U.S. DEPARTMENT OF THE INTERIOR

BUREAU OF LAND MANAGEMENT

Colorado Annual Air Resources Report

Prepared by the BLM Colorado State Office

2020 Report Year

Executive Summary

This report was prepared in accordance with Section V of the Bureau of Land Mangement (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 for project level authorizations for oil, gas, and coal related projects are effective in meeting the stated goals and objectives outlined within each field office's applicable Resource Management Plan (RMP). The CARPP also requires the ARS to assess whether current cumulative modeling is representative of "on the ground" conditions. This assessment allows the BLM to continue relying on the modeled results to authorize future project specific development and adequately describe their cumulative effects on National Ambient Air Quality Standards (NAAQS) and Air Quality Related Values (AQRVs).

All of the Colorado RMPs require the BLM to provide for compliance with Federal and State air quality regulations when authorizing federal actions. Some of the newer RMP revisions also contain specific management actions for accomplishing compliance and / or specific desired outcomes. In general, BLM Colorado uses the adaptive management processes outlined in the CARPP for analyzing and permitting federal actions with the potential to significantly impact air resources. The CARPP processes 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 to provide for the desired outcomes.

Since the adoption of the CARPP, BLM Colorado has worked to tease apart the data sources, develop the required tools, and communicate the cycle processes as envisioned in order to build capacity throughout the organization where necessary to implement and maintain the strategy. This work is ongoing, and as the cycle itself suggests, it will entail a continuous improvement process with anticipated future efficiencies. At this time, all field offices have achieved parity with initial CARPP mplementation,and all of the strategies, tools, and requirements outlined by the CARPP are being used to aid in NEPA analysis and decision making. The ARS have been providing assistance on individual project authorizations on a case-by-case basis to analyze design features and recommend mitigation options as necessary to ensure federal actions conform with field offices' RMP goals and objectives. As such, individual project authorizations are not expected to contribute significantly to air quality impacts on their own.

For this report, cumulative emissions from federal mineral development in each planning area are being used as a surrogate for the projected impacts associated with the Colorado Air Resources Management Modeling Study (CARMMS) results. The CARMMS initiative utilizes a photo-chemical model simulation to produce state-of-the-science cumulative impacts analysis for the entire state of Colorado. BLM Colorado initiated the CARMMS project to assess the statewide impacts of projected mineral development (i.e. federal and fee) for three development scenarios (i.e. low, medium, and high) over a period of ten years. Planning area emissions were modeled using source apportionment, which tracks the emissions within the domain to provide a culpability assessment of the NAAQS and AQRVs impacts associated with the projected development in these areas. The differences in the impacts between the scenarios and the base year provide insight into how the various scenario emissions affect the atmosphere on a relative basis. This insight is useful for making qualitative and quantitative impact comparisons with emissions levels at the current pace of development, which is how this data is used in the report.

The table below shows the cumulative source apportioned field office NAAQS and AQRV impact rankings for the report year. The range of values for the impact column include: 1.) None (indicates analysis indicators are not exceeded), 2.) SIL Exceedance (indicates the project level model threshold is exceeded for the NAAQS pollutant in parentheses), and 3.) DAT Exceedance (indicates the project level analysis threshold is

exceeded for the AQRV in parentheses). To be clear, the rank and significance values are relative to the current cumulative multi-year assessment for each field office. The SIL and DAT are not explicitly applicable since they are individual project thresholds. However, given that there are currently no cumulative contribution thresholds for NAAQS and AQRV concerns, the SIL and DAT are useful as indicators for whether or not further analysis is warranted (as shown in the individual field office section below).

Table ES-1 Field Office Air Resource Impact Ranks

Field Office	PM_{10}	$PM_{2.5}$	NO_2	O_3	Visibility	Deposition	Impact
Colorado River Valley (CRVFO)	2nd	2nd	3rd	2nd	3rd	1st	Exceeds DAT (Dep)
Grand Junction (GJFO)	4th	4th	6th	3rd	5th	4th	None
Kremmling (KFO)	7th	7th	1st	5th	2nd	2nd	Exceeds SIL (NO2 Annual), Exceeds DAT (Dep)
Little Snake (LSFO)	6th	6th	7th	7th	7th	7th	None
Royal Gorge (RGFO)	1st	1st	2nd	1st	1st	6th	None
Tres Rios (TRFO)	5th	5th	4th	6th	6th	5th	None
Uncompahgre (UFO)	8th	8th	8th	8th	8th	8th	None
White River (WRFO)	3rd	3rd	5th	4th	4th	3rd	None

Data shown for NAAQS pollutants and AQRVs of concern, PM = particulate matter, Rank 1^{st} = most impactful.

Findings

The data shows that 2020 cumulative emissions tracked over the monitoring period are all below the low CARMMS scenario, save for the VOCs. The primary drivers of source apportioned emissions are from oil and gas development in the Royal Gorge and Colorado River Valley field offices. None of the interpolated criteria pollutant concentrations are showing significant contributions to the NAAQS, which is expected given the CARMMS results overall do not predict significant impacts to the NAAQS from federal mineral development. Visibility impacts are also less than significant based on comparison to the project level DAT. The comparison shows just how little the current pace of new federal development is contributing to visibility issues at all of the Class I areas analyzed. Nitrogen deposition is very much an issue across the state. BLM Colorado's report year contributions are projected to be above the project level DAT at as many as 9 Class I areas. In general, the cumulative impacts to air resources across the state from new federal oil and gas development are relatively minor, and should continue to be so for the foreseeable future.

1.0 Introduction

About This Report

The Annual Report is a dynamic data-driven document and web-application designed to convey vast quantities of detailed air resource related data within a compact and reusable framework. As such, readers should be advised that the report will only render properly on a modern browser capable of supporting the latest HTML5, CSS3, and ECMAscript standards. For the best user experience, the developer recommends viewing this report on a PC using the ***Chrome Browser***. This report was developed and tested extensively using Chrome on a Windows PC, and the developer makes no claims or warranties for proper rendering or functionality on any other browser or on mobile devices. This version, Version 2.0, marks a total re-envisioning of the workflow and data structures used to produce the report. In the time that has lapsed between the release of Version 1.0 for the 2015 Report Year and the initial build of 2.0, several datasets for air resources and climate change became available. The advances in the state-of-the-science these datasets represent demanded incorporation within the context of this version. All of these updates conspired to delay the public release of 2.0.

Dynamic content contained within various report elements will load and render applicable datasets based on the user's interaction with the element's control(s). These controls are intuitive, and readers should be able to easily navigate through the report and view data as necessary to understand the report's content and conclusions. The navigation drawer, activated by the menu icon in the header at the top of the page, contains the report's overall context control, which allows readers to select the report year to be viewed. By default, the report always loads for the latest available year. BLM Colorado expects to publish annual updates of report content and analysis for previous calendar years by the end of each current fiscal year. Readers should also be mindful that static content within the report is still a "living document", meaning that it is subject to change over time as methods of analysis or additional data become available that require incorporation within the report. Some advances in the knowledge base and data could result in breaking changes to the document (i.e. lost content) that will not be captured within the application. As additional data years are made available, the BLM will strive to maintain the integrity and continuity of the content and analysis contained within the report to limit these changes.

Printing the Report

To print the Annual Report, click the ***printer icon*** on the report header. The print options dialog will open and allow the reader to filter the report for a specific field office or all of BLM CO (default) to enable efficient preinter use if so desired. The click the print button to activate the browser's print dialog, which will will open to allow readers to customize the look of the report from the various available options (e.g.

background image visibility, page numbers, headers). Printing web content can be cumbersome, particularly where dynamic elements render datasets one at a time and where some layout styles are incompatible with print layouts. For this version of the report, the BLM has taken care to ensure that the framework utilized to build the report does not interfere with the browser's ability to extract all visible parts of the document object model for printing. However, there still exists the limitation that the browser will only print what is rendered. Therefore, please ensure that all of the dynamic content contains the specific information you require before printing. Also, be advised that certain content (dynamic and static) is hidden in print view due to the aforementioned print layout issues.

Disclaimer

All information in this report is being provided ***"as is"***. While every attempt to ensure that the information is timely, complete, accurate, and obtained from reliable sources, the authors make no guarantee that this information is free of errors or omissions. Hyperlinks contained within the report connect to other websites that are maintained by other Government Agencies, or external third parties over which the BLM exercises no control. Therefore, we do not make any representation as to the accuracy or any other aspect of information contained in linked content. The projections and interpretations of the data disclosed in this report are being used strictly to provide analysis assumptions, and they should not be interpreted as an iron clad prediction, action authorization limit, or the official policy or position of the BLM, Department of the Interior, or the U.S. Government. In no event will the BLM, its partners, agents or employees thereof be liable for any consequential, special or similar damages, as a result of any decision made or action taken in reliance on the information within this report by any individual or organization that is external to the Federal Government.

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 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). The BLM initiated the CARMMS to assess statewide impacts of projected oil, gas, and coal mining development scenarios. Specific validation measures include reviewing annual oil and gas development emissions to determine which CARMMS scenario best approximates the current federal development track. 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, gas, and coal authorizations, as the 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)

⚠ Coal resource analysis integration within the annual report is still in formulation!

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 analyse. 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 sections have explicit connotation to NEPA requirements:

- Affected Environment – This section of the report 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); and provides for all available criteria pollutant monitoring data and geographically based national emissions inventory data. This section should be referenced to set the context for current conditions in the NEPA air resources analysis.
- Analysis Methods – This section describes 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; outlines the analysis methods used within the Annual Report to scale current cumulative development within the context of the applicable CARMMS scenario; demonstrates why scaling current report year emissions is a scientifically valid method for describing cumulative impacts; and provides graphs of the CARMMS high scenario emissions for various development and pollutant groups as well as plots of the modelled impacts for each CARMMS scenario. Additionally, this section includes a detailed description of the various tools the 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.
- Field Office & BLM Colorado Data – These sections provide details about the current and trending pace of oil and gas development; describe the interpretation of the available air resource metrics relative to the greatest impacts estimated for each area; discuss the CARMMS results of the modeled projection scenarios; and presents scaled source apportionment data from the applicable CARMMS scenario relative to the report year cumulative emissions from new federal authorizations. These sections should be referenced to set the current context and describe the potential (i.e. projected) NEPA cumulative impacts at Field Office and BLM Colorado (i.e. State wide) scales.
- Climate Data – This section describes Colorado's climate as summarized from the Western Regional Climate Center's data; outlines the science, metrics, and trends accounting for recent and projected climate change relative to future global emissions scenarios as summarized from the Intergovernmental Panel on Climate Change's (IPCC) Fifth Assessment Report (2015); discusses the anticipated human health effects associated with current and projected climate change; and explores estimates of various downstream combustion-related emissions from various federal and non-federal contributors relative to total U.S. and global emissions trends, as well as the projected RCP scenario emissions used to model and predict the future climatic changes associated with such emissions. This section should be referenced to provide support for greenhouse gas emissions intensities, any applicable climate change policy or analysis guidelines, and additional context to project-level NEPA assessments requiring analysis of greenhouse gases and/or climate impacts.

2.0 Affected Environment

Regulatory Drivers

The Clean Air Act (CAA) and the Federal Land Policy and Management Act of 1976 (FLPMA) require the BLM and other federal agencies to ensure actions taken by the agency comply with federal, state, tribal, and local air quality standards and regulations. FLPMA further directs the Secretary of the Interior to take any action necessary to prevent unnecessary or undue degradation of the lands [Section 302 (b)], and to manage the public lands "in a manner that will protect the quality of scientific, scenic, historical, ecological, environmental, air and atmospheric, water resource, and archeological values" [Section 102 (a)(8)]. The following lists and citations are not meant to be an exhaustive or comprehensive regulatory analysis for all oil, gas, and coal mining actions, but rather a foundation from which most typical actions will have some applicability.

Oil and Gas Regulations

Authority for regulating oil and gas activities in Colorado rests with four entities; 1) the Colorado Oil and Gas Conservation Commission (COGCC), 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 have to comply with the rules and regulations established for applicable activities and sources as defined and enforced by the COGCC, CDPHE and EPA.

The COGCC 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
  - III General Provisions
  - IV Storage of Highly Volatile Organic Compounds
  - V Disposal of Volatile Organic Compounds
  - VI Storage and Transfer of Petroleum Liquid
  - XII Volatile Organic Compound Emissions from Oil and Gas Operations
  - XVII (State Only, except Section XVII.E.3.a.) Statewide Controls for Oil and Gas Operations and Natural Gas-Fired Reciprocating Internal Combustion Engines
  - XVIII (State Only) Natural Gas-Actuated Pneumatic Controllers Associated with Oil and 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, including the Corporate Average Fuel Economy (CAFE) requirements.

Coal Mining Regulations

⚠ Coal resource analysis integration within the annual report is still in formulation!

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 stipulation types 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).

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.

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 general public has access. All criteria pollutants are directly emitted from a variety of source types, with the exception being ground-level ozone and the secondary formation of condensable particulate matter (secondary $PM_{2.5}$). Ozone is chemically formed in the atmosphere via interactions of oxides of nitrogen (NO_X) and volatile organic compounds (VOCs) in the presence of sunlight and under certain meteorological conditions. Secondary $PM_{2.5}$ forms when certain products of combustion cool sufficiently enough to condense and form a solid or aerosol that can then be measured via traditional particulate monitoring methods. The majority of oil and gas related emissions that can contribute to secondary PM formation include NO_X and SO_2 (via a reaction with ammonia in the presence of water to form ammonium nitrate or ammonium sulfate) and VOCs (which can react with ozone to form organic carbon).

The Clean Air Act (CAA) established two types of NAAQS:

Primary: Primary standards set limits to protect public health, including the health of "sensitive" populations (e.g. asthmatics, children, the elderly).

Secondary: 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.

Table 2-1 Ambient Air Quality Standards

Pollutant		Standard	Averaging Period	Level	Form
Carbon Monoxide		Primary	1-hour	35 ppm (40,000 µg/m^3)	Not to be exceeded more than once per year
			8-hour	9 ppm (10,000 µg/m^3)	
Lead		Primary and Secondary	Rolling 3-month average	0.15 µg/m^3	Not to be exceeded
Nitrogen Dioxide		Primary	1-hour	100 ppb (189 µg/m^3)	98th percentile, averaged over 3 years
		Primary and Secondary	Annual	53 ppb (100 µg/m^3)	Annual mean
Ozone		Primary and Secondary	8-hour	70 ppb (140 µg/m^3)	Annual fourth-highest daily maximum 8-hr concentration, averaged over 3 years
Particulate Matter	$PM_{2.5}$	Primary and secondary	24-hour	35 µg/m^3	98th percentile, averaged over 3 years
		Primary	Annual	12 µg/m^3	Annual mean, averaged over 3 years
		secondary	Annual	15 µg/m^3	Annual mean, averaged over 3 years
	PM_{10}	Primary and secondary	Annual	150 µg/m^3	Not to be exceeded more than once per year on average over 3 years
Sulfur Dioxide		Primary	1-hour	75 ppb (196 µg/m^3)	99th percentile of 1-hour daily maximum concentrations, averaged over 3 years
		Secondary	3-hour	0.5 ppm (1,300 µg/m^3)	Not to be exceeded more than once per year

Source: 40 CFR 50, 5 CCR 1001-14, µg/m3 = micrograms per cubic meter, ppb = parts per billion, ppm = parts per million, The Colorado Ambient Air Quality Standard for 3-hour SO_2 is 0.267 ppm (700 µg/m^3)

Ambient air quality (i.e. compliance with the NAAQS) is demonstrated by monitoring for 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. BLM Colorado currently sponsors three federal reference method compliant air quality stations, two stationary and one mobile station. These stations are located in the towns of Rangely, Meeker, and Paonia, though the mobile station was formerly located in Fairplay, Colorado from 2016 through 2018. The Interactive Element below summarizes all of the available monitoring data for criteria air pollutants of concern for the previous five years relative to the report year. Please note that the data excludes any records flagged as exceptional events, since they are not used in making NAAQS determinations. Click on chart data to drill down into trend and daily datasets.

Additional information on criteria pollutants, including emissions and modeling significance levels, can be found in the Colorado Modeling Guideline (CDPHE, 2018 - DRAFT). 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 of these documents are informative to the NEPA process, although not directly applicable.

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 to cause 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.

Table 2-2 Toxic Compound Thresholds

Pollutant	Reference Exposure Level (REL)	Reference Concentration (RfC)
Benzene	1,300	30
Toluene	37,000	400
Ethylbenzene	350,000	1,000
Xylenes	22,000	100
n-Hexane	390,000	200

Pollutant	Reference Exposure Level (REL)	Reference Concentration (RfC)
Formaldehyde	94	9.8

All units = ug/m3, REL = 1hr average, RfC = annual average

Airshed Classes and Prevention of Significant Deterioration

The overall health of any region's air quality is determined by monitoring for a pollutant at ground level and comparing the measured concentration to the pollutant's applicable design value. Areas where pollutant concentrations are below the standard are considered to be in attainment with the NAAQS. Areas currently designated as "nonattainment" violate a standard. Two additional subset categories of attainment exist for those areas where a formal designation has not been made: i.e. Attainment/Unclassifiable and Attainment/Maintenance. Attainment/Unclassifiable is generally assigned to rural or natural areas where no monitoring data exists, and Attainment/Maintenance is assigned to areas where previous violations of the NAAQS have been documented, but the pollutant concentration(s) no longer exceed the NAAQS design value(s).

Further, all geographical regions are assigned a priority Class (i.e. I, II, or III) which describes how much degradation to existing air quality is allowed to occur within the area under the Prevention of Significant Deterioration (PSD) permitting rules. Class I areas are areas of special national or regional natural, scenic, recreational, or historic value, and allow very little degradation in air quality, while Class II areas allow for reasonable industrial / economic expansion. There are currently no Class III areas defined in the U.S.

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 likely 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 oncentration 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 2-3 PSD Increments (ug/m^3)

Pollutant	Period	Class I	Class II
Nitrogen Dioxide	Annual	2.5	25
Sulfur Dioxide	3-hour	25	512
	24-hour	5	91
	Annual	2	20
Particulate Matter (< 10u)	24-hour	8	30
	Annual	4	17
Particulate Matter (< 2.5u)	24-hour	2	9
	Annual	1	4

Source: 40 CFR 51.166(c)

Air Quality Related Values

In addition to the NAAQS modeling required for PSD permitting, the PSD program also includes requirements for the assessment of a sources 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 assessing potential impacts to AQRVs are particularly 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 to ensure their goals for undue degradation to the resources are not impeded. 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).

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 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. 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 around 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 (FLAG 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 (see CARMMS and Report Year emissions inventories). Therefore sulfur deposition will not be discussed further in this report.

Visibility

Visibility impairment, or haze, is caused when sunlight encounters tiny pollution particles in the atmosphere and is either absorbed or scattered which reduces the clarity and color of what can be seen. Deciviews (dv) is a term used to express visibility quality. A change of one dv is approximately a 10% change in the light extinction coefficient (i.e. light that is scattered or absorbed and does not reach the observer), which is a small, but usually perceptible scenic change. Class I areas have legislative mandates to provide for natural visibility conditions such that visitors can experience a more pristine environment free from observable pollution effects. The ability of a pollutant to cause various degrees of visibility impacts is primarily a function of its physical size, chemical composition, and properties. Various visibility-impacting pollutant species have been monitored via the Interagency Monitoring of Protected Visual Environments (IMPROVE) network in many of the sensitive Class I areas around the country since the 1980s. The FLMs use a data analysis threshold (DAT) of 0.5 dv for projects that contribute to a visibility problem and a value of 1.0 dv for projects that cause visibility issues (see FLAG 2010 link above). IMPROVE data is available to the public on the Federal Land Manager Environmental Database (FED).

Ozone

Ozone affects sensitive vegetation and ecosystems, including forests, parks, wildlife refuges, and wilderness areas, and can especially cause damage during the growing season. Common effects on vegetation include reducing photosynthesis potential (i.e. slow plant growth), increasing sensitive plants' 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 as a whole, 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.

The impacts of ozone on trees, plants and ecosystems often is 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 (EPA 2014), which outlines the use of the W126 metric for assessing plant response to ground-level ozone. The EPA's assessment compiled the latest scientific evidence about impacts to vegetation, and found that for a W126 value of ≤ 7 ppm-hrs, tree seedling biomass loss is ≤ 2 % per year in sensitive species; and at ≥13 ppm-hrs, tree seedling biomass loss is 4–10 % per year in sensitive species. Not surprisingly, the NPS recommends a W126 of < 7 ppm-hrs to protect the most sensitive trees and vegetation. Benchmark W126 values between 7 and 13 warrant moderate concern, while values above 13 warrant significant concern (NPS 2017).

Nonattainment and General Conformity

If a nonattainment designation takes effect for any criteria pollutant, the State of Colorado would have 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.

Greenhouse Gases

Anthropogenic greenhouse gases (GHGs) are commonly emitted air pollutants that include carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), and several fluorinated species of gases such as hydrofluorocarbons, perfluorocarbons, and sulfur hexafluoride. Carbon dioxide is by far the most common and is emitted from the combustion of fossil fuels (i.e. oil, natural gas, and coal), solid waste, trees and wood products, and as a result of certain chemical reactions such as steam reforming for the production of hydrogen and calcination for the production of cement clinker. Methane is emitted during the production and transport of coal, natural gas, and oil. Methane also results from livestock and other agricultural practices and from the decay of organic waste in municipal solid waste landfills. Nitrous oxide is emitted during agricultural and industrial activities, as well as during combustion of fossil fuels and solid waste. Fluorinated gases are powerful greenhouse gases that are emitted from a variety of industrial processes and are often used as substitutes for ozone-depleting substances (i.e. chlorofluorocarbons, hydrochlorofluorocarbons, and halons), but are not typically associated with BLM authorized activities, and as such these GHG species will not be discussed further in this report.

Each of these gases can remain in the atmosphere for different lifetimes, ranging from a few years to thousands of years. As a result, these gases become well mixed such that their measurement in the atmosphere is roughly the same all over the world, regardless of the source or origin of the emissions. For this reason, the cumulative basis for analysis is the global emissions scope. Unlike other common air pollutants, the ecological impacts that are attributable to the greenhouse gases are not the result of localized or even regional emissions, but are entirely dependent on the collective behavior of the world's societies.

All of the different greenhouse gases have varying capacities to trap heat in the atmosphere, which are known as global warming potentials (GWPs). GWPs can be expressed for several different time horizons (i.e. near-term or further in the future) to fully account for the gases ability to absorb infrared radiation (heat) over their atmospheric lifetimes. The BLM uses the 100-year time interval for GWPs and most of the report metrics, since the majority of the climate change impacts derived from climate models are expressed toward the end of the century (i.e. 2100). Similarly, the climate models are often based on 100 year emissions projections, such that providing a 1 to 1 comparison of emissions relative to the cumulative emitted and modeled timeframe provides for a more meaningful and understandable analysis. Carbon dioxide has a GWP of 1, and so for the purposes of analysis, a GHG's GWP is generally standardized to a carbon dioxide equivalent (CO_2e), or the equivalent amount of CO_2 mass the GHG would represent. GWP values change over time, based on continued study and scientific understanding, and multiple citations exist where agencies and organizations may elect to specify one value over another for their own purposes (e.g. accounting, reporting). For the purposes of this report, the BLM uses the IPCC - AR5 values for methane (28 for the gas alone, and 36 with climate feedbacks), and the IPCC - AR4 value for nitrous oxide (298). These values were chosen because they represent the most conservative of the 100-year GWPs available for the pollutants of concern.

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.

The interactive element below can be used to view National Emissions Inventory (NEI) data for Colorado for the available years since 2008. The NEI is prepared by the states and the EPA every three years to fully account for all emissions generating sources / activities within the states (note: the NEI includes GHG data for only mobile sources and fires).

Interactive Element 2 - Colorado NEI Data

County	PM10	PM2.5	VOC	NOx	CO	SO2	CO2	CH4	N2O	HAPs

⚠ No data available

Source: EPA's NEI website

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, much of this data, including historical monitoring data, is available on an interactive map maintained by the EPA.

3.0 Analysis Methods and Tools

Background - Air 101

Air quality for any area is generally influenced by the amount of pollutants that are released within the vicinity and up wind 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, all of which are described above in the affected environment section for NAAQS, HAPs, and AQRVs.

In general, the 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.

Colorado Air Resource Management Modeling Study

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 fully 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 far more adaptive and defensive analysis posture versus a traditional one-off modeling approach performed for many discrete projects as was 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 contributes 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 ualitative and quantitative comparisons with emissions levels at the current tracked pace of development, which is how the data is 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 mine 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 was used to produce the 2015 Annual Report. The full CARMMS report can be found under the Quick Links on the BLM's website.

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. The 2.0 study leveraged the updated modeling platform derived from the Western Air Quality Study (WAQS) and the Intermountain West Data Warehouse (IWDW). The CARMMS 2.0 results were published in August 2017 and form the basis of analysis for the 2.0 Annual Report iterations.

The CARMMS study provides detailed results for the NAAQS pollutants of concern (PM_{10}, $PM_{2.5}$, NO_2, O_3), AQRVs (visibility, deposition, alpine lake acid neutralization capacity changes, ozone impacts to flora), and PSD Increment consumption (not a full regulatory increment analysis, for informational purposes only) at source apportioned and cumulative scales. The interactive element below provides a summarized account of this data, as well as scenario and assumption data, high scenario emissions, and various result plots. The results for all of BLM Colorado (i.e source group X) for both PSD and Acid Neutralization Capacity (ANC) do not show impacts above defined project-level analysis thresholds for any scenario. Thus, only the high scenario data is being shown in the data explorer to reduce unnecessary data calls. The SA Area Plots in the data explorer show the maximum modeled pollutant concentrations relative to the NAAQS, but do not necessarily reflect the maximum contributions to the maximum NAAQS values within the SA domain. The SA Area maximum contributions to area maximums are shown in the cumulative results for the available data sets.

Interactive Element 3 - CARMMS Data Explorer

○ SA Results ○ Cumulative Results ○ SA Emissions ○ SA Plots ○ Cumulative Plots

Annual Report

The Annual 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 itself provide an additional basis for developing authorization strategies that BLM Colorado can implement for subsequent tracking years, subject to management review and approval.

The report relies heavily on the CARMMS analysis and results to drive adaptive management implementation, which is wholly dependent on tracked conditions. External data sources are incorporated to assess current air resource conditions or trends, and total mineral development throughout Colorado. Annually, the BLM performs statistical analyses on the COGCC database to determine the total number of new and active wells, as well as the production related values from these wells. Production data from individual wells developed during the monitoring period are aggregated to provide for both the first year and cumulative production values relative to the totals reported to the COGCC. The first year fraction data is derived for each field office through county level surrogates or GIS intersects and is applied to federal production obtained from the ONNR database. The results of the first year and aggregated federal production data provide for the apportionment that would be considered applicable to the CARMMS modeled production projections at field office scales.

The development metrics (i.e. spuds, active well counts, production volumes) are then used as inputs for the CARMMS emissions calculators to estimate the report year emissions. 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. As the BLM moves forward with additional project level tool implementation (see EMIT below), surrogate data will be supplemented with project-specific variances considered as assumption in the study (e.g. engine hp, counts, op days, op hours, round trip miles). Overall, the aggregated ten year activity projections used in CARMMS will tend to smooth out most minor individual project variances. However, longer term trends in development, actual production declines for various formations or plays, and technology advances will need to be considered.

The BLM's preliminary analysis of the CARMMS results indicates that the correlation between emissions and impacts for each pollutant is fairly linear relative to each CARMMS analysis area (see Interactive Element below). The differences in the modeled results between the scenarios provide insight into how various emissions levels impact the atmosphere on a relative basis. For this report, the BLM will use the current report year's cumulative development emissions in each source apportionment or planning area to estimate comparable impacts derived from the CARMMS modeled results. Given the mostly linear relationship between emissions loading and impacts, it is reasonable to use current emissions as a surrogate for estimating impacts at the landscape scales that CARMMS analyzed. For each source apportionment or planning area, the BLM discloses the current metrics for oil and gas development, the associated emissions, and the resulting scaled impact estimates relative to the applicable high CARMMS scenario.

Interactive Element 4 - CARMMS 2.0 Pollutants (Emissions vs. Concentrations)

Ozone impacts are scaled based on the total combination of both NO_X and VOC emissions. For nitrogen deposition, we are using NOx as the surrogate. Scaling visibility impacts is not as straightforward. The new IMPROVE light extinction equation (shown below) has several pollutant terms, each with a unique coefficient that describes how the mass of the pollutant is expected to contribute to total visibility impairment. The majority of the terms are the result of atmospheric transformation (e.g. small and large Ammonium Sulfate and Nitrate, NO_2), specific emissions profiles (e.g. small and large Organic Mass, Fine Soil), or are emissions subsets that are not within the CARMMS scenario data sets (e.g. sea salt, elemental carbon).

$$b_{ext} \approx 2.2 \times f_S(RH) \times [\text{Small Ammonium Sulfate}] + 4.8 \times f_L(RH) \times [\text{Large Ammonium Sulfate}] + 2.4 \times f_S(RH) \times [\text{Small Ammonium Nitrate}] + 5.1 \times f_L(RH) \times [\text{Large Ammonium Nitrate}] + 2.8 \times [\text{Small Organic Mass}] + 6.1 \times [\text{Large Organic Mass}] + 10 \times [\text{Elemental Carbon}] + 1 \times [\text{Fine Soil}] + 1.7 \times f_{SS}(RH) \times [\text{Sea Salt}] + 0.6 \times [\text{Coarse Mass}] + \text{Rayleigh Scattering (Site Specific)} + 0.33 \times [NO_2\ (ppb)]$$

For scaling purposes, consideration of relative humidity (RH), sea salt, and Rayleigh Scattering can be excluded, as these factors are essentially static. Using Coarse Mass, Fine Soil (direct PM_{10} and $PM_{2.5}$ emissions), and NO_2 data seems unsuitable as a surrogate due to their low coefficients in the IMPROVE algorithm (0.6, 1, and 0.33 respectively). Sulfur is the next surrogate that is being eliminated since emissions are relatively low in terms of the total mass within the CARMMS data sets. Elemental Carbon is not delineated within the CARMMS data sets, but is likely small based on the typical relative fractions of 5 - 15% the pollutant makes up in terms of total $PM_{2.5}$, and so it is eliminated. The remaining terms, Nitrates and Organic Mass, have the largest coefficients combined and the greatest mass in terms of the CARMMS emissions profiles, and thus the BLM expects them to have the largest contribution to visibility impacts. Therefore, the report uses NO_X and VOC emissions as the surrogates to scale visibility impacts.

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 (summarized below). 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 inventories, 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) and the Colorado Emissions Tool. The EMIT (discussed below) is a next generation web application that will eventually replace the currently available Colorado Tool. The Colorado Tool was designed to be a "proof of concept - prototype" and, has little documentation. As such it is scheduled to be deprecated as soon as the EMIT is available to the public.

Analysis steps for an individual project

Please note, 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 (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 in excess of 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 rates of less than 2 tons per year. 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. 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 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 ensure 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 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 Federal impacts. The Gridded Emissions Impact Tool 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:** The above guidance is explicit to "traditional" air resource analyses, including NAAQS compliance, Toxics screening, and AQRV evaluations. The guidance does not apply to greenhouse gas disclosures and climate change analysis for which thresholds pertaining to analysis and significance levels have not yet been established. In general, BLM Colorado Air Resource Specialists recommend providing for ghg and climate change statistical disclosures whenever project specific NEPA is required.

Gridded Emissions / Impacts Tool

The Gridded Near-Field Assessment Tool was formulated based on the results of the CARMMS modeling study, specifically 2.0. The tool determines how much new federal and non-Federal oil and gas emissions were modeled in the CARMMS "project domain" (the 4km grid cell where the new proposed action would be located and the adjacent grid-cells, encompassing approximately a 10km radius from the proposed project) for all projected future emissions scenarios (i.e. low, medium, and high). The tool also 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. This data is useful for determining the relative contribution of federal oil and gas emissions to the cumulative concentrations modeled within the grid cells. Concentration data is 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 contribution to the site-specific 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. 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.

EMIT

The Emissions Modeling Impacts Tool (EMIT) is a user friendly 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 was 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 (DRAFT).

4.0 Field Office Data / Analysis

4.1 Colorado River Valley Field Office

The Colorado River Valley Field Office (CRVFO) is located in the Northwest District and is situated in the western central portion of the state. The 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 the Aspen Valley.

The RMP providing direction for CRVFO management actions was finalized in 2015. It 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. Management actions within the CRVFO to meet RMP goals and objectives include the following:

- During construction, reduce emissions of fugitive dust by requiring operators to implement watering a minimum of twice daily during dry conditions or the application of other dust suppressant agents at construction areas, including access roads used during construction. The authorized officer may direct the operator to change the level and type of dust abatement if the measures used are insufficient to prevent visible plumes of fugitive dust or deposition of excessive dust on nearby surfaces in conjunction with vehicular traffic, equipment operations or wind events. Require fugitive dust control plans in conjunction with oil and gas Master Development Plans (MDPs).
- Require that industrial operators use gravel (in combination with watering or other dust suppressant), chip-seal, asphalt, or other road-surfacing material to minimize fugitive dust emissions from BLM-authorized access roads, including “local” and “resource” roads, during long-term production and maintenance operations.
- Based on annual review necessitated by the CARPP and on the rate of development, require phased-in use of improved drilling and completion engines that meet or exceed Tier 4 nonroad diesel emission standards (40 C.F.R. 1039).
- Require that oil and gas operators use reduced-emission completion technologies (i.e., “green” completions) as defined in COGCC Rule 805 and the New Source Performance Standards for Crude Oil and Natural Gas Production at 40 CFR part 63, subpart OOOO for all wells on BLM lands and wells that access Federal minerals. An exemption may be granted on a case-by-case basis if the installation of necessary infrastructure is impracticable.
- Require flaring of natural gas during well completions that are exempted from green completion technology. Prohibit venting of natural gas except during emergency situations.
- Reduce emissions of VOCs and hazardous air pollutants associated with Federal oil and gas wells by requiring that operators achieve the minimum control required on glycol dehydrators and storage vessel and tank vents to comply with CDPHE Regulation Number 7, 5 CCR

1001-9, COGCC Rule 805, and the New Source Performance Standards for Crude Oil and Natural Gas Production at 40 C.F.R. part 63, subpart OOOO and NESHAPs for Oil and Natural Gas Production at 40 C.F.R. part 63, subparts HH and HHH.

- Require that Federal oil and gas developments use pipelines to transfer liquids to consolidated facilities, where feasible, to reduce truck haulage of liquids.
- Require natural gas-fired reciprocating internal combustion engines at BLM-authorized field compression facilities to comply with CDPHE Air Quality Control Commission Regulation No. 7, 5 CCR 1001-9 Section XVII.E.2 Emission Standards for New and Relocated engines, and Section XVII.E.3 for existing engines. Require compliance with applicable New Source Performance Standards and National Emission Standards for Hazardous Air Pollutants for all internal combustion engines.
- Powering centralized compression facilities with electricity may be required in the future based on the implementation of the CARPP, future availability of adequate electricity, and advances in compression technology.
- Manage air resources in accordance with the CARPP. Implement this adaptive management strategy for protecting air resources to include the management actions above, while monitoring air quality and tracking emissions for comparison against the most recent regional air quality model results to provide protection of air resources.

Air Quality Review

The CRVFO is split almost equally between CDPHE's Central Mountains and Western Slope air quality regions. The data for the regions show that Air quality within the CRVFO is designated as attainment and is in full compliance with the NAAQS for the report year; however, the Field Office does contain a PM_{10} Maintenance Area around the city of Aspen. There are two monitor locations within the CRVFO that provide monitoring for ozone (Rifle and Aspen) and one for particulate matter (Rifle).

A review of the available monitoring data for the district shows that all of the sites are in compliance with the NAAQS. The trends for all pollutants appear stable, with few notable exceptions. The area NO_2 monitors recorded not more than 26% of the 1 hour standard on a 3 year average basis (the form of the standard, not paired). For the annual average, the maximum monitor is trending near 10% of the NAAQS. No exceedances were recorded for either form of the NO_2 standard. The majority of area PM_{10} monitors are well below the NAAQS at approximately 35%. Area $PM_{2.5}$ monitors display a slight variance from site to site and year to year, particularly for the 24-hour standard. These monitors show the maximum annual and 24-hour standards trending around 55% and 70% of the of the NAAQS, respectively. Ozone monitors are typically recording 4th high values well above 60 ppb, where the highest 3 year average is approximately 64.6 ppb or 92% of the NAAQS. There were 3 ozone exceedances recorded in 2020, and overall the values are elevated compared to the previous year. Additional information on air quality trends within the CRVFO can be found in CDPHE's Air Quality Annual Reports.

There are three Class I areas partially contained or in close proximity to the CRVFO boundaries that could be potentially impacted by Federal oil and gas development: the Flat Tops, Eagles Nest, and Maroon Bells / Snowmass Wilderness areas. Potential AQRV concerns for these areas exist due to the possibility of relatively close development. Any actual proposed development will need a case-by-case analysis to determine the extent of the potential impacts beyond what CARMMS has already predicted for projected development in the area, as is true for any area.

NOTE: The AQRV datasets are currently limited to 2019 data. This section will be updated as the 2020 datsets become available.

Visibility monitoring near the CRVFO is limited to the Maroon Bells / Snowmass Wilderness areas. The Maroon Bells trend data (WHRI1) shows significant improvement over the monitoring period at -0.07 dv/yr and -0.14 dv/yr for the clearest days and haziest days, respectively, where the average values for these days are 0 dv and 7 dv.

There are three wet deposition monitors in the CRVFO located at Sunlight Peak (CO92), Four Mile Park (CO08), and Gothic, Colorado (CO10). The Gothic monitor is also co-located with a CASTNET monitor (GTH161), which is capable of measuring dry deposition flux rates. The Sunlight Peak trends show the average nitorgen deposition rate over the monitoring period is approximately 1.7 kg/ha-yr. The Four Mile monitor is located in close proximity to the Sunlight monitor but at a substantially lower elevation, and is recording increases in deposition rates over the monitoring period that max out at approximately 1.6 kg/ha-yr on average. The Gothic wet deposition trends appear relatively flat overall, at around 1.4 kg/ha-yr. Dry deposition appears to be slightly decreasing over the monitoring period, where the average is also approximately 1.3 kg/ha-yr. The wet and dry deposition combination brings the total deposition at the Gothic site to approximately 2.13 kg/ha-yr (the lowest recorded value in 20 years).

CARMMS Results

NAAQS - The maximum modeled source apportionment contributions (i.e. Federal) relative to any of the NAAQS pollutants of concern are shown in the table below. The table also displays the calculated effective mitigation rates relative to the high scenario as a percent reduction, based on the mitigated scenario results. The spatial extents and concentration gradients for the pollutants of concern for all scenarios are shown within the CARMMS Data Explorer (see SA Plots). It is important to remember that these maximums do not necessarily align, spatially or temporally, with the maximum modeled values within the CARMMS domain.

Table 4.1-1 Source Apportionment Results

Pollutants (standard)	Units	Low	Mitigated	High	Mitigation Rate (%)
PM10 (Annual)	ug/m3	1.1	1.3	2.4	45.8%

Pollutants (standard)	Units	Low	Mitigated	High	Mitigation Rate (%)
PM2.5 (24-hour)	ug/m3	0.5	0.6	1	40%
PM2.5 (Annual)	ug/m3	0.3	0.4	0.5	20%
NO2 (1-hour)	ppb	7.1	12.4	13.9	10.8%
NO2 (Annual)	ppb	2.9	4	4.9	18.4%
Ozone (4DM8A)	ppb	1.9	2.2	2.4	8.3%

All of the high scenario maximum values from cumulative projected development within the CRVFO are above the project level modeling SILs. As discussed in the cumulative BLM Colorado analysis section, there are no predicted exceedances of the NO_2 NAAQS anywhere in the CARMMS domain, excluding wildfire hotspots. Thus, the NO_2 contributions from the CRVFO are not significant in terms of NAAQS contribution levels. For all SIL-exceeding particulate matter species, the CRVFO maximum contributions grid cells intersect areas that are projected to easily comply with the NAAQS. The same is also true for ozone. The Model Attainment Test results show that the grid cells with the maximum ozone contributions are predicted to have future design values in the range of 65 to 70 ppb for the high development scenario.

AQRVs - The CARMMS visibility and deposition results for the CRVFO are shown in the scaled report year results tables below. The impacts to Class I area visibility are all well below the project-level DAT even for the high scenario at cumulative (i.e. aggregated source) scales. The maximum nitrogen deposition results indicate DAT exceedances for each CARMMS scenario. The high, mitigated, and low scenarios produced DAT exceedances at 6, 5, and 4 of the 26 Class I areas analyzed, respectively. The medium scenario produced an effective average mitigation rate of about 15.2% at DAT exceeded Class I areas. Potential impacts to acid lake neutralization capacity are well below the defined project level thresholds of analysis. See the CARMMs Data Explorer for all other analyzed Class I areas impacts resulting from projected CRVFO development.

Oil and Gas Development

The CRVFO was the second most actively developed area in Colorado in 2019, recording 191 well spuds of which 14 required federal approval. All of the development occured in the western portion of the field office, along the southern boarder of the Roan Plateau. Total production within the field office accounted for approximately 0.75% and 20% of the statewide total oil and gas production, respectively. COGCC data shows that active wells recorded production days for 89% of the year, and that 81% of these wells recorded oil volumes while 94% recorded gas volumes. In terms of total mineral production volumes in Colorado, the CRVFO region ranks 3rd overall for oil and gas production. The federal rankings relative to all of the field offices is shown in the table below.

Table 4.1-2 Oil and Gas Statistics

Development Map

Description	Federal	Cumulative	% Federal	FO Rank
New Wells (spuds)	14	191	7.33%	1
Active Wells	3,187	13,992	22.78%	1
Gas Production (Mcf)	188,658,253	463,158,144	40.73%	2
Liquids Production (bbl)	459,086	1,281,493	35.82%	3

Emissions Tracking

On a calendar year basis, 2020 represents 50% of the CARMMS emissions budget (assuming perfectly linear development / emissions ratios). In terms of idealized absolutes, none of the pollutants exceed the calendar year linear threshold relative to the high scenario and none are tracking above the levels analyzed by the low CARMMS scenario. The following section presents the report year tracking statistics and applicable scaled source apportionment parameters from CARMMS for the CRVFO.

Table 4.1-3 Report Year Oil and Gas Emissions

Description	PM_{10}	$PM_{2.5}$	VOC	NO_X	CO	SO_2	CO_2	CH_4	N_2O	HAPs
Existing (pre CARMMS)	136.716	69.386	3,801.848	1,239.047	975.178	2.005	732,978	21,070.145	12.677	505.562
New Federal	12.082	2.741	51.484	52.746	32.660	0.067	9,595	138.196	0.172	9.311
Per Well Average	0.863	0.196	3.677	3.768	2.333	0.005	685	9.871	0.012	0.665
Cumulative (Federal - SA)	29.971	14.788	662.906	384.952	233.677	0.940	99,996	2,242.000	1.468	118.857

Existing emissions (CARMMS 2015 base inventory year, declined), Cumulative - Source Apportioned (SA) emissions are tracked (since base year) to show relative to CARMMS model scenarios (below), GHGs do not include downstream (assumed combustion, shown in climate section below).

Figure 4.1-1 Relative Report Year Emissions

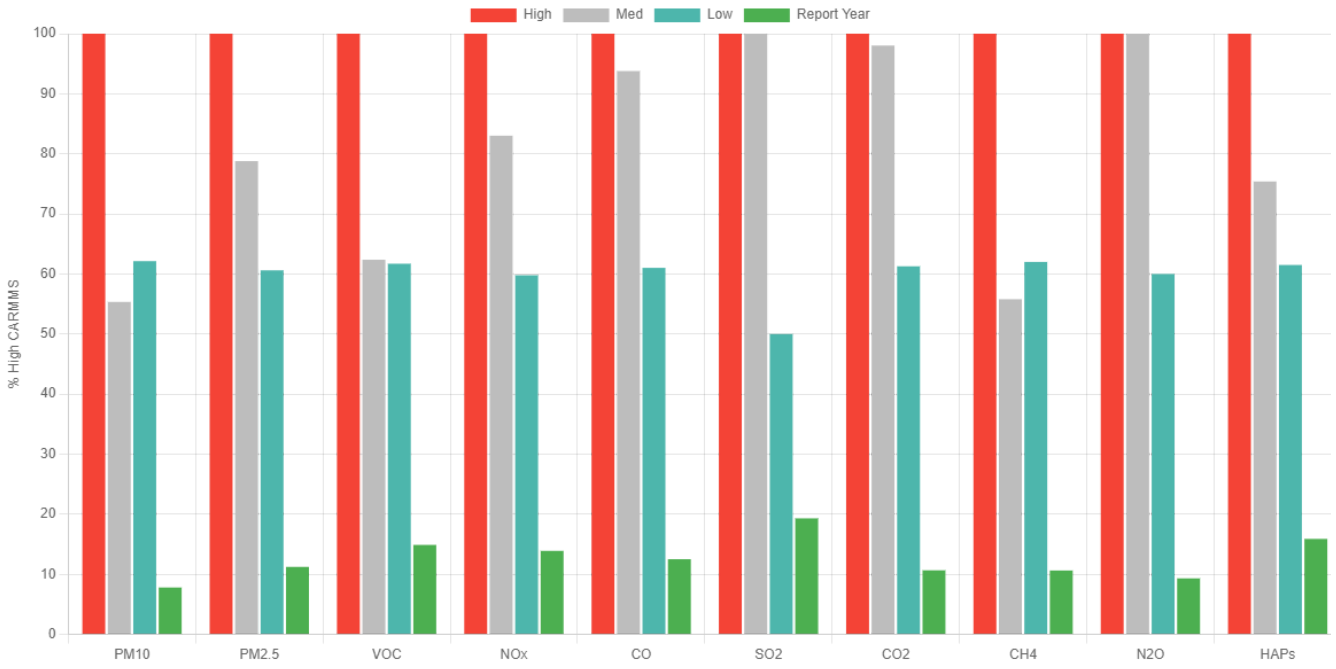

Table 4.1-4 Scaled NAAQS Analysis

Parameter	% High Scenario	Calculated RY NAAQS	% NAAQS	% SIL
PM10 (Annual)	7.81%	0.19 (ug/m3)	0.12%	18.73%
PM2.5 (24-hour)	11.24%	0.11 (ug/m3)	0.32%	9.37%
PM2.5 (Annual)	11.24%	0.06 (ug/m3)	0.47%	28.11%
NO2 (1-hour)	13.91%	1.93 (ppb)	1.93%	25.78%
NO2 (Annual)	13.91%	0.68 (ppb)	1.29%	68.16%
Ozone (4DM8A)	14.41%	0.35 (ppb)	0.49%	34.58%

Note: Table data based on source apportion results of high CARMMS scenario.

Table 4.1-5 Scaled Deposition Impacts (kg/ha-yr)

Scenario	Max Class I Impact	Class I % DAT	Class I Area	Max Class II Impact	Class II % DAT	Class II Area
Low	0.034	674%	Eagles_Nest_Wilderness	0.026	522%	Holy_Cross
Mitigated	0.051	1,028%	Eagles_Nest_Wilderness	0.040	798%	Holy_Cross
High	0.060	1,210%	Eagles_Nest_Wilderness	0.047	934%	Holy_Cross
Report Year	0.008	168%	Eagles_Nest_Wilderness	0.006	130%	Holy_Cross

Note: Low, Mitigated, and High data are actual CARMMS results (highest projected impact areas only, for full details see carmms section). Report Year data shows scaled impacts.

Table 4.1-6 Scaled Visibility Impacts (dv)

Scenario	Max Class I Impact	Days > 0.5dv	Days > 1.0dv	Class I Area	Max Class II Impact	Days > 0.5dv	Days > 1.0dv	Class II Area
Low	0.101	0	0	Black_Canyon	0.306	0	0	Colorado_NM
Mitigated	0.143	0	0	Black_Canyon	0.439	0	0	Colorado_NM
High	0.166	0	0	Black_Canyon	0.510	1	0	Colorado_NM
Report Year	0.024	0	0	Black_Canyon	0.074	0	0	Colorado_NM

Note: Low, Mitigated, and High data are actual CARMMS results (highest projected impact areas only, for full details see CARMMS section). Report Year data shows scaled impacts.

CRVFO Findings

The major air quality issue in the Northwest District appears to be potential projected deposition impacts. The spatial relationships between the district field offices and the proximate Class I areas, combined with the overall development potential contribute the most to projected nitrogen deposition impacts. The report year data shows that the current scaled source apportioned values for nitrogen deposition are exceeding the project level DAT at the Eagles Nest Wilderness, and also at the Flat Tops Wilderness Area (0.008 kg/ha-yr). The project level DAT is quite small relative to the cumulative deposition that was modeled for most Class I areas. Based on the CARMMS mitigation analysis and the current pace of development it is unlikely that the mitigation rates evaluated in CARMMS would be enough to offset the excess impacts of the report year impacts. There is no direct measurement of deposition at the Eagles Nest Wilderness, nor is the BLM aware of the actual critical load value for the area. Additionally, there are currently no defined aggregate analysis thresholds at full cumulative or sub-cumulative scales, and therefore it is presently not possible to assess the significance of the scaled model data other than to state that on a cumulative basis, the impacts are quite low. None of the calculated report year NAAQS contributions are above the project level SILs, save for the Annual NO_2 standard. Visibility impacts are not expected to exceed project level DAT thresholds until emissions reach the high scenario levels (Class II areas only). In general, air resource values in the CRVFO are meeting the objectives of the governing RMP and BLM's adaptive management strategy. No specific mitigation beyond that outlined in governing documents and the inherent project level analysis commitments that are part of BLM's review and approval process are required.

4.2 Grand Junction Field Office

The Grand Junction Field Office (GJFO) is administratively part of the BLM Colorado Southwest District. The GJFO manages 1.27 million surface acres of public land and almost 936 thousand acres of Federal fluid mineral estate. The Field Office in mostly contained in Mesa and Garfield counties, and includes the city Grand Junction, the largest metropolitan area on the western slope.

The RMP providing direction for the GJFO 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. Within the scope of the BLM's authority, the goals 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 (AQRVs) in Class I Airsheds affected by actions in the planning area. Management actions within the GJFO to meet RMP goals and objectives include the following:

- Develop COAs for project-specific, surface-disturbing activities to prevent BLM-permitted activities from causing or contributing to exceedances of ambient air quality standards or causing significant adverse impacts on air quality related values.
- Participate in, conduct, or require air modeling analyses as described in the CARPP. This is part of a comprehensive strategy to prevent BLM-permitted activities from causing or contributing to violations of ambient air quality standards or causing significant adverse impacts on air quality related values.
- Work cooperatively with local, State, and Federal agencies and tribal governments to enhance air monitoring efforts to provide a broader measure of spatially distributed air pollutant concentrations for the purposes of evaluating atmospheric conditions with respect to ambient air quality standards and air quality related values.
- Manage prescribed fire in accordance with the State of Colorado Department of Public Health and Environment Smoke Management Program and Regulation Number 9 (5 CCR 1001-11). The BLM will time prescribed burns during favorable meteorological conditions to minimize smoke impacts.
- Manage BLM-administered lands in a manner that protects the quality of air and atmospheric values as directed under the FLPMA.
- Implement the adaptive management strategy for protecting air resources to include the actions above project specific emissions for comparison against the most recent regional air quality model results to provide cumulative context for any analyzed contemporaneous development period, and providing an annual activity and air quality summary report of BLM activities as described in the CARPP.
- Minimize emissions, within the scope of the BLM's authority, from activities that cause or contribute to air quality impairment, visibility degradation, atmospheric deposition, or climate variability.
- Require all drilling and completion engines used on public lands or used to access federal minerals to be in conformance with information and guidance provided by the CARMMS modeling and CARPP protocol for engine type requirements.
- Require oil and gas operators to use reduced emission completion technology (i.e. "green" completion) as defined in COGCC Rule 805 and the New Source Performance Standards for Crude Oil and Natural Gas Production at 40 C.F.R. Part 63 Subpart OOOO at all wells on BLM-administered lands and wells that access Federal minerals. The BLM may grant an exemption on a case-by-case basis.
- Require flaring of natural gas during well completions that the BLM has exempted from green completion technology. Prohibit venting of natural gas except during emergency situations.
- Minimize emissions of greenhouse gases from BLM-authorized actions in accordance with State and Federal regulations, executive and secretarial orders, and BLM policy.
- Require proper road design, construction, and surfacing on BLM-authorized roads to reduce particulate matter emissions.

Air Quality Review

The GJFO is wholly contained within the 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. There are three monitor locations within the GJFO that provide monitoring for ozone (Palisade), carbon monoxide (Grand Junction) and particulate matter (Grand Junction and the Colorado National Monument).

A review of the available monitoring data for the district shows that all of the sites are in compliance with the NAAQS. The trends for all pollutants appear stable, with few notable exceptions. The area NO_2 monitors recorded not more than 26% of the 1 hour standard on a 3 year average basis (the form of the standard, not paired). For the annual average, the maximum monitor is trending near 10% of the NAAQS. No exceedances were recorded for either form of the NO_2 standard. The majority of area PM_{10} monitors are well below the NAAQS at approximately 35%. Area $PM_{2.5}$ monitors display a slight variance from site to site and year to year, particularly for the 24-hour standard. These monitors show the maximum annual and 24-hour standards trending around 55% and 70% of the of the NAAQS, respectively. Ozone monitors are typically recording 4th high values well above 60 ppb, where the highest 3 year average is approximately 66 ppb or 94% of the NAAQS. There were 3 ozone exceedances recorded in 2020, and overall the values are elevated compared to the previous year. Additional information on air quality trends within the GJFO can be found in CDPHE's Air Quality Annual Reports.

There are two Class I areas partially contained or in close proximity to the GJFO boundaries that could be potentially impacted by Federal oil and gas development: Maroon Bells / Snowmass Wilderness area and the Colorado National Monument. Note that the Colorado NM is Class I for SO_2 increment protections only (i.e. State only). Potential AQRV concerns for these areas exist due to the possibility of relatively close development. Any actual proposed development will need a case-by-case analysis to determine the extent of the potential impacts beyond what CARMMS has already predicted for projected development in the area, as is true for any area.

NOTE: The AQRV datasets are currently limited to 2019 data. This section will be updated as the 2020 datsets become available.

AQRV visibility monitoring near the GJFO is limited to the Maroon Bells / Snowmass Wilderness areas. The Maroon Bells trend data (WHRI1) shows significant improvement over the monitoring period at -0.07 dv/yr and -0.14 dv/yr for the clearest days and haziest days, respectively, where the average values for these days are 0 dv and 7 dv.

There are no deposition monitors in the GJFO.

CARMMS Results

NAAQS - The maximum modeled source apportionment contributions (i.e. Federal) relative to any of the NAAQS pollutants of concern are shown in the table below. The table also displays the calculated effective mitigation rates relative to the high scenario as a percent reduction, based on the mitigated scenario results. The spatial extents and concentration gradients for the pollutants of concern for all scenarios are shown within the CARMMS Data Explorer (see SA Plots). It is important to remember that these maximums do not necessarily align, spatially or temporally, with the maximum modeled values within the CARMMS domain.

Table 4.2-1 Source Apportionment Results

Pollutants (standard)	Units	Low	Mitigated	High	Mitigation Rate (%)
PM10 (Annual)	ug/m3	0.2	5	15.4	67.5%
PM2.5 (24-hour)	ug/m3	0	0.9	2.6	65.4%
PM2.5 (Annual)	ug/m3	0	0.6	1.2	50%
NO2 (1-hour)	ppb	1.8	21.9	27.6	20.7%
NO2 (Annual)	ppb	0.5	5.9	7.2	18.1%
Ozone (4DM8A)	ppb	0.2	3.2	3.8	15.8%

All high scenario maximum contribution values from the projected development within the GJFO are above the project level modeling SILs. As discussed in the cumulative BLM Colorado analysis section, there are no predicted exceedances of the NO_2 NAAQS anywhere in the CARMMS domain, excluding wildfire hotspots. Thus, the NO_2 contributions from the GJFO are not significant in terms of a cumulative NAAQS compliance assessment. The 2025 results for PM_{10} do show concentrations in excess of the NAAQS within the GJFO, and it does appear that the Field Office's contributions are above the SIL in overlapping grid cells. The CARMMS model also produced an exceedance of the PM_{10} NAAQS in the base year in multiple areas, which is not supported by the available monitoring data. The data suggest the model results are biased high and could be considered conservative at face value. Given the potential model bias and the fact that the contributions to the modeled PM_{10} exceedance (1 to 2 $\mu g/m^3$) are barely above the SIL (1 $\mu g/m^3$), it is unlikely that the projected development in the GJFO would contribute significantly to a PM_{10} NAAQS exceedance. All of the projected SIL exceeding $PM_{2.5}$ grid cells intersect areas that are projected to easily comply with the NAAQS for both the 24-hour and annual standards; thus, the $PM_{2.5}$ contributions are not significant in terms of a cumulative NAAQS compliance assessment. With respect to ozone, the Model Attainment Test results show that the grid cells with the maximum ozone contributions are predicted to have future design values in the range of 65 to 70 ppb for the high development scenario. Therefore, the SIL exceedances are not significant in terms of a cumulative NAAQS compliance assessment.

AQRVs - The CARMMS visibility and deposition results for the GJFO are shown in the scaled report year results tables below. The impacts to Class I area visibility are all below the project level DAT even for the high scenario at cumulative (i.e. aggregated source) scales. The maximum nitrogen deposition results indicate DAT exceedances for the high and mitigated CARMMS scenarios. Each scenario produced DAT exceedances at 12 of the 26 Class I areas analyzed. The medium scenario produced an effective average mitigation rate of about 19% at DAT exceeded Class I areas; however, it did not reduce the number of impacted areas overall. Potential impacts to acid lake neutralization capacity are well below the defined project level thresholds of analysis. See the CARMMs Data Explorer for all other analyzed Class I areas impacts resulting from projected GJFO development.

Oil and Gas Development

Federal oil and gas development in the GJFO was non-existent compared to the previous year, with the region recording just 2 new well spuds in 2020. Total production within the Field Office accounted for approximately 0.05% and 1.91% of the statewide total oil and gas production, respectively. COGCC data shows that active wells recorded production days for 82% of the year, and that 70% of these wells recorded oil volumes while 89% recorded gas volumes. In terms of total mineral production volumes in Colorado, the GJFO ranks 6th and 4th for oil and gas production. The federal rankings relative to all of the field offices is shown in the table below.

Table 4.2-2 Oil and Gas Statistics

Development Map

Description	Federal	Cumulative	% Federal	FO Rank
New Wells (spuds)	0	2	0.00%	4
Active Wells	432	2,041	21.17%	4
Gas Production (Mcf)	15,670,167	43,833,152	35.75%	5
Liquids Production (bbl)	29,250	92,177	31.73%	7

Emissions Tracking

On a calendar year basis, 2020 represents 50% of the CARMMS emissions budget (assuming perfectly linear development / emissions ratios). In terms of idealized absolutes, none of the pollutants are tracking above the linear threshold relative to the high scenario. Almost all of the pollutants are now exceeding the levels analyzed by the low CARMMS scenario. The following section presents the report year tracking statistics and applicable scaled source apportionment parameters from CARMMS for the GJFO.

Table 4.2-3 Report Year Oil and Gas Emissions

Description	PM_{10}	$PM_{2.5}$	VOC	NO_X	CO	SO_2	CO_2	CH_4	N_2O	HAPs
Existing (pre CARMMS)	43.711	26.422	615.834	493.628	433.672	0.964	248,238	3,401.101	4.620	54.593
New Federal	0.000	0.000	0.000	0.000	0.000	0.000	0	0.000	0.000	0.000
Per Well Average	0.000	0.000	0.000	0.000	0.000	0.000	0	0.000	0.000	0.000
Cumulative (Federal - SA)	4.826	3.914	159.742	136.853	100.194	0.533	33,009	573.739	0.490	22.274

Existing emissions (CARMMS 2015 base inventory year, declined), Cumulative - Source Apportioned (SA) emissions are tracked (since base year) to show relative to CARMMS model scenarios (below), GHGs do not include downstream (assumed combustion, shown in climate section below).

Figure 3 - Relative Report Year Emissions

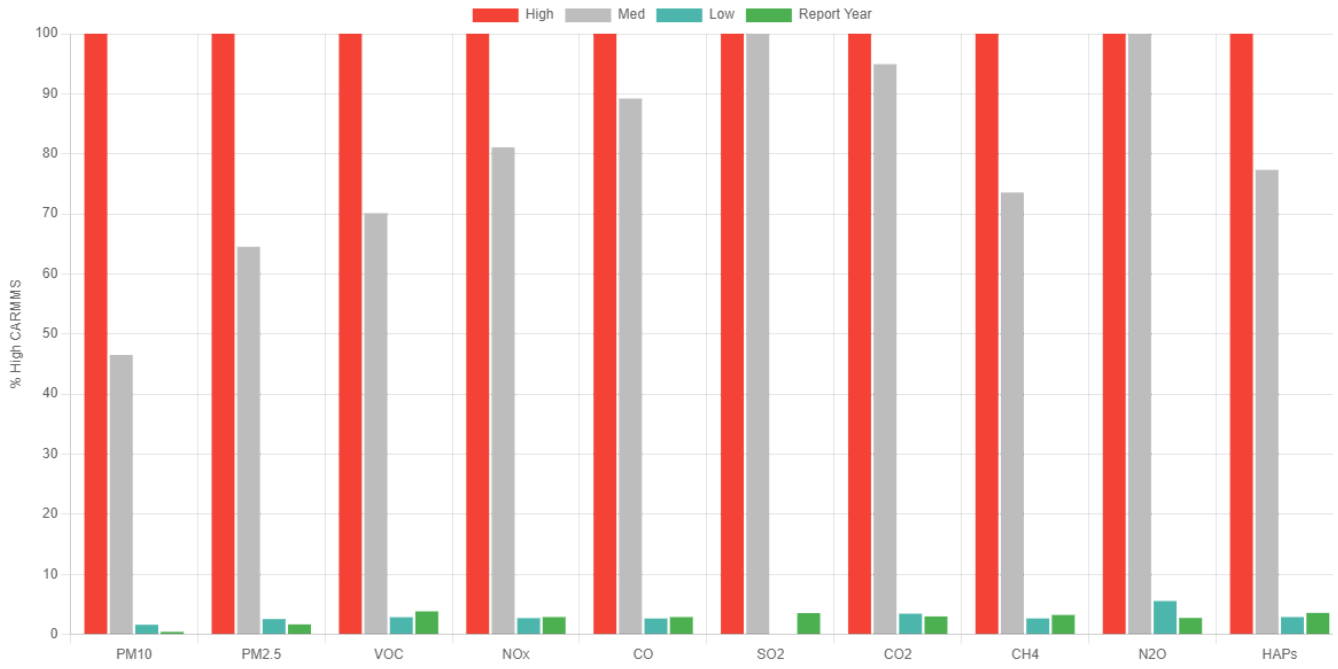

Table 4.2-4 Scaled NAAQS Analysis

Parameter	% High Scenario	Calculated RY NAAQS	% NAAQS	% SIL
PM10 (Annual)	0.43%	0.07 (ug/m3)	0.04%	6.63%
PM2.5 (24-hour)	1.67%	0.04 (ug/m3)	0.12%	3.62%
PM2.5 (Annual)	1.67%	0.02 (ug/m3)	0.17%	10.03%
NO2 (1-hour)	2.89%	0.80 (ppb)	0.80%	10.65%
NO2 (Annual)	2.89%	0.21 (ppb)	0.39%	20.83%
Ozone (4DM8A)	3.36%	0.13 (ppb)	0.18%	12.78%

Note: Table data based on source apportion results of high CARMMS scenario.

Table 4.2-5 - Scaled Deposition Impacts (kg/ha-yr)

Scenario	Max Class I Impact	Class I % DAT	Class I Area	Max Class II Impact	Class II % DAT	Class II Area
Low	0.003	50%	Flat_Tops_Wilderness	0.002	44%	Colorado_NM
Mitigated	0.042	840%	Flat_Tops_Wilderness	0.040	806%	Colorado_NM
High	0.052	1,034%	Flat_Tops_Wilderness	0.050	1,006%	Colorado_NM
Report Year	0.001	30%	Flat_Tops_Wilderness	0.001	29%	Colorado_NM

Note: Low, Mitigated, and High data are actual CARMMS results (highest projected impact areas only, for full details see carmms section). Report Year data shows scaled impacts.

Table 4.2-6 - Scaled Visibility Impacts (dv)

Scenario	Max Class I Impact	Days > 0.5dv	Days > 1.0dv	Class I Area	Max Class II Impact	Days > 0.5dv	Days > 1.0dv	Class II Area
Low	0.025	0	0	Arches_NP	0.069	0	0	Colorado_NM
Mitigated	0.397	0	0	Arches_NP	1.060	0	0	Colorado_NM
High	0.490	0	0	Arches_NP	1.299	6	1	Colorado_NM
Report Year	0.016	0	0	Arches_NP	0.044	0	0	Colorado_NM

Note: Low, Mitigated, and High data are actual CARMMS results (highest projected impact areas only, for full details see CARMMS section). Report Year data shows scaled impacts.

GJFO Findings

The major air quality issue in the Southwest District appears to be the elevated levels of ozone which are precipitously close to the level of the NAAQS. In the GJFO, the issue is not as pronounced as Mesa County monitors show three year averages hovering around 65 ppb, and is more in line with the Northwest District average values. Further the last five years of data for the county show no ozone exceedances have occured. The report year data shows emissions are tracking mostly above the low scenario levels for all pollutant species. Only the PM_{10} calculated report year NAAQS contributions are above the project level SIL, however there are no modeled source apportioned excedances at the field office or cumulative scales and thus the SIL exceedance is not significant.

Visibility impacts are not expected to exceed project level DAT thresholds until emissions reach the high scenario levels. Deposition impacts are roughly half the DAT at the highest impacted area for the report year and are roughly equivalent to the low scenario values overall.

In general, air resource values are meeting the objectives of the governing RMP and BLM's adaptive management strategy. No specific mitigation beyond that outlined in governing documents and the inherent project level analysis commitments that are part of BLM's review and approval process are required.

4.3 Kremmling Field Office

The Kremmling Field Office (KFO) is comprised of the North Park, Middle Park, and Laramie River Valley regions of Colorado and has a varied landscape that ranges from open sagebrush plain to 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 Field Office 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. Within the scope of the BLM's authority, the goals 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 (AQRVs) in Class I Airsheds affected by actions in the planning area. BLM management actions within the KFO to meet RMP goals and objectives include the following:

- Implement environmental protection measures as Conditions of Approval (COA) above and beyond current regulatory compliance requirements for any plan or project, where such conditions are validated or deemed necessary through an appropriate analysis of the applicable extenuating circumstances.
- Mitigate air quality violations or issues on BLM-managed public lands identified through monitoring sources.
- Require all new and existing drill-rig engines to meet EPA Tier 2 nonroad diesel engine emission standards or cleaner emission standards.
- Require Operators, as a COA, to implement dust abatement measures, as needed, in order to prevent at least 50% fugitive dust from vehicular traffic, equipment operations, or wind events.
- Require oil and gas operators to install stationary source engines that comply with the applicable standards referenced or found in CDPHE AQCC Regulations No. 6 (NSPS IIII or JJJJ) or Regulation No. 7.
- Require flaring of natural gas during well completions that do not use green completion technology. Emergency situations or where the need for direct venting can be documented on a legal or technical basis shall be considered exempt from the flaring requirement.
- Reduce emissions of VOCs and hazardous air pollutants associated with Federal oil and gas wells by requiring that operators achieve the minimum control required on glycol dehydrators and storage vessel and tank vents to comply with CDPHE Regulation Number 7, 5 CCR 1001-9, COGCC Rule 805, and the New Source Performance Standards for Crude Oil and Natural Gas Production at 40 C.F.R. Part 63 subpart OOOO and NESHAPs for Oil and Natural Gas Production at 40 C.F.R. Part 63 subparts HH and HHH.
- Cooperate with the CDPHE to identify monitoring needs, as well as monitoring installation and operation.

Air Quality Review

Air quality within the KFO is designated as attainment, and the area is also free of any maintenance areas. The Field Office is mostly contained within the CDPHE's Central Mountains air quality region, but it also spans into the far northwestern flank of the Denver Metro - Northern Front Range region. There are no active air quality monitors operating within the KFO, but historically there have been a variety of monitors (O_3, CO, PM_{10}, and SO_2) deployed within the Field Office's boundary or on its peripherals to gather data on pollutant concentrations. It is likely that the monitors were discontinued due to low recorded data values. Of note, the Field Office maintains the capacity to deploy particulate monitoring equipment for projects that warrant such action.

A review of the available monitoring data for the district shows that all of the sites are in compliance with the NAAQS. **Note:** there are no monitors located within the KFO field office boundaries. The trends for all pollutants appear stable, with few notable exceptions. The area NO_2 monitors recorded not more than 26% of the 1 hour standard on a 3 year average basis (the form of the standard, not paired). For the annual average, the maximum monitor is trending near 10% of the NAAQS. No exceedances were recorded for either form of the NO_2 standard. The majority of area PM_{10} monitors are well below the NAAQS at approximately 35%. Area $PM_{2.5}$ monitors display a slight variance from site to site and year to year, particularly for the 24-hour standard. These monitors show the maximum annual and 24-hour standards trending around 55% and 70% of the of the NAAQS, respectively. Ozone monitors are typically recording 4th high values well above 60 ppb, where the highest 3 year average is approximately 64.6 ppb or 92% of the NAAQS. There were 3 ozone exceedances recorded in 2020, and overall the values are

elevated compared to the previous year. Additional information on air quality trends within the KFO can be found in CDPHE's Air Quality Annual Reports.

There are four Class I areas partially contained or in close proximity to the KFO boundaries that could be potentially impacted by Federal oil and gas development: the Eagles Nest Wilderness (located near the southern boundary of the KFO, straddling Eagle and Summit counties in the White River National Forest), Rawah Wilderness (located east of the KFO in Larimer County in the Roosevelt National Forest), Mount Zirkel Wilderness (located on the northwest side of the Field Office, straddling Routt and Jackson counties in the Routt National Forest), and Rocky Mountain National Park (located on the eastern flank of the Field Office in Grand, Larimer and Boulder counties, and is also contained in the Roosevelt National Forest). Potential AQRV concerns for these areas exist due to the possibility of relatively close development. Any actual proposed development will need a case-by-case analysis to determine the extent of the potential impacts beyond what CARMMS has already predicted for projected development in the area, as is true for any area.

NOTE: The AQRV datasets are currently limited to 2019 data. This section will be updated as the 2020 datsets become available.

Of all the Class I areas in close proximity to the KFO, only Rocky Mountain NP and the Mount Zirkel Wilderness area have visibility monitoring. The available IMPROVE visibility monitoring data at Rocky Mountain National Park (ROMO1) shows a significant positive trending improvement of -0.09 dv/yr for the clearest days, and -0.07 dv/yr on the haziest days over the monitoring period. Similar conditions exist at Mount Zirkel, where monitoring data (MOZI1) shows a significant positive trending improvement of -0.12 dv/yr for the clearest days, and -0.1 dv/yr on the haziest days over the monitoring period.

Rocky Mountain NP and Mount Zirkel are also the only areas with any deposition monitoring. The available data at Rocky Mountain NP (ROM406) shows that wet deposition species are in decline, while the dry species appear to be flat on average. Total nitrogen deposition for 2019 was approximately 4.6 kg/ha-yr, which is above the critical load for sensitive species, but the lowest level recorded in 20 years. The Mt. Zirkel Wilderness area has two NADP wet chemestry monitors located on Buffalo Pass (Summit Lake - CO97). Over the last decade the Summit Lake data appears relatively stable (slight decline) where the range of wet deposition spans from approximately 2.0 to 3.0 kg/ha-yr.

CARMMS Results

NAAQS - The maximum modeled source apportionment contributions (i.e. Federal) relative to any of the NAAQS pollutants of concern are shown in the table below. The table also displays the calculated effective mitigation rates relative to the high scenario as a percent reduction, based on the mitigated scenario results. The spatial extents and concentration gradients for the pollutants of concern for all scenarios are shown within the CARMMS Data Explorer (see SA Plots). It is important to remember that these maximums do not necessarily align, spatially or temporally, with the maximum modeled values within the CARMMS domain.

Table 4.3-1 - Source Apportionment Results

Pollutants (standard)	Units	Low	Mitigated	High	Mitigation Rate (%)
PM10 (Annual)	ug/m3	0	0.2	0.6	66.7%
PM2.5 (24-hour)	ug/m3	0	0.08	0.11	27.3%
PM2.5 (Annual)	ug/m3	0	0.06	0.1	40%
NO2 (1-hour)	ppb	0.6	5.6	5.6	0%
NO2 (Annual)	ppb	0.1	1.1	1.1	0%
Ozone (4DM8A)	ppb	0	0.1	0.1	0%

The only high scenario maximum contribution value from the projected development within the KFO that is above the project level modeling SIL was for the annual NO_2 contribution. As discussed in the cumulative BLM Colorado analysis section, there are no predicted exceedances of the NO_2 NAAQS anywhere in the CARMMS domain, excluding wildfire hotspots. Thus, the NO_2 contributions from the KFO are not significant in terms of a cumulative NAAQS compliance assessment.

AQRVs - The CARMMS visibility and deposition results for the KFO are shown in the scaled report year results tables below. The impacts to Class I area visibility are all below the project level DAT even for the high scenario at cumulative (i.e. aggregated source) scales. The maximum nitrogen deposition results indicate a DAT exceedance for the high CARMMS scenarios at the Rawah Wilderness area. No other Class I areas are impacted at rates above the project level DAT. The medium scenario produced an effective mitigation rate of about 34% at the Rawah Wilderness. Potential impacts to acid lake neutralization capacity are well below the defined project level thresholds of analysis. See the CARMMs Data Explorer for all other analyzed Class I areas impacts resulting from projected KFO development.

Oil and Gas Development

There has been just 6 federal oil and gas wells developed in the KFO over the monitoring period. Non-federal development has been light, recording no new wells in 2020. Total production volumes of oil and gas are quite low, just 0.67% and 0.05% of the 2020 statewide totals, respectively. COGCC data shows that active wells recorded production days for 64% of the year, and that 77% of these wells recorded oil volumes while 33% recorded gas volumes. In terms of total mineral production volumes in Colorado, the KFO ranks 4th and 8th for oil and gas production in 2020. The federal rankings relative to all of the field offices is shown in the table below.

Table 4.3-2 - Oil and Gas Statistics

Development Map

Description	Federal	Cumulative	% Federal	FO Rank
New Wells (spuds)	0	0	0.00%	4
Active Wells	92	181	50.83%	7
Gas Production (Mcf)	73,329	1,196,638	6.13%	8
Liquids Production (bbl)	110,452	1,153,927	9.57%	5

Emissions Tracking

On a calendar year basis, 2020 represents 50% of the CARMMS emissions budget (assuming perfectly linear development / emissions ratios). No federal development has occurred in the Field Office over the last year. However, the tracking data shows that new wells are driving overall production at the field office scales, and this is having an inflationary effect on federal source apportionment tracking that is probably an artifact of the statistic vs. and actual leap in federal well productivity. Thus the emissions shown for KFO are likely over an overestimate given the actual low levels of development (none in the last three years). The following section presents the report year tracking statistics and applicable scaled source apportionment parameters from CARMMS for the KFO.

Table 4.3-3 - Report Year Oil and Gas Emissions

Description	PM_{10}	$PM_{2.5}$	VOC	NO_X	CO	SO_2	CO_2	CH_4	N_2O	HAPs
Existing (pre CARMMS)	11.563	3.084	49.227	35.846	33.438	0.023	21,998	293.684	0.417	2.720
New Federal	0.000	0.000	0.000	0.000	0.000	0.000	0	0.000	0.000	0.000
Per Well Average	0.000	0.000	0.000	0.000	0.000	0.000	0	0.000	0.000	0.000
Cumulative (Federal - SA)	0.903	0.315	45.508	198.920	13.913	0.008	14,932	68.383	0.057	11.843

Existing emissions (CARMMS 2015 base inventory year, declined), Cumulative - Source Apportioned (SA) emissions are tracked (since base year) to show relative to CARMMS model scenarios (below), GHGs do not include downstream (assumed combustion, shown in climate section below).

Figure 3 - Relative Report Year Emissions

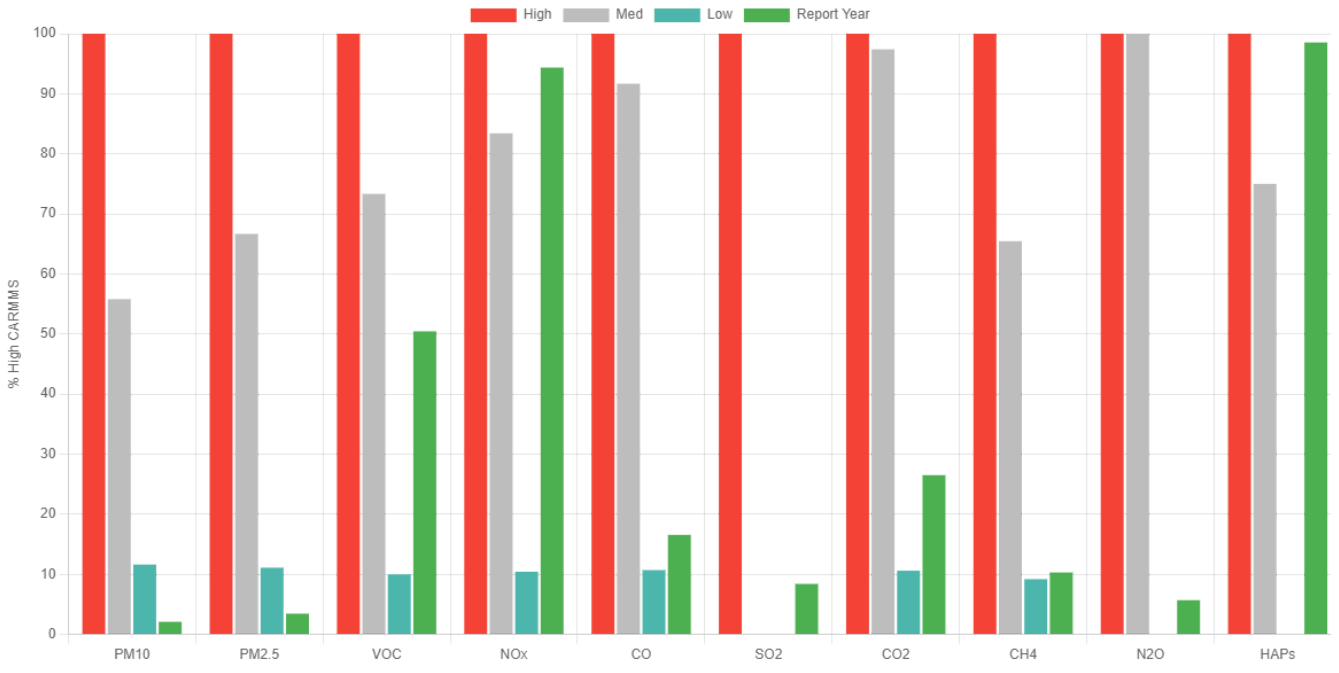

Table 4.3-4 - Scaled NAAQS Analysis

Parameter	% High Scenario	Calculated RY NAAQS	% NAAQS	% SIL
PM10 (Annual)	2.10%	0.01 (ug/m3)	0.01%	1.26%
PM2.5 (24-hour)	3.46%	0.00 (ug/m3)	0.01%	0.32%

Parameter	% High Scenario	Calculated RY NAAQS	% NAAQS	% SIL
PM2.5 (Annual)	3.46%	0.00 (ug/m3)	0.03%	1.73%
NO2 (1-hour)	94.36%	5.28 (ppb)	5.28%	70.45%
NO2 (Annual)	94.36%	1.04 (ppb)	1.96%	103.79%
Ozone (4DM8A)	72.40%	0.07 (ppb)	0.10%	7.24%

Note: Table data based on source apportion results of high CARMMS scenario.

Table 4.3-5 - Scaled Deposition Impacts (kg/ha-yr)

Scenario	Max Class I Impact	Class I % DAT	Class I Area	Max Class II Impact	Class II % DAT	Class II Area
Low	0.001	14%	Rawah	0.000	6%	Mount_Evans
Mitigated	0.005	92%	Rawah	0.003	52%	Mount_Evans
High	0.007	140%	Rawah	0.003	52%	Mount_Evans
Report Year	0.007	132%	Rawah_Wilderness	0.002	49%	Mount_Evans

Note: Low, Mitigated, and High data are actual CARMMS results (highest projected impact areas only, for full details see carmms section). Report Year data shows scaled impacts.

Table 4.3-6 - Scaled Visibility Impacts (dv)

Scenario	Max Class I Impact	Days > 0.5dv	Days > 1.0dv	Class I Area	Max Class II Impact	Days > 0.5dv	Days > 1.0dv	Class II Area
Low	0.005	0	0	CI_Rawah	0.003	0	0	CII_Savage_Run
Mitigated	0.034	0	0	CI_Rawah	0.017	0	0	CII_Savage_Run
High	0.402	0	0	CI_Rawah	0.026	0	0	CII_Savage_Run
Report Year	0.029	0	0	Rawah_Wilderness	0.019	0	0	Savage_Run

Note: Low, Mitigated, and High data are actual CARMMS results (highest projected impact areas only, for full details see CARMMS section). Report Year data shows scaled impacts.

KFO Findings

The pace of federal oil and gas development in the KFO field office has been quite low. No new federal oil and gas development has occurred in the KFO during the last three years and just 6 federal wells have been developed over the monitoring period. However, the methods used by BLM to track source apportionment emissions (county level well tracking) is skewing the federal production to appear as though it's resulting from the 6 wells vs. the 92 active wells BLM shows for KFO. The skewed tracking is very likely overestimating the source apportionment emissions for the KFO as well as inflating the calculated values for the tracked NAAQS and AQRV parameters. It is very unlikely the the level of federal development in the KFO would result in a SIL exceedance for the annual NO2 standard.

4.4 Little Snake Field Office

The Little Snake Field Office (LSFO) is located 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 White River Field Office and Routt and White River National Forests, 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 Field Office include the towns of Craig and Steamboat Springs.

The RMP providing direction for the LSFO management actions was finalized in 2007 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. Management actions within the LSFO to meet RMP goals and objectives include the following:

- Encourage the use of Best management practices (BMPs) to mitigate air quality impacts from oil and gas operations.

Air Quality Review

The LSFO is mostly contained within the CDPHE's Western Slope air quality region, but it also extends into the Central Mountains region on the eastern flank of the Field Office boundary. The available air quality data within the LSFO shows 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. There are two air quality monitoring stations

within the LSFO. The first monitors for PM_{10} and is located in the town of Steamboat springs (Routt County - 81070003), and the other monitors O_3 and is located in Elk Springs (Moffat County - 80810003).

A review of the available monitoring data for the district shows that all of the sites are in compliance with the NAAQS. The trends for all pollutants appear stable, with few notable exceptions. The area NO_2 monitors recorded not more than 26% of the 1 hour standard on a 3 year average basis (the form of the standard, not paired). For the annual average, the maximum monitor is trending near 10% of the NAAQS. No exceedances were recorded for either form of the NO_2 standard. The majority of area PM_{10} monitors are well below the NAAQS at approximately 35%. Area $PM_{2.5}$ monitors display a slight variance from site to site and year to year, particularly for the 24-hour standard. These monitors show the maximum annual and 24-hour standards trending around 55% and 70% of the of the NAAQS, respectively. Ozone monitors are typically recording 4th high values well above 60 ppb, where the highest 3 year average is approximately 64.6 ppb or 92% of the NAAQS. There were 3 ozone exceedances recorded in 2020, and overall the values are elevated compared to the previous year. Additional information on air quality trends within the LSFO can be found in CDPHE's Air Quality Annual Reports.

There are three Class I areas partially contained or in close proximity to the LSFO boundaries that could be potentially impacted by federal oil and gas development: Mount Zirkel Wilderness Area (located to the east of the Field Office), the Flat Tops Wilderness Area on the southern border, and the Dinosaur National Monument on the southwest edge of the LSFO. Potential AQRV concerns for these areas exist due to the possibility of relatively close development. We note that the Dinosaur National Monument is a State Class I area only, and only for sulfur dioxide impacts. Any actual proposed development will need a case-by-case analysis to determine the extent of the potential impacts beyond what CARMMS has already predicted for projected development in the area, as is true for any area.

NOTE: The AQRV datasets are currently limited to 2019 data. This section will be updated as the 2020 datsets become available.

AQRV visibility monitoring is limited to the Flat Tops and Mt. Zirkel Wilderness areas. The data shows improvements in visibility trends for both the clearest and haziest days at both Class I areas. The Mount Zirkel monitor (MOZI1) shows a significant positive trending improvement of -0.12 dv/yr for the clearest days, and -0.1 dv/yr on the haziest days over the monitoring period. The Flat Tops data (FLTO1) shows improvements in visibility trends of -0.02 dv/yr for the clearest days, where the average haze index is approximately 1.5 dv. The data for the haziest days is trending up at a rate of 0.22 dv/yr, where the average haze index is around 10 dv.

There are two wet deposition monitors in the LSFO located in Moffat (Sand Spring - CO15) and Routt (Buffalo Pass, Dry Lake - CO97) counties. The available data shows that wet deposition trends appear to be flat overall. The Sand Spring monitor has very low deposition values that range less than 1.0 kg/ha-yr on average. The Dry Lake data averages about 2.15 kg/ha-yr.

CARMMS Results

NAAQS - The maximum modeled source apportionment contributions (i.e. Federal) relative to any of the NAAQS pollutants of concern are shown in the table below. The table also displays the calculated effective mitigation rates relative to the high scenario as a percent reduction, based on the mitigated scenario results. The spatial extents and concentration gradients for the pollutants of concern for all scenarios are shown within the CARMMS Data Explorer (see SA Plots). It is important to remember that these maximums do not necessarily align, spatially or temporally, with the maximum modeled values within the CARMMS domain.

Table 4.4-1 - Source Apportionment Results

Pollutants (standard)	Units	Low	Mitigated	High	Mitigation Rate (%)
PM10 (Annual)	ug/m3	0.4	3.1	6.4	51.6%
PM2.5 (24-hour)	ug/m3	0.1	0.5	1.3	61.5%
PM2.5 (Annual)	ug/m3	0	0.3	0.6	50%
NO2 (1-hour)	ppb	2	15.6	18.3	14.8%
NO2 (Annual)	ppb	0.3	2.7	3.1	12.9%
Ozone (4DM8A)	ppb	0.1	0.9	1	10%

All of the high scenario maximum contribution values from the projected development within the LSFO are above the project level modeling SILs except for ozone. As discussed in the cumulative BLM Colorado analysis section, there are no predicted exceedances of the NO_2 NAAQS anywhere in the CARMMS domain, excluding wildfire hotspots. Therefore, the NO_2 contributions from the LSFO are not significant in terms of a cumulative NAAQS compliance assessment. The 2025 results for PM_{10} do not show concentrations in excess of the NAAQS within the LSFO. The SIL exceeding grid cells appear to overlap cells with maximum concentrations in the range of 25 to 75 $\mu g/m^3$. All of the SIL exceeding $PM_{2.5}$ grid cells intersect areas that are projected to comply with the NAAQS for both the 24-hour and annual standards; thus, the $PM_{2.5}$ contributions are not significant in terms of a cumulative NAAQS compliance assessment.

AQRVs - The CARMMS visibility and deposition results for the LSFO are shown in the scaled report year results tables below. The impacts to Class I area visibility are all below the project level SILs even for the high scenario at cumulative (i.e. aggregated source) scales. The maximum nitrogen deposition results indicate DAT exceedances for the high and mitigated CARMMS scenarios. Each scenario produced DAT exceedances at 5 of the 26 Class I areas analyzed. The medium scenario produced an effective average mitigation rate of about 20% at DAT

exceeded Class I areas; however, it did not reduce the number of impacted areas overall. Potential impacts to acid lake neutralization capacity are well below the defined project level thresholds of analysis. See the CARMMs Data Explorer for all other analyzed Class I areas impacts resulting from projected LSFO development.

Oil and Gas Development

There was no new oil and gas development in the LSFO in 2020. Total production within the Field Office declined from the previous year, accounting for approximately 0.16% and 0.38% of the statewide total oil and gas production, respectively. COGCC data shows that active wells recorded production days for 45% of the year, and that 53% of these wells recorded oil volumes while 59% recorded gas volumes. In terms of total mineral production volumes in Colorado, the LSFO region ranks near the bottom at 5th and 6th for oil and gas respectively. The federal rankings relative to all of the field offices is shown in the table below.

Table 4.4-2 - Oil and Gas Statistics

Development Map

Description	Federal	Cumulative	% Federal	FO Rank
New Wells (spuds)	0	0	0.00%	4
Active Wells	345	763	45.22%	6
Gas Production (Mcf)	7,583,543	8,426,035	90.00%	6
Liquids Production (bbl)	131,342	276,311	47.53%	4

Emissions Tracking

On a calendar year basis, 2020 represents 50% of the CARMMS emissions budget (assuming perfectly linear development / emissions ratios). In terms of idealized absolutes, there are no pollutants tracking above the linear calendar year threshold relative to the high scenario. In general, well development has been sluggish within the field office over the monitoring period, such that all pollutant emissions are tracking well below the low CARMMS scenario levels. The following section presents the report year tracking statistics and applicable scaled source apportionment parameters from CARMMS for the LSFO.

Table 4.4-3 - Report Year Oil and Gas Emissions

Description	PM_{10}	$PM_{2.5}$	VOC	NO_X	CO	SO_2	CO_2	CH_4	N_2O	HAPs
Existing (pre CARMMS)	93.854	28.203	632.207	512.206	409.425	6.671	217,123	3,147.133	4.058	79.657
New Federal	0.000	0.000	0.000	0.000	0.000	0.000	0	0.000	0.000	0.000
Per Well Average	0.000	0.000	0.000	0.000	0.000	0.000	0	0.000	0.000	0.000
Cumulative (Federal - SA)	3.582	0.591	4.357	3.738	3.196	0.003	2,698	33.709	0.050	0.336

Existing emissions (CARMMS 2015 base inventory year, declined), Cumulative - Source Apportioned (SA) emissions are tracked (since base year) to show relative to CARMMS model scenarios (below), GHGs do not include downstream (assumed combustion, shown in climate section below).

Figure 5 - Relative Report Year Emissions

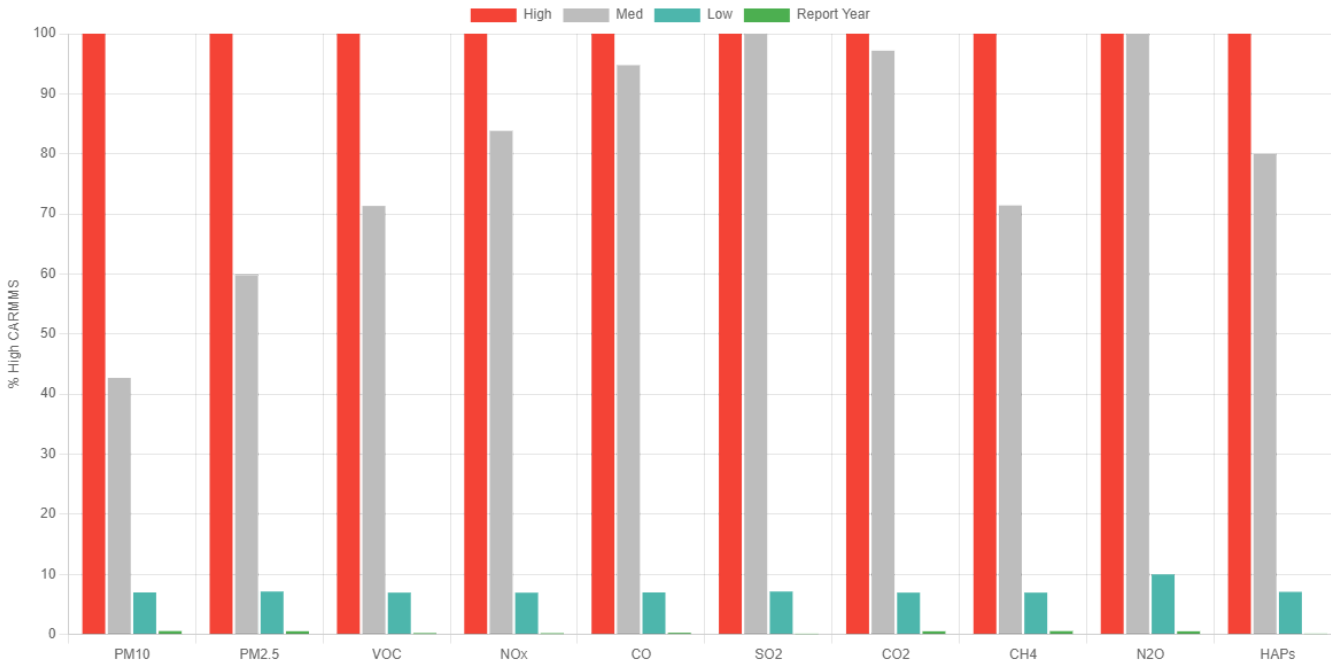

Table 4.4-4 - Scaled NAAQS Analysis

Parameter	% High Scenario	Calculated RY NAAQS	% NAAQS	% SIL
PM10 (Annual)	0.56%	0.04 (ug/m3)	0.02%	3.56%
PM2.5 (24-hour)	0.53%	0.01 (ug/m3)	0.02%	0.57%
PM2.5 (Annual)	0.53%	0.00 (ug/m3)	0.03%	1.59%
NO2 (1-hour)	0.22%	0.04 (ppb)	0.04%	0.53%
NO2 (Annual)	0.22%	0.01 (ppb)	0.01%	0.68%
Ozone (4DM8A)	0.23%	0.00 (ppb)	0.00%	0.23%

Note: Table data based on source apportion results of high CARMMS scenario.

Table 4.4-5 - Scaled Deposition Impacts (kg/ha-yr)

Scenario	Max Class I Impact	Class I % DAT	Class I Area	Max Class II Impact	Class II % DAT	Class II Area
Low	0.002	34%	Mount_Zirkel_Wilderness	0.001	26%	Dinosaur_NM
Mitigated	0.015	292%	Mount_Zirkel_Wilderness	0.011	214%	Dinosaur_NM
High	0.019	378%	Mount_Zirkel_Wilderness	0.013	250%	Dinosaur_NM
Report Year	0.000	1%	Mount Zirkel Wilderness	0.000	1%	Dinosaur_NM

Note: Low, Mitigated, and High data are actual CARMMS results (highest projected impact areas only, for full details see carmms section). Report Year data shows scaled impacts.

Table 4.4-6 - Scaled Visibility Impacts (dv)

Scenario	Max Class I Impact	Days > 0.5dv	Days > 1.0dv	Class I Area	Max Class II Impact	Days > 0.5dv	Days > 1.0dv	Class II Area
Low	0.026	0	0	Mount_Zirkel_Wilderness	0.021	0	0	Dinosaur_NM
Mitigated	0.199	0	0	Mount_Zirkel_Wilderness	0.156	0	0	Dinosaur_NM
High	0.245	0	0	Mount_Zirkel_Wilderness	0.204	0	0	Dinosaur_NM
Report Year	0.001	0	0	Mount_Zirkel_Wilderness	0.000	0	0	Dinosaur_NM

Note: Low, Mitigated, and High data are actual CARMMS results (highest projected impact areas only, for full details see CARMMS section). Report Year data shows scaled impacts.

LSFO Findings

The major air quality issue in the Northwest District appears to be potential projected deposition impacts. The spatial relationships between the district field offices and the proximate Class I areas, combined with the overall development potential contribute the most to projected nitrogen deposition impacts. The report year data shows that the current scaled source apportioned values for nitrogen deposition are below the project level DAT for all Class I areas, and none of the calculated report year NAAQS contributions are above the project level SILs. Visibility impacts are not expected to exceed project level DAT even at the high scenario emissions rates. In general, air quality in the LSFO is meeting the objectives of the governing RMP and BLM's adaptive management strategy. No specific mitigation beyond that outlined in governing documents and the inherent project level analysis commitments that are part of BLM's review and approval process are required.

4.5 Royal Gorge Field Office

The defining attribute of the Royal Gorge Field Office (RGFO) is its sheer size, which by itself constitutes over half of the land area of Colorado on the eastern flank of 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.

Air Quality Review

Air quality within the RGFO is mostly in attainment of the NAAQS, with the sole exception being the Denver - Front Range 8 hour Ozone Nonattainment Area. The NAA covers Adams, Arapahoe, Boulder, Broomfield, Denver, Douglas, and Jefferson counties, as well as the southern half of Larimer and Weld counties. The majority of monitoring sites within the NAA are clustered around the major metropolitan areas, as would be expected and consistent with implementation plan requirements. Primary standard monitors are sited to measure indicative human exposures. There are also a few maintenance areas defined within the RGFO for carbon monoxide and PM_{10}. The PM_{10} areas include the cities of Canon City and Lamar along with the Denver Metropolitan area, which includes Boulder, Broomfield, Denver, Douglas, and Jefferson counties as well as the western half of Adams and Arapahoe counties. The carbon monoxide maintenance areas include several partial counties and towns extending from Fort Collins to Colorado Springs along the I-25 and U.S. 24 West corridors. 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.

A review of the available monitoring data for the district shows that all of the sites are in compliance with the NAAQS, save for ground level ozone (within the current NAA). The trends for all pollutants appear stable, with few notable exceptions. The area NO_2 monitors recorded not more than 70% of the 1 hour standard on a 3 year average basis (the form of the standard). For the annual average, the maximum monitor is trending near 50% of the NAAQS. No exceedances were recorded for either form of the NO_2 standard. The majority of area PM_{10} monitors are well below the NAAQS at approximately 60%, where the highest readings are typically not more than 120 ug/m^3. The data shows several exceedances recorded at the Prowers county monitor for PM_{10}. Area $PM_{2.5}$ monitors display quite a bit of variance from site to site and year to year. There was no exceedances for the annual standard, however the 24 hour standard saw several exceedances in densly populated areas along the northern front range in 2020. Ozone exceedances have occurred within NAA counties each and every year for the available monitoring data where most of the highest readings seem to occur west and south of the Denver Metro area (perhaps indicating an upslope meteorological component to the highest ozone formation episodes). In 2019, the existing ozone NAA was redesignated to serious from moderate, thus lowering the analysis thresholds for permitting and general conformity requirements. Additionally, EL Paso County (outside of the NAA) recorded ozone exceedances in 2020. Additional information on air quality trends within the RGFO can be found in CDPHE's Air Quality Annual Reports.

There are two Class I areas partially contained or in close proximity to the RGFO boundaries that could be potentially impacted by Federal oil and gas development: the Rocky Mountain National Park and the Great Sand Dunes National Park and Preserve. Rocky Mountain National Park lies west of Boulder, CO and Fort Collins, CO in the Roosevelt National Forest. The area is subject to negative impacts from frequent visitation as well as area upslope meteorological conditions that have the potential to transport Front Range area pollutants into the Park, which can contribute to ozone transport, deposition, and visibility issues. The Great Sand Dunes National Park and Preserve is located west of the Field Office straddling Alamosa and Saguache counties near the southern boundary, and it is physically separated from the Field Office by the Sangre de Cristo Mountains. Potential AQRV concerns for this area exist due to the possibility of close oil and gas development. Any actual proposed development will need a case-by-case analysis to determine the extent of the potential impacts beyond what CARMMS has already predicted for projected development in the area, as is true for any area.

NOTE: The AQRV datasets are currently limited to 2019 data. This section will be updated as the 2020 datsets become available.

The available IMPROVE visibility monitoring data at Rocky Mountain National Park (ROMO1) shows a significant positive trending improvement of -0.09 dv/yr for the clearest days, and -0.07 dv/yr on the haziest days over the monitoring period. Similar conditions exist at the Great Sand Dunes, where monitoring data (GRSA1) shows a significant positive trending improvement of -0.09 dv/yr for the clearest days, and -0.07 dv/yr on the haziest days over the monitoring period.

The available nitrogen deposition monitoring data at Rocky Mountain National Park (CO19) shows that 2019 was on eof the lowest deposition years on record. The data shows a significant decline in wet deposition while dry deposition has been relatively stable (ROM406). In total, nitrogen deposition is slightly negatively biased (decreasing) over the monitoring period, although the total deposition remains well above the established critical load for the Park (2.5 kg/ha-yr). According to NPS data the maximum total nitrogen deposition at Rocky Mountain is approximately 7.0 kg/ha-yr. No deposition monitoring is available at the Great Sand Dunes, however nearby wet chemistry monitoring at the city of Alamosa (CO00) shows deposition appears to be on the rise in recent years, where the total wet deposition is tracking around 1.0 kg/ha-yr. NPS data for total nitrogen deposition at the Great Sand Dunes shows rates for the two ecoregions at 4.9 and 5.9 kg/ha-yr. The most sensitive species at the dunes has an established critical load of 2.5 kg/ha-yr.

CARMMS Results

NAAQS - The maximum modeled source apportionment contributions (i.e. Federal) relative to any of the NAAQS pollutants of concern are shown in the table below. The table also displays the calculated effective mitigation rates relative to the high scenario as a percent reduction, based on the mitigated scenario results. The spatial extents and concentration gradients for the pollutants of concern for all scenarios are shown within the CARMMS Data Explorer (see SA Plots). It is important to remember that these maximums do not necessarily align, spatially or temporally, with the maximum modeled values within the CARMMS domain.

Table 4.5-1 - Source Apportionment Results

Pollutants (standard)	Units	Low	Mitigated	High	Mitigation Rate (%)
PM10 (Annual)	ug/m3	1.6	4.3	10.3	58.3%
PM2.5 (24-hour)	ug/m3	0.3	0.7	1.4	50%
PM2.5 (Annual)	ug/m3	0.1	0.3	0.6	50%
NO2 (1-hour)	ppb	1.9	6.5	10.3	36.9%
NO2 (Annual)	ppb	0.3	1.3	2.1	38.1%
Ozone (4DM8A)	ppb	0.1	0.5	0.8	37.5%

All high scenario maximum values from cumulative RGFO projected development are above the project-level modeling SILs, except for ozone. As discussed in the cumulative BLM Colorado analysis section, there are no predicted exceedances of the NO_2 NAAQS anywhere in the CARMMS domain, excluding wildfire hotspots. Therefore, the NO_2 contributions from the RGFO are not significant. The 2025 results for all particulate matter species do show concentrations in excess of the NAAQS within the RGFO, and it does appear that the Field Office's contributions are above the SIL in overlapping grid cells. The CARMMS model also produced exceedances for each particulate matter NAAQS in the base year in multiple areas, which is not supported by the available monitoring data. The data suggest the model results are biased high, especially considering the spatial extent the modeled exceedances occupy. Given the potential model bias and the fact that the modeled contributions of the PM_{10} exceedance (3 to 4 $\mu g/m^3$) are relatively close to the SIL (1 $\mu g/m^3$), it is unlikely that the projected development in the RGFO would contribute significantly to any future PM_{10} NAAQS exceedance. An exceedance itself is unlikely given the current monitoring trends. This is also true for the $PM_{2.5}$ NAAQS. The maximum contribution to the 24-hour standard is 1.4 $\mu g/m^3$, which is just slightly above the 1.2 $\mu g/m^3$ SIL. For the annual standard, the model shows a contribution of 0.6 $\mu g/m^3$, compared to a SIL of 0.2 $\mu g/m^3$.

AQRVs - The source apportioned results for the RGFO do not show significant impacts to AQRVs at cumulative (i.e. aggregated source) scales. The data shows that even at the high development scenario, federal oil and gas does not contribute to deposition or visibility impacts even when compared to project-level DATs. Potential impacts to acid lake neutralization capacity are well below the defined project level thresholds of analysis. See the CARMMs Data Explorer for all other analyzed Class I areas impacts resulting from projected RGFO development.

Oil and Gas Development

The majority of RGFO development in 2020 occurred in the Denver Julesburg Basin, north of the Denver metro area and east of the I-25 corridor. Additionally the overwhelming majority of this development was for non-federal minerals. Total production within the Field Office accounted for approximately 96.3% and 50.9% of the statewide total oil and gas production, respectively. COGCC data shows that active wells recorded production days for 51% of the year, and that 44% of these wells recorded oil volumes while 69% recorded gas volumes. In terms of total mineral development and production volumes in Colorado, the Field Office's region ranks 1st for both oil and gas production. Many of the federal wells in this region often co-produce fee minerals (especially from horizontal wellbores). For example, railroad right-of-way wells typically have a maximum Federal mineral interest of only 6%. In general, federal development in this region is quite small relative to the total. The federal rankings relative to all of the field offices is shown in the table below.

Table 4.5-2 - Oil and Gas Statistics

Development Map

Description	Federal	Cumulative	% Federal	FO Rank
New Wells (spuds)	13	1,541	0.84%	2
Active Wells	637	35,691	1.78%	3
Gas Production (Mcf)	31,771,339	1,169,505,207	2.72%	4
Liquids Production (bbl)	5,472,332	165,200,871	3.31%	1

Emissions Tracking

On a calendar year basis, 2020 represents 50% of the CARMMS emissions budget (assuming perfectly linear development / emissions ratios). In terms of idealized absolutes, almost all of the pollutants are tracking above the linear calendar year threshold (relative to the high scenario), and all of the pollutants are above the low CARMMS scenario values. Only the VOCs and HAPs pollutants are tracking above the medium

scenario, and the VOCs are tracking above the high CARMMS levels. This result is not entirely unexpected given that the majority of the liquids production within the state occurs in the RGFO, and liquids tend to generate higher levels of volatile emissions given the process chain and handling requirements. Additionally, the production totals on a per well basis are significantly higher than what was estimated for CARMMS, and as such the scaling that is based on a production metric is driving emissions higher as well. The following section presents the report year tracking statistics and applicable scaled source apportionment parameters from CARMMS for the RGFO.

Table 4.5-3 - Report Year Oil and Gas Emissions

Description	PM_{10}	$PM_{2.5}$	VOC	NO_X	CO	SO_2	CO_2	CH_4	N_2O	HAPs
Existing (pre CARMMS)	172.304	41.897	1,483.164	436.005	652.777	1.344	164,199	714.208	2.347	64.301
New Federal	162.534	19.101	365.962	97.033	80.858	0.065	14,931	36.956	0.122	10.063
Per Well Average	12.503	1.469	28.151	7.464	6.220	0.005	1,149	2.843	0.009	0.774
Cumulative (Federal - SA)	239.592	50.881	6,490.206	987.505	886.286	1.708	105,423	504.490	1.073	162.900

Existing emissions (CARMMS 2015 base inventory year, declined), Cumulative - Source Apportioned (SA) emissions are tracked (since base year) to show relative to CARMMS model scenarios (below), GHGs do not include downstream (assumed combustion, shown in climate section below).

Figure 6 - Relative Report Year Emissions

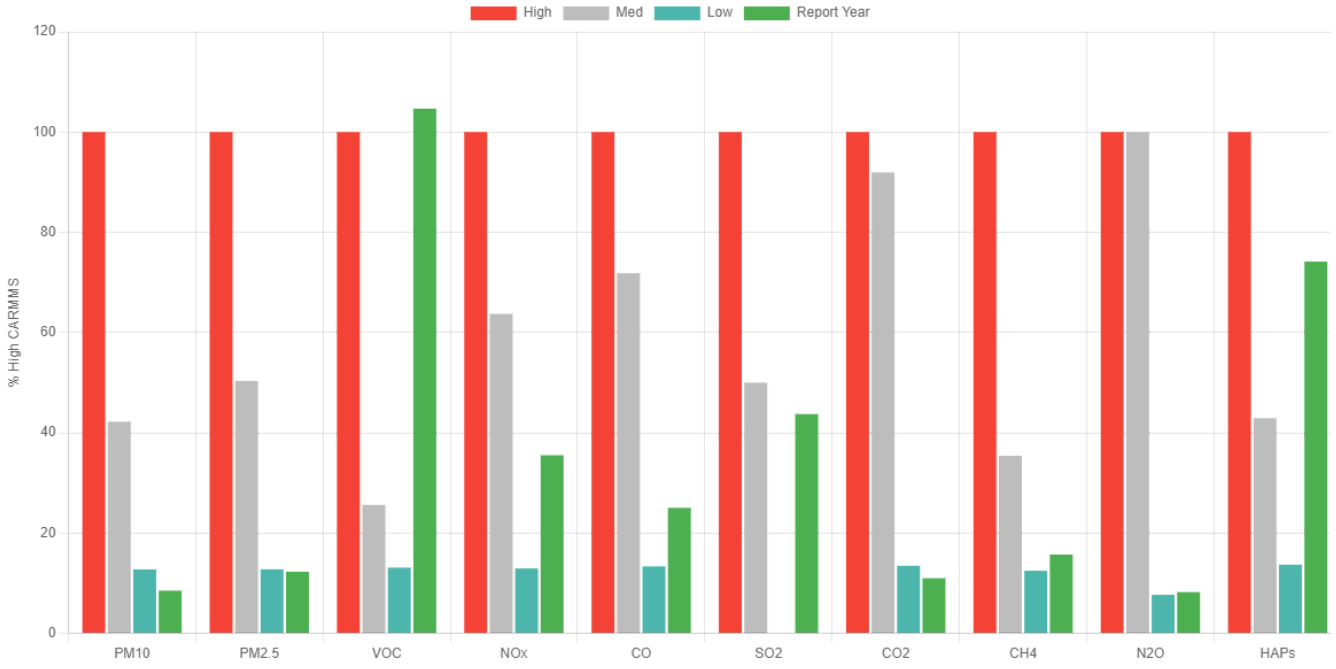

Table 4.5-4 - Scaled NAAQS Analysis

Parameter	% High Scenario	Calculated RY NAAQS	% NAAQS	% SIL
PM10 (Annual)	8.52%	0.88 (ug/m3)	0.58%	87.71%
PM2.5 (24-hour)	12.29%	0.17 (ug/m3)	0.49%	14.34%
PM2.5 (Annual)	12.29%	0.07 (ug/m3)	0.61%	36.88%
NO2 (1-hour)	35.53%	3.66 (ppb)	3.66%	48.79%
NO2 (Annual)	35.53%	0.75 (ppb)	1.41%	74.60%
Ozone (4DM8A)	70.09%	0.56 (ppb)	0.80%	56.08%

Note: Table data based on source apportion results of high CARMMS scenario.

Table 4.5-5 - Scaled Deposition Impacts (kg/ha-yr)

Scenario	Max Class I Impact	Class I % DAT	Class I Area	Max Class II Impact	Class II % DAT	Class II Area
Low	0.000	0%	Rocky_Mountain	0.000	2%	Spanish_Peaks

Scenario	Max Class I Impact	Class I % DAT	Class I Area	Max Class II Impact	Class II % DAT	Class II Area
Mitigated	0.000	4%	Rocky_Mountain	0.002	30%	Lost_Creek
High	0.000	6%	Rocky_Mountain	0.002	44%	Lost_Creek
Report Year	0.000	2%	Rocky_Mountain	0.001	16%	Lost_Creek

Note: Low, Mitigated, and High data are actual CARMMS results (highest projected impact areas only, for full details see carmms section). Report Year data shows scaled impacts.

Table 4.5-6 - Scaled Visibility Impacts (dv)

Scenario	Max Class I Impact	Days > 0.5dv	Days > 1.0dv	Class I Area	Max Class II Impact	Days > 0.5dv	Days > 1.0dv	Class II Area
Low	0.021	0	0	CI_Rocky_Mountain	0.017	0	0	CII_Florissant_Fossi
Mitigated	0.086	0	0	CI_Rocky_Mountain	0.072	0	0	CII_Florissant_Fossi
High	0.140	0	0	CI_Rocky_Mountain	0.120	0	0	CII_Florissant_Fossi
Report Year	0.098	0	0	CI_Rocky_Mountain	0.084	0	0	CII_Florissant_Fossi

Note: Low, Mitigated, and High data are actual CARMMS results (highest projected impact areas only, for full details see CARMMS section). Report Year data shows scaled impacts.

RGFO Findings

The major air quality issues in the Rocky Mountain District are the ozone non-attainment area and the elevated nitrogen deposition rates at Rocky Mountain National Park. The majority of all 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 from moderate to serious. 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. In general, all of BLM's analysis shows that federal oil and gas projects are below the 50 tpy de minimis thresholds for ozone precursor pollutants. However, the de minimis levels drop due to redesignation is likely to have an impact on the BLMs ability to approve projects under the general conformity rules using existing methodologies.

Federal development in the RGFO has been tracking just above the low scenario pace based solely on new well counts. Initial production from these wells is much higher than anticipated, and is likely an artifact from the switch over from vertical to horizontal development that makes up the majority of new well bores in the area, and may have not been fully captured within the BLMs original CARMMS 2.0 production estimates. In total the RGFO emissions are tracking around the medium CARMMS scenario. However, the tracking fails to fully account for what is very likely overstated development emissions. As stated in the Field Office introduction, most of the wells drilled in the NAA produce both federal and fee minerals, such that not all of the construction related emissions are attributable to the federal approval. The report year inventory does not fully account for this fact, and is thus likely overstated. Regardless, all of the scaled impacts based on the report year emissions levels are below the project level analysis thresholds for the NAAQS and AQRVs. Critical load deposition exceedances (monitored) at modeled National Park Units is of continuing concern. Analysis of the medium CARMMS scenario shows potential mitigation options for nitrogen deposition could reduce the projected federal impacts by a third (approximately 0.0001 kg/ha-yr, or 2% of the DAT) at Rocky Mountain National Park. In terms of total nitrogen deposition reductions, the analyzed mitigation would have a minor if not barely detectable effect (approximately a 0.0067% reduction) due in part to the reality that the Federal development in the RGFO does not contribute significantly to these impacts within the CARMMS 2.0 model results.

In general, air resource values are meeting the objectives of the governing RMP and BLM's adaptive management strategy. No specific mitigation beyond that outlined in governing documents and the inherent project level analysis commitments that are part of BLM's review and approval process are required.

4.6 Tres Rios Field Office

The Tres Rios Field Office (TRFO) is located in the southwest corner of Colorado and is responsible for 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 wholly contains Archuleta, Dolores, La Plata, and Montezuma counties in their entirety and partially 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 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 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 (AQRVs) in Class I Airsheds affected by actions in the planning area. Management actions within the TRFO to meet RMP goals and objectives include the following:

- Require all new facilities and installations to use engines that meet the following standards within a stationary facility for fluid minerals. This requirement does not apply to non-stationary drill rigs or other temporary / mobile engines. Engines less than 300 horsepower de-rated for elevation (excluding very small engines less than 40 horsepower) must not exceed a NOX limit of 2.0 grams per horsepower-hour or the minimum acceptable limit as determined by air quality regulatory agencies, using whichever is the most restrictive emission limit.
- Require that all replacement or reconditioned reciprocating internal combustion engines less than 300 horsepower de-rated for elevation (excluding very small engines less than 40 horsepower) not exceed a NOx limit of 2.0 grams per horsepower-hour or the minimum acceptable limit as determined by air quality regulatory agencies, using whichever is the lower emission limit.
- Require all new facilities and installations to use engines that meet the following standards within a stationary facility for fluid minerals. This requirement does not apply to non-stationary drill rigs or other temporary / mobile engines. Engines 300 horsepower or greater de-rated for elevation must not exceed a NOx limit of 1.0 gram per horsepower-hour or the minimum acceptable limit as determined by air quality regulatory agencies, using whichever is the lower emission limit.
- Ensure that all replacement or reconditioned reciprocating internal combustion engines 300 horsepower or greater de-rated for elevation not exceed a NOX limit of 1.0 gram per horsepower-hour or the minimum acceptable limit as determined by air quality regulatory agencies, using whichever is the lower emission limit.
- Require green completion technology for oil and natural gas well completions and for re-stimulation or re-fracture activities during workovers to prevent venting and most flaring of methane gas and other air pollutants into the atmosphere. Green completion practices include, but are not limited to: 1) maximal capturing of fluids, well effluent, and flammable gases as soon as practicable during flowback and cleanout operations; 2) separation of sand, hydrocarbon and other liquids, and gas from saleable products of saleable quantity; 3) storage and delivery of saleable products to sales line; and 4) environmentally safe disposal of non-saleable waste products. Operators must not allow venting of flammable gas during the well completion process except for gas testing or for safety and emergency situations. This standard is required for all non-wildcat oil and natural gas wells and will be implemented in all places where technically feasible. The BLM will determine technical feasibility with input from air quality regulatory agencies as needed.
- Prevent storage vessel leakage and require the closure of storage vessels when not being serviced during liquid transport, repair, or measuring activities. These requirements apply for the exploration, production, transport, and processing of oil and natural gas. Operators must maintain valves in a leak-free condition (i.e. less than 10,000 parts per million [ppm] leakage). The venting of volatile organic compounds and hazardous air pollutants emissions will achieve at least 95% emission reduction from uncontrolled emissions through the use of vapor recovery units, combustion, or other practices allowed by air quality regulatory agencies.
- Periodically inspect valves and pipes in liquid hydrocarbon service through visual, audible, or other means for evidence of leaks on an annual basis at minimum. If leaks are detected, equipment must either be repaired or replaced as applicable.
- Require no-bleed, low-bleed, or air-driven pneumatic devices for all new and retrofitted oil and natural gas production sites to reduce methane emissions. The BLM may make exceptions for safety and operational requirements.
- Require that all new separators and dehydrators used for natural gas production use 95% control efficiency or better VOC emission control technology compared to uncontrolled emissions.
- At any one point in time, construct, drill, or re-complete no more than four fluid mineral well pads and associated access roads with combustion engines concurrently in any given square mile. This standard does not limit the number of well pads per square mile, but only the simultaneous construction and drilling of wells. This standard is necessary to minimize near-field air pollutant concentrations and ensure compliance with National Ambient Air Quality Standards (EPA 2013).

Air Quality Review

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. There are four air quality monitoring stations within the TRFO that monitor for PM_{10} (Pagosa Springs, Telluride, and Durango) and ozone (Cortez and Mesa Verde National Park). The Field Office has two PM_{10} maintenance areas around the towns of Pagosa Springs and Telluride.

A review of the available monitoring data for the district shows that all of the sites are in compliance with the NAAQS. The trends for all pollutants appear stable, with few notable exceptions. The area NO_2 monitors recorded not more than 21% of the 1 hour standard on a 3 year average basis (the form of the standard). For the annual average, the maximum monitor is trending near 10% of the NAAQS. No exceedances were recorded for either form of the NO_2 standard. The majority of area PM_{10} monitors are well below the NAAQS at approximately 33%, where the highest readings are typically not more than 59 ug/m^3. Area $PM_{2.5}$ monitors display some variance from site to site and year to year. These monitors show the maximum annual and 24-hour standards trending around 50% of the NAAQS, respectively. Ozone monitors are typically recording 4th high values above 60 ppb, where the highest readings exceeded the NAAQS at most of the monitors over the last year. None of the exceedances produced violations. Additional information on air quality trends within the TRFO can be found in CDPHE's Air Quality Annual Reports.

There are two Class I areas partially contained or in close proximity to the TRFO boundaries that could be potentially impacted by Federal oil and gas development: the Weminuche Wilderness area and Mesa Verde National Park. Potential AQRV concerns for these areas exist due to the possibility of close oil and gas development. Any actual proposed development will need a case-by-case analysis to determine the extent of the potential impacts beyond what CARMMS has already predicted for projected development in the area, as is true for any area.

NOTE: The AQRV datasets are currently limited to 2019 data. This section will be updated as the 2020 datsets become available.

AQRV visibility monitoring data is available at three locations within the TRFO boundaries. Two are located at the aforementioned Class I areas and a third is sited about half way between Durango and Pagosa Springs. The Mesa Verde monitor (MEVE1) data shows significant trending improvement of -0.1 dv/yr for the clearest days, and -0.08 dv/yr on the haziest days over the monitoring period. The Weminuche monitor (WEMI1) data shows significant trending improvement of -0.1 dv/yr for the clearest days, and -0.07 dv/yr on the haziest days over the monitoring period. The Shamrock Mine monitor (SHMI1) data shows significant visibility improvements on the clearest days (-0.08 dv/yr) and marginal improvements on the haziest (0.07 dv/yr).

Similarly, there are three deposition monitors located with the Field Office boundaries. Two are located at the aforementioned Class I areas, while the third is just west of Pagosa Springs on Wolf Creek Pass. The NADP monitor at Mesa Verde (CO99) is showing some increases in wet deposition since 2002. The recent average rate of wet nitrogen deposition is about 1.8 kg/ha-yr. There is also a CASTNET monitor (MEV405) co-located with the NADP monitor at the Mesa Verde site. The CASTNET data shows a drop in some dry nitrogen species over the monitoring period. In general, total deposition is trending around 2.8 kg/ha-yr. The NADP monitor at Molas Pass (CO96) is showing some minor decreases in deposition, where the average rate of wet nitrogen deposition is about 1.7 kg/ha-yr. The NADP monitor at Wolf Creek Pass (CO91) is showing some decreases in deposition, where the average rate of wet nitrogen deposition is about 2.2 kg/ha-yr.

CARMMS Results

NAAQS - The maximum modeled source apportionment contributions (i.e. Federal) relative to any of the NAAQS pollutants of concern are shown in the table below. The table also displays the calculated effective mitigation rates relative to the high scenario as a percent reduction, based on the mitigated scenario results. The spatial extents and concentration gradients for the pollutants of concern for all scenarios are shown within the CARMMS Data Explorer (see SA Plots). It is important to remember that these maximums do not necessarily align, spatially or temporally, with the maximum modeled values within the CARMMS domain.

Table 4.6-1 - Source Apportionment Results

Pollutants (standard)	Units	Low	Mitigated	High	Mitigation Rate (%)
PM10 (Annual)	ug/m3	0.3	1	2.4	58.3%
PM2.5 (24-hour)	ug/m3	0.1	0.2	0.4	50%
PM2.5 (Annual)	ug/m3	0	0.1	0.2	50%
NO2 (1-hour)	ppb	2.7	9.2	9.2	0%
NO2 (Annual)	ppb	0.8	3.3	3.3	0%
Ozone (4DM8A)	ppb	0	0.2	0.2	0%

The TRFO high scenario produced maximum contribution values above the project-level modeling SIL for PM_{10} and NO_2. As discussed in the cumulative BLM Colorado analysis section, there are no predicted exceedances of the NO_2 NAAQS anywhere in the CARMMS domain, excluding wildfire hotspots. Therefore, the NO_2 contributions from the TRFO are not significant in terms of a cumulative NAAQS compliance assessment. For PM_{10}, the model plots show that the TRFO maximum contributions grid cells intersect areas that are projected to easily comply with the NAAQS on a cumulative basis, and thus the contributions are not significant.

AQRVs - The CARMMS visibility and deposition results for the TRFO are shown in the scaled report year results tables below. The impacts to Class I area visibility are all below the project level DAT even for the high scenario at cumulative (i.e. aggregated source) scales. The maximum nitrogen deposition results indicate a minor DAT exceedance for the high CARMMS scenario at a single Class I area. The medium scenario produced an effective average mitigation rate of about 99% at the DAT exceeded Class I area. Potential impacts to acid lake neutralization capacity are well below the defined project level thresholds of analysis. See the CARMMs Data Explorer for all other analyzed Class I areas impacts resulting from projected TRFO development.

Oil and Gas Development

Oil and gas development in the TRFO remained low in 2020, recording just 13 new spuds, of which none were federal. Total production within the Field Office accounted for approximately 0.05% and 24.5% of the statewide total oil and gas production, respectively. COGCC data shows that active wells recorded production days for 56% of the year, and that just 5.6% of these wells recorded oil volumes while 86.7% recorded gas volumes. In terms of total mineral production volumes in Colorado, the TRFO region ranks 7th and 2nd for oil and gas production. The federal rankings relative to all of the field offices is shown in the table below.

Table 4.6-2 - Oil and Gas Statistics

Development Map

Description	Federal	Cumulative	% Federal	FO Rank
New Wells (spuds)	0	13	0.00%	4
Active Wells	402	5,492	7.32%	5

Description	Federal	Cumulative	% Federal	FO Rank
Gas Production (Mcf)	236,566,601	562,076,915	42.09%	1
Liquids Production (bbl)	43,890	84,340	52.04%	6

Emissions Tracking

On a calendar year basis, 2020 represents 50% of the CARMMS emissions budget (assuming perfectly linear development / emissions ratios). In terms of idealized absolutes, none of the pollutant species are tracking above the linear thresholds relative to the high scenario. A majority of the pollutant species are tracking above the CARMMS low scenario levels, and none are above the medium scenario. The following section presents the report year tracking statistics and applicable scaled source apportionment parameters from CARMMS for the TRFO.

Table 4.6-3 - Report Year Oil and Gas Emissions

Description	PM_{10}	$PM_{2.5}$	VOC	NO_X	CO	SO_2	CO_2	CH_4	N_2O	HAPs
Existing (pre CARMMS)	448.962	142.477	3,609.873	3,214.232	4,155.300	30.077	918,273	38,680.727	15.699	180.015
New Federal	0.000	0.000	0.000	0.000	0.000	0.000	0	0.000	0.000	0.000
Per Well Average	0.000	0.000	0.000	0.000	0.000	0.000	0	0.000	0.000	0.000
Cumulative (Federal - SA)	3.566	1.193	86.658	129.092	171.548	1.003	10,145	573.547	0.089	3.757

Existing emissions (CARMMS 2015 base inventory year, declined), Cumulative - Source Apportioned (SA) emissions are tracked (since base year) to show relative to CARMMS model scenarios (below), GHGs do not include downstream (assumed combustion, shown in climate section below).

Figure 7 - Relative Report Year Emissions

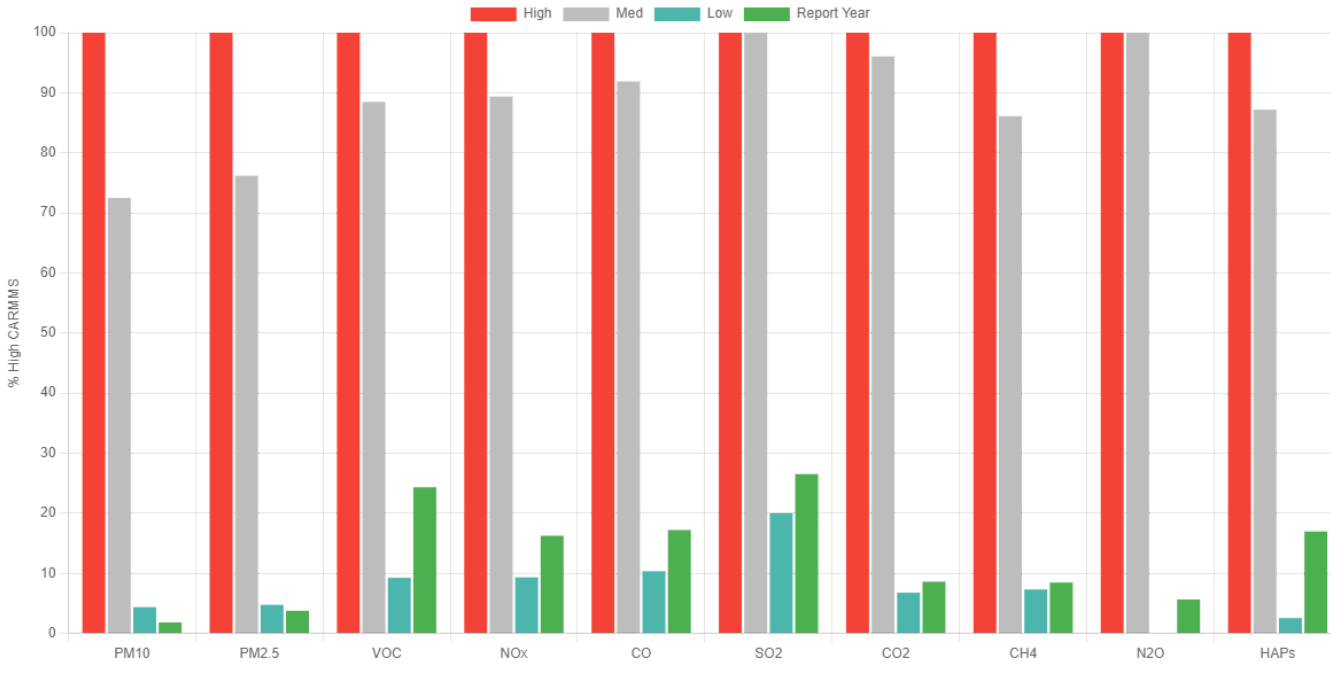

Table 4.6-4 - Scaled NAAQS Analysis

Parameter	% High Scenario	Calculated RY NAAQS	% NAAQS	% SIL
PM10 (Annual)	1.83%	0.04 (ug/m3)	0.03%	4.38%
PM2.5 (24-hour)	3.76%	0.02 (ug/m3)	0.04%	1.25%
PM2.5 (Annual)	3.76%	0.01 (ug/m3)	0.06%	3.76%
NO2 (1-hour)	16.26%	1.50 (ppb)	1.50%	19.94%
NO2 (Annual)	16.26%	0.54 (ppb)	1.01%	53.65%
Ozone (4DM8A)	20.29%	0.04 (ppb)	0.06%	4.06%

Note: Table data based on source apportion results of high CARMMS scenario.

Table 4.6-5 - Scaled Deposition Impacts (kg/ha-yr)

Scenario	Max Class I Impact	Class I % DAT	Class I Area	Max Class II Impact	Class II % DAT	Class II Area
Low	0.001	18%	Weminuche_Wilderness	0.001	26%	South_San_Juan
Mitigated	0.004	88%	Weminuche_Wilderness	0.007	146%	South_San_Juan
High	0.006	124%	Weminuche_Wilderness	0.013	266%	South_San_Juan
Report Year	0.001	20%	Weminuche_Wilderness	0.002	43%	South_San_Juan

Note: Low, Mitigated, and High data are actual CARMMS results (highest projected impact areas only, for full details see carmms section). Report Year data shows scaled impacts.

Table 4.6-6 - Scaled Visibility Impacts (dv)

Scenario	Max Class I Impact	Days > 0.5dv	Days > 1.0dv	Class I Area	Max Class II Impact	Days > 0.5dv	Days > 1.0dv	Class II Area
Low	0.006	0	0	Weminuche_Wilderness	0.010	0	0	South_San_Juan
Mitigated	0.024	0	0	Weminuche_Wilderness	0.044	0	0	South_San_Juan
High	0.041	0	0	Weminuche_Wilderness	0.089	0	0	South_San_Juan
Report Year	0.008	0	0	Weminuche_Wilderness	0.018	0	0	South_San_Juan

Note: Low, Mitigated, and High data are actual CARMMS results (highest projected impact areas only, for full details see CARMMS section). Report Year data shows scaled impacts.

TRFO Findings

The major air quality issue in the Southwest District appears to be the elevated levels of ozone that are precipitously close to the level of the NAAQS. The highest average values for the District are within the TRFO, and in 2018 there were exceedances recorded in La Plata and Montezuma Counties. There were no exceedances in 2020, and the previous exceedances did not produce any NAAQS violations. The report year data shows emissions are tracking above the low scenario levels. The calculated report year NAAQS and AQRV contributions are all below the project level analysis thresholds. In general air resources is meeting the objectives of the governing RMP and BLM's adaptive management strategy. No specific mitigation beyond that outlined in governing documents and the inherent project level analysis commitments that are part of BLM's review and approval process are required.

4.7 Uncompahgre Field Office

The Uncompahgre Field Office (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 contains a diverse topography, including lowland riparian along the Dolores River at around 4,700 feet, red rock desert, a moonscape of highly erodible Mancos Shale badlands, and the piñon-juniper woodlands of the Uncompahgre Plateau. The UFO encompasses a majority of Delta, Ouray, and Montrose counties, and parts of Mesa, San Miguel, and Gunnison counties. The major population center is the city of Montrose, located in the center of the Field Office.

Air Quality Review

The UFO is mostly contained within the CDPHE's Western Slope air quality region, but does extend east in the adjacent Central Mountain region as well. Air quality within the Field Office is 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. There are three air quality monitoring stations in the UFO that monitor for ozone (Paradox and Paonia), NO_2 and PM_{10} (Paonia) and $PM_{2.5}$ (Delta and Paonia.). The Paonia monitor is sponsored by the BLM.

A review of the available monitoring data for the district shows that all of the sites are in compliance with the NAAQS. The trends for all pollutants appear stable, with few notable exceptions. The area NO_2 monitors recorded not more than 25% of the 1 hour standard on a 3 year average basis (the form of the standard). For the annual average, the maximum monitor is trending near 10% of the NAAQS. No exceedances were recorded for either form of the NO_2 standard. The majority of area PM_{10} monitors are well below the NAAQS at approximately 33%, where the highest readings are typically not more than 50 ug/m^3. Area $PM_{2.5}$ monitors display some variance from site to site and year to year. These monitors show the maximum annual and 24-hour standards trending around 45% and 47% of the of the NAAQS, respectively. Ozone monitors are typically recording 4th high values around 60 ppb, where the highest reading is approximately 61 ppb or 87% of the NAAQS. Additional information on air quality trends within the UFO can be found in CDPHE's Air Quality Annual Reports.

There are three Class I areas partially contained or in close proximity to the UFO boundaries that could be potentially impacted by Federal oil and gas development: the Black Canyon of the Gunnison National Park and the Maroon Bells / Snowmass and West Elk Wilderness areas. Potential AQRV concerns for these areas exist due to the possibility of close oil and gas development. Any actual proposed development will need a case-by-case analysis to determine the extent of the potential impacts beyond what CARMMS has already predicted for projected development in the area, as is true for any area.

NOTE: The AQRV datasets are currently limited to 2019 data. This section will be updated as the 2020 datsets become available.

AQRV visibility monitoring near the UFO is limited to the Maroon Bells / Snowmass Wilderness areas. The Maroon Bells trend data (WHRI1) shows significant improvement over the monitoring period at -0.07 dv/yr and -0.14 dv/yr for the clearest days and haziest days, respectively, where the average values for these days are 0 dv and 7 dv.

There are no deposition monitors in the UFO.

CARMMS Results

NAAQS - The maximum modeled source apportionment contributions (i.e. Federal) relative to any of the NAAQS pollutants of concern are shown in the table below. The table also displays the calculated effective mitigation rates relative to the high scenario as a percent reduction, based on the mitigated scenario results. The spatial extents and concentration gradients for the pollutants of concern for all scenarios are shown within the CARMMS Data Explorer (see SA Plots). It is important to remember that these maximums do not necessarily align, spatially or temporally, with the maximum modeled values within the CARMMS domain.

Table 4.7-1 - Source Apportionment Results

Pollutants (standard)	Units	Low	Mitigated	High	Mitigation Rate (%)
PM10 (Annual)	ug/m3	0	0.3	0.9	66.7%
PM2.5 (24-hour)	ug/m3	0	0.2	0.2	0%
PM2.5 (Annual)	ug/m3	0	0.1	0.2	50%
NO2 (1-hour)	ppb	0.1	3	4.8	37.5%
NO2 (Annual)	ppb	0	1	1.5	33.3%
Ozone (4DM8A)	ppb	0	0.6	0.8	25%

The only high scenario maximum contribution value from the projected development within the UFO that is above the project level modeling SIL was for the annual NO_2 contribution. As discussed in the cumulative BLM Colorado analysis section, there are no predicted exceedances of the NO_2 NAAQS anywhere in the CARMMS domain, excluding wildfire hotspots. Therefore, the NO_2 contributions from the UFO are not significant in terms of a cumulative NAAQS compliance assessment.

AQRVs - The CARMMS visibility and deposition results for the UFO are shown in the scaled report year results tables below. The impacts to Class I area visibility are all below the project level SILs even for the high scenario at cumulative (i.e. aggregated source) scales. The maximum nitrogen deposition results indicate DAT exceedances for the high and mitigated CARMMS scenarios. Each scenario produced DAT exceedances at two of the 26 Class I areas analyzed. The medium scenario produced an effective average mitigation rate of about 29% at DAT-exceeded Class I areas; however, it did not reduce the number of impacted areas overall. Potential impacts to acid lake neutralization capacity are well below the defined project level thresholds of analysis. See the CARMMs Data Explorer for all other analyzed Class I areas impacts resulting from projected UFO development.

Oil and Gas Development

There was no new development in the UFO during 2020. Total production within the Field Office accounted for approximately 0.00% and 0.17% of the statewide total oil and gas production, respectively. COGCC data shows that active wells recorded production days for 53% of the year, and that 10% of these wells recorded oil volumes while 66% recorded gas volumes. In terms of total mineral production volumes in Colorado, the UFO region ranks 8th and 7th for oil and gas production. The federal rankings relative to all of the field offices is shown in the table below.

Table 4.7-2 - Oil and Gas Statistics

Development Map

Description	Federal	Cumulative	% Federal	FO Rank
New Wells (spuds)	0	0	0.00%	4
Active Wells	47	68	69.12%	8
Gas Production (Mcf)	2,153,570	3,941,446	54.64%	7
Liquids Production (bbl)	302	637	47.41%	8

Emissions Tracking

On a calendar year basis, 2020 represents 50% of the CARMMS emissions budget (assuming perfectly linear development / emissions ratios). In terms of idealized absolutes, none of the pollutants are tracking at the annualized rate. All of the estimated 2020 emissions are below the low CARMMS scenario levels. The following section presents the report year tracking statistics and applicable scaled source apportionment parameters from CARMMS for the UFO.

Table 4.7-3 - Report Year Oil and Gas Emissions

Description	PM_{10}	$PM_{2.5}$	VOC	NO_X	CO	SO_2	CO_2	CH_4	N_2O	HAPs
Existing (pre CARMMS)	11.214	3.398	44.777	58.450	66.355	0.023	19,497	378.443	0.327	7.675
New Federal	0.000	0.000	0.000	0.000	0.000	0.000	0	0.000	0.000	0.000
Per Well Average	0.000	0.000	0.000	0.000	0.000	0.000	0	0.000	0.000	0.000
Cumulative (Federal - SA)	0.109	0.038	0.864	0.696	0.805	0.004	243	6.533	0.004	0.094

Existing emissions (CARMMS 2015 base inventory year, declined), Cumulative - Source Apportioned (SA) emissions are tracked (since base year) to show relative to CARMMS model scenarios (below), GHGs do not include downstream (assumed combustion, shown in climate section below).

Figure 8 - Relative Report Year Emissions

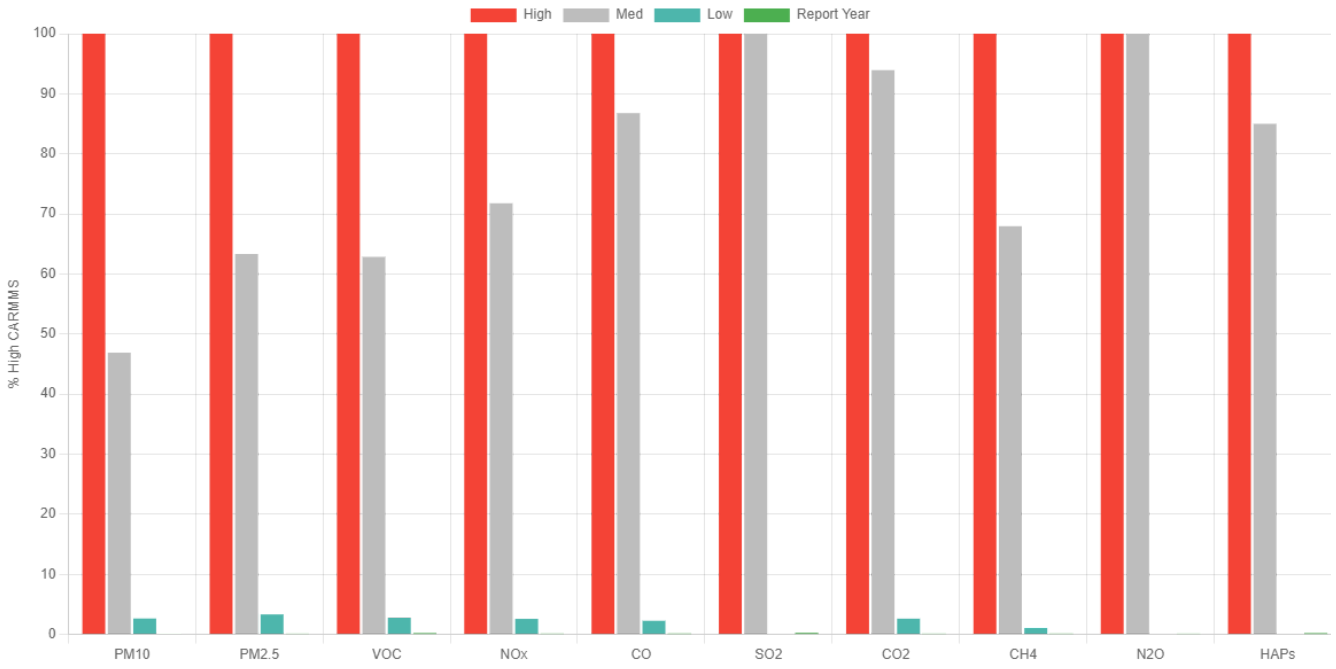

Table 4.7-4 - Scaled NAAQS Analysis

Parameter	% High Scenario	Calculated RY NAAQS	% NAAQS	% SIL
PM10 (Annual)	0.10%	0.00 (ug/m3)	0.00%	0.09%
PM2.5 (24-hour)	0.13%	0.00 (ug/m3)	0.00%	0.02%
PM2.5 (Annual)	0.13%	0.00 (ug/m3)	0.00%	0.13%
NO2 (1-hour)	0.15%	0.01 (ppb)	0.01%	0.10%
NO2 (Annual)	0.15%	0.00 (ppb)	0.00%	0.22%
Ozone (4DM8A)	0.20%	0.00 (ppb)	0.00%	0.16%

Note: Table data based on source apportion results of high CARMMS scenario.

Table 4.7-5 - Scaled Deposition Impacts (kg/ha-yr)

Scenario	Max Class I Impact	Class I % DAT	Class I Area	Max Class II Impact	Class II % DAT	Class II Area
Low	0.001	10%	Maroon_Bells-Snowmass_Wilderness	0.001	14%	Raggeds_Wilderness
Mitigated	0.015	304%	Maroon_Bells-Snowmass_Wilderness	0.017	342%	Raggeds_Wilderness
High	0.022	432%	Maroon_Bells-Snowmass_Wilderness	0.024	486%	Raggeds_Wilderness
Report Year	0.000	1%	Maroon_Bells-Snowmass_Wilderness	0.000	1%	Raggeds_Wilderness

Note: Low, Mitigated, and High data are actual CARMMS results (highest projected impact areas only, for full details see carmms section). Report Year data shows scaled impacts.

Table 4.7-6 - Scaled Visibility Impacts (dv)

Scenario	Max Class I Impact	Days > 0.5dv	Days > 1.0dv	Class I Area	Max Class II Impact	Days > 0.5dv	Days > 1.0dv	Class II Area
Low	0.002	0	0	Maroon_Bells-Snowmass_Wilderness	0.004	0	0	Raggeds_Wilderness
Mitigated	0.085	0	0	Maroon_Bells-Snowmass_Wilderness	0.096	0	0	Raggeds_Wilderness
High	0.130	0	0	Maroon_Bells-Snowmass_Wilderness	0.138	0	0	Raggeds_Wilderness
Report Year	0.000	0	0	Maroon_Bells-Snowmass_Wilderness	0.000	0	0	Raggeds_Wilderness

Note: Low, Mitigated, and High data are actual CARMMS results (highest projected impact areas only, for full details see CARMMS section). Report Year data shows scaled impacts.

UFO Findings

The major air quality issue in the Southwest District appears to be the elevated levels of ozone that are precipitously close to the level of the NAAQS. In the UFO, this issue is not as pronounced as the Paonia monitor is tracking levels closer to 60 ppb. There has been almost zero federal development in the Field Office over the monitoring period, and all of the scaled impacts are well below the project level analysis thresholds. In general, air resource values are meeting the objectives of the governing RMP and BLM's adaptive management strategy. No specific mitigation beyond that outlined in governing documents and the inherent project level analysis commitments that are part of BLM's review and approval process are required.

4.8 White River Field Office

The White River Field Office (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. Within the scope of the BLM's authority, the goals are to limit air quality degradation by implementing actions designed to minimize emissions that may cause or contribute to negative impacts to air quality or air quality-related values (AQRVs) in Class I Airsheds affected by actions in the planning area. Management actions within the WRFO to meet RMP goals and objectives include the following:

- Implement adaptive management strategy for protecting air resources to include the preceding actions, and track project-specific emissions for comparison against the most recent regional air quality model results as a means to provide context for any contemporaneous development period. Provide an annual activity and air quality summary report as described in the CARPP.
- Require the use of green completion technology in well completions and recompletions unless the operator can document the need for an exemption. During well completions that do not use green completion technology, flaring of natural gas would be required. Venting of natural gas would not be allowed, except during emergency situations. Requirements would be consistent with New Source Performance Standard OOOO Regulations.
- In addition to fugitive dust control plan implementation, require operators to treat construction sites and resource roads with water and/or a chemical dust suppressant during construction and drilling activities so that no dust plume is visible from construction sites or behind vehicles. All vehicles would abide by company or public speed restrictions.
- Require emission controls for glycol dehydrators, condensate tanks, and produced water tanks, without regard to the location of the equipment or the quantity of uncontrolled volatile organic compound (VOC) emissions from the equipment.
- Develop COAs for project-specific surface-disturbing activities to prevent BLM-permitted actions from causing or contributing to exceedances of ambient air quality standards or causing significant adverse impacts on air quality related values.
- Meet EPA requirements for drill rig engines and fracturing (frac) pump engines. Section 3.5 Mitigation regarding COAs where the BLM may require all new and existing drill rig engines to meet EPA generator set Tier 4 (or more stringent) emission standards at the Project-level stage by 2015.
- Require engines at field compression facilities to meet applicable Colorado Department of Public Health and Environment (CDPHE) guidelines, Air Quality Control Commission (AQCC) regulations, and EPA emission standards.
- Where feasible, promote the use of three-phase gathering systems to transport natural gas, condensate, and produced water to consolidated facilities where dehydration, temporary tank storage, and truck loading would occur.
- Evaluate possible emissions control effectiveness for permitting any actions at project-level analysis, and apply any requirements as COAs.

- Attach a Lease Notice to new oil and gas leasing agreements to provide notice to operators of analysis and mitigation requirements that will be determined on a case-by-case basis at the permitting / development stage.
- Participate in, conduct, or require air-modeling analyses as described in the CARPP as part of a comprehensive strategy to prevent BLM-permitted activities from causing or contributing to violations of ambient air quality standards or causing significant adverse impacts on air quality related values.

Air Quality Review

The WRFO is entirely contained within the CDPHE's Western Slope air quality region. The region is 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. The WRFO has two BLM-sponsored air quality monitors located in the towns of Rangely and Meeker that monitor for ozone, $PM_{2.5}$, and NO_2.

A review of the available monitoring data for the district shows that all of the sites are in compliance with the NAAQS. The trends for all pollutants appear stable, with few notable exceptions. The area NO_2 monitors recorded not more than 26% of the 1 hour standard on a 3 year average basis (the form of the standard, not paired). For the annual average, the maximum monitor is trending near 10% of the NAAQS. No exceedances were recorded for either form of the NO_2 standard. The majority of area PM_{10} monitors are well below the NAAQS at approximately 35%. Area $PM_{2.5}$ monitors display a slight variance from site to site and year to year, particularly for the 24-hour standard. These monitors show the maximum annual and 24-hour standards trending around 55% and 70% of the of the NAAQS, respectively. Ozone monitors are typically recording 4th high values well above 60 ppb, where the highest 3 year average is approximately 64.6 ppb or 92% of the NAAQS. There were 3 ozone exceedances recorded in 2020, and overall the values are elevated compared to the previous year. Additional information on air quality trends within the CRVFO can be found in CDPHE's Air Quality Annual Reports.

There are two Class I areas partially contained or in close proximity to the WRFO boundaries that could be potentially impacted by Federal oil and gas development: the Flat Tops Wilderness area and Dinosaur National Monument. The Monument is a Class I area for SO_2 increment protection (State only). Potential AQRV concerns for these areas exist due to the possibility of close oil and gas development. Any actual proposed development will need a case-by-case analysis to determine the extent of the potential impacts beyond what CARMMS has already predicted for projected development in the area, as is true for any area.

NOTE: The AQRV datasets are currently limited to 2019 data. This section will be updated as the 2020 datsets become available.

AQRV visibility monitoring is limited to the Flat Tops Wilderness areas. The Flat Tops data (FLTO1) shows improvements in visibility trends of -0.02 dv/yr for the clearest days, where the average haze index is approximately 1.5 dv. The data for the haziest days is trending up at a rate of 0.22 dv/yr, where the average haze index is around 10 dv.

There are no deposition monitors in the WRFO. The closest deposition monitors to the Dinosaur NM are in Utah. There is a NADP monitor (UT95), and a CASTNET monitor (DIN431) just west of the monument. The data shows a total deposition trend of approximately 2.5 kg/ha-yr.

CARMMS Results

NAAQS - The maximum modeled source apportionment contributions (i.e. Federal) relative to any of the NAAQS pollutants of concern are shown in the table below. The table also displays the calculated effective mitigation rates relative to the high scenario as a percent reduction, based on the mitigated scenario results. The spatial extents and concentration gradients for the pollutants of concern for all scenarios are shown within the CARMMS Data Explorer (see SA Plots). It is important to remember that these maximums do not necessarily align, spatially or temporally, with the maximum modeled values within the CARMMS domain.

Table 4.8-1 - Source Apportionment Results

Pollutants (standard)	Units	Low	Mitigated	High	Mitigation Rate (%)
PM10 (Annual)	ug/m3	2	11.3	19.6	42.3%
PM2.5 (24-hour)	ug/m3	0.9	5.5	6.3	12.7%
PM2.5 (Annual)	ug/m3	0.4	2.8	3.4	17.6%
NO2 (1-hour)	ppb	11.1	61.3	64.1	4.4%
NO2 (Annual)	ppb	4.5	22	24.3	9.5%
Ozone (4DM8A)	ppb	1	6.5	7.1	8.5%

All high scenario maximum contribution values from the projected development within the WRFO are above the project level modeling SILs. As discussed in the cumulative BLM Colorado analysis section, there are no predicted exceedances of the NO_2 NAAQS anywhere in the CARMMS domain, excluding wildfire hotspots. Therefore, the NO_2 contributions from the WRFO are not significant in terms of a cumulative NAAQS compliance assessment. The 2025 results for particulate matter do not show concentrations in excess of the NAAQS within the WRFO, and thus the PM contributions are not significant in terms of a cumulative NAAQS compliance assessment.

AQRVs - The CARMMS visibility and deposition results for the WRFO are shown in the scaled report year results tables below. The impacts to Class I area visibility are all below the project level SILs even for the high scenario at cumulative (i.e. aggregated source) scales, except for Dinosaur National Monument. Note that the Monument does not have Class I area protected status for visibility impacts, although the BLM acknowledges its special status as a National Monument and seeks to provide protections as appropriate. The medium scenario produced an effective mitigation rate of about 7%, which reduced 0.5dv exceeded days by 9 and 1.0dv exceeded days by 1. The maximum nitrogen deposition results indicate DAT exceedances for each CARMMS scenario. The high, mitigated, and low scenarios produced DAT exceedances at 15, 12, and 5 of the 26 Class I areas analyzed, respectively. The medium scenario produced an effective average mitigation rate of about 12% at DAT exceeded Class I areas. Potential impacts to acid lake neutralization capacity are well below the defined project-level thresholds of analysis. See the CARMMs Data Explorer for all other analyzed Class I areas impacts resulting from projected WRFO development.

Oil and Gas Development

Total development in 2020 was down sharply from the previous year. Total production within the Field Office accounted for approximately 1.98% and 1.87% of the statewide total oil and gas production, respectively. COGCC data shows that active wells recorded production days for 73% of the year, and that 60% of these wells recorded oil volumes while 84% recorded gas volumes. In terms of total mineral production volumes in Colorado, the WRFO region ranks 2nd and 5th for oil and gas production. The federal rankings relative to all of the field offices is shown in the table below.

Table 4.8-2 - Oil and Gas Statistics

Development Map

Description	Federal	Cumulative	% Federal	FO Rank
New Wells (spuds)	2	8	25.00%	3
Active Wells	2,544	4,328	58.78%	2
Gas Production (Mcf)	74,810,060	42,978,312	174.06%	3
Liquids Production (bbl)	1,812,995	3,394,064	53.42%	2

Emissions Tracking

On a calendar year basis, 2020 represents 50% of the CARMMS emissions budget (assuming perfectly linear development / emissions ratios). Federal development in the WRFO has been exceptionally low over the monitoring period, such that Field Office emissions are tracking well below the low CARMMS scenario levels. The following section presents the report year tracking statistics and applicable scaled source apportionment parameters from CARMMS for the WRFO.

Table 4.8-3 - Report Year Oil and Gas Emissions

Description	PM_{10}	$PM_{2.5}$	VOC	NO_X	CO	SO_2	CO_2	CH_4	N_2O	HAPs
Existing (pre CARMMS)	320.669	173.353	7,206.472	2,817.973	2,438.244	283.712	1,467,203	34,340.775	26.015	925.615
New Federal	1.738	0.349	2.016	5.632	3.838	0.020	1,183	13.377	0.030	0.274
Per Well Average	0.869	0.175	1.008	2.816	1.919	0.010	591	6.689	0.015	0.137
Cumulative (Federal - SA)	10.781	7.244	236.203	134.056	102.935	19.371	49,840	854.585	0.866	37.873

Existing emissions (CARMMS 2015 base inventory year, declined), Cumulative - Source Apportioned (SA) emissions are tracked (since base year) to show relative to CARMMS model scenarios (below), GHGs do not include downstream (assumed combustion, shown in climate section below).

Figure 9 - Relative Report Year Emissions

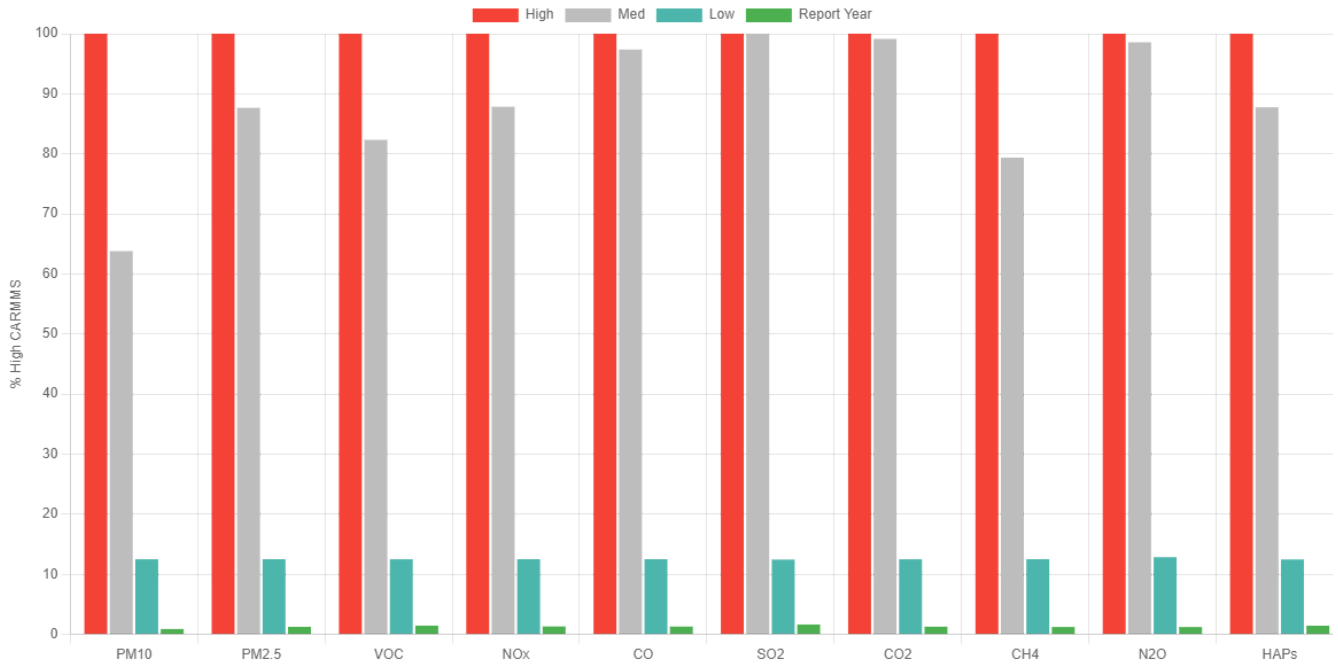

Table 4.8-4 - Scaled NAAQS Analysis

Parameter	% High Scenario	Calculated RY NAAQS	% NAAQS	% SIL
PM10 (Annual)	0.90%	0.18 (ug/m3)	0.12%	17.63%
PM2.5 (24-hour)	1.26%	0.08 (ug/m3)	0.23%	6.62%
PM2.5 (Annual)	1.26%	0.04 (ug/m3)	0.36%	21.42%
NO2 (1-hour)	1.32%	0.84 (ppb)	0.84%	11.25%
NO2 (Annual)	1.32%	0.32 (ppb)	0.60%	31.98%
Ozone (4DM8A)	1.39%	0.10 (ppb)	0.14%	9.84%

Note: Table data based on source apportion results of high CARMMS scenario.

Table 4.8-5 - Scaled Deposition Impacts (kg/ha-yr)

Scenario	Max Class I Impact	Class I % DAT	Class I Area	Max Class II Impact	Class II % DAT	Class II Area
Low	0.017	332%	Dinosaur_NM	0.044	888%	Dinosaur_NM
Mitigated	0.119	2,378%	Dinosaur_NM	0.307	6,148%	Dinosaur_NM
High	0.135	2,706%	Dinosaur_NM	0.349	6,984%	Dinosaur_NM
Report Year	0.002	36%	Dinosaur_NM	0.005	92%	Dinosaur_NM

Note: Low, Mitigated, and High data are actual CARMMS results (highest projected impact areas only, for full details see carmms section). Report Year data shows scaled impacts.

Table 4.8-6 - Scaled Visibility Impacts (dv)

Scenario	Max Class I Impact	Days > 0.5dv	Days > 1.0dv	Class I Area	Max Class II Impact	Days > 0.5dv	Days > 1.0dv	Class II Area
Low	0.246	0	0	Dinosaur_NM	0.511	0	0	Dinosaur_NM
Mitigated	1.449	0	0	Dinosaur_NM	2.389	0	0	Dinosaur_NM
High	1.555	41	1	Dinosaur_NM	2.558	83	25	Dinosaur_NM
Report Year	0.022	0	0	Dinosaur_NM	0.035	0	0	Dinosaur_NM

Note: Low, Mitigated, and High data are actual CARMMS results (highest projected impact areas only, for full details see CARMMS section). Report Year data shows scaled impacts.

WRFO Findings

The major air quality issue in the Northwest District appears to be potential projected deposition impacts. There has been very limited federal development in the Field Office during the monitoring period (approximately 78 wells). The scaled model impacts for 2020 are not showing exceedances of the project level SILs for any pollutants. There are also no scaled source apportioned values exceeding the DATs for nitrogen deposition or visibility AQRVs. In general, air resource values are meeting the objectives of the governing RMP and BLM's adaptive management strategy. No specific mitigation beyond that outlined in governing documents and the inherent project level analysis commitments that are part of BLM's review and approval process are required.

5.0 Cumulative Air Resources Assessment

BLM Colorado

This section provides a cumulative assessment of impacts from BLM Colorado actions as a whole for tracked emissions relative to the CARMMS model results (source group X). The discussion initially focuses on the overall cumulative CARMMS results and the interpretation of the raw data values. Then, this section discloses the report year metrics to provide the reader with an overall sense of the current intensity of BLM-analyzed actions. In general, the CARMMS model results for each scenario show improvements to future year metrics for most air quality parameters. Obviously, the greatest improvements to future year air quality parameters are shown for the low development scenario. As stated above, both the PSD and ANC analysis results indicated that project-level thresholds would not be exceeded by the cumulative BLM projections, and thus no further analysis is being presented for those metrics.

NAAQS

Nitrogen Dioxide: The cumulative CARMMS results do not predict exceedances of the annual or 1-hour NO_2 standards anywhere in Colorado. In general, the maximum impacts tend to occur in basins with higher levels of predicted oil and gas development and in major metropolitan areas. The spatial extent of the maximum impacted areas are virtually the same for the base year and each future year scenario, where the greatest predicted changes occur in the Piceance and Denver-Julesburg basins. BLM Colorado's cumulative contribution to the annual and 1-hour NO_2 standards are 24.7 ppb and 64.2 ppb, respectively. Both maximums occur in the White River Field Office. The mitigated scenario shows that the maximum impacts to the annual and 1-hour standards could be reduced by 10% and 4.5% on average.

Particulate Matter: The cumulative CARMMS results show potential exceedances of the PM_{10} NAAQS in Colorado for the base year and all three future scenarios. The base year and the future scenarios share similar spatial extents for the exceedances, which generally occur at the western edge of the Grand Junction Field Office, southern Weld County, and a few sparse areas in the southeast plains. The greatest changes occur in Weld County for all scenarios. The cumulative results for BLM Colorado show the high scenario contributes a maximum of 19.7 $\mu g/m^3$ towards the NAAQS within the White River Field Office. The source apportionment plot demonstrates higher contributions also occur in the Grand Junction Field Office (14 - 16 $\mu g/m^3$) and in northern Weld County, Colorado (10 - 12 $\mu g/m^3$). The spatial overlap of the highest contributions and the predicted exceedances do not appear to intersect. The maximum BLM contribution (3 $\mu g/m^3$) to any exceedance appears to be in southern Weld County. Although this is above the project level SIL (1 $\mu g/m^3$), on a cumulative basis the contribution is minor and unlikely to cause the predicted exceedance. The mitigated scenario shows a maximum PM_{10} contribution of 11.4 $\mu g/m^3$, which equates to an effective mitigation rate of 42% at the highest impacted location.

The spatial extent of the maximum cumulative annual and daily $PM_{2.5}$ impacts are mostly confined to Denver and southern Weld counties for the base year and for each future scenario. Both the base year and each future year are showing exceedances within these areas for the annual and 24-hour standards, where the high scenario predicts a maximum of 21.1 $\mu g/m^3$ and approximately 75 $\mu g/m^3$ for each standard, respectively. The maximum BLM Colorado contributions to the annual and daily $PM_{2.5}$ standards are 3.5 $\mu g/m^3$ and 6.3 $\mu g/m^3$, where both maximums occur in the White River Field Office. BLM Colorado's maximum contribution to the annual standard within an exceedance area is between 0.5 and 0.75 $\mu g/m^3$ Again, this value is above the project-level SIL (0.2 $\mu g/m^3$), but relatively minor at cumulative scales. The contributions appear to overlap at an exceedance cell that ranges between 12 and 18 $\mu g/m^3$. It is unlikely that BLM Colorado's contribution in this area would cause or contribute significantly to an exceedance of the annual standard. The BLM's maximum contribution to an exceedance of the 24-hour $PM_{2.5}$ standard is 1.4 $\mu g/m^3$, where the project level SIL for the NAAQS analysis is 1.2 $\mu g/m^3$. The corresponding modeled value for the exceedance was 39.3 $\mu g/m^3$; thus, it is highly likely that absent the BLM's contribution, the modeled NAAQS would still be exceeded. It is therefore unlikely that BLM Colorado's contribution is significant anywhere within the model domain.

Finally, it is noted that the CARMMS 2.0 model tends to over-predict particulate matter impacts across the domain. This is entirely evident given that the base year predicts widespread exceedances of the PM NAAQS despite the fact that no monitored exceedances were observed, except for a single record at the Commerce City (Adams County) $PM_{2.5}$ monitor (out of 26 operating PM monitors in the northern Front Range area in 2011). One of the most likely causes of the erroneous predictions is a problem with the modeled emissions inventories, specifically with the fugitive dust estimates. Numerous assumptions were made for fugitive dust generating sources and activities, which are notoriously difficult to estimate given the methods (EPA AP-42) and required data inputs. In general, it is very likely that the CARMMS results are conservative overall with respect to the modeled PM impacts.

Ozone: Cumulative ozone results for the future year CARMMS scenarios all show improving air quality relative to the base year, and all monitored locations have future year design values less than the base year design values. On average, the high, mitigated, and low scenarios show future monitor ozone design value decreases of 3.7, 3.9, and 4.8 parts per billion, respectively. The base year data shows that sixteen of Colorado's 27 ozone monitors had design values in excess of 71 ppb. The future year design value results show that for the high and mitigated scenarios, eight additional monitor locations are showing compliance, while the low scenario provides for an additional ten monitor locations

showing compliance. The average BLM Colorado contributions to the monitored location future design values for the high, mitigated, and low scenarios are 0.54, 0.43, and 0.15 ppb, respectively. To determine whether the Federal contributions have the potential to significantly influence the future design values at any monitor, the BLM subtracted the contribution from the future value to see if the result was below 71 ppb, which is the ozone NAAQS cutoff point. For the low scenario, the results did not show any monitor flipping to attainment from the reduction of the federal contribution. For the high and mitigated scenario, only a single monitor flipped to show attainment (Jefferson County - 80590002). The Federal contribution at the flipped monitor in the high and mitigated scenario was 0.4 ppb and 0.3 ppb, respectively. In each case, the Federal contribution is below the EPA's recommended PSD SIL of 1 ppb. Although the PSD SIL is not directly applicable to the aggregated Federal oil and gas sources, it provides some measure of the relative significance of the modeled impacts and suggests that on an aggregate basis, the federal contributions are not significant. The cumulative Model Attainment Test ozone plots of the entire CARMMS domain showing the predicted future ozone concentrations are available to be viewed in the CARMMS Data Explorer above. In general, the results show that federal mineral development has a minor impact on regional ozone formation potential, even at high development scenario scales.

In addition to the pollutants of concern identified above in the CARMMS section, the study also produced NAAQS impact results for carbon monoxide (CO) and sulfur dioxide SO_2). For these pollutants, the model predicted total maximum cumulative impacts for the high scenario that do not exceed the NAAQS in Colorado for any form of the applicable standards. Carbon monoxide and sulfur dioxide are generally not pollutants of concern for BLM-authorized activities; therefore, no further discussion or analysis of these pollutants is being presented in this report.

AQRVs

Deposition: Base year source apportioned deposition results are not available for the CARMMS model; however, the delta between the base and future year (source group A7) high scenario shows total deposition decreases for each class I area analyzed. The decreases range from 5.7% to 22.5%, where the average decrease across all of the Class I areas is 14.8%. The average deposition decrease for the Low CARMMS scenario across all Class I areas analyzed is 17.3%, and for the mitigated scenario the decrease is 15.3%. The source apportionment data for BLM Colorado (see CARMMS Data Explorer above) demonstrates that high scenario deposition rates are above the project level DAT for fifteen of the 26 Class I areas analyzed. For the low scenario the DAT exceedances drop to nine, while the mitigated scenario still predicts fifteen Class I areas above the DAT. The mitigated scenario provides for approximately a 16% reduction (0.0075 kg/ha-yr) of the maximum deposition rates on average across the fifteen DAT exceeding Class I areas. Recall that beyond full cumulative critical loads, there exists no quasi-cumulative thresholds for aggregated sources such as those analyzed within the CARMMS scenarios. Although the full cumulative CARMMS results show projected improvements at all Class I areas, we note that many sensitive species within these resource areas could still experience nitrogen deposition rates above established critical loads.

Visibility: The cumulative visibility analysis done within the CARMMS model is based on the Regional Haze Rule (RHR) guidelines. The RHR has the stated goal of achieving natural visibility conditions at 156 Federally mandated Class I areas by 2064. More specifically, the RHR goal is defined as (1) visibility improvement toward natural conditions for the 20% of days that have the worst visibility (termed “20% worst,” or W20%, visibility days) and (2) no worsening in visibility for the 20% of days that have the best visibility (“20% best,” or B20%, visibility days). The rule is applicable to states, where applicable regulatory agencies must submit a SIP that demonstrations to the EPA that they are making reasonable progress toward the 2064 goal. Reasonable progress is demonstrated by modeling base and future year emissions scenarios and compiling the results at existing IMPROVE monitor locations. The monitors are not installed at all Class I areas, so some monitor values and their associated modeling results are extended to represent other nearby areas where appropriate. Cumulative visibility impacts are available for review within the CARMMS Data Explorer above. The high scenario results indicate deteriorating W20% conditions at four Class I areas (three IMPROVE sites), all of which are outside of Colorado (max change is -0.11dv) except for Rocky Mountain National Park (-0.09dv). Only the Salt Creek monitor is showing negative results for the B20% metric (-0.01dv). The low scenario does not show any B20% degradation at any site. For the W20% metric, the low scenario shows degradation at three sites, all outside of Colorado, where the maximum change (-0.11dv) is at the Salt Creek site, same as for the high scenario results. For all other sites, the results show improvements across all scenarios. The source apportionment results for all of BLM Colorado show that the maximum impact to any Class I area occurs at the Dinosaur National Monument under all three emissions scenarios. The relative contributions are 1.57dv, 1.46dv, and 0.25dv for the high, medium, and low scenarios, respectively. Overall, the effective mitigation rate averaged across all Class I areas analyzed is 12.9%, which results in a contribution reduction of 0.04dv (on average). The mitigation scenario also shows a reduction in the number of days that contribute to (>0.5dv) and cause (>1.0dv) visibility impacts by 17 and 1 days, respectively. For the W20% metric, the data shows that BLM Colorado contributes less than 0.4dv of impairment to any Class I area analyzed.

Ozone: The CARMMS 2.0 study also analyzed ozone exposure stress impacts to flora via the W126 metric described above. To calculate the annual W126 metric, daily cumulative exposures from 8:00 AM to 8:00 PM were summed across the ozone season (defined as April to October) on a three-month consecutive rolling basis. The complied exposure sums provided five three-month datasets from which to find the maximum exposure data. The results show that the annual W126 index ranges from 4 to 35 ppm-hours for the 2011 Base Year. The high scenario results indicate the W126 ranges from 7 to 32 ppm-hours, where the maximum occurs along the southern portion of the 4km domain and the minimum occurs along the Utah and Wyoming border, just west of the Colorado border. Reductions of the W126 in the high scenario are seen over most areas within the 12/4 km domain except at some locations near Denver and in northwestern New Mexico. The annual W126 index for the 2025 low and medium CARMMS scenarios has a very similar spatial pattern to the 2025 high scenario, and show similar reduction compared to the 2011 Base Year. The contribution of new Federal oil and gas in Colorado (source group X) is very small for all three scenarios with spatial maximums of 0.82, 0.24, and 0.71 ppb, for the high, low, and medium scenarios, respectively. The maximum contribution from source group X to W126 within the 12/4 km domain occurs in the White River Field Office for the high and medium scenarios, and in the Colorado River Valley Field Office for the low scenario. The W126 is a cumulative exposure metric by default, and thus the Federal oil and gas contributions do not provide for any significance determinations relative to the metric itself. The data demonstrates that exposures across the state range between 8 and 29 ppm-hours, where the highest results are shown to occur along the front-range, the southern border, and the

southeast plains. A majority of Class I areas in Colorado show results that range from 11 to 17 ppm-hours, which is above the exposure index threshold of significant concern (NPS 2017).

Fluid Mineral Development Metrics

A query of the available COGCC production data for 2020 shows Colorado had approximately 62,556 distinct wells with a producing status. Of these wells, 31,979 reported oil production while 48,594 reported gas production during the year. The majority of the active fluid mineral wells are located in just two counties, Weld (35.8%) and Garfield (25.8%). In total Colorado produced 171,483,820 bbls of oil and 2,295,115,849 Mcf of natural gas, of which the Federal portion of each was 8,059,649 bbls (4.7%) and 557,286,862 Mcf (24.3%), respectively. Weld County alone is responsible for almost 88% of the total oil production, while a little over 70% of the total gas produced came from Weld, Garfield, and La Plata counties. From a field office perspective, the TRFO dominated Federal gas production, providing 42% of the federal production, followed by the CRVFO and the WRFO. Federal oil production was lead by the RGFO (67.9%) and WRFO (22.5%).

BLM compiles national oil and gas statistic annually for all Federal mineral producing states. A summary of this data is provided in the table below. The statistics show that despite continued leasing, the overall number of leased acres has declined over the monitoring period by approximately 21%. This fact accounts for a majority of the changes in the percent of leases held by production metric. APD approvals and spud rates have seen slight increases over the monitoring period. The data reinforces that fact that lease hold production increases are a result of shrinking lease acres more than actual increases in development. On average, BLM Colorado has about one well per 195 acres of producing lease acres for the report year. Extrapolating the calculated spacing data across the remaining leased acres indicates that there is presently the potential for another 4,650 wells that could be developed. Dividing the potential well estimate by the current 5 year average development rate (173 wells per year) yields a timeline of 27 years to develop the estimated remaining wells. To be clear, the statistics presented here are not a prediction of what will occur or what is even likely to occur, but they do present the reality of the current data trends over the monitoring period. These data trends show how RFD documents, that are developed for various analysis applications, are not entirely representative of the realities of a free energy market, and how market circumstances (or changes) drive development for what is essentially a global commodity.

Table 5-1 - Federal Oil and Gas Statistics

Parameter	2016	2017	2018	2019	2020
Total Leased Acres	3001009	2846286	2692029	2625627	2373847
Producing Leases	2238	2221	2204	2195	2145
Producing Acres	1526229	1511663	1502100	1484195	1468209
Percent of Leased Acres in Production *	0.5085	0.5311	0.5579	0.5652	0.6184
Leases Issued	128	139	105	62	20
Acres Leased	96622	114970	85835	25235	13678
Average Lease Size (acres) *	755	827	817	407	684
APDs Approved	218	319	402	354	250
Well Spuds	111	148	225	228	155
Number of Producible Wells	6815	7182	7342	7406	7539
Current Spacing *	224	210	205	200	195
Lease RFD (based on current spacing) *	13400	13523	13158	13102	12189
Potential New Wells *	6585	6341	5816	5696	4650

Source: BLM Oil and Gas Statistics (all statistics are relative to FY start and end dates, NOT calendar years), * calculated parameter

Figure 10 - Relative Report Year Emissions

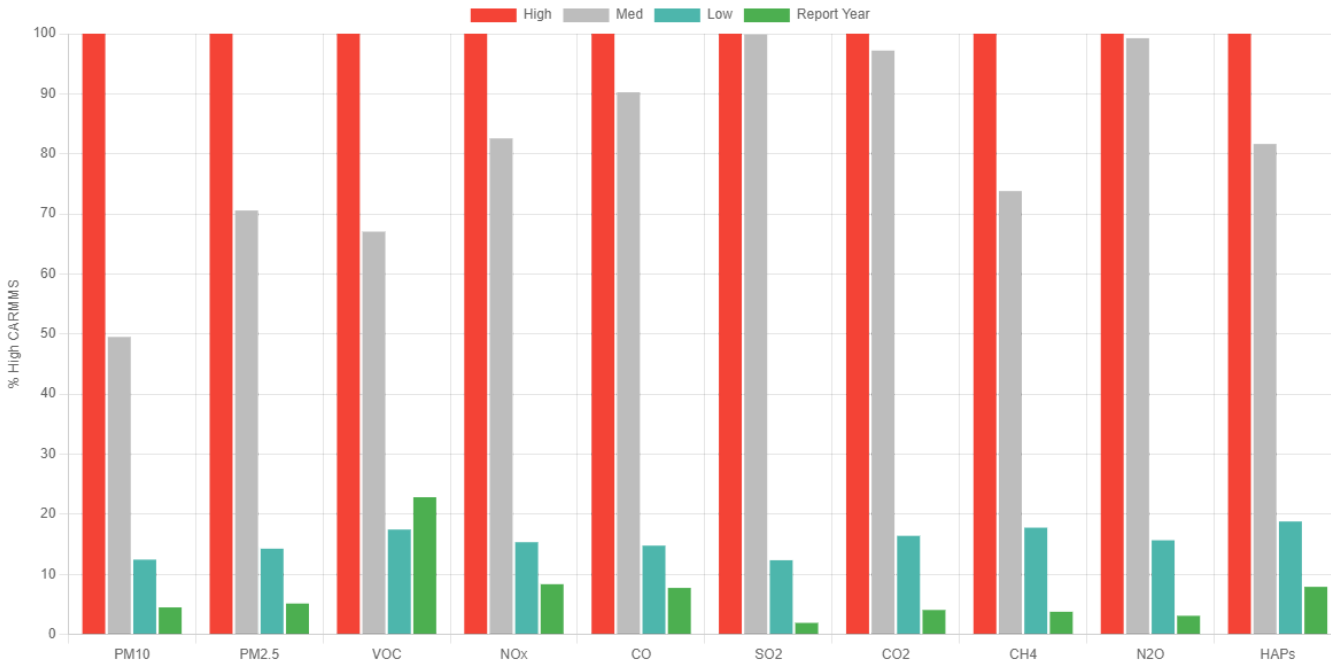

Table 5-2 - Scaled NAAQS Analysis

Parameter	% High Scenario	Calculated RY NAAQS	% NAAQS
PM10 (Annual)	4.50%	0.89 (ug/m3)	0.59
PM2.5 (24-hour)	5.14%	0.32 (ug/m3)	0.92
PM2.5 (Annual)	5.14%	0.18 (ug/m3)	1.50
NO2 (1-hour)	8.36%	5.36 (ppb)	5.36
NO2 (Annual)	8.36%	2.06 (ppb)	3.89
Ozone (4DM8A)	15.60%	1.36 (ppb)	1.94

Note: Table data based on source apportion results of high CARMMS scenario.

Table 5-3 - Scaled Deposition Impacts (kg/ha-yr)

Scenario	Max Class I Impact	Class I % DAT	Class I Area	Max Class II Impact	Class II % DAT	Class II Area
Low	0.042	836%	Eagles_Nest	0.169	3,376%	Dinosaur_all
Mitigated	0.129	2,570%	Eagles_Nest	1.149	22,978%	Dinosaur_all
High	0.151	3,018%	Eagles_Nest	1.310	26,192%	Dinosaur_all
Report Year	0.013	252%	Eagles_Nest_Wilderness	0.109	2,189%	Dinosaur_all

Note: Low, Mitigated, and High data are actual CARMMS results (highest projected impact areas only, for full details see carmms section). Report Year data shows scaled impacts.

Table 5-4 - Scaled Visibility Impacts (dv)

Scenario	Max Class I Impact	Days > 0.5dv	Days > 1.0dv	Class I Area	Max Class II Impact	Days > 0.5dv	Days > 1.0dv	Class II Area
Low	0.250	0	0	CI_Dinosaur_CO	0.513	1	0	CII_Dinosaur_all
Mitigated	1.457	36	3	CI_Dinosaur_CO	2.397	76	24	CII_Dinosaur_all
High	1.565	44	4	CI_Dinosaur_CO	2.567	89	32	CII_Dinosaur_all
Report Year	0.244	0	0	CI_Dinosaur_CO	0.400	0	0	CII_Dinosaur_all

Note: Low, Mitigated, and High data are actual CARMMS results (highest projected impact areas only, for full details see CARMMS section). Report Year data shows scaled impacts.

BLM CO Findings

The data shows that 2020 cumulative emissions tracked over the monitoring period are all roughly at the low CARMMS scenario, save for the particulate matter and VOC species. The primary drivers of source apportioned emissions are from oil and gas development in the Colorado River Valley and Kremmling field offices. None of the interpolated criteria pollutant concentrations are showing significant contributions to the NAAQS, which is expected given the CARMMS results overall do not predict significant impacts to the NAAQS from federal mineral development. Visibility impacts are also less than significant based on comparison to the project level DAT. The comparison shows just how little the current pace of new federal development is contributing to visibility issues at all of the Class I areas analyzed. Nitrogen deposition is very much an issue across the state. Based on the scaling calculations BLM Colorado's report year contributions are projected to be above the project level DAT at 9 of the most impacted Class I areas relative to the CARMMS high scenario results. The spatial dynamics of the report year emissions distributions line up for the Eagles Nest data (see CRVFO) and the Rawah Wilderness (see KFO). In general, the cumulative impacts to air resources across the state from new federal oil and gas development are relatively minor.

6.0 Climate Statistics and Analysis

IMPORTANT!! The content within this section of the Colorado Annual Report has been deprecated in order to defer to a National Report that provides a BLM wide analysis of GHGs and Climate, including the potential actions and effects related to Colorado. Readers can access the National GHG report at https://www.co.blm.gov/AirResourcesReport/ghg.