closed for oil and gas leasing. The supplemental RMP also provides additional air quality analysis for the fluid mineral management alternatives considered in the 2015 RMP. The 2015 RMP contains provisions to protect air quality and AQRVs by complying with applicable federal, state, and local air quality laws, regulations, standards, and implementation plans. Within the scope of the BLM's authority, the goals of the RMP are to limit air quality degradation by implementing actions to minimize emissions that may cause or contribute to negative impacts to air quality or air quality-related values (i.e. AQRVs) in Class I Airsheds affected by actions in the planning area.

5.2.1 Colorado River Valley Field Office Oil and Gas Development and Production

Table 20 provides the 2025 federal oil and gas development and production statistics for the CRVFO and the percentages of those annual levels when compared to the CARMMS 2.0 modeling federal input levels for year 2025. During the reporting year, no new federals wells were drilled.

Table 20. 2025 CRVFO Federal Oil and Gas Statistics.

Description	Federal	% CARMMS 2.0 - High - Fed	% CARMMS 2.0 - Low - Fed
New Wells (Spuds)	0	0%	0%
Oil Production (bbl)	300,901	27.8%	37.2%
Gas Production (mcf)	142,213,789	47.1%	60.3%

Since tracking began in 2016, spuds have averaged about 41% of the low scenario and an even lower percentage of the high scenario. For both oil and gas, CRVFO federal production has consistently fallen below the CARMMS 2.0 low scenario annual “new” oil and gas levels.

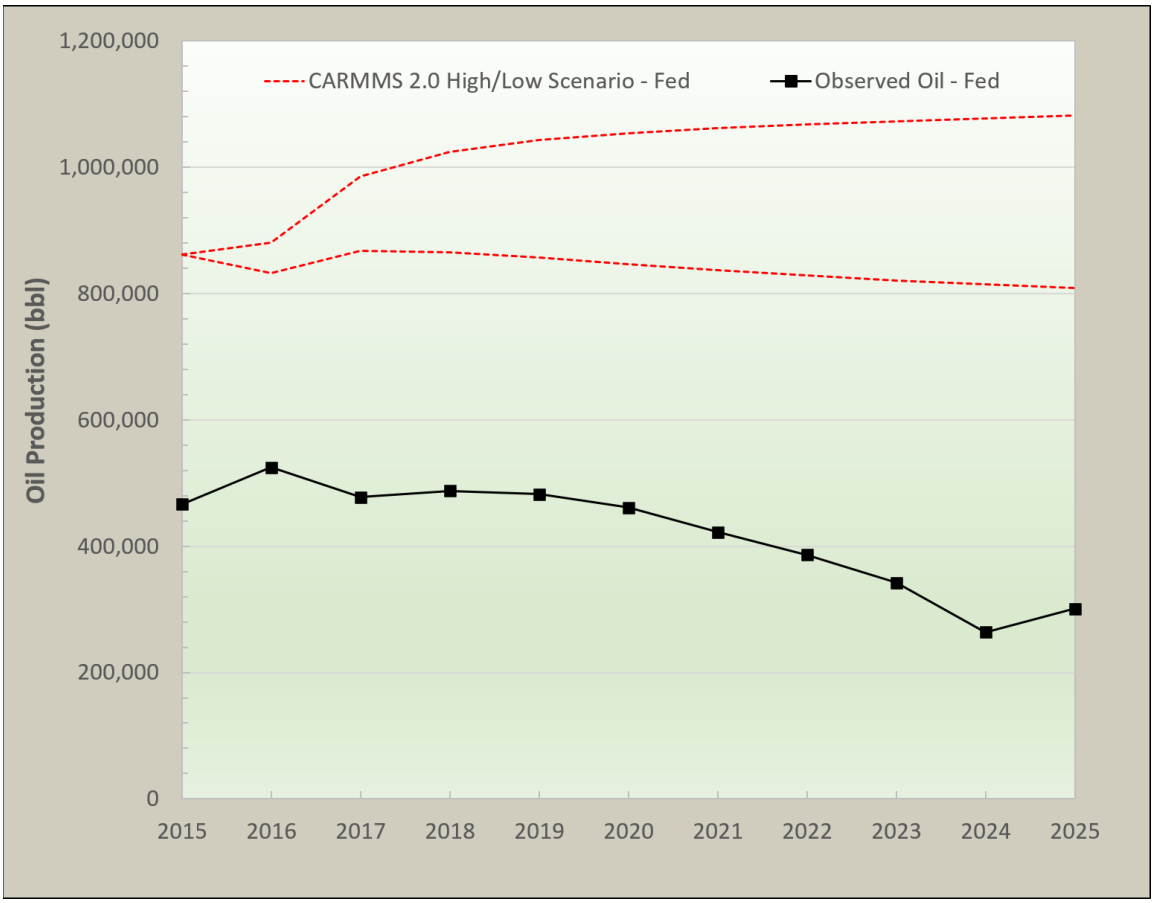


Figure 9. CRVFO Federal Oil Production vs. CARMMS 2.0 Modeled Levels.

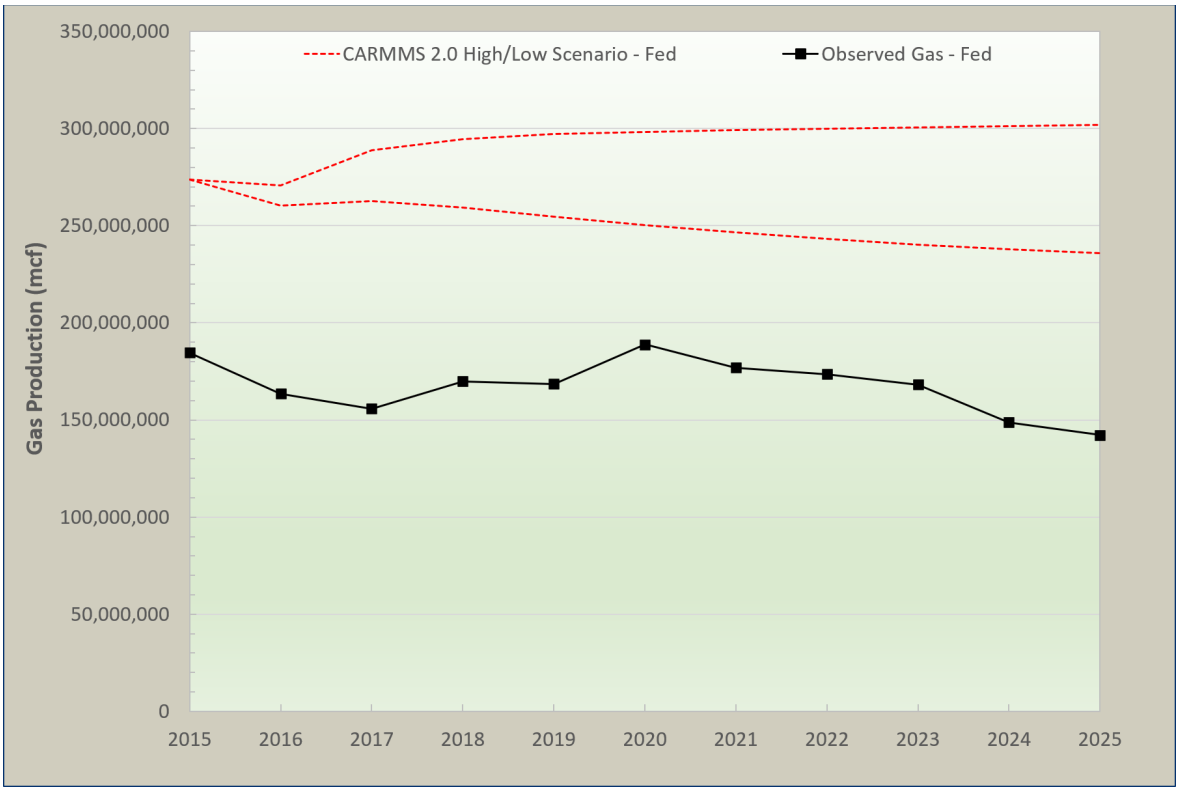


Figure 10. CRVFO Federal Gas Production vs. CARMMS 2.0 Modeled Levels.

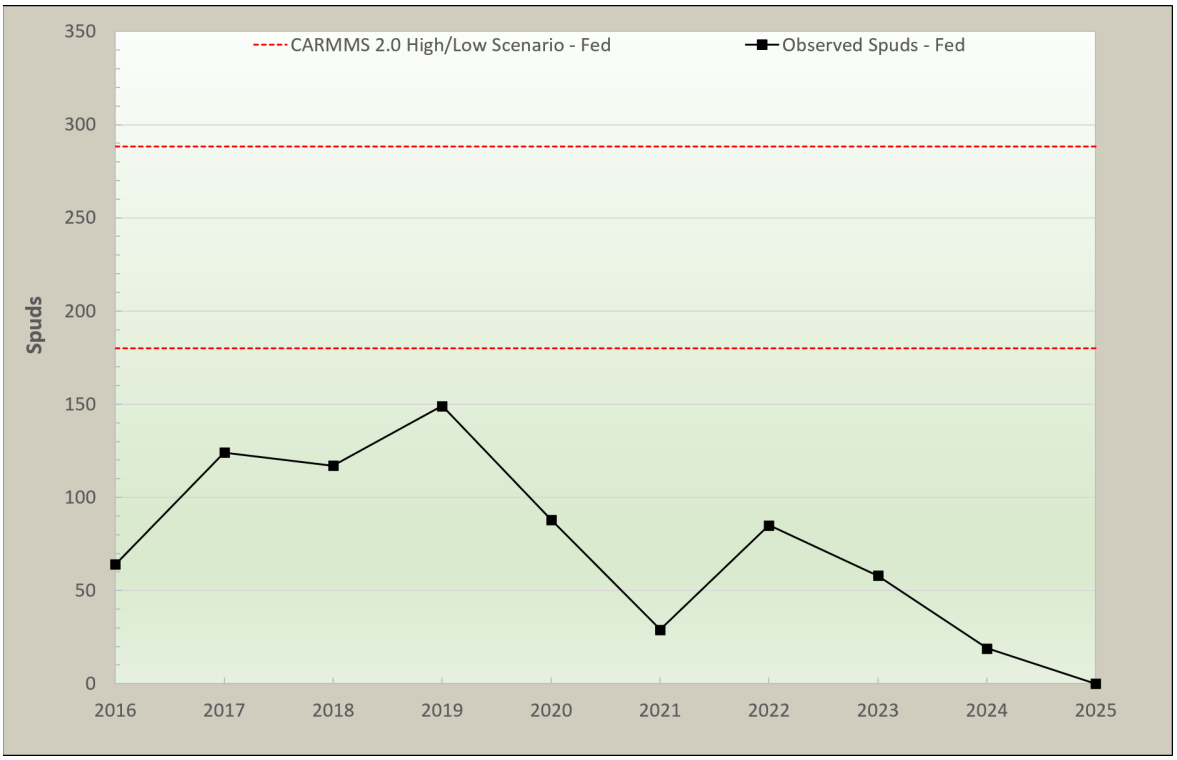


Figure 11. CRVFO Federal Spud Count vs. CARMMS 2.0 Modeled Levels.

Overall federal oil and gas production and spud counts have tracked below the low CARMMS 2.0 scenario suggesting that the CARMMS 2.0 low scenario modeling results would be most appropriate and conservative for describing CRVFO federal oil and gas emissions contributions to air quality conditions.

Since tracking began in 2020 for the BLM Regional Modeling Study, total annual new oil and gas completion counts including tribal, federal and non-federal completions have tracked well below the cumulative annual completion level modeled for the study for CRVFO. The BLM Regional Modeling Study modeled potential air quality impacts associated with 919 new oil and gas wells developed for years 2020 through 2025; there have been approximately 457 total oil and gas wells successfully completed in the CRVFO during this period. This suggests that the predicted air quality impacts associated with new CRVFO oil and gas for the BLM Regional Modeling Study are tracking to be conservative / over-predictions.



Figure 12. CRVFO Total Completion Count vs. Regional Modeling Study Annual Level.

Air quality trends for the CRVFO (discussed in Section 5.2.2 Colorado River Valley Field Office Air Trends) generally indicate stable or improving conditions, and modeling suggests that while following current trends, federal oil and gas is not a significant contribution to air quality conditions. Accordingly, CRVFO is currently meeting the objectives of the governing RMP and BLM's adaptive management strategy. Nevertheless, individual projects will still undergo site-specific analysis where any project near residences (or other sensitive ambient receptors) could require site-specific air quality modeling or additional analysis (beyond CARMMS, Regional Modeling Study, etc.) to show that CRVFO is meeting air resource protection objectives.

5.2.2 Colorado River Valley Field Office Air Trends

The CRVFO is split almost equally between CDPHE's Central Mountains and Western Slope air quality regions. The CDPHE notes that the primary monitoring concern in the Central Mountains region is particulate pollution from wood burning and road dust. In the Western Slope region, ground-level ozone is the primary pollutant of concern.

The 2024 CDPHE Annual Data Report indicates that both the Central Mountains and Western Slope region complied with federal air quality standards for the report year. As indicated in Table 15, the most recent ozone design value for Garfield County is 0.059 ppm with little variation since 2018. The AQI data in Table 10 show that 58% of the days in Garfield County over the previous three years were classified as good. The AQI data for Pitkin County indicates that 95% of the days recorded good air quality. The CRVFO does contain a PM Maintenance Area around the city of Aspen. Figure 4-1 from the 2024 CDPHE Annual Data Report shows the PM_{10} has varied little in Aspen since 2015 and is currently less than the statewide average. There were no exceedances of the 24-hour PM_{10} NAAQS (150 µg m^{-3}) observed in 2024 and the highest recorded value was approximately half of the NAAQS.

The White River NF (WHRI1) IMPROVE monitor located in the CRVFO allows for an evaluation of visibility trends. Since observations began in 2001, visibility at this location has improved considerably on the clearest and most impaired days. Prevailing visibility at WHRI1 is generally among the best in Colorado with only the Mount Zirkel location typically observing such low haze indices.

The NTN nitrogren deposition monitoring location in the CRVFO (Table 18) indicates that total deposition at the site is relatively low and less than critical load values recommended by (Pardo, et al., 2011) and (Bowman, Murgel, Blett, & Porter, 2012).

5.3 Grand Junction Field Office

The Grand Junction Field Office (GJFO) is administratively part of the BLM Colorado Southwest District and manages 1.27 million surface acres of public land and almost 936 thousand acres of federal fluid mineral estate. Located mostly within Mesa and Garfield Counties, the GJFO includes Grand Junction, the largest metropolitan area on the Western Slope. This region, along with the Central Mountains, is projected to be the fastest growing areas of Colorado through 2020 according to the Colorado Department of Local Affairs.

The RMP providing direction for GJFO management actions was finalized in 2015. As described above for CRVFO, a Supplemental EIS was recently completed for the CRVFO and GJFO with a purpose to broaden the range of alternatives in the 2015 CRVFO and GJFO Approved RMPs with respect to the lands that are allocated as open or closed for oil and gas leasing. The supplemental RMP provides additional air quality analysis for the fluid mineral management alternatives considered in the 2015 RMP. The 2015 RMP contains provisions to protect air quality and AQRVs by complying with applicable federal, state, and local air quality laws, regulations, standards, and implementation plans. Within the scope of the BLM's authority, the goals of the RMP are to limit air quality degradation by implementing actions to minimize emissions that may cause or contribute to negative impacts to air quality or air quality-related values (i.e. AQRVs) in Class I Airsheds affected by actions in the planning area.

5.3.1 Grand Junction Field Office Oil and Gas Development and Production

Table 21 presents the 2025 federal oil and gas development and production statistics for the GJFO. During the reporting year, there were no new wells drilled. With annual oil and gas production levels below the "low" levels modeled for CARMMS 2.0, active well emissions are also below those projected for the CARMMS 2.0 "low" scenario.

Table 21. 2025 GJFO Federal Oil and Gas Statistics.

Description	Federal	% CARMMS 2.0 - High - Fed	% CARMMS 2.0 - Low - Fed

New Wells (Spuds)	13	6.6%	224.1%
Oil Production (bbl)	11,811	1.1%	28.8%
Gas Production (mcf)	9,930,352	7.3%	59.7%

Overall federal oil and gas production and spud counts have tracked below the low CARMMS 2.0 scenario suggesting that the CARMMS 2.0 low scenario modeling results would be most appropriate and conservative for describing GJFO federal oil and gas emissions contributions to air quality conditions.

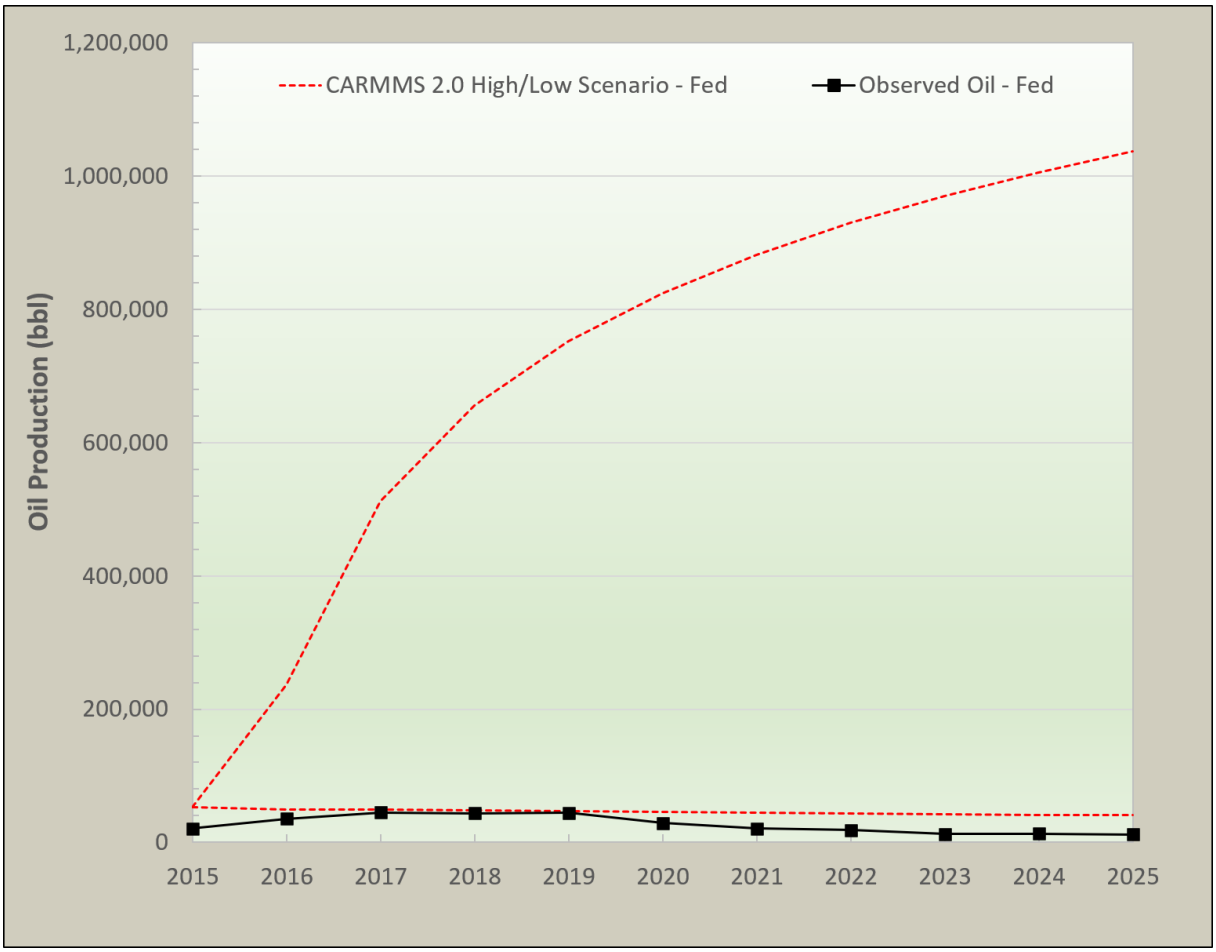


Figure 13. GJFO Federal Oil Production vs. CARMMS 2.0 Modeled Levels.

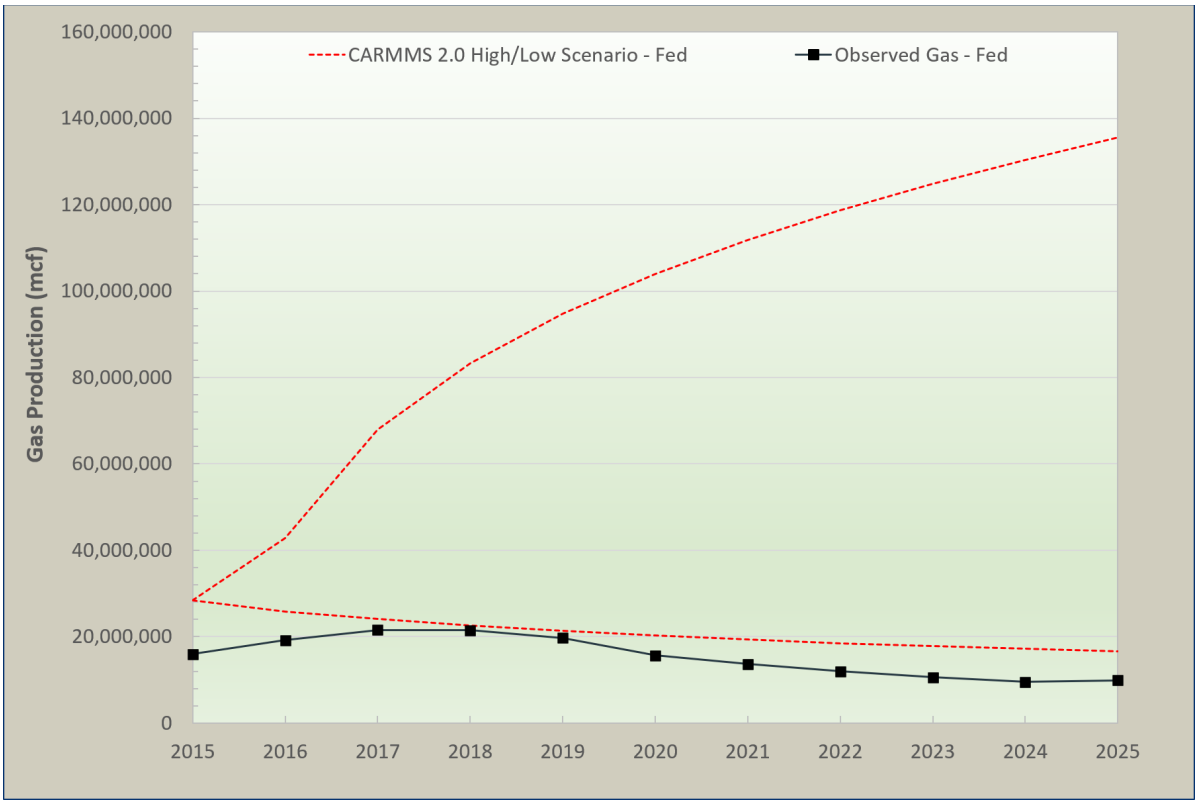


Figure 14. GJFO Federal Gas Production vs. CARMMS 2.0 Modeled Levels.

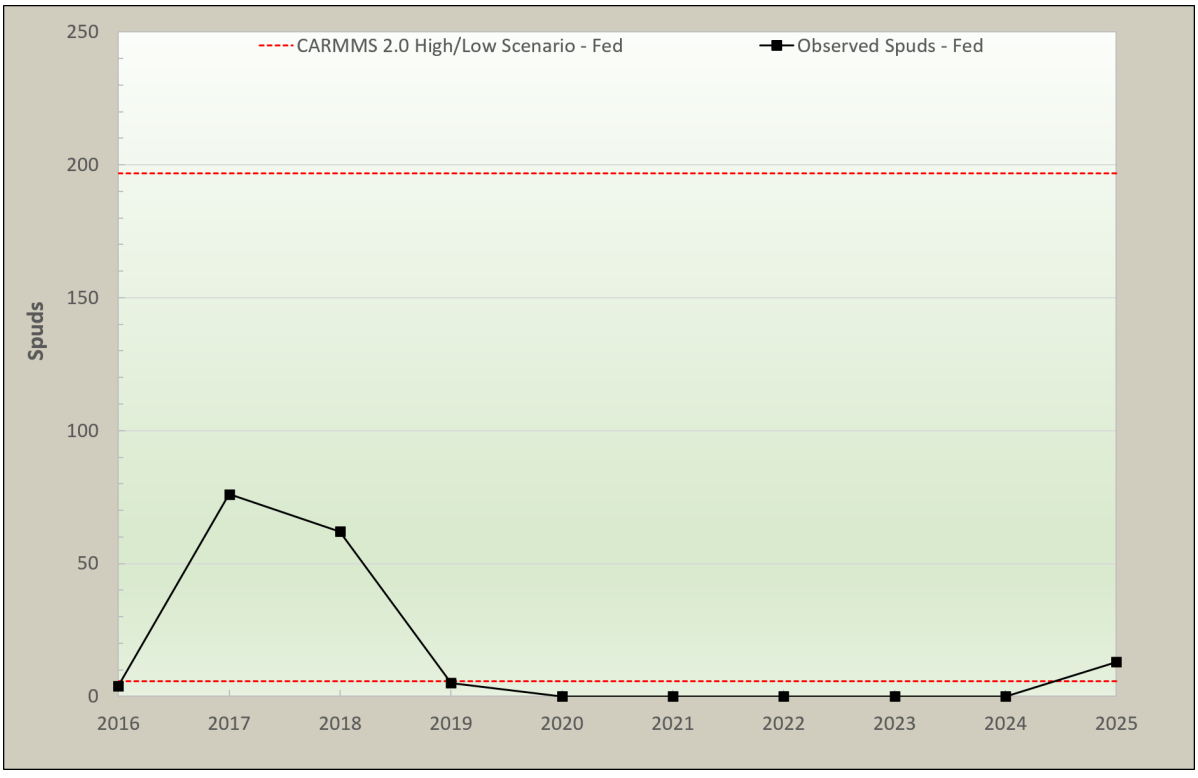


Figure 15. GJFO Federal Spud Count vs. CARMMS 2.0 Modeled Levels.

Since tracking began in 2020 for the BLM Regional Modeling Study, total annual new oil and gas completion counts including tribal, federal and non-federal completions have tracked well below the cumulative annual completion level modeled for the study for GJFO. The BLM Regional Modeling Study modeled potential air quality impacts associated with 192 new oil and gas wells developed for years 2020 through 2025 and there have been 42 new oil and gas wells successfully completed in the GJFO during this period. This suggests that the predicted air quality impacts associated with new GJFO oil and gas for the BLM Regional Modeling Study are tracking to be conservative / over-predictions.



Figure 16. GJFO Total Completion Count vs. Regional Modeling Study Annual Level.

Air quality trends for the GJFO (5.3.2 Grand Junction Field Office Air Trends) generally indicate stable or improving conditions, and modeling suggests that while following current trends, federal oil and gas is not a significant contribution to air quality conditions. Accordingly, the GJFO is currently meeting the objectives of the governing RMP and BLM's adaptive management strategy. Nevertheless, individual projects will still undergo site-specific analysis where any project near residences (or other sensitive ambient receptors) could require site-specific modeling or additional analysis (beyond CARMMS, Regional Modeling Study, etc.) to show that GJFO is meeting air resource objectives.

5.3.2 Grand Junction Field Office Air Trends

The GJFO is within the CDPHE's Western Slope air quality region (designated as attainment) and is in full compliance with the NAAQS for the report year. The field office is also free from any maintenance areas. In the Western Slope region, ozone is the primary pollutant of concern.

As indicated in Table 15, the most recent ozone design value for Mesa County is 0.063 ppm (NAAQS ~ 0.070 ppm). The AQI data in Table 10 show that 64% of the days in Mesa County over the past three years were classified as good, with ozone the main pollutant on most days. Figure 4-43 from the 2024 CDPHE Annual Data Report shows that the annual mean PM_{10} concentration has decreased over the past twenty

years at Grand Junction. Figure 4-44 from the 2024 CDPHE Annual Data Report shows that $PM_{2.5}$ amounts have also decreased over the same period. There is no trend in ozone (ozone levels have remained consistent) at Palisade and Rifle sites.

There are no IMPROVE monitors located in the GJFO, but the White River NF (WHRI1) IMPROVE monitor located in the adjacent CRVFO allows for an evaluation of visibility trends. Since observations began in 2001, visibility at this location has improved considerably on the clearest and most impaired days. Prevailing visibility at WHRI1 is generally among the best in Colorado with only the Mount Zirkel location typically observing such low haze indices.

There are no NTN sites located within the GJFO. The NTN nitrogren deposition monitoring location in the adjacent CRVFO (Table 18) indicates that total deposition is generally less than critical load values reported in (Pardo, et al., 2011) and (Bowman, Murgel, Blett, & Porter, 2012).

5.4 Kremmling Field Office

The Kremmling Field Office (KFO) is composed of the North Park, Middle Park, and Laramie River Valley regions of Colorado and has a varied landscape of open sagebrush plains and high mountain peaks. The KFO contains Jackson, Grand, and Summit counties in their entirety, as well as portions of Eagle, Larimer, and Routt counties. Administratively, the KFO is part of the BLM Colorado Northwest District and manages approximately 377,351 surface acres and 2,232,460 acres of federal minerals. The RMP providing direction for KFO management actions was finalized in 2015 and contains provisions to protect air quality and AQRVs by complying with applicable federal, state, and local air quality laws, regulations, standards, and implementation plans

5.4.1 Kremmling Field Office Oil and Gas Development and Production

Table 22 shows the 2025 federal oil and gas development and production statistics for the KFO. There were no new federal spuds in the KFO during the most recent reporting year.

Table 22. 2025 KFO Federal Oil and Gas Statistics.

Description	Federal	% CARMMS 2.0 - High - Fed	% CARMMS 2.0 - Low - Fed
New Wells (Spuds)	0	0%	0%
Oil Production (bbl)	355,203	236.2%	273.3%
Gas Production (mcf)	902,221	15.1%	125.3%

Since tracking began in 2016, federal spuds have averaged about 22% of the high scenario. Figure 17 and Figure 18 show that KFO federal production was less than the CARMMS 2.0 low scenario throughout the tracking period until the most recent three years. Oil and gas production within the KFO increased markedly in 2023. Even though there has been a significant increase in production the last couple of years, since tracking began in 2016, federal oil and gas production has averaged about 99% and 10% of the federal production levels modeled for the CARMMS 2.0 high scenario, respectively, suggesting that the CARMMS 2.0 high scenario modeling results would be most appropriate while conservative (likely over-estimate) for describing KFO federal oil and gas emissions contributions to air quality conditions.

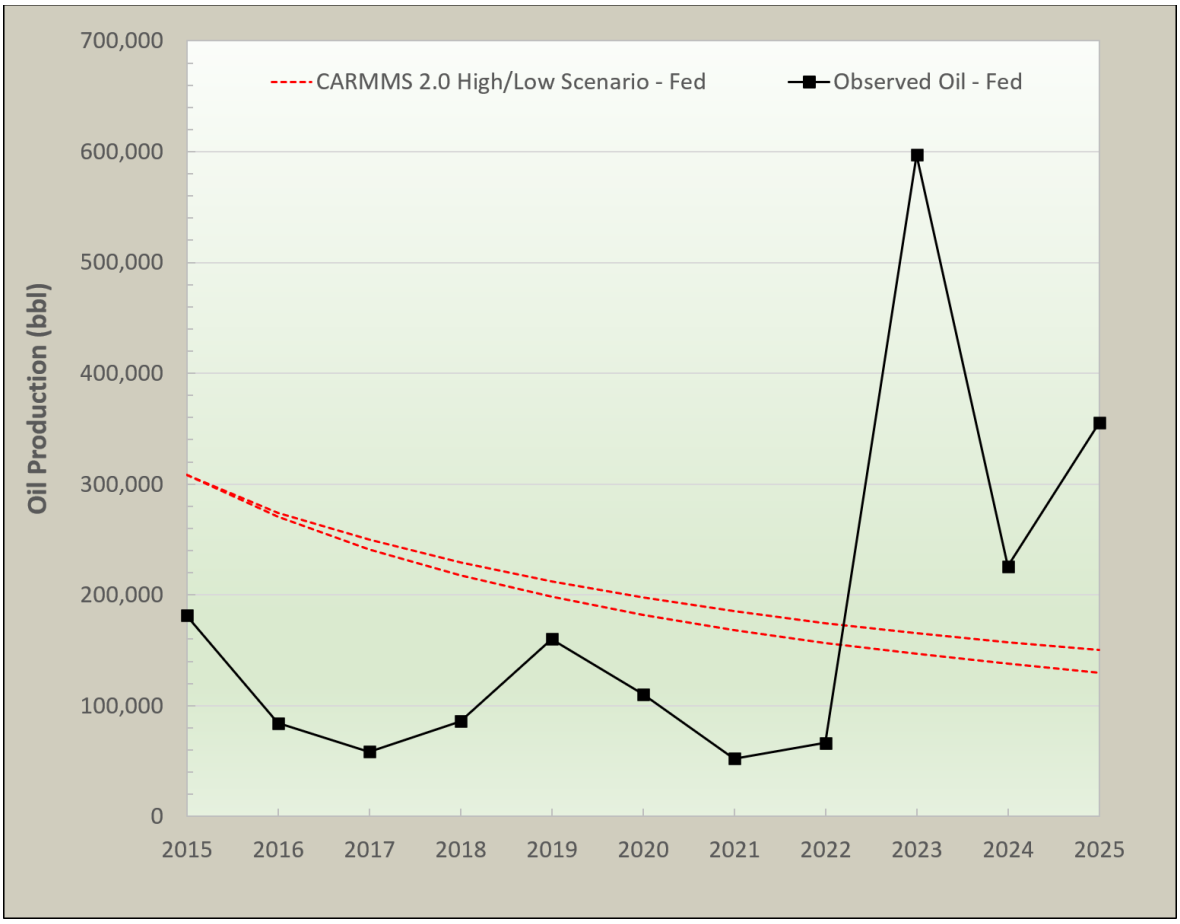


Figure 17. KFO Federal Oil Production vs. CARMMS 2.0 Modeled Levels.

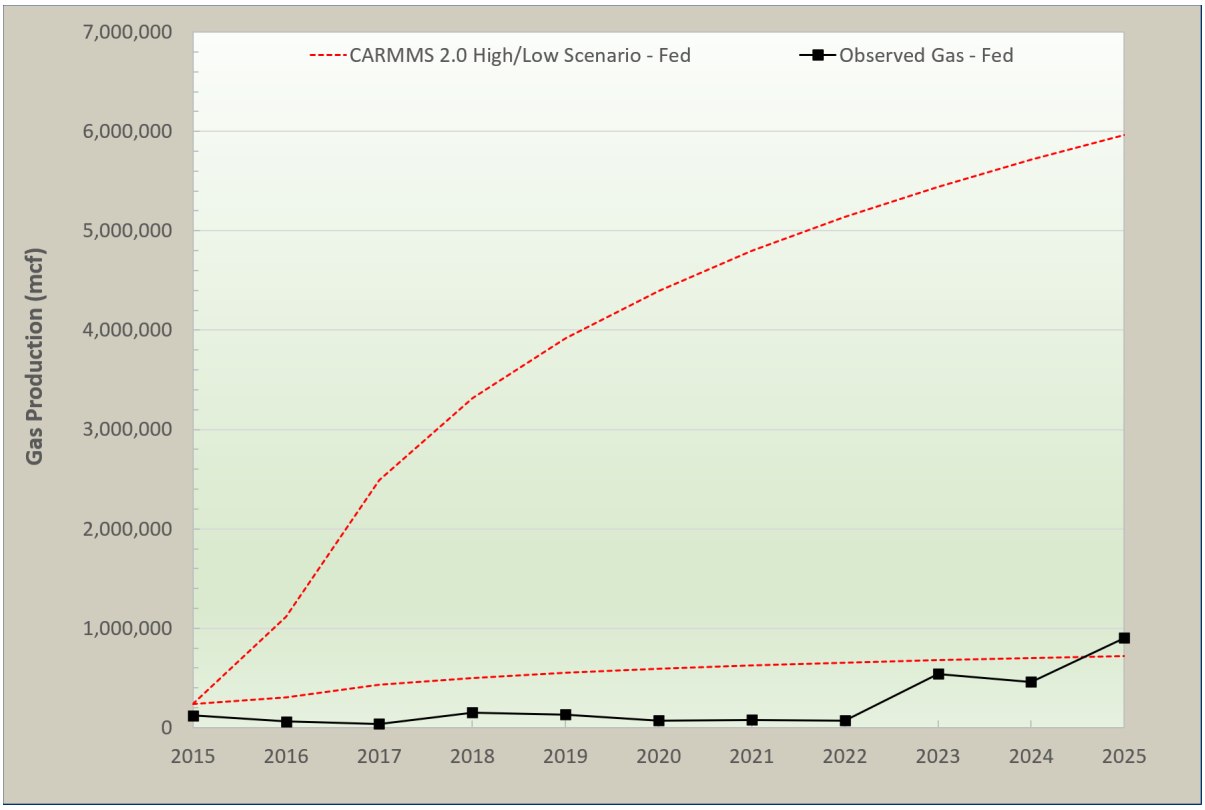


Figure 18. KFO Federal Gas Production vs. CARMMS 2.0 Modeled Levels.

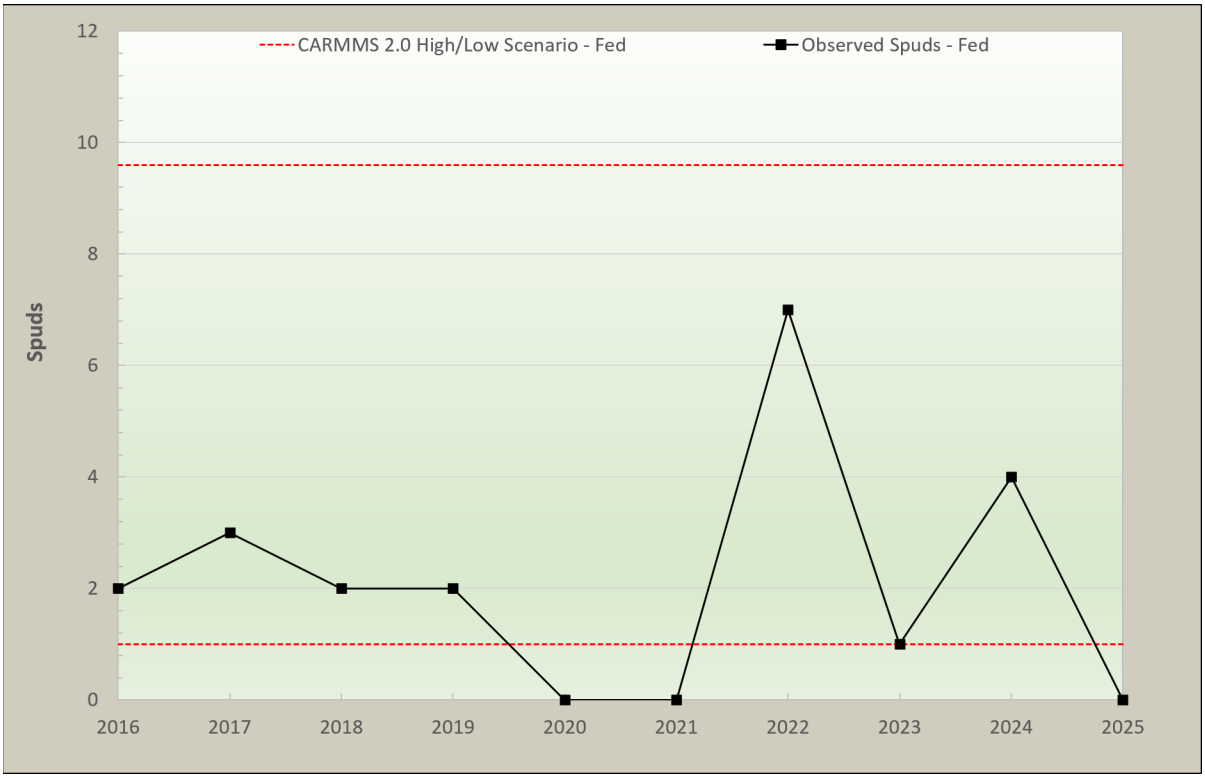


Figure 19. KFO Federal Spud Count vs. CARMMS 2.0 Modeled Levels.

Since tracking began in 2020 for the BLM Regional Modeling Study, total annual new oil and gas completion counts including tribal, federal and non-federal completions were below the cumulative annual completion level modeled for the study for KFO for years 2020 and 2021, then exceeded the modeled annual completion level for years 2022 – 2024 and was equal to the annual development rate for the modeling study in 2025. The BLM Regional Modeling Study modeled potential air quality impacts associated with 9 new oil and gas wells developed for years 2020 through 2025 and there were 17 new oil and gas wells successfully completed in the KFO during this period. This suggests that the predicted air quality impacts associated with new oil and gas for the BLM Regional Modeling Study are tracking to eventually be under-predictions, at least the portion of predicted impacts associated with new oil and gas development related activities (drilling, completion). Although actual spuds / completions have exceeded modeling input levels since 2019, the total new oil and gas emissions levels modeled for predicting circa 2032 concentrations, and associated federal source apportionment results have not been exceeded meaning that the modeling results are still valid for describing new federal oil and gas impacts on air quality. At current development rates, the new oil and gas development related modeled levels for circa 2032 would be fully exceeded before year 2032.

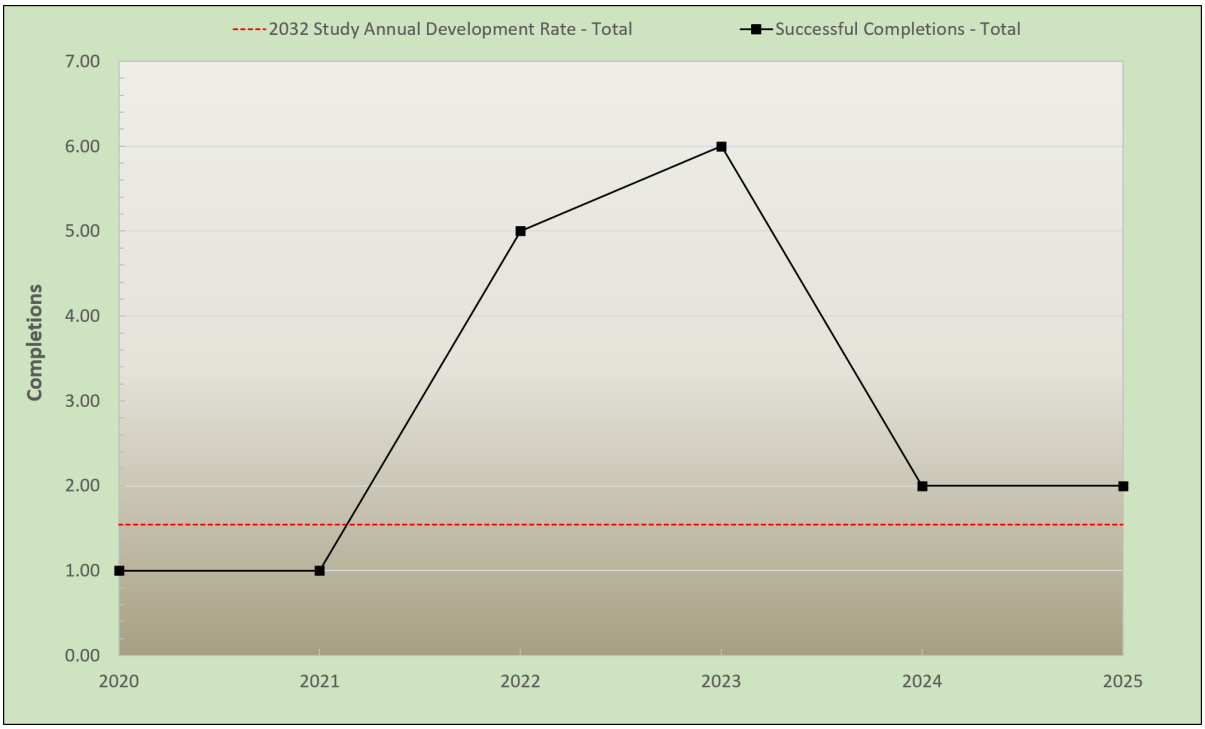


Figure 20. KFO Total Completion Count vs. Regional Modeling Study Annual Level.

Air quality trends for the KFO (discussed in 5.4.2 Kremmling Field Office Air Trends) generally indicate stable or improving conditions. Accordingly, the KFO is currently meeting the objectives of the governing RMP and BLM's adaptive management strategy. Nevertheless, individual projects will still undergo site-specific analysis where any project close to residences could require modeling or additional analysis (beyond CARMMS, Regional Modeling Study, etc.) to show that KFO is meeting air resource objectives.

5.4.2 Kremmling Field Office Air Trends

The KFO is mostly contained within the CDPHE's Central Mountains air quality region, though the eastern edge of the field office extends into the Denver Metro - Northern Front Range region. The primary

monitoring concern in this region is centered around particulate pollution from wood burning and road dust. The KFO complies with all federal air quality standards.

While there is little long-term air quality monitoring in the KFO, the BLM Colorado State Office operated the Hebron Air Quality Monitoring mobile station (AQS ID 08-057-0005) in Jackson County just south of Walden from July 2022 through March 2025. The mobile unit measured ozone, oxides of nitrogen, particulate matter, and meteorological conditions, and adhered to operational protocols established and accepted by the EPA to provide scientifically defensible air quality data. There were no NAAQS exceedances of any measured pollutants at the Hebron location over this monitoring period, and most days had an AQI characterized as "good" with the remaining days considered "moderate." Ozone was the pollutant with the highest concentrations relative to NAAQS standards with a 4th highest daily maximum value of 58 ppb (NAAQS 70 ppb). Comparing this to the values in Table 15 demonstrates that ozone at Hebron is lower than at any other routinely monitored location. Nitrogen dioxide and particulate matter concentrations were very low with concentrations well below the NAAQS. However, it is expected that particulate matter will be significantly elevated when there are nearby wildfires. In addition, BLM completed a hazardous air pollutant monitoring campaign for 16 weeks during 2024 at the Hebron site, and the collected samples indicate toxics concentrations are below unacceptable thresholds established by EPA at the monitoring site that is relatively close to multiple oil and gas operations.

The IMPROVE monitors at Mount Zirkel and Rocky Mountain provide representative AQRV observations for the KFO. Visibility has improved on the clearest and most impaired days at the Mount Zirkel (MOZI1) location, with a decrease of about 0.11 dv per year in the most impaired days over the record period. Visibility on the clearest days is near natural conditions (Figure 4). The trend for most impaired days at the MOZI1 site indicates steady improvement towards the 2064 endpoint set forth by the latest RHR guidance. At the Rocky Mountain (ROMO1) IMPROVE site, the haze index for the most impaired days has decreased by about 0.13 dv per since 1991. Visibility on the haziest days has improved slightly at the ROMO1 location, but this is countered by the high wildfire smoke experienced in 2020 and 2021. The long-term record at ROMO1 shows that overall visibility has improved with conditions on the most impaired days demonstrating progress towards the 2064 endpoint established in the latest RHR guidance.

Nitrogen deposition is monitored within the KFO at the Kawuneechee Meadow (not shown in Table 18) site. Despite ongoing monitoring at this location since 2012, only four years – 2014, 2015, 2016, and 2018 – have met NADP's data completeness criteria. Accordingly, a trend assessment is not possible. However, the observations during the four years indicate that nitrogen deposition is quite low with annual values ranging from 0.69 kg ha^{-1} in 2018 to 1.59 kg ha^{-1} in 2014. The four-year average of valid observations at Kawuneeche Meadow is 1.13 kg ha $^{-1}$, which is below key critical loads in the area.

5.5 Little Snake Field Office

The LSFO is in the BLM Colorado Northwest District and provides administrative management for approximately 1.3 million acres (32 percent of the total surface area) of public land within Moffat, Routt, and Rio Blanco counties. The LSFO is bordered on the north by the State of Wyoming, on the west by the State of Utah, on the south by the BLM WRFO and on the east by Routt National Forest. Additionally, 1.1 million acres of private and State lands are underlain by federally managed minerals. The major urban areas within the LSFO include the towns of Craig and Steamboat Springs. The RMP providing direction for the LSFO management actions was updated in 2010 and contains provisions to protect air quality and

AQRVs by complying with applicable federal, state, and local air quality laws, regulations, standards, and implementation plans. The RMP also states that the BLM will collaborate, as necessary, with federal and state partners to achieve standards and address air quality issues.

5.5.1 Little Snake Field Office Oil and Gas Development and Production

Table 23 shows the 2025 LSFO federal oil and gas development and production statistics. For 2025, there was no federal spud developed and there have only been 6 federal spuds dating back to the start of CARMMS tracking in 2016. The low amount of new development contrasts with the CARMMS 2.0 scenarios which projected between 54 (low scenario) and 776 total federal spuds for the 10-year period between 2016 and 2025. Except for federal oil production for this reporting year 2025, LSFO federal oil and gas production has also been less than anticipated with production consistently below the CARMMS 2.0 low scenario as shown in Figure 21 and Figure 22; the federal oil production annual average percentage of the CARMMS 2.0 low scenario annual federal oil production over the 2016 – 2025 period was approximately 95%. Accordingly, LSFO development and production are tracking below the CARMMS 2.0 low scenarios suggesting that the CARMMS 2.0 low scenario federal oil and gas source apportionment modeled impacts could be conservative / over-predictions for federal oil and gas emissions contributions to overall air quality conditions.

Table 23. 2025 LSFO Federal Oil and Gas Statistics.

Description	Federal	% CARMMS 2.0 - High - Fed	% CARMMS 2.0 - Low - Fed
New Wells (Spuds)	0	0%	0%
Oil Production (bbl)	177,973	19.8%	160.4%
Gas Production (mcf)	5,641,986	63.2%	13.6%

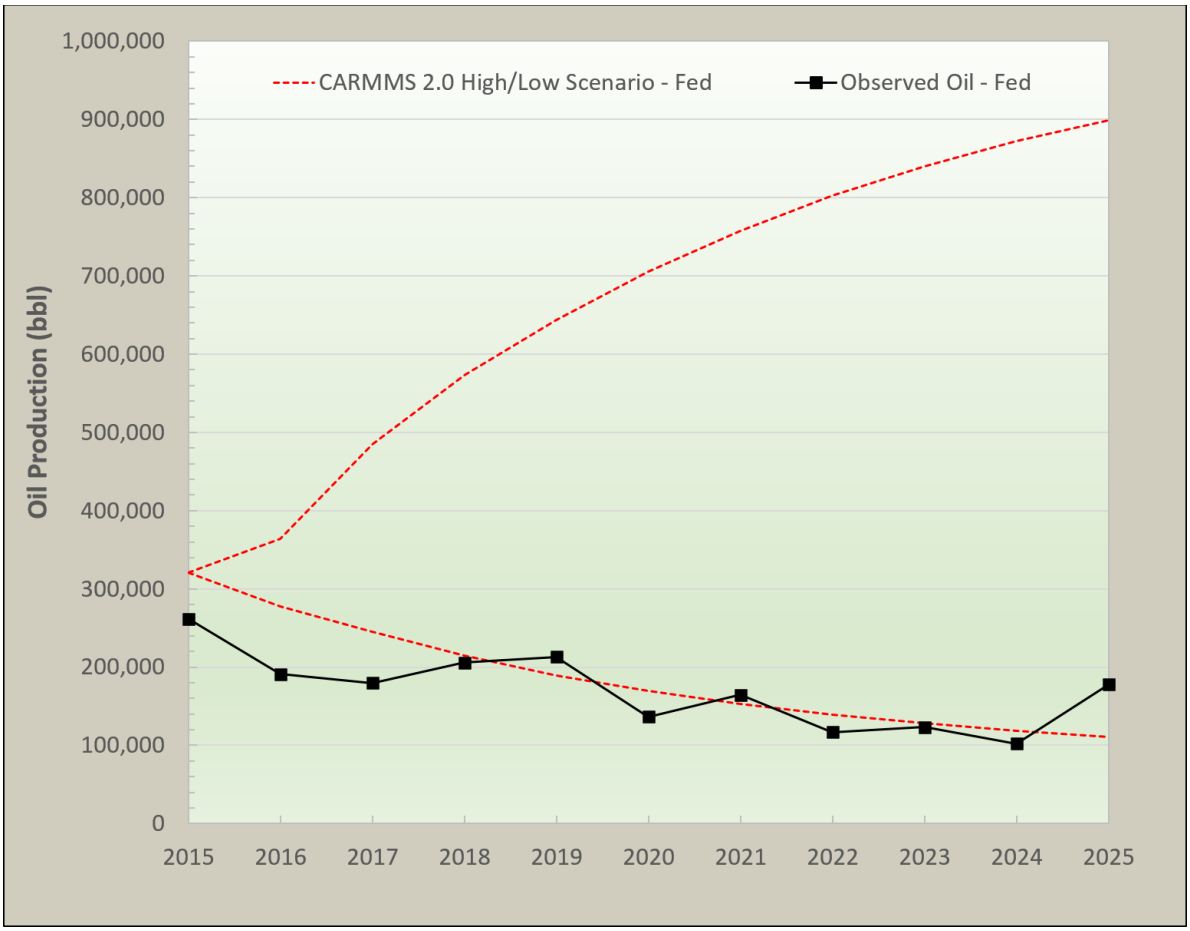


Figure 21. LSFO Federal Oil Production vs. CARMMS 2.0 Modeled Scenarios.

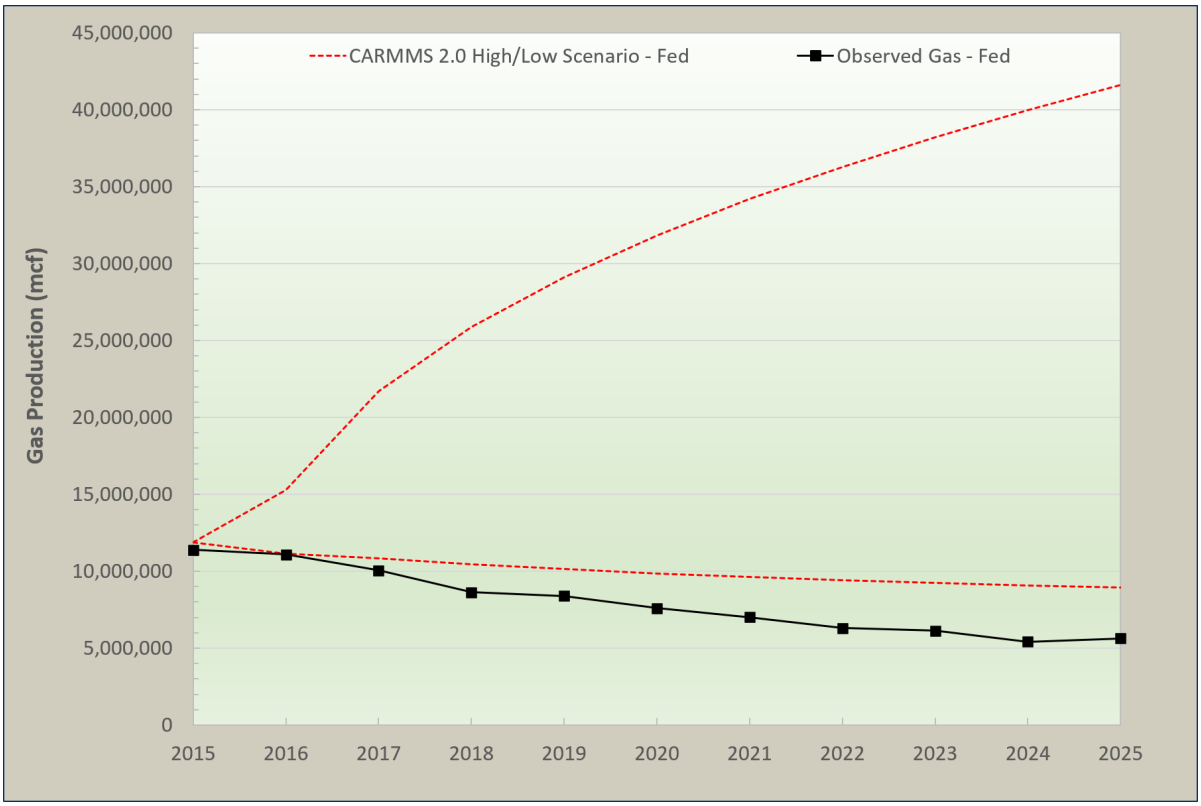


Figure 22. LSFO Federal Gas Production vs. CARMMS 2.0 Modeled Scenarios.

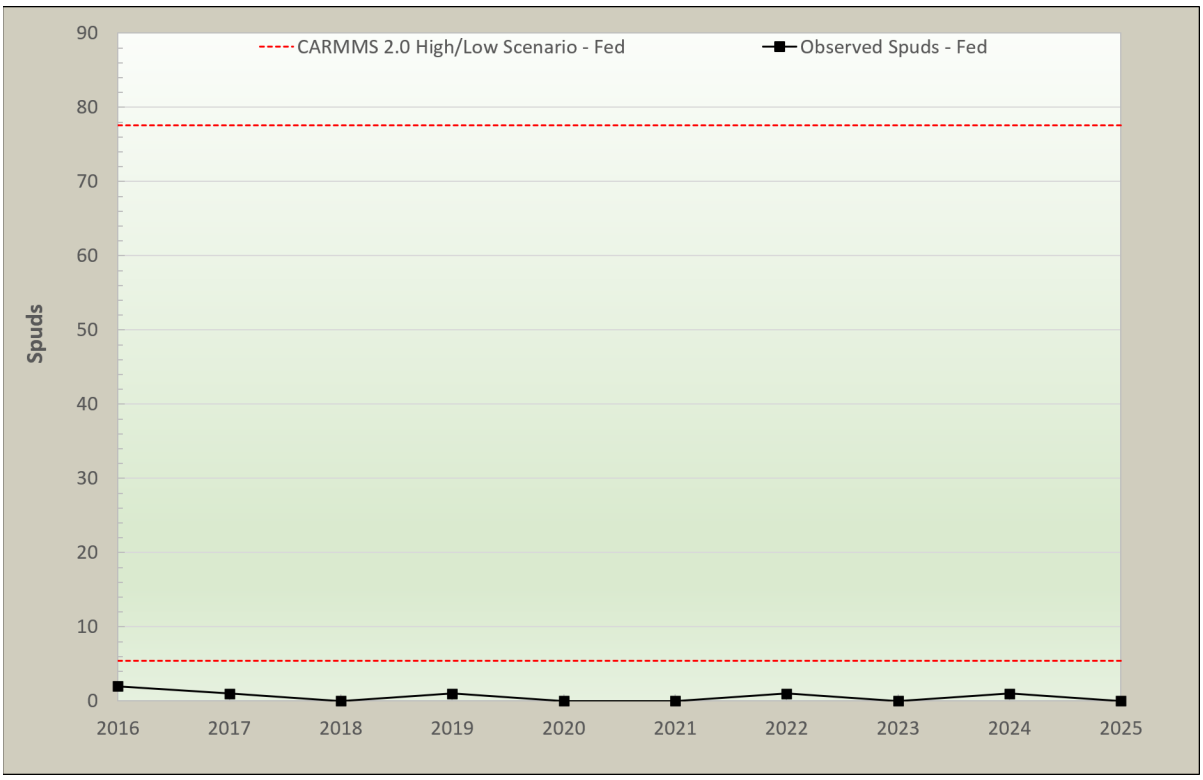


Figure 23. LSFO Federal Spud Count vs. CARMMS 2.0 Modeled Levels.

Since tracking began in 2020 for the BLM Regional Modeling Study, total annual new oil and gas completion counts including tribal, federal and non-federal completions have tracked well below the cumulative annual completion level modeled for the study for LSFO. The BLM Regional Modeling Study modeled potential air quality impacts associated with 37 new oil and gas wells developed for years 2020 through 2025 and there have been 9 new oil and gas wells successfully completed in the LSFO during this period. This suggests that the predicted air quality impacts associated with new LSFO oil and gas for the BLM Regional Modeling Study are tracking to be conservative / over-predictions.



Figure 24. LSFO Total Completion Count vs. Regional Modeling Study Annual Level.

5.5.2 Little Snake Field Office Air Trends

The LSFO is primarily within the CDPHE's Western Slope air quality region but also extends into the Central Mountains region on the eastern side of the field office boundary. The available air quality data within the LSFO show that the area is designated as attainment and is in full compliance with the NAAQS. The field office is also free from any maintenance areas.

The only active air quality monitoring within the LSFO is for PM_{10} in Steamboat Springs. There is ozone monitoring at Ripple Creek just south of the LSFO boundary near the eastern WRFO border. Additionally, BLM Colorado operated two monitors south of the LSFO in the WRFO at Rangely and the Piceance Basin through March 2025.

As indicated in Table 10, 97% of the days in Routt County recorded a “good” air quality index (AQI) for the most recent three-year reporting period, 2023-2025, with PM_{10} the primary pollutant of concern for the county. In adjacent Sweetwater County, WY located to the north of the LSFO, AQI data for 2023-2025 show that approximately 70% of days were characterized as “good,” while 28% were rated as “moderate.”

The Sweetwater County AQI data indicate that the primary pollutant of concern in the local airshed is ozone. Moffat County does not have AQI information. Mean annual PM_{10} concentrations at Steamboat Springs have decreased over the past two decades per the most recent CDPHE annual report. The 24-hour PM_{10} data from Steamboat Springs indicates large interannual variability, with no apparent long-term trend. As seen in Table 15, the latest ozone 3-year average / design value in Rio Blanco County is 67 ppb.

To characterize visibility trends, the Mount Zirkel (MOZO1) IMPROVE site located near the border of the LSFO and KFO provides representative AQRV observations for the area. Visibility has improved on the clearest and most impaired days at the Mount Zirkel (MOZI1) location, with a decrease of about 0.11 dv per year on the most impaired days over the period of record. Visibility on the clearest days is near natural conditions (Figure 4). The trend for most impaired days at the MOZI1 site indicates steady improvement towards the 2064 endpoint set forth by the latest RHR guidance. In 2018, an IMPROVE location in Dinosaur National Monument (DINO1) was established and could also be used to assess long-term visibility trends within the LSFO.

NTN sites including Buffalo Pass (Summit Lake) can be used to assess nitrogen deposition in the LSFO (Table 18). The most recent observation of 1.74 kg ha^{-1} is above the NPS benchmark of 1 kg ha^{-1} but generally less than critical load thresholds reported by (Pardo, et al., 2011) and (Bowman, Murgel, Blett, & Porter, 2012).

5.6 Royal Gorge Field Office

The Royal Gorge Field Office (RGFO) contains all of eastern Colorado and constitutes over half of the land area in the state. Administratively, the RGFO is part of the BLM Colorado Rocky Mountain District and manages approximately 658,200 surface acres and 3,311,900 acres of federal minerals. Nearly 81% of the federal mineral estate is underneath private or State-owned surface, which is otherwise known as split estate. In June 2015, the BLM published a notice of intent (NOI) in the Federal Register, initiating the planning process to revise the 1986 Northeast Resource Management Plan (RMP) (BLM 1986) and 1996 Royal Gorge Resource Area RMP (BLM 1996) and consolidate the revisions into one resource management plan/environmental impact statement (RMP/EIS). The updated Eastern Colorado RMP was completed in 2024.

5.6.1 Royal Gorge Field Office Oil and Gas Development and Production

Table 24 shows the 2025 oil and gas development and production statistics for the RGFO. Overall, there were 43 federal spuds in the RGFO during the most recent reporting year. The majority of RGFO development is in the Denver Julesburg Basin, north of the Denver metro area and east of the I-25 corridor.

Table 24. 2025 RGFO Federal Oil and Gas Statistics.

Description	Federal	% CARMMS 2.0 - High - Fed	% CARMMS 2.0 - Low - Fed
New Wells (Spuds)	43	25.6%	695.8%
Oil Production (bbl)	5,203,458	36.2%	79.8%
Gas Production (mcf)	25,014,431	69.8%	290.6%

For 2025, federal spuds in the RGFO were about 26% of the CARMMS 2.0 high scenario. Since tracking began in 2016, spuds have averaged about half of the high scenario. In general, spuds are a surrogate for construction / development emissions, thus report year emissions from new federal oil and gas

development would be expected to be around 26% of the annual construction / development related emissions modeled for the CARMMS 2.0 high scenario. Figure 25 and Figure 26 show that RGFO federal production for report year was about 36% and 70% of the modeled high scenario for cumulative oil and gas, respectively. Accordingly, since both development and production for federal oil and gas in the RGFO has been tracking below the high scenario but well above the low scenario in recent years, the CARMMS 2.0 high scenario modeling results would likely be most appropriate for describing air quality contributions associated with RGFO federal oil and gas emissions sources.

The major air quality issues in the RGFO are the ozone NAAs and the elevated nitrogen deposition rates at Rocky Mountain National Park. Most new oil and gas development is occurring within the ozone NAA area or just north and east of the NAA boundary. This trend is concerning for the future of federal mineral development given the redesignation of the area to "severe" in 2023 with respect to the 2008 ozone standard. Development occurring in the NAA is subject to the general conformity rule, and as such BLM project level analyses for federal permit actions that comply with the rule do not cause or contribute to continuing exceedances and violations. The decrease in de minimis levels from 50 tpy to 25 tpy due to the recent severe redesignation is likely to have a considerable impact on the BLM's ability to approve projects under the general conformity rules using existing methodologies (note: the DFR ozone NAA with respect to the 2015 ozone standard was recently downgraded from "moderate" to "serious" and includes areas of northern Weld County not part of the 2008 ozone standard NAA). More information on the Denver NAA is available from the CDPHE's Severe Ozone Planning website.

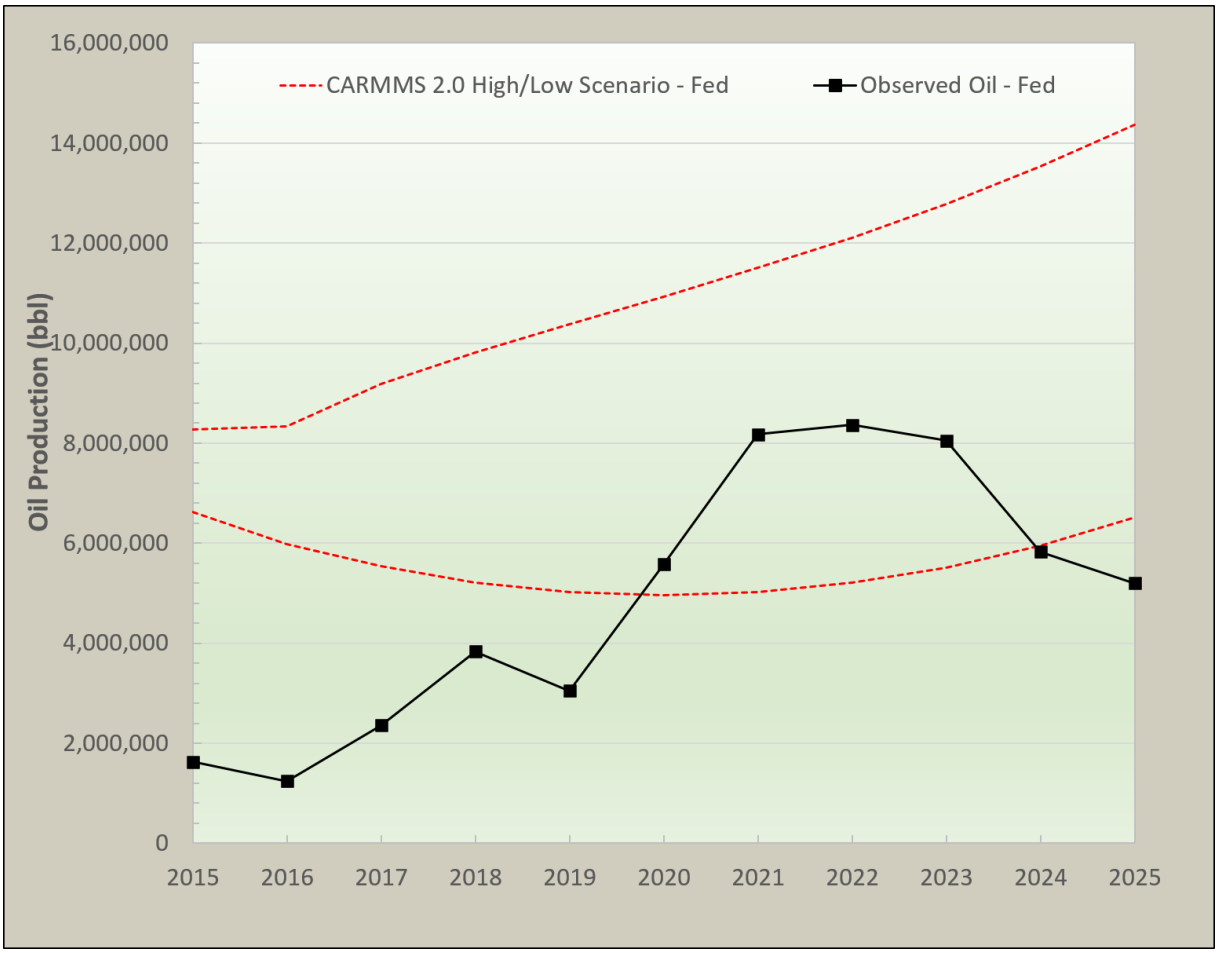


Figure 25. RGFO Federal Oil Production vs. CARMMS 2.0 Modeled Scenarios.

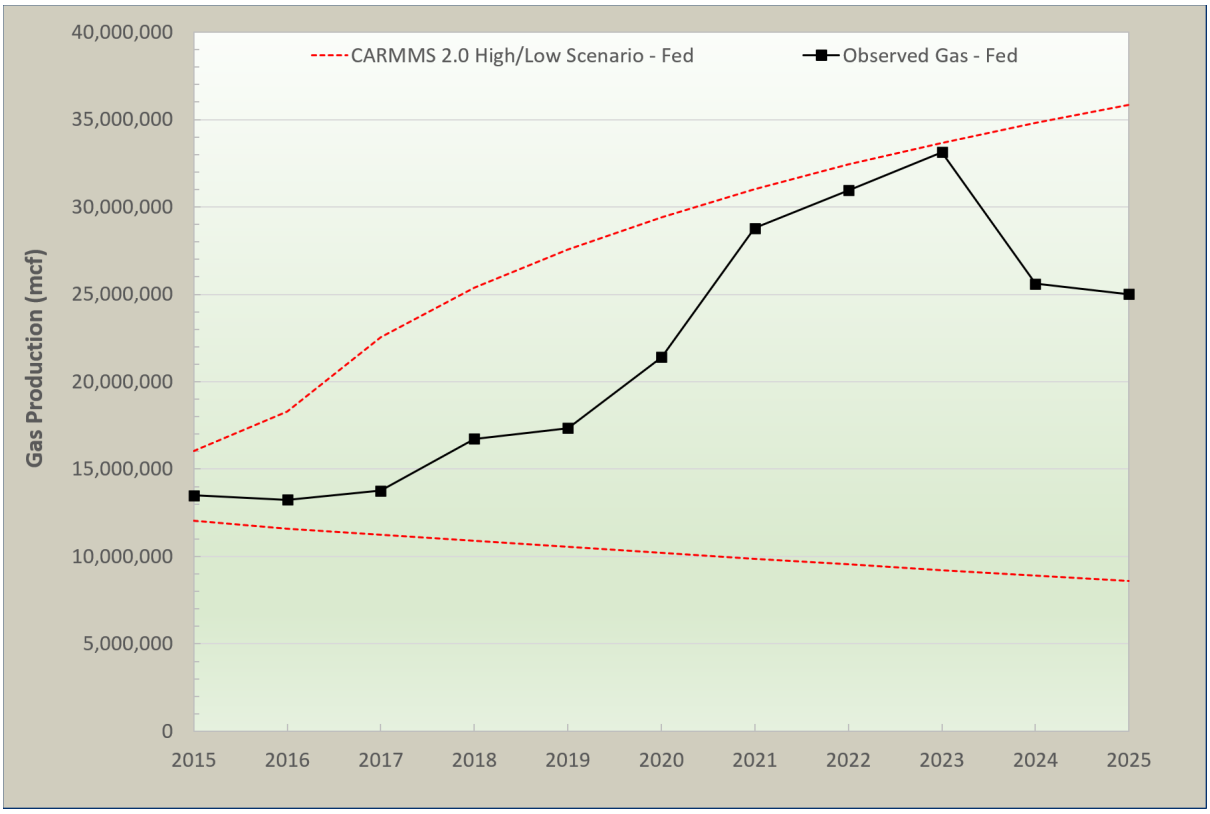


Figure 26. RGFO Federal Gas Production vs. CARMMS 2.0 Modeled Scenarios.

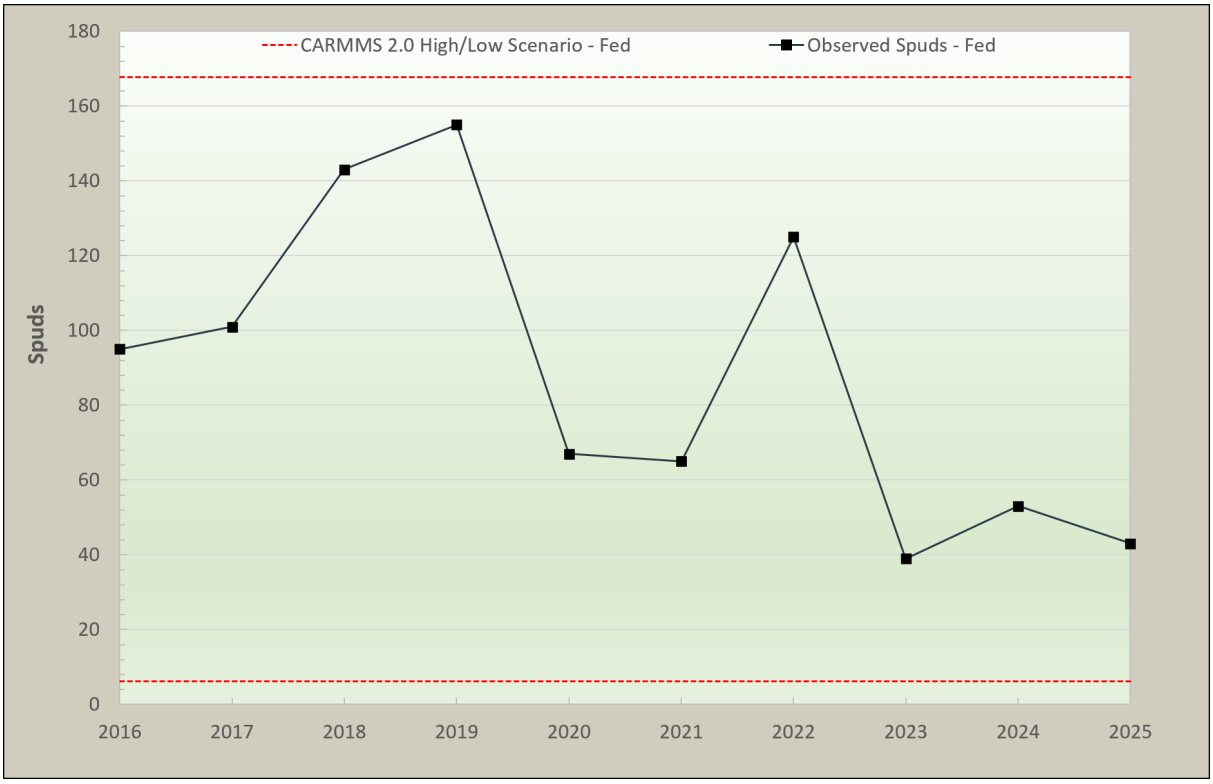


Figure 27. RGFO Federal Spud Count vs. CARMMS 2.0 Modeled Levels.

Since tracking began in 2020 for the BLM Regional Modeling Study, total annual new oil and gas completion counts including tribal, federal and non-federal completions have averaged below the cumulative annual completion level modeled for the study for RGFO. The BLM Regional Modeling Study modeled potential air quality impacts associated with 4,602 new oil and gas wells developed for years 2020 through 2025 and there were approximately 4,182 new oil and gas wells successfully completed in the RGFO during this period. This suggests that the predicted air quality impacts associated with new RGFO oil and gas for the BLM Regional Modeling Study are good approximations.

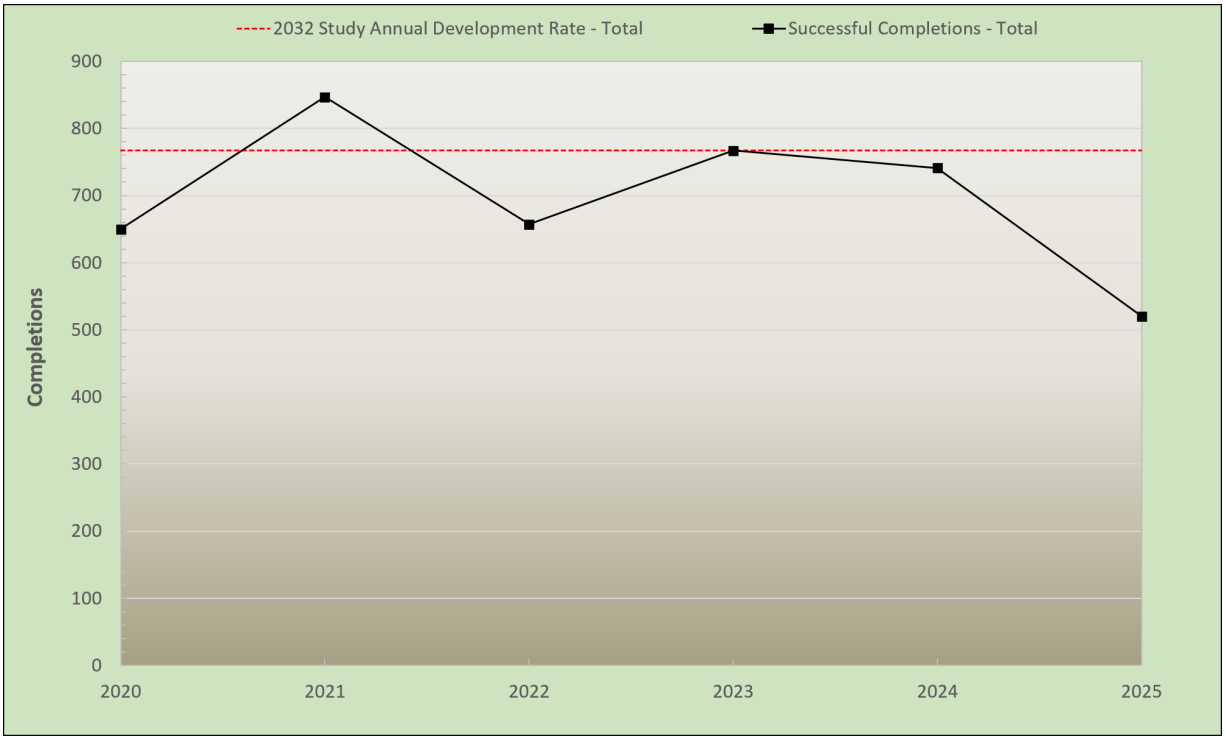


Figure 28. RGFO Total Completion Count vs. Regional Modeling Study Annual Level.

5.6.2 Royal Gorge Field Office Air Trends

The Field Office spans four of the CDPHE's air quality regions, including the Denver Metro - Northern Front Range, Eastern High Plains, South Central, and Pikes Peak areas. The Eastern High Plains, Pikes Peak, and South Central regions comply with federal air quality standards, but the state's most challenging air quality issue exists in and around the Denver metropolitan area.

The Denver Metro/North Front Range contains much of Colorado's population with over 4 million people living in the area according to the 2020 U.S. Census. Since 2002, the region has complied with all NAAQS, except for ozone. Unfortunately, it has been surpassing the EPA's ozone standards since the early 2000s. In 2007, the region received NAA status which persisted until 2012 when the EPA labeled the region as a "marginal" NAA due to the adoption of a more stringent ozone standard in 2008. In 2015, the EPA revised primary and secondary 8-hour ozone standards to a level of 0.070 ppm. Subsequently, in June 2018, the region was classified as a "marginal" nonattainment area for the 2015 8-hour ozone standard, effective August 3, 2018. The attainment deadline for the 2015 standard was August 3, 2021, based on 2018-2020 ozone season data. However, the region failed to meet this standard, leading to a reclassification as a

"serious" NAA under the 2008 ozone standard in January 2020. The attainment deadline for the 2008 standard was July 20, 2021, based on 2018-2020 ozone season data. Failing to attain this standard, the area was recently downgraded to a "severe" NAA for ozone.

Historically, the Denver-metropolitan area has violated health-based air quality standards for carbon monoxide and fine particles. In response, air quality improvement plans were developed and implemented to mitigate these pollutants. Fort Collins, Longmont, and Greeley in the Northern Front Range were NAAs for carbon monoxide in the 1980s and early 1990s but have adhered to federal standards since 1995.

The vast majority of air quality monitoring within Colorado is conducted near and within the Denver metropolitan region. During 2024, there were 59 air quality and meteorological monitors at 30 individual sites in the Northern Front Range Region. There were four CO monitors, 18 O_3 monitors, nine NO_2 monitors, three SO_2 monitors, as well as five PM_{10} monitors, 15 $PM_{2.5}$ monitors, and 14 meteorological towers. There were also seven air toxics monitoring sites including one in an area of oil and gas development (Platteville).

Air quality in RGFO counties shows significant variability (Table 10). Over the most recent three-year period (2023-2025), the sixteen counties with available data experienced an average of 60% of days classified as 'Good' based on the Air Quality Index (AQI). The best air quality within the RGFO is found in Fremont County, where 96% of days were classified as having 'Good' air quality, followed closely by Prowers County with 92% of days in the 'Good' range. In contrast, Denver County had only 41% of days with a 'Good' AQI. Additionally, up to 6% of days in some RGFO counties were classified as 'Unhealthy for Sensitive Groups.'

Under the previous annual standard of 12 µg/m³, none of the RGFO locations were at risk of exceeding the $PM_{2.5}$ limit (Table 11). However, with the recent reduction to 9 µg/m³, several RGFO counties are now approaching the threshold. The NO_2 data show that concentrations are highest in Denver County, where 1-hour values have been dropping over the past few years and the latest design value is approximately 60% of the NAAQS (Table 13). For the annual average, the maximum monitor is trending near 42% of the NAAQS (Table 14). No exceedances were recorded for either form of the NO_2 standard. Figure 4.23 from the 2024 CDPHE Air Quality Data Report shows that NO_2 has decreased markedly in the Denver metro area over the past few decades. Area PM_{10} monitored values are below the NAAQS. Each of the RGFO counties has ozone design values higher than the NAAQS (Table 15). More information on the spatial and temporal variability of ozone across the Denver metro area can be found in Section 4.2.3 of the 2024 CDPHE Air Quality Data Report. Overall, air quality was better for the Denver metro for the latest 3-year monitoring period (2023 – 2025).

Visibility monitoring at Rocky Mountain National Park (ROMO1) since 1991 indicates improvement on both the clearest and most impaired days (Figure 5). The haze index for the most impaired days has decreased by about 0.13 dv per year since 1991. Visibility trends at the park demonstrate progress towards the 2064 endpoint established in the latest RHR guidance.

NTN data for multiple monitoring sites in RGFO (Table 18) show that nitrogen deposition in the field office has generally remained unchanged over the period of observation at most locations and remains elevated above NPS standards and critical loads for aquatic eutrophication, tree growth and mycorrhizal communities.

5.7 Tres Rios Field Office

The TRFO is in the southwest corner of Colorado and oversees the administration of more than 600,000 acres of public surface lands and 2.6 million acres of subsurface federal mineral estate. The TRFO also has trust responsibility for mineral management on 800,000 acres of Tribal lands. The TRFO consists of Archuleta, Dolores, La Plata, and Montezuma counties in their entirety and contains portions of Hinsdale, Mineral, San Juan, and San Miguel counties. The major population centers include the cities of Cortez, Durango and Pagosa Springs. The RMP providing direction for the TRFO management actions was finalized in 2015 and includes provisions to protect air quality and AQRVs by complying with applicable federal, state, and local air quality laws, regulations, standards, and implementation plans.

5.7.1 Tres Rios Field Office Oil and Gas Development and Production

In 2025, there were 15 federal spuds in the TRFO, which is about 23% of the CARMMS high scenario (Table 25). Over the past nine years, spuds have averaged about one-third of the high scenario. Total (new and existing) federal oil production was less than the low scenario through 2020 but has since increased above both scenarios, though the range between the two cases is quite narrow (Figure 29). Total federal gas production is well above the cumulative level modeled for both CARMMS 2.0 scenarios. It's possible that the CARMMS 2.0 high scenario modeling results are underestimates or at least reasonable estimates for describing TRFO total (new and existing) federal oil and gas air quality impacts. Since the new annual federal oil and gas development rates since 2015 have been well below the CARMMS 2.0 high scenario spud count, the contribution to cumulative air quality associated with new federal oil and gas could be less than that modeled for the CARMMS 2.0 high scenario. Additional analyses are required at the project-level stage (when BLM receives permits to drill new wells) to determine whether CARMMS 2.0 modeled enough emissions to account for foreseeable oil and gas development / operations (see discussion for local analysis tool in Section 3.5.2).

Table 25. 2025 TRFO Federal Oil and Gas Statistics.

Description	Federal	% CARMMS 2.0 - High - Fed	% CARMMS 2.0 - Low - Fed
New Wells (Spuds)	15	43.0%	359.6%
Oil Production (bbl)	54,492	109.0%	130.4%
Gas Production (mcf)	212,959,076	281.5%	745.4%

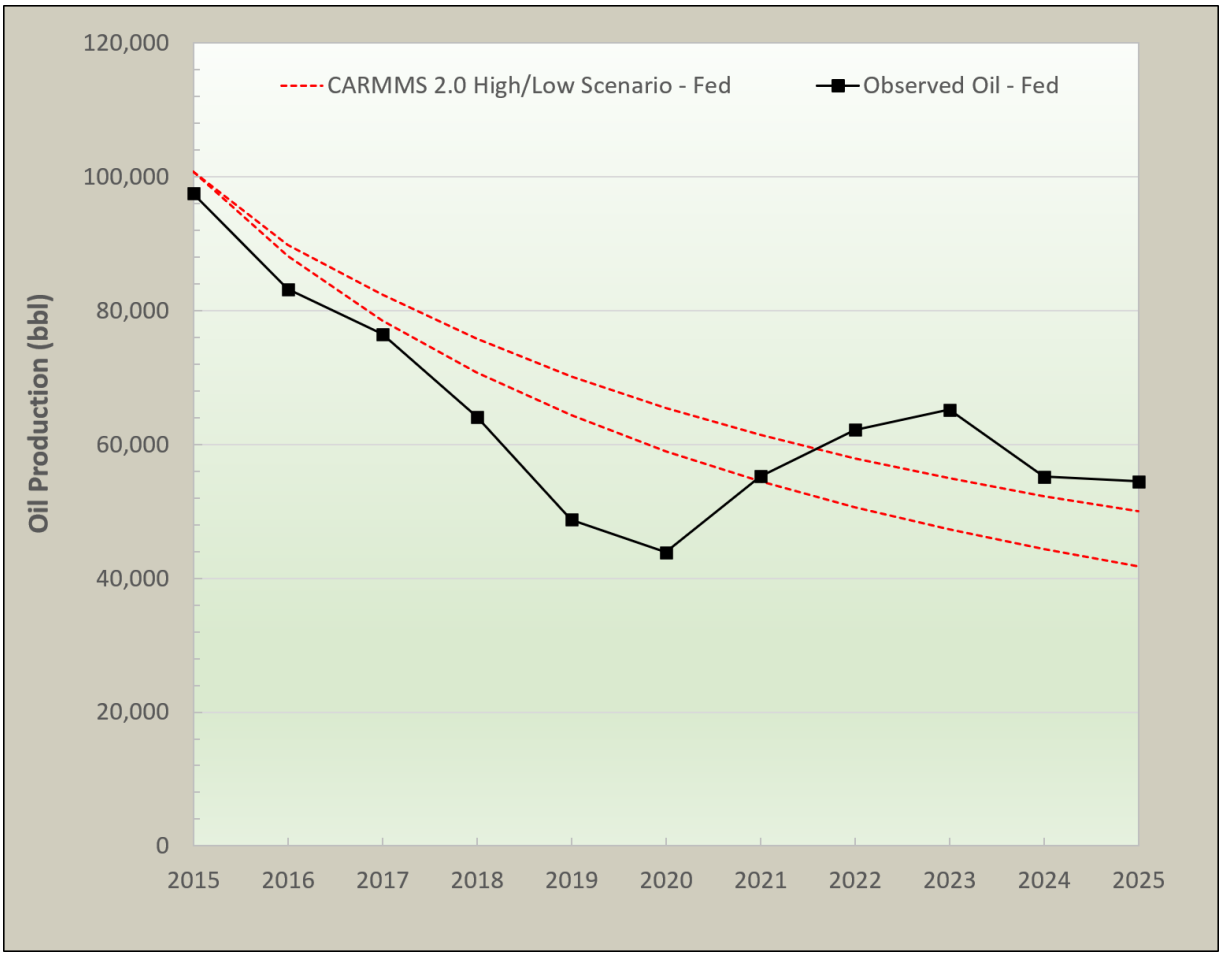


Figure 29. TRFO Federal Oil Production vs. CARMMS 2.0 Modeled Scenarios.

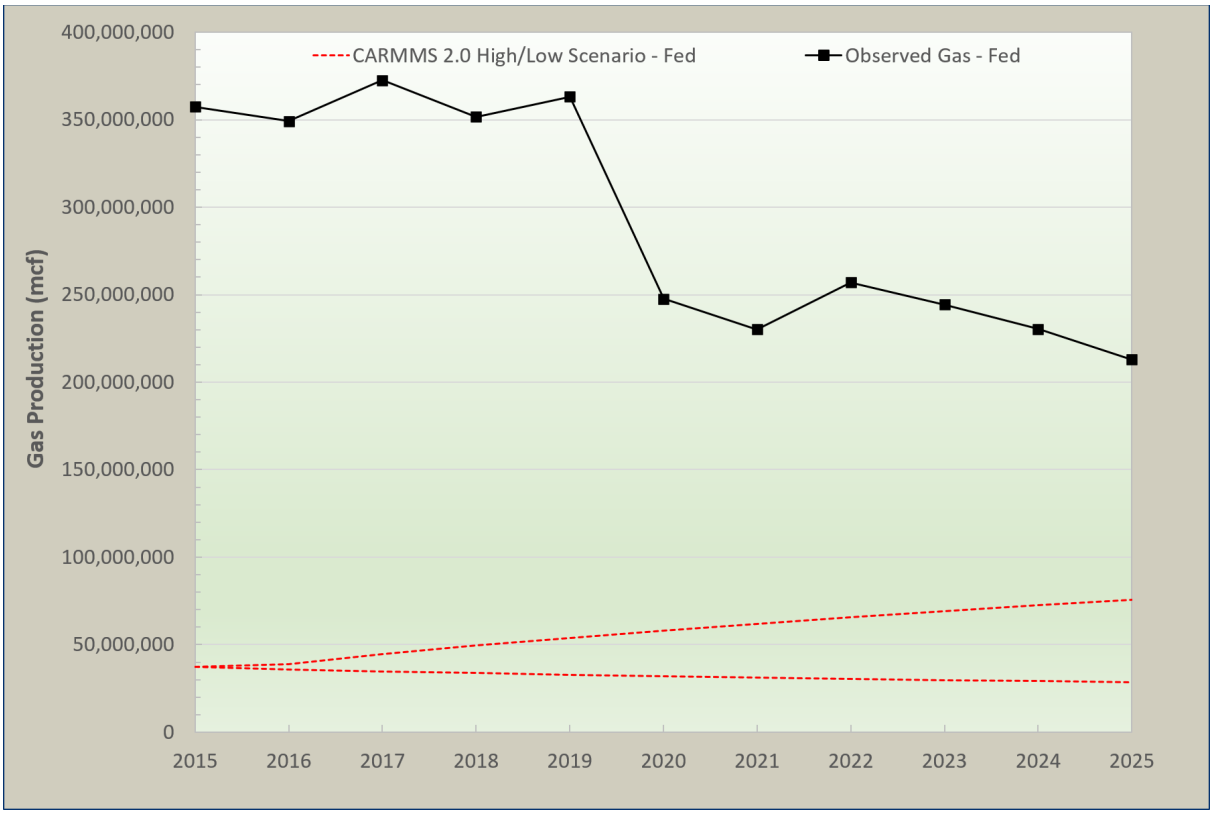


Figure 30. TRFO Federal Gas Production vs. CARMMS 2.0 Modeled Scenarios.

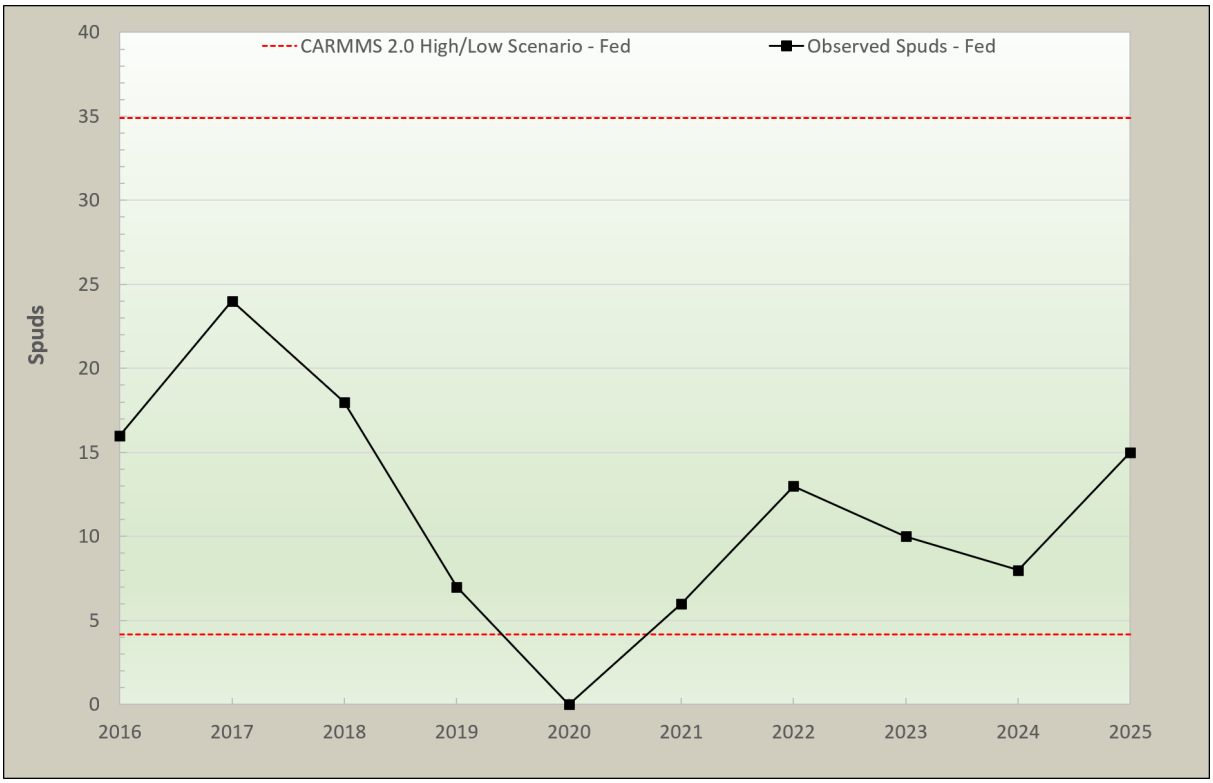


Figure 31. TRFO Federal Spud Count vs. CARMMS 2.0 Modeled Levels.

Since tracking began in 2020 for the BLM Regional Modeling Study, total annual new oil and gas completion counts including tribal, federal and non-federal completions have averaged below the cumulative annual completion level modeled for the study for TRFO. The BLM Regional Modeling Study modeled potential air quality impacts associated with 337 new oil and gas wells developed for years 2020 through 2025 and there were approximately 126 new oil and gas wells successfully completed in the TRFO during this period. This suggests that the predicted air quality impacts associated with new TRFO oil and gas for the BLM Regional Modeling Study could be over-estimates.



Figure 32. TRFO Total Completion Count vs. Regional Modeling Study Annual Level.

5.7.2 Tres Rios Field Office Air Trends

The TRFO is mostly contained within the CDPHE's Southwestern and Western Slope air quality regions. Air quality within the field office is designated as attainment and is in full compliance with the NAAQS for the report year. The TRFO has two PM_{10} maintenance areas around the towns of Pagosa Springs and Telluride. There is good air quality monitoring coverage throughout the TRFO with observations of CO, NO_2, PM_{10}, O_3, and SO_2 available. Additionally, the field office has three IMPROVE sites (

Table 16).

Table 10 shows that San Juan County had the best air quality in the TRFO, with 99% of days rated as good for the 2023 – 2025 period. In La Plata County, which includes the TRFO's largest city, Durango, 64% of days were classified as having good air quality over the same period. Ozone is the primary pollutant of concern for most days in the TRFO, though particulate matter occasionally becomes the leading pollutant.

The NO_2 design values for the TRFO in Table 13 and Table 14 show that concentrations are low and far below the NAAQS. Ozone is elevated in the TRFO but below the NAAQS with values between 0.064 ppm

and 0.065 ppm (Table 15) and no exceedances were recorded in 2025. Figure 4-42 in the 2024 CDPHE Air Quality Data Report indicates that ozone concentrations have remained relatively unchanged over the past decade.

Visibility within the TRFO can be assessed with three IMPROVE sites – Mesa Verde NP (MEVE1), Shamrock Mine (SHMI1), and Weminuche Wilderness (WEME1). At each of the locations, there has been a statistically significant decrease in haze on the clearest and most impaired days (Table 17).

Nitrogen deposition is monitored at multiple sites in the TRFO (Table 18). In general, nitrogen deposition is elevated above NPS benchmark standards, but near or below critical loads for many ecosystem components as described in (Pardo, et al., 2011) and (Bowman, Murgel, Blett, & Porter, 2012). Overall, current air quality is meeting the objectives of the governing RMP and BLM's adaptive management strategy.

5.8 Uncompahgre River Field Office

The UFO manages nearly 900,000 surface acres of public land in BLM Colorado's Southwest District and provides administrative services for approximately 971,000 acres of federal subsurface mineral estate within the planning area. The UFO encompasses a majority of Delta, Ouray, and Montrose counties, and portions of Mesa, San Miguel, and Gunnison counties. The major population center is the city of Montrose, located in the center of the field office.

5.8.1 Uncompahgre Field Office Oil and Gas Development and Production

For 2025, there was one federal spud in the UFO (Table 26). Accordingly, construction emissions have been far less than modeled in the CARMMS 2.0 high scenario. There has been very little oil production. Gas production has consistently been near or below the CARMMS 2.0 modeled low scenario. Due to minimal new federal development in the field office throughout the 2016 – 2025 tracking period, construction / development related emissions associated with new federal oil and gas have consistently remained below the CARMMS 2.0 low scenario until 2025 where federal gas production has almost doubled from previous year. Cumulatively (associated with new and existing), federal oil and gas production is below the CARMMS 2.0 low scenario suggesting that the CARMMS 2.0 low scenario modeling results are the most appropriate (possibly overpredictions) for describing air quality impacts associated with UFO federal oil and gas emissions.

Table 26. 2025 UFO Federal Oil and Gas Statistics.

Description	Federal	% CARMMS 2.0 - High - Fed	% CARMMS 2.0 - Low - Fed
New Wells (Spuds)	1	2.7%	125.0%
Oil Production (bbl)	164	0.3%	6.8%
Gas Production (mcf)	4,101,871	17.0%	170.8%

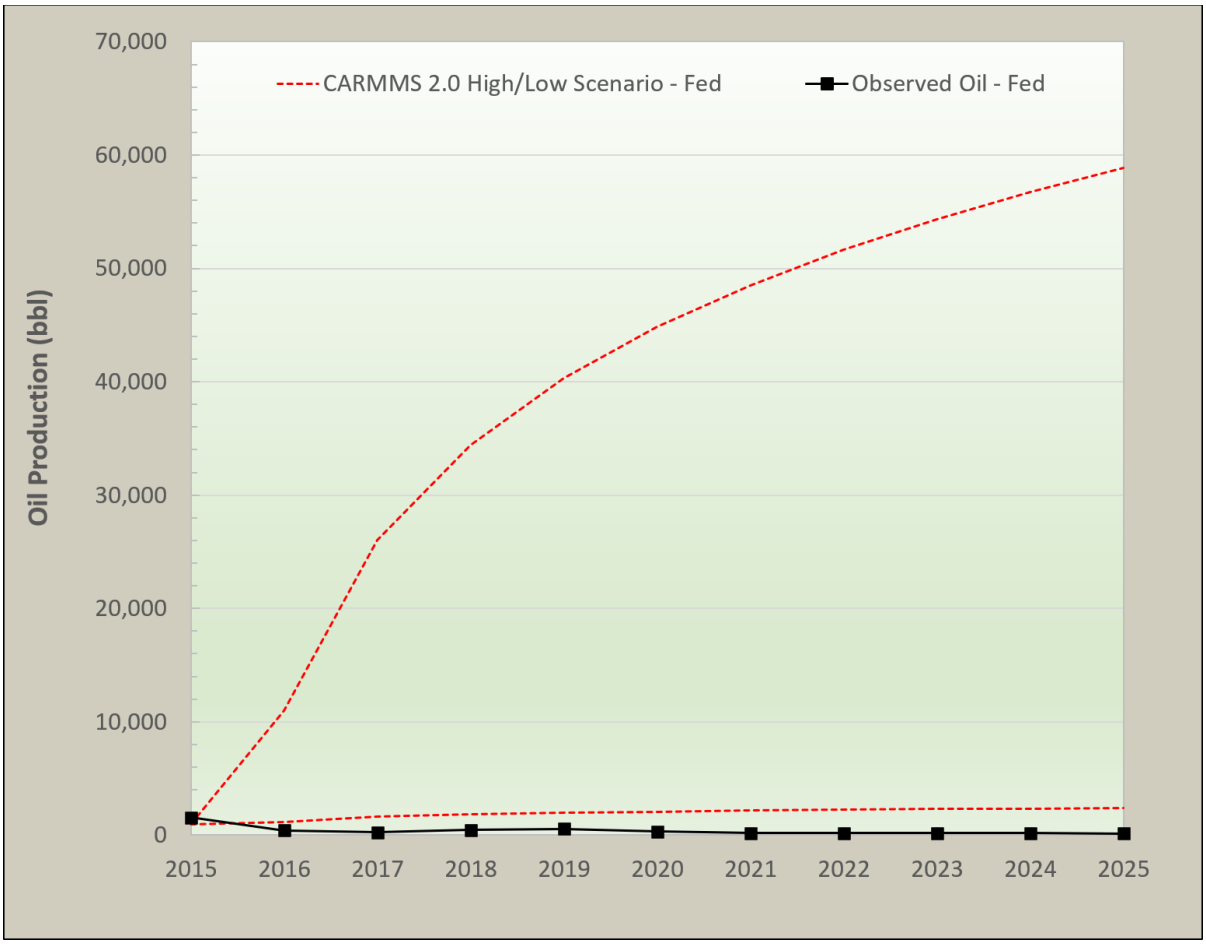


Figure 33. UFO Federal Oil Production vs. CARMMS 2.0 Modeled Scenarios.

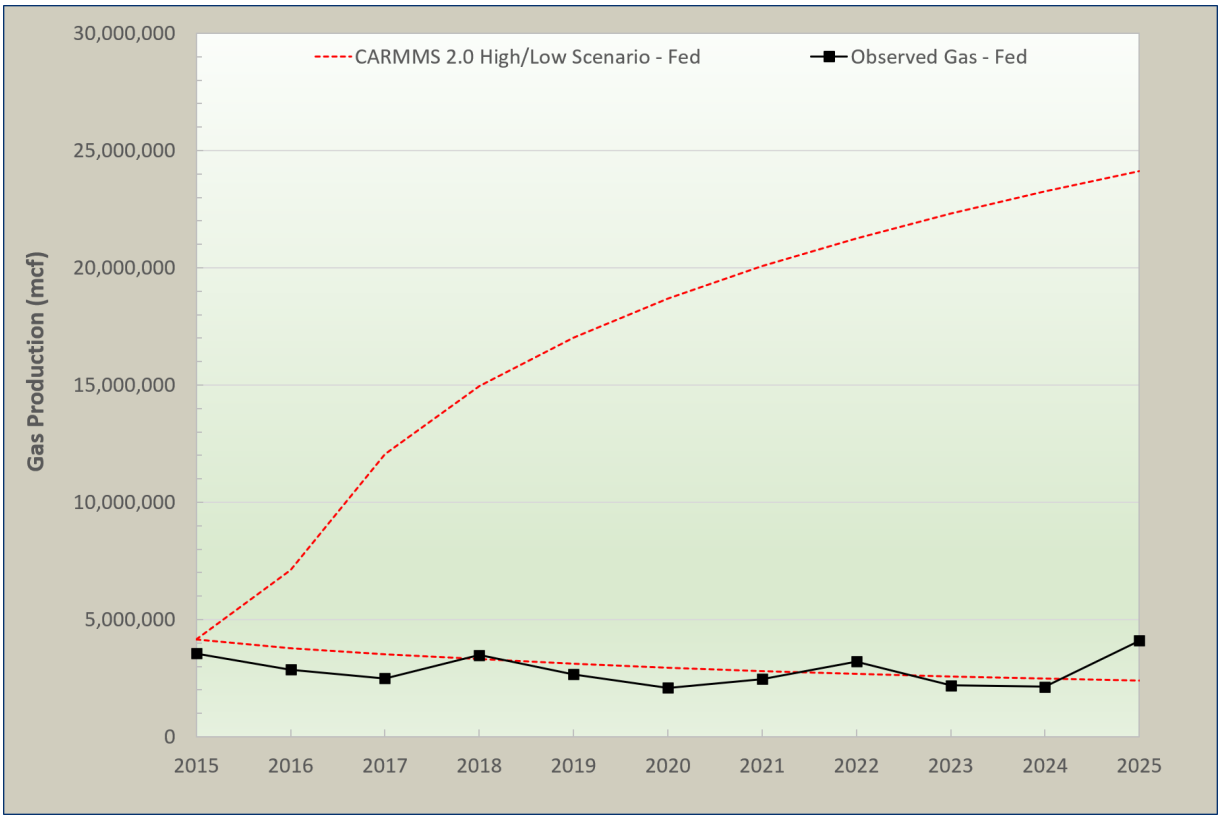


Figure 34. UFO Federal Gas Production vs. CARMMS 2.0 Modeled Scenarios.

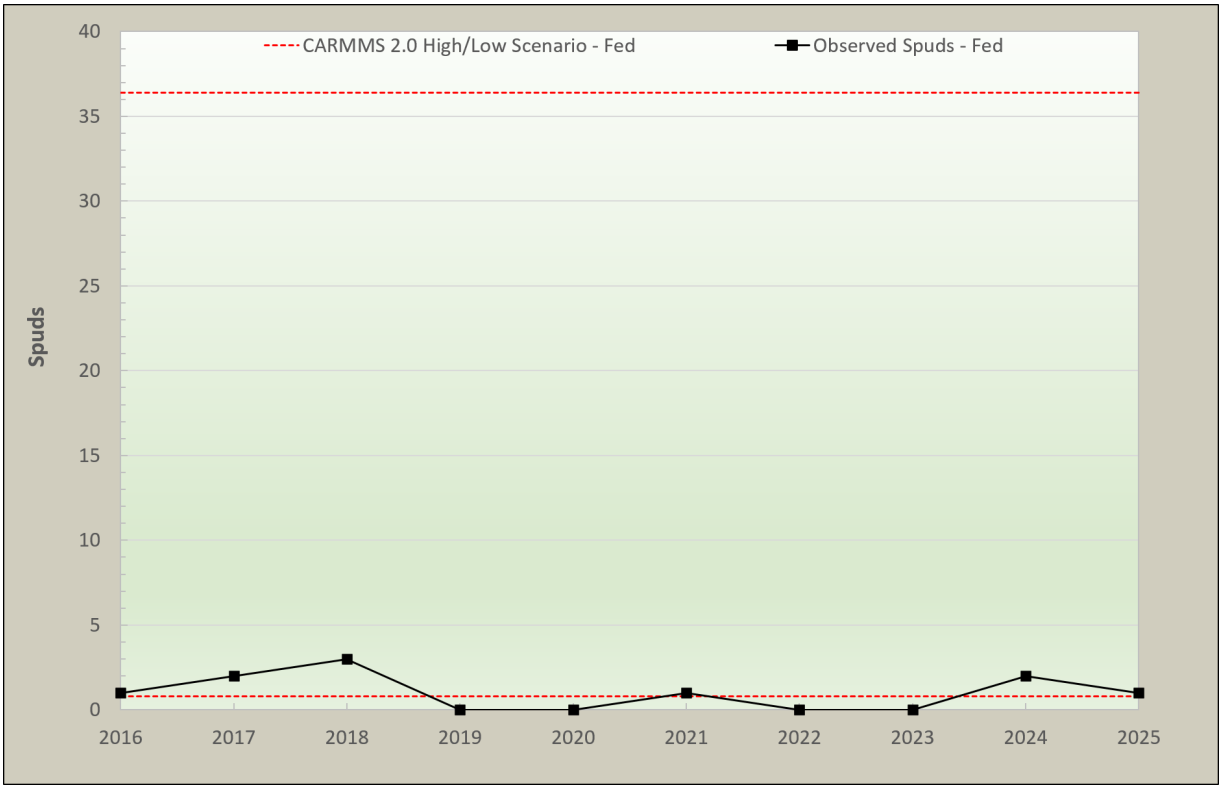


Figure 35. UFO Federal Spud Count vs. CARMMS 2.0 Modeled Levels.

Since tracking began in 2020 for the BLM Regional Modeling Study, total annual new oil and gas completion counts including tribal, federal and non-federal completions have averaged approximately equal to the cumulative annual completion level modeled for the study for UFO. The BLM Regional Modeling Study modeled potential air quality impacts associated with 4 new oil and gas wells developed for years 2020 through 2025 and there were 4 new oil and gas wells successfully completed in the UFO during this period. This suggests that the predicted air quality impacts associated with new UFO oil and gas for the BLM Regional Modeling Study are good approximations.

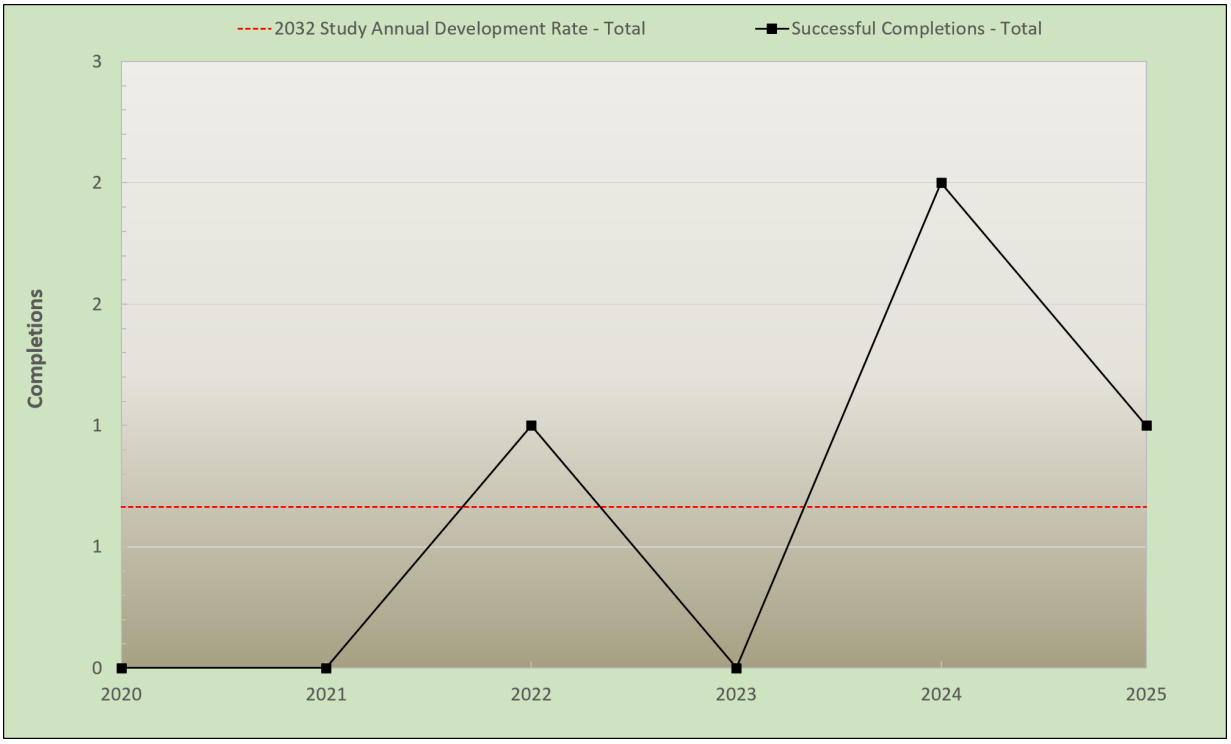


Figure 36. UFO Total Completion Count vs. Regional Modeling Study Annual Level.

5.8.2 Uncompahgre Field Office Air Trends

Most of the UFO is located within CDPHE's Western Slope air quality region, with a smaller portion extending into the adjacent Central Mountain region. Air quality in the UFO is classified as being in attainment and meets all National Ambient Air Quality Standards (NAAQS) for the report year, with no maintenance areas present. Air quality monitoring is limited, with PM10 monitored at Telluride and ozone monitored at Norwood and McClure Pass. Additional ozone monitoring sites are located just west of the field office at the base of Grand Mesa and to the east at Gothic. The BLM operated Paonia monitor, which collected data through 2021, has since been relocated to North Park in the KFO.

The AQI information for the UFO (Table 10) shows that good air quality conditions prevailed on 86% and 69% of the days over the previous three years in Delta and Gunnison counties, respectively. The primary pollutant of concern for each county is ozone. While NO_2 observations in the UFO ceased with the relocation of the Paonia monitor, the previously recorded data show that typical values were about 25% of the 1-hour standard and about 10% of the annual NO_2 standard. During 2025, there were no NAAQS exceedances of PM_{10} recorded at the Telluride site. There is no apparent trend in PM_{10} concentration in

Telluride as shown in Figure 4-43 of the 2024 CDPHE Air Quality Data Report. There is no $PM_{2.5}$ monitoring in the UFO, but area monitors typically record values less than 50% of the NAAQS. Ozone design values are elevated at 0.067 ppm (Table 15).

There are no IMPROVE sites in the UFO, but the White River NF (WHRI1) and Weminuche Wilderness (WEMI1) sites are proximate to the field office and provide representative visibility information. There has been a statistically significant improvement in visibility on the clearest and most impaired days at both IMPROVE monitors (Table 17), demonstrating progress towards 2064 RHR goals.

The most representative nitrogen deposition monitor for the UFO is in Gothic (CO10), where average total nitrogen deposition over the past three years has been approximately 1 kg ha^{-1}. This level is relatively low and generally below critical loads for most ecosystem components, and equals the NPS benchmark of 1 kg ha^{-1}. No significant long-term trend has been observed at the Gothic NTN site.

With oil and gas development and production tracking at or below the CARMMS low scenario and consistent with input for the 2032 Modeling Study, and the Planning Area has generally good prevailing air quality conditions, UFO air resources are meeting the objectives of the governing RMP and BLM's adaptive management strategy.

5.9 White River Field Office

The WRFO is part of the BLM Colorado Northwest District and provides administration for more than one million surface acres of public land in Rio Blanco, Moffat, and Garfield counties. The federal mineral estate in the WRFO in nearly twice that amount. The major urban areas in the WRFO include the towns of Rangely and Meeker. The RMP providing direction for the WRFO management actions was amended and finalized in 2016. The RMP contains provisions to protect air quality and AQRVs by complying with applicable federal, state, and local air quality laws, regulations, standards, and implementation plans.

5.9.1 White River Field Office Oil and Gas Development and Production

In 2025, there were 24 federal spuds, which is 4% of the CARMMS 2.0 high scenario and much less than the low scenario (Table 27). Since tracking began in 2016, there have been about 19 spuds per year on average, which is approximately 26% of the low scenario and only 3% of the high scenario. Total (associated with new and existing wells) federal oil production in the WRFO has been slightly higher than the low scenario (Figure 37) while federal gas production has consistently been less than the low scenario (Figure 38). New federal oil and gas development in the WRFO has been exceptionally low over the modeling period suggesting that field office emissions associated with new federal oil and gas developed 2016 – 2025 are tracking below the low CARMMS 2.0 scenario levels. Accordingly, the CARMMS 2.0 low scenario modeling results are most appropriate for describing new and cumulative (includes existing) WRFO federal oil and gas impacts on air quality.

Table 27. 2025 WRFO Federal Oil and Gas Statistics.

Description	Federal	% CARMMS 2.0 - High - Fed	% CARMMS 2.0 - Low - Fed
New Wells (Spuds)	24	4.0%	32.0%
Oil Production (bbl)	1,797,081	70.8%	147.5%
Gas Production (mcf)	72,639,451	17.8%	81.5%

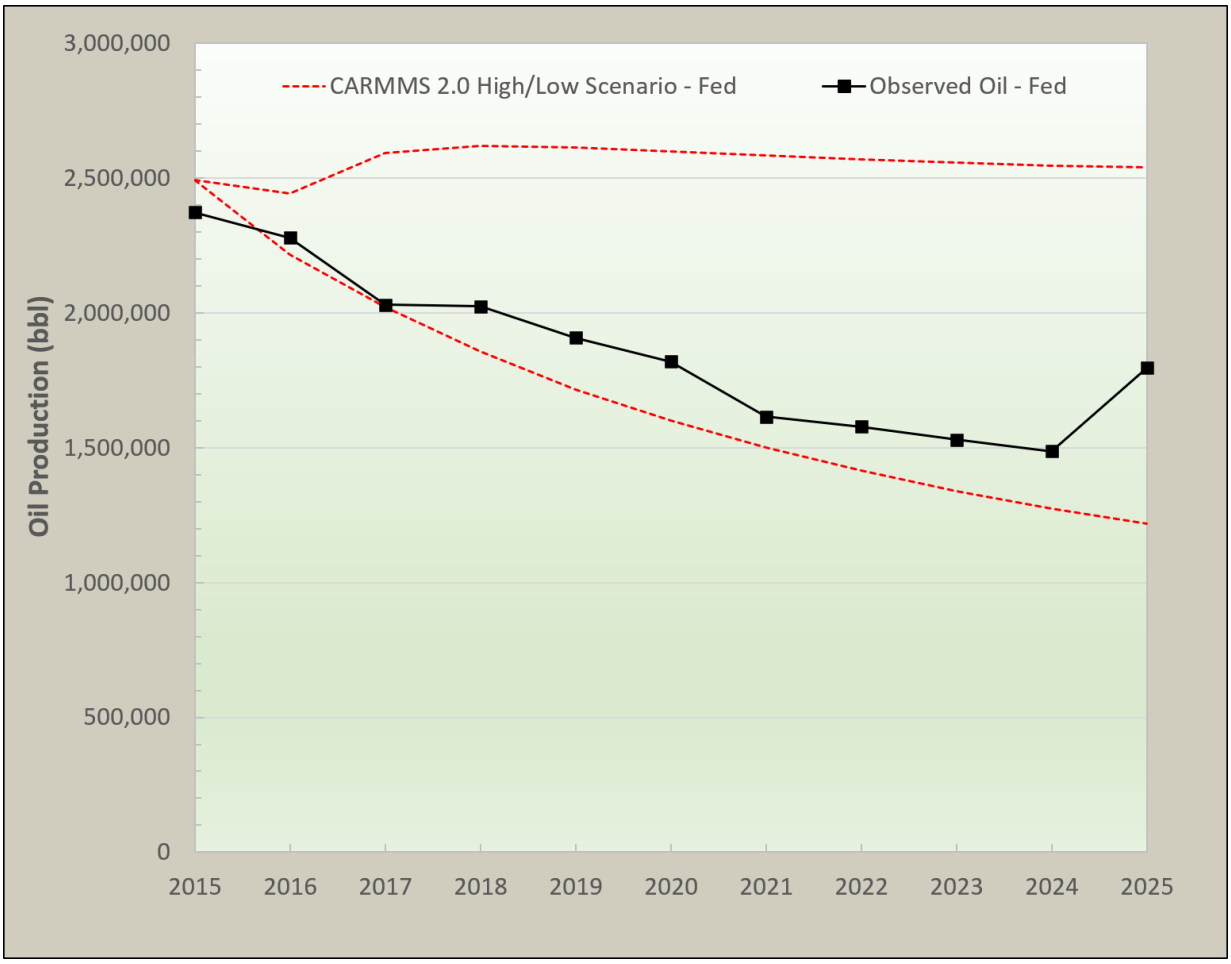


Figure 37. WRFO Federal Oil Production vs. CARMMS 2.0 Modeled Scenarios.

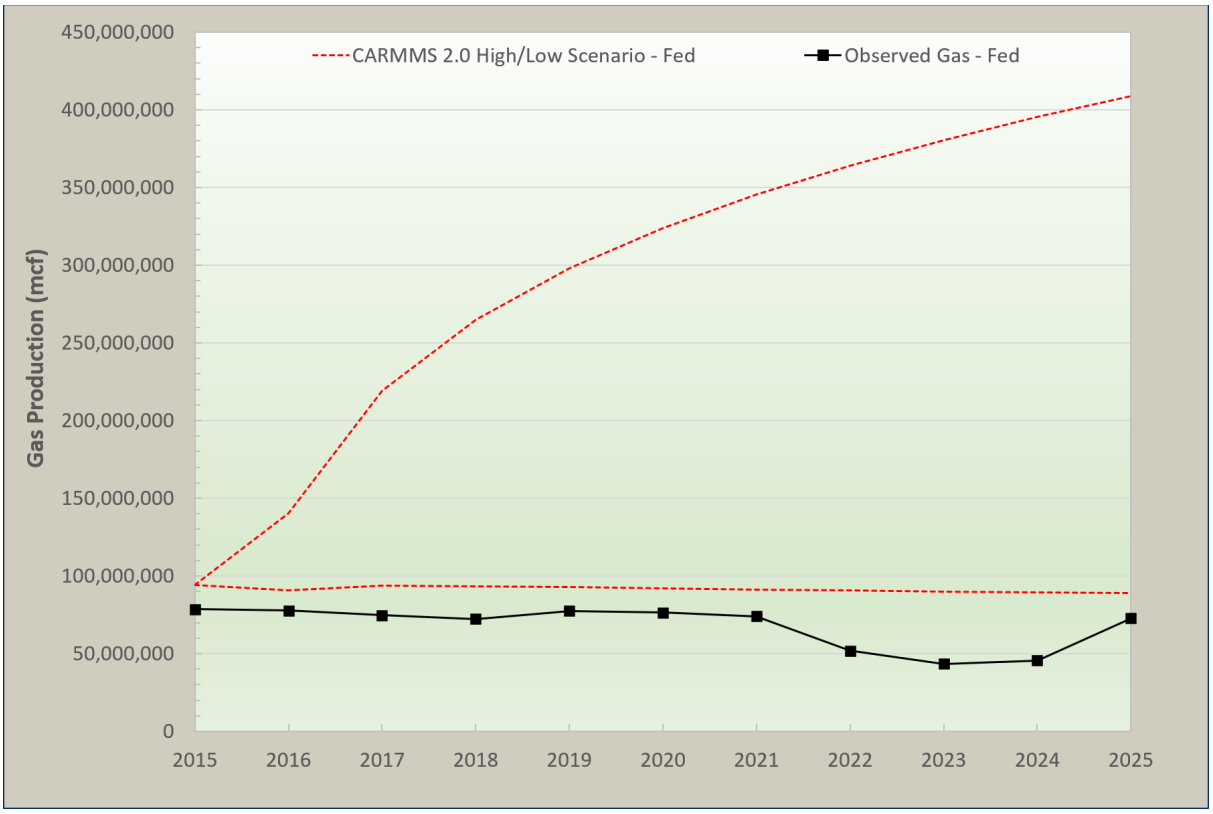


Figure 38. WRFO Federal Gas Production vs. CARMMS 2.0 Modeled Scenarios.

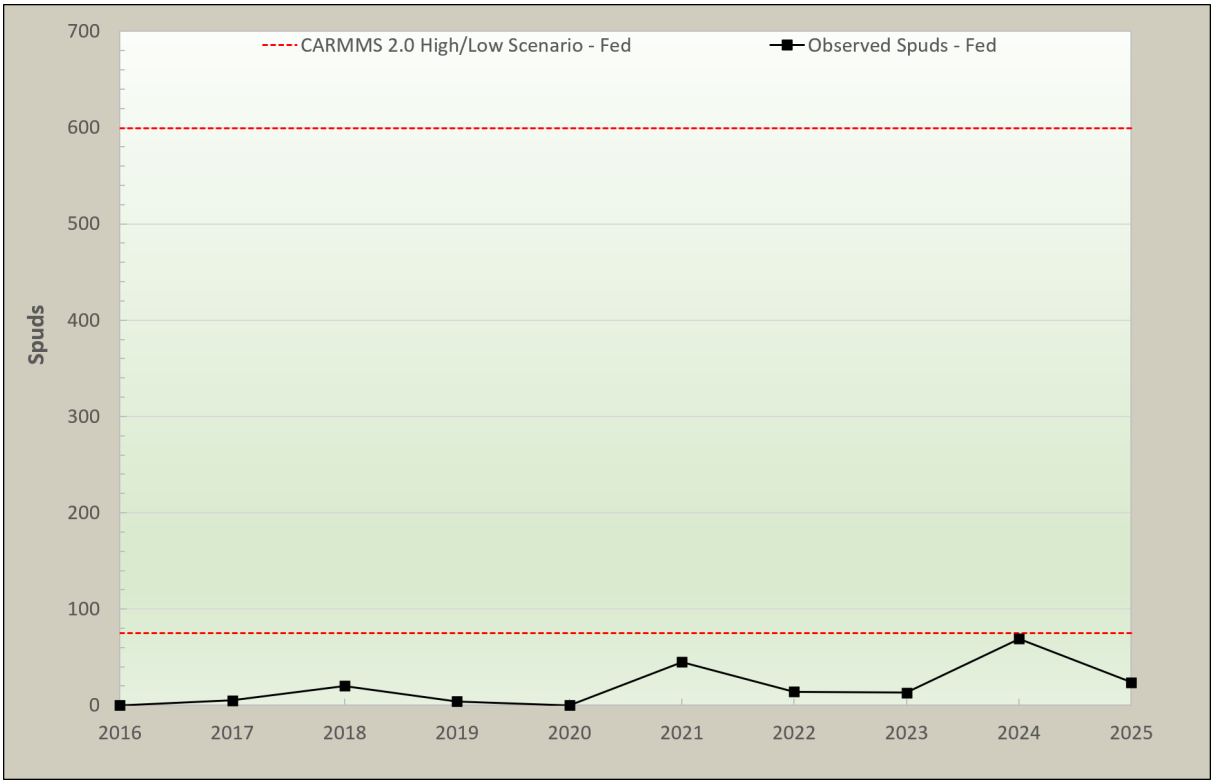


Figure 39. WRFO Federal Spud Count vs. CARMMS 2.0 Modeled Levels.

Since tracking began in 2020 for the BLM Regional Modeling Study, total annual new oil and gas completion counts including tribal, federal and non-federal completions have been well below the cumulative annual completion level modeled for the study for WRFO except for report year 2025 when the number of total annual completions was approximately equal to the annual rate for the study. The BLM Regional Modeling Study modeled potential air quality impacts associated with 344 new oil and gas wells developed for years 2020 through 2025 and there were approximately 105 new oil and gas wells successfully completed in the WRFO during this period. This suggests that the predicted air quality impacts associated with new WRFO oil and gas for the BLM Regional Modeling Study are applicable for describing potential federal oil and gas impacts and could be overestimates.



Figure 40. WRFO Total Completion Count vs. Regional Modeling Study Annual Level.

5.9.2 White River Field Office Air Trends

The WRFO is entirely contained within the CDPHE's Western Slope air quality region. The region is designated as in attainment and is in full compliance with the NAAQS for the report year. The field office is also free from any maintenance areas. Up until April 2025, BLM operated two air quality monitors located in RGFO - Rangely and the Piceance Basin that collected meteorological data and monitor for ozone, $PM_{2.5}$, and NO_2. There is also ozone monitoring in the far eastern portion of the field office at Ripple Creek Pass.

Air quality was considered good on 70% of days over the past three years in Rio Blanco County with ozone the primary pollutant of concern on most days (Table 10). $PM_{2.5}$ concentrations for the report year were well below the applicable annual and 24-hour NAAQS. Similarly, annual average NO_2 design values are well below NAAQS. Ozone is the primary concern in the field office with the most recent design value of 0.067

ppm, and historically, elevated ozone concentrations (exceeding the NAAQS) have been associated with winter-time ozone intrusions from neighboring Uinta Basin.

The Flattops (FLTO1) IMPROVE monitor within the field office is no longer active but observed conditions for the nine years (2012 – 2020) of monitoring indicate that visibility on the clearest days was only slightly above natural conditions and prevailing visibility in the absence of wildfire smoke was very good (Figure 1). The nearest two active IMPROVE sites – Mount Zirkel (MOZO1) and White River NF (WHRI1) – have observed statistically significant improvement in visibility (Table 17) on the most impaired and clearest days and have the lowest haze indices observed in Colorado.

There are no NTN or CASTNET sites in the WRFO thus the two nearest locations – Four Mile Park (CO08) and Sand Spring (CO15) – are likely the most representative of conditions in the field office. Nitrogen deposition at the Four Mile Park location has been relatively low in recent years with an annual average over the last three years of about 1.3 kg ha^{-1}. The annual average level of nitrogen deposition is low compared to other sites in Colorado (Table 18) and generally lower than critical loads thresholds, but slightly above the NPS benchmark standard of 1 kg ha^{-1} indicating some ecosystem components could be degraded.

References

BLM. (2023). *BLM Western U.S. Photochemical Air Quality Modeling for 2032.* Link to report: https://www.blm.gov/programs/air-resources/colorado

BLM. (2026). *BLM Specialist Report on Annual Greenhouse Gas Emission Trends in 2025 rom Coal, Oil, and Gas Exploration and Development on the Federal Mineral Estate.* Retrieved from https://www.blm.gov/sites/default/files/docs/2026-06/BLM-2025-GHG-Report-Final_508.pdf.

Booth, M. (2023, 11 8). How is Colorado doing on cutting carbon emissions? Not great, state analysis says. *The Colorado Sun*.

Bowman, W. D., Murgel, J., Blett, T., & Porter, E. (2012, July 30). Nitrogen critical loads for alpine vegetation and soils in Rocky Mountain National Park. *Journal of Environmental Management, 103*, 165-171. Retrieved from https://doi.org/10.1016/j.jenvman.2012.03.002

EPA. (2007). *The Plain English Guide to The Clean Air Act*. Retrieved from https://www.epa.gov/sites/production/files/2015-08/documents/peg.pdf

EPA. (2018). *Basic Information about Lead Air Pollution*. Retrieved from https://www.epa.gov/lead-air-pollution/basic-information-about-lead-air-pollution#how

EPA. (2018). *Basic Information about NO2*. Retrieved from https://www.epa.gov/no2-pollution/basic-information-about-no2#What is NO2

EPA. (2018). *Clean Air Act Permitting for Greenhouse Gases*. Retrieved from https://www.epa.gov/nsr/clean-air-act-permitting-greenhouse-gases

EPA. (2018, December). Code of Federal Regulations, 40: Chapter 1, Subchapter C, Part 51, Subpart F, 51100.

EPA. (2018). *Particulate Matter (PM) Pollution*. Retrieved from https://www.epa.gov/pm-pollution

EPA. (2018). *Sulfur Dioxide Basics*. Retrieved from https://www.epa.gov/so2-pollution/sulfur-dioxide-basics#what is so2

EPA. (2026). *National Emissions Inventory*. Retrieved from https://www.epa.gov/air-emissions-inventories/2023-nei-supporting-data-and-summaries

Hand, J. L., Prenni, A. J., Copeland, S., Schichtel, B. A., & Malm, W. C. (2020, December 15). Thirty years of the Clean Air Act Amendments: Impacts on haze in remote regions of the United States (1990–2018). *Atmospheric Environment, 243*, 117865. Retrieved from https://doi.org/10.1016/j.atmosenv.2020.117865

Longxiang, L., Bloomberg, A. J., Spengler, J. D., Coull, B. A., Schwartz, J. D., & Koutrakis, P. (2020). Unconventional oil and gas development and ambient particle radioactivity. *Nature Communications*, 11.

Malm, W. C. (1999). *Introduction to Visibility.* Fort Collins: Cooperative Institute for Research in the Atmosphere, Colorado State University.

Minor, N., & Brasch, S. (2023, 11 16). Why is Colorado off track to miss its first big climate goals? Short answer: cars. *Colorado Public Radio News*.

NPS. (2010). *Federal Land Managers' Air Quality Related Values Work Group*. Retrieved from https://www.fws.gov/guidance/sites/guidance/files/documents/FLAG%20Air%20Quality%20Phase%201%20report.pdf

Pardo, L. H., Fenn, M. E., Goodale, C. L., Geiser, L. H., Driscoll, C. T., Allen, E. B., . . . Bowman, W. D. (2011). Effects of nitrogen deposition and empirical nitrogen critical loads for ecoregions of the United States. *Ecological Applications*, 3049-3082. Retrieved from https://doi.org/10.1890/10-2341.1

Ramboll. (2017). 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. https://www.blm.gov/programs/air-resources/colorado.