U.S. DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

May 2023

Miles City Field Office

Draft Supplemental Environmental Impact Statement and Potential Resource Management Plan Amendment

United States Department of the Interior

BUREAU OF LAND MANAGEMENT
Miles City Field Office
111 Garryowen Road
Miles City, MT 59301
www.blm.gov/mt/

Dear Reader:

Enclosed is the Draft Supplemental Environmental Impact Statement (SEIS) to the 2021 Miles City Field Office Record of Decision/Approved Resource Management Plan Amendment (RMPA). The Bureau of Land Management (BLM) prepared the Draft SEIS in response to a United States District Court, District of Montana, opinion and order (*Western Organization of Resource Councils, et al. v. Bureau of Land Management*, Civil Action No. CV-00076-GF-BMM (D. Mont. 2022)). This is a potential RMPA because selecting an alternative other than the No Action alternative (Alternative A) would result in a plan amendment. Therefore, this SEIS process is completed in accordance with the BLM planning regulations. For ease of reading, this document will refer to the SEIS/Potential RMPA as the SEIS. The BLM developed the Draft SEIS in consultation with various federal, state, local, and tribal governments.

The purpose of the Draft SEIS is to complete new coal screens in accordance with 43 CFR 3420.1-4 that considers no-leasing and limited coal leasing alternatives; and to disclose the public health impacts, both climate and nonclimate, of burning fossil fuels (coal, oil, and gas) from the planning area. The need for action is to conduct coal screening that considers the impacts of climate change to assess whether there are areas suitable for leasing or unsuitable for all or certain types of coal mining operations under Section 522(b) of the Surface Mining Control and Reclamation Act. The BLM carries out this assessment in accordance with 43 CFR 3420.1-4.

The SEIS would replace decisions for coal resource leasing availability in the 2021 Miles City Field Office Record of Decision/Approved RMPA.

The BLM encourages the public to provide information and comments pertaining to the analysis presented in the Draft SEIS. We are interested in any new information that would help the BLM as it develops the Final SEIS. As a member of the public, your timely comments on the Draft SEIS will help formulate the Final SEIS. The BLM will accept comments for ninety (90) calendar days following the Environmental Protection Agency's publication of its Notice of Availability in the *Federal Register*. The BLM can best use your comments and resource information submissions if received within the review period.

Electronic comments may only be submitted via the ePlanning website: https://eplanning.blm.gov/eplanning-ui/project/2021155/510. You also may hand deliver hard copy comments during business hours (8:00 a.m. to 4:30 p.m.) or mail them to: Attention: Irma Nansel, Bureau of Land Management, Miles City Field Office, 111 Garryowen Road, Miles City, MT 59301. To facilitate analysis of comments and information submitted, we strongly encourage you to submit comments in an electronic format.

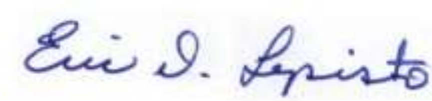
Your review and comments on the content of this document are critical to the success of this planning effort. If you wish to submit comments on the Draft SEIS, we request that you make your comments as specific as possible. Comments will be more helpful if they include suggested changes, sources, or methodologies, and reference to a section or page number. The BLM will consider and include comments containing only opinion or preferences as part of the decision-making process, although they will not receive a formal response from the BLM.

Before including your address, phone number, email address, or other personal identifying information in your comment, be advised that your entire comment—including your personal identifying information—may be made publicly available at any time. While you can ask us in your comment to withhold your personal identifying information from public review, we cannot guarantee that we will be able to do so.

Public meetings to provide an overview of the document, respond to questions, and take public comments will be announced by local media, website, or public mailings at least 15 days in advance.

The BLM has sent copies of the Draft SEIS to affected federal, state, tribal, and local government agencies. Copies are also available for public inspection at the following BLM locations and on the ePlanning website at https://eplanning.blm.gov/eplanning-ui/project/2021155/510.

Sincerely,



Eric Lepisto
Miles City Office Field Manager
Bureau of Land Management

Draft Supplemental Environmental Impact Statement
Miles City Field Office, Montana

Responsible Agency:	United States Department of the Interior Bureau of Land Management	
Type of Action:	Administrative (X)	Legislative ( )
Document Status:	Draft (X)	Final ( )

Abstract: This Draft Supplemental Environmental Impact Statement (SEIS) augments analysis for the 2019 Miles City Field Office Proposed Resource Management Plan Amendment (RMPA)/Final SEIS. This SEIS updates the coal screens; analyzes two reduced coal alternatives and a no-leasing alternative; supplements analysis of coal, oil, and gas downstream emissions; and discloses human health impacts of climate change from greenhouse gas emissions. The scope of the SEIS is limited to amending coal leasing acceptability decisions from the 2021 Miles City Field Office Record of Decision/Approved RMPA. The potential RMPA would affect up to 11.7 million acres of subsurface federal coal estate in eastern Montana administered by the United States Department of the Interior, Bureau of Land Management (BLM) Miles City Field Office. The potential RMPA is limited to amending decisions regarding lands acceptable for further consideration for leasing from the 2021 Miles City Field Office Record of Decision/Approved RMPA.

The BLM is the lead agency for the SEIS, with six cooperating agencies initially participating in the plan development. Planning issues address leasable minerals, greenhouse gases, climate change, economics, environmental justice, and public health. The SEIS considers four alternatives.

Alternative A, the No Action Alternative, continues management decisions for coal leasing availability under the 2021 Record of Decision/Approved RMPA. Alternative B would update management decisions for coal leasing availability based on a revised coal screen that considers conflicts with active oil and gas wells; active oil and gas units; perennial, riparian, and wetland resources; conservation easements; recreation areas; travel management areas; sport fishing reservoirs; areas of critical environmental concern; and cultural viewsheds. It also applies a multiple-use criterion for air resources whereby coal availability would be restricted to 2 miles of existing federal mine plan boundaries of active mines with federal coal. Alternative C uses the coal screens described under Alternative B, but the multiple-use criterion for air resources would be more restrictive. Under this alternative, coal availability would be restricted to the existing federal leases and pending federal lease applications within the existing federal mine plan boundaries of active mines with federal coal. Alternative D analyzes no new federal coal leasing in the planning area. Pending federal lease applications would not be authorized.

For further information contact:

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ACRONYMS AND ABBREVIATIONS — Full Phrase

	Full Phrase
AQRV	air quality related value
AQS	United States Environmental Protection Agency's Air Quality System
AR6	Sixth Assessment Report (of the Intergovernmental Panel on Climate Change)
BLM	United States Department of the Interior, Bureau of Land Management
°C	degrees Celsius
CAP	criteria air pollutant
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
CH_4	methane
CO	carbon monoxide
CO_2	carbon dioxide
CO_2e	carbon dioxide equivalent
COVID-19	coronavirus
DNA	deoxyribonucleic acid
DPM	diesel particulate matter
EGU	electricity generating unit
EIA	United States Energy Information Administration
EPA	United States Environmental Protection Agency
°F	degrees Fahrenheit
FLPMA	Federal Land Policy and Management Act of 1976
GHG	greenhouse gas
GHGRP	Greenhouse Gas Reporting Program
GIS	geographic information system
GWP	global warming potential
HAP	hazardous air pollutant
IMPLAN	Impact Analysis for Planning Model
IPCC	Intergovernmental Panel on Climate Change
IRIS	Integrative Risk Information System
IWG	Interagency Working Group
kg/ha	kilogram/hectare
MAAQS	Montana Ambient Air Quality Standards
MCFO	United States Department of the Interior, Bureau of Land Management, Miles City Field Office
MDEQ	Montana Department of Environmental Quality
MMT	million metric tons
MSHA	Mine Safety and Health Administration
N_2O	nitrous oxide
NAAQS	National Ambient Air Quality Standards
NCA	Fourth National Climate Assessment
NEPA	National Environmental Policy Act of 1969, as amended
NOI	notice of intent

NOx	nitrogen oxide
O_3	ozone
order	Western Organization of Resource Councils, et al. v. Bureau of Land Management, Civil Action No. CV-00076- GF-BMM
PM	particulate matter
$PM_{2.5}$	particulate matter equal to or lesser than 2.5 microns
PM_{10}	particulate matter equal to or lesser than 10 microns
RFD	reasonably foreseeable development
RMP(A)	resource management plan (amendment)
ROD	record of decision
SC-GHG	social cost of greenhouse gasses
(S)EIS	(supplemental) environmental impact statement
SO_2	sulfur dioxide
US	United States
VOC	volatile organic compound

Executive Summary

Introduction

In accordance with the National Environmental Policy Act of 1969, as amended (NEPA), and the Federal Land Policy and Management Act of 1976, as amended (FLPMA), the United States (US) Department of the Interior, Bureau of Land Management (BLM) Montana Miles City Field Office (MCFO) prepared this supplemental environmental impact statement (SEIS) for the 2021 MCFO Record of Decision (ROD) and Approved Resource Management Plan Amendment (RMPA) (BLM 2021).

The 2015 MCFO ROD/Approved Resource Management Plan (RMP) (BLM 2015a) was challenged by the Western Organization of Resource Councils in the US District Court of Montana in March 2016. The court issued an order on March 26, 2018, finding that the BLM violated NEPA in the Final EIS and required the BLM to complete a new coal screening and remedial NEPA analysis by November 29, 2019. Thereafter, the BLM signed the ROD on November 25, 2019.

On August 27, 2020, Western Organization of Resource Councils and others challenged the 2019 Miles City ROD/Approved RMPA in *Western Organization of Resource Councils, et al. v. Bureau of Land Management*, Civil Action No. CV-00076-GF-BMM (D. Mont. 2022). On October 16, 2020, the US District Court set aside this decision due to court case *Bullock v. United States Bureau of Land Management*, Civil Action No 4:20-CV-00062-BMM, citing violation of administrative procedures; numerous EISs were the subject of the litigation. To resolve the Bullock litigation, the MCFO issued a new ROD on January 4, 2021, which was signed by the Secretary of the Interior. Decisions in the January 4, 2021, ROD were the same as those in the November 25, 2019 ROD.

As a result of the challenge by Western Organization of Resource Councils and others to the 2019 ROD/Approved RMPA, the District Court for the District of Montana issued an order on August 22, 2022 (the Order). Pursuant to the Order, the court found that the BLM violated NEPA; the court ordered the BLM to complete a new coal screening and remedial NEPA analysis that considers no-leasing and limited coal leasing alternatives and discloses the public health impacts (both climate and nonclimate) of burning fossil fuels (coal, oil, and gas) from the planning area.[1] This SEIS is in response to the Order.

The SEIS will be used to decide whether to amend the 2021 ROD/Approved RMPA (BLM 2021), and it will guide management of public lands administered by the MCFO into the future. Information about the SEIS process can be obtained on the ePlanning website.[2]

The 2015 MCFO ROD/Approved RMP (BLM 2015a) was completed in September 2015 and provides management guidance and direction for approximately 2.75 million acres of BLM-administered surface land and 11.9 million acres of subsurface federal mineral estate in 17 eastern Montana counties. BLM management applies only to public lands, meaning those lands where the BLM has management

[1] The MCFO planning area includes all lands, regardless of ownership, in the 17 eastern Montana counties encompassed by the MCFO boundary.
[2] https://eplanning.blm.gov/eplanning-ui/project/2021155/510

responsibility for either the surface or the subsurface estate. Except as described *Management Alternatives*, planning decisions remain valid.

Purpose of and Need for Action

The purpose of and need for this SEIS is to:

- Complete new coal screens in accordance with 43 CFR 3420.1-4 and provide additional land use planning level analysis that considers no-leasing and limited coal leasing alternatives; and
- Disclose the public health impacts, both climate and nonclimate, of burning fossil fuels (coal, oil, and gas) from the planning area.

Scoping

The MCFO SEIS public scoping process began on October 3, 2022, with publication of the notice of intent (NOI) in the *Federal Register* (87 *Federal Register* 59818; BLM 2022a). It ended on November 2, 2022. The BLM sent a scoping letter soliciting comments from federal, state, and local agencies; Native American tribes; the public; stakeholders; and other interested parties and on October 18, 2022, the BLM MCFO conducted a public scoping meeting and a meeting with cooperating agencies at the field office in Miles City, Montana. The BLM MCFO announced the meeting through the NOI in the *Federal Register*, the ePlanning website,[1] and news releases. The BLM MCFO has provided public access to SEIS-related information on its ePlanning website.

During the public scoping period, the BLM received 27 unique written submissions, comprising 168 substantive comments. In addition, there were 274 form submissions based on one form campaign letter. The BLM put the comments into eight issue categories. Most comments were received for resource-specific issues: coal, oil and gas, air quality, climate change, public health, environmental justice, economic issues, best available information/baseline data, and the range of alternatives. Detailed information can be found in the scoping report (BLM 2022b) on the MCFO SEIS ePlanning website.

Issues

The BLM read and reviewed all 168 scoping comments received and categorized them into the following 8 issue categories:

- Best available information/baseline data
- Coal screening
- Cumulative impacts
- Direct/indirect impacts
- FLPMA
- Other laws
- Range of alternatives
- Resource specific

The BLM further categorized the 168 comments received that pertained to resources and resource uses based on the specific resource or resource use. The Miles City Field Office SEIS Scoping Report (BLM

[1] https://eplanning.blm.gov/eplanning-ui/project/2021155/510

2022b) shows the number of comments by specific resource or resource use. Resource topics analyzed in detail are air resources, including greenhouse gases and climate change; downstream public health impacts; and economics.

Planning Criteria

Planning criteria guide development of the SEIS by defining the decision space. Title 43 CFR 1610.4-2(b) states that the "Planning criteria will generally be based upon applicable law, Director and State Director guidance, the results of public participation, and coordination with any cooperating agencies and other federal agencies, state and local governments, and federally recognized Indian tribes."

Planning criteria represent the overarching factors used to resolve issues and to develop alternatives. The planning criteria considered in the development of this SEIS are as follows:

- The SEIS complies with NEPA, FLPMA, and other applicable laws, executive orders, regulations, and policy.
- Lands covered in the SEIS are federal lands, including split-estate,[1] administered by the BLM. No decisions will be made relative to non-BLM-administered lands.
- The SEIS makes land use planning decisions to allocate lands acceptable for further consideration for coal leasing.
- The SEIS uses a collaborative and multijurisdictional approach to determine the desired future condition of public lands.
- Decisions in the plan are compatible with the existing plans and policies of adjacent local, state, federal, and tribal agencies, as long as the decisions are consistent with the purposes, policies, and programs of federal law and regulations applicable to public lands.
- The SEIS recognizes valid existing rights (30 CFR 761.5 and 43 CFR 3400.0-5(r)).
- The SEIS does not change existing planning decisions that are still valid.

Management Alternatives

Issues identified through the BLM's scoping efforts and the Order helped the interdisciplinary team identify four management alternatives. The BLM's action alternatives update and modify the coal screen used to determine coal suitability (**Appendix A**), resulting in a range of areas identified as acceptable for further consideration for coal leasing. **Table ES-1**, below, shows a comparison of alternatives.

Alternative A (2021 Approved RMPA)

For the No Action Alternative, the BLM brought forward the management decision from the 2021 ROD/Approved RMPA (BLM 2021). **Table ES-1** shows the coal acceptability results for Alternative A. This alternative applied a criterion for maintaining air quality standards as part of the multiple-use screen; however, existing data and modeling done for analysis in the 2015 Proposed RMP/Final EIS (BLM 2015b) showed no air quality standards were exceeded based on the national ambient air quality standards under the Clean Air Act. Therefore, no geographic area of land was eliminated from further consideration for coal leasing because of air resources. However, federal lands were eliminated under Screen 3's multiple-

[1] Split-estate is subsurface federal coal overlain by state or private surface lands within the decision area.

Table ES-1
Alternatives Summary and Coal Acceptability Determination[1]

Alternative	Acres Acceptable	Acres Unacceptable
Alternative A (2021 RMPA)	1,214,380	530,420
Alternative B	57,940	1,687,110
Alternative C	810	1,744,240
Alternative D	0	1,745,040

Sources: BLM 2021; BLM geographic information system (GIS) 2022
[1] Acres unacceptable for further consideration for coal leasing and development are those without coal potential or lands that were identified as unacceptable for further consideration for leasing under the multiple-use screen, through the landowner consultation screen, and those that are unsuitable without exception under the unsuitability screen. In accordance with 43 CFR 3461.2-1, the BLM could, based on additional site-specific surveys or changes in resource conditions, change the unsuitability determination for screen 2 unsuitability of a given tract at the activity planning stage.

use criterion because of conflicts with oil and gas wells; oil and gas units; perennial, riparian, and wetland resources; conservation easements; recreation areas; sport fishing reservoirs; areas of critical environmental concern; and cultural viewsheds.

Alternative B

Alternative B represents an approach to a "limited coal leasing" alternative, per the Order. The BLM applied the coal screens using the most up-to-date resource data to determine areas acceptable and unacceptable for further consideration for coal leasing (**Table ES-1**). Under the Screen 3 (multiple use), the BLM applied a climate change criterion for air resources, further described below. **Appendix A** includes the new detailed coal screens and their supporting data.

The climate change criterion for air resources under the multiple-use screen restricts leasing and development to lands near existing mines in the decision area.[1] Knowing that the 8-mile buffer around the then-existing mines and infrastructure analyzed in Alternative C of the 2019 Proposed RMPA/Final SEIS (BLM 2019) did not result in a reduction in anticipated coal production—and therefore did not satisfy the need to look at a "limited coal leasing" alternative—the BLM applied a climate change criterion for air resources that would restrict future federal coal leasing and development to a 2-mile area around existing federal mine plan boundaries approved by the Office of Surface Mining Reclamation and Enforcement in the decision area. Under this criterion, federal lands with coal potential outside this 2-mile area would be removed as unacceptable for further consideration for leasing.

Alternative C

Alternative C represents another approach to a "limited coal leasing" alternative, per the Order. It uses the same coal screen applications for Screen 1 (coal potential), 2 (unsuitability), and 4 (landowner consultation) as Alternative B. It also uses the same application of coal Screen 3 (multiple use) as Alternative B; however, the climate change criterion for air resources was modified to further restrict new federal coal leasing and development to pending federal lease applications within the existing federal mine plan boundaries of mines currently mining federal coal (**Appendix A**). Whereas Alternative B would

[1] The decision area is comprised of the approximately 2.7 million acres of surface lands and 11.7 million acres of subsurface federal coal estate for which the BLM has the authority to determine its availability (98 percent of federal mineral estate in the MCFO's administrative boundaries).

restrict coal leasing and development to a 2-mile buffer from the existing federal mine plan boundaries, Alternative C would apply a 0-mile buffer to pending federal lease applications within the approved federal mine plan boundaries. Under this criterion, the BLM would remove unleased federal lands with coal potential outside the pending federal lease applications as unacceptable for further consideration. Further, if existing federal leases are relinquished, canceled, or otherwise returned back to the BLM, those lands would be unacceptable for further consideration for leasing. This would preclude the expansion of mines on federal coal outside of the existing federal mine plan boundaries, as well as outside pending federal lease applications within the existing federal mine plan boundaries. This would not preclude mine expansion to produce nonfederal coal.

Alternative D

As directed by the Order, the BLM "shall consider a no leasing alternative" (page 20). Therefore, only existing federal leases with valid existing rights could be developed under Alternative D. Any unleased federal coal in the decision area, including within existing federal mine plan boundaries, would be removed as unacceptable for further consideration under this alternative. Alternative D uses the same coal screen applications for Screen 1 (coal potential), 2 (unsuitability), and 4 (landowner consultation) as Alternative B. It also uses the same application of coal Screen 3 (multiple use) as Alternative B; however, the climate change criterion for air resources was modified to consider the Order for a no-new-coal-leasing alternative (**Appendix A**).

Alternative D would apply the climate change criterion that eliminates all new emissions from federal coal leasing and development by prohibiting new federal coal leasing. Any unleased federal coal in the decision area, including within existing federal mine plan boundaries, would be removed as unacceptable for further consideration under this criterion.

PREFERRED ALTERNATIVE

Consideration for Selecting a Preferred Alternative

The alternatives offer a range of discrete strategies for addressing the purpose and need. Comments submitted by other government agencies, public organizations, state and tribal entities, and interested individuals were given careful consideration.

Planning regulations require the BLM to identify a preferred alternative in the draft EIS (or SEIS, in this case). The preferred alternative represents the alternative determined to best address the purpose and need and the issues considered at this stage of the process. While collaboration is critical in developing and evaluating alternatives, the final designation of a preferred alternative remains the exclusive responsibility of the BLM.

Identification of the Preferred Alternative

Identifying a preferred alternative(s) does not indicate any final decision commitments from the BLM. In developing the Final SEIS and Potential RMPA, which is the next phase of the planning process, the decision maker may select various components from each of the alternatives analyzed in the Draft SEIS. The Final SEIS and Potential RMPA may also reflect changes and adjustments based on comments received on the Draft SEIS, new information, or changes in BLM policies or priorities.

The BLM used the impact analysis, along with recommendations from cooperating agencies consideration of planning criteria; and anticipated resolution of resource conflicts to identify Alternatives B and D as co-preferred alternatives from the suite of alternatives analyzed. Specifically, the identification of the co-preferred alternatives was based on the following:

- Two different alternatives have been identified has co-preferred alternatives for the purpose of public comment and review;
- Satisfaction of statutory requirements and the court order; and
- Provision of an acceptable approach to addressing key planning issues described in **Section 1.4.1**.

ENVIRONMENTAL CONSEQUENCES

The purpose of the environmental consequences analysis in this SEIS is to disclose the impacts of the federal action related to lands to be made acceptable for further consideration for coal leasing. The Council on Environmental Quality regulations for implementing NEPA state that the "human environment" is interpreted comprehensively to include the natural and physical environment and the relationship of people with that environment (40 CFR 1508.14). The federal action is the BLM's selection of land use actions related to coal availability for the MCFO.

Table 1-3 of **Chapter 1** lists resources eliminated from the impacts analysis. Resources carried forward for analysis are included in **Chapter 3**, which objectively evaluates the likely direct, indirect, and cumulative impacts on the human and natural environment in terms of environmental, social, and economic consequences that are forecasted to occur from implementing the alternatives.

The analysis for all alternatives is based on the reasonably foreseeable development (RFD) scenario that may be constrained by the land use plan allocations for a given alternative. **Table ES-2** demonstrates that the acres available for coal leasing does not directly correlate with production and thus emissions from coal. This SEIS discloses downstream combustion impacts from other fossil fuels and BLM activities. However, they are the same for all alternatives and so are not included in **Table ES-2**.

Air Resources

Production from existing federal and nonfederal leases is forecasted to continue until 2035 at Spring Creek Mine and until 2060 at Rosebud Mine, and mining emissions from these existing federal and nonfederal leases at the mines would continue through those periods based on existing authorizations. The production and corresponding emissions from all existing federal leases in the planning area are forecasted to peak in 2027 and then decline afterwards. These emissions would lead to air quality and AQRV impacts associated with increased ambient air concentrations of particulate matter equal to or less than 2.5 microns in diameter, particulate matter equal to or less than 10 microns in diameter, nitrogen dioxide, ground-level ozone, sulfur dioxide, carbon monoxide, hazardous air pollutants), and other related pollutants, as well as potential increases in visibility impairment and deposition of nitrogen, sulfur, mercury, and other compounds.

Under Alternative A, pending federal lease applications are forecasted to provide production from 2036 to 2061, with potential future subsequent federal leases providing production from 2062 to 2088. Emissions from mining, transportation, and downstream combustion of the coal from pending federal lease applications and potential future subsequent federal leases would occur during those periods. The modeled annual federal coal production from pending leases is estimated at 6.0 million tons per year for 2036, and 6.3 million tons per year from 2037 to 2088 from pending and potential future leases.

Table ES-2
Summary of Environmental Consequences

	Alternative A	Alternative B	Alternative C	Alternative D
Land Use Plan Allocation				
Acres Available for Further Consideration for Coal Leasing	1,214,380	57,940	810	0
Acres Unavailable for Further Consideration for Coal Leasing	530,420	1,687,110	1,744,240	1,745,040
Environmental Consequences The values below are based on the RFD scenario for each alternative and are attributed to new federal coal leases, not valid existing federal coal leases.				
Acres of Anticipated Development	2,710	2,710	810	0
Anticipated Coal Production (million tons)	337.9	337.9	95	0
Anticipated Coal Carbon Dioxide Equivalent (CO_2e)	584.4	584.4	165.07	0
Anticipated Duration of Impact (mine life)*	2088	2088	2060	2035

*Estimated life of mine is based on the BLM projected production rate for each mine.

Under Alternative B, although acres available for leasing differ, Alternative B would provide sufficient lands available for leasing to meet the needs of the RFD and production. Emissions and impacts would be the same as under Alternative A.

Under Alternative C, only the portions of the pending federal lease applications within the existing federal mine plan boundary would be acceptable for leasing, and there would be no federal coal acres available to cover the portion of the pending federal lease applications outside the current federal mine plan boundary or any potential future subsequent federal leases. The BLM forecasts that the portion of the pending federal lease applications within the current federal mine plan boundary would provide production from 2036 until 2050. Production and emissions from federal coal under Alternative C would be zero after 2050; therefore, mining, transportation, and downstream combustion emissions from potential future subsequent federal leases would be zero.

Under Alternative D, the production and emissions due to existing federal coal leases and associated mining, transportation, and downstream combustion would still occur. However, there would be no emissions or air quality impacts from coal mining, transportation, and downstream combustion due to pending federal lease applications or potential future subsequent federal leases, as pending federal lease applications and potential future subsequent federal coal leases would be denied or returned.

Socioeconomics

Forecast production from existing leases for both Spring Creek and Rosebud Mines from 2023 to 2035 is anticipated to support approximately 620 direct, indirect, and induced average annual jobs, $49.7 million in average annual income, and $194.2 million in average annual output. Coal production from 2036 to 2038 at Rosebud Mine is estimated to support approximately 188 direct, indirect, and induced average annual jobs in the socioeconomic analysis area. These jobs would support approximately $15.1 million in average annual income and $59.0 million in average annual output. Existing federal and nonfederal leases at Rosebud Mine are anticipated to support operations until 2060, and production and from Rosebud Mine is anticipated to continue at approximately the same rates from 2038 to 2060. However, no quantitative contribution estimates are provided beyond the analysis period (2038) due to uncertainties in regional economic setting, coal market, and other factors that may influence the specific level of jobs and income supported by a given production level.

Under all action alternatives, development from new and pending leases is anticipated to result in the same level production and economic contributions while coal reserves are available to support development. As such, the analysis by alternative examines the time frame for which development and associated economic contributions would be supported.

Under Alternative A, the decision from the coal screens performed for the MCFO 2019 Proposed RMPA/Final SEIS (BLM 2015b) would be carried forward. The pending federal lease applications would be entirely within the area screened as acceptable for coal leasing and development, and these leases could be issued if other statutory requirements are met. Spring Creek Mine operations are anticipated to continue to operations until 2088. Annual production is forecast to remain constant after 2038. Estimated annual contributions include 603 jobs and $29 million in labor income.

Under Alternative B, the area open to coal leasing would be reduced from the area available under Alternative A. However, the current pending federal lease applications would be entirely within the area screened as acceptable for coal leasing and development, and these leases could be issued if other statutory requirements are met. Production and estimated regional contributions to jobs, labor income, and output would be as described under Alternative A.

Under Alternative C, restrictions would be placed on pending federal lease applications. However, the constrained pending federal lease applications provide enough reserves to meet production throughout the analysis period (to 2038), although it is estimated that Spring Creek Mine would close in 2050 (38 years earlier than under Alternatives A and B). Cessation of federal mine operations in 2050 could impact the continuity of operations for nonfederal coal after this time period, resulting in additional impacts on regional jobs and income. This is because with the absence of federal coal, ultimately these parcels are too scattered and limited to allow efficient mining.

Under Alternative D, no new leasing would be permitted. As the majority of coal resources in the planning area are managed by the BLM, this alternative would likely result in the closure of coal mining operations as reserves under existing federal and nonfederal leases are exhausted. It is projected that Spring Creek Mine would run out of leased federal coal reserves approximately 53 years earlier (in 2035) than under Alternatives A or B, resulting in an expedited timeline for impacts on regional economic contributions.

Environmental Justice

Potential environmental justice impacts correlate with public health (and social cost of greenhouse gases) with respect to the duration of exposure to the emission of fossil fuel combustion (anticipated mine life). However, these potential environmental justice impacts would be observed to be more adverse and disproportionate in comparison to non-environmental justice proximal communities who could also be potentially exposed.

Environmental justice populations have been shown to be more vulnerable to health impacts from pollutants, in part due to reduced resources, such as comprehensive health care, to combat potential impacts (Bell and Dominici 2008; Zeger et al. 2008). Historically, low-income populations have been found to have disproportionately higher levels of exposure to air pollution (American Lung Association 2001). In addition, racial-ethnic minorities in the United States have been found to be exposed to disproportionately high levels of ambient fine particulate air pollution (particulate matter equal to or less than 2.5 microns in diameter). In the local analysis area for environmental justice, potential for direct impacts from mine operations would be concentrated in communities proximal to mining operations. Of the 20 block groups located within Big Horn, Rosebud, and Treasure Counties, 18 of the block groups met the criteria for environmental justice communities for at least one of the three demographic indicators. Only three block groups did not contain any environmental justice communities.

In addition, identified potential environmental justice communities throughout the local analysis area have potential to be impacted by emissions from downstream transportation and combustion. Public health impacts of coal-fired power plant emissions include, but are not limited to, respiratory symptoms and disease, declines in pulmonary function, cardiovascular disease, and cancer in nearby populations (for example, see Amster 2021 and Amster and Lew Levy 2019). There are a total of six power plants located within four states (Arizona, Michigan, Minnesota, and Washington). In total, 20 block groups were identified for further environmental justice consideration in the downstream analysis area.

Federal production from existing leases and related emissions with potential for health impacts on environmental justice communities would be present under all alternatives as a result of production at Spring Creek Mine until 2035 and Rosebud Mine until 2060. The analysis by alternative discusses incremental impacts from pending or potential future subsequent federal leases at Spring Creek Mine starting in 2036. Alternatives vary in terms of the timeframe during which MCFO coal-related emissions would continue to occur as a result of future leasing, rather than due to estimated changes in annual production or emission by alternative for a given year. Differences in alternatives below are described in terms of this timeframe.

Under Alternative A, the production and emissions due to existing federal coal leases and associated mining, transportation, and downstream combustion would still occur. Pending and potential future subsequent federal lease applications are forecasted to provide production from 2036 to 2088, and emissions from mining, transportation, and downstream combustion of the coal from pending and potential future subsequent federal lease applications would occur during those periods. As a result, emissions of criteria air pollutants and hazardous air pollutants from the mining, transportation, and downstream combustion of coal from pending federal lease applications in the planning area would continue through 2088, the year when coal is exhausted and health impacts from emissions from coal mining, transportation, and combustion would continue to contribute to local and downstream air pollution, with potential impacts on environmental justice communities.

The production estimated under Alternative B would be the same as Alternative A; therefore, the corresponding three emissions and impacts would also be the same.

Under Alternative C, the BLM forecasts that a portion of the pending federal lease applications within the current federal mine plan boundary at Spring Creek Mine would provide production from 2036 until 2050. Emission from coal mining and downstream emissions with the potential to impact environmental justice communities would occur. There would be continued potential for disproportionate impacts on environmental justice communities until 2050, at which time no additional emissions from the development of MCFO coal or related potential health impacts would occur. Impacts from federal production at Rosebud Mine would continue until 2060, as under Alternatives A and B.

Under Alternative D, no pending or future federal leases would be issued, and there would be no additional emissions from development of coal from Spring Creek Mine. As a result, after 2035 there would be no additional air quality impacts on environmental justice communities from coal mining, transportation, and downstream combustion due to pending or potential future subsequent federal lease applications at Spring Creek Mine.

Chapter 1. Purpose and Need

1.1 Introduction

In accordance with the National Environmental Policy Act of 1969, as amended (NEPA), and the Federal Land Policy and Management Act of 1976, as amended (FLPMA), the United States (US) Department of the Interior, Bureau of Land Management (BLM) Miles City Field Office (MCFO) prepared this supplemental environmental impact statement (SEIS) and potential resource management plan amendment (RMPA) to the 2021 MCFO Record of Decision (ROD)/Approved RMPA (BLM 2021). This is a potential RMPA because selecting an alternative other than the No Action alternative (Alternative A) would result in a plan amendment. Therefore, this SEIS process is completed in accordance with the BLM planning regulations. For ease of reading, this document will refer to the SEIS/potential RMPA as the SEIS.

The 2015 Miles City Field Office ROD/Approved Resource Management Plan (RMP) (BLM 2015a) was challenged by the Western Organization of Resource Councils in the US District Court of Montana in March 2016.[1] The court issued an order on March 26, 2018, finding that the BLM violated NEPA in the Final EIS and required the BLM to complete a new coal screening and remedial NEPA analysis by November 29, 2019. Thereafter, the BLM signed the ROD on November 25, 2019.

On August 27, 2020, Western Organization of Resource Councils and others challenged the 2019 Miles City ROD/Approved RMPA in *Western Organization of Resource Councils, et al. v. Bureau of Land Management*, Civil Action No. CV-00076-GF-BMM (D. Mont. 2022). On October 16, 2020, the US District Court set aside this decision due to court case *Bullock v. United States Bureau of Land Management*, Civil Action No 4:20-CV-00062-BMM, citing violation of administrative procedures; numerous EISs were the subject of the litigation. To resolve the Bullock litigation, the MCFO issued a new ROD on January 4, 2021, which was signed by the Secretary of the Interior. Decisions in the January 4, 2021, ROD were the same as those in the November 25, 2019 ROD.

As a result of the challenge by Western Organization of Resource Councils and others to the 2019 ROD/Approved RMPA (now the 2021 ROD/Approved RMPA due to the aforementioned Bullock litigation), the District Court for the District of Montana issued an order on August 22, 2022 (the Order). Pursuant to the Order, the court found that the BLM violated NEPA; the court ordered the BLM to complete a new coal screening and remedial NEPA analysis that considers no-leasing and limited coal leasing alternatives and discloses the public health impacts (both climate and nonclimate) of burning fossil fuels (coal, oil, and gas) from the planning area. This SEIS is in response to the Order.

The BLM prepared this SEIS in accordance with NEPA, the Council on Environmental Quality (CEQ) regulations implementing NEPA (40 Code of Federal Regulations [CFR] 1500–1508), Department of Interior NEPA regulations (43 CFR 46), and the requirements of the BLM's NEPA Handbook H-1790-1 (BLM 2008).

[1] *Western Organization of Resource Councils, et al. v. Bureau of Land Management*, Civil Action No. CV 16-21-GF-BMM (D. Mont. 2017)

1.2 Purpose of and Need for Action

The purpose of and need for this SEIS is to:

- Complete new coal screens in accordance with 43 CFR 3420.1-4 and provide additional land use planning level analysis that considers no-leasing and limited coal leasing alternatives; and
- Disclose the public health impacts, both climate and nonclimate, of burning fossil fuels (coal, oil, and gas) from the planning area.

1.3 Description of the Planning Area and Decision Area

The MCFO planning area includes all lands, regardless of ownership, in the 17 eastern Montana counties encompassed by the MCFO boundary.

The MCFO administers approximately 2.7 million acres of surface lands and 11.7 million acres of subsurface federal coal estate for which the BLM has the authority to determine its availability (98 percent of federal mineral estate in the MCFO's administrative boundaries; **Figure 1-1** and **Figure 1-2**).

1.4 Scoping Issues

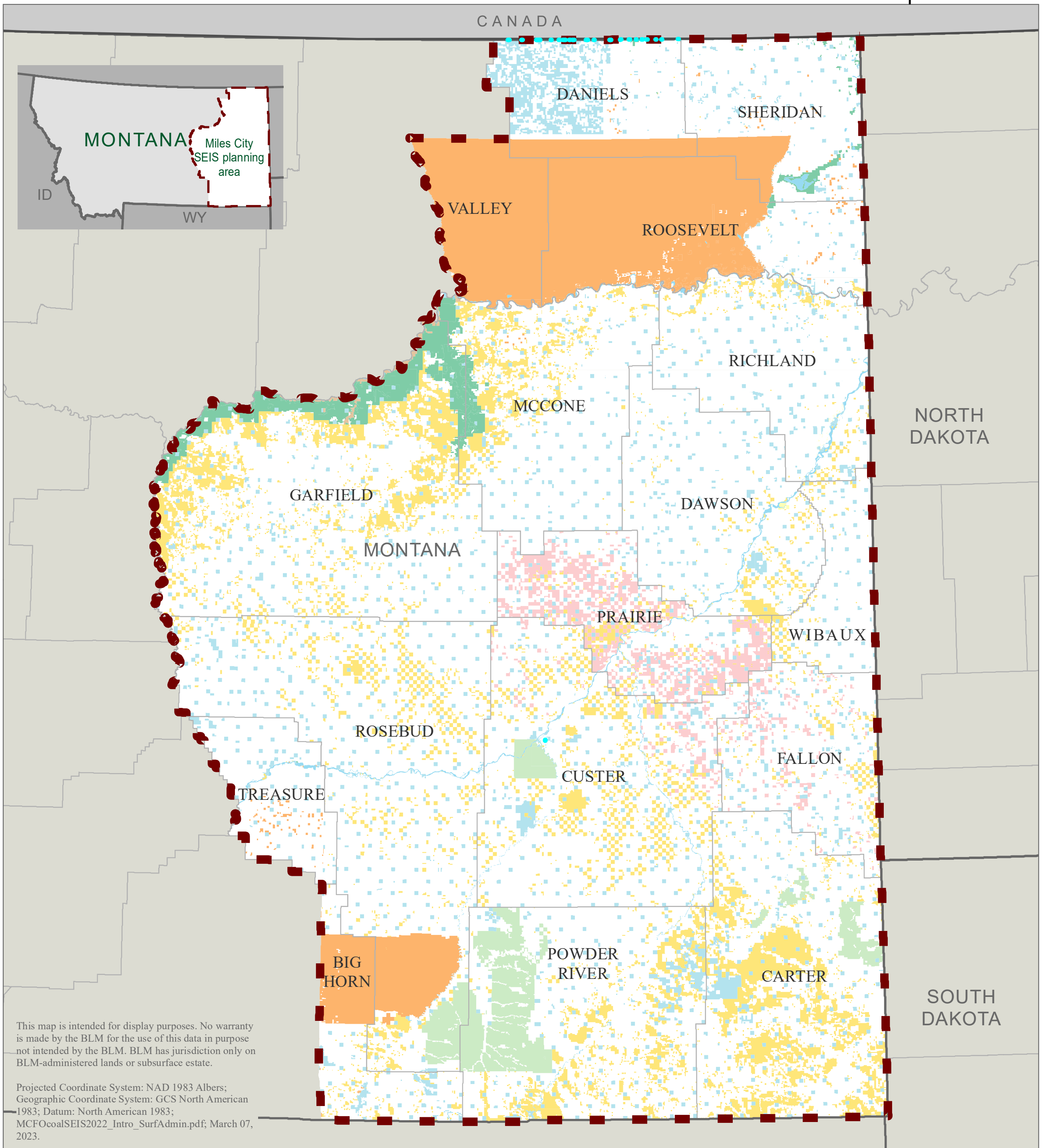
The MCFO SEIS public scoping process began on October 3, 2022, with publication of the notice of intent (NOI) in the *Federal Register* (87 *Federal Register* 59818; BLM 2022a). It ended on November 2, 2022. The BLM sent a scoping letter soliciting comments from federal, state, and local agencies; Native American tribes; the public; stakeholders; and other interested parties and on October 18, 2022, the BLM MCFO conducted a public scoping meeting and a meeting with cooperating agencies at the field office in Miles City, Montana. The BLM MCFO announced the meeting through the NOI in the *Federal Register*, the ePlanning website,[1] and news releases. The BLM MCFO has provided public access to SEIS-related information on its ePlanning website.

During the public scoping period, the BLM received 27 unique written submissions, comprising 168 substantive comments. In addition, there were 274 form submissions based on one form campaign letter. The BLM put the comments into eight issue categories. Most comments were received for resource-specific issues: coal, oil and gas, air quality, climate change, public health, environmental justice, economic issues, best available information/baseline data, and the range of alternatives. Detailed information can be found in the scoping report (BLM 2022b) on the MCFO SEIS ePlanning website.

1.4.1 Issues Identified for Detailed Consideration

Planning issues are disputes or controversies about existing and potential land and resource allocations, levels of resource use, production, and related management practices (BLM Land Use Planning Handbook H-1601-1; BLM 2005). These issues help inform alternatives development. A detailed description of the planning issues identified during public scoping can be found in the scoping report on the MCFO SEIS ePlanning website. **Table 1-1** aligns the planning issues identified for detailed consideration with the resources affected by the issues. **Chapter 3** analyzes the issues as they pertain to the identified resources.

[1] https://eplanning.blm.gov/eplanning-ui/project/2021155/510



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BUREAU OF LAND MANAGEMENT
MILES CITY FIELD OFFICE

1 inch = 39.3 miles

0 5 10 20 30 Miles

Figure 1-1
Surface Administration

- Bureau of Indian
- Bureau of Land Management
- Bankhead-Jones
- Bureau of Reclamation
- US Fish and Wildlife Service
- US Forest Service
- Other Federal
- State
- Private
- Water

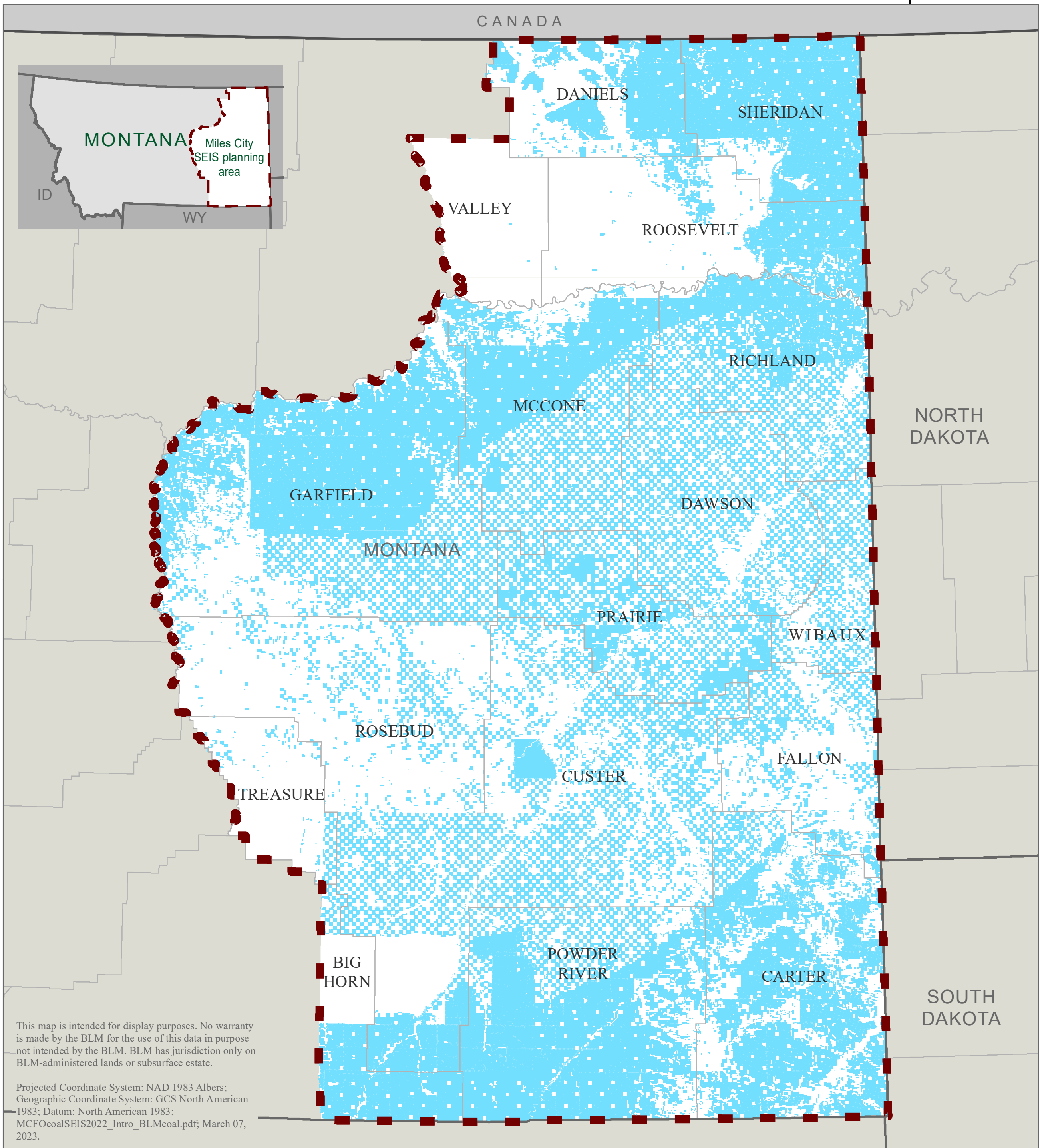

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Figure 1-2
BLM-administered Coal

Federal mineral coal estate

1 inch = 39.3 miles

0 5 10 20 30 Miles

Table 1-1
Scoping Issues and Resource Topics Affected

Issue	Resource Topic Affected
What methods will be used to address the downstream impacts of fossil fuel leasing and its impacts on climate change?	See **Chapter 3**, Air Quality, and Greenhouse Gases, Including Climate Change.
What new information will be referenced and incorporated into the SEIS?	Air quality, greenhouse gases (GHGs; including climate change and public health), economic considerations, and environmental justice will all be updated based on the following: • Updated minerals production data • A new coal screening using current data • An updated coal reasonably foreseeable development (RFD) scenario • GHG emissions inventory and downstream emissions • The social cost of GHGs
Will the SEIS consider a no-leasing or tapering down of coal alternatives? What alternatives will be included in the SEIS?	See **Chapter 2** for a range of alternatives.
How will the BLM comply with the FLPMA's multiple-use mandate to ensure that critical resources are protected?	This SEIS augments the 2015 RMP, as amended, meeting the multiple-use mandate of FLPMA. The BLM considered multiple uses during evaluation of Screen 3; see **Appendix A**.
How will the BLM apply suitability criteria when considering the coal development potential area?	See **Appendix A**.
How will the BLM review and analyze the indirect and direct impacts of fossil fuels' impacts on public health, air quality and climate change?	See **Chapter 3**, Air Quality, and Greenhouse Gases, Including Climate Change.
How will the BLM quantify and consider the cumulative impacts of GHG releases due to fossil fuels leasing and incorporate them into the cumulative effects analysis?	See **Chapter 3**, Greenhouse Gases, Including Climate Change.
How will air pollution affect the regional air quality and how will criteria air pollutants (CAPs) be analyzed?	See **Chapter 3**, Air Quality.
What are the direct, indirect, cumulative, downstream, and upstream air quality impacts resulting from mineral use?	See **Chapter 3**, Air Quality.
How will the BLM address downstream non-GHG emissions and impacts resulting from minerals available for extraction?	See **Chapter 3**, Greenhouse Gases, Including Climate Change.
What would be the short-term and long-term impact of climate change from additional coal leasing? How will the BLM quantify and analyze the project's GHG emissions?	See **Chapter 3**, Including Greenhouse Gases, Including Climate Change.
How does coal development impact human health and communities that are adjacent to coal mines and leases?	See **Chapter 3**, Including Greenhouse Gases, Including Climate Change.
What are the social costs of GHG emissions that result from fossil fuel extraction and use?	See **Chapter 3**, Greenhouse Gases, Including Climate Change.

Issue	Resource Topic Affected
How will the BLM analyze how emissions and waste from fossil fuel development in the planning area disparately impact low-income and minority populations?	See **Chapter 3**, Environmental Justice.
How would the alternatives impact the local economies?	See **Chapter 3,** Economic Considerations.

1.4.2 Issues Considered but Not Analyzed Further in This SEIS

The issues identified during public scoping (discussed above) shaped the alternatives carried forward in this SEIS. The BLM also considered other issues identified during public scoping but did not analyze them further; this is because they fall outside the BLM's jurisdiction, they are beyond the scope of this SEIS, they do not meet the purpose and need, or have been previously analyzed (**Table 1-2**). Where issues have been previously analyzed, action alternatives considered in this SEIS would not propose anything that would substantially change the impacts disclosed in the 2015 Proposed RMP/Final EIS (BLM 2015b) or the 2019 Proposed RMPA/Final SEIS (BLM 2019); therefore, they are not carried forward for additional analysis in this SEIS. Additional rationale is provided below.

Table 1-2
Scoping Issues Not Further Analyzed and the Rationale for Not Analyzing Further

Issue	Rationale
How will the BLM review the economic impacts of diversifying the local economies to include renewable energy development?	Decisions related to renewable energy are outside the scope of this SEIS.
Will any alternatives contain requirements or lease stipulations requiring emission-control technologies?	For oil and gas activities, this is out of scope. This SEIS does not consider stipulations for fluid minerals leasing and development. Those are included in the 2015 Approved RMP/ROD (BLM 2015a). For coal, the Office of Surface Mining Reclamation and Enforcement adds stipulations to the federal mine plan and MDEQ adds stipulations for the federal mine permit. The BLM adds stipulations at the lease phase.
How will the BLM consider and analyze the direct and indirect impacts on national historic landmarks?	National historic landmarks were considered in the unsuitability coal screen, per criterion 7 and lands removed from further consideration for leasing. Further, the climate change multiple-use consideration removes all national historic landmarks from consideration for further coal leasing in the action alternatives. See **Appendix A**.
How will the Inflation Reduction Act apply to this SEIS, and will GHG projections be used in the analysis?	This SEIS is being undertaken to meet the Order; it is not driven by the Inflation Reduction Act. However, a projection of GHG emissions is quantified; see **Section 3.4**, Greenhouse Gases, Including Climate Change.
What are some potential mitigation measures the BLM can implement to reduce the proposed action's impacts on air quality and climate change?	Air quality mitigation measures and stipulations are contained in the 2015 Approved RMP/ROD (BLM 2015a). Additionally, the multiple-use climate change criterion for air resources was developed in response to the Order (see **Chapter 2**). The US Environmental Protection Agency (EPA) and MDEQ determine air permits for each power plant and mine that would mitigate impacts.

Issue	Rationale
Will the BLM utilize a substitution analysis and if so, how will the BLM correct common pitfalls and inconsistencies with this analysis type?	To comply with various EPA requirements, such as the EPA Cross State Air Pollution Rule and Regional Haze Rule, a significant number of electricity generating units (EGUs) have adopted Powder River Basin coal as their primary source of fuel. Source-specific emission limits were established, which represent a combination of control technologies and use of lower sulfur coal. These are fixed considerations in the development of any quantification of downstream emissions that cannot be altered. Also, since energy substitution models cannot forecast regulatory requirements, the BLM determined that an energy substitution analysis would not be possible for this SEIS.
What are the direct, indirect, and cumulative effects of coal mining on pallid sturgeon?	Pallid sturgeon habitat was considered in the unsuitability coal screen, per criteria 9, and lands removed from further consideration for leasing. In addition, lands were removed under unsuitability coal screen criteria 16 (100-year floodplains) and multiple-use coal screen consideration for lotic and lentic systems. Finally, the climate change multiple-use consideration removes all pallid sturgeon habitat from consideration for further coal leasing in the action alternatives. See **Appendix A**. Additionally, the BLM is engaged in consultation efforts with the US Department of the Interior, Fish and Wildlife Service; see **Chapter 4**.
How will the BLM review potential adverse impacts on aquatic resources in the project area, and how will the BLM protect these resources?	Lentic and lotic systems were also removed from further consideration for coal leasing under the multiple-use coal screen. Finally, the climate change multiple-use consideration removes the majority of aquatic resources from consideration for further coal leasing in Alternative B and all aquatic resources in Alternatives C and D. See **Appendix A**.
How will the BLM review coal development and operations' impact on surface waters in the project area and develop a comprehensive baseline for an accurate analysis?	Perennial streams are unacceptable for further consideration for coal leasing through the multiple-use screen in all alternatives; therefore, there would be no impacts on those areas under the alternatives. Similarly, 100-year floodplains (unsuitability criterion 16) and alluvial valley floors (unsuitability criterion 19) are unsuitable for coal mining without exception. Finally, the climate change multiple-use consideration removes the majority of water resources from consideration for further coal leasing in Alternative B and all aquatic resources in Alternatives C and D. See **Appendix A**. Moreover, coal mines must comply with all State mining requirements which include the Cumulative Hydrologic, Impact Assessment.
How will the BLM consider the potential impacts of coal development on groundwater resources in the project area?	Unsuitability coal screen criterion 16, 17, 18, 19, and multiple-use coal screen criterion for perennial, intermittent, wetland riparian, and fishing reservoirs provide protection to water resources. See **Appendix A**. Moreover, coal mines must comply with all State mining requirements which include the Cumulative Hydrologic, Impact Assessment.

Issue	Rationale
How will the BLM review coal development and operations' impact on riparian areas in the project area and develop a comprehensive baseline for an accurate analysis?	Lentic and lotic systems were removed from further consideration for coal leasing under the multiple-use coal screen. Finally, the climate change multiple-use consideration removes the majority of aquatic resources from consideration for further coal leasing in Alternative B and all aquatic resources in Alternatives C and D. See **Appendix A**.

1.4.3 Resource Topics Not Carried Forward for Detailed Analysis

Table 1-3 lists the resources eliminated from further analysis and the rationale for elimination. In some cases, resources are not present in the decision area, so actions proposed in this SEIS would not affect them. Through the coal screening process, some resources would be removed from the potential for coal development under the alternatives either because they would be determined unacceptable for further consideration for leasing (Screen 3) or because they would be determined unsuitable for coal development without exception (Screen 2). In other cases, the action alternatives would not propose anything that would substantially change the impacts disclosed in the 2015 Proposed RMP/Final EIS (BLM 2015b) or the 2019 Proposed RMPA/Final SEIS (BLM 2019); therefore, those resources are not carried forward for additional analysis in this SEIS.

Since 2015, the BLM has updated the RFD scenario for coal from what was analyzed in the 2015 EIS (BLM 2015b) based on current market conditions in the 2019 Proposed RMPA/Final SEIS (BLM 2019) and again in this SEIS due to mine closures since 2019. Therefore, under the No Action Alternative in this SEIS, impacts would be reduced from those disclosed in the 2019 Proposed RMPA/Final SEIS, which were reduced from what was disclosed in the 2015 Proposed RMP/Final EIS. In other words, the type of impacts under the No Action Alternative would not be substantially different from those described in the 2015 Proposed RMP/Final EIS or the 2019 Proposed RMPA/Final SEIS. Some of the action alternatives would result in a further reduction in the amount of recoverable coal compared with the No Action Alternative. While there would be potential impacts from coal development, the potential magnitude, or acres impacted, would be less than described in the 2019 Proposed RMPA/Final SEIS because of the reduction in the amount of recoverable coal compared with the No Action Alternative. Additional rationale is provided below.

Table 1-3
Resources Eliminated from Further Analysis and the Rationale

Resource	Rationale
Wild horses and burros	Not present in the decision area
Wilderness areas	Not present in the decision area
Lands with wilderness characteristics	Portions of two lands with wilderness characteristics units overlap the area of coal development potential in the eastern portion of the planning area. The RFD scenario under Alternative A does not anticipate coal development in this area. The climate change multiple-use consideration removes all active oil and gas wells and units from consideration for further coal leasing in the action alternatives. See **Appendix A**.
Wild and scenic rivers	Not present in the decision area
Natural resource waters	Not present in the decision area

Resource	Rationale
Vegetation	While two new special status plant species have been identified since 2019, they are not in the area of coal development potential (screen 1).
Leasable minerals: fluids	Conflicts between coal and oil and gas development were removed through the multiple-use screen. Further, the climate change multiple-use consideration removes all active oil and gas wells and units from consideration for further coal leasing in the action alternatives. See **Appendix A**. The impacts on air quality and GHGs, including climate change, required in the Order are disclosed under **Sections 3.3** and **3.4**.
Areas of critical environmental concern	Areas of critical environmental concern were removed through the multiple-use screen. Further, the climate change multiple-use consideration removes all Areas of Critical Environmental Concern from consideration for further coal leasing in the action alternatives. See **Appendix A**.
National trails	The Lewis and Clark National Historic Trail is present within the decision area; however, as a special recreation management area, it was removed during the multiple-use screen. The cultural component is also unsuitable without exception under criterion 7. Finally, the climate change multiple-use consideration removes the Lewis and Clark National Historic Trail from consideration for further coal leasing in the action alternatives. See **Appendix A**.
Wilderness study areas	Wilderness study areas are unsuitable without exception under the unsuitability coal screen (criteria 4). Further, the climate change multiple-use consideration removes the wilderness study areas from consideration for further coal leasing in the action alternatives. See **Appendix A**.
Recreation and visitor services	Special recreation management areas and extensive recreation management areas, conservation easements, as well as fishing reservoirs, were removed during the multiple-use coal screen. Further, the climate change multiple-use consideration removes these areas from consideration for further coal leasing in the action alternatives. See **Appendix A**.
Sport fisheries	Sport fisheries were removed during the multiple-use coal screen. Further, the climate change multiple-use consideration removes these areas from consideration for further coal leasing in the action alternatives. See **Appendix A**.
Wildlife, including aquatic and special status species	Various unsuitability criteria and multiple-use considerations in the coal screens directly apply to wildlife, including aquatic and special status species. Further, the climate change multiple-use consideration removes the majority of these habitats from consideration for further coal leasing in the action alternatives. See **Appendix A**.
Visual resources	Visual resource management Class I areas are unsuitable without exception (criterion 5) and the multiple-use coal screen removed sensitive cultural viewsheds from further consideration for coal leasing; see **Appendix A**. Under all alternatives, including the No Action alternative, there would be a reduction in cultural modifications, which would preserve the existing scenic quality of the area. This is due to the revised RFD scenario and the reduction in availability of coal for development in the action alternatives.

Resource	Rationale
Travel and transportation management	Travel management areas were removed during the multiple-use coal screen; see **Appendix A**.
Cultural resources	Various unsuitability criteria and multiple-use considerations in the coal screens directly apply to cultural resources (cultural viewsheds multiple use consideration; unsuitability criteria 7). Further, the climate change multiple-use consideration removes these areas from consideration for further coal leasing in the action alternatives. See **Appendix A**.
Paleontological resources	The climate change multiple-use consideration removes at least 97 percent of federal coal development potential (BLM surface and split-estate; screen 1) lands from consideration for further coal leasing in the action alternatives.
Soil resources	The climate change multiple-use consideration removes at least 97 percent of federal coal development potential (BLM surface and split-estate; screen 1) lands from consideration for further coal leasing in the action alternatives.
Wildland fire management	There would be no change in impacts disclosed in the 2015 Proposed RMP/Final EIS (BLM 2015b).
Livestock grazing	There would be no change in impacts disclosed in the 2015 Proposed RMP/Final EIS (BLM 2015b).
Forest and woodland products	There would be no change in impacts disclosed in the 2015 Proposed RMP/Final EIS (BLM 2015b).
Locatable minerals	There would be no change in impacts disclosed in the 2015 Proposed RMP/Final EIS (BLM 2015b).
Mineral materials	There would be no change in impacts disclosed in the 2015 Proposed RMP/Final EIS (BLM 2015b).
Nonenergy leasable minerals	There would be no change in impacts disclosed in the 2015 Proposed RMP/Final EIS (BLM 2015b).
Lands and Realty	Existing rights-of-way and easements are unsuitable under criterion 2 under all alternatives and conservation easements are unacceptable for coal leasing under coal screen 3. Finally, the climate change multiple-use consideration removes the majority of these lands from consideration for further coal leasing in the action alternatives. See **Appendix A**.
Renewable energy	There would be no change in impacts disclosed in the 2015 Proposed RMP/Final EIS (BLM 2015b).
Backcountry byways	There would be no change in impacts disclosed in the 2015 Proposed RMP/Final EIS (BLM 2015b).

1.5 PLANNING CRITERIA AND REGULATORY CONSTRAINTS

1.5.1 Planning Criteria

Planning criteria guide development of the SEIS by defining the decision space. Title 43 CFR 1610.4-2(b) states that the "Planning criteria will generally be based upon applicable law, Director and State Director guidance, the results of public participation, and coordination with any cooperating agencies and other federal agencies, state and local governments, and federally recognized Indian tribes."

Planning criteria represent the overarching factors used to resolve issues and to develop alternatives. The planning criteria considered in the development of this SEIS are as follows:

- The SEIS complies with NEPA, FLPMA, and other applicable laws, executive orders, regulations, and policy.

- Lands covered in the SEIS are federal lands, including split-estate,[1] administered by the BLM. No decisions will be made relative to non-BLM-administered lands.
- The SEIS makes land use planning decisions to allocate lands acceptable for further consideration for coal leasing.
- The SEIS uses a collaborative and multijurisdictional approach to determine the desired future condition of public lands.
- Decisions in the plan are compatible with the existing plans and policies of adjacent local, state, federal, and tribal agencies, as long as the decisions are consistent with the purposes, policies, and programs of federal law and regulations applicable to public lands.
- The SEIS recognizes valid existing rights (30 CFR 761.5 and 43 CFR 3400.0-5l).
- The SEIS does not change existing planning decisions that are still valid.

This planning effort is not intended to be a full RMP revision; rather, it is intended to provide supplemental analysis for air quality, climate change, and public health as they pertain to coal decisions. It also provides additional relevant analysis considering the potential decisions to be made. This effort is also to consider plan-level decisions regarding the availability of lands for further consideration for coal leasing and the unsuitability of lands for all or certain stipulated methods of surface coal mining, consistent with the Order. Due to the limited focus of this planning, the BLM will not address decisions that would normally be considered in a full RMP revision.

In addition, because this is a land use plan review, this SEIS does not make coal leasing or development decisions; therefore, it is intended for analysis purpose only. Separate NEPA reviews and decisions, compliant with the land use plan decision, would be completed for all coal leasing and development implementation activities; however, authorization of development is under state and the Office of Surface Mining Reclamation and Enforcement jurisdiction.

All data used in this plan are best estimates for comparative and analysis purposes only. At the site-specific level, surveys and precision measures will be taken to improve accuracy.

1.5.2 Regulatory Considerations

Coal Screening Process

The BLM's authority to manage federal coal comes from the Mineral Leasing Act of 1920, as amended; the Mineral Leasing Act on Acquired Lands of 1947, as amended; and the FLPMA. Regulations developed from these statutes are in 43 CFR 3000 and 3400; these regulations guide the BLM's coal program management, setting requirements for land use planning, leasing, and post-lease maintenance.

Coal planning regulations in 43 CFR 3420.1-4 require the BLM to identify federal lands acceptable for further consideration for leasing. These lands are analyzed in the land use planning process. The four coal screens are:

1. Identification of coal with development potential—Lands determined to have development potential are considered acceptable for further consideration for leasing and are applied to the

[1] Split-estate is subsurface federal coal overlain by state or private surface lands within the decision area.

remaining coal screens. Lands determined to not have development potential are eliminated from further consideration for leasing.

2. Application of unsuitability criteria—Lands with coal potential are assessed with procedures outlined in 43 CFR 3461. Lands within coal potential may be eliminated from further consideration for leasing if they are determined to be unsuitable without exception pursuant to Section 522(b) of the Surface Mining Control and Reclamation Act. In accordance with 43 CFR 3461.2-1, the BLM could, based on additional site-specific surveys or changes in resource conditions, change the unsuitability determination of a given tract at the activity-planning stage.
3. Multiple-use conflict analysis—Title 43 CFR 3420.1-4e(3) states that "multiple land use decisions shall be made which may eliminate additional coal deposits from further consideration for leasing, to protect other resource values and land uses that are locally, regionally or nationally important or unique and that are not included in the unsuitability criteria." Multiple-use values may include possible oil and gas development and soil, forest, wildlife, recreation, agriculture, and watershed resources. Lands within coal potential areas may be eliminated from further consideration for leasing where multiple uses conflict.
4. Surface owner consultation—This screen requires the BLM to consult with qualified surface owners whose land overlies federal coal with development potential. The BLM asks the owners for their preference for or against offering the coal deposits under their land for lease. Lands within coal potential areas may be eliminated from further consideration for leasing based on qualified surface owner preference.

Federal lands made acceptable for coal leasing and development through the coal screening in the MCFO's administrative boundaries are the subject of this SEIS analysis; the results of the coal screening process are in **Appendix A**.

Only after lands have been allocated in the land use plan may coal leasing applications be proposed and submitted to the BLM for review (43 CFR 3425 and 43 CFR 3432). At that time, the BLM would complete a separate site-specific NEPA review with current resource data and issue a separate decision specific to the proposed federal lease. As noted in **Section 1.5.1**, this SEIS is a land use planning review; therefore, this SEIS does not make coal leasing or development decisions.

Coal and Mineral Leasing Management-Specific Laws, Regulations, and Policies

The BLM has several laws, regulations, and policies that guide its management of federal coal resources:

- Mineral Leasing Act of 1920, as amended
- Mineral Leasing Act for Acquired Lands of 1947, as amended
- Federal Coal Leasing Amendments Act of 1976
- FLPMA
- Surface Mining Control and Reclamation Act of 1977
- 43 CFR 3000 and 3400

Relationship to Other Federal Laws, Regulations, and Policies

Numerous federal and state laws and applicable regulations, policies, and actions affect the alternatives analyzed in the SEIS.

FLPMA is the primary authority for the BLM's management of public lands. It provides the policy by which the BLM manages federal coal. The BLM MCFO will make decisions for coal acceptable for further consideration for leasing under this SEIS. The BLM MCFO is required to follow the mandates of FLPMA when making those decisions.

The land use decisions made in this SEIS require analysis under NEPA. The BLM MCFO will analyze the impacts of the coal leasing decisions on the other resources identified in the decision area, including air quality, climate change, public health, socioeconomics, and environmental justice.

See the 2015 Proposed RMP/Final EIS (BLM 2015b) for the full list of additional laws, regulations, policies, and programs that are relevant to this analysis (Chapter 1, beginning on page 1-12).

1.6 COLLABORATION

The BLM is engaging in ongoing collaboration with federal, tribal, state, and local governments as part of this planning process. This collaboration includes government-to-government consultation with affected Native American tribes, the participation of cooperating agencies, and consultation with regulatory agencies, as required by law. **Chapter 4** provides more information about the involvement of these stakeholders.

1.7 RELATIONSHIP TO STATE AND LOCAL PLANS

In developing the alternatives considered in this SEIS, the BLM has considered plans of other state, local, and federal agencies that are relevant. Any decision resulting from this SEIS must be consistent, to the extent practicable, with these plans, as required by the consistency provisions of FLPMA (43 United States Code 1712l(9)) and the BLM's planning regulations at 43 CFR 1610.3-2. The plans considered during this supplemental analysis are listed in the 2015 Proposed RMP/Final EIS (BLM 2015b, pages 1-16 and 1-17).

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Chapter 2. Alternatives

2.1 Introduction

The BLM MCFO developed the three action alternatives considered in this SEIS in coordination with cooperating agencies, interested stakeholders, county and state governments, and tribal governments, and based on comments received from the general public during the scoping period. The SEIS alternatives focus solely on addressing the purpose and need items listed in **Section 1.2**. The range of alternatives meets the SEIS's purpose and need and responds to issues raised during scoping (see **Section 1.4** and the BLM Miles City Field Office RMP/SEIS Scoping Report [BLM 2022]).

2.2 Alternatives Development

The primary land use plan-level decision to be made regarding coal is identifying areas that are acceptable for further consideration for coal leasing and those that are not (BLM Land Use Planning Handbook H-1601-1, Appendix C). The process undertaken to arrive at a land use plan allocation must be consistent with federal regulations. Namely, the BLM is required to go through the coal screening process outlined in 43 CFR 3420 et. seq. to arrive at its decision.

In addition to input from cooperating agencies, interested stakeholders, county and state governments, tribal governments, and the public, the BLM performed coal screens 1–4 (see **Section 1.5.2** and **Appendix A**) in order to formulate the action alternatives. In all the action alternatives, the BLM eliminated federal lands based on the following: Screen 1, no coal development potential; Screen 2, unsuitable without exception; and Screen 4, the qualified surface owner was against coal mining of split-estate lands. Screen 3 is unique in each alternative because it allows the BLM to "eliminate additional coal deposits from further consideration for leasing to protect other resource values and land uses that are locally, regionally, or nationally important or unique" that are not considered in Screen 2 (43 CFR 3420.1-4e(3)). The Order stated that, "the coal screening can, and must, take into account climate change" (p. 16). Therefore, specific to this SEIS review and the Order,[1] the BLM applied a climate change criterion for air resources under Screen 3 (multiple-use) that considers climate change as resource value unique or of local, regional, or national importance, to develop a range of alternatives that meet the purpose and need.

To that end, to eliminate federal lands based on a climate change criterion for air resources, the BLM anticipates by limiting future opportunities for federal coal leasing and development there may be a reduction in GHG emissions from combustion of new federal coal, which would thus reduce climate change effects. In the 2018 Western Organization of Resource Councils and others case, the court acknowledged that using GHG emissions as a proxy for climate change is not arbitrary or capricious (Case 4:16-cv-00021-BMM, page 38). However, it is through the application of the climate change criterion for air resources, which could potentially change the projected RFD for each alternative, that the BLM is able to determine the anticipated GHG emissions associated with combustion from federal coal.

Knowing that the application of an 8-mile area around the then-existing mines and infrastructure analyzed in Alternative C of the 2019 Proposed RMPA/Final SEIS did not result in a reduction in anticipated coal

[1] Page 16 of the Order states, "…coal screening can, and must, take into account climate change."

production—and therefore did not satisfy the need to look at a "limited coal leasing" alternative as required in the 2018 Western Organization of Resource Councils court order—the BLM applied a climate change criterion for air resources that would further restrict future federal coal leasing and development in the Alternatives, as described below in **Section 2.2.1**.

The Order directed the BLM to consider "no coal leasing and limited coal leasing alternatives" (page 20). In interpreting the court's requirement to consider a "limited coal leasing" alternative, the BLM looked to the court's opinion that, in the 2019 SEIS (BLM 2019), the BLM failed to demonstrate a reasonable range of alternatives because "each alternative presents an identical amount of expected coal production" (page 13), the "BLM failed to consider any alternatives that would limit the expansion of existing mines" (page 14), and the BLM should "bookend its analysis by considering a no-future-leasing alternative and at least one alternative that further reduced leasing by reducing the potential for expansion" (pages 14–15). Pulling these statements together, the BLM understands the Order to consider a "limited coal leasing" alternative (page 20) to be one that reduces the potential for mine expansion by reducing the amount of recoverable coal at the existing mines so that there would be a correspondingly reduced amount of expected coal production.

In accordance with the coal screening process, the BLM developed a range of alternatives that would restrict, to varying degrees, future coal leasing and development to the mines currently producing federal coal. In addition to two "limited coal leasing" alternatives (Alternatives B and C), the BLM is also considering a "no coal leasing" alternative (Alternative D), per the Order. This allows the BLM to analyze how the alternatives would change the expected coal production projected in **Appendix B**.

As stated in **Section 1.5.1**, this SEIS recognizes valid existing rights, and these rights would remain unchanged. Existing leasing may only be relinquished, canceled, or terminated in accordance with 43 CFR 3452.

2.2.1 Alternatives Considered for Detailed Analysis

Alternative A (No Action Alternative)

For the No Action Alternative, the BLM brought forward the management decision from the 2021 ROD/Approved RMPA (BLM 2021). **Figure 2-1** shows the coal acceptability geospatial results from the MCFO 2019 Proposed RMP/Final SEIS (BLM 2019) for the No Action Alternative. **Table 2-1** shows the estimated coal acceptability results for Alternative A.

In the MCFO 2019 Proposed RMPA/Final SEIS (BLM 2019), this alternative applied a criterion for maintaining air quality standards as part of the multiple-use screen; however, existing data and modeling done for the 2015 Proposed RMPA/Final EIS (BLM 2015) showed no air quality standards were exceeded based on the national ambient air quality standards under the Clean Air Act. Therefore, no geographic area of land was eliminated from further consideration for coal leasing because of air resources. However, federal lands were eliminated under Screen 3's multiple-use criterion because of conflicts with oil and gas wells; oil and gas units; perennial, riparian, and wetland resources; conservation easements; recreation areas; sport fishing reservoirs; areas of critical environmental concern; and cultural viewsheds.

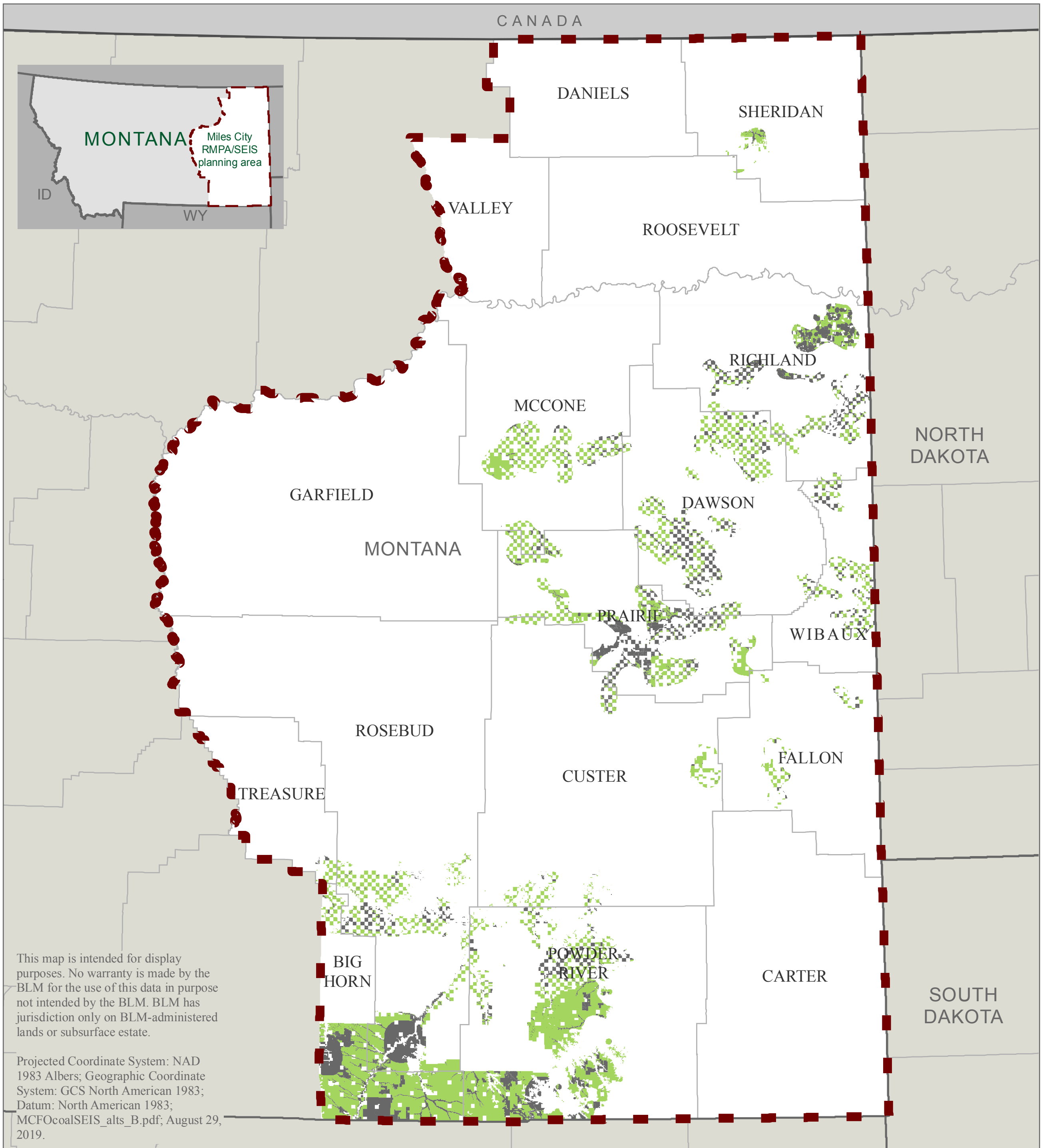

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Figure 2-1
Alternative A: Areas Acceptable for Further Consideration for Leasing

Unacceptable
Acceptable

1 inch = 39.3 miles

0 5 10 20 30 Miles

Table 2-1
Coal Screening Results for Alternative A

Coal Screen[1]	Total (Acres)[2]
Coal potential (Screen 1)	1,744,800
Unsuitable for all methods of coal mining without exception (Screen 2)	190,590
Unsuitable for all or certain stipulated methods of coal mining with exception/stipulation (Screen 2)	1,259,270
Unacceptable for further consideration for leasing (Screen 3)	193,010
Unacceptable for further consideration for leasing (Screen 4)	236,630
Total acceptable for further consideration for coal leasing	***1,214,380***
Total unacceptable for further consideration for coal leasing	***530,420***

Source: BLM 2019
[1] See **Appendix A** for the full coal screening results.
[2] There is overlap between the coal screens; acres for the screens are not additive.

For unsuitability criterion 15, Habitat for Species of High Interest to the State, the BLM would apply the following stipulation to coal leasing and development, as detailed in **Appendix A**:

> *The holder shall seed all disturbed areas with the seed mix, as agreed upon by the BLM, based on the soil type(s). There shall be no primary or secondary noxious weed seed in the seed mixture. Seed shall be tested, and the viability testing of seed shall be done in accordance with state law(s) and within 6 months prior to purchase. Commercial seed shall be either certified or registered seed. The seed mixture container shall be tagged in accordance with state law(s) and available for inspection by the BLM Authorized Officer.*

Reasonably Foreseeable Development Scenario

The BLM MCFO updated the RFD scenario from the 2015 Proposed RMP/Final EIS (BLM 2015) and the 2019 Proposed RMPA/Final SEIS (BLM 2019). The revised RFD scenario represents forecasted coal resource development from two surface mining operations actively mining federal coal, Spring Creek Mine and Rosebud Mine. Because these two mines produce federal and fee (nonfederal) coal, the forecasted production of the MCFO planning area reflects production from federal and nonfederal (state and private) coal.

As described in **Appendix B**, the Rosebud Mine does not anticipate needing additional coal beyond what is currently leased. Assuming constant annual production, Rosebud Mine will continue to produce federal and nonfederal coal until 2060.

The Spring Creek Mine currently has enough coal reserves, both federal and nonfederal, to produce coal until 2035. Spring Creek Mine currently has two pending federal lease applications that would extend the life of the mine to 2061. These two pending federal lease applications are for 1,410 acres and 167.9 million tons. Beyond these pending federal applications, Spring Creek Mine anticipates a need to lease approximately 1,300 additional federal acres with 170 million tons of coal. Doing so would extend the life of the mine to 2088. Alternative A would allow for full expansion of Spring Creek Mine on federal coal. Up to 2,710 acres of unleased (including pending) federal coal would be leased and up to 337.9 million tons of federal coal produced between 2036 and 2088.

Table 2-2 summarizes this information. See **Appendix B** for further information on the RFD scenarios.

Table 2-2
Reasonably Foreseeable Development Scenario, Alternatives A and B

	Spring Creek Mine	Rosebud Mine
Existing Leases		
Mine Life based on Existing Federal and Nonfederal Leases[1]	2035	2060
Total Federal Production from Existing Leases (tons)[2]	88.2 million tons	112.5 million tons
Pending Lease Applications		
Mine Life Based on Pending Federal and Nonfederal Lease Applications	2036-2061	N/A
Total Federal Production from Pending Lease Applications (tons)	167.9 million tons	0 tons
Total Disturbance from Federal Production of Pending Lease Applications (acres)	1,410 acres	0 acres
Potential Future Subsequent Leases		
Mine Life Based on Potential Future Subsequent Leases	2062-2088	N/A
Total Federal Production from Potential Future Subsequent Leases (tons)	170 million tons	0 tons
Total Disturbance from Federal Production of Potential Future Subsequent Leases (acres)	1,300 acres	0 acres
Total Federal Coal Production (2023-2088)[3] (tons)	426.1 million tons	112.5 million tons

[1] Estimated life of mine is based on the BLM projected production rate for each mine.
[2] Total federal production from existing leases is based on the modeled production forecast from 2023–2035 for Spring Creek Mine and from 2023–2060 for Rosebud Mine.
[3] Total federal and nonfederal production is based on the known nonfederal requirements of the mines. It assumes that there would be no new nonfederal leases beyond what is pending.

Alternative B

Alternative B represents an approach to a "limited coal leasing" alternative, per the Order. The BLM applied the coal screens using the most up-to-date resource data to determine areas acceptable and unacceptable for further consideration for coal leasing (**Table 2-3**). Under the Screen 3 (multiple-use), the BLM applied a climate change criterion for air resources, further described below. **Appendix A** includes the new detailed coal screens and their supporting data.

Table 2-3
Coal Screening Results for Alternative B

Coal Screen[1]	Total (Acres)[2]
Coal potential (Screen 1)	1,745,040
Unsuitable for all methods of coal mining without exception (Screen 2)	202,320
Unsuitable for all or certain stipulated methods of coal mining with exception/stipulation (Screen 2)	1,270,360
Unacceptable for further consideration for leasing (Screen 3)	1,671,040
Unacceptable for further consideration for leasing (Screen 4)	13,680
Total acceptable for coal leasing and development	***57,940***
Total unacceptable for coal leasing and development	***1,687,110***

[1] See **Appendix A** for the full coal screening results.
[2] There is overlap between the coal screens; the acres are not additive.

The climate change criterion for air resources under the multiple-use screen restricts leasing and development to lands near existing mines in the decision area. Under Alternative B, the BLM limited federal leasing development to a 2-mile area around existing federal mine plan boundaries approved by the Office of Surface Mining Reclamation and Enforcement. As explained in **Appendix B**, there are two active coal mines producing federal coal in the decision area; the 2-mile buffer is applied to the approved federal mine plan boundaries of these two mines. Under this criterion, federal lands with coal potential outside this 2-mile area would be removed as unacceptable for further consideration for leasing.

The BLM derived the 2-mile buffer around existing approved federal mine plan boundaries based on the typical mining sequence in the MCFO. Typical mining sequence considers leased coal, ongoing mining operations, and projected mine expansion relative to unleased coal and typically occurs within 1 to 2 miles from the federal mine plan boundary. To evaluate a limited leasing alternative as required by the Order, the BLM used the 2-mile buffer, the typical mining sequence area, to limit leasing to the existing mines producing federal coal.

Figure 2-2 shows the estimated geospatial results of the four coal screens for Alternative B. **Table 2-3** depicts the estimated coal screening results.

For unsuitability criterion 15, Habitat for Species of High Interest to the State, the BLM would apply the same stipulation to coal development as under Alternative A; this is detailed in **Appendix A**.

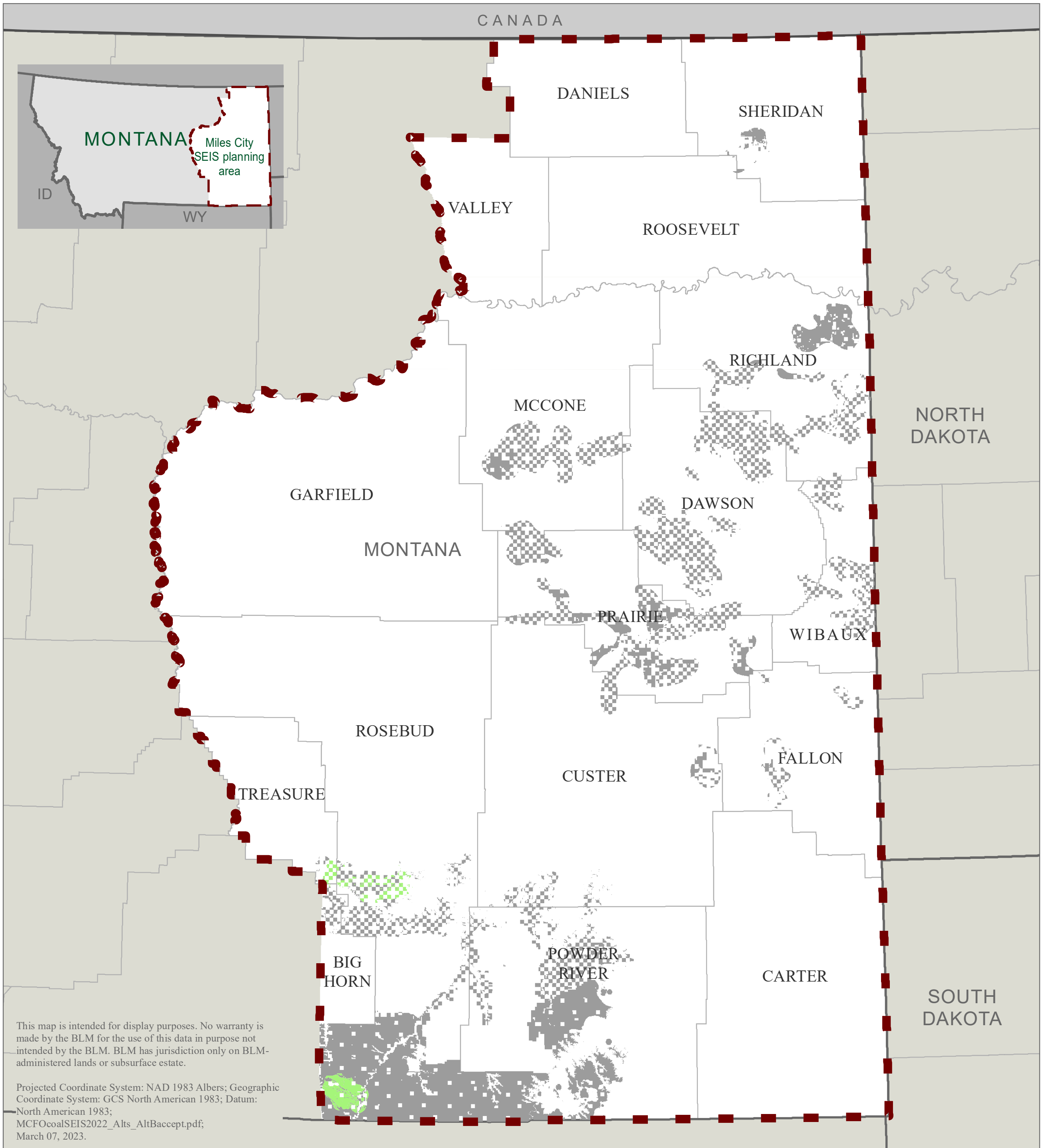
Reasonably Foreseeable Development Scenario

The RFD scenario does not change between Alternatives A and B, even though the acres available for leasing are different between the alternatives. This is because under Alternatives A and B there are sufficient lands available for leasing to meet the needs of the mines. In other words, the coal screens in these alternatives do not constrain the reasonably foreseeable federal coal production (see **Appendix B**). **Table 2-2** summarizes this information.

Alternative C

Alternative C represents another approach to a "limited coal leasing" alternative, per the Order. It uses the same coal screen applications for Screen 1 (coal potential), 2 (unsuitability), and 4 (landowner consultation) as Alternative B. It also uses the same application of coal Screen 3 (multiple use) as Alternative B; however, the climate change criterion for air resources was modified to further restrict new federal coal leasing and development to pending federal lease applications within the existing federal mine plan boundaries of mines currently mining federal coal (**Appendix A**). Whereas Alternative B would restrict coal leasing and development to a 2-mile buffer from the existing federal mine plan boundaries, Alternative C would apply a 0-mile buffer to the pending federal lease applications within the approved federal mine plan boundaries. Under this criterion, the BLM would remove unleased federal lands with coal potential outside the pending federal lease applications as unacceptable for further consideration. Further, if existing federal leases are relinquished, canceled, or otherwise returned back to the BLM, those lands would be unacceptable for further consideration for leasing. This would preclude the expansion of mines on federal coal outside of existing federal mine plan boundaries, as well as outside of pending federal lease applications within the existing federal mine plan boundaries. This would not preclude mine expansion to produce nonfederal coal.

Figure 2-3 shows the estimated geospatial results of the four coal screens for Alternative C. **Table 2-4** depicts the estimated coal screening results.



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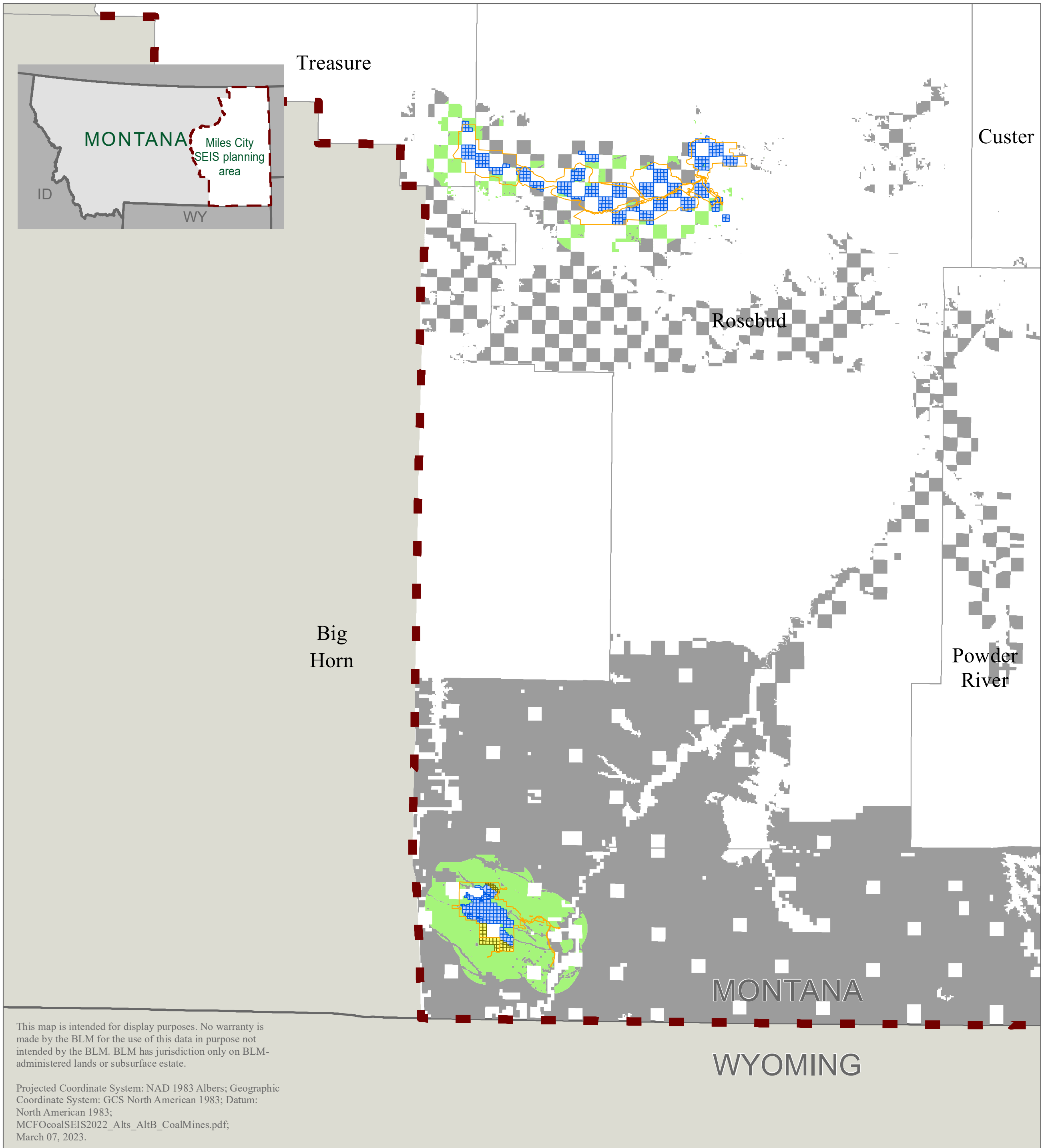
1 inch = 39.3 miles

0 5 10 20 30 Miles

Figure 2-2a
Alternative B: Area Acceptable for Further Consideration for Leasing (Field Office Extent)

Unacceptable

Acceptable



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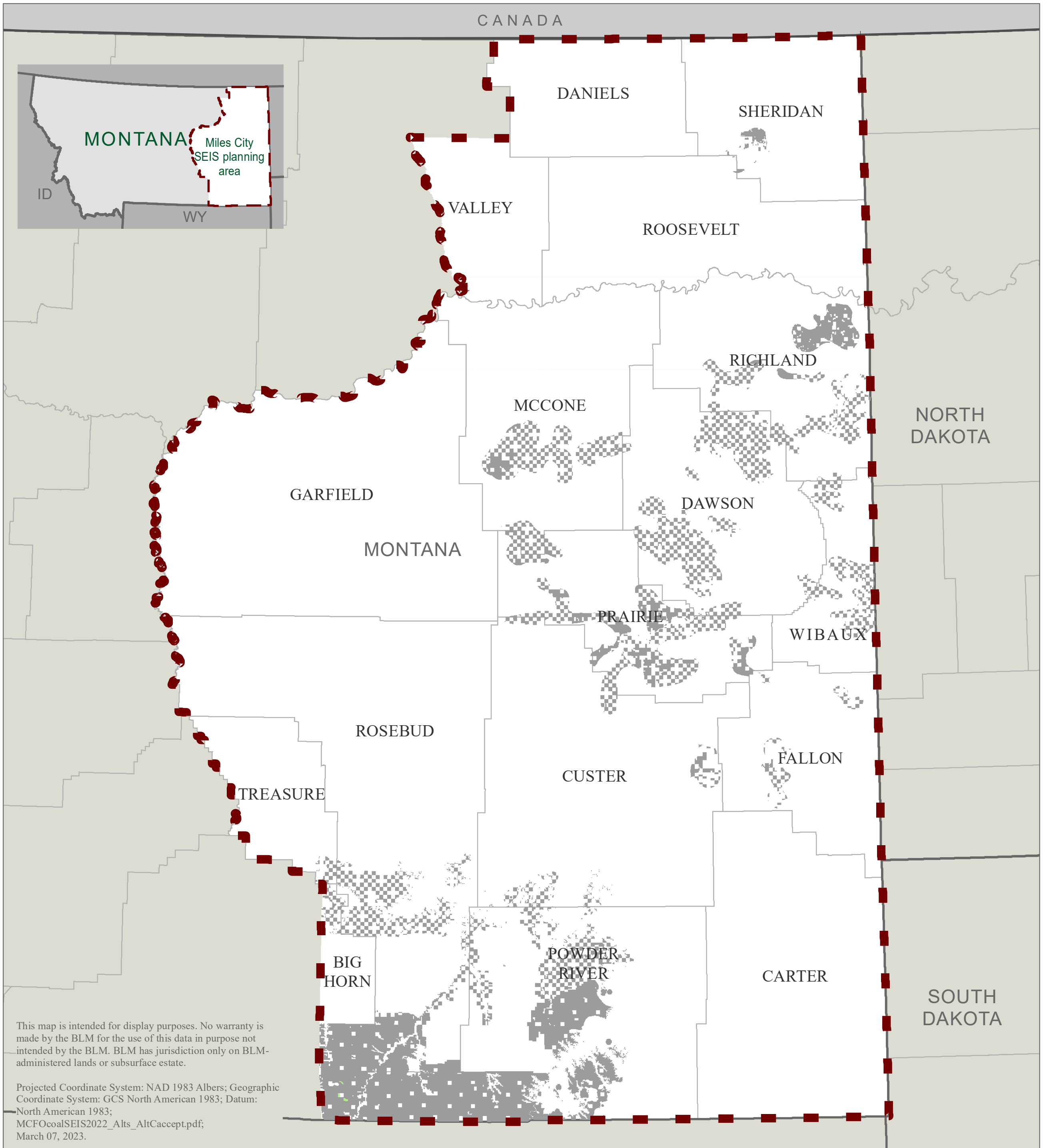
1 inch = 11.2 miles

0 5 10 Miles

Figure 2-2b
Alternative B: Area Acceptable for Further Consideration for Leasing (Coal Mines Extent)

- Acceptable
- Unacceptable
- Federal mine plan boundary
- Existing lease
- Pending lease application acceptable for consideration for coal leasing
- Miles City Field Office



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1 inch = 39.3 miles

0 5 10 20 30 Miles

Figure 2-3a
Alternative C: Area Acceptable for Further Consideration for Leasing (Field Office Extent)

Unacceptable

Acceptable

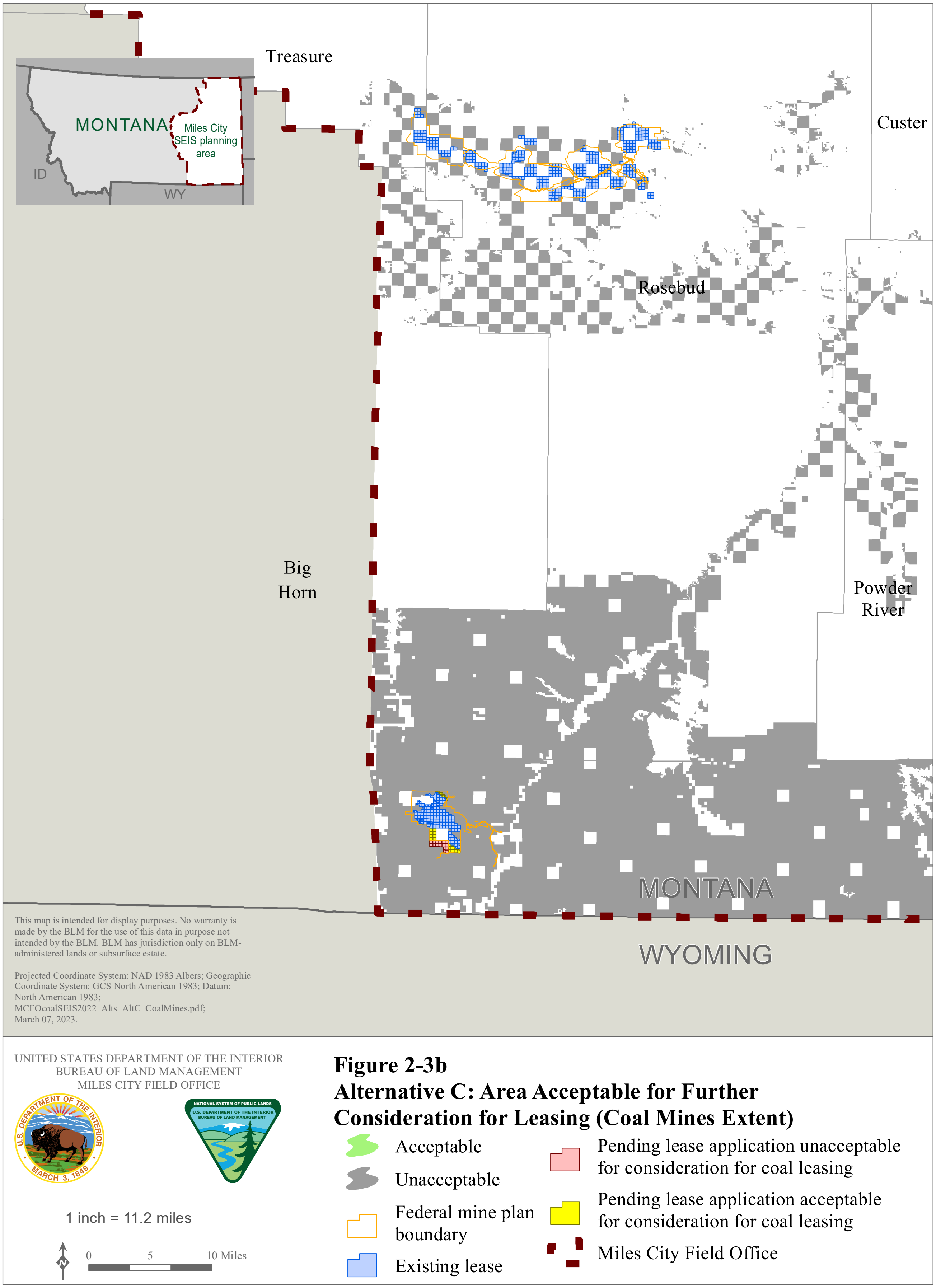


Figure 2-3b
Alternative C: Area Acceptable for Further Consideration for Leasing (Coal Mines Extent)

Table 2-4
Coal Screening Results for Alternative C

Coal Screen[1]	Total (Acres)[2]
Coal potential (Screen 1)	1,745,040
Unsuitable for all methods of coal mining without exception (Screen 2)	202,320
Unsuitable for all or certain stipulated methods of coal mining with exception/stipulation (Screen 2)	1,270,360
Unacceptable for further consideration for leasing (Screen 3)	1,744,240
Unacceptable for further consideration for leasing (Screen 4)	13,680
Total acceptable for coal leasing and development	***810***
Total unacceptable for coal leasing and development	***1,744,240***

[1] See **Appendix A** for the full coal screening results.
[2] There is overlap between the coal screens; the acres are not additive.

For unsuitability criterion 15, Habitat for Species of High Interest to the State, the BLM would apply the same stipulation to coal development as under Alternative A; this is detailed in **Appendix A**.

Reasonably Foreseeable Development Scenario

The RFD scenario is based on the acres available for coal leasing under Alternative C, as well as the anticipated needs from the two mines producing federal coal. The RFD does not project that the Rosebud Mine would need additional coal beyond what is currently leased. Assuming constant annual production, Rosebud Mine will continue to produce federal and nonfederal coal until 2060 (see **Appendix B**).

The Spring Creek Mine currently has enough coal reserves, both federal and nonfederal, to produce coal until 2035. Under Alternative C, the two pending federal lease applications would not be fully authorized. These pending federal lease applications would extend the mine life to 2050 and would be for 810 acres and 95 million tons of coal. None of the future anticipated needs would be satisfied through federal authorizations. For the reasons stated in **Appendix B**, it is assumed that Spring Creek Mine would close in 2050.

Table 2-5 summarizes this information. See **Appendix B** for further information on the RFD scenarios.

Table 2-5
Reasonably Foreseeable Development Scenario, Alternative C

	Spring Creek Mine	Rosebud Mine
Existing Leases		
Mine Life based on Existing Federal and Nonfederal Leases[1]	2035	2060
Total Federal Production from Existing Leases (tons)[2]	88.2 million tons	112.5 million tons
Pending Lease Applications		
Mine Life Based on Pending Federal and Nonfederal Lease Applications	2036-2050	N/A
Total Federal Production from Pending Lease Applications (tons)	95 million tons	0 tons
Total Disturbance from Federal Production of Pending Lease Applications (acres)	810 acres	0 acres

	Spring Creek Mine	Rosebud Mine
Potential Future Subsequent Leases		
Mine Life Based on Potential Future Subsequent Leases	N/A	N/A
Total Federal Production from Potential Future Subsequent Leases (tons)	0 tons	0 tons
Total Disturbance from Federal Production of Potential Future Subsequent Leases (acres)	0 acres	0 acres
Total Federal Coal Production (2023-2060)[3] (tons)	183 million tons	112.5 million tons

[1] Estimated life of mine is based on the BLM projected production rate for each mine.
[2] Total federal production from existing leases is based on the modeled production forecast from 2023–2035 for Spring Creek Mine and from 2023–2060 for Rosebud Mine.
[3] Total federal and nonfederal production is based on the known nonfederal requirements of the mines. It assumes that there would be no new nonfederal leases beyond what is pending.

Alternative D

As directed by the Order, the BLM "shall consider a no leasing alternative" (page 20). Therefore, only existing federal leases with valid existing rights could be developed under Alternative D. Any unleased federal coal in the decision area, including within existing federal mine plan boundaries, would be removed as unacceptable for further consideration under this alternative. Alternative D uses the same coal screen applications for Screen 1 (coal potential), 2 (unsuitability), and 4 (landowner consultation) as Alternative B. It also uses the same application of coal Screen 3 (multiple use) as Alternative B; however, the climate change criterion for air resources was modified to consider the Order for a no-new-coal-leasing alternative (**Appendix A**).

Alternative D would apply the climate change criterion that eliminates all new emissions from federal coal leasing and development by prohibiting new federal coal leasing. Any unleased federal coal in the decision area, including within existing federal mine plan boundaries, would be removed as unacceptable for further consideration under this criterion.

Figure 2-4 shows the estimated geospatial results of the four coal screens for Alternative D. **Table 2-6** depicts the estimated coal screening results.

Table 2-6
Coal Screening Results for Alternative D

Coal Screen[1]	Total (Acres)[2]
Coal potential (Screen 1)	1,745,040
Unsuitable for all methods of coal mining without exception (Screen 2)	202,325
Unsuitable for all or certain stipulated methods of coal mining with exception/stipulation (Screen 2)	1,270,360
Unacceptable for further consideration for leasing (Screen 3)	1,745,040
Unacceptable for further consideration for leasing (Screen 4)	13,680
Total acceptable for coal leasing and development	***0***
Total unacceptable for coal leasing and development	***1,745,040***

[1] See **Appendix A** for the full coal screening results.
[2] There is overlap between the coal screens; the acres are not additive.

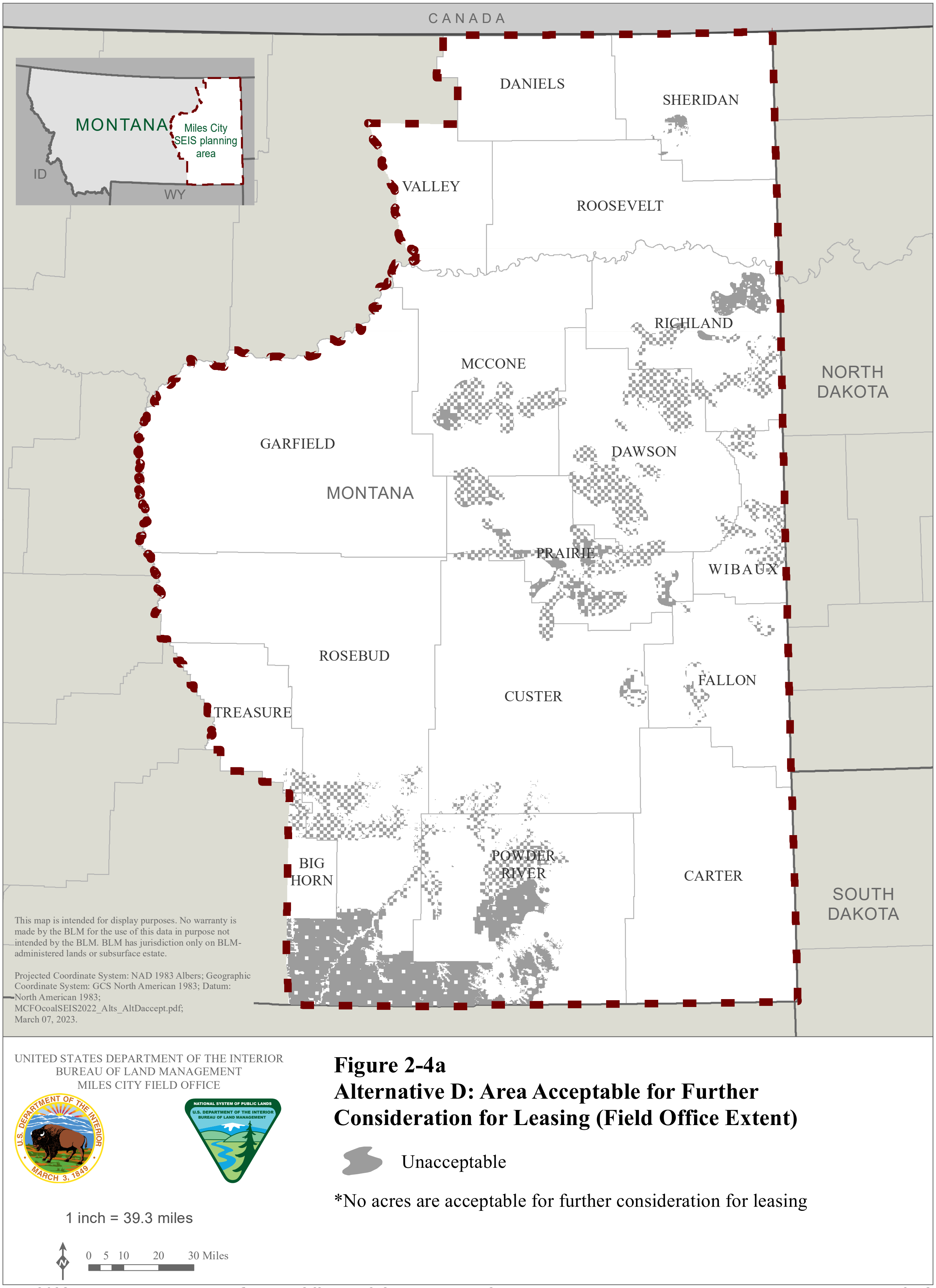
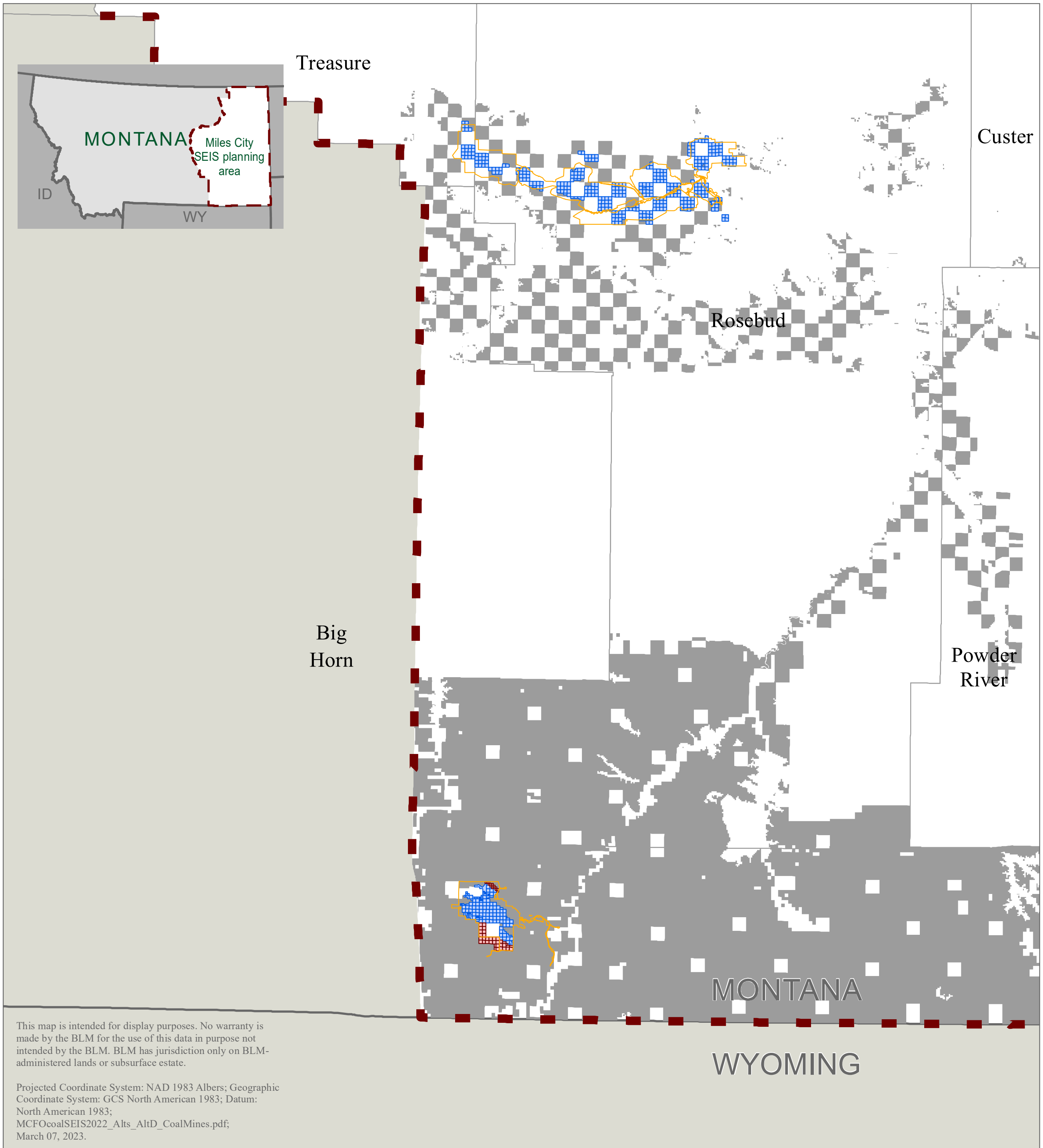


Figure 2-4a
Alternative D: Area Acceptable for Further Consideration for Leasing (Field Office Extent)



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1 inch = 11.2 miles

0 5 10 Miles

Figure 2-4b
Alternative D: Area Acceptable for Further Consideration for Leasing (Coal Mines Extent)

- Unacceptable
- Federal mine plan boundary
- Existing lease
- Pending lease application unacceptable for consideration for coal leasing
- Miles City Field Office

Reasonably Foreseeable Development Scenario

The RFD scenario is based on the acres available for coal leasing under Alternative D, as well as the anticipated needs from the two mines producing federal coal. As under Alternative A, the Rosebud Mine does not anticipate needing additional coal beyond what is currently leased. Assuming constant annual production, Rosebud Mine will continue to produce federal and nonfederal coal until 2060 (see **Appendix B**).

The Spring Creek Mine currently has enough coal reserves, both federal and nonfederal, to produce coal until 2035. Under Alternative D, the two pending federal lease applications would not be authorized. None of the future anticipated needs would be satisfied through federal authorizations. For the reasons stated in **Appendix B**, it is assumed that Spring Creek Mine would close in 2035.

Table 2-7 summarizes this information. See **Appendix B** for further information on the RFD scenarios.

Table 2-7
Reasonably Foreseeable Development Scenario, Alternative D

	Spring Creek Mine	Rosebud Mine
Existing Leases		
Mine Life based on Existing Federal and Nonfederal Leases[1]	2035	2060
Total Federal Production from Existing Leases (tons)[2]	88.2 million tons	112.5 million tons
Pending Lease Applications		
Mine Life Based on Pending Federal and Nonfederal Lease Applications	N/A	N/A
Total Federal Production from Pending Lease Applications (tons)	0 tons	0 tons
Total Disturbance from Federal Production of Pending Lease Applications (acres)	0 acres	0 acres
Potential Future Subsequent Leases		
Mine Life Based on Potential Future Subsequent Leases	N/A	N/A
Total Federal Production from Potential Future Subsequent Leases (tons)	0 tons	0 tons
Total Disturbance from Federal Production of Potential Future Subsequent Leases (acres)	0 acres	0 acres
Total Federal Coal Production (2023-2060)[3](tons)	88.2 million tons	112.5 million tons

[1] Estimated life of mine is based on the BLM projected production rate for each mine.
[2] Total federal production from existing leases is based on the modeled production forecast from 2023–2035 for Spring Creek Mine and from 2023–2060 for Rosebud Mine.
[3] Total federal and nonfederal production is based on the known nonfederal requirements of the mines. It assumes that there would be no new nonfederal leases beyond what is pending.

2.2.2 Alternatives Considered but Eliminated from Detailed Analysis

Leasing Limited to Existing Federal Mine Plan Boundaries

The BLM considered another approach to a "limited coal leasing" alternative, per the Order. It uses the same coal screen applications for Screen 1 (coal potential), 2 (unsuitability), and 4 (landowner consultation) as Alternative B. It also uses the same application of coal Screen 3 (multiple use) as Alternative B; however, the climate change criterion for air resources was modified to further restrict new federal coal leasing and development to the existing federal mine plan boundaries of active mines with federal coal leases (**Appendix A**). Under this criterion, the BLM would remove federal lands with coal potential outside the existing federal mine plan boundaries as unacceptable for further consideration for coal leasing. While this would not preclude expansion of the federal mine plan boundaries in the future, it would preclude the opportunity for operators to recover unleased federal coal in any expanded areas. Further, it would not preclude operators from recovering leased and unleased federal coal within the existing federal mine plan boundaries. This differs from Alternative C because Alternative C makes available only pending federal lease applications within the federal mine plan boundary, whereas this alternative would make available all unleased federal lands within the pending federal lease applications, including those outside of the existing federal mine plan boundaries.

As noted in **Appendix B**, there are two mines that are actively mining federal coal, the Rosebud Mine and Spring Creek Mine. The Rosebud Mine has existing federal leases with sufficient federal coal reserves to take the mine life to 2060. The BLM does not forecast a need beyond that at this time. The Spring Creek Mine has two pending federal coal lease applications: MTM 110693 lease modification for 150 acres and 6.9 million tons of recoverable coal, and MTM 10548501 lease application for 1,262 acres containing approximately 161 million tons of recoverable coal. In addition, Spring Creek Mine anticipates an additional 170 million tons (approximately 1,300 acres) for potential subsequent future leasing.

Under this alternative, the pending federal lease application (MTM 10548501) would be reduced to 662 acres (357 acres of BLM surface) and 87.85 million tons of federal coal. The pending lease modification (MTM 110693) would be reduced by 10 acres and does not modify the volume of recoverable coal (6.9 million tons). Spring Creek Mine would still have a need to obtain the approximately 73.15 million tons (approximately 600 acres) from the pending application that are outside the exiting federal mine plan boundary and an additional 170 million tons (approximately 1,300 acres) for potential subsequent future leasing. In this scenario, the 243 million tons would come from the 2,600 acres of unleased federal coal within the existing federal mine plan boundary. This would require a new federal lease or leases by 2050 to extend the life of the mine to 2088, the same as under Alternatives A and B.

Even by limiting expansion to the existing federal mine plan boundary, this alternative was considered but eliminated from detailed analysis because it would have similar impacts and forecasted mine life (2088) to Alternatives A and B, which are analyzed in detail, because the RFD scenario would not change. Moreover, this alternative is similar to Alternative C because it limits expansion to within the federal mine plan boundary and reduces the pending federal lease applications. However, it allows for additional unleased federal coal within the existing federal mine plan boundary to be considered for leasing to carry mine operation into the future. Because this alternative is a variation between Alternatives B and C and the impacts would not be substantially different that Alternative B, this alternative was considered but eliminated from detailed analysis in this SEIS.

Table 2-8 shows the acres of disturbance and tons of coal that would be produced under this scenario, and the timeline for development.

Table 2-8
Alternative Considered but Eliminated from Detailed Analysis: Limit Leasing to Existing Federal Mine Plan Boundaries

Total Federal and Nonfederal Production 2022–2038 (million tons)	Total Federal Production from Existing and Pending Leases/ Applications 2022–2038 (million tons)	Pending[1] Federal Lease Applications (acres/million tons)		Life of Mine Extension by Adding Pending Lease Applications[2] (years)		Potential Future Subsequent Federal Leases (acres/million tons)		Life of Mine Extension by Adding Subsequent Lease Decisions[2] (years)	
		Spring Creek Mine	Rosebud Mine	Spring Creek Mine	Rosebud Mine	Spring Creek Mine	Rosebud Mine	Spring Creek Mine	Rosebud Mine
291.31	178.34	810/95	0/0	15 (2036–2050)	0 (2060)	1,900/243	0/0	38 (2051 – 2088)	0 (2060)

[1] Rosebud Mine does not have any pending lease applications, and existing reserves would provide mining through 2060. Spring Creek Mine has two pending lease applications, and the mine forecasts a need for potential future subsequent leasing of approximately 1,300 acres/170 million tons.
[2] Estimated life of mine is based on the BLM projected production rate for each mine.

2.3 Preferred Alternative

2.3.1 Consideration for Selecting a Preferred Alternative

The alternatives offer a range of discrete strategies for addressing the purpose and need. Comments submitted by other government agencies, public organizations, state and tribal entities, and interested individuals were given careful consideration.

Planning regulations require the BLM to identify a preferred alternative in the draft EIS (or SEIS, in this case). The preferred alternative represents the alternative determined to best address the purpose and need and the issues considered at this stage of the process. While collaboration is critical in developing and evaluating alternatives, the final designation of a preferred alternative remains the exclusive responsibility of the BLM.

2.3.2 Identification of the Preferred Alternative

Identifying a preferred alternative(s) does not indicate any final decision commitments from the BLM. In developing the Final SEIS and Potential RMPA, which is the next phase of the planning process, the decision maker may select various components from each of the alternatives analyzed in the Draft SEIS. The Final SEIS and Potential RMPA may also reflect changes and adjustments based on comments received on the Draft SEIS, new information, or changes in BLM policies or priorities.

The BLM used the impact analysis, along with recommendations from cooperating agencies consideration of planning criteria; and anticipated resolution of resource conflicts to identify Alternatives B and D as co-preferred alternatives from the suite of alternatives analyzed. Specifically, the identification of the co-preferred alternatives was based on the following:

- Two different alternatives have been identified has co-preferred alternatives for the purpose of public comment and review;
- Satisfaction of statutory requirements and the court order; and
- Provision of an acceptable approach to addressing key planning issues described in **Section 1.4.1**.

Chapter 3. Affected Environment and Environmental Consequences

3.1 Introduction

This chapter describes the existing physical and socioeconomic characteristics of the decision area, including human uses that could be affected, and it evaluates the impacts or effects of implementing the proposed alternatives. The 2015 Proposed RMP/Final EIS described the baseline conditions in the decision area (BLM 2015a; Chapter 3, *Affected Environment*). Because the 2015 Proposed RMP/Final EIS describes the baseline conditions in detail, this chapter incorporates those conditions by reference and provides updated descriptions of those resources that have new or updated information. **Chapter 1** of this SEIS includes a list of those resources considered but eliminated from further analysis (see **Table 1-3**).

3.2 Methods and Assumptions

3.2.1 Analytical Assumptions

Several assumptions were made to facilitate the analysis of potential effects and to ensure that the analysis adheres to the Order. The following general assumptions apply to all resources:

- Planning issues identified in **Chapter 1** and the US District Court's opinion and Order provide the focus for the scope of effects analyzed in this chapter.
- All resources use baseline data from the 2015 Proposed RMP/Final EIS (BLM 2015a) and 2019 Proposed RMPA/Final SEIS (BLM 2019) unless updated information is identified.
- Unless otherwise indicated, impact analyses assume a 17-year time horizon (2022–2038), also referred to as the analysis period.
- The Rosebud Mine has leases that will extend production to 2060. It is not foreseeable that Rosebud Mine would need additional coal production during or beyond this time, so no additional disturbance would occur at the Rosebud Mine. Because the Rosebud Mine already has all of the coal it anticipates will be needed, emissions estimates and thus air quality impacts, public health impacts, economic impacts, and environmental justice impacts for Rosebud Mine are included in the Affected Environment and impacts for the alternatives are based on Spring Creek Mine; see below.
- Spring Creek Mine has leases that will extend production to 2035. Because these leases are valid existing rights, emissions estimates and thus air quality impacts, public health impacts, economic impacts, and environmental justice impacts for through 2035 are included in the Affected Environment. The *Direct and Indirect Impacts* include the impacts leasing that would occur after 2035.
- The BLM does not anticipate development of all the lands available for further consideration for coal leasing. While the alternatives would allocate different acres of land as available for further consideration for coal leasing, the analysis in this section is based on the RFD scenario for each alternative as described in **Appendix B** and in **Chapter 2**. The RFD scenario is the anticipated development based on information gathered from publicly available data and confirmed by data from the mine operators. The RFD scenario by alternative serves to provide context for the analysis in terms of magnitude and duration. Analyzing only the lands available for further

consideration for coal leasing would be speculative and not provide appropriate context. The RFD scenario does not change between Alternatives A and B, even though the acres available for leasing are different between the alternatives. This is because under Alternatives A and B there are sufficient lands available for leasing to meet the needs of the RFD. In other words, the coal screens in these alternatives do not constrain the reasonably foreseeable federal coal production (see **Appendix B**). However, Alternative C, which is another limited leasing scenario, does constrain the RFD scenario to the point that there is a reduction in both the acres available for further consideration for coal leasing and the anticipated production.

- For Alternatives A and B, the BLM forecasts 54 acres of surface disturbance annually related to federal coal development between 2036–2061 based on pending federal lease applications, as identified by operators and detailed in the RFD scenario in **Appendix B**. Beyond 2061, the BLM forecasts an additional 1,300 acres of disturbance through the foreseeable life of the Spring Creek Mine (2088). All federal mining-related disturbance associated with pending federal lease applications would be limited to Big Horn County.
- Under Alternative C, the BLM forecasts 54 acres of surface disturbance annually related to federal coal development between 2036–2050 based on pending federal lease applications, as identified by operators and detailed in the RFD scenario in **Appendix B**. All federal mining-related disturbance associated with pending federal lease applications would be limited to Big Horn County. There would be no disturbance associated with federal coal production outside of pending or potential future subsequent lease applications beyond 2050.
- Under Alternative D, there would be no surface disturbance from federal coal development associated with new leasing because there would be no lands available for further consideration for coal leasing.
- Based on the RFD scenario projections described in **Appendix B**, the impact analysis area for Alternatives B, C, and D is the lands acceptable for further consideration for leasing within Big Horn County and Rosebud County; it does not include the entire planning area from the 2015 Proposed RMP/Final EIS (BLM 2015a) or the analysis area in the 2019 Proposed RMPA/Final SEIS (BLM 2019). For Alternative A, the impact analysis area is the lands acceptable for further consideration for coal leasing described in Alternative B of the 2019 Proposed RMPA/Final SEIS (BLM 2019).
- The BLM used best available data at the time of application of coal screens for this effort. In accordance with 43 CFR 3461.2-1, the BLM could, based on additional site-specific surveys or changes in resource conditions, change the determination of Screen 2 (unsuitability) of a given tract at the activity planning stage without amending the decisions in this potential RMPA.
- Acre figures and other numbers used in the analysis are approximate projections for comparison and analytical purposes only.
- There are no underground mines in the decision area and, based on geology and economics, there are no reasonably foreseeable opportunities for underground mining in the decision area.

3.2.2 Reasonably Foreseeable Development Scenario

The BLM MCFO updated the RFD scenario from the 2015 Proposed RMP/Final EIS (BLM 2015a) and the 2019 Approved RMPA/Final SEIS (BLM 2019). The revised RFD scenario represents forecasted coal resource development from two surface mining operations actively mining federal coal, Spring Creek Mine and Rosebud Mine through the life of the mines based on their anticipated future needs.

Because these two mines produce federal and fee coal, the forecasted production of the MCFO planning area reflects production from state, federal, and private coal. This RFD scenario accounts for power plant closures or conversions.

Table 3-1 summarizes the RFD scenario by alternative based on the assumptions presented in **Appendix B**.

The RFD scenario forecasts that approximately 2,710 acres associated with pending federal lease applications at Spring Creek Mine would be disturbed over the life of the mines while mining the forecasted 337.9 million tons of federal coal. The Rosebud Mine would not expand beyond its current permitted operation (see **Appendix B**). There would be no new federal mines in the decision area.

3.2.3 Types of Effects

The analysis considers direct, indirect, and cumulative effects, consistent with direction at 40 CFR 1502.16.

- Direct effects are caused by an action or by implementation of an alternative and occur at the same time and place as that action or implementation. For example, for the action of building a road, a direct adverse effect is surface disturbance. Surface disturbance is the effect of heavy equipment (the cause) removing existing vegetation, wildlife habitat, and topsoil as it grades the road location.
- Indirect effects also result from an action or implementation of an alternative, but usually occur later in time or removed in distance from the action or implementation. For the action of building a road, an indirect effect could occur days after the surface is disturbed and some distance from the disturbance. Heavy precipitation following the removal of vegetation and disturbance of the ground surface could erode soil and transport sediment into streams. This effect on stream-water quality would be considered indirect.
- Cumulative effects result from individually minor but collectively significant actions over time. A cumulative effect is the effect on the environment that results from the incremental effect of the federal action when added to other past, present, and reasonably foreseeable future actions, federal and nonfederal.

3.2.4 Past, Present, and Reasonably Foreseeable Future Actions Considered in Cumulative Impacts Analysis

The past, present, and reasonably foreseeable actions considered in the cumulative impact analysis are the mining operations (past, present, and reasonably foreseeable) in Montana. The air, climate, and public health impacts also consider emissions from oil and gas production.

Table 3-1
Summary of RFD Scenario by Alternative

Alternative	Total Federal and Nonfederal Production 2022–2038 (million tons)	Total Federal Production from Existing and Pending Federal Leases/ Applications 2022–2038 (million tons)	Total Federal Production for Mine Life (million tons)	Pending[1] Federal Lease Applications (acres/ million tons)		Life of Mine Extension by Adding Pending Federal Leases (years)[2]		Potential Future Subsequent Federal Leases (acres/million tons)		Life of Mine Extension by Adding Subsequent Lease Decisions (years)[2]	
				Spring Creek Mine	Rosebud Mine	Spring Creek Mine	Rosebud Mine	Spring Creek Mine	Rosebud Mine	Spring Creek Mine	Rosebud Mine
A and B	**274.97**	**165.18**	335.18	1,410/167.9	0/0	26 (2036–2061)	0 (2060)	1,300/170	0/0	27 (2062–2088)	0 (2060)
C	**274.97**	**165.18**	165.18	810/95	0/0	15 (2036–2050)	0 (2060)	0/0	0/0	0 (2050)	0 (2060)
D	**248.40**	**140.61**	140.61	0/0	0/0	0 (2035)	0 (2060)	0/0	0/0	0 (2035)	0 (2060)

[1] Rosebud Mine does not have any pending lease applications, and existing reserves would provide mining through 2060. See the assumptions in the respective RFD scenario below. Spring Creek Mine has two pending federal lease applications, and the mine forecasts a need for future subsequent leasing of approximately 1,300 acres/170 million tons.
[2] Estimated life of mine is based on the BLM projected production rate for each mine.

3.3 AIR QUALITY

3.3.1 Affected Environment

The analysis area for direct impacts on air quality and air quality related values (AQRVs, visibility and deposition) is defined as the planning area and the following federal and tribal Class I areas that are near the planning area:

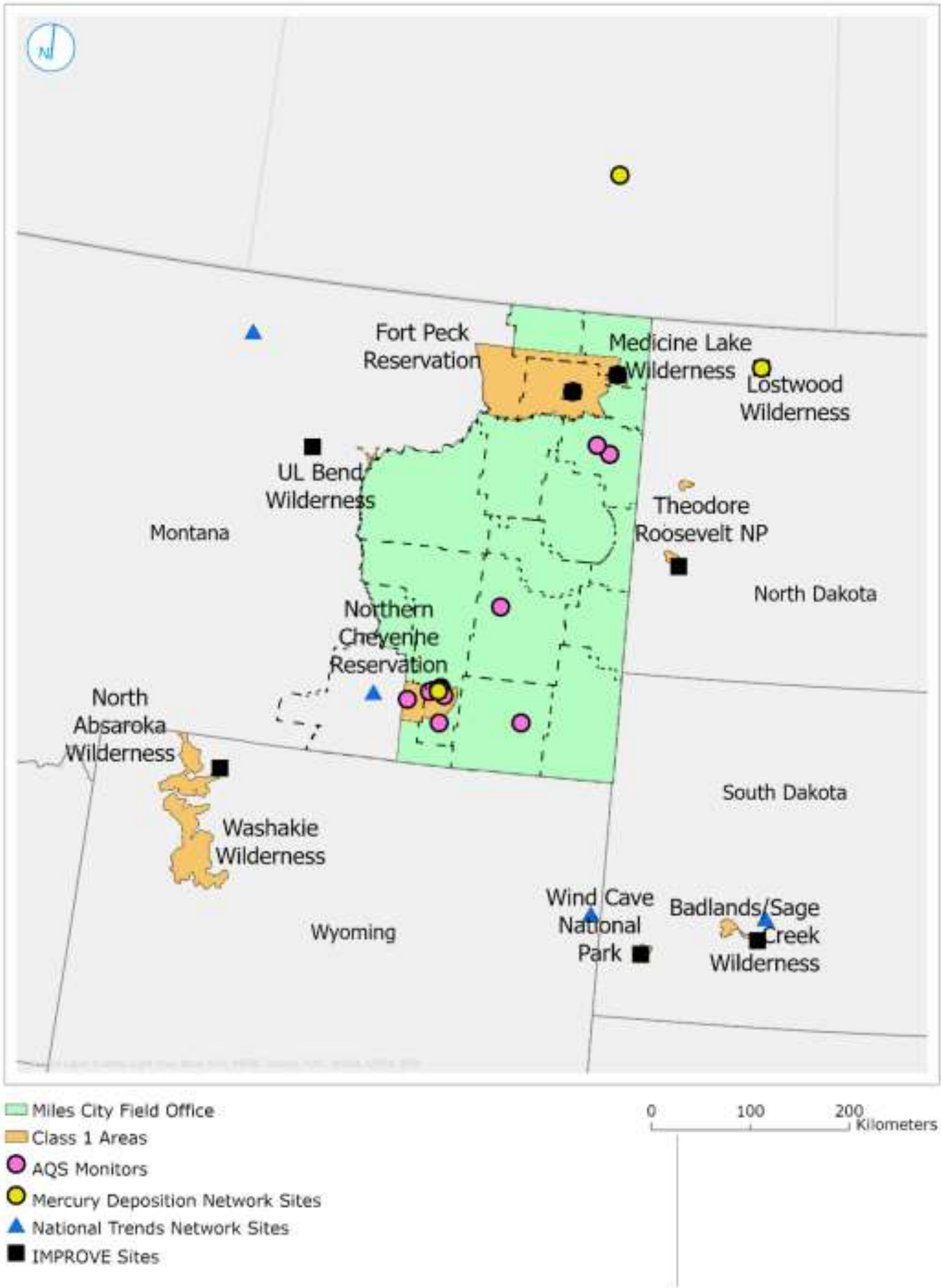
- Badlands National Park
- Fort Peck Reservation
- Lostwood Wilderness
- Medicine Lake Wilderness
- North Absaroka Wilderness
- Northern Cheyenne Reservation
- Theodore Roosevelt National Park
- UL Bend Wilderness
- Washakie Wilderness
- Wind Cave National Park

Since coal produced in the planning area could be combusted at numerous coal-fired power plants outside the planning area, or, in the case of oil and gas, anywhere in the country, the indirect analysis area for air quality and AQRVs is all of those regions that combust federal minerals that originate from the planning area.

The analysis conducted for direct and indirect impacts is quantitative or qualitative depending on the availability of data and uncertainties in data. In particular, a qualitative analysis is conducted for the indirect analysis area: the air quality and public health impacts of areas that receive federal coal or products of oil and gas from the planning area for reasons outlined in *Downstream Combustion Impacts on Air Quality and Public Health* under *Direct and Indirect Impacts*. The BLM also notes that power plants and oil and gas combustion sources in those areas would be subject to local, state, and federal regulations aimed at improving and maintaining air quality.

Figure 3-1 shows the location of the planning area, federal and tribal Class I areas, and the locations of monitoring stations for air quality and AQRVs. Air quality data from these locations provides an overall summary of current air quality conditions within the planning area and in the surrounding regions.

Figure 3-1
Map of the Planning Area, Nearby Class 1 Areas, and Monitoring Sites for Air Quality and Air Quality Related Values



Regulatory and Policy Framework

The Clean Air Act and its amendments mandate the control of air pollutants throughout the United States. It imposes an obligation on all state and federal agencies, including the BLM, to comply with all state and local air pollution requirements (42 United States Code § 7401, et seq.). The Clean Air Act addresses CAPs, state and National Ambient Air Quality Standards (NAAQS) for CAPs, AQRVs such as visibility and deposition, and the Prevention of Significant Deterioration program. The Clean Air Act also designates Class I areas, which are national parks and wilderness areas with special air quality protections.

Under the Clean Air Act, the EPA has established NAAQS for six CAPs—carbon monoxide (CO), nitrogen dioxide (NO_2), sulfur dioxide (SO_2), ground-level ozone (O_3), lead, and particulate matter (PM) (PM equal to or less than 10 microns in diameter [PM_{10}], and PM equal to or less than 2.5 microns in diameter [$PM_{2.5}$]). Primary standards provide public health protection, while secondary standards provide public welfare protection (such as protection against decreased visibility and damage to vegetation and buildings).

States are also empowered to establish their own state-specific standards for CAPs; in Montana, these are Montana Ambient Air Quality Standards (MAAQS; Administrative Rules of Montana [ARM] 17.8.201-17.8.230). These are regulated by the Montana Department of Environmental Quality (MDEQ). Montana has established additional ambient air quality standards for CO, NO_2, O_3, SO_2, lead, and PM_{10}, as well as hydrogen sulfide, fluoride in forage, settleable PM, and visibility. The current NAAQS and MAAQS are provided in **Table 3-2** and **Table 3-3**, respectively.

Table 3-2
National Ambient Air Quality Standards

Pollutant	Primary/ Secondary	Averaging Period	NAAQS	Form
CO	Primary	8 hours	9 ppm	Not to be exceeded more than once per year
		1 hour	35 ppm	
Lead	Primary and Secondary	Rolling 3-month average	0.15 µg/m^3	Not to be exceeded
NO_2	Primary and Secondary	Annual	53 ppb	Annual mean
	Primary	1 hour	100 ppb	98th percentile of 1-hour daily maximum concentrations, averaged over 3 years
O_3	Primary and secondary	8 hours	0.070 ppm (70 ppb)	Annual 4th highest daily maximum 8-hour concentration, averaged over 3 years
$PM_{2.5}$	Primary	Annual	12.0 µg/m^3	Annual mean averaged over 3 years
	Secondary	Annual	15.0 µg/m^3	Annual mean averaged over 3 years
	Primary and secondary	24 hours	35 µg/m^3	98th percentile, averaged over 3 years
PM_{10}	Primary and secondary	24 hours	150 µg/m^3	Not to be exceeded more than once a year, on average over 3 years
SO_2	Primary	1 hour	75 ppb	99th percentile of 1-hour daily maximum concentrations, averaged over 3 years
	Secondary	3 hours	0.5 ppm (500 ppb)	Not to be exceeded more than once per year

Source: EPA 2022a

Table 3-3
Montana Ambient Air Quality Standards

Pollutant	Averaging Period	MAAQS	Form
CO	8 hours	9 ppm	Not to be exceeded more than once over any 12 months
	1 hour	23 ppm	Not to be exceeded more than once over any 12 months
NO_2	Annual	0.05 ppm (50 ppb)	Not to be exceeded more than once over any 12 months
	1 hour	0.30 ppm (300 ppb)	Not to be exceeded
O_3	1 hour	0.10 ppm (100 ppb)	Not to be exceeded more than once over any 12 months
SO_2	1 hour	0.50 ppm (500 ppb)	Not to be exceeded more than eighteen times in any 12 consecutive months
	Annual	0.02 ppm (20 ppb)	Not to be exceeded by the arithmetic average over any four consecutive quarters
	24 hours	0.10 ppm (100 ppb)	Not to be exceeded more than once over any 12 months
PM_{10}	Annual	50 μg/m^3	Not to be exceeded
Fluoride in Forage	Monthly	50 μg/g	Not to be exceeded by 3-year average of annual means.
	Grazing Season	35 μg/g	Not to be exceeded
Hydrogen sulfide	1 hour	0.05 ppm (50 ppb)	Not to be exceeded
Settleable PM	30 days	10 g/m^2	Not to be exceeded more than once over any 12 months
Visibility	Annual	$3x10^{-5}$/m	Not to be exceeded

Source: ARM 17.8.201-17.8.230
Notes: ppm – parts per million; ppb – parts per billion; μg/m^3 – micrograms per cubic meter
A lead standard of 1.5 μg/m^3, quarterly average, remains in effect only in the East Helena Nonattainment Area, which is not within the planning area.

The Montana Settleable PM standard was designed for much larger particles than those covered under the federal NAAQS for PM_{10} and $PM_{2.5}$. Montana utilizes a number of measures through permitting and enforcement that serve to provide reasonable precautions against excess PM generation (ARM 17.8.308). These include, but are not limited to, the following requirements: (1) No person shall cause or authorize the production, handling, transportation, or storage of any material unless reasonable precautions to control emissions of airborne PM are taken. Such emissions of airborne PM from any stationary source shall not exhibit an opacity of 20 percent or greater averaged over six consecutive minutes, except for emission of airborne PM originating from any transfer ladle or operation engaged in the transfer of molten metal that was installed or operating prior to November 23, 1968; and (2) No person shall cause or authorize the use of any street, road, or parking lot without taking reasonable precautions to control emissions of airborne PM. These measures would also be applicable to the planning area. In addition, when Montana PM, PM_{10}, and $PM_{2.5}$ sources trigger permitting, they must go through a Best Available Control Technology analysis and controls that, while reducing PM_{10} and $PM_{2.5}$, would also provide total PM reductions.

Fluoride emissions are anticipated to be negligible from BLM activities in the planning area. Related to the hydrogen sulfide MAAQS standard, owners or operators of oil and gas wells that produce more than 20 million cubic feet of gas per day containing more than 20 parts per million hydrogen sulfide are required to report and analyze hydrogen sulfide production at their wells (ARM 36.22.1222). The Montana visibility standard is applicable only to Class I areas. Visibility impairment at federal and Tribal Class I areas due to oil, gas, and coal production in the planning area is evaluated in the *Air Quality Related Values* discussion below.

In addition to Montana, the states with power plants receiving MCFO planning area coal currently are Arizona, Michigan, Minnesota, Montana, and Washington (US Energy Information Administration [EIA] 2022a). The EPA allows states to set air quality standards that are stricter than the NAAQS; information on such standards, when established, are available from the individual state's environmental division. Information on receiving power plants is provided in the section *Downstream Combustion Impacts on Air Quality and Public Health* under *Direct and Indirect Impacts.*

The EPA assigns an attainment status to geographic areas based on compliance with the NAAQS. Ambient air quality monitoring data of criteria pollutants is used to derive a statistic referred to as a design value that describes air quality with respect to the NAAQS. The calculated design values are then used to officially designate the status of each area as attainment (demonstrates compliance with NAAQS), nonattainment (exceeds the NAAQS), maintenance (in the process of redesignating to attainment by continuing to show compliance with the NAAQS after having initially been in nonattainment), or unclassifiable (insufficient data for compliance determination). Because attainment status is assigned separately for each criteria pollutant, an area can be in attainment for one criteria pollutant and in nonattainment for another. Once a nonattainment designation occurs, state and local air agencies must develop a federally enforceable State Implementation Plan with EPA approval to outline the control measures and strategies that will be used to attain and maintain compliance with the NAAQS (40 CFR 51).

On November 30, 2022, BLM proposed new regulations (Waste Prevention Rule, 87 *Federal Register* 73588) to reduce the waste of natural gas from venting, flaring, and leaks during oil and gas production activities on federal and Indian leases. While the proposed rule is primarily focused on reducing waste of natural gas, BLM also seeks comment on appropriate methods for assessing the benefits of reducing air pollutants by decreasing natural gas emissions from pneumatic equipment and vapor recovery units and from the leak detection and recovery programs. Additional information on the proposed rule is provided in the *Regulatory and Policy Framework* section under *Greenhouse Gases, Including Climate Change*.

On November 11, 2022, EPA issued a supplemental proposal that strengthens and expands its November 2021 proposal by reducing emissions from both new and existing oil and gas operations. While the proposed rule is primarily focused on reducing methane (CH_4), it would also reduce volatile organic compounds (VOCs) and hazardous air pollutant (HAP) emissions. Additional information on the proposed rule is provided in the *Regulatory and Policy Framework* section under *Greenhouse Gases, Including Climate Change*.

HAPs are air pollutants that may present a threat of adverse human health effects (such as cancer or other serious health problems, including chronic respiratory disease, reproductive disorders, or birth defects). They consist of 188 pollutants listed pursuant to Section 112(b) of the Clean Air Act. There are no federal ambient air quality standards for HAPs. The Clean Air Act includes National Emission Standards for HAPs that define maximum achievable control technology standards that are technology-based standards for each regulated source category. maximum achievable control technology is applicable to all major sources (sources with the potential to emit more than 10 tons per year of a single HAP or 25 tons per year of any combination of HAPs) and some area sources (any stationary source of HAPs not classified as a major source) in specific source categories (40 CFR 51).

AQRVs, including visibility and deposition, are resources that may be affected by a change in air quality. Federal land managers are responsible for protecting AQRVs in Class I areas under the Clean Air Act (Federal Land Managers' Air Quality Related Values Work Group 2010).

Visibility describes how far an observer can see and how clear the view appears. Air pollution can impact visibility by causing light to be scattered or absorbed. Widespread visibility impairment caused by anthropogenic sources is referred to as regional haze (40 CFR 51.301). The Regional Haze Rule of the Clean Air Act (40 CFR 51, subpart P) protects visibility in Class I areas with the goal of achieving natural visibility conditions by 2064. Under the Regional Haze Rule, visibility conditions are tracked relative to estimated natural conditions on the 20 percent most anthropogenically impaired days and the 20 percent clearest days using the deciview (dv) haze index. Deciviews are designed such that a uniform change in haziness corresponds to uniform incremental change in perceived visibility for the entire range of visibility conditions (that is, from pristine to highly impaired) (40 CFR 51.301).

Atmospheric deposition can negatively affect ecosystems and other AQRVs. Atmospheric deposition is the transfer of gases and particles to surfaces and can occur with precipitation (wet deposition) or without precipitation (dry deposition). Potential deposition impacts include, but are not limited to, acidification of soils and waterbodies and nutrient enrichment (Federal Land Managers' Air Quality Related Values Work Group 2010). Wet or dry deposition of acidic pollutants formed from emitted SO_2 and nitrogen oxides (NOx) is referred to as acid rain. While there are no federal standards for atmospheric deposition, critical loads, the level of deposition below which no harmful effects to an ecosystem are expected, are used as indicators of impacts from atmospheric deposition.

Current Conditions and Trends

Monitoring Data

This section evaluates current conditions and recent trends in air quality and AQRVs by examining criteria pollutant, visibility, and deposition data collected at various monitoring sites. Regional air quality is a product of the concentrations of various air pollutants and is assessed through ambient air monitoring networks. To evaluate existing regional air quality and AQRVs, ambient monitoring data was acquired from a number of monitoring networks and databases, including the EPA's Air Quality System (AQS), MDEQ air quality monitors (MDEQ 2017, 2018, 2019, 2020, 2021, 2022), the Interagency Monitoring of Protected Visual Environments network, and the Clean Air Status and Trends Network, as well as the National Trends Network and Mercury Deposition Network that are part of the National Atmospheric Deposition Program.

Air Concentrations

Air quality data within the planning area are available for CAPs from the EPA's AQS; monitors reporting to AQS from 2017-2022 are shown in **Figure 3-1** and **Table 3-4**. Current values and recent trends in air concentrations of CAPs for counties in the MCFO are presented in the following sections.

Table 3-4
Criteria Air Pollutant Monitoring Sites within the Planning Area

AQS Number	Site Name	County	Parameters Measured
300170005	Miles City – Pines Hills	Big Horn	NO_2, PM_{10}, $PM_{2.5}$
300750001	Broadus	Custer	NO_2, O_3, PM_{10}, $PM_{2.5}$
300830002	Sidney 201	Powder River	NO_2, O_3, PM_{10}, $PM_{2.5}$, SO_2
300859000	--	Richland	PM_{10}, $PM_{2.5}$, SO_2
300870001	Birney – Tongue river	Richland	NO_2, O_3, PM_{10}, $PM_{2.5}$, SO_2
300870307	--	Roosevelt	PM_{10}, $PM_{2.5}$
300870760	--	Rosebud	NO_2, PM_{10}
300870761	--	Rosebud	NO_2, SO_2
300870762	--	Rosebud	NO_2, PM_{10}, $PM_{2.5}$, SO_2
300919000	--	Rosebud	PM_{10}, $PM_{2.5}$, SO_2

Source: EPA 2022b

Carbon Monoxide

Motor vehicles and other internal combustion engines are the dominant source of CO emissions in most areas. High CO levels develop primarily during winter when periods of light winds combine with ground-level temperature inversions (typically from the evening through early morning). These conditions result in reduced dispersion of vehicle emissions. Carbon monoxide is also created during refuse, agricultural, and wood-stove burning and through mining, oil and gas development, and other industrial processes.

There are no CO nonattainment areas in Montana. Due to historically low monitored CO concentrations compared to the NAAQS, MDEQ discontinued its traffic-related CO monitoring with EPA approval, and no community CO monitoring is currently being conducted. One trace level CO monitor at the NCore station north of Helena, Montana is currently active to track background CO concentrations over time (MDEQ 2018, 2019, 2020, 2021, 2022). This monitor is not located within the planning area. Concentrations of CO at this monitor remain relatively consistent over time and low in comparison to both the NAAQS and MAAQS. CO concentrations from 2017-2021 at the NCore station ranged from 132-151 ppb, well below both the 1-hour NAAQS of 35,000 ppb (35 ppm) and the MAAQS of 23,000 ppb (23 ppm), as shown in **Table 3-5**.

Table 3-5
CO 1-hour Design Values, 2017-2021

Station	2017	2018	2019	2020	2021	Met NAAQS (35,000 ppb)	Met MAAQS (23,000 ppb)
	1-hour average concentration (ppb)						
NCore	132	126	128	128	151	Yes	Yes

Source: MDEQ 2018, 2019, 2020, 2021, 2022

Lead

The primary historical source of lead emissions has been certain types of industrial sources and lead in gasoline and diesel fuel. However, because lead in fuels has decreased substantially, the processing of metals containing trace amounts of lead is now the primary source of lead emissions. The highest levels of lead in the air are generally found near lead smelters; however, there are no active lead smelters within the planning area. Other stationary sources include waste incinerators, utilities, and lead-acid battery manufacturing plants.

Colstrip facility was the only source within the planning area that reported lead emissions in excess of 0.5 tons per year that required monitoring under 40 CFR 58, Appendix D, Section 4.5(a). In 2018, the State of Montana submitted a monitoring waiver request along with supporting documentation to EPA Region 8 to forego monitoring in Colstrip because modeled lead concentrations in the ambient air were less than 50 percent of the NAAQS. EPA Region 8 granted a waiver from the lead monitoring requirement in Colstrip on November 5, 2018.

As required by 40 CFR 58 Appendix D Section 4.5(a), one lead monitor is required near the open pit copper and molybdenum mine and associated processing factories in Butte, Montana, and operated by Montana Resources. Preliminary monitoring conducted by Montana Resources provides reliable credible evidence of low lead concentration levels in the ambient air in Butte. Based on results from March 2019 through the end of 2021, the mean of samples as 3-month averages was 0.0061 $\mu g/m^3$. The NAAQS for lead established in 40 CFR 50.16 is 0.15 $\mu g/m^3$ arithmetic mean concentration over a 3-month period. These concentrations do not approach or exceed the monitoring threshold of 50 percent of the NAAQS value.

The MDEQ has monitored for lead in total suspended particulate concentrations from various locations within the Butte community since the 1970s. The Butte-Greeley (30-093-0005) station has been consistently confirmed as the highest point of concentration from historic and near-term monitoring data results, and so MDEQ has consolidated monitoring resources over time to the single Butte-Greeley site, which was still active in 2022 (MDEQ 2022). No exceedance of the lead NAAQS has been observed in the Butte area, and there are no lead nonattainment areas in the state.

Nitrogen Dioxide

Nitrogen oxides, including nitric oxide and NO_2, are formed when naturally occurring atmospheric nitrogen and oxygen are combusted with fuel, for example in mining activities, oil and gas development, automobiles, power plants, other industrial processes, and home and office heating. Within the atmosphere, NO_2 contributes to visibility impacts and may be visible as reddish-brown haze. Nitrogen dioxide (and other NOx compounds) also forms nitric acid, a component of atmospheric deposition (for example, acid rain).

As shown in **Table 3-6**, county-level NO_2 1-hour design values (98th percentile of 1-hour daily maximum concentrations, averaged over 3 years) within the planning area from 2017-2021 were all below 11 ppb, well below the annual 1-hour NAAQS of 100 ppb and MAAQS of 300 ppb. Similarly, county-level annual design values were all below 3 ppb from 2017-2021, less than 10 percent of the MAAQS of 50 ppb, which is a lower standard than the NAAQS of 53 ppb, as shown in **Table 3-7**. There are little to no trends in NO_2 concentrations over time, which remain relatively constant between 2017 and 2021.

Table 3-6
NO_2 1-hour Design Values, 2017-2021

County Name	AQS Site ID	2017 1-hour Design Value (ppb)[1,2,3]	2018 1-hour Design Value (ppb)[1,2,3]	2019 1-hour Design Value (ppb)[1,2,3]	2020 1-hour Design Value (ppb)[1,2,3]	2021 1-hour Design Value (ppb)[1,2,3]	Met NAAQS (100 ppb)	Met MAAQS (300 ppb)
Richland	300830002	Sidney 201			11	10	Yes	Yes
Rosebud	300870001	Birney - Tongue River	9	9	6	6	Yes	Yes

Source: EPA 2022b
[1]The level of the 2010 1-hour NAAQS for nitrogen dioxide is 100 parts per billion (ppb). The design value is the annual 98th percentile of the daily maximum 1-hour concentration values, averaged over three consecutive years.
[2]The design values shown here are computed using Federal Reference Method or equivalent data reported by State, Tribal, and Local monitoring agencies to EPA's AQS as of May 4, 2022. Concentrations flagged by State, Tribal, or Local monitoring agencies as having been affected by an exception event (for example, wildfire and volcanic eruption) and concurred by the associated EPA Regional Office are not included in these calculations.
[3]Only valid design values are shown; blanks represent insufficient data or site closure.

Table 3-7
County-Level NO_2 Annual Design Values, 2017-2021

County Name	AQS Site ID	2017 1-hour Design Value (ppb)[1,2,3]	2018 1-hour Design Value (ppb)[1,2,3]	2019 1-hour Design Value (ppb)[1,2,3]	2020 1-hour Design Value (ppb)[1,2,3]	2021 1-hour Design Value (ppb)[1,2,3]	Met NAAQS (100 ppb)	Met MAAQS (300 ppb)
Powder River	300750001	1	1		1	1	Yes	Yes
Richland	300830002		1	1	1	1	Yes	Yes
Rosebud	300870001	3	1	1	1	1	Yes	Yes

Source: EPA 2022b
[1]The level of the 1971 annual NAAQS for nitrogen dioxide is 53 parts per billion (ppb). The design value is the annual average of the hourly concentration values.
[2]The design values shown here are computed using Federal Reference Method or equivalent data reported by State, Tribal, and Local monitoring agencies to EPA's AQS as of May 4, 2022. Concentrations flagged by State, Tribal, or Local monitoring agencies as having been affected by an exception event (for example, wildfire and volcanic eruption) and concurred by the associated EPA Regional Office are not included in these calculations.
[3]Only valid design values are shown; blanks represent insufficient data or site closure.

Ozone

Tropospheric O_3 is not emitted directly into the atmosphere. Instead, it is formed by photochemical reactions of precursor air pollutants, including VOCs and nitrogen oxides. These precursors are emitted by mobile sources, stationary combustion equipment, and other industrial sources. Ozone formation is enhanced by increased sunlight and higher air temperatures. Elevated O_3 concentrations may also occur during winter in snow-covered rural areas.

County-level monitored O_3 concentrations display minor variability across time and across space, despite the spatial breadth, the significant topographic variability, and the population diversity of the monitor sites. All design values (4th highest daily maximum 8-hour O_3 concentration over the past 3 years) for stations within the planning area were below the NAAQS standard of 0.070 ppm, as shown in **Table 3-8**. In the planning area, there are little to no trends in monitored O_3 values over time.

Table 3-8
County-Level O_3 Design Values, 2017-2021

County Name	AQS Site ID	2017 Design Value (ppm)[1,2,3]	2018 Design Value (ppm)[1,2,3]	2019 Design Value (ppm)[1,2,3]	2020 Design Value (ppm)[1,2,3]	2021 Design Value (ppm)[1,2,3]	Met NAAQS (0.070 ppm)
Powder River	300750001	0.057	0.060	0.063			Yes
Richland	300830002			0.060	0.058	0.061	Yes
Rosebud	300870001	0.057	0.058	0.058	0.058		Yes

Source: EPA 2022b
[1]The level of the 2015 8-hour O_3 NAAQS is 0.070 parts per million (ppm). The design value is the 3-year average of the annual 4th highest daily maximum 8-hour O_3 concentration.
[2]The design values shown here are computed using Federal Reference Method or equivalent data reported by State, Tribal, and Local monitoring agencies to EPA's AQS as of May 4, 2022. Concentrations flagged by State, Tribal, or Local monitoring agencies as having been affected by an exception event (for example, wildfire and volcanic eruption) and concurred by the associated EPA Regional Office are not included in these calculations.
[3]Only valid design values are shown; blanks represent insufficient data or site closure.

Particulate Matter

Emissions of PM are generated by a variety of sources, including agricultural activities, industrial emissions, and road dust re-suspended by vehicle traffic. Within the planning area, primary sources of PM include smoke from wildland fire, residential wood burning, mining, oil and gas development, street sand, physically disturbed soils, and dust from unpaved roads. Impacts of PM include health effects, deposition on plants and surfaces (including soiling of snow, which can contribute to climate change), localized reductions in visibility, and potential corrosion. $PM_{2.5}$ also contributes to reduced visibility in nationally important areas such as national parks. $PM_{2.5}$ emissions are primarily generated by internal combustion diesel engines, soils with high silt and clay content, and secondary aerosols formed by chemical reactions in the atmosphere.

The PM_{10} design values from 2017-2021 (calculated as the number of exceedances of the 150 $\mu g/m^3$ standard averaged over 3 years) from MDEQ monitors inside the planning area are shown in **Table 3-9**. For compliance with the 24-hour PM_{10} NAAQS, a monitor may only have one exceedance (a 24-hour average concentration greater than 150 $\mu g/m^3$) per year on average over a 3-year period. All design values available for sites within the planning area were less than the NAAQS from 2017-2021.

Table 3-9
PM_{10} Annual Design Values, 2017-2021

Station	2017 Design Value	2018 Design Value	2019 Design Value	2020 Design Value	2021 Design Value	Met NAAQS (Not exceeded more than 1 once per year on average over 3 years)
			Number of Exceedances			
Birney[1]	--	--	--	--	--	Yes
Sidney - 201	--	--	0	--	0	Yes

Source: MDEQ 2018, 2019, 2020, 2021, 2022
[1]Designated as Special Purpose Monitor (SPM), which are nonregulatory (NAAQS excluded) as they do not meet appropriate siting criteria for the spatial scale of representation
-- represents insufficient data for calculating a design value

Montana also has a statewide PM_{10} standard of 50 μg/m³, calculated as an annual average. All MDEQ monitoring sites within the planning area were below 22 μg/m³, less than 50 percent of the MAAQS; these data are shown in **Table 3-10**. Annual PM_{10} concentrations may be increasing over time.

Table 3-10
PM_{10} Annual Values Compared to the MAAQS, 2017-2021

Station	2017 (μg/m³)	2018 (μg/m³)	2019 (μg/m³)	2020 (μg/m³)	2021 (μg/m³)	Met MAAQS (50 μg/m³)
Birney	13	11	10	18	22	Yes
Sidney - 201	9.7	9.6	9.7	9.8	11	Yes

Source: MDEQ 2018, 2019, 2020, 2021, 2022

Table 3-11 and **Table 3-12** show the county-level 24-hour and annual $PM_{2.5}$ design values calculated for 2017 through 2021. The design values in the form of the 24-hour $PM_{2.5}$ NAAQS (that is, 98th percentile of 24-hour average concentrations over 3 years) ranged from 15 to 30 μg/m³ between 2017 and 2021, below the NAAQS of 35 μg/m³. The 2017-2021 annual design values (averaged over 3 years) were below the NAAQS of 12 μg/m³. All sites also would be below the proposed (EPA 2023) primary annual $PM_{2.5}$ standard within the range of 9.0 to 10.0 μg/m³ (note that EPA also took comments on lower and higher levels).

Table 3-11
County-Level $PM_{2.5}$ 24-hour Design Values, 2017-2021

County Name	AQS Site ID	2017 24-hour Design Value (μg/m³)[1,2,3]	2018 24-hour Design Value (μg/m³)[1,2,3]	2019 24-hour Design Value (μg/m³)[1,2,3]	2020 24-hour Design Value (μg/m³)[1,2,3]	2021 24-hour Design Value (μg/m³)[1,2,3]	Met NAAQS (35 μg/m³)
Powder River	300750001	30	28	27	23	27	Yes
Richland	300830002				15	18	Yes
Rosebud	300870001	29	28	28	24		Yes

Source: EPA 2022b
[1]The level of the 2006 24-hour $PM_{2.5}$ NAAQS is 35 micrograms per cubic meter (μg/m³). The design value is the annual 98th percentile concentration, averaged over 3 consecutive years.
[2]The design values shown here are computed using Federal Reference Method or equivalent data reported by State, Tribal, and Local monitoring agencies to EPA's AQS as of May 4, 2022. Concentrations flagged by State, Tribal, or Local monitoring agencies as having been affected by an exception event (for example, wildfire and volcanic eruption) and concurred by the associated EPA Regional Office are not included in these calculations.
[3]Only valid design values are shown; blanks represent insufficient data or site closure.

Table 3-12
County-Level $PM_{2.5}$ Annual Design Values, 2017-2021

County Name	AQS Site ID	2017 Annual Design Value (µg/m³)[1,2,3]	2018 Annual Design Value (µg/m³)[1,2,3]	2019 Annual Design Value (µg/m³)[1,2,3]	2018-2020 Annual Design Value (µg/m³)[1,2,3]	2019-2021 Annual Design Value (µg/m³)[1,2,3]	Met NAAQS (12 µg/m³)[4]
Powder River	300750001	7.8	7.6	7.3	6.7	7.5	Yes
Richland	300830002				4.8	5	Yes
Rosebud	300870001	6.5	6.2	6	5.6		Yes

Source: EPA 2022b
Notes: NAAQS = National Ambient Air Quality Standards;
[1]The level of the 2012 Annual $PM_{2.5}$ NAAQS is 12.0 micrograms per cubic meter (µg/m³).
[2]The design values shown here are computed using Federal Reference Method or equivalent data reported by state, Tribal, and local monitoring agencies to EPA's AQS as of May 4, 2022. Concentrations flagged by state, Tribal, or local monitoring agencies as having been affected by an exception event (for example, wildfire and volcanic eruption) and concurred by the associated EPA Regional Office are not included in these calculations.
[3]Only valid design values are shown; blanks represent insufficient data or site closure.
[4]In January 2023, EPA announced its proposed decision to revise the primary (health-based) annual $PM_{2.5}$ standard from its current level of 12.0 µg/m³ to within the range of 9.0 to 10.0 µg/m³ and also took comments on lower and higher levels.

Sulfur Dioxide

Sulfur dioxide is a colorless gas with a pungent odor. It is emitted primarily from stationary sources that burn fossil fuels (that is, coal, oil, and gas) containing trace amounts of elemental sulfur. Some other human sources of SO_2 include metal smelters and petroleum refineries. SO_2 is also emitted from natural sources such as volcanoes. In the atmosphere, SO_2 converts to sulfuric acid, a component of atmospheric deposition (acid rain), and forms secondary aerosols, subsequently contributing to visibility impacts at Class I areas.

The county-level SO_2 1-hour design values (99th percentile of 1-hour daily maximum concentrations, averaged over 3 years) were below the SO_2 1-hour NAAQS of 75 ppb, and below the MAAQS of 500 ppb, as shown in **Table 3-13**. Annual average concentrations at monitored sites were below the state-specific MAAQS of 75 ppb, as shown in **Table 3-14**. Annual SO_2 concentrations have consistently decreased from 2017-2021.

Table 3-13
County-Level SO_2 1-hour Design Values, 2017-2021

County Name	AQS Site ID	2015-2017 1-hour Design Value (ppb)[1,2,3]	2016-2018 1-hour Design Value (ppb)[1,2,3]	2017-2019 1-hour Design Value (ppb)[1,2,3]	2018-2020 1-hour Design Value (ppb)[1,2,3]	2019-2021 1-hour Design Value (ppb)[1,2,3]	Met NAAQS (75 ppb)	Met MAAQS (500 ppb)
Richland	300830002				7		Yes	Yes

Source: MDEQ 2017, 2018, 2019, 2020, 2021, 2022; EPA 2022b
[1]The level of the 1-hour NAAQS for SO_2 is 75 parts per billion (ppb). The design value is the annual 99th percentile of the daily maximum 1-hour concentration values, averaged over three consecutive years.
[2]The design values shown here are computed using Federal Reference Method or equivalent data reported by State, Tribal, and Local monitoring agencies to EPA's AQS as of May 4, 2022. Concentrations flagged by State, Tribal, or Local monitoring agencies as having been affected by an exception event (for example, wildfire and volcanic eruption) and concurred by the associated EPA Regional Office are not included in these calculations.
[3]Only valid design values are shown; blanks represent insufficient data or site closure.

Table 3-14
SO_2 Annual Comparison to MAAQS, 2017-2021

Station	2017 (ppb)	2018 (ppb)	2019 (ppb)	2020 (ppb)	2021 (ppb)	Met MAAQS (75 ppb)
Billings - Coburn Road	32	22	18	18	20	Yes
Sidney	37	6	9	7	5	Yes

Source: MDEQ 2017, 2018, 2019, 2020, 2021, 2022

The Coburn Road site in Billings (30-111-0066) is currently operating as a State or Local Air Monitoring Station, part of the approved Maintenance Plan (81 *Federal Register* 28718, Re-designation Request and Associated Maintenance Plan for Billings, MT 2010 SO_2 Nonattainment Area) to provide an ongoing assessment of SO_2 compliance in the Billings area. The site is located within the Yellowstone County (partial) SO_2 Nonattainment Area and has been in continuous operation since 1981 for NAAQS comparison purposes. This site is not representative at a county-level for SO_2.

Attainment Status

Within the direct analysis area for air quality, there are two areas that are designated as nonattainment in Montana, as shown in **Table 3-15** and **Figure 3-2**. Lame Deer in Rosebud County is within the planning area. This area was designated as a moderate PM_{10} nonattainment area in 1990. Laurel was designated nonattainment in 1978 for the 1971 24-hour SO_2 NAAQS, but MDEQ is in the process of a re-designation request and maintenance plan for the Laurel area. Laurel is approximately 50 miles west of the planning area.

Table 3-15
Nonattainment/Maintenance Areas near the Planning Area

Location	County	State	NAAQS	Nonattainment Designation
Laurel Area	Yellowstone County	Montana	Sulfur Dioxide (1971 Standard)	3/3/1978
Lame Deer	Rosebud County	Montana	PM_{10} (1987 Standard)	11/15/1990

Source: EPA 2022c

The nonattainment status of regions with coal-fired power plants where downstream combustion of MCFO coal could occur is shown in Section 3.1.3 of **Appendix C**. There is negligible overlap between MCFO coal downstream combustion power plants and CO/lead/NO_2/PM_{10} nonattainment areas. The Detroit, Michigan, O_3 nonattainment area has a power plant burning MCFO coal. This is also true of the $PM_{2.5}$ nonattainment area in Michigan. States where receiving power plants are in or near SO_2 nonattainment areas include Arizona, Michigan, and Minnesota. The design values corresponding to the monitored ambient air concentrations at these and other areas are available from EPA[1]. The power plants typically receive both federal and nonfederal coal and may combust coal from sources outside the MCFO planning area as well. The nonattainment areas present in urban regions commonly have a multitude of other emission sources also contributing to nonattainment. In general, the power plants and other sources in the regions are subject to local, state and federal regulations aimed at improving local and regional air quality and making progress towards attainment.

[1] https://www.epa.gov/air-trends/air-quality-design-values#report

Figure 3-2
Nonattainment Areas Near the Planning Area

More discussion on the receiving power plants and impacts of burning coal is presented in the section on *Downstream Combustion* under *Coal* and the section *Downstream Combustion Impacts on Air Quality and Public Health* under *Direct and Indirect Impacts*. Potential impacts on communities affected by the downstream combustion of planning area coal are discussed in the *Environmental Justice* section.

Air Quality Related Values

To aid the implementation of the Regional Haze Rule, the visibility in Class I areas is monitored by the Interagency Monitoring of Protected Visual Environments network. Monitors are located close to Class I areas across the country; the closest monitors to the planning area from the Class I areas analyzed are shown in **Figure 3-1** and **Table 3-16**.

Estimation of atmospheric deposition involves field measurements of atmospheric pollutant concentrations both in ambient air or dissolved in water, as well as modeled estimates of deposition velocities. These estimates and measurements can be combined using mathematical and statistical techniques to create deposition estimates in kilograms/hectare (kg/ha), as well as maps of deposition.

Table 3-16
Interagency Monitoring of Protected Visual Environments Monitors at Select Federal and Tribal Class I Areas

Site ID	Class I Area Name	State
BADL1	Badlands	South Dakota
FOPE1	Fort Peck	Montana
LOST1	Lostwood	North Dakota
MELA1	Medicine Lake	Montana
NOAB1	North Absaroka	Wyoming
NOCH1	Northern Cheyenne	Montana
THRO1	Theodore Roosevelt	North Dakota
ULBE1	UL Bend	Montana
WICA1	Wind Cave	South Dakota

Source: Interagency Monitoring of Protected Visual Environments 2022

Monitored total nitrogen and sulfur wet deposition data are available from the National Trends Network monitors. The sites are shown in **Table 3-17**.

Table 3-17
National Trend Network Wet Deposition Monitors within the Direct Analysis Area for Air Quality

Site ID	Area Name	State
SD08	Cottonwood	South Dakota
MT98	Havre - Northern Agricultural Research Center	Montana
MT00	Little Bighorn Battlefield National Monument	Montana
WY99	Newcastle	Wyoming
MT96	Poplar River	Montana
ND00	Theodore Roosevelt National Park-Painted Canyon	North Dakota
SD04	Wind Cave National Park-Elk Mountain	South Dakota

Source: National Atmospheric Deposition Program 2022a

Critical loads are used as indicators of impacts from atmospheric deposition. Critical loads of deposition are an estimate of the deposition of a pollutant below which significant harmful effects are not expected to occur based on current knowledge (Federal Land Managers' Air Quality Related Values Work Group 2010). Relevant critical loads for nitrogen deposition in the Class I areas, determined from the EPA critical load mapper tool (EPA 2021a), are listed in **Table 3-18**. Since multiple critical loads are available for nitrogen deposition, conservatively, the lowest nitrogen critical load representing the resource most sensitive to deposition at each Class I area is used in this analysis. A critical load of 5 kilograms sulfur per hectare per year is used for total sulfur deposition (Fox et al. 1989).

Monitored mercury deposition data are available from the Mercury Deposition Network monitors within the direct analysis area. The sites are shown in **Table 3-19**.

Table 3-18
Minimum Critical Load Values for Nitrogen Deposition at Federal and Tribal Class I Areas

Class I Area	Ecological Receptor	Critical load kg N/ha-year
Fort Peck Indian Reservation	Empirical herb/shrub	5
	Empirical mycorrhizae	12
Medicine Lake National Wildlife Refuge	Empirical herb/shrub	5
	Empirical mycorrhizae	12
Northern Cheyenne Indian Reservation	Empirical herb/shrub	5
	Empirical mycorrhizae	12
	Herb Species Richness – open canopy	8.26
UL Bend National Wildlife Refuge	Empirical herb/shrub	5
	Empirical mycorrhizae	12
	Herb Species Richness – open canopy	8.26
Theodore Roosevelt National Park	Empirical herb/shrub	5
	Empirical mycorrhizae	12
	Herb Species Richness – open canopy	8.26
Badlands National Park	Empirical herb/shrub	5
	Empirical mycorrhizae	12
	Herb Species Richness – open canopy	8.25
Wind Cave National Park	Empirical Forest	4
	Empirical herb/shrub	4
	Empirical mycorrhizae	5
	Herb Species Richness – open canopy	8.08
North Absaroka Wilderness	Empirical Forest	4
	Empirical herb/shrub	4
	Empirical mycorrhizae	5
	Herb Species Richness – open canopy	8.13
Washakie Wilderness	Empirical Forest	4
	Empirical herb/shrub	3.99
	Empirical mycorrhizae	5
	Herb Species Richness – open canopy	8.09
Yellowstone National Park	Empirical Forest	4
	Empirical herb/shrub	4
	Empirical mycorrhizae	5
	Herb Species Richness – open canopy	8.09

Source: EPA 2021a
Notes: Where multiple critical loads were available, the minimum value was used.
kg N/ha-year = kilograms of nitrogen per hectare per year

Table 3-19
Mercury Deposition Network Monitors within the Direct Analysis Area for Air Quality

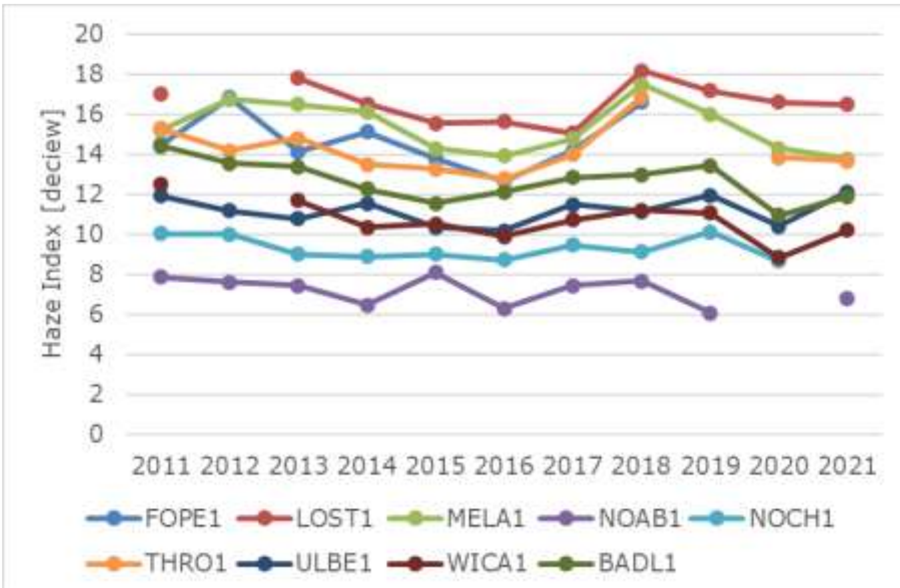
Site	Name	County	State
ND01	Lostwood National Wildlife Refuge	Burke	North Dakota
MT95	Badger Peak	Rosebud	Montana
SK12	Bratt's Lake BSRN	N/A	Saskatchewan, Canada

Source: National Atmospheric Deposition Program 2022b

Visibility

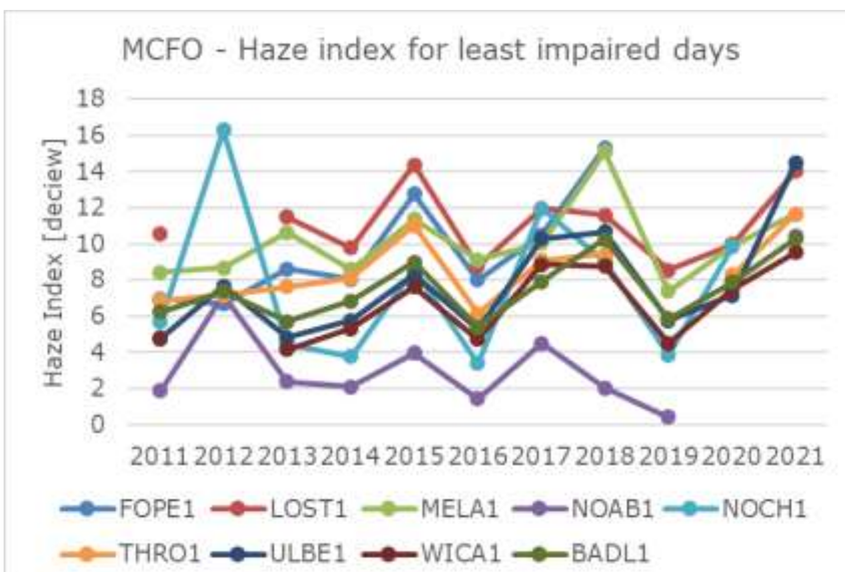
Figure 3-3 and **Figure 3-4** present the annual haze index for the 20 percent most impaired and 20 percent clearest days since for 2011 to 2021, respectively. During the last 10 years, visibility on the most impaired days has generally remained similar at all monitored sites in the direct analysis area for air quality and AQRVs. On the 20 percent clearest days, visibility has remained variable over time.

Figure 3-3
Haze Index for Most Impaired Days, 2011-2021*



*Monitoring sites listed in the legend are monitors located in Class I areas (see **Table 3-16**).

Figure 3-4
Haze Index for Clearest Days, 2011-2021*



*Monitoring sites listed in the legend are monitors located in Class I areas (see **Table 3-16**).

Deposition

Figure 3-5 shows nitrogen wet deposition across the United States, as a gradient map estimated by the National Trends Network (National Atmospheric Deposition Program 2022a). Spatially, nitrogen deposition across the United States in 2021 was highly variable, with deposition in Montana on the lower range of values. Deposition was highest in the western portion of the state, and along the Montana-Idaho border; total nitrogen deposition rates are small relative to the rest of the United States. The maximum and average total deposition of nitrogen across Class I areas are provided in **Table 3-20** for the period 2017 to 2021. The total deposition values are estimates constructed by the National Atmospheric Deposition Program using a combination of measured wet deposition and modeled dry deposition. Average annual total deposition values estimated by the National Atmospheric Deposition Program in 2021 exceed the critical load at Badlands, North Absaroka Wilderness, Washakie, and Wind Cave. Maximum total deposition values, also shown in **Table 3-20**, show a generally decreasing annual trend across the Class I areas.

Figure 3-6 presents annual nitrogen wet deposition for the period 2011-2021 at the monitored sites. There is no clear trend in the nitrogen wet deposition at these stations.

Figure 3-5
Nitrogen Wet Deposition in 2021

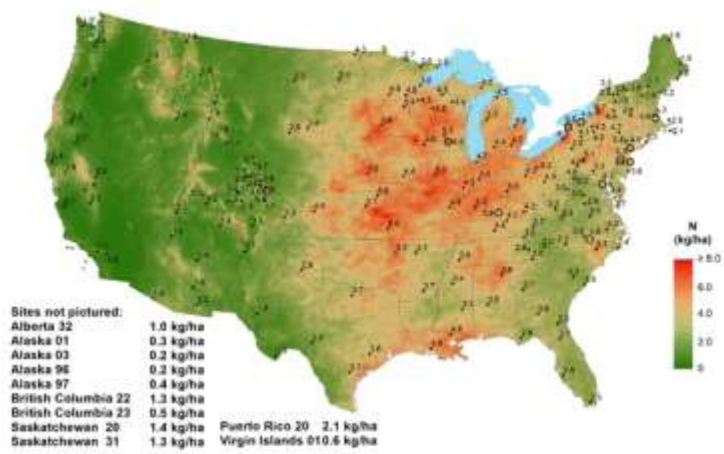


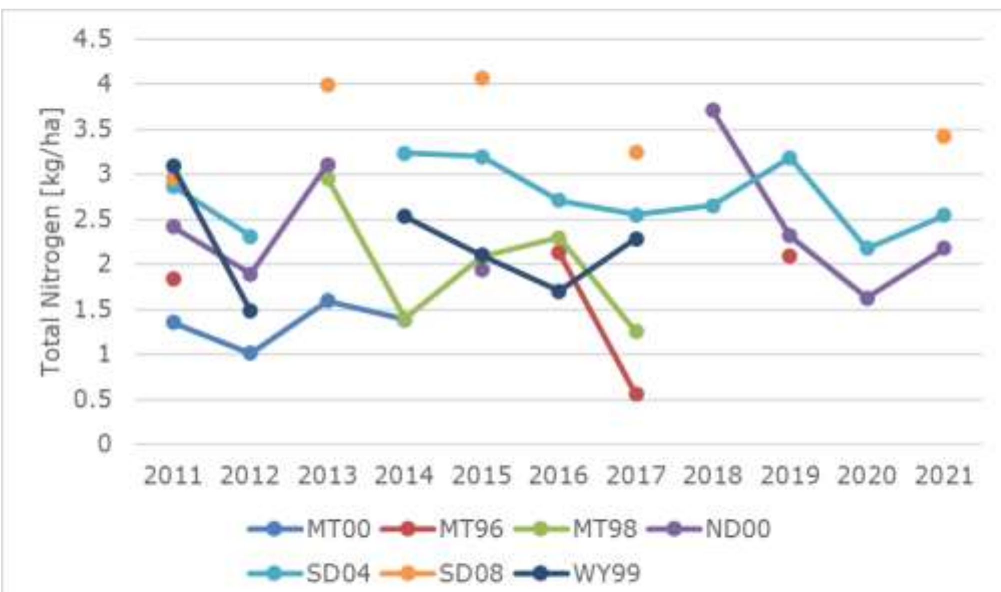
Table 3-20
Annual Average and Maximum Total Deposition of Nitrogen for Class I Areas, 2017 to 2021

Name	Critical Load (kg N/ha-year)	Average Total Nitrogen Deposition (kg N/ha-year)					Maximum Total Nitrogen Deposition (kg N/ha-year)				
		2017	2018	2019	2020	2021	2017	2018	2019	2020	2021
Badlands/ Sage Creek Wilderness	5	4.54	4.01	6.29	3.39	5.94	4.92	4.28	6.58	3.51	6.17
Lostwood Wilderness	5	3.07	5.23	4.32	3.17	4.64	3.13	5.38	4.43	3.26	6.07

Name	Critical Load (kg N/ha-year)	Average Total Nitrogen Deposition (kg N/ha-year)					Maximum Total Nitrogen Deposition (kg N/ha-year)				
		2017	2018	2019	2020	2021	2017	2018	2019	2020	2021
Medicine Lake Wilderness	5	4.78	4.05	5.73	3.98	3.22	7.34	5.78	11.10	9.35	4.73
North Absaroka Wilderness	4	3.56	5.06	3.92	3.26	4.24	3.74	5.41	4.01	3.50	3.40
Theodore Roosevelt NP	5	1.93	2.70	3.20	2.10	3.67	1.98	2.81	3.36	2.14	9.69
UL Bend Wilderness	5	4.50	4.07	4.54	3.87	1.97	6.24	5.55	9.43	8.25	3.86
Washakie Wilderness	3.99	5.51	6.15	7.05	5.98	4.48	6.09	6.75	7.87	6.64	2.03
Wind Cave National Park	4	2.29	3.97	3.89	3.15	6.91	2.93	5.18	5.66	4.62	8.88
Fort Peck Reservation	5	2.94	3.60	4.00	2.81	2.92	3.77	4.57	6.45	5.08	7.83
Northern Cheyenne Reservation	5	4.05	5.94	4.49	3.60	3.27	4.10	5.99	4.53	3.69	4.13

Source: Maximum and average values calculated from data from National Atmospheric Deposition Program 2022a. Nitrogen deposition critical load from EPA 2021a.

Figure 3-6
Monitored Nitrogen Wet Deposition, 2011-2021



Spatially, sulfate deposition in 2021 was low across the entire state of Montana, and deposition rates are typically small relative to the rest of the United States, as shown in **Figure 3-7**. The maximum and average annual deposition fluxes of sulfur across the Class I areas are provided in **Table 3-21** for the period 2017 to 2021. All average and maximum annual deposition values are below the critical load (5 kg/ha-year). **Figure 3-8** presents annual sulfate deposition for the past 10 years at the monitored sites, as recorded by the National Trends Network (National Atmospheric Deposition Program 2022a). Sulfate deposition has decreased or increased depending on the location.

Figure 3-7
Monitored Sulfate Wet Deposition Across the United States, 2021

Table 3-21
Annual Average and Maximum Total Deposition of Sulfur at Class I Areas, 2017 to 2021

Name	Critical Load (kg S/ha-year)	Average Sulfur Deposition (kg S/ha-year)					Maximum Sulfur Deposition (kg S/ha-year)				
		2017	2018	2019	2020	2021	2017	2018	2019	2020	2021
Badlands/ Sage Creek Wilderness	5	0.80	0.73	1.14	0.58	0.95	0.90	0.77	1.23	0.59	0.99
Lostwood Wilderness	5	1.1	0.76	0.89	0.76	0.94	1.5	1.02	1.1	0.99	1.4
Medicine Lake Wilderness	5	1.04	0.68	0.82	0.67	0.94	1.3	0.92	1.1	0.84	1.2
North Absaroka Wilderness	5	1.3	0.97	1.13	0.98	0.90	2.1	1.7	1.8	1.6	1.4
Theodore Roosevelt NP	5	1.68	1.51	1.52	1.20	1.81	1.71	1.53	1.52	1.23	1.83
UL Bend Wilderness	5	1.13	1.18	1.35	0.94	1.15	1.15	1.21	1.37	0.95	1.21
Washakie Wilderness	5	1.26	0.95	1.18	0.75	0.88	1.91	1.37	1.59	1.17	1.27
Wind Cave National Park	5	1.5	1.07	1.17	1.09	1.02	1.9	1.3	1.5	1.4	1.26

Name	Critical Load (kg S/ha-year)	Average Sulfur Deposition (kg S/ha-year)					Maximum Sulfur Deposition (kg S/ha-year)				
		2017	2018	2019	2020	2021	2017	2018	2019	2020	2021
Fort Peck Reservation	5	0.92	1.04	1.01	0.80	1.04	1.00	1.10	1.05	0.87	1.19
Northern Cheyenne Reservation	5	0.66	0.62	0.89	0.52	0.49	0.67	0.67	0.95	0.53	0.51

Source: Maximum and average values calculated from data from National Atmospheric Deposition Program 2022a. Sulfur critical load from Fox et al. 1989.

Figure 3-8
Monitored Sulfate Wet Deposition, 2011-2021

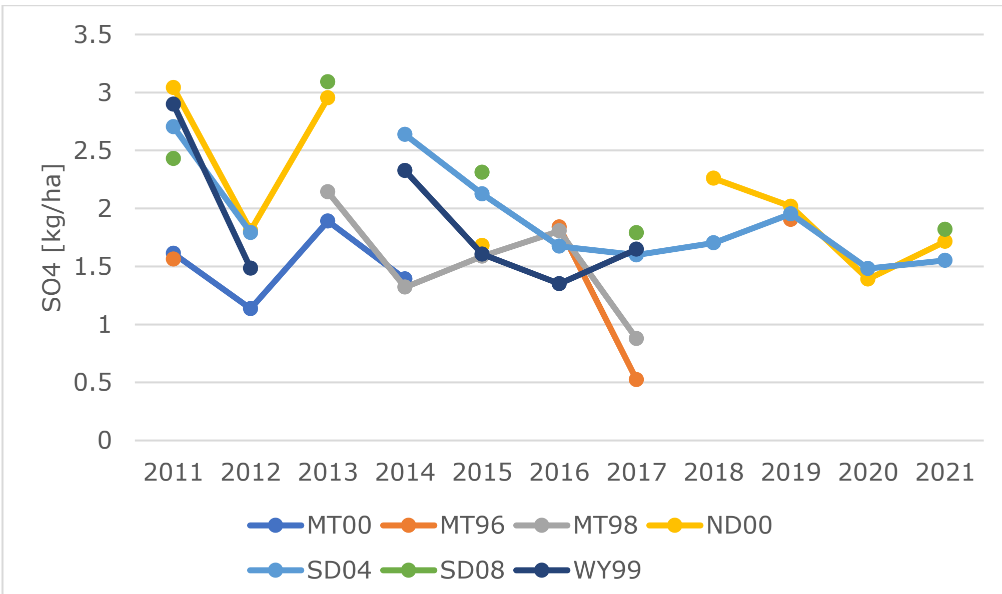


Figure 3-9 shows the spatial variation in mercury wet deposition across the United States in 2019 (National Atmospheric Deposition Program 2022b). Mercury wet deposition rates are generally comparable or lower in the planning area compared to the rest of the United States. **Figure 3-10** presents trends in annual wet mercury deposition for the past 10 years, as recorded at Mercury Deposition Network monitoring sites in or near the planning area. Rates of deposition over time demonstrate no clear trends over the period on record.

Figure 3-9
Total Mercury Deposition Across the United States, 2019

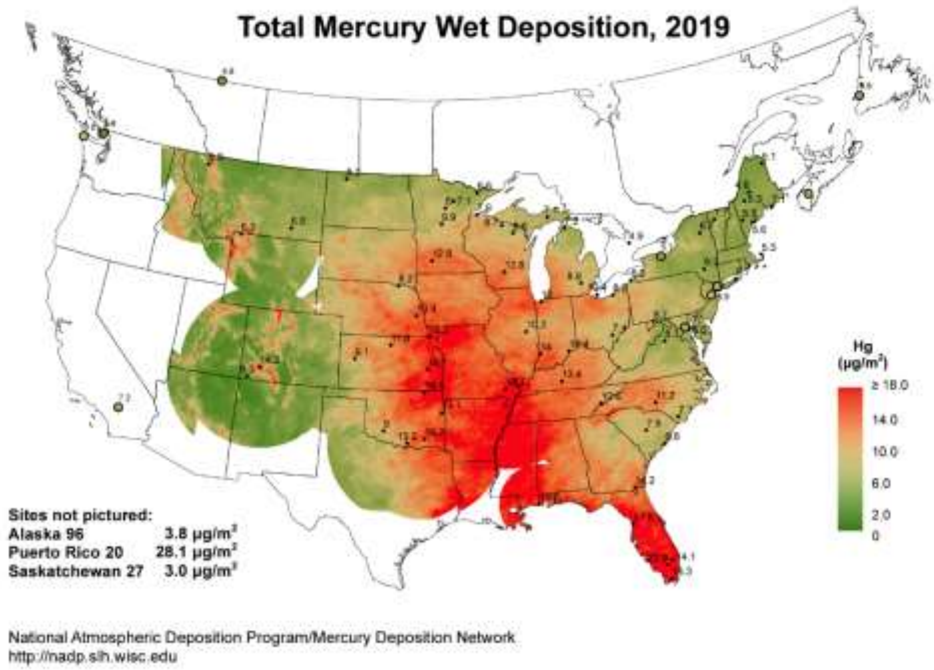
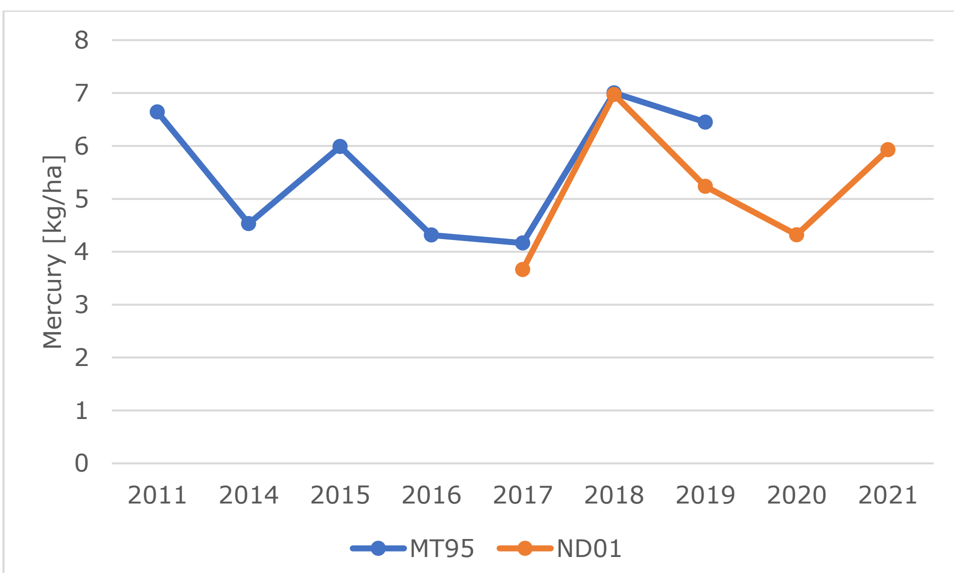


Figure 3-10
Monitored Mercury Wet Deposition, 2011-2021



Coal

Coal Mining

Coal mining generates emissions of CAPs and HAPs from various sources. Fugitive dust (PM_{10} and $PM_{2.5}$) emissions are generated from activities such as earth moving, coal processing, blasting, and vehicle travel on unpaved roads as well as wind erosion of stockpiles and other exposed areas. Gaseous (for example, NOx, CO, SO_2, and VOC) and PM emissions are released from tailpipe exhaust from nonroad and onroad mobile sources, explosives use, and stationary and portable engines. Additionally, coal mining emits HAPs such as diesel particulate matter (DPM) from diesel exhaust.

Coal production is in decline both nationally and in the West. The EIA forecasts that total United States production will drop from over 610 million tons in 2022 to 450 million tons in 2040 (EIA 2022a), and production in the Western region (which includes the planning area) will drop from 335 million tons in 2022 to 224 million tons in 2040 (EIA 2022a).

As discussed in **Section 2.2** and **Appendix B**, there are two mines in the MCFO planning area that are actively mining federal coal—the Rosebud Mine and Spring Creek Mine. The Rosebud Mine has existing federal and nonfederal leases with sufficient federal coal reserves to take the mine life to 2060, which is reflected in this analysis. However, as discussed in **Appendix B**, there is ongoing litigation at the mine and Colstrip Power Plant, the primary consumer of coal from the mine. This could lead to the Rosebud Mine closing earlier. The BLM anticipates that reserves at Spring Creek Mine from existing federal and nonfederal leases would allow for production through 2035.

Table 3-22 shows the estimated federal, nonfederal, and total (federal plus nonfederal) emissions of CAPs and HAPs from coal mining in the planning area in 2022. The technical approach for the estimation of these emissions is described in Section 2.1 of **Appendix C**. Total (federal plus nonfederal) production and the corresponding emissions peak in 2022 and then decline thereafter.

Production from existing federal and nonfederal leases is forecasted to continue until 2035 at Spring Creek Mine and until 2060 at Rosebud Mine, and mining emissions from these existing federal and nonfederal leases at the mines would continue through those periods based on existing authorizations. The production and corresponding emissions from all existing federal leases in the planning area are forecasted to peak in 2027 and then decline afterwards; these peak federal emissions are shown in **Table 3-23** along with the corresponding nonfederal and total emissions. These emissions would lead to air quality and AQRV impacts associated with increased ambient air concentrations of $PM_{2.5}$, PM_{10}, NO_2, O_3, SO_2, CO, HAPs, and other related pollutants as well as potential increases in visibility impairment and deposition of nitrogen, sulfur, mercury and other compounds as discussed in the sections above.

Table 3-22
Coal Mining Emissions of Criteria and Hazardous Air Pollutants in 2022 of Coal Production from Existing Leases in the Planning Area

Mineral Designation	Annual Production (million tons/year)	PM_{10} (tons/year)	$PM_{2.5}$ (tons/year)	NOx (tons/year)	CO (tons/year)	VOC (tons/year)	SO_2 (tons/year)	DPM (tons/year)	Other HAP (tons/year)
Federal	11.05	1,493	253	401	711	21	20	9.32	2.06
Nonfederal	9.80	1,471	224	480	687	29	19	12.87	2.85
Total	20.85	2,964	477	881	1,398	49	38	22.19	4.92

Table 3-23
Coal Mining Emissions of Criteria and Hazardous Air Pollutants in the Peak Year (2027) of Coal Production from Existing Leases in the Planning Area

Mineral Designation	Annual Production (million tons/year)	PM_{10} (tons/year)	$PM_{2.5}$ (tons/year)	NOx (tons/year)	CO (tons/year)	VOC (tons/year)	SO_2 (tons/year)	DPM (tons/year)	Other HAP (tons/year)
Federal	12.30	1,659	312	1,165	971	86	23	38.72	8.58
Nonfederal	6.42	1,112	153	620	553	45	13	20.22	4.48
Total	18.72	2,771	465	1,785	1,524	131	37	58.94	13.05

Coal Transportation

The majority of the coal produced by the Rosebud Mine is provided by conveyor to Colstrip Power Plant in a "mine-to-mouth" operation (for example, approximately 6.2 million of the 6.5 million tons produced in 2021 [EIA 2022a]). These conveyor emissions are included in the federal mining emissions from existing federal leases presented in **Table 3-22** and **Table 3-23**, above. Additionally, approximately 200 to 250 thousand tons of coal are transported annually by semi-truck to the nearby Colstrip Energy Limited Partnership Power Plant, and a relatively small amount is sold directly at the mine to domestic users in the local area. Estimated emissions of CAPs and precursors from semi-truck shipments to Colstrip Energy Limited Partnership Power Plant are provided in **Table 3-24**. All of these emissions were conservatively allocated to the federal emissions from coal transportation and were assumed to remain constant for the remaining life of the Rosebud Mine.

Table 3-24
Annual Criteria Air Pollutant and Precursor Emissions from Transportation of Rosebud Mine Coal to the Colstrip Energy Limited Partnership Power Plant

PM_{10} (tons/year)	$PM_{2.5}$ (tons/year)	NOx (tons/year)	CO (tons/year)	SO_2 (tons/year)	VOC (tons/year)
0.26	0.22	6.30	1.73	0.00	0.30

Source: Office of Surface Mining Reclamation and Enforcement 2018

As discussed in **Appendix B**, the Spring Creek Mine serves both domestic and international markets. Approximately 50 percent of the coal is transported by rail to domestic coal-fired power plants, which are listed in **Table 3-40**. Of the remainder, approximately 30 to 40 percent is transported by rail to a port in Vancouver, British Columbia and shipped to Asian markets and approximately 10 percent is transported by rail to industrial markets. The estimated CAPs and HAP emissions from the rail transportation of federal, nonfederal, and total coal from Spring Creek Mine in 2022 are shown in **Table 3-25**, and the emissions from the peak year of federal production from existing federal leases are shown in **Table 3-26**. The technical approach for the estimation of these emissions is described in Section 2.4 of **Appendix C**.

These emissions would lead to air quality and AQRV impacts associated with increased ambient air concentrations of $PM_{2.5}$, PM_{10}, NO_2, O_3, SO_2, CO, HAPs, and other related pollutants as well as potential increases in visibility impairment and deposition of nitrogen, sulfur, mercury and other compounds as discussed in the sections above.

Table 3-25
Coal Transportation Emissions of Criteria and Hazardous Air Pollutants in 2022 of Coal Production from Existing Leases in the Planning Area

Mineral Designation	Annual Production (million tons/year)	PM_{10} (tons/year)	$PM_{2.5}$ (tons/year)	NOx (tons/year)	CO (tons/year)	VOC (tons/year)	SO_2 (tons/year)	HAP (tons/year)
Federal	11.05	67	65	2,977	855	118	3	52
Nonfederal	9.80	47	46	2,103	604	83	2	37
Total	20.85	114	111	5,081	1,460	201	5	89

Table 3-26
Coal Transportation Emissions of Criteria and Hazardous Air Pollutants in 2022 of Coal Production from Existing Leases in the Planning Area

Mineral Designation	Annual Production (million tons/year)	PM_{10} (tons/year)	$PM_{2.5}$ (tons/year)	NOx (tons/year)	CO (tons/year)	VOC (tons/year)	SO_2 (tons/year)	HAP (tons/year)
Federal	12.30	56	54	2,587	1,012	101	4	44
Nonfederal	6.42	14	14	647	253	25	1	11
Total	18.72	70	68	3,234	1,265	126	5	56

Notes: The peak federal coal production from existing leases is anticipated to occur in 2027 based on forecast production rates and estimated federal contributions. Note that transportation emissions become less with time due to the phase in of cleaner locomotives.

Coal Downstream Combustion

Most coal in the United States is combusted to generate electricity. In 2021, 91.9 percent of coal was used for electric power, 8.0 percent was used in the industrial sector (such as coke plants, heat, and power), and 0.1 percent was used in the commercial sector. Minor amounts of coal are used for residential and transportation purposes (EIA 2022b). All coal mined in the planning area is subbituminous, which is primarily used as fuel for steam-electric power generation. Downstream coal combustion emits CAPs, precursors (NH_3 and VOCs), and HAPs that may impact air quality and public health. From an air quality perspective, some of the key pollutants emitted from downstream coal combustion are $PM_{2.5}$, PM_{10}, SO_2, NO_2, NH_3, HAPs, and other VOCs. From a public health perspective, some of the key pollutants emitted from downstream coal combustion are NOx, SO_2, $PM_{10\text{-}2.5}$,[1] $PM_{2.5}$, acrolein, arsenic, benzo(a)pyrene, cadmium, chlorine gas, hexavalent chromium, hydrogen chloride, mercury, manganese, nickel, and dioxins, as these could have either high exposure or high toxicity. Additional information about the HAPs chosen for this assessment is provided in Section 4.6 of **Appendix C**.

Based on the EPA 2017 national emissions inventory (the most recent version of data as of January 2023 is for year 2017; EPA 2017a), coal combustion in the United States annually emits 4.9×10^5 tons of CO, 1.0×10^6 tons of NOx, 1.5×10^5 tons of PM_{10}, 8.6×10^4 tons of $PM_{2.5}$, 1.5×10^6 tons of SO_2, 14.6 tons of lead, 6.3×10^3 tons of NH_3, and 1.8×10^4 tons of VOCs (EPA 2017a). National annual coal combustion emissions of CAPs, precursors, and HAPs from individual source sectors are provided in **Table 3-27** and **Table 3-28**. Note that these emissions include sources which burn coal from both within and outside the planning area as well as both federal and nonfederal coal. All CAPs and precursors have the highest coal combustion emissions from EGUs, which make up between 54 percent and 85 percent of the total coal combustion emissions. Industrial sources are also fairly important for PM_{10} and lead, contributing 32.9 percent and 41.9 percent of the annual coal combustion emissions in the United States, respectively. All the key HAPs listed above also have the highest coal combustion emissions from EGUs, which make up 53 to 95 percent of the total coal combustion emissions.

Emissions of CAPs, precursors, and various HAPs from power plants that received coal from the planning area are presented in **Table 3-40**.

Table 3-27
US Annual Coal Combustion Emissions of Criteria Air Pollutants and Precursors by Percentage from Source Sector Groups

Emission Source Sector	CO	NOx	PM_{10}	$PM_{2.5}$	SO_2	Lead	NH_3	Total VOC
Commercial/ Institutional	0.2%	0.4%	0.7%	0.5%	0.8%	3.4%	0.1%	0.8%
Electric generation	93.3%	91.0%	66.4%	86.1%	85.4%	54.7%	91.0%	95.4%
Industrial	6.5%	8.6%	32.9%	13.4%	13.8%	41.9%	8.9%	3.8%
Total coal combustion emissions (tons/year)	4.9E+05	1.0E+06	1.5E+05	8.6E+04	1.5E+06	14.6	6.3E+03	1.7E+04

Source: EPA 2017a

Note: Total emissions (in tons/year) are for 2017 and are calculated as a sum of emissions in the categories.

[1] $PM_{10\text{-}2.5}$ is the coarse fraction of PM_{10} (that is, PM_{10} minus $PM_{2.5}$)

Table 3-28
United States Annual Coal Combustion Emissions of Hazardous Air Pollutants by Percentage from Source Sector Groups

Pollutant	Emission Source Sector			Total Coal Combustion Emissions (tons/year)
	Commercial/ Institutional	Electric Generation	Industrial	
Acrolein	0.3%	94.7%	5.0%	54.6
Arsenic	3.7%	53.8%	42.6%	11.2
Benzo(a)pyrene	0.0%	81.5%	18.5%	0.3
Cadmium	2.5%	65.4%	32.1%	1.4
Chlorine gas	7.8%	69.4%	22.8%	69.7
Hexavalent chromium	0.9%	82.2%	16.9%	6.6
Hydrogen chloride	3.2%	60.1%	36.7%	5948.3
Manganese	0.7%	84.0%	15.3%	68.9
Mercury	3.7%	87.8%	8.4%	5.2
Nickel	1.3%	90.1%	8.5%	26.4
Dioxins/furans*	--	--	--	1.3E-12 to 1.2E-7*

Source: EPA 2017a; * Electric Power Research Institute 2018a
Note: Total emissions (in tons/year), except for dioxins/furans, are for 2017 and are calculated as a sum of other categories reported in the EPA national emissions inventory. Dioxins/furans emissions are from Electric Power Research Institute 2018a and reported as the range across all power plants assessed for 2017. Dioxins/furans emissions are expressed in Electric Power Research Institute 2018a as 2,3,7,8-TCDD toxic equivalents. EPA has not evaluated the completeness or accuracy of dioxin and furan emissions estimates so they are not included in the national emissions inventory (EPA 2021b).

Oil and Gas

Oil and natural gas are produced at wells throughout the planning area. Oil production in Montana occurs primarily in the Bakken Formation in the northeast corner of the state (EIA 2022c), which overlaps with the planning area. A number of crude oil pipelines cross through the planning area, connecting to oil refineries within the state, in other states (including Wyoming, North Dakota, and Minnesota), and internationally to Canada (EIA 2022d). According to EIA data, an average of only 0.18 percent of the crude oil produced in the Rocky Mountain region (Montana, Wyoming, Colorado, Idaho and Utah) has been exported internationally over the 5-year period from 2017-2021 (EIA 2022e). Crude oil is refined into petroleum products that can be burned by a variety of sources, including on-road and off-road vehicles and stationary sources.

About one-fourth of Montana's natural gas production occurs in the Williston Basin in the northeastern portion of the state, which overlaps with the planning area. According to state data from the EIA, most of the natural gas produced in Montana is processed within the state and then distributed to other regions (EIA 2022c). The final destinations (that is, locations of downstream combustion) of the petroleum products and natural gas from the planning area are innumerable and highly uncertain.

The federal and nonfederal production rates and emissions of CAPs and HAPs in 2022 from oil, conventional natural gas, and coalbed natural gas produced in the planning area are shown in **Table 3-29**, **Table 3-30**, and **Table 3-31**, respectively.

Table 3-29
Oil Production and Midstream Emissions of Criteria and Hazardous Air Pollutants from the Planning Area in 2022

Mineral Designation	Production Rate (MMBO)	PM_{10} (tons/year)	$PM_{2.5}$ (tons/year)	NOx (tons/year)	CO (tons/year)	VOC (tons/year)	SO_2 (tons/year)	HAP (tons/year)
Federal	3.0	49	14	223	492	405	3	34
Nonfederal	20.6	368	147	2,495	2,997	2,783	22	234
Total	23.7	417	161	2,718	3,488	3,188	26	268

Note: MMBO = millions of barrels of oil

Table 3-30
Conventional Natural Gas Production and Midstream Emissions of Criteria and Hazardous Air Pollutants from the Planning Area in 2022

Mineral Designation	Production Rate (billion cubic feet)	PM_{10} (tons/year)	$PM_{2.5}$ (tons/year)	NOx (tons/year)	CO (tons/year)	VOC (tons/year)	SO_2 (tons/year)	HAP (tons/year)
Federal	5.1	12	4	79	192	54	0.2	5
Nonfederal	34.1	93	46	915	1,221	374	6	37
Total	39.2	105	50	995	1,413	428	6	43

Table 3-31
Coalbed Natural Gas Production and Midstream Emissions of Criteria and Hazardous Air Pollutants from the Planning Area in 2022

Mineral Designation	Production Rate (billion cubic feet)	PM_{10} (tons/year)	$PM_{2.5}$ (tons/year)	NOx (tons/year)	CO (tons/year)	VOC (tons/year)	SO_2 (tons/year)	HAP (tons/year)
Federal	8.0	25	8	116	230	80	0.1	15
Nonfederal	10.8	35	11	206	313	111	16	21
Total	18.8	61	18	322	542	190	16	36

Oil and Gas Downstream Combustion

Because the final destination and end use of oil and gas produced in the planning area is uncertain, national average data are used to estimate emissions from downstream combustion. The EIA reports the percent yield of individual petroleum products from United States crude oil refineries on a yearly basis (EIA 2022f). Average product yield values over the 5-year period from 2017-2021 are presented in Section 4.6 of **Appendix C**. Motor gasoline is the primary petroleum product manufactured, contributing an average of 46.7 percent of the total yield over the 5-year period. Distillate fuel oil and kerosene-type jet fuel follow in production, contributing 30.0 percent and 9.2 percent of the yield during that period, respectively. Together, these three products made up nearly 86 percent of total United States refinery output and can be burned by a variety of sources, including on-road and off-road vehicles and stationary sources. More details on the petroleum products are included in Section 4.6 of **Appendix C**.

Most natural gas in the United States is combusted to generate electricity and for the industrial sector. In 2021, 37 percent of natural gas was used for electric power, 33 percent was used in the industrial sector, 15 percent was used in the residential sector, 11 percent was used in the commercial sector, and 4 percent was used for transportation. Natural gas in the industrial sector is primarily used for process heating; in combined heat and power systems; as a feedstock for chemical, fertilizer, and hydrogen production; and as lease and plant fuel (EIA 2022g).

Downstream oil and gas combustion emits CAPs, precursors, and HAPs, which may impact air quality and public health. O_3, $PM_{2.5}$, PM_{10}, SO_2, NO_2, HAPs, other VOCs, and NH_3 are the key pollutants that may impact air quality. From a public health perspective, some of the key pollutants are O_3, NOx, SO_2, $PM_{10-2.5}$[1], $PM_{2.5}$, acrolein, 1,3-butadiene, benzene, formaldehyde, hexane, ethylbenzene, toluene, and xylenes.

Based on the EPA's 2017 national emissions inventory (EPA 2017a), petroleum product combustion in the United States annually emits 3.1×10^7 tons of CO, 6.3×10^6 tons of NOx, 4.2×10^5 tons of PM_{10}, 2.9×10^5 tons of $PM_{2.5}$, 3.0×10^5 tons of SO_2, 4.9×10^2 tons of lead, 1.1×10^5 tons of NH_3, and 2.9×10^6 tons of VOCs. National annual petroleum product combustion emissions of CAPs, precursors, and HAPs from individual source sectors are provided in **Table 3-32** and **Table 3-33**. Note that these emissions include sources that burn oil from both within and outside the planning area as well as both federal and nonfederal oil. Off-road gasoline sources include vehicles and equipment used in the following categories: airport services, construction, farm, industrial, lawn and garden, light commercial, logging, railway maintenance, recreational, and recreational marine vessels (EPA 2017a). Diesel emissions also include DPM, which can lead to adverse health outcomes such as cancer. DPM emissions, along with ultrafine particle emissions, are included in $PM_{2.5}$ emissions.

Mobile sources make up the majority of petroleum product emissions for all CAPs, precursors, and the HAPs listed above. CO, NH_3, VOCs, 1,3-butadiene, benzene, hexane, ethyl benzene, toluene, and xylenes have the greatest petroleum product emissions from motor gasoline. All motor gasoline emissions are dominated by light-duty vehicles. NOx, PM_{10}, $PM_{2.5}$, SO_2, formaldehyde, and acrolein have the greatest emissions from distillate fuel oil. On-road heavy-duty vehicles are the dominant distillate fuel emissions for NOx and PM_{10}, commercial marine vessels dominate for SO_2, and off-road equipment dominate for $PM_{2.5}$, formaldehyde, and acrolein. The highest petroleum product emissions of lead are from jet fuel.

[1] $PM_{10-2.5}$ is the coarse fraction of PM_{10}, (that is, PM_{10} minus $PM_{2.5}$)

Table 3-32
US Annual Petroleum Product Combustion Emissions of Criteria Air Pollutants and Precursors by Percentage from Source Sector Groups

Petroleum Product and Source Sector	CO	NOx	PM_{10}	$PM_{2.5}$	SO_2	Lead	NH_3	Total VOC
Gasoline: On-road light duty	58.8%	29.9%	32.5%	17.4%	6.8%	--	85.1%	52.0%
Gasoline: On-road heavy duty	2.0%	1.0%	0.9%	0.5%	0.2%	--	1.3%	1.0%
Gasoline: Off-road mobile	32.8%	3.0%	9.6%	12.9%	0.3%	<0.1%	0.7%	34.8%
Fuel oil: On-road light duty	1.2%	2.3%	2.0%	2.0%	0.1%	--	1.3%	1.3%
Fuel oil: On-road heavy duty	1.5%	22.2%	21.3%	20.1%	1.3%	--	7.0%	3.4%
Fuel oil: Off-road mobile	1.3%	13.2%	14.7%	21.2%	0.4%	<0.1%	1.1%	2.6%
Fuel oil: Railroad	0.4%	9.5%	4.1%	5.8%	0.2%	<0.1%	0.3%	1.0%
Fuel oil: Commercial marine vessels	0.3%	13.4%	8.3%	11.4%	60.1%	0.8%	0.6%	1.5%
Fuel oil: Commercial/ Institutional	0.1%	0.6%	0.7%	1.0%	2.1%	0.5%	0.2%	0.1%
Fuel oil: Electric generation	<0.1%	0.9%	1.2%	1.5%	13.0%	0.2%	0.6%	0.1%
Fuel oil: Industrial	0.1%	1.4%	1.7%	2.2%	6.3%	1.7%	0.3%	0.2%
Fuel oil: Residential	<0.1%	0.5%	0.9%	1.2%	3.8%	0.4%	1.5%	<0.1%
Jet and aircraft fuel	1.5%	2.0%	2.3%	3.0%	5.3%	96.3%	--	1.9%
Total petroleum product combustion emissions (tons/year)	3.1E+07	6.3E+06	4.2E+05	2.9E+05	3.0E+05	4.9E+02	1.1E+05	2.9E+06

Source: EPA 2017a
Note: Total emissions (in tons/year) are for 2017 and are calculated as a sum of the categories. $PM_{2.5}$ emissions include DPM and ultrafine particle emissions.

Table 3-33
US Annual Petroleum Product Combustion Emissions of Hazardous Air Pollutants by Percentage from Source Sector Groups

Petroleum Product and Source Sector	1,3-buta diene	Benzene	Formal-dehyde	Hexane	Ethyl benzene	Toluene	Xylenes	Acrolein
Gasoline: On-road light duty	51.0%	53.5%	18.3%	69.2%	56.0%	59.9%	57.1%	15.3%
Gasoline: On-road heavy duty	0.7%	1.1%	0.6%	1.4%	1.1%	1.2%	1.1%	0.3%
Gasoline: Off-road mobile	35.9%	34.4%	9.9%	28.0%	40.5%	37.1%	39.8%	5.9%
Fuel oil: On-road light duty	0.9%	0.4%	5.1%	0.2%	0.2%	0.1%	0.1%	4.8%
Fuel oil: On-road heavy duty	2.1%	1.2%	16.1%	0.5%	0.7%	0.4%	0.7%	13.3%
Fuel oil: Off-road mobile	1.2%	3.8%	28.4%	0.2%	0.9%	0.8%	0.7%	28.9%

Petroleum Product and Source Sector	1,3-buta diene	Benzene	Formal-dehyde	Hexane	Ethyl benzene	Toluene	Xylenes	Acrolein
Fuel oil: Railroad	0.4%	0.8%	8.7%	0.2%	0.2%	0.2%	0.3%	7.6%
Fuel oil: Commercial marine vessels	0.4%	0.3%	2.8%	0.2%	<0.1%	<0.1%	<0.1%	1.4%
Fuel oil: Commercial/ Institutional	<0.1%	<0.1%	0.2%	<0.1%	<0.1%	<0.1%	<0.1%	<0.1%
Fuel oil: Electric generation	<0.1%	<0.1%	0.1%	0.1%	<0.1%	<0.1%	<0.1%	<0.1%
Fuel oil: Industrial	<0.1%	<0.1%	0.4%	<0.1%	<0.1%	<0.1%	<0.1%	0.1%
Fuel oil: Residential	--	<0.1%	0.1%	<0.1%	--	--	--	--
Jet and aircraft fuel	7.4%	1.3%	9.4%	<0.1%	0.3%	0.2%	0.1%	22.4%
Total petroleum product combustion emissions (tons/year)	1.2E+04	7.3E+04	6.7E+04	5.2E+04	4.6E+04	2.5E+05	1.7E+05	5.5E+03

Source: EPA 2017a

Note: Total emissions (in tons/year) are for 2017 and are calculated as a sum of the categories.

Natural gas combustion in the United States annually emits $6.3x10^5$ tons of CO, $1.1x10^6$ tons of NOx, $5.7x10^4$ tons of PM_{10}, $5.5x10^4$ tons of $PM_{2.5}$, $2.6x10^4$ tons of SO_2, 5.9 tons of lead, 5.6×10^4 tons of NH_3, and 9.5×10^4 tons of VOCs (EPA 2017a). National annual natural gas combustion emissions of CAPs, precursors, and HAPs from individual source sectors are provided in **Table 3-34** and **Table 3-35**. Note that these emissions include sources that burn gas from both within and outside the planning area as well as both federal and nonfederal gas. The largest emissions from natural gas combustion for CO, NOx, SO_2, lead, and total VOCs come from the industrial sector, which makes up between 54 percent and 67 percent of the total natural gas emissions for these pollutants. For PM_{10} and $PM_{2.5}$, electricity generation produces the highest annual emissions, but it is comparable to emissions from the industrial sector, both contributing 40 to 45 percent of total emissions. NH_3 emissions from natural gas combustion are dominated by residential burning. All the HAPs discussed in this analysis also have the highest natural gas combustion emissions from either the industrial sector or EGUs. Benzene, 1,3-butadiene, formaldehyde, hexane, and acrolein have the largest emissions from industrial sources, whereas ethyl benzene, toluene, and xylenes have the largest emissions from EGUs.

National oil and gas combustion emissions for CAPs, precursors, and HAPs are provided in Section 4.6 of **Appendix C**.

Table 3-34
United States Annual Natural Gas Combustion Emissions of Criteria Air Pollutants and Precursors by Percentage from Source Sector Groups

Emission Source Sector	CO	NOx	PM_{10}	$PM_{2.5}$	SO_2	Lead	NH_3	Total VOC
Commercial/ Institutional	18.9%	13.1%	8.1%	8.0%	5.1%	29.5%	2.4%	10.3%
Residential	14.2%	18.7%	7.1%	7.1%	4.6%	2.0%	60.5%	12.5%
Electric generation	12.4%	13.3%	43.5%	44.3%	29.2%	9.8%	22.1%	10.0%
Industrial	54.5%	54.9%	41.3%	40.6%	61.1%	58.7%	15.0%	67.2%
Total natural gas combustion emissions (tons/year)	6.3E+05	1.1E+06	5.7E+04	5.5E+04	2.6E+04	5.9	5.6E+04	9.5E+04

Source: EPA 2017a
Note: Total emissions (in tons/year) are for 2017 and are calculated as a sum of other categories.

Table 3-35
United States Annual Natural Gas Combustion Emissions of Hazardous Air Pollutants by Percentage from Source Sector Groups

Emission Source Sector	1,3-butadiene	Benzene	Formal-dehyde	Hexane	Ethyl benzene	Toluene	Xylenes	Acrolein
Commercial/ Institutional	0.2%	3.0%	2.6%	13.2%	3.8%	3.3%	4.3%	1.1%
Residential	0.0%	1.0%	1.1%	13.5%	0.0%	0.1%	0.0%	0.0%
Electric generation	1.8%	9.7%	12.5%	19.5%	59.2%	50.1%	52.2%	1.6%
Industrial	98.0%	86.3%	83.8%	53.8%	37.1%	46.5%	43.5%	97.3%
Total natural gas combustion emissions (tons/year)	2.7E+02	4.7E+02	1.5E+04	3.1E+03	1.7E+02	8.1E+02	3.8E+02	1.9E+03

Source: EPA 2017a
Note: Total emissions (in tons/year) are for 2017 and are calculated as a sum of other categories.

3.3.2 Direct and Indirect Impacts

Analysis Methods

Updated coal production forecasts for all alternatives for the two existing coal mines in the planning area are used to assess impacts separately for existing federal leases, pending federal lease applications, and potential future subsequent federal leases. Coal mining and transportation emissions of CAPs and precursors (NOx, CO, $PM_{2.5}$, PM_{10}, SO_2, and VOC) and HAPs are estimated using production forecasts, emissions inventory reports from MDEQ, and other data from EPA, BLM, and the literature. The methodology for estimating emissions is described in Section 2.1.1 and Section 2.4.1 of **Appendix C**. The emissions shown under each alternative represent the increment over the existing emissions presented in the Affected Environment.

The oil and gas emission calculators for CAPs and HAPs from the 2015 Proposed RMP/Final EIS (BLM 2015a) and the 2019 Proposed RMPA/Final SEIS (BLM 2019) are used to estimate annual federal and nonfederal oil and gas development emissions of criteria pollutants and HAPs for the remainder of the planning period (2023 to 2038) using the same calculation methodology and RFD activity as the 2015 Proposed RMP/Final EIS and 2019 Proposed RMPA/Final SEIS.

The temporal scale of analysis for direct and indirect impacts related to coal is through 2088 because that is reasonably foreseeable temporal extent of federal coal production in the MCFO. The future emissions and associated impacts related to the existing federal leases, which constitute valid existing rights, are disclosed in the *Affected Environment*, above. The direct and indirect impacts of implementing the alternatives are related to the constraints of future leasing imposed by the alternatives pertaining to the pending federal lease applications and potential future subsequent federal leases.

Impacts are presented following the BLM annual reasonably foreseeable production forecast through 2038, which is the extent of the oil and gas reasonably foreseeable production forecast used for analysis in the 2015 Proposed RMP/Final EIS (BLM 2015a).

Impacts on air quality and AQRVs are also assessed by tiering to regional photochemical source apportionment modeling conducted separately by the BLM.

A qualitative analysis of the air quality and public health effects due to downstream combustion of coal, oil, and gas from the planning area is conducted using location, source, emissions, and health data from EPA, BLM, and peer-reviewed and other literature. A discussion of the disproportionate public health impacts on potential environmental justice communities is discussed in **Section 3.6.2**.

The annual emissions of CAPs and HAPs from other BLM-authorized activities (that is, vegetation management, fire management, forestry and woodland products, livestock grazing, trails and travel management, and road maintenance) from the 2015 Proposed RMP/Final EIS (BLM 2015a) are applied directly.

Assumptions

- Historical coal mining emissions intensities (that is, ton of pollutant per ton of coal) are representative of future emission intensities and coal mining emissions scale linearly with production.
- The oil and gas production RFD from the 2019 Proposed RMPA/Final SEIS (BLM 2019) is applicable.
- Other BLM-authorized activity emissions from the 2015 Proposed RMP/Final EIS (BLM 2015a) are representative of the planning period and do not vary by year.
- The photochemical modeling that is tiered to represents a future year (circa 2028[1]) projection for a specific set of activity levels and not any of the specific alternatives. A separate emissions assessment was performed based on the projected production rate and time period under each alternative.
- Only 1 year of photochemical modeling is tiered to, with the meteorology representative of 2014. One year of modeling also means that metrics for the NAAQS are approximate for those pollutants that are based on observations of multi-year values.

[1] This year was used in the photochemical modeling, as it leveraged data from the EPA 2028 modeling platform.

- The near-field air quality analysis discussed in 2015 Proposed RMP/Final EIS (BLM 2015a) for oil and gas development approximately represents impacts during the remainder of the planning period (that is, 2023 to 2038).

Indicators

- Air concentrations with respect to the NAAQS and MAAQS and federal attainment status
- Emissions of criteria pollutants, VOCs, and HAPs from coal production and transportation
- Emissions of criteria pollutants, VOCs, and HAPs from oil and gas production and midstream sources
- Qualitative assessment of downstream coal, oil, and gas combustion
- Visibility impairment
- Critical loads of total atmospheric deposition for nitrogen and sulfur deposition

Impacts Common to All Alternatives

Coal Mining

Impacts on air quality from coal mining, transportation, and downstream combustion vary based on the RFD scenario expected under each alternative. However, because the methodology for impact analysis is similar across alternatives, a brief overview of the regional modeling and impact assessment approach is presented here.

The regional photochemical modeling study was conducted separately by BLM to assess the potential air quality impacts from federal coal and oil and gas production and other cumulative sources in the intermountain west states. The advanced photochemical model, CAMx (Comprehensive Air Quality Model with Extensions), was applied at 12 km grid resolution for the year circa 2028 with a series of "source apportionment" groups for which emission contributions were tracked. These included federal coal production in individual states, new production (wells drilled from 2020 onwards) and existing production (wells drilled prior to 2020) of oil and gas in individual states, coal EGUs combined for all Western Regional Air Partnership states, other coal combustion sources for all Western Regional Air Partnership states combined, nonfederal coal, nonfederal and tribal oil and gas development, other anthropogenic sources, and natural sources. Modeling was assessed to identify impacts on criteria pollutants and precursors as well as deposition and visibility. The modeling was based on assumed levels of coal production forecast in the planning area and elsewhere in the state (see Section 4.2.1.1 of **Appendix C**. The production rate of coal or oil and gas modeled for the planning area and corresponding modeled impacts are used here to estimate potential impacts of production in the planning area for each alternative. These "tiering" results are presented below under each alternative. An overview of the regional modeling study and corresponding modeling results may be found in Sections 4.1 and 4.2 of **Appendix C**.

Oil and Gas Development

Impacts are presented following the BLM annual reasonably foreseeable production forecast through 2038, which is the extent of the oil and gas reasonably foreseeable production forecast used for analysis in the 2015 Proposed RMP/Final EIS (BLM 2015a). The oil and gas production and therefore associated emissions and air quality impacts do not change by alternative because decisions pertaining to oil and gas leasing and development are not the subject of this SEIS. The annual federal production and emissions of CAPs and

HAPs from oil, conventional natural gas, and coalbed natural gas production in the planning area from 2023 to 2038 are shown in **Table 3-36**, **Table 3-37**, and **Table 3-38**, respectively. Information on nonfederal oil and gas production and emissions during the planning period is provided in Section 4.3.1 of **Appendix C**.

The modeled federal production in the MCFO in the BLM regional modeling study was 17 million barrels of crude oil and 22 billion cubic feet of gas. The peak federal oil production under all alternatives is 3.0 million barrels of oil (**Table 3-36**; the values are the same for all alternatives). The peak production of natural gas (conventional plus coalbed gas) is 13.1 billion cubic feet of gas (**Table 3-37** and **Table 3-38**); the values are the same for all alternatives. Thus, the projected federal oil and gas production rates in the MCFO for any alternatives are lower than the production used in modeling. Thus, air quality impacts under any alternative would be lower than those modeled. Federal oil and gas development is not anticipated to contribute to regional exceedances of the NAAQS and MAAQS (see Sections 4.2.1.2 and 4.2.1.3 of **Appendix C**). The near-field modeling conducted during the 2015 RMP process and incorporated here by reference (see Section 4.4.2 of **Appendix C**) indicated no exceedances of the NAAQS, MAAQS, or Prevention of Significant Deterioration increments. Total nitrogen deposition is predicted to exceed or be close to exceedance of nitrogen deposition critical loads in the regional modeling at the following federal and tribal Class I areas: Fort Peck, Lostwood, Medicine Lake, North Absaroka, Northern Cheyenne, Theodore Roosevelt, Washakie, and Wind Cave (Table 4-7 in **Appendix C**); the corresponding contribution from federal oil and gas production is relatively very small (Table 4-7 and Figures 4-31 and 4-32 of **Appendix C**). To further mitigate any potential oil and gas production impacts on nitrogen deposition at the Class I areas, emissions reduction mitigation measures, including those for NOx emissions, will be considered during project-level planning as noted in the Adaptive Management Plan (Appendix I) in the 2015 ROD/Approved RMP (BLM 2015b). These would also help reduce elevated concentrations of 1-hour NO_2 and 24-hour PM_{10} that could occur in the vicinity of well pads.

Federal oil and gas production in the planning area were modeled to have a small (less than a 0.5 delta deciview[1]) contribution to visibility impairment at any of the Class I areas.

As oil and gas production does not vary by alternative, the downstream impacts on emissions, air quality, and public health from combustion of oil and gas produced in the planning area would be the same for all alternatives. The indirect impacts of burning the oil and natural gas from the planning area are discussed in the section *Downstream Combustion Impacts on Air Quality and Public Health*.

[1] Deciviews are a unit of measurement of haze (referred to as the haze index) derived from calculated light extinction. Delta deciviews is a metric used to represent the change in atmospheric light extinction due to emissions from a source or group of sources relative to background conditions. A threshold of 1.0 deciview (approximately a 10 percent change in light extinction) is applied by federal land managers to identify individual sources that cause visibility impairment.

Table 3-36
Federal Oil Production and Midstream Emissions of Criteria and Hazardous Air Pollutants from the Planning Area in 2023-2038

Year	Production Rate (MMBO)	PM_{10} (tons/year)	$PM_{2.5}$ (tons/year)	NOx (tons/year)	CO (tons/year)	VOC (tons/year)	SO_2 (tons/year)	HAP (tons/year)
2023	3.0	49	14	223	492	405	3	34
2024	3.0	49	14	223	492	405	3	34
2025	3.0	49	14	223	492	405	3	34
2026	3.0	49	14	223	492	405	3	34
2027	3.0	49	14	223	492	405	3	34
2028	3.0	49	14	223	492	405	3	34
2029	3.0	49	14	223	492	405	3	34
2030	3.0	49	14	223	492	405	3	34
2031	3.0	49	14	223	492	405	3	34
2032	3.0	49	14	223	492	405	3	34
2033	3.0	49	14	223	492	405	3	34
2034	3.0	49	14	223	492	405	3	34
2035	3.0	49	14	223	492	405	3	34
2036	3.0	49	14	223	492	405	3	34
2037	3.0	49	14	223	492	405	3	34
2038	3.0	49	14	223	492	405	3	34
Total	48.7	783	222	3,566	7,867	6,482	50	543

Table 3-37
Federal Conventional Natural Gas Production and Midstream Emissions of Criteria and Hazardous Air Pollutants from the Planning Area in 2023-2038

Year	Production Rate (billion cubic feet)	PM_{10} (tons/year)	$PM_{2.5}$ (tons/year)	NOx (tons/year)	CO (tons/year)	VOC (tons/year)	SO_2 (tons/year)	HAP (tons/year)
2023	5.1	12	4	79	192	54	0.2	5
2024	5.1	12	4	79	192	54	0.2	5
2025	5.1	12	4	79	192	54	0.2	5
2026	5.1	12	4	79	192	54	0.2	5
2027	5.1	12	4	79	192	54	0.2	5
2028	5.1	12	4	79	192	54	0.2	5
2029	5.1	12	4	79	192	54	0.2	5
2030	5.1	12	4	79	192	54	0.2	5
2031	5.1	12	4	79	192	54	0.2	5
2032	5.1	12	4	79	192	54	0.2	5
2033	5.1	12	4	79	192	54	0.2	5
2034	5.1	12	4	79	192	54	0.2	5
2035	5.1	12	4	79	192	54	0.2	5
2036	5.1	12	4	79	192	54	0.2	5
2037	5.1	12	4	79	192	54	0.2	5
2038	5.1	12	4	79	192	54	0.2	5
Total	81.8	198	72	1,268	3,072	863	2.8	86

Table 3-38
Federal Coalbed Natural Gas Production and Midstream Emissions of Criteria and Hazardous Air Pollutants from the Planning Area in 2023-2038

Year	Production Rate (billion cubic feet)	PM_{10} (tons/year)	$PM_{2.5}$ (tons/year)	NOx (tons/year)	CO (tons/year)	VOC (tons/year)	SO_2 (tons/year)	HAP (tons/year)
2023	8.0	25	8	116	230	80	0.1	15
2024	8.0	25	8	116	230	80	0.1	15
2025	8.0	25	8	116	230	80	0.1	15
2026	8.0	25	8	116	230	80	0.1	15
2027	8.0	25	8	116	230	80	0.1	15
2028	8.0	25	8	116	230	80	0.1	15
2029	8.0	25	8	116	230	80	0.1	15
2030	8.0	25	8	116	230	80	0.1	15
2031	8.0	25	8	116	230	80	0.1	15
2032	8.0	25	8	116	230	80	0.1	15
2033	8.0	25	8	116	230	80	0.1	15
2034	8.0	25	8	116	230	80	0.1	15
2035	8.0	25	8	116	230	80	0.1	15
2036	8.0	25	8	116	230	80	0.1	15
2037	8.0	25	8	116	230	80	0.1	15
2038	8.0	25	8	116	230	80	0.1	15
Total	127.7	402	123	1,859	3,678	1,272	2.3	243

Other BLM-Authorized Activities

This section discusses the air quality impacts of BLM-authorized activities other than oil and gas development and coal mining in the planning area. The emissions and air quality impacts analysis of other BLM-authorized activities from the Proposed Plan (Alternative E) in the 2015 Proposed RMP/Final EIS (BLM 2015a) are incorporated by reference and summarized below. The activities assessed in the 2015 Proposed RMP/Final EIS (BLM 2015a) were:

- Vegetation management
- Fire management
- Forestry and woodland products
- Livestock grazing
- Recreation – trails and travel management
- General purpose BLM fleet travel
- Road maintenance

The BLM expects that the annual activity rates and corresponding emissions from these activities remain representative of expected activity levels and emissions for the remaining plan life. The annual emissions from other BLM-authorized activities are shown in **Table 3-39**.

Table 3-39
Annual Emissions of Criteria and Hazardous Air Pollutants and Precursors from Other BLM-Authorized Activities in the Planning Area

Other BLM-authorized Activity	PM_{10} (tons/ year)	$PM_{2.5}$ (tons/ year)	NOx (tons/ year)	SO_2 (tons/ year)	CO (tons/ year)	VOC (tons/ year)	HAP (tons/ year)
Vegetation Management	11	1	0	0	11	3	0
Fire Management	211	151	58	14	1,742	97	10
Forestry and Woodland Products	11	1	4	0	3	0	0
Livestock Grazing	137	14	9	0	11	4	0
Recreation – Trails and Travel Management	293	30	0	0	27	27	3
General Purpose BLM Fleet Travel	73	7	2	0	5	2	0
Road Maintenance	1	0	1	0	0	0	0
Total	**737**	**204**	**74**	**14**	**1,799**	**133**	**13**

Source: BLM 2015a

Downstream Combustion Impacts on Air Quality and Public Health

Downstream combustion of coal, oil, and gas produced in the planning area would lead to emissions of CAPs and HAPs that are known to impact air quality and public health. This section provides an analysis of these impacts. Due to the numerous uncertainties in such an assessment as discussed further below, a qualitative analysis has been conducted. Additional supporting information is provided in **Appendix C**. We note that the sources combusting coal, oil and gas from the MCFO would be subject to local, state, and federal regulations to protect air quality and public health.

Air quality impacts affecting public health include changes to pollutant concentrations in the air and changes to deposition of pollutants on soils and water that may indirectly affect human health. Increased pollutant concentrations, particularly PM, could lead to degraded visibility, but visibility does not directly affect human health. From an air quality perspective, some of the key pollutants resulting from downstream coal, oil, and gas combustion are O_3, $PM_{2.5}$, PM_{10}, SO_2, NO_2, and HAPs and other VOCs. Downstream combustion could also result in the deposition of one or more compounds such as mercury and other species. From a public health perspective some of the key pollutants are O_3, NOx, SO_2, $PM_{10-2.5}$,[1] $PM_{2.5}$, acrolein, arsenic, benzo(a)pyrene, cadmium, chlorine gas, hexavalent chromium, hydrogen chloride, mercury, manganese, nickel, dioxins, 1,3-butadiene, benzene, formaldehyde, hexane, ethylbenzene, toluene, and xylenes as these could have either high exposure or high toxicity.

The specific coal-fired power-plants that currently receive planning area coal have been identified by the EIA (2022a) and are presented in Section 4.6 of **Appendix C**. Emissions of CAPs, precursors, and various HAPs from each of these power plants are presented in **Table 3-40**. Power plant destination data are for 2021, and emissions data are for 2017. In addition to MCFO coal, the power plants may also burn coal produced outside the planning area as well as nonfederal coal sourced from the planning area. Therefore, the emissions presented are not necessarily due only to the combustion of MCFO coal.

The exact future destinations and corresponding coal shipment amounts from the planning area are unknown. The current destinations of coal produced in the planning area are based on data from 2021 (EIA 2022a) and will likely change during the planning period and beyond due to power plant and mine closures. Closures of power plants would remove emissions and impacts from those sources. Future downstream combustion emissions from planning area coal are also uncertain. The emissions presented in **Table 3-40** are for 2017, which is the most recent EPA national emissions inventory data. As discussed previously in **Section 3.3.1**, coal production nationally and in the West is in decline. This decreasing trend is expected regardless of alternative and would likely lead to lower downstream coal combustion emissions compared to existing conditions. Consequently, the impacts to air quality and public health discussed below would likely be reduced during the planning period and beyond as coal emissions decline.

The final destinations (that is, locations of downstream combustion) of the petroleum products and natural gas from the planning area are innumerable and highly uncertain. The general distribution of planning area oil and gas, typical combustion uses, and 2017 annual US combustion emissions were discussed previously in **Section 3.3.1** and are used in this downstream combustion assessment. The emission sources may burn fuels produced outside the planning area as well as nonfederal mineral sourced from the planning area. Therefore, the emissions presented and the resulting impacts on air quality and public health are not necessarily due only to planning area fossil fuels.

[1] $PM_{10-2.5}$ is the coarse fraction of PM_{10}, (that is, PM_{10} minus $PM_{2.5}$)

Table 3-40
Annual Downstream Combustion Emissions of Criteria and Hazardous Air Pollutants from Power Plants that Received Federal Coal from the Planning Area

Pollutant	Pollutant Type	Total Annual Emissions (tons/year)						
		DTE Belle River	Clay Boswell	Coronado	Transalta Centralia	D.E. Karn	Colstrip	Colstrip Energy Limited Partner-ship Power Plant
NH_3	CAP precursor	1.6	1.4	2.9	17.8	6.9	0.2	--
CO	CAP	1656.2	3297.2	3519.5	1389.5	468.2	2122.5	3.5
NOx	CAP	13186.0	4082.6	4154.5	6214.4	788.4	12393.8	569.0
PM_{10}	CAP	63.7	944.1	695.5	419.3	46.9	1934.5	12.4
$PM_{2.5}$	CAP	31.2	709.3	695.2	199.0	35.7	1570.4	4.8
SO_2	CAP	36921.0	3138.6	221.9	1689.6	845.6	8490.0	797.7
VOCs	CAP precursor	191.7	64.7	71.3	10.3	51.6	297.0	4.0
Lead	CAP/HAP	4.9E-02	0.4	1.3E-02	3.4E-02	4.9E-03	0.4	1.4E-03
Acrolein	HAP	0.2	0.6	0.3	0.5	4.1E-02	--	--
Arsenic	HAP	4.9E-02	4.0E-02	2.0E-02	5.1E-02	1.8E-03	0.2	3.4E-04
Benzo(a)pyrene	HAP	1.8E-02	8.0E-05	--	5.7E-08	3.0E-05	--	--
Cadmium	HAP	1.9E-02	4.3E-03	2.9E-03	7.6E-03	2.0E-03	4.5E-02	1.9E-05
Chlorine gas	HAP	--	--	--	--	--	--	--
Hexavalent chromium	HAP	5.9E-02	1.6E-02	2.4E-02	6.1E-02	1.3E-03	4.0E-02	2.6E-04
Hydrogen chloride	HAP	25.6	7.0	0.8	6.9	3.2	39.8	1.7
Manganese	HAP	0.3	0.2	0.2	0.6	1.7E-02	1.3	6.0E-03
Mercury	HAP	4.4E-02	1.7E-02	1.8E-02	3.0E-02	9.8E-03	5.9E-02	1.2E-03
Nickel	HAP	0.4	0.2	6.9E-02	0.2	7.6E-02	0.3	4.0E-03
Dioxins/ furans	HAP	4.9E-08	4.8E-08	--	3.7E-08	1.4E-08	7.5E-08	--

Source: EPA 2017a; EIA 2022a; Electric Power Research Institute 2018a
Notes: Destination data are from EIA for 2021, and emissions data are for 2017 from EPA national emissions inventory and Electric Power Research Institute 2018a (dioxins/furans only). Emissions presented here are total emissions which may include both federal and nonfederal coal, as well as coal from within and outside the planning area. Dioxins/furans emissions are expressed in Electric Power Research Institute 2018a as 2,3,7,8-TCDD toxic equivalents. EPA has not evaluated the completeness or accuracy of dioxin and furan emissions estimates so they are not included in the national emissions inventory (EPA 2021b).

The impact of combustion is highly dependent on source operational and control configurations, local and regional policies and requirements, and local conditions, so it is uncertain how downstream combustion emissions may change in the future. For example, power plants may implement additional emissions mitigation infrastructure or modify the types of fuels that are combusted. Future changes in energy demands and uses will also affect downstream combustion emissions. Any changes in emissions will likely affect the air quality and public health impacts discussed below. Due to these uncertainties, a qualitative analysis of the effect of downstream combustion on local and regional air quality and public health is more appropriate and is provided below.

Air Quality Impacts

Since combustion of all fossil fuels emit CAP and HAP emissions, local ambient concentrations of these pollutants would likely increase in areas where planning area coal, oil, and gas are combusted. This may contribute to an area exceeding national or state air quality standards. Increased pollutant concentrations would also likely enhance local and regional atmospheric deposition. Deposition of mercury and other HAPs emitted from combustion may be followed by uptake in other media and eventual intake by humans.

Deposition of nitrogen and sulfur species can lead to acidification of water and affect biological diversity. The consumption of fish from water contaminated by mercury poses a potential health risk.

Air quality involves complex physical and chemical transformations at a local or regional level, so impacts would vary considerably depending on background concentrations, meteorology, and other local pollutant sources. If any pollutant concentration is near or above its standard in a particular area, the combustion of planning area petroleum products, natural gas, or coal may contribute to or exacerbate nonattainment. Potential pollutant concentration change resulting from combustion is therefore often a key driver of public policy to mitigate air quality and public health impacts in such areas.

Because the majority of refined petroleum products are combusted in mobile sources, the impacts of CAPs and HAPs emissions from planning area oil combustion would likely be greatest in areas with heavy vehicle usage and high roadway density (Henneman et al. 2021). Motor gasoline is the dominant product from crude oil and is used predominantly in densely populated urban centers. Transportation corridors, such as railroads, diesel truck routes, and marine ports, are also expected to see a greater influence from petroleum product combustion than other remote or rural areas. Downstream combustion of oil would therefore likely have the greatest overall impact in these areas. Emissions vary from vehicle to vehicle, however, and are not constant over the entire drive cycle (Wallingford et al. 2022), and so the impact of emissions from downstream combustion of planning area oil on local air quality would depend on the specific vehicle fleet in use, driving and traffic patterns, and existing local or regional air quality.

Natural gas and coal are combusted primarily in stationary sources in the industrial sector or in EGUs. Emissions of CAPs, HAPs, and precursors would therefore have the largest impact on air quality near these sources. The greatest air quality impacts typically occur within a 50- to 100-kilometer radius of stationary sources (Baker and Kelly 2014; Burney 2020; Kelly et al. 2015) but this can vary due to a number of factors, including site-specific emissions controls, local meteorology, and background pollutant concentrations. Regions with a high density of stationary sources (both EGUs and industrial) would likely experience greater air quality impacts than those with relatively few sources. The specific EGUs that receive planning area coal are listed in Table 4-73 in Section 4.6 of **Appendix C**. The greatest air quality impacts from coal combustion would likely occur near these sites, but as discussed above, the future destination of planning area coal is uncertain and will likely vary.

Air quality impacts related to specific pollutants are provided in the sections below. Impacts specific to environmental justice populations of concern are discussed in **Section 3.6**.

Ozone Pollution

Both NOx and VOCs are emitted by downstream combustion of planning area coal, petroleum products, and natural gas which would potentially increase O_3 concentrations. The magnitude of any O_3 change due to combustion is subject to background NOx and VOC concentrations (and whether a region has limited NOx or VOC), their local sources, and other local conditions, which would cause considerable variation from region to region. Combustion occurring under conditions more favorable to O_3 formation (for example, warm temperatures and high solar radiation) would cause a larger impact on O_3 concentrations.

Light duty motor vehicles are the largest source of NOx and VOC emissions from petroleum product combustion. This, in addition to motor gasoline being the dominant product from crude oil, indicates that ambient levels of NOx and VOCs would be most impacted in regions with high vehicle use such as densely populated urban centers. Throughout much of the United States, the mobile sector provides the greatest source of precursor NOx that leads to O_3 formation (Foley et al. 2015). O_3 levels would consequently see the largest increases in these regions (especially if the regions are NOx-limited to begin with), particularly in areas with high levels of direct sunlight. A small amount of petroleum products are also burned in stationary sources, primarily distillate fuel used in power plants, which would cause similar downwind impacts in O_3. Most petroleum products are burned in mobile sources, however, which are dispersed over a larger area, causing broader regional changes to O_3 levels.

NOx and VOC emissions from natural gas combustion occur primarily in the industrial sector, including in process heating; in combined heat and power systems; as a feedstock for chemical, fertilizer, and hydrogen production; and as lease and plant fuel. Impacts on O_3 concentrations would therefore likely be greatest downwind of these stationary industrial sources. Generally, O_3 impacts from stationary sources tend to be greater near sources with higher NOx and VOC emissions (Baker et al. 2016).

Since coal is primarily used in power plants, the largest NOx and VOC emissions from planning area coal combustion would occur from EGUs that receive shipments from the planning area. O_3 concentrations would likely be most impacted downwind of these EGUs. O_3 impacts are strongly dependent on NOx emissions, which vary significantly between power plants due to the technological controls implemented at each site. Regional variability of O_3 sensitivity to NOx, which is determined by local concentrations and emission sources, plays a large role in O_3 chemistry (Strasert et al. 2019). Similar to natural gas stationary sources, the largest O_3 impacts would again be greatest near sources with high NOx and VOC emissions.

While many other pollutants show a clear trend of decreasing concentrations with increasing distance from the EGU source, O_3 trends are more variable. Baker and others (2016) found that peak O_3 impacts typically occur within 50 kilometers downwind of stationary sources, and the impact decreases moving further from the emission source. O_3 formation associated with EGU emissions however is nonlinear and may not be confined to the area surrounding the EGU (Burney 2020). Close to the source, there may be a decrease in O_3 levels due to titration by the NOx emissions (Baker and Kelly 2014; Kelly et al. 2015).

Particle Pollution

PM_{10} and $PM_{2.5}$ are both directly emitted from coal, petroleum product, and natural gas combustion. Secondary particle precursor species, including SO_2, NOx, NH_3, and VOCs, are also emitted from fossil fuel combustion so the downstream burning of planning area coal, oil, and natural gas would likely lead to an increase in both primary and secondary particle concentrations. Since particles are deposited more quickly and have a shorter atmospheric lifetime than most gaseous pollutants, the greatest impact on ambient concentrations would likely occur close to emission sources. Generally, secondary PM impacts from stationary sources tend to be larger downwind from sources with higher NOx and SO_2 emissions (Baker et al. 2016).

In the United States, petroleum product emissions of PM_{10} are dominated by light-duty gasoline powered vehicles, while emissions of $PM_{2.5}$ are dominated by off-road diesel fuel powered sources. The greatest influence of direct emissions from planning area oil combustion on ambient concentrations of PM_{10} would therefore be in areas with high on-road vehicle use, such as in cities and along roadways. $PM_{2.5}$ concentrations would be most impacted by direct emissions where off-road diesel vehicles and equipment are used, such as at construction sites or where recreational vehicles are driven. Direct $PM_{2.5}$ emissions from on-road heavy-duty diesel vehicles and on-road light-duty gasoline vehicles are comparable to off-road diesel emissions, so cities and transportation corridors would also see increased $PM_{2.5}$ concentrations as a result of downstream combustion of planning area oil.

The relatively high petroleum product emissions from mobile sources would likely lead to the greatest impacts on secondary PM levels in regions with high vehicle use. NOx, NH_3, and VOCs in particular have their highest petroleum product combustion emissions in the United States from on-road light-duty vehicles. VOCs emitted in diesel exhaust are also particularly efficient at producing particles (Srivastava et al. 2022). SO_2 is emitted from on-road vehicles but its largest petroleum product emission is from commercial marine vessels. The influence of SO_2 emissions on concentrations of secondary particles would therefore likely be greatest along shipping routes. Electric generation using distillate fuel is the second most important source of SO_2 emissions. PM formation downwind of power plants will also likely be impacted by petroleum product combustion.

For natural gas combustion, EGUs are the greatest source of primary PM_{10} and $PM_{2.5}$ annual emissions in the United States, contributing 43.5 percent and 44.3 percent of total natural gas emissions, respectively. This is closely followed by industrial sector emissions, which make up 41.3 percent and 40.6 percent of the PM_{10} and $PM_{2.5}$ emissions from natural gas combustion. Since EGUs and industrial sources are both stationary sources, the impacts on particle pollution from both will show similar trends. In particular, the impact of direct emissions on ambient particle concentrations will likely be largest close to these sources.

Annual natural gas combustion emissions of NOx, SO_2, and VOCs in the United States are highest from EGUs so the greatest formation of secondary PM formation from these species will likely occur near natural gas powered plants. Most NH_3 emissions from natural gas combustion are from residential sources. The chemical makeup of secondary PM formed from natural gas combustion will therefore be different between residential areas and regions with greater number of EGUs. There is also variability in fuel sources used for home heating so the impact of NH_3 emissions on particle pollution will not be consistent among all residential communities.

The largest emissions of PM_{10}, $PM_{2.5}$, and secondary particle precursors (SO_2, NOx, NH_3, and VOCs) from coal combustion in the United States occur at EGUs. Particle pollution as a result of planning area coal combustion would therefore be most impacted near EGUs that receive coal from the planning area. The relatively short atmospheric lifetime of particles generally confines the greatest impacts to the area 50 to 125 kilometers downwind of the EGU (Baker et al. 2016; Burney 2020). These impacts decrease as the distance from the source increases.

Secondary formation of PM from power plants is strongly dependent on SO_2 emissions. For example, Strasert et al. 2019 found in a study of 13 Texas power plants that the largest $PM_{2.5}$ formation occurred from plants with the largest SO_2 emissions. SO_2 emissions from EGUs that receive coal from the planning area are variable (**Table 3-40**) and it is expected that $PM_{2.5}$ formation will be greatest downwind of the plants with the highest SO_2 emissions. High emissions of other particle precursors will also likely contribute to $PM_{2.5}$ formation. Secondary PM formation also is influenced by ambient pollutant levels and local meteorology, which will vary by region.

Differences in emissions of secondary particle precursor species from region to region would cause the chemical makeup of particles to differ across the country. Seasonal changes in fuel use also would contribute to PM composition and concentration variations. SO_2 emissions from power plants are particularly variable throughout the year due to electricity demands for residential and commercial heating and cooling purposes.

Nitrogen Oxides and Sulfur Dioxide

While the impact of NOx and SO_2 on O_3 and secondary particle formation is discussed above, both are also criteria pollutant regulated by the EPA. Direct emissions of NOx and SO_2 from downstream coal, petroleum product, and natural gas combustion would increase ambient levels of these pollutants and may cause exceedances of national or local standards. The impacts would likely be greatest near the emission sources.

In the United States, annual NOx emissions from petroleum product combustion are greatest from light-duty motor gasoline vehicles. The greatest risk of exceedance would likely be in regions with high vehicle use such as in densely populated urban centers. Commercial marine vessels dominate SO_2 petroleum product emissions and would consequently lead to the greatest increases in ambient SO_2 levels along commercial shipping routes. Electricity generation using distillate fuel also emits SO_2, so concentrations would likely increase near these power plant locations.

Industrial sector sources provide the highest natural-gas combustion emissions of NOx and SO_2 in the United States. The greatest potential for NOx and SO_2 increases from downstream natural gas combustion would therefore likely occur near these sources.

Annual United States emissions of NOx and SO_2 from coal combustion are predominantly from EGUs. The greatest impact of downstream planning area coal combustion on NOx and SO_2 concentrations would likely occur near the EGUs that receive coal from the planning area.

Mercury

Mercury is emitted from coal combustion, primarily from EGUs, which make up 87.8 percent of the total mercury emissions from coal combustion. The greatest impact of downstream coal combustion on mercury concentrations would likely occur near the EGUs that receive coal from the planning area. Inorganic mercury is emitted from coal fired power plants in three forms, gaseous elemental mercury (Hg^0), gaseous oxidized mercury (Hg^{II}), and particulate mercury (Hg^P). Concentrations of Hg^{II} and Hg^P would be highest near the power plant source whereas Hg^0 would be dispersed over large distances due to its long residence time.

Mercury in the air is a public health concern at relatively high concentrations and is discussed in the public health section. A frequent concern over mercury is its deposition to soils and waterways and the resulting bioaccumulation. Among the three forms of inorganic mercury emitted from EGUs, Hg^0 can be deposited via dry deposition, but wet deposition is negligible and it undergoes long-range transport; Hg^{II} can be deposited via dry and wet deposition near the emission source; and Hg^P deposition is variable. In water and sediment, Hg^{II} is converted to the toxic organic form of mercury (methylmercury), which bioaccumulates in fish and other organisms. This could result in adverse health outcomes, as discussed below under *Public Health Impacts*.

Other Hazardous Air Pollutants

The downstream combustion of oil, natural gas, and coal may result in localized increases in ambient air concentrations of HAPs. Increased deposition of HAPs such as arsenic can affect water and soil concentrations which may then affect human health through noninhalation pathways. Specific HAPs that are emitted from each type of combustion and are most important to air quality and public health are listed in the section *Downstream Combustion Impacts on Air Quality and Public Health*. Potential health impacts of these HAPs are discussed in the section below under *Public Health Impacts*.

Nitrogen and Sulfur Deposition

Deposition resulting from the downstream combustion of oil, natural gas, and coal produced in the planning area would follow a similar trend discussed in the NOx and SO_2 section above. Increased NOx and SO_2 concentrations resulting from combustion emissions would consequently lead to increased deposition. The rate of deposition and the specific compounds deposited would vary from region to region depending on local air quality and meteorology.

Public Health Impacts

There are several possible approaches to understanding the potential public health impacts of the downstream combustion of coal, oil, and natural gas. The first is to examine evidence that directly studies the impact of burning coal, oil, or gas. However, there are few situations where these combustion products can be studied in isolation as opposed to exposure to the effect of pollution from multiple sources. The second approach examines potential health impacts of the components of oil, gas, or coal combustion. There are a large number of chemicals generated from the burning of fossil fuels; this analysis focuses on the subset which are likely, either due to their concentration or their toxicity, to contribute the most to potential health effects. All of the criteria pollutants (CO, $PM_{2.5}$, PM_{10}, NO_2, SO_2, O_3, and lead) are examined due to their generation or secondary production from the combustion categories. HAPs are also produced by combustion of fossil fuels as outlined in **Section 3.3.1** above and in Section 4.6 of **Appendix C**. Some of the health information about these substances is derived from epidemiological studies and other information comes from toxicology studies. Both provide useful information individually, but often our understanding of the health effects literature comes from an integration of both types of studies, particularly for chemicals such as these where there is a large amount of available information.

Epidemiology studies are observational studies that examine how often various diseases occur in different populations of people and examine the strength of the statistical association between exposure (in this case to combustion products) and individual diseases. Since exposures are not controlled, epidemiology studies often have exposures to other substances that may also be responsible for the observed disease (known as potential confounders). Statistical techniques may be used to differentiate between the exposure of interest and potential confounders.

Toxicology studies use controlled exposure conditions to examine health effects outcomes. Toxicology studies are often performed in laboratory animals, and exposures are carefully controlled (duration of exposure and concentration of tested agent). If the health endpoint is not extreme, toxicology studies can also be performed in people where individuals are contained in an exposure chamber for relatively short durations (minutes to hours) and the exposures in the chambers are carefully controlled. Examples of acceptable health endpoints are mild, reversible irritation, as well as blood markers of a process that might lead to a disease.

This section summarizes epidemiology evidence for associations between oil, gas, and coal combustion products in terms of short-term and long-term health effects. Findings were considered for this section if they focused on exposure to the fuel combustion itself, or exposure to air pollutants that the authors believe originated primarily from the fuel combustion processes.

In a study examining the impacts of different types of electricity generation in Europe, air pollution from gas combustion was found to have lower health impacts compared to combustion of oil or coal (Markandya and Wilkinson 2007). Health effects from gas combustion, reported as deaths, serious illness, or minor illness, are estimated as lower than those from coal, largely due to lesser generation of primary and secondary particles. Calculated health burdens associated with oil combustion are higher than those from gas combustion, but lower than for coal combustion (**Table 3-41**). Although these projections are based on European electricity generation, the relative health impacts can be extrapolated to US-based use.

Table 3-41
Air Pollution-related Health Effects of Electricity Generation in Europe by Primary Energy Source

Fuel Source	Deaths (Deaths per TWh)[1]	Serious Illness (Cases per TWh)[2]	Minor Illness (Cases per TWh)[3]
Coal	24.5 (6.12-98)	225 (56.2-899)	13,288 (3,322-53,150)
Gas	2.8 (0.70-11.2)	30 (7.48-120)	703 (176-2,813)
Oil	18.4 (4.6-73.6)	161 (40.4-645.6)	9,551 (2,388-38,204)

Source: Adapted from Markandya and Wilkerson 2007
Notes: TWh = 10^{12} Watt hours. Data are mean estimate (95 percent Confidence Interval)
[1] Includes acute and chronic effects. Chronic effect deaths are between 88 percent and 99 percent of total.
[2] Includes respiratory and cerebrovascular hospital admissions, congestive heart failure, and chronic bronchitis.
[3] Includes restricted activity days, bronchodilator use cases, cough, and lower-respiratory symptom days in patients with asthma and chronic cough episodes.

Oil Combustion. A major use of oil is as a fuel of the refined product for motor vehicles. As such, its combustion products are part of the complex mixture that comprises traffic-related air pollution. Traffic-related air pollution is a combination of tailpipe emissions, nontailpipe emissions, and the associated mixture of gases and particles, including NOx, elemental carbon, PM ($PM_{2.5}$ and ultrafine particles), heavy metals, VOCs, and polycyclic aromatic hydrocarbons. There is high confidence in an association between long-term exposure to traffic-related air pollution and premature death (all-cause mortality, and specific deaths related to circulatory and ischemic heart disease), and moderate-to-high confidence on associations with lung cancer mortality, asthma onset in adults and children, and acute respiratory infections in children (Health Effects Institute Panel on the Health Effects of Long-Term Exposure to Traffic-Related Air Pollution 2022). Short-term exposures are associated with a series of pre-clinical outcomes (changes in inflammatory markers, blood pressure, endothelial function), exacerbation of respiratory and cardiovascular disease, and premature death (Health Effects Institute Panel on the Health Effects of Traffic-Related Air Pollution 2010; Health Effects Institute Panel on the Health Effects of Long-Term Exposure to Traffic-Related Air Pollution 2022).

Oil is also used as fuel for diesel vehicles after refining. There have been numerous studies and reviews of the health effects of diesel emissions, particularly with respect to cancer (Garshick et al. 2004; Attfield et al. 2012; Silverman et al. 2012; Health Effects Institute Diesel Epidemiology Panel 2015; Silverman 2018). Many of these studies examine occupationally exposed individuals (truck drivers, railway workers, miners), but the findings in these populations are generally relevant for individuals exposed to diesel emissions in the ambient air. Diesel emissions include DPM, which is a HAP and is considered an important component responsible for the cancer observed in these studies.

Another sector that uses oil for fuel is the aviation industry. In recent years, researchers have recognized that aircraft engine exhaust emissions may be a source of ultrafine particles at and downwind of airports, with exposures correlating with aviation activities such as takeoffs and landings (Hudda et al. 2018; Stacey 2019). The influence of ultrafine particles from airports was seen at nearby residences, as well as inside the residences, indicating the small particles infiltrate homes and other indoor spaces (Hudda et al. 2018). Although ultrafine particles also originate from traffic-related sources, ultrafine particles that originate from aircraft were found further away from their sources. These particles are believed to originate from the aircraft, with downward transport plumes appearing to distribute the particles further away from the source without losses to coagulation into larger particles (Austin et al. 2019). This may have implications for nearby residences. Mild respiratory effects were observed in the general population exposed to ultrafine particles from aircraft (Habre et al. 2018; Lammers et al. 2020).

A few epidemiological studies directly measure exposure to oil combustion. While some of these studies examine populations believed to be occupationally exposed to PM dominated by oil combustion sources, most studies instead measure PM and its components and apply statistical methods to attribute pollutants back to their sources (a technique known as source apportionment). Note that although many of these studies involve occupational exposures, the findings point to health effects that might be present in the ambient air, where concentrations are anticipated to be lower. Taken together, these studies suggest that there may be various health impacts from exposure to oil combustion including impacts on asthma/allergic symptoms, oxidative deoxyribonucleic acid (DNA) damage, birthweight, heart rate variability, mortality and hospitalizations, and inflammatory markers.

Gas Combustion. While there are numerous studies addressing the health impacts of exposure to gas, for communities living near gas development sites, as reviewed by Health Effects Institute-Energy (Health Effects Institute-Energy Research Committee 2019), very few epidemiological studies directly measure exposure to gas combustion products. In searching for relevant publications, papers discussing exposures to sour gas were deemed not to be relevant as sour gas from the planning area is less common.

Many of the studies of gas combustion come from the use of gas as a heating source in homes or other dwellings. For example, fumes from gas-fueled cooking were found to be associated with higher indoor air concentrations of NO_2, lower respiratory function (measured as the percentage of predicted forced expiratory volume in the first second) and higher inflammatory markers (measured as interleukin-6, IL-6) in a Danish cohort of 5,199 men and women (Lim et al. 2022). In this study, exposure to outdoor ambient air pollution and secondhand smoke were found to have greater impacts compared to exposure to gas cooking fumes.

In addition to NO_2, CO can be emitted from gas cooking source, and to a lesser extent, produced as a byproduct of cooking. Several studies examined indoor NO_2 from gas cooking and compared observed health effects as compared to homes using electric cook tops (Lin et al. 2013; Willers et al. 2006). NO_2 is not the only pollutant present in these homes, as cooking itself is a well-recognized source of PM in homes. This PM will be produced due to the cooking process itself (for example, frying, sautéing, and toasting) and is similar whether the energy source is gas or electric (Abt et al. 2000; Sun et al. 2018). NO_2 concentrations in indoor air have decreased substantially over the years, due in part to the introduction of pilot-less gas stoves (Belanger et al. 2006, 2013; Lee et al. 1998; Spengler et al. 1994; US Department of Energy 2009).

Coal Combustion. Coal combustion results in release of a variety of particulate, semi-volatile, and volatile pollutants, including a range of metals (for example, mercury, arsenic, nickel, chromium, lead, and selenium) which naturally occur in coal, and gaseous pollutants such as NOx, SO_2 and CO. When burnt in coal-fired power plants, fly ash, bottom ash (boiler slag), and flue gas desulfurization material are formed (Tishmack and Burns 2004), collectively known as coal combustion residuals (EPA 2014). The HAPs associated with coal combustion residuals generally also are found in coal combustion emissions (but are concentrated in the coal combustion residuals); the health effects of these are discussed below. In addition to air emissions from coal-fired power plants, these waste products are often disposed of in landfills, or stored in ponds at coal-fired power plants, leading to potential risk of groundwater or surface water pollution. Fugitive emissions from ash also may affect air quality.

A systematic review of epidemiology studies examining public health impacts of coal-fired power plant emissions on children's health reported 17 studies showing statistically significant associations of exposure with adverse pediatric neurodevelopment (motor, language, and total average developmental quotients), preterm births, lower birth weights, and pediatric respiratory disease (Amster and Lew Levy 2019).

Another systematic review more broadly examining the public health impacts of coal-fired power plant emissions on health identified 40 relevant studies (Amster 2021). These studies included impacts on children's health as well as adult populations. In addition to the impacts on children discussed in their earlier review (Amster and Lew Levy 2019), authors found studies that identified respiratory symptoms and disease, declines in pulmonary function, cardiovascular disease, and cancer in nearby populations. Authors point to limitations in the studies reviewed, including possible confounding by inadequate control for socioeconomic status of communities living closest to coal-fired power plants. However, several of the studies reviewed include "intervention" studies where the same population is examined during periods where coal-fired power plants are shut down, or where coal-based power generation is transitioned to other fuel sources (such as natural gas). These studies are less impacted by residual confounding.

A review of the public health impacts across the life cycle of coal production (extraction, processing, use, and waste) concludes that use of coal results in respiratory illness, cancer, cardiovascular disease, preterm birth, and premature death (Hendryx et al. 2020). Authors also discuss impacts on child development from waste products.

Criteria Air Pollutants (CAPs)

The following sections briefly review evidence for associations between short-term or long-term inhalation exposures to criteria pollutants CO, lead, O_3, PM, NO_2, and SO_2 and adverse health impacts. This information was summarized from the associated Integrative Science Assessment documents prepared by EPA in support of the NAAQS (EPA 2013, 2016, 2017b, 2019, 2020, 2022g). Each document also discusses potentially susceptible populations, which may be important for understanding environmental justice concerns in disproportionally impacted communities. The primary peer-reviewed literature, which includes both epidemiological and toxicological studies (including controlled human exposure studies), is reviewed in depth in individual EPA documents.

Most epidemiology studies of criteria pollutants involve studying large populations who are exposed to the pollutant in the ambient air. This means that individuals are exposed to a mixture of many different chemicals, including a set associated with various combustion sources. This makes it more difficult to tease out the impact of one criteria pollutant from another, but it may be possible using statistical tools. Key to supporting the epidemiology studies is supporting evidence from toxicology studies. Furthermore, since large populations are examined in these epidemiology studies, exposures are often estimated using measurements at central monitoring sites. These concentrations are then applied to an entire location (for example, a city), even though the pollutant concentration may vary within that location. Finally, different averaging times are often applied to the measurements, so associations are examined compared to short-term averages or long-term averages.

When EPA evaluates criteria pollutants for health effects, they look at all streams of scientific evidence, including epidemiology studies and toxicology studies (including both controlled human exposure studies in people and studies in laboratory animals) and come up with a set of determinations. These determinations are: causal relationship; likely to be causal relationship; suggestive of but not sufficient to infer a causal relationship; inadequate to infer the presence or absence of a causal relationship; or not likely to be a causal relationship. Table 4-75 in Section 4.6 of **Appendix C** outlines the criteria for each determination. **Table 3-42** summarizes the health impacts associated with exposure to criteria pollutants and the various health effects, along with the weight of evidence, as summarized by the EPA Integrated Science Assessments. Additional information about each pollutant is also provided below.

Exposure to PM_{10} and $PM_{2.5}$ can impact human health in a variety of ways. When inhaled, $PM_{2.5}$ can cause inflammation in the lungs (EPA 2019). Short-term exposure to PM_{10} or $PM_{2.5}$ can increase risk of myocardial infarction, with risks being stronger for the smaller $PM_{2.5}$ (Luo et al. 2015; EPA 2019) and are associated with increased risk of arrhythmias in people with heart disease (EPA 2019). Short-term exposure to $PM_{2.5}$ can lead to a variety of respiratory-related health effects, including worsening asthma or worsening symptoms of chronic obstructive pulmonary disease, leading to emergency room visits and hospital admissions (EPA 2019). Exposure of women during pregnancy to $PM_{2.5}$ is associated with lower birth weights, decreased fetal growth, and preterm births, and may contribute to respiratory-related post-neonatal deaths and potentially higher rates of infant mortality (Chen et al. 2002; Woodruff et al. 2008; EPA 2019; Kihal-Talantikite et al. 2020). Long-term exposure to $PM_{2.5}$ has been associated with higher morbidity and mortality from respiratory, cardiovascular, pulmonary, and cerebrovascular diseases, and lung cancer (Romieu et al. 2012; Liu et al. 2013; EPA 2019, 2022g).

McDuffie and co-investigators (McDuffie et al. 2021a, 2021b) examined different sources of $PM_{2.5}$ in the United States and other countries to simulate $PM_{2.5}$ concentrations in different geological regions and estimated total disease burden for six mortality endpoints and two neonatal disorders associated with exposure to ambient $PM_{2.5}$. $PM_{2.5}$ is considered a risk-driver for combustion-related air pollution. They then estimated the contribution from various sources of origin, including the categories "liquid oil and natural gas" (light oil, heavy oil, and diesel oil) and "coal" (hard coal, brown coal, coal coke; includes electricity and heat production, residential heating, and cooking). This study estimated that 3.85 million deaths occur worldwide each year from total $PM_{2.5}$ exposure in its evaluation of the contribution from anthropogenic and manmade sources in different regions. Of these, they estimate one million deaths occur globally from combustion of fossil fuels (coal, oil, and natural gas).

Table 3-42
Health Impacts from Criteria Air Pollutants

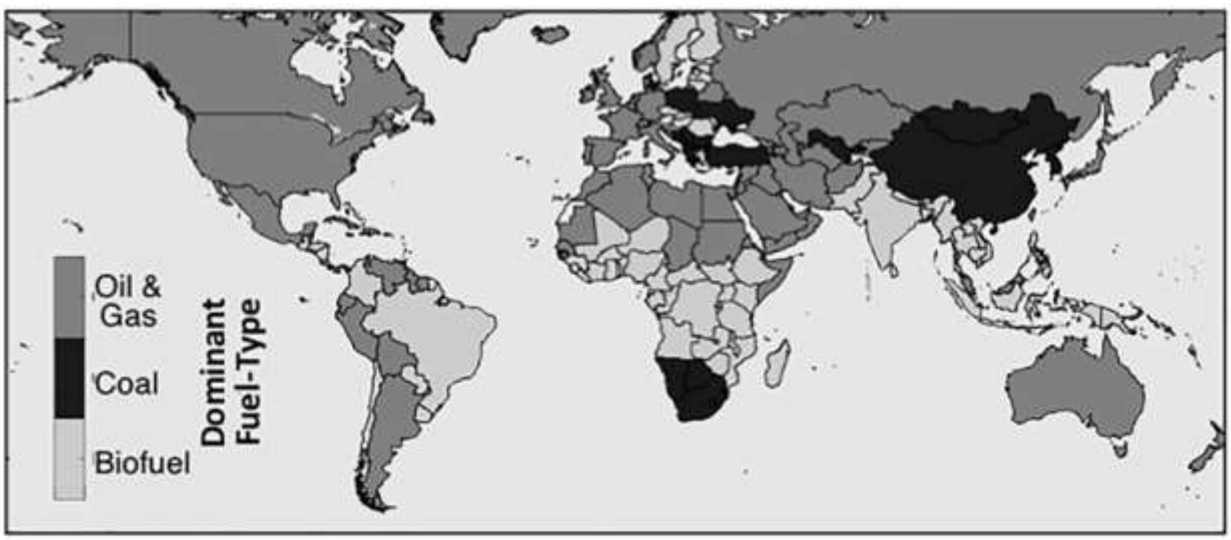
Health Impact	Exposure Duration	CO EPA (2010)	NO_2 EPA (2016)	SO_2 EPA (2017b)	O_3 EPA (2020)	$PM_{2.5}$ EPA (2019, 2022g)	$PM_{10-2.5}$ EPA (2019, 2022g)
Respiratory	Short-term	Suggestive	Causal	Causal	Causal	Likely	Suggestive
	Long-term	Inadequate	Likely	Suggestive	Likely	Likely	Inadequate
Cardiovascular	Short-term	Likely	Suggestive	Inadequate	Suggestive	Causal	Suggestive
	Long-term	Suggestive	Suggestive	Inadequate	Suggestive	Causal	Suggestive
Central Nervous System	Short-term	Suggestive	*	*	Suggestive	Suggestive	Inadequate
	Long-term	Suggestive	*	*	Suggestive	Suggestive	Suggestive
Birth Outcomes and Developmental	Consider a wide range of exposure durations	Suggestive	Suggestive/ Inadequate	Inadequate	Suggestive	Suggestive	Inadequate
Total Mortality	Short-term	Suggestive	Suggestive	Suggestive	Suggestive	Causal	Suggestive
	Long-term	Not likely	Suggestive	Inadequate	Suggestive	Causal	Suggestive
Cancer	Long-term	*	Suggestive	Inadequate	Inadequate	Likely	Suggestive
Metabolic Effects	Short-term	*	*	*	Likely	Suggestive	Inadequate
	Long-term	*	*	*	Suggestive	Suggestive	Suggestive
Susceptible Populations	Long-term or short-term	People with underlying coronary artery disease, and possibly the elderly, fetuses, people with anemia, people with obstructive lung disease, and people with diabetes	People with asthma, children, and older adults	People with pre-existing asthma, particularly children	People with pre-existing asthma, children, older adults, individuals with reduced intake of certain nutrients (that is, vitamins C and E), and outdoor workers.	Strong evidence: Children, minorities (specifically Black), and people of low socioeconomic status. Suggestive evidence: people with pre-existing cardiovascular or respiratory disease, overweight or obese, with particular genetic variants, current or former smokers. Inadequate evidence: pre-existing diabetes, older life stages, residential location, gender, or diet.	Strong evidence: Children, minorities (specifically Black), and people of low socioeconomic status. Suggestive evidence: people with pre-existing cardiovascular or respiratory disease, overweight or obese, with particular genetic variants, current or former smokers. Inadequate evidence: pre-existing diabetes, older life stages, residential location, gender, or diet.

Source: EPA Integrated Science Assessments; the referenced assessments for each pollutant are indicated in column headers.
Notes: *Causal determination not presented. Causal determination for lead is available in EPA 2013.

This study allowed the authors to address the potential contribution of the "liquid oil and natural gas" and "coal" sectors to global disease, both domestically and internationally. Dominant combustion fuel types across the globe are shown in **Figure 3-11**. In the United States, total population-weighted $PM_{2.5}$ concentrations from all source sectors were modeled as 7.8 µg/m^3, which the investigators estimate would be associated with 47,000 deaths a year or 13.2 percent of the total global burden of disease. These deaths were largely estimated to be from stroke and ischemic heart disease. Of these deaths, the combined sector "oil and gas" was the dominant contributor, with approximately 25 percent of the deaths attributable to that fuel source. Globally, total population-weighted $PM_{2.5}$ concentrations from all source sectors were modeled as 41.7 µg/m^3, which the investigators estimate would be associated with 3,833,000 activities, with an additional 20 percent attributable to solid biomass fuel, particularly for residential heating and cooking activities.

Note that population-weighted exposures to $PM_{2.5}$ are not directly proportional to deaths. For example, while $PM_{2.5}$ concentrations were relatively lower in the United States compared to many other countries, the United States had high burdens of disease because of demographic differences (for example, older populations) and lower prevalence of infectious diseases.

Figure 3-11
Dominant Combustion Fuel Type



Source: McDuffie et al. 2021b

Exposure to $PM_{2.5}$ and the burden of disease from that exposure varies globally, based on demographics as well as $PM_{2.5}$ concentrations. Seventy-seven percent of the deaths attributable to $PM_{2.5}$ worldwide are in east Asia and south Asia, where $PM_{2.5}$ concentrations are 5- to 10-fold higher than those in the United States. A variety of factors contribute to this, including the health and age of the overall population, as well as the $PM_{2.5}$ exposure concentrations and the sources of the $PM_{2.5}$. For example, coal combustion is much greater in China and India compared to the United States, leading to more $PM_{2.5}$ from that source. Since $PM_{2.5}$ composition will vary with source, these differences might impact the overall burden of disease in these locations, making the relative impact of combustion lower in these countries. On the other hand, the modeled disease impact of $PM_{2.5}$ sources in the United States (where the population-weighted annual $PM_{2.5}$ concentration in 2017 was 7.8 µg/m^3) is higher than the modeled disease impacts other countries with higher $PM_{2.5}$ exposures (for example, in Iran where 2017 annual $PM_{2.5}$ concentrations were 38.3 $\mu g/m^3$). This is likely due to the greater proportion of elderly in the United States, as the elderly are a susceptible population.

The nature of impacts on air quality and public health due to the foreign combustion of coal, oil, and gas produced in the planning area would be similar to those discussed above except that impacts would be higher if emission controls were less stringent; impacts would also be influenced by the atmospheric environment in the region and the population characteristics.

Exposure to SO_2 can also irritate the nose, throat, and respiratory tract. Breathing SO_2 can cause coughing, wheezing, and shortness of breath and exacerbate respiratory symptoms of other medical conditions (Greenberg et al. 2016, 2017; EPA 2017b). Studies have found that exposure to SO_2 is associated with increased severity and frequency of asthma attacks (Greenberg et al. 2016, 2017; EPA 2017b) and has been correlated with higher rates of asthma hospitalization, particularly among children and adults over 65 years old. Even relatively low levels of SO_2 concentrations (<10 ppb 24-hr average) are associated with increased risk of cardiovascular and respiratory deaths (EPA 2017b).

Exposure to NOx can also irritate the eyes, nose, throat, and respiratory tract. Exposure to NOx reportedly can lead to coughing and choking, shortness of breath, tiredness, nausea, and headache (US Department of Health and Human Services 2014) and can exacerbate respiratory diseases, like asthma (Greenberg et al. 2016, 2017; EPA 2016). Studies have found that even exposures to low concentrations may be associated with increased respiratory infections and emergency hospital visits (Lin et al. 2003; EPA 2016). Long-term exposure to NOx has been associated with decreases in lung function, increased risk of developing respiratory conditions, and increased responses to allergens (Barck et al. 2002; EPA 2016). People with asthma, especially children and the elderly, are most susceptible to adverse health effects from NOx (EPA 2016).

CO, like oxygen, binds to hemoglobin, the protein that transports oxygen through the bloodstream and releases it to cells and tissues. Hemoglobin is much more likely to bind CO compared to oxygen, so even small amounts present in the blood can impact oxygenation in the body (US Department of Health and Human Services 2012a). Exposure to CO is associated with heart disease, especially among individuals with existing heart or lung disease (Chaitman et al. 1992; Bell et al. 2009; US Department of Health and Human Services 2012a). It can also lead to headaches, dizziness, and cognitive difficulties, particularly at higher exposures (US Department of Health and Human Services 2012a). CO exposure during pregnancy can be dangerous for the development of the fetus and may cause preterm birth and cardiac birth defects (Salam et al. 2005; US Department of Health and Human Services 2012a).

Exposure to O_3 is associated with a variety of respiratory issues, including chest pain, coughing, throat irritation, and congestion (EPA 2020). O_3 can reduce pulmonary function and worsen existing chronic respiratory diseases such as bronchitis and emphysema and can also bring on asthma attacks in those with pre-existing disease. Exposure to O_3 can also increase the risk of respiratory infections. Children are at greatest risk from exposure to O_3 because their lungs are still developing, and exposures may be particularly high when they are active outdoors and O_3 levels are high. Repeated exposure to O_3 can inflame the lining of the lungs, potentially leading to scarring of the pulmonary tissue.

Exposure to lead is associated with a variety of neurobehavioral issues (EPA 2013). Exposure of children to any amount of lead can cause cognitive function decrements, such as reduced IQ, decreased academic performance, and poor performance on tests of executive function. Exposure to lead is also associated with decreased attention, increased impulsivity and hyperactivity, and possibly conduct disorders in children and young adults. Exposure of children or adults to lead may cause hypertension and harmful effects on sperm, the blood and blood-forming organs, and the immune system.

Hazardous Air Pollutants

Unlike for criteria pollutants, HAPs are evaluated under the EPA Integrative Risk Information System (IRIS) and have toxicological review documents prepared. The toxicological review is a critical review of the physicochemical and toxicokinetic properties of the chemical and its toxicity in humans and experimental systems. The assessment presents reference values for noncancer effects of a chemical (reference concentration for inhalation exposure) and a cancer assessment (including both a qualitative and quantitative risk), where supported by available data.

To select the most important HAPs for gas, oil, and coal combustion, a combination of expert judgement and publications examining risks in such mixtures was used. For example, Electric Power Research Institute conducted a multi-pathway risk assessment of pollutants from coal-fired power plants and found that arsenic, chromium, and nickel were risk drivers for cancer risk and hydrogen chloride, arsenic and acrolein were risk drivers for noncancer effects from inhalation exposures (Electric Power Research Institute 2018a, b). Benzene, toluene, ethylbenzene, and xylenes are commonly emitted from combustion of fuel from mobile sources. **Table 3-43** summarizes the most sensitive noncancer endpoint, the cancer assessment, and the benchmark health values for acrolein, arsenic, benzo(a)pyrene, benzene, 1,3 butadiene, cadmium, chlorine, chromium, dioxins and furans, ethylbenzene, formaldehyde, *n*-hexane, hydrogen chloride, mercury, manganese, nickel, toluene, and xylenes. Further information about these pollutants is discussed in **Appendix C**.

Table 3-43
Health Impacts from Select Hazardous Air Pollutants Found in Combustion Products of Coal, Oil, and Natural Gas

Chemical (Data Source)	**Non-Cancer Endpoints (most sensitive)**	**Reference Concentration (mg/m3)**	**Cancer Assessment****	**Cancer Potency (per µg/m^3)**
Acrolein (EPA 2003a, 1999)	Respiratory System (Nasal lesions)	2×10^{-5}	Inadequate information to assess cancer potential	Inadequate information to assess carcinogenic potential
Arsenic* (EPA 1986, 1995a)	Respiratory System	Not assessed under the IRIS Program	Human carcinogen (Lung Cancer)	4.3×10^{-3}
Benzo(a)pyrene (EPA 2005a, 2017b)	Developmental System	2×10^{-6}	Carcinogenic to humans (Respiratory, Gastrointestinal)	6×10^{-4}
Benzene (EPA 1986, 1996, 2002a)	Immune – hematotoxicity	3×10^{-2}	Known human carcinogen (Leukemia)	2.2×10^{-6}

Chemical (Data Source)	**Non-Cancer Endpoints (most sensitive)**	**Reference Concentration (mg/m3)**	**Cancer Assessment****	**Cancer Potency (per µg/m³)**
1,3-Butadiene (EPA 1999, 2002b)	Reproductive System	2×10^{-3}	Known human carcinogen (Lymphohematopoietic System)	3×10^{-5}
Cadmium (EPA 1986, 1987a)	Not assessed under the IRIS Program	Not assessed under the IRIS Program	Probable human carcinogen	1.8×10^{-3}
Chlorine (EPA 1994)	Not assessed under the IRIS Program	Not assessed under the IRIS Program	Not assessed under the IRIS Program	Not assessed under the IRIS Program
Chromium* (EPA 1986, 1996, 1998)	Respiratory System	8×10^{-6} (Chromic acid mists and dissolved chromium aerosols)	Human Carcinogen (EPA, 1986) Known/likely human carcinogen (EPA, 1996) (Lung Cancer)	1×10^{-2}
	Respiratory System	1×10^{-4} (chromium particulates)		
Dioxins and Furans	Not assessed under the IRIS program	Not assessed under the IRIS program	Not assessed under the IRIS program	Not assessed under the IRIS program
Ethylbenzene* (EPA 1986, 1991a)	Developmental	1	Not classifiable as to human carcinogenicity	Inadequate information to assess carcinogenic potential
Formaldehyde (EPA 1986, 1991b, 1999; Kaden et al. 2010)	Irritation at site of contact (for example, skin, eyes, and upper respiratory)	Not assessed under the IRIS Program	Probable human carcinogen	1.3×10^{-5}
***n*-Hexane** (EPA 2005a, b)	Nervous system	7×10^{-1}	Inadequate information to assess cancer potential	Inadequate information to assess carcinogenic potential
Hydrogen Chloride (EPA 1995b)	Respiratory System	2×10^{-2}	Not assessed under the IRIS program.	Not assessed under the IRIS program.
Mercury, elemental (EPA 1986, 1995c)	Nervous System	3×10^{-4}	Not classifiable as to human carcinogenicity	Not assessed under the IRIS Program
Methylmercury* (EPA 2001)	Nervous System	Not assessed under the IRIS Program	Possible human carcinogen	Not assessed under the IRIS program.
Manganese (EPA 1986, 1995c)	Nervous System	5×10^{-5}	Not classifiable as to human carcinogenicity	Not assessed under the IRIS program
Nickel (Nickel subsulfide) (EPA 1986, 1987b)	Respiratory System	Not assessed under the IRIS Program	Human Carcinogen (Lung Cancer)	4.8×10^{-4}

Chemical (Data Source)	**Non-Cancer Endpoints (most sensitive)**	**Reference Concentration (mg/m3)**	**Cancer Assessment****	**Cancer Potency (per µg/m^3)**
Toluene (EPA 2005a, c)	Nervous System	5	Inadequate information to assess cancer potential	Inadequate information to assess carcinogenic potential
Xylenes (EPA 1999, 2003b)	Nervous System	1×10^{-1}	Inadequate information to assess cancer potential	Inadequate information to assess carcinogenic potential

Source: Referenced information for each pollutant is indicated in the first column.
Notes: *Reviews of these HAPs are currently (2023) being updated by EPA.
**Chemicals assessed under EPA's 1986, draft 1996, or 2005 Guidelines for Carcinogenic Risk Assessment have different cancer assessment notations, as EPA has restructured the cancer assessment categories when updating the guidelines.

Public health impacts from fossil fuel combustion will be experienced more acutely in susceptible sub-populations (see **Table 3-42**). This is particularly important in disproportionately impacted communities. This is discussed further in **Section 3.6**.

Alternative A

Under this alternative, the production and emissions due to existing federal coal leases and associated mining, transportation, and downstream combustion discussed in **Section 3.3.1** would occur. Pending federal lease applications are forecasted to provide production from 2036 to 2061, with potential future subsequent federal leases providing production from 2062 to 2088. Emissions from mining, transportation, and downstream combustion of the coal from pending federal lease applications and potential future subsequent federal leases would occur during those periods.

Emissions of CAPs and HAPs from the mining, transportation, and downstream combustion of coal from pending federal lease applications under Alternative A are shown in **Table 3-44**, **Table 3-45**, and **Table 3-46**, respectively. Emissions are shown through 2088 in each table because 2088 is the year when coal is exhausted under Alternatives A and B to facilitate comparison across all alternatives. The emissions from coal produced from pending federal lease applications would occur from 2036 to 2061, and then be zero after that point. Emissions from the mining, transportation, and downstream combustion of coal from potential future subsequent federal leases are shown in **Table 3-47**, **Table 3-48**, and **Table 3-49**, respectively. These emissions would occur from 2062 until 2088.

The modeled annual federal coal production in the BLM regional photochemical modeling study in the MCFO planning area for circa 2028 was 11.9 million tons. Thus, the projected peak annual federal coal production under Alternative A is much lower (by approximately 47 percent) than that modeled, so federal coal production and downstream combustion impacts are expected to be correspondingly lower than that modeled. The nature of downstream combustion-related public health impacts under Alternative A would be similar to the types of impacts discussed in the section *Downstream Combustion Impacts on Air Quality and Public Health*.

Table 3-44
Annual Coal Mining Emissions of Criteria and Hazardous Air Pollutants due to Federal Production from Pending Federal Lease Applications in the Planning Area under Alternative A

Years	Annual Production (tons/year)	PM_{10} (tons/year)	$PM_{2.5}$ (tons/year)	NOx (tons/year)	CO (tons/year)	VOC (tons/year)	SO_2 (tons/year)	DPM (tons/year)	HAP (tons/year)
2023-2035	0	0	0	0	0	0	0	0	0
2036	6,010,658	671.1	158.2	562.5	448.3	41.9	10.5	18.9	4.2
2037-2061	6,270,578	700.1	165.0	586.8	467.6	43.7	11.0	19.7	4.4
2062-2088	0	0	0	0	0	0	0	0	0

Notes: Production from pending federal lease applications would occur from 2036-2050.

Table 3-45
Annual Coal Transportation Emissions of Criteria and Hazardous Air Pollutants due to Federal Production from Pending Federal Lease Applications in the Planning Area under Alternative A

Years	Annual Production (tons/year)	PM_{10} (tons/year)	$PM_{2.5}$ (tons/year)	NOx (tons/year)	CO (tons/year)	VOC (tons/year)	SO_2 (tons/year)	DPM (tons/year)	HAP (tons/year)
2023-2035	0	0	0	0	0	0	0	0	0
2036	6,010,658	16.0	15.5	916.8	664.0	34.7	2.3	15.5	15.3
2037-2061	6,270,578	16.6	16.1	900.0	692.7	35.8	2.4	16.1	15.8
2062-2088	0	0	0	0	0	0	0	0	0

Notes: Production from pending federal lease applications would occur from 2036-2050.

Table 3-46
Annual Coal Downstream Combustion Emissions of Criteria and Hazardous Air Pollutants due to Federal Production from Pending Federal Lease Applications in the Planning Area under Alternative A

Years	Annual Production (tons/year)	PM_{10} (tons/year)	$PM_{2.5}$ (tons/year)	Nox (tons/year)	CO (tons/year)	VOC (tons/year)	SO_2 (tons/year)	DPM (tons/year)	HAP (tons/year)
2023-2035	0	0	0	0	0	0	0	0	0
2036	6,010,658	Qualitatively Addressed in Section on *Downstream Combustion Impacts on Air Quality and Public Health*							
2037-2061	6,270,578								
2062-2088	0	0	0	0	0	0	0	0	0

Notes: Production from pending federal lease applications would occur from 2036-2050.

Table 3-47
Annual Coal Mining Emissions of Criteria and Hazardous Air Pollutants due to Federal Coal Production from Potential Future Subsequent Federal Lease Applications in the Planning Area under Alternative A

Years	Annual Production (tons/year)	PM_{10} (tons/year)	$PM_{2.5}$ (tons/year)	Nox (tons/year)	CO (tons/year)	VOC (tons/year)	SO_2 (tons/year)	DPM (tons/year)	HAP (tons/year)
2023-2061	0	0	0	0	0	0	0	0	0
2062-2088	6,270,578	700.1	165.0	586.8	467.6	43.7	11.0	19.7	4.4

Table 3-48
Annual Coal Transportation Emissions of Criteria and Hazardous Air Pollutants due to Federal Coal Production from Potential Future Subsequent Federal Lease Applications in the Planning Area under Alternative A

Years	Annual Production (tons/year)	PM_{10} (tons/year)	$PM_{2.5}$ (tons/year)	Nox (tons/year)	CO (tons/year)	VOC (tons/year)	SO_2 (tons/year)	DPM (tons/year)	HAP (tons/year)
2023-2061	0	0	0	0	0	0	0	0	0
2062-2088	6,270,578	16.6	16.1	900.0	692.7	35.8	2.4	16.1	15.8

Table 3-49
Annual Coal Downstream Combustion Emissions of Criteria and Hazardous Air Pollutants due to Federal Coal Production from Potential Future Subsequent Federal Lease Applications in the Planning Area under Alternative A

Years	Annual Production (tons/year)	PM_{10} (tons/year)	$PM_{2.5}$ (tons/year)	NOx (tons/year)	CO (tons/year)	VOC (tons/year)	SO_2 (tons/year)	DPM (tons/year)	HAP (tons/year)
2023-2061	0	0	0	0	0	0	0	0	0
2062-2088	6,270,578	Qualitatively addressed in section on *Downstream Combustion Impacts on Air Quality and Public Health*							

Alternative B

The RFD scenario does not change between Alternatives A and B, even though the acres available for leasing are different between the alternatives. This is because under Alternatives A and B there are sufficient lands available for leasing to meet the needs of the RFD. In other words, the coal screens in these alternatives do not constrain the reasonably foreseeable federal coal production (see **Appendix B**). As the production under Alternative B would be the same as Alternative A, the corresponding emissions and impacts would also be the same. Emissions of CAPs and HAPs from the mining, transportation, and downstream combustion of coal from pending federal lease applications under Alternative B are shown in **Table 3-50, Table 3-51**, and **Table 3-52**, respectively, and the emissions from potential future subsequent federal leases are shown in **Table 3-53, Table 3-54**, and **Table 3-55**, respectively. The conclusions discussed above under Alternative A with respect to impacts due to coal-related emissions also apply here.

In general, Alternatives A and B would have the highest impact across all alternatives.

Table 3-50
Annual Coal Mining Emissions of Criteria and Hazardous Air Pollutants due to Federal Production from Pending Federal Lease Applications in the Planning Area under Alternative B

Years	Annual Production (tons/year)	PM_{10} (tons/year)	$PM_{2.5}$ (tons/year)	Nox (tons/year)	CO (tons/year)	VOC (tons/year)	SO_2 (tons/year)	DPM (tons/year)	HAP (tons/year)
2023-2035	0	0	0	0	0	0	0	0	0
2036	6,010,658	671.1	158.2	562.5	448.3	41.9	10.5	18.9	4.2
2037-2061	6,270,578	700.1	165.0	586.8	467.6	43.7	11.0	19.7	4.4
2062-2088	0	0	0	0	0	0	0	0	0

Notes: Production from pending federal lease applications would occur from 2036-2050.

Table 3-51
Annual Coal Transportation Emissions of Criteria and Hazardous Air Pollutants due to Federal Production from Pending Federal Lease Applications in the Planning Area under Alternative B

Years	Annual Production (tons/year)	PM_{10} (tons/year)	$PM_{2.5}$ (tons/year)	Nox (tons/year)	CO (tons/year)	VOC (tons/year)	SO_2 (tons/year)	DPM (tons/year)	HAP (tons/year)
2023-2035	0	0	0	0	0	0	0	0	0
2036	6,010,658	16.0	15.5	916.8	664.0	34.7	2.3	15.5	15.3
2037-2061	6,270,578	16.6	16.1	900.0	692.7	35.8	2.4	16.1	15.8
2062-2088	0	0	0	0	0	0	0	0	0

Notes: Production from pending federal lease applications would occur from 2036-2050.

Table 3-52
Annual Coal Downstream Combustion Emissions of Criteria and Hazardous Air Pollutants due to Federal Production from Pending Federal Lease Applications in the Planning Area under Alternative B

Years	Annual Production (tons/year)	PM_{10} (tons/year)	$PM_{2.5}$ (tons/year)	Nox (tons/year)	CO (tons/year)	VOC (tons/year)	SO_2 (tons/year)	DPM (tons/year)	HAP (tons/year)
2023-2035	0	0	0	0	0	0	0	0	0
2036	6,010,658	Qualitatively Addressed in Section on *Downstream Combustion Impacts on Air Quality and Public Health*							
2037-2061	6,270,578								
2062-2088	0	0	0	0	0	0	0	0	0

Notes: Production from pending federal lease applications would occur from 2036-2050.

Table 3-53
Annual Coal Mining Emissions of Criteria and Hazardous Air Pollutants due to Federal Coal Production from Potential Future Subsequent Federal Lease Applications in the Planning Area under Alternative B

Years	Annual Production (tons/year)	PM_{10} (tons/year)	$PM_{2.5}$ (tons/year)	NOx (tons/year)	CO (tons/year)	VOC (tons/year)	SO_2 (tons/year)	DPM (tons/year)	HAP (tons/year)
2023-2061	0	0	0	0	0	0	0	0	0
2062-2088	6,270,578	700.1	165.0	586.8	467.6	43.7	11.0	19.7	4.4

Table 3-54
Annual Coal Transportation Emissions of Criteria and Hazardous Air Pollutants due to Federal Coal Production from Potential Future Subsequent Federal Lease Applications in the Planning Area under Alternative B

Years	Annual Production (tons/year)	PM_{10} (tons/year)	$PM_{2.5}$ (tons/year)	Nox (tons/year)	CO (tons/year)	VOC (tons/year)	SO_2 (tons/year)	DPM (tons/year)	HAP (tons/year)
2023-2061	0	0	0	0	0	0	0	0	0
2062-2088	6,270,578	16.6	16.1	900.0	692.7	35.8	2.4	16.1	15.8

Table 3-55
Annual Coal Downstream Combustion Emissions of Criteria and Hazardous Air Pollutants due to Federal Coal Production from Potential Future Subsequent Federal Lease Applications in the Planning Area under Alternative B

Years	Annual Production (tons/year)	PM_{10} (tons/year)	$PM_{2.5}$ (tons/year)	Nox (tons/year)	CO (tons/year)	VOC (tons/year)	SO_2 (tons/year)	DPM (tons/year)	HAP (tons/year)
2023-2061	0	0	0	0	0	0	0	0	0
2062-2088	6,270,578	Qualitatively Addressed in Section on *Downstream Combustion Impacts on Air Quality and Public Health*							

Alternative C

Under Alternative C, only the portions of the pending federal lease applications within the existing federal mine plan boundary would be acceptable for leasing, and there would be no federal coal acres available to cover the portion of the pending federal lease applications outside the current federal mine plan boundary or any potential future subsequent federal leases (**Appendix B**). BLM forecasts that the portion of the pending federal lease applications within the current federal mine plan boundary would provide production from 2036 until 2050. Emissions of CAPs and HAPs from the mining, transportation, and downstream combustion of coal from pending federal lease applications in the planning area under Alternative C are shown in **Table 3-56**, **Table 3-57**, and **Table 3-58**, respectively. Emissions are shown through 2088 in each table because 2088 is the year when coal is exhausted under Alternatives A and B to facilitate comparison across all alternatives; however, production and emissions from federal coal under Alternative C would be zero after 2050. There would be no future subsequent federal leases under Alternative C, and so the mining, transportation, and downstream combustion emissions from potential future subsequent federal leases would be zero (**Table 3-59**, **Table 3-60,** and **Table 3-61** respectively).

Impacts under Alternative C would be significantly lower than Alternative A and B beyond 2051.

Table 3-56
Annual Coal Mining Emissions of Criteria and Hazardous Air Pollutants due to Federal Production from Pending Federal Lease Applications in the Planning Area under Alternative C

Years	Annual Production (tons/year)	PM_{10} (tons/year)	$PM_{2.5}$ (tons/year)	NOx (tons/year)	CO (tons/year)	VOC (tons/year)	SO_2 (tons/year)	DPM (tons/year)	HAP (tons/year)
2023-2035	0	0	0	0	0	0	0	0	0
2036	6,010,658	671.1	158.2	562.5	448.3	41.9	10.5	18.9	4.2
2037-2050	6,270,578	700.1	165.0	586.8	467.6	43.7	11.0	19.7	4.4
2051-2088	0	0	0	0	0	0	0	0	0

Notes: Production from pending federal lease applications would occur from 2036-2050.

Table 3-57
Coal Transportation Emissions of Criteria and Hazardous Air Pollutants due to Federal Production from Pending Federal Lease Applications in the Planning Area under Alternative C

Years	Annual Production (tons/year)	PM_{10} (tons/year)	$PM_{2.5}$ (tons/year)	Nox (tons/year)	CO (tons/year)	VOC (tons/year)	SO_2 (tons/year)	DPM (tons/year)	HAP (tons/year)
2023-2035	0	0	0	0	0	0	0	0	0
2036	6,010,658	16.0	15.5	916.8	664.0	34.7	2.3	15.5	15.3
2037-2050	6,270,578	16.6	16.1	900.0	692.7	35.8	2.4	16.1	15.8
2051-2088	0	0	0	0	0	0	0	0	0

Notes: Production from pending federal lease applications would occur from 2036-2050.

Table 3-58
Coal Downstream Combustion Emissions of Criteria and Hazardous Air Pollutants due to Federal Production from Pending Federal Lease Applications in the Planning Area under Alternative C

Years	Annual Production (tons/year)	PM_{10} (tons/year)	$PM_{2.5}$ (tons/year)	Nox (tons/year)	CO (tons/year)	VOC (tons/year)	SO_2 (tons/year)	DPM (tons/year)	HAP (tons/year)
2023-2035	0	0	0	0	0	0	0	0	0
2036	6,010,658	Qualitatively addressed in section on *Downstream Combustion Impacts on Air Quality and Public Health*							
2037-2050	6,270,578								
2051-2088	0	0	0	0	0	0	0	0	0

Notes: Production from pending federal lease applications would occur from 2036-2050.

Table 3-59
Annual Coal Mining Emissions of Criteria and Hazardous Air Pollutants due to Federal Coal Production from Potential Future Subsequent Federal Lease Applications in the Planning Area under Alternative C

Years	Annual Production (tons/year)	PM_{10} (tons/year)	$PM_{2.5}$ (tons/year)	NOx (tons/year)	CO (tons/year)	VOC (tons/year)	SO_2 (tons/year)	DPM (tons/year)	HAP (tons/year)
2023-2088	0	0	0	0	0	0	0	0	0

Table 3-60
Annual Coal Transportation Emissions of Criteria and Hazardous Air Pollutants due to Federal Coal Production from Potential Future Subsequent Federal Lease Applications in the Planning Area under Alternative C

Years	Annual Production (tons/year)	PM_{10} (tons/year)	$PM_{2.5}$ (tons/year)	NOx (tons/year)	CO (tons/year)	VOC (tons/year)	SO_2 (tons/year)	DPM (tons/year)	HAP (tons/year)

Table 3-61
Annual Coal Downstream Combustion Emissions of Criteria and Hazardous Air Pollutants due to Federal Coal Production from Potential Future Subsequent Federal Lease Applications in the Planning Area under Alternative C

Years	Annual Production (tons/year)	PM_{10} (tons/year)	$PM_{2.5}$ (tons/year)	NOx (tons/year)	CO (tons/year)	VOC (tons/year)	SO_2 (tons/year)	DPM (tons/year)	HAP (tons/year)
2023-2088	0	0	0	0	0	0	0	0	0

Alternative D

Under this alternative, the production and emissions due to existing federal coal leases and associated mining, transportation, and downstream combustion discussed in **Section 3.3.1** would occur. However, there would be no emissions or air quality impacts from coal mining, transportation, and downstream combustion due to pending federal lease applications (**Table 3-62**, **Table 3-63**, **Table 3-64**) or potential future subsequent federal leases (**Table 3-65**, **Table 3-66**, **Table 3-67**), as pending federal lease applications and potential future subsequent federal coal leases would be denied or returned. Emissions are shown through 2088 in each table because 2088 is the year when coal is exhausted under Alternatives A and B to facilitate comparison across all alternatives.

D would have the lowest impact across all alternatives.

Table 3-62
Annual Coal Mining Emissions of Criteria and Hazardous Air Pollutants due to Federal Production from Pending Federal Lease Applications in the Planning Area under Alternative D

Years	Annual Production (tons/year)	PM_{10} (tons/year)	$PM_{2.5}$ (tons/year)	NOx (tons/year)	CO (tons/year)	VOC (tons/year)	SO_2 (tons/year)	DPM (tons/year)	HAP (tons/year)
2023-2088	0	0	0	0	0	0	0	0	0

Notes: The pending federal lease applications occur in the years 2036-2050.

Table 3-63
Coal Transportation Emissions of Criteria and Hazardous Air Pollutants due to Federal Production from Pending Federal Lease Applications in the Planning Area under Alternative D

Years	Annual Production (tons/year)	PM_{10} (tons/year)	$PM_{2.5}$ (tons/year)	NOx (tons/year)	CO (tons/year)	VOC (tons/year)	SO_2 (tons/year)	DPM (tons/year)	HAP (tons/year)
2023-2088	0	0	0	0	0	0	0	0	0

Notes: The pending federal lease applications occur in the years 2036-2050.

Table 3-64
Coal Downstream Combustion Emissions of Criteria and Hazardous Air Pollutants due to Federal Production from Pending Federal Lease Applications in the Planning Area under Alternative D

Years	Annual Production (tons/year)	PM_{10} (tons/year)	$PM_{2.5}$ (tons/year)	NOx (tons/year)	CO (tons/year)	VOC (tons/year)	SO_2 (tons/year)	DPM (tons/year)	HAP (tons/year)
2023-2088	0	0	0	0	0	0	0	0	0

Notes: The pending federal lease applications occur in the years 2036-2050.

Table 3-65
Annual Coal Mining Emissions of Criteria and Hazardous Air Pollutants due to Federal Coal Production from Potential Future Subsequent Federal Leases in the Planning Area under Alternative D

Years	Annual Production (tons/year)	PM_{10} (tons/year)	$PM_{2.5}$ (tons/year)	NOx (tons/year)	CO (tons/year)	VOC (tons/year)	SO_2 (tons/year)	DPM (tons/year)	HAP (tons/year)
2023-2088	0	0	0	0	0	0	0	0	0

Table 3-66
Annual Coal Transportation Emissions of Criteria and Hazardous Air Pollutants due to Federal Coal Production from Potential Future Subsequent Federal Leases in the Planning Area under Alternative D

Years	Annual Production (tons/year)	PM_{10} (tons/year)	$PM_{2.5}$ (tons/year)	NOx (tons/year)	CO (tons/year)	VOC (tons/year)	SO_2 (tons/year)	DPM (tons/year)	HAP (tons/year)
2023-2088	0	0	0	0	0	0	0	0	0

Table 3-67
Annual Coal Downstream Combustion Emissions of Criteria and Hazardous Air Pollutants due to Federal Coal Production from Potential Future Subsequent Federal Leases in the Planning Area under Alternative D

Years	Annual Production (tons/year)	PM_{10} (tons/year)	$PM_{2.5}$ (tons/year)	NOx (tons/year)	CO (tons/year)	VOC (tons/year)	SO_2 (tons/year)	DPM (tons/year)	HAP (tons/year)
2023-2088	0	0	0	0	0	0	0	0	0

3.3.3 Cumulative Impacts

Cumulative emissions are presented for criteria pollutants and HAPs in the peak year of total (federal plus nonfederal) coal production in the planning area (**Table 3-68**). Because the peak year (2024) of production occurs when only existing federal and nonfederal leases are being developed, the cumulative emissions are the same across all alternatives. Cumulative emissions would be lower in all future years.

Because the BLM regional photochemical modeling study uses all known cumulative sources in the United States and background contributions from outside the country, it represents a cumulative analysis. The modeling shows that contributions from federal coal and oil and gas development are unlikely to result in exceedances of the standards; however, elevated concentrations or deposition may be present near sources such as mines, well pads, and power plants. The BLM will continue to follow its Adaptive Management Strategy outlined in the 2015 RMP (BLM 2015b) to mitigate potential impacts.

Table 3-68
Coal Mining Emissions of Criteria and Hazardous Air Pollutants in the Peak Year* of Total (Federal plus Nonfederal) Coal Production in the Planning Area

Mineral Designation	Annual Production (tons/year)	PM_{10} (tons/year)	$PM_{2.5}$ (tons/year)	NOx (tons/year)	CO (tons/year)	VOC (tons/year)	SO_2 (tons/year)	DPM (tons/year)	HAP (tons/year)
Existing Federal Leases	11,046,605	1,506.3	276.0	1,036.5	868.9	76.2	20.8	34.4	7.6
Pending Federal Lease Applications	0	0	0	0	0	0	0	0	0
Potential Future Subsequent Federal Leases	0	0	0	0	0	0	0	0	0
Total Federal	11,046,605	1,506.3	276.0	1,036.5	868.9	76.2	20.8	34.4	7.6
Nonfederal	10,517,605	1,495.7	243.4	941.6	809.6	68.7	19.5	31.0	6.9
Total	**10,929,783**	**3,002.0**	**519.4**	**1,978.1**	**1,678.5**	**144.9**	**40.3**	**65.4**	**14.5**

* The peak year of total (federal + nonfederal) production from 2023 to 2088 occurs in 2023 and 2024. Emissions for 2024 are shown here because federal production and thus emissions are higher in that year.

3.3.4 Summary

There are two mines in the MCFO planning area that are actively mining federal coal—the Rosebud Mine and Spring Creek Coal Company Mine. CAP and HAP emissions from the mining and transportation of federal coal produced at these mines are evaluated separately for existing leases, pending lease applications, and potential future subsequent federal leases. Similar emissions are developed for the production and midstream processing of federal and nonfederal oil and gas in the planning area. A qualitative assessment was performed to assess the air quality and public health impacts of downstream combustion of coal and oil and gas due to uncertainties in available information.

All four alternatives have the same projected oil and gas production. Consequently, the impacts from production or combustion of oil and gas produced in the planning area would be the same for all alternatives.

Alternatives A and B would have identical coal production in any year due to the approval and development of pending federal lease applications or potential future subsequent federal leases and therefore would have comparable impacts from coal production and transportation.

Under Alternative D, BLM would not approve pending federal lease applications or any new federal lease applications. Thus, there would be no impacts from production or transportation in any year due to the federal action in this alternative.

During both 2036-2038 (that is, through end of the planning period) and 2039-2050, Alternatives A, B, and C would have identical coal production from the approval and development of pending federal lease applications and thus would have comparable impacts. Alternative D would have no impact as explained above.

Unlike Alternatives A and B, Alternative C would not approve federal coal leases applications outside the existing federal mine plan boundaries or any future subsequent coal leases. Therefore, Alternative C would result in production impacts from the federal action only as long as coal was available from leases within the existing federal mine plan boundaries (that is, through 2050). Impacts would be comparable to those modeled by BLM in the regional photochemical modeling study. From 2051 onwards, Alternative C would result in no air quality impacts.

During 2062-2088, Alternatives C and D are anticipated to have no impacts from production or downstream coal combustion, while Alternatives A and B would continue to have similar impacts due to the subsequent new federal leasing and development of approximately 169 million tons of coal.

The four alternatives have the same nonfederal production within the planning area in any year and hence would have comparable impacts due to nonfederal production. Cumulative source modeling performed as part of the BLM regional modeling study indicates that federal coal or oil and gas production would not contribute to exceedances of air quality standards. Some elevated concentrations occur at or near locations of coal mining, oil and gas production, or downstream combustion. The BLM will follow the Adaptive Management Strategy described in the 2015 RMP to mitigate potential impacts from federal development.

Downstream combustion of oil, natural gas, and coal produced in the planning area would lead to emissions of CAPs and HAPs, which may impact air quality and public health. Air quality impacts affecting public health include changes to pollutant concentrations in the air and changes to deposition of pollutants on soils and water that may indirectly affect human health. Due to the numerous uncertainties in such an assessment, a qualitative analysis was performed to assess the air quality and public health impacts from downstream combustion of planning area coal, oil, and natural gas. From an air quality perspective, some of the key pollutants resulting from downstream oil, gas, and coal combustion are O_3, $PM_{2.5}$, PM_{10}, SO_2, NO_2, NH_3, HAPs such as mercury, and VOCs. Adverse public health effects could occur for O_3, NOx, SO_2, $PM_{10-2.5}$, $PM_{2.5}$, acrolein, benzene, 1,3-butadiene, ethylbenzene, formaldehyde, hexane, hydrogen chloride, toluene, xylenes, arsenic, hexavalent chromium, mercury, benzo(a)pyrene, cadmium, chlorine gas, dioxins, manganese, and nickel due to their high exposure or high toxicity.

Natural gas and coal are primarily burned in stationary EGUs or industrial sources, whereas oil is mostly burned in mobile sources. National annual emissions from the EPA's National Emissions Inventory indicate that coal combustion emissions of CAPs and the HAPs listed above are dominated by EGUs. Petroleum product combustion emissions of CO, NH_3, VOCs, 1,3-butadiene, benzene, hexane, ethyl benzene, toluene, and xylenes are dominated by motor gasoline use in light-duty vehicles and emissions of NOx, PM_{10}, $PM_{2.5}$, SO_2, formaldehyde, and acrolein are dominated by distillate fuel use in heavy-duty vehicles, commercial marine vessels, or off-road equipment. Natural gas combustion emissions of CO, NOx, SO_2, lead, and total VOCs are dominated by industrial sources and PM_{10} and $PM_{2.5}$ are dominated by EGUs.

The impact of combustion emissions on air quality and public health was assessed using information from a variety of sources, including peer-reviewed literature and the EPA. Air quality involves complex physical and chemical transformations at a local or regional level, so impacts would vary considerably depending on background concentrations, meteorology, and other local pollutant sources, making a qualitative analysis more appropriate. Changes to air concentrations and deposition of the pollutants listed above may result in short-term and long-term health effects, including asthma/allergic symptoms, oxidative DNA damage, birthweight, heart rate variability, mortality and hospitalizations, and inflammatory markers. Calculated health burdens associated with coal combustion are higher than those from oil and gas combustion. Although the most recent data were used in this assessment, the exact final destinations (that is, locations of downstream combustion) and emissions rates over the planning period and beyond are variable and uncertain. Any changes in emissions will likely affect the air quality and public health impacts discussed in this analysis.

All four alternatives have the same projected oil and gas production. Consequently, the downstream impacts on air quality and public health from combustion of oil and gas produced in the planning area would be the same for all alternatives. Coal production and therefore downstream impacts would vary among the alternatives depending on the year. In any year, all four alternatives would have the same federal production from valid existing rights from approved federal leases in the two existing coal mine federal mine plan boundaries, and therefore would have comparable downstream air quality and public health impacts due to these existing federal leases. Under Alternative D, BLM would not approve any pending federal lease applications or future subsequent federal lease applications. Thus, there would be no air quality or public health impacts from downstream coal combustion in any year due to the federal action in this alternative. During both 2036-2038 and 2039-2050, Alternatives A, B, and C would have identical coal production from the approval and development of pending federal lease applications and thus would have comparable downstream air quality and public health impacts. Alternative C would not approve federal coal lease applications outside the existing federal mine plan boundaries or any future subsequent coal leases. Therefore, downstream impacts from the federal action would only occur as long as coal was available from existing federal leases within the existing mine federal mine plan boundaries (that is, through 2050). From 2051 onwards, Alternative C would result in no air quality or public health impacts due to downstream coal combustion. In contrast, Alternatives A and B would result in considerably higher downstream combustion impacts, namely the impacts associated with the leasing and production of approximately 238 million tons of additional federal coal in the planning area from 2051 to 2088. During 2062-2088, Alternatives C and D are anticipated to have no air quality and public health impacts from downstream coal combustion, while Alternatives A and B would continue to have similar impacts due to the subsequent new federal leasing and development of approximately 169 million tons of coal.

Cumulative nitrogen deposition could exceed critical loads of nitrogen deposition at some federal and tribal Class I areas. Federal contributions are minimal at these locations. However, the BLM will continue to follow its Adaptive Management Strategy outlined in the 2015 RMP to reduce any potential impacts by mitigating emissions.

3.4 Greenhouse Gases, Including Climate Change

3.4.1 Affected Environment

The Intergovernmental Panel on Climate Change (IPCC) describes climate change as "a change in the state of the climate that can be identified (for example, by using statistical tests) by changes in the mean and/or the variability of its properties, and persists for an extended period, typically decades or longer. Climate change may be due to natural internal processes or external forcings such as modulations of the solar cycles, volcanic eruptions and persistent anthropogenic changes in the composition of the atmosphere or in land use" (IPCC 2013, 2021).

Current ongoing global climate change is caused, in part, by the atmospheric buildup of GHGs, which may persist for decades or even centuries. Although largely invisible to the short wavelength incoming solar radiation that heats the earth's surface, GHGs absorb a portion of the outgoing long wavelength infrared heat radiated back from the surface, preventing it from escaping out into space. As a result, the buildup of GHGs since the start of the industrial revolution has increased the global mean temperature and has altered the earth's climate in complex ways.

This section analyzes the three main GHGs (carbon dioxide [CO_2], CH_4, and nitrous oxide [N_2O]) associated with the production, transportation, and downstream combustion of coal, oil, and gas in the planning area. In addition, GHG emissions are also summarized in terms of carbon dioxide equivalents (CO_2e) using global warming potential (GWP) of each GHG from the Sixth Assessment Report (AR6) of the IPCC (IPCC 2021). More information on GWPs is provided in Section 2.6 of **Appendix C**.

Because climate change is a global issue, the analysis area for GHG cannot be restricted to one region. Thus, while the GHG/climate change analysis area is primarily focused on the planning area, data at the state, national and global scales are also used.

This section incorporates by reference the description of the affected environment in the 2015 Proposed RMP/Final EIS (BLM 2015a; *Climate – Affected Environment*, pages 3-2 through 3-4; and *Climate Change – Affected Environment*, pages 3-4 through 3-12) and the 2019 Proposed RMPA/Final SEIS (BLM 2019; *Air Resources, Including Greenhouse Gases and Climate Change – Affected Environment*, page 3-6 through 3-11). A summary of the information from these documents is provided below along with discussion of new and updated information. Additionally, the *National BLM Specialist Report on Annual Greenhouse Gas Emissions* *and Climate Trends* (BLM 2022a, herein referred to as the National BLM Specialist Report) is incorporated by reference, specifically the discussion of relevant policy and regulations (Section 2.0), global, national and state emissions (Section 6.0), climate change science and trends (Section 8.0), and projected climate change (Section 9.0). The National BLM Specialist Report provides estimated emissions of GHGs attributable to development and consumption of federal fossil fuels produced on lands and mineral estate managed by the BLM across the United States (BLM 2022a).

Regulatory and Policy Framework

Greenhouse gases are considered air pollutants under the Clean Air Act (42 United States Code § 7401, et seq.). In 2009, the EPA published a rule for the mandatory reporting of GHGs (40 CFR Part 98, Subpart C), referred to as the Greenhouse Gas Reporting Program (GHGRP). It generally requires large emitters (any facility emitting over 25,000 metric tons of CO_2e annually) to report their emissions annually. The facility-level emission information reported under the GHGRP are published and accessible through the Facility Level Information on Greenhouse Gases Tool (EPA 2022d). Facility Level Information on Greenhouse Gases Tool data reported by large emitters is estimated to represent 85 percent to 90 percent of the total US emissions (EPA 2022d).

President Biden issued two executive orders in January 2021 to address the climate crisis and focus on GHG emission reductions:

- Executive Order 13990, Protecting Public Health and the Environment and Restoring Science to Tackle the Climate Crisis (January 25, 2021): Directs all executive departments and agencies to commence work on confronting the climate crisis to improve public health and the environment. Among other things, it established the Interagency Working Group (IWG) on the Social Cost of Greenhouse Gas Emissions to develop and promulgate costs for agencies to apply during cost-benefit analysis and rescinded the 2019 CEQ Draft National Environmental Policy Act Guidance on Consideration of Greenhouse Gas Emissions (84 *Federal Register* 30097).
- Executive Order 14008, Tackling the Climate Crisis at Home and Abroad (January 27, 2021): Reaffirms the United States' decision to rejoin the Paris Agreement and its commitment to achieve net-zero emissions by no later than 2050. It also establishes a National Climate Task Force. Specific directives for US Department of the Interior and BLM include increasing renewable energy production on public lands and waters, performing a comprehensive review of potential climate and other impacts from oil and natural gas development on public lands, establishing a civilian climate corps, and working with key stakeholders to achieve a goal of conserving at least 30 percent of the nation's lands and waters by 2030.

Pursuant to Executive Order 13990, the CEQ issued National Environmental Policy Act Guidance on Consideration of Greenhouse Gas Emissions and Climate Change on January 9, 2023 (86 *Federal Register* 1196). It builds upon and updates CEQ's 2016 Final Guidance for Federal Departments and Agencies on Consideration of Greenhouse Gas Emissions and the Effects of Climate Change in National Environmental Policy Act Reviews, highlighting best practices for analysis grounded in science and agency experience.

Consistent with Executive Order 14008, the United States has established an economy-wide target of reducing its net GHG emissions (including anthropogenic and natural GHG emissions as well as GHG removals by sinks) by 50 percent to 52 percent below 2005 levels in 2030 in its Nationally Determined Contribution under the Paris Agreement (United Nations Framework Convention on Climate Change

2021). The net emissions (including sinks) in 2005 were 6,635 million metric tons (MMT) CO_2e (United Nations Framework Convention on Climate Change 2021). So far, the United States is anticipated to have met and surpassed the 2020 target of 17 percent reduction in net economy-wide emissions below 2005 levels and is broadly on-track to meet the 2025 goal of 26 percent to 28 percent emissions reductions below 2005 levels (United Nations Framework Convention on Climate Change 2021).

In November 2022, BLM proposed new regulations (Waste Prevention Rule, 87 *Federal Register* 73588) to reduce the waste of natural gas from venting, flaring, and leaks during oil and gas production activities on federal and Indian leases. This proposed rule would replace the BLM's current requirements governing venting and flaring, which are contained in Notice to Lessees and Operators of Onshore Federal and Indian Oil and Gas Leases: Royalty or Compensation for Oil and Gas Lost ("NTL-4A") (44 *Federal Register* 76600). Operators must use all reasonable precautions to prevent the waste of oil or gas developed from the lease. Requirements are proposed for venting and flaring from oil and gas wells. For example, flares or combustion devices would be required to have automatic ignition systems for continuous combustion. New requirements would be established under the rule for leak detection and upgrades to equipment such as pneumatic controllers and pumps. The BLM also proposes several exceptions in which natural gas would be considered unavoidably lost. Additional information is available at 87 *Federal Register* 73588[1].

Also, in November 2022, EPA issued a supplemental proposal that strengthens and expands its November 2021 proposal by reducing emissions of methane from both new and existing oil and gas operations. This would include leak monitoring, strengthen requirements for flares, require owners/operators of oil wells with associated gas to implement alternatives to flaring the gas, continue monitoring at abandoned and unplugged wells until wells are plugged, require zero-emission pneumatic pumps, and implement several other measures to mitigate emissions. The updated requirements EPA is proposing would apply to both the agency's New Source Performance Standards for new, modified, and reconstructed sources and as presumptive standards to assist states in developing plans under the proposed emissions guidelines for existing sources. Additional information is available at the EPA.[2]

Additional discussion of laws and policies relevant to GHGs and climate change can be found in the National BLM Specialist Report (BLM 2022a).

Current Conditions and Trends

Changes in climate and the potential effects of climate change were described in the 2015 Proposed RMP/Final EIS (BLM 2015a, pages 3-2 to 3-10) and the 2019 Proposed RMPA/Final SEIS (BLM 2019, pages 3-8 to 3-10) discussed new findings from the Fourth National Climate Assessment (NCA; US Global Change Research Program 2018), the 2017 Montana Climate Assessment (Whitlock et al. 2017), and other sources. This information is incorporated by reference and summarized below. Major findings from more recently published reports such as the IPCC (2021) AR6 and the 2021 Special Report of the Montana Climate Assessment on Climate Change and Human Health in Montana (Adams et al. 2021) are also summarized in the following sections.

[1] https://www.govinfo.gov/content/pkg/FR-2022-11-30/pdf/2022-25345.pdf
[2] https://www.epa.gov/system/files/documents/2022-11/OIl%20and%20Gas%20Supplemental.%20Overview%20Fact%20Sheet.pdf

Observed Climate Trends and Impacts

Warming of the earth's climate since the industrial revolution has been observed to coincide with widespread effects throughout the earth-atmosphere system, including reductions in the extent and duration of polar sea ice and mountain winter snowpack, rising sea levels, increases in mean nighttime minimum temperatures, shifts in historical rainfall patterns, and changes in the frequency, severity, and duration of weather events. These effects, in turn, have affected natural and human systems regardless of cause, implicating the sensitivity of natural and human systems to changing climate (IPCC 2013, 2021).

The IPCC (2021) has concluded that human activities such as the burning of fossil fuels have caused GHG concentrations to increase since the mid-18th century and that "it is unequivocal that human influence has warmed the atmosphere, ocean and land." The IPCC's (2021) best estimate of the human-caused increase in global surface temperatures between 1850-1900 and 2010-2019 is 1.07 degrees Celsius (°C), and it is "very likely" that well-mixed GHGs were the main driver of this warming since 1979. Evidence of the observed change and the human influence in extreme events such as heat waves, heavy precipitation, and droughts has strengthened since the IPCC Fifth Assessment Report (IPCC 2013). For example, it is "virtually certain" that the frequency and intensity of extreme heat events have increased across most regions since the 1950s and cold extremes have become less extreme and less severe, and there is "high confidence" that human-induced climate change is the main driver of these changes (IPCC 2021).

Across the United States, annual average temperatures have increased by 1.8 degrees Fahrenheit (°F) since the beginning of the 20th century and by 1.2°F over the last few decades (BLM 2022a; US Global Change Research Program 2018). According to the NCA (US Global Change Research Program 2018), the largest increases in annual average temperatures since the beginning of the 20th century were observed in the western United States (including the Northern Great Plains), while the southeastern United States had the least warming. Annual precipitation has increased in the northern and eastern United States since the beginning of 20th century and decreased in most of the southern and western United States (US Global Change Research Program 2018). The frequency and intensity of heavy precipitations have increased in most parts of the United States since the 20th century (US Global Change Research Program 2018).

The National Oceanic and Atmospheric Administration publishes annual climate summaries for each state. The 2022 state climate summary for Montana (National Oceanic and Atmospheric Administration 2022) reports that:

- Temperatures in the state have risen by almost 2.5°F since the beginning of the 20th century, which is higher than rate of warming across the contiguous United States as a whole, and the 2000 to 2020 was the warmest period on record.
- The number of very hot days (with maximum temperature of 95°F or higher) per year was higher in 2000 to 2007 than any time since the extreme summer heat of the 1930s Dust Bowl era, and 2015 tied with 1934 for the hottest year on record.
- In 2012, the state experienced the driest July-September period on record dating back to 1985. This resulted in severe drought across much of the southern half of the state and more than 1.2 million acres were burned by wildfires.

Projected Climate Trends and Impacts

Over the contiguous United States, the annual average temperature is expected to increase by 2.5°F over the next few decades compared to present-day, regardless of future emissions (US Global Change Research Program 2018). By the end of the 21st century, the annual average temperature for the contiguous United States is expected to increase by 3 to 12°F depending on future emissions scenarios, and high temperature extremes are expected to increase accordingly (US Global Change Research Program 2018). The frequency and intensity of heavy precipitation are projected to continue increase over the coming century in the United States, and winter and spring precipitation are projected to increase significantly over the Northern Great Plains, the Upper Midwest, and the Northeast (US Global Change Research Program 2018).

As reported in the NCA (US Global Change Research Program 2018) and summarized in the 2019 SEIS, climate model projections show a warmer future in the Northern Great Plains (Montana, Wyoming, North Dakota, South Dakota, and Nebraska) with conditions becoming consistently warmer in 2 to 3 decades and temperatures rising steadily toward the middle of this century, irrespective of the climate scenario modeled. The NCA relies on recent climate modeling scenarios developed by the integrated assessment modeling community, known as the Representative Concentration Pathways (RCP). The "lower scenario" assumes lower emissions and concentrations of GHGs and aerosols, and projects a lower amount of warming by 2100. The "higher scenario" assumes a continued dependence on fossil fuels and higher GHG emissions and concentrations; it projects a higher amount of warming forcing by 2100.

For the Northern Great Plains, the NCA reports that temperature increases of 2° to 4°F projected by 2050 under the lower scenario are expected to increase the occurrence of both drought and heat waves; these projected trends would be greater under the higher scenario. The probability of more very hot days (those with maximum temperatures above 90°F) is expected to increase. There are projected to be many fewer cool days (those with minimum temperatures less than 28°F), with decreases of 30 days or more per year by mid-century (US Global Change Research Program 2018).

The amount, distribution, and variability of annual precipitation are anticipated to change, with increases in winter and spring precipitation of 10 to 30 percent by the end of this century and a decrease in the amount of precipitation falling as snow under a higher scenario (US Global Change Research Program 2018). Summer precipitation is expected to vary across the Northern Great Plains, ranging from no change under a lower scenario to 10 to 20 percent reductions under a higher scenario. Further, the frequency of heavy precipitation events is projected to increase, with an increase of about 50 percent in the frequency of 2-day heavy rainfall events by 2050 under the higher scenario. The amount falling in single-day heavy events is projected to increase 8 to 10 percent by mid-century depending on the scenario. While there is high confidence in future increases in temperature, uncertainties exist as to the degree of precipitation variability from year to year and within season (Conant et al. 2018).

Montana is projected to continue to warm in all geographic locations, seasons, and under all emission scenarios throughout the twenty-first century. Annual average temperatures are projected to most likely exceed historical record levels by the middle of the century and the intensity of heat waves is projected to increase, while the intensity of cold waves is projected to decrease (National Oceanic and Atmospheric Administration 2022). Rising temperatures are expected to reduce the amount of precipitation that falls as snow and also cause earlier melting of the snowpack, which will further decrease water availability during the summer months (National Oceanic and Atmospheric Administration 2022). While winter and spring precipitation is projected to increase across the state, the intensity of future droughts is projected to increase as rising temperatures increase the rate of soil moisture evaporation during dry spells. Thus, summer droughts are likely to become more intense, which may potentially increase the frequency and severity of wildfires.

In 2021, Montana Climate published a special report titled *Climate Change and Human Health in Montana* (Adams et al. 2021) that summarizes how climate change will impact the health of the people of Montana. Major findings from this report include:

- Increased summer temperatures and periods of extreme heat, reduced air quality from smoke from increasing wildfire size and frequency, and more unexpected climate-related weather events, including rapid spring snowmelt flooding, severe summer drought, and more extreme storms, are the aspects of climate change that are of greatest concern for human health in the state
- Projected increases in summer temperatures and wildfire frequency will worsen heat- and smoke-related health problems
- Projected increases in flooding from earlier snow melt and more intense precipitation events will endanger lives and lead to more diseases from contaminated water supplies
- Increased summer drought will pose challenges to local agriculture and the safety and availability of water supplies
- Climate changes alone or in combination with other effects are reducing the availability of wild game, fish, and many plants, threatening food security, community health, and cultural well-being, especially for tribal communities

<u>Global and US Emissions and Trends</u>

GHG emissions are reported at a number of spatial scales, including globally, nationally, and at the state level. In addition to these scales,[1] GHG emissions from fossil fuels produced on federal lands and emissions reported in the three planning area counties are described below.

The United Nations Environment Programme (2022) reports that total global GHG emissions in 2019 reached a record high of 56.4 gigatons of CO_2e (Gt CO_2e), before dropping 4.7 percent in 2020 to 50.8 Gt CO_2e due to the global response to the coronavirus (COVID-19) pandemic. While the average rate of growth in global GHG emissions was lower from 2010 to 2019 than 2000 to 2009 (that is, 1.1 and 2.6 percent per year, respectively), average global GHG emissions were still the highest on record. The reasons for the slower rate of growth in the past decade include a global reduction in coal capacity additions, steady substitution of coal by natural gas for power generation in developed counties, and the increasing pace of renewable energy deployments globally (United Nations Environment Programme 2022). While the United Nations Environment Programme (2022) could not estimate total global GHG emissions in 2021 as estimates of emissions from land use, land-use change, and forestry were not yet available, the preliminary estimates of total global emissions excluding land use, land-use change, and forestry for 2021 exceeds the comparable emissions in 2019 by 0.2 percent, suggesting that 2021 emissions will be similar to or higher than the record emissions in 2019.

The IPCC (2022) AR6 estimates that global GHG emissions would need to be approximately 43 percent lower than 2019 emissions by 2030 in order to limit global warming to 1.5°C with no or limited overshoot.

[1] See *Direct and Indirect Impacts*, *Analysis Methods* for the emission scales used for this analysis.

The United Nations Environment Programme (2022) estimates that current unconditional national commitments under the Paris agreement would only reduce global GHG emissions in 2030 by 5 percent relative to emissions under current policies, while 30 and 45 percent reductions are needed to limit warming to 2.0°C and 1.5°C, respectively.

The EPA estimates current total United States emissions in its annual *Inventory of US Greenhouse Gases and Sinks* (EPA 2022e). It is intended to represent all GHG emissions in the United States, including those sources that are not required to report annual emissions under the GHGRP. The latest report was published by EPA in 2022 and provides emissions estimates for 1990 to 2020. The EPA (2022e) estimates that total gross United States GHG emissions (excluding land use, land-use change, and forestry emissions and sinks) were 5,981.4 MMT of CO_2e in 2020, a decrease of approximately 9 percent from 2019 and a decrease of approximately 20 percent from the peak emissions in 2007. EPA reports that the decrease in total GHG emissions between 2019 and 2020 was largely due to the impacts of the COVID-19 pandemic on travel and economic activity, but that the decline also reflects the combined impacts of many long-term trends, including population, economic growth, energy market trends, technological changes that include energy efficiency, and the carbon intensity of energy fuel choices. Approximately 81 percent (4,854.7 MMT CO_2e) of the total United States emissions in 2020 were from the energy sector, primarily fossil fuel combustion for transportation and electricity generation. Note that the emissions presented in this paragraph were calculated by the EPA using GWPs from the IPCC's AR4. More information on recent trends in United States GHG emissions can be found in the National BLM Specialist Report.

Montana Emissions and Trends

The EPA also publishes an *Inventory of US Greenhouse Gas Emissions and Sinks by State* that is derived from the annual national emissions inventory and uses the same methodologies (EPA 2022f). In 2020, the gross total emissions from Montana were approximately 49.4 MMT CO_2e, which is approximately a 14 percent reduction from 2019 levels and a 21 percent reduction from peak emissions in 2007. Agriculture and the electric power industry are the largest sources of GHG emissions in the state followed by industry and transportation. Between 1990 and 2019, agriculture and transportation emissions in the state increased by approximately 14.7 percent and 30.8 percent, respectively, while emissions from the electric power industry and other industry decreased by approximately 1.0 percent and 3.5 percent, respectively.

Emissions and Trends in the Planning Area

GHG emissions from major sources in the planning area that report annual emissions under the GHGRP are shown in **Table 3-69** for 2017 to 2021. As noted previously, the EPA estimates that the emissions reported under the GHGRP account for 85 to 90 percent of total GHG emissions nationally. Between 2017 and 2019, total reported emissions from the planning area were relatively stable ranging from approximately 15.0 MMT of CO_2e to 15.4 MMT of CO_2e. In 2020, total reported emissions decreased to 9.4 MMT of CO_2e and then increased to 11.5 MMT of CO_2e in 2021. The reduction in emissions between 2019 and 2020 was largely driven by Colstrip Power Plant, which receives coal from the Rosebud Mine as part of a mine-to-mouth operation. In 2020, emissions fell by almost 6 MMT of CO_2e following the retirement of two of the four units at the power plant (that is, Units 1 and 2). Colstrip comprised approximately 87 percent of the GHG emissions from major sources in the planning area in 2021.

Table 3-69
Annual Greenhouse Gas Emissions from Major Facilities in the Planning Area from 2017 to 2021

Facility	2017 (metric tons of CO_2e)	2018 (metric tons of CO_2e)	2019 (metric tons of CO_2e)	2020 (metric tons of CO_2e)	2021 (metric tons of CO_2e)
Colstrip	13,934,589	13,315,612	14,277,559	8,340,434	10,035,340
Hardin Generating Station	155,954	208,493	212,250	73,621	692,184
Colstrip Energy Ltd Partnership	313,011	414,892	380,050	373,440	491,021
Sidney Sugars Incorporated	132,099	123,608	96,553	126,731	109,977
Lewis & Clark	311,859	322,282	352,646	317,241	90,127
Culbertson Station	26,037	59,544	66,168	25,841	51,892
Cabin Creek Compressor Station	27,454	28,966	29,901	22,471	28,283
Northern Border Pipeline Culbertson CS#3	81,164	20,839	2,136	1,672	805
Hiland Partners Bakken Gathering Plant	24,062	21,706	22,545	18,263	-
Total	**15,006,229**	**14,515,942**	**15,439,808**	**9,299,714**	**11,499,629**

Source: EPA 2022d
Note: The CO_2e emissions shown here are reported by the EPA using 100-year global warming potentials from the Fourth Assessment Report of the IPCC.

Coal

The Rosebud Mine has existing federal and nonfederal leases with sufficient federal coal reserves to take the mine life to 2060, which is reflected in this analysis. The BLM anticipates that reserves at Spring Creek Mine from existing federal leases would enable production through 2035. The GHG emissions from the production, transportation, and downstream combustion of federal, nonfederal, and total coal in the planning area in 2022 are shown in **Table 3-70**. **Table 3-71** presents the GHG emissions from mining, transportation, and downstream combustion of coal from existing federal leases in the planning area from 2023 to 2060. Both the federal production and corresponding emissions are estimated to peak in 2027 and decline thereafter. The BLM forecasts that existing leases at Spring Creek Mine would be exhausted in 2035, and so the federal production and corresponding emissions from 2036 to 2060 would be from existing federal and nonfederal leases at Rosebud Mine. Production and emissions from existing federal and nonfederal leases after 2060 are zero. The technical approach for the estimation of these emissions is provided in **Appendix C**, along with the emissions for individual GHGs.

Table 3-70
Estimated Greenhouse Gas Emissions from Mining, Transportation, and Downstream Combustion of Federal, Nonfederal, and Total Coal in the Planning Area in 2022

Mineral Designation	Annual Production (tons)	Coal Mining Emissions (MMT CO_2e)	Coal Transportation Emissions (MMT CO_2e)	Coal Downstream Combustion Emissions (MMT CO_2e)	Total Coal Emissions (MMT CO_2e)
Federal	11,046,605	0.24	0.30	18.77	19.31
Nonfederal	9,801,355	0.21	0.21	16.66	17.08
Total	20,847,961	0.45	0.51	35.43	36.39

Notes: CO_2e are calculated using the 20-year time horizon global warming potentials from the AR6 (IPCC 2021): CO_2 = 1; CH_4 = 82.5; N_2O = 273. Emissions by individual gas and for 100-year CO_2e are provided in **Appendix C**.

Oil and Gas

The GHG emissions from the production, transportation/processing, and downstream combustion of federal, nonfederal, and total oil, conventional natural gas, and coalbed natural gas in the planning area in 2022 are shown in **Table 3-71**, **Table 3-72**, and **Table 3-73**, respectively.

Table 3-71
Greenhouse Gas Emissions from Production, Transportation, Processing, and Downstream Combustion of Federal, Nonfederal, and Total Oil in the Planning Area in 2022

Mineral Designation	Annual Production (MMBO)	Production Emissions (MMT CO_2e)	Transportation/ Processing Emissions (MMT CO_2e)	Downstream Combustion Emissions (MMT CO_2e)	Total Emissions (MMT CO_2e)
Federal	3.0	0.08	0.18	1.32	1.58
Nonfederal	20.6	0.50	1.24	8.97	10.71
Total	23.7	0.58	1.43	10.29	12.29

Notes: CO_2e are calculated using the 20-year time horizon global warming potentials from the AR6 (IPCC 2021): CO_2 = 1; CH_4 = 82.5; N_2O = 273. Emissions by individual gas and for 100-year CO_2e are provided in **Appendix C**.

Table 3-72
Estimated Greenhouse Gas Emissions from Production of Federal, Nonfederal, and Total Conventional Natural Gas in the Planning Area in 2022

Mineral Designation	Annual Production (billion cubic feet)	Production Emissions (MMT CO_2e)	Transportation/ Processing Emissions (MMT CO_2e)	Downstream Combustion Emissions (MMT CO_2e)	Total Emissions (MMT CO_2e)
Federal	5.1	0.02	0.11	0.28	0.42
Nonfederal	34.1	0.15	0.77	1.86	2.78
Total	39.2	0.17	0.88	2.14	3.20

Notes: CO_2e are calculated using the 20-year time horizon global warming potentials from the AR6 (IPCC 2021): CO_2 = 1; CH_4 = 82.5; N_2O = 273. Emissions by individual gas and for 100-year CO_2e are provided in **Appendix C**.

Table 3-73
Estimated Greenhouse Gas Emissions from Production of Federal, Nonfederal, and Total Coalbed Natural Gas in the Planning Area in 2022

Mineral Designation	Annual Production (billion cubic feet)	Production Emissions (MMT CO_2e)	Transportation/ Processing Emissions (MMT CO_2e)	Downstream Combustion Emissions (MMT CO_2e)	Total Emissions (MMT CO_2e)
Federal	8.0	0.03	0.18	0.44	0.64
Nonfederal	10.8	0.03	0.24	0.59	0.87
Total	18.8	0.06	0.42	1.03	1.51

Notes: CO_2e are calculated using the 20-year time horizon global warming potentials from the AR6 (IPCC 2021): CO_2 = 1; CH_4 = 82.5; N_2O = 273. Emissions by individual gas and for 100-year CO_2e are provided in **Appendix C**.

Social Cost of Greenhouse Gas Emissions from Existing Leases

The social cost of carbon, social cost of N_2O, and social cost of methane—together, the social cost of GHGs (SC-GHG)—are estimates of the monetized damages associated with incremental increases in GHG emissions in a given year. It includes the estimated value of all climate change impacts, including but not limited to public health effects, changes in net agricultural productivity, property damage from increased flood risk, natural disasters, disruption of energy systems, risk of conflict, environmental migration, and the value of ecosystem services (IWG 2021).

On January 20, 2021, President Biden issued Executive Order 13990, *Protecting Public Health and the Environment and Restoring Science to Tackle the Climate Crisis*.[1] Section 1 of the order establishes an administration policy to, among other things, listen to the science; improve public health and protect our environment; ensure access to clean air and water; reduce GHG emissions; and bolster resilience to the impacts of climate change.[2] Section 2 of the order calls for federal agencies to review existing regulations and policies issued between January 20, 2017, and January 20, 2021, for consistency with the policy articulated in the order and to take appropriate action.

Consistent with Executive Order 13990, the CEQ rescinded its 2019 Draft National Environmental Policy Act Guidance on Considering Greenhouse Gas Emissions, has issued interim NEPA Guidance on Consideration of Greenhouse Gas Emissions and Climate Change, and is seeking public comment on the interim guidance through April 10, 2023.[3] The CEQ is issuing this guidance as interim guidance so that agencies may make use of it immediately while the CEQ seeks public comment on the guidance. The CEQ intends to either revise the guidance in response to public comments or to finalize the interim guidance. GHG guidance, effective upon publication, builds upon and updates the CEQ's 2016 Final Guidance for Federal Departments and Agencies on Consideration of Greenhouse Gas Emissions and the Effects of Climate Change in National Environmental Policy Act Reviews.[4]

Regarding the use of Social Cost of Carbon or other monetized costs and benefits of GHGs, the 2016 GHG Guidance noted that NEPA does not require monetizing costs and benefits.[5] It also noted that "the weighing of the merits and drawbacks of the various alternatives need not be displayed using a monetary cost-benefit analysis and should not be when there are important qualitative considerations."[6]

Section 5 of Executive Order 13990 emphasized how important it is for federal agencies to "capture the full costs of GHG emissions as accurately as possible, including by taking global damages into account" and established the IWG.[7] In February 2021, the IWG published *Technical Support Document: Social Cost of Carbon, Methane, and Nitrous Oxide: Interim Estimates under Executive Order 13990* (IWG 2021).[8] This is an interim report that updated previous guidance from 2016.

For federal agencies, the best currently available estimates of the SC-GHG are the interim estimates of the social cost of carbon dioxide, methane, and N_2O developed by the IWG on the SC-GHG. Select estimates are published in the Technical Support Document (IWG 2021) and the complete set of annual estimates are available on the Office of Management and Budget's website.[9]

[1] 86 *Federal Register* 7037 (January 25, 2021).
[2] *Id*., sec. 1.
[3] 88 *Federal Register* 1196 (January 9, 2023).
[4] *Id.*
[5] 2016 GHG Guidance, p. 32, available at: https://ceq.doe.gov/docs/ceq-regulations-and-guidance/nepa_final_ghg_guidance.pdf
[6] *Id.*
[7] Executive Order 13990, Sec. 5.
[8] https://www.whitehouse.gov/wp-content/uploads/2021/02/TechnicalSupportDocument_SocialCostofCarbonMethaneNitrousOxide.pdf
[9] https://www.whitehouse.gov/omb/information-regulatory-affairs/regulatory-matters/#scghgs

The IWG's SC-GHG estimates are based on complex models describing how GHG emissions affect global temperatures, sea level rise, and other biophysical processes; how these changes affect society through, for example, agricultural, health, or other effects; and monetary estimates of the market and nonmarket values of these effects. One key parameter in the models is the discount rate, which is used to estimate the present value of the stream of future damages associated with emissions in a particular year. A higher discount rate assumes that future benefits or costs are more heavily discounted than benefits or costs occurring in the present (that is, future benefits or costs are a less significant factor in present-day decisions). The current set of interim estimates of SC-GHG have been developed using three different annual discount rates: 2.5 percent, 3 percent, and 5 percent (IWG 2021).

As expected with such a complex model, there are multiple sources of uncertainty inherent in the SC-GHG estimates. Some sources of uncertainty relate to physical effects of GHG emissions, human behavior, future population growth and economic changes, and potential adaptation (IWG 2021). To better understand and communicate the quantifiable uncertainty, the IWG method generates several thousand estimates of the social cost for a specific gas, emitted in a specific year, with a specific discount rate. These estimates create a frequency distribution based on different values for key uncertain climate model parameters. The shape and characteristics of that frequency distribution demonstrate the magnitude of uncertainty relative to the average or expected outcome.

To further address uncertainty, the IWG recommends reporting four SC-GHG estimates in any analysis. Three of the SC-GHG estimates reflect the average damages from the multiple simulations at each of the three discount rates. The fourth value represents higher-than-expected economic impacts from climate change. Specifically, it represents the 95th percentile of damages estimated, applying a 3 percent annual discount rate for future economic effects. This is a low probability, but high damage scenario, that represents an upper bound of damages within the 3 percent discount rate model. The estimates below follow the IWG recommendations.

The SC-GHGs described below are associated with estimated emissions from existing federal leases as described in emissions trends. These estimates represent the present value of future market and nonmarket costs associated with CO_2, CH_4, and N_2O emissions. Estimates are calculated based on IWG estimates of social cost per metric ton of emissions for a given emissions year and BLM's estimates of emissions in each year. They are rounded to the nearest $1,000.

Table 3-74 provides annual estimates for the for total coal lifespan emissions associated with existing federal leases in Spring Creek and Rosebud Mines, which is through 2060. Detailed tables with social cost specific to CO_2, CH_4, and NO_2 are included in **Appendix D**, Table D-8.

Table 3-74
Social Cost of Greenhouse Gas Emissions from Mining, Transportation, and Downstream Combustion Coal from Existing Federal Leases in the Planning Area from 2023 to 2060 (2020$)

Year	Average Value, 5% discount rate	Average Value, 3% discount rate	Average Value, 2.5% discount rate	95th Percentile Value, 3% discount rate
2023	$278,096,000	$286,256,000	$1,428,387,000	$2,866,522,000
2024	$283,330,000	$961,306,000	$1,470,548,000	$2,952,541,000
2025	$274,430,000	$988,118,000	$1,439,339,000	$2,890,384,000

Year	Average Value, 5% discount rate	Average Value, 3% discount rate	Average Value, 2.5% discount rate	95th Percentile Value, 3% discount rate
2026	$265,989,000	$965,614,000	$1,410,860,000	$2,833,283,000
2027	$299,857,000	$944,862,000	$1,610,463,000	$3,234,060,000
2028	$223,542,000	$1,076,449,000	$1,212,879,000	$2,433,990,000
2029	$217,352,000	$809,409,000	$1,196,320,000	$2,400,291,000
2030	$205,404,000	$796,536,000	$1,145,445,000	$2,296,759,000
2031	$201,418,000	$761,060,325	$1,134,124,000	$2,274,733,000
2032	$189,204,000	$752,292,000	$1,076,045,000	$2,158,359,000
2033	$185,189,000	$712,553,000	$1,064,793,000	$2,135,716,000
2034	$181,251,000	$703,784,000	$1,054,042,000	$2,113,625,000
2035	$184,478,000	$695,325,943	$1,085,747,000	$2,176,443,000
2036	$60,778,000	$714,771,000	$358,767,000	$717,343,000
2037	$57,266,000	$236,057,000	$345,527,000	$691,769,000
2038	$55,898,000	$226,498,000	$341,765,000	$683,684,000
2023-2038 total	$2,445,667,000	$10,820,961,000	$16,948,777,000	$33,144,531,000
2039 – 2060 Average annual costs	$42,109,000	$189,481,100	$297,732,000	$580,673,000

Source: GHG emission calculation and IWG 2021

Note: Social cost estimates for emissions years beyond 2050 are estimated using an annual growth rate equal to the average annual growth in social cost estimates for the last 5 years of available estimates from the TSD (2046-2050).

3.4.2 Direct and Indirect Impacts

Analysis Methods

This section analyzes the three main GHGs (CO_2, N_2O, and CH_4) associated with the production, transportation, and downstream combustion of coal, oil, gas, and other BLM-authorized activities over the analysis period. Emissions from the production, transportation/processing, and downstream combustion of oil, gas, and coal from the planning area are estimated using BLM forecasted production rates and emission factors from the EPA and National Energy Technology Laboratory of the Department of Energy. Descriptions of the approaches used to estimate GHG emissions are provided in Section 2.0 of **Appendix C**. The emissions shown under each alternative represent the increment over the existing emissions presented in **Section 3.4.1**.

Emissions in CO_2e are calculated using 20-year and 100-year time horizon GWPs from the AR6 (IPCC 2021). GHG emissions are presented in this section as 20-year CO_2e unless otherwise noted. Emissions by individual GHG and as 100-year CO_2e are presented in **Appendix C**.

Assumptions

- Coal mining emission factors from NETL and transportation and downstream combustion emission factors from EPA are representative of the direct and indirect emissions of coal development in the planning area.
- The GHG impact analysis is performed both annually for GHG emissions through 2088 as well as cumulatively for the planning period and beyond.
- Emissions factors used for coal combustion assume all coal is combusted in United States energy-generating units.

Indicators

The following indicators are used in the analysis of GHGs and climate change:

- Statistical descriptions of climate variables (for example, mean annual temperature) as indicators of climate change
- Emissions (in MMT) of CO_2, CH_4, N_2O, and CO_2e from coal production, transportation and downstream combustion annually and cumulatively
- Emissions (in MMT) of CO_2, CH_4, N_2O, and CO_2e from oil and gas production, gathering/boosting and downstream combustion annually and cumulatively

Impacts Common to All Alternatives

Oil and Gas

Impacts for oil and gas are presented following the annual reasonably foreseeable production forecast through the end of the planning period (that is, 2038). The oil and gas production and therefore associated GHG emissions do not change by alternative. The GHG emissions from the production, transportation and processing, and downstream combustion of federal oil, conventional natural gas, and coalbed natural gas from the planning area from 2023 to 2038 are shown in **Table 3-75**, **Table 3-76**, and **Table 3-77**, respectively. These GHG emissions would contribute incrementally to global climate change.

Table 3-75
Federal Oil Production and Midstream Emissions of Greenhouse Gases from the Planning Area in 2023-2038

Year	Annual Production (MMBO)	Production Emissions (MMT CO_2e)	Transportation/ Processing Emissions (MMT CO_2e)	Downstream Combustion Emissions (MMT CO_2e)	Total Emissions (MMT CO_2e)
2023	3.0	0.08	0.18	1.32	1.58
2024	3.0	0.08	0.18	1.32	1.58
2025	3.0	0.08	0.18	1.32	1.58
2026	3.0	0.08	0.18	1.32	1.58
2027	3.0	0.08	0.18	1.32	1.58
2028	3.0	0.08	0.18	1.32	1.58
2029	3.0	0.08	0.18	1.32	1.58
2030	3.0	0.08	0.18	1.32	1.58
2031	3.0	0.08	0.18	1.32	1.58
2032	3.0	0.08	0.18	1.32	1.58
2033	3.0	0.08	0.18	1.32	1.58
2034	3.0	0.08	0.18	1.32	1.58
2035	3.0	0.08	0.18	1.32	1.58
2036	3.0	0.08	0.18	1.32	1.58
2037	3.0	0.08	0.18	1.32	1.58
2038	3.0	0.08	0.18	1.32	1.58
Total	48.7	1.24	2.94	21.16	25.33

Notes: CO_2e are calculated using the 20-year time horizon GWPs from the AR6 (IPCC 2021): CO_2 = 1; CH_4 = 82.5; N_2O = 273. Emissions by individual gas and for 100-year CO_2e are provided in **Appendix C**.

Table 3-76
Federal Conventional Natural Gas Production and Midstream Emissions of Greenhouse Gases from the Planning Area in 2023-2038

Year	Annual Production (billion cubic feet)	Production Emissions (MMT CO_2e)	Transportation/ Processing Emissions (MMT CO_2e)	Downstream Combustion Emissions (MMT CO_2e)	Total Emissions (MMT CO_2e)
2023	5.1	0.02	0.11	0.28	0.42
2024	5.1	0.02	0.11	0.28	0.42
2025	5.1	0.02	0.11	0.28	0.42
2026	5.1	0.02	0.11	0.28	0.42
2027	5.1	0.02	0.11	0.28	0.42
2028	5.1	0.02	0.11	0.28	0.42
2029	5.1	0.02	0.11	0.28	0.42
2030	5.1	0.02	0.11	0.28	0.42
2031	5.1	0.02	0.11	0.28	0.42
2032	5.1	0.02	0.11	0.28	0.42
2033	5.1	0.02	0.11	0.28	0.42
2034	5.1	0.02	0.11	0.28	0.42
2035	5.1	0.02	0.11	0.28	0.42
2036	5.1	0.02	0.11	0.28	0.42
2037	5.1	0.02	0.11	0.28	0.42
2038	5.1	0.02	0.11	0.28	0.42
Total	81.8	0.38	1.84	4.46	6.68

Notes: CO_2e are calculated using the 20-year time horizon GWPs from the AR6 (IPCC 2021): CO_2 = 1; CH_4 = 82.5; N_2O = 273. Emissions by individual gas and for 100-year CO_2e are provided in **Appendix C**.

Table 3-77
Federal Coalbed Natural Gas Production and Midstream Emissions of Greenhouse Gases from the Planning Area in 2023-2038

Year	Annual Production (billion cubic feet)	Production Emissions (MMT CO_2e)	Transportation/ Processing Emissions (MMT CO_2e)	Downstream Combustion Emissions (MMT CO_2e)	Total Emissions (MMT CO_2e)
2023	8.0	0.03	0.18	0.44	0.64
2024	8.0	0.03	0.18	0.44	0.64
2025	8.0	0.03	0.18	0.44	0.64
2026	8.0	0.03	0.18	0.44	0.64
2027	8.0	0.03	0.18	0.44	0.64
2028	8.0	0.03	0.18	0.44	0.64
2029	8.0	0.03	0.18	0.44	0.64
2030	8.0	0.03	0.18	0.44	0.64
2031	8.0	0.03	0.18	0.44	0.64
2032	8.0	0.03	0.18	0.44	0.64
2033	8.0	0.03	0.18	0.44	0.64
2034	8.0	0.03	0.18	0.44	0.64
2035	8.0	0.03	0.18	0.44	0.64
2036	8.0	0.03	0.18	0.44	0.64
2037	8.0	0.03	0.18	0.44	0.64
2038	8.0	0.03	0.18	0.44	0.64
Total	127.7	0.40	2.87	6.97	10.24

Notes: CO_2e are calculated using the 20-year time horizon GWPs from the AR6 (IPCC 2021): CO_2 = 1; CH_4 = 82.5; N_2O = 273. Emissions by individual gas and for 100-year CO_2e are provided in **Appendix C**.

Other BLM-Authorized Activities

The GHG emissions from other BLM-authorized activities from the Proposed Plan (Alternative E) in the 2015 Proposed RMP/Final EIS are incorporated by reference and summarized below. The activities assessed in the 2015 Proposed RMP/Final EIS (BLM 2015a) were:

- Vegetation management
- Fire management
- Forestry and woodland products
- Livestock grazing
- Recreation – trails and travel management
- General purpose BLM fleet travel
- Road maintenance

The BLM expects that the annual activity rates and corresponding emissions from these activities remain representative of expected activity levels and emissions for the remaining plan life under all alternatives. The GHG emissions from these activities are shown in **Table 3-78**. Emissions from fire management and livestock grazing comprise approximately 58 percent and 41 percent of the total 20-year CO_2e emissions from these activities, respectively.

Table 3-78
Annual Emissions of Greenhouse Gases from Other BLM-Authorized Activities in the Planning Area

Other BLM-authorized Activity	CO_2 (metric tons/year)	CH_4 (metric tons/year)	N_2O (metric tons/year)	100-year CO_2e[1] (metric tons/year)	20-year CO_2e[1] (metric tons/year)
Vegetation Management	31	0	0	31	31
Fire Management	262,218	110	22	271,433	277,218
Forestry and Woodland Products	475	0	0	475	475
Livestock Grazing[2]	1,254	2,409	0	66,792	195,940
Recreation – Trails and Travel Management	71	0	0	71	71
General Purpose BLM Fleet Travel	276	0	0	276	276
Road Maintenance	133	0	0	133	133
Total	**264,458**	**2,519**	**22**	**339,211**	**474,144**

Source: BLM 2015a

Notes:

[1] CO_2e for other BLM activities except for livestock grazing management are calculated using 100-year and 20-year GWPs designated for fossil origin GHG emissions from the AR6 (IPCC 2021).

[2] CO_2e for livestock grazing management are calculated using 100-year and 20-year GWPs designated for nonfossil origin GHG emissions from the AR6 (IPCC 2021)

Social Cost of Greenhouse Gas Emissions from Planning Area Oil and Natural Gas and Other BLM-authorized Activities

This subsection monetizes the GHG emissions as presented above in **Table 3-75**, **Table 3-76**, **Table 3-77**, and **Table 3-78**. Such analysis should not be construed to mean a cost determination is necessary to address potential impacts of GHGs associated with specific alternatives. These numbers were monetized; however, they do not constitute a complete cost-benefit analysis, nor do the SC-GHG numbers present a direct comparison with other impacts analyzed in this document. SC-GHG is provided only as a useful measure of the benefits of GHG emissions reductions to inform agency decision-making. Additional details related to the methods utilized for SC-GHG calculations and BLM SC-GHG policy are included in Section 3.4.1.

Under all alternatives, emissions from federal oil and natural gas and other sources would be consistent, as discussed in the section above. Estimated social cost of carbon for 2023- 2038 are included in **Table 3-79**. Detailed tables with social costs specific to CO_2, CH_4, and NO_2 are included in **Appendix D**, Tables D-9, D-10, and D-11.

Table 3-79
Planning Area Oil and Gas and Other Emissions Social Cost of Carbon 2023-2038 (total in $2020)

Emission Type	Average Value, 5% discount rate	Average Value, 3% discount rate	Average Value, 2.5% discount rate	95th Percentile Value, 3% discount rate
Federal Oil	$327,415,000	$1,209,740,000	$1,820,692,000	$3,653,453,000
Federal Conventional Natural Gas	$81,161,000	$290,450,000	$434,030,000	$870,755,000
Federal Coal Bed Natural Gas	$124,456,000	$445,346,000	$665,481,000	$1,335,095,000
Other Emissions	$82,611,800	$273,625,000	$401,515,000	$802,578,000

Source: GHG emission calculation and IWG 2021

Alternative A

Under Alternative A, the production and emissions due to existing federal coal leases and associated mining, transportation, and downstream combustion discussed in **Section 3.4.1** would occur. Pending federal lease applications are forecasted to provide production from 2036 to 2061 with potential future subsequent federal leases providing production from 2062 to 2088. Emissions of GHGs would result from the mining, transportation, and downstream combustion of the coal from pending and potential future subsequent federal lease applications during those periods. These emissions would contribute incrementally to global climate change and the climate impacts discussed in the *Affected Environment*.

Emissions of GHGs from the mining, transportation, and downstream combustion of coal from pending federal lease applications in the planning area under Alternative A are shown in **Table 3-80** and GHG emissions from potential future subsequent federal leases are shown in **Table 3-81**. Emissions are shown through 2088 in each table because 2088 is the year when coal is exhausted under Alternatives A and B to facilitate comparison across all alternatives. The production and corresponding emissions from coal produced from pending federal lease applications are anticipated to occur from 2036 to 2061; there would be no GHG emissions from pending federal lease applications after that point. Coal production and emissions from potential future subsequent federal leases would occur from 2062 until 2088 and would be zero before and after that period.

In total, the mining, transportation, and downstream combustion of coal from pending and potential future subsequent federal lease applications under Alternative A would result in GHG emissions of 584.4 MMT CO_2e between 2036 and 2088. This is same as the total federal coal-related GHG emissions under Alternative B and higher than Alternatives C and D.

Table 3-80
Greenhouse Gas Emissions from Mining, Transportation, and Downstream Combustion of Federal Coal from Pending Federal Lease Applications in the Planning Area under Alternative A

Year	Federal Production (tons)	Federal Coal Mining Emissions (MMT CO_2e)	Federal Coal Transportation Emissions (MMT CO_2e)	Federal Coal Downstream Combustion Emissions (MMT CO_2e)	Federal Coal Total Emissions (MMT CO_2e)
2023-2035	0	0.00	0.00	0.00	0.00
2036	6,010,658	0.13	0.23	10.21	10.58
2037	6,270,578	0.14	0.24	10.66	11.04
2038	6,270,578	0.14	0.24	10.66	11.04
2039-2061	6,270,578	0.14	0.24	10.66	11.04
2062-2088	0	0.00	0.00	0.00	0.00
Total from 2023-2038	**18,551,815**	**0.40**	**0.72**	**31.53**	**32.65**
Total from 2023-2088	**162,775,118**	**3.51**	**6.33**	**276.62**	**286.45**

Notes:
CO_2e are calculated using the 20-year time horizon GWPs from the AR6 (IPCC 2021): CO_2 = 1; CH_4 = 82.5; N_2O = 273.
Emissions by individual GHG and 100-year CO_2e are provided in **Appendix C**.

Table 3-81
Greenhouse Gas Emissions from Mining, Transportation, and Downstream Combustion of Federal Coal from Potential Future Subsequent Lease Applications in the Planning Area under Alternative A

Year	Annual Federal Production (tons)	Federal Coal Mining Emissions (MMT CO_2e)	Federal Coal Transportation Emissions (MMT CO_2e)	Federal Coal Downstream Combustion Emissions (MMT CO_2e)	Federal Coal Total Emissions (MMT CO_2e)
2023-2061	0	0.00	0.00	0.00	0.00
2062-2088	6,270,578	0.14	0.24	10.66	11.04
Total from 2023-2038	**0**	**0.00**	**0.00**	**0.00**	**0.00**
Total from 2023-2088	**169,305,617**	**3.65**	**6.59**	**287.71**	**297.95**

Notes:
CO_2e are calculated using the 20-year time horizon GWPs from the AR6 (IPCC 2021): CO_2 = 1; CH_4 = 82.5; N_2O = 273.
Emissions by individual GHG and 100-year CO_2e are provided in **Appendix C**.

Table 3-82 shows the number of coal-fired power plants, gasoline-powered passenger vehicles, and other more readily understandable sources that would result in the equivalent amount of annual emissions (produced, avoided or sequestered) as the annual average coal-related emissions under each alternative. As with the coal-related GHG emissions discussed above, the equivalent emissions under Alternative A are the same as Alternative B and higher than Alternatives C and D.

Table 3-82
Comparison of the Annual Average Coal-Related Greenhouse Gas Emissions from Pending and Potential Future Subsequent Federal Lease Applications under Alternatives A, B, C and D to Equivalent Annual GHG Emissions Produced, Avoided, or Sequestered from other Common Activities

Federal Lease Applications	Alternative	Average Annual Federal Coal-Related Emissions* (MMT CO_2e)	Number of Coal-fired Power Plants†	Number of Gasoline-Powered Passenger Vehicles†	Number of Homes' Electricity Use†	Number of Wind Turbines§	Acres of US Forests¶
Pending	A	11.00	2.9	2,371,146	2,141,209	2,991	13,023,194
	B	11.00	2.9	2,371,146	2,141,209	2,991	13,023,194
	C	11.00	2.9	2,371,146	2,141,209	2,991	13,023,194
	D	0	0	0	0	0	0
Potential Future Subsequent	A	11.04	3	2,377,716	2,147,142	3,000	13,059,282
	B	11.04	3	2,377,716	2,147,142	3,000	13,059,282
	C	0	0	0	0	0	0
	D	0	0	0	0	0	0

Source: Calculated using the EPA Greenhouse Gas Equivalencies Calculator (https://www.epa.gov/energy/greenhouse-gas-equivalencies-calculator) with the 100-year CO_2e emissions from coal-related activities (direct, transportation, and downstream combustion) from potential future subsequent federal leases under each alternative.
Notes: Calculated using the EPA Greenhouse Gas Equivalencies Calculator (https://www.epa.gov/energy/greenhouse-gas-equivalencies-calculator) with the 100-year CO_2e emissions from coal-related activities (direct, transportation, and downstream combustion) from pending and potential future subsequent federal lease applications under each alternative. CO_2e are calculated using the 100-year time horizon GWPs from the AR6 (IPCC 2021): CO_2 = 1; CH_4 = 29.8; N_2O = 273.
* The average annual emissions were calculated for the period 2036 to 2050 for pending federal lease applications and 2062 to 2088 for potential future subsequent federal lease applications under each alternative to allow for a consistent comparison between alternatives. The coal-related emissions include direct, transportation, and downstream combustion emissions.
† Annual equivalent emissions produced by
§ Annual equivalent emissions avoided
¶ Annual equivalent emissions sequestered

Social Cost of Greenhouse Gas Emissions from Pending and Potential Future Subsequent Coal Lease Applications

This subsection monetizes the GHG emissions as presented above in **Table 3-80** and **Table 3-81**. SC-GHG calculation are included in **Table 3-83**. Estimates are provided for 2036-2088. Values provided past 2038 have lower confidence than those in the near term due to uncertainty in modeling factors such as physical effects of GHG emissions, human behavior, future population growth and economic changes. Detailed tables with social cost specific to CO_2, CH_4, and NO_2 are included in **Appendix D**, Table D-9.

Table 3-83
Social Cost of GHG Emissions from Pending and Potential Future Subsequent Federal Lease Applications in the Planning Area under Alternative A

Years	Average Value, 5% discount rate	Average Value, 3% discount rate	Average Value, 2.5% discount rate	95th Percentile Value, 3% discount rate
2036	$121,702,800	$476,325,600	$725,055,400	$1,452,585,600
2037	$124,014,600	$490,524,500	$748,309,600	$1,498,163,500
2038	$121,051,700	$484,076,800	$740,162,400	$1,480,652,100
Total 2036-2038	$366,769,100	$1,450,926,900	$2,213,527,400	$4,431,401,100
2039	$118,094,500	$477,588,400	$731,960,500	$1,462,883,200
2040	$115,144,500	$471,067,400	$723,718,300	$1,444,899,700
2041	$112,478,900	$464,538,700	$715,263,500	$1,424,724,200
2042	$109,806,100	$457,990,700	$706,790,600	$1,404,492,100
2043	$107,132,700	$451,430,000	$698,299,100	$1,384,235,800
2044	$104,465,000	$444,863,000	$689,807,700	$1,363,967,900
2045	$101,808,400	$438,290,100	$681,315,000	$1,343,706,500
2046	$99,171,300	$431,728,000	$672,826,300	$1,323,462,800
2047	$96,551,300	$425,176,300	$664,346,300	$1,303,263,700
2048	$93,956,000	$418,640,000	$655,874,100	$1,283,118,500
2049	$91,388,800	$412,119,000	$647,425,500	$1,263,036,300
2050	$88,853,200	$405,627,300	$638,998,800	$1,243,040,100
2051	$86,467,100	$399,393,200	$630,856,900	$1,223,831,300
2052	$84,145,100	$393,254,900	$622,818,800	$1,204,919,500
2053	$81,885,500	$387,211,100	$614,883,300	$1,186,300,200
2054	$79,686,600	$381,260,300	$607,049,100	$1,167,968,800
2055	$77,546,700	$375,401,000	$599,314,900	$1,149,920,900
2056	$75,464,300	$369,631,800	$591,679,300	$1,132,152,100
2057	$73,437,800	$363,951,400	$584,141,200	$1,114,658,100
2058	$71,465,800	$358,358,400	$576,699,300	$1,097,434,600
2059	$69,546,700	$352,851,400	$569,352,400	$1,080,477,400
2060	$67,679,100	$347,429,200	$562,099,200	$1,063,782,500
2061	$65,861,700	$342,090,300	$554,938,600	$1,047,345,700
Total 2039-2061	$2,073,884,000	$9,372,940,000	$14,743,827,000	$28,721,844,000
2062-2088 average annual value	$40,738,000	$253,154,000	$429,887,000	$776,197,000

Source: GHG emission calculation and IWG 2021
Note: Social cost estimates for emissions years beyond 2050 are estimated using an annual growth rate equal to the average annual growth in social cost estimates for the last 5 years of available estimates from IWG 2021 (2046-2050).

Table 3-84 shows the comparison of the social cost of GHG emissions under each alternative for 2036-2061. As with the coal-related GHG emissions discussed above, costs under Alternative A are the same as Alternative B and higher than Alternatives C and D.

Table 3-84
Comparison of the Total Coal-Related Social Cost from Greenhouse Gas Emissions from Pending and Potential Future Subsequent Federal Lease Applications under Alternatives A, B, C, and D (2036-2061)

Alternative	Average Value, 5% discount rate	Average Value, 3% discount rate	Average Value, 2.5% discount rate	95th Percentile Value, 3% discount rate
A	$2,438,806,000	$10,820,819,000	$16,953,986,000	$33,145,023,000
B	$2,438,806,000	$10,820,819,000	$16,953,986,000	$33,145,023,000
C	$1,605,620,000	$6,749,986,000	$10,440,153,000	$20,676,232,000
D	0	0	0	0

Source: GHG emission calculation and IWG 2021
Note: Social Cost estimates for emissions years beyond 2050 are estimated using an annual growth rate equal to the average annual growth in social cost estimates for the last 5 years of available estimates from IWG 2021 (2046-2050).

Alternative B

The federal coal production in the planning area from pending and potential future subsequent federal lease applications under Alternative B would be the same as Alternative A, and thus the corresponding GHG emissions from the mining, transportation, and downstream combustion of federal coal would also be the same. Emissions of GHGs from the mining, transportation, and downstream combustion of coal from pending federal lease applications in the planning area under Alternative B are shown in **Table 3-85** and the emissions from potential future subsequent federal leases are shown in **Table 3-86**.

Table 3-85
Greenhouse Gas Emissions from Mining, Transportation, and Downstream Combustion of Federal Coal from Pending Federal Lease Applications in the Planning Area under Alternative B

Year	Annual Federal Production (tons)	Federal Coal Mining Emissions (MMT CO_2e)	Federal Coal Transportatio n Emissions (MMT CO_2e)	Federal Coal Downstream Combustion Emissions (MMT CO_2e)	Federal Coal Total Emissions (MMT CO_2e)
2023-2035	0	0.00	0.00	0.00	0.00
2036	6,010,658	0.13	0.23	10.21	10.58
2037	6,270,578	0.14	0.24	10.66	11.04
2038	6,270,578	0.14	0.24	10.66	11.04
2039-2061	6,270,578	0.14	0.24	10.66	11.04
2062-2088	0	0.00	0.00	0.00	0.00
Total from 2023-2038	**18,551,815**	**0.40**	**0.72**	**31.53**	**32.65**
Total from 2023-2088	**162,775,118**	**3.51**	**6.33**	**276.62**	**286.45**

Notes:
CO_2e are calculated using the 20-year time horizon GWPs from the AR6 (IPCC 2021): CO_2 = 1; CH_4 = 82.5; N_2O = 273.
Emissions by individual GHG and 100-year CO_2e are provided in **Appendix C**.

Table 3-86
Greenhouse Gas Emissions from Mining, Transportation, and Downstream Combustion of Federal Coal from Potential Future Subsequent Lease Applications in the Planning Area under Alternative B

Year	Annual Federal Production (tons)	Federal Coal Mining Emissions (MMT CO_2e)	Federal Coal Transportation Emissions (MMT CO_2e)	Federal Coal Downstream Combustion Emissions (MMT CO_2e)	Federal Coal Total Emissions (MMT CO_2e)
2023-2061	0	0.00	0.00	0.00	0.00
2062-2088	6,270,578	0.14	0.24	10.66	11.04
Total from 2023-2038	**0**	**0.00**	**0.00**	**0.00**	**0.00**
Total from 2023-2088	**169,305,617**	**3.65**	**6.59**	**287.71**	**297.95**

Notes:
CO_2e are calculated using the 20-year time horizon GWPs from the AR6 (IPCC 2021): CO_2 = 1; CH_4 = 82.5; N_2O = 273.
Emissions by individual GHG and 100-year CO_2e are provided in **Appendix C**.

In total, the mining, transportation, and downstream combustion of coal from pending and potential future subsequent federal lease applications under Alternative B would result in GHG emissions of 584.4 MMT CO_2e between 2036 and 2088. This is the same as the total federal coal-related GHG emissions under Alternative B and higher than Alternatives C and D.

Table 3-82 shows the number of coal-fired power plants, gasoline-powered passenger vehicles, and other more readily understandable sources that would result in the equivalent amount of annual emissions (produced, avoided, or sequestered) as the annual average coal-related emissions under each alternative. The equivalencies under Alternative B are the same as Alternative A as the federal production and GHG emissions are the same.

Social Cost of Greenhouse Gas Emissions from Pending and Potential Future Subsequent Coal Lease Applications

This subsection monetizes the GHG emissions as presented above in **Table 3-86** and **Table 3-87**. Social Cost of Greenhouse Gas calculation are included in **Table 3-83**. Emissions estimates under Alternative B are the same as those under Alternative A. As a result, the social cost of GHG estimates are the same as discussed under Alternative A.

Alternative C

As with the other alternatives, the production and emissions due to existing coal leases and associated mining, transportation, and downstream combustion discussed in **Section 3.4.1** would occur under this alternative. Greenhouse gas emissions from the mining, transportation, and downstream combustion of federal coal produced under Alternative C are shown in **Table 3-87** for pending federal lease applications and **Table 3-88** for potential future subsequent federal leases. Emissions and SC-GHG emissions would be the same as described under Alternative A, with the exception that since no potential future subsequent leases would be issued, emissions and associated SC-GHG would be diminished following the cessation of mining and combustion of pending federal lease applications for Spring Creek Mine after 2050.

Table 3-87
Greenhouse Gas Emissions from Mining, Transportation, and Downstream Combustion of Federal Coal from Pending Federal Lease Applications in the Planning Area under Alternative C

Year	Annual Federal Production (tons)	Federal Coal Mining Emissions (MMT CO_2e)	Federal Coal Transportation Emissions (MMT CO_2e)	Federal Coal Downstream Combustion Emissions (MMT CO_2e)	Federal Coal Total Emissions (MMT CO_2e)
2023-2035	0	0.00	0.00	0.00	0.00
2036	6,010,658	0.13	0.23	10.21	10.58
2037	6,270,578	0.14	0.24	10.66	11.04
2038	6,270,578	0.14	0.24	10.66	11.04
2039-2050	6,270,578	0.14	0.24	10.66	11.04
2051-2088	0	0.00	0.00	0.00	0.00
Total from 2023-2038	**18,551,815**	**0.40**	**0.72**	**31.53**	**32.65**
Total from 2023-2088	**93,798,756**	**2.02**	**3.65**	**159.40**	**165.07**

Notes:
CO_2e are calculated using the 20-year time horizon GWPs from the AR6 (IPCC 2021): CO_2 = 1; CH_4 = 82.5; N_2O = 273.
Emissions by individual GHG and 100-year CO_2e are provided in **Appendix C**.

Table 3-88
Greenhouse Gas Emissions from Mining, Transportation, and Downstream Combustion of Federal Coal from Potential Future Subsequent Lease Applications in the Planning Area under Alternative C

Year	Annual Federal Production (tons)	Federal Coal Mining Emissions (MMT CO_2e)	Federal Coal Transportation Emissions (MMT CO_2e)	Federal Coal Downstream Combustion Emissions (MMT CO_2e)	Federal Coal Total Emissions (MMT CO_2e)
2023-2088	0	0	0	0	0
Total from 2023-2038	**0**	**0**	**0**	**0**	**0**
Total from 2023-2088	**0**	**0**	**0**	**0**	**0**

Notes:
CO_2e are calculated using the 20-year time horizon GWPs from the AR6 (IPCC 2021): CO_2 = 1; CH_4 = 82.5; N_2O = 273.
Emissions by individual GHG and 100-year CO_2e are provided in **Appendix C**.

Under Alternative C, pending federal lease applications would be restricted to the existing federal mine plan boundary, which BLM forecasts would allow for production from pending federal lease applications through 2050. Thus, GHG emissions during the remaining planning period (that is, 2023 to 2038) and through 2050 would be the same as Alternatives A and B. These GHG emissions would contribute incrementally to global climate change. After 2050, pending federal lease applications would be exhausted, and there would be no production and corresponding GHG emissions from the development of pending federal lease applications. Thus, GHG emissions from pending federal lease applications under Alternative C would be lower than Alternatives A and B from 2051 to 2061 due to 11 fewer years of production.

There would also be no federal coal acres available for any potential future subsequent federal leases (**Appendix B**), and so emissions from potential future subsequent leases would be zero (**Table 3-88**).

In total, the mining, transportation, and downstream combustion of coal from pending and future subsequent federal lease applications under Alternative C would result in GHG emissions of 165.1 MMT CO_2e between 2036 and 2088. This is approximately 72 percent lower than the total coal-related GHG emissions under Alternatives A and B during the same period, but higher than the total coal-related emissions under Alternative D as no new federal coal leases would be issued under that alternative.

Table 3-82 shows the number of coal-fired power plants, gasoline-powered passenger vehicles, and other more readily understandable sources that would result in the equivalent amount of annual emissions (produced, avoided, or sequestered) as the annual average coal-related emissions under each alternative. The annual equivalencies from pending federal lease applications under Alternative C are the same as Alternatives A and B through 2050 as annual production and emissions are the same during that period. However, as discussed above, there would be no production and emissions under Alternative C from potential future subsequent federal leases after 2050, and so the equivalencies would be zero in 2051 and after.

Social Cost of Greenhouse Gas Emissions from Pending and Potential Future Subsequent Coal Lease Applications

This subsection monetizes the GHG emissions as presented above in **Table 3-87** and **Table 3-88**. Under this alternative, the production and emissions due to existing coal leases and associated mining, transportation, and downstream combustion discussed under *Affected Environment* would occur. The annual equivalencies from pending federal lease applications under Alternative C are the same as Alternatives A and B through 2050 as annual production and emissions are the same during that period. However, as discussed above, no additional emission would occur in 2051 and after; therefore, there would be no additional social costs associated with GHG emissions from MCFO coal after this time period. SC-GHG calculations are included below for 2036 to 2050 (**Table 3-89**). Detailed tables with social cost specific to CO_2, CH_4, and NO_2 are included in **Appendix D**, Table D-10.

Table 3-89
Alternative C Social Cost of Greenhouse Gas Estimates 2023-2088 (2020$)

Years	Average Value, 5% discount rate	Average Value, 3% discount rate	Average Value, 2.5% discount rate	95th Percentile Value, 3% discount rate
Total 2036-2038	$366,769,100	$1,450,926,900	$2,213,527,400	$4,431,401,100
Total from 2036-2050	$1,605,620,000	$6,749,986,000	$10,440,153,000	$20,676,232,000
2051-2088	No additional social cost of GHG contributions			

Source: GHG emission calculation and IWG 2021
Note: Social cost estimates for emissions years beyond 2050 are estimated using an annual growth rate equal to the average annual growth in social cost estimates for the last 5 years of available estimates from IWG 2021 (2046-2050).

Alternative D

Under this alternative, the production and emissions due to existing coal leases and associated mining, transportation, and downstream combustion discussed in **Section 3.4.1** would occur. However, there would be no development of new federal coal leases as these applications would be denied or returned. Thus, there would be no coal-related GHG emissions (that is, zero CO_2e) from mining, transportation, and downstream combustion of coal from pending (**Table 3-90**) or potential future subsequent federal leases (**Table 3-91**) under Alternative D and the GHG emissions would be the lowest of all alternatives. Under this alternative, emissions and social costs due to existing coal leases and associated mining, transportation, and downstream combustion discussed in **Section 3.4.1** would occur. Pending and potential future subsequent federal coal lease applications would be denied or returned therefore no additional social costs due to GHG emission would occur.

Table 3-90
Greenhouse Gas Emissions from Mining, Transportation, and Downstream Combustion of Federal Coal from Pending Federal Lease Applications in the Planning Area under Alternative D

Year	Annual Federal Production (tons)	Federal Coal Mining Emissions (MMT CO_2e)	Federal Coal Transportation Emissions (MMT CO_2e)	Federal Coal Downstream Combustion Emissions (MMT CO_2e)	Federal Coal Total Emissions (MMT CO_2e)
2023-2088	0	0	0	0	0
Total from 2023-2038	**0**	**0**	**0**	**0**	**0**
Total from 2023-2088	**0**	**0**	**0**	**0**	**0**

Notes:
CO_2e are calculated using the 20-year time horizon GWPs from the AR6 (IPCC 2021): CO_2 = 1; CH_4 = 82.5; N_2O = 273.
Emissions by individual GHG and 100-year CO_2e are provided in **Appendix C**.

Table 3-91
Greenhouse Gas Emissions from Mining, Transportation, and Downstream Combustion of Federal Coal from Potential Future Subsequent Federal Lease Applications in the Planning Area under Alternative D

Year	Annual Federal Production (tons)	Federal Coal Mining Emissions (MMT CO_2e)	Federal Coal Transportation Emissions (MMT CO_2e)	Federal Coal Downstream Combustion Emissions (MMT CO_2e)	Federal Coal Total Emissions (MMT CO_2e)
2023-2088	0	0	0	0	0
Total from 2023-2038	**0**	**0**	**0**	**0**	**0**
Total from 2023-2088	**0**	**0**	**0**	**0**	**0**

Notes:
CO_2e are calculated using the 20-year time horizon GWPs from the AR6 (IPCC 2021): CO_2 = 1; CH_4 = 82.5; N_2O = 273.
Emissions by individual GHG and 100-year CO_2e are provided in **Appendix C**.

Social Cost of Greenhouse Gas Emissions from Pending and Potential Future Subsequent Coal Lease Applications

Under Alternative D, as shown above (**Table 3-90** and **Table 3-91**) the production and emissions due to existing coal leases and associated mining, transportation, and downstream combustion discussed in **Section 3.4.1** would occur. However, there would be no development of pending or potential future subsequent federal leases as these applications would be denied or returned. Thus, GHG emissions and associated social costs from mining, transportation, and downstream combustion of federal coal from new leases would be zero.

3.4.3 Cumulative Impacts

The production, transportation and processing, and downstream combustion of federal oil, gas, and coal produced in the planning area along with other BLM-authorized activities would result in the emission of GHGs that would contribute to global warming and the climate change impacts discussed in **Section 3.4.1**.

Table 3-92 shows the cumulative GHG emissions from federal and nonfederal coal-related activities related to mining, transportation, and downstream combustion. Total emissions are shown for the 2023 to 2038 planning period as well as through 2088, which is the year when coal is exhausted under Alternatives A and B. These cumulative coal emissions during the remaining planning period (that is, 2023-2038) total approximately 442.7 MMT CO_2e under Alternatives A, B, C and 408.4 MMT CO_2e under Alternative D.

From 2023-2088, the total (federal plus nonfederal) coal-related GHG emissions are highest under Alternatives A and B. The total coal-related emissions during this period under Alternative C and Alternative D are approximately 33.9 percent and 47.3 percent lower than Alternatives A and B, respectively. Downstream coal combustion comprises more than 97 percent of the emissions in all cases.

Table 3-92
Cumulative Greenhouse Gas Emissions from Federal and Nonfederal Coal-related Activities

Period	Alternative	Coal Mining Emissions (MMT CO_2e)	Coal Transportation Emissions (MMT CO_2e)	Coal Downstream Combustion Emissions (MMT CO_2e)	Total Coal Emissions (MMT CO_2e)
2023-2038	A	5.5	5.3	431.9	442.7
	B	5.5	5.3	431.9	442.7
	C	5.5	5.3	431.9	442.7
	D	5.1	4.6	398.7	408.4
2023-2088	A	15.8	18.0	1,247.6	1,281.4
	B	15.8	18.0	1,247.6	1,281.4
	C	10.5	8.4	827.9	846.8
	D	8.4	4.6	662.3	675.3

Notes:
CO_2e are calculated using the 20-year time horizon GWPs from the AR6 (IPCC 2021): CO_2 = 1; CH_4 = 82.5; N_2O = 273.
Emissions by individual GHG and using the 100-year GWPs from AR6 are provided in **Appendix C**.

Table 3-93 shows the cumulative GHG emissions from MCFO federal activities related to coal, oil, and gas and other BLM-authorized activities during the planning period (that is, through 2038). The federal coal emissions shown here represent the sum of mining, transportation, and downstream combustion of coal produced in the planning area. The federal oil and gas emissions represent the sum of production, transportation/processing, and downstream combustion of oil, conventional natural gas, and coalbed natural gas produced in the planning area. These emissions total approximately 319.1 MMT CO_2e under Alternatives A, B, and C and 286.5 MMT CO_2e under Alternative D. Federal coal-related emissions comprise more approximately 84 percent of the total federal emissions under Alternatives A, B, and C and 74 percent under Alternative D. **Table 3-94** presents the cumulative GHG emissions due to MCFO federal activities and nonfederal activities, including direct emissions, processing, transportation and downstream combustion of coal, oil, and gas from the planning period for 2023 to 2038. Under Alternatives A, B, and C, nonfederal activities add 403.1 MMT CO_2e to the federal emissions discussed above resulting in a total of approximately 722.3 MMT CO_2e. Under Alternative D, nonfederal activities add 401.5 MMT CO_2e resulting in a total of 688.0 MMT CO_2e during the remaining planning period.

Table 3-93
Cumulative Greenhouse Gas Emissions from Miles City Field Office Federal Activities from 2023 to 2038

Alternative	Federal Coal-related Emissions (MMT CO_2e)	Federal Oil and Gas-related (MMT CO_2e)	Other BLM-Authorized Activities (MMT CO_2e)	Total Federal Emissions (MMT CO_2e)
A	269.3	42.3	7.6	319.1
B	269.3	42.3	7.6	319.1
C	269.3	42.3	7.6	319.1
D	236.7	42.3	7.6	286.5

Notes:
CO_2e are calculated using the 20-year time horizon GWPs from the AR6 (IPCC 2021): CO_2 = 1; CH_4 = 82.5; N_2O = 273. Emissions by individual GHG and using the 100-year GWPs from AR6 are provided in **Appendix C**.

Table 3-94
Cumulative Greenhouse Gas Emissions due to Miles City Field Office Federal Activities and Nonfederal Activities from 2023 to 2038

Alternative	Federal Emissions (direct + processing + transportation + downstream combustion) (MMT CO_2e)	Nonfederal Emissions (direct + processing + transportation + downstream combustion) (MMT CO_2e)	Total Emissions (direct + processing + transportation + downstream combustion) (MMT CO_2e)
A	319.1	403.1	722.3
B	319.1	403.1	722.3
C	319.1	403.1	722.3
D	286.5	401.5	688.0

Notes: CO_2e are calculated using the 20-year time horizon GWPs from the AR6 (IPCC 2021): CO_2 = 1; CH_4 = 82.5; N_2O = 273. Emissions by individual GHG and using the 100-year GWPs from AR6 are provided in **Appendix C**.

In November 2021, Denbury Carbon Solutions, LLC, submitted a Right-of-Way Grant Application (SF-299) and preliminary plan of development to the MCFO proposing a deep permanent CO_2 geologic sequestration project in Carter County, Montana. The application involves approximately 100,190 acres of BLM-administered lands. The project includes access roads, well pads for 15 underground injection wells (12 on BLM, 3 on State), powerlines, substation, main bulk line, flowlines, temporary use areas, underground pore space, and two pump stations. CO_2 injection would be reviewed and authorized by EPA Underground Injection Control Program for Class VI injection wells.

It is estimated that over a 20-year injection time period, the project area has a potential storage of approximately 409.5 MMT of CO_2 on federal land that would be injected by the 15 proposed wells.[1] This project (if approved) when fully operational would potentially more than offset the total federal GHG emissions from production, transportation, and downstream combustion of MCFO federal coal, oil, and gas through 2038. This would be responsive to the United States' 2050 net-zero goal outlined in Executive Order 14008.

Major non-BLM sources of GHG emissions in the planning area are shown in **Table 3-69** in **Section 3.4.1**. EPA reported emissions of approximately 11.5 MMT CO_2e (based on 100-year GWPs from the IPCC Fourth Assessment Report) for large emitters of GHGs (greater than 25,000 tons/year) in the planning area in 2021. This included coal-fired power plants, agricultural processing facilities, and infrastructure associated with mineral development. However, as discussed in **Section 3.4.1**, Colstrip comprised approximately 87 percent of these emissions in 2021.

The National BLM Specialist Report provides an estimate of GHG emissions attributable to federal mineral estate across the United States. It estimates that approximately 913.9 MMT CO_2e were produced from the extraction, processing, transportation, and end use of fossil fuels on federal mineral estate in the United States in fiscal year 2021 (BLM 2022a). The report also estimates long-term onshore federal oil, gas, and coal production and emissions, and the cumulative emissions estimate from 2022 to 2050 is approximately 24,299 MMT of CO_2e (BLM 2022a). This is based on the 2022 EIA Annual Energy Outlook reference case projection.

Using the Model for the Assessment of Greenhouse Gas Induced Climate Change, the BLM (2022a) estimated that nationally "30-plus years of projected federal emissions would raise average global surface temperatures by approximately 0.0158°C" or 1 percent of the temperature target of limiting global warming to 1.5°C. The long-term federal emissions projections used in the Model for the Assessment of Greenhouse Gas Induced Climate Change run were developed using EIA Annual Energy Outlook reference case projection (BLM 2022a).

3.4.4 Summary

Greenhouse gas emissions from the mining, transportation, and downstream combustion of federal coal produced at the two active mines are evaluated separately for existing, pending, and potential future subsequent federal coal leases.

Existing federal leases are anticipated to allow for federal production to continue until 2060 at Rosebud Mine and 2035 at Spring Creek Mine. As these leases are previously approved actions, the GHG emissions from these existing federal leases were evaluated under the *Affected Environment* and do not vary by alternative. Rosebud Mine does not have any pending federal lease applications, and no new federal leases are needed in the short term or long term (see **Appendix B**); therefore, production and GHG emissions from the mine are only from existing federal leases assessed in **Section 3.4.1**. The GHG emissions from

[1] Denbury Carbon Solutions personal communication by phone on February 1, 2023, regarding the geologic sequestration project.

the mining, transportation, and downstream combustion of coal from existing federal leases at the two mines from 2023 to 2060 are estimated to total approximately 348.8 MMT CO_2e (**Table 3-38**).

Pending federal lease applications would allow production to continue at Spring Creek Mine after existing federal reserves are exhausted in 2035. Under Alternatives A and B, pending federal lease applications are anticipated to allow mining of federal coal to continue at the forecasted production rate until 2061. Under Alternative C, only the portions of the pending federal lease applications within the existing federal mine plan boundary would be acceptable for leasing, and there would be no federal coal acres available to cover the portion of the pending federal lease applications outside the current federal mine plan boundary (or any potential future subsequent federal lease applications). BLM forecasts that the portion of the pending federal lease applications that are acceptable for leasing under Alternative C would allow production to continue until 2050. Under Alternative D, pending federal lease applications would not be approved and thus no production or GHG emissions would occur.

The GHG emissions from the mining, transportation, and downstream combustion of coal from pending federal lease applications during the remaining planning period (that is, 2023 to 2038) are estimated to be approximately 32.7 MMT CO_2e under Alternatives A, B, and C (**Table 3-80**, **Table 3-85**, and **Table 3-87**, respectively) and zero under Alternative D (**Table 3-90**). After 2038, the development of pending federal lease applications are estimated to result in total GHG emissions of 286.5 MMT CO_2e under Alternatives A and B (**Table 3-80**, **Table 3-85**) and 165.1 MMT CO_2e under Alternative C (**Table 3-87**). Thus, the GHG emissions from the mining, transportation, and downstream combustion of coal from pending federal lease applications under Alternative C are approximately 42 percent lower than those under Alternatives A and B due to 11 fewer years of production. Alternative D would have no GHG emissions from pending federal lease applications, as discussed above.

Potential future subsequent federal leases under Alternatives A and B would allow for coal mining to continue at Spring Creek Mine from 2062 to 2088. The mining, transportation, and downstream combustion of coal from potential future subsequent leases under Alternative A and Alternative B during this period are estimated to result in approximately 297.9 MMT CO_2e (**Table 3-81** and **Table 3-86**, respectively). Potential future subsequent leases would not be issued under Alternatives C and D and thus these additional GHG emissions would not occur.

In total, the GHG emissions and resulting climate change impacts from mining, transportation, and downstream combustion of coal from pending and potential future subsequent federal lease applications would be the highest under Alternatives A and B (that is, 584.4 MMT CO_2e between 2036 and 2088), lower under Alternative C (that is, 165.1 MMT CO_2e between 2036 and 2088), and zero under Alternative D.

The forecasted activity levels from oil and gas and other BLM-authorized activities are the same across all alternatives, and thus the GHG emissions and resulting climate change impacts from these federal activities would also be the same. The public health effects due to GHGs from the downstream combustion of planning area coal and oil and gas are monetized in the social cost of GHG analysis.

The proposed CO_2 injection project in Carter County in the planning area has a potential for geological sequestration of approximately 409.5 MMT of CO_2 on federal land that could potentially more than offset the total federal GHG emissions from production, transportation, and downstream combustion of MCFO federal coal, oil, and gas through 2038. This would be responsive to the United States' 2050 net-zero goal outlined in Executive Order 14008.

3.5 ECONOMIC CONSIDERATIONS

This section incorporates by reference the affected environment described in the 2015 Proposed RMP/Final EIS (BLM 2015a; *Social and Economic Conditions – Affected Environment*, pages 3-129 through 3-145). Updated baseline information as it pertains to the decisions for this SEIS is included below. This section discloses the economic impacts of the actions considered in this SEIS, including an updated RFD scenario, as discussed in **Chapter 2**.

3.5.1 Affected Environment

Socioeconomic Analysis Area

Big Horn, Rosebud, and Treasure Counties are located within the jurisdiction of the BLM MCFO and contain authorized federal coal leases. Therefore, baseline information is included for the social and economic conditions of these counties. Yellowstone County, Montana, and Sheridan County, Wyoming, do not contain active coal mines within the jurisdiction of the MCFO. However, based on intercounty commuting patterns, these counties are included in the socioeconomic analysis area. An overview of the socioeconomic analysis area is provided in **Figure 3-12**.

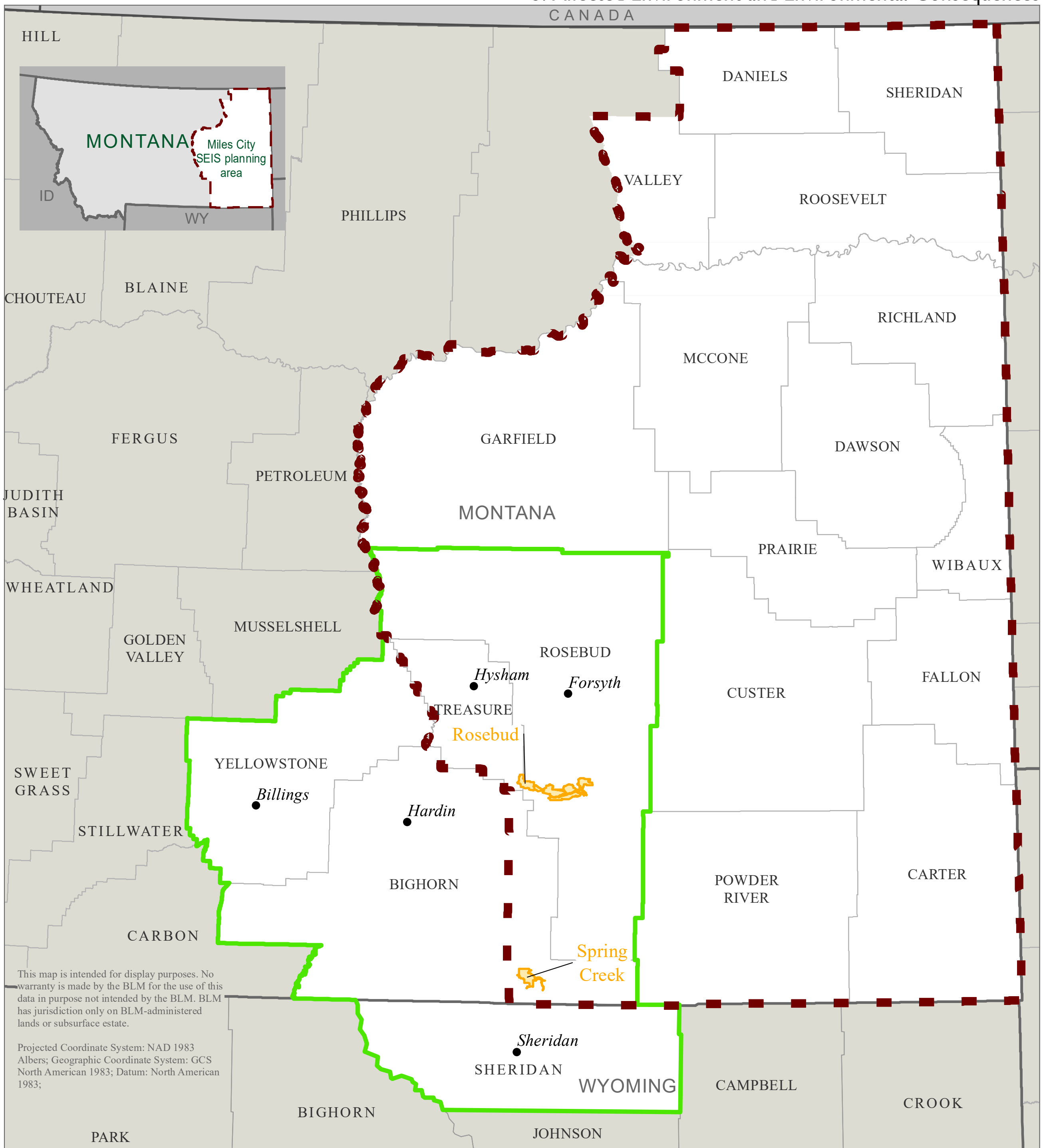
In addition to the direct socioeconomic analysis area described above, additional social and economic impacts are possible due to coal processing at power plants.

In addition to the areas described above, the MCFO has authorized federal leases for Richland County (Savage Mine). The Savage Mine served the Lewis and Clark Station and the Sidney Sugars Processing Plant located near Sidney, Montana. The Savage Mine ceased mining on its only federal lease in September 2017 and is now in reclamation status. All current production comes from nonfederal leases and only occurs for a few weeks a year, as needed to supply the limited coal required for the Sugar Processing Plant operations. Savage Mine plans to close and complete reclamation when Sidney Sugars Plant no longer requires coal as a fuel source due to conversion to natural gas, estimated by 2028. Savage Mine has no plans to pursue any future mining of federal coal. Therefore, future production from Savage Mine is not considered in the updated RFD scenario or economic analysis in this section, and Richland County is not included in the socioeconomic analysis area.

Economic Conditions

Economic Setting

In 2021, mining, quarrying, and oil and gas extraction represented an important source of employment and income in the socioeconomic analysis area counties, particularly for Bighorn County, where jobs in this sector represented 14.5 percent of total private employment compared to 2.5 percent at the state level (see **Appendix D**, Tables D-3 and D-4). Coal represents only a portion of total mineral extraction jobs. In 2021, coal mining represented approximately 12.4 percent of total private jobs in Big Horn County and 15.0 percent in Rosebud County, with additional jobs related to coal support jobs. In Treasure and Sheridan County no coal mining jobs were reported and in Yellowstone County, jobs represented 0.1 percent of private employment (**Table 3-95**).



UNITED STATES DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT
MILES CITY FIELD OFFICE

Figure 3-12
Socioeconomic Overview

Socioeconomic study area
Active coal mine permit
Miles City Field Office

1 inch = 43.4 miles

0 5 10 20 30 40 Miles

Table 3-95
Estimated Coal Sector Employment

Geographic Area	Sector	Number and Percent of Total Private Employment
Big Horn County, MT	Coal Mining[1]	251
		12.4%
	Coal Support Activities[2]	58
		2.9%
	All Private Employment	2,020
Rosebud County, MT	Coal Mining[1]	310
		15.0%
	Coal Support Activities[2]	0
		0.0%
	All Private Employment	2,070
Treasure County, MT	Coal Mining[1]	0
		0.0%
	Coal Support Activities[2]	0
		0.0%
	All Private Employment	144
Yellowstone County, MT	Coal Mining[1]	60
		0.1%
	Coal Support Activities[2]	0
		0.0%
	All Private Employment	73,613
Sheridan County, WY	Coal Mining[1]	0
		0.0%
	Coal Support Activities[2]	0
		0.0%
	All Private Employment	10,067
Montana	Coal Mining[1]	831
		0.2%
	Coal Support Activities[2]	127
		0.0%
	All Private Employment	395,464

Source: Bureau of Labor Statistics 2022
[1] North American Industry Classification System code 2121
[2] North American Industry Classification System code 213113
Notes: Percent represents percent of private employment for the county.
(ND): Not Disclosable – data do not meet Bureau of Labor Statistics or State agency disclosure standards.
(-) indicates no data availability.

Coal jobs have historically paid higher annual wages on average when compared with all private sector employment. In the State of Montana, based on 2017 Bureau of Labor Statistics data, coal mining paid 2.24 times higher than average private sector employment (more recent data are not available from the Bureau of Labor Statistics due to nondisclosure for proprietary reasons). As a result, reductions in coal employment may have a higher level of economic impact on the regional economy compared with reductions in other, lower paying sectors. Rosebud County had higher average earning per job than the

State of Montana based on Bureau of Economic Analysis 2021 data, which may be in part due to coal sector employment (see **Appendix D**, Table D-5).

For a more detailed discussion of employment and earnings within the socioeconomic analysis area see **Appendix D**.

Coal Production

This section serves to update the coal market information provided in the 2019 SEIS, Appendix D, Supplemental Coal Market Report (BLM 2019). See the 2019 SEIS and **Appendix D** of this SEIS for additional historical information.

The United States holds the largest single-region coal reserves in the world, accounting for approximately 30 percent of global reserves. In 2021, US coal production was approximately 577 million short tons (MMst; EIA 2022i). US coal reserves are concentrated in three regions: the Appalachian, Interior, and Western coal regions. Each region contains coal-producing basins (EIA 2022i). Montana is part of the Western coal region, the largest coal-producing region in the United States. The Powder River Basin, within the Western coal region, is the largest coal-producing basin in the United States, accounting for approximately 76.5 percent of total coal production in the Western coal region and 43.5 percent of total coal production in the United States (EIA 2022i). In 2021, the Western coal region produced a total of 328 MMst from 45 mines. Within the Western coal region, the Powder River Basin produced 251 MMst of surface coal from 16 mines (EIA 2022i).

In 2021, Montana was the fifth-highest coal producer in the United States, with approximately 28.6 MMst mined within the state (EIA 2022i). Historically, the Montana coal industry has been an important economic driver for the state, accounting for a total employment contribution of 6,138 direct and indirect jobs and generating approximately $828 million in total contributions to state gross domestic product in 2021 (National Mining Association 2022). The coal industry also provides revenue in the form of state and local tax distributions. Information is described in further detail in the *Mineral Revenue* section, below.

Coal production in Montana also contributes to the Montana Coal Severance Tax Trust Fund, which supports a variety of public infrastructure projects throughout the state, not just in coal-producing counties (Montana Department of Commerce 2017; Montana Legislative Fiscal Division 2015).

In 2021, approximately 21.3 MMst of coal were produced within the socioeconomic analysis area of Big Horn and Rosebud Counties and Treasure County. Approximately 69.7 percent of production in the socioeconomic analysis area occurred in Big Horn County (Mine Safety and Health Administration [MSHA] 2022). Of the total coal production in the socioeconomic analysis area, approximately 58 percent came from coal mined on federal mineral estate. **Table 3-96** describes coal production in each county, the Powder River Basin, and the State of Montana.

Coal production from the Powder River Basin has been on a declining trend since reaching a peak in 2008 when annual production was approximately 496 MMst. In 2021, the most recent year for which complete data are available, reported production was 251 MMst (EIA 2022i). The decline in coal production is generally attributed to several factors, including the hydraulic fracturing boom beginning in the late 2000s, which prompted generating units to switch from coal to lower-cost natural gas as a fuel source; competition from other power sources, such as natural gas and renewable sources, forced older and less-

Table 3-96
Socioeconomic Analysis Area Coal Production, 2021

Production Category	Big Horn County	Rosebud County	Powder River Basin	Montana
Number of Mines	3	1	16	6
Coal Production (MMst)	14.7	6.5	251.3	28.6

Source: MSHA 2022
Note: The Powder River Basin and Western coal region include mines that are not within the state of Montana. Four mines within the Powder River Basin are also within Montana. Two mines within the remainder of the Western coal region are within Montana. No active mines are located within Sheridan and Yellowstone Counites. Treasure County includes federal leases within MCFO, but no active mining has occurred. Mining at the Rosebud Mine is captured in Big Horn County data.

efficient generating units out of business; and increasingly stringent emissions regulations, which forced some generating unit retirements and prompted others to switch away from coal as a fuel source (Roemer et al. 2021). These factors are expected to continue to impact future demand for thermal coal.

Since the start of 2020, Montana has lost almost 7 million tons of annual coal production capacity from its taxable mines. This is due to multiple factors, including a reduction in the generating capacity at Montana's Colstrip Power Plant, which is supplied by the Rosebud Mine; and closure of the Dakota Utilities' Lewis and Clark Generating Station (44 megawatts), which resulted in the reduction of the Savage Mine that supplied coal to this plant. The Decker Mine in Big Horn County also ceased operation in February 2021, citing tough market conditions for coal (Governor's Office of Budget and Program Planning 2021).

The Spring Creek Mine produced the most coal in the planning area in 2021, accounting for approximately 13.1 MMst, or 62 percent of the socioeconomic analysis area total (MSHA 2022). **Table 3-97** presents 2017 and 2021 coal production by mine. Compared with 2017 data, 2021 production represents an approximate 27 percent decrease.

Recoverable reserves present the forecasted amount of coal that can be potentially recovered with today's mining technology after considering accessibility constraints and recovery factors. In 2021, Montana had approximately 559 MMst of recoverable reserves, accounting for 4.5 percent of total US reserves (EIA 2022i).

The BLM obtained the price of coal from the EIA Minemouth price database. Coal prices were derived from the quality of the coal produced and the ease of the mineral's extraction. Because Powder River Basin coal has a lower heating value and can be mined from the surface relatively inexpensively, it commands a lower price than coal from other coal-producing regions. In 2021, the average annual price for Powder River Basin coal was $12.43 per short ton (EIA 2022k). **Table 3-98** shows the 2021 average coal prices by region. These prices do not include transportation costs, which can increase overall coal costs, especially if shipped to out-of-state customers.

Table 3-97
Socioeconomic Analysis Area Production by Coal Mine, 2017–2021

Mine Name	Percent Federal Permitted Acres	County	Mine Status as of 2022	2017 Coal Production (MMst)	2021 Coal Production (MMst)	% change Production 2017-2021
Decker Mine (East and West)	87.5	Big Horn	Temporary cessation, awaiting reclamation.	4.2	0.2	-95.2%
Absaloka Mine	0 (Crow Indian Tribe)	Big Horn	Active	3.6	1.4	-61.1%
Spring Creek Mine	85.6	Big Horn	Active	12.7	13.1	.03%
Rosebud Mine	39.9	Rosebud and Treasure	Active	8.6	6.5	-24.4%
Socioeconomic Analysis Area Total	**-**	**-**		**29.0**	**21.1**	**-27.2%**

Source: MSHA 2022
[1]See the RFD scenario in **Appendix B** for details on permitted acres.
Note: Excludes Savage Mine in Richland County, which is located within the MCFO but outside of the socioeconomic analysis area. The Savage Mine ceased mining on its only federal lease in September 2017 and it is now in reclamation status. There are no active mines in Yellowstone County, MT or Sheridan County, WY.

Table 3-98
Minemouth Database Coal Prices by Region, 2021

Basin	Price per Short Ton (2021$)
Arizona/New Mexico	36.19
Northern Appalachia	60.72
Central Appalachia	81.18
Southern Appalachia	101.95
Eastern Interior	41.33
Rocky Mountain	40.81
Gulf	16.77
Powder River Basin	**12.43**

Source: EIA 2022k

Compared with other coal-producing basins that provided low-sulfur, sub-bituminous coal, in 2021, Montana coal had the second-lowest price in the United States; only Wyoming Powder River Basin coal held lower prices. The average price of Western region Montana low-sulfur sub-bituminous coal, at $15.34 per short ton, was higher than the Powder River Basin average of $12.43 per short ton, while Wyoming Powder River Basin coal, at $12.40 per short ton, was slightly lower than the Powder River Basin average (EIA 2022k). The average price of low-sulfur, sub-bituminous coal is shown in **Table 3-99**.

Table 3-99
Low-Sulfur, Sub-Bituminous Coal Price per Basin 2021

Basin	Price per Short Ton (2021$)
Washington/Alaska	70.80
Rocky Mountain	43.77
Wyoming – Powder River Basin	12.40
Western Montana[1s]	**15.34**

Source: EIA 2022k
[1]The EIA Minemouth database category of Western Montana is defined as including Western region coal from Montana.

Coal Employment

Employment levels varied across mines and counties in the socioeconomic analysis area. In 2021, a total of 668 people were employed in the socioeconomic analysis area (MSHA 2022). The Rosebud Mine, located in Rosebud and Treasure Counties, represented the majority of coal employment, accounting for 44.4 percent of coal employment in the socioeconomic analysis area (MSHA 2022). No active mines are located within Yellowstone County, Montana, or Sheridan County, Wyoming. See **Table 3-100** for more information on employment distribution. As discussed above, recent mine closures (for example, Decker Mine) have already resulted in decreased employment, a trend that is likely to continue and will likely result in decreased employment in future years.

Table 3-100
Socioeconomic Analysis Area Employment by Mine, 2021

Mine Name	County	Average Annual Employment
Decker Mine	Big Horn	28
Absaloka Mine	Big Horn	67
Spring Creek Mine	Big Horn	273
Rosebud Mine	Rosebud and Treasure	300
Planning Area Total	**-**	**668**

Source: MSHA 2022

Coal employment data identify the relative intensity of the coal industry to total employment. In 2021, Big Horn County had the larger percentage of coal employment relative to total employment at 9.7 percent (MSHA 2022; Bureau of Economic Analysis 2021), although the percentage has decreased to 7.1 percent since 2017. While coal employment at socioeconomic analysis area mines may not provide major employment contributions to state totals, they do provide a larger contribution to the counties within the socioeconomic area of analysis. See **Table 3-101** for more detailed information on coal employment.

Table 3-101
Socioeconomic Analysis Area Coal Employment Ratio, 2017–2021

Year	County	Coal Employment	Total Employment	Percentage Coal Employment
2017	Big Horn	553	5,695	9.7
	Rosebud	327	5,539	5.9
	Treasure	2	382	0.5

Year	County	Coal Employment	Total Employment	Percentage Coal Employment
2021	Big Horn	368	5,159	7.1
	Rosebud	300	4,879	6.1
	Treasure	2	395	0.5
Percent change 2017-2021	Big Horn	-185	-536	2.6% reduction
	Rosebud	-27	-660	0.2% increase
	Treasure	0	13	No change

Source: MSHA 2022; Bureau of Economic Analysis 2021
Note: Yellowstone County, MT and Sheridan County, WY excluded due to lack of active mines in these counties.

Mineral Revenue

Coal mining activities within the socioeconomic analysis area contribute to federal, state, and county fiscal revenues. This SEIS discusses the current conditions of mineral revenues related to coal production within the decision area.

Coal production has historically provided an important revenue source for Montana, through coal severance taxes and coal gross proceeds taxes. These funds support state and local social services such as education, road maintenance, public services, cities, towns, special districts, and more. A trend in reduced coal revenue is anticipated to result in a reduction in statewide and local revenue over the next two decades (Governor's Office of Budget and Program Planning 2021).

Federal Revenues

Surface coal production on federal land in Montana is subject to a federal royalty rate, a rental rate, and abandoned mine land fees. Domestic coal producers are also required to pay a coal excise tax on production volume.

The revenue collected from the coal excise tax by the Internal Revenue Service goes directly into the Black Lung Disability Trust Fund to support medical services for miners with black lung disease (US Office of Natural Resources Revenue 2019). Coal excise taxes were restructured at the beginning of calendar year 2019 to $0.25 per short ton of produced coal (minus the tonnage of moisture content) but may not exceed 2 percent of the market value of production (US Office of Natural Resources Revenue 2019).

Federal royalty rates for surface coal production are prescribed as 12.5 percent of the taxable production value; however, under certain conditions, coal mines can negotiate lower effective royalty rates. As such, Montana reports an average federal royalty rate of 11.61 percent. Rosebud and Spring Creek Mines, however, have an effective royalty percent rate of 12.5 percent. The federal government returns 49 percent of revenues collected back to the states in which they were generated. In Montana, 25 percent of these funds are then distributed to the impacted county.

Federal coal leases are subject to annual rent payments equal to $3 per acre. Abandoned mine land fees are identified as $0.28 per short ton for surface mined coal (US Office of Natural Resources Revenue 2019).

The US Office of Natural Resources Revenue collects 100 percent of federal mineral royalties and returns 49 percent to the state where extraction occurs. Of the 51 percent retained, approximately 40 percent of onshore revenues are sent to the reclamation fund, 10 percent are sent to the US Treasury, and 1 percent are retained for administrative purposes (US Office of Natural Resources Revenue 2019).

For the 2021 fiscal year, the federal government collected approximately $22,202,356 in federal revenue from coal production in Big Horn and Rosebud Counties. This included approximately $15,489,109 in federal revenue from coal production in Big Horn County and $6,713,247 from coal production in Rosebud County (US Office of Natural Resources Revenue 2022; see **Table 3-102**). Treasure County collected federal mineral revenue for rents but not royalties due to a lack of production in the county during the time period examined.

Table 3-102
Estimated Federal Mineral Royalties Collected

	Big Horn County	Rosebud County
2021		
Coal	$15,489,109	$6,713,247
Oil	-	$48,665
Gas	-	-
2020		
Coal	$11,281,906	$9,758,906
Oil	-	$19,713
Gas	-	-
2019		
Coal	$19,545,008	$14,029,542
Oil	-	$44,821
Gas	$736	-
2018		
Coal	$20,283,631	$14,407,742
Oil	-	$64,371
Gas	$2,280	-
2017		
Coal	$22,329,140	$10,147,577
Oil	-	$51,562
Gas	$3,249	-
2016		
Coal	$12,643,703	$16,057,102
Oil	-	$41,180
Gas	$928	-

Source: US Office of Natural Resources Revenue 2022

State Mineral Revenues

The State of Montana imposes two forms of taxes on coal production: the resource indemnity and groundwater assessment tax and a coal severance tax. The resource indemnity and groundwater assessment tax is applied as 0.4 percent of the taxable value of production (US Office of Natural Resources Revenue 2019).

Coal severance taxes vary by quality and mining method; however, surface coal within the socioeconomic analysis area in the Spring Creek and Rosebud Mines is taxed as 15 percent on the taxable value of production (US Office of Natural Resources Revenue 2019). Article XI, Section 5 of the Montana State Constitution requires that 50 percent of collected coal severance taxes be allocated to the Coal Severance Tax Trust Fund, which supports renewable energy development projects, regional water systems, economic development opportunities, and state-operated educational facilities (Montana Department of Commerce 2017; Montana Legislative Fiscal Division 2015). Collected end of year coal severance taxes from 2013 to 2021 are available in **Table 3-103**. Montana imposes production property rents on coal mines located on state land. Rental rates on state land are prescribed at $3 per acre (US Office of Natural Resources Revenue 2019).

The federal government returns 49 percent of federal royalty revenues collected back to the states in which they were generated.

Table 3-103
Montana Coal Severance Taxes

Fiscal Year	Fiscal Year-End (Millions)
2013	$54.5
2014	$56.8
2015	$61.8
2016	$54.5
2017	$55.4
2018	$58.3
2019	$61.0
2020	$51.8
2021	$39.6

Source: Montana Department of Revenue 2022a

County Revenue

Counties in Montana impose a 5 percent flat coal gross proceed on the taxable value of production, where gross proceeds are defined as the "number of tons multiplied by the contract sales price" (Montana Department of Revenue 2022a; US Office of Natural Resources Revenue 2019). Gross proceeds are applied before any costs or expenses are deducted from the total collected contract sale. The revenue is proportionally distributed to the appropriate taxing jurisdictions in which production occurred based on the total number of mills levied in Fiscal Year 1990. Counties rely on gross proceeds taxes to support public and social support services. Changes in collected tax revenue may have disproportionate effects on local economies given the importance to the overall budget. Counties impose gross proceeds taxes on the short tons of coal produced by the contract sales. The county treasurer collects the taxes and disburses them proportionately to the appropriate taxing jurisdiction (Nowakowski 2018).

In 2017, statewide collection of gross proceeds tax totaled $19,856,903, and in 2021, this decreased to $15,109,671. Distribution in 2021 included approximately $4,292,678 for Big Horn County and $3,370,721 for Rosebud County (Montana Department of Revenue 2022b). Although Treasure County contains MCFO coal leases, no mining has occurred associated with these leases, therefore no taxes have been collected.

The federal government returns 49 percent of federal royalty revenues collected back to the states in which they were generated. In Montana, 25 percent of these funds are then distributed to the impacted county. The county share of federal mineral revenue distributed for Rosebud County was $1,727,247, Big Horn County was $1,892,598, and Treasure County was $344 in 2021 (Montana Department of Revenue 2022b). This included all mineral revenue distribution, including that from oil and gas in Rosebud County.

Forecast Production and Economic Contributions

Coal production is driven primarily by the market demand for coal in the US electric generation fuel energy mix. The national coal market is in a decline and is anticipated to maintain this trend throughout the analysis period (to 2038). The EIA forecasts that total US production will drop from over 611 million tons in 2022 to 427 million tons in 2050 (EIA 2022k), with production in the Western region (which includes the MCFO) producing 329 million tons in 2022 and an anticipated decline to 224 million tons in 2050. The decline is associated with multiple factors including the retirement of coal-fired power stations, or the conversion of power stations from coal to natural gas or renewable energy. According to data from the EIA, coal-fired power plants were repurposed to burn other types of fuels between 2011 and 2019, 103 of which were converted to or replaced by natural gas-fired plants. The decision for plants to switch from coal to natural gas was driven by stricter emission standards, low natural gas prices, and more efficient new natural gas turbine technology (EIA 2020). At the state level, it is also anticipated that shipments from Montana mines to domestic coal-fired power plants will continue to fall. In the near term, through 2025, 3.5 gigawatts of coal-fired capacity fueled by Montana coal is slated to go offline, representing approximately 6 million tons of annual coal consumption. By 2035, and additional 4 gigawatts of electric-generating capacity (6 million tons of annual coal consumption) that burns Montana coal will be shut down (Governor's Office of Budget and Program Planning 2021).

Montana mines are more vulnerable to shifts in the domestic market than other states in the Western coal region because they are the marginal producers of western coal. For example, Wyoming mines produce one-third more coal per worker hour than Montana mines. In addition, severance and gross proceeds tax rates in Montana are double the tax rates that Wyoming mines pay. Because gross proceeds and severance taxes are the largest component of operating costs (exceeding payroll costs), Montana mines will be the first to close and the last to reopen when demand declines (Coal County Coalition 2017).

Roughly half of Montana coal production supplies domestic power plants, while the remainder is exported, primarily to the Asia-Pacific region. International exports of Montana coal could help mitigate declines in domestic deliveries; however, transportation costs are high (export volumes are shipped by rail to Westshore Terminal in British Columbia). Other countries more proximal to Asia (such as Australia and Indonesia) could be better suited to meet the Asian coal needs than the United States. Currently, the United States contributes approximately 4.9 percent to the global coal trade (International Energy Agency 2022). Trends between 1990 and 2020 have shown a steady decrease in US coal exports (International Energy Agency 2022). The US coal quality, regulations, and transportation challenges may play a critical factor in the United States' ability to become a larger player in global coal trade. These challenges are not anticipated to be abated during the analysis period. Given the global decline in US exports, other factors that could make exporting more difficult, as well as no definitive factors that would quantify further decrease in US coal exports, the RFD scenario (**Appendix B**) considers a steady state in exports during the analysis period. World prices are, however, volatile, and export volumes vary in response to international prices (Governor's Office of Budget and Program Planning 2021).

Within the socioeconomic analysis area, most of the federal coal produced in the MCFO is burned for energy needs (such as for coal-fired electrical generation). Spring Creek Mine sends up to 10 percent of their production to support non-energy related industrial uses[1], and up to 40 percent of their production is exported. These markets are assumed to remain constant throughout the analysis period. Therefore, it can be assumed that approximately 1.3 million tons of annual production are used for industrial uses, and up to 5.2 million tons of annual production are exported. Because Spring Creek Mine mineral ownership is approximately 85 percent federal minerals (MDEQ permit), it is assumed that approximately 85 percent or more of these annual shipments would be comprised of federal minerals. As Spring Creek Mine completes mining on its private and state leases, more and more of the annual production will be from federal minerals.

Existing federal and nonfederal leases are anticipated to take Spring Creek Mine and Rosebud Mines until 2060 before existing reserves are exhausted. Based on EIA estimates, decreased coal production is anticipated over the analysis period (for additional details, see **Appendix B**). As a result, decreased contributions to employment and income are anticipated in the socioeconomic analysis area. Estimates are provided below for economic contributions from development of existing federal leases.

Forecast production for both Spring Creek and Rosebud Mines from 2023 to 2035 is anticipated to support approximately 620 direct, indirect, and induced average annual jobs. These jobs would support approximately $49.7 million in average annual income and $194.2 million in average annual output from 2023 to 2035. **Table 3-104** shows the detailed effects.

Coal production from 2036 to 2038 at Rosebud Mine is estimated to support approximately 188 direct, indirect, and induced average annual jobs in the socioeconomic analysis area. These jobs would support approximately $15.1 million in average annual income and $59.0 million in average annual output. **Table 3-104** provides detailed effects. Existing federal and nonfederal leases at Rosebud Mine are anticipated to support operations until 2060 and production and from Rosebud Mine is anticipated to continue at approximately the same rates from 2038 to 2060. However, no quantitative contribution estimates are provided beyond the analysis period (2038) due to uncertainties in regional economic setting, coal market, and other factors which may influence the specific level of jobs and income supported by a given production level.

[1] For example, the steel industry uses coal indirectly as coal coke to smelt iron ore into iron to make steel. The high temperatures created by burning coal coke give steel the strength and flexibility needed for bridges, buildings, and automobiles. Similarly, the concrete and paper industries burn large amounts of coal to produce heat for material production-related processes (EIA 2023).

Table 3-104
Average Annual Economic Effects from Existing Federal Leases, 2023–2038

Impact Type	Employment	Labor Income ($)	Output ($)
Rosebud and Spring Creek Mine 2023-2035			
Direct Effect	282	29,103,067	118,792,151
Indirect Effect	166	11,942,403	47,953,916
Induced Effect	172	8,663,348	27,414,260
Total Effect	620	49,708,819	194,160,327
Rosebud Mine 2036-2038			
Direct Effect	86	8,841,651	36,089,625
Indirect Effect	51	3,628,160	14,568,630
Induced Effect	52	2,631,967	8,328,584
Total Effect	188	15,101,778	58,986,839

Source: Calculated based on RFD using Impact Analysis for Planning Model (IMPLAN) 2021

Note: Direct income and employment includes mine employment supported by federal mineral production. Indirect employment and labor income includes industries that supply goods and services to the coal industry, such as drilling equipment. Induced employment and labor income includes industries where miners, mine operations personnel, and those who work in the coal industry's supply chain spend their income, such as restaurants and retail stores.

Note: Direct effects are reflective of production changes or expenditures made by producers/consumers as a result of an activity or policy; Indirect effects are the business-to-business purchases in the supply chain taking place in the region that stem from the initial industry input purchases and occur as the industry specified spends money in the region with their suppliers; Induced effects are the values stemming from household spending of labor income, generated by the spending of the employees within the business supply chain and after removal of taxes, savings, and commuter income. It should be noted that long-term IMPLAN projections assume no major structural changes occurring in the underlying economies.

Mineral Revenue Forecast from Existing Federal Leases

Mineral revenues associated with coal production were calculated by estimating the taxable market value of coal production in the socioeconomic analysis area through federal coal production forecasts over the analysis period. Coal price forecasts were calculated by taking EIA forecasted high economic growth and low economic growth prices and calculating an average growth rate. Revenue was forecasted by applying the percent tax rate to the forecasted market value of production.

A summary of anticipated average annual revenue from existing federal and nonfederal leases for Spring Creek and Rosebud Mines for 2023 to 2035 and for Rosebud Mine from 2036 to 2038 is shown in **Table 3-105**. Rosebud Mine estimates the same level of production for Rosebud Mine from 2038 to 2060. Assuming all state and federal tax rates remain consistent, continued revenue would be anticipated. The exact level would depend on production rates and market value.

Table 3-105
Mineral Revenue from Existing Federal Leases, 2023–2038 (2022$)

	2023–2035 (Rosebud and Spring Creek Mines)	2036–2038 (Rosebud Mine)
Average Annual County Gross Proceed Contributions ($)	$76,102,644	$17,558,444
Federal Royalty Disbursements($)	$6,660,621	$1,997,764
State Severance Taxes($)	$17,562,148	$5,267,532
Resource Indemnity and Groundwater Assessment Tax($)	$4,683,239	$1,404,675
State Totals($)	$28,906,008	$8,669,971
Average Annual Contributions to Montana Coal Severance Tax Trust Fund($)	$8,781,074	$2,633,766
Coal Royalties ($)	$13,593,103	$4,077,070
Coal Excise Tax Contributions ($)	42,436,597	$740,250

<u>Downstream Economic Opportunities and Employment</u>

Based on EIA data, six power plants received MCFO coal in 2021 in four states. It is estimated that on average, 0.18 people are supported per megawatt in operations and maintenance at a coal powered power-plant on a permanent basis (Singh and Fehrs 2001). As a result, an average 300-megawatt coal-fired power plant would employ 54 people on an ongoing basis. This estimate is supported by analysis of EIA rate-regulated, coal-fired power plants (Union of Concerned Scientists 2013). Direct employment at downstream power plants would support additional indirect employment in the regional economy around each power plant. It should be noted that the combustion points identified are supported by coal from other mines in addition to those within the MCFO local analysis area. As a result, employment supported by combustion of coal originating in the MCFO decision area would represent only a portion of jobs and income at each downstream power plant.

3.5.2 Direct and Indirect Impacts

Analysis Methods

Assumptions

This analysis is based on the following assumptions:

- Existing permits for Rosebud Mine would take the mine to 2060 at the BLM-forecasted production rate. No new federal leases are needed for the short- or long-term production under any alternative for Rosebud Mine.
- The existing federal permits and leases are anticipated to take Spring Creek Mine until 2035.
- Economic contribution calculations are based on BLM-projected production rate for Rosebud and Spring Creek Mines.

- Federal, state, and local taxes will continue to be collected on coal produced in the socioeconomic analysis area.
- International, national, and regional market conditions will continue to affect the pace and timing of coal development in the planning area; these issues are outside the BLM's control.
- The 2021 coal production output per worker will hold constant over the analysis period.
- There will be no disruptive changes to existing coal development technology.
- Future coal production being analyzed encompasses low-sulfur, sub-bituminous coal comparable with what is currently produced in socioeconomic analysis area mines.

Indicators

This analysis assesses the following indicators:

- Employment supported by coal production
- Labor income supported by coal production
- Value added supported by coal production
- Revenue collected by federal, state, and county governments supported by coal production

Methodology

To calculate the economic contribution of forecasted federal coal production in the socioeconomic analysis area, an input-output model, IMPLAN, was used to estimate the economic activity supported by forecasted production levels. The IMPLAN model estimates the effects of changes in employment on economic indicators that follow from direct, indirect, and induced impacts.

For this analysis, direct effects can be described as the direct jobs and incomes associated with federal coal production. Indirect effects are the economic changes associated with backward-linked industries, such as the purchases made by suppliers to coal production in the planning area. Induced effects are the economic changes resulting from household spending from changes in household income. Taken together, these combined economic effects describe the contribution of employment shocks from changes in the level of coal production. Effects are described in terms of output, income, and jobs. Additional details about methodology are included in **Appendix D**.

Monetary transfers in the form of taxes or fees were excluded from the IMPLAN analysis; however, these transfer payments are discussed in the *Mineral Revenue* section, above.

Direct, Indirect, and Induced Effects

Economic Contributions

Economic output is converted to a consistent dollar year (2022$ US dollars). Data are reported as annual averages for multi-year increments due to changes in the annual forecast production. Production from existing federal and nonfederal leases would continue to support jobs and income as described in the *Affected Environment, Forecast Production and Economic Contributions* section, above, and would account for economic contributions for the time period of 2023 to 2035 for the Spring Creek Mine and 2023 to 2060 for the Rosebud Mine.

This impact analysis discussion, therefore, provides economic contribution analysis based on anticipated pending and potential future subsequent federal lease applications for Spring Creek Mine by alternative for the time period of 2036 to 2088 (depending on the alternative). These results are described in the tables below, with quantitative estimates provided for 2036 to 2038. Qualitative information is provided for forecasts outside of the analysis period.

Alternative A

Under Alternative A, the decision from the coal screens performed for the MCFO 2019 Proposed RMPA/Final SEIS would be carried forward. The pending federal lease applications would be entirely within the area screened as acceptable for coal leasing and development, and these leases could be issued if other statutory requirements are met. Estimated contributions are shown in **Table 3-106**.

Spring Creek Mine operations would be anticipated to continue to operations until 2088. Annual production is forecast to remain constant after 2038; therefore, economic contributions are anticipated to remain similar over this time frame. Actual income and employment supported during this time period could be impacted by future planning decisions, changes to regional economic conditions, or other factors affecting the relationship between direct employment in the coal sector and indirect and induced effects, as the current forecasts are based on 2021 baseline data.

Table 3-106
Average Annual Economic Effects from Spring Creek Mine Pending Federal Lease Applications

Year	Impact Type	Employment	Labor Income ($)	Output ($)
2036 – 2038	Direct Effect	179	16,290,444	72,495,186
	Indirect Effect	322	7,610,894	30,452,105
	Induced Effect	102	5,112,997	16,129,892
	Total Effect	603	29,014,335	119,077,184

Source: Calculated based on RFD using IMPLAN 2021
Note: direct income and employment includes mine employment supported by federal mineral production. Indirect employment and labor income includes industries that supply goods and services to the coal industry, such as drilling equipment. Induced employment and labor income includes industries where miners, mine operations personnel, and those who work in the coal industry's supply chain spend their income, such as restaurants and retail stores.

Alternative B

Under Alternative B, the area open to coal leasing would be reduced from the area available under Alternative A. However, the current pending federal lease applications would be entirely within the area screened as acceptable for coal leasing and development, and these leases could be issued if other statutory requirements are met. Production estimates would be the same as Alternative A, and estimated regional contributions to jobs, labor income, and output would be as described under Alternative A.

Alternative C

Under Alternative C, restrictions would be placed on pending federal lease applications. However, the constrained pending federal lease applications provide enough reserves to meet production throughout the analysis period (to 2038). Therefore, forecast economic contributions are the same as Alternative A for the analysis period. However, under Alternative C, with BLM-forecast production, the pending federal applications under Alternative C would result in Spring Creek Mine's closure in 2050 (38 years earlier than under Alternatives A and B). Cessation of federal mine operations in 2050 could impact the continuity of operations for nonfederal coal after this time period. This is because with the absence of federal coal, ultimately these parcels are too scattered and limited to allow efficient mining.

In the absence of economic diversification, reduction in coal related economic contributions after 2050 in local communities historically dependent on this economic sector could experience economic and social impacts. Declining coal production and employment in the coal industry, whether projected or realized, can be concerning to rural communities, not only because local employment opportunities can be more limited, but because nonmanagement wages in the coal industry are often higher than those in other local industries. The loss of coal jobs can also have a ripple effect within the regional economy, resulting in additional job losses in industries that supply goods and services to the coal industry, as well as in industries where miners, mine operations personnel, and those who work in the coal industry's supply chain spend their wages.

Increases in unemployment often cause economic instability in rural communities, and the stress of financial uncertainty and instability can negatively affect residents' well-being. During periods of economic downturns from reduced mineral development, increased rates of depression have been reported. In addition, Demand for public services, including public assistance programs, alcohol and drug treatment, and law enforcement, has also been observed to increase during economic downturns following slowed activity and lower employment in mineral extraction industries (Shandro et al. 2011). Collectively, these factors can adversely affect community cohesion and the quality of life in affected communities (Klasic et al. 2022).

It should be noted, however, that job losses in some industries may be offset by job gains in other industries, although this tradeoff may occur outside of the local area economy. This is evidenced in statewide total employment numbers for Montana, which increased by approximately 14 percent from 2012 to 2022, while employment in the mining industry declined by approximately 23 percent over the same period (Bureau of Labor Statistics 2023).

<u>Alternative D</u>

Under Alternative D no new leasing would be permitted. As the majority of coal resources in the planning area are managed by the BLM, this alternative would likely result in the closure of coal mining operations as reserves under existing federal and nonfederal leases are exhausted. Reserves under state or private ownership could allow a short extension of operations, but as noted under Alternative C, ultimately these parcels are too scattered and limited to allow efficient mining. Under Alternative D, it is projected that Spring Creek Mine would run out of leased federal coal reserves approximately 53 years earlier (in 2035) than under Alternatives A or B. This would result in a long-term reduction in federal coal production in the planning area and an associated reduction in economic contributions although, as noted under Alternative C, job losses in some industries may be offset by job gains in other industries.

Revenue Analysis

Information on collected taxes associated with coal production are discussed in **Section 3.5.1**, above. The effects analysis provides a quantitative assessment of the impacts on federal, state, and local government revenues associated with production. Revenue associates with existing federal leases at Spring Creek and Rosebud Mine is discussed in the *Affected Environment*. This analysis is based on forecasted federal production volumes from pending federal lease applications and potential future subsequent lease applications for Spring Creek Mine. Because this analysis assumes that federal coal production would continue to be produced from recoverable reserves, annual rents are anticipated to remain constant at levels reported in the *Affected Environment* and are not reported here.

Mineral revenue would be collected at the same level for Alternatives A, B, and C for the time period of 2036 to 2038 for Spring Creek Mine (see **Table 3-107**). This is due to the forecast level of annual production being the same across Alternatives for the analysis period. Under Alternatives A and B, mineral revenue would be supported until 2088, based on forecasts for continued production with pending federal lease applications and potential future subsequent federal leases at Spring Creek Mine for this time period. Continued mineral revenue would fund services supported by this revenue, such as schools, roads, and infrastructure.

Table 3-107
Federal Mineral Revenue Overview, 2036–2038 (2022$)

	2036–2038 (Alternatives A-C)
Average Annual County Gross Proceed Contributions ($)	$6,949,953
Federal Royalty Disbursements($)	$7,907,518
State Severance Taxes($)	$20,849,860
Resource Indemnity and Groundwater Assessment Tax($)	$55,59,963
State Totals($)	$28,757,378
Average Annual Contributions to Montana Coal Severance Tax Trust Fund($)	$10,424,930
Coal Royalties ($)	$16,137,792
Coal Excise Tax Contributions ($)	$2,424,815

Under Alternative C, mineral revenue supported by Spring Creek Mine federal production would be limited to 2050. After this time period, reduced mineral revenue could impact state and local funding for services. The level of impact on services would be determined by any corresponding changes to other revenue sources (such as oil and gas revenue).

Under Alternative D, Spring Creek Mine federal production would end by 2035, with potential impacts on mineral revenue-supported services (as noted for Alternative C) possible after this time period.

3.5.3 Cumulative Impacts

Past, present, and reasonably foreseeable future actions in and adjacent to the decision area have the potential to affect coal production outside of BLM management decisions.

In this analysis, induced effects, which are those occurring from changes in household spending as a result from changes in household income, are higher than indirect effects, which are those occurring from economic changes with backward-linked industries. This is partially due to the inclusion of Yellowstone County as part of the socioeconomic analysis area. The BLM included Yellowstone County in Montana and Sheridan County in Wyoming due to intercounty commuting patterns for regional coal employment. While no coal production in the MCFO occurs in Yellowstone County, potential actions occurring in or adjacent to the decision area outside of BLM management that may affect coal production in Big Horn or Rosebud Counties may disproportionately affect Yellowstone County due to employment patterns.

The BLM does not expect new coal mines on federal mineral estate in the decision area. New federal leases authorized in the decision area would maintain production at existing mines.

Nonfederal coal accounts for approximately 58 percent of total coal production in Big Horn and Rosebud Counties and employs workers from Yellowstone, Treasure, and Sheridan Counties. Direct spending and employment from nonfederal coal producers have additional direct, indirect, and induced economic effects that ripple throughout the state and local economies. Nonfederal coal production is not subject to federal royalty rates or federal rent; however, companies must pay corporate income taxes to the Internal Revenue Service and a coal excise tax upon mining. Current coal excise rates are $0.55 per ton of coal produced for subsurface mines, but coal excise taxes are limited to 2 percent of the market value (US Office of Natural Resources Revenue 2019). The Internal Revenue Service transfers collected funds to the Black Lung Disability Trust Fund (US Office of Natural Resources Revenue 2019). Changes in nonfederal production could have additional economic effects not described in this document.

Coal market demand has the potential to vary from EIA forecasts based on market factors driving changes in demand for the domestic fuel generation energy mix. The abundance and low prices of natural gas are expected to reduce the demand for coal production for energy generation and lead to the retirements of less efficient coal plants through 2050. Export-driven coal production would rely on regional competitiveness compared with global suppliers closer to major global coal consumers, such as China and India. The economic viability of export-driven coal production is also dependent on other factors outside BLM management decisions, such as exchange rates, trade barriers, permitting, and transportation cost changes.

Forecasted reductions in coal demand for the fuel generation energy mix have the potential to reduce coal production in the socioeconomic analysis area. Reductions in coal production would be due to the inability of mines to compete for future coal supply contracts, which could lead to losses in employment, labor income, value added, and total economic output. Reductions in coal production would likely occur on mines producing lower-quality coal than the open market demands (Institute for Energy Economics and Financial Analysis 2019). Collected fiscal revenues associated with coal production would also be reduced, and revenue losses may have disproportionate effects on counties in the socioeconomic analysis area that rely on coal revenues to support public and social services. Continued coal market downturn under these alternatives over time may change the communities that are identified as those for potential environmental justice consideration. A reduction in local jobs and income from associated coal related job losses may result in more coal-reliant populations meeting the criteria for additional consideration as potential environmental justice communities, specifically with respect to low-income criteria.

3.6 ENVIRONMENTAL JUSTICE

3.6.1 Affected Environment

Executive Order 12898 requires federal agencies to identify and address any disproportionately high and adverse effects to human health or environmental resources of any proposed actions on minority, low-income, and Native American populations. An evaluation of environmental justice impacts includes identification of minority, low-income, and Native American populations within the affected area; and if minority, low-income, or Native American populations are identified, an analysis on any impacts of proposed alternatives to determine if the impacts are adverse and disproportionately affect the identified minority, low-income, or Native American populations.

The local analysis area for environmental justice is Rosebud, Treasure, and Big Horn Counites, Montana, including US Census block groups in the vicinity of mines with active federal coal leases within these counties. Block groups are statistical, geographic divisions of census tracts and are generally defined to contain between 600 and 3,000 people. A block group usually covers a contiguous area. Each census tract contains at least one block group, and block groups are uniquely numbered within the census tract. The local analysis area for environmental justice is limited to the location of mines, as such it does not include Sheridan and Yellowstone counties, as they have no mines. Data were collected on low-income and minority populations as well as indigenous populations for both counites and all block groups within the counties. Data were also collected from the State of Montana, which was used as the reference population.

The CEQ issued guidance for considering environmental justice within the NEPA process (CEQ 1997). This guidance defines minorities as individuals who identify as being one or more of the following population groups: American Indian or Alaskan Native; Asian or Pacific Islander; Black, not of Hispanic origin; or Hispanic. The guidance further defines a minority population as follows: "Minority populations should be identified where either: (a) the minority population of the affected area exceeds 50 percent or (b) the minority population percentage of the affected area is meaningfully greater than the minority population percentage in the general population or other appropriate unit of geographic analysis" (CEQ 1997). The CEQ guidance does not define what constitutes meaningfully greater.

For minority populations, meaningfully greater populations were determined using BLM 2022 environmental justice guidance (BLM 2022b). For this analysis, the BLM used a threshold analysis and meaningfully greater analysis. The 50 percent threshold analysis involves identifying any block groups with a total indigenous population 50 percent or greater. For the meaningfully greater analysis, BLM uses 110 percent of the minority percentage of the geographic reference area as the threshold for meaningfully greater (BLM 2022b). More detailed information on these two thresholds is provided in **Appendix E**.

The state minority population is multiplied by 110 percent to obtain a value of 16.4 percent for the State of Montana. The counties and block groups were compared to this calculated value. Any counties or block groups that have a minority population at or above 16.4 percent meet the meaningfully greater threshold and are considered environmental justice communities.

For indigenous communities, any counties or block groups with indigenous populations equal to or greater than the state value, in this case 8.17 percent, meet the meaningfully greater threshold and are considered environmental justice communities.

Low-income populations are defined relative to the annual statistical poverty thresholds from the US Census Bureau (CEQ 1997). The CEQ guidance on environmental justice (CEQ 1997) defines low-income populations based on the US Census Bureau's annual statistical poverty thresholds. CEQ guidance does not provide criteria for determining low-income populations as specifically as it does for minority populations; however, the BLM defines low-income individuals as people whose income is less than or equal to twice (200 percent of) the federal "poverty level" (BLM 2022b). For this analysis, the BLM used a 50 percent threshold analysis and low-income threshold analysis. A county is considered to have a low-income population if poverty levels are at or above the state population poverty levels (in this case, 32 percent).

An overview of US Census block groups is included in **Figure 3-13**, Environmental Justice Overview. Low-income and minority population by block group is shown in **Figure 3-14**, MCFO Local Analysis Area Low Income Population; **Figure 3-15**, MCFO Local Analysis Area Minority Population; and **Figure 3-16**, MCFO Local Analysis Area Indigenous People. The legends for these figures were developed considering the respective thresholds described above. These legends can be referenced to see which block groups meet the environmental justice criteria compared to the state reference area. Block groups meeting the criteria for further consideration for one or more factors are identified in **Appendix E**, Table E-1.

According to 2021 Census Bureau data, Big Horn County had minority population, indigenous population, and low-income population exceeding 50 percent (73.78 percent, 68.36 percent, and 56 percent, respectively). In addition to Big Horn County, Rosebud County had minority, indigenous, and low-income populations that exceed the state level (48.56 percent, 40.99 percent, and 41 percent, respectively). While Treasure County had minority and indigenous populations well below the respective state populations, the low-income population (39 percent) exceeded the state population (32 percent).

Of the 20 block groups located within Big Horn, Rosebud, and Treasure Counties, 18 of the block groups met the criteria for constituting as environmental justice communities for at least one of the three demographic indicators. Only three block groups did not contain any environmental justice communities. Twelve block groups had minority, indigenous, and low-income populations that meet the criteria and thresholds described above. Additional information on minority, low-income, and indigenous populations at the block group and county levels, are provided in **Appendix E**. **Table 3-108** shows the local analysis area counties and block groups and associated identified environmental justice community types using the respective thresholds described above.

Table 3-108
Local Analysis Area Environmental Justice Screening Results

Block Group Community Type Identified As	Total Identified Counties of Potential Concern	Total Identified Block Groups of Potential Concern
Minority	Big Horn, Rosebud, Treasure	16
Low Income	Big Horn, Rosebud, Treasure	18
Indigenous	Big Horn, Rosebud, Treasure	14
Both Low Income and Minority	Big Horn, Rosebud, Treasure	13
Both Low Income and Indigenous	Big Horn, Rosebud, Treasure	13
Both Minority and Indigenous	Big Horn, Rosebud, Treasure	14
Low Income, Minority, and Indigenous	Big Horn, Rosebud, Treasure	13

Source: EPA 2022h; US Census Bureau 2021

In addition to screening criteria for minority, low-income, and Native American populations, data were also examined for environmental factors that may result in increased sensitivity to impacts from coal mine emissions. The EPA's environmental justice screen was utilized to examine these factors, such as air toxics respiratory health indices, air toxics cancer risk, and asthma incidence, compared with state levels. Data for environmental factors by block group are included in **Appendix E**.

In addition to reviewing block groups in the vicinity of coal mines with producing federal coal leases, analysis was conducted to determine the occurrence of populations for environmental justice consideration in block groups overlapping or in the vicinity of (generally within 1 mile) downstream combustion points. There are a total of six power plants located within four states (Arizona, Michigan, Minnesota, and Washington). **Table 3-109** shows the downstream analysis area power plants and block groups and associated identified environmental justice community types using the respective thresholds described above. In total, 20 block groups were identified for further environmental justice consideration in the downstream analysis area.[1] Details for each combustion point are included in **Appendix E**. As described in **Appendix B**, each of these power plants are anticipated to close or convert to another fuel source by 2035 and one retired in 2021.

Table 3-109
Downstream Analysis Area Environmental Justice Screening Results

Power Plant/Block Group Community Type Identified As	Number of Power Plants with Identified Block Groups of Potential Concern	Total Identified Block Groups of Potential Concern
Minority	1	3
Low Income	6	11
Indigenous	5	6
Both Low Income and Minority	1	3
Both Low Income and Indigenous	3	5
Both Minority and Indigenous	1	3
Low Income, Minority, and Indigenous	1	3

Source: EPA 2022; US Census Bureau 2021
Note: Categories are not additive.

Figure 3-17 show the powerplants receiving coal from the MCFO and the percentage of block groups within 1-mile of the power plants that have populations which meet at least one of the three criteria (minority, low-income, and indigenous status) for further environmental justice consideration.

[1] There is one additional Block Group for DTE Shared Storage; however, the US Environmental Protection Agency's Environmental Justice Screening Tool could not provide the information associated with the Block Group.

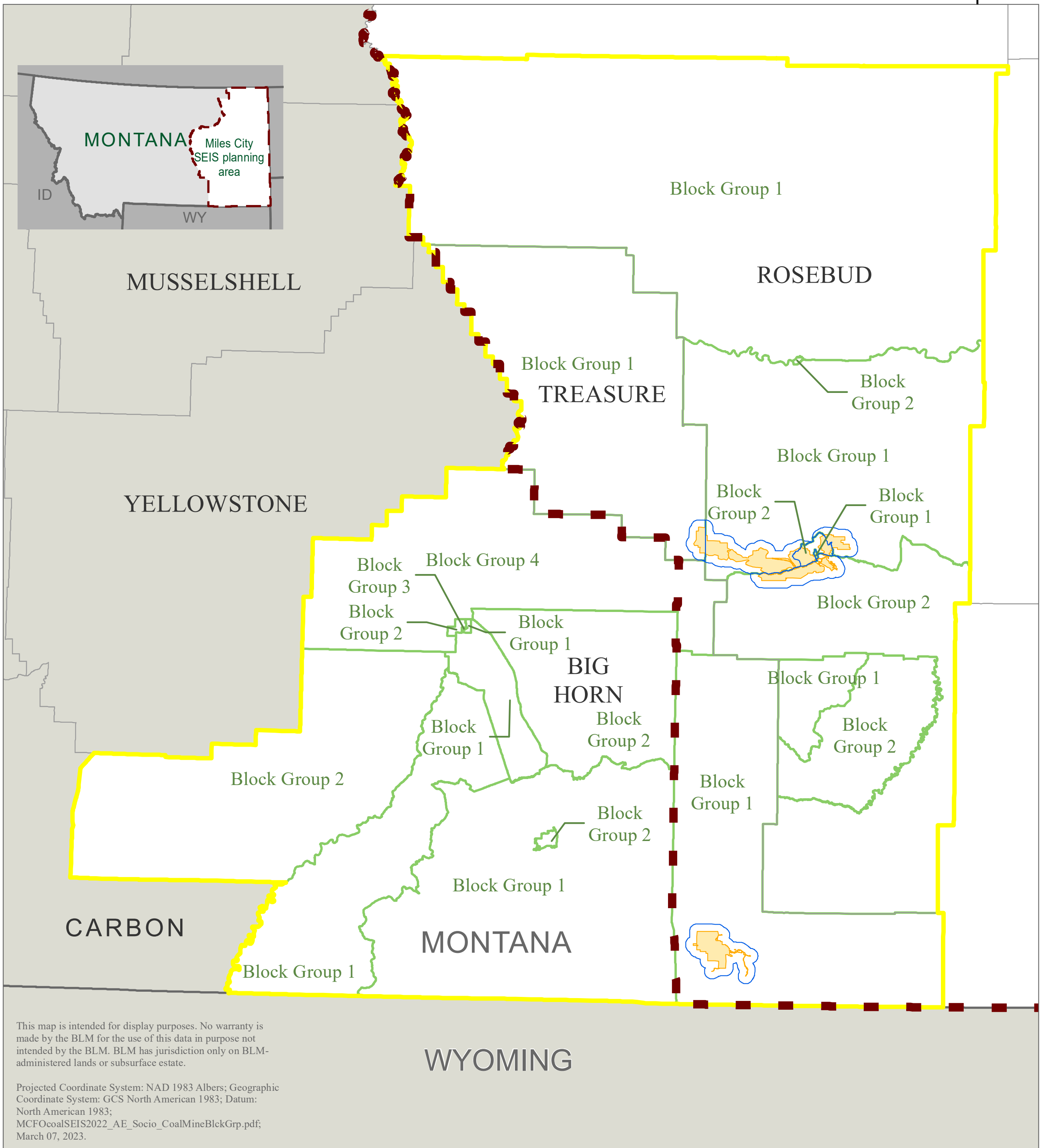


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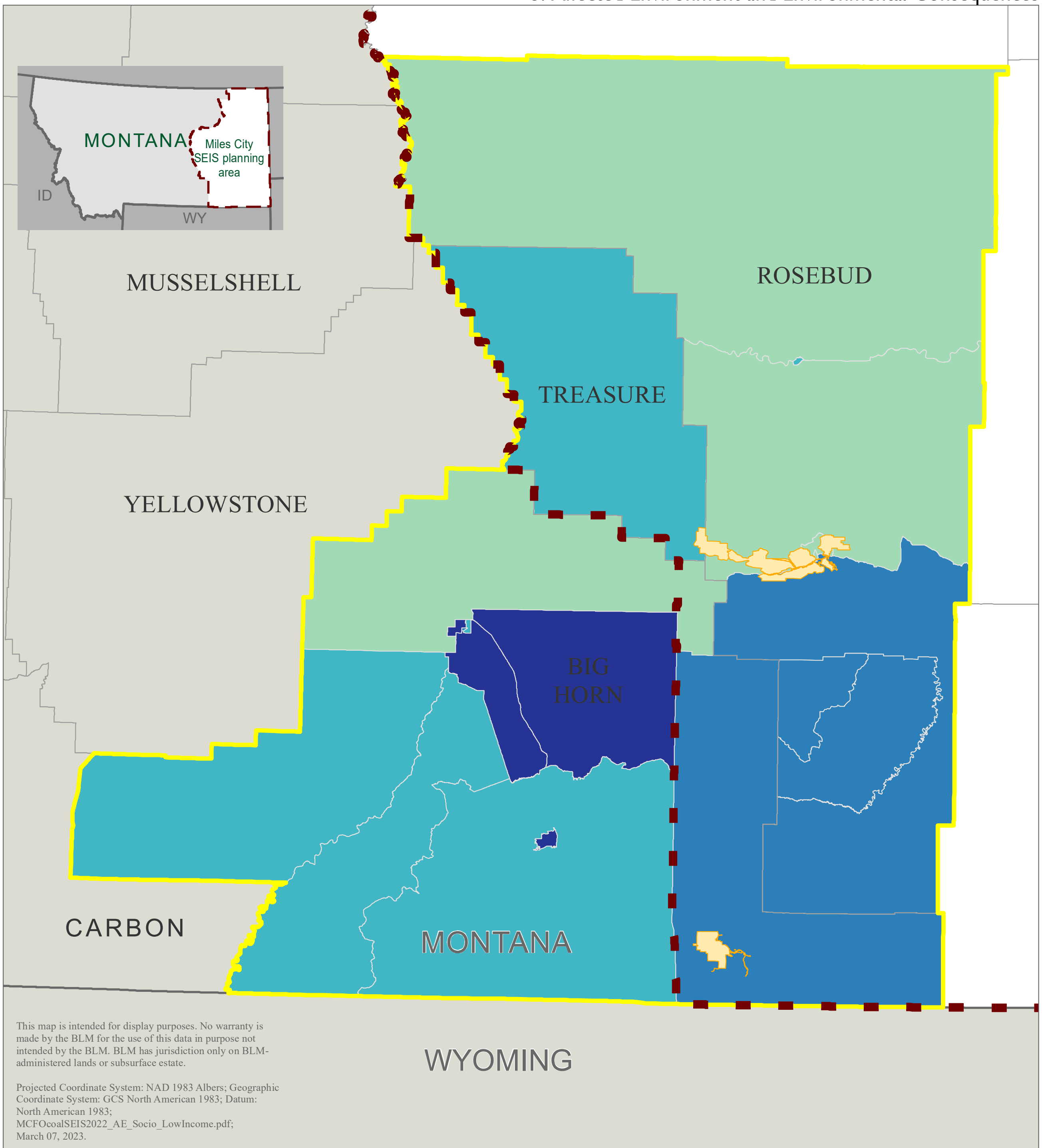
Figure 3-13
Environmental Justice Overview

Coal mine
Census block group within 1 mile of a coal mine
Census block group
Environmental Justice analysis area
Miles City Field Office

1 inch = 20.9 miles

0 5 10 20 Miles



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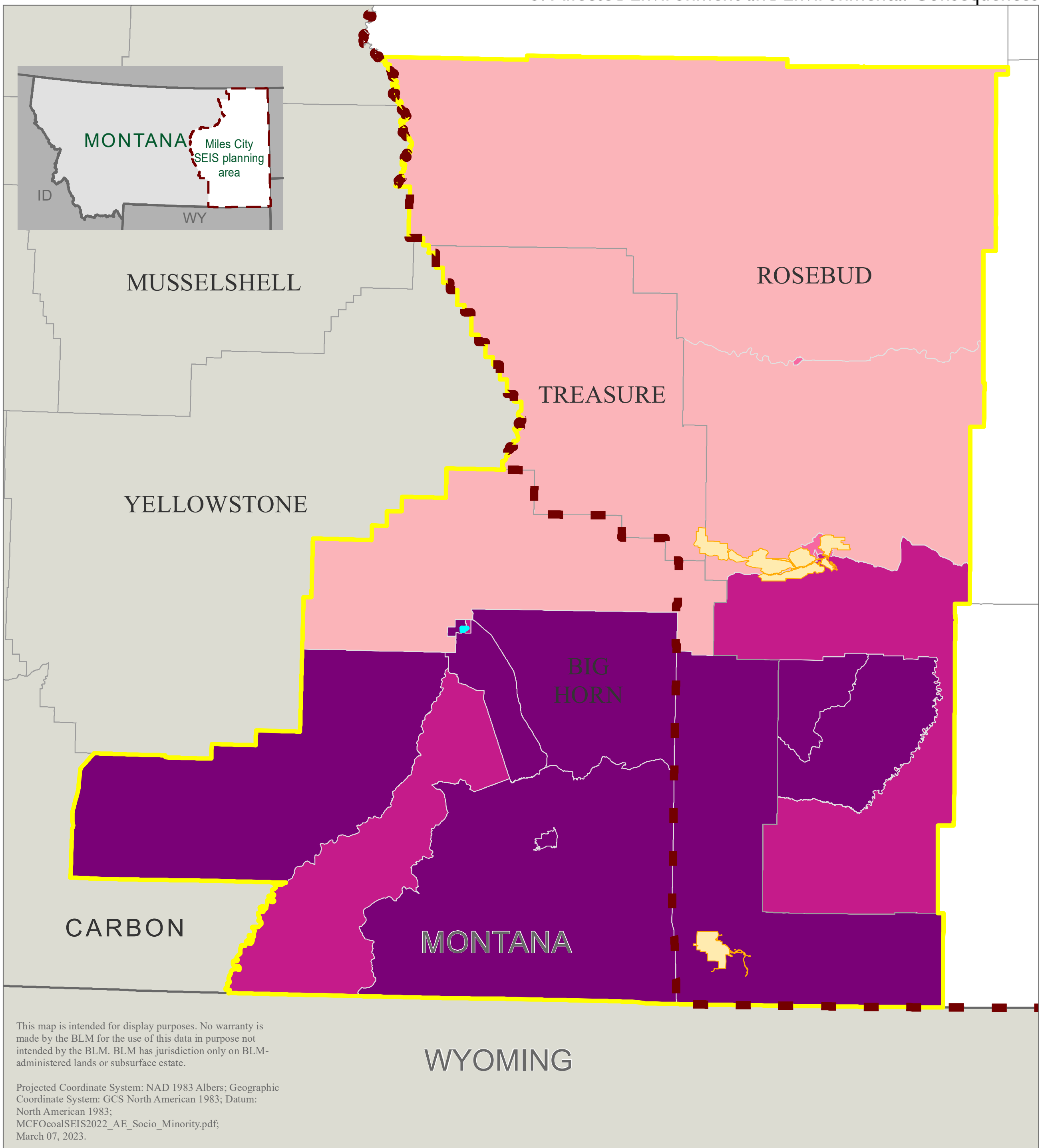
1 inch = 20.9 miles

0 5 10 20 Miles

Figure 3-14
MCFO Local Analysis Area Low Income Population

Low income population at the census block group level
- 15 - 32%
- 32.1 - 50%
- 50 - 60%
- 60 - 75%

- Coal mine
- Environmental Justice analysis area
- Miles City Field Office



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1 inch = 20.9 miles

0 5 10 20 Miles

Figure 3-15
MCFO Local Analysis Area Minority Population

Minority population at the census block group level

- 0 -16.3%
- 16.4 - 35%
- 35.1 - 50%
- 50.1 - 99.04%

- Coal mine
- Environmental Justice analysis area
- Miles City Field Office

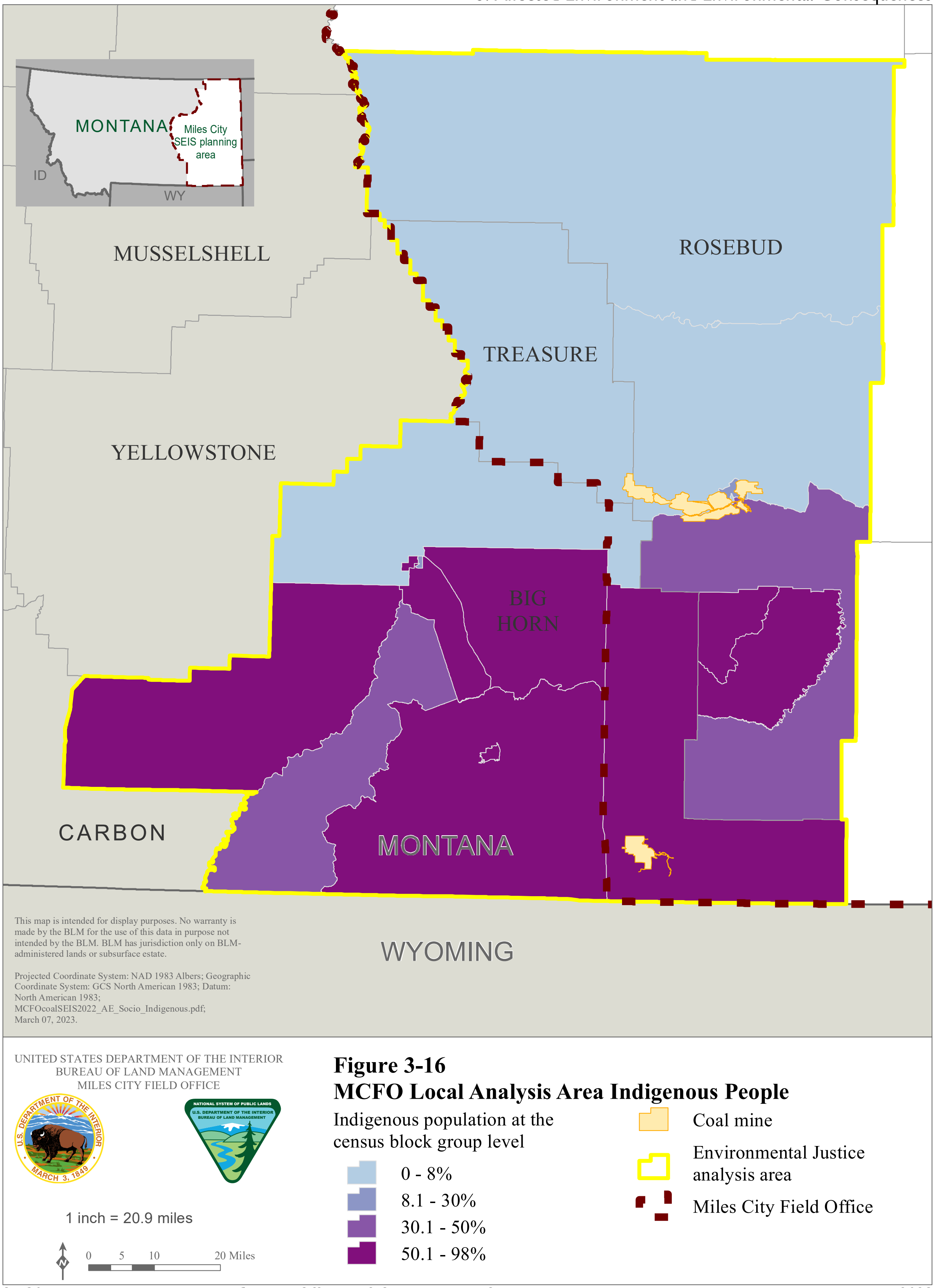

Figure 3-16
MCFO Local Analysis Area Indigenous People

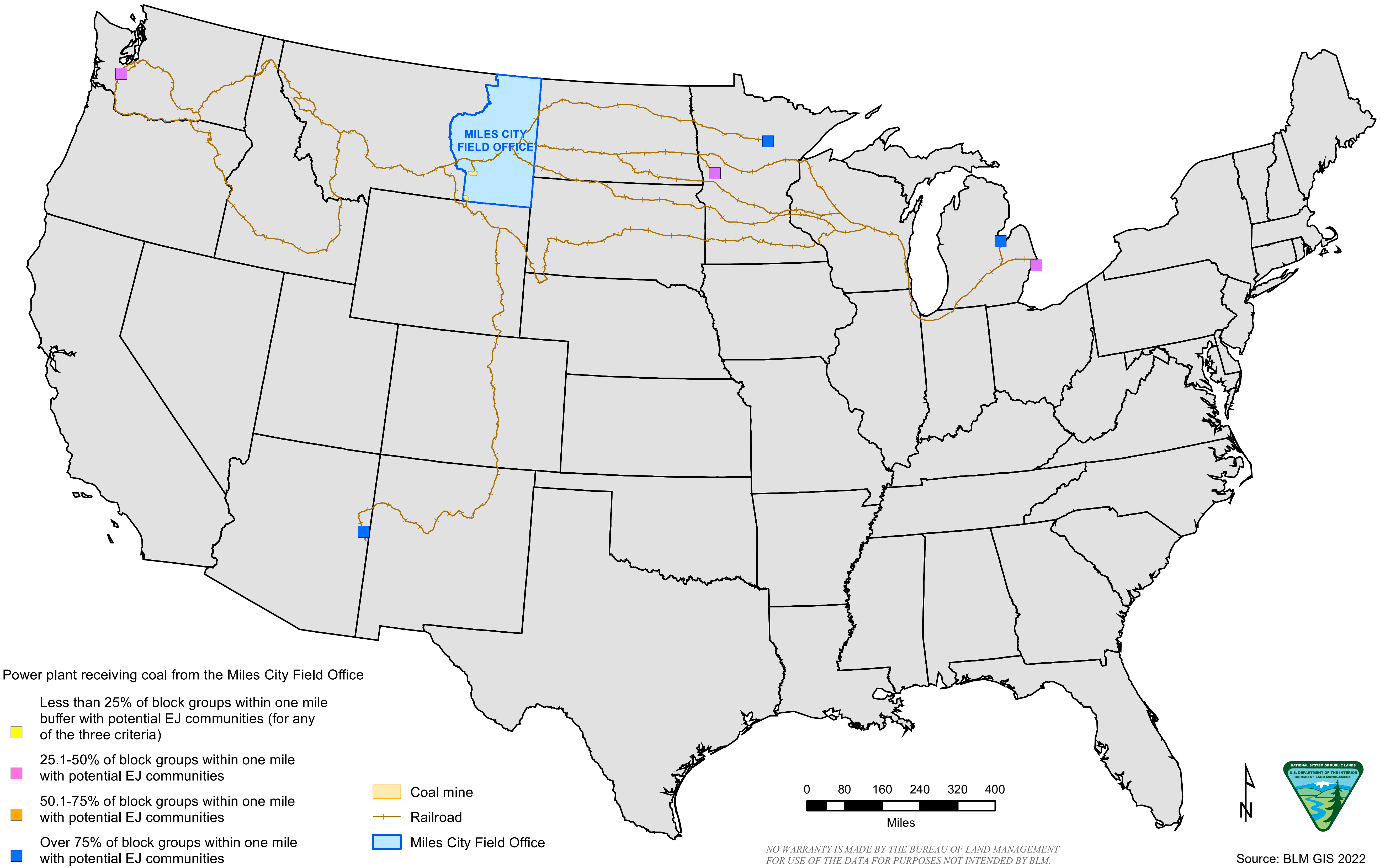

Figure 3-17
Potential Environmental Justice Populations in MCFO Downstream Analysis Area

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3.6.2 Direct and Indirect Impacts

Analysis Methods

Assumptions

This analysis is based on the following assumptions:

- Existing permits for Rosebud Mine would take the mine to 2060 at the BLM-forecasted production rate. No new federal leases are needed for the short- or long-term production under any alternative for Rosebud Mine.
- The existing federal permits and leases are anticipated to take Spring Creek Mine until 2035.
- There will be no disruptive changes to existing coal development technology.
- Future coal production being analyzed encompasses low-sulfur, sub-bituminous coal comparable with what is currently produced in socioeconomic analysis area mines.

Indicators

This analysis assesses the following indicator:

- Presence of environmental justice communities that could experience disproportionate adverse human health or environmental impacts

Methodology

As discussed in the 2015 Proposed RMP/Final EIS (BLM 2015a) and **Section 3.3.2** (*Public Health Impacts*), coal mining and oil and gas development can contribute to environmental impacts with potential implications on public health if not mitigated, including impacts associated with water quality and air quality and hazardous material exposure. This discussion examines the potential for disproportionate adverse impacts on public health for identified environmental justice populations from coal mining and transportation, as well as downstream coal combustion and oil and gas emissions.

Disproportionate downstream health impacts on environmental justice populations at the six power plants receiving federal coal identified in the *Affected Environment* are related to the existing federal coal leases from Spring Creek Mine because all of these power plants are expected to retire or convert to an alternate fuel source in or before 2035. Downstream impacts from combustion of federal coal from Spring Creek Mine from pending federal coal lease applications and potential future subsequent federal leases could be experienced depending on where and when federal coal is shipped from Spring Creek Mine. As such, this analysis describes potential impacts through the mine life under each alternative, but timeframe and location of impacts would depend on where federal coal is shipped in the future.

Impacts Common to All Alternatives

Historically, low-income populations have been found to have disproportionately higher levels of exposure to air pollution (American Lung Association 2001). In addition, racial-ethnic minorities in the United States have been found to be exposed to disproportionately high levels of ambient fine particulate air pollution ($PM_{2.5}$). However, it is unknown which emission sources drive this disparity and whether differences exist by emission sector, geography, or demographics (Tessum et al. 2021).

In addition, environmental justice populations have been shown to be more vulnerable to health impacts from pollutants, in part due to reduced resources, such as comprehensive health care, to combat potential impacts (Bell et al. 2008; Zeger et al. 2008).

In the local analysis area for environmental justice, potential for direct impacts from mine operations would be concentrated in communities proximal to mining operations. US Census block groups within 1 mile of mining operations are identified in **Figure 3-13**, Environmental Justice Overview.

In addition, identified potential environmental justice communities throughout the local analysis area have potential to be impacted by emissions from mining and transportation. **Section 3.3.2** (*Public Health Impacts*), describes public health impacts associated with the lifecycle of coal production. As noted in that section, coal combustion emits CAPs, precursors (NH_3 and VOCs), and HAPs that would impact air quality and public health (see **Section 3.3.2** [*Public Health Impacts*]). Some of the key pollutants include $PM_{2.5}$, PM_{10}, SO_2, NO_2, NH_3, and HAPs and other VOCs. Public health impacts of coal-fired power plant emissions include, but are not limited to, respiratory symptoms and disease, declines in pulmonary function, cardiovascular disease, and cancer in nearby populations (for example, see Amster 2021 and Amster and Lew Levy 2019). A review of the public health impacts across the life cycle of coal production (extraction, processing, use, and waste) concludes that use of coal results in respiratory illness, cancer, cardiovascular disease, preterm birth, and premature death (Hendryx et al. 2020). Long-term exposure to $PM_{2.5}$ has also been associated with higher morbidity and mortality from respiratory, cardiovascular, pulmonary, and cerebrovascular diseases, and lung cancer (Romieu et al. 2012; Liu et al. 2013; EPA 2019, 2022g).

Based on EPA's EJSCREEN environmental data, the majority of identified populations in the local analysis area also have a higher level of incidence of existing risk factors that may make them more vulnerable to air pollution. **Appendix E**, Table E-2, notes which block groups have high $PM_{2.5}$ compared with state averages. In addition, this table indicates which block groups have higher air toxics cancer risk and air toxics respiratory health impacts indicators. These populations may be more susceptible to disproportionate public health impacts identified in **Section 3.3.2** (*Public Health Impacts*) due to the pre-existing higher risk for air quality indicators and the associated pre-existing health risks.

Appendix E, Table E-3, identifies block groups that meet qualifications as environmental justice communities that are proximal to downstream combustion points. As reported in **Section 3.3.2** (*Public Health Impacts*), oil, gas, and coal combustion products as a whole are linked with various short-term and/or long-term health effects. Health outcomes identified include asthma or allergic symptoms and other respiratory illness, oxidative DNA damage, cancer, cardiovascular disease, preterm birth and low birthweight, and inflammatory markers and premature death (see **Table 3-43**). As previously noted, environmental justice communities are more vulnerable to health impacts from pollutants and, therefore, may experience disproportionate levels of these health impacts and/or more adverse health outcomes from exposure to pollution.

As discussed in **Section 3.5.1**, national and state coal market trends indicate a reduced demand for coal production. In the absence of economic diversification, reduced coal demand would result in a related decrease in economic contributions and government revenue for the local analysis area coal-dependent communities under all Alternatives. Potential environmental justice communities as identified in **Section 3.6.1** discussion represent communities that meet identified criteria for consideration based on the best available information at the time of document preparation. Changes to economic conditions or population demographics over time may change the communities that are identified as those for potential environmental justice consideration. For example, reduction in jobs and income as a result of coal related jobs losses may result in more populations meeting the low-income criteria for consideration as potential environmental justice communities.

Federal production from existing leases, and related emissions with potential for health impacts to environmental justice communities would be present under all alternatives as a result of production at Spring Creek Mine until 2035 and Rosebud Mine until 2060. The analysis below discusses incremental impacts from pending or potential future subsequent federal leases at Spring Creek Mine, starting in 2036. Alternatives vary in terms of the timeframe during which MCFO coal related emissions would continue to occur as a result of future leasing, rather than the due to estimated changes in annual production or emission by alternative for a given year. Differences in alternatives below are described in terms of this timeframe.

Alternative A

Under this alternative, the production and emissions due to existing federal coal leases and associated mining, transportation, and downstream combustion discussed in **Section 3.6.1** would occur. Pending and potential future subsequent federal lease applications are forecasted to provide production from 2036 to 2088, and emissions from mining, transportation, and downstream combustion of the coal from pending and potential future subsequent federal lease applications would occur during those periods. As a result, emissions of CAPs and HAPs from the mining, transportation, and downstream combustion of coal from pending federal lease applications in the planning area under would continue through 2088, the year when coal is exhausted (see **Table 3-44** through **Table 3-49** for detailed air pollutant data). As a result, health impacts from emissions from coal mining, transportation, and combustion would continue to contribute to local and downstream air pollution, with potential to impact environmental justice communities as described in *Impacts Common to All Alternatives*, until 2088. Health impacts with potential for disproportionate impacts on environmental justice communities would occur throughout this time period, with the level of impacts varying based on site specific conditions.

Alternative B

The production under Alternative B would be the same as Alternative A; therefore, the corresponding three emissions and impacts would also be the same. Under this alternative, pending and potential future subsequent federal leases could be issued with production and emissions possible until 2088, as described under Alternative A. As a result, potential for disproportionate health impacts from coal related emissions on environmental justice communities would occur throughout this time period, as described under Alternative A.

Alternative C

Under Alternative C, the BLM forecasts that a portion of the pending federal lease applications within the current federal mine plan boundary at Spring Creek Mine would provide production from 2036 until 2050. Emission from coal mining and downstream emissions with the potential to impact environmental justice communities would occur. There would be continued potential for disproportionate impacts on environmental justice communities until 2050, at which time no additional emissions from the development of MCFO coal or related potential for health impacts would occur. Impacts from federal production at Rosebud Mine would continue until 2060, as under Alternatives A and B.

Alternative D

Under Alternative D, no pending or future federal leases would be issued, and there would be no additional emissions from development of coal from Spring Creek Mine. As a result, after 2035 there would be no additional air quality impacts on environmental justice communities from coal mining, transportation, and downstream combustion due to pending or potential future subsequent federal lease applications at Spring Creek Mine.

3.6.3 Cumulative Impacts

Local and downstream analysis area emissions, as well as pollutants emitted through coal mining and combustion, would continue to have potential impacts on identified environmental justice communities. The contribution to cumulative impacts would be greatest under the Alternatives A and B, as impacts could continue until 2088, given the available coal reserves. Under Alternative C, health-related impacts on environmental justice communities would be reduced for the local analysis area following the cessation of federal coal production at Spring Creek Mine around 2050. Under Alternative D, due to a lack of issuance of new leases, potential for incremental impacts from emissions would be reduced after 2035.

Federal coal produced from the planning area would continue to contribute to GHG emissions, which add to ongoing impacts from climate change on human health and disease in numerous ways, as detailed in **Section 3.4**. Some existing health threats would intensify, and new health threats would emerge as a result of climate change. Factors such as age, economic resources, and location are likely to impact specific threats. In the United States, public health can be affected by disrupting physical, biological, and ecological systems. Some health effects disruptions of physical, biological, and ecological systems may include increased respiratory and cardiovascular disease, injuries and premature deaths related to extreme weather events, changes in the prevalence and geographical distribution of food- and water-borne illnesses and other infectious diseases, and threats to mental health (US Global Change Research Program 2016). Studies have indicated that the most severe harms from climate change fall disproportionately upon low-income and minority populations, who are least able to prepare for, and recover from, heat waves, poor air quality, flooding, and other impacts (EPA 2021c). Environmental justice communities would therefore continue to be vulnerable to disproportionate impacts from these threats based on factors such as socioeconomic status, race, and current health level.

3.7 UNAVOIDABLE ADVERSE IMPACTS

Section 102 of NEPA mandates disclosure of "any adverse environmental effects which cannot be avoided should the proposal be implemented." These are impacts for which there are no mitigation measures or impacts that would remain, even after mitigation measures are implemented. Implementing Alternatives A, B, or C of this SEIS, issuing new coal leases, and the subsequent coal mining would result in unavoidable adverse impacts on some resources.

In general, development and surface-disturbing activities associated with coal extraction would result in unavoidable adverse impacts, including soil compaction and erosion, soil homogenization, loss of vegetation cover, spread of noxious weeds, disturbance to and displacement of wildlife, visual intrusions on the landscape, and potential loss of cultural or paleontological resources. These impacts are described in detail in Chapter 3 of the 2019 Proposed RMPA/Final SEIS (BLM 2019).

As discussed under irreversible and irretrievable commitment of resources, below, the specific nature and extent of the implementation-level impacts cannot be clearly defined, due to unknowns about site-specific implementation and associated mitigation measures.

3.8 Irreversible and Irretrievable Commitment of Resources

Section 102(2)(C) of NEPA and Section 1502.16 of the CEQ regulations for implementing NEPA require that the discussion of environmental consequences include a description of ". . . any irreversible or irretrievable commitment of resources which would be involved in the proposal should it be implemented."

Coal extraction from lands acceptable for further consideration for leasing would result in the irreversible and irretrievable loss of those coal reserves. In addition, coal mining development and surface disturbance would have potentially irretrievable and potentially irreversible effects on vegetation, wildlife habitat, and livestock grazing if reclamation proves unsuccessful. Irreversible effects on soil and water quality could occur, depending on the implementation of mitigation measures and their efficacy. However, state and federal laws, regulations, and stipulations on the various permits for mining provide further protections and requirements to ensure reclamation success and efficacy.

3.9 Relationship Between Local Short-term Uses and Long-term Productivity

Section 102(C) of NEPA requires a discussion of the relationship between local, short-term uses of the human environment and the maintenance and enhancement of long-term productivity of resources. Short-term is defined as anticipated to occur within 1 to 5 years of implementation of the activity. Long-term is defined as following the first 5 years of implementation but within the analysis period of this SEIS (to 2038).

Coal extraction and the resulting surface disturbance would result in various short-term adverse impacts, such as increased localized soil erosion or damage to wildlife habitat. Management actions and best management practices would minimize the effect of short-term uses and would reverse the change in the long term; however, coal extraction and the associated infrastructure could result in some long-term productivity impacts, regardless of reclamation.

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Chapter 4. Coordination and Consultation

4.1 Introduction

This chapter describes the public outreach and participation opportunities associated with developing this SEIS. As part of the process, the BLM consulted and coordinated with tribes, government agencies, and other stakeholders.

The BLM conducts land use planning in accordance with NEPA requirements, CEQ regulations, US Department of the Interior and BLM policies and procedures for implementing NEPA, and FLPMA. The NEPA and associated laws, regulations, and policies require the BLM to seek public involvement early in and throughout the planning process. This is to develop a reasonable range of alternatives to the proposed actions and to prepare environmental documents that disclose the potential impacts of proposed actions and alternatives.

The BLM involved the public and other agencies by way of *Federal Register* notices, public and informal meetings, individual contacts, media releases, planning newsletters, and the MCFO SEIS ePlanning website.[1]

4.2 Public Collaboration and Outreach

Public involvement is a vital and legal component of the SEIS process. Public involvement vests the public in the decision-making process and allows for full environmental disclosure. Guidance for implementing public involvement under NEPA is codified in 40 CFR 1506.6, thereby ensuring federal agencies make a diligent effort to involve the public in the NEPA process. The BLM involved the public in the SEIS during public scoping to determine the scope of issues and alternatives to be addressed in the SEIS.

The public scoping phase has been completed and is described below; the public outreach and collaboration phases are ongoing throughout the SEIS process. The public can obtain information on the SEIS from the MCFO SEIS ePlanning website.

4.3 Public Scoping

The purpose of the public scoping process is to identify issues and planning criteria that should be considered in the Draft SEIS and to initiate public participation in the planning process. Detailed information about public scoping can be found in the Miles City SEIS Scoping Report (see the MCFO SEIS ePlanning website).

4.3.1 Notice of Intent

The formal public scoping process for the SEIS began with the publication of the NOI in the *Federal Register* on October 3, 2022 (87 *Federal Register* 59818); the BLM also posted the NOI on the ePlanning website. The NOI notified the public of the BLM's intent to prepare the SEIS and potential amendment to the 2021 ROD/Approved RMPA to respond to the Order. The NOI included a call for coal and other resource information and identified revision topics. It also requested comments on planning issues and planning criterion relevant to the SEIS. The scoping period lasted 30 days, ending on November 2, 2022.

[1] https://eplanning.blm.gov/eplanning-ui/project/2021155/510

4.3.2 ePlanning Website

The BLM maintains an ePlanning website (https://eplanning.blm.gov/eplanning-ui/project/2021155/510) with information related to the development of the SEIS. The website includes background documents, public meeting information, and contact information.

4.3.3 News Releases and Other Notifications

During the public scoping period (October 3 through November 2, 2022), the BLM sent press releases to media contacts in the planning area. These press releases announced public involvement opportunities and the scoping meeting. In addition to press releases, the BLM notified members of the public about the scoping process via newspapers, both in and outside the planning area. The newspapers published local and regional articles and news bulletins regarding some aspects of the SEIS process.

4.3.4 Scoping Meeting

Following publication of the NOI for the SEIS, the BLM conducted one scoping meeting in Miles City, Montana, on October 18, 2022. The meeting included a PowerPoint presentation describing the purpose of the SEIS, the project approach, and opportunities for public involvement. Materials presented and additional information can be found in the scoping report.

4.3.5 Scoping Comments Received

The BLM received 27 unique written comment submissions during the public scoping period (October 3 to November 2, 2022). These submissions contained 166 unique comments. Detailed information about the comments received and about the public outreach process can be found in the Miles City SEIS Scoping Report. The issues identified during public scoping and outreach helped refine the list of planning issues, which guided the development of alternative management strategies for the SEIS.

4.4 Mailing List

The BLM initially compiled a mailing list of over 118 individuals, agencies, and organizations that had participated in past BLM projects. The BLM added the attendees at the public meeting to the mailing list, if the attendees wanted to receive or continue to receive project information. In addition, all individuals or organizations that submitted scoping comments were added to the mailing list.

4.5 Future Public Involvement

Public participation will be ongoing throughout the remainder of the SEIS development process. One substantial part of the process is providing an opportunity for the public to comment on this Draft SEIS during the comment period. In the Final SEIS, the BLM will respond to all substantive comments received during the 90-day comment period. The BLM will issue the ROD after the release of the Final SEIS, the governor's consistency review, and any resolution of protests received on the potential RMPA/Final SEIS.

4.6 Tribal Consultation

Consultation with Native American tribes is part of the NEPA scoping process and a requirement of FLPMA. On September 28, 2022, the MCFO sent letters to the following tribes inviting them to assist with the SEIS:

- Cheyenne River Sioux Tribe
- Chippewa Cree Tribe

- Crow Tribe
- Crow Creek Sioux Tribe
- Eastern Shoshone Tribe
- Fort Belknap Indian Community
- Fort Peck Tribes-Sioux and Assiniboine
- Lower Brule Sioux Tribe
- Northern Arapaho Tribe
- Northern Cheyenne Tribe
- Oglala Sioux Tribe
- Rosebud Sioux Tribe
- Spirit Lake Sioux Tribe
- Standing Rock Sioux Tribe
- Three Affiliated Tribes – Mandan, Hidatsa, Arikara
- Turtle Mountain Band of Chippewa
- Yankton Sioux Tribe

4.6.1 Indigenous Knowledge

This section acknowledges the indigenous knowledge provided to the BLM in their engagement with sovereign tribal nations during the development of this SEIS. The purpose of acquiring indigenous knowledge is to promote the inclusion of indigenous knowledge in the BLM's decision making. Indigenous knowledge is a body of observations, oral and written knowledge, innovations, practices, and beliefs developed by indigenous peoples through interaction and experience with the environment. It is applied to phenomena across biological, physical, social, cultural, and spiritual systems. Indigenous knowledge can be developed over millennia, continues to develop, and includes understanding based on evidence acquired through direct contact with the environment and long-term experiences, as well as extensive observations, lessons, and skills passed from generation to generation.

As noted above, the BLM initiated consultation with Tribes as part of this effort. As of the publication of the Draft SEIS, the BLM has not received new information from the tribes pertaining to indigenous knowledge. Due to the limited scope of this SEIS, which is based on responding to the Order, the BLM used information from past consultation and coordination efforts in application of the coal screens. Specifically, criterion 7 and 20 of coal screen 2 (unsuitability) screen out cultural resources and areas important to tribes. Any information provided during the review of the Draft SEIS will be considered for the Final SEIS.

4.7 Cooperating Agencies

The BLM is the lead agency for the SEIS. On September 28, 2022, the BLM wrote to local, state, and federal agencies and tribes inviting them to participate as cooperating agencies for the SEIS (see **Table 4-1**). The following entities agreed to participate in the SEIS development as designated cooperating agencies and signed a memorandum of understanding with the BLM: Custer County Commissioners, McCone County Commissioners, Richland County Commissioners, Rosebud County Commissioners, Office of Surface Mining Reclamation and Enforcement, and the EPA.

Table 4-1
Cooperating Agency Participation

Agencies and Tribes Invited to Be Cooperators	Agencies that Signed Memoranda of Understandings
Carter County Commissioners	
Custer County Commissioners	✓
Daniels County Commissioners	
Dawson County Commissioners	
Fallon County Commissioners	
Garfield County Commissioners	
McCone County Commissioners	✓
Richland County Commissioners	✓
Roosevelt County Commissioners	
Powder River County Commissioners	
Prairie County Commissioners	
Rosebud County Commissioners	✓
Sheridan County Commissioners	
Wibaux County Commissioners	
Valley County Commissioners	
Office of the Governor, Montana	
Montana Department of Natural Resources and Conservation	
Montana Department of Fish, Wildlife and Parks	
Montana Department of Fish, Wildlife and Parks – Region 7	
Montana Department of Environmental Quality	
Montana Department of Fish, Wildlife and Parks – Region 6	
Montana Department of Natural Resources and Conservation – Eastern Land Office	
Montana Department of Natural Resources and Conservation – Board of Oil and Gas	
Montana State Historic Preservation Office	
Montana Department of Environmental Quality, Industrial and Energy Minerals Bureau	
Montana Heritage Program	
US Army Corps of Engineers	
US Coal Resources and Reserves Assessment Project	
US Department of the Interior – Bureau of Indian Affairs, Rocky Mountain Region, Regional Bureau of Indian Affairs	
US Department of the Interior – Fish and Wildlife Service	
US Department of the Interior – Office of Surface Mining Reclamation and Enforcement	✓
US Environmental Protection Agency, Montana Operations Office	
US Environmental Protection Agency, Region 8	✓
US Geological Survey Energy Resources Program	

4.8 MONTANA STATE HISTORIC PRESERVATION OFFICE CONSULTATION

The BLM MCFO sent a letter on September 28, 2022, to the State Historic Preservation Office to notify them of this SEIS's scoping period. To identify and protect cultural resources in the decision area, the two agencies are coordinating under the National Historic Preservation Act.

4.9 US Fish and Wildlife Coordination

On September 28, 2022, the BLM MCFO sent a letter to the US Department of the Interior, Fish and Wildlife Service to notify them of this SEIS's scoping period. The two agencies had a meeting on December 12, 2022, and confirmed they would reinitiate consultation.

4.10 Agencies, Organizations, and Persons to Whom Copies of the SEIS Are Sent

The following agencies and organizations will receive a copy of the Draft SEIS, Final SEIS, and ROD:

- Carter County Commissioners
- Custer County Commissioners
- Daniels County Commissioners
- Dawson County Commissioners
- Fallon County Commissioners
- Garfield County Commissioners
- McCone County Commissioners
- Richland County Commissioners
- Roosevelt County Commissioners
- Powder River County Commissioners
- Prairie County Commissioners
- Rosebud County Commissioners
- Sheridan County Commissioners
- Wibaux County Commissioners
- Valley County Commissioners
- Office of the Governor, Montana
- Montana Department of Natural Resources and Conservation
- Montana Department of Fish, Wildlife and Parks
- Montana Department of Fish, Wildlife and Parks – Region 7
- Montana Department of Environmental Quality
- Montana Department of Fish, Wildlife and Parks – Region 6
- Montana Department of Natural Resources and Conservation – Eastern Land Office
- Montana Department of Natural Resources and Conservation – Board of Oil and Gas
- Montana State Historic Preservation Office
- Montana Department of Environmental Quality Industrial and Energy Minerals Bureau
- Montana Heritage Program
- US Army Corps of Engineers
- US Coal Resources and Reserves Assessment Project
- US Department of the Interior – Bureau of Indian Affairs, Rocky Mountain Region, Regional Bureau of Indian Affairs
- US Department of the Interior – Fish and Wildlife Service
- US Department of the Interior – Office of Surface Mining Reclamation and Enforcement
- US Environmental Protection Agency, Montana Operations Office
- US Environmental Protection Agency, Region 8
- US Geological Survey Energy Resources Program
- Cheyenne River Sioux Tribe
- Chippewa Cree Tribe
- Crow Tribe
- Crow Creek Sioux Tribe
- Eastern Shoshone Tribe
- Fort Belknap Indian Community
- Fort Peck Tribes-Sioux and Assiniboine
- Lower Brule Sioux Tribe
- Northern Arapaho Tribe

- Northern Cheyenne Tribe
- Oglala Sioux Tribe
- Rosebud Sioux Tribe
- Spirit Lake Sioux Tribe
- Standing Rock Sioux Tribe
- Three Affiliated Tribes – Mandan, Hidatsa, Arikara
- Turtle Mountain Band of Chippewa
- Yankton Sioux Tribe

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	Debra Kaden	Public Health Impacts of Downstream Combustion
	John Grant	Air Quality

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Chapter 6. Glossary

100-year floodplain—The area inundated by the 100-year flood or the 1 percent annual exceedance probability flood. It is the flood event that has a 1 percent chance of being equaled or exceeded in any single year. It is often mistakenly thought of as the flood that occurs once every 100 years. In actuality, if a project is within the 100-year floodplain and the project life is expected to be 20 years, it would have an 18 percent chance of experiencing flood damage due to a 100-year flood. For a project with an anticipated life of 15 years, the chance of incurring flood damage due to a 100-year flood would be 14 percent.

1976 Federal Leasing Law—A law mandating that 49 percent of collected federal royalties are returned to the state where the natural resource extraction occurred. The remainder of the collected federal royalties is distributed to federal funds and administration fees.

Alluvial valley floor—An area of unconsolidated stream-laid deposits holding streams with water availability sufficient for sub-irrigation or flood irrigation agricultural activities (Public Law 95-87).

Black Lung Disability Trust Fund—A fund developed to ensure the coal industry bears the burden associated with providing black lung benefits.

Capacity utilization rate—Identifies the ratio of annual coal produced to annual productive capacity and helps identify the operating rate of a coal mine.

Coal excise tax—A production tax levied on domestic coal production within the United States. Revenue is collected by the Internal Revenue Service and funds the Black Lung Disability Trust Fund. The coal excise tax was restructured at the beginning of calendar year 2019 to $0.25 per short ton of produced coal; the tax may not exceed 2 percent of the market value of production.

Crucial habitat—Parts of the habitat necessary to sustain a wildlife population at critical periods of its life cycle. This is often a limiting factor on the population, such as breeding or winter habitat.

Crucial winter range—That portion of the winter range on which a wildlife species depends for survival during periods of the heaviest snow cover.

Cultural resources—The present expressions of human culture and the physical remains of past activities, such as historic buildings, structures, objects, districts, landscapes, and archaeological sites. These resources can be significant in the context of national, regional, or local history, architecture, archaeology, engineering, or culture. They also may include sacred sites and natural features of landscapes that are significant to living communities.

Cultural viewshed—The geographical area that is visible from a location that contributes to the historic or cultural resource integrity of a historic property or to the cultural landscape values. It includes such information as whether the viewpoint or viewed landscape includes designated scenic or cultural features, historic properties, cultural landscapes, or other specially designated areas.

Gross proceeds tax—The county-level flat tax of 5 percent on the taxable value of production imposed by counties in Montana.

Habitat—Includes the following two usages: a species-specific environment or environmental conditions suitable for occupancy by that species, or a particular land cover type that provides an environment or environmental conditions suitable for occupancy by many species. In wildlife management, the major elements of habitat are food, water, cover, and living space.

Historic property—Cultural resources, such as historic buildings, structures, objects, districts, or archaeological sites, that are listed on, or eligible for inclusion on, the National Register of Historic Places.

IMPLAN (Impact Analysis for Planning)—An input-output model designed to identify regional economic impacts in response to a change in the economy.

Input-output (IO)—A linear, quantitative model that identifies and represents economic linkages between different branches of a regional economy. Input-output is a static model that measures output in a regional economy at a singular point in time in response to a change to that regional economy.

Lek—A traditional breeding area for greater sage-grouse and sharp-tailed grouse in which males assemble to establish dominance, display, and breed. Leks are also called dancing grounds or strutting grounds.

Lentic—Of, relating to, or living in still waters (such as lakes, ponds, or swamps).

Location quotients—A regional economic measurement intended to identify the concentration of a particular industry within a specified region compared with a larger reference region.

Lotic—Of, relating to, or living in actively moving water.

Mine mouth—Electric plants that are coal-burning, electricity-generating power plants that purchase directly from coal mines. They report prices to the US Energy Information Administration within the US Department of Energy.

Montana Coal Severance Tax Trust Fund—A fund that supports renewable energy development projects, regional water systems, economic development opportunities, and state-operated education facilities. Article XI, Section 5 of the Montana State Constitution requires that 50 percent of collected coal severance taxes be allocated to the Coal Severance Tax Trust Fund. Counties can take loans against the fund.

Municipal watershed—A watershed that serves a public water system, as defined in Public Law 93-523 (Safe Drinking Water Act) or as defined in state safe drinking water regulations.

National Register of Historic Places (NRHP)—A listing of resources that are considered significant at the national, state, or local level and that meet specific criteria of historic significance, integrity, and age.

Office of Natural Resources Revenue—An office with the US Department of the Interior responsible for collecting, accounting, and verifying natural resource and energy revenues owed to states, American Indians, and the US Treasury.

Qualified surface owner—The natural person or persons (or corporation, the majority stock of which is held by a person or persons otherwise meeting the requirements of this section) who:

(1) Hold legal or equitable title to the surface of split-estate lands

(2) Have their principal place of residence on the land, or personally conduct farming or ranching operations upon a farm or ranch unit to be affected by surface mining operations, or receive directly a significant portion of their income, if any, from such farming and ranching operations

(3) Have met the conditions of paragraphs (1) and (2) for a period of at least 3 years, except for persons who gave written consent less than 3 years after they met the requirements of both paragraphs (1) and (2). In computing the 3-year period, the BLM Authorized Officer shall include periods during which title was owned by a relative of such person by blood or marriage if, during such periods, the relative would have met the requirements of this section (43 Code of Federal Regulations 3400.0-5).

Raptor—Bird of prey with sharp talons and strongly curved beaks (hawks, falcons, owls, and eagles).

Recoverable coal—For the purposes of this supplemental environmental impact statement (SEIS), the estimate of acres of coal potential identified in Screen 1. The acreage of recoverable coal available for leasing is calculated by applying all four coal screens.

Recoverable reserves—Represent the tonnage of coal that can be recovered from existing coal reserves at producing coal mines.

Resource indemnity trust and groundwater assessment tax—A tax the state of Montana collects on the gross taxable value of mineral production to fund the Montana Resource Indemnity Trust intended to reclaim land disturbed from natural resource extraction. This tax is applied to coal production.

Riparian—An area of land directly influenced by permanent water. It has visible vegetation or physical characteristics reflective of a permanent water influence. Lakeshores and streambanks are typical riparian areas. Excluded are such sites as ephemeral streams or washes that do not exhibit the presence of vegetation dependent on free water in the soil.

Royalty rate—The federal royalty rate on minerals extracted on federal land that the Office of Natural Resources Revenue collects. Federal royalty rates vary by state. Montana has a federal royalty rate of 12.5 percent; however, companies are allowed to negotiate lower effective rates upon securing leasing rights. In Montana, the average effective royalty rate is 11.61 percent.

Sensitive species—Species designated by a BLM state director, usually in cooperation with the state agency responsible for managing the species and state natural heritage programs, as sensitive. They are those species that could become endangered in or extirpated from a state or within a significant portion of its distribution; are under status review by the US Department of Interior, Fish and Wildlife Service or National Oceanic and Atmospheric Administration Fisheries; are undergoing significant current or predicted downward trends in habitat capability that would reduce the species' existing distribution; are undergoing significant current or predicted downward trends in population or density such that federally listed, proposed, candidate, or state-listed status may become necessary; typically have small and widely dispersed populations; inhabit ecological refugia or other specialized or unique habitats; or are state-listed species that may be better conserved by applying the BLM sensitive species status.

Severance tax—Statewide taxes imposed on the extraction of natural resources intended for consumption. The severance tax for Montana is 15 percent for surface coal.

Special status species—Species that the Secretary of the Interior has officially proposed for listing as threatened or endangered; species the Secretary of the Interior has officially listed as threatened or endangered under the provisions of the Endangered Species Act of 1973; species the US Department of Interior, Fish and Wildlife Service or National Oceanic and Atmospheric Administration Fisheries designates as candidates for listing as threatened or endangered; species listed by a state in a category implying, but not limited to, potential endangerment or extinction; and sensitive species as designated by a BLM state director.

Ton (short ton)—The equivalent of 2,000 pounds. All tons in this SEIS are short tons.

Unacceptable—According to 43 Code of Federal Regulations 3420.1-4e(3), "Multiple land use decisions shall be made which may eliminate additional coal deposits from further consideration for leasing, to protect resource values of a locally important or unique nature not included in the unsuitability criteria." Multiple-use values may include possible oil and gas development, and soil, forest, wildlife, recreation, agriculture, air, and watershed resources. Lands with coal potential may be eliminated from further consideration for leasing where multiple uses conflict.

Unsuitable—Lands with coal potential are assessed with procedures outlined in 43 Code of Federal Regulations 3461. Lands with coal potential may be eliminated from further consideration for leasing if they are determined unsuitable without exception pursuant to Section 522(b) of the Surface Mining Control and Reclamation Act. In accordance with 43 Code of Federal Regulations 3461.2-1, the BLM could, based on additional site-specific surveys or changes in resource conditions, change the unsuitability determination of a given tract at the activity-planning stage.

Waterway—Any body of water, including lakes, rivers, streams, and ponds, whether they contain aquatic life.

Wetlands—Areas that are inundated or saturated by surface water or groundwater at a frequency and duration sufficient to support, and which under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions.

Wildlife habitat—A species-specific environment and environmental conditions suitable for occupancy by that species, or a particular land cover type that provides an environment and environmental conditions suitable for occupancy by many species.

Chapter 7. Index

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Appendix A
Coal Screening Process

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Appendix A. Coal Screening Process

A.1 Introduction

As part of the land use planning process (regulated under 43 Code of Federal Regulations [CFR] 1600), surface management agencies are charged with filtering lands overlying federally administered coal through four screens. These screens result in the allocation of lands as acceptable for further consideration for leasing and development, giving consideration to resource conflicts with coal development (43 CFR 3420.1–4(d)).

This appendix describes the coal screening process undertaken by the United States (US) Department of the Interior, Bureau of Land Management (BLM) for the Miles City Field Office (MCFO), complying with 43 CFR 3420.1-4(e). The screening process informs potential land use decisions regarding coal leasing availability under the alternatives analyzed in this supplemental environmental impact statement (SEIS).

In the 2019 SEIS, the BLM updated the coal screens from those used in the 2015 Miles City Approved Resource Management Plan (RMP)/Record of Decision (BLM 2015a). The results of that screening process are static for the purposes of this SEIS. That is, the BLM did not update the coal screens for Alternative A, which is the 2019 coal screen results. Therefore, the acreages and data reported in this appendix apply only to Alternatives B, C, and D. The total acres acceptable for further consideration for leasing and development based on this coal screening process are in **Chapter 2**, **Table 2-3**, **Table 2-4**, and **Table 2-6**.

A.2 Regulatory Overview

Federal coal is governed by Section 522(b) of the Surface Mining Control and Reclamation Act and by the Federal Land Management and Policy Act and its implementing regulations at 43 CFR 3400 and 43 CFR 1600. One aspect of coal leasing governed under these regulations is land use planning (43 CFR 3420.1–4(d); 43 CFR 1610.7-1) and the review of federal lands for suitability for coal leasing (43 CFR 3461). These regulations identify certain lands as unsuitable for surface mining or surface mining operations because they contain significant values that conflict with coal development. These include components of the National Wildlife Refuge System, the National System of Trails, and incorporated cities, towns, and villages, among other entities. Other unsuitability criteria include critical habitat for threatened and endangered species and cultural resources listed on the National Register of Historic Places.

The regulations at 43 CFR 3420 govern the land use planning process as it pertains to coal, including the four coal screens for identifying areas acceptable for further consideration for leasing and unsuitable for surface mining or surface mining operations (43 CFR 3420.1–4). Under this process, the BLM must complete the following:

1. Identification of coal with development potential—Lands determined to have development potential are considered acceptable for further consideration for leasing. These lands are applied to the remaining coal screens. Lands determined to not have development potential are eliminated from further consideration for leasing.
2. Application of unsuitability criteria—Lands with coal potential are assessed with procedures outlined in 43 CFR 3461. Lands with coal potential may be eliminated from further consideration

for leasing if they are determined unsuitable without exception pursuant to Section 522(b) of the Surface Mining Control and Reclamation Act. In accordance with 43 CFR 3461.2-1, the BLM could, based on additional site-specific surveys or changes in resource conditions, change the unsuitability determination of a given tract at the activity-planning stage.

3. Multiple-use conflict analysis—Title 43 CFR 3420.1-4e(3) states that "multiple land use decisions shall be made which may eliminate additional coal deposits from further consideration for leasing, to protect resource values of a locally important or unique nature not included in the unsuitability criteria." Multiple-use values may include possible oil and gas development and soil, forest, wildlife, recreation, agriculture, air, and watershed resources. Lands with coal potential may be eliminated from further consideration for leasing where multiple uses conflict.
4. Surface owner consultation—This screen requires the BLM to consult with qualified surface owners whose land overlies federal coal with development potential. The BLM asks the qualified surface owners for their preference for or against offering the coal deposits under their land for lease. Lands with coal potential may be eliminated from further consideration for leasing based on qualified surface owner preference.

A.3 COAL SCREENING RESULTS

A.3.1 Screen 1—Coal Development Potential

Coal potential was evaluated through consultation with Montana Bureau of Mines and Geology and the United States Geological Survey (USGS) in 2018. The USGS models have not been updated and BLM has not authorized new exploration since that time. The mines and the public did not provide additional data regarding coal potential during the call for coal data initiated as part of scoping for this effort (October 3, 2022-November 2, 2022). Therefore, BLM determined that Coal Screen 1 conducted for the 2019 effort (BLM 2019, Appendix A) is still adequate and carried forward for this analysis.

There are approximately 1,745,040 acres of BLM-administered federal coal in the decision area. **Figure A-1** displays the results of Screen 1.

A.3.2 Screen 2—Unsuitability

The BLM interdisciplinary team of resource specialists reviewed available data and solicited expertise and data from state and federal agencies (the Montana Fish, Wildlife and Parks; Montana Department of Environmental Quality; US Fish and Wildlife Service; and USGS) to assess the applicability of each of the 20 unsuitability criteria to the decision area.

The acres designated unsuitable under each unsuitability criterion are tabulated under **Table A-1**. Areas identified as unsuitable under each unsuitability criterion are mapped in **Figures A-2** through **A-15**, **Attachment 1**. For each criterion, resources that trigger unsuitability are identified. Please note that the resources identified are not exhaustive of that type of resource in the decision area; they are only those resources that overlie areas with coal potential identified under Screen 1 (**Figure A-1**), which result in areas being identified as unsuitable for Screen 2. Acreages are not additive across the table because of overlapping resources (for example, wilderness study areas that drive unsuitability are also managed as visual resource management Class I; therefore, they are subject to both criteria 5 and 6). **Figure A-15** shows the aggregate result of Screen 2.

Table A-1
Screen 2 Results

Criterion Number	Criterion Name/Applicable Resources[1]	Acres Unsuitable
Criterion 1 *Figure A-2*	*Federal Land System* • Lewis and Clark National Historic Trail System	15,270
Criterion 2 *Figure A-3*	*Federal Lands within Rights-of-Ways* • Rights-of-way	48,870
Criterion 3 *Figure A-4*	*Buffer Zones along Public Roads, Schools, and Parks* • Parks • Cemeteries • Schools • Public roadways • Dwellings	41,930
Criterion 4 *Figure A-5*	*Wilderness Study Areas (WSAs)* • Terry Badlands WSA	15,600
Criterion 5 *Figure A-6*	*Scenic Areas* • Terry Badlands WSA	14,970
Criterion 6	*Scientific Study*	0
Criterion 7 *Figure A-7*	*Historic Lands and Sites* • Battlegrounds • Listed Sites	8,640
Criterion 8	*Natural Areas*	0
Criterion 9 *Figure A-8*	*Federally Designated, Proposed, or Essential Critical Habitat for Threatened and Endangered Species* • Least tern • Whooping crane • Pallid sturgeon	124,480
Criterion 10	*State-listed Threatened and Endangered Species*	0
Criterion 11	*Bald and Golden Eagle Nest Sites*	24,770
Criterion 12	*Bald and Golden Eagle Roost and Concentration Areas*	0
Criterion 13 *Figure A-9*	*Falcon Cliff Nesting Sites* • Prairie falcon or merlin, or both	13,390
Criterion 14 *Figure A-10*	*Migratory Birds of High Federal Interest*	118,500
Criterion 15 *Figure A-11*	*Habitat for Species of High Interest to the State* • Big game crucial winter range (mule deer, white-tailed deer, and antelope) • Shortnose gar, blue sucker, sicklefin chub, sturgeon chub, and paddlefish • Greater sage-grouse leks and habitat management areas (for example, priority habitat management areas) • Sharp-tailed grouse leks and buffer zones • Nuttall Desert-parsley *(Lomatium nuttallii)* • Visher's Buckwheat *(Eriogonum visheri)*	1,169,960
Criterion 16 *Figure A-12*	*100-Year Floodplain*	4,460
Criterion 17 *Figure A-13*	*Municipal Watersheds*	8,190
Criterion 18	*National Resource Waters*	0

Criterion Number	Criterion Name/Applicable Resources[1]	Acres Unsuitable
Criterion 19 Figure A-14	*Alluvial Valley Floors*	175,060
Criterion 20	*Tribal and State Proposed Criteria*	0

Source: BLM GIS 2022
[1]The BLM applied this screen only to lands within the coal development potential area.

Stipulation for Criterion 15

All of the species listed under criterion 15, Habitat for Species of High Interest to the State, have reclamation as a stipulated method of coal mining. This stipulation requires reclamation using an approved seed mix that is appropriate to the soil type(s) found within the disturbance area.

Stipulation

The holder shall seed all disturbed areas with the seed mix, as agreed upon by the BLM, based on the soil type(s). There shall be no primary or secondary noxious weed seed in the seed mixture. Seed shall be tested, and the viability testing of seed shall be done in accordance with state law(s) and within 6 months prior to purchase. Commercial seed shall be either certified or registered seed. The seed mixture container shall be tagged in accordance with state law(s) and available for inspection by the BLM Authorized Officer.

A.3.3 Screen 3—Multiple Use

In addition to the areas unsuitable under Screen 2, land use decisions to protect resources of high value to the public may eliminate additional coal deposits from further consideration. The BLM reviewed other resource values and land uses not addressed under the 20 unsuitability criteria; additional lands were determined unacceptable for further consideration for leasing.

After close review of resources in the decision area, and in consultation with state and federal agencies, the BLM identified a number of resources that are eliminated from further consideration for coal leasing under Screen 3 in this SEIS. Approximately 193,010 acres were determined unacceptable for further consideration for leasing in the 2019 SEIS based on the same concerns below (**Table A-2**). However, the application of the air resources criterion was different. The 2015 Approved RMP/ROD (BLM 2015a) considered air resources by looking at exceedance of the National Ambient Air Quality Standards. Data and modeling done for the 2015 Proposed RMP/Final EIS (BLM 2015b) showed no air quality standards were exceeded. Therefore, no resulting geographic area of land was removed as unacceptable for further leasing of coal in the 2019 SEIS.

Cultural Resources

Coal leasing and potential development activity would adversely affect the landscapes of two properties listed on the National Register of Historic Places (Rosebud Battlefield and Battle Butte) and two BLM-administered ACECs (Powder River ACEC and Reynold's Battlefield ACEC) by impacting the visual settings integral to those resources and their value to the public. The BLM developed viewshed analyses from these sites to identify potential conflicts.

Table A-2
Screen 3 Results

Multiple-Use Screen[1]	Acres Unacceptable for Further Consideration for Leasing
Cultural Viewsheds (Figure A-16)	99,050
Recreation Areas (Figure A-16) • Special recreation management areas/extensive recreation management areas • Travel management areas	8,770
Areas of Critical Environmental Concern (ACECs; Figure A-16)	1,410
Active Oil and Gas Wells (Figure A-17) • 0.5-mile buffer on active gas wells	46,580
Active Oil and Gas Units (Figure A-17) • All lands within an active oil and gas unit agreement (excluding coalbed natural gas units)	1,440
Perennial, Riparian, and Wetland Resources (Figure A-18) • 300-foot buffer on all lentic and lotic systems, including perennial streams • 100-foot buffer on all riparian habitat	104,100
Fishing Reservoirs (Figure A-18) • 0.25-mile buffer on all sport fish reservoirs on BLM-administered lands	830
Conservation Easements (Figure A-18)	1,840
Air Resources—Alternative B (Figure A-19) • Excludes federal coal outside a 2-mile buffer of existing federal mine plan boundaries	1,661,530
Air Resources—Alternative C (Figure A-20) • Excludes federal coal outside existing and pending federal leases/ applications and outside the existing federal mine plan boundaries	1,744,240
Air Resources—Alternative D (Figure A-21) • Excludes federal coal outside valid existing federal leases	1,745,040

Source: BLM GIS 2022
[1]The BLM applied this screen only to lands within the coal development potential area.

Recreation Areas

Recreation opportunities are available to the public on all BLM-administered lands with legal access. The BLM can designate these lands as either a special recreation management area or an extensive recreation management area. There are also travel management areas that require special management by the BLM. Potential conflicts between development of coal mineral resources and special recreation management areas, extensive recreation management areas, the Hay Draw Travel Management Area, and the Knowlton Travel Management Area warrant their designation as unsuitable.

Areas of Critical Environmental Concern

ACECs are unique to the BLM and can be designated only on BLM-administered surfaces. These areas require special management to protect and prevent irreparable damage to important historic, cultural, or scenic values; fish and wildlife resources; or other natural systems or processes, or to protect life and safety from natural hazards (43 CFR 1610). An ACEC may emphasize one or more unique resources. Potential conflicts between development of coal mineral resources and two ACECs (Powder River ACEC and Reynold's Battlefield ACEC) warrant their designation as unsuitable.

Fluid Minerals

Coal development activities can compromise oil and gas well integrity and oil and gas infrastructure around active wells where the two overlap. Oil and gas development and current oil and gas agreements merit buffers on coal leasing availability to prevent such conflicts. The delineated areas below reflect the smallest area reliably needed to protect equipment, flow lines, and well integrity, based on an assumption that 1.0 square mile was the minimum amount of land needed to develop a coal mine. The BLM excluded coalbed natural gas units from the multiple-use screen due to the short project durations and the ability for coalbed natural gas and coal development to coexist. The following delineated areas apply to all active wells and units, regardless of ownership:

- A 0.5-mile buffer from all active oil and gas wells
- Existing oil and gas unit agreements (excluding coalbed natural gas units)

Wildlife

Potential conflicts between development of coal mineral resources and riparian areas, perennial streams, and sport fish reservoirs warrant their designation as unsuitable. These areas include:

- A 300-foot buffer on all lentic and lotic systems, including perennial streams
- A 100-foot buffer on all riparian habitat
- A 0.25-mile buffer on all sport fish reservoirs on BLM-administered lands

Conservation Easements

A conservation easement is a tool used between a volunteering landowner and a government agency to permanently limit uses of the land to protect its conservation values. The MCFO identified Montana Fish, Wildlife and Parks conservation easements within the decision area that protect natural resource values in the areas. Potential conflicts between development of coal mineral resources and conservation easements warrant their designation as unsuitable.

Air Resources

Alternative B represents an approach to a limited coal leasing alternative, per the Order. The BLM applied a climate change criterion that would limit future federal coal leasing and development to a 2-mile area around existing federal mine plan boundaries of active mines with federal coal leases. Two active coal mines produce federal coal in the decision area; (see **Appendix B**) the 2-mile buffer is applied to the existing federal mine plan boundary of these two mines. Federal lands with coal potential outside this 2-mile area would be removed as unacceptable for further consideration for leasing under this criterion.

Alternative C represents another approach to a limited coal leasing alternative, per the Order. The climate change criterion was modified from Alternative B to further restrict new federal coal leasing and development to the existing federal mine plan boundaries of mines that have indicated a need for additional federal coal leases. In other words, whereas Alternative B would limit coal leasing and development to a 2-mile buffer from the existing federal mine plan boundaries, Alternative C would apply a 0-mile buffer to the existing federal leases and pending federal lease applications within the existing federal mine plan boundaries. Federal lands with coal potential outside the existing federal leases and pending federal lease applications would be determined as unacceptable for further consideration for coal leasing. Further, if existing leases are relinquished, canceled, or otherwise returned back to the BLM, those lands would be unacceptable for further consideration for leasing. This would preclude the expansion of mines on federal coal outside existing federal mine plan boundaries; it also would preclude the expansion of mines on federal coal outside pending federal lease applications within the existing federal mine plan boundaries. This would not preclude mine expansion to produce nonfederal coal.

Alternative D represents the no-leasing alternative, as directed by the Order (page 20 of the order). Only existing federal leases with valid existing rights could be developed under Alternative D. Under this climate change criterion, any unleased federal coal in the decision area, including within existing federal mine plan boundaries, would be removed as unacceptable for further consideration.

A.3.4 Screen 4—Consultation with Qualified Surface Owners

The BLM sent letters to surface owners with lands overlying BLM-administered federal coal in the 2-mile buffer area around existing federal mine plan boundaries[1] requesting that the surface owners confirm they are qualified to express their preference on mining federal coal (see 43 CFR 3400.0-5(gg)). The BLM also asked that the surface owners respond with their preference for or against mining by other-than-underground methods (that is, surface mining) on the BLM-administered federal coal beneath their land. A sample of the letters sent to private surface owners can be found in **Attachment 2**.

To be a qualified surface owner in accordance with the regulations at 43 CFR 3400.0-5(gg), the individual(s) must:

1. Hold legal or equitable title to the surface of split-estate lands
2. Have their principal place of residence on the land; personally conduct farming or ranching operations upon a farm or ranch unit to be affected by surface mining operations; or receive directly a significant portion of their income, if any, from such farming and ranching operations
3. Have met the first two conditions for a period of at least 3 years, except for persons who gave written consent less than 3 years after they met the requirements. In computing the 3-year period, the BLM Authorized Officer shall include periods during which title was owned by a relative of such person by blood or marriage if, during such periods, the relative would have met the requirements of this section.

On September 28, 2022, the BLM mailed 43 letters to surface owners with lands overlying BLM-administered federal coal in the 2-mile buffer area around existing federal mine plan boundaries. The BLM requested a response by October 31, 2022. Responses received by November 14, 2022, were included in Screen 4 of the Draft SEIS. In the letter, the BLM requested verification of landowner qualifications and an opinion on leasing federal coal beneath their surface (in favor, against, and undecided). The BLM included an addressed, postage-paid envelope to encourage a response. Of the 43 letters mailed, the BLM MCFO received 31 responses from the time of mailing and November 14, 2022. The BLM will consider any responses received after November 14, 2022, during development of the Final SEIS.

A qualified surface owner that has previously given consent to mine their property is considered in favor of leasing per 43 CFR 3420.1-4(e)(4)(ii). Therefore, those landowners that have given consent to mine at

[1] The BLM reached out only to landowners within the 2-mile buffer area around existing federal mine plan boundaries; this is because under all the action alternatives, coal resources outside this buffer would be unacceptable for further consideration for leasing, based on the air resources criterion in the multiple-use screen (Screen 3). Therefore, outreach to landowners outside the 2-mile buffer area was not needed.

Rosebud Mine, Spring Creek Mine, or Decker Mine were identified as in favor even if they submitted a response of not in favor. The BLM identified lands as unavailable for further consideration for coal leasing under this screen only where qualified landowners clearly stated they were not in favor of leasing. All other lands were identified as available for further consideration for coal leasing under this screen. Because of the landowner responses, the BLM MCFO removed 13,680 acres from consideration for coal leasing (**Figure A-25**). The project record includes the landowner response letters.

At the time of coal leasing, the current landowners will need to provide written consent to mine, whether they have expressed an opinion in favor of or against leasing in this process (30 United States Code 1304).

A.4 References

BLM (United States Department of Interior, Bureau of Land Management). 2015a. Miles City Field Office Approved Resource Management Plan. BLM, Miles City Field Office, Miles City, MT. Internet website: https://eplanning.blm.gov/public_projects/lup/59042/86804/104007/Miles_City_Field_Office_Approved_Resource_Management_Plan_(2015).pdf.

______. 2015b. Miles City Field Office Proposed Resource Management Plan and Final Environmental Impact Statement. BLM, Miles City Field Office, Miles City, MT.

______. 2019. Miles City Field Office Proposed Resource Management Plan Amendment and Final Supplemental Environmental Impact Statement. BLM, Miles City Field Office, Miles City, MT. Internet website: https://www.govinfo.gov/content/pkg/GOVPUB-I53-PURL-gpo127568/pdf/GOVPUB-I53-PURL-gpo127568.pdf.

BLM GIS (United States Department of Interior, Bureau of Land Management geographic information systems). 2022. GIS data on file with the BLM's eGIS server, used for calculations or figures related to the coal development strategy. BLM, Miles City Field Office, Montana.

Attachment 1

Figures

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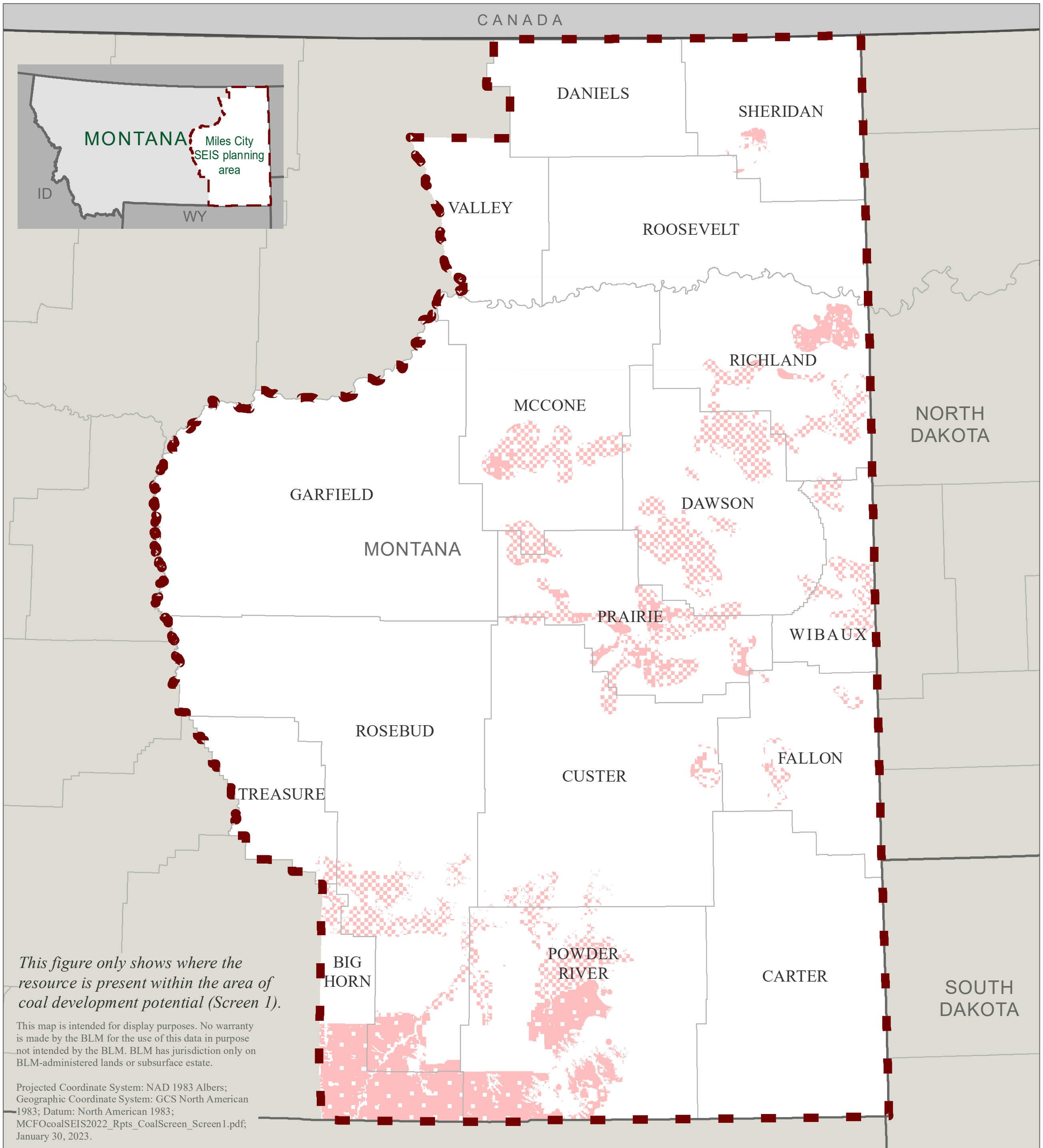

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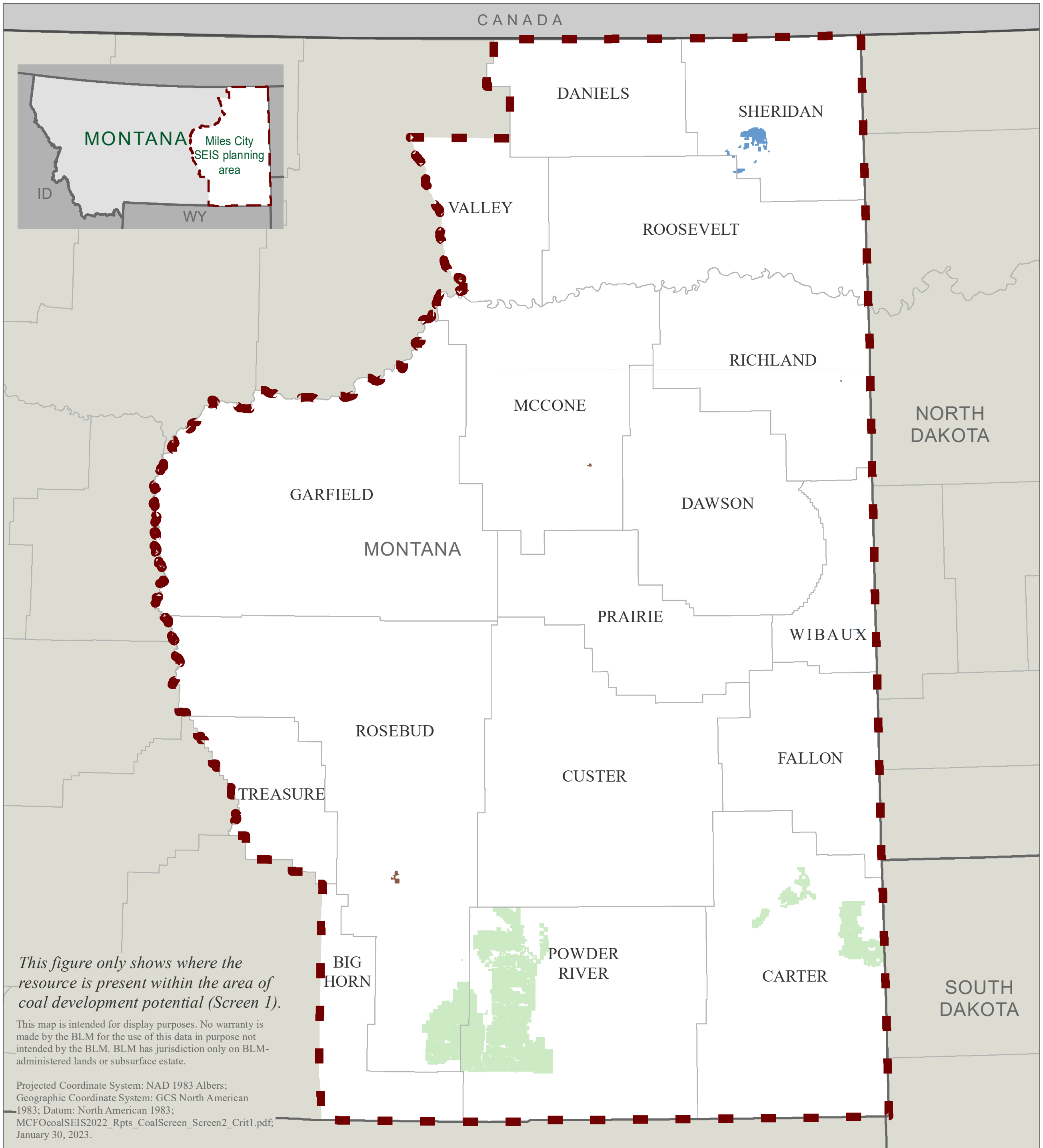
Figure A-1
Screen 1
Coal Development Potential

Coal development potential

1 inch = 39.3 miles

0 5 10 20 30 Miles



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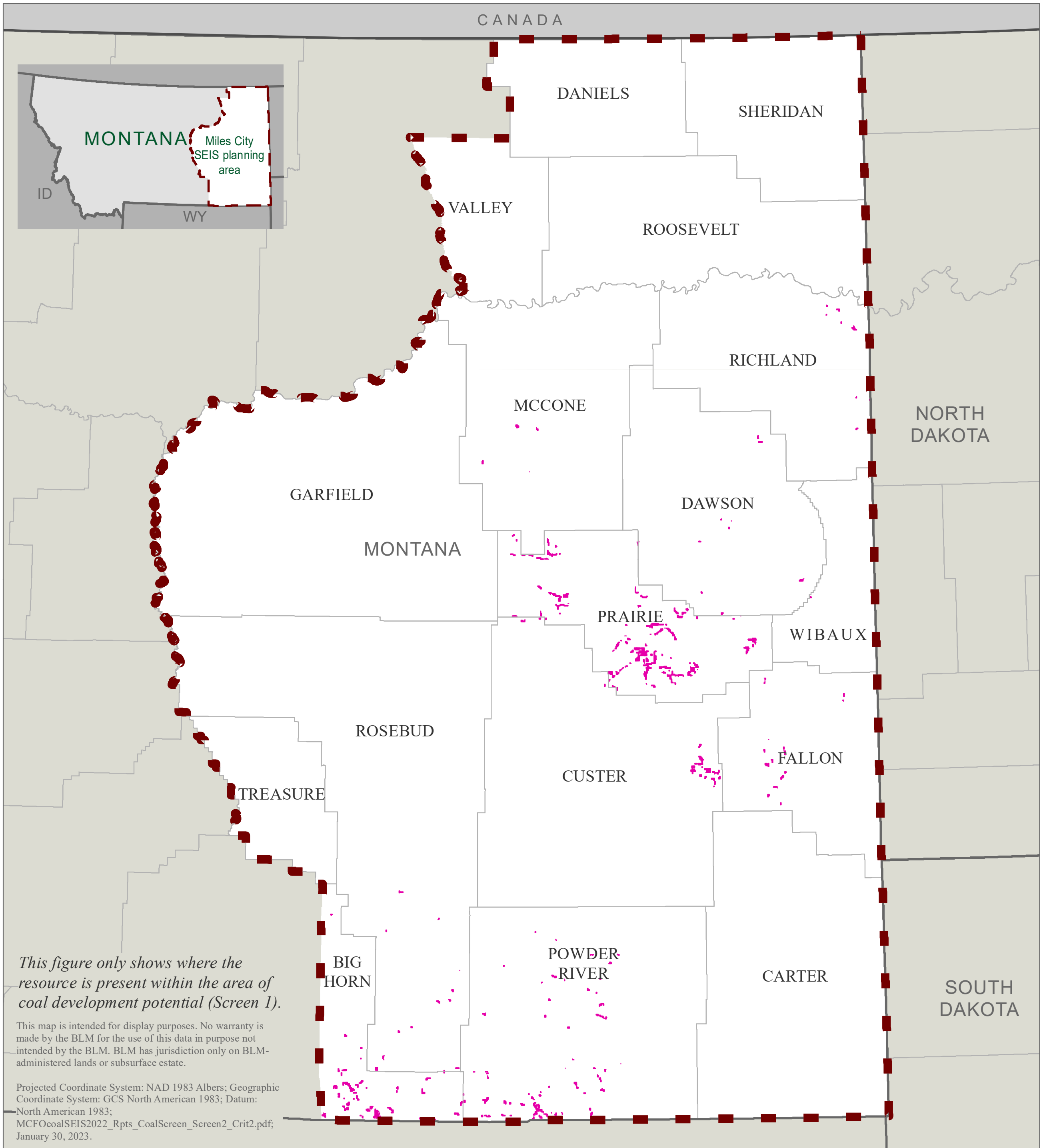
1 inch = 39.3 miles

0 5 10 20 30 Miles

Figure A-2
Screen 2 Criterion 1 (Without Exception)—Federal Land System

- Incorporated area
- US Fish and Wildlife Service
- US Forest Service



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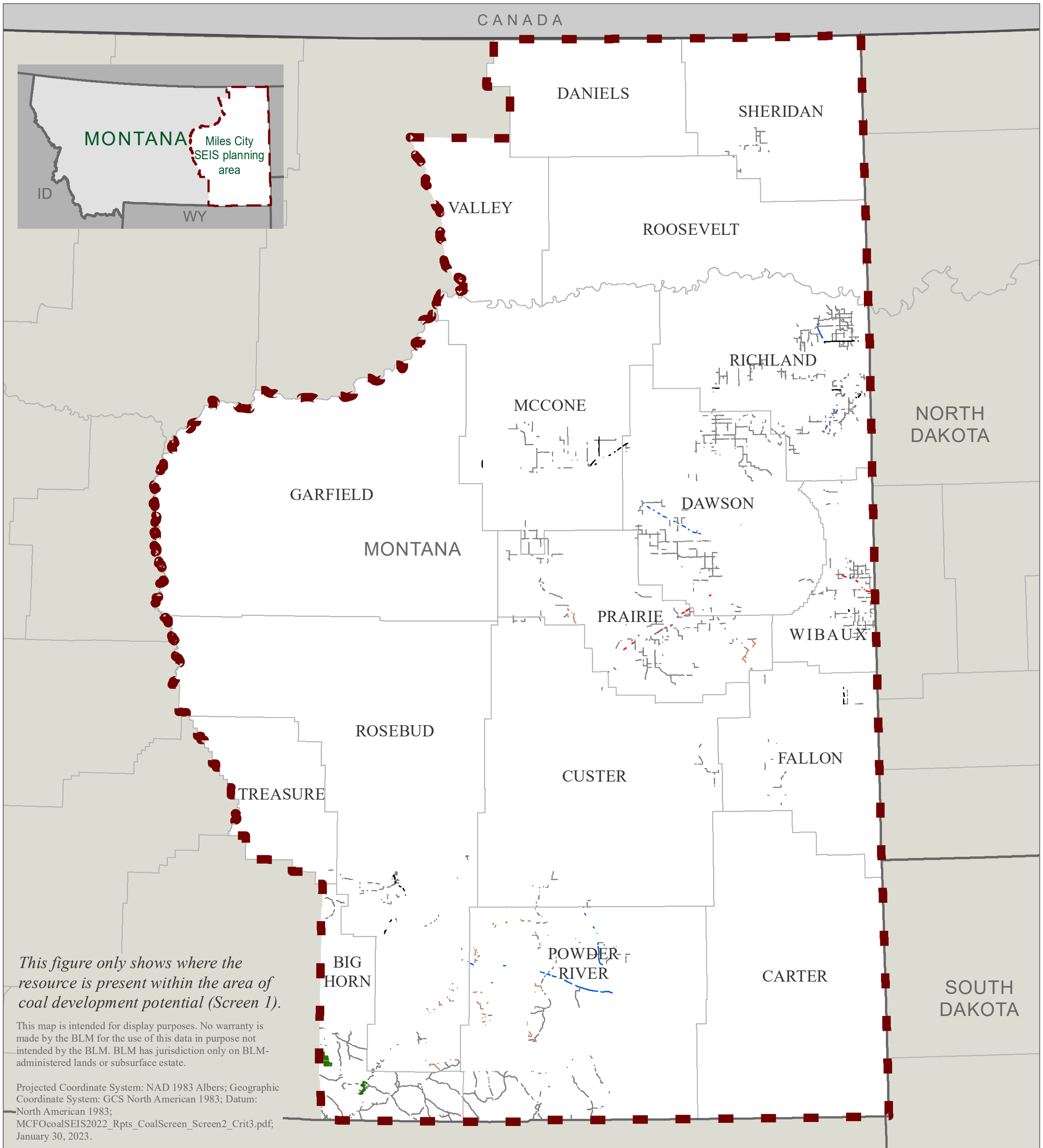
1 inch = 39.3 miles

0 5 10 20 30 Miles

Figure A-3
Screen 2 Criterion 2 (With Exception)—
Federal Lands within Rights-of-Ways

Rights-of-way



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1 inch = 39.3 miles

0 5 10 20 30 Miles

Figure A-4
Screen 2 Criterion 3 (With Exception)—
Buffer Zones along Public Roads, Schools, and Parks

- State Park
- Interstate
- Major highway
- Primary road
- Public road
- Agency road

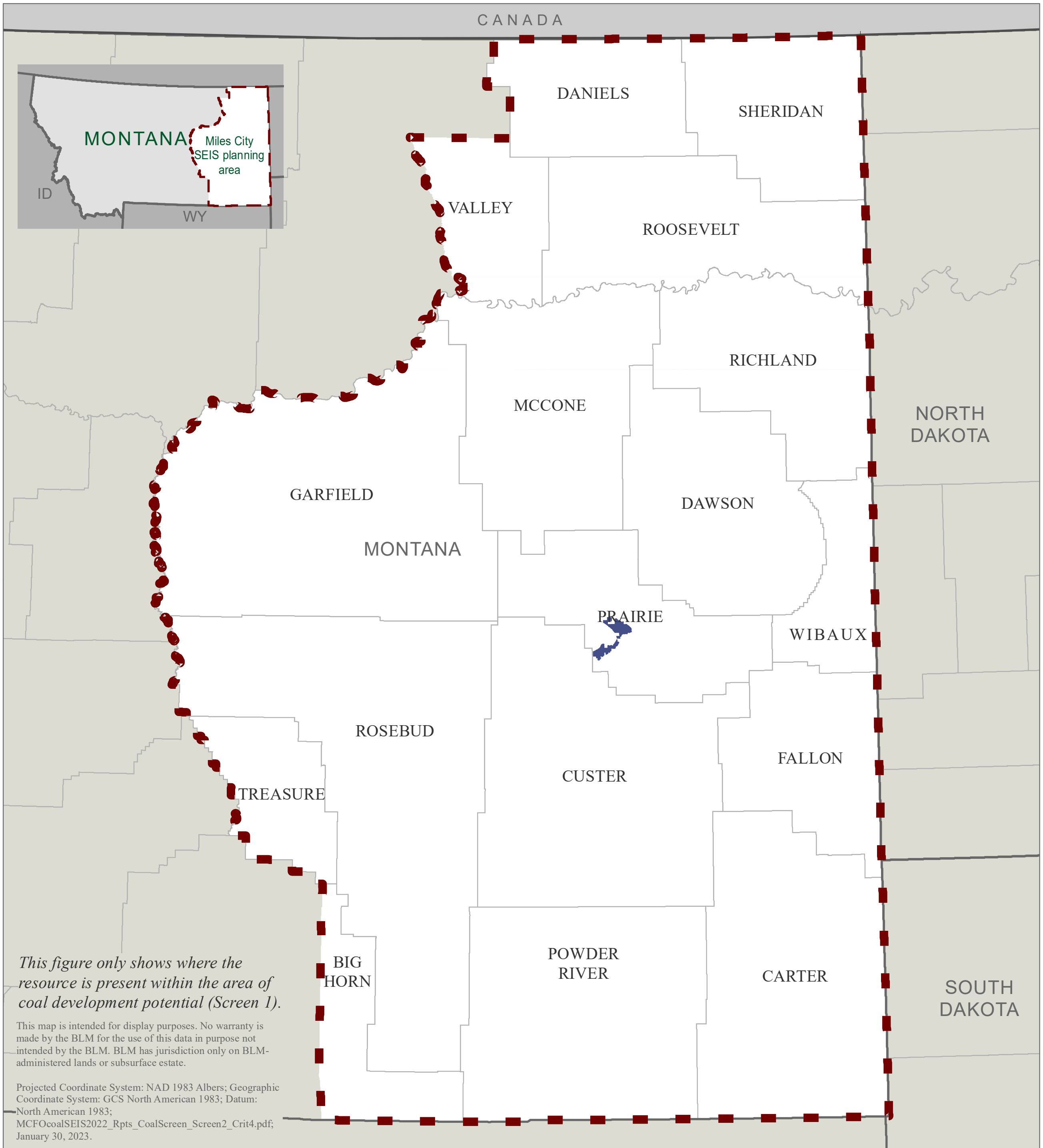

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Figure A-5
Screen 2 Criterion 4 (Without Exception)—
Wilderness Study Areas

Terry Badlands wilderness study area

1 inch = 39.3 miles

0 5 10 20 30 Miles

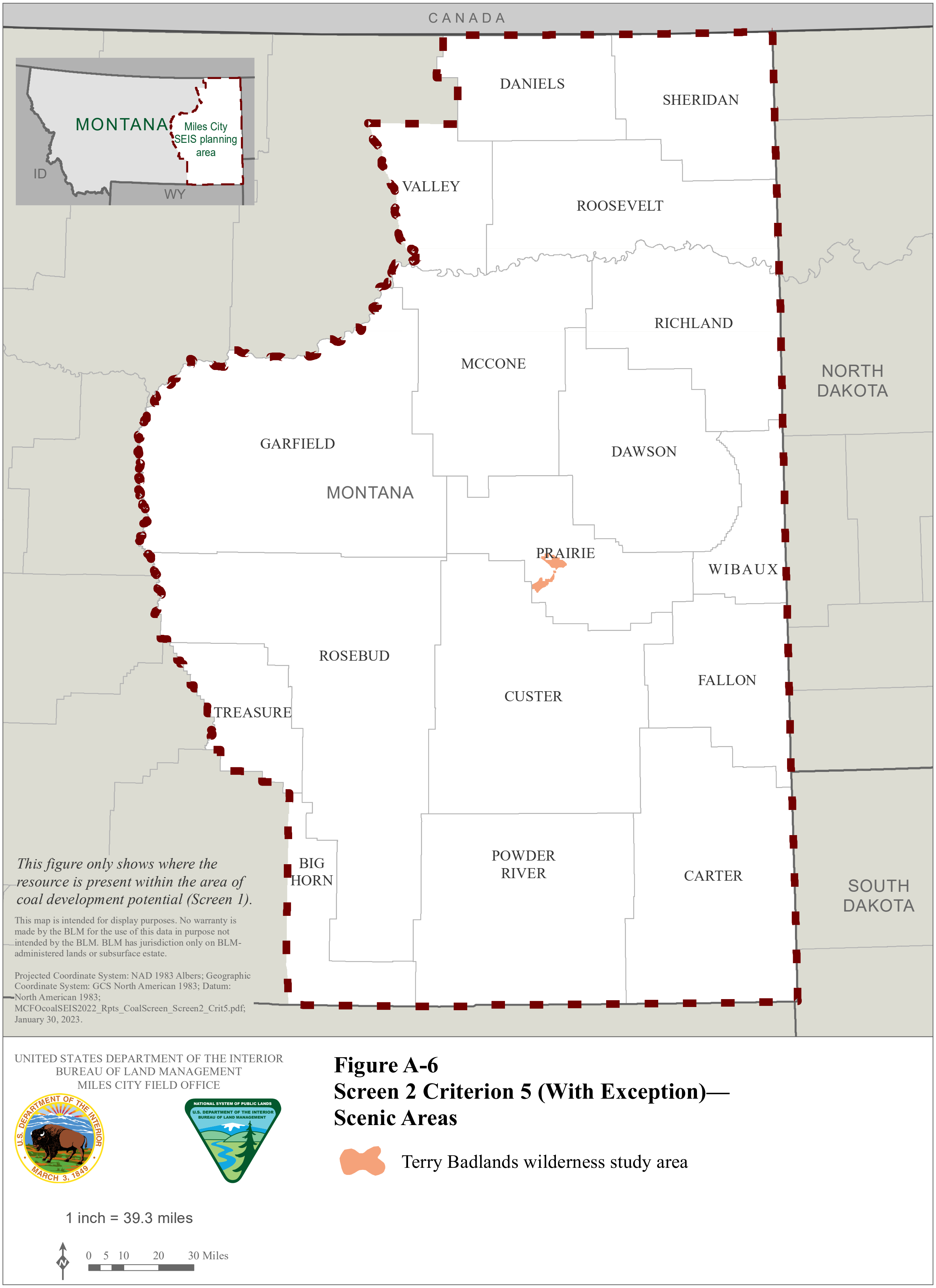
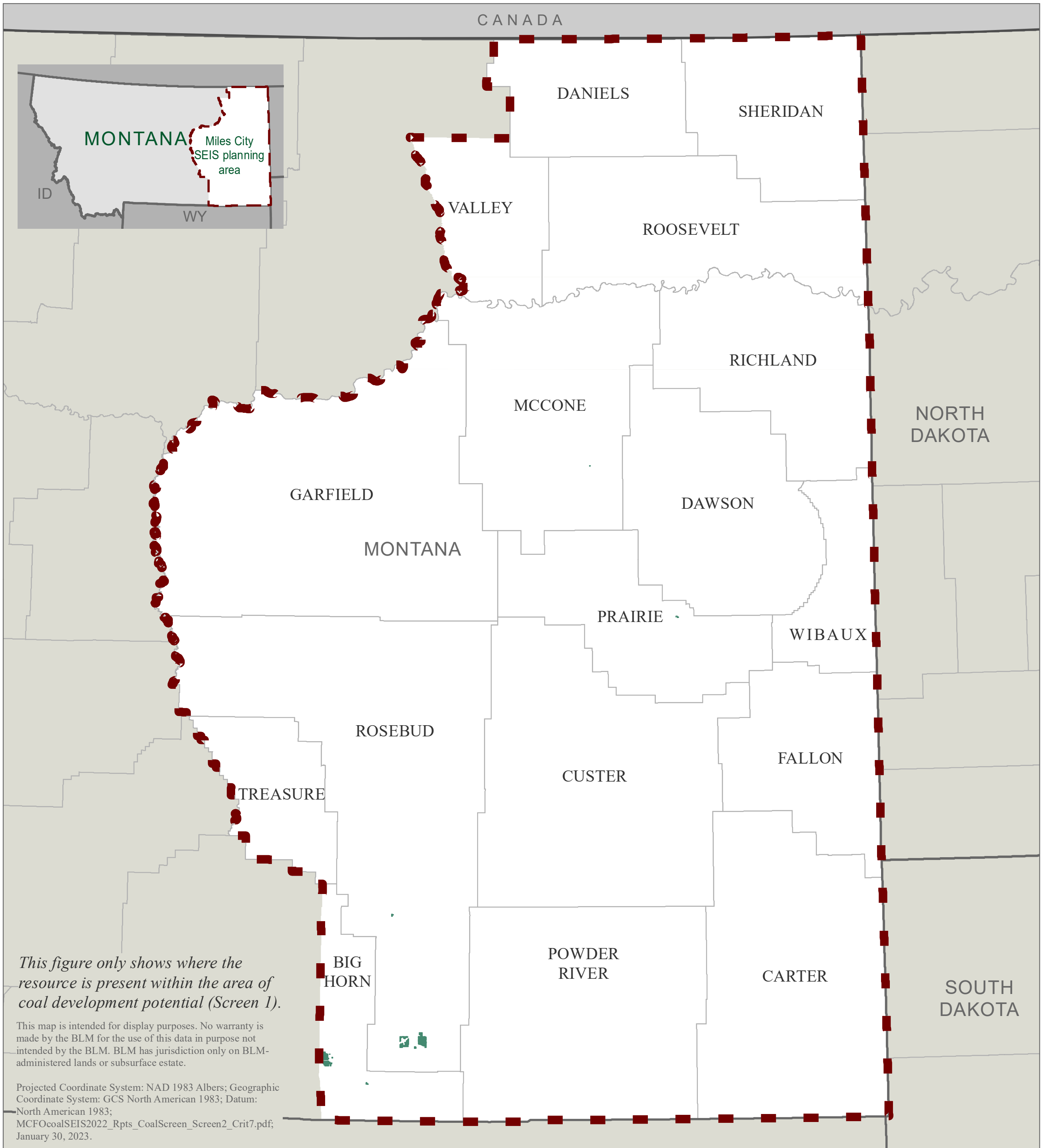


Figure A-6
Screen 2 Criterion 5 (With Exception)—
Scenic Areas



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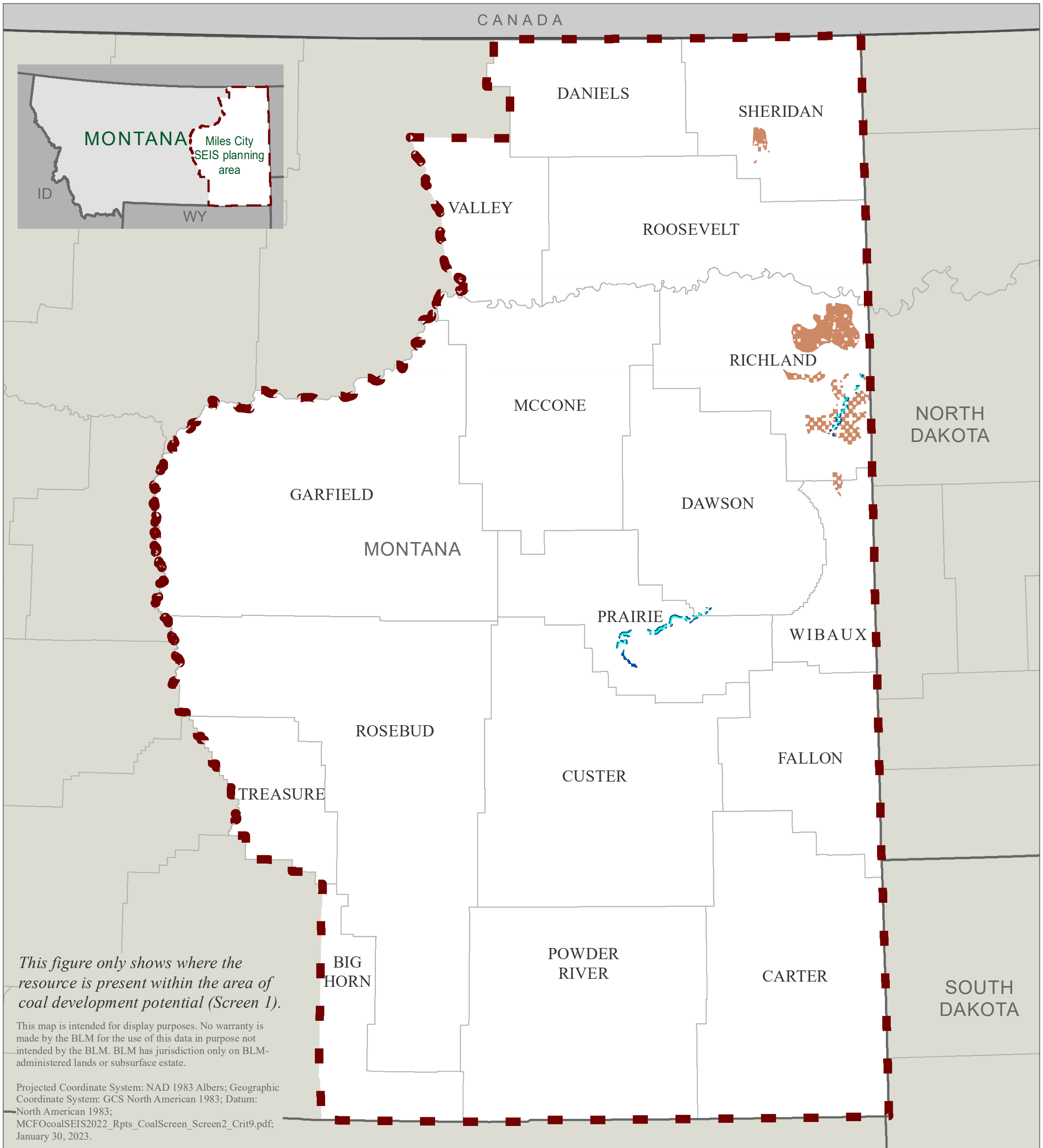
1 inch = 39.3 miles

0 5 10 20 30 Miles

Figure A-7
Screen 2 Criterion 7 (With Exception)—
Historic Lands and Sites

Historic lands and sites



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1 inch = 39.3 miles

0 5 10 20 30 Miles

Figure A-8
Screen 2 Criterion 9 (With Exception)—
Federally Designated Critical Essential or Proposed Habitat for Threatened and Endangered Species

Least tern
Pallid sturgeon
Whooping crane

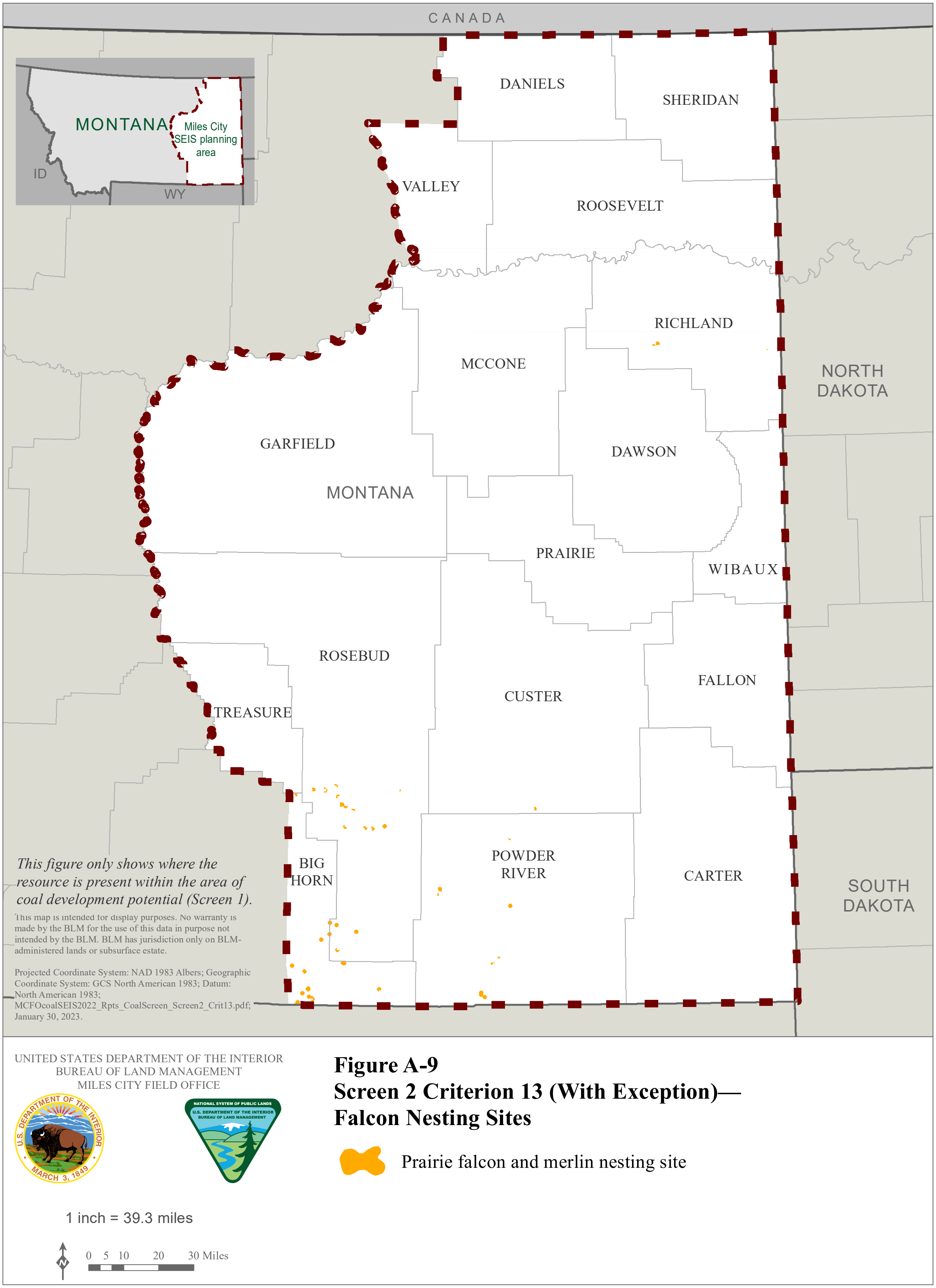

Figure A-9
Screen 2 Criterion 13 (With Exception)—Falcon Nesting Sites

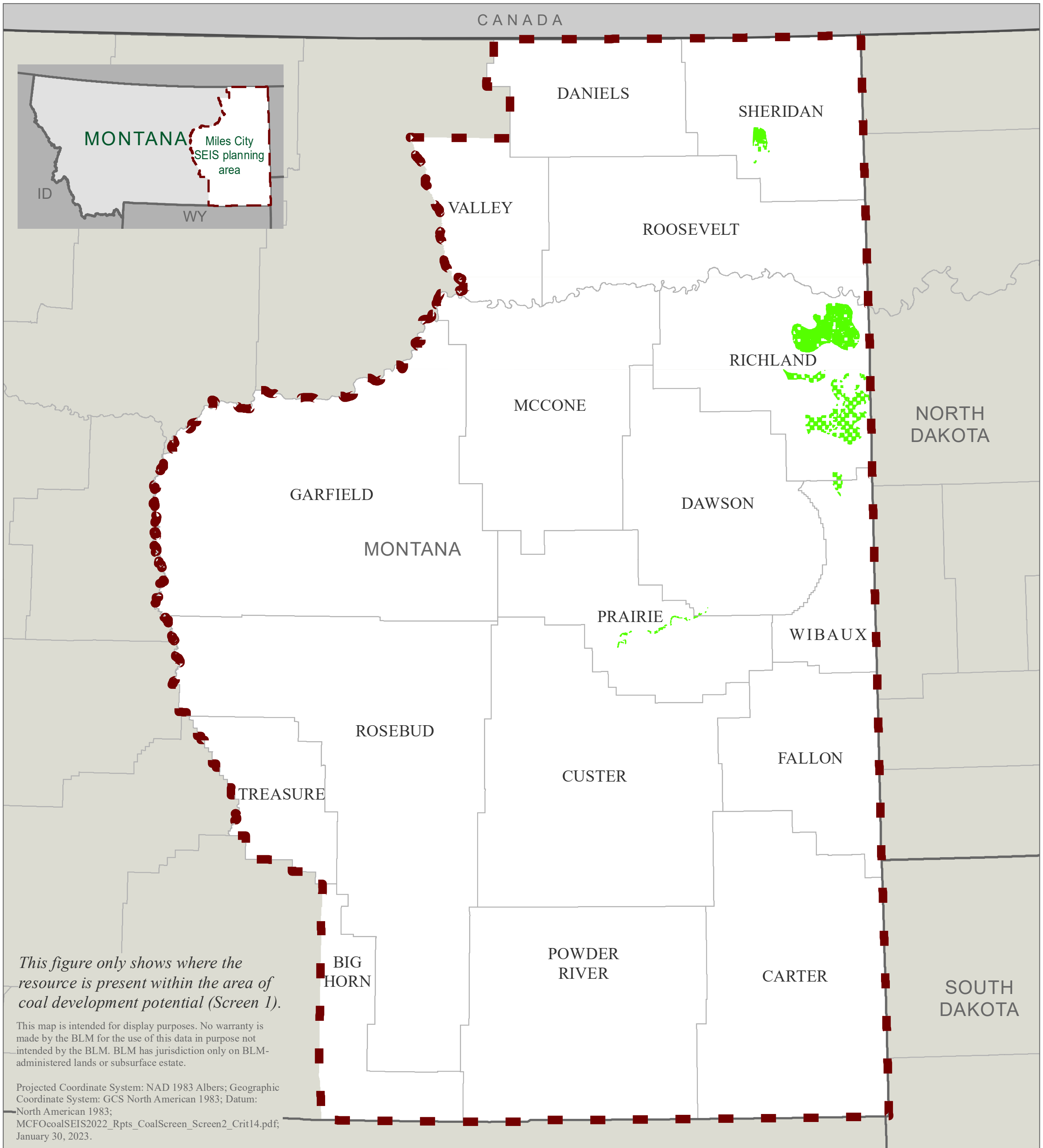

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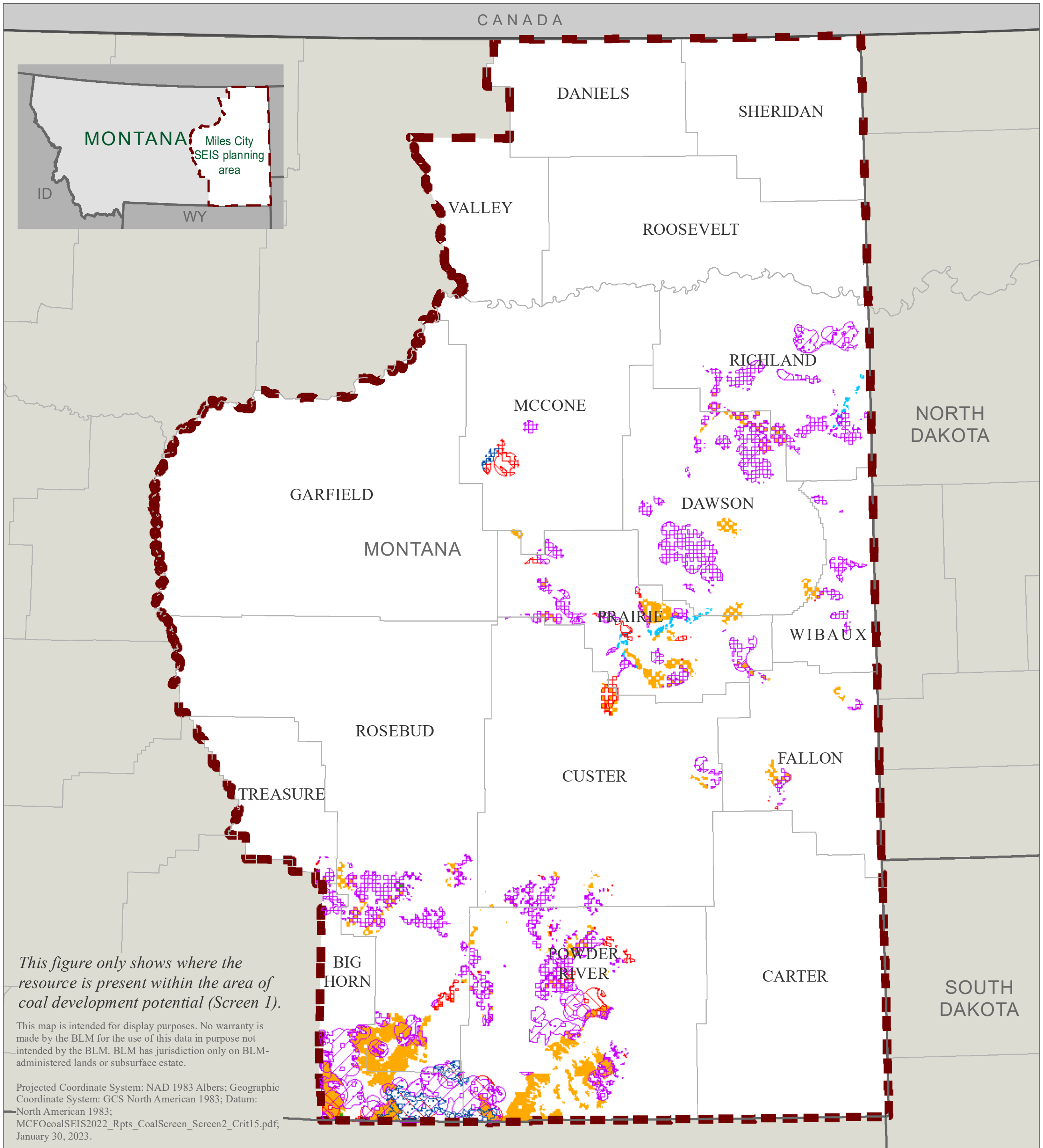
Figure A-10
Screen 2 Criterion 14 (With Exception)—Migratory Birds of High Federal Interest

Habitat for migratory birds of high federal interest

1 inch = 39.3 miles

0 5 10 20 30 Miles



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1 inch = 39.3 miles

0 5 10 20 30 Miles

Figure A-11
Screen 2 Criterion 15 (With Exception)—
Habitat for Species of High Interest to the State

- Sharp-tailed grouse leks
- Greater sage-grouse leks
- Greater sage-grouse priority habitat management area
- BLM sensitive plants
- High priority fish species habitat
- Big game crucial winter range

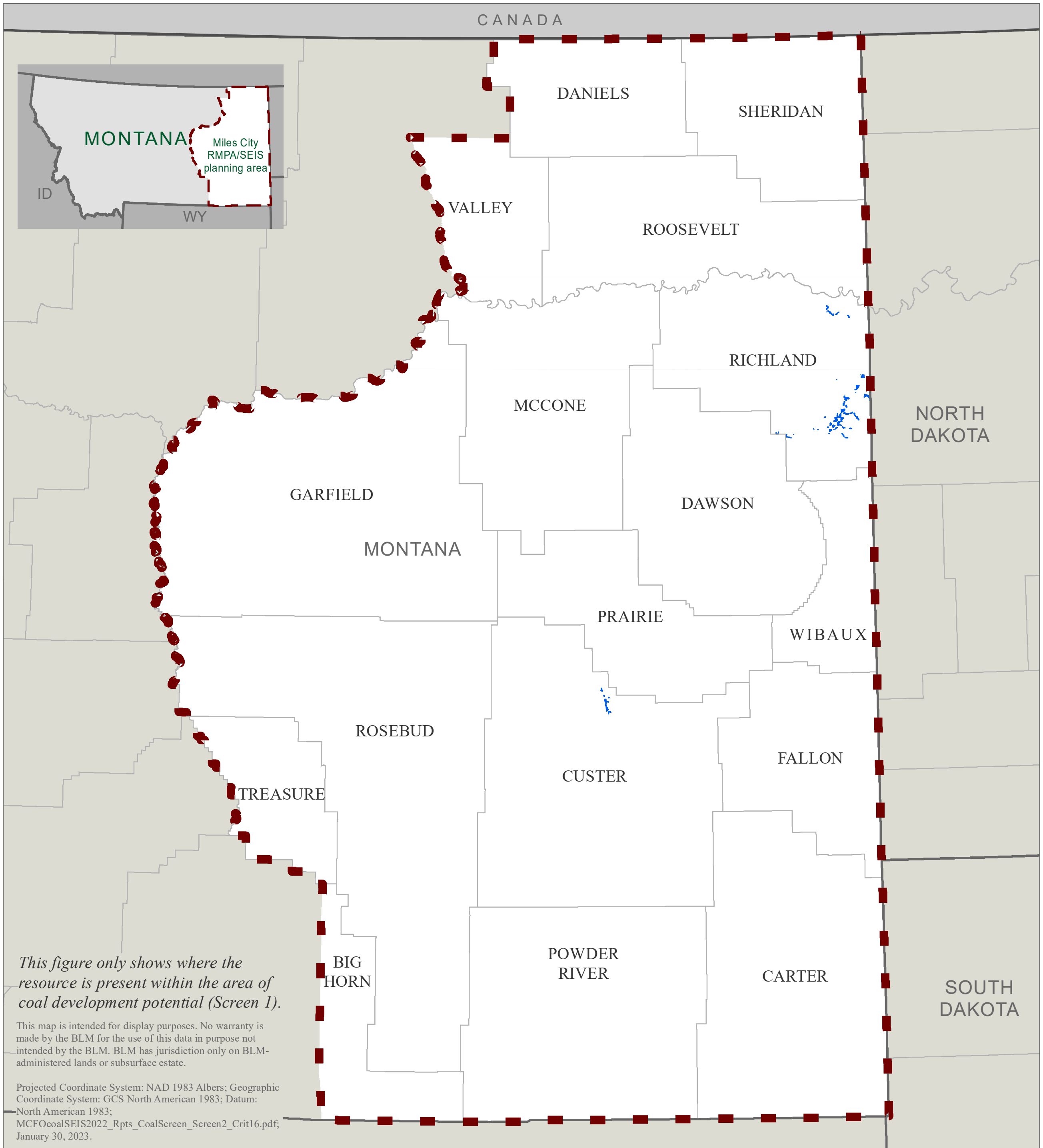

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Figure A-12
Screen 2 Criterion 16 (Without Exception)—
100-Year Floodplain

Floodplain

1 inch = 39.3 miles

0 5 10 20 30 Miles

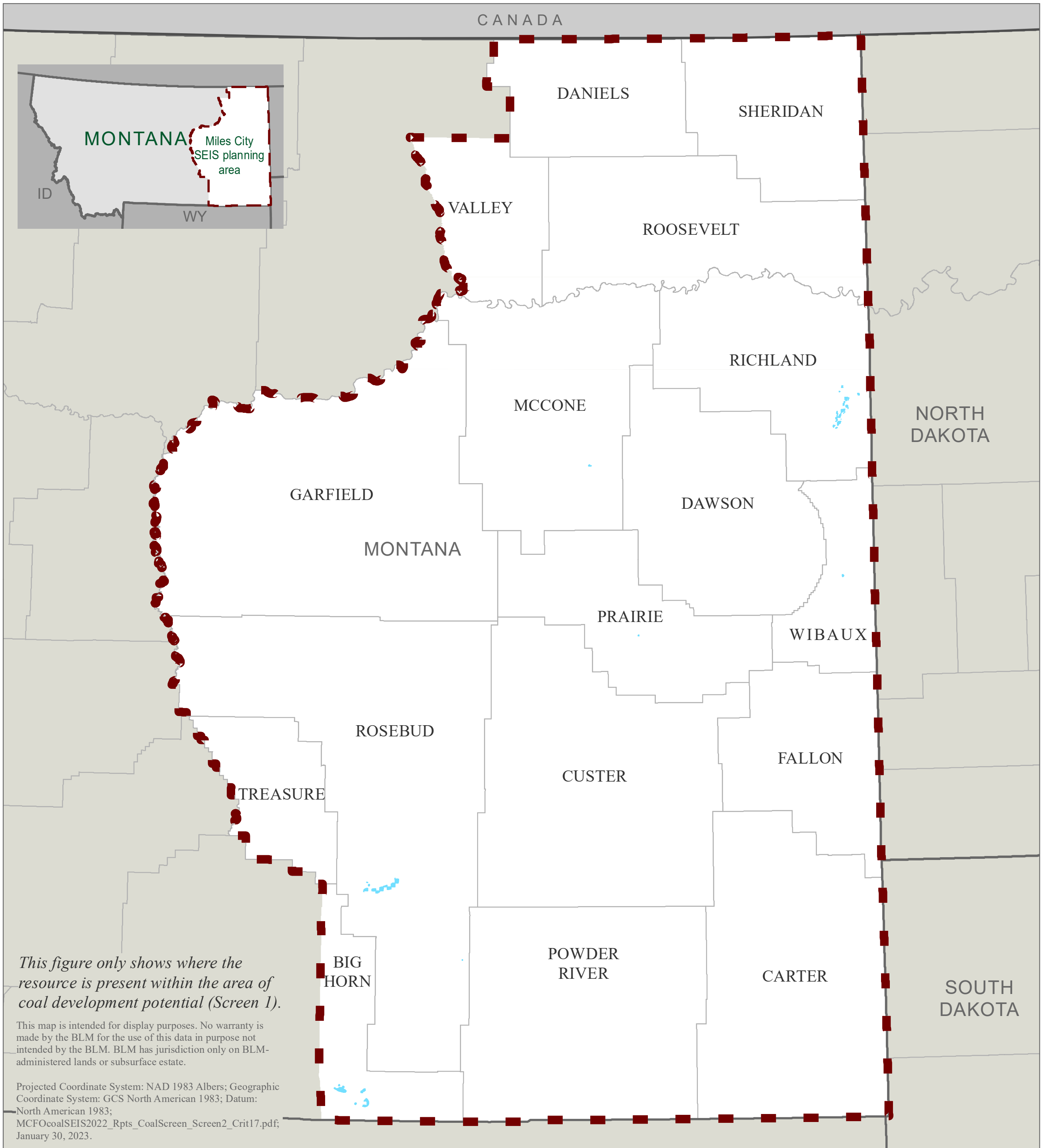

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Figure A-13
Screen 2 Criterion 17 (With Exception)—
Municipal Watersheds

Municipal watershed

1 inch = 39.3 miles

0 5 10 20 30 Miles

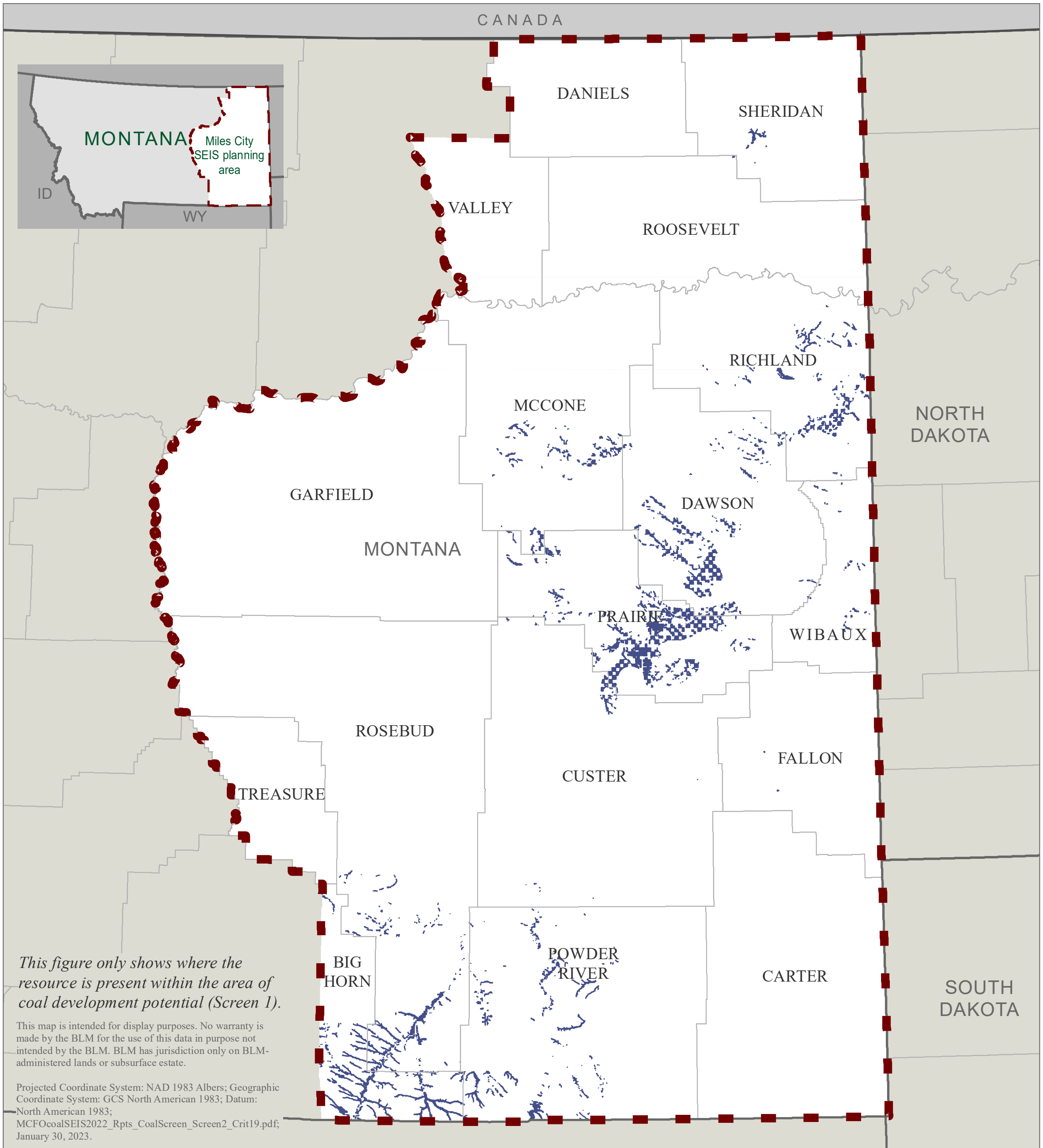

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Figure A-14
Screen 2 Criterion 19 (Without Exception)—
Alluvial Valley Floors

Alluvial valley floor

1 inch = 39.3 miles

0 5 10 20 30 Miles

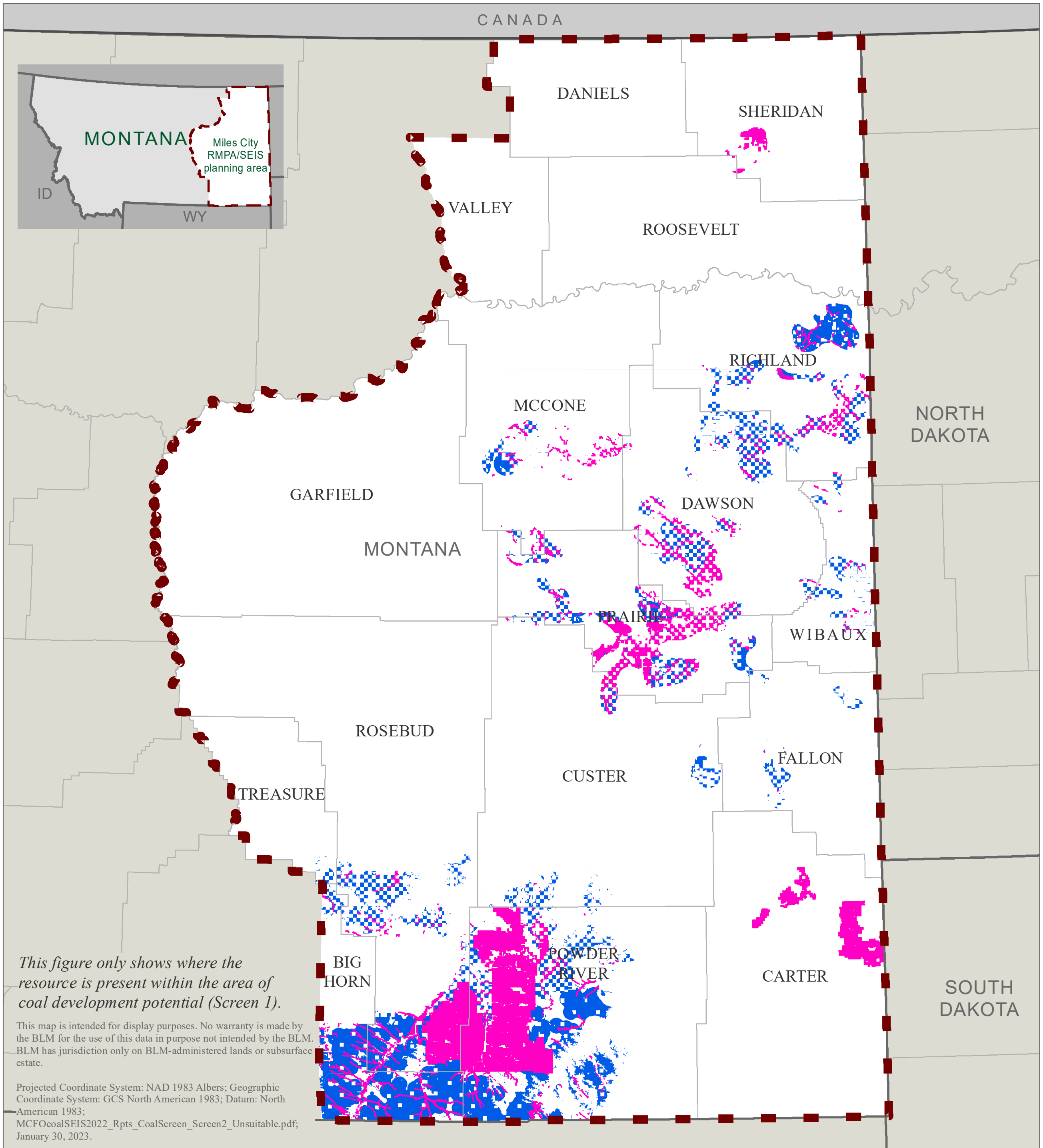

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Figure A-15
Screen 2 (Unsuitable for All or Certain Stipulated Methods of Coal Mining)

- Unsuitable without exception
- Unsuitable with exception

1 inch = 39.3 miles

0 5 10 20 30 Miles

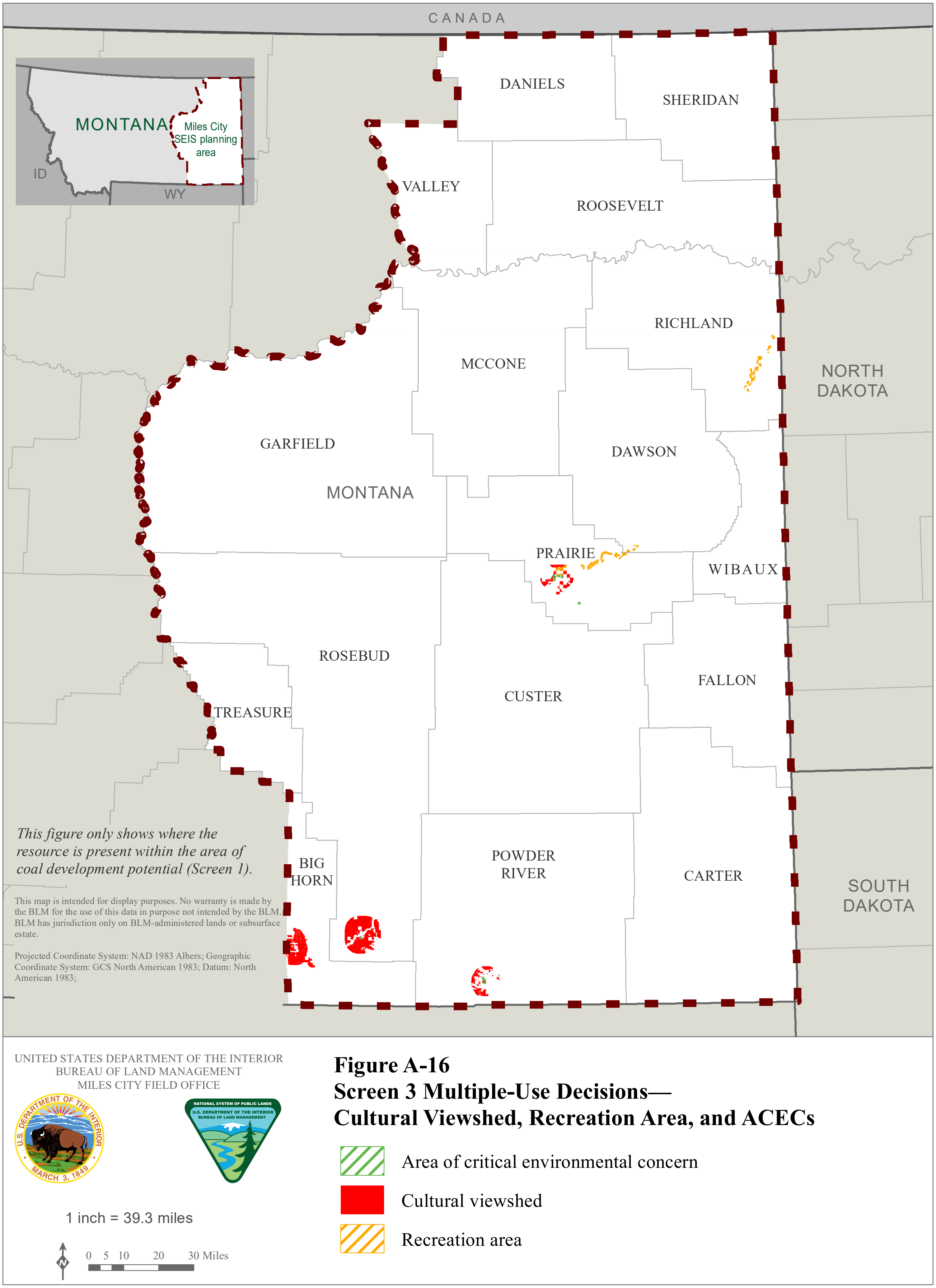
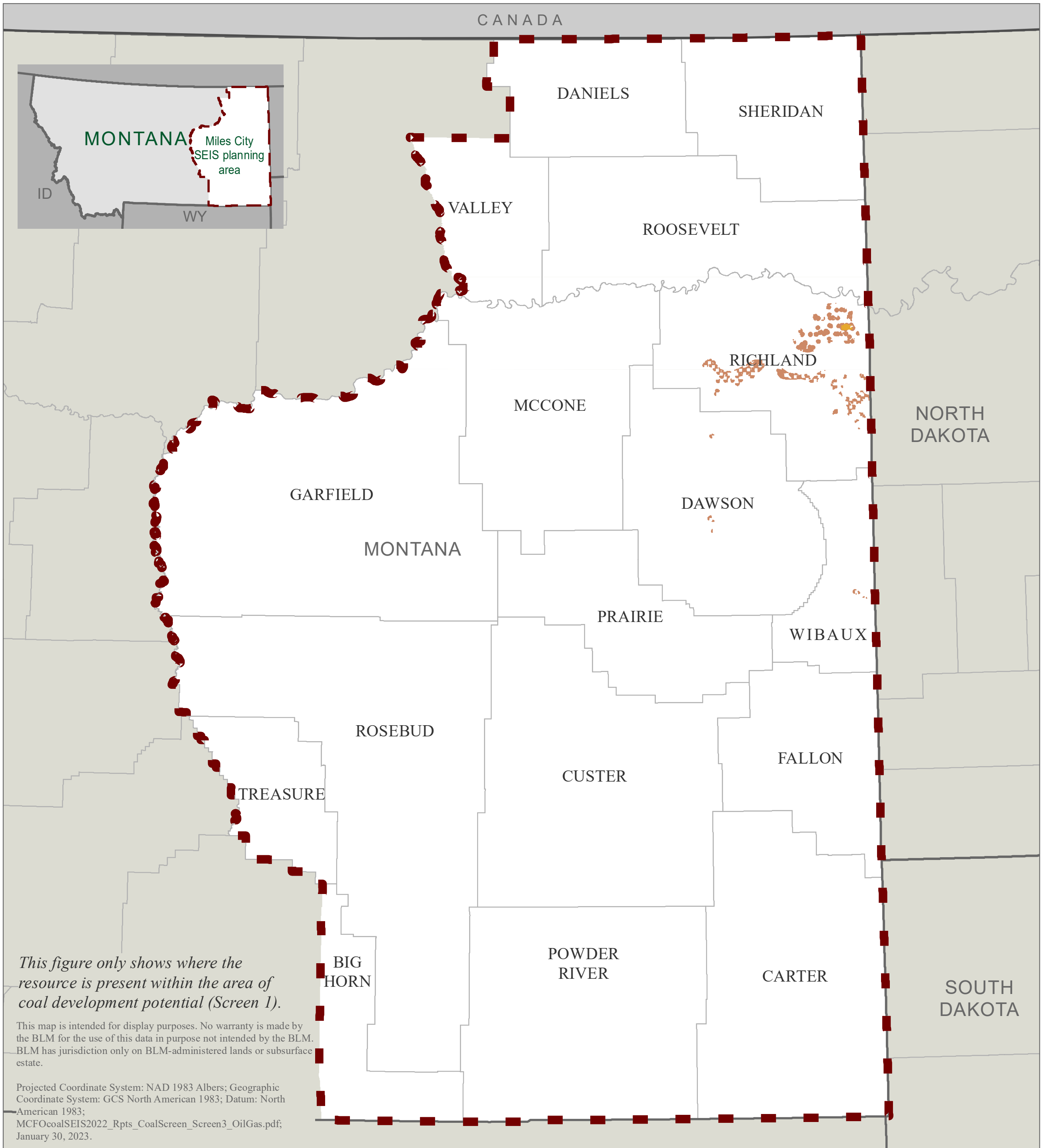


Figure A-16
Screen 3 Multiple-Use Decisions—
Cultural Viewshed, Recreation Area, and ACECs



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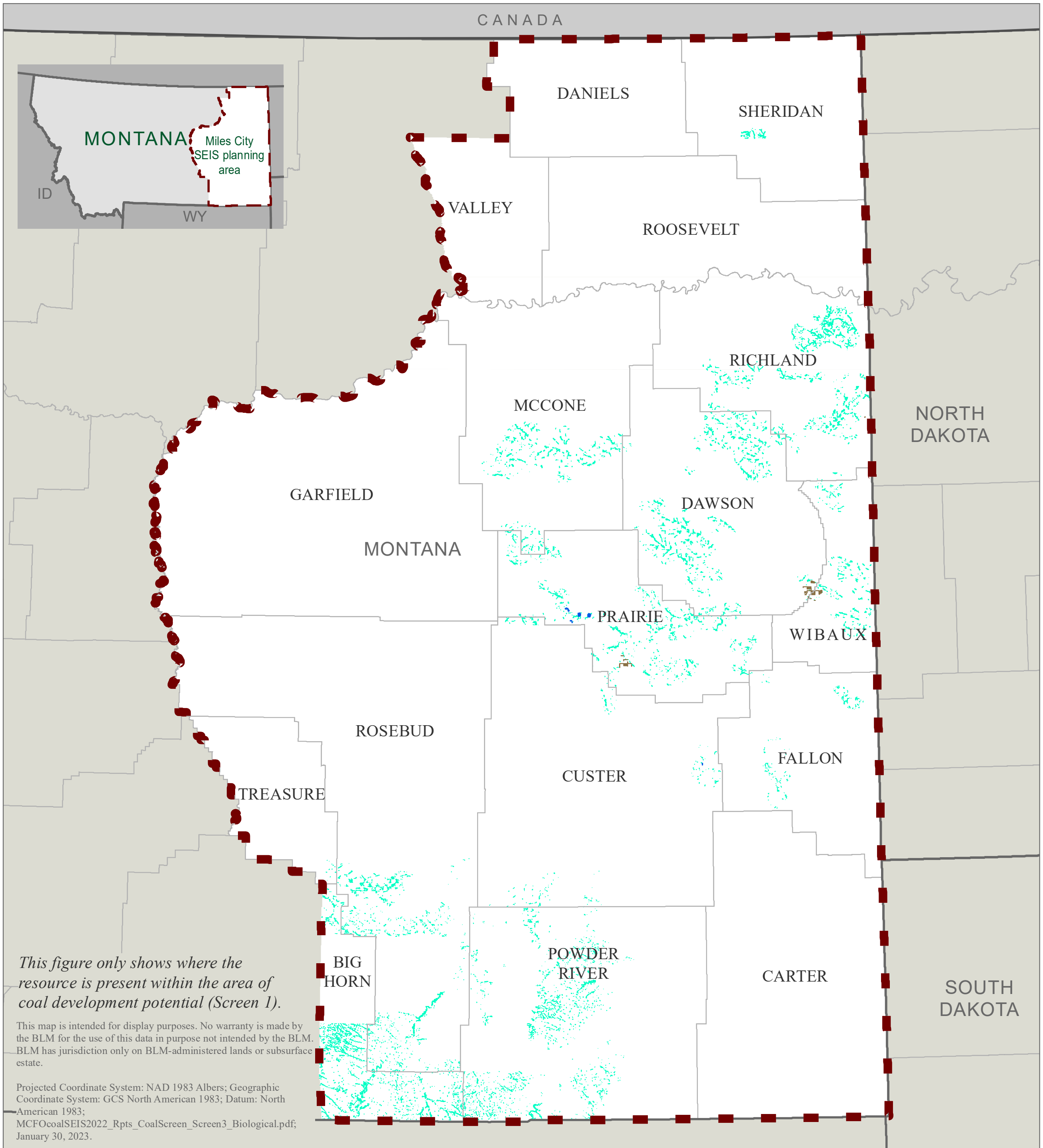
1 inch = 39.3 miles

0 5 10 20 30 Miles

Figure A-17
Screen 3 Multiple-Use Decisions—
Oil and Gas

Active oil and gas well

Active oil and gas unit



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1 inch = 39.3 miles

0 5 10 20 30 Miles

Figure A-18
Screen 3 Multiple-Use Decisions—
Biological Resources

Conservation easement
Fishing reservoir
Lentic and lotic systems

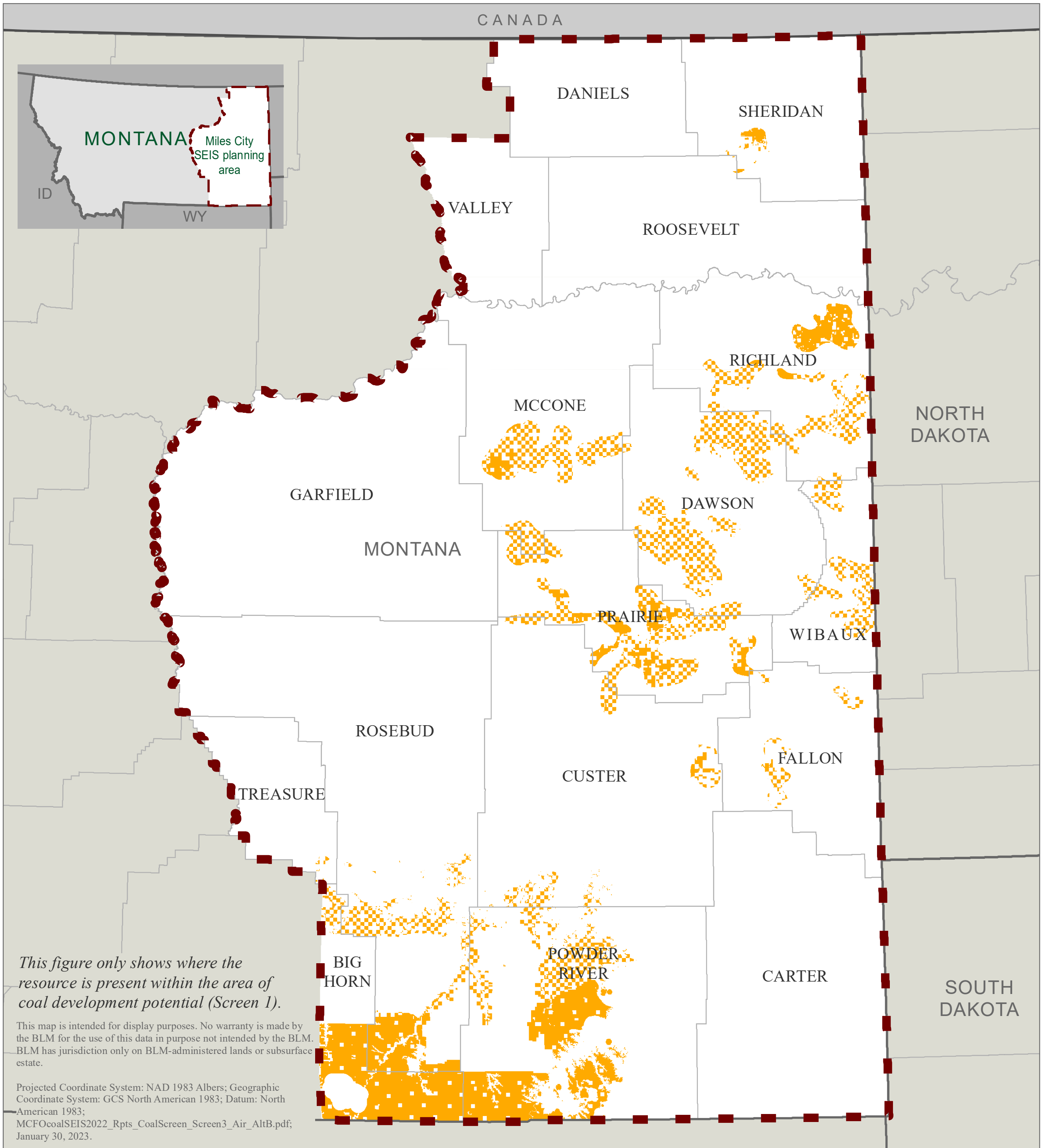

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Figure A-19
Screen 3 Multiple-Use Decisions—
Air Resources Alternative B

Air and climate

1 inch = 39.3 miles

0 5 10 20 30 Miles

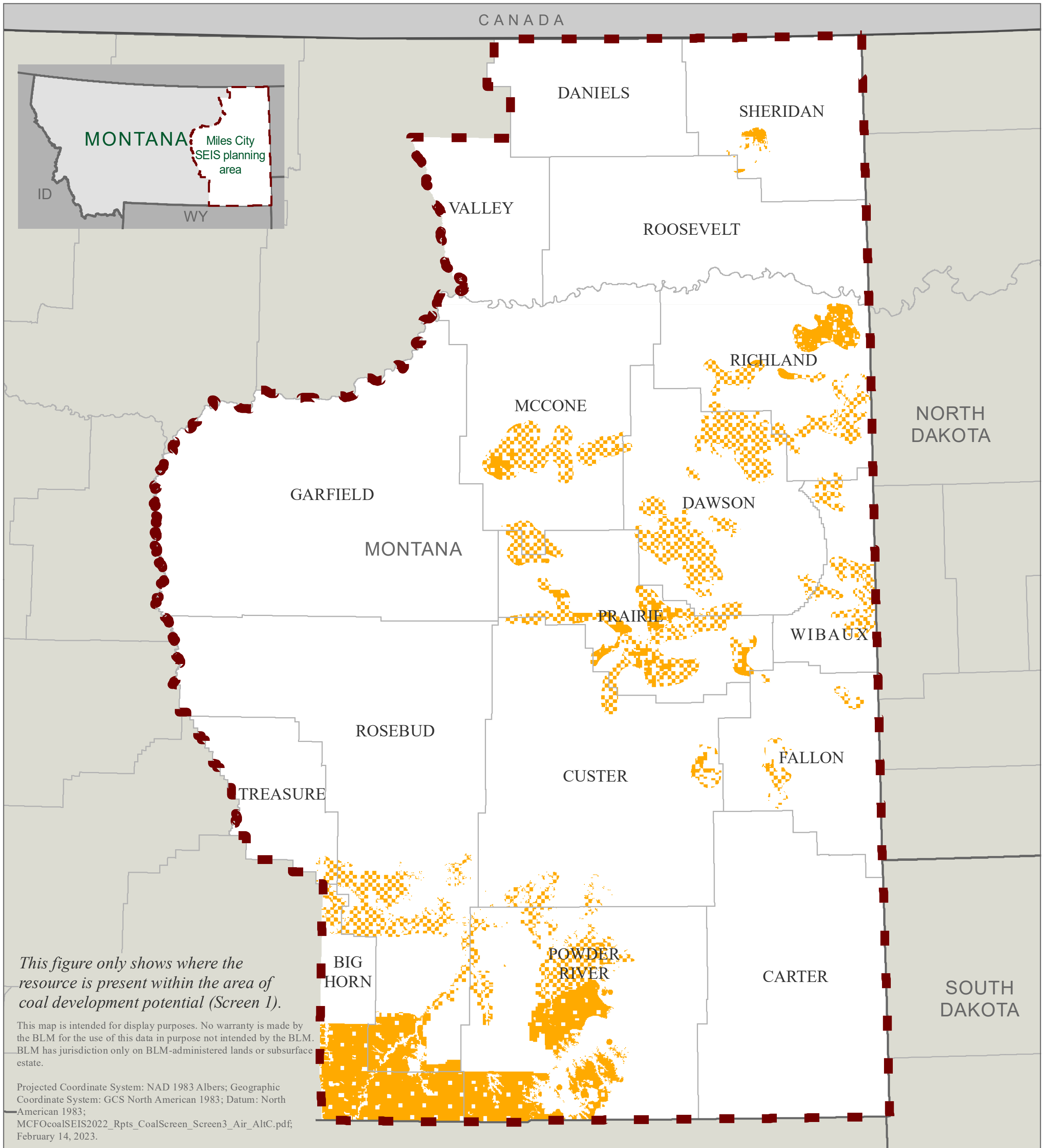

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Figure A-20
Screen 3 Multiple-Use Decisions—
Air Resources Alternative C

Air and climate

1 inch = 39.3 miles

0 5 10 20 30 Miles

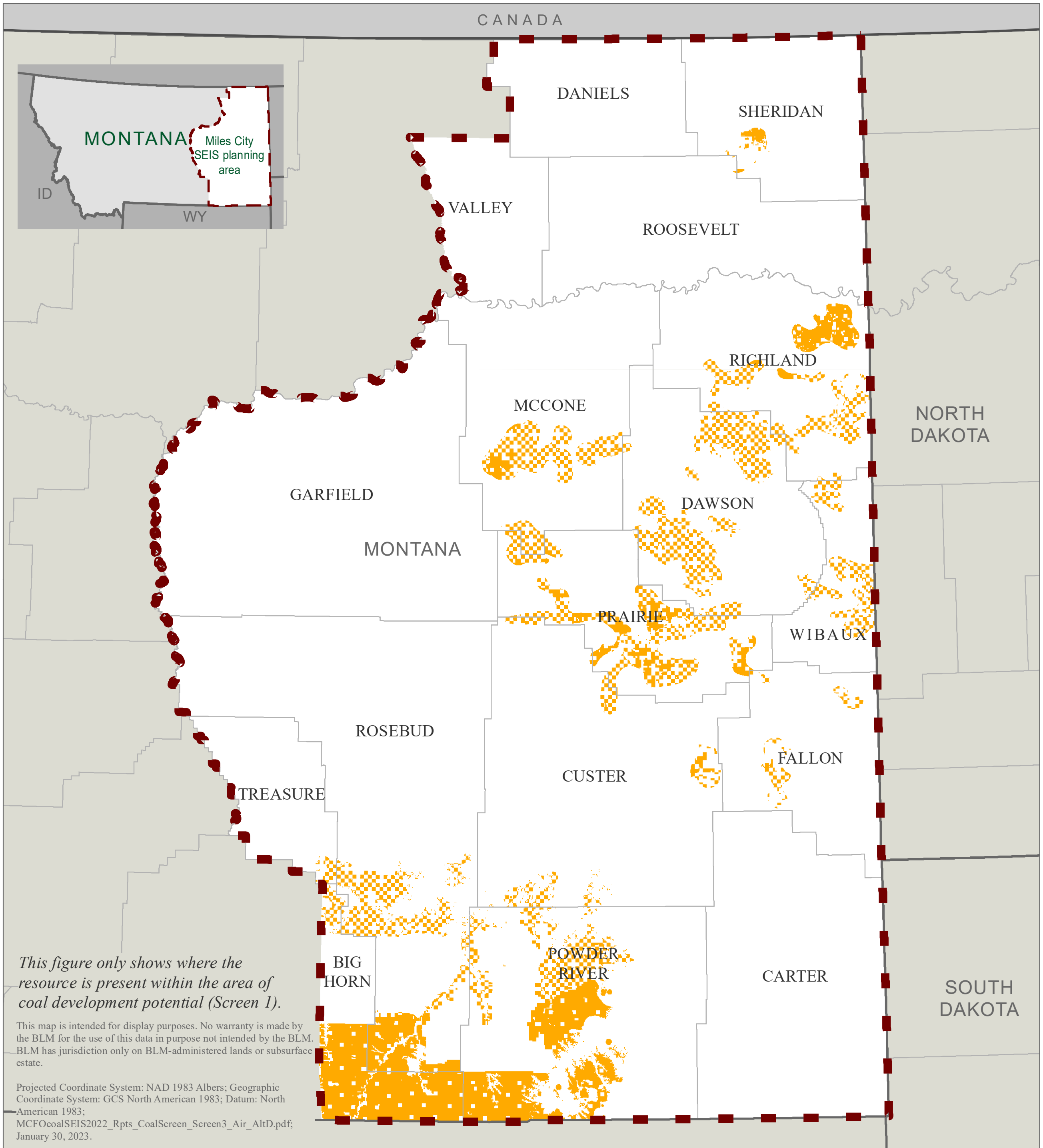

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Figure A-21
Screen 3 Multiple-Use Decisions—
Air Resources Alternative D

Air and climate

1 inch = 39.3 miles

0 5 10 20 30 Miles

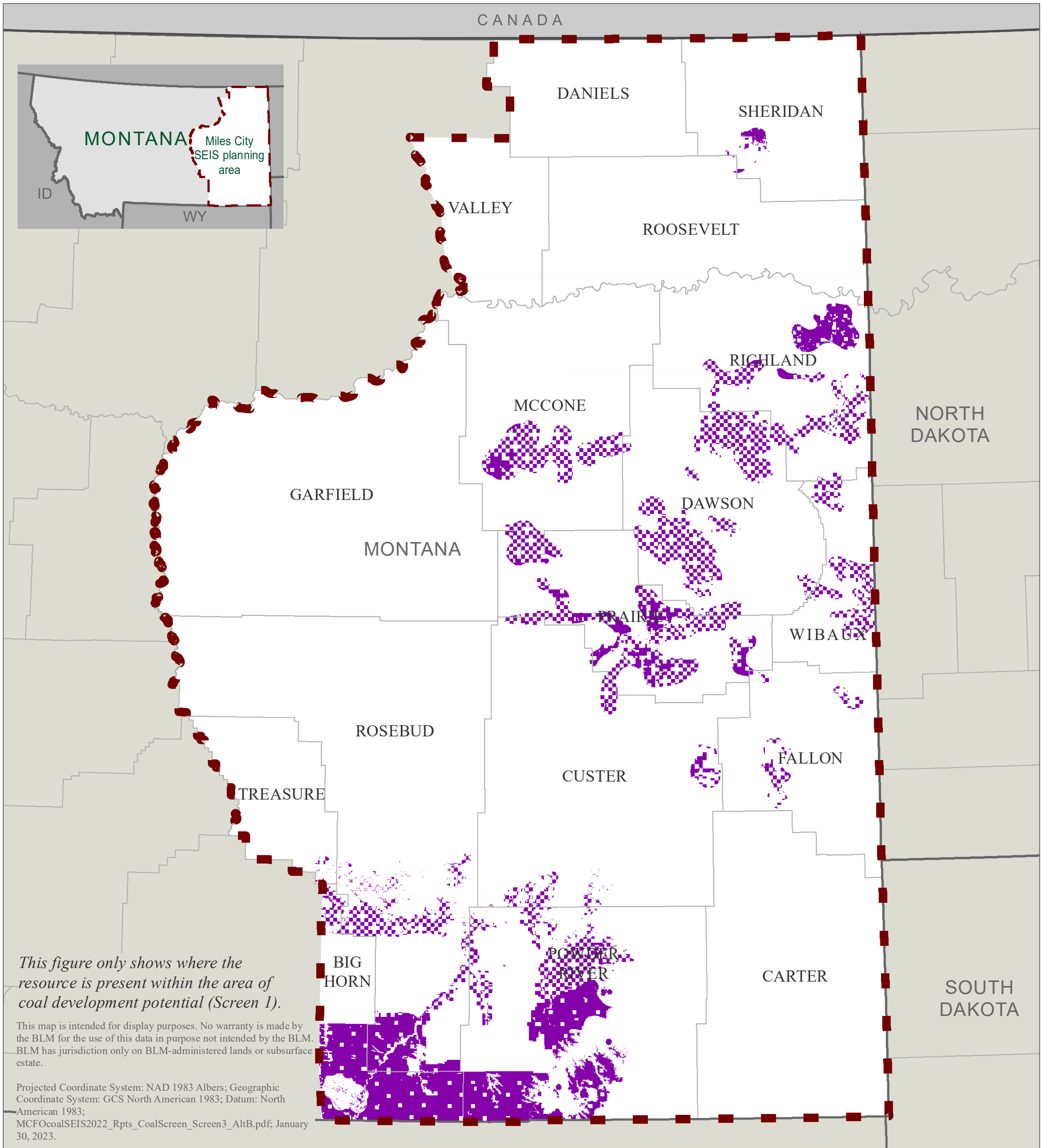

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Figure A-22
Screen 3 (Multiple-Use)—Alternative B

Unavailable for leasing

1 inch = 39.3 miles

0 5 10 20 30 Miles

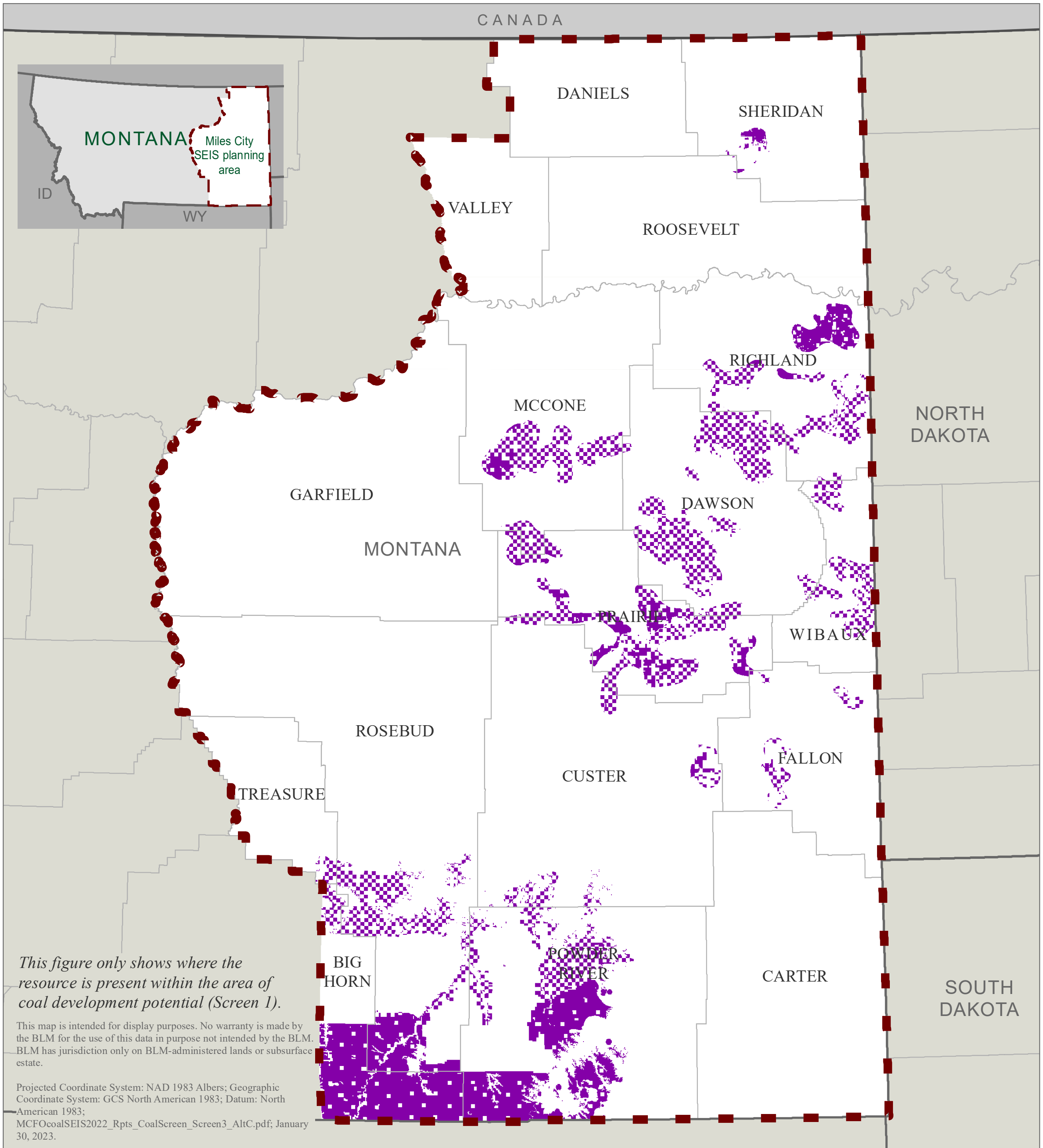

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Figure A-23
Screen 3 (Multiple-Use)—Alternative C

Unavailable for leasing

1 inch = 39.3 miles

0 5 10 20 30 Miles

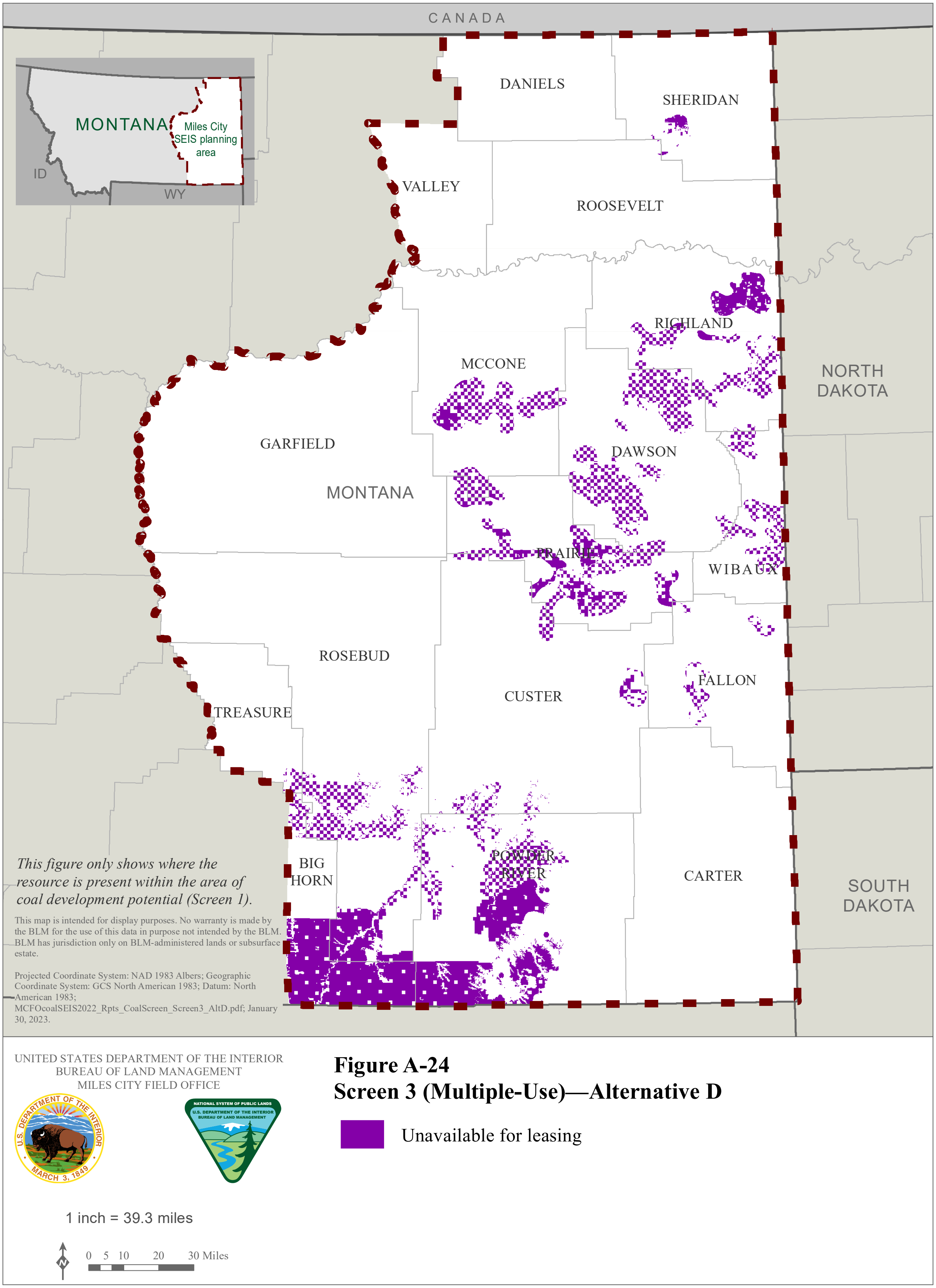
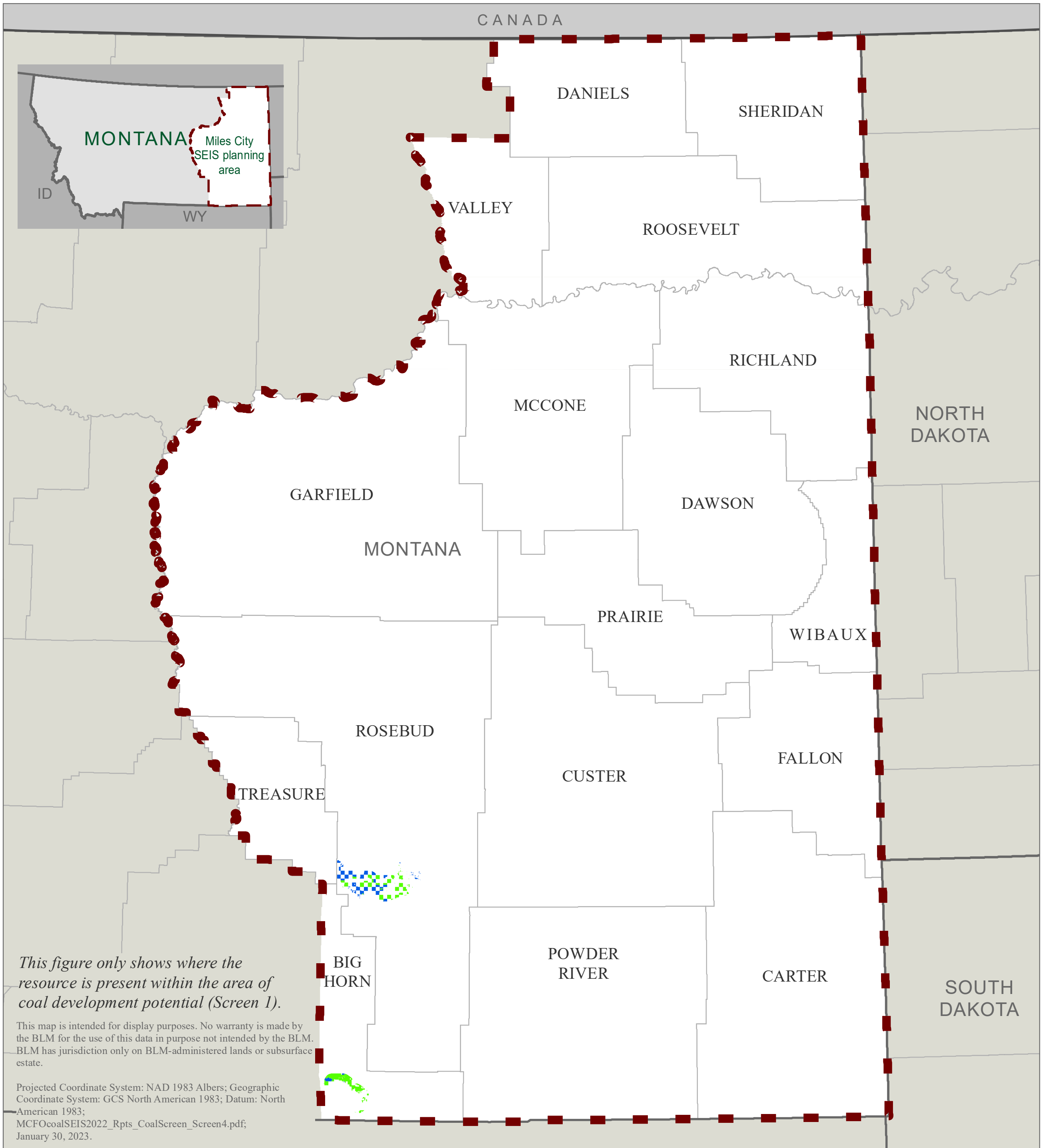


Figure A-24
Screen 3 (Multiple-Use)—Alternative D



UNITED STATES DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT
MILES CITY FIELD OFFICE

1 inch = 39.3 miles

0 5 10 20 30 Miles

Figure A-25
Screen 4 Consultation with Qualified Surface Owners

- In favor (acceptable for further consideration for coal leasing)
- Not in favor (unacceptable for further consideration for coal leasing)

The BLM reached out to landowners only within the 2-mile buffer area around 2022-approved federal mine permit boundaries because under all of the action alternatives, coal resources outside of this buffer would be unacceptable for further consideration for leasing based on the air resources criterion in the multiple-use screen (Screen 3).

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Attachment 2

Sample Private Landowner Letter

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United States Department of the Interior

BUREAU OF LAND MANAGEMENT
Miles City Field Office
111 Garryowen Road
Miles City, MT 59301
http://www.blm.gov/montana-dakotas

September 28, 2022

CERTIFIED MAIL NO.:
RETURN RECEIPT REQUESTED

Subject: Surface Owner Consultation (Coal Screen 4) -Miles City Field Office Resource Management Plan Amendment and Supplemental Environmental Impact Statement

Dear Surface Owner:

The United States Department of the Interior, Bureau of Land Management (BLM), Miles City Field Office (MCFO) is preparing a Supplemental Environmental Impact Statement (SEIS) and potential amendment to the Approved Resource Management Plan (RMP) for MCFO. This potential amendment and associated SEIS are in response to a United States Montana District Court opinion and order (Western Organization of Resource Councils, et al vs BLM; 4:20-CV-00076-GF-BMM; 8/3/2022). As part of this effort, the BLM is required to conduct new coal screening in accordance with the Code of Federal Regulations (CFR), 43 CFR 3420.1-4.

Pursuant to 43 CFR 3420.1-4(e)(4)(i), the BLM is providing you official notification that, based on publicly accessible State of Montana Cadastral data, the BLM has identified your private surface lands, which overlie federal coal deposits, as lands determined to have coal developmental potential. The BLM has identified the legal land descriptions of these lands on *Enclosure 1* of this letter for your review. As part of the planning process, the BLM is required to solicit a preference for surface mining from every qualified surface owner for lands we are considering making acceptable for future consideration for coal leasing. This notification provides you the opportunity to submit your preference.

If you are a "qualified surface owner", as defined by 43 CFR 300.0-5 (gg) (1) and (2), please respond by completing and returning the *Enclosure 2* using the prepaid envelope. If you are not the "qualified surface owner," please respond by completing and returning the *Enclosure 3*. Please see *Enclosure 4* and *Enclosure 5* for additional information, definitions, and specific Federal coal regulations. We ask you respond by **no later than Oct 31, 2022.**

This planning effort does not authorize coal leasing. Future leasing of Federal coal would require a company to obtain your written consent prior to submitting a lease application to the BLM for review. Leasing action would be subject to separate additional National Environmental Policy Act review.

For additional information please contact Irma Nansel, Project Manager, at 406-233-3653 or inansel@blm.gov.

We appreciate your interest in our planning efforts and look forward to hearing from you.

Sincerely,

Eric Lepisto
Miles City Field Manager

ENCLOSURE 1
LEGAL LAND DESCRIPTION

Unique ID

Legal Land Descriptions and land parcel information was obtained from the State of Montana Cadastral Website. This data was used to identify private lands with split estate federal coal rights. To view the original source of this parcel information, please visit The State of Montana Cadastral website: https://svc.mt.gov/msl/mtcadastral/

ENCLOSURE 2
QUALIFIED SURFACE OWNER

Unique ID

Return no later than October 31, 2022, using the self-addressed, stamped envelope provided.

Dear BLM Field Manager:

In response to your letter soliciting each qualified surface owner's "preference in favor of" or "preference against" mining federally owned coal deposits underlying split estate by other than underground mining techniques (surface coal mining) within the Miles City planning area, I submit the following written response **as the legal qualified surface owner**, as defined by 43 CFR 300.0-5 (gg) (1) and (2):

Note: if you are **NOT** the legal qualified surface owner, please complete Enclosure 3.

☐ After reading and considering the provided references, I submit that I have **a preference in favor of** mining coal deposits underlying my surface estate by other than underground mining techniques (surface coal mining).

☐ After reading and considering the provided references, I submit that I have **a preference against** mining coal deposits underlying my surface estate by other than underground mining techniques (surface coal mining).

☐ After reading and considering the provided references, I submit that I am **undecided** on my preference in regard to mining coal deposits underlying my surface estate by other than underground mining techniques (surface coal mining).

Sincerely,

____

Signature Date

____

Your Name (printed)

ENCLOSURE 3
NOT A QUALIFIED SURFACE OWNER

Unique ID

Return no later than October 31, 2022, using the self-addressed, stamped envelope provided.

Dear BLM Field Manager:

In response to your letter soliciting each qualified surface owner's "preference in favor of" or "preference against" mining federally owned coal deposits underlying split estate by other than underground mining techniques (surface coal mining) within the Miles City planning area, I am notifying you that, as defined by 43 CFR 300.0-5(gg) (1) and (2):

☐ I am **NOT** the "legal qualified surface owner"

Qualified Surface Owner Information, if available:

Below, I have provided the name and address of the qualified surface owner:

Name: ______________________________

Address: ______________________________

____

____

____
Your Name (printed)

ENCLOSURE 4
FREQUENTLY ASKED QUESTIONS

1. **What are you doing and why?**

   The 2015 Miles City Resource Management Plan (RMP) was challenged by the Western Organization of Resource Councils (WORC) in the U.S. District Court of Montana in March 2016 (WORC I). An Order was issued on March 26, 2018, finding that BLM violated National Environmental Policy Act (NEPA) and required BLM to complete new coal screening and remedial NEPA analysis by November 29, 2019. The BLM signed the Record of Decision on November 25, 2019.

   On August 27, 2020, WORC challenged the 2019 the Miles City Supplemental EIS (WORC II). An Order was issued on August 3, 2022. It found that BLM violated NEPA and ordered BLM to complete within 12 months new coal screening and remedial analysis. As part of this effort, the BLM will complete a Supplemental EIS and is required to conduct coal screening in accordance with the Code of Federal Regulations (CFR), 43 CFR 3420.1-4. Coal screening requires consultation with the qualified surface owner (Coal Screen 4).

2. **What is a qualified surface owner? (43 CFR 3400.0-5(gg))**

   The natural person or persons (or corporation, the majority stock of which is held by a person or persons otherwise meeting the requirements of this section) who:

   - Hold(s) legal or equitable title to the surface of split estate lands;
   - Have their principal place of residence on the land, or personally conduct farming or ranching operations upon a farm or ranch unit to be affected by surface mining operations; or directly receive a significant portion of their income, if any, from such farming and ranching operations; and
   - Have met the conditions of paragraphs (1) and (2) of this section for a period of at least 3 years, except for persons who gave written consent less than 3 years after they met the requirements of both paragraphs (gg) (1) and (2) of this section. In computing the three-year period, the authorized officer shall include periods during which title was owned by a relative of such person by blood or marriage if, during such periods, the relative would have met the requirements of this section.

3. **What are split estate lands?**

   Land in which the ownership of the surface is held by persons, including governmental bodies, other than the Federal government and the ownership of underlying coal is, in whole or in part, reserved to the Federal government.

4. **What is surface coal mining?**

   Surface coal mining (also referred to as: “other than underground mining techniques”) operations means activities conducted on the surface of lands in connection with a surface coal mine or surface operations and surface impacts incident to an underground mine, as defined in section 701(28) of the Surface Mining Control and Reclamation Act (30 U.S.C. 1291(28)).

ENCLOSURE 4
FREQUENTLY ASKED QUESTIONS

5. **Why do you own my minerals? Do I own my minerals?**
Using GIS (a mapping program) analysis and based on best available data at least a portion of your parcel(s) identified in this letter have federal coal minerals. These minerals were most likely reserved when the land was homesteaded. You can look up more information regarding the land by visiting glorecords.blm.gov/. Copies of the original land patents can be found by clicking on "Land Patents" and searching for the parcel by land description or using the second tab to search by location using a map. The master title plats can be found by clicking on "Land Status Records" and performing a similar search to find the parcel of land.

6. **How does this affect me?**
This step does not have an impact on you or your lands. We are asking your opinion to be considered in the coal screen process which will determine what lands may be made available for further consideration for leasing. Written surface owner consent would be needed to lease the lands and they would also need surface owner consent to issue a permit to mine. No lands are being leased for coal during this review.

7. **Does this mean my land will be developed?**
No. Land use planning will determine if lands are available for consideration. Written surface owner consent is needed to lease the lands and to issue a permit to mine. You will be involved if anyone is interested in leasing and developing your land.

8. **What comes next?**
Writing of the draft RMP/SEIS will occur this winter, with the documents available for public review and comment this spring/summer 2023. Unless otherwise requested, your address will be added to the project mailing list to receive notification of public meetings and the availability of draft documents for public review and comment. Additional, information will be posted on the BLM e-Planning website at https://eplanning.blm.gov by searching for NEPA number: DOI-BLM-MT-C020-2022-0086-RMP-EIS.

ENCLOSURE 5
FEDERAL REGULATIONS

43 CFR 3420.0-2 - Objectives.
The objectives of these regulations are to establish policies and procedures for considering development of coal deposits through a leasing system involving land use planning and environmental assessment or environmental impact statement processes; to promote the timely and orderly development of publicly owned coal resources; to ensure that coal deposits are leased at their fair market value; and to ensure that coal deposits are developed in consultation, cooperation and coordination with the public, state and local governments, Indian tribes and involved Federal agencies.

43 CFR 3420.1-4 - General requirements for land use planning.
(a) The Secretary may not hold a lease sale under this part unless the lands containing the coal deposits are included in a comprehensive land use plan or land use analysis. The land use plan or land use analysis will be conducted with public notice and opportunity for participation at the points specified in § 1610.2(f) of this title. The sale must be compatible with, and subject to, any relevant stipulations, guidelines, and standards set out in that plan or analysis.
(b)

(1) The Bureau of Land Management shall prepare comprehensive land use plans and land use analyses for lands it administers in conformance with 43 CFR part 1600.
(2) The Department of Agriculture or any other Federal agency with surface management authority over lands subject to leasing shall prepare comprehensive land use plans or land use analyses for lands it administers.
(3) The Secretary may lease in any area where it is found either that there is no Federal interest in the surface or that the coal deposits in an area are insufficient to justify the costs of a Federal land use plan upon completion of a land use analysis in accordance with this section and 43 CFR part 1600.

(c) In an area of Federal lands not covered by a completed comprehensive land use plan or scheduled for comprehensive land use planning, a member of the public may request the appropriate Bureau of Land Management State Office to prepare a land use analysis for coal related uses of the land as provided for in this group.

(d) A comprehensive land use plan or land use analysis shall contain an estimate of the amount of coal recoverable by either surface or underground mining operations or both.

(e) The major land use planning decision concerning the coal resource shall be the identification of areas acceptable for further consideration for leasing which shall be identified by the screening procedures listed below:

(1) Only those areas that have development potential may be identified as acceptable for further consideration for leasing. The Bureau of Land Management shall estimate coal development potential for the surface management agency. Coal companies, State and local governments and the general public are encouraged to submit information to the

Bureau of Land Management at any time in connection with such development potential determinations. Coal companies, State and local governments and members of the general public may also submit non-confidential coal geology and economic data during the inventory phase of planning to the surface management agency conducting the land use planning. Where such information is determined to indicate development potential for an area, the area may be included in the land use planning for evaluation for coal leasing.

(2) The Bureau of Land Management or the surface managing agency conducting the land use planning shall, using the unsuitability criteria and procedures set out in subpart 3461 of this title, review Federal lands to assess where there are areas unsuitable for all or certain stipulated methods of mining. The unsuitability assessment shall be consistent with any decision of the Office of Surface Mining Reclamation and Enforcement to designate lands unsuitable or to terminate a designation in response to a petition.

(3) Multiple land use decisions shall be made which may eliminate additional coal deposits from further consideration for leasing to protect other resource values and land uses that are locally, regionally, or nationally important or unique and that are not included in the unsuitability criteria discussed in paragraph (e) of this section. Such values and uses include, but are not limited to, those identified in section 522(a)(3) of the Surface Mining Reclamation and Control Act of 1977 and as defined in 30 CFR 762.5. In making these multiple use decisions, the Bureau of Land Management or the surface management agency conducting the land use planning shall place particular emphasis on protecting the following: Air and water quality; wetlands, riparian areas, and sole-source aquifers; the Federal lands which, if leased, would adversely impact units of the National Park System, the National Wildlife Refuge System, the National System of Trails, and the National Wild and Scenic Rivers System.

(4)

(i) While preparing a comprehensive land use plan or land use analysis, the Bureau of Land Management shall consult with all surface owners who meet the criteria in paragraphs (gg) (1) and (2) of § 3400.0-5 of this title, and whose lands overlie coal deposits, to determine preference for or against mining by other than underground mining techniques.

(ii) For the purposes of this paragraph, any surface owner who has previously granted written consent to any party to mine by other than underground mining techniques shall be deemed to have expressed a preference in favor of mining. Where a significant number of surface owners in an area have expressed a preference against mining those deposits by other than underground mining techniques, that area shall be considered acceptable for further consideration only for development by underground mining techniques. In addition, the area may be considered acceptable for further consideration for leasing for development by other than underground techniques if there are no acceptable alternative areas available to meet the regional leasing level.

(iii) An area eliminated from further consideration by this subsection may be considered acceptable for further consideration for leasing for mining by other than underground mining techniques if:

(A) The number of surface owners who have expressed their preference against mining by other than underground techniques is reduced below a significant number because such surface owners have given written consent for such mining or have transferred ownership to unqualified surface owners; and

(B) The land use plan is amended accordingly.

(f) In its review of cumulative impacts of coal development, the regional coal team shall consider any threshold analysis performed during land-use planning as required by § 1610.4-4 of this title and shall apply this analysis, where appropriate, to the region as a whole.

Appendix B

Coal Reasonably Foreseeable Development Scenario

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TABLES

Page

FIGURE

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Appendix B. Coal Reasonably Foreseeable Development Scenario

This reasonably foreseeable development (RFD) scenario describes anticipated coal resource development within the administrative boundaries of the United States (US) Department of the Interior, Bureau of Land Management (BLM) Montana Miles City Field Office (MCFO; planning area) through 2088, based on development trends and expected changes to those development trends. The RFD scenario for this effort has been updated from the RFD scenario used in the analysis for the 2015 Proposed Resource Management Plan (RMP)/Final Environmental Impact Statement (EIS) and 2019 Proposed RMP Amendment (RMPA)/Final Supplemental EIS because market conditions have changed; therefore, the BLM has updated the RFD scenario accordingly. The geographic scope of this RFD scenario is limited to federal coal within the planning area.

This supplemental environmental impact statement (SEIS) decision area encompasses approximately 1.7 million acres of federal coal mineral estate with development potential in the MCFO.

Estimating the level of future coal development in the decision area has a high amount of uncertainty; this is because coal development depends on the continued operation of power plants, global coal markets, the ability to bring coal to market, and mining technologies. Energy policies can also shape demand by influencing the incentive and disincentives for coal development; these policies are often less foreseeable than the above-listed factors. Nevertheless, reasonable estimations of baseline future conditions can be forecast based on existing mine operations, expected changes in power plant operations, and coal mines actively under planning.

The BLM provided mining companies an opportunity to submit current mine-specific data to be considered for the RFD scenario. Two companies submitted data, including confidential and proprietary information. The BLM compared the data with publicly available information from the US Energy Information Administration (EIA), the Mine Safety and Health Administration (MSHA), the Montana Department of Environmental Quality (MT DEQ), and other public sources. The BLM deemed the proprietary figures were comparable with publicly available data. Therefore, the BLM has used publicly available data or aggregated internal and proprietary data to protect all companies' confidential data. The RFD scenario does not account for scenarios based on uncertain or speculative assumptions.

Table B-1 provides the summary of the RFD scenarios by alternative. The RFD scenarios are primarily driven by the multiple-use climate change criterion for air resources; this is because it is the most restrictive screening criterion that reduces lands available in each alternative. The results of applying the multiple-use climate change criterion for air resources are further described in **Sections B.1** through **B.3**, below.

Table B-1
Summary of RFD Scenario by Alternative

Alternative	Total Federal and Nonfederal Production 2022-2038 (million tons)	Total Federal Production from Existing and Pending Leases/ Applications 2022-2038 (million tons)	Total Federal Production for Mine Life (million tons)	Pending[1] Federal Lease Applications (acres/million tons)		Life of Mine Extension by Adding Pending Federal Leases (years)[2]		Potential Future Subsequent Federal Leases (acres/million tons)		Life of Mine Extension by Adding Subsequent Lease Decisions (years)[2]	
				Spring Creek Mine	Rosebud Mine	Spring Creek Mine	Rosebud Mine	Spring Creek Mine	Rosebud Mine	Spring Creek Mine	Rosebud Mine
A and B	**274.97**	**165.18**	335.18	1,410/167.9	0/0	26 (2036–2061)	0 (2060)	1,300/170	0/0	27 (2062–2088)	0 (2060)
C	**274.97**	**165.18**	165.18	810/95	0/0	15 (2036–2050)	0 (2060)	0/0	0/0	0 (2050)	0 (2060)
D	**248.40**	**140.61**	140.61	0/0	0/0	0 (2035)	0 (2060)	0/0	0/0	0 (2035)	0 (2060)

[1] Rosebud Mine does not have any pending applications, and existing reserves would provide mining through 2060. See the assumptions in the respective RFD scenario below. Spring Creek Mine has two pending federal lease applications, and the mine forecasts a need for future subsequent leasing of approximately 1,300 acres/170 million tons.
[2] Estimated life of mine is based on the BLM projected production rate for each mine.

B.1 UNCONSTRAINED COAL REASONABLY FORESEEABLE DEVELOPMENT SCENARIO

B.1.1 Introduction

The unconstrained RFD scenario, or baseline RFD, provides information about the level of coal mining and associated disturbance necessary to analyze temporal and spatial effects that could result from possible leasing and/or production of coal in the planning area during the life of a plan without land use management constraints on future actions (that is, resource conflicts and mitigation requirements). An RFD is not a decision; it was developed for analysis purposes for this planning effort.

Under Alternatives A and B, the unconstrained RFD is not restricted due to the projected amount of federal coal acres/tons being made available in and around the existing mines and existing authorized federal and nonfederal leases at each mine. Therefore, the unconstrained RFD would be carried out in both Alternatives A and B, as projected in **Section B.1.3**. See the alternative's maps in **Chapter 2**.

B.1.2 Existing Coal Mining Activity

Current Conditions and Recent Changes in Coal Mining Activity

The MCFO has authorized federal leases for Savage Mine (Richland County), Rosebud Mine (Rosebud County), Spring Creek Mine (Big Horn County), and Decker Mine (Big Horn County) totaling approximately 34,542 acres (BLM 2022). **Table B-2** discusses the acres of federal and nonfederal surface involved in the permits at each mine. Mine-specific conversion factors are included to approximate the tonnage of coal available per acre when data are not otherwise available.

Table B-2
Federal and Nonfederal Coal Acres within MT DEQ Permits by Mine

Mine	Permitted Federal Acres	Permitted Nonfederal Acres	Tons per Acre Conversion
Savage	292	875	34,848
East Decker	3,575	786	139,392
West Decker	6,677	680	139,392
Spring Creek	7,859	1,324	139,392
Rosebud	15,994	24,092	38,333
Total for MCFO	**34,397**	**27,757**	

Data Sourced from MT DEQ permits; the conversion factor is calculated by the coal seam thickness and density.

Table B-3 provides a summary of total tons leased (as described in the original lease estimates), tons mined out, and tons remaining to be mined for the planning area. This table provides an overview of the leased federal reserves remaining to be mined at each mine; remaining tonnages at Savage, East Decker, and West Decker will not be produced, as described later in this section.

Decker Mine

The Decker Mine, comprised of East Decker and West Decker permit areas, owned by Lighthouse Resources, filed for bankruptcy on December 3, 2020. Decker requested to relinquish and reclaim the East Decker permit as part of the bankruptcy plans. On April 28, 2021, MT DEQ approved a permanent cessation on the East Decker permit. West Decker has remained in temporary cessation and is awaiting reclamation. Decker Mine ceased mining operations in January 2021 and shipping of stockpiled coal was completed within the first quarter of that year. Currently, Decker Mine has completed bankruptcy proceedings and has transitioned into the reclamation phase for both permit areas.

Table B-3
Summary of Tons by Mine at the End of Fiscal Year 2021

Mine	Total Tons Leased	Tons Mined Out	Tons Remaining
Savage	26,166,900	18,720,477	7,446,423
East Decker	274,357,500	149,903,464	124,454,036
West Decker	329,347,453	301,535,492	27,811,961
Rosebud	405,760,000	349,620,139	56,139,861
Spring Creek	367,106,000	237,161,325	129,944,675
Total for MCFO	1,441,105,447	1,095,308,491	345,796,956

Source: ONRR 2022a

Even though mining has ceased, and reclamation efforts are underway, formal closure of the mine permits and federal leases has not occurred to date. The Decker Mine has not produced coal in over a year, it is not in compliance with the BLM lease terms, and it is now subject to cancellation of all its federal leases; in accordance with 43 Code of Federal Regulations 3452, the BLM is pursuing to cancel all federal Decker Mine leases. Therefore, the BLM considers any projections in future development at the Decker Mine speculative and uncertain. While mining and production was forecast for the Decker Mine in the 2019 Final SEIS, it is not considered in this RFD.

Savage Mine

The Savage Mine in Richland County served the Lewis and Clark Station and the Sidney Sugars Processing Plant. The Lewis and Clark Station was closed in March 2021. The Sugar Plant remains burning approximately 50,000–70,000 tons of coal supplied annually from the Savage Mine. However, this plant is planning to convert to natural gas in the near future. The Savage Mine ceased mining on its only federal lease in September 2017, and it is now in reclamation status. All current production comes from nonfederal leases and only occurs for a few weeks a year. Savage Mine plans to close and complete reclamation when the Sidney Sugars Plant no longer requires coal as a fuel source. Savage Mine has no plans to pursue any future mining of federal coal. Therefore, future production from Savage Mine is not considered in this RFD.

Domestic License

MCFO has one domestic coal license for an individual to mine coal for personal heating needs. This domestic license can produce up to 20 tons annually. The license is currently for an 80-acre tract in Fallon County, Montana, with disturbance less than 2 acres at a time. The BLM anticipates the license to be renewed every 2 years during the term of the planning period. The quantity produced is a negligible fraction of the production at the other mines (less than a day's production of either operating mine); therefore, it is not included in the RFD scenario.

Rosebud Mine

The Rosebud Mine was owned and operated by Western Energy Company, a subsidiary of Westmoreland Coal, until the company filed bankruptcy in late 2018. The Rosebud Mine was sold to Westmoreland Rosebud Mining LLC as part of the bankruptcy resolution in March 2019. The leases were transferred to Westmoreland Rosebud Mining, but a pending lease modification application was not pursued by the new owners. There are no current pending applications to lease federal coal at the Rosebud Mine.

The Rosebud Mine consists of five MT DEQ permit areas (A, B, C, D, and F). The Rosebud Mine is a checkerboard of mixed mineral ownership containing very little federal surface. The future mining in Area B will contain no federal surface or minerals. Area F contains approximately 48.6 percent federal minerals and no federal surface (MT DEQ 2022).

Most of the MT DEQ permits are mined out. By 2025, Area A, Area C, and Area D will be mined out. Area B will also be mined out, except for the new amendment area AM5. Area F and Area B AM5 would comprise the production throughout the planning period. Area F is currently permitted to mine until 2039; Area B is permitted to mine until 2040.

Approximately 40 percent (15,994 acres) of all the Rosebud Mine MT DEQ mine permits consist of leased federal coal. Only 0.08 percent (33 acres) of the mine permits contain BLM surface estate.

For the MT DEQ, Area B permit is currently under litigation; this includes AM4 and AM5. However, the mine is authorized to operate during litigation. AM4 has federal coal, but AM5 does not contain federal coal.

The OSMRE federal mine plan for Area F is under litigation. Area F is 48 percent federal minerals. As directed by the court order, OSMRE is required to complete supplemental analysis under the National Environmental Policy Act (NEPA) by April 30, 2024. The current record of decision would be vacated by the court on April 30, 2024. If the new EIS is not prepared by then, the federal mine plan decision would no longer be valid, and mining would stop, pending resolution of the litigation.

If access to the Area B amendment or Area F is denied, Rosebud Mine could shut down within the planning period or could need new leases and permits to continue operating to meet contracts. However, it is uncertain at this time if any of these litigations would stop the mining short of its permitted life of the mine.

The Rosebud Mine provides coal to the Colstrip Power Plant, Colstrip Energy Limited Partnership (CELP) Power Plant, and domestic users in the local area. The Colstrip Power Plant had four operating units prior to 2020. In 2020, Units 1 and 2 were permanently shut down. Units 3 and 4 continued operating to produce up to 1480 megawatts of energy annually. The life of the Colstrip Power Plant is uncertain due to ongoing litigation and bankruptcy of Talen Energy, a co-owner of the Colstrip Power Plant. Current operating plans keep both units operating until 2042.

Production at the Rosebud Mine is directly tied to the consumption of coal to make electricity at these two units. Prolonged or unplanned maintenance of the units could result in a decrease in mine production. However, this type of production decrease is unpredictable and was not considered in the RFD scenario. The CELP Power Plant and the direct sales to domestic users have not changed in recent years and are both forecast to remain at current levels.

The Rosebud Mine decreased production by approximately 2 million tons when Units 1 and 2 shut down in 2020. There are only 2 years of production data for supplying only Units 3 and 4 in 2021 and 2022. These years were also simultaneous with the effects of the COVID-19 pandemic. However, the Rosebud Mine indicated that 2021 was approximate to what a standard year was anticipated to be with only Units 3 and 4 operating, and the quarterly reports for 2022 thus far are a reasonable match to the quarterly reports of 2021 (MSHA 2022). **Table B-4** shows the 2-year Rosebud Mine reported production only for those shipments to the Colstrip Power Plant. The tonnages shipped to the CELP Power Plant and sold directly at the mine are not included.

Table B-4
Recent Coal Production at the Rosebud Mine

Year	Total Production (Tons)
2020	5,315,470
2021	6,498,182

Source: EIA 2022b

Approximately 200,000–250,000 tons of coal will be transported by semitruck annually to the nearby CELP Power Plant, and approximately 200,000 tons will be sold to local residents for home heating needs.

The BLM has determined an aggregate annual production value for the Rosebud Mine based on publicly reported production for the Colstrip Power Plant, along with internal and company data for the other shipments. The BLM anticipates an average of 7.05 million tons a year to be used in the annual RFD calculations.

As stated above, the future of the Colstrip Power Plant is unknown. As a mine-to-mouth operation, that uncertainty produces an uncertain future for the Rosebud Mine. Pending the litigations previously described above, the mine has enough reserves on existing leases (federal and nonfederal) and approved mine plans to continue operation during the planning period. A decision to close the Colstrip Power Plant early could be issued by the courts or the operators of the Colstrip Power Plant as that litigation proceeds. This could lead the Rosebud Mine to close early.

Spring Creek Mine

In 2020, Cloud Peak Energy filed bankruptcy. During bankruptcy, the Spring Creek Mine was bought by the Navajo Transitional Energy Company LLC (NTEC). NTEC has assumed the existing federal, private, and State leases for the Spring Creek Mine. NTEC has also resubmitted the federal coal lease applications for a lease modification to MTM 110693, containing 150 acres and 6.9 million tons of minable coal, and a lease by application (LBA) (MTM 10548501) for 1,262 acres containing approximately 161 million tons of recoverable coal. NTEC also purchased the Youngs Creek Mine and is pursuing the development of a haul road to connect the mine to the Spring Creek Mine coal processing and loadout facilities, which would allow operation as one mining complex.

The Youngs Creek Mine (south of the Spring Creek Mine in Wyoming) is projected to produce 2–5 million tons a year. This could augment production at the Spring Creek Mine. The Youngs Creek Mine is 100 percent nonfederal coal estate. However, due to ongoing litigation and uncertainty on when mining would occur, this projected contribution is not included in the RFD for the Spring Creek Mine. Similarly, production from the proposed Big Metal Mine (west of the Spring Creek Mine on the Crow Indian Reservation) is not being pursued by NTEC; therefore, it is also not included in this RFD.

The OSMRE federal mine plan for Spring Creek is currently under litigation. The court has required OSMRE to complete a supplemental analysis under NEPA with a deadline of April 1, 2023. The current decision record would be vacated by the court on April 1, 2023. Therefore, the federal mine plan decision would no longer be valid unless the ongoing NEPA analysis has been completed and supports the previous decision. If the federal mine plan is invalid without a current NEPA decision, then mining would stop, pending resolution of the litigation or further decision by the court.

The Spring Creek Mine consists of one MT DEQ permit with approximately 4,270 acres of existing federal coal leases (BLM 2022). At this time, approximately 85 percent (7,859 acres) of the Spring Creek MT DEQ mine permit is federal coal estate (including unleased federal coal). The publicly available Spring Creek Mine permit documents do not contain a summary of permitted and disturbed acres by ownership (MT DEQ 2022). However, the 2020 TR1 Revision to the Spring Creek Permit documents the disturbance and total permit acres in the Final EIS (Table S-1.1-1; MT DEQ 2020).

The Spring Creek Mine is currently mining its only private coal lease and anticipates completion within a few years. Upon completing mining of the private lease, the Spring Creek Mine's production would be approximately 80–90 percent federal, with the remainder on State lands. New federal coal leases (pending and forecast) are needed to expand the Spring Creek Mine and to continue operations to meet demand throughout and beyond the planning period. There are limited options for the mine to expand without additional federal leases.

Currently, outside the northwest corner of the federal mine plan boundary, there are approximately 760 acres of unleased nonfederal coal where the mine could expand. However, this nonfederal expansion could contain high overburden ratios, which could render the expansion uneconomic. The mineral estate beyond the Spring Creek Mine federal mine plan boundary, except for the 760 acres previously noted, consists of unleased federal coal. Due to the amount of federal coal in the area, the BLM anticipates that any additional future coal needs would likely be derived from unleased federal coal resources.

The Spring Creek Mine's production has varied over the years with a range wider than 8 million tons. On average over the last 10 years, the Spring Creek Mine has produced approximately 14,047,167 million tons a year (**Table B-5**).

Table B-5
Spring Creek Annual Production for the Last 10 Years: 2012–2021

Year	Total Production (Tons)
2021	13,095,744
2020	9,513,255
2019	11,928,834
2018	13,768,055
2017	12,725,656
2016	10,245,081
2015	16,987,420
2014	17,338,424
2013	17,669,717
2012	17,199,485
10-year Average:	14,047,167

Source: MSHA 2022

The Spring Creek Mine would continue to produce approximately 14 million tons of coal annually and serve domestic and international markets. The Spring Creek Mine's current MT DEQ mine permit allows mining through 2030. However, end-of-mine dates for mine permits are typically calculated using a higher production rate; for the Spring Creek Mine, the permit shows a rate of 18 million tons per year. Since 2011, MSHA production records for Spring Creek Mine show a range of annual production between 9.5 million tons to 17.7 million tons. Because of the historical trend of production less than 18 million tons per year, the life of the mine could be extended, assuming the MT DEQ approves future permit modifications to extend the end-of-mine date. Considering the available reserves and anticipated production rates, the BLM reserves would be exhausted by 2035.

The Spring Creek Mine serves domestic and international markets. Approximately 10 percent of production is transported by rail to industrial markets. Approximately 30 to 40 percent of its annual production is transported by rail to a port in Vancouver, British Columbia, and shipped to Asian markets. A minimal amount of coal is trucked to the adjacent Wolf Mountain Coal processing plant, which sells to local residents and businesses for heating needs. The Spring Creek Mine ships approximately 50 percent of its coal by rail to several domestic power plants and across the country, including but not limited to, the Coronado Generating Station (Arizona; fully retired by 2032), Clay Boswell Plant (Minnesota; planned retirement of one unit in 2030 and the second unit by 2035), Hoot Lake Power Plant (Minnesota; retired in 2021), DTE Energy Belle River Plant (Michigan; retiring or converting to an alternate fuel source by 2028), Karn Coal Plant (Michigan; retiring 2023), and Transalta Centralia Generating Station (Washington; retiring by 2025) (EIA 2022b).

Information for retirements was found in each plant's retirement plans and other publicly available documents. All of the Spring Creek Mine's current domestic energy consumers are anticipated to close or convert to another fuel source by 2035. The BLM's projection of production shows a decrease as each of the power plants close. There would continue to be an industrial and international market for coal during the planning time frame.

B.1.3 Forecast of Existing Mining Activities

Market Trends in Coal Production

Total coal production for Montana in 2020 was 26,421,553 tons (EIA 2022b). The Spring Creek and Rosebud Mines have consistently made up over 50 percent of Montana's production. In **Table B-6**, 2021 is used as a model year because 2021 is when the Colstrip Power Plant only operated Units 3 and 4; the Decker Mine did not operate, except for the first quarter; and 2021 is the best data available after the onset of the COVID-19 pandemic. Without Decker Mine's contributing production, the Spring Creek and Rosebud Mines make up a large portion of Montana's coal production.

Table B-6
Montana Production as Compared with Mine-Specific Production in 2021

	Tons	Percentage of Montana Production
Rosebud Mine	6,498,182	23
Spring Creek Mine	13,095,744	46
Montana Total Production	28,579,592	—

Source: EIA 2022b

The national coal market is in a decline; the BLM anticipates this trend to maintain throughout the planning period. The EIA forecasts that total US production will drop from over 610 million tons in 2022 to 450 million tons in 2040 (EIA 2022a). Production in the western region (which includes the MCFO) produced 335 million tons in 2022 and is anticipated to decline to 224 million tons in 2040. The decline is associated with the retirement of coal-fired power stations or the conversion from coal to natural gas energy production across the country. According to the EIA (2022a), almost 100 gigawatts of generation capacity of coal would be replaced by renewable energy and oil and gas in response to both regulatory measures and market factors. In particular, low natural gas prices in the early years of the RFD's time frame could contribute to the retirement of coal-fired plants. All five of Spring Creek Mine's 2021 energy customers have published plans to close or convert by 2035.

Global coal markets are expected to remain steady or possibly see a slight increase throughout the planning period (EIA 2022c). The demand for coal in Europe is declining, but the demand in Asia is increasing. While Asians counties are increasing their production of coal to meet their needs, there would still be a steady need for imports. Other countries more proximal to Asia (such as Australia and Indonesia) or with better coal quality could be better suited to meet the Asian coal needs, compared with the United States. Currently, the United States contributes approximately 4.9 percent to the global coal trade (IEA 2021).

Trends between 1990 and 2020 have shown a steady decrease in US coal exports (IEA 2021). The US' coal quality, regulations, and transportation challenges may play a critical factor in the US' ability to become a larger player in the global trade of coal. These challenges are not anticipated to be abated during the planning period. Given the global decline in US exports, other factors that could make exporting more difficult, and no definitive factors that would quantify a further decrease in US coal exports, this RFD scenario considers a steady state in exports during the planning period.

Forecast Coal Production

Spring Creek Mine

The BLM projects an annual production of 14 million tons per year for the Spring Creek Mine during the planning period. Throughout the planning period, there is an anticipated decrease in annual production due to the closure or conversion of coal-fired power plants; however, industrial uses and exports are assumed to remain steady at approximately 6.5 million tons per year. **Table B-7** shows total, federal, and nonfederal production by year.

NTEC's (Spring Creek Mine) pending applications for a lease modification to MTM 110693 (containing 150 acres and 6.9 million tons of minable coal) and an LBA (MTM 10548501) for 1,262 acres containing approximately 161 million tons of recoverable coal would be available.

In addition to the pending federal lease applications, the Spring Creek Mine foresees the need to lease a subsequent 170 million tons of federal coal in the planning period. The exact locations of the tracts are unknown; however, the BLM assumes the lease size would be similar to the mine's pending LBA and, therefore, projects 1,300 acres for the 170 million tons. Historically, the review and authorization process for federal coal leasing, federal mine plan approval, and MT DEQ mine permit approval has taken on average 10 years. Therefore, coal mines have to plan ahead before there is an actual need for coal resources. The BLM projects these potential subsequent future federal leases may be authorized during the life of the plan, but no actual mining is anticipated during the life of the plan. These federal leases would be needed to keep operations going after the planning period; they will be needed during the planning period to procure permits in time for their future needs. However, the BLM production forecast does not include expansion of nonfederal coal leasing and development.

The Spring Creek Mine would have limited options to expand without additional federal leases. There are no pending applications or other mine data that consider expanding mining within the existing permits. Therefore, there are no estimates of tonnage that could expand the life of the mine past the current permitted reserves. However, the mine plan for the pending LBA assumes more of the adjacent State lease would be mined for the continuity of the mining operations. Therefore, the forecast production assumes a contribution of nonfederal coal from continuity of the existing State leases.

Most of the federal coal produced in the planning area is burned for energy needs. However, the Spring Creek Mine sends up to 10 percent of its production to industrial users, and up to 40 percent of its production is exported. These markets are assumed to remain constant throughout the planning period. Therefore, it can be assumed that approximately 1.3 million tons of annual production are used for industrial uses and up to 5.2 million tons of annual production are exported. Because Spring Creek Mine mineral ownership is about 85 percent federal mineral (MT DEQ permit), it is assumed that about 85 percent or more of these annual shipments would be comprised of federal minerals. As the Spring Creek Mine completes mining on its private and State leases, more of the annual production will be from federal minerals.

Rosebud Mine

At the BLM's forecast production rate, Rosebud Mine's existing permits for Area F and Area B would take the mine to 2060. No new federal leases are needed until then.

Forecast Assumptions

Based on the information provided above, the unconstrained RFD coal forecast is based on the following BLM assumptions:

1. Development of a new coal mine would not occur in the decision area during the planning period.
2. Rosebud Mine and Spring Creek Mine would account for all future production of federal coal resources in the planning area.
3. Rosebud Mine and Spring Creek Mine would continue to use existing coal mining production facilities and technologies.
4. Rosebud Mine and Spring Creek Mine would obtain necessary State and federal mine permits and resolve litigation of current permits to continue mining without any disruption in operations.
5. Coal production at Rosebud Mine would remain constant, and coal production at the Spring Creek Mine would decrease.
6. Rosebud Mine would continue to supply the Colstrip Power Plant and the CELP Power Plant.
7. Spring Creek Mine would continue to supply domestic and industrial customers, as well as exports to Asian markets through ports in British Columbia. Any reduction in domestic contracts due to coal-fired power plant closures or conversions would not be made up with new domestic, industrial, or export contracts.
8. The two pending federal coal leasing actions (MTM 110693 lease modification containing 150 acres and 6.9 million tons of minable coal and the MTM 10548501 lease application for 1,262 acres

containing approximately 161 million tons of recoverable coal) at the Spring Creek Mine would be authorized and developed.

9. For the Spring Creek Mine, the potential subsequent future federal leasing of approximately 1,300 acres containing approximately 170 million tons would be authorized for leasing and would be developed beyond the planning period.
10. Production at each mine is forecast to remain constant at the 2038 production rate until the life of mine is reached as a result of a constant customer base as described previously in the market trends and forecast for each mine.

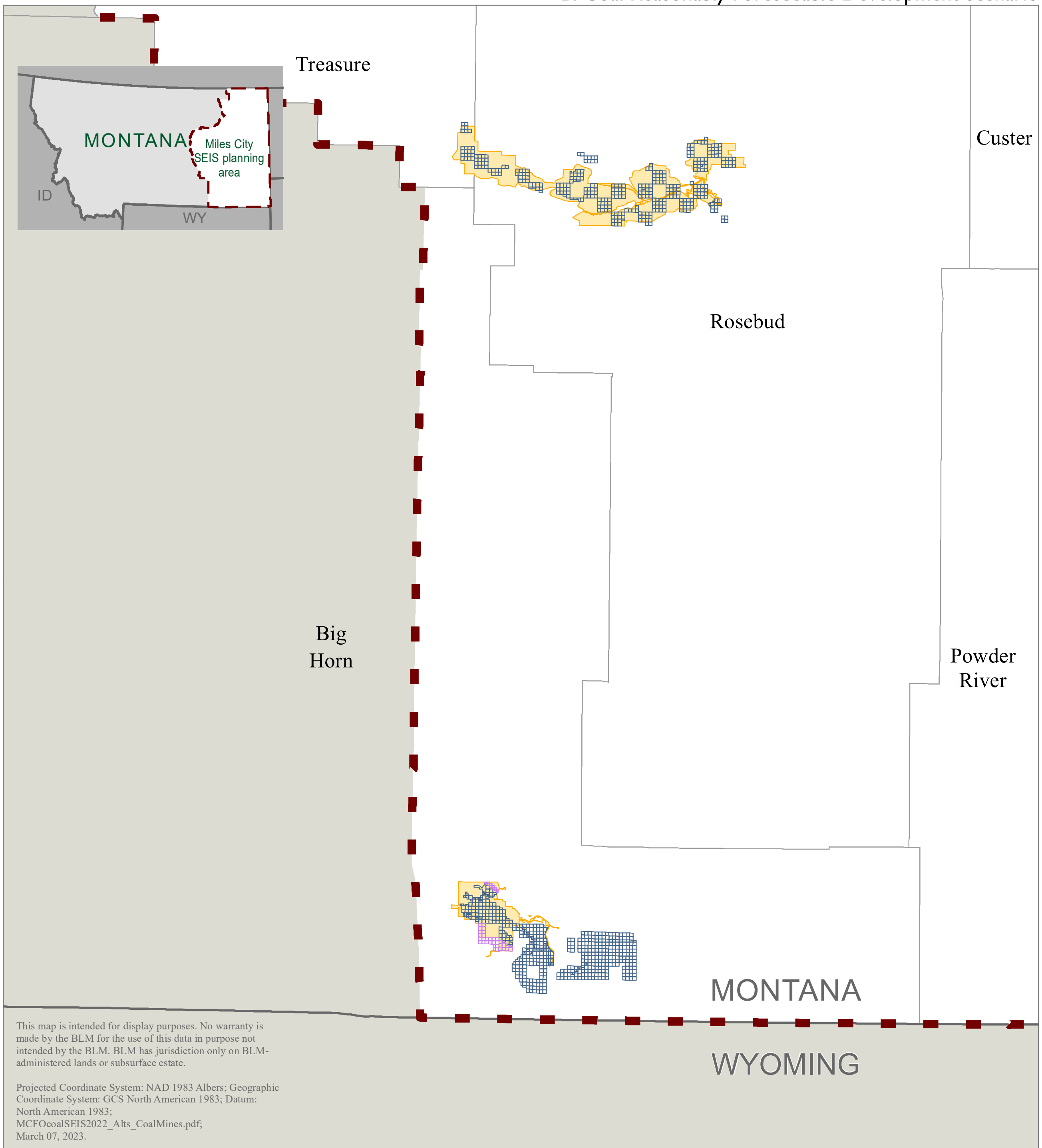
Considering the annual production of the Rosebud and Spring Creek Mines, relative portion of federal and nonfederal leases in the mine plan, and these assumptions, the unconstrained coal RFD forecast for 2022–2038 is shown in **Table B-7**.

Table B-7
Unconstrained Coal RFD Production Forecast: Rosebud and Spring Creek Mines

Year	Total Production (tons)	Federal Production (tons)	Nonfederal Production (tons)
2022	20,847,961	11,046,605	9,801,356
2023	20,789,282	10,517,605	10,271,677
2024	20,789,282	10,929,783	9,859,498
2025	18,722,745	10,781,739	7,941,006
2026	18,722,745	10,665,012	8,057,733
2027	18,722,745	12,299,196	6,423,549
2028	14,996,522	9,318,217	5,678,304
2029	14,996,522	9,318,217	5,678,304
2030	14,607,411	9,006,929	5,600,482
2031	14,607,411	9,006,929	5,600,482
2032	14,131,674	8,626,340	5,505,335
2033	14,131,674	8,626,340	5,505,335
2034	14,131,674	8,626,340	5,505,335
2035	14,131,674	8,980,423	5,151,251
2036	13,548,009	8,971,658	4,576,351
2037	13,548,009	9,231,578	4,316,430
2038	13,548,009	9,231,578	4,316,430

Data compiled by the BLM.

The existing federal and nonfederal permits and leases are anticipated to take Spring Creek Mine until 2035. The pending federal lease applications at the BLM's forecast production would extend the mine's life for another 26 years (2036–2061). Annual production is forecast to remain constant after 2038. Therefore, the potential subsequent future leasing of 170 million tons of federal coal could add an additional 27 years to the life of the mine at the BLM forecast production rate of approximately 6.5 million tons per year. **Figure B-1** shows the existing leases and pending lease applications for Spring Creek and Rosebud Mines.



UNITED STATES DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT
MILES CITY FIELD OFFICE

Figure B-1
Existing Leases and Pending Lease Applications (Spring Creek and Rosebud Mines)

Existing lease
Pending lease application
Federal mine plan boundary
Miles City Field Office

1 inch = 11.2 miles

0 5 10 Miles

B.2 CONSTRAINED COAL REASONABLY FORESEEABLE DEVELOPMENT SCENARIO

Under Alternative C, the amount of land available for further consideration for coal leasing was reduced, thereby restricting the unconstrained RFD described above. Under Alternative C, leasing would be limited to the pending applications within the federal mine plan boundary. All lands outside of the federal mine plan boundary, as well as unleased federal coal within the federal mine plan boundary but outside of pending federal lease application areas would be eliminated from further consideration for leasing. See the alternative's maps in **Chapter 2**. This constrained RFD is the result of the BLM's consideration of the changes to factors considered in the unconstrained RFD. The *Market Trends in Coal Production* and the *Forecast Coal Production* sections of the unconstrained RFD scenario (**Section B.1.3**). Only the *Forecast Assumptions* would change for the constrained RFD.

B.2.1 Forecast Coal Production

The unconstrained RFD scenario assumptions 1 to 7, listed in **Section B.1.3** (*Forecast Assumptions)*, are still valid and apply to this RFD scenario, as described above. However, assumptions 8 and 9 change under Alternative C due to federal coal lands being eliminated from further consideration for coal leasing.

Assumption number 8 regarding the two Spring Creek Mine pending federal coal leasing actions (MTM 110693 lease modification containing 150 acres and 6.9 million tons of minable coal and MTM 10548501 lease application for 1,262 acres containing approximately 161 million tons of recoverable coal) was modified to consider lands eliminated under Alternative C because the pending federal lease areas extend beyond the federal mine plan boundary. The pending LBA (MTM 10548501) would be reduced to 662 acres (357 acres of BLM surface) and 87.85 million tons of federal coal. The pending federal lease modification application (MTM 110693) would be reduced by 10 acres; this would not modify the volume of minable coal (6.9 million tons). The new assumption 8 for the constrained RFD would be:

8. Only the portion of the two pending federal coal leasing actions within the federal mine plan boundary at the Spring Creek Mine would be authorized. The MTM 110693 lease modification would be reduced to 140 acres containing approximately 6.9 million tons of minable coal; MTM 10548501 would be reduced to approximately 662 acres and 87.85 million tons of recoverable coal. It is assumed the portions of the federal lease applications within the federal mine plan boundary would still be developed as currently submitted in the applications.

Assumption number 9, regarding Spring Creek Mine's projection of approximately 1,300 acres containing approximately 170 million tons proposed for future leasing beyond the planning period was modified to consider lands eliminated under Alternative C. Spring Creek Mine still has a need to obtain the approximately 73.15 million tons severed under Alternative C from the pending application and the additional subsequent 170 million tons for future federal production. However, the BLM does not have the necessary information to determine unleased nonfederal coal resources available near the mine. The new assumption 9 for the constrained RFD would be:

9. No acres outside of assumption 8 would be made available. There would be no federal coal acres available for the 73.15 million tons removed from the pending applications or the 170 million tons anticipated for future production. These federal tonnages would not be available for future production.

Under Alternative C, the Spring Creek Mine would have limited options to expand without additional federal leases. There are no pending applications or other mine data that consider expanding mining within the existing MT DEQ permit. Therefore, there are no estimates of tonnage that could expand the life of the mine past the current permitted reserves. However, the mine plan for the LBA assumes more of the adjacent existing State lease would be mined for the continuity of mining operations. Therefore, the forecast production assumes a contribution of nonfederal coal for continuity of the existing State lease adjacent to the pending applications.

The constrained pending LBA provides enough reserves to meet production throughout the planning period. Therefore, after considering the annual production of each mine, the relative portion of federal and nonfederal leases in the mine plan, and these nine assumptions, the constrained RFD scenario for Alternative C is the same as the forecast production in **Table B-7** for the unconstrained RFD scenario.

The existing federal and nonfederal permits and leases are anticipated to take Spring Creek Mine until 2035. Under Alternative C, the LBA (MTM 10548501) would be reduced to 662 acres (357 acres of BLM surface) and 87.85 million tons of federal coal. With the BLM forecast production, the LBA under Alternative C would extend the mine life for another 15 years (to 2050). Annual production is forecast to remain constant after 2038. Unless other private or state coal is available, the mine would close in 2050.

Under Alternative C, the Rosebud Mine's existing permits for Area F and Area B would take the mine to 2060 at the BLM forecast production rate. No new federal leases would be needed until then.

Production at each mine is forecast to remain constant at the 2038 production rate until the life of mine is reached as a result of a constant customer base as described previously in the market trends and forecast for each mine.

B.3 Reasonably Foreseeable Development Scenario with No New Leasing

The no-leasing RFD described in this section is needed for Alternative D; this is because Alternative D reduces the lands available to meet some assumptions in the unconstrained RFD. See the alternative's map in **Chapter 2**. This RFD scenario looks at the impacts on production of no new federal leasing. Valid existing leases would continue under the approved permits.

The *Market Trends in Coal Production* and the *Forecast Coal Production* sections of the unconstrained RFD scenario (**Section B.1.3**) would remain true and accurate in this RFD scenario. Only the *Forecast Assumptions* would change for the no-leasing RFD scenario.

B.3.1 Forecast Coal Production

The unconstrained RFD scenario assumptions 1 to 7, listed in **Section B.1.3** (*Forecast Assumptions)*, are still valid and would apply to this RFD scenario, as described above. However, assumptions 8 and 9 would change under Alternative D due to federal coal lands being eliminated from further consideration for coal leasing.

Assumption number 8 regarding the two Spring Creek Mine pending federal coal leasing actions (MTM 110693 lease modification containing 150 acres and 6.9 million tons of minable coal and MTM 10548501 lease application for 1,262 acres containing approximately 161 million tons of recoverable coal) was modified to consider lands eliminated under Alternative D. The pending LBA (MTM 10548501) would not be available for leasing under Alternative D; therefore, it would not be leased (that is, the federal lease application would be denied). Without the pending federal lease applications or any new federal leases, the BLM anticipates Spring Creek Mine would mine out its existing federal and nonfederal leases in the mine plan and subsequently close the mine. Given the existing reserves and the forecast production rates, mining would end in approximately 2035. Assumption 8 reads as follows:

8. There would be no further federal leasing. The pending applications would not be approved.

Assumption number 9 (regarding Spring Creek Mine's projection of potential future subsequent leasing of approximately 1,300 acres containing approximately 170 million tons of federal coal for future leasing during the planning period) was modified to consider lands eliminated under Alternative D. Spring Creek Mine would still have a demand for additional coal, but there would be no federal coal available to lease.

9. Potential future subsequent leasing of approximately 1,300 acres containing approximately 170 million tons of federal coal would not be available for leasing beyond the planning period. Therefore, BLM's analyses would assume the mine would close in 2035 under this Alternative.

Under Alternative D, Spring Creek Mine would have limited options to expand without additional federal leases. There are no pending applications or other mine data that consider expanding mining within the existing permits. Therefore, there are no estimates of tonnage that could expand the life of the mine past the current permitted reserves. As a result, this RFD scenario cuts off at 2035 because that is when the mine is assumed to close under this alternative. Under Alternative D, the expansion of mining onto leased and unleased nonfederal coal or currently leased federal coal would not be restricted; however, the BLM does not have any indication this would occur to include a forecast beyond 2035. Therefore, the BLM's analyses would assume the mine would close in 2035 under this alternative.

Considering the annual production of each mine, the relative portion of federal and nonfederal leases in the mine plan, and these nine assumptions, the no-leasing RFD scenario from 2022 to 2038 is shown in **Table B-8**.

Table B-8
Forecast Coal Production: Rosebud and Spring Creek Mines

Year	Total Production (tons)	Federal Production (tons)	Nonfederal Production (tons)
2022	20,847,961	11,046,605	9,801,356
2023	20,789,282	10,517,605	10,271,677
2024	20,789,282	10,929,783	9,859,498
2025	18,722,745	10,781,739	7,941,006
2026	18,722,745	10,665,012	8,057,733
2027	18,722,745	12,299,196	6,423,549
2028	14,996,522	9,318,217	5,678,304
2029	14,996,522	9,318,217	5,678,304
2030	14,607,411	9,006,929	5,600,482
2031	14,607,411	9,006,929	5,600,482
2032	14,131,674	8,626,340	5,505,335
2033	14,131,674	8,626,340	5,505,335
2034	14,131,674	8,626,340	5,505,335
2035	14,131,674	8,980,423	5,151,251

Year	Total Production (tons)	Federal Production (tons)	Nonfederal Production (tons)
2036	7,050,000	2,961,000	4,089,000
2037	7,050,000	2,961,000	4,089,000
2038	7,050,000	2,961,000	4,089,000

Data compiled by the BLM.

With no new federal leasing decisions to be made, the BLM would not contribute to further mine expansion. The BLM would project closure of the Spring Creek Mine when the existing permitted reserves are mined through in 2035.

Under Alternative D, the Rosebud Mine's existing permits for Area F and Area B would take the mine to 2060 at the BLM forecast production rate. No new federal leases would be needed for the short term or long term.

B.4 References

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Appendix C
Air Resources Technical Support Document

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Air Resources Technical Support Document

BLM Miles City Field Office Draft Supplemental Environmental Impact Statement and Potential Resource Management Plan Amendment

Air Resources Technical Support Document

BLM Miles City Office Draft Supplemental Environmental Impact Statement and Potential Resource Management Plan Amendment

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1.0 INTRODUCTION

The United States Department of Interior, Bureau of Land Management (BLM) Miles City Field Office (MCFO) prepared a Supplemental Environmental Impact Statement (SEIS) and potential Resource Management Plan Amendment (RMPA) for the 2015 Resource Management Plan (RMP)/Final Environmental Impact Statement (EIS), as amended, under the National Environmental Policy Act (NEPA).

The 2015 Record of Decision (ROD)/Approved RMP was challenged by the Western Organization of Resource Councils (WORC) in the US District Court of Montana in March 2016, and the court found that BLM violated NEPA and required the BLM to complete a new coal screening and remedial NEPA analysis. The RMPA/Supplemental EIS (2019 SEIS) was completed in 2019. On August 27, 2022, WORC challenged the 2019 SEIS in Western Organization of Resource Councils, et al. v. Bureau of Land Management, Civil Action No. CV-00076-GF-BMM. The District Court for the District of Montana found that BLM violated NEPA and ordered the BLM to complete a new coal screening and remedial NEPA analysis that considers no-leasing and limited coal leasing alternatives and disclosed the public health impacts (both climate and non-climate) of burning fossil fuels (coal, oil, and gas) from the planning area. This SEIS/RMPA is in response to that order.

This report provides technical support documentation for the Air Resources portion of the SEIS, including greenhouse gases (GHG) and climate change and the public health effects of downstream combustion. Section 2.0 describes the methodologies used to develop the emissions inventories for criteria and hazardous air pollutants and GHGs. Sections 3.0 and 4.0 provide supporting information for the Affected Environment and Environmental Consequences sections of the SEIS, respectively.

2.0 EMISSION INVENTORY METHODOLOGY

2.1 Coal Mining

There are two mines in the MCFO planning area that are actively mining federal coal — the Rosebud Mine and Spring Creek Coal Company Mine. MCFO has developed coal reasonably foreseeable development (RFD) scenarios (Appendix B of the SEIS, *Coal Reasonably Foreseeable Development Scenarios*) that describe anticipated coal resource development in the planning area from these mines under four alternatives. For each alternative, the coal RFD scenarios provide forecasts of annual federal coal production separately for existing federal leases, pending federal leases, and potential future subsequent federal leases as well as annual nonfederal coal production. Annual federal and non-federal coal production rates are provided for 2022, the remaining planning period (2023 to 2038), and for the remaining life of the mines after the planning period under each alternative. The four alternatives are described below:

- Alternative A – The No Action Alternative under which BLM brought forward the management decision from the coal screens performed for the 2019 RMP/SEIS.
- Alternative B – Coal leasing and development is restricted to a 2-mile area around the 2022 Office of Surface Mining Reclamation and Enforcement (OSMRE) Federal Mine Plan boundary of the two active federal coal mines in the planning area. Federal lands with coal potential outside the 2-mile area would be unacceptable for coal leasing.
- Alternative C – Coal leasing and development is restricted to the portion of pending federal leases within the 2022 OSMRE Federal Mine Plan boundary of existing coal mines (i.e., 0 miles from the 2022 boundary). All federal lands outside the existing Federal Mine Plan boundaries would be unacceptable for coal leasing.
- Alternative D – New coal leasing and development is prohibited and all unleased federal lands in the planning area would be unacceptable for coal leasing.

Rosebud Mine does not have any pending federal leasing applications and existing federal and nonfederal reserves would provide mining through 2060 at the BLM forecast production rate. No new federal leases are needed for the short-term or long-term, and thus all forecasted federal production from the mine is entirely from existing leases and production does not vary by alternative.

Existing federal and nonfederal leases at Spring Creek Mine are anticipated to provide production through 2035 at the BLM forecast production rate. The mine has two pending federal lease applications and a potential need for future subsequent federal lease applications (Appendix B of the SEIS). The forecasted federal production from these pending federal lease applications and future subsequent federal lease applications varies by alternative. Under Alternatives A and B, pending federal leases are forecasted to provide production from 2036 to 2061 with potential future subsequent federal leases providing production from 2062 to 2088. Under Alternative C, only the portions of the pending federal lease applications within the current OSMRE Federal Mine Plan boundary would be acceptable for leasing, and there would be no federal coal acres available to cover the portion of the pending federal lease applications outside the current Federal Mine Plan boundary or any future subsequent federal lease applications. BLM forecasts that portion of the pending federal leases within the current Federal Mine Plan boundary would provide production from 2036 until 2050. Under Alternative D, no pending federal or future subsequent federal lease applications would be approved and BLM forecasts that coal production would stop in 2035 once existing federal and nonfederal leases are exhausted.

2.1.1 Criteria Air Pollutants

Historical emissions and production data for these mines were obtained from the 2019 annual emission inventory reports of the Montana Department of Environmental Quality (MDEQ) and used to develop emissions intensities (tons of emitted pollutant per ton of produced coal) for each criteria air pollutant (CAP) separately for each mine. Coal mining emissions intensities of criteria air pollutants and precursors (PM_{10}, $PM_{2.5}$, NO_x, CO, VOC, and SO_2) and hazardous air pollutants were estimated under each alternative for stationary sources, non-road equipment, blasting, and fugitive dust emissions from earth moving, coal processing and vehicle travel on unpaved roads. No mobile source emissions were included in the MDEQ inventory for Spring Creek Coal Company, and so the mobile source emission intensities for Rosebud Mine were applied as a surrogate. All processes are combined in the tabulated emissions intensities and tables of annual CAP and HAP emissions from coal mining in the planning area shown below.

Hazardous air pollutant (HAP) emissions were estimated by applying a 0.1 factor to the total volatile organic compound (VOC) emissions. Diesel particulate matter (DPM) emissions were estimated by assuming all $PM_{2.5}$ from mobile source were DPM.

The CAP, HAP, and DPM emissions intensities for each Spring Creek Coal Company and Rosebud Mine used to develop the coal mining emissions inventory are shown in Table 2-1.

Table 2-1. Criteria and hazardous air pollutant emissions intensities used for coal mining (tons pollutant per ton of coal).

Mine	PM_{10}	$PM_{2.5}$	NOx	CO	VOC	SO_2	HAP	DPM
Spring Creek Coal Company	1.12E-04	2.62E-05	9.26E-05	7.40E-05	5.08E-06	1.70E-06	5.08E-07	3.15E-06
Rosebud Mine	2.08E-04	2.24E-05	9.82E-05	9.28E-05	6.97E-06	2.30E-06	6.97E-07	3.15E-06

Notes: PM_{10} =particulate matter with a diameter less than or equal to 10 microns; $PM_{2.5}$ =particulate matter with a diameter less than or equal to 2.5 microns; NOx = nitrogen oxides; CO = carbon monoxide; VOC = volatile organic compounds; SO_2 = sulfur dioxide; HAPs = hazardous air pollutants; DPM = Diesel particulate matter.

2.1.2 Greenhouse Gases

Emissions of greenhouse gases (GHGs) were estimated following the approaches applied by BLM to estimate emissions from coal mining in the Powder River Basin of Wyoming and Montana in the *National BLM Specialist Report on Annual Greenhouse Gas Emissions and Climate Trends* (BLM 2022a, herein referred to as the National BLM Specialist Report). BLM used average life cycle GHG emission factors in carbon dioxide equivalents (CO_2e) from the 2016 National Energy Technology Laboratory (NETL) report titled *Life Cycle Analysis of Coal Exports from the Powder River Basin* (NETL 2016).[1] These emissions factors are shown in Table 2-2. Direct emissions are from processes including mine reclamation, coal extraction, overburden removal, and construction, accounting for fugitive methane emissions at the mine (NETL 2016). In addition to CO_2e to the CO_2e factors used in the National BLM Specialist Report, this assessment also applies the NETL emission factors for carbon dioxide (CO_2), methane (CH_4), and nitrous dioxide (N_2O) following the same approaches. The emission factors from the NETL report are provided in units of kg CO_2e/MWh; they were converted to units of kg CO_2e/short ton of coal using a factor of 0.455 short tons of PRB coal per MWh derived by BLM using data from NETL (BLM 2022a).

[1] https://www.blm.gov/content/ghg/2021/

Emissions in carbon dioxide equivalents (CO_2e) were calculated using 20-year and 100-year time horizon global warming potentials (GWPs) from the Sixth Assessment Report (AR6) of the Intergovernmental Panel on Climate Change (IPCC 2021) (see Section 2.6 for more information).

Table 2-2. Greenhouse gas emissions factors used for coal mining (kg GHG per short ton).

CO_2	CH_4	N_2O	20-year CO_2e	100-year CO_2e
7.867	0.147	0.006	21.5	13.8

Source: BLM 2022a, NETL 2016

Notes: CO_2 = carbon dioxide; CH_4 = methane; N_2O = nitrous oxide; CO_2e = carbon dioxide equivalents; 20-year time horizon global warming potentials (GWPs) applied to calculate CO_2e from the Intergovernmental Panel on Climate Change (IPCC) Sixth Assessment Report (AR6): CO_2 = 1; CH_4 = 82.5; N_2O = 273. 100-year time horizon GWPs applied to calculate CO_2e from the IPCC AR6: CO_2 = 1; CH_4 = 29.8; N_2O = 273.

2.2 Oil and Gas Production and Midstream Sources

2.2.1 Emission Sources

The oil and gas emission inventory includes emissions from the following phases, similar to the 2015 RMP/EIS (BLM 2015) and 2019 SEIS (BLM 2019):

- **Construction phase** (e.g., well-pad and road construction, vehicle travel on unpaved roads, surface disturbance)
- **Pre-production** (e.g., drilling, fracturing, completion)
- **Operational** phase (e.g., well workover, dehydrators, tanks, commuting vehicles for workers, liquids transfer operations, wellhead fugitives, well venting and flaring, compressor stations)

2.2.2 Years

Emissions were estimated for base year 2022 and forecast years from 2023 to 2038 using the same calculation methodology and O&G activity as the 2015 RMP/EIS and 2019 SEIS.

2.2.3 Geographical

The O&G emission inventory includes the entire MCFO planning area. The MCFO administers approximately 2.75 million acres of surface lands and 11.9 million acres of subsurface federal mineral estate in 17 eastern Montana counties.

2.2.4 Pollutants

Emissions were estimated for the following pollutants/gases:

- Criteria air pollutants (CAP)
  - Nitrogen oxides (NO_x)
  - Volatile organic compounds (VOC)
  - Particulate matter with a diameter less than or equal to 10 microns (PM_{10})
  - Particulate matter with a diameter less than or equal to 2.5 microns ($PM_{2.5}$)
  - Sulfur dioxide (SO_2)
- Hazardous air pollutants (HAP)
  - Benzene
  - Ethylbenzene
  - Formaldehyde
  - N-hexane
  - Toluene
  - Xylenes
- Greenhouse gases (GHG)
  - Carbon dioxide (CO_2)
  - Methane (CH_4)

- Nitrous oxide (N_2O)
- Carbon dioxide equivalent (CO_2e)

Carbon dioxide equivalent (CO_2e) emissions were calculated using the latest available Global Warming Potentials (GWPs) from IPCC AR6 assessment report (IPCC 2022).

2.2.5 Mineral Designation

Emissions were estimated for BLM-administered O&G activities (federal) and O&G sources not administered by the BLM (non-federal) within the planning area.

2.2.6 Oil and Gas Activity

The emission inventory includes three well types: oil, coal-bed natural gas (CBNG), and conventional natural gas. Annual O&G active well counts and production were estimated by well type are based on estimates from the BLM (2019).

2.2.7 Emission Inventory Development Methodology

The emissions inventory GHG emissions were estimated based on BLM (2019); CAP and HAP emissions were developed by leveraging oil and gas calculators from the 2015 RMP/EIS emission inventory. The following 2015 RMP/EIS calculator spreadsheets were used to develop annual emissions for each well type and mineral designation.

- Oil wells: MCFO_oil_Alt_E.2015-RMP.xlsx
- Convectional natural gas: MCFO_NG_Alt_E.2015-RMP.xlsx
- CBNG: MCFO_CBNG_Alt_E.2015-RMP.xlsx

The calculation spreadsheets include source category specific equations and emission factors. Emission factors estimates are based on reference sources including the US Environmental Protection Agency (USEPA's) AP-42 Fifth Edition (EPA 2022b), MOBILE6.2.03 (EPA 2004), and NONROAD2008a (EPA 2008). Emissions were calculated for each phase and source category, then summed to generate annual emissions by well type and mineral designation.

2.3 Other BLM-authorized Activities

The emissions analysis of BLM-authorized activities other than oil and gas development and coal mining from the 2015 RMP are incorporated by reference for the selected alternative of the 2015 RMP (Alternative E) and summarized in Section 4.5. The other BLM-authorized activities assessed in the 2015 RMP were:

- Vegetation management
- Fire management
- Forestry and woodland products
- Livestock grazing
- Recreation – trails and travel management
- General purpose BLM fleet travel
- Road maintenance

Note that BLM expects that the annual activity rates and corresponding emissions from these activities remain representative of expected activity levels and emissions for this SEIS.

2.4 Coal Transportation and Downstream Combustion

2.4.1 Transportation

The majority of the coal produced by the Rosebud Mine is provided by conveyor to Colstrip Power Plant in a mine-to-mouth operation (e.g., approximately 6.2 million of total 6.5 million tons produced in 2021 [EIA 2022a]); these conveyor emissions are included in coal mining emissions intensities shown in Section 2.1.1. Additionally, approximately 200 to 250 thousand tons of coal are transported annually by semi-truck to the nearby Colstrip Energy Limited Partnership Power Plant (CELP) and a relatively small amount is sold directly at the mine to domestic users in the local area. Estimated emissions of criteria air pollutants and precursors from semi-truck shipments to CELP from OSMRE (2018) are provided in Table 2-3.

Table 2-3. Annual Criteria Air Pollutant and Precursor Emissions from Transportation of Rosebud Mine Coal to the Colstrip Energy Limited Partnership Power Plant (tons/year)

PM10	PM2.5	NOx	CO	SO2	VOC
0.26	0.22	6.30	1.73	0.00	0.30

Source: OSMRE 2018

The EPA Guidance (2022a) approach was used to estimate emissions using activity for the rail freight movements from Spring Creek Coal Mine.

The EPA guidance indicates that using gross ton-miles (GTM) is the preferred option for freight rail activity. Rail gross tonnage combines the weight of the locomotives, the tare weight of rail cars, and revenue freight tonnage. EPA recommends calculating fuel consumption from the average fuel consumption factor (FCF) and GTM and emissions from the fuel consumption using equations 1 and 2.

$$FC = GTM \times FCF \qquad (1)$$

Where FC = fuel consumption (gal)
GTM = gross ton-miles (ton-mi)
FCF = fleet average fuel consumption factor (gal/ton-mi)

$$Emissions = EF\ (g/gallon) \times FC \qquad (2)$$

The FCF was derived from the annual reporting by railroads ("R-1 Report"), in this case, BNSF[2] railroad, and the calendar year 2021 BNSF report was the latest available report at the time of writing. The report provides annual gross and revenue ton-miles and fuel consumption for line-haul, switching, and work trains (used to maintain the system).

It was not feasible to identify specific train configurations (number of locomotives and rail cars) relative to the freight movements to estimate the Gross to Revenue weight fraction. As a result, revenue (actual paying freight) ton-miles (RTM) was substituted for GTM to compare with the overall fuel consumption to calculate the FCF. The use of fuel consumption by RTM is consistent with the EPA guidance because it uses the average annual revenue to gross weight fraction for the fuel consumption calculation.

[2] https://www.bnsf.com/about-bnsf/financial-information/pdf/21R1.pdf, accessed in December 2022. Table 750 provides fuel consumption, and Table 755 provides gross and revenue ton-miles.

BLM provided estimated one-way rail miles from Spring Creek Coal Mine to its end-users and 2022-2038 annual coal shipments data. A coal shipment weighted average distance was calculated for each year. End-user closure was also taken into account in the calculation. Table 2-4 shows the calculated weighted average rail transport distances from Spring Creek to the end-users.

Table 2-4. Coal shipment weighted average rail distances from Spring Creek to end-users for each year and alternatives (miles).

Year	Alternatives A, B, and C	Alternative D
2022	1,823	1,823
2023	1,822	1,822
2024	1,822	1,822
2025	1,867	1,867
2026	1,867	1,867
2027	1,867	1,867
2028	1,805	1,805
2029	1,805	1,805
2030	1,836	1,836
2031	1,836	1,836
2032	1,845	1,845
2033	1,845	1,845
2034	1,845	1,845
2035	1,845	1,845
2036	1,903	-
2037	1,903	-
2038	1,903	-

BNSF activity in the calendar year 2021 resulted in an average of 507 RTM/gallon (1/FCF). Of the total fuel consumption, 4.4% was from switching and work trains with the remainder of fuel consumption used in the line-haul activity. RTM/gallon average activity derived from the R-1 Report total freight moves and fuel consumption incorporates the fuel consumption from empty train return moves.

EPA (2009) provides locomotive engine emission factors for HC, CO, NOx, and PM directly in gram per gallon units accounting for the expected fleet age distribution and other factors. A fuel consumption weighted combination of "Large Railroads 'Line-haul' and 'Switch'" was used to calculate the emission factors of HC, CO, NOx, and PM. EPA (2022a) provides VOC and $PM_{2.5}$ conversions from HC and PM respectively and emission rates for methane (CH_4) and nitrous oxide (N_2O). EPA (2022a and 2009) estimated the average diesel fuel density of 3200 grams per gallon to convert emission factors in gram per gram of fuel to gram per gallon units. Appendix J in the EPA (2022a) emission inventory guidance provides hazardous air pollutants (HAPs) as a fraction of either $PM_{2.5}$ or VOC emissions. Multiplying the freight tonnage by the distance moved (one-way) provides RTM and dividing by the freight transport efficiency estimates the fuel consumed by mode. Then the fuel consumption multiplied by the emission factors in gallons units provides the expected emissions from freight transport.

2.4.2 Downstream Combustion

To estimate GHG emissions from the downstream combustion of the coal produced in the planning area, EPA (2022a) emissions factors for stationary combustion of sub-bituminous coal were applied following the approach of the National BLM Specialist Report (BLM 2022a). The emissions factors are presented in Table 2-5.

Table 2-5. Greenhouse gas emissions factors used for downstream coal combustion (kg GHG per short ton).

CO_2	CH_4	N_2O	20-year CO_2e	100-year CO_2e
1676.183	0.190	0.028	1699.4	1689.4

Notes: CO_2 = carbon dioxide; CH_4 = methane; N_2O = nitrous oxide; CO_2e = carbon dioxide equivalents; 20-year time horizon global warming potentials (GWPs) applied to calculate CO_2e from the Intergovernmental Panel on Climate Change (IPCC) Sixth Assessment Report (AR6): CO_2 = 1; CH_4 = 82.5; N_2O = 273. 100-year time horizon GWPs applied to calculate CO_2e from the IPCC AR6: CO_2 = 1; CH_4 = 29.8; N_2O = 273.

The names and locations of the coal-fired power plants that burn coal produced in the planning area in year 2021 are reported in Section 4.6. Emissions of criteria and hazardous air pollutants from these power plants were also reported in that section. The exact coal-fired power plant destinations and the amount of coal that would be supplied to those plants from the planning area in the future are uncertain. In addition, there is uncertainty over the federal vs non-federal fraction of coal that will be burned at these power plants as well as the amount of coal they may burn from outside the planning area. Since coal production from the planning area shows a declining trend, emissions of criteria and hazardous air pollutants from the downstream combustion of coal from the planning area would be comparable to or lower than the emissions reported in Section 4.6.

2.5 Oil and Gas Processing, Transportation, and Downstream Combustion

GHG emissions of CO_2, CH_4, and N_2O from oil and gas processing, transportation and downstream combustion were calculated for the base year 2022 and for future years 2023 through 2038 using the estimated oil and gas production rates from the planning area.

Emissions factors developed by the Department of Energy's National Energy Technology Laboratory were used to calculate GHG emissions of CO_2, CH_4, and N_2O from the refining and transportation of produced oil (NETL 2008). The emissions factors are provided in terms of kilograms per barrel of oil developed and GHG emissions are calculated using the emissions factors and the estimated oil production from wells developed. Emissions from refining are weighted based on fuel (product) type as reported in the BLM's "Oil and Gas Leasing Greenhouse Gas Emission Inventory Tool" version 2022c (BLM 2022b). The emissions factors for the refining and transportation of oil are shown in Table 2.2 and Table 2.3, respectively.

Table 2-2. Greenhouse gas emissions factors for the refining of oil.

Refining Product	U.S. Consumption	CO_2 (kg/bbl)	CH_4 (kg/bbl)	N_2O (kg/bbl)
Gasoline	44.3%	4.60E+01	5.62E-02	7.45E-04
Diesel	20.8%	5.08E+01	6.27E-02	7.85E-04
Kerosene (Jet)	6.1%	3.05E+01	3.76E-02	4.72E-04
Residual Fuel Oil	1.2%	3.57E+01	4.38E-02	5.64E-04
Coke	1.4%	4.24E+01	5.10E-02	7.28E-04
Light Ends	22.8%	2.89E+01	3.50E-02	4.84E-04
Heavy Ends	3.3%	6.70E+01	8.09E-02	1.13E-03
Total	**100%**	**1.54E+09**	**1.88E+06**	**2.51E+04**

Source: NETL 2008, BLM 2022b

Notes: CO_2 = carbon dioxide; CH_4 = methane; N_2O = nitrous oxide; kg = kilograms; bbl = barrel.

Table 2-3. Greenhouse gas emissions factors for the transportation of oil.

	CO_2 (kg/bbl)	CH_4 (kg/bbl)	N_2O (kg/bbl)
Transport of Crude	7.92E+00	4.27E-03	1.59E-04
Transport of Product	4.54E+00	2.81E-03	8.93E-05
Total	**1.25E+01**	**7.08E-03**	**2.48E-04**

Source: NETL 2008, BLM 2022b
Notes: CO_2 = carbon dioxide; CH_4 = methane; N_2O = nitrous oxide; kg = kilograms; bbl = barrel.

Emissions factors developed by the Department of Energy's National Energy Technology Laboratory were used to calculate GHG emissions of CO_2, CH_4, and N_2O from the processing, gathering and boosting, transmission, storage, and distribution of natural gas (NETL 2019). These emissions factors are provided in terms of kilograms per mega joule of natural gas and GHG emissions are calculated using the emissions factors and the estimated natural gas production from wells developed. The emission factors for gathering and boosting, transmission, storage, and distribution of natural gas are combined to create a single emissions factor for transportation of natural gas. The emissions factors used to calculate GHG emissions from the processing and transportation of natural gas are shown in Table 2.4. These emission factors are used for both conventional natural gas and coalbed methane natural gas.

Table 2-4. Greenhouse gas emissions factors for the processing and transportation of natural gas.

	CO_2 (kg/MJ)	CH_4 (kg/MJl)	N_2O (kg/MJ)
Processing	**1.33E-03**	**1.38E-05**	**4.73E-09**
Transportation:			
Gathering/Boosting	3.20E-03	5.10E-05	0.00E+00
Transmission Station	4.61E-03	3.62E-05	1.21E-07
Transmission Pipeline	1.40E-07	6.71E-06	0.00E+00
Storage	4.41E-07	1.56E-06	3.06E-13
Distribution	1.02E-05	2.86E-05	0.00E+00
Total Transportation	**7.82E-03**	**1.24E-04**	**1.21E-07**

Source: NETL 2019
Notes: CO_2 = carbon dioxide; CH_4 = methane; N_2O = nitrous oxide; kg = kilograms;MJ = mega joule.

Table 2-5 provides the emissions factors that were used to calculate GHG emissions of CO_2, CH_4, and N_2O from the downstream combustion of oil and natural gas (conventional and coalbed). These emission factors were obtained from EPA's 40CFR Part 98 Table C-1 and Table C-2 (EPA 2023)

Table 2-5. Greenhouse gas emissions factors for the downstream combustion of oil and natural gas.

	CO_2	CH_4	N_2O	
Oil	1.029E+01	4.140E-04	8.280E-05	kg/gal
Gas	5.444E-02	1.026E-06	1.026E-07	kg/cf

Source: EPA 2023
Notes: CO_2 = carbon dioxide; CH_4 = methane; N_2O = nitrous oxide; kg = kilograms; gal = gallon; cf = cubic feet.

2.6 Global Warming Potentials

The discussion of global warming potentials (GWP) from the National BLM Specialist Report (BLM 2022a, Section 3.4) is incorporated by reference and summarized below.

Different GHGs absorb varying amounts of outgoing radiation relative to the amount of incoming radiation it allows to pass through (i.e., radiative forcing) and also have different atmospheric lifetimes (BLM 2022a), and both of these factors influence the GHGs impact on global warming. Climate scientists have developed GWPs for individual GHGs to account for these effects. GWPs are a measure of how much energy the emissions of 1 ton of a GHG will absorb over a given period relative to 1 ton of CO_2. GWPs are used to convert emissions of different GHGs into CO_2e. The larger the GWP, the more the GHG warms the earth compared to CO_2.

GWPs can be only roughly estimated due to various complex feedbacks in the earth-atmosphere system (BLM 2022a). The IPCC (2021) reports that GWPs have a large uncertainty: ±26 percent and ±11 percent for the 20-year and 100-year CH_4 GWPs, respectively, and ±118 percent and ±130 percent for the 20-year and 100-year N_2O GWPs, respectively (IPCC 2021).

This SEIS reports CO_2e emissions using the 20-year and 100-year time horizon GWPs from IPCC AR6 (Table 2-6). The 20-year CO_2e is included to estimate the relative impacts of shorter-lived GHGs more clearly (i.e., CH4) over the 20-year life of the SEIS. The IPCC AR6 provides different warming potentials for CH_4 based on whether the greenhouse gas is fossil or non-fossil originated. The GWPs for fossil originated CH_4 are applied for all emission sources except for emissions related to livestock grazing, which use the non-fossil origin GWP is used for CH_4. Note that the choice of adapting 100-year and 20-year GWPs from AR6 will result in differences in calculated CO_2e values compared to ones calculated based on other GWPs (i.e., 100-year time horizon GWPs from the IPCC Fourth Assessment Report).

Table 2-6. Global warming potentials adapted from Sixth Assessment Report of the Intergovernmental Panel on Climate Change (2021).

Time horizon	CO_2	CH_4 - Fossil Origin	CH_4 - Non-Fossil Origin	N_2O
100 Year	1	29.8	27.2	273
20 Year	1	82.5	80.8	273

Source: IPCC 2021

Notes: CO_2 = carbon dioxide; CH_4 = methane; N_2O = nitrous oxide.

3.0 SUPPORTING INFORMATION FOR AFFECTED ENVIRONMENT

3.1 Coal Emissions

3.1.1 Mining

Table 3-1. Existing federal and non-federal greenhouse gas emissions from coal mining in the planning area for 2022.

Mineral Designation	Coal Production (million short tons per year)	CO_2 (metric tons)	CH_4 (metric tons)	N_2O (metric tons)	20-yr CO_2e (metric tons)	100-yr CO_2e (metric tons)
Federal	11.05	86,908	1,619	64	238,004	152,706
Non-Federal	9.80	77,111	1,436	57	211,175	135,492
Total	20.85	164,019	3,055	121	449,179	288,198

Notes: CO_2 = carbon dioxide; CH_4 = methane; N_2O = nitrous oxide; CO_2e = carbon dioxide equivalents; 20-year time horizon global warming potentials (GWPs) applied to calculate CO_2e from the Intergovernmental Panel on Climate Change (IPCC) Sixth Assessment Report (AR6): CO_2 = 1; CH_4 = 82.5; N_2O = 273. 100-year time horizon GWPs applied to calculate CO_2e from the IPCC AR6: CO_2 = 1; CH_4 = 29.8; N_2O = 273.

Table 3-2. Existing federal and non-federal criteria air pollutant and precursor emissions from coal mining in the planning area for 2022.

Mineral Designation	Coal Production (million short tons per year)	PM_{10} (short tons)	$PM_{2.5}$ (short tons)	NOx (short tons)	CO (short tons)	VOC (short tons)	SO_2 (short tons)	HAPs (short tons)	DPM (short tons)
Federal	11.05	1,493	253	401	711	21	20	2.06	9.32
Non-Federal	9.80	1,471	224	480	687	29	19	2.85	12.87
Total	20.85	2,964	477	881	1,398	49	38	4.92	22.19

Notes: PM_{10} =particulate matter with a diameter less than or equal to 10 microns; $PM_{2.5}$ =particulate matter with a diameter less than or equal to 2.5 microns; NOx = nitrogen oxides; CO = carbon monoxide; VOC = volatile organic compounds; SO_2 = sulfur dioxide; HAPs = hazardous air pollutants; DPM = Diesel particulate matter.

3.1.2 Transportation

Table 3-3. Existing (2022) federal, nonfederal, and total criteria air pollutant emissions and total hazardous air pollutant emissions from the transportation of coal produced in the planning area (tons per year).

Mineral Designation	NO_x	PM_{10}	$PM_{2.5}$	VOC	SO_2	CO	Total HAPs
Federal	2,977.2	66.8	64.8	117.8	3.0	855.4	52.0
Non-federal	2,103.3	47.2	45.8	83.2	2.1	604.3	36.7
Total	**5,080.5**	**114.0**	**110.6**	**201.0**	**5.1**	**1,459.7**	**88.7**

Notes: NOx = Nitrogen Oxides; PM10 = Particulate matter less than 10 microns; PM2.5 = Particulate matter less than 2.5 microns; VOC = Volatile Organic Compounds; SO2 = Sulfur Dioxide; CO = Carbon Monoxide.

Table 3-4. Existing (2022) federal and nonfederal hazardous air pollutant emissions from the transportation of coal produced in the planning area (lbs).

Hazardous Air Pollutant	Federal	Non-federal	Total
1,2,3,4,6,7,8-Heptachlorodibenzofuran	3.3E-04	2.3E-04	**5.6E-04**
1,2,3,4,6,7,8-Heptachlorodibenzo-p-Dioxin	6.3E-04	4.5E-04	**1.1E-03**
1,2,3,4,7,8-Hexachlorodibenzofuran	1.2E-04	8.6E-05	**2.1E-04**
1,2,3,6,7,8-Hexachlorodibenzofuran	6.4E-05	4.6E-05	**1.1E-04**
1,2,3,6,7,8-Hexachlorodibenzo-p-Dioxin	1.6E-05	1.1E-05	**2.7E-05**
1,2,3,7,8,9-Hexachlorodibenzofuran	4.6E-05	3.3E-05	**7.9E-05**
1,2,3,7,8,9-Hexachlorodibenzo-p-Dioxin	7.3E-05	5.1E-05	**1.2E-04**
1,2,3,7,8-Pentachlorodibenzofuran	2.1E-04	1.5E-04	**3.6E-04**
1,3-Butadiene	4.4E+02	3.1E+02	**7.5E+02**
2,2,4-Trimethylpentane	1.7E+03	1.2E+03	**2.9E+03**
2,3,4,7,8-Pentachlorodibenzofuran	3.4E-04	2.4E-04	**5.7E-04**
2,3,7,8-Tetrachlorodibenzofuran	9.9E-04	7.0E-04	**1.7E-03**
2,3,7,8-Tetrachlorodibenzo-p-Dioxin	3.4E-05	2.4E-05	**5.8E-05**
Acenaphthene	8.9E+01	6.3E+01	**1.5E+02**
Acenaphthylene	1.2E+02	8.2E+01	**2.0E+02**
Acetaldehyde	1.8E+04	1.3E+04	**3.1E+04**
Acrolein	3.8E+03	2.7E+03	**6.4E+03**
Anthracene	1.3E+01	9.0E+00	**2.2E+01**
Arsenic	1.3E+02	9.5E+01	**2.3E+02**
Benz[a]Anthracene	1.1E+00	8.0E-01	**1.9E+00**
Benzene	5.3E+03	3.7E+03	**9.0E+03**
Benzo[a]Pyrene	2.8E-01	1.9E-01	**4.7E-01**
Benzo[b]Fluoranthene	3.4E-01	2.4E-01	**5.7E-01**
Benzo[g,h,i,]Perylene	4.8E-01	3.4E-01	**8.2E-01**
Benzo[k]Fluoranthene	2.6E-01	1.9E-01	**4.5E-01**
Chromium (VI)	6.5E-01	4.6E-01	**1.1E+00**
Chrysene	1.7E+00	1.2E+00	**2.8E+00**
Dibenzo[a,h]Anthracene	1.2E-01	8.8E-02	**2.1E-01**
Ethyl Benzene	9.0E+02	6.4E+02	**1.5E+03**
Fluoranthene	1.4E+01	9.8E+00	**2.4E+01**
Fluorene	1.2E+02	8.3E+01	**2.0E+02**
Formaldehyde	5.3E+04	3.7E+04	**9.0E+04**
Hexane	6.6E+02	4.6E+02	**1.1E+03**
Indeno[1,2,3-c,d]Pyrene	2.0E-01	1.4E-01	**3.4E-01**
Manganese	2.9E+02	2.0E+02	**4.9E+02**
Mercury	2.5E-01	1.8E-01	**4.3E-01**
Naphthalene	6.4E+02	4.5E+02	**1.1E+03**
Nickel	5.1E+02	3.6E+02	**8.6E+02**
Octachlorodibenzofuran	2.8E-04	2.0E-04	**4.8E-04**
Octachlorodibenzo-p-Dioxin	2.4E-03	1.7E-03	**4.2E-03**

Hazardous Air Pollutant	Federal	Non-federal	Total
Phenanthrene	2.5E+02	1.8E+02	**4.3E+02**
Propionaldehyde	9.1E+03	6.4E+03	**1.6E+04**
Pyrene	1.9E+01	1.3E+01	**3.2E+01**
Toluene	5.1E+03	3.6E+03	**8.6E+03**
Xylenes (Mixed Isomers)	3.9E+03	2.7E+03	**6.6E+03**

Table 3-5. Existing (2022) federal and nonfederal greenhouse gas emissions from the transportation of coal produced in the planning area (metric tons).

Mineral Designation	CO_2	CH_4	N_2O	20-year GWP CO_2e	100-year GWP CO_2e
Federal	297,265.7	23.3	7.5	301,222.9	299,995.1
Non-federal	210,013.6	16.5	5.3	212,809.3	211,941.9
Total	**507,279.3**	**39.8**	**12.7**	**514,032.2**	**511,937.1**

Notes: CO_2 = carbon dioxide; CH_4 = methane; N_2O = nitrous oxide; CO_2e = carbon dioxide equivalents. 20-year time horizon global warming potentials (GWPs) applied to calculate CO_2e from the Intergovernmental Panel on Climate Change (IPCC) Sixth Assessment Report (AR6): CO_2 = 1; CH_4 = 82.5; N_2O = 273. 100-year time horizon GWPs applied to calculate CO_2e from the IPCC AR6: CO_2 = 1; CH_4 = 29.8; N_2O = 273.

3.1.3 Downstream Combustion and Nonattainment Areas

The nonattainment areas for all criteria pollutants in the country (EPA 2023b) are shown along with the locations of coal-fired power plants receiving planning area coal (EIA 2022a) in Figure 3-1 through Figure 3-7. There is negligible overlap between CO and MCFO coal downstream combustion power plants (Figure 3-1). The same is true of Pb (Figure 3-2), NO_2 (Figure 3-3) and PM_{10} (Figure 3-5) nonattainment areas. The Detroit, Michigan, O_3 and $PM_{2.5}$ nonattainment area has a power plant burning MCFO coal. States where receiving power plants are in or near SO_2 nonattainment areas include Arizona, Michigan and Minnesota. The strengthening of the $PM_{2.5}$ or O_3 standards by EPA may increase the number of nonattainment areas that contain receiving power plants. The power plants typically receive both federal and non-federal coal and may combust coal from sources outside the MCFO planning area as well. Nonattainment is caused by a combination of source sectors and federal, state and/or local regulations are applicable that are aimed at attainment.

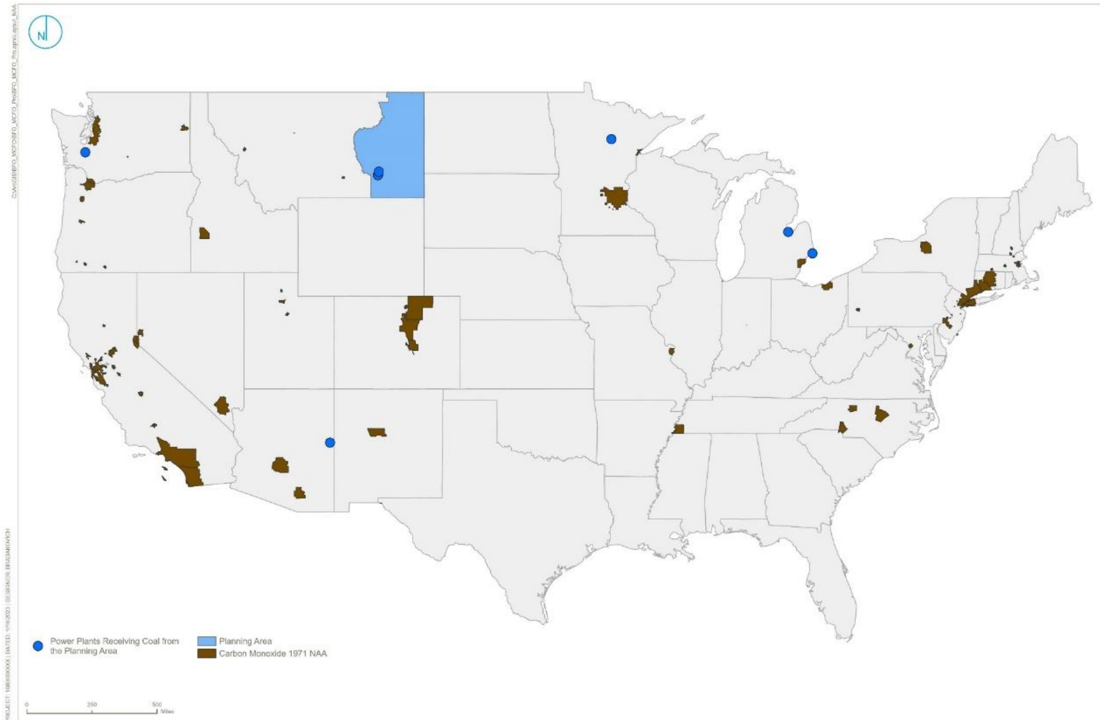

Figure 3-1. US power plants receiving coal from the Miles City Field Office Planning Area and carbon monoxide nonattainment areas

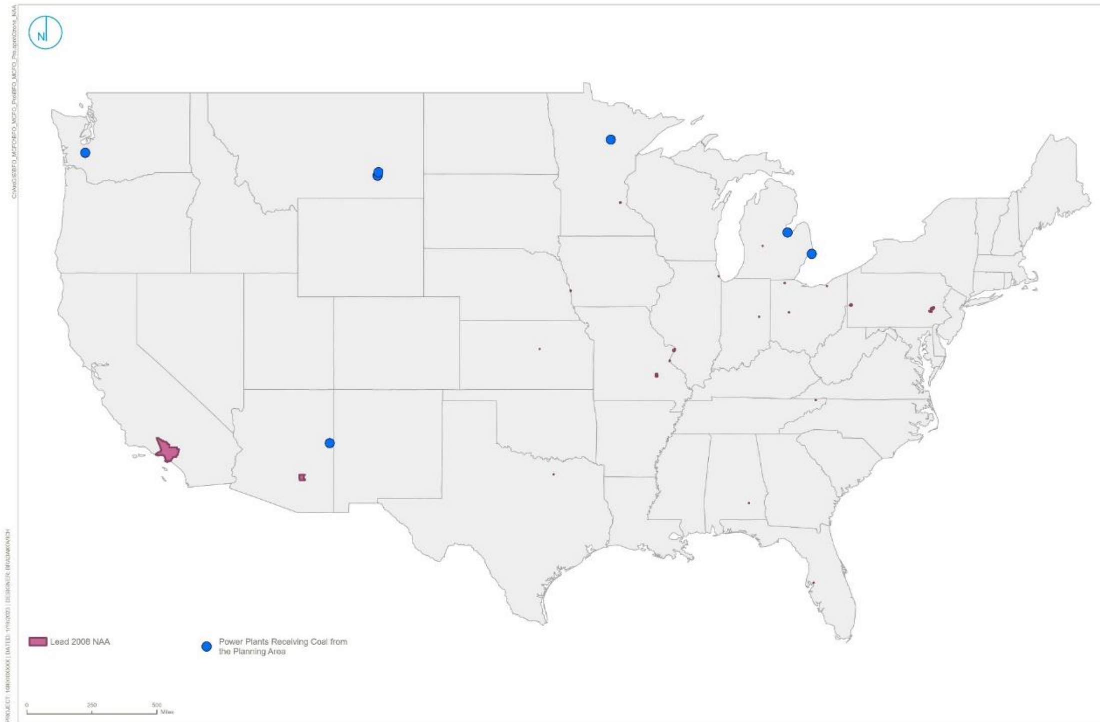

Figure 3-2. US power plants receiving coal from the Miles City Field Office Planning Area and lead nonattainment areas

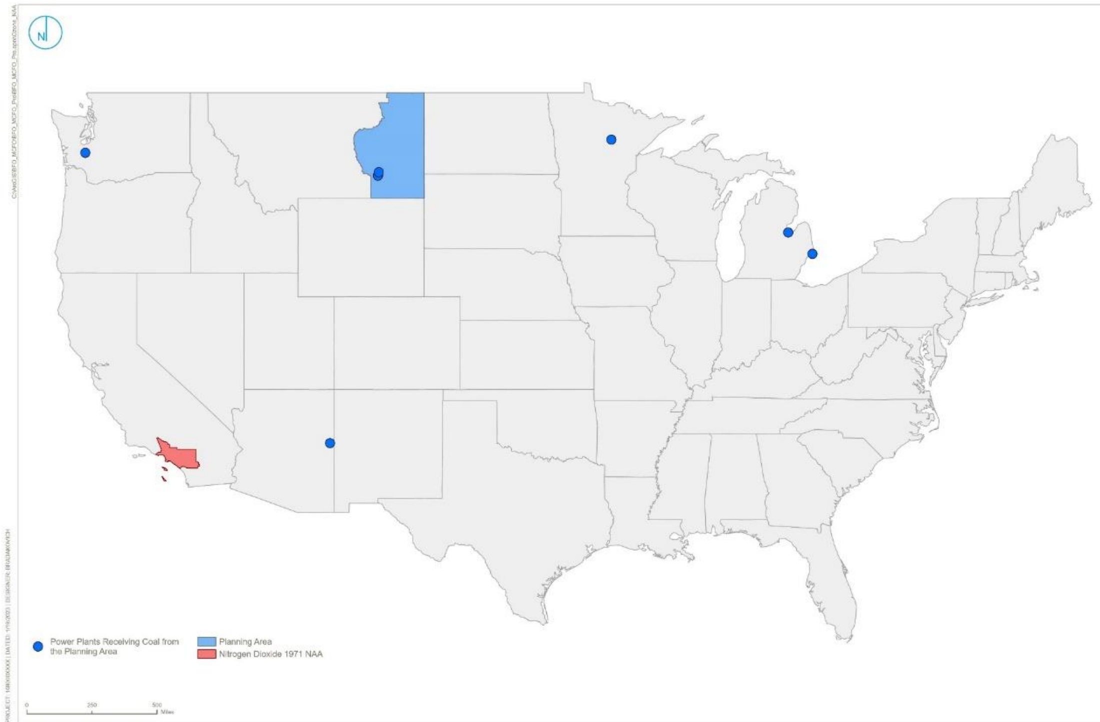

Figure 3-3. US power plants receiving coal from the Miles City Field Office Planning Area and nitrogen dioxide nonattainment areas

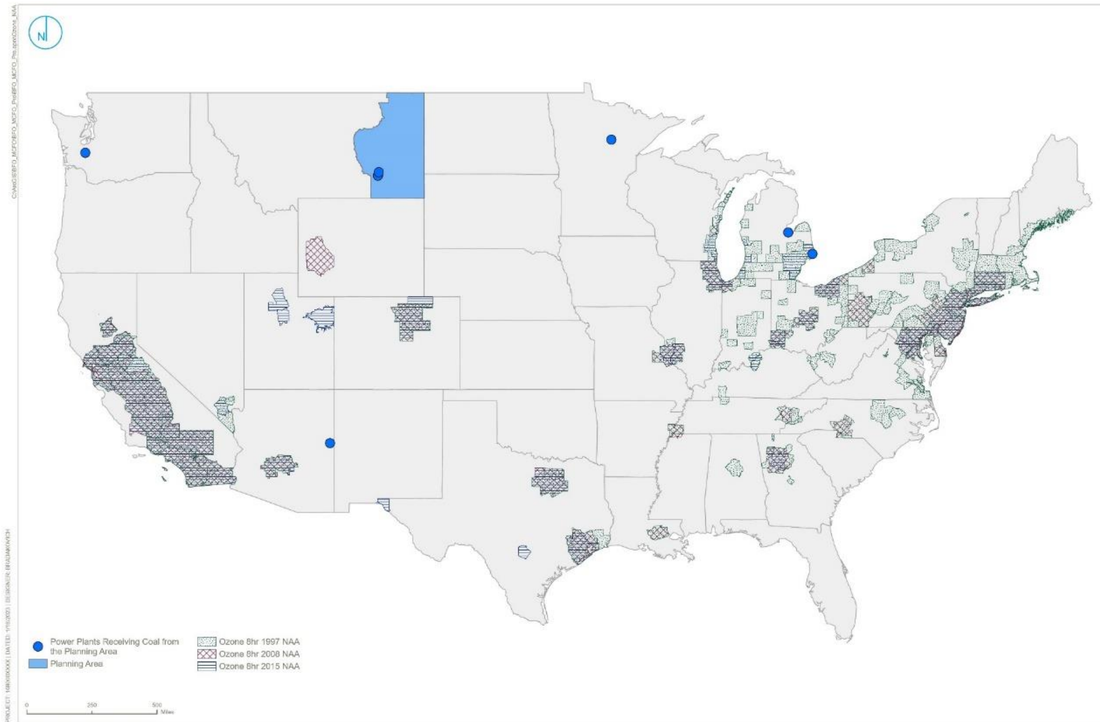

Figure 3-4. US power plants receiving coal from the Miles City Field Office Planning Area and ozone nonattainment areas

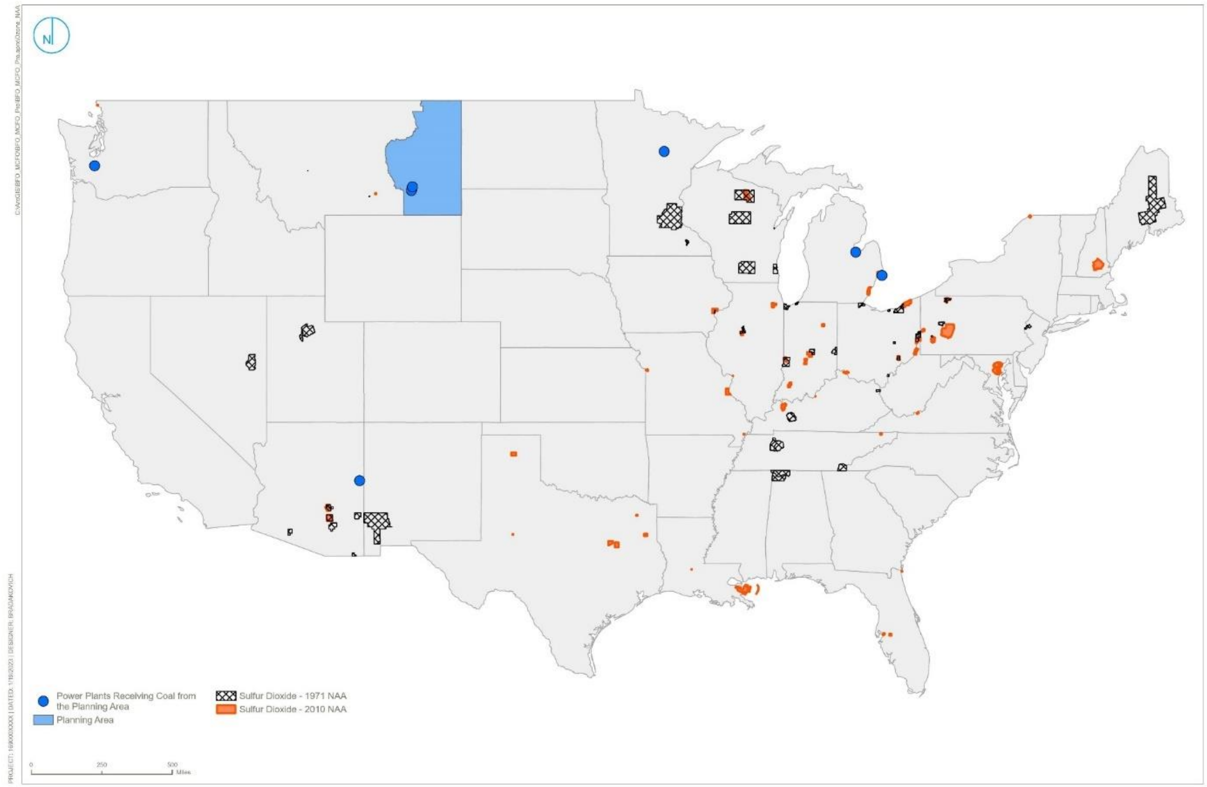

Figure 3-5. US power plants receiving coal from the Miles City Field Office Planning Area and sulfur dioxide nonattainment areas

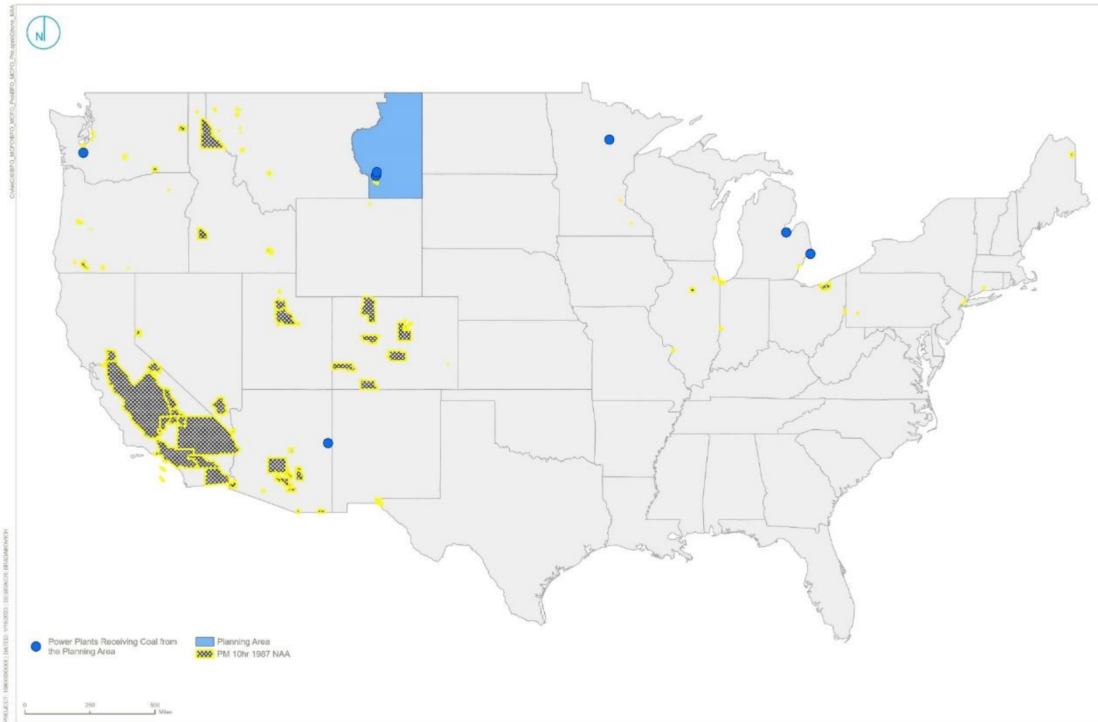

Figure 3-6. US power plants receiving coal from the Miles City Field Office Planning Area and PM_{10} nonattainment areas

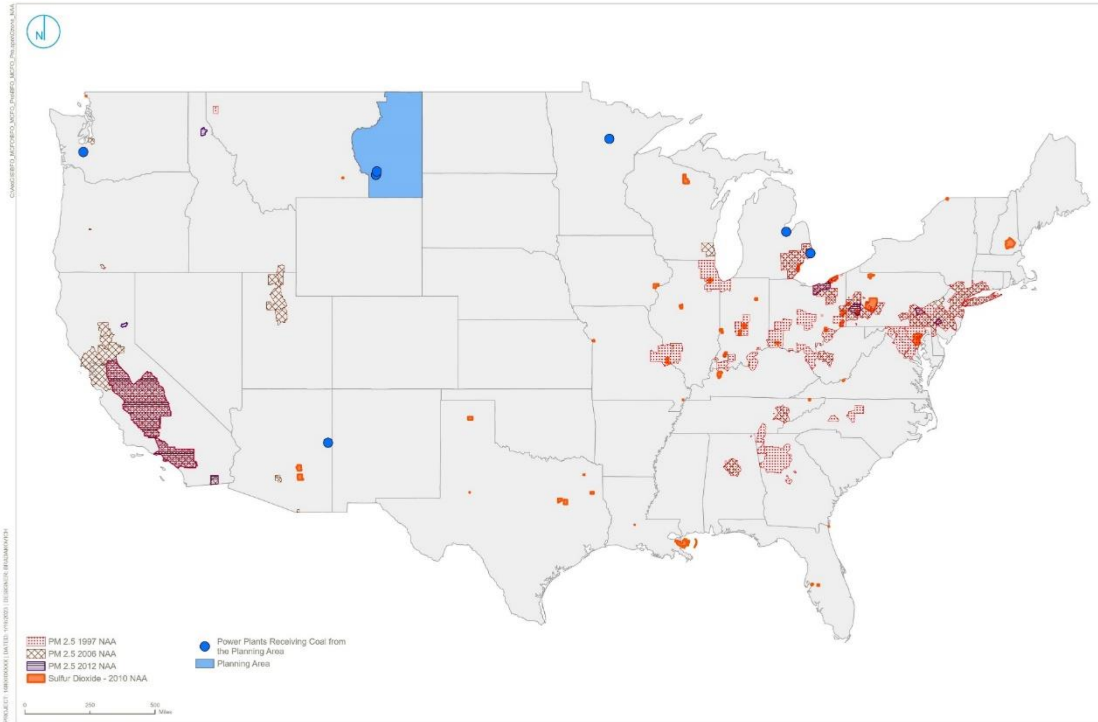

Figure 3-7. US power plants receiving coal from the Miles City Field Office Planning Area and $PM_{2.5}$ nonattainment areas

3.1.4 Downstream Combustion and Greenhouse Gases

Table 3-6. Existing federal and nonfederal greenhouse gas emissions from downstream combustion for 2022.

Mineral Designation	Coal Production (million short tons per year)	CO_2 (metric tons)	CH_4 (metric tons)	N_2O (metric tons)	20-yr CO_2e (metric tons)	100-yr CO_2e (metric tons)
Federal	11.05	18,516,126	2,096	305	18,772,287	18,661,823
Non-Federal	9.80	16,428,861	1,860	271	16,656,146	16,558,134
Total	20.85	34,944,987	3,956	575	35,428,434	35,219,958

Notes: CO_2 = carbon dioxide; CH_4 = methane; N_2O = nitrous oxide; CO_2e = carbon dioxide equivalents; 20-year time horizon global warming potentials (GWPs) applied to calculate CO_2e from the Intergovernmental Panel on Climate Change (IPCC) Sixth Assessment Report (AR6): CO_2 = 1; CH_4 = 82.5; N_2O = 273. 100-year time horizon GWPs applied to calculate CO_2e from the IPCC AR6: CO_2 = 1; CH_4 = 29.8; N_2O = 273.

3.2 Oil and Gas Emissions

3.2.1 Production and Midstream Sources

Base year 2022 production and emissions estimates are shown in Table 3-7, Table 3-8, and Table 3-9 for oil, conventional natural gas, and coalbed natural gas wells respectively. CAPs and HAPs emissions are shown in short tons per year while greenhouse gases are shown in metric tons per year.

Table 3-7. 2022 oil production and emissions by mineral designation.

Year	Mineral Designation	Production Rate (MMBO)	NO_x (short tons)	CO (short tons)	VOC (short tons)	PM_{10} (short tons)	$PM_{2.5}$ (short tons)	SO_2 (short tons)	HAPs (short tons)	CO_2 (metric tons)	CH_4 (metric tons)	N_2O (metric tons)	20-year GWP CO_2e (metric tons)	100-year GWP CO_2e (metric tons)
2022	Federal	3.0	223	492	405	49	14	3	34	54,951	268	0.5	77,245	63,093
2022	Non-federal	20.6	2,495	2,997	2,783	368	147	22	234	351,984	1,809	2.6	501,919	406,589

NOx = nitrogen oxides; CO = carbon monoxide; VOC = volatile organic compounds; PM_{10} = particulate matter with a diameter less than or equal to 10 microns; $PM_{2.5}$ =particulate matter with a diameter less than or equal to 2.5 microns; SO_2 = sulfur dioxide; HAPs = hazardous air pollutants; CO_2 = carbon dioxide; CH_4 = methane; N_2O = nitrous oxide; CO_2e = carbon dioxide equivalent

Greenhouse gas emissions shown are in metric tons per year

MMBO = millions of barrels of oil

GWP = global warming potentials

20-year time horizon global warming potentials applied to calculate CO_2e: CO_2 = 1; methane (CH_4) = 82.5; nitrous oxide (N_2O) = 273 from the IPCC AR6. 100-year time horizon global warming potentials applied to calculate CO_2e: CO_2 = 1; methane (CH_4) = 29.8; nitrous oxide (N_2O) = 273 from the IPCC AR6

Table 3-8. 2022 conventional natural gas production and emissions by mineral designation.

Year	Mineral Designation	Production Rate (BCF)	NOx (short tons)	CO (short tons)	VOC (short tons)	PM_{10} (short tons)	$PM_{2.5}$ (short tons)	SO_2 (short tons)	HAPs (short tons)	CO_2 (metric tons)	CH_4 (metric tons)	N_2O (metric tons)	20-year GWP CO_2e (metric tons)	100-year GWP CO_2e (metric tons)
2022	Federal	5.1	79	192	54	12	4	0	5	17,344	77	0.1	23,737	19,674
2022	Non-federal	34.1	915	1,221	374	93	46	6	37	107,860	510	0.5	150,048	123,179

NOx = nitrogen oxides; CO = carbon monoxide; VOC = volatile organic compounds; PM_{10} = particulate matter with a diameter less than or equal to 10 microns; $PM_{2.5}$ =particulate matter with a diameter less than or equal to 2.5 microns; SO_2 = sulfur dioxide; HAPs = hazardous air pollutants; CO_2 = carbon dioxide; CH_4 = methane; N_2O = nitrous oxide; CO_2e = carbon dioxide equivalent

Greenhouse gas emissions shown are in metric tons per year

BCF = billions cubic feet

GWP = global warming potentials

20-year time horizon global warming potentials applied to calculate CO_2e: CO_2 = 1; methane (CH_4) = 82.5; nitrous oxide (N_2O) = 273 from the IPCC AR6. 100-year time horizon global warming potentials applied to calculate CO_2e: CO_2 = 1; methane (CH_4) = 29.8; nitrous oxide (N_2O) = 273 from the IPCC AR6.

Table 3-9. 2022 coalbed natural gas production and emissions by mineral designation.

Year	Mineral Designation	Production Rate (BCF)	NOx (short tons)	CO (short tons)	VOC (short tons)	PM_{10} (short tons)	$PM_{2.5}$ (short tons)	SO_2 (short tons)	HAPs (short tons)	CO_2 (metric tons)	CH_4 (metric tons)	N_2O (metric tons)	20-year GWP CO_2e (metric tons)	100-year GWP CO_2e (metric tons)
2022	Federal	8.0	116	230	80	25	8	0	15	16,988	99	0.1	25,161	19,950
2022	Non-federal	10.8	206	313	111	35	11	16	21	23,018	133	0.1	34,047	27,019

NOx = nitrogen oxides; CO = carbon monoxide; VOC = volatile organic compounds; PM_{10} = particulate matter with a diameter less than or equal to 10 microns; $PM_{2.5}$ =particulate matter with a diameter less than or equal to 2.5 microns; SO_2 = sulfur dioxide; HAPs = hazardous air pollutants; CO_2 = carbon dioxide; CH_4 = methane; N_2O = nitrous oxide; CO_2e = carbon dioxide equivalent

Greenhouse gas emissions shown are in metric tons per year

BCF = billions cubic feet

GWP = global warming potentials

20-year time horizon global warming potentials applied to calculate CO_2e: CO_2 = 1; methane (CH_4) = 82.5; nitrous oxide (N_2O) = 273 from the IPCC AR6. 100-year time horizon global warming potentials applied to calculate CO_2e: CO_2 = 1; methane (CH_4) = 29.8; nitrous oxide (N_2O) = 273 from the IPCC AR6.

2022 production value and emissions estimates by mineral designation and well type are the same across all alternatives.

3.2.2 Transportation, Processing, and Downstream Combustion

GHG emissions of CO_2, CH_4, and N_2O from oil and gas processing, transportation and downstream combustion were calculated for the base year 2022 using the estimated oil and gas production rates from the planning area. Emissions were calculated for both federal and non-federal oil and gas wells.

The CO_2, CH_4, and N_2O emission for year 2022, along with CO2e emissions using both the 20-year and 100-year time horizon AR6 GWPs, from oil processing, conventional natural gas processing, and coalbed natural gas processing emissions, are shown in Table 3-7 through Table 3-12, respectively. The GHG emissions from transportation are provided in Table 3-13 through Table 3-15, and the emissions from downstream combustion activities are provided in Table 3-16 through Table 3-18. Note that these emissions are the same for all alternatives.

Table 3-10. Existing (2022) federal and nonfederal greenhouse gas emissions from processing of oil produced in the planning area (metric tons).

Mineral Designation	CO_2	CH_4	N_2O	20-year GWP CO_2e	100-year GWP CO_2e
Federal	129,904	158.8	2.1	143,579	135,209
Non-Federal	880,670	1,076.8	14.2	973,379	916,632
Total	1,010,574	1,235.6	16.3	1,116,959	1,051,841

Notes: CO_2 = carbon dioxide; CH_4 = methane; N_2O = nitrous oxide; CO_2e = carbon dioxide equivalents. 20-year time horizon global warming potentials (GWPs) applied to calculate CO_2e from the Intergovernmental Panel on Climate Change (IPCC) Sixth Assessment Report (AR6): CO_2 = 1; CH_4 = 82.5; N_2O = 273. 100-year time horizon GWPs applied to calculate CO_2e from the IPCC AR6: CO_2 = 1; CH_4 = 29.8; N_2O = 273.

Table 3-11. Existing (2022) federal and nonfederal greenhouse gas emissions from processing of conventional natural gas produced in the planning area (metric tons).

Mineral Designation	CO_2	CH_4	N_2O	20-year GWP CO_2e	100-year GWP CO_2e
Federal	7,436	77.2	0.03	13,808	9,742
Non-Federal	49,671	515.4	0.2	92,239	65,078
Total	57,107	592.5	0.2	106,047	74,820

Notes: CO_2 = carbon dioxide; CH_4 = methane; N_2O = nitrous oxide; CO_2e = carbon dioxide equivalents. 20-year time horizon global warming potentials (GWPs) applied to calculate CO_2e from the Intergovernmental Panel on Climate Change (IPCC) Sixth Assessment Report (AR6): CO_2 = 1; CH_4 = 82.5; N_2O = 273. 100-year time horizon GWPs applied to calculate CO_2e from the IPCC AR6: CO_2 = 1; CH_4 = 29.8; N_2O = 273.

Table 3-12. Existing (2022) federal and nonfederal greenhouse gas emissions from processing of coalbed natural gas produced in the planning area (metric tons).

Mineral Designation	CO_2	CH_4	N_2O	20-year GWP CO_2e	100-year GWP CO_2e
Federal	11,616	120.5	0.04	21,570	15,219
Non-Federal	15,775	163.7	0.1	29,293	20,667
Total	27,390	284.2	0.1	50,864	35,886

Notes: CO_2 = carbon dioxide; CH_4 = methane; N_2O = nitrous oxide; CO_2e = carbon dioxide equivalents. 20-year time horizon global warming potentials (GWPs) applied to calculate CO_2e from the Intergovernmental Panel on Climate Change (IPCC) Sixth Assessment Report (AR6): CO_2 = 1; CH_4 = 82.5; N_2O = 273. 100-year time horizon GWPs applied to calculate CO_2e from the IPCC AR6: CO_2 = 1; CH_4 = 29.8; N_2O = 273.

Table 3-13. Existing (2022) federal and nonfederal greenhouse gas emissions from transport of oil produced in the planning area (metric tons).

Mineral Designation	CO_2	CH_4	N_2O	20-year GWP CO_2e	100-year GWP CO_2e
Federal	37,929	21.6	0.8	39,914	38,778
Non-Federal	257,138	146.1	5.1	270,591	262,891
Total	295,068	167.7	5.9	310,505	301,669

Notes: CO_2 = carbon dioxide; CH_4 = methane; N_2O = nitrous oxide; CO_2e = carbon dioxide equivalents. 20-year time horizon global warming potentials (GWPs) applied to calculate CO_2e from the Intergovernmental Panel on Climate Change (IPCC) Sixth Assessment Report (AR6): CO_2 = 1; CH_4 = 82.5; N_2O = 273. 100-year time horizon GWPs applied to calculate CO_2e from the IPCC AR6: CO_2 = 1; CH_4 = 29.8; N_2O = 273.

Table 3-14. Existing (2022) federal and nonfederal greenhouse gas emissions from transport of conventional natural gas produced in the planning area (metric tons).

Mineral Designation	CO_2	CH_4	N_2O	20-year GWP CO_2e	100-year GWP CO_2e
Federal	43,725	693.7	0.7	101,136	64,580
Non-Federal	292,082	4,633.6	4.5	675,590	431,398
Total	335,807	5327.3	5.2	776,726	495,978

Notes: CO_2 = carbon dioxide; CH_4 = methane; N_2O = nitrous oxide; CO_2e = carbon dioxide equivalents. 20-year time horizon global warming potentials (GWPs) applied to calculate CO_2e from the Intergovernmental Panel on Climate Change (IPCC) Sixth Assessment Report (AR6): CO_2 = 1; CH_4 = 82.5; N_2O = 273. 100-year time horizon GWPs applied to calculate CO_2e from the IPCC AR6: CO_2 = 1; CH_4 = 29.8; N_2O = 273.

Table 3-15. Existing (2022) federal and nonfederal greenhouse gas emissions from transport of coalbed natural gas produced in the planning area (metric tons).

Mineral Designation	CO_2	CH_4	N_2O	20-year GWP CO_2e	100-year GWP CO_2e
Federal	68,304	1,083.6	1.1	157,989	100,884
Non-Federal	92,759	1,471.5	1	214,553	137,003
Total	161,064	2,555.1	2.5	372,542	237,887

Notes: CO_2 = carbon dioxide; CH_4 = methane; N_2O = nitrous oxide; CO_2e = carbon dioxide equivalents. 20-year time horizon global warming potentials (GWPs) applied to calculate CO_2e from the Intergovernmental Panel on Climate Change (IPCC) Sixth Assessment Report (AR6): CO_2 = 1; CH_4 = 82.5; N_2O = 273. 100-year time horizon GWPs applied to calculate CO_2e from the IPCC AR6: CO_2 = 1; CH_4 = 29.8; N_2O = 273.

Table 3-16. Existing (2022) federal and nonfederal greenhouse gas emissions from downstream combustion of oil produced in the planning area (metric tons).

Mineral Designation	CO_2	CH_4	N_2O	20-year GWP CO_2e	100-year GWP CO_2e
Federal	1,315,154	52.9	10.6	1,322,411	1,319,622
Non-Federal	8,915,926	358.8	71.8	8,965,122	8,946,211
Total	10,231,080	411.8	82.4	10,287,533	10,265,833

Notes: CO_2 = carbon dioxide; CH_4 = methane; N_2O = nitrous oxide; CO_2e = carbon dioxide equivalents. 20-year time horizon global warming potentials (GWPs) applied to calculate CO_2e from the Intergovernmental Panel on Climate Change (IPCC) Sixth Assessment Report (AR6): CO_2 = 1; CH_4 = 82.5; N_2O = 273. 100-year time horizon GWPs applied to calculate CO_2e from the IPCC AR6: CO_2 = 1; CH_4 = 29.8; N_2O = 273.

Table 3-17. Existing (2022) federal and nonfederal greenhouse gas emissions from downstream combustion of conventional natural gas produced in the planning area (metric tons).

Mineral Designation	CO_2	CH_4	N_2O	20-year GWP CO_2e	100-year GWP CO_2e
Federal	278,186	5.2	0.5	278,762	278,486
Non-Federal	1,858,283	35.0	3.5	1,862,129	1,860,283
Total	2,136,470	40.3	4.0	2,140,891	2,138,769

Notes: CO_2 = carbon dioxide; CH_4 = methane; N_2O = nitrous oxide; CO_2e = carbon dioxide equivalents. 20-year time horizon global warming potentials (GWPs) applied to calculate CO_2e from the Intergovernmental Panel on Climate Change (IPCC) Sixth Assessment Report (AR6): CO_2 = 1; CH_4 = 82.5; N_2O = 273. 100-year time horizon GWPs applied to calculate CO_2e from the IPCC AR6: CO_2 = 1; CH_4 = 29.8; N_2O = 273.

Table 3-18. Existing (2022) federal and nonfederal greenhouse gas emissions from downstream combustion of coalbed natural gas produced in the planning area (metric tons).

Mineral Designation	CO_2	CH_4	N_2O	20-year GWP CO_2e	100-year GWP CO_2e
Federal	434,567	8.2	0.8	435,466	435,034
Non-Federal	590,152	11.1	1.1	591,373	590,787
Total	1,024,719	19.3	1.9	1,026,839	1,025,821

Notes: CO_2 = carbon dioxide; CH_4 = methane; N_2O = nitrous oxide; CO_2e = carbon dioxide equivalents. 20-year time horizon global warming potentials (GWPs) applied to calculate CO_2e from the Intergovernmental Panel on Climate Change (IPCC) Sixth Assessment Report (AR6): CO_2 = 1; CH_4 = 82.5; N_2O = 273. 100-year time horizon GWPs applied to calculate CO_2e from the IPCC AR6: CO_2 = 1; CH_4 = 29.8; N_2O = 273.

4.0 SUPPORTING INFORMATION FOR ENVIRONMENTAL CONSEQUENCES

4.1 Regional Modeling Overview

The MCFO SEIS tiers off western US regional photochemical modeling for circa 2028 conducted separately by BLM (2023). The BLM modeling incorporated data from the Western Regional Air Partnership/Western Air Quality Study Regional Haze modeling study (WRAP/WAQS[3,4]). The WRAP/WAQS photochemical modeling data was previously developed and vetted by the consortium of state and federal agencies under the WRAP. For the circa 2028 BLM regional modeling, the platform was supplemented with additional oil and gas forecasted production and coal mining data from the BLM. The regional photochemical modeling was performed using the Comprehensive Air Quality Model with Extensions (CAMx) version 7.10 (www.camx.com). The following sections provide a summary of the modeling domains, configuration, emissions, and other inputs used in the BLM modeling platform.

4.1.1 Modeling Domains

The modeling domains have horizontal resolutions of 36 km and 12 km and are the same as those used in the WRAP/WAQS modeling. The 36 km resolution domain covers the continental United States (CONUS), while the 12 km resolution domain covers the western US and those areas with oil and gas development and coal mining that are relevant to the BLM. Map projection and definition parameters for these domains are shown in Table 4-1 and Table 4-2. Figure 4-1 shows the extent of both modeling domains.

Table 4-1. Projection parameters for the modeling domains.

Parameter	Value
Projection	Lambert-Conformal Conic
1st True Latitude	33 degrees N
2nd True Latitude	45 degrees N
Central Longitude	97 degrees W
Central Latitude	40 degrees N

Table 4-2. Grid definitions for 36 km and 12 km resolution modeling domains.

Grid	Origin (Southwest) (km)*	Extent (NE) (km)	Number of grid cells in X direction (NX)	Number of grid cells in Y direction (NY)
36 km CONUS	(-2736, -2088)	(2592, 1944)	148	112
12 km Western US	(-2388, -1236)	(336, 1344)	227	215

*Coordinates shown are relative to the central longitude and latitude in Table 2-1.

[3] https://www.wrapair2.org/

[4] https://views.cira.colostate.edu/wiki/#WAQS-2014-Modeling-Platform

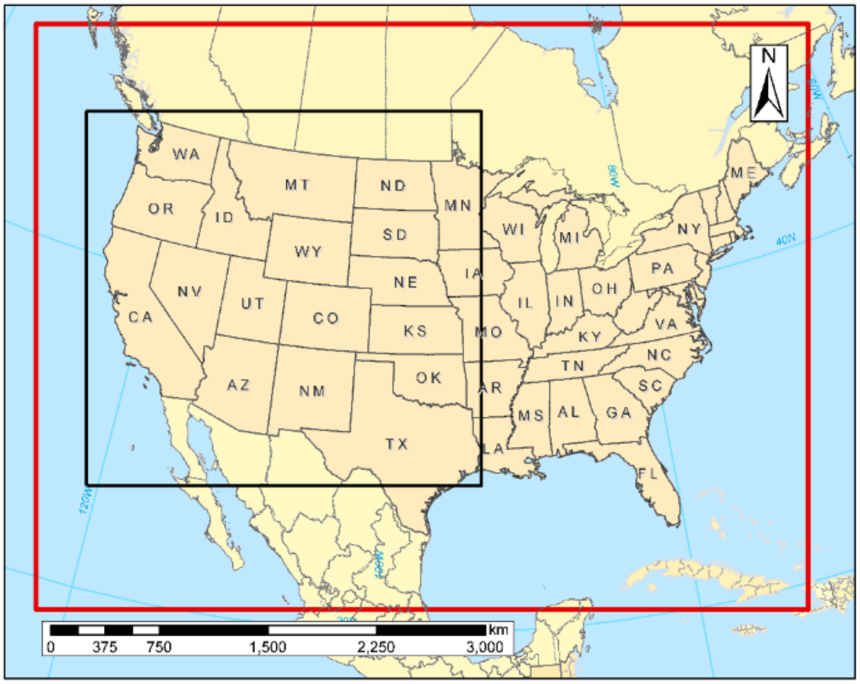

Figure 4-1. Continental (36 km) US modeling domain in red and western US (12 km) modeling domain in black.

The vertical layer structure is identical to that used in the WRAP/WAQS modeling study. The vertical domain is derived from the WRF meteorological model that initially had 36 vertical layers, but for the 2028 BLM modeling were collapsed, resulting in 25 layers in the CAMx domain for optimal computational efficiency.

4.1.2 Model Inputs

The circa 2028 BLM photochemical modeling used meteorological data developed with the Weather Research and Forecasting model (WRF) (Skamarock et al., 2008). This dataset, developed by the University of North Carolina for the year 2014 as part of the WRAP/WAQS modeling study, was obtained from the Intermountain West Data Warehouse (IWDW) and used without modification. The dataset has been previously reviewed and evaluated by WRAP states and federal agencies (UNC 2016).

The boundary and initial conditions for the 36 km domain in the 2028 BLM modeling were derived from a GEOS-Chem global chemistry model simulation conducted for the WRAP/WAQS modeling study. To remove the effects of the initial concentrations, CAMx was run for a ten-day spin-up period. Additional inputs, such as gridded daily ozone column data, were obtained from the Ozone Monitoring Instrument (OMI) database and processed for use in CAMx. The OMI dataset was also used to calculate photolysis rates for CAMx with the TUV radiation model preprocessor.

4.1.3 CAMx Model Configuration

The CAMx model configuration and science options, including the Carbon Bond 6 mechanism (CB6r4) for gas-phase chemistry (Yarwood et al., 2010), the Piecewise Parabolic Method (Colella and Woodward, 1984) for horizontal transport, the CAMx implicit scheme with vertical velocity update for vertical advection (Emery et al., 2011), and the Zhang et al. (2003) approach for dry deposition, were identical to those used in the WRAP/WAQS modeling study. This CAMx modeling system has been previously evaluated in a 2014 base case simulation (2014v2) as part of the WRAP/WAQS modeling study and underwent a rigorous technical review by the interagency stakeholder group[5].

4.1.4 Source Apportionment Groups

The CAMx Anthropogenic Precursor Culpability Assessment (APCA) version of the Ozone Source Apportionment Technology (OSAT) tool and the Particulate Source Apportionment Technology (PSAT) tool were used in the circa 2028 BLM modeling to assess the contributions of ozone, particulate sulfate, and nitrate among other pollutants from the specific source groups shown in Table 4-3. These groups were defined to better understand the impacts of federal and non-federal coal and oil and gas development sources in the intermountain west states.

Table 4-3. CAMx source apportionment groups.

Group	ID	Description
1	Natural STATE[a]	Natural emissions in individual state (fires, biogenic, lightning, sea salt, windblown dust)
2	OilGas_ExistFed STATE	Existing federal oil and gas development in individual state ("existing" defined here as prior to 2020)
3	OilGas_NewFed STATE	New federal oil and gas development in individual state ("new" defined here as 2020 onwards)
4	Coal_Fed STATE	Federal coal mining in in individual state
5	OilGas_ExisTribal	Existing tribal oil and gas development ("existing" defined here as prior to 2020)
6	OilGas_NewTribal	New tribal oil and gas development ("new" defined here as 2020 onwards)
7	Coal_EGU WRAP states	Coal electric generating units in WRAP states (including individual state and others)
8	Coal_comb WRAP states	Other (non-EGU) coal combustion sources in WRAP states (including individual state and others)
9	OilGas_NonFed	Non-federal oil and gas development
10	Coal_NonFed	Non-federal coal mining
11	Anthro_Rest[b]	Other anthropogenic sources inside and outside individual state
12	Natural outside STATE	Natural emissions outside individual state

[a] STATE. Results are reported for the source group within each individual state: CO, MT, NM, SD, UT or WY

[b] The anthropogenic emissions outside the individual "target' state include the contributions from oil and gas and coal emissions from states outside the "target" state

Air quality and AQRV modeling results are assessed for separate sub-domains, i.e., analysis areas (Figure 4-2), each including the state of interest and the additional regions within approximately 60 kilometers (km) of the state.

[5] https://views.cira.colostate.edu/iwdw/docs/WRAP_WAQS_2014v2_MPE.aspx

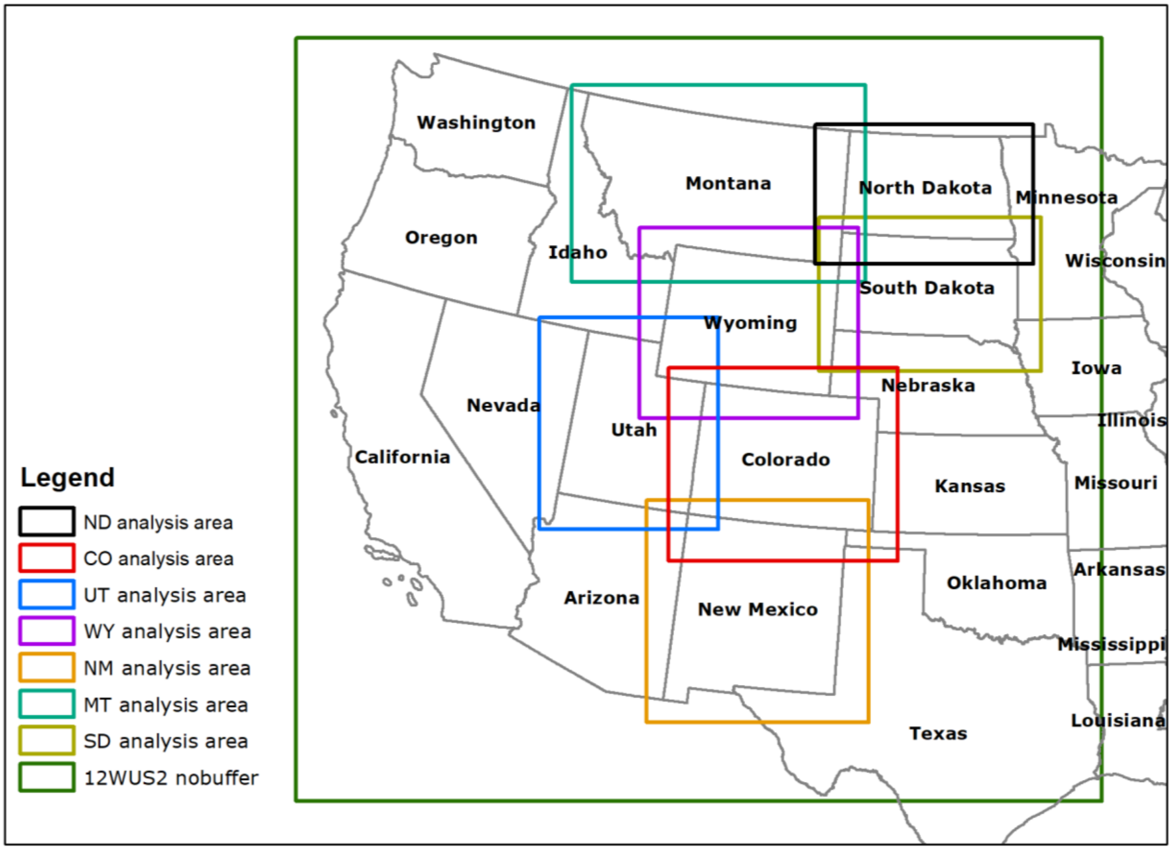

Figure 4-2. Overview of analysis areas (sub-domains) in 2028 BLM modeling study.

4.2 Regional Modeling Results

Impacts are discussed in the following sections for the following source apportionment groups:

- Federal coal in Montana
- Federal oil and gas (new and existing)
- Coal EGUs in WRAP states
- Other coal combustion in WRAP states
- Cumulative

4.2.1.1 Regional Modeling Results for Coal Mining and Combustion

In the BLM circa 2028 regional photochemical modeling study, the air quality impacts of 16.9 million tons of federal coal in Montana were modeled from four mines combined – Spring Creek, Rosebud, Decker and Bull Mountains. The federal coal production modeled in the MCFO planning area from mines that are active (i.e., Spring Creek and Rosebud) was 11.9 million tons. The non-federal coal production modeled was 13.1 million tons for all of Montana and 7.1 million tons for MCFO coal.

The air quality impacts from federal coal are shown in Table 4-4. For each form of the NAAQS pollutant three metrics are shown in Montana in general and at individual areas:

- Cumulative – this is the total impact from all sources anywhere inside and outside Montana, both anthropogenic and natural
- Federal coal percent contribution – this is the impact from total Montana federal coal at the same time and place as the cumulative, expressed as a percent of the cumulative
- Peak source contribution – this is the maximum impact from total Montana federal coal anywhere in the region of interest and at any time, i.e., it is not co-located with the cumulative value.

The modeling study included the impacts of coal fired EGUs and other coal combustion sources in the Western Regional Air Partnership (WRAP) states of Arizona, California, Colorado, Idaho, Montana, Nevada, New Mexico, North Dakota, Oregon, South Dakota, Utah, Wyoming, Washington. These impacts are reported in Table 4-5 and Table 4-6, respectively. Figure 4-3 to Figure 4-18 show the spatial extent of the impacts from federal coal and coal EGUs on AQ and AQRV metrics. The figure maps center on the planning area in eastern Montana. State boundaries are shown with darker lines and county boundaries are shown with lighter lines.

Table 4-4. Modeled air concentrations and air quality related values due to emissions from federal coal mining in Montana.

		Montana	Badlands	Fort Peck Reservation	Lostwood Wilderness	Medicine Lake Wilderness	North Absaroka Wilderness	Northern Cheyenne Reservation	Theodore Roosevelt NP	UL Bend Wilderness	Washakie Wilderness	Wind Cave National Park
8-hour Ozone	Cumulative (ppb)	71.0	54.5	58.5	53.5	57.0	60.5	59.9	56.7	60.3	58.8	56.1
(standard = 70 ppb)	Federal Coal Percent Contribution	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
	Peak source contribution (ppb)	1.2	0.0	0.1	0.0	0.0	0.0	0.6	0.0	0.1	0.0	0.1
1-hour NO_2	Cumulative (ppb)	23.9	3.0	7.9	3.3	7.3	1.0	9.7	15.8	3.0	1.4	2.5
(standard = 100 ppb)	Federal Coal Percent Contribution	0%	0%	0%	0%	0%	0%	1%	0%	0%	0%	0%
	Peak source contribution (ppb)	15.8	0.0	0.0	0.0	0.0	0.0	2.4	0.0	0.0	0.0	0.0
24-hour $PM_{2.5}$ (standard = 35 μg/m^3)	Cumulative (μg/m^3)	230.7	10.1	20.2	12.1	20.2	6.3	72.1	13.9	13.0	6.3	26.5
	Federal Coal Percent Contribution	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
	Peak source contribution (mg/m^3)	0.4	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0
Annual $PM_{2.5}$ (standard = 12 μg/m^3)	Cumulative (μg/m^3)	18.3	3.1	5.4	4.0	4.9	2.3	7.0	10.9	3.7	4.3	3.8
	Federal Coal Percent Contribution	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
	Peak source contribution (mg/m^3)	0.6	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0
24-hour PM_{10} (standard = 150 μg/m^3)	Cumulative (μg/m^3)	636.6	20.2	52.5	22.5	97.0	22.5	420.1	258.3	68.8	385.7	64.6
	Federal Coal Percent Contribution	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
	Peak source contribution (μg/m^3)	4.6	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.0

		Montana	Badlands	Fort Peck Reservation	Lostwood Wilderness	Medicine Lake Wilderness	North Absaroka Wilderness	Northern Cheyenne Reservation	Theodore Roosevelt NP	UL Bend Wilderness	Washakie Wilderness	Wind Cave National Park
1-hour SO_2 (standard = 75 ppb)	Cumulative (ppb)	20.5	1.4	2.5	1.8	2.4	0.9	9.9	3.3	1.8	4.4	2.6
	Federal Coal Percent Contribution	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
	Peak source contribution (ppb)	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3-hour SO_2 (standard = 0.5 ppm or 500 ppb)	Cumulative (ppb)	220.5	1.1	28.1	1.7	13.4	4.6	25.2	118.2	6.9	30.6	3.5
	Federal Coal Percent Contribution	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
	Peak source contribution (ppb)	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AQRV: Nitrogen deposition (critical load = 5 to 12 kg N/ha)	Cumulative (kg N/ha-year)	20.4	4.2	5.2	6.1	5.2	12.5	4.8	5.7	4.1	8.8	4.6
	Federal Coal Percent Contribution	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
	Peak source contribution (kg N/ha-year)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AQRV: Sulfur deposition (critical load = 5 kg S/ha)	Cumulative (kg S/ha-year)	1.5	0.5	0.6	0.7	0.6	0.8	0.5	0.6	0.4	0.7	0.5
	Federal Coal Percent Contribution	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
	Peak source contribution (kg S/ha-year)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AQRV: Visibility change	Peak source group contribution in delta deciviews and days > 1.0 in parentheses	—	0.0 (0)	0.1 (0)	0.1 (0)	0.1 (0)	0.0 (0)	1.7 (8)	0.1 (0)	0.1 (0)	0.0 (0)	0.0 (0)

ppb = parts per billion; µg/m3 = micrograms per cubic meter; ppm = parts per million; kg N/ha = kilograms of nitrogen per hectare; kg S/ha = kilograms of sulfur per hectare

Table 4-5. Modeled air concentrations and air quality related values due to emissions from coal EGUs in Western Regional Air Partnership states.

		Montana	Badlands	Fort Peck Reservation	Lostwood Wilderness	Medicine Lake Wilderness	North Absaroka Wilderness	Northern Cheyenne Reservation	Theodore Roosevelt NP	UL Bend Wilderness	Washakie Wilderness	Wind Cave National Park
8-hour Ozone (standard = 70 ppb)	Cumulative (ppb)	71.0	54.5	58.5	53.5	57.0	60.5	59.9	56.7	60.3	58.8	56.1
	Coal EGU Percent Contribution	0%	2%	2%	0%	0%	0%	0%	0%	0%	0%	1%
	Peak source contribution (ppb)	8.0	0.8	1.3	0.1	0.2	0.2	6.1	0.5	1.0	0.2	1.3
1-hour NO_2 (standard = 100 ppb)	Cumulative (ppb)	23.9	3.0	7.9	3.3	7.3	1.0	9.7	15.8	3.0	1.4	2.5
	Coal EGU Percent Contribution	0%	0%	0%	5%	2%	0%	0%	1%	0%	0%	1%
	Peak source contribution (ppb)	2.8	0.0	0.2	0.2	0.1	0.0	0.5	0.2	0.0	0.0	0.0
24-hour $PM_{2.5}$ (standard = 35 µg/m³)	Cumulative (µg/m³)	230.7	10.1	20.2	12.1	20.2	6.3	72.1	13.9	13.0	6.3	26.5
	Coal EGU Percent Contribution	0%	1%	0%	0%	0%	0%	0%	1%	0%	0%	0%
	Peak source contribution (mg/m³)	0.6	0.9	0.2	0.0	0.0	0.0	0.2	0.3	0.0	0.0	0.2
Annual $PM_{2.5}$ (standard = 12 µg/m³)	Cumulative (µg/m³)	18.3	3.1	5.4	4.0	4.9	2.3	7.0	10.9	3.7	4.3	3.8
	Coal EGU Percent Contribution	0%	2%	1%	3%	1%	0%	1%	1%	1%	0%	1%
	Peak source contribution (mg/m³)	0.2	0.1	0.0	0.1	0.0	0.0	0.1	0.1	0.0	0.0	0.1
24-hour PM_{10} (standard = 150 µg/m³)	Cumulative (µg/m³)	636.6	20.2	52.5	22.5	97.0	22.5	420.1	258.3	68.8	385.7	64.6
	Coal EGU Percent Contribution	0%	2%	0%	0%	0%	0%	0%	0%	0%	0%	0%
	Peak source contribution (µg/m³)	0.5	0.6	0.3	0.0	0.0	0.0	0.2	0.1	0.0	0.0	0.1

		Montana	Badlands	Fort Peck Reservation	Lostwood Wilderness	Medicine Lake Wilderness	North Absaroka Wilderness	Northern Cheyenne Reservation	Theodore Roosevelt NP	UL Bend Wilderness	Washakie Wilderness	Wind Cave National Park
1-hour SO_2 (standard = 75 ppb)	Cumulative (ppb)	20.5	1.4	2.5	1.8	2.4	0.9	9.9	3.3	1.8	4.4	2.6
	Coal EGU Percent Contribution	0%	75%	0%	70%	62%	5%	0%	1%	7%	0%	0%
	Peak source contribution (ppb)	2.5	1.1	1.1	1.2	1.5	0.1	0.1	1.6	0.1	0.2	0.1
3-hour SO_2 (standard = 0.5 ppm or 500 ppb)	Cumulative (ppb)	220.5	1.1	28.1	1.7	13.4	4.6	25.2	118.2	6.9	30.6	3.5
	Coal EGU Percent Contribution	0%	74%	0%	58%	0%	0%	0%	0%	0%	0%	2%
	Peak source contribution (ppb)	2.1	0.8	0.7	1.0	0.2	0.0	0.1	1.9	0.0	0.1	0.1
AQRV: Nitrogen deposition (critical load = 5 to 12 kg N/ha)	Cumulative (kg N/ha-year)	20.4	4.2	5.2	6.1	5.2	12.5	4.8	5.7	4.1	8.8	4.6
	Coal EGU Percent Contribution	0%	1%	1%	1%	1%	0%	2%	1%	0%	0%	1%
	Peak source contribution (kg N/ha-year)	0.0	0.0	0.0	0.1	0.0	0.0	0.1	0.0	0.0	0.0	0.0
AQRV: Sulfur deposition (critical load = 5 kg S/ha)	Cumulative (kg S/ha-year)	1.5	0.5	0.6	0.7	0.6	0.8	0.5	0.6	0.4	0.7	0.5
	Coal EGU Percent Contribution	2%	11%	12%	17%	19%	11%	14%	12%	6%	2%	3%
	Peak source contribution (kg S/ha-year)	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0
AQRV: Visibility change	Peak source group contribution in delta deciviews and days > 1.0 in parentheses	—	0.0 (0)	0.4 (0)	0.4 (0)	0.3 (0)	0.1 (0)	0.1 (0)	0.4 (0)	0.1 (0)	0.1 (0)	0.0 (0)

ppb = parts per billion; µg/m3 = micrograms per cubic meter; ppm = parts per million; kg N/ha = kilograms of nitrogen per hectare; kg S/ha = kilograms of sulfur per hectare

Table 4-6. Modeled air concentrations and air quality related values due to emissions from other coal combustion sources in Western Regional Air Partnership states.

		Montana	Badlands	Fort Peck Reservation	Lostwood Wilderness	Medicine Lake Wilderness	North Absaroka Wilderness	Northern Cheyenne Reservation	Theodore Roosevelt NP	UL Bend Wilderness	Washakie Wilderness	Wind Cave National Park
8-hour Ozone (standard = 70 ppb)	Cumulative (ppb)	71.0	54.5	58.5	53.5	57.0	60.5	59.9	56.7	60.3	58.8	56.1
	Coal Combustion Percent Contribution	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
	Peak source contribution (ppb)	0.3	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.0	0.1	0.0
1-hour NO_2 (standard = 100 ppb)	Cumulative (ppb)	23.9	3.0	7.9	3.3	7.3	1.0	9.7	15.8	3.0	1.4	2.5
	Coal Combustion Percent Contribution	0%	0%	1%	1%	0%	0%	0%	0%	0%	0%	0%
	Peak source contribution (ppb)	0.4	0.0	0.1	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0
24-hour $PM_{2.5}$ (standard = 35 μg/m^3)	Cumulative (μg/m^3)	230.7	10.1	20.2	12.1	20.2	6.3	72.1	13.9	13.0	6.3	26.5
	Coal Combustion Percent Contribution	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
	Peak source contribution (mg/m^3)	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Annual $PM_{2.5}$ (standard = 12 μg/m^3)	Cumulative (μg/m^3)	18.3	3.1	5.4	4.0	4.9	2.3	7.0	10.9	3.7	4.3	3.8
	Coal Combustion Percent Contribution	0%	0%	0%	1%	0%	0%	0%	0%	0%	0%	0%
	Peak source contribution (mg/m^3)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
24-hour PM_{10} (standard = 150 μg/m^3)	Cumulative (μg/m^3)	636.6	20.2	52.5	22.5	97.0	22.5	420.1	258.3	68.8	385.7	64.6
	Coal Combustion Percent Contribution	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
	Peak source contribution (μg/m^3)	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

		Montana	Badlands	Fort Peck Reservation	Lostwood Wilderness	Medicine Lake Wilderness	North Absaroka Wilderness	Northern Cheyenne Reservation	Theodore Roosevelt NP	UL Bend Wilderness	Washakie Wilderness	Wind Cave National Park
1-hour SO_2 (standard = 75 ppb)	Cumulative (ppb)	20.5	1.4	2.5	1.8	2.4	0.9	9.9	3.3	1.8	4.4	2.6
	Coal Combustion Percent Contribution	0%	10%	0%	9%	9%	0%	0%	0%	0%	0%	0%
	Peak source contribution (ppb)	0.2	0.1	0.2	0.2	0.2	0.2	0.0	0.2	0.0	0.3	0.0
3-hour SO_2 (standard = 0.5 ppm or 500 ppb)	Cumulative (ppb)	220.5	1.1	28.1	1.7	13.4	4.6	25.2	118.2	6.9	30.6	3.5
	Coal Combustion Percent Contribution	0%	10%	0%	8%	0%	0%	0%	0%	0%	0%	0%
	Peak source contribution (ppb)	0.2	0.1	0.2	0.1	0.0	0.0	0.0	0.3	0.0	0.3	0.0
AQRV: Nitrogen deposition (critical load = 5 to 12 kg N/ha)	Cumulative (kg N/ha-year)	20.4	4.2	5.2	6.1	5.2	12.5	4.8	5.7	4.1	8.8	4.6
	Coal Combustion Percent Contribution	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
	Peak source contribution (kg N/ha-year)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AQRV: Sulfur deposition (critical load = 5 kg S/ha)	Cumulative (kg S/ha-year)	1.5	0.5	0.6	0.7	0.6	0.8	0.5	0.6	0.4	0.7	0.5
	Coal Combustion Percent Contribution	1%	2%	2%	3%	1%	2%	2%	2%	1%	3%	3%
	Peak source contribution (kg S/ha-year)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AQRV: Visibility change	Peak source group contribution in delta deciviews and days > 1.0 in parentheses	—	0.8 (0)	0.4 (0)	0.9 (0)	0.4 (0)	0.8 (0)	0.6 (0)	0.9 (0)	0.2 (0)	0.8 (0)	0.3 (0)

ppb = parts per billion; µg/m3 = micrograms per cubic meter; ppm = parts per million; kg N/ha = kilograms of nitrogen per hectare; kg S/ha = kilograms of sulfur per hectare

The maps in the following figures center on the MCFO planning area in eastern Montana, with state boundaries shown with darker lines and county boundaries shown with lighter lines.

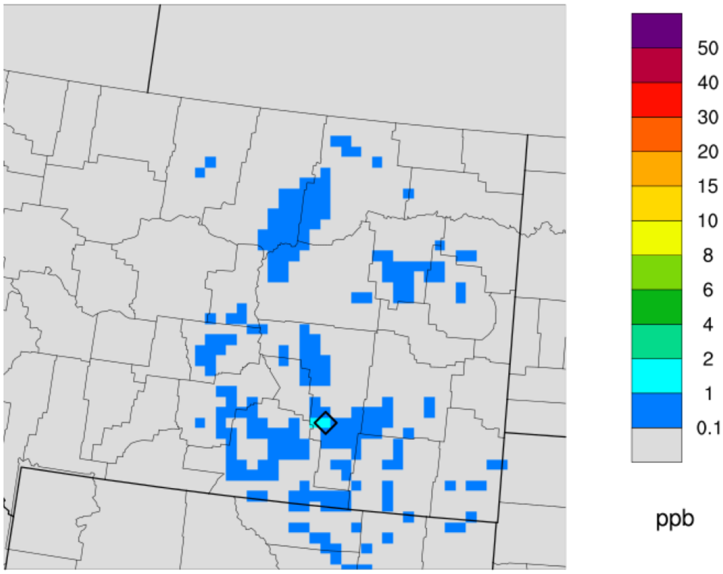

Figure 4-3. Modeled cumulative 4th highest daily maximum 8-hour ozone contribution from federal coal in Montana

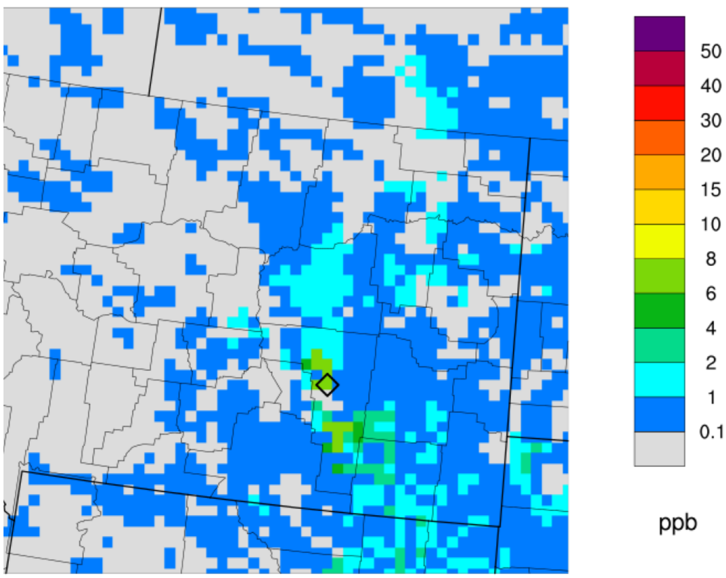

Figure 4-4. Modeled cumulative 4th highest daily maximum 8-hour ozone contribution from coal EGUs

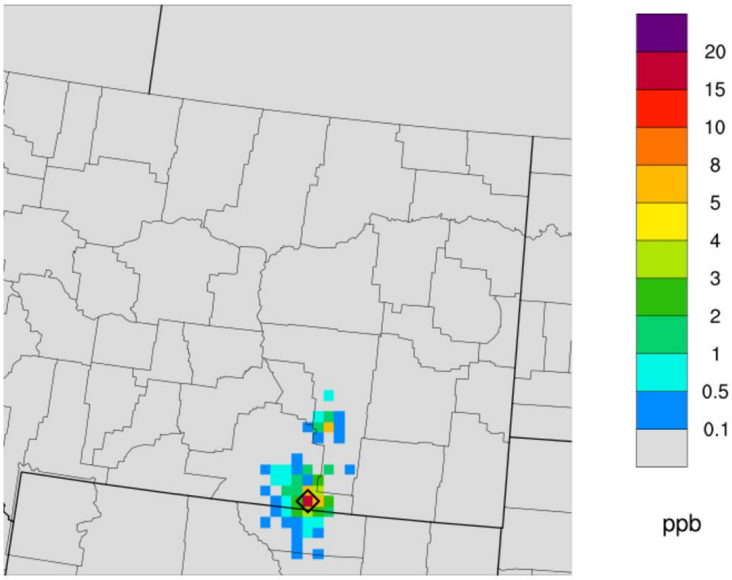

Figure 4-5. Modeled cumulative 8th highest daily maximum NO_2 contribution from federal coal in Montana.

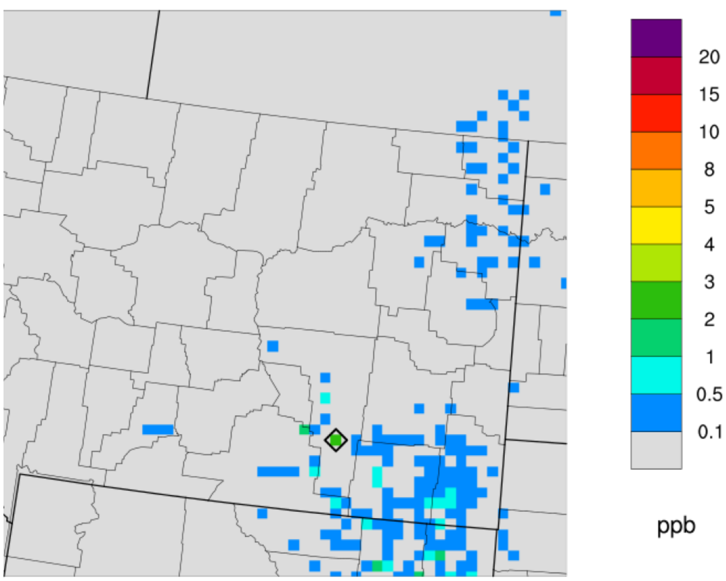

Figure 4-6. Modeled cumulative 8th highest daily maximum NO_2 contribution from coal EGUs.

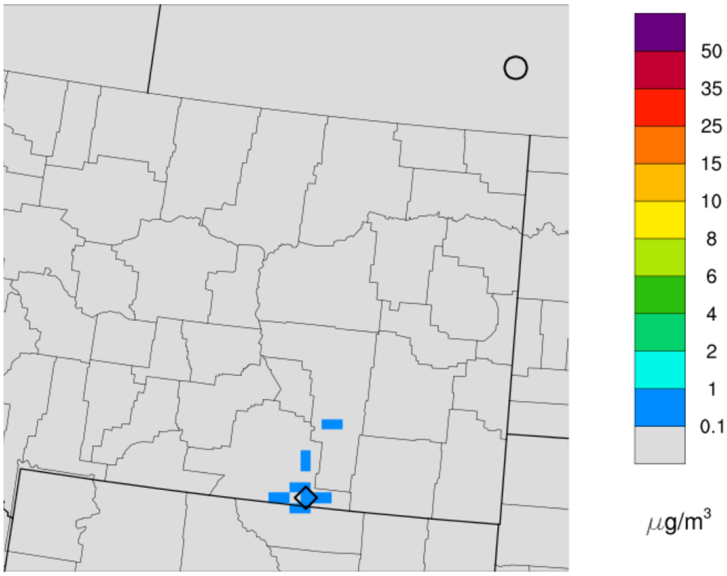

Figure 4-7. Modeled cumulative 8th highest daily $PM_{2.5}$ contribution from federal coal in Montana.

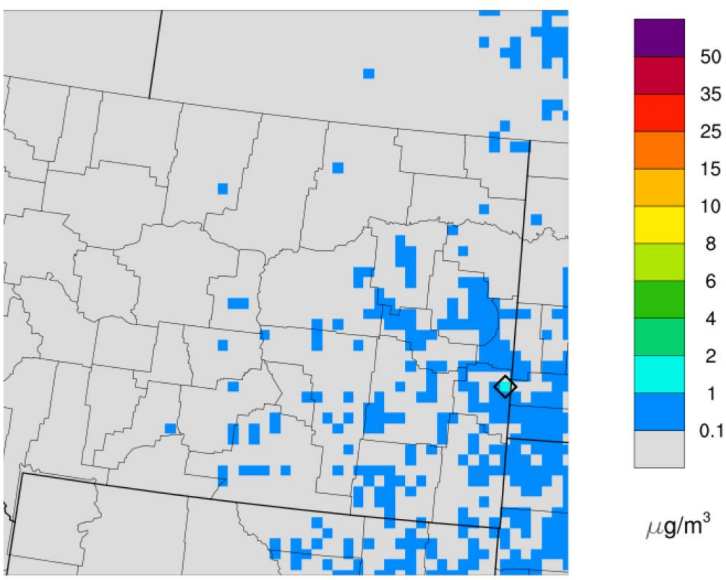

Figure 4-8. Modeled cumulative 8th highest daily $PM_{2.5}$ contribution from coal EGUs.

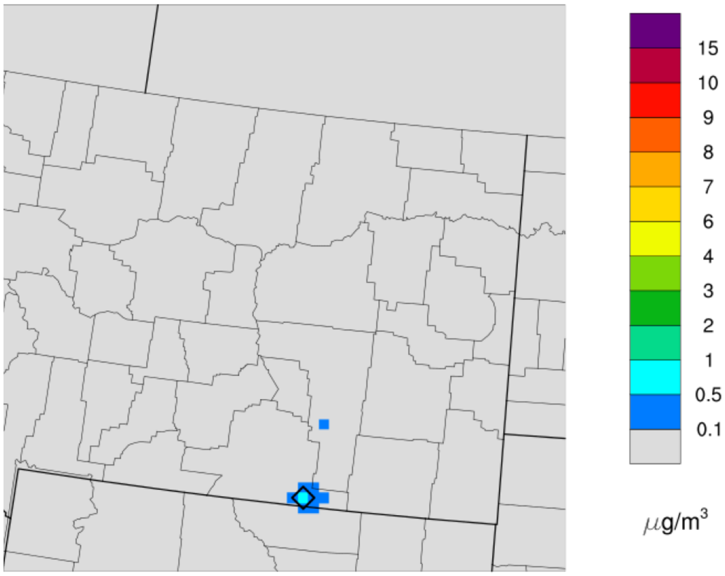

Figure 4-9. Modeled cumulative annual $PM_{2.5}$ contribution from federal coal in Montana.

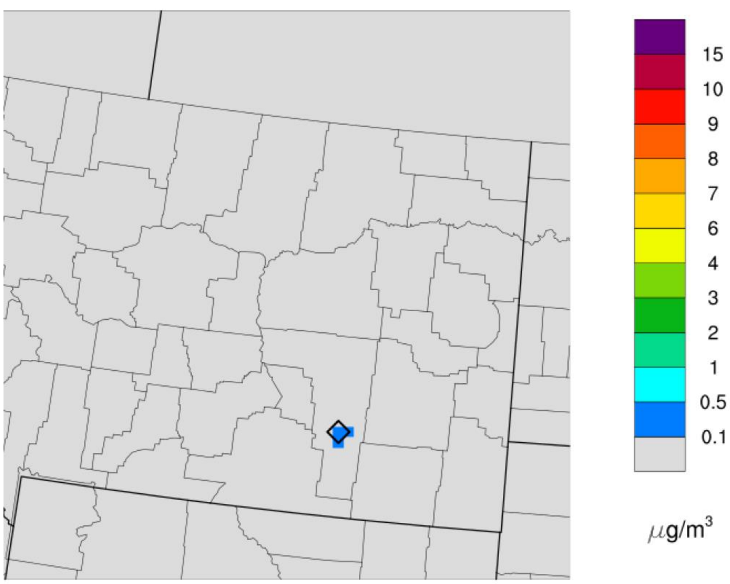

Figure 4-10. Modeled cumulative annual $PM_{2.5}$ contribution from coal EGUs.

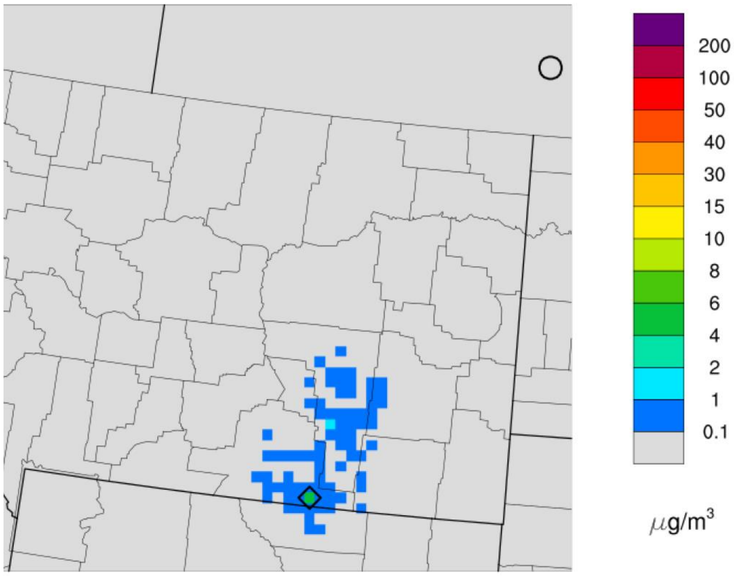

Figure 4-11. Modeled cumulative 2nd highest daily average PM_{10} contribution from federal coal in Montana.

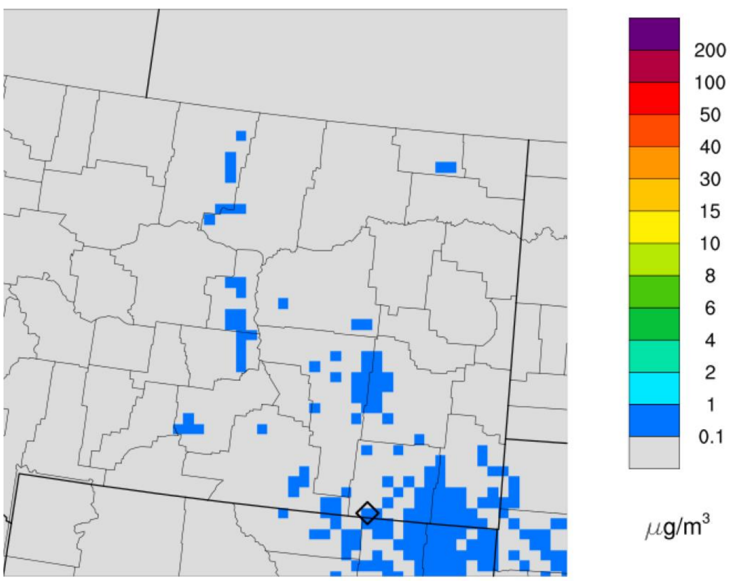

Figure 4-12. Modeled cumulative 2nd highest daily average PM_{10} contribution from coal EGUs.

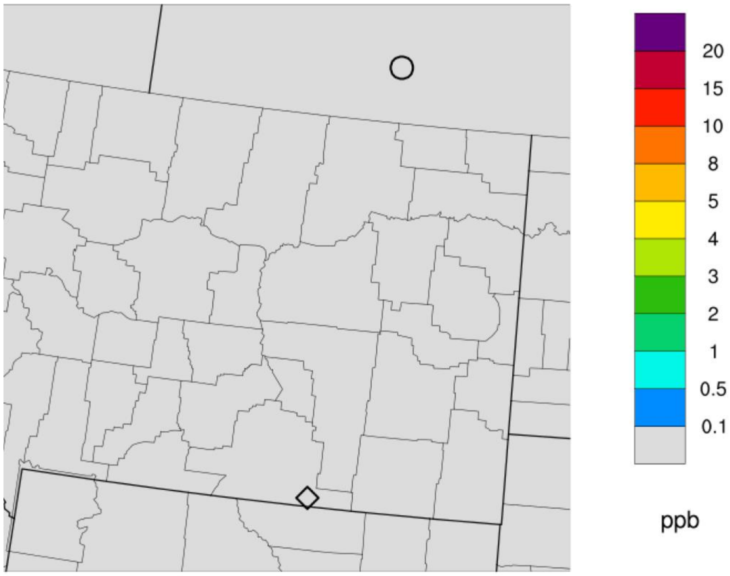

Figure 4-13. Modeled cumulative 4th highest 1-hour daily maximum SO_2 contribution from federal coal in Montana.

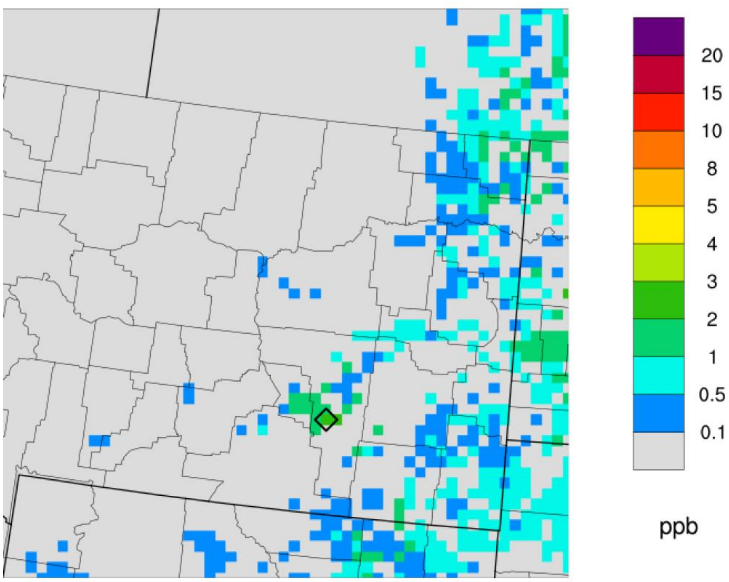

Figure 4-14. Modeled cumulative 4th highest 1-hour daily maximum SO_2 contribution from coal EGUs.

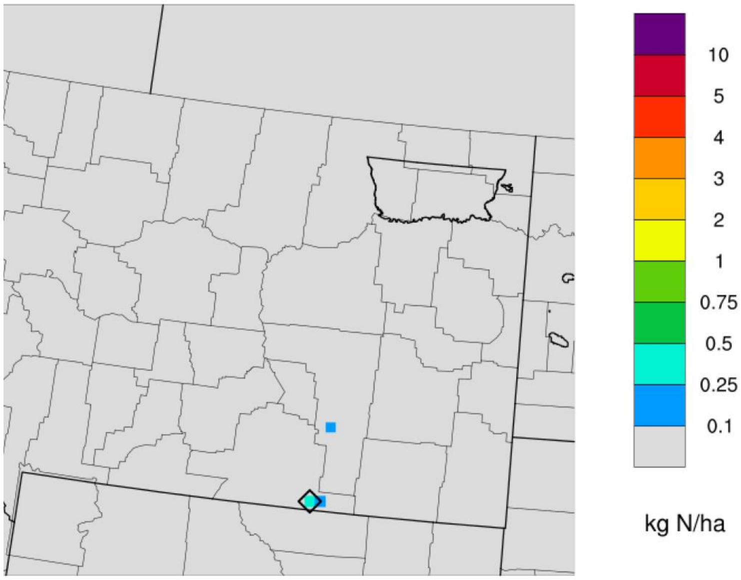

Figure 4-15. Modeled cumulative annual nitrogen deposition (kg N/ha-yr) contribution from federal coal in Montana

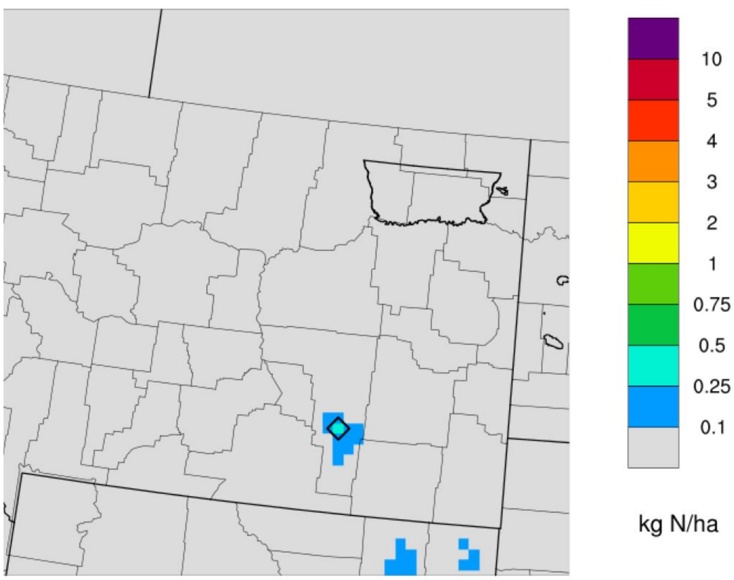

Figure 4-16. Modeled cumulative annual nitrogen deposition (kg N/ha-yr) contribution from coal EGUs

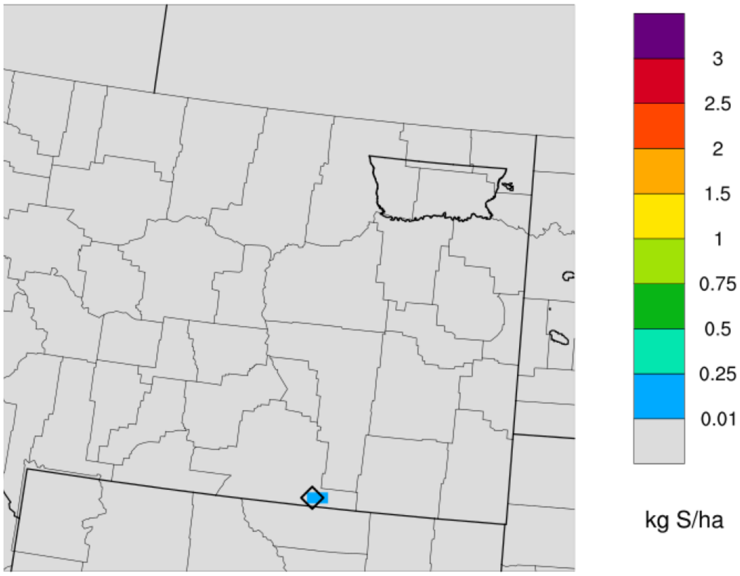

Figure 4-17. Modeled cumulative annual sulfur deposition (kg S/ha-yr) contribution from federal coal in Montana.

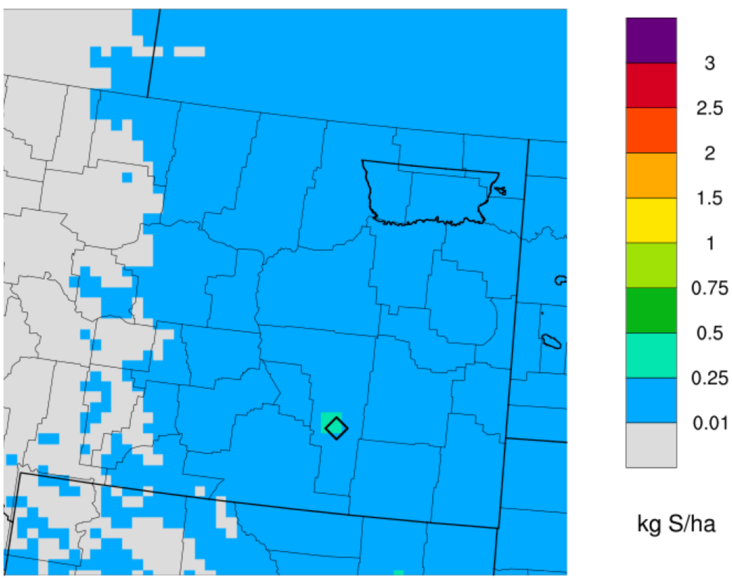

Figure 4-18. Modeled cumulative annual sulfur deposition (kg S/ha-yr) contribution from coal EGUs.

4.2.1.2 Regional Modeling Results for Oil and Gas

The modeling study included impacts of federal oil and gas development in Montana of approximately 19 million barrels of crude oil per year and 42 billion cubic feet of gas per year. Of these amounts, the modeled federal production in the MCFO was 17 million barrels of crude oil and 22 billion cubic feet of gas. The modeled total (federal + non-federal) production in the MCFO was 45 million barrels of crude oil and 61 billion cubic feet of gas.

The modeled impacts are shown in Table 4-7. Figure 4-19 to Figure 4-34 show the spatial extent of the impacts from federal oil and gas on AQ and AQRV metrics. The figure maps center on the MCFO area in eastern Montana. State boundaries are shown with darker lines and county boundaries are shown with lighter lines.

Table 4-7. Modeled air concentrations and air quality related values due to emissions from federal oil and gas (new plus existing) development in Montana.

		Montana	Badlands	Fort Peck Reservation	Lostwood Wilderness	Medicine Lake Wilderness	North Absaroka Wilderness	Northern Cheyenne Reservation	Theodore Roosevelt NP	UL Bend Wilderness	Washakie Wilderness	Wind Cave National Park
8-hour Ozone	Cumulative (ppb)	71.0	54.5	58.5	53.5	57.0	60.5	59.9	56.7	60.3	58.8	56.1
(standard = 70 ppb)	Federal Oil and Gas Percent Contribution	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
	Peak source contribution (ppb)	0.4	0.1	0.1	0.0	0.0	0.1	0.1	0.0	0.1	0.0	0.0
1-hour NO_2	Cumulative (ppb)	23.9	3.0	7.9	3.3	7.3	1.0	9.7	15.8	3.0	1.4	2.5
(standard = 100 ppb)	Federal Oil and Gas Percent Contribution	0%	0%	1%	0%	0%	0%	0%	0%	0%	0%	0%
	Peak source contribution (ppb)	1.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
24-hour $PM_{2.5}$ (standard = 35 μg/m^3)	Cumulative (μg/m^3)	230.7	10.1	20.2	12.1	20.2	6.3	72.1	13.9	13.0	6.3	26.5
	Federal Oil and Gas Percent Contribution	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
	Peak source contribution (mg/m^3)	0.2	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Annual $PM_{2.5}$ (standard = 12 μg/m^3)	Cumulative (μg/m^3)	18.3	3.1	5.4	4.0	4.9	2.3	7.0	10.9	3.7	4.3	3.8
	Federal Oil and Gas Percent Contribution	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
	Peak source contribution (mg/m^3)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
24-hour PM_{10} (standard = 150 μg/m^3)	Cumulative (μg/m^3)	636.6	20.2	52.5	22.5	97.0	22.5	420.1	258.3	68.8	385.7	64.6
	Federal Oil and Gas Percent Contribution	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
	Peak source contribution (μg/m^3)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

		Montana	Badlands	Fort Peck Reservation	Lostwood Wilderness	Medicine Lake Wilderness	North Absaroka Wilderness	Northern Cheyenne Reservation	Theodore Roosevelt NP	UL Bend Wilderness	Washakie Wilderness	Wind Cave National Park
1-hour SO_2 (standard = 75 ppb)	Cumulative (ppb)	20.5	1.4	2.5	1.8	2.4	0.9	9.9	3.3	1.8	4.4	2.6
	Federal Oil and Gas Percent Contribution	0%	0%	0%	0%	0%	2%	0%	0%	0%	0%	0%
	Peak source contribution (ppb)	0.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3-hour SO_2 (standard = 0.5 ppm or 500 ppb)	Cumulative (ppb)	220.5	1.1	28.1	1.7	13.4	4.6	25.2	118.2	6.9	30.6	3.5
	Federal Oil and Gas Percent Contribution	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
	Peak source contribution (ppb)	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AQRV: Nitrogen deposition (critical load = 5 to 12 kg N/ha)	Cumulative (kg N/ha-year)	20.4	4.2	5.2	6.1	5.2	12.5	4.8	5.7	4.1	8.8	4.6
	Federal Oil and Gas Percent Contribution	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
	Peak source contribution (kg N/ha-year)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AQRV: Sulfur deposition (critical load = 5 kg S/ha)	Cumulative (kg S/ha-year)	1.5	0.5	0.6	0.7	0.6	0.8	0.5	0.6	0.4	0.7	0.5
	Federal Oil and Gas Percent Contribution	1%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
	Peak source contribution (kg S/ha-year)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AQRV: Visibility change	Peak source group contribution in delta deciviews and days > 1.0 in parentheses	—	0.0 (0)	0.4 (0)	0.4 (0)	0.3 (0)	0.1 (0)	0.1 (8)	0.4 (0)	0.1 (0)	0.3 (0)	0.0 (0)

ppb = parts per billion; µg/m3 = micrograms per cubic meter; ppm = parts per million; kg N/ha = kilograms of nitrogen per hectare; kg S/ha = kilograms of sulfur per hectare

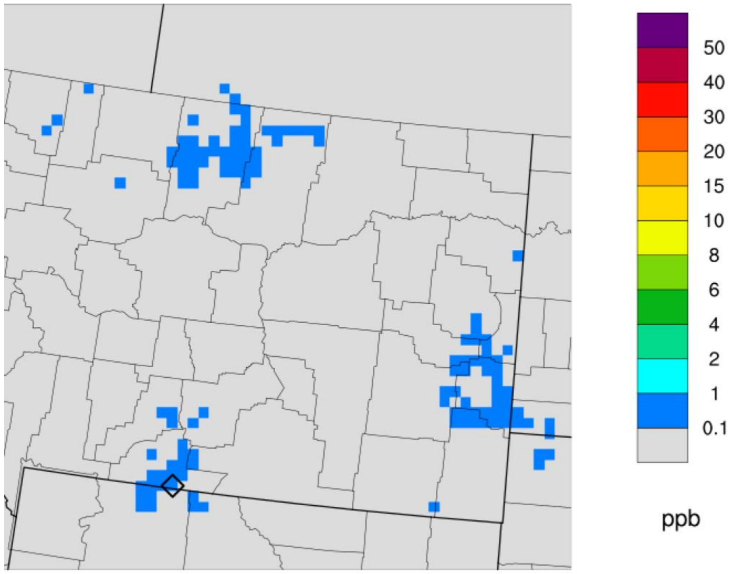

Figure 4-19. Modeled cumulative 4th highest daily maximum 8-hour ozone contribution from existing federal oil and gas in Montana

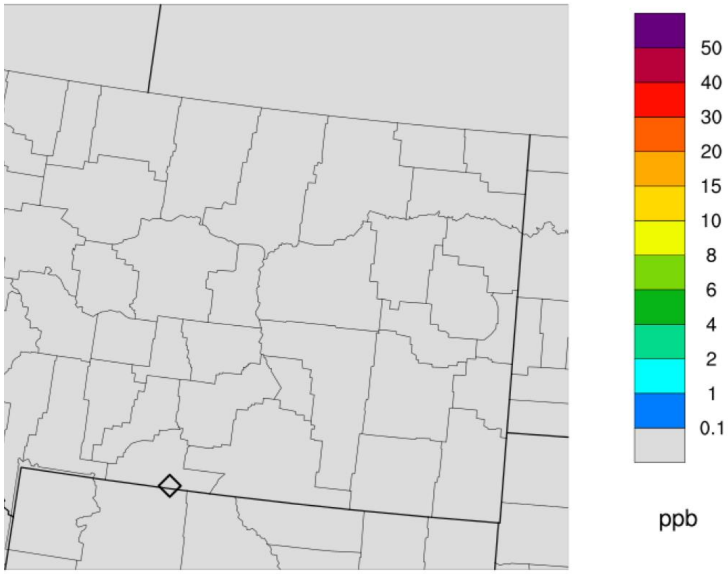

Figure 4-20. Modeled cumulative 4th highest daily maximum 8-hour ozone contribution from new federal oil and gas in Montana

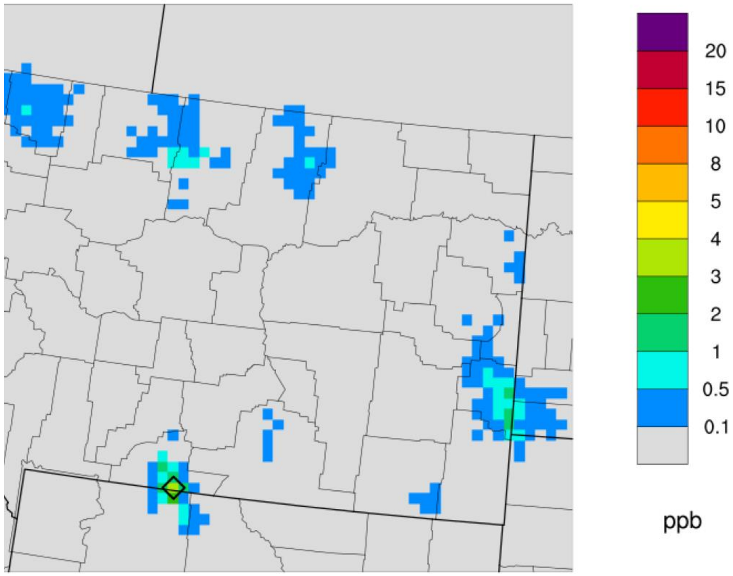

Figure 4-21. Modeled cumulative 8th highest daily maximum NO_2 contribution from existing federal oil and gas in Montana.

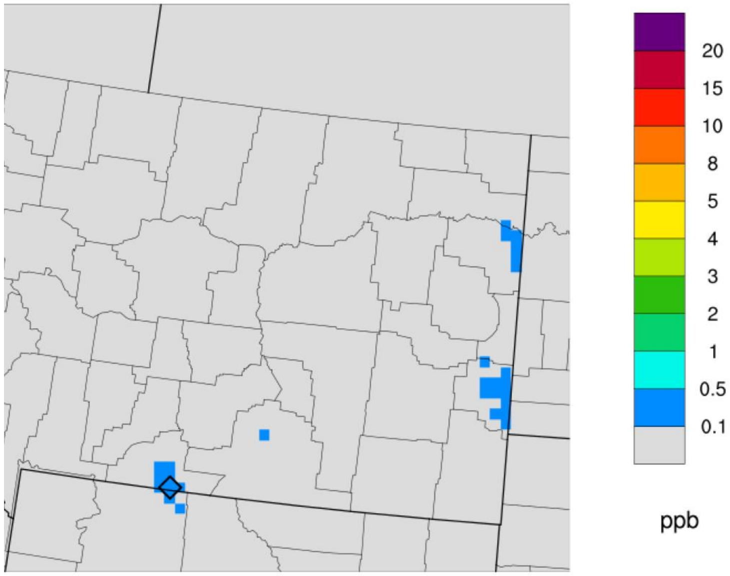

Figure 4-22. Modeled cumulative 8th highest daily maximum NO_2 contribution from new federal oil and gas in Montana.

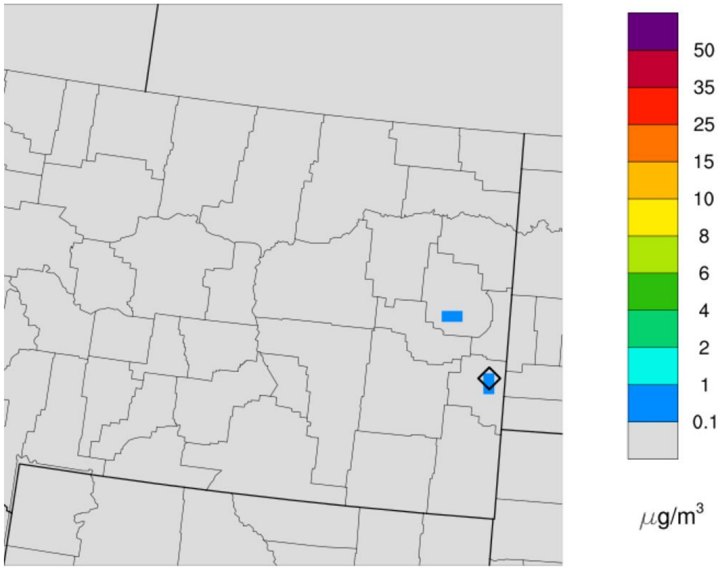

Figure 4-23. Modeled cumulative 8th highest daily $PM_{2.5}$ contribution from existing federal oil and gas in Montana.

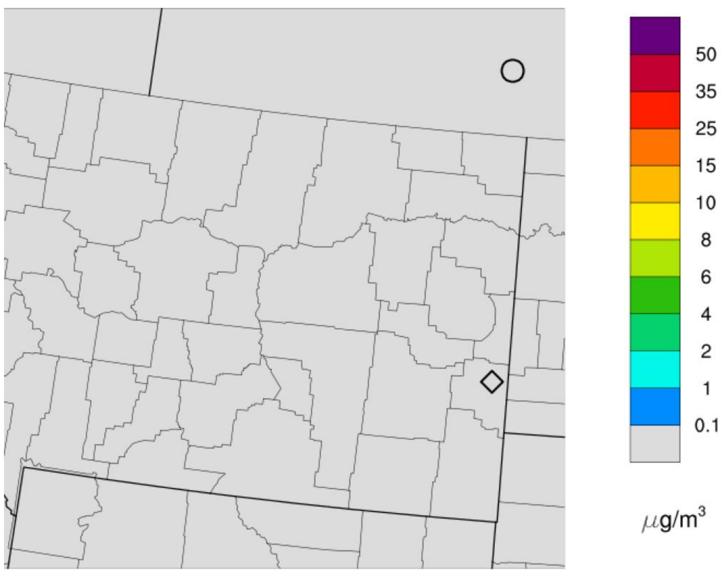

Figure 4-24. Modeled cumulative 8th highest daily $PM_{2.5}$ contribution from new federal oil and gas in Montana.

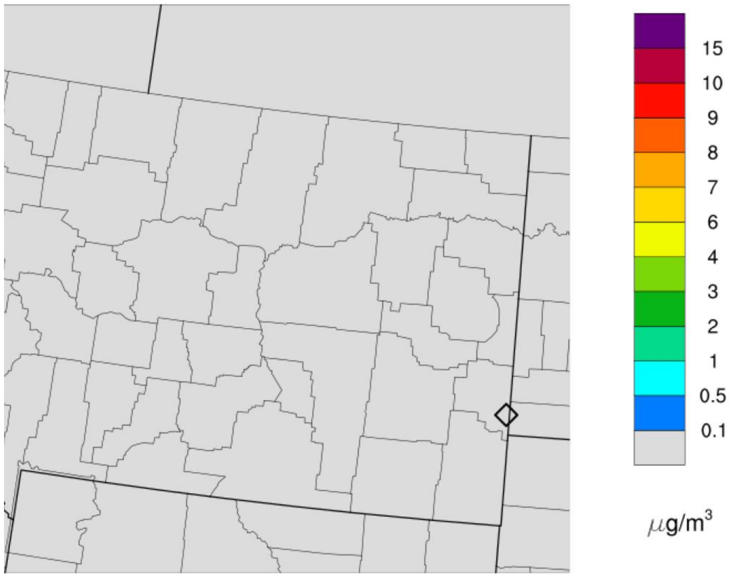

Figure 4-25. Modeled cumulative annual $PM_{2.5}$ contribution from existing federal oil and gas in Montana.

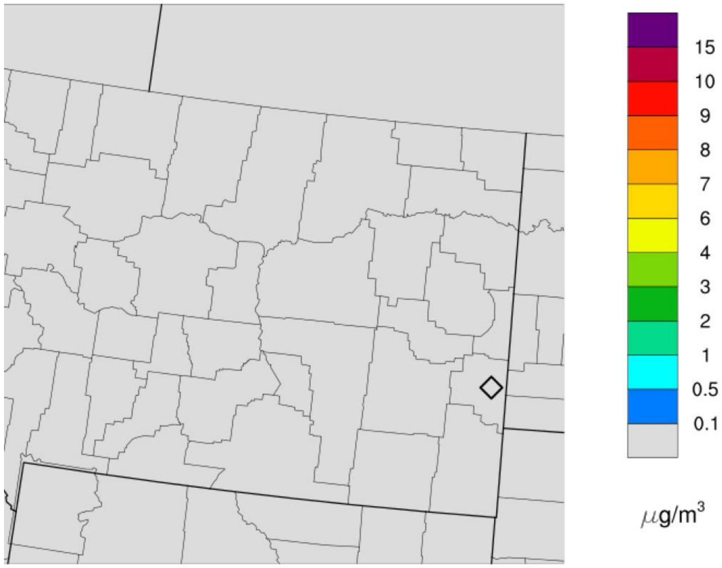

Figure 4-26. Modeled cumulative annual $PM_{2.5}$ contribution from new federal oil and gas in Montana.

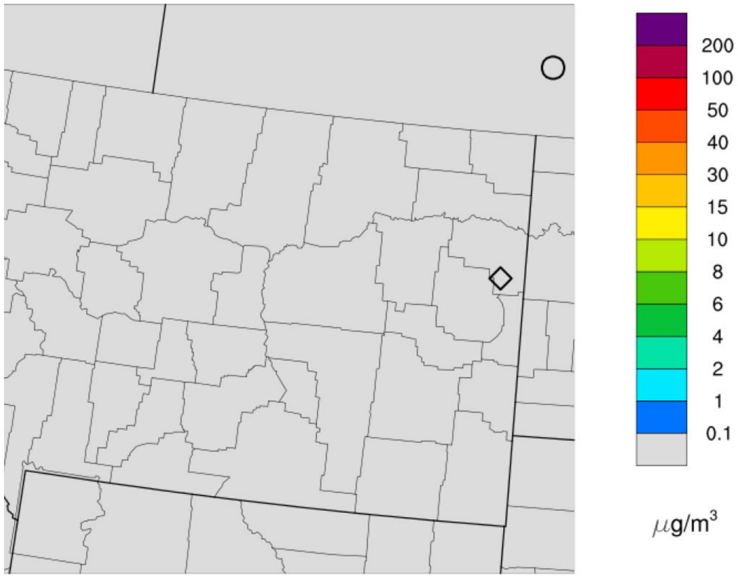

Figure 4-27. Modeled cumulative 2nd highest daily average PM_{10} contribution from existing federal oil and gas in Montana.

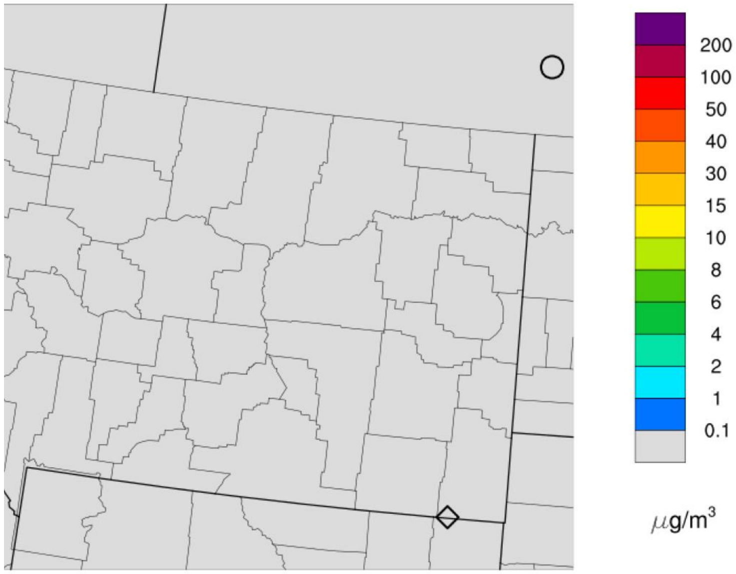

Figure 4-28. Modeled cumulative 2nd highest daily average PM_{10} contribution from new federal oil and gas in Montana.

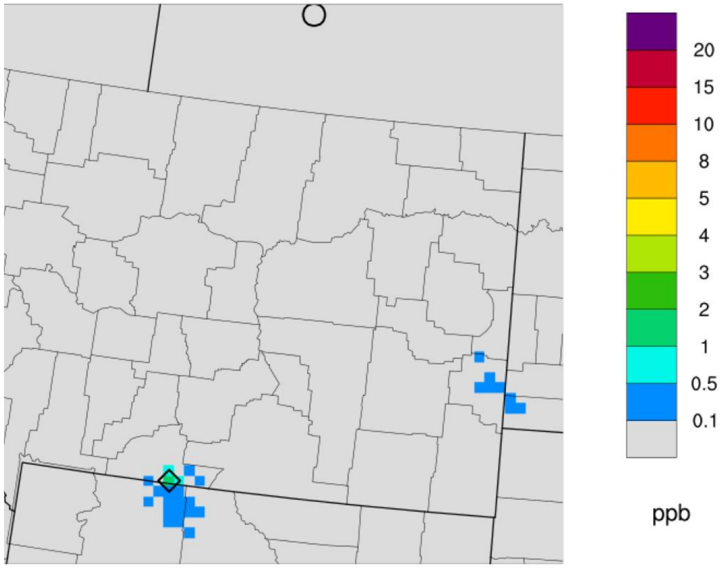

Figure 4-29. Modeled cumulative 4th highest 1-hour daily maximum SO_2 contribution from existing federal oil and gas in Montana.

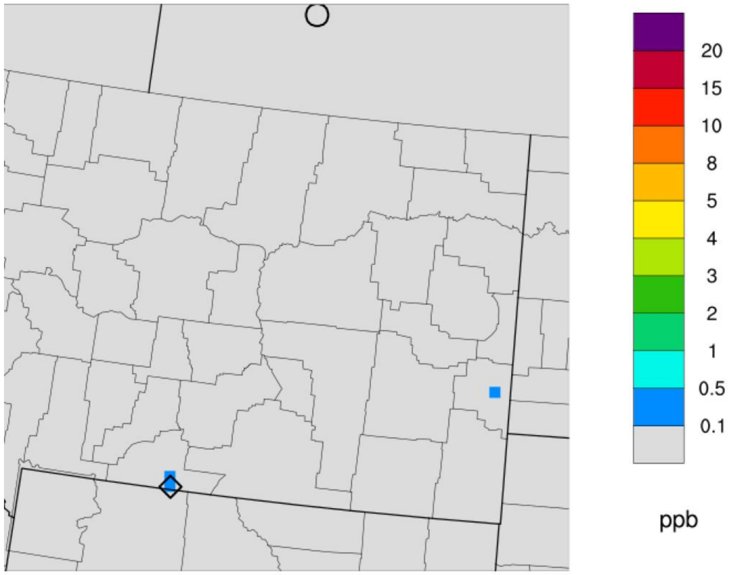

Figure 4-30. Modeled cumulative 4th highest 1-hour daily maximum SO_2 contribution from new federal oil and gas in Montana.

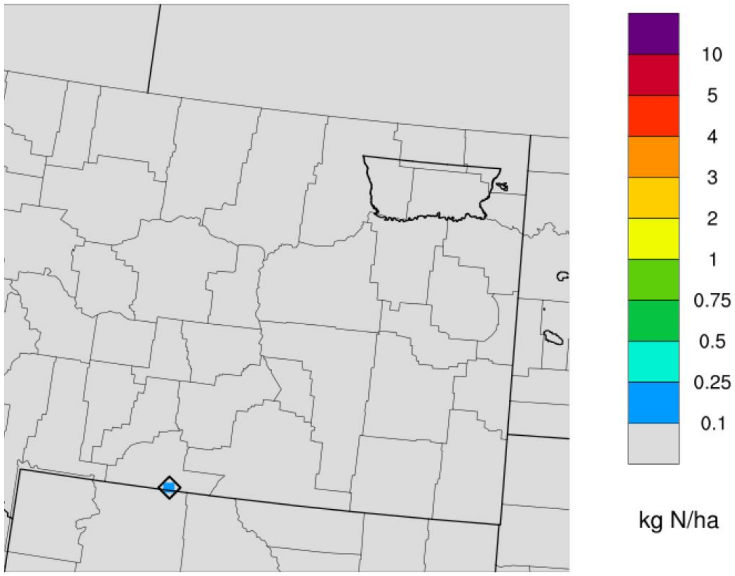

Figure 4-31. Modeled cumulative annual nitrogen deposition (kg N/ha-yr) contribution from existing federal oil and gas in Montana.

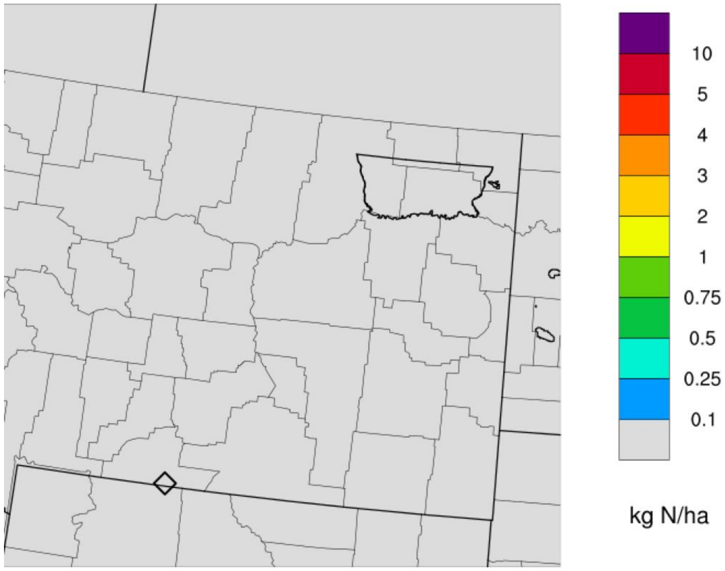

Figure 4-32. Modeled cumulative annual nitrogen deposition (kg N/ha-yr) contribution from new federal oil and gas in Montana.

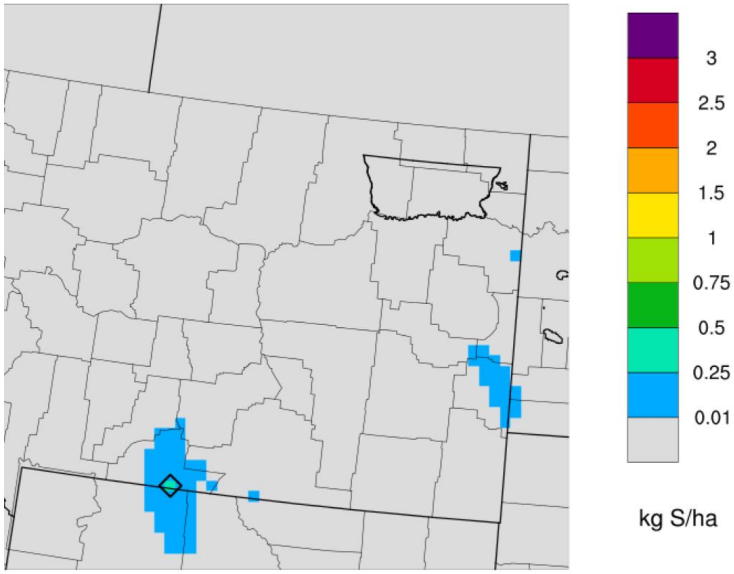

Figure 4-33. Modeled cumulative annual sulfur deposition (kg S/ha-yr) contribution from existing federal oil and gas in Montana.

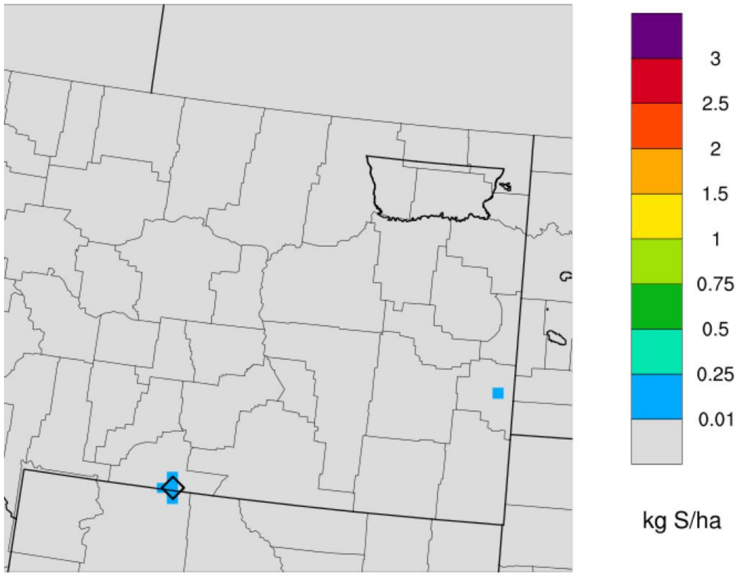

Figure 4-34. Modeled cumulative annual sulfur deposition (kg S/ha-yr) contribution from new federal oil and gas in Montana.

4.2.1.3 Regional Modeling Results for Cumulative Sources

The subdomain for Montana shown in Figure 4-2 above was used in the assessment of cumulative effects for air quality and AQRVs. Cumulative air quality impacts were modeled using the CAMx photochemical model, as discussed above. The modeling accounts for emissions from federal coal mining, federal oil and gas development, coal combustion, and other cumulative sources including anthropogenic and natural sources.

Table 4-8 summarizes the impacts to both AQ and AQRV due to all cumulative sources.

Table 4-8. Modeled air concentrations and air quality related values due to emissions from cumulative sources.

	Montana	Badlands	Fort Peck Reservation	Lostwood Wilderness	Medicine Lake Wilderness	North Absaroka Wilderness	Northern Cheyenne Reservation	Theodore Roosevelt NP	UL Bend Wilderness	Washakie Wilderness	Wind Cave National Park
8-hour Ozone (ppb)	71.0	54.5	58.5	53.5	57.0	60.5	59.9	56.7	60.3	58.8	56.1
1-hour NO_2 (ppb)	23.9	3.0	7.9	3.3	7.3	1.0	9.7	15.8	3.0	1.4	2.5
24-hour $PM_{2.5}$ (µg/m^3)	230.7	10.1	20.2	12.1	20.2	6.3	72.1	13.9	13.0	6.3	26.5
Annual $PM_{2.5}$ (µg/m^3)	18.3	3.1	5.4	4.0	4.9	2.3	7.0	10.9	3.7	4.3	3.8
24-hour PM_{10} (µg/m^3)	636.6	20.2	52.5	22.5	97.0	22.5	420.1	258.3	68.8	385.7	64.6
1-hour SO_2 (ppb)	20.5	1.4	2.5	1.8	2.4	0.9	9.9	3.3	1.8	4.4	2.6
3-hour SO_2 (ppb)	220.5	1.1	28.1	1.7	13.4	4.6	25.2	118.2	6.9	30.6	3.5
AQRV: Nitrogen deposition (kg N/ha)	20.4	4.2	5.2	6.1	5.2	12.5	4.8	5.7	4.1	8.8	4.6
AQRV: Sulfur deposition (kg S/ha)	1.5	0.5	0.6	0.7	0.6	0.8	0.5	0.6	0.4	0.7	0.5

Figure 4-35 to Figure 4-42 show the cumulative impacts for AQ and AQRV metrics due to contributions from all the sources included in the BLM circa 2028 modeling. The figure maps center on the MCFO area in eastern Montana. State boundaries are shown with darker lines and county boundaries are shown with lighter lines. Cumulative impacts in the MT subdomain are predicted to be below the NAAQS and MAAQS for NO_2, and SO_2. Cumulative impacts for ozone, $PM_{2.5}$, and PM_{10} exceed the NAAQS at isolated areas throughout the state, mostly due to the modeled natural source group that includes fires, biogenic emissions, windblown dust, and lightning NOx. The contributions from federal oil and gas and federal coal development are less than 1 percent at the location of these exceedances.

Modeled cumulative nitrogen deposition is below the lowest critical load (5 kg N/ha-year for herb/shrubs [EPA 2021c]) except at Fort Peck Reservation, Lostwood Wilderness, Medicine Lake Wilderness, North Absaroka Wilderness, Theodore Roosevelt and Washakie Wilderness. Contributions are minimal at these locations from the Federal coal and oil and gas, and never exceed more than 2 percent of the total deposition. Sulfur deposition is below the critical load of 5 kg S/ha-year over Montana. Visibility impacts are higher than 1 delta deciview at Northern Cheyenne Reservation, from impacts of the Federal coal sector (both Wyoming and Montana), the visibility impacts never exceed 1 delta deciview for other sectors. Note that a 1 delta deciview threshold is applicable to individual projects not regional resource management plans.

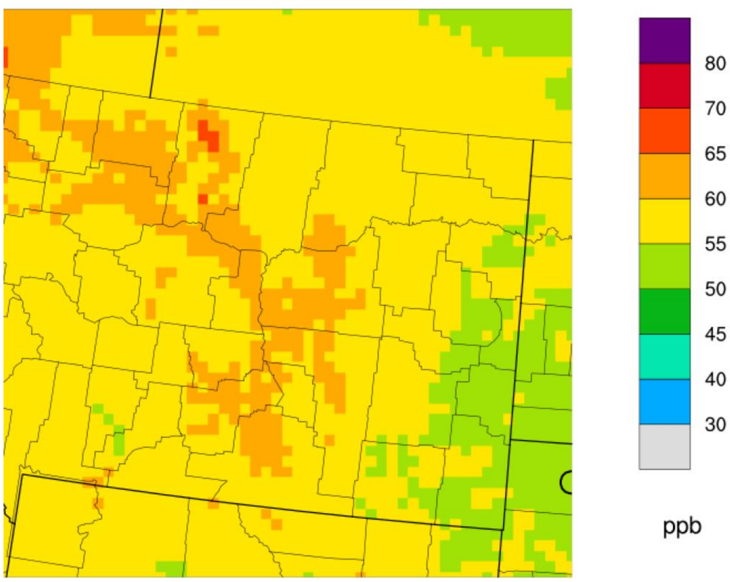

Figure 4-35. Modeled cumulative 4th highest daily maximum 8-hour ozone.

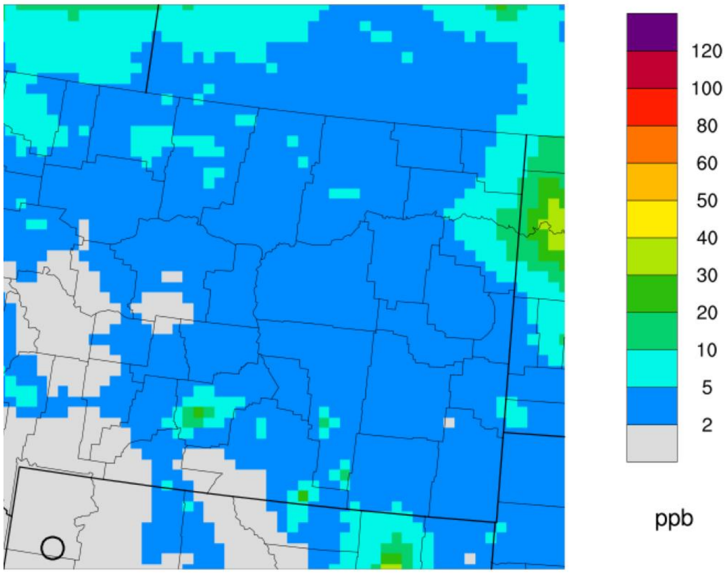

Figure 4-36. Modeled cumulative 8th highest daily maximum NO_2.

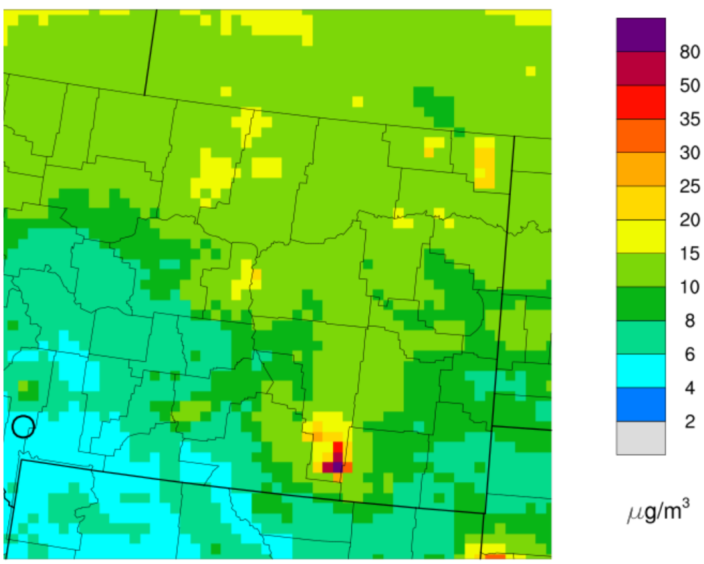

Figure 4-37. Modeled cumulative 8th highest daily $PM_{2.5}$.

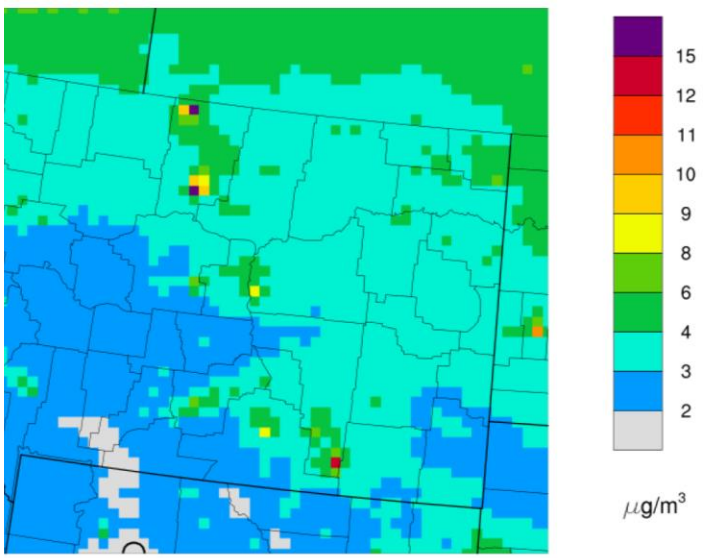

Figure 4-38. Modeled cumulative annual $PM_{2.5}$.

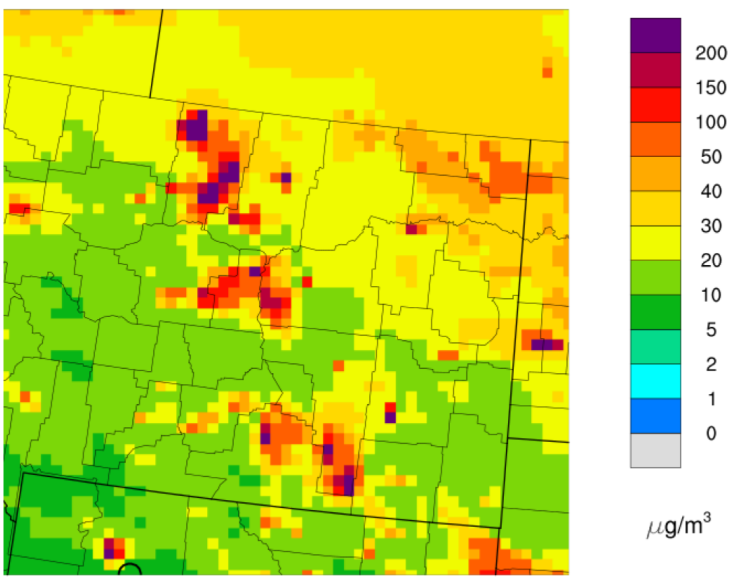

Figure 4-39. Modeled cumulative 2nd highest daily average PM_{10}.

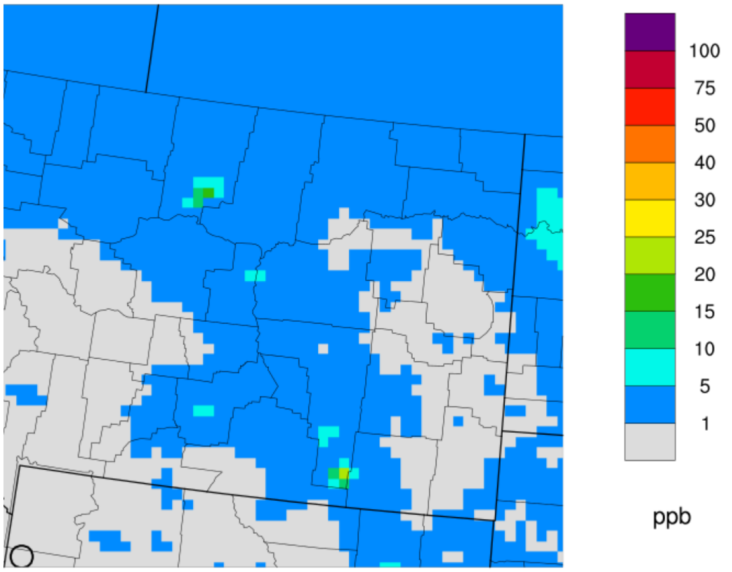

Figure 4-40. Modeled cumulative 4[th] highest 1-hour daily maximum SO_2.

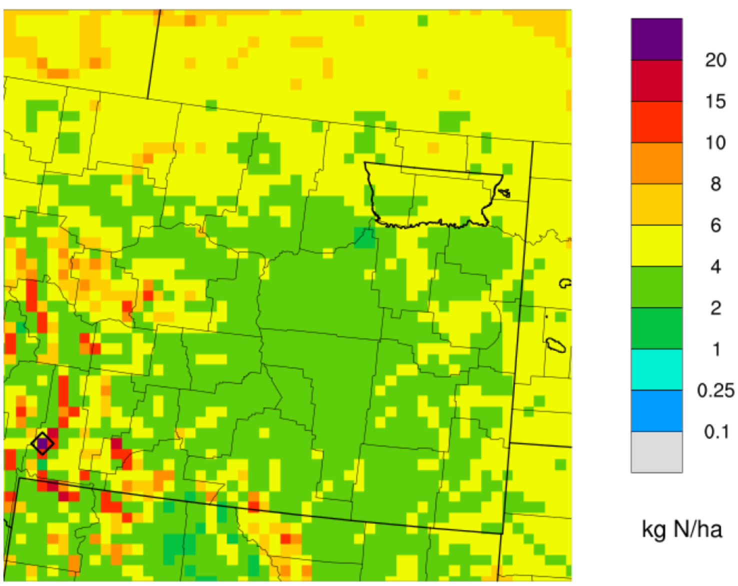

Figure 4-41. Modeled cumulative annual nitrogen deposition.

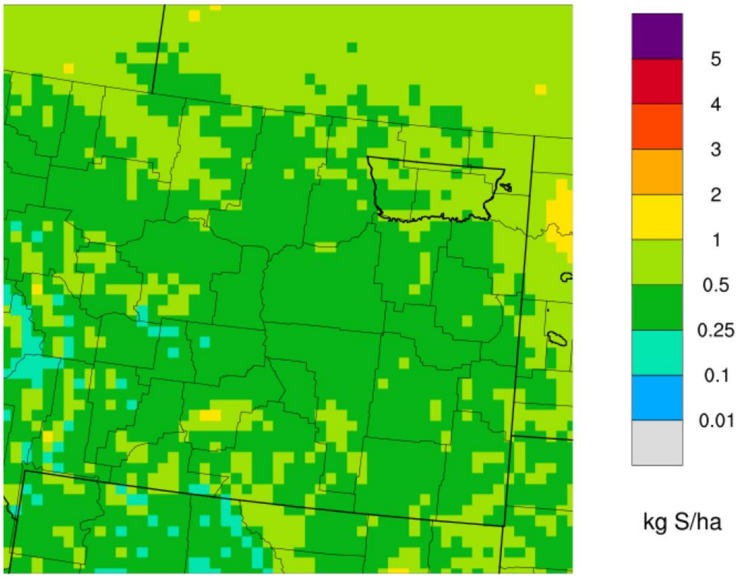

Figure 4-42. Modeled cumulative annual sulfur deposition.

4.3 Coal Emissions

4.3.1 Mining

Table 4-9. Federal criteria and hazardous air pollutant and precursor emissions from coal mining of existing federal and pending federal leases in the planning area under Alternatives A, B, and C for 2022 through 2038.

Year	Coal Production (million short tons per year)	PM_{10} (short tons)	$PM_{2.5}$ (short tons)	NOx (short tons)	CO (short tons)	VOC (short tons)	SO_2 (short tons)	HAPs (short tons)	DPM (short tons)
2022	11.05	1,519	279	1,047	878	77	21	7.70	34.78
2023	10.52	1,460	265	998	838	73	20	7.33	33.11
2024	10.93	1,506	276	1,037	869	76	21	7.62	34.41
2025	10.78	1,490	272	1,023	858	75	21	7.52	33.94
2026	10.67	1,477	269	1,012	849	74	20	7.44	33.57
2027	12.30	1,659	312	1,165	971	86	23	8.58	38.72
2028	9.32	1,326	234	886	749	65	18	6.50	29.33
2029	9.32	1,326	234	886	749	65	18	6.50	29.33
2030	9.01	1,292	225	857	726	63	17	6.28	28.35
2031	9.01	1,292	225	857	726	63	17	6.28	28.35
2032	8.63	1,249	215	821	697	60	17	6.01	27.16
2033	8.63	1,249	215	821	697	60	17	6.01	27.16
2034	8.63	1,249	215	821	697	60	17	6.01	27.16
2035	8.98	1,289	225	854	724	63	17	6.26	28.27
2036	8.97	1,288	224	853	723	63	17	6.26	28.24
2037	9.23	1,317	231	878	742	64	18	6.44	29.06
2038	9.23	1,317	231	878	742	64	18	6.44	29.06

Notes: PM_{10} =particulate matter with a diameter less than or equal to 10 microns; $PM_{2.5}$ =particulate matter with a diameter less than or equal to 2.5 microns; NOx = nitrogen oxides; CO = carbon monoxide; VOC = volatile organic compounds; SO_2 = sulfur dioxide; HAPs = hazardous air pollutants; DPM = Diesel particulate matter

Table 4-10. Nonfederal criteria and hazardous air pollutant and precursor emissions from coal mining in the planning area under Alternatives A, B, and C for 2022 through 2038.

Year	Coal Production (million short tons per year)	PM_{10} (short tons)	$PM_{2.5}$ (short tons)	NOx (short tons)	CO (short tons)	VOC (short tons)	SO_2 (short tons)	HAPs (short tons)	DPM (short tons)
2022	9.80	1,489	242	936	805	68	19	6.83	30.86
2023	10.27	1,542	254	980	840	72	20	7.16	32.34
2024	9.86	1,496	243	942	810	69	20	6.87	31.04
2025	7.94	1,282	193	762	667	55	16	5.54	25.00
2026	8.06	1,295	196	773	675	56	16	5.62	25.37
2027	6.42	1,112	153	620	553	45	13	4.48	20.22

Year	Coal Production (million short tons per year)	PM_{10} (short tons)	$PM_{2.5}$ (short tons)	NOx (short tons)	CO (short tons)	VOC (short tons)	SO_2 (short tons)	HAPs (short tons)	DPM (short tons)
2028	5.68	1,029	133	550	498	40	12	3.96	17.88
2029	5.68	1,029	133	550	498	40	12	3.96	17.88
2030	5.60	1,020	131	543	492	39	12	3.90	17.63
2031	5.60	1,020	131	543	492	39	12	3.90	17.63
2032	5.51	1,010	129	534	485	38	12	3.84	17.33
2033	5.51	1,010	129	534	485	38	12	3.84	17.33
2034	5.51	1,010	129	534	485	38	12	3.84	17.33
2035	5.15	970	120	501	458	36	11	3.59	16.22
2036	4.58	906	104	447	416	32	10	3.19	14.41
2037	4.32	877	98	423	396	30	10	3.01	13.59
2038	4.32	877	98	423	396	30	10	3.01	13.59

Notes: PM_{10} =particulate matter with a diameter less than or equal to 10 microns; $PM_{2.5}$ =particulate matter with a diameter less than or equal to 2.5 microns; NOx = nitrogen oxides; CO = carbon monoxide; VOC = volatile organic compounds; SO_2 = sulfur dioxide; HAPs = hazardous air pollutants; DPM = Diesel particulate matter

Table 4-11. Criteria and hazardous air pollutant and precursor emissions from mining of federal existing, federal pending, and nonfederal leases in the planning area under Alternatives A, B, and C for 2022 through 2038.

Year	Coal Production (million short tons per year)	PM_{10} (short tons)	$PM_{2.5}$ (short tons)	NOx (short tons)	CO (short tons)	VOC (short tons)	SO_2 (short tons)	HAPs (short tons)	DPM (short tons)
2022	20.85	3,009	521	1,984	1,683	145	40	14.54	65.63
2023	20.79	3,002	519	1,978	1,679	145	40	14.49	65.45
2024	20.79	3,002	519	1,978	1,679	145	40	14.49	65.45
2025	18.72	2,771	465	1,785	1,524	131	37	13.05	58.94
2026	18.72	2,771	465	1,785	1,524	131	37	13.05	58.94
2027	18.72	2,771	465	1,785	1,524	131	37	13.05	58.94
2028	15.00	2,355	367	1,436	1,247	105	30	10.46	47.21
2029	15.00	2,355	367	1,436	1,247	105	30	10.46	47.21
2030	14.61	2,312	357	1,400	1,218	102	29	10.18	45.98
2031	14.61	2,312	357	1,400	1,218	102	29	10.18	45.98
2032	14.13	2,259	344	1,355	1,182	99	29	9.85	44.49
2033	14.13	2,259	344	1,355	1,182	99	29	9.85	44.49
2034	14.13	2,259	344	1,355	1,182	99	29	9.85	44.49
2035	14.13	2,259	344	1,355	1,182	99	29	9.85	44.49
2036	13.55	2,194	329	1,300	1,139	94	28	9.45	42.65

Year	Coal Production (million short tons per year)	PM_{10} (short tons)	$PM_{2.5}$ (short tons)	NOx (short tons)	CO (short tons)	VOC (short tons)	SO_2 (short tons)	HAPs (short tons)	DPM (short tons)
2037	13.55	2,194	329	1,300	1,139	94	28	9.45	42.65
2038	13.55	2,194	329	1,300	1,139	94	28	9.45	42.65

Notes: PM_{10} =particulate matter with a diameter less than or equal to 10 microns; $PM_{2.5}$ =particulate matter with a diameter less than or equal to 2.5 microns; NOx = nitrogen oxides; CO = carbon monoxide; VOC = volatile organic compounds; SO_2 = sulfur dioxide; HAPs = hazardous air pollutants; DPM = Diesel particulate matter

Table 4-12. Federal criteria and hazardous air pollutant and precursor emissions from mining of coal from existing federal leases in the planning area under Alternative D for 2022 through 2038.

Year	Coal Production (million short tons per year)	PM_{10} (short tons)	$PM_{2.5}$ (short tons)	NOx (short tons)	CO (short tons)	VOC (short tons)	SO_2 (short tons)	HAPs (short tons)	DPM (short tons)
2022	11.05	1,519	279	945	446	77	8	7.70	34.78
2023	10.52	1,460	265	904	436	73	8	7.33	33.11
2024	10.93	1,506	276	934	443	76	8	7.62	34.41
2025	10.78	1,490	272	922	440	75	8	7.52	33.94
2026	10.67	1,477	269	912	437	74	8	7.44	33.57
2027	12.30	1,659	312	1,043	471	86	8	8.58	38.72
2028	9.32	1,326	234	804	409	65	8	6.50	29.33
2029	9.32	1,326	234	804	409	65	8	6.50	29.33
2030	9.01	1,292	225	780	403	63	8	6.28	28.35
2031	9.01	1,292	225	780	403	63	8	6.28	28.35
2032	8.63	1,249	215	743	391	60	8	6.01	27.16
2033	8.63	1,249	215	743	391	60	8	6.01	27.16
2034	8.63	1,249	215	743	391	60	8	6.01	27.16
2035	8.98	1,289	225	772	399	63	8	6.26	28.27
2036	2.96	617	66	291	275	21	7	2.06	9.32
2037	2.96	617	66	291	275	21	7	2.06	9.32
2038	2.96	617	66	929	436	21	8	2.06	9.32

Notes: PM_{10} =particulate matter with a diameter less than or equal to 10 microns; $PM_{2.5}$ =particulate matter with a diameter less than or equal to 2.5 microns; NOx = nitrogen oxides; CO = carbon monoxide; VOC = volatile organic compounds; SO_2 = sulfur dioxide; HAPs = hazardous air pollutants; DPM = Diesel particulate matter

Table 4-13. Non-federal criteria and hazardous air pollutant and precursor emissions from coal mining in the planning area under Alternative D for 2022 through 2038.

Year	Coal Production (million short tons per year)	PM_{10} (short tons)	$PM_{2.5}$ (short tons)	NOx (short tons)	CO (short tons)	VOC (short tons)	SO_2 (short tons)	HAPs (short tons)	DPM (short tons)
2022	9.80	1,489	242	936	805	68	19	6.83	30.86
2023	10.27	1,542	254	980	840	72	20	7.16	32.34
2024	9.86	1,496	243	942	810	69	20	6.87	31.04
2025	7.94	1,282	193	762	667	55	16	5.54	25.00
2026	8.06	1,295	196	773	675	56	16	5.62	25.37
2027	6.42	1,112	153	620	553	45	13	4.48	20.22
2028	5.68	1,029	133	550	498	40	12	3.96	17.88
2029	5.68	1,029	133	550	498	40	12	3.96	17.88
2030	5.60	1,020	131	543	492	39	12	3.90	17.63
2031	5.60	1,020	131	543	492	39	12	3.90	17.63
2032	5.51	1,010	129	534	485	38	12	3.84	17.33
2033	5.51	1,010	129	534	485	38	12	3.84	17.33
2034	5.51	1,010	129	534	485	38	12	3.84	17.33
2035	5.15	970	120	501	458	36	11	3.59	16.22
2036	4.09	851	92	402	379	29	9	2.85	12.87
2037	4.09	851	92	402	379	29	9	2.85	12.87
2038	4.09	851	92	402	379	29	9	2.85	12.87

Notes: PM_{10} =particulate matter with a diameter less than or equal to 10 microns; $PM_{2.5}$ =particulate matter with a diameter less than or equal to 2.5 microns; NOx = nitrogen oxides; CO = carbon monoxide; VOC = volatile organic compounds; SO_2 = sulfur dioxide; HAPs = hazardous air pollutants; DPM = Diesel particulate matter

Table 4-14. Total criteria and hazardous air pollutant and precursor emissions from mining of existing federal leases and nonfederal leases in the planning area under Alternative D for 2022 through 2038.

Year	Coal Production (million short tons per year)	PM_{10} (short tons)	$PM_{2.5}$ (short tons)	NOx (short tons)	CO (short tons)	VOC (short tons)	SO_2 (short tons)	HAPs (short tons)	DPM (short tons)
2022	20.85	3,009	521	1,984	1,683	145	40	14.54	65.63
2023	20.79	3,002	519	1,978	1,679	145	40	14.49	65.45
2024	20.79	3,002	519	1,978	1,679	145	40	14.49	65.45
2025	18.72	2,771	465	1,785	1,524	131	37	13.05	58.94
2026	18.72	2,771	465	1,785	1,524	131	37	13.05	58.94
2027	18.72	2,771	465	1,785	1,524	131	37	13.05	58.94
2028	15.00	2,355	367	1,436	1,247	105	30	10.46	47.21
2029	15.00	2,355	367	1,436	1,247	105	30	10.46	47.21
2030	14.61	2,312	357	1,400	1,218	102	29	10.18	45.98

Year	Coal Production (million short tons per year)	PM_{10} (short tons)	$PM_{2.5}$ (short tons)	NOx (short tons)	CO (short tons)	VOC (short tons)	SO_2 (short tons)	HAPs (short tons)	DPM (short tons)
2031	14.61	2,312	357	1,400	1,218	102	29	10.18	45.98
2032	14.13	2,259	344	1,355	1,182	99	29	9.85	44.49
2033	14.13	2,259	344	1,355	1,182	99	29	9.85	44.49
2034	14.13	2,259	344	1,355	1,182	99	29	9.85	44.49
2035	14.13	2,259	344	1,355	1,182	99	29	9.85	44.49
2036	7.05	1,468	158	692	654	49	16	4.92	22.19
2037	7.05	1,468	158	692	654	49	16	4.92	22.19
2038	7.05	1,468	158	692	654	49	16	4.92	22.19

Notes: PM_{10} =particulate matter with a diameter less than or equal to 10 microns; $PM_{2.5}$ =particulate matter with a diameter less than or equal to 2.5 microns; NOx = nitrogen oxides; CO = carbon monoxide; VOC = volatile organic compounds; SO_2 = sulfur dioxide; HAPs = hazardous air pollutants; DPM = Diesel particulate matter

Table 4-15. Federal greenhouse gas emissions from mining of coal from existing and pending federal under Alternatives A, B, and C for 2022 through 2038.

Year	Coal Production (million short tons per year)	CO_2 (metric tons)	CH_4 (metric tons)	N_2O (metric tons)	20-yr CO_2e (metric tons)	100-yr CO_2e (metric tons)
2022	11.05	86,908	1,619	64	238,004	152,706
2023	10.52	82,746	1,541	61	226,607	145,393
2024	10.93	85,989	1,601	64	235,487	151,091
2025	10.78	84,824	1,580	63	232,298	149,045
2026	10.67	83,906	1,563	62	229,783	147,431
2027	12.30	96,763	1,802	72	264,992	170,022
2028	9.32	73,310	1,365	54	200,765	128,813
2029	9.32	73,310	1,365	54	200,765	128,813
2030	9.01	70,861	1,320	52	194,059	124,510
2031	9.01	70,861	1,320	52	194,059	124,510
2032	8.63	67,867	1,264	50	185,859	119,249
2033	8.63	67,867	1,264	50	185,859	119,249
2034	8.63	67,867	1,264	50	185,859	119,249
2035	8.98	70,653	1,316	52	193,488	124,144
2036	8.97	70,584	1,315	52	193,299	124,022
2037	9.23	72,628	1,353	54	198,899	127,615
2038	9.23	72,628	1,353	54	198,899	127,615

Notes: CO_2 = carbon dioxide; CH_4 = methane; N_2O = nitrous oxide; CO_2e = carbon dioxide equivalents; 20-year time horizon global warming potentials (GWPs) applied to calculate CO_2e from the Intergovernmental Panel on Climate Change (IPCC) Sixth Assessment Report (AR6): CO_2 = 1; CH_4 = 82.5; N_2O = 273. 100-year time horizon GWPs applied to calculate CO_2e from the IPCC AR6: CO_2 = 1; CH_4 = 29.8; N_2O = 273.

Table 4-16. Non-federal greenhouse gas emissions from mining activities under Alternatives A, B, and C for 2022 through 2038.

Year	Coal Production (million short tons per year)	CO_2 (metric tons)	CH_4 (metric tons)	N_2O (metric tons)	20-yr CO_2e (metric tons)	100-yr CO_2e (metric tons)
2022	9.80	77,111	1,436	57	211,175	135,492
2023	10.27	80,811	1,505	60	221,308	141,994
2024	9.86	77,569	1,445	57	212,428	136,296
2025	7.94	62,475	1,164	46	171,093	109,775
2026	8.06	63,393	1,181	47	173,608	111,388
2027	6.42	50,537	941	37	138,398	88,798
2028	5.68	44,673	832	33	122,342	78,496
2029	5.68	44,673	832	33	122,342	78,496
2030	5.60	44,061	821	33	120,665	77,420
2031	5.60	44,061	821	33	120,665	77,420
2032	5.51	43,313	807	32	118,615	76,105
2033	5.51	43,313	807	32	118,615	76,105
2034	5.51	43,313	807	32	118,615	76,105
2035	5.15	40,527	755	30	110,986	71,210
2036	4.58	36,004	671	27	98,600	63,263
2037	4.32	33,959	632	25	93,000	59,669
2038	4.32	33,959	632	25	93,000	59,669

Notes: CO_2 = carbon dioxide; CH_4 = methane; N_2O = nitrous oxide; CO_2e = carbon dioxide equivalents; 20-year time horizon global warming potentials (GWPs) applied to calculate CO_2e from the Intergovernmental Panel on Climate Change (IPCC) Sixth Assessment Report (AR6): CO_2 = 1; CH_4 = 82.5; N_2O = 273. 100-year time horizon GWPs applied to calculate CO_2e from the IPCC AR6: CO_2 = 1; CH_4 = 29.8; N_2O = 273.

Table 4-17. Total greenhouse gas emissions from mining of coal from existing and pending federal leases and nonfederal leases under Alternatives A, B, and C for 2022 through 2038.

Year	Coal Production (million short tons per year)	CO_2 (metric tons)	CH_4 (metric tons)	N_2O (metric tons)	20-yr CO_2e (metric tons)	100-yr CO_2e (metric tons)
2022	20.85	164,019	3,055	121	449,179	288,198
2023	20.79	163,557	3,046	121	447,915	287,387
2024	20.79	163,557	3,046	121	447,915	287,387
2025	18.72	147,299	2,743	109	403,391	258,819
2026	18.72	147,299	2,743	109	403,391	258,819
2027	18.72	147,299	2,743	109	403,391	258,819
2028	15.00	117,984	2,197	87	323,107	207,309
2029	15.00	117,984	2,197	87	323,107	207,309
2030	14.61	114,922	2,140	85	314,724	201,930
2031	14.61	114,922	2,140	85	314,724	201,930

Year	Coal Production (million short tons per year)	CO_2 (metric tons)	CH_4 (metric tons)	N_2O (metric tons)	20-yr CO_2e (metric tons)	100-yr CO_2e (metric tons)
2032	14.13	111,179	2,071	82	304,474	195,353
2033	14.13	111,179	2,071	82	304,474	195,353
2034	14.13	111,179	2,071	82	304,474	195,353
2035	14.13	111,179	2,071	82	304,474	195,353
2036	13.55	106,588	1,985	79	291,898	187,285
2037	13.55	106,588	1,985	79	291,898	187,285
2038	13.55	106,588	1,985	79	291,898	187,285

Notes: CO_2 = carbon dioxide; CH_4 = methane; N_2O = nitrous oxide; CO_2e = carbon dioxide equivalents; 20-year time horizon global warming potentials (GWPs) applied to calculate CO_2e from the Intergovernmental Panel on Climate Change (IPCC) Sixth Assessment Report (AR6): CO_2 = 1; CH_4 = 82.5; N_2O = 273. 100-year time horizon GWPs applied to calculate CO_2e from the IPCC AR6: CO_2 = 1; CH_4 = 29.8; N_2O = 273.

Table 4-18. Federal greenhouse gas emissions from mining of existing federal leases under Alternative D for 2022 through 2038.

Year	Coal Production (million short tons per year)	CO_2 (metric tons)	CH_4 (metric tons)	N_2O (metric tons)	20-yr CO_2e (metric tons)	100-yr CO_2e (metric tons)
2022	11.05	86,908	1,619	64	238,004	152,706
2023	10.52	82,746	1,541	61	226,607	145,393
2024	10.93	85,989	1,601	64	235,487	151,091
2025	10.78	84,824	1,580	63	232,298	149,045
2026	10.67	83,906	1,563	62	229,783	147,431
2027	12.30	96,763	1,802	72	264,992	170,022
2028	9.32	73,310	1,365	54	200,765	128,813
2029	9.32	73,310	1,365	54	200,765	128,813
2030	9.01	70,861	1,320	52	194,059	124,510
2031	9.01	70,861	1,320	52	194,059	124,510
2032	8.63	67,867	1,264	50	185,859	119,249
2033	8.63	67,867	1,264	50	185,859	119,249
2034	8.63	67,867	1,264	50	185,859	119,249
2035	8.98	70,653	1,316	52	193,488	124,144
2036	2.96	23,295	434	17	63,796	40,932
2037	2.96	23,295	434	17	63,796	40,932
2038	2.96	23,295	434	17	63,796	40,932

Notes: CO_2 = carbon dioxide; CH_4 = methane; N_2O = nitrous oxide; CO_2e = carbon dioxide equivalents; 20-year time horizon global warming potentials (GWPs) applied to calculate CO_2e from the Intergovernmental Panel on Climate Change (IPCC) Sixth Assessment Report (AR6): CO_2 = 1; CH_4 = 82.5; N_2O = 273. 100-year time horizon GWPs applied to calculate CO_2e from the IPCC AR6: CO_2 = 1; CH_4 = 29.8; N_2O = 273.

Table 4-19. Non-federal greenhouse gas emissions from mining activities under Alternative D for 2022 through 2038.

Year	Coal Production (million short tons per year)	CO_2 (metric tons)	CH_4 (metric tons)	N_2O (metric tons)	20-yr CO_2e (metric tons)	100-yr CO_2e (metric tons)
2022	9.80	77,111	1,436	57	211,175	135,492
2023	10.27	80,811	1,505	60	221,308	141,994
2024	9.86	77,569	1,445	57	212,428	136,296
2025	7.94	62,475	1,164	46	171,093	109,775
2026	8.06	63,393	1,181	47	173,608	111,388
2027	6.42	50,537	941	37	138,398	88,798
2028	5.68	44,673	832	33	122,342	78,496
2029	5.68	44,673	832	33	122,342	78,496
2030	5.60	44,061	821	33	120,665	77,420
2031	5.60	44,061	821	33	120,665	77,420
2032	5.51	43,313	807	32	118,615	76,105
2033	5.51	43,313	807	32	118,615	76,105
2034	5.51	43,313	807	32	118,615	76,105
2035	5.15	40,527	755	30	110,986	71,210
2036	4.09	32,170	599	24	88,099	56,526
2037	4.09	32,170	599	24	88,099	56,526
2038	4.09	32,170	599	24	88,099	56,526

Notes: CO_2 = carbon dioxide; CH_4 = methane; N_2O = nitrous oxide; CO_2e = carbon dioxide equivalents; 20-year time horizon global warming potentials (GWPs) applied to calculate CO_2e from the Intergovernmental Panel on Climate Change (IPCC) Sixth Assessment Report (AR6): CO_2 = 1; CH_4 = 82.5; N_2O = 273. 100-year time horizon GWPs applied to calculate CO_2e from the IPCC AR6: CO_2 = 1; CH_4 = 29.8; N_2O = 273.

Table 4-20. Total greenhouse gas emissions from mining of existing federal leases and nonfederal leases under Alternative D for 2022 through 2038.

Year	Coal Production (million short tons per year)	CO_2 (metric tons)	CH_4 (metric tons)	N_2O (metric tons)	20-yr CO_2e (metric tons)	100-yr CO_2e (metric tons)
2022	11.05	86,908	1,619	64	238,004	152,706
2023	10.52	82,746	1,541	61	226,607	145,393
2024	10.93	85,989	1,601	64	235,487	151,091
2025	10.78	84,824	1,580	63	232,298	149,045
2026	10.67	83,906	1,563	62	229,783	147,431
2027	12.30	96,763	1,802	72	264,992	170,022
2028	9.32	73,310	1,365	54	200,765	128,813
2029	9.32	73,310	1,365	54	200,765	128,813
2030	9.01	70,861	1,320	52	194,059	124,510
2031	9.01	70,861	1,320	52	194,059	124,510

Year	Coal Production (million short tons per year)	CO_2 (metric tons)	CH_4 (metric tons)	N_2O (metric tons)	20-yr CO_2e (metric tons)	100-yr CO_2e (metric tons)
2032	8.63	67,867	1,264	50	185,859	119,249
2033	8.63	67,867	1,264	50	185,859	119,249
2034	8.63	67,867	1,264	50	185,859	119,249
2035	8.98	70,653	1,316	52	193,488	124,144
2036	8.97	70,584	1,315	52	193,299	124,022
2037	9.23	72,628	1,353	54	198,899	127,615
2038	9.23	72,628	1,353	54	198,899	127,615

Notes: CO_2 = carbon dioxide; CH_4 = methane; N_2O = nitrous oxide; CO_2e = carbon dioxide equivalents; 20-year time horizon global warming potentials (GWPs) applied to calculate CO_2e from the Intergovernmental Panel on Climate Change (IPCC) Sixth Assessment Report (AR6): CO_2 = 1; CH_4 = 82.5; N_2O = 273. 100-year time horizon GWPs applied to calculate CO_2e from the IPCC AR6: CO_2 = 1; CH_4 = 29.8; N_2O = 273.

4.3.2 Transportation

Table 4-21. 2023-2038 Federal criteria air pollutant and total hazardous air pollutant emissions from the rail transportation of coal produced from existing federal and pending federal leases at Spring Creek Mine under Alternatives A, B, and C (short tons).

Year	NO_x	PM_{10}	$PM_{2.5}$	VOC	SO_2	CO	Total HAPs
2023	2,631.1	59.3	57.5	103.6	2.8	799.0	45.7
2024	2,609.8	56.2	54.5	102.0	3.0	842.6	45.0
2025	2,456.7	53.1	51.5	94.9	3.0	847.6	41.9
2026	2,262.2	49.1	47.7	89.7	2.9	834.9	39.6
2027	2,586.9	55.8	54.1	100.6	3.6	1,012.0	44.4
2028	1,600.4	34.1	33.1	60.7	2.3	666.0	26.8
2029	1,498.3	29.2	28.3	57.7	2.3	666.0	25.4
2030	1,349.7	25.7	25.0	53.1	2.3	644.3	23.4
2031	1,249.9	25.6	24.9	47.8	2.3	644.3	21.1
2032	1,105.0	21.8	21.1	42.4	2.1	606.8	18.7
2033	1,032.8	19.5	18.9	39.7	2.1	606.8	17.5
2034	960.6	17.1	16.6	37.0	2.1	606.8	16.3
2035	943.9	18.0	17.4	36.5	2.3	644.7	16.1
2036	916.8	16.0	15.5	34.7	2.3	664.0	15.3
2037	900.0	16.6	16.1	35.8	2.4	692.7	15.8
2038	845.8	14.0	13.6	33.1	2.4	692.7	14.5
Total	**24,949.8**	**511.0**	**495.7**	**969.3**	**40.4**	**11,471.2**	**427.3**

Notes: NOx = Nitrogen Oxides; PM10 = Particulate matter less than 10 microns; PM2.5 = Particulate matter less than 2.5 microns; VOC = Volatile Organic Compounds; SO2 = Sulfur Dioxide; CO = Carbon Monoxide.

Table 4-22. 2023-2038 nonfederal criteria air pollutant and total hazardous air pollutant emissions from the rail transportation of coal produced at Spring Creek Mine under Alternatives A, B, and C (short tons).

Year	NO_x	PM_{10}	$PM_{2.5}$	VOC	SO_2	CO	Total HAPs
2023	2,152.8	48.5	47.0	84.7	2.3	653.7	37.4
2024	1,889.9	40.7	39.5	73.9	2.1	610.2	32.6
2025	1,210.0	26.1	25.3	46.7	1.5	417.5	20.6
2026	1,165.4	25.3	24.6	46.2	1.5	430.1	20.4
2027	646.7	13.9	13.5	25.2	0.9	253.0	11.1
2028	400.1	8.5	8.3	15.2	0.6	166.5	6.7
2029	374.6	7.3	7.1	14.4	0.6	166.5	6.4
2030	337.4	6.4	6.2	13.3	0.6	161.1	5.8
2031	312.5	6.4	6.2	11.9	0.6	161.1	5.3
2032	276.2	5.4	5.3	10.6	0.5	151.7	4.7
2033	258.2	4.9	4.7	9.9	0.5	151.7	4.4
2034	240.1	4.3	4.2	9.2	0.5	151.7	4.1
2035	166.6	3.2	3.1	6.4	0.4	113.8	2.8
2036	74.3	1.3	1.3	2.8	0.2	53.8	1.2
2037	32.6	0.6	0.6	1.3	0.1	25.1	0.6
2038	30.7	0.5	0.5	1.2	0.1	25.1	0.5
Total	**9,568.1**	**203.4**	**197.3**	**373.1**	**13.0**	**3,692.6**	**164.5**

Notes: NOx = Nitrogen Oxides; PM10 = Particulate matter less than 10 microns; PM2.5 = Particulate matter less than 2.5 microns; VOC = Volatile Organic Compounds; SO2 = Sulfur Dioxide; CO = Carbon Monoxide.

Table 4-23. 2023-2038 federal hazardous air pollutant emissions from the rail transportation of coal produced from existing federal and pending federal leases at Spring Creek Mine under Alternatives A, B, and C(pounds) – Part 1.

Year	1,2,3,4,6,7,8-Heptachlorodibenzofuran	1,2,3,4,6,7,8-Heptachlorodibenzo-p-Dioxin	1,2,3,4,7,8-Hexachlorodibenzofuran	1,2,3,6,7,8-Hexachlorodibenzofuran	1,2,3,6,7,8-Hexachlorodibenzo-p-Dioxin	1,2,3,7,8,9-Hexachlorodibenzofuran	1,2,3,7,8,9-Hexachlorodibenzo-p-Dioxin	1,2,3,7,8-Pentachlorodibenzofuran	1,3-Butadiene	2,2,4-Trimethylpentane	2,3,4,7,8-Pentachlorodibenzofuran	2,3,7,8-Tetrachlorodibenzofuran	2,3,7,8-Tetrachlorodibenzo-p-Dioxin	Acenaphthene	Acenaphthylene
2023	2.9E-04	5.6E-04	1.1E-04	5.7E-05	1.4E-05	4.1E-05	6.4E-05	1.9E-04	3.9E+02	1.5E+03	3.0E-04	8.8E-04	3.0E-05	7.9E+01	1.0E+02
2024	2.8E-04	5.3E-04	1.0E-04	5.4E-05	1.3E-05	3.9E-05	6.1E-05	1.8E-04	3.8E+02	1.5E+03	2.8E-04	8.3E-04	2.8E-05	7.7E+01	1.0E+02
2025	2.6E-04	5.0E-04	9.7E-05	5.1E-05	1.2E-05	3.7E-05	5.8E-05	1.7E-04	3.5E+02	1.4E+03	2.7E-04	7.8E-04	2.7E-05	7.2E+01	9.4E+01
2026	2.4E-04	4.7E-04	9.0E-05	4.7E-05	1.2E-05	3.4E-05	5.3E-05	1.5E-04	3.3E+02	1.3E+03	2.5E-04	7.2E-04	2.5E-05	6.8E+01	8.9E+01
2027	2.7E-04	5.3E-04	1.0E-04	5.4E-05	1.3E-05	3.8E-05	6.0E-05	1.8E-04	3.7E+02	1.4E+03	2.8E-04	8.2E-04	2.8E-05	7.6E+01	1.0E+02
2028	1.7E-04	3.2E-04	6.2E-05	3.3E-05	8.0E-06	2.3E-05	3.7E-05	1.1E-04	2.3E+02	8.6E+02	1.7E-04	5.0E-04	1.7E-05	4.6E+01	6.0E+01
2029	1.4E-04	2.7E-04	5.3E-05	2.8E-05	6.8E-06	2.0E-05	3.1E-05	9.1E-05	2.1E+02	8.2E+02	1.5E-04	4.3E-04	1.5E-05	4.4E+01	5.7E+01
2030	1.3E-04	2.4E-04	4.7E-05	2.5E-05	6.0E-06	1.8E-05	2.8E-05	8.0E-05	2.0E+02	7.6E+02	1.3E-04	3.8E-04	1.3E-05	4.0E+01	5.3E+01
2031	1.3E-04	2.4E-04	4.6E-05	2.5E-05	6.0E-06	1.8E-05	2.8E-05	8.0E-05	1.8E+02	6.8E+02	1.3E-04	3.8E-04	1.3E-05	3.6E+01	4.7E+01
2032	1.1E-04	2.0E-04	3.9E-05	2.1E-05	5.1E-06	1.5E-05	2.3E-05	6.8E-05	1.6E+02	6.0E+02	1.1E-04	3.2E-04	1.1E-05	3.2E+01	4.2E+01
2033	9.5E-05	1.8E-04	3.5E-05	1.9E-05	4.5E-06	1.3E-05	2.1E-05	6.1E-05	1.5E+02	5.7E+02	9.7E-05	2.8E-04	9.7E-06	3.0E+01	3.9E+01
2034	8.3E-05	1.6E-04	3.1E-05	1.6E-05	4.0E-06	1.2E-05	1.8E-05	5.3E-05	1.4E+02	5.3E+02	8.5E-05	2.5E-04	8.5E-06	2.8E+01	3.7E+01
2035	8.8E-05	1.7E-04	3.3E-05	1.7E-05	4.2E-06	1.2E-05	1.9E-05	5.6E-05	1.4E+02	5.2E+02	9.0E-05	2.6E-04	9.0E-06	2.8E+01	3.6E+01
2036	7.8E-05	1.5E-04	2.9E-05	1.5E-05	3.7E-06	1.1E-05	1.7E-05	5.0E-05	1.3E+02	4.9E+02	8.0E-05	2.3E-04	8.0E-06	2.6E+01	3.4E+01
2037	8.1E-05	1.6E-04	3.0E-05	1.6E-05	3.9E-06	1.1E-05	1.8E-05	5.2E-05	1.3E+02	5.1E+02	8.3E-05	2.4E-04	8.3E-06	2.7E+01	3.5E+01
2038	6.8E-05	1.3E-04	2.5E-05	1.3E-05	3.2E-06	9.5E-06	1.5E-05	4.4E-05	1.2E+02	4.7E+02	7.0E-05	2.0E-04	7.0E-06	2.5E+01	3.3E+01
Total	**2.5E-03**	**4.8E-03**	**9.3E-04**	**4.9E-04**	**1.2E-04**	**3.5E-04**	**5.5E-04**	**1.6E-03**	**3.6E+03**	**1.4E+04**	**2.6E-03**	**7.5E-03**	**2.6E-04**	**7.3E+02**	**9.6E+02**

Table 4-24. 2023-2038 federal hazardous air pollutant emissions from the rail transportation of coal produced from existing federal and pending federal leases at Spring Creek Mine under Alternatives A, B, and C(pounds) – Part 2.

Year	Acetaldehyde	Acrolein	Anthracene	Arsenic	Benz[a]Anthracene	Benzene	Benzo[a]Pyrene	Benzo[b]Fluoranthene	Benzo[g,h,i,]Perylene	Benzo[k]Fluoranthene	Chromium (VI)	Chrysene	Dibenzo[a,h]Anthracene	Ethyl Benzene	Fluoranthene
2023	1.6E+04	3.3E+03	1.1E+01	1.2E+02	1.0E+00	4.7E+03	2.4E-01	3.0E-01	4.2E-01	2.3E-01	5.8E-01	1.5E+00	1.1E-01	8.0E+02	1.2E+01
2024	1.6E+04	3.3E+03	1.1E+01	1.1E+02	9.5E-01	4.6E+03	2.3E-01	2.8E-01	4.0E-01	2.2E-01	5.5E-01	1.4E+00	1.1E-01	7.8E+02	1.2E+01
2025	1.5E+04	3.0E+03	1.0E+01	1.1E+02	9.0E-01	4.3E+03	2.2E-01	2.7E-01	3.8E-01	2.1E-01	5.2E-01	1.3E+00	9.9E-02	7.3E+02	1.1E+01
2026	1.4E+04	2.9E+03	9.4E+00	9.9E+01	8.3E-01	4.0E+03	2.0E-01	2.5E-01	3.5E-01	1.9E-01	4.8E-01	1.2E+00	9.2E-02	6.9E+02	1.0E+01
2027	1.6E+04	3.2E+03	1.1E+01	1.1E+02	9.5E-01	4.5E+03	2.3E-01	2.8E-01	4.0E-01	2.2E-01	5.4E-01	1.4E+00	1.0E-01	7.7E+02	1.2E+01
2028	9.5E+03	1.9E+03	6.5E+00	6.8E+01	5.8E-01	2.7E+03	1.4E-01	1.7E-01	2.5E-01	1.3E-01	3.3E-01	8.5E-01	6.4E-02	4.7E+02	7.1E+00
2029	9.0E+03	1.8E+03	5.6E+00	5.8E+01	5.0E-01	2.6E+03	1.2E-01	1.5E-01	2.1E-01	1.2E-01	2.8E-01	7.3E-01	5.5E-02	4.4E+02	6.1E+00
2030	8.3E+03	1.7E+03	5.0E+00	5.1E+01	4.4E-01	2.4E+03	1.1E-01	1.3E-01	1.9E-01	1.0E-01	2.5E-01	6.4E-01	4.8E-02	4.1E+02	5.4E+00
2031	7.5E+03	1.5E+03	4.9E+00	5.1E+01	4.4E-01	2.2E+03	1.1E-01	1.3E-01	1.8E-01	1.0E-01	2.5E-01	6.4E-01	4.8E-02	3.7E+02	5.3E+00
2032	6.6E+03	1.4E+03	4.2E+00	4.3E+01	3.7E-01	1.9E+03	9.0E-02	1.1E-01	1.6E-01	8.6E-02	2.1E-01	5.4E-01	4.1E-02	3.3E+02	4.5E+00
2033	6.2E+03	1.3E+03	3.8E+00	3.9E+01	3.3E-01	1.8E+03	8.1E-02	9.8E-02	1.4E-01	7.7E-02	1.9E-01	4.9E-01	3.6E-02	3.0E+02	4.1E+00
2034	5.8E+03	1.2E+03	3.3E+00	3.4E+01	2.9E-01	1.7E+03	7.1E-02	8.6E-02	1.2E-01	6.7E-02	1.6E-01	4.3E-01	3.2E-02	2.8E+02	3.6E+00
2035	5.7E+03	1.2E+03	3.5E+00	3.6E+01	3.1E-01	1.6E+03	7.4E-02	9.1E-02	1.3E-01	7.1E-02	1.7E-01	4.5E-01	3.4E-02	2.8E+02	3.7E+00
2036	5.4E+03	1.1E+03	3.1E+00	3.2E+01	2.7E-01	1.6E+03	6.6E-02	8.1E-02	1.2E-01	6.3E-02	1.5E-01	4.0E-01	3.0E-02	2.7E+02	3.4E+00
2037	5.6E+03	1.1E+03	3.2E+00	3.3E+01	2.8E-01	1.6E+03	6.9E-02	8.4E-02	1.2E-01	6.5E-02	1.6E-01	4.2E-01	3.1E-02	2.7E+02	3.5E+00
2038	5.2E+03	1.1E+03	2.7E+00	2.8E+01	2.4E-01	1.5E+03	5.8E-02	7.1E-02	1.0E-01	5.5E-02	1.3E-01	3.5E-01	2.6E-02	2.5E+02	2.9E+00
Total	**1.5E+05**	**3.1E+04**	**9.8E+01**	**1.0E+03**	**8.7E+00**	**4.4E+04**	**2.1E+00**	**2.6E+00**	**3.7E+00**	**2.0E+00**	**4.9E+00**	**1.3E+01**	**9.6E-01**	**7.4E+03**	**1.1E+02**

Table 4-25. 2023-2038 federal hazardous air pollutant emissions from the rail transportation of coal produced from existing federal and pending federal leases at Spring Creek Mine under Alternatives A, B, and C(pounds) – Part 3.

Year	Fluorene	Formaldehyde	Hexane	Indeno[1,2,3-c,d]Pyrene	Manganese	Mercury	Naphthalene	Nickel	Octachlorodibenzofuran	Octachlorodibenzo-p-Dioxin	Phenanthrene	Propionaldehyde	Pyrene	Toluene	Xylenes (Mixed Isomers)
2023	1.0E+02	4.6E+04	5.8E+02	1.8E-01	2.6E+02	2.2E-01	5.7E+02	4.5E+02	2.5E-04	2.2E-03	2.2E+02	8.0E+03	1.7E+01	4.5E+03	3.4E+03
2024	9.9E+01	4.5E+04	5.7E+02	1.7E-01	2.4E+02	2.2E-01	5.6E+02	4.2E+02	2.4E-04	2.1E-03	2.1E+02	7.9E+03	1.6E+01	4.4E+03	3.4E+03
2025	9.4E+01	4.2E+04	5.3E+02	1.6E-01	2.3E+02	2.0E-01	5.2E+02	4.0E+02	2.2E-04	1.9E-03	2.0E+02	7.3E+03	1.5E+01	4.1E+03	3.1E+03
2026	8.7E+01	4.0E+04	5.0E+02	1.5E-01	2.1E+02	1.9E-01	4.9E+02	3.7E+02	2.1E-04	1.8E-03	1.9E+02	6.9E+03	1.4E+01	3.9E+03	3.0E+03
2027	9.9E+01	4.5E+04	5.6E+02	1.7E-01	2.4E+02	2.2E-01	5.5E+02	4.2E+02	2.3E-04	2.0E-03	2.1E+02	7.8E+03	1.6E+01	4.3E+03	3.3E+03
2028	6.0E+01	2.7E+04	3.4E+02	1.0E-01	1.5E+02	1.3E-01	3.3E+02	2.6E+02	1.4E-04	1.2E-03	1.3E+02	4.7E+03	9.6E+00	2.6E+03	2.0E+03
2029	5.2E+01	2.6E+04	3.2E+02	8.7E-02	1.3E+02	1.2E-01	3.2E+02	2.2E+02	1.2E-04	1.1E-03	1.1E+02	4.5E+03	8.3E+00	2.5E+03	1.9E+03
2030	4.6E+01	2.4E+04	3.0E+02	7.6E-02	1.1E+02	1.0E-01	2.9E+02	1.9E+02	1.1E-04	9.3E-04	9.9E+01	4.1E+03	7.3E+00	2.3E+03	1.7E+03
2031	4.6E+01	2.1E+04	2.7E+02	7.6E-02	1.1E+02	1.0E-01	2.6E+02	1.9E+02	1.1E-04	9.3E-04	9.8E+01	3.7E+03	7.3E+00	2.1E+03	1.6E+03
2032	3.9E+01	1.9E+04	2.4E+02	6.5E-02	9.3E+01	8.7E-02	2.3E+02	1.6E+02	9.1E-05	7.9E-04	8.3E+01	3.3E+03	6.2E+00	1.8E+03	1.4E+03
2033	3.5E+01	1.8E+04	2.2E+02	5.8E-02	8.3E+01	8.0E-02	2.2E+02	1.5E+02	8.1E-05	7.1E-04	7.5E+01	3.1E+03	5.5E+00	1.7E+03	1.3E+03
2034	3.1E+01	1.6E+04	2.1E+02	5.1E-02	7.3E+01	7.1E-02	2.0E+02	1.3E+02	7.1E-05	6.2E-04	6.6E+01	2.9E+03	4.9E+00	1.6E+03	1.2E+03
2035	3.2E+01	1.6E+04	2.0E+02	5.3E-02	7.7E+01	7.2E-02	2.0E+02	1.3E+02	7.5E-05	6.5E-04	6.9E+01	2.8E+03	5.1E+00	1.6E+03	1.2E+03
2036	2.9E+01	1.5E+04	1.9E+02	4.8E-02	6.8E+01	6.6E-02	1.9E+02	1.2E+02	6.7E-05	5.8E-04	6.2E+01	2.7E+03	4.6E+00	1.5E+03	1.1E+03
2037	3.0E+01	1.6E+04	2.0E+02	4.9E-02	7.1E+01	6.7E-02	2.0E+02	1.2E+02	6.9E-05	6.0E-04	6.4E+01	2.8E+03	4.7E+00	1.5E+03	1.2E+03
2038	2.5E+01	1.5E+04	1.8E+02	4.2E-02	6.0E+01	5.8E-02	1.8E+02	1.0E+02	5.8E-05	5.1E-04	5.4E+01	2.6E+03	4.0E+00	1.4E+03	1.1E+03
Total	**9.1E+02**	**4.3E+05**	**5.4E+03**	**1.5E+00**	**2.2E+03**	**2.0E+00**	**5.3E+03**	**3.8E+03**	**2.1E-03**	**1.9E-02**	**2.0E+03**	**7.5E+04**	**1.4E+02**	**4.2E+04**	**3.2E+04**

Table 4-26. 2023-2038 nonfederal hazardous air pollutant emissions from the rail transportation of coal produced at Spring Creek Mine under Alternatives A, B, and C(pounds) – Part 1.

Year	1,2,3,4,6,7,8-Heptachlorodibenzofuran	1,2,3,4,6,7,8-Heptachlorodibenzo-p-Dioxin	1,2,3,4,7,8-Hexachlorodibenzofuran	1,2,3,6,7,8-Hexachlorodibenzofuran	1,2,3,6,7,8-Hexachlorodibenzo-p-Dioxin	1,2,3,7,8,9-Hexachlorodibenzofuran	1,2,3,7,8,9-Hexachlorodibenzo-p-Dioxin	1,2,3,7,8-Pentachlorodibenzofuran	1,3-Butadiene	2,2,4-Trimethylpentane	2,3,4,7,8-Pentachlorodibenzofuran	2,3,7,8-Tetrachlorodibenzofuran	2,3,7,8-Tetrachlorodibenzo-p-Dioxin	Acenaphthene	Acenaphthylene
2023	2.4E-04	4.6E-04	8.9E-05	4.7E-05	1.1E-05	3.3E-05	5.3E-05	1.5E-04	3.2E+02	1.2E+03	2.4E-04	7.2E-04	2.5E-05	6.4E+01	8.4E+01
2024	2.0E-04	3.9E-04	7.4E-05	3.9E-05	9.6E-06	2.8E-05	4.4E-05	1.3E-04	2.7E+02	1.1E+03	2.0E-04	6.0E-04	2.1E-05	5.6E+01	7.3E+01
2025	1.3E-04	2.5E-04	4.8E-05	2.5E-05	6.1E-06	1.8E-05	2.8E-05	8.2E-05	1.7E+02	6.7E+02	1.3E-04	3.9E-04	1.3E-05	3.5E+01	4.6E+01
2026	1.2E-04	2.4E-04	4.6E-05	2.4E-05	5.9E-06	1.7E-05	2.7E-05	8.0E-05	1.7E+02	6.6E+02	1.3E-04	3.7E-04	1.3E-05	3.5E+01	4.6E+01
2027	6.8E-05	1.3E-04	2.5E-05	1.3E-05	3.3E-06	9.6E-06	1.5E-05	4.4E-05	9.4E+01	3.6E+02	7.0E-05	2.1E-04	7.0E-06	1.9E+01	2.5E+01
2028	4.2E-05	8.1E-05	1.6E-05	8.2E-06	2.0E-06	5.9E-06	9.2E-06	2.7E-05	5.6E+01	2.2E+02	4.3E-05	1.3E-04	4.3E-06	1.2E+01	1.5E+01
2029	3.6E-05	6.9E-05	1.3E-05	7.0E-06	1.7E-06	5.0E-06	7.9E-06	2.3E-05	5.4E+01	2.1E+02	3.6E-05	1.1E-04	3.7E-06	1.1E+01	1.4E+01
2030	3.1E-05	6.1E-05	1.2E-05	6.1E-06	1.5E-06	4.4E-06	6.9E-06	2.0E-05	4.9E+01	1.9E+02	3.2E-05	9.4E-05	3.2E-06	1.0E+01	1.3E+01
2031	3.1E-05	6.0E-05	1.2E-05	6.1E-06	1.5E-06	4.4E-06	6.9E-06	2.0E-05	4.4E+01	1.7E+02	3.2E-05	9.4E-05	3.2E-06	9.1E+00	1.2E+01
2032	2.7E-05	5.1E-05	9.9E-06	5.2E-06	1.3E-06	3.7E-06	5.9E-06	1.7E-05	3.9E+01	1.5E+02	2.7E-05	8.0E-05	2.7E-06	8.0E+00	1.0E+01
2033	2.4E-05	4.6E-05	8.8E-06	4.6E-06	1.1E-06	3.3E-06	5.2E-06	1.5E-05	3.7E+01	1.4E+02	2.4E-05	7.1E-05	2.4E-06	7.5E+00	9.8E+00
2034	2.1E-05	4.0E-05	7.7E-06	4.1E-06	9.9E-07	2.9E-06	4.6E-06	1.3E-05	3.4E+01	1.3E+02	2.1E-05	6.2E-05	2.1E-06	7.0E+00	9.2E+00
2035	1.5E-05	3.0E-05	5.7E-06	3.0E-06	7.4E-07	2.2E-06	3.4E-06	9.9E-06	2.4E+01	9.2E+01	1.6E-05	4.6E-05	1.6E-06	4.9E+00	6.4E+00
2036	6.3E-06	1.2E-05	2.3E-06	1.2E-06	3.0E-07	8.8E-07	1.4E-06	4.0E-06	1.0E+01	4.0E+01	6.5E-06	1.9E-05	6.5E-07	2.1E+00	2.8E+00
2037	2.9E-06	5.7E-06	1.1E-06	5.8E-07	1.4E-07	4.1E-07	6.5E-07	1.9E-06	4.8E+00	1.8E+01	3.0E-06	8.8E-06	3.0E-07	9.8E-01	1.3E+00
2038	2.5E-06	4.8E-06	9.1E-07	4.8E-07	1.2E-07	3.4E-07	5.4E-07	1.6E-06	4.5E+00	1.7E+01	2.5E-06	7.4E-06	2.5E-07	9.1E-01	1.2E+00
Total	**1.0E-03**	**1.9E-03**	**3.7E-04**	**2.0E-04**	**4.8E-05**	**1.4E-04**	**2.2E-04**	**6.4E-04**	**1.4E+03**	**5.3E+03**	**1.0E-03**	**3.0E-03**	**1.0E-04**	**2.8E+02**	**3.7E+02**

Table 4-27. 2023-2038 nonfederal hazardous air pollutant emissions from the rail transportation of coal produced at Spring Creek Mine under Alternatives A, B, and C(pounds) – Part 2.

Year	Acetaldehyde	Acrolein	Anthracene	Arsenic	Benz[a]Anthracene	Benzene	Benzo[a]Pyrene	Benzo[b]Fluoranthene	Benzo[g,h,i,]Perylene	Benzo[k]Fluoranthene	Chromium (VI)	Chrysene	Dibenzo[a,h]Anthracene	Ethyl Benzene	Fluoranthene
2023	1.3E+04	2.7E+03	9.2E+00	9.8E+01	8.2E-01	3.8E+03	2.0E-01	2.4E-01	3.5E-01	1.9E-01	4.7E-01	1.2E+00	9.1E-02	6.5E+02	1.0E+01
2024	1.2E+04	2.4E+03	7.8E+00	8.2E+01	6.9E-01	3.3E+03	1.7E-01	2.1E-01	2.9E-01	1.6E-01	4.0E-01	1.0E+00	7.6E-02	5.7E+02	8.4E+00
2025	7.3E+03	1.5E+03	5.0E+00	5.3E+01	4.4E-01	2.1E+03	1.1E-01	1.3E-01	1.9E-01	1.0E-01	2.5E-01	6.5E-01	4.9E-02	3.6E+02	5.4E+00
2026	7.2E+03	1.5E+03	4.8E+00	5.1E+01	4.3E-01	2.1E+03	1.0E-01	1.3E-01	1.8E-01	1.0E-01	2.5E-01	6.3E-01	4.7E-02	3.6E+02	5.2E+00
2027	3.9E+03	8.0E+02	2.7E+00	2.8E+01	2.4E-01	1.1E+03	5.8E-02	7.0E-02	1.0E-01	5.5E-02	1.4E-01	3.5E-01	2.6E-02	1.9E+02	2.9E+00
2028	2.4E+03	4.9E+02	1.6E+00	1.7E+01	1.4E-01	6.8E+02	3.5E-02	4.3E-02	6.1E-02	3.4E-02	8.3E-02	2.1E-01	1.6E-02	1.2E+02	1.8E+00
2029	2.3E+03	4.6E+02	1.4E+00	1.5E+01	1.2E-01	6.5E+02	3.0E-02	3.7E-02	5.3E-02	2.9E-02	7.0E-02	1.8E-01	1.4E-02	1.1E+02	1.5E+00
2030	2.1E+03	4.2E+02	1.2E+00	1.3E+01	1.1E-01	6.0E+02	2.7E-02	3.2E-02	4.6E-02	2.5E-02	6.2E-02	1.6E-01	1.2E-02	1.0E+02	1.3E+00
2031	1.9E+03	3.8E+02	1.2E+00	1.3E+01	1.1E-01	5.4E+02	2.6E-02	3.2E-02	4.6E-02	2.5E-02	6.2E-02	1.6E-01	1.2E-02	9.2E+01	1.3E+00
2032	1.7E+03	3.4E+02	1.0E+00	1.1E+01	9.3E-02	4.8E+02	2.2E-02	2.7E-02	3.9E-02	2.1E-02	5.3E-02	1.4E-01	1.0E-02	8.1E+01	1.1E+00
2033	1.6E+03	3.2E+02	9.4E-01	9.7E+00	8.3E-02	4.5E+02	2.0E-02	2.5E-02	3.5E-02	1.9E-02	4.7E-02	1.2E-01	9.1E-03	7.6E+01	1.0E+00
2034	1.4E+03	3.0E+02	8.3E-01	8.5E+00	7.3E-02	4.2E+02	1.8E-02	2.2E-02	3.1E-02	1.7E-02	4.1E-02	1.1E-01	8.0E-03	7.1E+01	9.0E-01
2035	1.0E+03	2.1E+02	6.1E-01	6.3E+00	5.4E-02	2.9E+02	1.3E-02	1.6E-02	2.3E-02	1.2E-02	3.1E-02	7.9E-02	5.9E-03	5.0E+01	6.6E-01
2036	4.4E+02	9.0E+01	2.5E-01	2.6E+00	2.2E-02	1.3E+02	5.4E-03	6.6E-03	9.4E-03	5.1E-03	1.2E-02	3.3E-02	2.4E-03	2.2E+01	2.7E-01
2037	2.0E+02	4.2E+01	1.2E-01	1.2E+00	1.0E-02	5.8E+01	2.5E-03	3.0E-03	4.3E-03	2.4E-03	5.8E-03	1.5E-02	1.1E-03	1.0E+01	1.3E-01
2038	1.9E+02	3.8E+01	9.8E-02	1.0E+00	8.7E-03	5.4E+01	2.1E-03	2.6E-03	3.7E-03	2.0E-03	4.9E-03	1.3E-02	9.5E-04	9.2E+00	1.1E-01
Total	**5.8E+04**	**1.2E+04**	**3.9E+01**	**4.1E+02**	**3.4E+00**	**1.7E+04**	**8.4E-01**	**1.0E+00**	**1.5E+00**	**8.0E-01**	**2.0E+00**	**5.1E+00**	**3.8E-01**	**2.9E+03**	**4.2E+01**

Table 4-28. 2023-2038 nonfederal hazardous air pollutant emissions from the rail transportation of coal produced at Spring Creek Mine under Alternative A, B, AND C (pounds) – Part 3.

Year	Fluorene	Formaldehyde	Hexane	Indeno[1,2,3-c,d]Pyrene	Manganese	Mercury	Naphthalene	Nickel	Octachlorodibenzofuran	Octachlorodibenzo-p-Dioxin	Phenanthrene	Propionaldehyde	Pyrene	Toluene	Xylenes (Mixed Isomers)
2023	8.5E+01	3.8E+04	4.7E+02	1.4E-01	2.1E+02	1.8E-01	4.6E+02	3.7E+02	2.0E-04	1.8E-03	1.8E+02	6.5E+03	1.4E+01	3.6E+03	2.8E+03
2024	7.2E+01	3.3E+04	4.1E+02	1.2E-01	1.8E+02	1.6E-01	4.0E+02	3.1E+02	1.7E-04	1.5E-03	1.5E+02	5.7E+03	1.1E+01	3.2E+03	2.4E+03
2025	4.6E+01	2.1E+04	2.6E+02	7.8E-02	1.1E+02	1.0E-01	2.6E+02	2.0E+02	1.1E-04	9.6E-04	9.9E+01	3.6E+03	7.4E+00	2.0E+03	1.5E+03
2026	4.5E+01	2.1E+04	2.6E+02	7.5E-02	1.1E+02	9.7E-02	2.5E+02	1.9E+02	1.1E-04	9.3E-04	9.6E+01	3.6E+03	7.1E+00	2.0E+03	1.5E+03
2027	2.5E+01	1.1E+04	1.4E+02	4.1E-02	6.0E+01	5.4E-02	1.4E+02	1.1E+02	5.9E-05	5.1E-04	5.3E+01	1.9E+03	3.9E+00	1.1E+03	8.3E+02
2028	1.5E+01	6.8E+03	8.5E+01	2.5E-02	3.7E+01	3.3E-02	8.3E+01	6.4E+01	3.6E-05	3.1E-04	3.2E+01	1.2E+03	2.4E+00	6.5E+02	5.0E+02
2029	1.3E+01	6.4E+03	8.1E+01	2.2E-02	3.1E+01	2.9E-02	7.9E+01	5.5E+01	3.1E-05	2.7E-04	2.8E+01	1.1E+03	2.1E+00	6.2E+02	4.7E+02
2030	1.1E+01	5.9E+03	7.4E+01	1.9E-02	2.8E+01	2.6E-02	7.2E+01	4.8E+01	2.7E-05	2.3E-04	2.5E+01	1.0E+03	1.8E+00	5.7E+02	4.4E+02
2031	1.1E+01	5.3E+03	6.7E+01	1.9E-02	2.8E+01	2.6E-02	6.5E+01	4.8E+01	2.7E-05	2.3E-04	2.5E+01	9.2E+02	1.8E+00	5.1E+02	3.9E+02
2032	9.7E+00	4.7E+03	5.9E+01	1.6E-02	2.3E+01	2.2E-02	5.8E+01	4.1E+01	2.3E-05	2.0E-04	2.1E+01	8.2E+02	1.5E+00	4.6E+02	3.5E+02
2033	8.7E+00	4.4E+03	5.5E+01	1.4E-02	2.1E+01	2.0E-02	5.4E+01	3.6E+01	2.0E-05	1.8E-04	1.9E+01	7.7E+02	1.4E+00	4.3E+02	3.3E+02
2034	7.7E+00	4.1E+03	5.2E+01	1.3E-02	1.8E+01	1.8E-02	5.0E+01	3.2E+01	1.8E-05	1.5E-04	1.6E+01	7.1E+02	1.2E+00	4.0E+02	3.0E+02
2035	5.6E+00	2.9E+03	3.6E+01	9.4E-03	1.4E+01	1.3E-02	3.5E+01	2.4E+01	1.3E-05	1.2E-04	1.2E+01	5.0E+02	9.0E-01	2.8E+02	2.1E+02
2036	2.3E+00	1.3E+03	1.6E+01	3.9E-03	5.6E+00	5.3E-03	1.5E+01	9.7E+00	5.4E-06	4.7E-05	5.0E+00	2.2E+02	3.7E-01	1.2E+02	9.2E+01
2037	1.1E+00	5.8E+02	7.2E+00	1.8E-03	2.6E+00	2.4E-03	7.1E+00	4.5E+00	2.5E-06	2.2E-05	2.3E+00	1.0E+02	1.7E-01	5.6E+01	4.3E+01
2038	9.1E-01	5.3E+02	6.7E+00	1.5E-03	2.2E+00	2.1E-03	6.5E+00	3.8E+00	2.1E-06	1.8E-05	2.0E+00	9.3E+01	1.5E-01	5.2E+01	3.9E+01
Total	**3.6E+02**	**1.7E+05**	**2.1E+03**	**6.0E-01**	**8.8E+02**	**7.9E-01**	**2.0E+03**	**1.5E+03**	**8.6E-04**	**7.4E-03**	**7.7E+02**	**2.9E+04**	**5.7E+01**	**1.6E+04**	**1.2E+04**

Table 4-29. 2023-2038 federal greenhouse gas emissions from the rail transportation of coal produced from existing federal and pending federal leases at Spring Creek Mine under Alternatives A, B, and C (metric tons).

Year	CO_2	CH_4	N_2O	20-year GWP CO_2e	100-year GWP CO_2e
2023	277,671.1	21.8	7.0	281,367.5	280,220.6
2024	292,816.8	22.9	7.3	296,714.8	295,505.4
2025	294,548.4	23.1	7.4	298,469.4	297,252.9
2026	290,152.2	22.7	7.3	294,014.6	292,816.3
2027	351,699.6	27.6	8.8	356,381.4	354,928.8
2028	231,447.5	18.1	5.8	234,528.5	233,572.6
2029	231,447.5	18.1	5.8	234,528.5	233,572.6
2030	223,900.5	17.5	5.6	226,881.1	225,956.3
2031	223,900.5	17.5	5.6	226,881.1	225,956.3
2032	210,873.6	16.5	5.3	213,680.7	212,809.8
2033	210,873.6	16.5	5.3	213,680.7	212,809.8
2034	210,873.6	16.5	5.3	213,680.7	212,809.8
2035	224,053.2	17.6	5.6	227,035.8	226,110.4
2036	230,733.3	18.1	5.8	230,733.3	230,733.3
2037	240,711.0	18.9	6.0	240,711.0	240,711.0
2038	240,711.0	18.9	6.0	240,711.0	240,711.0
Total	**3,986,413.3**	**312.4**	**100.0**	**4,030,000.0**	**4,016,477.0**

Notes: CO_2 = carbon dioxide; CH_4 = methane; N_2O = nitrous oxide; CO_2e = carbon dioxide equivalents. 20-year time horizon global warming potentials (GWPs) applied to calculate CO_2e from the Intergovernmental Panel on Climate Change (IPCC) Sixth Assessment Report (AR6): CO_2 = 1; CH_4 = 82.5; N_2O = 273. 100-year time horizon GWPs applied to calculate CO_2e from the IPCC AR6: CO_2 = 1; CH_4 = 29.8; N_2O = 273.

Table 4-30. 2023-2038 nonfederal greenhouse gas emissions from the rail transportation of coal produced at Spring Creek Mine under Alternatives A, B, and C(metric tons).

Year	CO_2	CH_4	N_2O	20-year GWP CO_2e	100-year GWP CO_2e
2023	227,185.5	17.8	5.7	230,209.7	229,271.4
2024	212,039.8	16.6	5.3	214,862.4	213,986.7
2025	145,076.1	11.4	3.6	147,007.3	146,408.1
2026	149,472.3	11.7	3.7	151,462.1	150,844.8
2027	87,924.9	6.9	2.2	89,095.3	88,732.2
2028	57,861.9	4.5	1.5	58,632.1	58,393.1
2029	57,861.9	4.5	1.5	58,632.1	58,393.1
2030	55,975.1	4.4	1.4	56,720.3	56,489.1
2031	55,975.1	4.4	1.4	56,720.3	56,489.1
2032	52,718.4	4.1	1.3	53,420.2	53,202.4

Year	CO_2	CH_4	N_2O	20-year GWP CO_2e	100-year GWP CO_2e
2033	52,718.4	4.1	1.3	53,420.2	53,202.4
2034	52,718.4	4.1	1.3	53,420.2	53,202.4
2035	39,538.8	3.1	1.0	40,065.1	39,901.8
2036	18,708.1	1.5	0.5	18,708.1	18,708.1
2037	8,730.5	0.7	0.2	8,730.5	8,730.5
2038	8,730.5	0.7	0.2	8,730.5	8,730.5
Total	**1,283,235.5**	**100.6**	**32.2**	**1,299,836.4**	**1,294,685.9**

Notes: CO_2 = carbon dioxide; CH_4 = methane; N_2O = nitrous oxide; CO_2e = carbon dioxide equivalents. 20-year time horizon global warming potentials (GWPs) applied to calculate CO_2e from the Intergovernmental Panel on Climate Change (IPCC) Sixth Assessment Report (AR6): CO_2 = 1; CH_4 = 82.5; N_2O = 273. 100-year time horizon GWPs applied to calculate CO_2e from the IPCC AR6: CO_2 = 1; CH_4 = 29.8; N_2O = 273.

Table 4-31. 2023-2038 federal criteria air pollutant and total hazardous air pollutant emissions from the transportation of coal produced in the planning area from existing federal leases at Spring Creek Mine under Alternative D (short tons).

Year	NO_x	PM_{10}	$PM_{2.5}$	VOC	SO_2	CO	Total HAPs
2023	2,631.1	59.3	57.5	103.6	2.8	799.0	45.7
2024	2,609.8	56.2	54.5	102.0	3.0	842.6	45.0
2025	2,456.7	53.1	51.5	94.9	3.0	847.6	41.9
2026	2,262.2	49.1	47.7	89.7	2.9	834.9	39.6
2027	2,586.9	55.8	54.1	100.6	3.6	1,012.0	44.4
2028	1,600.4	34.1	33.1	60.7	2.3	666.0	26.8
2029	1,498.3	29.2	28.3	57.7	2.3	666.0	25.4
2030	1,349.7	25.7	25.0	53.1	2.3	644.3	23.4
2031	1,249.9	25.6	24.9	47.8	2.3	644.3	21.1
2032	1,105.0	21.8	21.1	42.4	2.1	606.8	18.7
2033	1,032.8	19.5	18.9	39.7	2.1	606.8	17.5
2034	960.6	17.1	16.6	37.0	2.1	606.8	16.3
2035	943.9	18.0	17.4	36.5	2.3	644.7	16.1
2036	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2037	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2038	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total	**22,287.3**	**464.4**	**450.5**	**865.8**	**33.2**	**9,421.9**	**381.8**

Notes: NOx = Nitrogen Oxides; PM10 = Particulate matter less than 10 microns; PM2.5 = Particulate matter less than 2.5 microns; VOC = Volatile Organic Compounds; SO2 = Sulfur Dioxide; CO = Carbon Monoxide.

Table 4-32. 2023-2038 nonfederal criteria air pollutant and total hazardous air pollutant emissions from the transportation of coal produced from Spring Creek Mine under Alternative D (short tons).

Year	NO_x	PM_{10}	$PM_{2.5}$	VOC	SO_2	CO	Total HAPs
2023	2,152.8	48.5	47.0	84.7	2.3	2,152.8	37.4
2024	1,889.9	40.7	39.5	73.9	2.1	1,889.9	32.6
2025	1,210.0	26.1	25.3	46.7	1.5	1,210.0	20.6
2026	1,165.4	25.3	24.6	46.2	1.5	1,165.4	20.4
2027	646.7	13.9	13.5	25.2	0.9	646.7	11.1
2028	400.1	8.5	8.3	15.2	0.6	400.1	6.7
2029	374.6	7.3	7.1	14.4	0.6	374.6	6.4
2030	337.4	6.4	6.2	13.3	0.6	337.4	5.8
2031	312.5	6.4	6.2	11.9	0.6	312.5	5.3
2032	276.2	5.4	5.3	10.6	0.5	276.2	4.7
2033	258.2	4.9	4.7	9.9	0.5	258.2	4.4
2034	240.1	4.3	4.2	9.2	0.5	240.1	4.1
2035	166.6	3.2	3.1	6.4	0.4	166.6	2.8
2036	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2037	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2038	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total	**9,430.5**	**201.0**	**195.0**	**367.8**	**12.6**	**3,588.5**	**162.2**

Notes: NOx = Nitrogen Oxides; PM10 = Particulate matter less than 10 microns; PM2.5 = Particulate matter less than 2.5 microns; VOC = Volatile Organic Compounds; SO2 = Sulfur Dioxide; CO = Carbon Monoxide.

Table 4-33. 2023-2038 federal hazardous air pollutant emissions from the transportation of coal produced from existing federal leases at Spring Creek Mine under for Alternative D (pounds) – Part 1.

Year	1,2,3,4,6,7,8-Heptachlorodibenzofuran	1,2,3,4,6,7,8-Heptachlorodibenzo-p-Dioxin	1,2,3,4,7,8-Hexachlorodibenzofuran	1,2,3,6,7,8-Hexachlorodibenzofuran	1,2,3,6,7,8-Hexachlorodibenzo-p-Dioxin	1,2,3,7,8,9-Hexachlorodibenzofuran	1,2,3,7,8,9-Hexachlorodibenzo-p-Dioxin	1,2,3,7,8-Pentachlorodibenzofuran	1,3-Butadiene	2,2,4-Trimethylpentane	2,3,4,7,8-Pentachlorodibenzofuran	2,3,7,8-Tetrachlorodibenzofuran	2,3,7,8-Tetrachlorodibenzo-p-Dioxin	Acenaphthene	Acenaphthylene
2023	2.9E-04	5.6E-04	1.1E-04	5.7E-05	1.4E-05	4.1E-05	6.4E-05	1.9E-04	3.9E+02	1.5E+03	3.0E-04	8.8E-04	3.0E-05	7.9E+01	1.0E+02
2024	2.8E-04	5.3E-04	1.0E-04	5.4E-05	1.3E-05	3.9E-05	6.1E-05	1.8E-04	3.8E+02	1.5E+03	2.8E-04	8.3E-04	2.8E-05	7.7E+01	1.0E+02
2025	2.6E-04	5.0E-04	9.7E-05	5.1E-05	1.2E-05	3.7E-05	5.8E-05	1.7E-04	3.5E+02	1.4E+03	2.7E-04	7.8E-04	2.7E-05	7.2E+01	9.4E+01
2026	2.4E-04	4.7E-04	9.0E-05	4.7E-05	1.2E-05	3.4E-05	5.3E-05	1.5E-04	3.3E+02	1.3E+03	2.5E-04	7.2E-04	2.5E-05	6.8E+01	8.9E+01
2027	2.7E-04	5.3E-04	1.0E-04	5.4E-05	1.3E-05	3.8E-05	6.0E-05	1.8E-04	3.7E+02	1.4E+03	2.8E-04	8.2E-04	2.8E-05	7.6E+01	1.0E+02
2028	1.7E-04	3.2E-04	6.2E-05	3.3E-05	8.0E-06	2.3E-05	3.7E-05	1.1E-04	2.3E+02	8.6E+02	1.7E-04	5.0E-04	1.7E-05	4.6E+01	6.0E+01
2029	1.4E-04	2.7E-04	5.3E-05	2.8E-05	6.8E-06	2.0E-05	3.1E-05	9.1E-05	2.1E+02	8.2E+02	1.5E-04	4.3E-04	1.5E-05	4.4E+01	5.7E+01
2030	1.3E-04	2.4E-04	4.7E-05	2.5E-05	6.0E-06	1.8E-05	2.8E-05	8.0E-05	2.0E+02	7.6E+02	1.3E-04	3.8E-04	1.3E-05	4.0E+01	5.3E+01
2031	1.3E-04	2.4E-04	4.6E-05	2.5E-05	6.0E-06	1.8E-05	2.8E-05	8.0E-05	1.8E+02	6.8E+02	1.3E-04	3.8E-04	1.3E-05	3.6E+01	4.7E+01
2032	1.1E-04	2.0E-04	3.9E-05	2.1E-05	5.1E-06	1.5E-05	2.3E-05	6.8E-05	1.6E+02	6.0E+02	1.1E-04	3.2E-04	1.1E-05	3.2E+01	4.2E+01
2033	9.5E-05	1.8E-04	3.5E-05	1.9E-05	4.5E-06	1.3E-05	2.1E-05	6.1E-05	1.5E+02	5.7E+02	9.7E-05	2.8E-04	9.7E-06	3.0E+01	3.9E+01
2034	8.3E-05	1.6E-04	3.1E-05	1.6E-05	4.0E-06	1.2E-05	1.8E-05	5.3E-05	1.4E+02	5.3E+02	8.5E-05	2.5E-04	8.5E-06	2.8E+01	3.7E+01
2035	8.8E-05	1.7E-04	3.3E-05	1.7E-05	4.2E-06	1.2E-05	1.9E-05	5.6E-05	1.4E+02	5.2E+02	9.0E-05	2.6E-04	9.0E-06	2.8E+01	3.6E+01
2036	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
2037	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
2038	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Total	**2.3E-03**	**4.4E-03**	**8.4E-04**	**4.5E-04**	**1.1E-04**	**3.2E-04**	**5.0E-04**	**1.5E-03**	**3.2E+03**	**1.2E+04**	**2.3E-03**	**6.8E-03**	**2.3E-04**	**6.6E+02**	**8.6E+02**

Table 4-34. 2023-2038 federal hazardous air pollutant emissions from the transportation of coal produced from existing federal leases at Spring Creek Mine under for Alternative D (pounds) – Part 2.

Year	Acetaldehyde	Acrolein	Anthracene	Arsenic	Benz[a]Anthracene	Benzene	Benzo[a]Pyrene	Benzo[b]Fluoranthene	Benzo[g,h,i,]Perylene	Benzo[k]Fluoranthene	Chromium (VI)	Chrysene	Dibenzo[a,h]Anthracene	Ethyl Benzene	Fluoranthene
2023	1.6E+04	3.3E+03	1.1E+01	1.2E+02	1.0E+00	4.7E+03	2.4E-01	3.0E-01	4.2E-01	2.3E-01	5.8E-01	1.5E+00	1.1E-01	8.0E+02	1.2E+01
2024	1.6E+04	3.3E+03	1.1E+01	1.1E+02	9.5E-01	4.6E+03	2.3E-01	2.8E-01	4.0E-01	2.2E-01	5.5E-01	1.4E+00	1.1E-01	7.8E+02	1.2E+01
2025	1.5E+04	3.0E+03	1.0E+01	1.1E+02	9.0E-01	4.3E+03	2.2E-01	2.7E-01	3.8E-01	2.1E-01	5.2E-01	1.3E+00	9.9E-02	7.3E+02	1.1E+01
2026	1.4E+04	2.9E+03	9.4E+00	9.9E+01	8.3E-01	4.0E+03	2.0E-01	2.5E-01	3.5E-01	1.9E-01	4.8E-01	1.2E+00	9.2E-02	6.9E+02	1.0E+01
2027	1.6E+04	3.2E+03	1.1E+01	1.1E+02	9.5E-01	4.5E+03	2.3E-01	2.8E-01	4.0E-01	2.2E-01	5.4E-01	1.4E+00	1.0E-01	7.7E+02	1.2E+01
2028	9.5E+03	1.9E+03	6.5E+00	6.8E+01	5.8E-01	2.7E+03	1.4E-01	1.7E-01	2.5E-01	1.3E-01	3.3E-01	8.5E-01	6.4E-02	4.7E+02	7.1E+00
2029	9.0E+03	1.8E+03	5.6E+00	5.8E+01	5.0E-01	2.6E+03	1.2E-01	1.5E-01	2.1E-01	1.2E-01	2.8E-01	7.3E-01	5.5E-02	4.4E+02	6.1E+00
2030	8.3E+03	1.7E+03	5.0E+00	5.1E+01	4.4E-01	2.4E+03	1.1E-01	1.3E-01	1.9E-01	1.0E-01	2.5E-01	6.4E-01	4.8E-02	4.1E+02	5.4E+00
2031	7.5E+03	1.5E+03	4.9E+00	5.1E+01	4.4E-01	2.2E+03	1.1E-01	1.3E-01	1.8E-01	1.0E-01	2.5E-01	6.4E-01	4.8E-02	3.7E+02	5.3E+00
2032	6.6E+03	1.4E+03	4.2E+00	4.3E+01	3.7E-01	1.9E+03	9.0E-02	1.1E-01	1.6E-01	8.6E-02	2.1E-01	5.4E-01	4.1E-02	3.3E+02	4.5E+00
2033	6.2E+03	1.3E+03	3.8E+00	3.9E+01	3.3E-01	1.8E+03	8.1E-02	9.8E-02	1.4E-01	7.7E-02	1.9E-01	4.9E-01	3.6E-02	3.0E+02	4.1E+00
2034	5.8E+03	1.2E+03	3.3E+00	3.4E+01	2.9E-01	1.7E+03	7.1E-02	8.6E-02	1.2E-01	6.7E-02	1.6E-01	4.3E-01	3.2E-02	2.8E+02	3.6E+00
2035	5.7E+03	1.2E+03	3.5E+00	3.6E+01	3.1E-01	1.6E+03	7.4E-02	9.1E-02	1.3E-01	7.1E-02	1.7E-01	4.5E-01	3.4E-02	2.8E+02	3.7E+00
2036	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
2037	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
2038	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Total	**1.4E+05**	**2.8E+04**	**8.9E+01**	**9.3E+02**	**7.9E+00**	**3.9E+04**	**1.9E+00**	**2.3E+00**	**3.3E+00**	**1.8E+00**	**4.5E+00**	**1.2E+01**	**8.7E-01**	**6.6E+03**	**9.7E+01**

Table 4-35. 2023-2038 federal hazardous air pollutant emissions from the transportation of coal produced from existing federal leases at Spring Creek Mine under for Alternative D (pounds) – Part 3.

Year	Fluorene	Formaldehyde	Hexane	Indeno[1,2,3-c,d]Pyrene	Manganese	Mercury	Naphthalene	Nickel	Octachlorodibenzofuran	Octachlorodibenzo-p-Dioxin	Phenanthrene	Propionaldehyde	Pyrene	Toluene	Xylenes (Mixed Isomers)
2023	1.0E+02	4.6E+04	5.8E+02	1.8E-01	2.6E+02	2.2E-01	5.7E+02	4.5E+02	2.5E-04	2.2E-03	2.2E+02	8.0E+03	1.7E+01	4.5E+03	3.4E+03
2024	9.9E+01	4.5E+04	5.7E+02	1.7E-01	2.4E+02	2.2E-01	5.6E+02	4.2E+02	2.4E-04	2.1E-03	2.1E+02	7.9E+03	1.6E+01	4.4E+03	3.4E+03
2025	9.4E+01	4.2E+04	5.3E+02	1.6E-01	2.3E+02	2.0E-01	5.2E+02	4.0E+02	2.2E-04	1.9E-03	2.0E+02	7.3E+03	1.5E+01	4.1E+03	3.1E+03
2026	8.7E+01	4.0E+04	5.0E+02	1.5E-01	2.1E+02	1.9E-01	4.9E+02	3.7E+02	2.1E-04	1.8E-03	1.9E+02	6.9E+03	1.4E+01	3.9E+03	3.0E+03
2027	9.9E+01	4.5E+04	5.6E+02	1.7E-01	2.4E+02	2.2E-01	5.5E+02	4.2E+02	2.3E-04	2.0E-03	2.1E+02	7.8E+03	1.6E+01	4.3E+03	3.3E+03
2028	6.0E+01	2.7E+04	3.4E+02	1.0E-01	1.5E+02	1.3E-01	3.3E+02	2.6E+02	1.4E-04	1.2E-03	1.3E+02	4.7E+03	9.6E+00	2.6E+03	2.0E+03
2029	5.2E+01	2.6E+04	3.2E+02	8.7E-02	1.3E+02	1.2E-01	3.2E+02	2.2E+02	1.2E-04	1.1E-03	1.1E+02	4.5E+03	8.3E+00	2.5E+03	1.9E+03
2030	4.6E+01	2.4E+04	3.0E+02	7.6E-02	1.1E+02	1.0E-01	2.9E+02	1.9E+02	1.1E-04	9.3E-04	9.9E+01	4.1E+03	7.3E+00	2.3E+03	1.7E+03
2031	4.6E+01	2.1E+04	2.7E+02	7.6E-02	1.1E+02	1.0E-01	2.6E+02	1.9E+02	1.1E-04	9.3E-04	9.8E+01	3.7E+03	7.3E+00	2.1E+03	1.6E+03
2032	3.9E+01	1.9E+04	2.4E+02	6.5E-02	9.3E+01	8.7E-02	2.3E+02	1.6E+02	9.1E-05	7.9E-04	8.3E+01	3.3E+03	6.2E+00	1.8E+03	1.4E+03
2033	3.5E+01	1.8E+04	2.2E+02	5.8E-02	8.3E+01	8.0E-02	2.2E+02	1.5E+02	8.1E-05	7.1E-04	7.5E+01	3.1E+03	5.5E+00	1.7E+03	1.3E+03
2034	3.1E+01	1.6E+04	2.1E+02	5.1E-02	7.3E+01	7.1E-02	2.0E+02	1.3E+02	7.1E-05	6.2E-04	6.6E+01	2.9E+03	4.9E+00	1.6E+03	1.2E+03
2035	3.2E+01	1.6E+04	2.0E+02	5.3E-02	7.7E+01	7.2E-02	2.0E+02	1.3E+02	7.5E-05	6.5E-04	6.9E+01	2.8E+03	5.1E+00	1.6E+03	1.2E+03
2036	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
2037	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
2038	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Total	**8.2E+02**	**3.9E+05**	**4.8E+03**	**1.4E+00**	**2.0E+03**	**1.8E+00**	**4.7E+03**	**3.5E+03**	**1.9E-03**	**1.7E-02**	**1.8E+03**	**6.7E+04**	**1.3E+02**	**3.7E+04**	**2.8E+04**

Table 4-36. 2023-2038 nonfederal hazardous air pollutant emissions from the transportation of coal produced in the planning area for Alternative D (pounds) – Part 1.

Year	1,2,3,4,6,7,8-Heptachlorodibenzofuran	1,2,3,4,6,7,8-Heptachlorodibenzo-p-Dioxin	1,2,3,4,7,8-Hexachlorodibenzofuran	1,2,3,6,7,8-Hexachlorodibenzofuran	1,2,3,6,7,8-Hexachlorodibenzo-p-Dioxin	1,2,3,7,8,9-Hexachlorodibenzofuran	1,2,3,7,8,9-Hexachlorodibenzo-p-Dioxin	1,2,3,7,8-Pentachlorodibenzofuran	1,3-Butadiene	2,2,4-Trimethylpentane	2,3,4,7,8-Pentachlorodibenzofuran	2,3,7,8-Tetrachlorodibenzofuran	2,3,7,8-Tetrachlorodibenzo-p-Dioxin	Acenaphthene	Acenaphthylene
2023	2.4E-04	4.6E-04	8.9E-05	4.7E-05	1.1E-05	3.3E-05	5.3E-05	1.5E-04	3.2E+02	1.2E+03	2.4E-04	7.2E-04	2.5E-05	6.4E+01	8.4E+01
2024	2.0E-04	3.9E-04	7.4E-05	3.9E-05	9.6E-06	2.8E-05	4.4E-05	1.3E-04	2.7E+02	1.1E+03	2.0E-04	6.0E-04	2.1E-05	5.6E+01	7.3E+01
2025	1.3E-04	2.5E-04	4.8E-05	2.5E-05	6.1E-06	1.8E-05	2.8E-05	8.2E-05	1.7E+02	6.7E+02	1.3E-04	3.9E-04	1.3E-05	3.5E+01	4.6E+01
2026	1.2E-04	2.4E-04	4.6E-05	2.4E-05	5.9E-06	1.7E-05	2.7E-05	8.0E-05	1.7E+02	6.6E+02	1.3E-04	3.7E-04	1.3E-05	3.5E+01	4.6E+01
2027	6.8E-05	1.3E-04	2.5E-05	1.3E-05	3.3E-06	9.6E-06	1.5E-05	4.4E-05	9.4E+01	3.6E+02	7.0E-05	2.1E-04	7.0E-06	1.9E+01	2.5E+01
2028	4.2E-05	8.1E-05	1.6E-05	8.2E-06	2.0E-06	5.9E-06	9.2E-06	2.7E-05	5.6E+01	2.2E+02	4.3E-05	1.3E-04	4.3E-06	1.2E+01	1.5E+01
2029	3.6E-05	6.9E-05	1.3E-05	7.0E-06	1.7E-06	5.0E-06	7.9E-06	2.3E-05	5.4E+01	2.1E+02	3.6E-05	1.1E-04	3.7E-06	1.1E+01	1.4E+01
2030	3.1E-05	6.1E-05	1.2E-05	6.1E-06	1.5E-06	4.4E-06	6.9E-06	2.0E-05	4.9E+01	1.9E+02	3.2E-05	9.4E-05	3.2E-06	1.0E+01	1.3E+01
2031	3.1E-05	6.0E-05	1.2E-05	6.1E-06	1.5E-06	4.4E-06	6.9E-06	2.0E-05	4.4E+01	1.7E+02	3.2E-05	9.4E-05	3.2E-06	9.1E+00	1.2E+01
2032	2.7E-05	5.1E-05	9.9E-06	5.2E-06	1.3E-06	3.7E-06	5.9E-06	1.7E-05	3.9E+01	1.5E+02	2.7E-05	8.0E-05	2.7E-06	8.0E+00	1.0E+01
2033	2.4E-05	4.6E-05	8.8E-06	4.6E-06	1.1E-06	3.3E-06	5.2E-06	1.5E-05	3.7E+01	1.4E+02	2.4E-05	7.1E-05	2.4E-06	7.5E+00	9.8E+00
2034	2.1E-05	4.0E-05	7.7E-06	4.1E-06	9.9E-07	2.9E-06	4.6E-06	1.3E-05	3.4E+01	1.3E+02	2.1E-05	6.2E-05	2.1E-06	7.0E+00	9.2E+00
2035	1.5E-05	3.0E-05	5.7E-06	3.0E-06	7.4E-07	2.2E-06	3.4E-06	9.9E-06	2.4E+01	9.2E+01	1.6E-05	4.6E-05	1.6E-06	4.9E+00	6.4E+00
2036	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
2037	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
2038	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Total	**9.9E-04**	**1.9E-03**	**3.7E-04**	**1.9E-04**	**4.7E-05**	**1.4E-04**	**2.2E-04**	**6.3E-04**	**1.4E+03**	**5.2E+03**	**1.0E-03**	**3.0E-03**	**1.0E-04**	**2.8E+02**	**3.6E+02**

Table 4-37. 2023-2038 nonfederal hazardous air pollutant emissions from the transportation of coal produced in the planning area for Alternative D (pounds) – Part 2.

Year	Acetaldehyde	Acrolein	Anthracene	Arsenic	Benz[a]Anthracene	Benzene	Benzo[a]Pyrene	Benzo[b]Fluoranthene	Benzo[g,h,i,]Perylene	Benzo[k]Fluoranthene	Chromium (VI)	Chrysene	Dibenzo[a,h]Anthracene	Ethyl Benzene	Fluoranthene
2023	1.3E+04	2.7E+03	9.2E+00	9.8E+01	8.2E-01	3.8E+03	2.0E-01	2.4E-01	3.5E-01	1.9E-01	4.7E-01	1.2E+00	9.1E-02	6.5E+02	1.0E+01
2024	1.2E+04	2.4E+03	7.8E+00	8.2E+01	6.9E-01	3.3E+03	1.7E-01	2.1E-01	2.9E-01	1.6E-01	4.0E-01	1.0E+00	7.6E-02	5.7E+02	8.4E+00
2025	7.3E+03	1.5E+03	5.0E+00	5.3E+01	4.4E-01	2.1E+03	1.1E-01	1.3E-01	1.9E-01	1.0E-01	2.5E-01	6.5E-01	4.9E-02	3.6E+02	5.4E+00
2026	7.2E+03	1.5E+03	4.8E+00	5.1E+01	4.3E-01	2.1E+03	1.0E-01	1.3E-01	1.8E-01	1.0E-01	2.5E-01	6.3E-01	4.7E-02	3.6E+02	5.2E+00
2027	3.9E+03	8.0E+02	2.7E+00	2.8E+01	2.4E-01	1.1E+03	5.8E-02	7.0E-02	1.0E-01	5.5E-02	1.4E-01	3.5E-01	2.6E-02	1.9E+02	2.9E+00
2028	2.4E+03	4.9E+02	1.6E+00	1.7E+01	1.4E-01	6.8E+02	3.5E-02	4.3E-02	6.1E-02	3.4E-02	8.3E-02	2.1E-01	1.6E-02	1.2E+02	1.8E+00
2029	2.3E+03	4.6E+02	1.4E+00	1.5E+01	1.2E-01	6.5E+02	3.0E-02	3.7E-02	5.3E-02	2.9E-02	7.0E-02	1.8E-01	1.4E-02	1.1E+02	1.5E+00
2030	2.1E+03	4.2E+02	1.2E+00	1.3E+01	1.1E-01	6.0E+02	2.7E-02	3.2E-02	4.6E-02	2.5E-02	6.2E-02	1.6E-01	1.2E-02	1.0E+02	1.3E+00
2031	1.9E+03	3.8E+02	1.2E+00	1.3E+01	1.1E-01	5.4E+02	2.6E-02	3.2E-02	4.6E-02	2.5E-02	6.2E-02	1.6E-01	1.2E-02	9.2E+01	1.3E+00
2032	1.7E+03	3.4E+02	1.0E+00	1.1E+01	9.3E-02	4.8E+02	2.2E-02	2.7E-02	3.9E-02	2.1E-02	5.3E-02	1.4E-01	1.0E-02	8.1E+01	1.1E+00
2033	1.6E+03	3.2E+02	9.4E-01	9.7E+00	8.3E-02	4.5E+02	2.0E-02	2.5E-02	3.5E-02	1.9E-02	4.7E-02	1.2E-01	9.1E-03	7.6E+01	1.0E+00
2034	1.4E+03	3.0E+02	8.3E-01	8.5E+00	7.3E-02	4.2E+02	1.8E-02	2.2E-02	3.1E-02	1.7E-02	4.1E-02	1.1E-01	8.0E-03	7.1E+01	9.0E-01
2035	1.0E+03	2.1E+02	6.1E-01	6.3E+00	5.4E-02	2.9E+02	1.3E-02	1.6E-02	2.3E-02	1.2E-02	3.1E-02	7.9E-02	5.9E-03	5.0E+01	6.6E-01
2036	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
2037	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
2038	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Total	**5.8E+04**	**1.2E+04**	**3.8E+01**	**4.0E+02**	**3.4E+00**	**1.7E+04**	**8.3E-01**	**1.0E+00**	**1.4E+00**	**7.9E-01**	**2.0E+00**	**5.0E+00**	**3.8E-01**	**2.8E+03**	**4.2E+01**

Table 4-38. 2023-2038 nonfederal hazardous air pollutant emissions from the transportation of coal produced in the planning area for Alternative D (pounds) – Part 3.

Year	Fluorene	Formaldehyde	Hexane	Indeno[1,2,3-c,d]Pyrene	Manganese	Mercury	Naphthalene	Nickel	Octachlorodibenzofuran	Octachlorodibenzo-p-Dioxin	Phenanthrene	Propionaldehyde	Pyrene	Toluene	Xylenes (Mixed Isomers)
2023	8.5E+01	3.8E+04	4.7E+02	1.4E-01	2.1E+02	1.8E-01	4.6E+02	3.7E+02	2.0E-04	1.8E-03	1.8E+02	6.5E+03	1.4E+01	3.6E+03	2.8E+03
2024	7.2E+01	3.3E+04	4.1E+02	1.2E-01	1.8E+02	1.6E-01	4.0E+02	3.1E+02	1.7E-04	1.5E-03	1.5E+02	5.7E+03	1.1E+01	3.2E+03	2.4E+03
2025	4.6E+01	2.1E+04	2.6E+02	7.8E-02	1.1E+02	1.0E-01	2.6E+02	2.0E+02	1.1E-04	9.6E-04	9.9E+01	3.6E+03	7.4E+00	2.0E+03	1.5E+03
2026	4.5E+01	2.1E+04	2.6E+02	7.5E-02	1.1E+02	9.7E-02	2.5E+02	1.9E+02	1.1E-04	9.3E-04	9.6E+01	3.6E+03	7.1E+00	2.0E+03	1.5E+03
2027	2.5E+01	1.1E+04	1.4E+02	4.1E-02	6.0E+01	5.4E-02	1.4E+02	1.1E+02	5.9E-05	5.1E-04	5.3E+01	1.9E+03	3.9E+00	1.1E+03	8.3E+02
2028	1.5E+01	6.8E+03	8.5E+01	2.5E-02	3.7E+01	3.3E-02	8.3E+01	6.4E+01	3.6E-05	3.1E-04	3.2E+01	1.2E+03	2.4E+00	6.5E+02	5.0E+02
2029	1.3E+01	6.4E+03	8.1E+01	2.2E-02	3.1E+01	2.9E-02	7.9E+01	5.5E+01	3.1E-05	2.7E-04	2.8E+01	1.1E+03	2.1E+00	6.2E+02	4.7E+02
2030	1.1E+01	5.9E+03	7.4E+01	1.9E-02	2.8E+01	2.6E-02	7.2E+01	4.8E+01	2.7E-05	2.3E-04	2.5E+01	1.0E+03	1.8E+00	5.7E+02	4.4E+02
2031	1.1E+01	5.3E+03	6.7E+01	1.9E-02	2.8E+01	2.6E-02	6.5E+01	4.8E+01	2.7E-05	2.3E-04	2.5E+01	9.2E+02	1.8E+00	5.1E+02	3.9E+02
2032	9.7E+00	4.7E+03	5.9E+01	1.6E-02	2.3E+01	2.2E-02	5.8E+01	4.1E+01	2.3E-05	2.0E-04	2.1E+01	8.2E+02	1.5E+00	4.6E+02	3.5E+02
2033	8.7E+00	4.4E+03	5.5E+01	1.4E-02	2.1E+01	2.0E-02	5.4E+01	3.6E+01	2.0E-05	1.8E-04	1.9E+01	7.7E+02	1.4E+00	4.3E+02	3.3E+02
2034	7.7E+00	4.1E+03	5.2E+01	1.3E-02	1.8E+01	1.8E-02	5.0E+01	3.2E+01	1.8E-05	1.5E-04	1.6E+01	7.1E+02	1.2E+00	4.0E+02	3.0E+02
2035	5.6E+00	2.9E+03	3.6E+01	9.4E-03	1.4E+01	1.3E-02	3.5E+01	2.4E+01	1.3E-05	1.2E-04	1.2E+01	5.0E+02	9.0E-01	2.8E+02	2.1E+02
2036	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
2037	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
2038	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Total	**3.6E+02**	**1.6E+05**	**2.1E+03**	**6.0E-01**	**8.7E+02**	**7.8E-01**	**2.0E+03**	**1.5E+03**	**8.5E-04**	**7.3E-03**	**7.7E+02**	**2.8E+04**	**5.7E+01**	**1.6E+04**	**1.2E+04**

Table 4-39. 2023-2038 federal greenhouse gas emissions from the transportation of coal produced from existing federal leases at Spring Creek Mine for Alternative D (metric tons).

Year	CO_2	CH_4	N_2O	20-year GWP CO_2e	100-year GWP CO_2e
2023	277,671.1	21.8	7.0	281,367.5	280,220.6
2024	292,816.8	22.9	7.3	296,714.8	295,505.4
2025	294,548.4	23.1	7.4	298,469.4	297,252.9
2026	290,152.2	22.7	7.3	294,014.6	292,816.3
2027	351,699.6	27.6	8.8	356,381.4	354,928.8
2028	231,447.5	18.1	5.8	234,528.5	233,572.6
2029	231,447.5	18.1	5.8	234,528.5	233,572.6
2030	223,900.5	17.5	5.6	226,881.1	225,956.3
2031	223,900.5	17.5	5.6	226,881.1	225,956.3
2032	210,873.6	16.5	5.3	213,680.7	212,809.8
2033	210,873.6	16.5	5.3	213,680.7	212,809.8
2034	210,873.6	16.5	5.3	213,680.7	212,809.8
2035	224,053.2	17.6	5.6	227,035.8	226,110.4
2036	0.0	0.0	0.0	0.0	0.0
2037	0.0	0.0	0.0	0.0	0.0
2038	0.0	0.0	0.0	0.0	0.0
Total	**3,274,258.0**	**256.6**	**82.1**	**3,317,844.6**	**3,304,321.6**

Notes: CO_2 = carbon dioxide; CH_4 = methane; N_2O = nitrous oxide; CO_2e = carbon dioxide equivalents. 20-year time horizon global warming potentials (GWPs) applied to calculate CO_2e from the Intergovernmental Panel on Climate Change (IPCC) Sixth Assessment Report (AR6): CO_2 = 1; CH_4 = 82.5; N_2O = 273. 100-year time horizon GWPs applied to calculate CO_2e from the IPCC AR6: CO_2 = 1; CH_4 = 29.8; N_2O = 273.

Table 4-40. 2023-2038 nonfederal greenhouse gas emissions from the transportation of coal produced in the planning area for Alternative D (metric tons).

Year	CO_2	CH_4	N_2O	20-year GWP CO_2e	100-year GWP CO_2e
2023	227,185.5	17.8	5.7	230,209.7	229,271.4
2024	212,039.8	16.6	5.3	214,862.4	213,986.7
2025	145,076.1	11.4	3.6	147,007.3	146,408.1
2026	149,472.3	11.7	3.7	151,462.1	150,844.8
2027	87,924.9	6.9	2.2	89,095.3	88,732.2
2028	57,861.9	4.5	1.5	58,632.1	58,393.1
2029	57,861.9	4.5	1.5	58,632.1	58,393.1
2030	55,975.1	4.4	1.4	56,720.3	56,489.1
2031	55,975.1	4.4	1.4	56,720.3	56,489.1
2032	52,718.4	4.1	1.3	53,420.2	53,202.4
2033	52,718.4	4.1	1.3	53,420.2	53,202.4

Year	CO_2	CH_4	N_2O	20-year GWP CO_2e	100-year GWP CO_2e
2034	52,718.4	4.1	1.3	53,420.2	53,202.4
2035	39,538.8	3.1	1.0	40,065.1	39,901.8
2036	0.0	0.0	0.0	0.0	0.0
2037	0.0	0.0	0.0	0.0	0.0
2038	0.0	0.0	0.0	0.0	0.0
Total	**1,247,066.5**	**97.7**	**31.3**	**1,263,667.3**	**1,258,516.8**

Notes: CO_2 = carbon dioxide; CH_4 = methane; N_2O = nitrous oxide; CO_2e = carbon dioxide equivalents. 20-year time horizon global warming potentials (GWPs) applied to calculate CO_2e from the Intergovernmental Panel on Climate Change (IPCC) Sixth Assessment Report (AR6): CO_2 = 1; CH_4 = 82.5; N_2O = 273. 100-year time horizon GWPs applied to calculate CO_2e from the IPCC AR6: CO_2 = 1; CH_4 = 29.8; N_2O = 273.

4.3.3 Downstream Combustion

Table 4-41. 2023-2038 federal greenhouse gas emissions from downstream combustion of coal produced from existing federal and pending federal leases under Alternative A, B, and C.

Year	Coal Production (million short tons per year)	CO_2 (metric tons)	CH_4 (metric tons)	N_2O (metric tons)	AR6 20-yr CO_2e (metric tons)	AR6 100-yr CO_2e (metric tons)
2022	11.05	18,516,126	2,096	305	18,772,287	18,661,823
2023	10.52	17,629,425	1,996	290	17,873,320	17,768,146
2024	10.93	18,320,311	2,074	302	18,573,764	18,464,468
2025	10.78	18,072,162	2,046	298	18,322,182	18,214,366
2026	10.67	17,876,506	2,024	294	18,123,819	18,017,170
2027	12.30	20,615,697	2,334	339	20,900,905	20,777,915
2028	9.32	15,619,033	1,768	257	15,835,115	15,741,934
2029	9.32	15,619,033	1,768	257	15,835,115	15,741,934
2030	9.01	15,097,257	1,709	249	15,306,120	15,216,052
2031	9.01	15,097,257	1,709	249	15,306,120	15,216,052
2032	8.63	14,459,319	1,637	238	14,659,357	14,573,095
2033	8.63	14,459,319	1,637	238	14,659,357	14,573,095
2034	8.63	14,459,319	1,637	238	14,659,357	14,573,095
2035	8.98	15,052,828	1,704	248	15,261,077	15,171,274
2036	8.97	15,038,136	1,702	248	15,246,182	15,156,467
2037	9.23	15,473,810	1,752	255	15,687,883	15,595,569
2038	9.23	15,473,810	1,752	255	15,687,883	15,595,569

Notes: CO_2 = carbon dioxide; CH_4 = methane; N_2O = nitrous oxide; CO_2e = carbon dioxide equivalents; 20-year time horizon global warming potentials (GWPs) applied to calculate CO_2e from the Intergovernmental Panel on Climate Change (IPCC) Sixth Assessment Report (AR6): CO_2 = 1; CH_4 = 82.5; N_2O = 273. 100-year time horizon GWPs applied to calculate CO_2e from the IPCC AR6: CO_2 = 1; CH_4 = 29.8; N_2O = 273.

Table 4-42. 2023-2038 non-federal greenhouse gas emissions from downstream combustion for Alternative A, B, AND C.

Year	Coal Production (million short tons per year)	CO_2 (metric tons)	CH_4 (metric tons)	N_2O (metric tons)	AR6 20-yr CO_2e (metric tons)	AR6 100-yr CO_2e (metric tons)
2022	9.80	16,428,861	1,860	271	16,656,146	16,558,134
2023	10.27	17,217,205	1,949	283	17,455,396	17,352,681
2024	9.86	16,526,318	1,871	272	16,754,952	16,656,359
2025	7.94	13,310,575	1,507	219	13,494,720	13,415,312
2026	8.06	13,506,231	1,529	222	13,693,084	13,612,508
2027	6.42	10,767,040	1,219	177	10,915,997	10,851,763
2028	5.68	9,517,874	1,077	157	9,649,550	9,592,768
2029	5.68	9,517,874	1,077	157	9,649,550	9,592,768
2030	5.60	9,387,430	1,063	155	9,517,301	9,461,297
2031	5.60	9,387,430	1,063	155	9,517,301	9,461,297
2032	5.51	9,227,946	1,045	152	9,355,610	9,300,558
2033	5.51	9,227,946	1,045	152	9,355,610	9,300,558
2034	5.51	9,227,946	1,045	152	9,355,610	9,300,558
2035	5.15	8,634,437	977	142	8,753,890	8,702,379
2036	4.58	7,670,799	868	126	7,776,921	7,731,158
2037	4.32	7,235,125	819	119	7,335,219	7,292,056
2038	4.32	7,235,125	819	119	7,335,219	7,292,056

Notes: CO_2 = carbon dioxide; CH_4 = methane; N_2O = nitrous oxide; CO_2e = carbon dioxide equivalents; 20-year time horizon global warming potentials (GWPs) applied to calculate CO_2e from the Intergovernmental Panel on Climate Change (IPCC) Sixth Assessment Report (AR6): CO_2 = 1; CH_4 = 82.5; N_2O = 273. 100-year time horizon GWPs applied to calculate CO_2e from the IPCC AR6: CO_2 = 1; CH_4 = 29.8; N_2O = 273.

Table 4-43. 2023-2038 total greenhouse gas emissions from downstream combustion of coal produced from existing and pending federal leases and nonfederal leases under Alternatives A, B, and C.

Year	Coal Production (million short tons per year)	CO_2 (metric tons)	CH_4 (metric tons)	N_2O (metric tons)	AR6 20-yr CO_2e (metric tons)	AR6 100-yr CO_2e (metric tons)
2022	20.85	34,944,987	3,956	575	35,428,434	35,219,958
2023	20.79	34,846,630	3,945	574	35,328,716	35,120,827
2024	20.79	34,846,630	3,945	574	35,328,716	35,120,827
2025	18.72	31,382,737	3,553	517	31,816,902	31,629,678
2026	18.72	31,382,737	3,553	517	31,816,902	31,629,678
2027	18.72	31,382,737	3,553	517	31,816,902	31,629,678
2028	15.00	25,136,907	2,846	414	25,484,664	25,334,702
2029	15.00	25,136,907	2,846	414	25,484,664	25,334,702
2030	14.61	24,484,687	2,772	403	24,823,421	24,677,349
2031	14.61	24,484,687	2,772	403	24,823,421	24,677,349

Year	Coal Production (million short tons per year)	CO_2 (metric tons)	CH_4 (metric tons)	N_2O (metric tons)	AR6 20-yr CO_2e (metric tons)	AR6 100-yr CO_2e (metric tons)
2032	14.13	23,687,265	2,681	390	24,014,967	23,873,653
2033	14.13	23,687,265	2,681	390	24,014,967	23,873,653
2034	14.13	23,687,265	2,681	390	24,014,967	23,873,653
2035	14.13	23,687,265	2,681	390	24,014,967	23,873,653
2036	13.55	22,708,935	2,571	374	23,023,102	22,887,625
2037	13.55	22,708,935	2,571	374	23,023,102	22,887,625
2038	13.55	22,708,935	2,571	374	23,023,102	22,887,625

Notes: CO_2 = carbon dioxide; CH_4 = methane; N_2O = nitrous oxide; CO_2e = carbon dioxide equivalents; 20-year time horizon global warming potentials (GWPs) applied to calculate CO_2e from the Intergovernmental Panel on Climate Change (IPCC) Sixth Assessment Report (AR6): CO_2 = 1; CH_4 = 82.5; N_2O = 273. 100-year time horizon GWPs applied to calculate CO_2e from the IPCC AR6: CO_2 = 1; CH_4 = 29.8; N_2O = 273.

Table 4-44. 2023-2038 federal greenhouse gas emissions from downstream combustion of coal from existing federal leases under Alternative D.

Year	Coal Production (million short tons per year)	CO_2 (metric tons)	CH_4 (metric tons)	N_2O (metric tons)	AR6 20-yr CO_2e (metric tons)	AR6 100-yr CO_2e (metric tons)
2022	11.05	18,516,126	2,096	305	18,772,287	18,661,823
2023	10.52	17,629,425	1,996	290	17,873,320	17,768,146
2024	10.93	18,320,311	2,074	302	18,573,764	18,464,468
2025	10.78	18,072,162	2,046	298	18,322,182	18,214,366
2026	10.67	17,876,506	2,024	294	18,123,819	18,017,170
2027	12.30	20,615,697	2,334	339	20,900,905	20,777,915
2028	9.32	15,619,033	1,768	257	15,835,115	15,741,934
2029	9.32	15,619,033	1,768	257	15,835,115	15,741,934
2030	9.01	15,097,257	1,709	249	15,306,120	15,216,052
2031	9.01	15,097,257	1,709	249	15,306,120	15,216,052
2032	8.63	14,459,319	1,637	238	14,659,357	14,573,095
2033	8.63	14,459,319	1,637	238	14,659,357	14,573,095
2034	8.63	14,459,319	1,637	238	14,659,357	14,573,095
2035	8.98	15,052,828	1,704	248	15,261,077	15,171,274
2036	2.96	4,963,176	562	82	5,031,840	5,002,230
2037	2.96	4,963,176	562	82	5,031,840	5,002,230
2038	2.96	4,963,176	562	82	5,031,840	5,002,230

Notes: CO_2 = carbon dioxide; CH_4 = methane; N_2O = nitrous oxide; CO_2e = carbon dioxide equivalents; 20-year time horizon global warming potentials (GWPs) applied to calculate CO_2e from the Intergovernmental Panel on Climate Change (IPCC) Sixth Assessment Report (AR6): CO_2 = 1; CH_4 = 82.5; N_2O = 273. 100-year time horizon GWPs applied to calculate CO_2e from the IPCC AR6: CO_2 = 1; CH_4 = 29.8; N_2O = 273.

Table 4-45. 2023-2038 non-federal greenhouse gas emissions from downstream combustion for Alternative D.

Year	Coal Production (million short tons per year)	CO_2 (metric tons)	CH_4 (metric tons)	N_2O (metric tons)	AR6 20-yr CO_2e (metric tons)	AR6 100-yr CO_2e (metric tons)
2022	9.80	16,428,861	1,860	271	16,656,146	16,558,134
2023	10.27	17,217,205	1,949	283	17,455,396	17,352,681
2024	9.86	16,526,318	1,871	272	16,754,952	16,656,359
2025	7.94	13,310,575	1,507	219	13,494,720	13,415,312
2026	8.06	13,506,231	1,529	222	13,693,084	13,612,508
2027	6.42	10,767,040	1,219	177	10,915,997	10,851,763
2028	5.68	9,517,874	1,077	157	9,649,550	9,592,768
2029	5.68	9,517,874	1,077	157	9,649,550	9,592,768
2030	5.60	9,387,430	1,063	155	9,517,301	9,461,297
2031	5.60	9,387,430	1,063	155	9,517,301	9,461,297
2032	5.51	9,227,946	1,045	152	9,355,610	9,300,558
2033	5.51	9,227,946	1,045	152	9,355,610	9,300,558
2034	5.51	9,227,946	1,045	152	9,355,610	9,300,558
2035	5.15	8,634,437	977	142	8,753,890	8,702,379
2036	4.09	6,853,910	776	113	6,948,731	6,907,841
2037	4.09	6,853,910	776	113	6,948,731	6,907,841
2038	4.09	6,853,910	776	113	6,948,731	6,907,841

Notes: CO_2 = carbon dioxide; CH_4 = methane; N_2O = nitrous oxide; CO_2e = carbon dioxide equivalents; 20-year time horizon global warming potentials (GWPs) applied to calculate CO_2e from the Intergovernmental Panel on Climate Change (IPCC) Sixth Assessment Report (AR6): CO_2 = 1; CH_4 = 82.5; N_2O = 273. 100-year time horizon GWPs applied to calculate CO_2e from the IPCC AR6: CO_2 = 1; CH_4 = 29.8; N_2O = 273.

Table 4-46. 2023-2038 total greenhouse gas emissions from downstream combustion of coal from existing federal leases and nonfederal leases under Alternative D.

Year	Coal Production (million short tons per year)	CO_2 (metric tons)	CH_4 (metric tons)	N_2O (metric tons)	AR6 20-yr CO_2e (metric tons)	AR6 100-yr CO_2e (metric tons)
2022	20.85	34,944,987	3,956	575	35,428,434	35,219,958
2023	20.79	34,846,630	3,945	574	35,328,716	35,120,827
2024	20.79	34,846,630	3,945	574	35,328,716	35,120,827
2025	18.72	31,382,737	3,553	517	31,816,902	31,629,678
2026	18.72	31,382,737	3,553	517	31,816,902	31,629,678
2027	18.72	31,382,737	3,553	517	31,816,902	31,629,678
2028	15.00	25,136,907	2,846	414	25,484,664	25,334,702
2029	15.00	25,136,907	2,846	414	25,484,664	25,334,702
2030	14.61	24,484,687	2,772	403	24,823,421	24,677,349

Year	Coal Production (million short tons per year)	CO_2 (metric tons)	CH_4 (metric tons)	N_2O (metric tons)	AR6 20-yr CO_2e (metric tons)	AR6 100-yr CO_2e (metric tons)
2031	14.61	24,484,687	2,772	403	24,823,421	24,677,349
2032	14.13	23,687,265	2,681	390	24,014,967	23,873,653
2033	14.13	23,687,265	2,681	390	24,014,967	23,873,653
2034	14.13	23,687,265	2,681	390	24,014,967	23,873,653
2035	14.13	23,687,265	2,681	390	24,014,967	23,873,653
2036	7.05	11,817,087	1,338	195	11,980,570	11,910,072
2037	7.05	11,817,087	1,338	195	11,980,570	11,910,072
2038	7.05	11,817,087	1,338	195	11,980,570	11,910,072

Notes: CO_2 = carbon dioxide; CH_4 = methane; N_2O = nitrous oxide; CO_2e = carbon dioxide equivalents; 20-year time horizon global warming potentials (GWPs) applied to calculate CO_2e from the Intergovernmental Panel on Climate Change (IPCC) Sixth Assessment Report (AR6): CO_2 = 1; CH_4 = 82.5; N_2O = 273. 100-year time horizon GWPs applied to calculate CO_2e from the IPCC AR6: CO_2 = 1; CH_4 = 29.8; N_2O = 273.

4.4 Oil and Gas

4.4.1 Production and Midstream Sources

Table 4-47. Federal oil production rates and emissions from 2023-2038.

Year	Production Rate (MMBO)	NOx (short tons)	CO (short tons)	VOC (short tons)	PM_{10} (short tons)	$PM_{2.5}$ (short tons)	SO_2 (short tons)	HAPs (short tons)	CO_2 (metric tons)	CH_4 (metric tons)	N_2O (metric tons)	20-year GWP CO_2e (metric tons)	100-year GWP CO_2e (metric tons)
2023	3.0	223	492	405	49	14	3	34	54,951	268	0.5	77,245	63,093
2024	3.0	223	492	405	49	14	3	34	54,951	268	0.5	77,245	63,093
2025	3.0	223	492	405	49	14	3	34	54,951	268	0.5	77,245	63,093
2026	3.0	223	492	405	49	14	3	34	54,951	268	0.5	77,245	63,093
2027	3.0	223	492	405	49	14	3	34	54,951	268	0.5	77,245	63,093
2028	3.0	223	492	405	49	14	3	34	54,951	268	0.5	77,245	63,093
2029	3.0	223	492	405	49	14	3	34	54,951	268	0.5	77,245	63,093
2030	3.0	223	492	405	49	14	3	34	54,951	268	0.5	77,245	63,093
2031	3.0	223	492	405	49	14	3	34	54,951	268	0.5	77,245	63,093
2032	3.0	223	492	405	49	14	3	34	54,951	268	0.5	77,245	63,093
2033	3.0	223	492	405	49	14	3	34	54,951	268	0.5	77,245	63,093
2034	3.0	223	492	405	49	14	3	34	54,951	268	0.5	77,245	63,093
2035	3.0	223	492	405	49	14	3	34	54,951	268	0.5	77,245	63,093
2036	3.0	223	492	405	49	14	3	34	54,951	268	0.5	77,245	63,093
2037	3.0	223	492	405	49	14	3	34	54,951	268	0.5	77,245	63,093
2038	3.0	223	492	405	49	14	3	34	54,951	268	0.5	77,245	63,093

NOx = nitrogen oxides; CO = carbon monoxide; VOC = volatile organic compounds; PM_{10} =particulate matter with a diameter less than or equal to 10 microns; $PM_{2.5}$ =particulate matter with a diameter less than or equal to 2.5 microns; SO_2 = sulfur dioxide; HAPs = hazardous air pollutants; CO_2 = carbon dioxide; CH_4 = methane; N_2O = nitrous oxide; CO_2e = carbon dioxide equivalent

Greenhouse gas emissions shown are in metric tons per year

MMBO = millions of barrels of oil

GWP = global warming potentials

20-year time horizon global warming potentials applied to calculate CO_2e: CO_2 = 1; methane (CH_4) = 82.5; nitrous oxide (N_2O) = 273 from the IPCC AR6. 100-year time horizon global warming potentials applied to calculate CO_2e: CO_2 = 1; methane (CH_4) = 29.8; nitrous oxide (N_2O) = 273 from the IPCC AR6.

Table 4-48. Non-federal oil production rates and emissions in 2023-2038.

Year	Production Rate (MMBO)	NOx (short tons)	CO (short tons)	VOC (short tons)	PM_{10} (short tons)	$PM_{2.5}$ (short tons)	SO_2 (short tons)	HAPs (short tons)	CO_2 (metric tons)	CH_4 (metric tons)	N_2O (metric tons)	20-year GWP CO_2e (metric tons)	100-year GWP CO_2e (metric tons)
2023	20.6	2,495	2,997	2,783	368	147	22	234	351,984	1,809	2.6	501,919	406,589
2024	20.6	2,495	2,997	2,783	368	147	22	234	351,984	1,809	2.6	501,919	406,589
2025	20.6	2,495	2,997	2,783	368	147	22	234	351,984	1,809	2.6	501,919	406,589
2026	20.6	2,495	2,997	2,783	368	147	22	234	351,984	1,809	2.6	501,919	406,589
2027	20.6	2,495	2,997	2,783	368	147	22	234	351,984	1,809	2.6	501,919	406,589
2028	20.6	2,495	2,997	2,783	368	147	22	234	351,984	1,809	2.6	501,919	406,589
2029	20.6	2,495	2,997	2,783	368	147	22	234	351,984	1,809	2.6	501,919	406,589
2030	20.6	2,495	2,997	2,783	368	147	22	234	351,984	1,809	2.6	501,919	406,589
2031	20.6	2,495	2,997	2,783	368	147	22	234	351,984	1,809	2.6	501,919	406,589
2032	20.6	2,495	2,997	2,783	368	147	22	234	351,984	1,809	2.6	501,919	406,589
2033	20.6	2,495	2,997	2,783	368	147	22	234	351,984	1,809	2.6	501,919	406,589
2034	20.6	2,495	2,997	2,783	368	147	22	234	351,984	1,809	2.6	501,919	406,589
2035	20.6	2,495	2,997	2,783	368	147	22	234	351,984	1,809	2.6	501,919	406,589
2036	20.6	2,495	2,997	2,783	368	147	22	234	351,984	1,809	2.6	501,919	406,589
2037	20.6	2,495	2,997	2,783	368	147	22	234	351,984	1,809	2.6	501,919	406,589
2038	20.6	2,495	2,997	2,783	368	147	22	234	351,984	1,809	2.6	501,919	406,589

NOx = nitrogen oxides; CO = carbon monoxide; VOC = volatile organic compounds; PM_{10} =particulate matter with a diameter less than or equal to 10 microns; $PM_{2.5}$ =particulate matter with a diameter less than or equal to 2.5 microns; SO_2 = sulfur dioxide; HAPs = hazardous air pollutants; CO_2 = carbon dioxide; CH_4 = methane; N_2O = nitrous oxide; CO_2e = carbon dioxide equivalent

Greenhouse gas emissions shown are in metric tons per year

MMBO = millions of barrels of oil

GWP = global warming potentials

20-year time horizon global warming potentials applied to calculate CO_2e: CO_2 = 1; methane (CH_4) = 82.5; nitrous oxide (N_2O) = 273 from the IPCC AR6. 100-year time horizon global warming potentials applied to calculate CO_2e: CO_2 = 1; methane (CH_4) = 29.8; nitrous oxide (N_2O) = 273 from the IPCC AR6.

Table 4-49. Federal conventional natural gas production rates and emissions in 2023-2038.

Year	Production Rate (MMBO)	NOx (short tons)	CO (short tons)	VOC (short tons)	PM_{10} (short tons)	$PM_{2.5}$ (short tons)	SO_2 (short tons)	HAPs (short tons)	CO_2 (metric tons)	CH_4 (metric tons)	N_2O (metric tons)	20-year GWP CO_2e (metric tons)	100-year GWP CO_2e (metric tons)
2023	5.1	79	192	54	12	4	0	5	17,344	77	0.1	23,737	19,674
2024	5.1	79	192	54	12	4	0	5	17,344	77	0.1	23,737	19,674
2025	5.1	79	192	54	12	4	0	5	17,344	77	0.1	23,737	19,674
2026	5.1	79	192	54	12	4	0	5	17,344	77	0.1	23,737	19,674
2027	5.1	79	192	54	12	4	0	5	17,344	77	0.1	23,737	19,674
2028	5.1	79	192	54	12	4	0	5	17,344	77	0.1	23,737	19,674
2029	5.1	79	192	54	12	4	0	5	17,344	77	0.1	23,737	19,674
2030	5.1	79	192	54	12	4	0	5	17,344	77	0.1	23,737	19,674
2031	5.1	79	192	54	12	4	0	5	17,344	77	0.1	23,737	19,674
2032	5.1	79	192	54	12	4	0	5	17,344	77	0.1	23,737	19,674
2033	5.1	79	192	54	12	4	0	5	17,344	77	0.1	23,737	19,674
2034	5.1	79	192	54	12	4	0	5	17,344	77	0.1	23,737	19,674
2035	5.1	79	192	54	12	4	0	5	17,344	77	0.1	23,737	19,674
2036	5.1	79	192	54	12	4	0	5	17,344	77	0.1	23,737	19,674
2037	5.1	79	192	54	12	4	0	5	17,344	77	0.1	23,737	19,674
2038	5.1	79	192	54	12	4	0	5	17,344	77	0.1	23,737	19,674

NOx = nitrogen oxides; CO = carbon monoxide; VOC = volatile organic compounds; PM_{10} =particulate matter with a diameter less than or equal to 10 microns; $PM_{2.5}$ =particulate matter with a diameter less than or equal to 2.5 microns; SO_2 = sulfur dioxide; HAPs = hazardous air pollutants; CO_2 = carbon dioxide; CH_4 = methane; N_2O = nitrous oxide; CO_2e = carbon dioxide equivalent

Greenhouse gas emissions shown are in metric tons per year

BCF = billions cubic feet

GWP = global warming potentials

20-year time horizon global warming potentials applied to calculate CO_2e: CO_2 = 1; methane (CH_4) = 82.5; nitrous oxide (N_2O) = 273 from the IPCC AR6. 100-year time horizon global warming potentials applied to calculate CO_2e: CO_2 = 1; methane (CH_4) = 29.8; nitrous oxide (N_2O) = 273 from the IPCC AR6.

Table 4-50. Non-federal conventional natural gas production rates and emissions in 2023-2038.

Year	Production Rate (MMBO)	NOx (short tons)	CO (short tons)	VOC (short tons)	PM_{10} (short tons)	$PM_{2.5}$ (short tons)	SO_2 (short tons)	HAPs (short tons)	CO_2 (metric tons)	CH_4 (metric tons)	N_2O (metric tons)	20-year GWP CO_2e (metric tons)	100-year GWP CO_2e (metric tons)
2023	34.1	915	1,221	374	93	46	6	37	107,860	510	0.5	150,048	123,179
2024	34.1	915	1,221	374	93	46	6	37	107,860	510	0.5	150,048	123,179
2025	34.1	915	1,221	374	93	46	6	37	107,860	510	0.5	150,048	123,179
2026	34.1	915	1,221	374	93	46	6	37	107,860	510	0.5	150,048	123,179
2027	34.1	915	1,221	374	93	46	6	37	107,860	510	0.5	150,048	123,179
2028	34.1	915	1,221	374	93	46	6	37	107,860	510	0.5	150,048	123,179
2029	34.1	915	1,221	374	93	46	6	37	107,860	510	0.5	150,048	123,179
2030	34.1	915	1,221	374	93	46	6	37	107,860	510	0.5	150,048	123,179
2031	34.1	915	1,221	374	93	46	6	37	107,860	510	0.5	150,048	123,179
2032	34.1	915	1,221	374	93	46	6	37	107,860	510	0.5	150,048	123,179
2033	34.1	915	1,221	374	93	46	6	37	107,860	510	0.5	150,048	123,179
2034	34.1	915	1,221	374	93	46	6	37	107,860	510	0.5	150,048	123,179
2035	34.1	915	1,221	374	93	46	6	37	107,860	510	0.5	150,048	123,179
2036	34.1	915	1,221	374	93	46	6	37	107,860	510	0.5	150,048	123,179
2037	34.1	915	1,221	374	93	46	6	37	107,860	510	0.5	150,048	123,179
2038	34.1	915	1,221	374	93	46	6	37	107,860	510	0.5	150,048	123,179

NOx = nitrogen oxides; CO = carbon monoxide; VOC = volatile organic compounds; PM_{10} =particulate matter with a diameter less than or equal to 10 microns; $PM_{2.5}$ =particulate matter with a diameter less than or equal to 2.5 microns; SO_2 = sulfur dioxide; HAPs = hazardous air pollutants; CO_2 = carbon dioxide; CH_4 = methane; N_2O = nitrous oxide; CO_2e = carbon dioxide equivalent

Greenhouse gas emissions shown are in metric tons per year

BCF = billions cubic feet

GWP = global warming potentials

20-year time horizon global warming potentials applied to calculate CO_2e: CO_2 = 1; methane (CH_4) = 82.5; nitrous oxide (N_2O) = 273 from the IPCC AR6. 100-year time horizon global warming potentials applied to calculate CO_2e: CO_2 = 1; methane (CH_4) = 29.8; nitrous oxide (N_2O) = 273 from the IPCC AR6.

Table 4-51. Federal coalbed natural gas production rates and emissions in 2023-2038.

Year	Production Rate (MMBO)	NOx (short tons)	CO (short tons)	VOC (short tons)	PM_{10} (short tons)	$PM_{2.5}$ (short tons)	SO_2 (short tons)	HAPs (short tons)	CO_2 (metric tons)	CH_4 (metric tons)	N_2O (metric tons)	20-year GWP CO_2e (metric tons)	100-year GWP CO_2e (metric tons)
2023	8.0	116	230	80	25	8	0	15	16,988	99	0.1	25,161	19,950
2024	8.0	116	230	80	25	8	0	15	16,988	99	0.1	25,161	19,950
2025	8.0	116	230	80	25	8	0	15	16,988	99	0.1	25,161	19,950
2026	8.0	116	230	80	25	8	0	15	16,988	99	0.1	25,161	19,950
2027	8.0	116	230	80	25	8	0	15	16,988	99	0.1	25,161	19,950
2028	8.0	116	230	80	25	8	0	15	16,988	99	0.1	25,161	19,950
2029	8.0	116	230	80	25	8	0	15	16,988	99	0.1	25,161	19,950
2030	8.0	116	230	80	25	8	0	15	16,988	99	0.1	25,161	19,950
2031	8.0	116	230	80	25	8	0	15	16,988	99	0.1	25,161	19,950
2032	8.0	116	230	80	25	8	0	15	16,988	99	0.1	25,161	19,950
2033	8.0	116	230	80	25	8	0	15	16,988	99	0.1	25,161	19,950
2034	8.0	116	230	80	25	8	0	15	16,988	99	0.1	25,161	19,950
2035	8.0	116	230	80	25	8	0	15	16,988	99	0.1	25,161	19,950
2036	8.0	116	230	80	25	8	0	15	16,988	99	0.1	25,161	19,950
2037	8.0	116	230	80	25	8	0	15	16,988	99	0.1	25,161	19,950
2038	8.0	116	230	80	25	8	0	15	16,988	99	0.1	25,161	19,950

NOx = nitrogen oxides; CO = carbon monoxide; VOC = volatile organic compounds; PM10 =particulate matter with a diameter less than or equal to 10 microns; PM2.5 =particulate matter with a diameter less than or equal to 2.5 microns; SO2 = sulfur dioxide; HAPs = hazardous air pollutants; CO2 = carbon dioxide; CH4 = methane; N2O = nitrous oxide; CO2e = carbon dioxide equivalent

Greenhouse gas emissions shown are in metric tons per year

BCF = billions cubic feet

GWP = global warming potentials

20-year time horizon global warming potentials applied to calculate CO2e: CO2 = 1; methane (CH4) = 82.5; nitrous oxide (N2O) = 273 from the IPCC AR6.
100-year time horizon global warming potentials applied to calculate CO2e: CO2 = 1; methane (CH4) = 29.8; nitrous oxide (N2O) = 273 from the IPCC AR6.

Table 4-52. Non-federal coalbed natural gas production rates and emissions in 2023-2038.

Year	Production Rate (MMBO)	NOx (short tons)	CO (short tons)	VOC (short tons)	PM_{10} (short tons)	$PM_{2.5}$ (short tons)	SO_2 (short tons)	HAPs (short tons)	CO_2 (metric tons)	CH_4 (metric tons)	N_2O (metric tons)	20-year GWP CO_2e (metric tons)	100-year GWP CO_2e (metric tons)
2023	10.8	206	313	111	35	11	16	21	23,018	133	0.1	34,047	27,019
2024	10.8	206	313	111	35	11	16	21	23,018	133	0.1	34,047	27,019
2025	10.8	206	313	111	35	11	16	21	23,018	133	0.1	34,047	27,019
2026	10.8	206	313	111	35	11	16	21	23,018	133	0.1	34,047	27,019
2027	10.8	206	313	111	35	11	16	21	23,018	133	0.1	34,047	27,019
2028	10.8	206	313	111	35	11	16	21	23,018	133	0.1	34,047	27,019
2029	10.8	206	313	111	35	11	16	21	23,018	133	0.1	34,047	27,019
2030	10.8	206	313	111	35	11	16	21	23,018	133	0.1	34,047	27,019
2031	10.8	206	313	111	35	11	16	21	23,018	133	0.1	34,047	27,019
2032	10.8	206	313	111	35	11	16	21	23,018	133	0.1	34,047	27,019
2033	10.8	206	313	111	35	11	16	21	23,018	133	0.1	34,047	27,019
2034	10.8	206	313	111	35	11	16	21	23,018	133	0.1	34,047	27,019
2035	10.8	206	313	111	35	11	16	21	23,018	133	0.1	34,047	27,019
2036	10.8	206	313	111	35	11	16	21	23,018	133	0.1	34,047	27,019
2037	10.8	206	313	111	35	11	16	21	23,018	133	0.1	34,047	27,019
2038	10.8	206	313	111	35	11	16	21	23,018	133	0.1	34,047	27,019

NOx = nitrogen oxides; CO = carbon monoxide; VOC = volatile organic compounds; PM_{10} =particulate matter with a diameter less than or equal to 10 microns; $PM_{2.5}$ =particulate matter with a diameter less than or equal to 2.5 microns; SO_2 = sulfur dioxide; HAPs = hazardous air pollutants; CO_2 = carbon dioxide; CH_4 = methane; N_2O = nitrous oxide; CO_2e = carbon dioxide equivalent

Greenhouse gas emissions shown are in metric tons per year

BCF = billions cubic feet

GWP = global warming potentials

20-year time horizon global warming potentials applied to calculate CO_2e: CO_2 = 1; methane (CH_4) = 82.5; nitrous oxide (N_2O) = 273 from the IPCC AR6. 100-year time horizon global warming potentials applied to calculate CO_2e: CO_2 = 1; methane (CH_4) = 29.8; nitrous oxide (N_2O) = 273 from the IPCC AR6.

4.4.2 Near-Field Modeling

The 2015 RMP conducted a near-field assessment of impacts on ambient air quality to evaluate maximum pollutant impacts within the MCFO planning area resulting from oil and gas activities. A summary is provided here.

The near-field modeling used five years of hourly surface meteorological data (2005-2009) collected at Sidney, Montana along with concurrent twice daily upper air meteorological data collected at Glasgow, Montana. EPA's Guideline model, AERMOD (version 12060), was used to assess these near-field impacts. AERMOD modeling was performed for Alternative A, which was the highest emitting alternative for oil and gas activities and represented potentially dense well pad spacing. The AERMET processor was used to process the meteorological data into formats compatible with the AERMOD model.

A near-field criteria pollutant assessment was performed to estimate maximum potential impacts of criteria pollutants (CO, NO_2, SO_2, PM_{10}, and $PM_{2.5}$) from construction, drilling, completion and fracing, and production emissions sources. Predicted criteria air pollutant concentrations were compared to the National Ambient Air Quality Standards (NAAQS) and Montana Ambient Air Quality Standards (MAAQS), and Prevention of Significant Deterioration (PSD) increments.

Near-field HAP (benzene, toluene, ethyl benzene, xylenes, n-hexane, and formaldehyde) emissions were also evaluated for purposes of assessing impacts in the within planning area for both short-term (acute) exposure and for calculation of long-term human health risk. Short-term (1-hour) HAP concentrations were compared to EPA’s acute Reference Exposure Levels (RELs). RELs are defined as concentrations at or below which no adverse health effects are expected. Long-term exposure to air toxics were compared to EPA’s Reference Concentrations for Chronic Inhalation (RfCs). An RfC is defined by the EPA as the daily inhalation concentration at which no long-term adverse health effects are expected. Annual modeled air toxics concentrations for all air toxics emitted were compared directly to non-carcinogenic RfCs. Long-term exposures to emissions of suspected carcinogenic HAPs (benzene, ethyl benzene, and formaldehyde) were also evaluated based on estimates of the increased latent cancer risk over a 70-year lifetime

An emissions inventory was developed for construction activities including fugitive dust from surface disturbance associated with well pad and road constructions and vehicle traffic on unpaved roads, and exhaust emissions from construction equipment; drilling activities, including exhaust emissions from drill rig and associated engines and drill rig boilers, as well as fugitive dust from vehicle traffic on unpaved roads; completion activities, including exhaust emissions from completion engines and completion flaring, and fugitive dust from vehicle traffic on unpaved roads; and production activities, including exhaust emissions from pumpjack engines, heaters, tanks, flares, and fugitive dust from vehicle traffic on unpaved roads

The near-field analysis included assessments of combined equipment scenarios that were modeled to address multiple well types (oil, natural gas, and CBNG). The analysis was a conservative assessment, which included: the largest well pad (from all types of wells) for wind erosion and construction activities; the drill rig with the largest horsepower, drilling time, and emissions; the completion rig with the largest horsepower, completion time, and emissions, and largest flaring event; and a combination of oil and gas wells under production.

The modeling analysis included five 3-acre well pads within a 6 kilometer (km) by 6 km domain, and it assumed an ambient air boundary defined as 100 meters (m) from the edge of the well pads and 20 m from the edge of access roads. Cartesian grid receptors were spaced at 25-m intervals along the ambient air boundary, at 100-m intervals from the ambient boundary to 2 km from the center of the domain, and at 250-m intervals from 2 km out to 3 km from the center of the domain. Flat terrain was assumed.

Air pollutant dispersion modeling was performed to quantify maximum potential criteria pollutant (CO, NO_2, SO_2, PM_{10}, and $PM_{2.5}$) and HAP (benzene, toluene, ethyl benzene, xylenes, n-hexane, and formaldehyde) impacts from development and production. AERMOD was used to model the maximum potential emissions of CO, NO_2, SO_2, PM_{10}, and $PM_{2.5}$ and HAPs that could occur from the Proposed Action's well pad/road construction, drilling/completion and production sources.

When maximum modeled concentrations of criteria pollutant (CO, NO_2, SO_2, PM_{10}, and $PM_{2.5}$) impacts from the modeled scenarios were added to representative background concentrations, it was demonstrated that the total ambient air concentrations were less than the applicable NAAQS and MAAQS. In addition, direct modeled concentrations resulting from production activities were below the applicable PSD Class II increments for production activities.

Maximum modeled HAP impacts (benzene, toluene, ethyl benzene, xylenes, n-hexane, and formaldehyde) were shown to be well below applicable RELs and RFCs. In addition, incremental cancer risks were well below a one-in-one million risk for suspected or known carcinogens benzene, ethyl benzene and formaldehyde.

4.4.3 Transportation, Processing, and Downstream Combustion

GHG emissions of CO_2, CH_4, and N_2O from oil and gas processing, transportation and downstream combustion were calculated for years 2023-2038 using the estimated oil and gas production rates from the planning area. Emissions were calculated for both federal and non-federal oil and gas wells.

The federal and nonfederal CO_2, CH_4, and N_2O emissions for years 2023-2038, along with CO2e emissions using both the 20-year and 100-year time horizon AR6 GWPs , from oil processing, conventional natural gas processing, and coalbed natural gas processing emissions, are shown in Table 4-53 through Table 4-58, respectively. The GHG emissions from transportation are provided in Table 4-59 through Table 4-64, and the emissions from downstream combustion activities are provided in Table 4-65 through Table 4-70. Note that these emissions are the same for all alternatives.

Table 4-53. 2023-2038 Federal greenhouse gas emissions from the processing of oil produced in the planning area for all alternatives (metric tons).

Year	CO_2	CH_4	N_2O	20-year GWP CO_2e	100-year GWP CO_2e
2023	129,904	159.8	2.1	143,579	135,209
2024	129,904	158.8	2.1	143,579	135,209
2025	129,904	158.8	2.1	143,579	135,209
2026	129,904	158.8	2.1	143,579	135,209
2027	129,904	158.8	2.1	143,579	135,209
2028	129,904	158.8	2.1	143,579	135,209
2029	129,904	158.8	2.1	143,579	135,209
2030	129,904	158.8	2.1	143,579	135,209
2031	129,904	158.8	2.1	143,579	135,209

Year	CO_2	CH_4	N_2O	20-year GWP CO_2e	100-year GWP CO_2e
2032	129,904	158.8	2.1	143,579	135,209
2033	129,904	158.8	2.1	143,579	135,209
2034	129,904	158.8	2.1	143,579	135,209
2035	129,904	158.8	2.1	143,579	135,209
2036	129,904	158.8	2.1	143,579	135,209
2037	129,904	158.8	2.1	143,579	135,209
2038	129,904	158.8	2.1	143,579	135,209
Total	**2,078,467**	**2,541.4**	**33.5**	**2,297,272**	**2,163,342**

Notes: CO_2 = carbon dioxide; CH_4 = methane; N_2O = nitrous oxide; CO_2e = carbon dioxide equivalents. 20-year time horizon global warming potentials (GWPs) applied to calculate CO_2e from the Intergovernmental Panel on Climate Change (IPCC) Sixth Assessment Report (AR6): CO_2 = 1; CH_4 = 82.5; N_2O = 273. 100-year time horizon GWPs applied to calculate CO_2e from the IPCC AR6: CO_2 = 1; CH_4 = 29.8; N_2O = 273.

Table 4-54. 2023-2038 Nonfederal greenhouse gas emissions from the processing of oil produced in the planning area for all alternatives (metric tons).

Year	CO_2	CH_4	N_2O	20-year GWP CO_2e	100-year GWP CO_2e
2023	880,670	1,076.8	14.2	973,379	916,632
2024	880,670	1,076.8	14.2	973,379	916,632
2025	880,670	1,076.8	14.2	973,379	916,632
2026	880,670	1,076.8	14.2	973,379	916,632
2027	880,670	1,076.8	14.2	973,379	916,632
2028	880,670	1,076.8	14.2	973,379	916,632
2029	880,670	1,076.8	14.2	973,379	916,632
2030	880,670	1,076.8	14.2	973,379	916,632
2031	880,670	1,076.8	14.2	973,379	916,632
2032	880,670	1,076.8	14.2	973,379	916,632
2033	880,670	1,076.8	14.2	973,379	916,632
2034	880,670	1,076.8	14.2	973,379	916,632
2035	880,670	1,076.8	14.2	973,379	916,632
2036	880,670	1,076.8	14.2	973,379	916,632
2037	880,670	1,076.8	14.2	973,379	916,632
2038	880,670	1,076.8	14.2	973,379	916,632
Total	**14,090,714**	**17,228.9**	**227.0**	**15,574,070**	**14,666,107**

Notes: CO_2 = carbon dioxide; CH_4 = methane; N_2O = nitrous oxide; CO_2e = carbon dioxide equivalents. 20-year time horizon global warming potentials (GWPs) applied to calculate CO_2e from the Intergovernmental Panel on Climate Change (IPCC) Sixth Assessment Report (AR6): CO_2 = 1; CH_4 = 82.5; N_2O = 273. 100-year time horizon GWPs applied to calculate CO_2e from the IPCC AR6: CO_2 = 1; CH_4 = 29.8; N_2O = 273.

Table 4-55. 2023-2038 Federal greenhouse gas emissions from the processing of conventional natural gas produced in the planning area for all alternatives (metric tons).

Year	CO_2	CH_4	N_2O	20-year GWP CO_2e	100-year GWP CO_2e
2023	7,436	77.2	0.03	13,808	9,742
2024	7,436	77.2	0.03	13,808	9,742
2025	7,436	77.2	0.03	13,808	9,742
2026	7,436	77.2	0.03	13,808	9,742
2027	7,436	77.2	0.03	13,808	9,742
2028	7,436	77.2	0.03	13,808	9,742
2029	7,436	77.2	0.03	13,808	9,742
2030	7,436	77.2	0.03	13,808	9,742
2031	7,436	77.2	0.03	13,808	9,742
2032	7,436	77.2	0.03	13,808	9,742
2033	7,436	77.2	0.03	13,808	9,742
2034	7,436	77.2	0.03	13,808	9,742
2035	7,436	77.2	0.03	13,808	9,742
2036	7,436	77.2	0.03	13,808	9,742
2037	7,436	77.2	0.03	13,808	9,742
2038	7,436	77.2	0.03	13,808	9,742
Total	**118,973**	**1,234.5**	**0.4**	**220,932**	**155,876**

Notes: CO_2 = carbon dioxide; CH_4 = methane; N_2O = nitrous oxide; CO_2e = carbon dioxide equivalents. 20-year time horizon global warming potentials (GWPs) applied to calculate CO_2e from the Intergovernmental Panel on Climate Change (IPCC) Sixth Assessment Report (AR6): CO_2 = 1; CH_4 = 82.5; N_2O = 273. 100-year time horizon GWPs applied to calculate CO_2e from the IPCC AR6: CO_2 = 1; CH_4 = 29.8; N_2O = 273.

Table 4-56. 2023-2038 Nonfederal greenhouse gas emissions from the processing of conventional natural gas produced in the planning area for all alternatives (metric tons).

Year	CO_2	CH_4	N_2O	20-year GWP CO_2e	100-year GWP CO_2e
2023	49,671	515.4	0.2	92,239	65,078
2024	49,671	515.4	0.2	92,239	65,078
2025	49,671	515.4	0.2	92,239	65,078
2026	49,671	515.4	0.2	92,239	65,078
2027	49,671	515.4	0.2	92,239	65,078
2028	49,671	515.4	0.2	92,239	65,078
2029	49,671	515.4	0.2	92,239	65,078
2030	49,671	515.4	0.2	92,239	65,078
2031	49,671	515.4	0.2	92,239	65,078
2032	49,671	515.4	0.2	92,239	65,078
2033	49,671	515.4	0.2	92,239	65,078
2034	49,671	515.4	0.2	92,239	65,078
2035	49,671	515.4	0.2	92,239	65,078
2036	49,671	515.4	0.2	92,239	65,078
2037	49,671	515.4	0.2	92,239	65,078

Year	CO_2	CH_4	N_2O	20-year GWP CO_2e	100-year GWP CO_2e
2038	49,671	515.4	0.2	92,239	65,078
Total	**794,742**	**8,246**	**2.8**	**1,475,824**	**1,041,250**

Notes: CO_2 = carbon dioxide; CH_4 = methane; N_2O = nitrous oxide; CO_2e = carbon dioxide equivalents. 20-year time horizon global warming potentials (GWPs) applied to calculate CO_2e from the Intergovernmental Panel on Climate Change (IPCC) Sixth Assessment Report (AR6): CO_2 = 1; CH_4 = 82.5; N_2O = 273. 100-year time horizon GWPs applied to calculate CO_2e from the IPCC AR6: CO_2 = 1; CH_4 = 29.8; N_2O = 273.

Table 4-57. 2023-2038 Federal greenhouse gas emissions from the processing of coalbed natural gas produced in the planning area for all alternatives (metric tons).

Year	CO_2	CH_4	N_2O	20-year GWP CO_2e	100-year GWP CO_2e
2023	11,616	120.5	0.04	21,570	15,219
2024	11,616	120.5	0.04	21,570	15,219
2025	11,616	120.5	0.04	21,570	15,219
2026	11,616	120.5	0.04	21,570	15,219
2027	11,616	120.5	0.04	21,570	15,219
2028	11,616	120.5	0.04	21,570	15,219
2029	11,616	120.5	0.04	21,570	15,219
2030	11,616	120.5	0.04	21,570	15,219
2031	11,616	120.5	0.04	21,570	15,219
2032	11,616	120.5	0.04	21,570	15,219
2033	11,616	120.5	0.04	21,570	15,219
2034	11,616	120.5	0.04	21,570	15,219
2035	11,616	120.5	0.04	21,570	15,219
2036	11,616	120.5	0.04	21,570	15,219
2037	11,616	120.5	0.04	21,570	15,219
2038	11,616	120.5	0.04	21,570	15,219
Total	**185,853**	**1,928.4**	**0.7**	**345,127**	**243,500**

Notes: CO_2 = carbon dioxide; CH_4 = methane; N_2O = nitrous oxide; CO_2e = carbon dioxide equivalents. 20-year time horizon global warming potentials (GWPs) applied to calculate CO_2e from the Intergovernmental Panel on Climate Change (IPCC) Sixth Assessment Report (AR6): CO_2 = 1; CH_4 = 82.5; N_2O = 273. 100-year time horizon GWPs applied to calculate CO_2e from the IPCC AR6: CO_2 = 1; CH_4 = 29.8; N_2O = 273.

Table 4-58. 2023-2038 Nonfederal greenhouse gas emissions from the processing of coalbed natural gas produced in the planning area for all alternatives (metric tons).

Year	CO_2	CH_4	N_2O	20-year GWP CO_2e	100-year GWP CO_2e
2023	15,775	163.7	0.1	29,293	20,667
2024	15,775	163.7	0.1	29,293	20,667
2025	15,775	163.7	0.1	29,293	20,667
2026	15,775	163.7	0.1	29,293	20,667
2027	15,775	163.7	0.1	29,293	20,667
2028	15,775	163.7	0.1	29,293	20,667

Year	CO_2	CH_4	N_2O	20-year GWP CO_2e	100-year GWP CO_2e
2029	15,775	163.7	0.1	29,293	20,667
2030	15,775	163.7	0.1	29,293	20,667
2031	15,775	163.7	0.1	29,293	20,667
2032	15,775	163.7	0.1	29,293	20,667
2033	15,775	163.7	0.1	29,293	20,667
2034	15,775	163.7	0.1	29,293	20,667
2035	15,775	163.7	0.1	29,293	20,667
2036	15,775	163.7	0.1	29,293	20,667
2037	15,775	163.7	0.1	29,293	20,667
2038	15,775	163.7	0.1	29,293	20,667
Total	**252,393**	**2,618.8**	**0.9**	**468,691**	**330,679**

Notes: CO_2 = carbon dioxide; CH_4 = methane; N_2O = nitrous oxide; CO_2e = carbon dioxide equivalents. 20-year time horizon global warming potentials (GWPs) applied to calculate CO_2e from the Intergovernmental Panel on Climate Change (IPCC) Sixth Assessment Report (AR6): CO_2 = 1; CH_4 = 82.5; N_2O = 273. 100-year time horizon GWPs applied to calculate CO_2e from the IPCC AR6: CO_2 = 1; CH_4 = 29.8; N_2O = 273.

Table 4-59. 2023-2038 Federal greenhouse gas emissions from the transport of oil produced in the planning area for all alternatives (metric tons).

Year	CO_2	CH_4	N_2O	20-year GWP CO_2e	100-year GWP CO_2e
2023	37,929	21.6	0.8	39,914	38,778
2024	37,929	21.6	0.8	39,914	38,778
2025	37,929	21.6	0.8	39,914	38,778
2026	37,929	21.6	0.8	39,914	38,778
2027	37,929	21.6	0.8	39,914	38,778
2028	37,929	21.6	0.8	39,914	38,778
2029	37,929	21.6	0.8	39,914	38,778
2030	37,929	21.6	0.8	39,914	38,778
2031	37,929	21.6	0.8	39,914	38,778
2032	37,929	21.6	0.8	39,914	38,778
2033	37,929	21.6	0.8	39,914	38,778
2034	37,929	21.6	0.8	39,914	38,778
2035	37,929	21.6	0.8	39,914	38,778
2036	37,929	21.6	0.8	39,914	38,778
2037	37,929	21.6	0.8	39,914	38,778
2038	37,929	21.6	0.8	39,914	38,778
Total	**606,872**	**344.8**	**12.1**	**638,622**	**620,449**

Notes: CO_2 = carbon dioxide; CH_4 = methane; N_2O = nitrous oxide; CO_2e = carbon dioxide equivalents. 20-year time horizon global warming potentials (GWPs) applied to calculate CO_2e from the Intergovernmental Panel on Climate Change (IPCC) Sixth Assessment Report (AR6): CO_2 = 1; CH_4 = 82.5; N_2O = 273. 100-year time horizon GWPs applied to calculate CO_2e from the IPCC AR6: CO_2 = 1; CH_4 = 29.8; N_2O = 273.

Table 4-60. 2023-2038 Nonfederal greenhouse gas emissions from the transportation of oil produced in the planning area for all alternatives (metric tons).

Year	CO_2	CH_4	N_2O	20-year GWP CO_2e	100-year GWP CO_2e
2023	257,138	146.1	5.1	270,591	262,891
2024	257,138	146.1	5.1	270,591	262,891
2025	257,138	146.1	5.1	270,591	262,891
2026	257,138	146.1	5.1	270,591	262,891
2027	257,138	146.1	5.1	270,591	262,891
2028	257,138	146.1	5.1	270,591	262,891
2029	257,138	146.1	5.1	270,591	262,891
2030	257,138	146.1	5.1	270,591	262,891
2031	257,138	146.1	5.1	270,591	262,891
2032	257,138	146.1	5.1	270,591	262,891
2033	257,138	146.1	5.1	270,591	262,891
2034	257,138	146.1	5.1	270,591	262,891
2035	257,138	146.1	5.1	270,591	262,891
2036	257,138	146.1	5.1	270,591	262,891
2037	257,138	146.1	5.1	270,591	262,891
2038	257,138	146.1	5.1	270,591	262,891
Total	**4,114,212**	**2,337.8**	**82.0**	**4,329,461**	**4,206,260**

Notes: CO_2 = carbon dioxide; CH_4 = methane; N_2O = nitrous oxide; CO_2e = carbon dioxide equivalents. 20-year time horizon global warming potentials (GWPs) applied to calculate CO_2e from the Intergovernmental Panel on Climate Change (IPCC) Sixth Assessment Report (AR6): CO_2 = 1; CH_4 = 82.5; N_2O = 273. 100-year time horizon GWPs applied to calculate CO_2e from the IPCC AR6: CO_2 = 1; CH_4 = 29.8; N_2O = 273.

Table 4-61. 2023-2038 Federal greenhouse gas emissions from the transportation of conventional natural gas produced in the planning area for all alternatives (metric tons).

Year	CO_2	CH_4	N_2O	20-year GWP CO_2e	100-year GWP CO_2e
2023	43,725	693.7	0.7	101,136	64,580
2024	43,725	693.7	0.7	101,136	64,580
2025	43,725	693.7	0.7	101,136	64,580
2026	43,725	693.7	0.7	101,136	64,580
2027	43,725	693.7	0.7	101,136	64,580
2028	43,725	693.7	0.7	101,136	64,580
2029	43,725	693.7	0.7	101,136	64,580
2030	43,725	693.7	0.7	101,136	64,580
2031	43,725	693.7	0.7	101,136	64,580
2032	43,725	693.7	0.7	101,136	64,580
2033	43,725	693.7	0.7	101,136	64,580
2034	43,725	693.7	0.7	101,136	64,580
2035	43,725	693.7	0.7	101,136	64,580
2036	43,725	693.7	0.7	101,136	64,580
2037	43,725	693.7	0.7	101,136	64,580

Year	CO_2	CH_4	N_2O	20-year GWP CO_2e	100-year GWP CO_2e
2038	43,725	693.7	0.7	101,136	64,580
Total	**699,597**	**11,098.5**	**10.8**	**1,618,179**	**1,033,288**

Notes: CO_2 = carbon dioxide; CH_4 = methane; N_2O = nitrous oxide; CO_2e = carbon dioxide equivalents. 20-year time horizon global warming potentials (GWPs) applied to calculate CO_2e from the Intergovernmental Panel on Climate Change (IPCC) Sixth Assessment Report (AR6): CO_2 = 1; CH_4 = 82.5; N_2O = 273. 100-year time horizon GWPs applied to calculate CO_2e from the IPCC AR6: CO_2 = 1; CH_4 = 29.8; N_2O = 273.

Table 4-62. 2023-2038 Nonfederal greenhouse gas emissions from the transportation of conventional natural gas produced in the planning area for all alternatives (metric tons).

Year	CO_2	CH_4	N_2O	20-year GWP CO_2e	100-year GWP CO_2e
2023	292,082	4,633.6	4.5	675,590	431,398
2024	292,082	4,633.6	4.5	675,590	431,398
2025	292,082	4,633.6	4.5	675,590	431,398
2026	292,082	4,633.6	4.5	675,590	431,398
2027	292,082	4,633.6	4.5	675,590	431,398
2028	292,082	4,633.6	4.5	675,590	431,398
2029	292,082	4,633.6	4.5	675,590	431,398
2030	292,082	4,633.6	4.5	675,590	431,398
2031	292,082	4,633.6	4.5	675,590	431,398
2032	292,082	4,633.6	4.5	675,590	431,398
2033	292,082	4,633.6	4.5	675,590	431,398
2034	292,082	4,633.6	4.5	675,590	431,398
2035	292,082	4,633.6	4.5	675,590	431,398
2036	292,082	4,633.6	4.5	675,590	431,398
2037	292,082	4,633.6	4.5	675,590	431,398
2038	292,082	4,633.6	4.5	675,590	431,398
Total	**4,673,309**	**74,138.0**	**72.3**	**10,809,437**	**6,902,362**

Notes: CO_2 = carbon dioxide; CH_4 = methane; N_2O = nitrous oxide; CO_2e = carbon dioxide equivalents. 20-year time horizon global warming potentials (GWPs) applied to calculate CO_2e from the Intergovernmental Panel on Climate Change (IPCC) Sixth Assessment Report (AR6): CO_2 = 1; CH_4 = 82.5; N_2O = 273. 100-year time horizon GWPs applied to calculate CO_2e from the IPCC AR6: CO_2 = 1; CH_4 = 29.8; N_2O = 273.

Table 4-63. 2023-2038 Federal greenhouse gas emissions from the transportation of coalbed natural gas produced in the planning area for all alternatives (metric tons).

Year	CO_2	CH_4	N_2O	20-year GWP CO_2e	100-year GWP CO_2e
2023	68,304	1,083.6	1.1	157,989	100,884
2024	68,304	1,083.6	1.1	157,989	100,884
2025	68,304	1,083.6	1.1	157,989	100,884
2026	68,304	1,083.6	1.1	157,989	100,884
2027	68,304	1,083.6	1.1	157,989	100,884
2028	68,304	1,083.6	1.1	157,989	100,884
2029	68,304	1,083.6	1.1	157,989	100,884

Year	CO_2	CH_4	N_2O	20-year GWP CO_2e	100-year GWP CO_2e
2030	68,304	1,083.6	1.1	157,989	100,884
2031	68,304	1,083.6	1.1	157,989	100,884
2032	68,304	1,083.6	1.1	157,989	100,884
2033	68,304	1,083.6	1.1	157,989	100,884
2034	68,304	1,083.6	1.1	157,989	100,884
2035	68,304	1,083.6	1.1	157,989	100,884
2036	68,304	1,083.6	1.1	157,989	100,884
2037	68,304	1,083.6	1.1	157,989	100,884
2038	68,304	1,083.6	1.1	157,989	100,884
Total	**1,092,871**	**17,337.5**	**16.9**	**2,527,827**	**1,614,143**

Notes: CO_2 = carbon dioxide; CH_4 = methane; N_2O = nitrous oxide; CO_2e = carbon dioxide equivalents. 20-year time horizon global warming potentials (GWPs) applied to calculate CO_2e from the Intergovernmental Panel on Climate Change (IPCC) Sixth Assessment Report (AR6): CO_2 = 1; CH_4 = 82.5; N_2O = 273. 100-year time horizon GWPs applied to calculate CO_2e from the IPCC AR6: CO_2 = 1; CH_4 = 29.8; N_2O = 273.

Table 4-64. 2023-2038 Nonfederal greenhouse gas emissions from the transportation of coalbed natural gas produced in the planning area for all alternatives (metric tons).

Year	CO_2	CH_4	N_2O	20-year GWP CO_2e	100-year GWP CO_2e
2023	92,759	1,471.5	1.4	214,553	137,003
2024	92,759	1,471.5	1.4	214,553	137,003
2025	92,759	1,471.5	1.4	214,553	137,003
2026	92,759	1,471.5	1.4	214,553	137,003
2027	92,759	1,471.5	1.4	214,553	137,003
2028	92,759	1,471.5	1.4	214,553	137,003
2029	92,759	1,471.5	1.4	214,553	137,003
2030	92,759	1,471.5	1.4	214,553	137,003
2031	92,759	1,471.5	1.4	214,553	137,003
2032	92,759	1,471.5	1.4	214,553	137,003
2033	92,759	1,471.5	1.4	214,553	137,003
2034	92,759	1,471.5	1.4	214,553	137,003
2035	92,759	1,471.5	1.4	214,553	137,003
2036	92,759	1,471.5	1.4	214,553	137,003
2037	92,759	1,471.5	1.4	214,553	137,003
2038	92,759	1,471.5	1.4	214,553	137,003
Total	**1,484,145**	**23,544.7**	**23.0**	**3,432,851**	**2,192,046**

Notes: CO_2 = carbon dioxide; CH_4 = methane; N_2O = nitrous oxide; CO_2e = carbon dioxide equivalents. 20-year time horizon global warming potentials (GWPs) applied to calculate CO_2e from the Intergovernmental Panel on Climate Change (IPCC) Sixth Assessment Report (AR6): CO_2 = 1; CH_4 = 82.5; N_2O = 273. 100-year time horizon GWPs applied to calculate CO_2e from the IPCC AR6: CO_2 = 1; CH_4 = 29.8; N_2O = 273.

Table 4-65. 2023-2038 Federal greenhouse gas emissions from the downstream combustion of oil produced in the planning area for all alternatives (metric tons).

Year	CO_2	CH_4	N_2O	20-year GWP CO_2e	100-year GWP CO_2e
2023	1,315,154	52.9	10.6	1,322,411	1,319,622
2024	1,315,154	52.9	10.6	1,322,411	1,319,622
2025	1,315,154	52.9	10.6	1,322,411	1,319,622
2026	1,315,154	52.9	10.6	1,322,411	1,319,622
2027	1,315,154	52.9	10.6	1,322,411	1,319,622
2028	1,315,154	52.9	10.6	1,322,411	1,319,622
2029	1,315,154	52.9	10.6	1,322,411	1,319,622
2030	1,315,154	52.9	10.6	1,322,411	1,319,622
2031	1,315,154	52.9	10.6	1,322,411	1,319,622
2032	1,315,154	52.9	10.6	1,322,411	1,319,622
2033	1,315,154	52.9	10.6	1,322,411	1,319,622
2034	1,315,154	52.9	10.6	1,322,411	1,319,622
2035	1,315,154	52.9	10.6	1,322,411	1,319,622
2036	1,315,154	52.9	10.6	1,322,411	1,319,622
2037	1,315,154	52.9	10.6	1,322,411	1,319,622
2038	1,315,154	52.9	10.6	1,322,411	1,319,622
Total	**21,042,467**	**846.9**	**169.4**	**21,158,576**	**21,113,945**

Notes: CO_2 = carbon dioxide; CH_4 = methane; N_2O = nitrous oxide; CO_2e = carbon dioxide equivalents. 20-year time horizon global warming potentials (GWPs) applied to calculate CO_2e from the Intergovernmental Panel on Climate Change (IPCC) Sixth Assessment Report (AR6): CO_2 = 1; CH_4 = 82.5; N_2O = 273. 100-year time horizon GWPs applied to calculate CO_2e from the IPCC AR6: CO_2 = 1; CH_4 = 29.8; N_2O = 273.

Table 4-66 2023-2038 Nonfederal greenhouse gas emissions from the downstream combustion of oil produced in the planning area for all alternatives (metric tons).

Year	CO_2	CH_4	N_2O	20-year GWP CO_2e	100-year GWP CO_2e
2023	8,915,926	358.8	71.8	8,965,122	8,946,211
2024	8,915,926	358.8	71.8	8,965,122	8,946,211
2025	8,915,926	358.8	71.8	8,965,122	8,946,211
2026	8,915,926	358.8	71.8	8,965,122	8,946,211
2027	8,915,926	358.8	71.8	8,965,122	8,946,211
2028	8,915,926	358.8	71.8	8,965,122	8,946,211
2029	8,915,926	358.8	71.8	8,965,122	8,946,211
2030	8,915,926	358.8	71.8	8,965,122	8,946,211
2031	8,915,926	358.8	71.8	8,965,122	8,946,211
2032	8,915,926	358.8	71.8	8,965,122	8,946,211
2033	8,915,926	358.8	71.8	8,965,122	8,946,211
2034	8,915,926	358.8	71.8	8,965,122	8,946,211
2035	8,915,926	358.8	71.8	8,965,122	8,946,211
2036	8,915,926	358.8	71.8	8,965,122	8,946,211
2037	8,915,926	358.8	71.8	8,965,122	8,946,211

Year	CO_2	CH_4	N_2O	20-year GWP CO_2e	100-year GWP CO_2e
2038	8,915,926	358.8	71.8	8,965,122	8,946,211
Total	**142,654,809**	**5,741.4**	**1,148.3**	**143,441,956**	**143,139,384**

Notes: CO_2 = carbon dioxide; CH_4 = methane; N_2O = nitrous oxide; CO_2e = carbon dioxide equivalents. 20-year time horizon global warming potentials (GWPs) applied to calculate CO_2e from the Intergovernmental Panel on Climate Change (IPCC) Sixth Assessment Report (AR6): CO_2 = 1; CH_4 = 82.5; N_2O = 273. 100-year time horizon GWPs applied to calculate CO_2e from the IPCC AR6: CO_2 = 1; CH_4 = 29.8; N_2O = 273.

Table 4-67. 2023-2038 Federal greenhouse gas emissions from the downstream combustion of conventional natural gas produced in the planning area for all alternatives (metric tons).

Year	CO_2	CH_4	N_2O	20-year GWP CO_2e	100-year GWP CO_2e
2023	278,186	5.2	0.5	278,762	278,486
2024	278,186	5.2	0.5	278,762	278,486
2025	278,186	5.2	0.5	278,762	278,486
2026	278,186	5.2	0.5	278,762	278,486
2027	278,186	5.2	0.5	278,762	278,486
2028	278,186	5.2	0.5	278,762	278,486
2029	278,186	5.2	0.5	278,762	278,486
2030	278,186	5.2	0.5	278,762	278,486
2031	278,186	5.2	0.5	278,762	278,486
2032	278,186	5.2	0.5	278,762	278,486
2033	278,186	5.2	0.5	278,762	278,486
2034	278,186	5.2	0.5	278,762	278,486
2035	278,186	5.2	0.5	278,762	278,486
2036	278,186	5.2	0.5	278,762	278,486
2037	278,186	5.2	0.5	278,762	278,486
2038	278,186	5.2	0.5	278,762	278,486
Total	**4,450,978**	**83.9**	**8.4**	**4,460,189**	**4,455,768**

Notes: CO_2 = carbon dioxide; CH_4 = methane; N_2O = nitrous oxide; CO_2e = carbon dioxide equivalents. 20-year time horizon global warming potentials (GWPs) applied to calculate CO_2e from the Intergovernmental Panel on Climate Change (IPCC) Sixth Assessment Report (AR6): CO_2 = 1; CH_4 = 82.5; N_2O = 273. 100-year time horizon GWPs applied to calculate CO_2e from the IPCC AR6: CO_2 = 1; CH_4 = 29.8; N_2O = 273.

Table 4-68. 2023-2038 Nonfederal greenhouse gas emissions from the downstream combustion of conventional natural gas produced in the planning area for all alternatives (metric tons).

Year	CO_2	CH_4	N_2O	20-year GWP CO_2e	100-year GWP CO_2e
2023	1,858,283	35.0	3.5	1,862,129	1,860,283
2024	1,858,283	35.0	3.5	1,862,129	1,860,283
2025	1,858,283	35.0	3.5	1,862,129	1,860,283
2026	1,858,283	35.0	3.5	1,862,129	1,860,283
2027	1,858,283	35.0	3.5	1,862,129	1,860,283
2028	1,858,283	35.0	3.5	1,862,129	1,860,283

Year	CO_2	CH_4	N_2O	20-year GWP CO_2e	100-year GWP CO_2e
2029	1,858,283	35.0	3.5	1,862,129	1,860,283
2030	1,858,283	35.0	3.5	1,862,129	1,860,283
2031	1,858,283	35.0	3.5	1,862,129	1,860,283
2032	1,858,283	35.0	3.5	1,862,129	1,860,283
2033	1,858,283	35.0	3.5	1,862,129	1,860,283
2034	1,858,283	35.0	3.5	1,862,129	1,860,283
2035	1,858,283	35.0	3.5	1,862,129	1,860,283
2036	1,858,283	35.0	3.5	1,862,129	1,860,283
2037	1,858,283	35.0	3.5	1,862,129	1,860,283
2038	1,858,283	35.0	3.5	1,862,129	1,860,283
Total	**29,732,536**	**560.4**	**56.0**	**29,794,063**	**29,764,532**

Notes: CO_2 = carbon dioxide; CH_4 = methane; N_2O = nitrous oxide; CO_2e = carbon dioxide equivalents. 20-year time horizon global warming potentials (GWPs) applied to calculate CO_2e from the Intergovernmental Panel on Climate Change (IPCC) Sixth Assessment Report (AR6): CO_2 = 1; CH_4 = 82.5; N_2O = 273. 100-year time horizon GWPs applied to calculate CO_2e from the IPCC AR6: CO_2 = 1; CH_4 = 29.8; N_2O = 273.

Table 4-69. 2023-2038 Federal greenhouse gas emissions from the downstream combustion of coalbed natural gas produced in the planning area for all alternatives (metric tons).

Year	CO_2	CH_4	N_2O	20-year GWP CO_2e	100-year GWP CO_2e
2023	434,567	8.2	0.8	435,466	435,034
2024	434,567	8.2	0.8	435,466	435,034
2025	434,567	8.2	0.8	435,466	435,034
2026	434,567	8.2	0.8	435,466	435,034
2027	434,567	8.2	0.8	435,466	435,034
2028	434,567	8.2	0.8	435,466	435,034
2029	434,567	8.2	0.8	435,466	435,034
2030	434,567	8.2	0.8	435,466	435,034
2031	434,567	8.2	0.8	435,466	435,034
2032	434,567	8.2	0.8	435,466	435,034
2033	434,567	8.2	0.8	435,466	435,034
2034	434,567	8.2	0.8	435,466	435,034
2035	434,567	8.2	0.8	435,466	435,034
2036	434,567	8.2	0.8	435,466	435,034
2037	434,567	8.2	0.8	435,466	435,034
2038	434,567	8.2	0.8	435,466	435,034
Total	**6,953,064**	**131.0**	**13.1**	**6,967,453**	**6,960,547**

Notes: CO_2 = carbon dioxide; CH_4 = methane; N_2O = nitrous oxide; CO_2e = carbon dioxide equivalents. 20-year time horizon global warming potentials (GWPs) applied to calculate CO_2e from the Intergovernmental Panel on Climate Change (IPCC) Sixth Assessment Report (AR6): CO_2 = 1; CH_4 = 82.5; N_2O = 273. 100-year time horizon GWPs applied to calculate CO_2e from the IPCC AR6: CO_2 = 1; CH_4 = 29.8; N_2O = 273.

Table 4-70. 2023-2038 Nonfederal greenhouse gas emissions from the downstream combustion of coalbed natural gas produced in the planning area for all alternatives (metric tons).

Year	CO_2	CH_4	N_2O	20-year GWP CO_2e	100-year GWP CO_2e
2023	590,152	11.1	1.1	591,373	590,787
2024	590,152	11.1	1.1	591,373	590,787
2025	590,152	11.1	1.1	591,373	590,787
2026	590,152	11.1	1.1	591,373	590,787
2027	590,152	11.1	1.1	591,373	590,787
2028	590,152	11.1	1.1	591,373	590,787
2029	590,152	11.1	1.1	591,373	590,787
2030	590,152	11.1	1.1	591,373	590,787
2031	590,152	11.1	1.1	591,373	590,787
2032	590,152	11.1	1.1	591,373	590,787
2033	590,152	11.1	1.1	591,373	590,787
2034	590,152	11.1	1.1	591,373	590,787
2035	590,152	11.1	1.1	591,373	590,787
2036	590,152	11.1	1.1	591,373	590,787
2037	590,152	11.1	1.1	591,373	590,787
2038	590,152	11.1	1.1	591,373	590,787
Total	**9,442,433**	**178.0**	**17.8**	**9,461,973**	**9,452,594**

Notes: CO_2 = carbon dioxide; CH_4 = methane; N_2O = nitrous oxide; CO_2e = carbon dioxide equivalents. 20-year time horizon global warming potentials (GWPs) applied to calculate CO_2e from the Intergovernmental Panel on Climate Change (IPCC) Sixth Assessment Report (AR6): CO_2 = 1; CH_4 = 82.5; N_2O = 273. 100-year time horizon GWPs applied to calculate CO_2e from the IPCC AR6: CO_2 = 1; CH_4 = 29.8; N_2O = 273.

4.5 Other BLM-authorized Activities

Annual emissions of criteria and hazardous air pollutants from BLM-authorized activities other than oil and gas development and coal mining in the planning area are provided in Table 4-71 and emissions of GHGs are provided in Table 4-72.

Table 4-71. Annual emissions of criteria and hazardous air pollutants for other BLM-authorized activities in the planning area (tons per year).

Activity	PM_{10}	$PM_{2.5}$	NO_x	SO_2	CO	VOCs	HAPs
Vegetation Management	11	1	0	0	11	3	0
Fire Management	211	151	58	14	1,742	97	10
Forestry and Woodland Products	11	1	4	0	3	0	0
Livestock Grazing	137	14	9	0	11	4	0
Recreation – Trails and Travel Management	293	30	0	0	27	27	3
General Purpose BLM Fleet Travel	73	7	2	0	5	2	0

Activity	PM_{10}	$PM_{2.5}$	NO_x	SO_2	CO	VOCs	HAPs
Road Maintenance	1	0	1	0	0	0	0
Total	**737**	**204**	**74**	**14**	**1,799**	**133**	**13**

Source: BLM 2015

Notes: PM_{10} = particulate matter with a diameter less than or equal to 10 microns; $PM_{2.5}$ = particulate matter with a diameter less than or equal to 2.5 microns; NOx = nitrogen oxides; SO_2 = sulfur dioxide; CO = carbon monoxide; VOC = volatile organic compounds; HAPs = hazardous air pollutants.

Table 4-72. Estimated annual greenhouse gases emissions for other BLM-authorized activities in the planning area (metric tons per year).

Activity	CO_2	CH_4	N_2O	100-year GWP CO_2e	20-year GWP CO_2e
Vegetation Management	30.8	0.0	0.0	30.8	30.8
Fire Management	262,218.1	109.8	21.8	271,433.1	277,218.0
Forestry and Woodland Products	475.4	0.0	0.0	475.4	475.4
Livestock Grazing	1,253.7	2,409.5	0.0	66,791.7	195,939.9
Recreation – Trails and Travel Management	70.8	0.0	0.0	70.8	70.8
General Purpose BLM Fleet Travel	275.8	0.0	0.0	275.8	275.8
Road Maintenance	133.4	0.0	0.0	133.4	133.4
Total	**264,458.0**	**2,519.3**	**21.8**	**339,210.9**	**474,144.0**

Source: BLM 2015

Notes: CO_2 = carbon dioxide; CH_4 = methane; N_2O = nitrous oxide; CO_2e = carbon dioxide equivalents. 20-year time horizon global warming potentials (GWPs) applied to calculate CO_2e for all activities except livestock grazing from the Intergovernmental Panel on Climate Change (IPCC) Sixth Assessment Report (AR6): CO_2 = 1; CH_4 (fossil) = 82.5; N_2O = 273. 100-year time horizon GWPs applied to calculate CO_2e from all activities except for livestock grazing from the IPCC AR6: CO_2 = 1; CH_4 (fossil) = 29.8; N_2O = 273. The AR6 non-fossil 20-year and 100-year GWPs of CH_4 of 80.8 and 27.2, respectively, were applied to CH_4 emissions from livestock grazing.

4.6 Supporting Information for Downstream Combustion Impacts on Air Quality and Public Health

4.6.1 Coal Shipments from the Planning Area

From mines located in the planning area, coal is transported via rail, truck, and/or conveyor to coal-fired power plants, which are listed in Table 4-73. Due to potential mine and power plant closures in future years, the destinations and shipping distances may vary over the planning period (2023-2038) and beyond.

Table 4-73. Power plants that received MCFO coal in 2021 and corresponding coal shipments.

Power Plant	Power Plant Location	Supplying Mine	Amount of Coal Received (million short tons)
Clay Boswell	Itasca, MN	Spring Creek	1.0
Coronado	Apache, AZ	Spring Creek	0.3
Dan E. Karn	Bay, MI	Spring Creek	0.06
DTE Belle River	St. Clair, MI	Spring Creek	4.4

Power Plant	Power Plant Location	Supplying Mine	Amount of Coal Received (million short tons)
Transalta Centralia	Lewis, WA	Spring Creek	1.1
Colstrip Power Plant	Rosebud, MT	Rosebud	6.2
Colstrip Energy Limited Partnership (CELP)*	Rosebud, MT	Rosebud*	0.20-0.25*

Source: EIA 2022a; *BLM 2022c

Notes: The amount of coal received by each power plant is from the listed supplying mine only and may include coal from both federal and non-federal mineral. Plants may receive additional coal from mines outside the planning area. Shipment information to CELP is from BLM 2022c and based on data as of December 2022, which has remained relatively consistent.

Since 2011, all coal shipments from the Rosebud Mine have gone to the Colstrip Power Plant or the Colstrip Energy Limited Partnership (CELP) Power Plant, and a very small amount has been sold to local residents for home heating (EIA 2022a, BLM 2022c). The majority of coal in 2021 was sent to the Colstrip Power Plant (6.2 million short tons) with relatively minor amounts sent to CELP (0.2-0.25 million short tons) or sold to local residents (0.2 million short tons) (BLM 2022c). Both Colstrip and CELP Power Plants are within the planning area. Ongoing litigation related to the Rosebud Mine and Colstrip power plant introduces considerable uncertainty in the amount of future coal used for combustion.

In 2021, domestic coal shipments from Spring Creek Mine were distributed to five power plants, namely the Dan E. Karn Facility and DTE Belle River Power Plant in Michigan, Clay Boswell Energy Center in Minnesota, Transalta Centralia Generation in Washington, and Coronado Generating Plant in Arizona (EIA 2022a). The largest amount of coal is sent to DTE Belle River, followed by Transalta Centralia, Clay Boswell, Coronado, and Dan E. Karn (Table 4-73). Approximately 37% of the annual coal shipments from Spring Creek are exported to Canada (EIA 2022a) via rail to a port in Vancouver, British Columbia. From here, coal is shipped to Asian markets. Approximately 10% of Spring Creek coal is transported to other industrial markets (BLM 2022c).

During the planning period (2023-2038), some of these power plants are expected to close which may impact the amount of coal that is shipped from Spring Creek Mine, the total shipping distance, and the method of transport. The Dan E. Karn Facility is scheduled to close in 2023 (Consumers Energy 2022). Transalta Centralia Generation is scheduled to close in 2025 (TransAlta 2022) and Coronado Generating Plant is scheduled to close in 2032 (SRP 2022). Forty percent of the Clay Boswell Energy Center is scheduled to close in 2030, with the rest planning to close by 2035 (Kraker 2021). The DTE Belle River Power Plant will be converted to natural gas in 2028 (Monroe News 2022, Fitzgerald 2021).

4.6.2 Refined Petroleum Products from Oil

The U.S. EIA reports the percent yield of individual petroleum products from U.S. refineries on a yearly basis. The average values over the five year period from 2017-2021 are presented in Table 4-74. Most of the crude oil produced in the Rocky Mountain region is transported to refineries within the U.S., so domestic averages provide a reasonable basis for this analysis. Some refinery products, such as lubricants and asphalt and road oil, are not combusted and their impacts are therefore not included in this study. Combustible petroleum products can be burned by a variety of sources including on-road and off-road vehicles and stationary sources.

Table 4-74. Average product yield from U.S. refineries.

Petroleum product	Refinery yield (%) 2017-2021 average
Finished motor gasoline	46.7
Distillate fuel oil	30.0
Kerosene-type jet fuel	9.2
Petroleum coke	5.1
Still gas	4.0
Hydrocarbon gas liquids	3.7
Asphalt and road oil	2.0
Residential fuel oil	2.0
Naphtha for petrochemical feedstock use	1.1
Lubricants	1.0
Other oils for petrochemical feedstock use	0.6
Miscellaneous products	0.5
Special naphthas	0.2
Finished aviation gasoline	0.1
Kerosene	0.1
Waxes	<0.0

Source: EIA 2022b

Note: The individual products do not sum to 100 percent due to refinery processing gain, which is due to crude oil having a higher specific gravity than the finished products.

Motor gasoline is the most used petroleum product in the U.S. Gasoline is primarily used in the transportation sector and is dominated by light-duty vehicles (e.g., cars, sport utility vehicles, small trucks), which make up 91% of total gasoline use (EIA 2022c). Additional uses include recreational vehicles and boats, small aircraft, equipment and tools used in various industries (e.g., construction, farming, forestry), and portable electricity generators. Distillate fuel oil, which includes diesel fuel and heating oil, is the second most used petroleum product in the U.S. Approximately 77% of diesel fuel is used in the transportation sector in freight and delivery trucks, trains, buses, boats, electricity generators, and farm, construction, and miliary vehicles and equipment. Some cars and light trucks also have diesel engines (EIA 2022d). Jet fuel is used in commercial, private, and military aircraft. Stationary source emissions are predominantly from distillate fuel combustion used for commercial and residential heating, industrial boilers, and power plant electricity generation (EIA 2022e).

4.6.3 Emissions from Coal Combustion

U.S. annual emissions of CAPs, precursors, and HAPs from coal combustion for individual source sectors are presented in the *Affected Environment* section of the EIS. Data for all pollutants except dioxins/furans is from the U.S. EPA 2017 NEI (EPA 2017a). Dioxins and furans are not included in the EPA NEI since the EPA has not evaluated the completeness or accuracy of emissions estimates from state, local, or tribal agencies (EPA 2021). The dioxins/furans emissions value is instead the range reported by EPRI 2018a for all power plants assessed for 2017. Dioxins/furans emissions are expressed as 2,3,7,8-TCDD toxic equivalents in EPRI 2018a.

The list of HAPs focused on in this assessment was developed using coal-fired power plant emissions studies by the Electric Power Research Institute (EPRI 2018a, 2018b) and the EPA NEI (EPA 2017a). Measurement data and previous emissions inventories from EPA, the Department of Energy (DOE), and EPRI were used by EPRI (2018a) to determine which HAPs are most relevant to coal combustion. Inhalation risk assessments by EPRI (2018a) showed that As, Cr (VI), Ni, Cl_2, acrolein, and Cd had the greatest impact on the modeled cancer risk, chronic non-cancer hazard index, and acute hazard quotients (HQ). In addition to these HAPs, a multi-pathway risk assessment (EPRI 2018b) also identified Hg, B(a)P, dioxin, and HCl as pollutants that contribute to the cancer risk and hazard index. It is highly likely that these HAPs account for the majority of cancer and non-cancer risk from coal-fired power plants. Emissions information for additional HAPs that may be emitted from coal combustion can be found in the EPA NEI (EPA 2017a) and EPRI 2018a.

The U.S. EPA NEI also provides facility-level emissions. Emissions of CAPs, precursors, and the HAPs discussed above are presented in the tables in the EIS for each of the power plants that receive MCFO coal. As noted above, dioxins and furans are not included in the EPA NEI and these emissions are instead from EPRI (2018a).

4.6.4 Public Health Impacts of Downstream Combustion

Studies of health impacts of fuel combustion were identified by performing separate literature searches for each fuel type through PubMed, a search engine supported by the US National Institutes of Health's National Library of Medicine (US National Library of Medicine n.d.), which contains details of journal citations and abstracts for biomedical and life science literature from around the world.

Coal Combustion Products

Two studies examine the association of oil combustion products and asthma or allergic symptoms (Lawrence et al. 2022; Sigsgaard et al. 2015). One study involved cleanup workers without prior diagnosis of asthma who were followed after the 2010 Deepwater Horizon Oil spill (Lawrence et al. 2022). These workers were exposed to oil burning and flaring so were anticipated to be exposed to oil combustion products. Examining information on asthma symptoms between 2011 and 2013, increased asthma in oil cleanup workers was observed as compared to non-workers. However, no trends were noted within the worker population based on work tasks associated with burning or flaring. The other asthma-related study (Sugiyama et al. 2020) uses source apportionment to identify oil combustion sources for school children in Fukuoka, Japan, examining the association between daily oil-attributable $PM_{2.5}$ and self-reported symptoms. They observed increased risk of nasal symptoms (e.g., sneezing, runny nose, congestion) but not ocular or dermal symptoms (e.g., itching, irritation) associated with exposure to increased daily concentrations of oil attributable $PM_{2.5}$.

Two studies (Bell et al. 2010; Ottone et al. 2020) examined association between maternal exposure to $PM_{2.5}$ modeled to be linked with oil combustion and its potential with birth outcomes. Both studies linked PM to oil combustion based on its nickel and vanadium content. One study (Bell et al. 2010) compared average daily $PM_{2.5}$ concentrations measured between 2000 and 2004 in 4 counties in the Northeast United States and compared these values to various birth outcomes. Estimated total exposure to $PM_{2.5}$ from oil combustion was not associated with either decreased birthweight or full-term births with weights less than 2,500 grams (5.5 pounds). However, increased nickel or vanadium content of the PM was associated with an increased risk of being small for gestational age (having birthweights below the 10^{th} percentile for gestational age) and increased nickel content was associated with decreased average birthweight. The other study (Ottone et al. 2020) examined preterm birth, low birth weight, and small for gestational age outcomes in a northern Italy population. Daily average gestational exposures to $PM_{2.5}$ from 2012 to 2014 were estimated and source apportionment techniques were used to identify the influence of traffic, biomass burning, oil combustion, anthropogenic mixes, and secondary sources. Although an increased risk of preterm birth was found to be associated with exposure to oil-associated $PM_{2.5}$, especially at the highest exposures, no associations were found for low birthweight or small-at-term births. Evidence for associations with birth outcomes is limited by the small number of studies and lack of consistent results.

Chen and others (2020) examined cardiac outcomes associated with exposure to oil combustion products. Using source apportionment techniques to attribute $PM_{2.5}$ oil combustion products, daily ambient $PM_{2.5}$ concentrations were compared to heart rate measurements in the elderly population of Beijing, China. Authors reported that both increased daily cumulative $PM_{2.5}$ exposures attributable to oil combustion were associated with greater heart rate variability. No association was reported for very low frequency band results. The small sample size of individuals with measurements (22) and the cross-sectional study design limited the strength of this study.

Two studies (Samoli et al. 2016; Chen et al. 2022) examined mortality and hospitalizations patterns and their association with PM exposure believed to be associated with oil combustion. One study followed the populations of various European countries, estimating total $PM_{2.5}$ exposure in a city by using the annual 2010 average $PM_{2.5}$ concentrations measured at monitoring sites (Chen et al. 2022). High concentrations of vanadium and nickel in the $PM_{2.5}$ were used to attribute the material to oil combustion. Increasing $PM_{2.5}$ concentrations from oil combustion was found to be associated with increased risk of non-malignant respiratory-related mortality and general natural-cause mortality, but not with cardiovascular or lung cancer-related mortality. Dependence on a single year and annual average exposure data are weaknesses of this study. Samoli and others (2016) examined mortality and hospitalizations in London as compared to daily ambient PM_{10} concentrations. Source apportionment techniques were used to link PM_{10} with oil combustion sources. Authors concluded that higher concentrations PM_{10} believed to originate from oil were associated with increased respiratory related hospitalizations in subjects aged 14 and under, but not other age groups. No associations were observed for PM_{10} in either overall or cardiovascular-specific hospitalizations or mortality.

Dai and others (2016) examined concentrations of $PM_{2.5}$ in the ambient air and markers of inflammation in blood samples. Using source apportionment techniques to link $PM_{2.5}$ concentrations to oil combustion processes, 2-day average concentrations of $PM_{2.5}$ were associated with increased blood markers for some inflammation markers (ICAM-1 and VCAM-1) but not others (IL-6 or CRP).

One study, involving boilermakers occupationally exposed to oil combustion products (Kim et al., 2004), examined the presence of a biomarker for oxidative DNA damage (8-hydroxyguanosine; 8-OH-dG) in urine and evaluated whether there was an association with exposure to $PM_{2.5}$ from residual oil fly ash. DNA damage is not in itself a health effect but might be indicative of increased cancer risk. By comparing pre-shift and post-shift concentrations of urinary 8-OH-dG, investigators found increasing concentrations of total $PM_{2.5}$, as well as $PM_{2.5}$ with vanadium, manganese, nickel, and lead, were associated with higher urinary 8-OH-dG. The small sample size (20 workers) and brief study period (5 days) limited the conclusions that could be drawn from this study.

Taken together, these studies suggest that there may be various health impacts from exposure to oil combustion although it should be noted that there are only two studies that directly examine populations which have been exposed to oil combustion products (Kim et al., 2004; Lawrence et al., 2022), and one of these studies (Kim et al., 2004) looks at biomarkers that are only indirectly linked to health impacts.

Gas Combustion Products

A case-control study of cancer in Danish workers potentially exposure to automobile gasoline and combustion products found exposed male workers had a higher incidence of breast cancer (odds ratio 2.5; 95% confidence interval 1.3-4.5) compared to unexposed male workers (Hansen 2000). This finding was more pronounced among workers with longer exposures and those who were younger at first exposure. The study did not differentiate gasoline vapors from gasoline combustion products.

$PM_{2.5}$

In China, total population-weighted $PM_{2.5}$ concentrations from all source sectors were modeled as 49.8 μg/m^3, which investigators calculate are associated with 1,387,000 deaths. Among fuels, coal was the dominant energy sector in China. In India, total population-weighted $PM_{2.5}$ concentrations from all source sectors were modeled as 80.2 μg/m^3, which investigators calculate are associated with 857,000 deaths. In India, solid biofuels were the dominant energy sector.

Using similar techniques, $PM_{2.5}$ concentrations modeled from source sectors in India show that emissions from residential energy use dominate exposures (52%, believed to be largely biomass and biofuel burning), followed by power generation (21%) (Conibear et al. 2018). Modeled $PM_{2.5}$ concentrations of 57.2 μg/m^3 were compared to measured $PM_{2.5}$ concentrations to validate use of modeled values. The investigators then compared $PM_{2.5}$ concentrations to anticipated premature mortality, using concentration-response functions developed from epidemiological studies. They estimate premature deaths in India due to $PM_{2.5}$ exposure to be 990,000 (95% CI [confidence interval] 660,000-1,350,000) per year corresponding to 24,606,000 (95% CI 14,567,000-32,698,000) years of life lost. The death estimate is similar to the 857,000 premature deaths calculated by McDuffie (McDuffie, Martin, Yin, et al. 2021). The dominant diseases associated with $PM_{2.5}$ exposures are ischemic heart disease and chronic obstructive pulmonary disease. However, the modeled as $PM_{2.5}$ concentration in the McDuffie study was 80.2 μg/m^3.

Table 4-75 outlines the determinations used by EPA to evaluate the health effects of criteria pollutants.

Table 4-75. Weight-of-Evidence for causality determinations.

Determination	Health Effects
Causal relationship (Causal)	Evidence is sufficient to conclude that there is a causal relationship with relevant pollutant exposures (e.g., doses or exposures are generally within one to two orders of magnitude of recent concentrations). That is, the pollutant has been shown to result in health effects in studies in which chance, confounding, and other biases could be ruled out with reasonable confidence. For example: (1) controlled human exposure studies that demonstrate consistent effects, or (2) observational studies that cannot be explained by plausible alternatives or that are supported by other lines of evidence (e.g., animal studies, mode-of-action information). Generally, the determination is based on multiple high-quality studies conducted by multiple research groups.
Likely to be causal relationship (Likely)	Evidence is sufficient to conclude that a causal relationship is likely to exist with relevant pollutant exposures. That is, the pollutant has been shown to result in health effects in studies where results are not explained by chance, confounding, and other biases, but uncertainties remain in the evidence overall. For example: (1) observational studies show an association, but copollutant exposures are difficult to address and/or other lines of evidence (controlled human exposure, animal, or mode of action information) are limited or inconsistent or (2) animal toxicological evidence from multiple studies from different laboratories demonstrate effects but limited or no human data are available. Generally, the determination is based on multiple high-quality studies.

Determination	Health Effects
Suggestive of but not sufficient to infer a causal relationship (Suggestive)	Evidence is suggestive of a causal relationship with relevant pollutant exposures but is limited, and chance, confounding, and other biases cannot be ruled out. For example: (1) when the body of evidence is relatively small, at least one high-quality epidemiologic study shows an association with a given health outcome and/or at least one high-quality toxicological study shows effects relevant to humans in animal species or (2) when the body of evidence is relatively large, evidence from studies of varying quality is generally supportive but not entirely consistent, and there may be coherence across lines of evidence (e.g., animal studies, mode of action information) to support the determination.
Inadequate to infer the presence or absence of a causal relationship (Inadequate)	Evidence is inadequate to determine that a causal relationship exists with relevant pollutant exposures. The available studies are of insufficient quantity, quality, consistency, or statistical power to permit a conclusion regarding the presence or absence of an effect.
Not likely to be a causal relationship (Not likely)	Evidence indicates there is no causal relationship with relevant pollutant exposures. Several adequate studies, covering the full range of levels of exposure that human beings are known to encounter and considering at-risk populations and lifestages, are mutually consistent in not showing an effect at any level of exposure.

Source: EPA 2015

Acrolein

The human carcinogenic potential of acrolein has been classified by EPA as "inadequate for assessment of human carcinogenic potential" due to the lack of adequate data to evaluate oral or inhalation exposure (EPA 1999, 2003b). The Department of Health and Human Services (DHHS) and the International Agency for Research on Cancer (IARC) have not classified the carcinogenicity of acrolein (ATSDR 2007a). Noncancer endpoints have been assessed in experimental animals exposed to acrolein via inhalation. Acrolein was reported to induce increased lesions in the nasal cavity and trachea of rats, rabbits, and hamsters and induced moderate to marked effects in the bronchi and lungs of rats and rabbits (ATSDR 2007a; Feron et al. 1978; Cassee, Groten, and Feron 1996). Nasal lesions reported in rats were the basis for the RfC of 2 x 10^{-5} mg/m^3 calculated for acrolein (EPA 2003b). An acute Minimal Risk Level (MRL) of 3.0 x 10^{-3} ppm was derived for acrolein based on eye, nose, and throat irritation and decreased breathing rate in humans following inhalation exposure (ATSDR 2007a). The intermediate inhalation MRL of 4.0 x 10^{-5} ppm was derived based on nasal epithelial metaplasia and bronchial inflammation in rats following exposure to acrolein (Feron et al. 1978; ATSDR 2007a).

Benzene

Benzene is classified as a known human carcinogen (Category A) by EPA (EPA 1986) for all routes of exposure (EPA 1996), a known human carcinogen by DHHS, and a human carcinogen by IARC (ATSDR 2007c). Occupational epidemiological studies support the classification of benzene as a human carcinogen via inhalation exposure, based on increased risk of cancer, specifically leukemia (ATSDR 2007c, 2015; Rinsky, Young, and Smith 1981). Chronic benzene inhalation exposure in workers resulted in anemia, leukopenia, lymphocytopenia, thrombocytopenia, pancytopenia, and aplastic anemia (ATSDR 2007c, 2015; Aksoy 1989). The target organ for benzene toxicity is the bone marrow, with expression of hematotoxicity and immunotoxicity reported as the most sensitive indicators for noncancer toxicity in both humans and experimental animals (Aksoy 1989; Snyder, Witz, and Goldstein 1993; Rothman et al. 1996; EPA 2002b). The RfC of 3 x 10^{-2} mg/m^3 calculated for benzene was based on hematotoxicity reported in occupationally exposed workers from three factories that either manufactured rubber padding for printing presses, manufactured adhesive tape, or used benzene-based paint in a factory (Rothman et al. 1996; EPA 2002b). An acute inhalation MRL of 9.0 x 10^{-3} ppm was derived for benzene based on decreased lymphocyte proliferation following mitogen stimulation in mice (Rozen, Snyder, and Albert 1984; ATSDR 2007c). The intermediate inhalation MRL reported for benzene is 6.0 x 10^{-3} ppm, based on delayed splenic lymphocyte reaction when evaluated in vitro following inhalation exposure in mice (Rosenthal and Snyder 1987; ATSDR 2007c). A statistically significant decrease in B-lymphocyte counts was the basis for the chronic inhalation MRL of 3.0 x 10^{-3} following inhalation exposure of occupational workers from a shoe factory (Lan et al. 2004; ATSDR 2007c).

1,3-Butadiene

EPA, IARC, and the National Toxicology Program (NTP) classify 1,3 butadiene as carcinogenic to humans via the inhalation pathway (EPA 1999; ATSDR 2012a). The target organ for 1,3 butadiene toxicity is the lymphohematopoietic system, which includes leukemia and lymphoma as lymphohematopoietic cancers as classified by the Revised European-American Lymphoma (REAL) and the Leukemia Society of America (EPA 2002a). Increased lymphohematopoietic cancers were reported in occupational workers exposed to the monomer and polymer forms of 1,3 butadiene (ATSDR 2012a; Delzell et al. 1996). Excess leukemia was mainly reported in polymer production workers (Santos-Burgoa et al. 1992 as cited in ATSDR 2012a), while increased risk of non-Hodgkin's lymphomas were reported in monomer production workers (ATSDR 2012a; Ward et al. 1995). Noncancer effects associated with 1,3 butadiene exposure in experimental animals consist of decreased fetal weight in mice (Hackett et al. 1987), fetal death in mice (Brinkworth et al. 1998), ovarian atrophy in female mice (NTP 1993), and testicular atrophy in male mice (NTP 1993). Ovarian atrophy was the basis for the chronic RfC of 2 x 10^{-3} mg/m^3 calculated for 1,3 butadiene. There are no reproductive or developmental human inhalation data available (ATSDR 2012a; EPA 2002a). There are no acute, intermediate, or chronic MRLs derived for 1,3 butadiene (ATSDR 2012a).

Ethylbenzene

The human carcinogenic potential of ethylbenzene has been classified by EPA as "Category D (not classifiable as to human carcinogenicity)" due to a lack of human studies and animal bioassays (EPA 1986; 1991). Carcinogenic risk for ethylbenzene was not assessed under the IRIS Program (EPA 1991). Short-term exposure to high concentrations of ethylbenzene in the air has been reported to cause eye irritation, throat irritation, vertigo, and dizziness in humans (ATSDR 2010). Noncancer endpoints evaluated in experimental animals following inhalation exposure to ethylbenzene showed fewer live births per litter in rabbits, increased incidence of supernumerary and rudimentary ribs and extra ribs in fetuses of exposed rats, and significantly increased absolute and relative liver, kidney, and spleen weights in pregnant rats (ATSDR 2010; Andrew et al. 1981). Hearing loss, inner ear damage, and kidney damage have also been reported in experimental animals following long-term exposure at relatively low concentrations of ethylbenzene (ATSDR 2010). Based on developmental toxicity findings, an RfC of 1 mg/m^3 has been derived for ethylbenzene (EPA 1991). It should be noted that ethylbenzene is currently (as of January 1, 2023) in Step 1, Draft Development, of evaluation in the IRIS Program. An acute inhalation MRL of 5 ppm was derived for ethylbenzene based on auditory capacity damage reported in rats following exposure (Cappaert et al. 2000; ATSDR 2010). An intermediate MRL of 2 ppm was derived for ethylbenzene based on ototoxicity reported in rats following inhalation exposure (Gagnaire et al. 2007; ATSDR 2010). A chronic inhalation MRL of 6.0 x 10^{-2} ppm was derived for ethylbenzene based on chronic progressive nephropathy reported in rats following inhalation exposure (NTP 1999; ATSDR 2010).

Formaldehyde

EPA has classified formaldehyde as "Category B1 (Probable human carcinogen-based on limited evidence of carcinogenicity in humans)" (EPA 1986; 1990a, 1990b). This classification is based on an increased incidence of squamous cell carcinomas reported in rats following inhalation exposure (EPA 1990a, 1990b; Kerns et al. 1983). Another consideration to support formaldehyde's carcinogenic potential is its similar structure to acetaldehyde, the closest aldehyde to formaldehyde. Acetaldehyde causes nasal cancers in rats and cancers of the nose and trachea in hamsters following inhalation exposure. An RfC has not been assessed under the IRIS Program for formaldehyde (EPA 1990a, 1990b). An acute MRL of 4.0 x 10^{-2} ppm was derived for formaldehyde based on mild eye, nose, and throat irritation, elevated eosinophil counts, and transient increased albumin content of nasal lavage fluid in humans following a two-hour inhalation exposure (ATSDR 1999a; Pazdrak et al. 1993). An intermediate MRL of 3.0 x 10^{-2} ppm was derived for formaldehyde based on respiratory effects which included hoarseness, nasal congestion and discharge, and lesions in the nasal epithelium of Cynomolgus monkeys (ATSDR 1999a; Rusch et al. 1983). A chronic MRL of 8.0 x 10^{-3} ppm was derived for formaldehyde based on histological changes in nasal tissues reported in occupational workers exposed to formaldehyde for an average of 10.4 years (Holmström et al. 1989 as cited in ATSDR 1999a).

n-Hexane

The human carcinogenic potential of n-hexane has been classified by EPA as "inadequate information to assess carcinogenic potential" (EPA 2005a; 2005b, 2005c). Noncancer endpoints have been assessed in experimental animals exposed to *n*-hexane via inhalation. A RfC of 7 x 10-^{1} mg/m^3 was derived for *n*-hexane based on peripheral neuropathy reported in rats following inhalation exposure (Huang et al. 1989; EPA 2005b, 2005c). An MRL of 0.6 ppm was derived for n-hexane based on a chronic inhalation study that resulted in reduced motor nerve conduction velocity in occupational workers (ATSDR 1999b; Sanagi et al. 1980).

Hydrogen Chloride

The human carcinogenic potential of hydrogen chloride (HCl) has not been classified by EPA, IARC, or DHHS (ATSDR 2002) or assessed under the IRIS Program (EPA 1995b). Noncancer effects associated with HCl following inhalation exposure include epithelial or squamous hyperplasia in the nasal mucosa of rats, as well as squamous metaplasia and hyperplasia of laryngeal-tracheal segments (Albert et al. 1982 as cited in 1995b; Sellakumar et al. 1985). Hyperplasia of the nasal mucosa, larynx, and trachea is the basis for the RfC of 2 x 10^{-2} mg/m^3 calculated for HCl (EPA 1995b). There are no acute, intermediate, or chronic MRLs derived for HCl (ATSDR 2002).

Toluene

The carcinogenic potential of toluene has not been classified by EPA due to the lack of adequate human or animal data (EPA 2005a; 2005d). IRIS derived an RfC of 5 mg/m^3 for toluene, based on neurological effects identified in a collection of ten studies evaluating occupational workers following inhalation exposure to toluene (EPA 2005d). An acute MRL of 2 ppm was derived based on neurological effects such as impaired immediate and delayed prose memory in male and female volunteers following inhalation exposure to toluene (Little et al. 1999 as cited in ATSDR 2017). A chronic MRL of 1 ppm was derived for toluene based on neurological effects such as performance on psychomotor tasks, color vision, and hearing in occupational workers exposed to toluene via inhalation (ATSDR 2017).

Xylenes

The carcinogenic potential of xylenes has not been classified by EPA due to the lack of adequate human or animal data (EPA 1999; 2003a). There were no sufficient human data available to derive an RfC for xylenes (EPA 2003a); therefore, an RfC of 1×10^{-1} mg/m^3 was derived based on impaired motor coordination reported in rats following inhalation exposure to xylenes (Korsak, Wiśniewska-Knypl, and Swiercz 1994; ATSDR 2007d; EPA 2003a). ATSDR derived an acute, intermediate, and chronic-duration inhalation MRL of 2 ppm, 0.6 ppm, and 0.05 ppm, respectively. The acute MRL is based on neurological and respiratory effects reported in men and women volunteers following inhalation exposure to *m*-xylene (Ernstgård et al. 2002; ATSDR 2007d). The intermediate duration MRL is based on neurotoxicity reported in rats following inhalation exposure to m-xylene (Korsak, Wiśniewska-Knypl, and Swiercz 1994; ATSDR 2007d). Respiratory and neurological effects were the basis of the chronic inhalation MRL, in which occupational workers were exposed to mixed xylenes for an average of 7 years (Uchida et al. 1993; ATSDR 2007d).

Arsenic

Arsenic is classified as a human carcinogen (Category A) (EPA 1986; 1995a). This classification is based on the increased incidence of lung cancer mortality mainly through inhalation exposure (EPA 1995a). A significant increase in lung cancer incidence has been reported in occupational workers from the Anaconda smelter (Brown and Chu 1983; EPA 1995a) and the ASARCO smelter (Enterline and Marsh 1982a as cited in EPA 1995a). An RfC was not assessed under the IRIS Program (EPA 1995a). No acute, intermediate, or chronic MRLs were derived for inorganic arsenic due to a lack of adequate human or animal data (ATSDR 2007b). Arsenic is currently (as of January 1, 2023) in Step 3 (Interagency Science Consultation) of evaluation in the IRIS Program (EPA 1995a).

Chromium (VI)

Chromium (VI) is classified as a known human carcinogen (Category A) (EPA 1986) for the inhalation route of exposure (EPA 1996; 1998a). This classification is based on the increased incidence of lung cancer in chromate-production workers exposed via inhalation to soluble and insoluble chromium (Cr) (Mancuso 1975 as cited in EPA 1998a). The RfC of 8×10^{-6} mg/m^3 derived for chromic acid mists and dissolved Cr (VI) aerosols was based on a subchronic occupational study in which workers from a chrome plating plant developed atrophy of the nasal septum following inhalation exposure (Lindberg and Hedenstierna 1983 as cited in EPA 1998a). The RfC of 1×10^{-4} mg/m^3 derived for Cr (VI) particulates was based on a subchronic study in rats in which increased lactate dehydrogenase (LDH) in bronchioalveolar lavage (BAL) fluid was reported following inhalation exposure (Glaser, Hochrainer, and Steinhoff 1990; EPA 1998a). However, Cr (VI) is currently in Step 4 (Public Comment and External Peer Review) of evaluation in the IRIS Program. The EPA has released an external review draft of the IRIS Toxicological Review of Hexavalent Chromium (2022) with a revised lifetime inhalation unit risk (IUR) and revised RfCs (EPA 2022d, 2022e). The EPA's 1998 classification of Cr (VI) as a known human carcinogen by the inhalation route of exposure did not change in the 2022 Draft Proposal. However, a new IUR of 2×10^{-2} (per µg Cr (VI)/m^3) was derived. The proposed IUR is based on increased incidence of lung cancer in chromate production workers exposed via inhalation to Cr (VI) (Gibb et al. 2015, 2020; EPA 2022d, 2022e). The EPA has proposed new RfCs for Cr (VI) for the lower respiratory tract, upper respiratory tract and an overall RfC. The RfC of 1×10^{-4} mg/m^3 was derived for the lower respiratory tract and based on cellular and histopathological changes reported in the lungs of rats. These changes included LDH, albumin, and total protein in BAL fluid and histiocytosis and bronchioalveolar hyperplasia of the lung (Glaser, Hochrainer, and Steinhoff 1990; EPA 2022d, 2022e). The proposed RfC of 1×10^{-5} mg/m^3 derived for the upper respiratory tract was based on ulcerated nasal septum reported in occupational workers exposed to Cr (VI) (Gibb et al. 2000; EPA 2022d, 2022e). The EPA proposes an overall RfC of 1×10^{-5} mg/m^3 for Cr (VI) based on the effect of ulcerated nasal septum in occupationally exposed workers (EPA 2022d, 2022e). A MRL of 5.0×10^{-6} mg/m^3, based on respiratory effects observed in occupational workers, was derived for Cr (VI) aerosol mists following intermediate and chronic inhalation exposure (Lindberg and Hedenstierna 1983 as cited in ATSDR 2012c). A MRL of 3.0×10^{-4} mg/m^3, based on respiratory effects in rats, was derived for Cr (VI) particulates following intermediate inhalation exposure (Glaser, Hochrainer, and Steinhoff 1990; ATSDR 2012c).

Mercury

Mercury is a naturally occurring element found in the air, water, and soil, and is released primarily during the combustion of coal. ATSDR categorizes mercury into three classes of compounds which include elemental mercury, inorganic mercury, and organic mercury. Occupational workers are mainly exposed to elemental mercury via inhalation of mercury vapor, while the majority of the population is exposed to organic mercury in the form of methylmercury through dietary ingestion. Inorganic mercury is not a leading source of mercury exposure for the general population (ATSDR 2022).

Methylmercury is highly toxic, with the nervous system being the most sensitive target organ for toxicity. Methylmercury bioaccumulates in fish and plants, in turn providing a higher source of exposure to the general public (ATSDR 2022). The EPA has classified methylmercury as a "Possible Human Carcinogen," but has not derived an oral carcinogenic potency factor due to inadequate data (EPA 2001). However, methylmercury is currently in Step 1, Draft Development, of evaluation in the IRIS Program. The existing oral RfD of 1×10^{-4} mg/kg/day was derived based on epidemiological studies in which adverse neuropsychological effects were reported in children following prenatal exposure to methylmercury via consumption of dietary fish (Budtz-Jørgensen et al. 1999; Grandjean et al. 1997; EPA 2001). A chronic oral MRL of 1.0×10^{-1} µg/kg/day was derived by ATSDR, based on neurodevelopmental effects in children whose mothers were chronically exposed to methylmercury through ingestion of dietary fish (Axelrad et al. 2007; ATSDR 2022). There is insufficient data to derive an inhalation MRL for methylmercury (ATSDR 2022).

Elemental Mercury is classified by the EPA as "Category D (Not classifiable as to human carcinogenicity)" based on inadequate human and animal data (EPA 1986; 1995d). An RfC of 3 x 10^{-4} mg/m^3 was derived for elemental mercury based on neurobehavioral effects reported in a collection of epidemiological studies. Hand tremors, EEG abnormalities, memory disturbances, sleep disorders, anger, fatigue, confusion, autonomic dysfunction, motor speed, visual scanning, visuomotor coordination and concentration, visual memory, and visuomotor coordination speed were reported to be adversely affected in occupational workers exposed to low level mercury vapor (EPA 1995d). There is insufficient data to derive an acute and intermediate MRL, however a chronic MRL of 3.0 x 10^{-1} µg Hg/m^3 was derived for elemental mercury based on tremors reported in occupational workers following inhalation exposure (ATSDR 2022).

Nickel

Nickel is a component of fly ash which is a product of coal and oil combustion. The main species of nickel found in fly ash includes nickel sulfate, nickel oxide, nickel chloride, and nickel sulfide (EPRI 1998; WHO 1987). A toxicological profile for nickel sulfate and nickel oxide, the two main species of nickel in fly ash, has not been developed under the IRIS Program (WHO 1987). However, a toxicological profile for nickel subsulfide has been developed under the IRIS Program. Nickel subsulfide is classified as a human carcinogen (Category A) by the EPA (EPA 1986; 1987b) and has an inhalation unit risk of 4.8 x 10^{-4} µg/m^3 based on the increased incidence of lung cancer in occupational workers (Enterline and Marsh 1982b as cited in EPA 1987b). ATSDR assessed the toxicity of metallic nickel, nickel sulfate, nickel chloride, nickel subsulfide, and nickel oxide following intermediate-duration inhalation exposures in experimental animals. ATSDR determined that the most sensitive target organ for nickel toxicity was the lung, and that nickel sulfate was observed to be the most toxic form evaluated (NTP 1996a; 1996b; 1996c; ATSDR 2005). An intermediate duration MRL of 2.0 x 10^{-4} mg/m^3 was derived for nickel, based on respiratory effects in rats exposed via inhalation to nickel sulfate. A chronic MRL of 9 x 10^{-5} mg/m^3 was derived for nickel based on respiratory effects in rats following chronic inhalation exposure to nickel sulfate (NTP 1996c; ATSDR 2005).

In addition to the key pollutants discussed in this section, health effect information on additional HAPs can be found on the EPA Integrated Risk Information System (IRIS) website and on the ATSDR website.

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Appendix D

Economic Technical Support Document

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Appendix D. Economic Technical Support Document

This appendix provides additional information on the baseline social and economic conditions in the socioeconomic analysis area, as well as details on the assumptions and methods used to assess impacts, as discussed in **Section 3.5.2**, Economic Considerations, Direct and Indirect Impacts, of this supplemental environmental impact statement for the United States (US) Department of the Interior, Bureau of Land Management (BLM) Miles City Field Office (MCFO) 2021 Record of Decision and Approved Resource Management Plan Amendment (BLM 2021).

D.1 BASELINE DEMOGRAPHICS AND ECONOMIC CONDITIONS

Table D-1 summarizes population trends for towns and counties in the socioeconomic analysis area between 2010 and 2020. Yellowstone County, Montana, with the highest population in the socioeconomic analysis area, experienced the largest population growth (11.3 percent) between 2010 and 2020. During the same timeframe, Sheridan County, Wyoming, experienced a population growth of 7.1 percent, and Big Horn County, Montana, saw 5.0 percent growth. Rosebud and Treasure Counties, Montana, both experienced population loss (-0.8 percent and -27.6 percent, respectively). For comparison, Montana experienced a population growth of 9.0 percent between 2010 and 2020.

Table D-1
Socioeconomic Analysis Area Population (2010–2020)

Geographic Area	Population 2010	Population 2020	Percent Population Change 2010–2020
County			
Big Horn County, MT	12,663	13,302	5.0
Rosebud County, MT	9,134	9,065	-0.8
Treasure County, MT	848	614	-27.6
Yellowstone County, MT	144,050	160,390	11.3
Sheridan County, WY	28,380	30,397	7.1
City/Town			
Hardin, MT	3,505	3,777	7.8
Billings, MT	104,170	109,705	5.3
Hysham, MT	312	224	-28.2
Forsyth, MT	1,777	1,596	-10.2
Sheridan, WY	17,444	17,938	2.8
State			
Montana	973,739	1,061,705	9.0

Source: Headwaters Economics 2022; US Census Bureau 2020
Notes: 2020 data for cities and towns from American Community Survey 2016–2020 data. Due to redistricting, 2020 decennial data were not available for all geographic areas.

Table D-2 shows projected population estimates for the counties in the socioeconomic analysis area between 2025 and 2040. Of these counties, Big Horn and Rosebud Counties in Montana are projected to experience population decreases between 2025 and 2040 (9.7 percent and 17.9 percent, respectively). In contrast, Treasure County, Montana, is projected to experience the largest population growth (28.4 percent), followed by Sheridan County, Wyoming (6.6 percent), and Yellowstone County, Montana (4.5 percent). Montana, by comparison, is projected to experience 8.7 percent population growth between 2025 and 2040 (Montana Department of Commerce 2022).

Table D-2
Socioeconomic Analysis Area Projected Population (2025–2040)

Geographic Area	Population 2025	Population 2030	Population 2035	Population 2040
Big Horn County, MT	12,382	11,710	11,318	11,178
Rosebud County, MT	7,702	6,959	6,542	6,323
Treasure County, MT	784	877	980	1,007
Yellowstone County, MT	170,683	175,270	177,275	178,358
Sheridan County, WY	31,590	32,550	33,130	33,670
Montana	1,130,421	1,172,150	1,206,445	1,229,024

Source: Montana Department of Commerce 2022

Table D-3 and **Table D-4** show county-level earnings and employment by industry, and **Table D-5** shows per capita personal income and average earnings per job for the counties in the socioeconomic analysis area and the state of Montana (for comparison). Sheridan County, Wyoming, had the highest per capita personal income ($64,449), higher than per capita personal income in Montana ($56,949), while Big Horn County, Montana, had the lowest per capita personal income ($36,517). Industries with the largest percent contribution to total earnings varied across the socioeconomic analysis area counties. The county with the highest proportion of mining, quarrying, and oil and gas extraction employment and income was Big Horn County, Montana, representing 14.5 percent of total income and 8.1 percent of total employment. Mining earnings and employment in Rosebud County, Montana, were not available due to Bureau of Economic Analysis nondisclosure rules; instead, estimates were included in higher-level totals. Earning and employment from mining-related activities in the remaining socioeconomic analysis area counties represented less than 3.0 percent of total county earnings and less than 1.0 percent of total county employment and were more comparable to that of Montana, which had a mining income of 2.5 percent of total earnings and mining employment of 1.4 percent of total employment (Bureau of Economic Analysis 2021a, 2021b).

As shown in **Table D-6**, with the exception of Big Horn County, Montana, unemployment rates from 2015 to 2021 followed a similar trend for Montana as a whole. This trend included a steady decrease in unemployment rates between 2015 and 2018. Unemployment began increasing in 2019 and peaked in 2020 due to the coronavirus (COVID-19) pandemic, which affected local and regional economies through a severe short-term reduction in employment and industrial output. While employment rates in 2021 appear to have recovered to pre-pandemic levels, the economic impacts of the pandemic remain to be seen and are not distributed evenly across industries. Unemployment rates in Big Horn County, Montana, have been consistently higher than other counties, peaking in 2013 and 2017, while remaining relatively low in 2020 (Bureau of Labor Statistics 2022).

Table D-3
Socioeconomic Analysis Area Personal Income and Earnings by Industry (2021)

	Big Horn County, MT	Rosebud County, MT	Treasure County, MT	Yellowstone County, MT	Sheridan County, WY	Montana
Personal Income ($1,000s)	473,150	434,318	38,174	9,930,988	2,039,562	62,886,699
Per Capita Personal Income	$36,517	$53,461	$49,706	$ 59,415	$64,449	$56,949
Earnings by Place of Work	$276,320	$291,453	$17,710	$6,963,050	$1,065,297	$38,034,685
Wages and Salaries	$197,217	$217,772	$8,396	$4,945,455	$723,159	$26,086,727
Supplements to Wages and Salaries	$60,244	$ 64,722	$2,606	$1,127,325	$205,644	$6,251,082
Proprietor's Income	$18,859	$ 8,959	$6,708	$890,270	$136,494	$4,068,547
Earnings by Industry (Total and Percent of Earnings)						
Mining, Quarrying, and Oil and Gas Extraction	$ 40,025	(D)	$ 0	172,074	$9,277	$933,503
	14.5%	(D)	0.0%	2.5%	0.9%	2.5%
Utilities	(D)	$ 46,830	(D)	$ 36,517	(D)	$390,355
	(D)	16.1%	(D)	0.5%	(D)	1.0%
Construction	(D)	$ 27,946	(D)	$ 565,853	$101,735	$3,494,985
	(D)	9.6%	(D)	8.1%	9.5%	9.2%
Manufacturing	(D)	$ 416	25	$407,865	$51,664	$ 1,688,847
	(D)	0.1%	0.1%	5.9%	4.8%	4.4%
Wholesale Trade	(D)	$ 174	1,525	$517,014	(D)	$1,556,606
	(D)	0.1%	8.6%	7.4%	(D)	4.1%
Retail Trade	$14,515	$7,528	(D)	$518,990	$82,908	$3,333,510
	5.3%	2.6%	(D)	7.5%	7.8%	8.8%
Transportation and Warehousing	$7,173	$9,122	(D)	$363,984	$63,869	$1,421,264
	2.6%	3.1%	(D)	5.2%	6.0%	3.7%
Finance and Insurance	$3,628	$3,294	(D)	$368,412	$42,136	$1,790,781
	1.3%	1.1%	(D)	5.3%	4.0%	4.7%
Real Estate Rental and Leasing	$2,026	$653	$200	$323,268	$17,021	$1,353,015
	0.7%	0.2%	1.1%	4.6%	1.6%	3.6%
Professional, Scientific, and Technical Services	$4,799	(D)	(D)	$553,331	$92,553	$2,879,811
	1.7%	(D)	(D)	7.9%	8.7%	7.6%
Administrative, Support, and Waste Management	(D)	(D)	$62	$268,185	$19,955	$1,208,555
	(D)	(D)	0.4%	3.9%	1.9%	3.2%
Health Care and Social Assistance	(D)	(D)	(D)	$1,243,338	$88,536	$5,409,554
	(D)	(D)	(D)	17.9%	8.3%	14.2%
Accommodation and Food Services	$8,940	$3,664	(D)	$292,385	$44,704	$1,932,422
	3.2%	1.3%	(D)	4.2%	4.2%	5.1%
Other Services	$5,956	$6,089	359	$257,421	$40,474	$1,389,360
	2.2%	2.1%	2.0%	3.7%	3.8%	3.7%
Government and Government Enterprises	$124,445	$108,642	$2,759	$770,139	$314,675	$6,824,631
	45.0%	37.3%	15.6%	11.1%	29.5%	17.9%

Source: Bureau of Economic Analysis 2021a
Notes: (D) = Not shown to avoid disclosure of confidential information; estimates are included in higher-level totals. Excludes sectors with approximately less than 2 percent of total employment for socioeconomic study area counties. Includes nonfarm employment only.

Table D-4
Socioeconomic Analysis Area Employment by Industry (2021)

	Big Horn County, MT	Rosebud County, MT	Treasure County, MT	Yellowstone County MT	Sheridan County, WY	Montana
Total Employment	5,159	4,879	395	113,665	25,067	709,342
Wage and Salary Employment	4,013	3,740	217	88,558	14,397	507,125
Proprietors Employment	1,146	1,139	178	25,107	10,670	202,217
Employment by Industry (Total and Percent)						
Mining, Quarrying, and Oil and Gas Extraction	417	(D)	0	1,145	284	9,581
	8.1%	(D)	0.0%	1.0%	1.1%	1.4%
Utilities	(D)	301	(D)	278	(D)	2,993
	(D)	6.2%	(D)	0.2%	(D)	0.4%
Construction	(D)	370	(D)	8,467	1,849	55,366
	(D)	7.6%	(D)	7.4%	7.4%	7.8%
Manufacturing	(D)	30	4	4,024	955	25,703
	(D)	0.6%	1.0%	3.5%	3.8%	3.6%
Wholesale Trade	(D)	15	26	5,867	(D)	19,577
	(D)	0.3%	6.6%	5.2%	(D)	2.8%
Retail Trade	407	303	(D)	12,944	2,677	77,062
	7.9%	6.2%	(D)	11.4%	10.7%	10.9%
Transportation and Warehousing	146	93	(D)	6,092	696	24,342
	2.8%	1.9%	(D)	5.4%	2.8%	3.4%
Finance and Insurance	101	93	(D)	5,762	2,314	29,912
	2.0%	1.9%	(D)	5.1%	9.2%	4.2%
Real Estate Rental and Leasing	95	72	12	6,642	2,666	43,224
	1.8%	1.5%	3.0%	5.8%	10.6%	6.1%
Professional, Scientific, and Technical Services	125	(D)	(D)	6,699	1,717	42,756
	2.4%	(D)	(D)	5.9%	6.8%	6.0%
Administrative, Support, and Waste Management	(D)	(D)	5	5,843	695	28,489
	(D)	(D)	1.3%	5.1%	2.8%	4.0%
Health Care and Social Assistance	(D)	(D)	(D)	15,557	1,694	79,590
	(D)	(D)	(D)	13.7%	6.8%	11.2%
Arts, Entertainment, and Recreation	141	89	3	3,113	573	21,488
	2.7%	1.8%	0.8%	2.7%	2.3%	3.0%
Accommodation and Food Services	328	208	(D)	9,825	1,611	60,521
	6.4%	4.3%	(D)	8.6%	6.4%	8.5%
Other Services	168	157	14	6,053	1,147	35,648
	3.3%	3.2%	3.5%	5.3%	4.6%	5.0%
Government and Government Enterprises	1,757	1,648	66	10,033	3,695	95,814
	34.1%	33.8%	16.7%	8.8%	14.7%	13.5%

Source: Bureau of Economic Analysis 2021b
Notes: (D) = Not shown to avoid disclosure of confidential information; estimates are included in higher-level totals. Excludes sectors with approximately less than 2 percent of total employment for socioeconomic study area counties. Includes nonfarm employment. Represents total full-time and part-time employment.

Table D-5
Socioeconomic Analysis Area Per Capita Income and Average Annual Income (2021)

	Big Horn County, MT	Rosebud County, MT	Treasure County, MT	Yellowstone County, MT	Sheridan County, WY	Montana
Per Capita Income	$36,517	$53,461	$49,706	$59,415	$64,449	$56,949
Average Earnings Per Job	$53,561	$59,736	$44,835	$61,259	$42,498	$53,620

Source: Bureau of Economic Analysis 2021c

Table D-6
Socioeconomic Analysis Area Unemployment, 2015–2021 (percent)

Annual Average Unemployment	Big Horn County, MT	Rosebud County, MT	Treasure County, MT	Yellowstone County, MT	Sheridan County, WY	Montana
2015	6.8	5.5	5.0	3.4	4.2	4.3
2016	7.5	5.7	4.5	3.7	4.7	4.3
2017	13.6	5.2	3.8	3.6	4.0	4.1
2018	9.6	5.3	3.0	3.3	4.1	3.7
2019	7.5	5.1	2.9	3.3	3.7	3.6
2020	7.2	5.5	3.5	5.3	4.9	5.8
2021	7.8	4.0	3.2	3.2	4.2	3.4

Source: Bureau of Labor Statistics 2022

D.2 Economic Contribution Analysis Methods

Qualitative and quantitative data were collected to determine the significance of the coal industry to the regional social and economic environment. An economic contribution analysis was further conducted to measure how employment and labor income generated in the coal sector further generates additional economic opportunities and employment in other sectors of the regional economy. The first step in conducting the contribution analysis was to obtain from the Mine Safety and Health Administration the 2021 production and employment data for the two active mines operating in the MCFO (Rosebud and Spring Creek Mines). These data were then used to estimate an average production volume per job that could be applied to annual federal production levels forecasted in the coal reasonably foreseeable development (RFD) scenario (**Appendix B**). Next, a regional input-output model for the local analysis area (Rosebud, Treasure, Yellowstone, and Bighorn Counties in Montana and Sheridan County in Wyoming) was generated using IMPLAN 2021 software and databases,[1] and response coefficients for a job change in employment in the coal sector were obtained. These response coefficients were then applied to direct employment supported by federal coal production under the RFD scenario (**Appendix B**) to estimate its annual direct, indirect, and induced economic contributions. Economic contributions were measured in terms of jobs, income, and economic output (that is, value of production). As described in **Section 3.5.2**, Economic Considerations, Direct and Indirect Impacts, direct contributions are those in the coal industry, indirect contributions are those in the coal industry's supply chain, and induced contributions are those in industries where direct and indirect labor wages are spent. It should be noted that direct estimates for employment are limited to those associated with federal production, and therefore differ from the estimate for recent coal mining jobs

[1] IMPLAN is a platform that combines a set of extensive databases, economic factors, multipliers, and demographic statistics with a highly refined modeling system that is fully customizable. It is one of the most widely used input-output models for conducting regional economic analyses. More information on IMPLAN software and databases is available at: https://www.implan.com/.

supported at Rosebud and Spring Hill Mines from Mine Safety and Health Administration data. Projected annual average contributions for economic activity (that is, jobs, income, and the value of output in industries) will fluctuate with production levels. As a result, the actual contribution level could vary from the forecasted level depending on the production level at a given time.

Existing federal and nonfederal leases are anticipated to take Spring Creek Mine until 2035 and Rosebud Mine until 2060. Based on US Energy Information Administration estimates, decreased coal production is anticipated over the analysis period (for additional details, see **Appendix B**). Analysis is presented in **Section 3.5.2**, Economic Considerations, Direct and Indirect Impacts.

For direct and indirect impacts, economic contribution analysis is based on anticipated pending and future federal leases for Spring Creek Mine from the time period of 2036 to 2088 (depending on the alternative selected). Qualitative information is provided for forecasts outside of the analysis period. The regional economic model was adjusted for this analysis to be limited to those counites with economic connections to Spring Creek Mine (Rosebud and Bighorn Counites, Montana, and Sheridan County, Wyoming).

Quantitative analysis is based on the anticipated production level of federal coal. This analysis does not capture quantitative analysis for reduction in nonfederal coal, should the absence of future federal leases limit the economic viability of continued mining operations and result in mine closure.

D.3 MINERAL REVENUES AND FUNDING FOR PUBLIC SERVICES

As discussed in **Section 3.5.1**, Economic Considerations, Affected Environment, Montana and local governments, municipalities, and special districts rely on revenues generated from mineral leasing and production. Forty-nine percent of federal mineral royalties are disbursed to Montana and distributed according to its statutes. Montana also assesses a severance tax on all minerals extracted in the state. These revenues are distributed to statewide funds and local governments according to a legislatively established two-tier formula.

In addition to federal and state revenues, federal production and the facilities and equipment at mines are also subject to county property taxes, known as ad valorem taxes. While local governments may receive a small disbursement of mineral revenues from the state, ad valorem mineral revenues account for a much larger share of total revenues at the county level each year. This is vital funding for school districts, libraries, workforce centers, public safety services, and public works projects.

Because federal, state, and local mineral revenues are based on the value of production, with the exception of federal rents, they are highly responsive to changes in market conditions. As production changes in response to changes in price and demand, so does the assessed value of production subject to set royalties and tax rates. Projected mineral revenues in the coal RFD scenario (Appendix B) were estimated based on a number of assumptions, including annual production levels, projected coal prices over the next planning period, royalty and tax rates, and the number of federal coal acres under lease. Assumptions for the various calculations are reported in **Table D-7**.

Table D-7
Assumptions for Estimating Mineral Revenues, 2023–2038

Type	Assumption
Production	Annual production was provided by the coal RFD scenario (**Appendix B**).
Price	A weighted average price was estimated by averaging US Energy Information Administration price forecasts for Wyoming Powder River Basin coal under the high and low economic growth scenarios and weighting average prices by annual production under the coal RFD scenario (**Appendix B**).
Federal royalties and royalty disbursement	Federal royalties were estimated at 12.5 percent of the market value of federal mineral production based on historical royalty rates paid. It assumes that 49 percent of revenue collected is disbursed to the state.
Resource indemnity and groundwater assessment tax	It assumes that this tax is collect at 0.4 percent of market value of federal mineral production.
Coal excise tax	This assumes a rate of $0.25 per short ton of produced coal.
Gross proceeds tax	This is a flat 5 percent of market value of federal mineral production.
Severance taxes	State severance taxes were estimated at 15 percent of market value of federal mineral production.

D.4 SOCIAL COSTS OF GREENHOUSE GAS EMISSIONS

Details for greenhouse gas emission calculations and methodology for social cost of greenhouse gas emission calculations are included in **Section 3.4**, Greenhouse Gases, Including Climate Change. **Table D-8** provides social cost calculations for carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_2O) for existing leases. **Table D-9** provides Information for greenhouse gas-specific calculations for oil and gas development and other uses. **Table D-10** provides information for greenhouse gas-specific calculations for Alternatives A and B from 2039-2061 from new federal leases. **Table D-11** provides information for pending and future leases under Alternative C. No new federal leases would be issued under Alternative D (no leasing Alternative), therefore no additional social costs from coal emission would occur under this Alternative.

Table D-8
Social Cost of Greenhouse Gas Emissions from Mining, Transportation, and Downstream Combustion Coal from Existing Federal Leases in the Planning Area from 2023 to 2038 (2020$)

	Average Value, 5% discount rate	Average Value, 3% discount rate	Average Value, 2.5% discount rate	95th Percentile Value, 3% discount rate
CO_2	$3,105,870,000	$11,404,400,000	$17,143,048,000	$34,425,385,000
CH_4	$31,324,000	$75,248,000	$100,166,000	$199,837,000
N_2O	$26,283,000	$88,509,000	$131,836,000	$234,280,000
Total	$3,163,477,000	$11,568,157,000	$17,375,050,000	$34,859,502,000

Source: Greenhouse gas emission calculation and Interagency Working Group 2021
Notes: CO_2 = carbon dioxide, CH_4 = methane, and N_2O = nitrous oxide.

Table D-9
Planning Area Oil and Gas and Other Emissions Social Cost of Carbon 2023-2038 (total in $2020)

Emission Type	Average Value, 5% discount rate	Average Value, 3% discount rate	Average Value, 2.5% discount rate	95th Percentile Value, 3% discount rate
Federal Oil				
CO_2	$321,160,000	$1,193,383,000	$1,798,230,000	$3,610,007,000
CH_4	$5,085,000	$12,372,000	$16,512,000	$32,888,000
N_2O	$1,171,000	$3,985,000	$5,951,000	$10,558,000
Total	$327,415,000	$1,209,740,000	$1,820,692,000	$3,653,453,000
Federal Conventional Natural Gas				
CO_2	$72,398,000	$269,019,000	$405,367,000	$813,788,000
CH_4	$8,652,000	$21,052,000	$28,097,000	$55,965,000
N_2O	$111,000	$378,000	$565,000	$1,003,000
Total	$81,161,000	$290,450,000	$434,030,000	$870,755,000
Federal Coal Bed Natural Gas				
CO_2	$110,985,000	$412,405,000	$621,425,000	$1,247,532,000
CH_4	$13,301,000	$32,362,000	$43,191,000	$86,029,000
N_2O	$170,000	$579,000	$865,000	$1,534,000
Total	$124,456,000	$445,346,000	$665,481,000	$1,335,095,000
Other Emissions				
CO_2	$55,225,000	$205,210,000	$309,217,000	$620,763,000
CH_4	$25,553,000	$62,173,000	$82,978,000	$165,277,000
N_2O	$1,834,000	$6,243,000	$9,321,000	$16,538,000
Total	$82,611,800	$273,625,000	$401,515,000	$802,578,000

Source: GHG emission calculation and Interagency Working Group 2021

Table D-10
Annual Coal Mining Emissions of Criteria and Hazardous Air Pollutants (tons/year) due to Federal Production from Pending Federal Leases in the Planning Area under Alternatives A and B (2036-2061)

	Average Value, 5% discount rate	Average Value, 3% discount rate	Average Value, 2.5% discount rate	95th Percentile Value, 3% discount rate
CO_2	$2,394,555,000	$10,663,302,000	$16,719,776,000	$32,724,556,000
CH_4	$24,463,000	$75,106,000	$105,376,000	$ 200,329,000
N_2O	$19,788,000	$82,411,210	$128,835,000	$220,138,000
Total	$2,438,806,000	$10,820,819,000	$16,953,986,000	$33,145,023,000

Source: GHG emission calculation and Interagency Working Group 2021
Note: Social Cost estimates for emissions years beyond 2050 are estimated using an annual growth rate equal to the average annual growth in social cost estimates for the last 5 years of available estimates from the Interagency Working Group 2021 (2046-2050).

Table D-11
Alternative C Social Cost of Greenhouse Gas Estimates 2036-2050 (2020$)

Years	Average Value, 5% discount rate	Average Value, 3% discount rate	Average Value, 2.5% discount rate	95th Percentile Value, 3% discount rate
CO_2	$1,576,786,000	$6,653,645,000	$10,299,009,000	$20,418,838,000
CH_4	$15,912,000	$45,621,000	$62,989,000	$122,013,000
N_2O	$12,922,000	$50,719,000	$78,155,000	$135,381,000
Total	$1,605,620,000	$6,749,986,000	$10,440,153,000	$20,676,232,000

Source: GHG emission calculation and Interagency Working Group 2021

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Appendix E
Environmental Justice Support Document

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Appendix E. Environmental Justice Support Document

This appendix supports the environmental justice screening of the local analysis area (Big Horn, Treasure, and Rosebud Counties, Montana), as well as for communities adjacent to downstream combustion points, as discussed in **Section 3.6**, Environmental Justice, of this supplemental environmental impact statement for the United States (US) Department of the Interior, Bureau of Land Management (BLM) Montana Miles City Field Office 2021 Record of Decision and Approved Resource Management Plan Amendment (BLM 2021).

As discussed above, the local analysis area includes Big Horn, Treasure, and Rosebud Counties, Montana. The local analysis area for environmental justice is limited to the location of mines, as such it does not include Sheridan and Yellowstone counties, as they have no mines. The local analysis area includes all block groups within the three local analysis area counties. Block groups are statistical, geographic divisions of census tracts and are generally defined to contain between 600 and 3,000 people. A block group usually covers a contiguous area. Each census tract contains at least one block group, and block groups are uniquely numbered within the census tract. The total minority populations are defined as the total population minus those who identify as white, of non-Hispanic descent. For this analysis, the BLM used a threshold analysis and meaningfully greater analysis. The 50 percent threshold analysis involves identifying any block groups with a total minority population of 50 percent or greater. Based on 2020 US Census Bureau data, a total of 11 block groups met this threshold. For the meaningfully greater analysis, the BLM uses 110 percent of the minority percentage of the geographic reference area as the threshold for meaningfully greater (BLM 2022). In this case, 110 percent of the total minority population for Montana (the reference area) is 14.39 percent. Based on 2020 US Census Bureau data, 18 block groups met the criteria for the meaningfully greater analysis.

The BLM used 2020 US Census Bureau data to identify indigenous populations. Indigenous populations for the purpose of this analysis include those who identify as American Indian or Alaska native alone or in combination with one or more other races. The BLM also used a threshold analysis and meaningfully greater analysis to identify indigenous populations who meet the criteria for environmental justice consideration. The 50 percent threshold analysis involves identifying any block groups with a total indigenous population 50 percent or greater. Based on 2020 US Census Bureau data, Big Horn County and a total of 10 block groups met this threshold. For this analysis, the BLM also considered block groups at or above the state indigenous population to be environmental justice communities of potential concern. In this case, the total indigenous population for Montana (the reference area) is 8.17 percent. Based on 2020 US Census Bureau data, Big Horn and Rosebud Counties and 16 block groups met the criteria for the meaningfully greater analysis.

Low-income populations are defined relative to the annual statistical poverty thresholds from the US Census Bureau (Council on Environmental Quality 1997). This guidance on environmental justice defines low-income populations based on the US Census Bureau's annual statistical poverty thresholds. Council on Environmental Quality guidance does not provide criteria for determining low-income populations as specifically as it does for minority populations; however, the BLM defines low-income individuals as people whose income is less than or equal to twice (200 percent of) the federal "poverty level" (BLM 2022). For this analysis, the BLM used a 50 percent threshold analysis and low-income threshold analysis. For the 50 percent threshold analysis, areas in which the percent of the population living at or below 200 percent of the poverty line exceeds 50 percent are considered low-income populations. Based on 2020 US Census Bureau data, Big Horn County and nine block groups met this threshold. For the low-income threshold analysis, any study area that has a low-income percentage of the population equal to or higher than the reference area is identified as having a low-income environmental justice community of concern. Based on 2020 US Census Bureau data, all 3 counties and 14 block groups within the local analysis area counties met the low-income threshold and have been identified as having low-income environmental justice communities of concern for this analysis. Additionally, the local analysis area as a whole has a low-income population higher than the reference area (Montana) and, as such, all three counties are identified as low-income environmental justice communities of concern. **Table E-1** provides an overview of the screening for block groups within the local analysis area. A total of 10 block groups (91 percent of block groups) in Big Horn County, 6 block groups (75 percent of block groups) in Rosebud County, and the 1 block group (100 percent of block groups) in Treasure County meet one or more criteria for consideration as environmental justice communities of concern. Values with an asterisk indicate data that meets or exceeds environmental justice criteria for a given data set.

Table E-2 provides an overview of select health disparities indicators in local analysis area counties. Indicators such as asthma and heart disease prevalence provide information about a population's health status with respect to environmental factors. Research has shown that some people are more susceptible than others to air pollutants. These groups include children, pregnant women, older adults, and individuals with pre-existing heart and lung disease (EPA 2023). For instance, communities in which pre-existing health conditions are prevalent could be more vulnerable to increased health impacts associated with air pollutants, such as greenhouse gas emissions.

Asthma prevalence describes the size of a state's population with asthma, as well as the overall asthma prevalence relative to other chronic conditions. The greater the prevalence of asthma, the greater the likelihood of adverse outcomes from asthma, including emergency department visits, hospitalizations, and death. In Montana, asthma prevalence among adults ranges from 9 percent to 12.3 percent. Compared with the United States, all three local analysis area counties have higher asthma prevalence.

Heart disease prevalence describes the size of a state's population with coronary heart disease. All three local analysis area counties have a higher prevalence of heart disease among adults compared with the United States.

Table E-1
Local Analysis Area Environmental Justice Screening Results

Geographic Area	Total Population	Minority Population Percentage of Geographic Area	Indigenous Population Percentage of Geographic Area	Low-income Population Percentage of Geographic Area	Meets Criteria for Environmental Justice Communities of Concern?
Reference Area: Montana	1,077,978	14.93	8.17	32	Areas at or above these values meet the BLM thresholds for environmental justice consideration
Big Horn County	13,198	73.78*	68.36*	56*	Yes
Rosebud County	8,464	48.56*	40.99*	41*	Yes
Treasure County	693	2.89	0.14	39*	Yes
Block Group 1, Census Tract 1, Big Horn County	840	42.26*	22.62*	42*	Yes
Block Group 2, Census Tract 1, Big Horn County	1,946	74.31*	52.93*	61*	Yes
Block Group 3, Census Tract 1, Big Horn County	1,099	51.68*	51.68*	55*	Yes
Block Group 4, Census Tract 1, Big Horn County	618	2.91	1.46	30	No
Block Group 1, Census Tract 9404, Big Horn County	1,745	91.69*	88.71*	55*	Yes
Block Group 1, Census Tract 9405, Big Horn County	656	46.80*	42.07*	44*	Yes
Block Group 2, Census Tract 9405, Big Horn County	760	66.97*	66.97*	47*	Yes
Block Group 1, Census Tract 9406, Big Horn County	1,295	89.19*	86.72*	74*	Yes
Block Group 2, Census Tract 9406, Big Horn County	2,038	94.65*	94.65*	65*	Yes
Block Group 1, Census Tract 9407, Big Horn County	1,326	75.41*	75.41*	39*	Yes
Block Group 2, Census Tract 9407, Big Horn County	875	97.26*	96.00*	75*	Yes

Geographic Area	Total Population	Minority Population Percentage of Geographic Area	Indigenous Population Percentage of Geographic Area	Low-income Population Percentage of Geographic Area	Meets Criteria for Environmental Justice Communities of Concern?
Block Group 1, Census Tract 1, Rosebud County	608	1.48	1.32	25	No
Block Group 2, Census Tract 1, Rosebud County	1,408	24.22*	4.83	45	Yes
Block Group 1, Census Tract 2, Rosebud County	644	2.02	2.02	27	No
Block Group 2, Census Tract 2, Rosebud County	568	42.78*	42.78*	55*	Yes
Block Group 1, Census Tract 3, Rosebud County	1,240	27.82*	7.50	19	Yes
Block Group 2, Census Tract 3, Rosebud County	854	18.15*	13.00*	16	Yes
Block Group 1, Census Tract 9404, Rosebud County	2,297	99.04*	98.00*	59*	Yes
Block Group 2, Census Tract 9404, Rosebud County	845	86.27*	80.71*	56*	Yes
Block Group 1, Census Tract 9635, Treasure County	693	2.89	0.14	39*	Yes

Source: US Environmental Protection Agency 2022; US Census Bureau 2021

Note: Data with an asterisk indicates data that meet or exceed environmental justice criteria for a given data set

Table E-2
Local Analysis Area Health Disparities Indicators

Geographic Area	Asthma Prevalence among Adults Aged 18 Years and Older (2020)	Heart Disease Prevalence among Adults Aged 18 Years and Older (2020)
Big Horn County	12.8%	7.8%
Rosebud County	11.4%	8.1%
Treasure County	10.4%	6.7%
United States	9.2%	5.5%

Source: US Center for Disease Control 2020a, 2020b

Table E-3 provides an overview of select environmental and public health indices for local analysis area block groups. This table shows select data from the US Environmental Protection Agency's Environmental Justice Screen (EJSCREEN) index. The index shows environmental and demographic raw data (such as the estimated concentration of ozone in the air), and also shows what percentile each raw data value represents. These percentiles provide perspective on how the selected block group or buffer area compares with the entire state, US Environmental Protection Agency region, or country. For example, if a given location is at the 95th percentile nationwide, this means that only 5 percent of the US population has a higher block group value than the average person in the location being analyzed. Data provided in standard reports include the following:

- Environmental Justice Index for Particulate Matter 2.5
- Environmental Justice Index for Ozone
- Environmental Justice Index for Diesel Particulate Matter
- Environmental Justice Index for Air Toxics Cancer Risk
- Environmental Justice Index for Air Toxics Respiratory Hazard Index
- Environmental Justice Index for Underground Storage Tanks
- Environmental Justice Index for Traffic Proximity
- Environmental Justice Index for Lead Paint
- Environmental Justice Index for Superfund Proximity
- Environmental Justice Index for Risk Management Plan Facility Proximity
- Environmental Justice Index for Hazardous Waste Proximity
- Environmental Justice Index for Wastewater Discharge

In this appendix, select information is presented related to the overall comparison of the above indices with state and national levels. In addition, detailed information is provided for indices likely to have cumulative impacts from coal mining and combustion, specifically the environmental justice indices for air toxics cancer risk, air toxics respiratory hazard index, particulate matter 2.5, and ozone. Data are presented for each criterion compared with state levels; those indices where block group levels were 80 percent or higher than state levels are identified in red bold text.

Table E-3
Local Analysis Area Select Environmental and Health Indices

Geographic Area	Percentile in State of Montana					One or More Indices at or above 80th Percentile for the Country
	Index for Air Toxics Cancer Risk* (lifetime risk per million)	Air Toxics Respiratory Hazard Index*	Index for Particulate Matter 2.5	Index for Ozone	One or More Indices at or above 80th Percentile for the State	
Reference Area Values: Montana (State Average)	21	0.32	6.84	42.2	-	-
Block Group 1, Census Tract 1, Big Horn County	89*	63	86*	84*	Yes	Yes
Block Group 2, Census Tract 1, Big Horn County	97*	85*	96*	95*	Yes	Yes
Block Group 3, Census Tract 1, Big Horn County	97*	83*	95*	95*	Yes	Yes
Block Group 4, Census Tract 1, Big Horn County	39	18	48	39	No	No
Block Group 1, Census Tract 9404, Big Horn County	0	89*	82*	99*	Yes	Yes
Block Group 1, Census Tract 9405, Big Horn County	0	0	56	95*	Yes	No
Block Group 2, Census Tract 9405, Big Horn County	0	0	67	97*	Yes	Yes
Block Group 1, Census Tract 9406, Big Horn County	0	93*	98*	99*	Yes	Yes
Block Group 2, Census Tract 9406, Big Horn County	0	90*	97*	98*	Yes	Yes
Block Group 1, Census Tract 9407, Big Horn County	0	0	71	96*	Yes	Yes
Block Group 2, Census Tract 9407, Big Horn County	0	0	86*	99*	Yes	Yes
Block Group 1, Census Tract 1, Rosebud County	31	13	33	30	No	No
Block Group 2, Census Tract 1, Rosebud County	80	50	64	72	Yes	No

Geographic Area	Percentile in State of Montana					One or More Indices at or above 80th Percentile for the Country
	Index for Air Toxics Cancer Risk* (lifetime risk per million)	Air Toxics Respiratory Hazard Index*	Index for Particulate Matter 2.5	Index for Ozone	One or More Indices at or above 80th Percentile for the State	
Block Group 1, Census Tract 2, Rosebud County	33	14	43	42	No	No
Block Group 2, Census Tract 2, Rosebud County	93*	69	88*	92*	Yes	Yes
Block Group 1, Census Tract 3, Rosebud County	0	35	62	66	No	No
Block Group 2, Census Tract 3, Rosebud County	0	35	62	66	No	No
Block Group 1, Census Tract 9404, Rosebud County	98*	91*	90*	99*	Yes	Yes
Block Group 2, Census Tract 9404, Rosebud County	98*	89*	87*	99*	Yes	Yes
Block Group 1, Census Tract 9635, Treasure County	0	28	56	48	No	No

Source: US Environmental Protection Agency 2023
Note: Data are presented for each criterion compared with state levels; those indices where block group levels were 80 percent or higher than state levels are identified with an asterisk.
*Air toxics cancer risk and air toxics respiratory hazard index are from the US Environmental Protection Agency's Air Toxics Data Update, which is the Agency's ongoing, comprehensive evaluation of air toxics in the United States. This effort aims to prioritize air toxics, emission sources, and locations of interest for further study. It is important to remember that the air toxics data presented here provide broad estimates of health risks over geographic areas of the country, not definitive risks to specific individuals or locations. Cancer risks and hazard indices from the Air Toxics Data Update are reported to one significant figure and any additional significant figures here are due to rounding. More information on the Air Toxics Data Update can be found at https://www.epa.gov/haps/air-toxics-data-update.

Table E-4 provides the environmental justice screening results for the downstream environmental justice analysis area. The BLM identified six power plant locations within four states that receive federal coal from the Miles City Field Office. The BLM used the US Environmental Protection Agency's EJSCREEN tool to identify all block groups within a 1-mile radius of each power plant location (US Environmental Protection Agency 2022). The BLM also used the EJSCREEN tool to gather the minority and low-income populations. To gather information on the indigenous populations, the BLM used US Census Bureau data for those who identify as American Indian and Alaska Native Alone or In Combination with One or More Other Races (US Census Bureau 2020). The BLM used these US Census Bureau data to provide more comprehensive information on indigenous populations. For instance, this data set includes those who identify as American Indian or Alaska Native, who may not have tribal membership, or who are a part of nonfederally recognized tribes.

The total minority, indigenous, and low-income populations are displayed in **Table E-4** for each block group. The BLM used the same criteria applied for the local analysis area (described above) to determine which block groups meet the criteria for consideration as environmental justice communities of concern. The BLM then used each state as a reference population to determine whether the block groups had minority, indigenous, or low-income populations. Of the 20 block groups located within a 1-mile radius of the six power plant locations,[1] 65 percent meet the criteria for consideration as an environmental justice community for at least one of the three demographic indicators. As such, according to 2021 US Census Bureau data, a total of 13 environmental justice communities of potential concern exist within the downstream analysis area. It is important to note that the identification of environmental justice communities is dependent on existing conditions. Block groups identified as meeting or not meeting environmental justice communities at this point in time may meet or no longer meet the criteria in the future as social and economic conditions change.

[1] There is one additional Block Group for DTE Shared Storage; however, the US Environmental Protection Agency's Environmental Justice Screening Tool could not provide the information associated with the Block Group.

Table E-4
Downstream Analysis Area Environmental Justice Screening Results

Geographic Area	Total Population	Minority Population Percentage	Low-income Population Percentage	Indigenous Population Percentage	Meets Criteria for Environmental Justice Communities of Concern?
Arizona					
Coronado Mine					
Block Group 040019702011	1,489	26	37*	1	Yes
Block Group 040019702012	1,251	56*	19*	26*	Yes
Block Group 040019703002	743	57*	38*	2	Yes
Block Group 040019703001	1,613	47*	44*	21*	Yes
Michigan					
DTE Shared Storage					
Block Group 261476430001	20	0	50*	0	Yes
Block Group 261476430007	138	9	0	0	No
Block Group 261476430004	715	13	22	6*	Yes
Block Group 261476430003	441	0	21	0	No
Block Group 261476430005	1,561	0	18	0	No
Block Group 261476410001	1,334	1	16	0	No
Karn					
Block Group 260172852021	2,127	15	29	2*	Yes
Block Group 260172859001	1,371	9	37*	0	Yes
Minnesota					
Boswell					
Block Group 270614807022	1,769	11	37*	3*	Yes
Block Group 270614803011	701	9	34*	0	Yes
Hoot Lake[1]					
Block Group 271119611004	970	5	8	0	No
Block Group 271119611002	864	15	35*	3*	Yes
Block Group 271119610004	1,243	0	58*	0	Yes
Block Group 271119611003	1,781	2	16	0	No

Geographic Area	Total Population	Minority Population Percentage	Low-income Population Percentage	Indigenous Population Percentage	Meets Criteria for Environmental Justice Communities of Concern?
Washington					
Centralia					
Block Group 530419711001	1,644	7	19	3	No
Block Group 530670126205	836	9	41*	2	Yes
Total number of block groups that meet the criteria for 1 or more measures					13
Percentage of block groups that meet the criteria for 1 or more measures					65

Source: US Environmental Protection Agency 2022; US Census Bureau 2021

Note: Data with an asterisk indicates data that meets or exceeds environmental justice criteria for a given data set.

[1] As noted in the coal reasonably foreseeable development scenario (**Appendix B**), Hoot Lake Power Plant retired in 2021.

E.1 References

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