Western Energy Company's Rosebud Mine Area F

Final Environmental Impact Statement Appendices A through H

November 2018

Montana Department of Environmental Quality

Appendix A – List of Western Energy's Area F Permit (C2011003F) Application Documents

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Appendix A – List of Western Energy's Area F Permit (C2011003F) Application Package Documents

Table 1. Area F Permit (C2011003F) MSUMRA Completeness and Acceptability Review Documents

Document Name[1]	Date	Author
Permit Application Package (PAP)	11/02/2011	Western Energy
Completeness Deficiency	01/10/2012	DEQ
Completeness Deficiency Response	05/07/2012	Western Energy
Completeness Determination	08/01/2012	DEQ
1st Round Acceptability Deficiency	11/29/2012	DEQ
1st Round Acceptability Deficiency Response	02/11/2014	Western Energy
2nd Round Acceptability Deficiency	06/09/2014	DEQ
2nd Round Acceptability Deficiency Response	07/10/2015	Western Energy
3rd Round Acceptability Deficiency	11/06/2015	DEQ
3rd Round Acceptability Deficiency Response	02/29/2016	Western Energy
4th Round Acceptability Deficiency	6/27/2016	DEQ
4th Round Acceptability Deficiency Response	8/29/2016	Western Energy
5th Round Acceptability Deficiency	12/23/2016	DEQ
5th Round Acceptability Deficiency Response	05/05/2017	Western Energy
6th Round Acceptability Deficiency	06/07/2017	DEQ
6th Round Acceptability Deficiency Response	06/26/2017	Western Energy
7th Round Acceptability Deficiency	10/19/2017	DEQ
7th Round Acceptability Deficiency Response	12/21/2017	Western Energy
8th Round Acceptability Deficiency	4/20/2018	DEQ
8th Round Acceptability Deficiency Response	6/8/2018	Western Energy

[1]***Permit documents can be requested from DEQ:*** http://deq.mt.gov/Public/RequestPublicRecords

Table 2. Area F Permit (C2011003F) Permit Application Package (PAP) Documents	
PAP Component	**Contents**
Permit (Note: Permit subchapters correspond to subchapters of MSUMRA's implementing regulations, ARM 17.24.301-1309)	
Subchapter 3	Definitions and Strip Mine Permit Application Requirements
Subchapter 4	Mine Permit and Test Pit Prospecting Permit Procedures
Subchapter 5	Backfilling and Grading Requirements
Subchapter 6	Transportation Facilities, Use of Explosives and Hydrology
Subchapter 7	Topsoiling, Revegetation, and Protection of Wildlife and Air Resources
Subchapter 8	Alluvial Valley Floors, Prime Farmlands, Alternate Reclamation and Auger Mining
Subchapter 9	Underground Coal and Uranium Mining
Subchapter 10	Prospecting
Subchapter 11	Bonding, Insurance, Reporting, and Special Areas
Subchapter 12	Special Departmental Procedures and Programs
Subchapter 13	Miscellaneous Provisions
Appendices	
Appendix A	Cultural Resources A-1: Area F - Class III Cultural & Paleontological Resource Inventory 2010-10 A-2: Additional Area - Class III Cultural & Paleontological Resource Inventory 2012-01 A-3: Area F NRHP report 46 Archaeological Properties 2013-11
Appendix B	Hydrology
Appendix C	Climatology
Appendix D	Overburden Quality
Appendix E	Baseline Vegetation Report and Wetland Delineation Report E-1: Area F – 2006 Baseline Vegetation Survey E-2: Area F – 2013 Rosebud Mine Wetlands Delineation Maps
Appendix F	Wildlife
Appendix G	Baseline Soils
Appendix H	Leases (Confidential)
Appendix I	Groundwater Model I-A: Rosebud Mine Groundwater model I-B: Area F Groundwater Model
Appendix J	Protection of the Hydrologic Balance
Appendix K	Geology
Appendix L	Well Logs
Appendix M	Facilities Sampling Plan
Appendix N	Fish and Wildlife N-1: Fish and Wildlife Report
Appendix O	Probable Hydrologic Consequences (PHC) O-1: Sediment Yield Modeling Addendum to Area F PHC
Appendix P	Monitoring and Quality Assurance Plan

Table 2. Area F Permit (C2011003F) Permit Application Package (PAP) Documents	
PAP Component	**Contents**
Appendix Q	Alluvial Valley Floors (AVF) Q-1: Baseline Evaluation for Alluvial Valley Floor Determination Q-2: Alluvial Valley Floor Determination
Appendix R	Aquatic Survey
Appendix S	Steep Slope Inventory
Appendix T	Pond Designs and As-Builts
Appendix U	Sediment Yield Monitoring
Exhibits	
A	Approximate Mine Plan
B	Approximate Postmine Topography with Drainage Basins (500 scale)
C	Approximate Revegetation and Wildlife Enhancement Plan
D	Approximate Hydrologic Control Plan
E	Premine Vegetation Survey
F	Cultural Resource Sites (Confidential)
G1, G2, G3, G4, and G5	Reclamation Bond and Bond Calculations
H	Surface and Groundwater Monitoring Sites
I and I1	Reclamation Cross Sections and Locations
J	Approximate Reclamation Plan
K	Aerial Photograph
L1 and L2	Surface and Mineral Ownership Maps
M	Coal Conservation Plan Map
N1 and N2	Premine and Postmine Drainage Profiles
O	Haul Road Design Plan, Profile, and Details
P1 and P2	Phase I and Phase II County Road Relocations
Q1, Q2, and Q3	Drill Hole and Geological Cross Sections and Locations
R1, R2, R3, R4, and R5	Overburden Isopach, Rosebud Coal Isopach and Bottom Elevation, and McKay Coal Isopach and Bottom Elevation
S	Surface Geology
T1 and T2	Premine and Postmine Slope Histogram and Slope Aspect Wire Diagram
U and U1	Premine Topography with Drainage Basins (1000 scale and 5000 scale)

Appendix B – DEQ's Eighth Round Acceptability Deficiency Letter to Western Energy

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April 20, 2018

Sent via electronic mail

Dicki Peterson
Western Energy Company
Rosebud Coal Mine Area F
P.O. Box 99
138 Rosebud Lane
Colstrip, MT 59323

Permit ID: C2011003F
Revision Type: N/A
Permitting Action: Deficiency
Subject: Eighth Round Acceptability Deficiency

Dear Dicki:

The Department of Environmental Quality (DEQ) has completed its acceptability review regarding Western Energy Company's application for SMP C2011003F. The following deficiencies must be adequately addressed before DEQ can determine the application acceptable:

ARM 17.24.314(3): Comments submitted on the draft EIS for Area F raise several issues regarding hydrology. These issues include:

- Changes in surface water flow outside permit boundary both during and after mining
- Changes in alluvial groundwater flow outside permit boundary both during and after mining
- Changes in surface water quality outside permit boundary after mining
- Changes in alluvial groundwater quality outside permit boundary after mining
- Replacement of adversely affected water rights

Please review the draft EIS comments and provide more detail in the PHC on these issues.

Upon receipt of satisfactory responses to this deficiency, DEQ will determine the application to be acceptable.

Please feel free to contact Robert D. Smith at 406-444-7444 with questions regarding this letter.

Sincerely,

Chris Yde, Supervisor
Coal Section
Coal and Opencut Mining Bureau
Phone: 406-444-4967
Fax: 406-444-4988
Email: CYde@mt.gov

C: Jeff Fleischman, Office of Surface Mining
Lauren Mitchell, Office of Surface Mining

FC: 620.170 (Area F)

Gilbert, Sharona

Sent:
To:
Cc:

Subject:
Attachments:

Please see attached correspondence. Have a great day!

Sharona Gilbert
Administrative Assistant
Coal Section
Coal and Opencut Mining Bureau
Ph: 444-4966
Fax: 444-4988

The best laid schemes o' Mice an' Men,
Gang aft agley ~Robert Burns

Appendix C – Seed Mixtures

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TABLE 313-2. Lowland Mixture

SCIENTIFIC NAME	COMMON NAME	PERCENT PLS RANGE
COOL SEASON :		70 – 80
Agropyron riparium	Streambank wheatgrass	5 – 15
Agropyron smithii	Western wheatgrass	30 – 40
Agropyron trachycaulum	Slender wheatgrass	5 – 15
Poa canbyi	Canby bluegrass	5 – 15
Poa pratensis	Kentucky bluegrass	5 – 15
WARM SEASON:		10 – 20
Panicum virgatum	Switchgrass	10 -20
PERENNIAL FORB:		5-15
Achillia millefolium	Common yarrow	1-5
Echinacea angustifolia	Narrowleaf purple coneflower	1-5
Linum lewisii	Perennial Flax	1-5
Dalea purpureum	Purple prairie coneflower	1-5
	Minimum Seeding Rate =	10 PLS lbs/acre

LOWLAND MIXTURE - SUBSTITUTE SPECIES

SCIENTIFIC NAME	COMMON NAME
COOL SEASON:	
Phalaris arundinacea	Reed canarygrass
Phragmites communis	Common reed
Scirpus maritimus	Alkali bulrush
Agropyron dasystachyum	Thickspike wheatgrass
Elymus canadensis	Canada wildrye
Poa compressa	Canada Bluegrass
WARM SEASON:	
Andropogon hallii	Sand bluestem
Distichlis stricta	Inland saltgrass
Andropogon gerardii	Big bluestem
PERENNIAL FORB:	
Heterotheca villosa	Hairy golden aster
Psoralea argophylla	Silverleaf scurf-pea
Liatria punctata	Dotted gayfeather
Aster falcatus	Prairie aster
Gallardia aristata	Common gaillardia
Sphaeralcea coccinea	Scarlet globemallow

TABLE 313-3. Upland Mixture

SCIENTIFIC NAME	COMMON NAME	PERCENT PLS RANGE
COOL SEASON:		45 – 55
Agropyron dasytachyum	Thickspike wheatgrass	1 – 10
Agropyron smithii	Western wheatgrass	5 – 15
Agropyron spicatum	Bluebunch wheatgrass	1 – 10
Koeleria cristata	Prairie junegrass	1 – 10
Oryzopsis hymenoides	Indian ricegrass	5 – 15
Stipa viridula	Green needlegrass	5 – 15
WARM SEASON:		35 – 45
Bouteloua gracilis	Blue grama	5 - 15
Bouteloua curtipendula	Side-oats grama	5 – 15
Calamovilfa longifolia	Prairie sandreed	1 – 10
Panicum virgatum	Switchgrass	1 – 10
Sporobolus cryptandrus	Sand dropseed	5 - 15
PERENNIAL FORB:		5-15
Achillia millefolium	Common yarrow	1 – 5
Echinacea angustifolia	Narrowleaf purple coneflower	1 – 5
Linum lewisii	Perennial flax	1 – 5
Dalea purpureum	Purple prairie clover	1 – 5
Ratibida columnifera	Prairie coneflower	1 – 5
Sphaeralcea munroana	Munro globemallow	1 - 5
SHRUB:		1-5
Artemisia cana	Silver sagebrush	1-5
Artemisia tridentata	Big Sagebrush	1-5
	Minimum Seeding Rate =	10 PLS lbs/acre

UPLAND MIXTURE - SUBSTITUTE SPECIES

SCIENTIFIC NAME	COMMON NAME
COOL SEASON:	
Elymus Canadensis	Canada wildrye
Elymus cinereus	Basin wildrye
Festuca idahoensis	Idaho fescue
Poa sandbergii	Sandberg bluegrass
Stipa comata	Needleandthread
Koeleria cristata	Prairie junegrass
WARM SEASON:	
Andropogon scoparius	Little bluestem
Muhlenbergia cuspidate	Plains muhly
Sporobolus cryptandrus	Sand dropseed
PERENNIAL FORB:	
Heterotheca villosa	Hairy golden aster
Psoralea argophylla	Silverleaf scurf-pea
Liatria punctata	Dotted gayfeather
Aster falcatus	Prairie aster
Gaillardia aristata	Common gaillardia
Sphaeralcea coccinea	Scarlet globemallow
Krascheninnikovia lanata	Winterfat
SHRUB:	
Atriplex canescens	Fourwing saltbush
Chrysothamnus nauseosus	Rubber rabbitbrush

TABLE 313-4. Conifer Mixture

SCIENTIFIC NAME	COMMON NAME	PERCENT PLS RANGE
COOL SEASON:		10 – 20
Agropyron smithii	Western wheatgrass	1 – 10
Agropyron spicatum	Bluebunch wheatgrass	1 – 10
Oryzopsis hymenoides	Indian ricegrass	1 – 10
WARM SEASON:		80 – 90
Andropogon hallii	Sand bluestem	15 – 25
Andropogon scoparius	Little bluestem	20 – 30
Bouteloua curtipendula	Side-oats grama	15 – 25
Calamovilfa longifolia	Prairie sandreed	15 – 25
PERENNIAL FORB:		1 – 10
Echinacea angustifolia	Narrowleaf purple coneflower	1 - 10
Ratibida columnifera	Prairie coneflower	1 – 10
Krascheninnikovia lanata	Winterfat	1 – 5
SHRUB:		1 – 5
Artemisia tridentata	Big sagebrush	1 – 5
Rhus trilobata	Skunkbush sumac	1 – 5
	Minimum Seeding Rate =	10 PLS lbs/acre

CONIFER MIXTURE - SUBSTITUTE SPECIES

SCIENTIFIC NAME	COMMON NAME
COOL SEASON:	
Agropyron trachycaulum	Slender wheatgrass
Stipa viridula	Green needlegrass
Poa sandbergii	Sandberg bluegrass
WARM SEASON:	
Bouteloua gracilis	Blue grama
Sporobolus airoides	Alkali sacaton
Sporobolus cryptandrus	Sand dropseed
PERENNIAL FORB:	
Heterotheca villosa	Hairy golden aster
Psoralea argophylla	Silverleaf scurf-pea
Liatria punctata	Dotted gayfeather
Aster falcatus	Prairie aster
Gaillardia aristata	Common gaillardia
Sphaeralcea coccinea	Scarlet globemallow
SHRUB:	
Chrysothamnus nauseosus	Rubber rabbitbrush
Artemisia cana	Silver sagebrush

TABLE 313-4A. Mixed Shrub-Grass Mixture

SCIENTIFIC NAME	COMMON NAME	PERCENT PLS RANGE
COOL SEASON:		
Elymus cinereus	Basin wildrye	10 – 20
Agropyron spicatum	Bluebunch wheatgrass	10 – 20
Oryzopsis hymenoides	Indian ricegrass	10 – 20
Stipa viridula	Green needlegrass	10 – 20
WARM SEASON:		25-35
Andropogon scoparius	Little bluestem	10 – 20
Bouteloua curtipendula	Side-oats grama	10 – 20
	Minimum Seeding Rate =	15 PLS lbs/acre

MIXED SHRUB-GRASS MIXTURE - SUBSTITUTE SPECIES

SCIENTIFIC NAME	COMMON NAME
COOL SEASON:	
Agropyron trachycaulum	Slender wheatgrass
Elymus cinereus	Basin wildrye
Poa canbyi	Canby bluegrass
Poa sandbergii	Sandberg bluegrass
WARM SEASON:	
Calamovilfa longifolia	Prairie sandreed
Bouteloua gracilis	Blue grama
Sporobolus airoides	Alkali sacaton
Sporobolus cryptandrus	Sand dropseed

TABLE 313-4B. Mixed Shrub – Forb and Shrub Mixture

SCIENTIFIC NAME	COMMON NAME	PERCENT PLS RANGE
PERENNIAL FORB:		5 – 15
Artemisia ludoviciana	Prairie sagewort	1 – 5
Eriogonum umbellatum	Sulphur buckwheat	5 – 15
Artemisia frigida	Fringed sagewort	1 – 5
Krascheninnikovia lanata	Winterfat	5 – 15
SHRUBS:		85 – 95
Artemisia cana	Silver sagebrush	5 – 15
Artemisia tridentate	Big sagebrush	60 – 70
Chrysothamnus nauseosus	Rubber Rabbitbrush	1 – 10
	Minimum Seeding Rate =	15 PLS lbs/acre

MIXED SHRUB-FORB AND SHRUB MIXTURE - SUBSTITUTE SPECIES

SCIENTIFIC NAME	COMMON NAME
PERENNIAL FORB:	
Psoralea argophylla	Silverleaf scurf-pea
Gaillardia aristata	Common gaillardia
Balsamorhiza sagittata	Arrowleaf balsamroot
Echinacea angustifolia	Narrowleaf Purple coneflower
Heterotheca villosa	Hairy golden aster
SHRUB:	
Chrysothamnus viscidiflorus	Green rabbitbrush
Calylophus serrulatus	Shrubby evening primrose
Atriplex confertifolia	Shadscale saltbush

TABLE 313-4C. Shrub Complex Mixture

SCIENTIFIC NAME	COMMON NAME	PERCENT PLS RANGE
ANNUAL FORB:		1 – 15
Helianthus annus	Annual sunflower	1 – 10
PERENNIAL FORB:		1 – 15
Artemisia ludoviciana	Prairie sagewort	1 – 10
Echinacea angustifolia	Narrowleaf purple coneflower	1 – 10
Artemisia frigida	Fringed sagewort	1 – 15
Krascheninnikovia lanata	Winterfat	1 – 15
SHRUB:		85 – 99
Artemisia cana	Silver sagebrush	10 – 50
Artemisia tridentata	Big sagebrush	10 – 50
Atriplex canescens	Fourwing saltbush	5 – 30
Chrysothamnus nauseosus	Rubber rabbitbrush	1 – 15
	Minimum Seeding Rate =	5 PLS lbs/acre

SHRUB COMPLEX MIXTURE - SUBSTITUTE SPECIES

SCIENTIFIC NAME	COMMON NAME
ANNUAL FORB:	
Coreopsis tinctoria	Plains coreopsis
Cleome serrulata	Rocky Mountain beeplant
PERENNIAL FORB:	
Psoralea argophylla	Silverleaf scurf-pea
Gaillardia aristata	Common gaillardia
Balsamorhiza sagittata	Arrowleaf balsamroot
Heterotheca villosa	Hairy golden aster
Eriogonum umbellatum	Sulphur buckwheat
Calylophus serrulatus	Shrubby evening primrose
SHRUB:	
Atriplex confertifolia	Shadscale saltbush
Calylophus serrulatus	Shrubby evening primrose

TABLE 313-5A. Pasture Mixture

SCIENTIFIC NAME	COMMON NAME	PERCENT PLS RANGE
COOL SEASON:		40-50
Agropyron dasystachyum	Thickspike wheatgrass	5 – 15
Agropyron smithii	Western wheatgrass	5 – 15
Elymus junceus	Russian wildrye	5 – 15
Oryzopsis hymenoides	Indian ricegrass	5 - 15
Stipa comata	Needleandthread grass	5 - 15
WARM SEASON:		40 - 50
Bouteloua curtipendula	Side-oats grama	10 - 20
Bouteloua gracilis	Blue grama	10 - 20
Eragrostis trichodes	Sand lovegrass	10 - 20
PERENNIAL FORB:		5 - 15
Medicago sativa	Alfalfa	5 - 15
	Minimum Seeding Rate =	10 PLS lbs/acre

PASTURE MIXTURE - SUBSTITUTE SPECIES

SCIENTIFIC NAME	COMMON NAME
COOL SEASON:	
Agropyron trachycaulum	Slender wheatgrass
Elymus cinerius	Basin wildrye
Koeleria cristata	Prairie junegrass
Stipa viridula	Green needlegrass
WARM SEASON:	
Andropogon hallii	Sand bluestem
Calamovilfa longifolia	Prairie sandreed
Panicum virgatum	Switchgrass

TABLE 313-5B. Seed Rate PLS Formula

1. Species PLS = (Purity) X (Germination) X (100)

2. Bulk Seed Mix PLS% = [Σ(specie PLS%) X (# of species included)] / [total lbs of bulk seed mix] X 100%.

3. Bulk Seeding Rate, lbs/Acre = [desired total PLS lbs/acre] / [PLS% of bulk seed mix]

4. PLS Mix % (i.e. ratio of species in mix) = [(species PLS %) X (# of species)] / [(bulk seed mix PLS %) X (total lbs bulk seed mix)]

TABLE 313-6. Indigenous Trees and Shrubs for Revegetation*

Common Name	Scientific Name	Revegetation Type
Box Elder	*Acer negundo*	Lowland
Silver sagebrush	*Artemisia cana*	Lowland; Upland; Conifer; Mixed Shrub
Big sagebrush	*Artemisia tridentata*	Upland; Conifer; Mixed Shrub
Shadscale saltbush	*Atriplex confertifolia*	Mixed Shrub
Fourwing saltbush	*Atriplex canescens*	Mixed Shrub
Rubber rabbitbrush	*Chrysothamnus nauseosus*	Upland; Conifer; Mixed Shrub
Green rabbitbrush	*Chrysothamnus viscidiflorus*	Upland; Conifer
Fleshy hawthorn	*Crataegus succulenta*	Lowland
Silverberry	*Elaeagnus commutata*	Lowland; Upland
Green ash	*Fraxinus pennsylvanica*	Lowland
Rocky Mountain juniper	*Juniperus scopulorum*	Lowland; Conifer
Ponderosa pine	*Pinus ponderosa*	Conifer; Mixed Shrub
Narrowleaf cottonwood	*Populus angustifolia*	Lowland
Plains cottonwood	*Populus deltoids*	Lowland
American plum	*Prunus Americana*	Lowland; Mixed Shrub
Chokecherry	*Prunus virginiana*	Lowland; Mixed Shrub
Skunkbush sumac	*Rhus trilobata*	Upland; Conifer; Mixed Shrub
Golden current	*Ribes aureum*	Lowland; Upland; Conifer; Mixed Shrub
Squaw current	*Ribes cereum*	Lowland; Upland; Conifer; Mixed Shrub
Redshoot gooseberry	*Ribes setosum*	Lowland; Mixed Shrub
Woods rose	*Rosa woodsii*	Lowland; Mixed Shrub
Prairie rose	*Rosa arkansana*	Lowland; Mixed Shrub; Upland
Peachleaf willow	*Salix amygdaloides*	Lowland
Tealeaf willow	*Salix phylicifolia*	Lowland
Common snowberry	*Symphoricarpos albus*	Lowland; Upland; Mixed Shrub
Western snowberry	*Symphoricarpos occidentalis*	Lowland
Buffaloberry	*Sheperdia argentea*	Lowland

* When not commercially available, and when practical, seeds from native indigenous stands of the above species are collected on an annual basis. The seeds are sent to a greenhouse for propagation as containerized plants for use in reclamation. Transplanting densities and seeding rates for all species used in reclamation will be identified in the Annual Report.

TABLE 313-7. Indigenous Forbs and Half Shrubs for Revegetation*

Common Name	Scientific Name
Common yarrow	*Achillea millefolium*
Prairie onion	*Allium textile*
Leadplant	*Amorpha canescens*
Prickly poppy	*Argemone polyanthemos*
Fringed Sagewort**	*Artemisia frigida*
Prairie sagewort	*Artemisia ludoviciana*
Plains milkweed	*Asclepias pumila*
Groundplum milkvetch	*Astragalus crassicarpus*
Slender milkvetch	*Astragalus gracilis*
Missouri milkvetch	*Astragalus missouriensis*
Nuttall saltbush**	*Atriplex gardneri*
Arrowleaf balsamroot	*Balsamorhiza sagittata*
Sego (mariposa) lily	*Calochortius nuttallii*
Roundleaf harebell	*Campanula rotundifolia*
Shrubby evening primrose**	*Calylophus serrulata*
Downy Indian paintbrush	*Castilleja sessiliflora*
Rocky Mountain beeplant	*Cleome serrulata*
White prairie clover	*Dalea candida*
Purple prairie clover	*Dalea purpurea*
Narrowleaf purple coneflower	*Echinacea angustifolia*
Purple coneflower	*Echinacea purpurea*
Annual buckwheat	*Eriogonum annuum*
Sulphur buckwheat	*Erigonum umbellatum*
Western wallflower	*Erysimum asperum*
Common gaillardia	*Gaillardia aristata*
Broom snakeweed**	*Gutierrezia sarothrae*
Northern sweetvetch	*Hedysarum boreale*
White sweetvetch	*Hedysarum sulpherescens*
Prairie sunflower	*Helianthus petiolaris*
Hairy golden aster	*Heterotheca villosa*
Winterfat**	*Krascheninnikovia lanata*
Dotted gayfeather	*Liatris punctata*
Perennial flax	*Linum lewisii*
Narrowleaf gromwell	*Lithospermum incisum*
Oregon grape**	*Mahonia repens*
Tenpetal mentzelia	*Mentzelia decapetala*
Tufted evening primrose	*Oenothera cespitosa*
White penstemon	*Penstemon albidus*
Silverleaf scurf-pea	*Psoralea argophylla*
Breadroot scurf-pea	*Psoralea esculenta*
Prairie coneflower	*Ratibida columnifera*
Scarlet globemallow	*Sphaeralcea coccinea*
Munro globemallow	*Sphaeralcea munroana*
Prairie goldenpea	*Thermopsis rhombifolia*
American vetch	*Vicia americana*
Soapweed	*Yucca glauca*

These species may be utilized in conjunction with each of the seed mixes.

* When not commercially available, and when practical, seeds from native indigenous stands of the above species are collected and sent to a greenhouse for propagation as containerized plants for use in reclamation. Transplanting densities and seeding rates for all species used in reclamation will be identified in the Annual Report.

** Half Shrub species

Appendix D – Air Quality Permits, Monitoring Data, and Supplemental Information

- D-1 Montana Air Quality Permit #1570-08 (Area C) and Montana Air Quality Permit #1570-07 Preliminary Determination (Areas C and F)
- D-2 Montana Air Quality Permit #1483-08 for Areas A/B/D/E
- D-3 County Level Monitoring Data
- D-4 Monitored Visibility Trends for IMPROVE sites
- D-5 Historic Deposition Trends
- D-6 Supplemental Information for Cumulative Effects for Air Quality
- D-7 Supplemental Information, Rosebud Area F Photochemical Model (CAMx) Inputs and Configuration
- D-8 Supporting Information for Air Quality Impact Analysis for Rosebud Mine Area F DEIS

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APPENDIX D-1

Montana Air Quality Permit #1570-08 (Area C) and Montana Air Quality Permit #1570-07 Preliminary Determination (Areas C and F).

Montana Department of
ENVIRONMENTAL QUALITY

Steve Bullock, Governor
Tracy Stone-Manning, Director

P. O. Box 200901 Helena, MT 59620-0901 (406) 444-2544 Website: www.deq.mt.gov

October 31, 2014

Richard Spang
Western Energy Company
P.O. Box 99
Colstrip, MT 59323

Dear Mr. Spang:

Montana Air Quality Permit #1570-08 is deemed final as of October 31, 2014, by the Department of Environmental Quality (Department). This permit is for a surface coal mine and associated equipment. All conditions of the Department's Decision remain the same. Enclosed is a copy of your permit with the final date indicated.

For the Department,

Julie Merkel
Air Permitting Program Supervisor
Air Resources Management Bureau
(406) 444-3626

Doug Kuenzli
Environmental Science Specialist
Air Resources Management Bureau
(406) 444-4267

JM:DCK
Enclosure

Montana Department of Environmental Quality
Permitting and Compliance Division

Montana Air Quality Permit #1570-08

Western Energy Company
P.O. Box 99
Colstrip, MT 59323

October 31, 2014

MONTANA AIR QUALITY PERMIT

Issued to: Western Energy Company
P.O. Box 99
Colstrip, MT 59323

MAQP: #1570-08
Application Complete: 08/18/2014
Preliminary Determination: 09/26/2014
Department's Decision Issued: 10/15/2014
Permit Final: 10/31/2014
AFS #: 087-0004

A Montana Air Quality Permit (MAQP), with conditions, is hereby granted to Western Energy Company (Western Energy), pursuant to Sections 75-2-204 and 211 of the Montana Code Annotated (MCA), as amended, and the Administrative Rules of Montana (ARM) 17.8.740 *et seq.,* as amended, for the following:

Section I: Permitted Facilities

A. Plant Location

Western Energy operates a surface coal mine and extraction facility located in Area C of the Rosebud Mine. The total estimated coal production for the life of the mine is 241,000,000 tons. Area C is located west of Colstrip in Sections 1-3 of Township 1 North, Range 39 East; Sections 34-36 of Township 2 North, Range 39 East; Sections 1-6, 8-12, and 13-17 of Township 1 North, Range 40 East; and Sections 28, 29, and 31-33 of Township 2 North, Range 40 East in Rosebud County. The list of permitted equipment can be found in Section I of the permit analysis.

B. Current Permit Action

On August 18, 2014, the Department of Environmental Quality (Department) received an application from Bison Engineering, Inc. (Bison), on behalf of Western Energy, for modification of Western Energy's air quality permit to authorize replacement of the particulate matter control technology on the secondary crushers and the transfer points on the overland conveyor. Western Energy currently employs mechanical local exhaust ventilation in conjunction with baghouse control for the capture and removal of airborne particulate matter from the referenced coal processing and handling equipment. Western Energy proposed the installation and operation of a foam dust suppression control system (FDSS) in the control of particulate matter in lieu of the currently installed negative pressure capture and baghouse removal systems. The current permit action authorizes the removal of the existing control equipment and accounts for the installation and operation of the FDSS on the secondary crushers and overland conveyor transfer points.

Section II: Conditions and Limitations

A. Emissions Limitations

1. The Area C primary crushers and coal handling facility, including the negative pressure system on the truck dump, shall be vented to and particulate matter controlled by a baghouse(s) (ARM.17.8.752).

2. A foam dust suppression system shall be installed and operated on the secondary crushers and each of three transfer points on the overland conveyor to control particulate matter emissions (ARM 17.8.752).

3. Western Energy shall not cause visible emissions of greater than 20% opacity to be discharged into the atmosphere from any coal handling, conveying, crushing, processing, storing or loading system averaged over 6 consecutive minutes (ARM 17.8.308, ARM 1.7.8.304, 340 and 40 CFR Part 60, Subpart Y).

4. Western Energy shall not cause or authorize the use of any street, road, or parking lot without taking reasonable precautions to control emissions of airborne particulate matter (ARM 17.8.308).

5. Western Energy shall treat all unpaved portions of the haul roads, access roads, parking lots, or general plant area with water and/or chemical dust suppression as necessary to maintain compliance with the reasonable precautions limitation in Section II.A.3 (ARM 17.8.749).

6. The following control measures shall be applied on an as necessary basis (ARM 17.8.752, ARM 17.8.749 and ARM 17.8.308):

    a. Chemically stabilize and maintain all active haul and access roads and supplement by watering;

    b. Apply water to temporary roads such as scraper travel areas;

    c. Adequately maintain open coal storage and minimize equipment activity on stockpiles;

    d. Minimize fall/drop distance on all coal and overburden handling activities;

    e. Minimize area of surface disturbance;

    f. Promptly revegetate exposed/disturbed areas, including temporary vegetative cover of topsoil stockpiles;

    g. Minimize emissions from coal and overburden drilling through the use of dust curtains, water sprays, dust collectors, or other appropriate techniques;

    h. Conduct blasting operations in such a manner as to minimize emissions, prevent overshooting, provide stemming of holes, and minimize area to be blasted;

    i. Extinguish areas of burning or smoldering coal;

    j. Restrict and maintain vehicle speeds on haul roads as necessary to minimize emissions; and,

    k. Other control practices which may be determined by the Department to be necessary.

7. Western Energy shall maintain a fugitive dust control plan. Elements of the plan shall include, but not be limited to, the conditions established within Section II.A.1 through II.A.5 (ARM 17.8.749 and 752).

8. Combined annual coal production from Areas C and F shall be limited to 8,000,000 tons per year (ARM 17.8.749).

9. Western Energy shall comply with all applicable standards and limitations, and the reporting, recordkeeping, testing, and notification requirements contained in 40 Code of Federal Regulations (CFR), Subpart Y, *Standards of Performance for Coal Preparation Plants and Processing Plants* (ARM 17.8.340 and 40 CFR 60, Subpart Y).

B. Testing Requirements

1. All compliance source tests shall conform to the requirements of the Montana Source Test Protocol and Procedures Manual (ARM 17.8.106).

2. The Department may require testing (ARM 17.8.105).

C. Operational Reporting Requirements

1. Western Energy shall supply the Department with annual production information for all emission points, as required by the Department in the annual emission inventory request. The request will include, but is not limited to, all sources of emissions identified in the emission inventory contained in the permit analysis and sources identified in Section I of the permit analysis.

   Production information shall be gathered on a calendar-year basis and submitted to the Department by the date required in the emission inventory request. The information shall include the following and shall be in the units required by the Department. This information may be used for calculating operating fees, based on actual emissions from the facility, and/or to verify compliance with permit limitations (ARM 17.8.505). Western Energy shall submit the following information annually to the Department by March 1, of each year; the information may be submitted along with the annual emission inventory (ARM 17.8.505).

2. Western Energy shall notify the Department of any construction or improvement project conducted pursuant to ARM 17.8.745 that would include the ***addition of a new emission unit***, change in control equipment, stack height, stack diameter, stack flow, stack gas temperature, source location, or fuel specifications, or would result in an increase in source capacity above its permitted operation. The notice must be submitted to the Department, in writing, 10 days prior to start up or use of the proposed de minimis change or as soon as reasonably practicable in the event of an unanticipated circumstance causing the de minimis change and must include the information requested in ARM 17.8.745 (l)(d) (ARM 17.8.745).

3. All records compiled in accordance with this permit must be maintained by Western Energy as a permanent business record for at least 5-years following the date of the measurement, must be available at the plant site for inspection by the department, and must be submitted to the department upon request (ARM 17.8.749).

D. Notification

Western Energy shall provide the Department with written notification of the actual date upon which the FDSS system is initially operated. The notice shall be postmarked or hand-delivered no later than 15 days after the actual operational commencement date (ARM 17.8.749).

E. Ambient Monitoring

1. Particulate matter within an aerodynamic diameter of ten microns or less (PM_{10}) data has been collected at the Western Energy mine since 1992. During the 1992-2000 period, the annual means at all sites were less than 28% of the annual standard. For the 24-hour PM_{10} concentrations, all of the annual, maximum 24-hour values were less than 53% of the 24-hour standard. Therefore, in accordance with the October 9, 1998, monitoring guidance statement developed by the Department, Western Energy may discontinue operation of their ambient air-monitoring network.

2. The Department may require Western Energy to conduct additional ambient air monitoring, if necessary (ARM 17.8.749).

Section III: General Conditions

A. Inspection – Western Energy shall allow the Department's representatives access to the source at all reasonable times for the purpose of making inspections or surveys, collecting samples, obtaining data, auditing any monitoring equipment (Continuous Emission Monitoring Systems CEMS, Continuous Emission Rate Monitoring Systems (CERMS) or observing any monitoring or testing, and otherwise conducting all necessary functions related to this permit.

B. Waiver – The permit and all the terms, conditions, and matters stated herein shall be deemed accepted if Western Energy fails to appeal as indicated below.

C. Compliance with Statutes and Regulations - Nothing in this permit shall be construed as relieving Western Energy of the responsibility for complying with any applicable federal or Montana statute, rule, or standard, except as specifically provided in ARM 17.8.740, *et seq.* (ARM 17.8.756).

D. Enforcement – Violations of limitations, conditions and requirements contained herein may constitute grounds for permit revocation, penalties or other enforcement as specified in Section 75-2-401 *et seq.*, MCA.

E. Appeals – Any person or persons jointly or severally adversely affected by the Department's decision may request, within 15 days after the Department renders its decision, upon affidavit setting forth the grounds therefore, a hearing before the Board of Environmental Review (Board). A hearing shall be held under the provisions of the Montana Administrative Procedures Act. The filing of a request for a hearing does not stay the Department's decision unless the Board issues a stay upon receipt of a petition and a finding that a stay is appropriate under Section 75-2-211(11)(b), MCA. The issuance of a stay on a permit by the Board postpones the effective date of the Department's decision until conclusion of the hearing and issuance of a final decision by the Board. If a stay is not issued by the Board, the Department's decision on the application is final 16 days after the Department's decision is made.

F. Permit Inspection – As required by ARM 17.8.755, Inspection of Permit, a copy of the air quality permit shall be made available for inspection by Department personnel at the location of the permitted source.

G. Permit Fees – Pursuant to Section 75-2-220, MCA, as amended by the 1991 Legislature, failure to pay the annual operation fee by Western Energy may be grounds for revocation of this permit, as required by that section and rules adopted there under by the Board.

H. Duration of Permit – Construction or installation must begin or contractual obligations entered into that would constitute substantial loss within 3 years of permit issuance and proceed with due diligence until the project is complete or the permit shall expire (ARM 17.8.762).

Montana Air Quality Permit (MAQP) Analysis
Western Energy Company - Rosebud Mine
MAQP #1570-08

I. Introduction/Process Description

A. Permitted Equipment

Western Energy Company (Western Energy) operates the following equipment;

1. Coal handling facilities - include, but are not limited to:

   a. Truck dump with two 500-ton capacity dump hoppers.

   b. Two primary crushers with capacities of 1650 ton/hr each.

   c. Two secondary crushers with capacities of 1650 ton/hr each.

   d. One overland conveyor with a capacity of 1650 ton/hr, approximately 5 miles in length. . This conveyor transports coal from the Area C preparation facility to the Colstrip power plants, Units 3 and 4. The conveyor and transfer points are fully enclosed and utilize a foam dust suppression system (FDSS) in the control particulate matter.

   NOTE: Only one dump hopper, primary crusher and secondary crusher will operate at a time, with the other being a redundant system. The primary crushers and initial conveyors at the preparation facility are fully enclosed and vented to a central baghouse. The truck dump is equipped with a negative pressure system vented to the central baghouse.

2. Necessary auxiliaries include, but are not limited to: draglines, coal shovels, trucks, front-end loaders, graders, scrapers, dozers, other mobile units, auxiliary facilities, etc., as applicable.

B. Source Description

Western Energy operates a surface coal extraction facility and mine located in Area C of the Rosebud Mine. Area C is located west of Colstrip in Sections 1-3 of Township 1 North, Range 39 East; Sections 34-36 of Township 2 North, Range 39 East; Sections 1-6, 8-12, and 13-17 of Township 1 North, Range 40 East; and Sections 28, 29, and 31-33 of Township 2 North, Range 40 East of Rosebud County.

Western Energy has a combined maximum annual production limit of 8,000,000 tons of coal per year. The total projected coal production for the life of the mine is estimated at 241,000,000 tons. All Coal extracted from Area C will be transported by haul truck to the Area C or Area A truck dump for further processing.

C. Permit History

MAQP #1570 was originally issued to Western Energy for Area C of the Rosebud Mine on August 2, 1982. The coal processing facilities, with emissions controlled by baghouses, included primary and secondary crushers and conveyors. Area C coal was used exclusively at the local power generating facilities known as Colstrip Units 3 and 4. An overland conveyor, with baghouse controls at each transfer point, transported coal 5 miles from Area C to the power plants. The original permit contained a coal production limit of 5.6 million tons per year. Overburden was stripped using standard dragline practices and shovel and truck removed coal. Other mine related activities included topsoil handling (primarily with scrapers), drilling and blasting of overburden and coal, vehicle traffic, and reclamation/farming activities.

MAQP #1570A was a modification issued on January 6, 1986. The permit action discontinued ambient air monitoring for meteorological parameters and settled particulate matter (a.k.a. dustfall). Total suspended particulate (TSP) monitoring was still required; however, five TSP sites were discontinued, five existing TSP sites continued to operate, and two new TSP sites were added. MAQP #1570A replaced MAQP #1570.

MAQP #1570B was a modification issued on December 22, 1988. The annual coal production limit was increased from 5.6 to 6.5 million tons per year. No changes were made to the coal mining methods or coal handling procedures. MAQP #1570B replaced MAQP #1570A.

MAQP #1570C was a modification issued on March 22, 1990, that dealt only with ambient air monitoring. A new particulate matter-monitoring site was required near Castle Rock Lake Drive. The description of monitoring sites #12 & #13 were revised to correct a transposition error from an earlier permitting action. Clarifying language was added that explained the Department of Environmental Quality's (Department) policy for future ambient PM_{10} monitoring requirements. Lastly, the ambient air monitoring requirements were removed from the body of the permit and placed in an attachment to the main permit (hereafter referred to as Attachment 1). MAQP #1570C replaced MAQP #1570B.

MAQP #1570-04 was a modification issued on September 1, 1994. The annual coal production limit was increased from 6.5 to 7.5 million tons per year. No other operational changes were made. MAQP #1570-04 replaced MAQP #1570C.

MAQP #1570-05 was a modification issued on June 15, 2000. The permit action was an administrative change requested by Western Energy on March 30, 2000. Western Energy requested corrections to the site location description in their permit. Additionally, the permit was updated to reflect the current format and language used in permits. MAQP #1570-05 replaced MAQP #1570-04.

MAQP #1570-06 was a modification issued on July 19, 2001. The Department received a letter, dated April 27, 2001, from Western Energy requesting termination of the ambient air-monitoring network. Following the October 9, 1998, permitting guidance statement, the Department reviewed the ambient air monitoring data. In a letter dated May 23, 2001, the Department agreed to Western Energy's request to terminate their ambient monitoring program, effective July 1, 2001. The permit action updated the monitoring requirements to reflect the termination of the ambient air-monitoring network. MAQP #1570-06 replaced MAQP #1570-05.

On April 18, 2013, the Department received an initial application from Bison Engineering, Inc. (Bison), on behalf of Western Energy, for modification of Western Energy's air quality permit to allow expansion to the geographic extent of the mine. The existing MAQP explicitly defined the physical area in which mining activities are permitted. As such, the application requests an expansion of this physical boundary into a new area designated as Area F. No additional coal production capacity was requested, the objective of the expansion is to further extend the life of the mine by replacing areas from which coal has been extracted. Supplemental information and data was received by the Department on June 12, 2013. The current permit action provides for an expansion of the mines operational boundary. No additional stationary or portable equipment are proposed.

This permit action also incorporates a de minimis action approved by the Department on July 20, 2013, which increased the annual production capacity limit by 500,000 tons to a total of 8.0 million tons per year. In addition this permit action updates permit language and rule references used by the Department, as well as updates the emission inventory. **MAQP #1570-07** is pending until issuance of the final Environmental Impact Statement.

D. Current Permit Action

On August 18, 2014, the Department received an application from Bison Engineering, Inc. (Bison), on behalf of Western Energy, for modification of Western Energy's air quality permit to authorize replacement of the particulate matter control technology on the secondary crushers and the transfer sites on overland conveyor. Western Energy currently employs mechanical local exhaust ventilation in conjunction with baghouse control for the capture and removal of airborne particulate matter from the referenced coal processing and handling equipment. Western Energy proposed the installation and operation of a foam suppression dust control system (FDSS) in the control of particulate matter in lieu of the currently installed negative pressure capture and baghouse removal systems. The current permit action authorizes the removal of the existing control equipment and accounts for the installation and operation of the FDSS on the secondary crushers and overland conveyor transfer points. **MAQP #1570-08** replaces MAQP #1570-06.

E. Additional Information

Additional information, such as applicable rules and regulations, Best Available Control Technology (BACT)/Reasonably Available Control Technologies (RACT) determinations, air quality impacts, and environmental assessments, is included in the analysis associated with each change to the permit.

II. Applicable Rules and Regulations

The following are partial explanations of some applicable rules and regulations that apply to the facility. The complete rules are stated in the Administrative Rules of Montana (ARM) and are available upon request from the Department. Upon request, the Department will provide references for locations of complete copies of all applicable rules and regulations or copies where appropriate.

A. ARM 17.8, Subchapter 1 - General Provisions, including, but not limited to:

1. ARM 17.8.101 Definitions: This rule includes a list of applicable definitions used in this chapter, unless indicated otherwise in a specific subchapter.

2. ARM 17.8.105 Testing Requirements. Any person or persons responsible for the emission of any air contaminant into the outdoor atmosphere shall, upon written request of the Department, provide the facilities and necessary equipment (including instruments and sensing devices) and shall conduct tests, emission or ambient, for such periods of time as may be necessary using methods approved by the Department.

3. ARM 17.8.106 Source Testing Protocol. The requirements of this rule apply to any emission source testing conducted by the Department, any source, or other entity as required by any rule in this chapter, or any permit or order issued pursuant to this chapter, or the provisions of the Clean Air Act of Montana, 75-2-101, *et seq*., Montana Code Annotated (MCA).

   Western Energy shall comply with the requirements contained in the Montana Source Test Protocol and Procedures Manual, including, but not limited, using the proper test methods and supplying the required reports. A copy of the Montana Source Test Protocol and Procedures Manual is available from the Department upon request.

4. ARM 17.8.110 Malfunctions. (2) The Department must be notified promptly by telephone whenever a malfunction occurs that can be expected to create emissions in excess of any applicable emission limitation, or to continue for a period greater than 4 hours.

5. ARM 17.8.111 Circumvention. (1) No person shall cause or permit the installation or use of any device or any means which, without resulting in reduction in the total amount of air contaminant emitted, conceals or dilutes an emission of air contaminant which would otherwise violate an air pollution control regulation. (2) No equipment that may produce emissions shall be operated or maintained in such a manner that a public nuisance is created.

B. ARM 17.8, Subchapter 2 - Ambient Air Quality, including, but not limited to:

1. ARM 17.8.204 Ambient Air Monitoring
2. ARM 17.8.210 Ambient Air Quality Standards for Sulfur Dioxide (SO_2)
3. ARM 17.8.211 Ambient Air Quality Standards for Nitrogen Dioxide (NO_2)
4. ARM 17.8.212 Ambient Air Quality Standards for Carbon Monoxide (CO)
5. ARM 17.8.213 Ambient Air Quality Standards for Ozone (O_3)
6. ARM 17.8.214 Ambient Air Quality Standard for Hydrogen Sulfide (H_2S)
7. ARM 17.8.220 Ambient Air Quality Standard for Settled Particulate Matter (PM)
8. ARM 17.8.221 Ambient Air Quality Standard for Visibility
9. ARM 17.8.222 Ambient Air Quality Standards for Lead
10. ARM 17.8.223 Ambient Air Quality Standard for Particulate Matter with an Aerodynamic Diameter of Ten Microns or Less (PM_{10})

Western Energy must maintain compliance with the applicable ambient air quality standards.

C. ARM 17.8, Subchapter 3 - Emission Standards, including, but not limited to:

1. ARM 17.8.304 Visible Air Contaminants. This rule requires that no person may cause or authorize emissions to be discharged into the outdoor atmosphere from any source installed after November 23, 1968, that exhibit an opacity of 20% or greater averaged over 6 consecutive minutes.

2. ARM 17.8.308, Particulate Matter Airborne. (1) This rule requires an opacity limitation of 20% for all fugitive emission sources and that reasonable precautions are taken to control emissions of airborne particulate matter. (2) Under this rule, Western Energy shall not cause or authorize the use of any street, road or parking lot without taking reasonable precautions to control emissions of airborne particulate matter.

3. ARM 17.8.309 Particulate Matter Fuel Burning Equipment. This rule requires that no person shall cause, allow or permit to be discharged into the atmosphere particulate matter caused by the combustion of fuel in excess of the amount determined by this rule.

4. ARM 17.8.310 Particulate Matter Industrial Processes. This rule requires that no person shall cause, suffer, allow, or permit to be discharged into the outdoor atmosphere from any operation, process or activity, particulate matter in excess of the amount shown in this rule.

5. ARM 17.8.322, Sulfur Oxide Emissions-Sulfur in Fuel. This rule requires that no person shall cause, allow or permit to be discharged into the atmosphere particulate matter in excess of the amount set forth in this rule

6. ARM 17.8.324(3) Hydrocarbon Emissions--Petroleum Products. No person shall load or permit the loading of gasoline into any stationary tank with a capacity of 250 gallons or more from any tank truck or trailer, except through a permanent submerged fill pipe, unless such tank is equipped with a vapor loss control device as described in (1) of this rule

7. ARM 17.8.340 Standard of Performance for New Stationary Sources. This rule incorporates, by reference, 40 CFR Part 60, Standards of Performance for New Stationary Sources (NSPS). The owner and operator of any stationary source or modification, as defined and applied in 40 CFR Part 60, shall comply with the NSPS.

   a. 40 CFR Part 60, Subpart A – General Provisions apply to all equipment or facilities subject to an NSPS Subpart as listed below:

   b. 40 CFR Part 60, Subpart Y – Standards of Performance for Coal Preparation Plants and Processing Plants. Process operations at this facility that meet the definition of affected facilities include any coal processing and conveying equipment, coal storage systems, or coal transfer and loading systems.

8. ARM 17.8.342 Emission Standards for Hazardous Air Pollutants for Source Categories. This rule incorporates, by reference, 40 CFR Part 63, National Emission Standards for Hazardous Air Pollutants (NESHAPs) for Source Categories. Western Energy shall comply with the requirements of 40 CFR Part 63, as applicable.

D. ARM 17.8, Subchapter 5 - Air Quality Permit Application, Operation and Open Burning Fees, including but not limited to:

1. ARM 17.8.504 Air Quality Permit Application Fees. This rule requires that an applicant submit an air quality permit application fee concurrent with the submittal of an MAQP application. A permit application is incomplete until the proper application fee is paid to the Department. Western Energy submitted the appropriate permit application fee for the current permit action.

2. ARM 17.8.505, Air Quality Operation Fees. An annual air quality operation fee must, as a condition of continued operation, be submitted to the Department by each source of air contaminants holding an MAQP (excluding an open burning permit) issued by the Department. The air quality operation fee is based on the actual or estimated actual amount of air pollutants emitted during the previous calendar year.

   An air quality operation fee is separate and distinct from an air MAQP application fee. The annual assessment and collection of the air quality operation fee, described above, shall take place on a calendar-year basis. The Department may insert into any final permit issued after the effective date of these rules, such conditions as may be necessary to require the payment of an air quality operation fee on a calendar year basis, including provisions that prorate the required fee amount.

E. ARM 17.8, Subchapter 7 - Permit, Construction and Operation of Air Contaminant Sources, including but not limited to:

1. ARM 17.8.740 Definitions. This rule is a list of applicable definitions used in this chapter, unless indicated otherwise in a specific subchapter.

2. ARM 17.8.743 Montana Air Quality Permits--When Required. This rule requires a person to obtain an MAQP or permit modification to construct, modify, or use any air contaminant sources that have the potential to emit (PTE) greater than 25 tons per year of any pollutant. Western Energy has a PTE greater than 25 tons per year of PM, PM_{10}, Volatile Organic Compounds (VOC); therefore, an MAQP is required.

3. ARM 17.8.744 Montana Air Quality Permits--General Exclusions. This rule identifies the activities that are not subject to the MAQP program.

4. ARM 17.8.745 Montana Air Quality Permits--Exclusion for De Minimis Changes. This rule identifies the de minimis changes at permitted facilities that do not require a permit under the MAQP Program.

5. ARM 17.8.748 New or Modified Emitting Units--Permit Application Requirements. (1) This rule requires that a permit application be submitted prior to installation, modification, or use of a source. Western Energy submitted the required permit application for the current permit action. (7) This rule requires that the applicant notify the public by means of legal publication in a newspaper of general circulation in the area affected by the application for a permit. Western Energy submitted an affidavit of publication of public notice for the August 7, 14, and 21, 2014, issue of the *Independent Press*, a newspaper of general circulation in the City of Forsyth in Rosebud County, as proof of compliance with the public notice requirements.

6. ARM 17.8.749 Conditions for Issuance or Denial of Permit. This rule requires that the permits issued by the Department must authorize the construction and operation of the facility or emitting unit subject to the conditions in the permit and the requirements of this subchapter. This rule also requires that the permit must contain any conditions necessary to assure compliance with the Federal Clean Air Act (FCAA), the Clean Air Act of Montana, and rules adopted under those acts.

7. ARM 17.8.752 Emission Control Requirements. This rule requires a source to install the maximum air pollution control capability that is technically practicable and economically feasible, except that BACT shall be utilized. The required BACT analysis is included in Section III of this permit analysis.

8. ARM 17.8.755 Inspection of Permit. This rule requires that MAQPs shall be made available for inspection by the Department at the location of the source.

9. ARM 17.8.756 Compliance with Other Requirements. This rule states that nothing in the permit shall be construed as relieving Western Energy of the responsibility for complying with any applicable federal or Montana statute, rule, or standard, except as specifically provided in ARM 17.8.740, *et seq*.

10. ARM 17.8.759 Review of Permit Applications. This rule describes the Department's responsibilities for processing permit applications and making permit decisions on those permit applications that do not require the preparation of an environmental impact statement.

11. ARM 17.8.762 Duration of Permit. An MAQP shall be valid until revoked or modified, as provided in this subchapter, except that a permit issued prior to construction of a new or modified source may contain a condition providing that the permit will expire unless construction is commenced within the time specified in the permit, which in no event may be less than 1 year after the permit is issued.

12. ARM 17.8.763 Revocation of Permit. An MAQP may be revoked upon written request of the permittee, or for violations of any requirement of the Clean Air Act of Montana, rules adopted under the Clean Air Act of Montana, the FCAA, rules adopted under the FCAA, or any applicable requirement contained in the Montana State Implementation Plan (SIP).

13. ARM 17.8.764 Administrative Amendment to Permit. An MAQP may be amended for changes in any applicable rules and standards adopted by the Board of Environmental Review (Board) or changed conditions of operation at a source or stack that do not result in an increase of emissions as a result of those changed conditions. The owner or operator of a facility may not increase the facility's emissions beyond permit limits unless the increase meets the criteria in ARM 17.8.745 for a de minimis change not requiring a permit, or unless the owner or operator applies for and receives another permit in accordance with ARM 17.8.748, ARM 17.8.749, ARM 17.8.752, ARM 17.8.755, and ARM 17.8.756, and with all applicable requirements in ARM Title 17, Chapter 8, Subchapters 8, 9, and 10.

14. ARM 17.8.765 Transfer of Permit. This rule states that an MAQP may be transferred from one person to another if written notice of intent to transfer, including the names of the transferor and the transferee, is sent to the Department.

F. ARM 17.8, Subchapter 8 – Prevention of Significant Deterioration (PSD) of Air Quality, including but not limited to:

1. ARM 17.8.801 Definitions. This rule is a list of applicable definitions used in this subchapter.

2. ARM 17.8.818 Review of Major Stationary Sources and Major Modifications--Source Applicability and Exemptions. The requirements contained in ARM 17.8.819 through 17.8.827 shall apply to any major stationary source and any major modification, with respect to each pollutant subject to the Federal Clean Air Act (FCAA) that it would emit, except as this subchapter would otherwise allow.

   This facility is not a major stationary source since this facility is not a listed source and the source's potential to emit (excluding fugitive emissions) is below 250 tons per year of any pollutant.

G. ARM 17.8. Subchapter 12 – Operating Permit Program Applicability, including, but not limited to:

1. ARM 17.8.1201 Definitions. (23) Major Source under Section 7412 of the FCAA is defined as any source having:

   a. Potential to emit (PTE) > 10 ton/year of any single Hazardous Air Pollutant (HAP), PTE > 25 ton/year of total combined HAPs, or lesser quantity as the Department may establish by rule;

   b. PTE > 100 ton/year of any pollutant; or

   c. Sources with the PTE > 70 ton/year of PM_{10} in a serious PM_{10} non-attainment area.

2. ARM 17.8.1204 Air Quality Operating Permit Program. (1) Title V of the FCAA amendments of 1990 requires that all sources, as defined in ARM 17.8.1204(1), obtain a Title V Operating Permit. In reviewing and issuing MAQP #1570-08 for Western Energy, the following conclusions were made:

   a. The facility's PTE is less than 100 ton/year for any pollutant, excluding fugitives.

   b. The facility's PTE is less than 10 tons/year for any single HAP and less than 25 ton/year of combined HAPs.

   c. This source is not located in a serious PM_{10} non-attainment area.

   d. This facility is subject to NSPS 40 CFR 60 Subpart Y

   e. This facility is not subject to any current NESHAP standards.

f. This source is not a Title IV affected source, nor a solid waste combustion unit.

g. This source is not an EPA designated Title V sources.

Based on these conclusions, the Department has determined that Western Energy will be a minor source of emissions as defined under Title V. Therefore, a Title V operating permit is not required. However, if minor sources subject to NSPS are required to obtain a Title V Operating Permit, Western Energy will be required to obtain a Title V Operating Permit.

III. BACT Determination

A BACT determination is required for each new or modified source. Western Energy shall install on the new or modified source the maximum air pollution control capability that is technically practicable and economically feasible, except that BACT shall be utilized.

On behalf of Western Energy, Bison provided a BACT analysis for the control of fugitive particulate emission associated with the proposed project. The BACT document analyzed available methods for controlling fugitive particulate emissions from the processing, handling and transfer of coal related to the proposed project and subsequent justification for selection of the proposed option as BACT. The elements of this BACT analysis are as follows:

A. Identification of Control Options

In the consideration for BACT, Western Energy, identified and evaluated the follow available control options for the proposed project.

Best Operating Practices (BOPs)	BOPs include practices such as minimizing drop heights for transfers and minimizing turbulence in the process stream. BOPs were the base case control for the BACT analysis.
Enclosure	Enclosures function as control techniques by employing structures or underground placement to shelter material from wind entrainment. Enclosures can fully or partially surround the source.
Passive Enclosure Containment System (PEC)	PECs are a special class of enclosure control designed into the transfer and conveyance structure to limit the amount of turbulence and impacts to materials as it passes through a system. PECs are also designed to limit air pressure differences that would force particulate laden air from the transfer process.
Wet Dust Suppression (Water Spray)	Wet dust suppression methods apply water to materials in a bulk processing and/or transfer system generally b spray application. Emissions are prevented through agglomerate formation by combining small dust particles with larger aggregate or with liquid droplets. Water retained by sprayed material reduces emissions in downstream transfers.
Fogging Dust Suppression System	Fogging systems work on the same principle as wet dust suppression. Fogging systems create a fine mist of micron-sized water droplets in an area above an emission point. As fine particles are emitting into the fog they impact water droplets and agglomerate with other wetted particle and drop from suspension.

Foam Dust Suppression System (FDSS)	Like wet fogging systems, FDSSs are a specialized type of wet dust suppression system that incorporates a chemical foaming agent and surfactant. Relatively small amounts of chemical and water are mixed in a controlled ratio and then atomized with compressed air to create a large volume of stiff foam. The foam is then mixed into the bulk material stream where it wets fine particles and facilitates agglomeration that prevents escape to the atmosphere.
Wet Particulate Scrubber	Wet scrubbers typically use water to impact, intercept, or diffuse particulate in a waste gas stream. Particulate material is accelerated and impacted onto a solid surface or into a liquid droplet through devices such as a venture and spray chamber. The wet slurry material that is generated is typically stored in an on-site waste impoundment.
Electrostatic Precipitator (ESP)	An ESP uses electrical forces to move entrained particles onto a collection surface. Periodically the collection surface must be cleaned to remove dust cake, which drops into a collection hopper.
Fabric Filter Dust Collector (Baghouse)	Baghouses direct particulate laden exhaust through fine mesh fabric which traps particulate by sieving or filtration. Filters are intermittently cleaned by shaking, air pulsing (reverse jet) or reversed airflow direction

B. Control Technology Selection

As part of the analysis, Western Energy evaluated each identified method for technical practicability and the ability to provide a maximum degree of control of fugitive particulate emissions. Of the identified control technologies selected, only ESP was determined not to be technically practicable due to performance limitations. The other identified methods were determined to provide comparable control efficiencies depending upon certain operating variables and environmental conditions. Economic feasibility was not specifically addressed as the identified control technologies presented comparable costs.

Western Energy concluded that installation and operation of an FDSS constitutes BACT in the control of particulate matter, as this technology is capable of providing an effective means of particulate control for the material processing and transfer operations associated with this proposed project.

The Department concurs with this this BACT determination, as the control option selected achieves equivalent pollution control levels and costs comparable to other recently permitted similar sources and is capable of achieving the appropriate emission standards. FDSS technology performs well within a broad spectrum of operating conditions and has been employed in the control of particulate emissions from operating coal mines located within the western United States.

As part of the change Western Energy will remove the baghouses from each of the overland conveyor transfer points and isolate the secondary crushers from the main baghouse. However, the enclosures around the equipment will be maintained and retrofitted to accept the FDSS system. Upon consideration, the Department has concluded that maintenance of the existing source enclosures and installation and operation of FDSS on the secondary crushers and overland conveyor transfer points constitutes BACT in this application.

IV. Emission Inventory

A complete emission inventory is available from the Department.

Area C - Potential Emissions Summary

Fugitive Emissions							
Emission Source(s)	PM	PM_{10}	$PM_{2.5}$	CO	NO_x	SO_2	VOC
Topsoil Removal	74.93	37.46	3.75	--	--	--	--
Topsoil Dumping	2.85	1.35	0.2	--	--	--	--
Overburden Drilling	4.22	0.52	0.05	--	--	--	--
Overburden Blasting Cast Blasting	110.95	57.69	3.33	--	--	--	--
Overburden Removal - Dragline	623.78	120.22	10.6	--	--	--	--
Overburden Handling - Truck/Shovel	250.88	188.16	4.77	--	--	--	--
Overburden Dumping	2.85	1.35	0.2	--	--	--	--
Overburden Handling - Bulldozer	97.8	18.57	10.27	--	--	--	--
Haul Roads - Travel	852.27	227.09	22.57	--	--	--	--
Access Roads - Unpaved	374	101.56	10.16	--	--	--	--
Coal Drilling	0.71	0.09	0.01	--	--	--	--
Coal Blasting	40.67	21.15	1.22	--	--	--	--
Coal Removal	0.33	0.11	0.02	--	--	--	--
Explosive Detonation (ANFO)	--	--	--	577.04	146.41	17.23	--
Disturbed Acres - Complete (< 2 yrs.)	39.79	19.89	1.99	--	--	--	--
Disturbed Acres - Partial (< 1 yrs.)	134.06	67.03	6.7	--	--	--	--
Disturbed Acres - Partial (> 1 yrs.)	119.51	59.76	5.98	--	--	--	--
Disturbed Acres - Pits, Peaks, Soil Stripping	1066.13	533.06	53.31	--	--	--	--
Coal Crushing (secondary)	2.0	0.60	0.06				
Overland Conveyor	0.15	0.07	0.01				
TOTAL FUGITIVE EMISSIONS ►	3797.88	1455.73	135.20	577.04	146.41	17.23	0

Stationary Source Emissions (Non-Fugitive)							
Emission Source(s)	PM	PM_{10}	$PM_{2.5}$	CO	NO_x	SO_2	VOC
Truck Dump – Coal	0.27	0.1	0.01	--	--	--	--
Primary Coal Crusher	0.8	0.24	0.02	--	--	--	--
TOTAL NON-FUGITIVE EMISSIONS ►	1.07	0.34	0.03	0	0	0	0

V. Existing Air Quality

The Rosebud Mine is located in areas designated as unclassifiable/attainment for all National Ambient Air Quality Standards (NAAQS) pollutants and attainment for all Montana Ambient Air Quality Standards (MAAQS) pollutants. .

VI. Air Quality Impact Analysis

The current permit action allows for a minor increase in potential emissions from the Rosebud mine complex. The allowable PTE increase is below levels which would otherwise meet the definition of a de minimis change, therefore the Department believes it will not cause or contribute to a violation of any ambient air quality standards.

VII. Taking or Damaging Implication Analysis

As required by 2-10-105, MCA, the Department conducted the following private property taking and damaging assessment.

YES	NO	
✓		1. Does the action pertain to land or water management or environmental regulation affecting private real property or water rights?
	✓	2. Does the action result in either a permanent or indefinite physical occupation of private property?
	✓	3. Does the action deny a fundamental attribute of ownership? (ex.: right to exclude others, disposal of property)
	✓	4. Does the action deprive the owner of all economically viable uses of the property?
	✓	5. Does the action require a property owner to dedicate a portion of property or to grant an easement? [If no, go to (6)].
		5a. Is there a reasonable, specific connection between the government requirement and legitimate state interests?
		5b. Is the government requirement roughly proportional to the impact of the proposed use of the property?
	✓	6. Does the action have a severe impact on the value of the property? (consider economic impact, investment-backed expectations, character of government action)
	✓	7. Does the action damage the property by causing some physical disturbance with respect to the property in excess of that sustained by the public generally?
	✓	7a. Is the impact of government action direct, peculiar, and significant?
	✓	7b. Has government action resulted in the property becoming practically inaccessible, waterlogged or flooded?
	✓	7c. Has government action lowered property values by more than 30% and necessitated the physical taking of adjacent property or property across a public way from the property in question?
	✓	Takings or damaging implications? (Taking or damaging implications exist if YES is checked in response to question 1 and also to any one or more of the following questions: 2, 3, 4, 6, 7a, 7b, 7c; or if NO is checked in response to questions 5a or 5b; the shaded areas)

Based on this analysis, the Department determined there are no taking or damaging implications associated with this permit action.

VIII. Environmental Assessment

An environmental assessment, required by the Montana Environmental Policy Act, was completed for this project. A copy is attached.

DEPARTMENT OF ENVIRONMENTAL QUALITY
Permitting and Compliance Division
Air Resources Management Bureau
P.O. Box 200901, Helena, Montana 59620
(406) 444-3490

FINAL ENVIRONMENTAL ASSESSMENT (EA)

Issued To: Western Energy Company
P.O. Box 99
Colstrip, MT 59323

Montana Air Quality Permit (MAQP): 1570-08
Preliminary Determination Issued: 09/26/2014
Department Decision Issued: 10/15/2014
Permit Final: 10/31/2014

1. *Legal Description of Site*: Area C is located west of Colstrip in Sections 1-3 of Township 1 North, Range 39 East; Sections 34-36 of Township 2 North, Range 39 East; Sections 1-6, 8-12, and 13-17 of Township 1 North, Range 40 East; and Sections 28, 29, and 31-33 of Township 2 North, Range 40 East in Rosebud County. The list of permitted equipment can be found in Section I of the permit analysis.

2. *Description of Project*: Western Energy Company (Western Energy) proposed the installation and operation of a foam suppression dust control system (FDSS) in the control of particulate matter in lieu of the currently installed negative pressure capture and baghouse removal systems. No additional coal production capacity or coal processing equipment are proposed.

3. *Objectives of Project*: the objective of the expansion project is to further extend the life of the mine by expanding areas from which coal will be extracted.

4. *Alternatives Considered*: In addition to the proposed action, the Montana Department of Environmental Quality – Air Resources Management Bureau (Department) considered the "no-action" alternative. The "no-action" alternative would deny issuance of the air quality preconstruction permit to the proposed facility. However, the Department does not consider the "no-action" alternative to be appropriate because Western Energy demonstrated compliance with all applicable rules and regulations as required for permit issuance. Therefore, the "no-action" alternative was eliminated from further consideration.

5. *A Listing of Mitigation, Stipulations, and Other Controls*: A list of enforceable conditions, including a Best Available Control Technology (BACT) analysis, would be included in MAQP #1570-08.

6. *Regulatory Effects on Private Property*: The Department considered alternatives to the conditions imposed in this permit as part of the permit development. The Department determined that the permit conditions are reasonably necessary to ensure compliance with applicable requirements and demonstrate compliance with those requirements and do not unduly restrict private property rights.

7. *The following table summarizes the potential physical and biological effects of the proposed project on the environment. The "no-action" alternative was discussed previously.*

Potential Physical and Biological Effects							
Item	Description	Major	Moderate	Minor	None	Unknown	Comments Included
A	Terrestrial and Aquatic Life and Habitats				✓		yes
B	Water Quality, Quantity, and Distribution			✓			yes
C	Geology and Soil Quality, Stability, and Moisture				✓		yes
D	Vegetation Cover, Quantity, and Quality				✓		yes
E	Aesthetics				✓		yes
F	Air Quality			✓			yes
G	Unique Endangered, Fragile, or Limited Environmental Resource			✓			yes
H	Demands on Environmental Resource of Water, Air, and Energy			✓			yes
I	Historical and Archaeological Sites				✓		yes
J	Cumulative and Secondary Impacts			✓			yes

SUMMARY OF COMMENTS ON POTENTIAL PHYSICAL AND BIOLOGICAL EFFECTS: The following comments have been prepared by the Department.

A. Terrestrial and Aquatic Life and Habitats

Air quality impacts from the current permit action would be negligible as the proposed action would lead to a marginal potential increase in air emissions. This emissions increase under this proposed action would be less than those allowed under the de minimis rule provisions of Administrative Rules of Montana 17.8.745. As such Department has determined that any additional impact to terrestrial and aquatic life and habitats related to the current permit action would not likely occur.

B. Water Quality, Quantity and Distribution

This project would expect to have a little additional effect on the water quality, quantity, and distribution due to the use of water for FDSS. Any increase in particulate matter emissions would be negligible and not likely to impact water quality. Water would be required for the FDSS, however any volumes necessary for foam generation would not likely impact the quantity and distribution of water. Therefore, the Department has determined that the impacts to the water quality, quantity, and distribution would likely be minor.

C. Geology and Soil Quality, Stability and Moisture

This project would expect to have a little additional effect on geology and soil quality, stability and moisture due to the employment of the FDSS. Any increase in particulate matter emissions would be negligible and not likely to impact these aspects. Therefore, the Department has determined that any additional impacts to the geology and soil quality, stability, and moisture related to the current permit action would likely not occur.

D. Vegetation Cover, Quantity, and Quality

The particulate matter emissions increase from this project would be expected to present no additional impact on the surrounding vegetation with respect to cover, quantity and quality. Any potential increase in emissions would be negligible; therefore, the Department has determined that any additional impacts to the vegetation cover, quantity, and quality related to the current permit action would not likely occur.

E. Aesthetics

There will be no additional equipment added to the mine site and activity levels, including noise, would be consistent with existing coal mine operations. There are visual emissions associated with the proposed action would be representative of current conditions. Therefore, Department has determined that the additional impacts to the aesthetics related to the current permit action would not likely occur.

F. Air Quality

The area surrounding the proposed project is unclassifiable/attainment for all NAAQS criteria air pollutants. The Department believes that current concentrations of criteria pollutants in the area are at or near background levels and well below any NAAQS levels. The proposed project would not create any additional impact to receptors and resources within the proposed project area due to this slight increase in fugitive emissions of particulate matter.

The Department has determined that the amount of increased particulate emissions resulting from the proposed project would not create additional degradation and any such impact to air quality from the proposed project would be to be minor.

G. Unique Endangered, Fragile, or Limited Environmental Resources

The current permit action would occur within the previously disturbed industrial site at the mine. As part of the MEPA analysis on initial mine development, assessments of potential impacts to unique endangered, fragile, or limited environmental resources were done by the Department, including contact with the Montana Natural Heritage Program – Natural Resource Information System (NRIS) to identify species of special concern at the mine site. Due to the location of the sources within the existing mine and the negligible amount of increase in potential emissions, the Department determined that impacts to unique endangered, fragile, or limited environmental resources associated with the current permit action would be expected minor as a result of this permit action.

H. Demands on Environmental Resource of Water, Air and Energy

The current permitting action would have a minor impact to the demand on environmental resources of water, air, and energy. Additional demand for water and energy will be required for the production of foam and operation of the FDSS. However, with the removal of the exhaust fans associated with the baghouse installations, the net result may likely be a reduction in these aspects. Any demands are expected to be equally representative of current levels. Further, emissions generated from the proposed permit action would place limited demands on air because of the conditions placed in MAQP

#1570-08. Overall, the Department determined that the demands on the environmental resource of water, air, and energy related to the current permit action would be expected to be minor.

I. Historical and Archaeological Sites

The current permit action would occur within the previously disturbed industrial site at the mine. According correspondence from the Montana State Historic Preservation Office, there is low likelihood of adverse disturbance to any known archaeological or historic site because of previous industrial disturbances. Therefore, the Department determined that the likelihood that the current permit action would have an impact on historical or archaeological sites would likely not exist.

J. Cumulative and Secondary Impacts

The cumulative and secondary impacts from the proposed project on physical and biological receptors in the immediate area due to an increase in emissions from the proposed project would be expected to be minor. Air pollution from the facility would be controlled by Department-determined BACT, as discussed in Section III of the permit analysis, along with the limitations and conditions in MAQP #1570-08. The Department believes that this facility could be expected to operate in compliance with all applicable rules and regulations as outlined within the air quality permit.

8. *The following table summarizes the potential economic and social effects of the proposed project on the human environment. The "no-action" alternative was discussed previously.*

Potential Social and Economic Effects							
Item	Description	Major	Moderate	Minor	None	Unknown	Comments Included
A	Social Structures and Mores				✓		yes
B	Cultural Uniqueness and Diversity				✓		yes
C	Local and State Tax Base and Tax Revenue				✓		yes
D	Agricultural or Industrial Production				✓		yes
E	Human Health			✓			yes
F	Access to and Quality of Recreational and Wilderness Activities				✓		yes
G	Quantity and Distribution of Employment				✓		yes
H	Distribution of Population				✓		yes
I	Demands for Government Services			✓			yes
J	Industrial and Commercial Activity				✓		yes
K	Locally Adopted Environmental Plans and Goals				✓		yes
L	Cumulative and Secondary Impacts			✓			yes

SUMMARY OF COMMENTS ON POTENTIAL ECONOMIC AND SOCIAL EFFECTS: The following comments have been prepared by the Department.

A. Social Structures and Mores

The current permitting action would not create additional disruption to any native or traditional lifestyles or communities (social structures or mores) in the area as the project will occur within the boundary of the existing mine and only a negligible increase in emissions is expected. The Department is not aware of any current utilization by native or traditional communities. Therefore no known impact to social structures and mores would be expected.

B. Cultural Uniqueness and Diversity

The Department determined that the current permit action would not have any additional impact on the cultural uniqueness and diversity of this area of operation because the proposed project would occur within the previously disturbed industrial area. The surrounding area would remain unchanged as a result of the proposed project.

C. Local and State Tax Base and Tax Revenue

The current permit action will not have an the impact on the local and state tax base and tax revenue due to this permit action as no additional coal production will result and no new employees are planned as a result of this project. Therefore the cumulative impact to the tax base and revenue will not result.

D. Agricultural or Industrial Production

No additional agricultural or industrial production will occur as a result of this permit action. Therefore, the overall impacts to agricultural or industrial production would not likely occur.

E. Human Health

The proposed project would result in a negligible increase in emissions due to the proposed project. Further MAQP #1570-09 contains limitations and conditions including, but not limited to, the BACT requirements discussed in Section III of the permit analysis, to ensure that the operations would maintain compliance with all applicable rules and standards. These rules and standards are designed to be protective of human health. Therefore any impact to human health from the proposed project would be expected to be minor.

F. Access to and Quality of Recreational and Wilderness Activities

The current permit action would occur within the existing mine boundary and would not impact access to recreational and wilderness activities. Emissions from the proposed project would be negligible and will not likely present any additional impacts to the quality of recreational activities. No designated wilderness areas would be impacted by the project. Therefore, the associated impacts on the access to and quality of recreational and wilderness activities would likely not occur.

G. Quantity and Distribution of Employment

According to Western Energy the proposed project would not necessitate the hiring of additional employees; therefore no effect on the quantity and distribution of employment would be expected as a result of the expansion.

H. Distribution of Population

No full time or permanent employees would be added as a result of proposed project. Therefore the distribution of population in the area would not be impacted as a result of the current permit action.

I. Demands for Government Services

Government services would be required for acquiring the appropriate permits from government agencies and for ongoing interaction with Western Energy. The proposed project would not likely increase the need for government service resources beyond the current capacity. As a result of this project any addition demands for government services would be expected to be minor.

J. Industrial and Commercial Activity

The proposed project would not result in an increase in production from the mine site, the industrial activity would be commensurate with current operations, and no additional coal processing or handling equipment or manpower would be requirement. As such, no additional increases to industrial and commercial activity would be expected to occur.

K. Locally Adopted Environmental Plans and Goals

The Department is not aware of any locally adopted environmental plans or goals that would be affected by the proposed project.

L. Cumulative and Secondary Impacts

Overall, cumulative and secondary impacts from this project would result in only minor impacts to the social and economic aspects addressed. The Department believes Western Energy would be expected to operate in compliance with all applicable rules and regulations as outlined in MAQP #1570-08.

Recommendation: No Environmental Impact Statement (EIS) is required.

If an EIS is not required, explain why the EA is an appropriate level of analysis: The current permitting action is for a proposed replacement of the control technology on the secondary coal crusher and overland conveyor which results in only minor impacts to items addressed within this EA. MAQP #1570-08 includes conditions and limitations to ensure the facility will operate in compliance with all applicable rules and regulations. In addition, there are no significant impacts associated with this proposal.

Other groups or agencies contacted or which may have overlapping jurisdiction: Montana Historical Society – State Historic Preservation Office, Natural Resource Information System – Montana Natural Heritage Program

Individuals or groups contributing to this EA: Department of Environmental Quality – Air Resources Management Bureau

EA prepared by: D. Kuenzli
Date: September 24, 2014

Montana Department of
ENVIRONMENTAL QUALITY

Steve Bullock, Governor
Tracy Stone-Manning, Director

P. O. Box 200901 Helena, MT 59620-0901 (406) 444-2544 Website: www.deq.mt.gov

PRELIMINARY DETERMINATION
ON PERMIT APPLICATION

Date of Mailing: July 22, 2013

Name of Applicant: Western Energy Company

Source: Surface Coal Mine and Extraction Facility

Proposed Action: The Department of Environmental Quality (Department) proposes to issue a permit, with conditions, to the above-named applicant. The application was assigned Montana Air Quality Permit Application Number 1570-07.

Proposed Conditions: See attached.

Public Comment: Any member of the public desiring to comment must submit such comments in writing to the Air Resources Management Bureau (Bureau) of the Department at the above address. Comments may address the Department's analysis and determination, or the information submitted in the application. In order to be considered, comments on this Preliminary Determination are due by August 6, 2013. Copies of the application and the Department's analysis may be inspected at the Bureau's office in Helena. For more information, you may contact the Department.

Departmental Action: The Department intends to make a decision on the application after expiration of the Public Comment period described above. A copy of the decision may be obtained at the above address. The permit shall become final on the date stated in the Department's Decision on this permit, unless an appeal is filed with the Board of Environmental Review (Board).

Procedures for Appeal: Any person jointly or severally adversely affected by the final action may request a hearing before the Board. Any appeal must be filed by the date stated in the Department's Decision on this permit. The request for a hearing shall contain an affidavit setting forth the grounds for the request. Any hearing will be held under the provisions of the Montana Administrative Procedures Act. Submit requests for a hearing in triplicate to: Chairman, Board of Environmental Review, P.O. Box 200901, Helena, MT 59620.

For the Department,

Julie A Merkel

Julie Merkel
Air Permitting Program Supervisor
Air Resources Management Bureau
(406) 444-3626

Doug Kuenzli
Environmental Science Specialist
Air Resources Management Bureau
(406) 444-4267

JM:DCK
Enclosure

MONTANA AIR QUALITY PERMIT

Issued to: Western Energy Company
P.O. Box 99
Colstrip, MT 59323

MAQP: #1570-07
Application Complete: 04/22/2013
Preliminary Determination: 07/22/2013
Department's Decision Issued:
Permit Final:
AFS #: 087-0004

A Montana Air Quality Permit (MAQP), with conditions, is hereby granted to Western Energy Company (Western Energy), pursuant to Sections 75-2-204 and 211 of the Montana Code Annotated (MCA), as amended, and the Administrative Rules of Montana (ARM) 17.8.740 *et seq.*, as amended, for the following:

Section I: Permitted Facilities

A. Plant Location

Western Energy operates a surface coal mine and extraction facility located in Area C and Area F of the Rosebud Mine. The total estimated coal production for the life of the mine is 241,000,000 tons. Area C is located west of Colstrip in Sections 1-3 of Township 1 North, Range 39 East; Sections 34-36 of Township 2 North, Range 39 East; Sections 1-6, 8-12, and 13-17 of Township 1 North, Range 40 East; and Sections 28, 29, and 31-33 of Township 2 North, Range 40 East in Rosebud County. Area F is located in Sections 3-6, Township 1 North, Range 40 East in Rosebud County, Sections 19, 20, and 27-34 in Township 2 North, Range 40 East in Rosebud County, and Sections 12-14 and 23-25, Township 2 North, Rage 39 East in Treasure County. The list of permitted equipment can be found in Section I of the permit analysis.

B. Current Permit Action

On April 18, 2013, the Department of Environmental Quality (Department) received an initial application from Bison Engineering, Inc. (Bison), on behalf of Western Energy, for modification of Western Energy's air quality permit to allow expansion to the geographic extent of the mine. The existing MAQP explicitly defined the physical area in which mining activities are permitted. As such, the application requests an expansion of this physical boundary into a new area designated as Area F. No additional coal production capacity was requested, the objective of the expansion is to further extend the life of the mine by replacing areas from which coal has been extracted. Supplemental information and data was received by the Department on June 12, 2013. The current permit action provides for an expansion of the mines operational boundary, incorporates a single de minimis action, updates permit language and rule references used by the Department, and updates the emission inventory.

Section II: Conditions and Limitations

A. Emissions Limitations

1. All emissions at the Area C crusher and coal handling facility, including the negative pressure system on the truck dump, shall be vented to a common baghouse. Each of the three transfer points on the overland conveyor shall be controlled by a baghouse (ARM 17.8.340 and 40 CFR Part 60, Subpart Y).

2. Western Energy shall not cause visible emissions of greater than 20% opacity to be discharged into the atmosphere from any coal handling, conveying, crushing, processing, storing or loading system averaged over 6 consecutive minutes (ARM 17.8.308, 304, 340 and 40 CFR Part 60, Subpart Y).

3. Western Energy shall not cause or authorize the use of any street, road, or parking lot without taking reasonable precautions to control emissions of airborne particulate matter (ARM 17.8.308).

4. Western Energy shall treat all unpaved portions of the haul roads, access roads, parking lots, or general plant area with water and/or chemical dust suppression as necessary to maintain compliance with the reasonable precautions limitation in Section II.A.3 (ARM 17.8.749).

5. The following control measures shall be applied on an as necessary basis (ARM 17.8.752, 749 and 308):

    a. Chemically stabilize and maintain all active haul and access roads and supplement by watering;

    b. Apply water to temporary roads such as scraper travel areas;

    c. Adequately maintain open coal storage and minimize equipment activity on stockpiles;

    d. Minimize fall/drop distance on all coal and overburden handling activities;

    e. Minimize area of surface disturbance;

    f. Promptly revegetate exposed/disturbed areas, including temporary vegetative cover of topsoil stockpiles;

    g. Minimize emissions from coal and overburden drilling through the use of dust curtains, water sprays, dust collectors, or other appropriate techniques;

    h. Conduct blasting operations in such a manner as to minimize emissions, prevent overshooting, provide stemming of holes, and minimize area to be blasted;

    i. Extinguish areas of burning or smoldering coal;

    j. Restrict and maintain vehicle speeds on haul roads as necessary to minimize emissions; and,

    k. Other control practices which may be determined by the department to be necessary.

6. Western Energy shall maintain a fugitive dust control plan. Elements of the plan shall include, but not be limited to, the conditions established within Section II.A.1 through II.A.5 (ARM 17.8.749 and 752).

7. Combined annual coal production from Areas C and F shall be limited to 8,000,000 tons per year (ARM 17.8.749).

8. Annual coal production from Area F shall be limited to 4,000,000 tons per year (ARM 17.8.749).

9. Western Energy shall comply with all applicable standards and limitations, and the reporting, recordkeeping, testing, and notification requirements contained in 40 Code of Federal Regulations (CFR), Subpart Y, *Standards of Performance for Coal Preparation Plants and Processing Plants* (ARM 17.8.340 and 40 CFR 60, Subpart Y).

B. Testing Requirements

1. All compliance source tests shall conform to the requirements of the Montana Source Test Protocol and Procedures Manual (ARM 17.8.106).

2. The Department may require testing (ARM 17.8.105).

C. Operational Reporting Requirements

1. Western Energy shall supply the Department with annual production information for all emission points, as required by the Department in the annual emission inventory request. The request will include, but is not limited to, all sources of emissions identified in the emission inventory contained in the permit analysis and sources identified in Section I of the permit analysis.

   Production information shall be gathered on a calendar-year basis and submitted to the Department by the date required in the emission inventory request. The information shall include the following and shall be in the units required by the Department. This information may be used for calculating operating fees, based on actual emissions from the facility, and/or to verify compliance with permit limitations (ARM 17.8.505). Western Energy shall submit the following information annually to the Department by March 1, of each year; the information may be submitted along with the annual emission inventory (ARM 17.8.505).

2. Western Energy shall notify the Department of any construction or improvement project conducted pursuant to ARM 17.8.745 that would include the ***addition of a new emission unit***, change in control equipment, stack height, stack diameter, stack flow, stack gas temperature, source location, or fuel specifications, or would result in an increase in source capacity above its permitted operation. The notice must be submitted to the Department, in writing, 10 days prior to start up or use of the proposed de minimis change or as soon as reasonably practicable in the event of an unanticipated circumstance causing the de minimis change and must include the information requested in ARM 17.8.745 (l)(d) (ARM 17.8.745).

3. All records compiled in accordance with this permit must be maintained by Western Energy as a permanent business record for at least 5-years following the date of the measurement, must be available at the plant site for inspection by the department, and must be submitted to the department upon request (ARM 17.8.749).

D. Notification

Western Energy shall provide the Department with written notification of the actual date upon which mining operations commence in the Area F expansion. The notice shall be postmarked or hand-delivered no later than 15 days after the actual operational commencement date of the Area F expansion (ARM 17.8.749).

E. Ambient Monitoring

1. Particulate matter within an aerodynamic diameter of ten microns or less (PM_{10}) data has been collected at the Western Energy mine since 1992. During the 1992-2000 period, the annual means at all sites were less than 28% of the annual standard. For the 24-hour PM_{10}

concentrations, all of the annual, maximum 24-hour values were less than 53% of the 24-hour standard. Therefore, in accordance with the October 9, 1998, monitoring guidance statement developed by the Department, Western Energy may discontinue operation of their ambient air-monitoring network.

2. The Department may require Western Energy to conduct additional ambient air monitoring, if necessary (ARM 17.8.749).

Section III: General Conditions

A. Inspection – Western Energy shall allow the Department's representatives access to the source at all reasonable times for the purpose of making inspections or surveys, collecting samples, obtaining data, auditing any monitoring equipment (Continuous Emission Monitoring Systems CEMS, Continuous Emission Rate Monitoring Systems (CERMS) or observing any monitoring or testing, and otherwise conducting all necessary functions related to this permit.

B. Waiver – The permit and all the terms, conditions, and matters stated herein shall be deemed accepted if Western Energy fails to appeal as indicated below.

C. Compliance with Statutes and Regulations - Nothing in this permit shall be construed as relieving Western Energy of the responsibility for complying with any applicable federal or Montana statute, rule, or standard, except as specifically provided in ARM 17.8.740, *et seq*. (ARM 17.8.756).

D. Enforcement – Violations of limitations, conditions and requirements contained herein may constitute grounds for permit revocation, penalties or other enforcement as specified in Section 75-2-401 *et seq.*, MCA.

E. Appeals – Any person or persons jointly or severally adversely affected by the Department's decision may request, within 15 days after the Department renders its decision, upon affidavit setting forth the grounds therefore, a hearing before the Board of Environmental Review (Board). A hearing shall be held under the provisions of the Montana Administrative Procedures Act. The filing of a request for a hearing does not stay the Department’s decision unless the Board issues a stay upon receipt of a petition and a finding that a stay is appropriate under Section 75-2-211(11)(b), MCA. The issuance of a stay on a permit by the Board postpones the effective date of the Department’s decision until conclusion of the hearing and issuance of a final decision by the Board. If a stay is not issued by the Board, the Department’s decision on the application is final 16 days after the Department’s decision is made.

F. Permit Inspection – As required by ARM 17.8.755, Inspection of Permit, a copy of the air quality permit shall be made available for inspection by Department personnel at the location of the permitted source.

G. Permit Fees – Pursuant to Section 75-2-220, MCA, as amended by the 1991 Legislature, failure to pay the annual operation fee by Western Energy may be grounds for revocation of this permit, as required by that section and rules adopted there under by the Board.

H. Duration of Permit – Construction or installation must begin or contractual obligations entered into that would constitute substantial loss within 3 years of permit issuance and proceed with due diligence until the project is complete or the permit shall expire (ARM 17.8.762).

Montana Air Quality Permit (MAQP) Analysis
Western Energy Company - Rosebud Mine
MAQP #1570-07

I. Introduction/Process Description

A. Permitted Equipment

Western Energy Company (Western Energy) operates the following equipment at Area C and Area F of the Rosebud Mine.

1. "Coal handling facilities" include, but are not limited to:

   a. Truck dump with two 500-ton capacity dump hoppers.

   b. Two primary crushers with capacities of 1650 ton/hr each.

   c. Two secondary crushers with capacities of 1650 ton/hr each.

   NOTE: Only one dump hopper, primary crusher and secondary crusher will operate at a time, with the other being a redundant system. The crushers and conveyors at the preparation facility are fully enclosed and vented to a central baghouse. The truck dump is equipped with a negative pressure system vented to the central baghouse.

   d. One overland conveyor with a capacity of 1650 ton/hr, approximately 5 miles in length. The conveyor and transfer points are fully enclosed and vented to baghouses. This conveyor transports coal from the Area C preparation facility to the Colstrip power plants, Units 3 and 4.

2. Necessary auxiliaries include, but are not limited to: draglines, coal shovels, trucks, front-end loaders, graders, scrapers, dozers, other mobile units, auxiliary facilities, etc., as applicable.

B. Source Description

Western Energy operates a surface coal extraction facility and mine located in Area C and Area F of the Rosebud Mine. Area C is located west of Colstrip in Sections 1-3 of Township 1 North, Range 39 East; Sections 34-36 of Township 2 North, Range 39 East; Sections 1-6, 8-12, and 13-17 of Township 1 North, Range 40 East; and Sections 28, 29, and 31-33 of Township 2 North, Range 40 East of Rosebud County. Area F is located immediately west of Area C within Sections 3-6, Township 1 North, Range 40 East in Rosebud County, Sections 19, 20, and 27-34 in Township 2 North, Range 40 East in Rosebud County, and Sections 12-14 and 23-25, Township 2 North, Rage 39 East in Treasure County

Areas C and F have a combined maximum annual production limit of 8,000,000 tons of coal per year. Annual coal production from Area F is limited to 4,000,000 tons. The total projected coal production for the life of the mine is estimated at 241,000,000 tons. All Coal extracted from Area F will be transported by haul truck to the Area C or Area A truck dump for further processing.

C. Permit History

MAQP #1570 was originally issued to Western Energy for Area C of the Rosebud Mine on August 2, 1982. The coal processing facilities, with emissions controlled by baghouses, included primary and secondary crushers and conveyors. Area C coal was used exclusively at the local power generating facilities known as Colstrip Units 3 and 4. An overland conveyor, with baghouse controls at each transfer point, transported coal 5 miles from Area C to the power plants. The original permit contained a coal production limit of 5.6 million tons per year. Overburden was stripped using standard dragline practices and shovel and truck removed coal. Other mine related activities included topsoil handling (primarily with scrapers), drilling and blasting of overburden and coal, vehicle traffic, and reclamation/farming activities.

MAQP #1570A was a modification issued on January 6, 1986. The permit action discontinued ambient air monitoring for meteorological parameters and settled particulate matter (a.k.a. dustfall). Total suspended particulate (TSP) monitoring was still required; however, five TSP sites were discontinued, five existing TSP sites continued to operate, and two new TSP sites were added. MAQP #1570A replaced MAQP #1570.

MAQP #1570B was a modification issued on December 22, 1988. The annual coal production limit was increased from 5.6 to 6.5 million tons per year. No changes were made to the coal mining methods or coal handling procedures. MAQP #1570B replaced MAQP #1570A.

MAQP #1570C was a modification issued on March 22, 1990, that dealt only with ambient air monitoring. A new particulate matter-monitoring site was required near Castle Rock Lake Drive. The description of monitoring sites #12 & #13 were revised to correct a transposition error from an earlier permitting action. Clarifying language was added that explained the Department of Environmental Quality's (Department) policy for future ambient PM_{10} monitoring requirements. Lastly, the ambient air monitoring requirements were removed from the body of the permit and placed in an attachment to the main permit (hereafter referred to as Attachment 1). MAQP #1570C replaced MAQP #1570B.

MAQP #1570-04 was a modification issued on September 1, 1994. The annual coal production limit was increased from 6.5 to 7.5 million tons per year. No other operational changes were made. MAQP #1570-04 replaced MAQP #1570C.

MAQP #1570-05 was a modification issued on June 15, 2000. The permit action was an administrative change requested by Western Energy on March 30, 2000. Western Energy requested corrections to the site location description in their permit. Additionally, the permit was updated to reflect the current format and language used in permits. MAQP #1570-05 replaced MAQP #1570-04.

MAQP #1570-06 was a modification issued on July 19, 2001. The Department received a letter, dated April 27, 2001, from Western Energy requesting termination of the ambient air-monitoring network. Following the October 9, 1998, permitting guidance statement, the Department reviewed the ambient air monitoring data. In a letter dated May 23, 2001, the Department agreed to Western Energy's request to terminate their ambient monitoring program, effective July 1, 2001. The permit action updated the monitoring requirements to reflect the termination of the ambient air-monitoring network. MAQP #1570-06 replaced MAQP #1570-05.

D. Current Permit Action

On April 18, 2013, the Department received an initial application from Bison Engineering, Inc. (Bison), on behalf of Western Energy, for modification of Western Energy's air quality permit to allow expansion to the geographic extent of the mine. The existing MAQP explicitly defined the physical area in which mining activities are permitted. As such, the application requests an expansion of this physical boundary into a new area designated as Area F. No additional coal production capacity was requested, the objective of the expansion is to further extend the life of the mine by replacing areas from which coal has been extracted. Supplemental information and data was received by the Department on June 12, 2013. The current permit action provides for an expansion of the mines operational boundary. No additional stationary or portable equipment are proposed.

This permit action also incorporates a de minimis action approved by the Department on July 20, 2013, which increased the annual production capacity limit by 500,000 tons to a total of 8.0 million tons per year. In addition this permit action updates permit language and rule references used by the Department, as well as updates the emission inventory. **MAQP #1570-07** replaces MAQP #1570-06

E. Additional Information

Additional information, such as applicable rules and regulations, Best Available Control Technology (BACT)/Reasonably Available Control Technologies (RACT) determinations, air quality impacts, and environmental assessments, is included in the analysis associated with each change to the permit.

II. Applicable Rules and Regulations

The following are partial explanations of some applicable rules and regulations that apply to the facility. The complete rules are stated in the Administrative Rules of Montana (ARM) and are available upon request from the Department. Upon request, the Department will provide references for locations of complete copies of all applicable rules and regulations or copies where appropriate.

A. ARM 17.8, Subchapter 1 - General Provisions, including, but not limited to:

1. ARM 17.8.101 Definitions: This rule includes a list of applicable definitions used in this chapter, unless indicated otherwise in a specific subchapter.

2. ARM 17.8.105 Testing Requirements. Any person or persons responsible for the emission of any air contaminant into the outdoor atmosphere shall, upon written request of the Department, provide the facilities and necessary equipment (including instruments and sensing devices) and shall conduct tests, emission or ambient, for such periods of time as may be necessary using methods approved by the Department.

3. ARM 17.8.106 Source Testing Protocol. The requirements of this rule apply to any emission source testing conducted by the Department, any source, or other entity as required by any rule in this chapter, or any permit or order issued pursuant to this chapter, or the provisions of the Clean Air Act of Montana, 75-2-101, *et seq.*, Montana Code Annotated (MCA).

Western Energy shall comply with the requirements contained in the Montana Source Test Protocol and Procedures Manual, including, but not limited, using the proper test methods and supplying the required reports. A copy of the Montana Source Test Protocol and Procedures Manual is available from the Department upon request.

4. ARM 17.8.110 Malfunctions. (2) The Department must be notified promptly by telephone whenever a malfunction occurs that can be expected to create emissions in excess of any applicable emission limitation, or to continue for a period greater than 4 hours.

5. ARM 17.8.111 Circumvention. (1) No person shall cause or permit the installation or use of any device or any means which, without resulting in reduction in the total amount of air contaminant emitted, conceals or dilutes an emission of air contaminant which would otherwise violate an air pollution control regulation. (2) No equipment that may produce emissions shall be operated or maintained in such a manner that a public nuisance is created.

B. ARM 17.8, Subchapter 2 - Ambient Air Quality, including, but not limited to:

1. ARM 17.8.204 Ambient Air Monitoring
2. ARM 17.8.210 Ambient Air Quality Standards for Sulfur Dioxide (SO_2)
3. ARM 17.8.211 Ambient Air Quality Standards for Nitrogen Dioxide (NO_2)
4. ARM 17.8.212 Ambient Air Quality Standards for Carbon Monoxide (CO)
5. ARM 17.8.213 Ambient Air Quality Standards for Ozone (O_3)
6. ARM 17.8.214 Ambient Air Quality Standard for Hydrogen Sulfide (H_2S)
7. ARM 17.8.220 Ambient Air Quality Standard for Settled Particulate Matter (PM)
8. ARM 17.8.221 Ambient Air Quality Standard for Visibility
9. ARM 17.8.222 Ambient Air Quality Standards for Lead
10. ARM 17.8.223 Ambient Air Quality Standard for Particulate Matter with an Aerodynamic Diameter of Ten Microns or Less (PM_{10})

Western Energy must maintain compliance with the applicable ambient air quality standards.

C. ARM 17.8, Subchapter 3 - Emission Standards, including, but not limited to:

1. ARM 17.8.304 Visible Air Contaminants. This rule requires that no person may cause or authorize emissions to be discharged into the outdoor atmosphere from any source installed after November 23, 1968, that exhibit an opacity of 20% or greater averaged over 6 consecutive minutes.

2. ARM 17.8.308, Particulate Matter Airborne. (1) This rule requires an opacity limitation of 20% for all fugitive emission sources and that reasonable precautions are taken to control emissions of airborne particulate matter. (2) Under this rule, Western Energy shall not cause or authorize the use of any street, road or parking lot without taking reasonable precautions to control emissions of airborne particulate matter.

3. ARM 17.8.309 Particulate Matter Fuel Burning Equipment. This rule requires that no person shall cause, allow or permit to be discharged into the atmosphere particulate matter caused by the combustion of fuel in excess of the amount determined by this rule.

4. ARM 17.8.310 Particulate Matter Industrial Processes. This rule requires that no person shall cause, suffer, allow, or permit to be discharged into the outdoor atmosphere from any operation, process or activity, particulate matter in excess of the amount shown in this rule.

5. ARM 17.8.322, Sulfur Oxide Emissions-Sulfur in Fuel. This rule requires that no person shall cause, allow or permit to be discharged into the atmosphere particulate matter in excess of the amount set forth in this rule

6. ARM 17.8.324(3) Hydrocarbon Emissions--Petroleum Products. No person shall load or permit the loading of gasoline into any stationary tank with a capacity of 250 gallons or more from any tank truck or trailer, except through a permanent submerged fill pipe, unless such tank is equipped with a vapor loss control device as described in (1) of this rule

7. ARM 17.8.340 Standard of Performance for New Stationary Sources. This rule incorporates, by reference, 40 CFR Part 60, Standards of Performance for New Stationary Sources (NSPS). The owner and operator of any stationary source or modification, as defined and applied in 40 CFR Part 60, shall comply with the NSPS.

   a. 40 CFR Part 60, Subpart A – General Provisions apply to all equipment or facilities subject to an NSPS Subpart as listed below:

   b. 40 CFR Part 60, Subpart Y – Standards of Performance for Coal Preparation Plants and Processing Plants. Process operations at this facility that meet the definition of affected facilities include any coal processing and conveying equipment, coal storage systems, or coal transfer and loading systems.

8. ARM 17.8.342 Emission Standards for Hazardous Air Pollutants for Source Categories. This rule incorporates, by reference, 40 CFR Part 63, National Emission Standards for Hazardous Air Pollutants (NESHAPs) for Source Categories. Western Energy shall comply with the requirements of 40 CFR Part 63, as applicable.

D. ARM 17.8, Subchapter 5 - Air Quality Permit Application, Operation and Open Burning Fees, including but not limited to:

1. ARM 17.8.504 Air Quality Permit Application Fees. This rule requires that an applicant submit an air quality permit application fee concurrent with the submittal of an MAQP application. A permit application is incomplete until the proper application fee is paid to the Department. Western Energy submitted the appropriate permit application fee for the current permit action.

2. ARM 17.8.505, Air Quality Operation Fees. An annual air quality operation fee must, as a condition of continued operation, be submitted to the Department by each source of air contaminants holding an MAQP (excluding an open burning permit) issued by the Department. The air quality operation fee is based on the actual or estimated actual amount of air pollutants emitted during the previous calendar year.

   An air quality operation fee is separate and distinct from an air MAQP application fee. The annual assessment and collection of the air quality operation fee, described above, shall take place on a calendar-year basis. The Department may insert into any final permit issued after the effective date of these rules, such conditions as may be necessary to require the payment of an air quality operation fee on a calendar year basis, including provisions that prorate the required fee amount.

E. ARM 17.8, Subchapter 7 - Permit, Construction and Operation of Air Contaminant Sources, including but not limited to:

1. ARM 17.8.740 Definitions. This rule is a list of applicable definitions used in this chapter, unless indicated otherwise in a specific subchapter.

2. ARM 17.8.743 Montana Air Quality Permits--When Required. This rule requires a person to obtain an MAQP or permit modification to construct, modify, or use any air contaminant sources that have the potential to emit (PTE) greater than 25 tons per year of any pollutant. Western Energy has a PTE greater than 25 tons per year of PM, PM_{10}, Volatile Organic Compounds (VOC); therefore, an MAQP is required.

3. ARM 17.8.744 Montana Air Quality Permits--General Exclusions. This rule identifies the activities that are not subject to the MAQP program.

4. ARM 17.8.745 Montana Air Quality Permits--Exclusion for De Minimis Changes. This rule identifies the de minimis changes at permitted facilities that do not require a permit under the MAQP Program.

5. ARM 17.8.748 New or Modified Emitting Units--Permit Application Requirements. (1) This rule requires that a permit application be submitted prior to installation, modification, or use of a source. Western Energy submitted the required permit application for the current permit action. (7) This rule requires that the applicant notify the public by means of legal publication in a newspaper of general circulation in the area affected by the application for a permit. Western Energy submitted an affidavit of publication of public notice for the April 18, 2013, issue of the *Independent Press*, a newspaper of general circulation in the City of Forsyth in Rosebud County, as proof of compliance with the public notice requirements.

6. ARM 17.8.749 Conditions for Issuance or Denial of Permit. This rule requires that the permits issued by the Department must authorize the construction and operation of the facility or emitting unit subject to the conditions in the permit and the requirements of this subchapter. This rule also requires that the permit must contain any conditions necessary to assure compliance with the Federal Clean Air Act (FCAA), the Clean Air Act of Montana, and rules adopted under those acts.

7. ARM 17.8.752 Emission Control Requirements. This rule requires a source to install the maximum air pollution control capability that is technically practicable and economically feasible, except that BACT shall be utilized. The required BACT analysis is included in Section III of this permit analysis.

8. ARM 17.8.755 Inspection of Permit. This rule requires that MAQPs shall be made available for inspection by the Department at the location of the source.

9. ARM 17.8.756 Compliance with Other Requirements. This rule states that nothing in the permit shall be construed as relieving Western Energy of the responsibility for complying with any applicable federal or Montana statute, rule, or standard, except as specifically provided in ARM 17.8.740, *et seq*.

10. ARM 17.8.759 Review of Permit Applications. This rule describes the Department's responsibilities for processing permit applications and making permit decisions on those permit applications that do not require the preparation of an environmental impact statement.

11. ARM 17.8.762 Duration of Permit. An MAQP shall be valid until revoked or modified, as provided in this subchapter, except that a permit issued prior to construction of a new or modified source may contain a condition providing that the permit will expire unless construction is commenced within the time specified in the permit, which in no event may be less than 1 year after the permit is issued.

12. ARM 17.8.763 Revocation of Permit. An MAQP may be revoked upon written request of the permittee, or for violations of any requirement of the Clean Air Act of Montana, rules adopted under the Clean Air Act of Montana, the FCAA, rules adopted under the FCAA, or any applicable requirement contained in the Montana State Implementation Plan (SIP).

13. ARM 17.8.764 Administrative Amendment to Permit. An MAQP may be amended for changes in any applicable rules and standards adopted by the Board of Environmental Review (Board) or changed conditions of operation at a source or stack that do not result in an increase of emissions as a result of those changed conditions. The owner or operator of a facility may not increase the facility's emissions beyond permit limits unless the increase meets the criteria in ARM 17.8.745 for a de minimis change not requiring a permit, or unless the owner or operator applies for and receives another permit in accordance with ARM 17.8.748, ARM 17.8.749, ARM 17.8.752, ARM 17.8.755, and ARM 17.8.756, and with all applicable requirements in ARM Title 17, Chapter 8, Subchapters 8, 9, and 10.

14. ARM 17.8.765 Transfer of Permit. This rule states that an MAQP may be transferred from one person to another if written notice of intent to transfer, including the names of the transferor and the transferee, is sent to the Department.

F. ARM 17.8, Subchapter 8 – Prevention of Significant Deterioration (PSD) of Air Quality, including but not limited to:

1. ARM 17.8.801 Definitions. This rule is a list of applicable definitions used in this subchapter.

2. ARM 17.8.818 Review of Major Stationary Sources and Major Modifications--Source Applicability and Exemptions. The requirements contained in ARM 17.8.819 through 17.8.827 shall apply to any major stationary source and any major modification, with respect to each pollutant subject to the Federal Clean Air Act (FCAA) that it would emit, except as this subchapter would otherwise allow.

   This facility is not a major stationary source since this facility is not a listed source and the source's potential to emit (excluding fugitive emissions) is below 250 tons per year of any pollutant.

G. ARM 17.8. Subchapter 12 – Operating Permit Program Applicability, including, but not limited to:

1. ARM 17.8.1201 Definitions. (23) Major Source under Section 7412 of the FCAA is defined as any source having:

   a. Potential to emit (PTE) > 10 ton/year of any single Hazardous Air Pollutant (HAP), PTE > 25 ton/year of total combined HAPs, or lesser quantity as the Department may establish by rule;

b. PTE > 100 ton/year of any pollutant; or

c. Sources with the PTE > 70 ton/year of PM_{10} in a serious PM_{10} non-attainment area.

2. ARM 17.8.1204 Air Quality Operating Permit Program. (1) Title V of the FCAA amendments of 1990 requires that all sources, as defined in ARM 17.8.1204(1), obtain a Title V Operating Permit. In reviewing and issuing MAQP #1570-07 for Western Energy, the following conclusions were made:

   a. The facility's PTE is less than 100 ton/year for any pollutant, excluding fugitives.

   b. The facility's PTE is less than 10 tons/year for any single HAP and less than 25 ton/year of combined HAPs.

   c. This source is not located in a serious PM_{10} non-attainment area.

   d. This facility is subject to NSPS 40 CFR 60 Subpart Y

   e. This facility is not subject to any current NESHAP standards.

   f. This source is not a Title IV affected source, nor a solid waste combustion unit.

   g. This source is not an EPA designated Title V sources.

   Based on these conclusions, the Department has determined that Western Energy will be a minor source of emissions as defined under Title V. Therefore, a Title V operating permit is not required.

III. BACT Determination

A BACT determination is required for each new or modified source. Western Energy shall install on the new or modified source the maximum air pollution control capability that is technically practicable and economically feasible, except that BACT shall be utilized.

The expansion of mining activities into Area F will result in an increase in fugitive dust from light vehicle and heavy truck traffic. Coal extraction techniques employed within Area F will remain the same as with the rest of the mine. An increase in coal production capacities will not result from this action and the area of disturbed acres from the stages of mining will be equivalent to past activity. As such, emissions from topsoil removal, overburden, removal, coal extraction, coal processing, and reclaim activities are accounted for within the current emission inventory. Coal extracted from Area F will be transported via haul truck to the Area C or Area A truck dump for further processing. Additional activity presented by the Area F expansion is limited the extended access roads distance within the expansion boundary and the haul roads to the existing coal handing facilities at Area C and Area A. Therefore, the only increase in emissions as result of this permit action is that from coal haul trucks and light duty support vehicle traffic.

The following BACT analysis addresses available and proposed methods for controlling fugitive particulate emissions from haul roads and access roads. The Department presents the following BACT determinations.

The application of water and/or chemical dust suppressants represent the most common and readily available method for controlling fugitive dust from haul roads. These practices are addressed within the existing MAQP covering Area C mining activities. Further Western Energy is required to comply with the reasonable precaution requirements prescribed within ARM 17.8.308 for minimizing particulate emissions from access roads, haul roads, and general mine areas.

Western Energy currently maintains a Fugitive Dust Control Plan in accordance to ARM 17.24.761and the work practice standards established within MAQP, which includes elements utilized in the control of dust from haul roads. Specific elements of the plan which address haul roads include;

- All unpaved roads will be watered or a dust palliative used as needed to reduce fugitive dust.
- Vehicle speeds will be restricted on haul roads to reduce the amount of fugitive dust.
- Unpaved haul and access roads will be chemically stabilized with nontoxic soil cement or dust palliatives mixed into the upper 1 to 2 inches of road surface as necessary.
- All roads will be routinely maintained by means such as, but not limited to, wetting, scraping or surfacing, chemical dust suppression addition, sanding, and replacement of surfacing materials.

Western Energy proposes the ongoing maintenance and implementation of a dust control plan, which includes the aforementioned techniques as BACT for the control of fugitive particulate matter. The control options selected contain control equipment and control costs comparable to other recently permitted similar sources and are capable of achieving the appropriate emission standards. The Department determined that implementation and maintenance an of an formal dust control plan, which includes using water and/or chemical dust suppressant to ensure compliance with the opacity requirements and reasonable precaution limitations, constitutes BACT.

IV. Emission Inventory

The following table presents the total emissions from Area C and the proposed Area F expansion. As a result of this permit action the emission inventory for Area C was updated to reflect emission factors and estimation methods currently employed by the Department. All mining activity, coal extraction, and coal processing are accounted for under the Area C emission inventory. A complete emission inventory is available from the Department.

Area C - Potential Emissions Summary

Fugitive Emissions							
Emission Source(s)	PM	PM_{10}	$PM_{2.5}$	CO	NO_x	SO_2	VOC
Topsoil Removal	74.93	37.46	3.75	--	--	--	--
Topsoil Dumping	2.85	1.35	0.2	--	--	--	--
Overburden Drilling	4.22	0.52	0.05	--	--	--	--
Overburden Blasting Cast Blasting	110.95	57.69	3.33	--	--	--	--
Overburden Removal - Dragline	623.78	120.22	10.6	--	--	--	--
Overburden Handling - Truck/Shovel	250.88	188.16	4.77	--	--	--	--
Overburden Dumping	2.85	1.35	0.2	--	--	--	--
Overburden Handling - Bulldozer	97.8	18.57	10.27	--	--	--	--
Haul Roads - Travel	852.27	227.09	22.57	--	--	--	--
Access Roads - Unpaved	374	101.56	10.16	--	--	--	--

Area C - Potential Emissions Summary

Fugitive Emissions							
Emission Source(s)	PM	PM_{10}	$PM_{2.5}$	CO	NO_x	SO_2	VOC
Coal Drilling	0.71	0.09	0.01	--	--	--	--
Coal Blasting	40.67	21.15	1.22	--	--	--	--
Coal Removal	0.33	0.11	0.02	--	--	--	--
Explosive Detonation (ANFO)	--	--	--	577.04	146.41	17.23	--
Disturbed Acres - Complete (< 2 yrs.)	39.79	19.89	1.99	--	--	--	--
Disturbed Acres - Partial (< 1 yrs.)	134.06	67.03	6.7	--	--	--	--
Disturbed Acres - Partial (> 1 yrs.)	119.51	59.76	5.98	--	--	--	--
Disturbed Acres - Pits, Peaks, Soil Stripping	1066.13	533.06	53.31	--	--	--	--
TOTAL FUGITIVE EMISSIONS ►	3795.73	1455.06	135.13	577.04	146.41	17.23	0

Non-Fugitive Emissions							
Emission Source(s)	PM	PM_{10}	$PM_{2.5}$	CO	NO_x	SO_2	VOC
Truck Dump - Coal	0.27	0.1	0.01	--	--	--	--
Coal Crusher	0.8	0.24	0.02	--	--	--	--
Coal Conveyors	0.08	0.03	0.004	--	--	--	--
TOTAL NON-FUGITIVE EMISSIONS ►	1.15	0.37	0.034	0	0	0	0

Area F - Potential Emissions Summary

Fugitive Emissions							
Emission Source(s)	PM	PM_{10}	$PM_{2.5}$	CO	NO_x	SO_2	VOC
Haul Roads - Travel	309.51	82.47	8.2	--	--	--	--
Access Roads - Unpaved	36	9.78	0.98	--	--	--	--
TOTAL FUGITIVE EMISSIONS ►	345.51	92.25	9.18	0	0	0	0

V. Existing Air Quality

The Rosebud Mine is located in areas designated as attainment/unclassifiable for the PM_{10} National Ambient Air Quality Standard (NAAQS). MAQP #1570-07 contains emission limits and control measures to limit impacts to existing air quality.

VI. Air Quality Impact Analysis

Based upon an evaluation of historical data, consideration of the activities proposed, and limitations and control measures present within MAQP #1570-07, the Department has determined that impacts to ambient air quality from this permit action will be minor. Furthermore, the proposed expansion into Area F will not result in a violation of ambient air quality standards.

Historical data relates to past PM_{10} monitoring results and a review of available production data collected during the monitoring period. Pursuant to permit conditions, Western Energy was required to operate seven PM_{10} ambient air quality monitoring sites from 1992 through 2000. These sites were

situated throughout the entire Rosebud Mine complex. Monitoring during the period from 1992-2000 demonstrated that ambient concentrations of PM_{10} were well below the NAAQS and Montana Ambient Air Quality Standards (MAAQS). The highest 24-hour average PM_{10} concentration recorded from any individual station during the active monitoring period was 80 micrograms per cubic meter ($\mu g/m^3$). The next highest 24-hour average concentration reported was 78$\mu g/m^3$. In turn, the highest annual average PM_{10} concentration recorded from any individual site was 14 $\mu g/m^3$. The highest 24-hour and annual average PM_{10} are 53% and 28% of the respective ambient air quality standard. Based on an ongoing demonstration of compliance with the PM_{10} NAAQS and MAAQS, Western Energy requested authorization from the Department to discontinue ambient monitoring. The request was approved and monitoring ceased in 2001.

A review of production related data from the period in which monitoring was performed (1992-2000) indicates Area C mining activity was generally representative of current activity. Coal production for the years 1994 through 2000 (years of available data during the 1992-2000 monitoring time period) from Area C averaged 6.29 million tons per year, with a high production of 7.52 million tons in 1999. In comparison, coal production during the period 2008 through 2012 from Area C averaged 6.96 million tons per year, with a high production of 7.87 million tons in 2008. As a result, ambient PM_{10} concentrations produced during 1992 through 2000 should be representative of current and projected mine activity.

In considering the activities proposed under the current permit action. The expansion into Area F will encompass an additional 6,746 acres, bringing the combined extent addressed by MAQP #1570-07 to 12,817 acres. As proposed the expansion does not entail any additional mining activity or associated emission increase. Emissions concomitant with topsoil and overburden removal and handling, blasting, and coal extraction are accounted for with the existing emission inventory. A portion of this mining activity will be reallocated to the expansion site. Any new or increased sources of emissions will be limited to the extension of access and haul roads necessary to bring coal to the existing truck dump area located in Area C. MAQP #1570-07 will place a restriction on the amount of coal produced from Area F to 4.0 million tons per year. With the coal production limit of 4.0 million tons per year placed on Area F, the continuation of the existing permit-wide coal production limit of 8.0 million tons per year, as well as the effective expansion to the geographic extent of mining activities over a larger area; it is reasonable to consider impacts from this permit action will not create significant additional impacts to air quality.

Concerning particulate emission with an aerodynamic diameter of 2.5 microns or less ($PM_{2.5}$), the Department took derived PM_{10} ambient concentrations from past monitoring and applied given $PM_{2.5}$ to PM_{10} ratios. Several EPA referenced emission factors have been generated from test programs aimed to establish this correlation. Generally accepted estimates from such initiatives consistently present emission fractions of $PM_{2.5}$ at a range of 0.1 to 0.15 for unpaved roadways and 0.15 to 0.2 for wind erosion from industrial and construction sites. No specific data is available for western coal mines, however emission factors were developed from sources with similar characteristics, including; large open cut aggregate mines and large-scale construction projects.

Application of the highest $PM_{2.5}$ to PM_{10} ratio referenced, in conjunction with the highest 24-hour and annual average PM_{10} observed concentrations from the previously mention monitoring data, indicates expected $PM_{2.5}$ ambient concentration will be well below the prescribed NAAQS and MAAQS. Consequently $PM_{2.5}$ emissions resulting from this permit action will not significantly impact air quality.

Therefore, at this time the Department is not requiring Western Energy to present ambient air quality modeling or the operation of ongoing ambient air monitoring systems to demonstrate compliance with the NAAQS/MAAQS.

VII. Taking or Damaging Implication Analysis

As required by 2-10-105, MCA, the Department conducted the following private property taking and damaging assessment.

YES	NO	
✓		1. Does the action pertain to land or water management or environmental regulation affecting private real property or water rights?
	✓	2. Does the action result in either a permanent or indefinite physical occupation of private property?
	✓	3. Does the action deny a fundamental attribute of ownership? (ex.: right to exclude others, disposal of property)
	✓	4. Does the action deprive the owner of all economically viable uses of the property?
	✓	5. Does the action require a property owner to dedicate a portion of property or to grant an easement? [If no, go to (6)].
		5a. Is there a reasonable, specific connection between the government requirement and legitimate state interests?
		5b. Is the government requirement roughly proportional to the impact of the proposed use of the property?
	✓	6. Does the action have a severe impact on the value of the property? (consider economic impact, investment-backed expectations, character of government action)
	✓	7. Does the action damage the property by causing some physical disturbance with respect to the property in excess of that sustained by the public generally?
	✓	7a. Is the impact of government action direct, peculiar, and significant?
	✓	7b. Has government action resulted in the property becoming practically inaccessible, waterlogged or flooded?
	✓	7c. Has government action lowered property values by more than 30% and necessitated the physical taking of adjacent property or property across a public way from the property in question?
	✓	Takings or damaging implications? (Taking or damaging implications exist if YES is checked in response to question 1 and also to any one or more of the following questions: 2, 3, 4, 6, 7a, 7b, 7c; or if NO is checked in response to questions 5a or 5b; the shaded areas)

Based on this analysis, the Department determined there are no taking or damaging implications associated with this permit action.

VIII. Environmental Assessment

An environmental assessment, required by the Montana Environmental Policy Act, was completed for this project. A copy is attached.

DEPARTMENT OF ENVIRONMENTAL QUALITY
Permitting and Compliance Division
Air Resources Management Bureau
P.O. Box 200901, Helena, Montana 59620
(406) 444-3490

DRAFT ENVIRONMENTAL ASSESSMENT (EA)

Issued To: Western Energy Company
P.O. Box 99
Colstrip, MT 59323

Montana Air Quality Permit (MAQP): 1570-07
Preliminary Determination Issued: 07/22/2013
Department Decision Issued:
Permit Final:

1. *Legal Description of Site*: Area F is located in Sections 3-6, Township 1 North, Range 40 East in Rosebud County, Sections 19, 20, and 27-34 in Township 2 North, Range 40 East in Rosebud County, and Sections 12-14 and 23-25, Township 2 North, Rage 39 East in Treasure County. The list of permitted equipment can be found in Section I of the permit analysis.

2. *Description of Project*: Western Energy Company (Western Energy) proposed an expansion to the geographic extent of the mine. The existing air quality permit explicitly defined the physical area in which mining activities are permitted. As such, Western Energy requested an expansion of this physical boundary into a new area designated as Area F. No additional coal production capacity or stationary or portable equipment are proposed.

3. *Objectives of Project*: the objective of the expansion project is to further extend the life of the mine by expanding areas from which coal will be extracted.

4. *Alternatives Considered*: In addition to the proposed action, the Montana Department of Environmental Quality – Air Resources Management Bureau (Department) considered the "no-action" alternative. The "no-action" alternative would deny issuance of the air quality preconstruction permit to the proposed facility. However, the Department does not consider the "no-action" alternative to be appropriate because Western Energy demonstrated compliance with all applicable rules and regulations as required for permit issuance. Therefore, the "no-action" alternative was eliminated from further consideration.

5. *A Listing of Mitigation, Stipulations, and Other Controls*: A list of enforceable conditions, including a Best Available Control Technology (BACT) analysis, would be included in MAQP #1570-07.

6. *Regulatory Effects on Private Property*: The Department considered alternatives to the conditions imposed in this permit as part of the permit development. The Department determined that the permit conditions are reasonably necessary to ensure compliance with applicable requirements and demonstrate compliance with those requirements and do not unduly restrict private property rights.

7. *The following table summarizes the potential physical and biological effects of the proposed project on the environment. The "no-action" alternative was discussed previously.*

Potential Physical and Biological Effects							
		Major	Moderate	Minor	None	Unknown	Comments Included
A	Terrestrial and Aquatic Life and Habitats					✓	yes
B	Water Quality, Quantity, and Distribution			✓			yes
C	Geology and Soil Quality, Stability, and Moisture					✓	yes
D	Vegetation Cover, Quantity, and Quality					✓	yes
E	Aesthetics			✓			yes
F	Air Quality			✓			yes
G	Unique Endangered, Fragile, or Limited Environmental Resource					✓	yes
H	Demands on Environmental Resource of Water, Air, and Energy					✓	yes
I	Historical and Archaeological Sites					✓	yes
J	Cumulative and Secondary Impacts			✓			yes

SUMMARY OF COMMENTS ON POTENTIAL PHYSICAL AND BIOLOGICAL EFFECTS: The following comments have been prepared by the Department. Only off-site impacts created by the release of air pollutants are address. Some inferences are made to the potential physical and biological effects to receptors within the boundary of the project are address.

Department of Environmental Quality (DEQ) officials under the Montana Environmental Policy Act (MEPA), in conjunction with the United States Department of Interior – Office of Surface Mining, Reclamation, and Enforcement (OSMRE) are conducting a formal Environmental Impact Statement (EIS). Any conclusions present within this preliminary assessment are based information available to the Department as the time of this assessment. The conclusions of the EIS will supersede those presented within this draft EA. Department will update this section or provide reference at the time the EIS is final.

A. Terrestrial and Aquatic Life and Habitats:

The proposed expansion would result in increased emissions of fugitive dust and loss of terrestrial habitants by disturbances created by surface mining activities. Conditions which control fugitive dust would be required within MAQP #1570-07 to ensure significant air quality impacts would not occur. Such conditions would include; specific best management practices, requirement to maintain a fugitive dust control plan, as well as, inherit reasonable precautions requirements. No significant sources of surfaces waters are near the project site. Due to the proximity of surface waters to the Western Energy site, any impact to off-site aquatic life and habitant would be expect to be minor.

B. Water Quality, Quantity, and Distribution:

Emissions resulting from this permitting action would likely have a minor or limited effect on the water quality, water quantity, and distribution, as surface waters are not prevalent within the immediate area surrounding the mine site. Particulate matter emissions from disturbance of soils and coal deposits would be deposited at varying distance within the mine boundary or vicinity depending upon particle size, location of release, and wind affects. However, because of pollutant characteristics and generally good dispersion in the area, minor pollutant deposition on surface waters near the project area may occur from surface disturbances and roadways. Air emissions from this source would not likely impact groundwater. Therefore, fugitive dust emissions the project would be expected to have only minor impacts to water quality, quantity or distribution in the area.

C. Geology and Soil Quality, Stability, and Moisture:

This project would be expected to impact the geology and soil properties from land disturbances associated with mining operations and material handling activity. The air quality permit associated with this project would contain limitations and conditions to minimize the effect of the emissions to off-site aspects. However, the potential effects would be determined through the formal EIS.

D. Vegetation Cover, Quantity, and Quality:

The particulate matter, PM_{10}, and $PM_{2.5}$ emissions from this project would be expected to have an effect on the surrounding vegetation with respect to cover, quantity and quality; however, the air quality permit associated with this project would contain limitations to minimize the impact on the surrounding environment. Overall, this project would expect to have minor effects on the vegetation cover, quantity and quality. The formal EIS will address the overall impact, as well, as require reclamation step to ensure that native vegetation is returned to the site.

E. Aesthetics:

The expansion project would likely have minor impacts on the surrounding property from a visual perspective. However, activity within the expansion area would be similar to current mining operations located adjacent to the proposed project area. The degree of visual impact would be similar to existing impacts from current operations. In addition, depositions of particulate matter species would not likely have any significant impact to other aesthetic aspects of the surround area as only a minor increase in emission would occur as a result of this project. The Department determined minor changes in the aesthetic value of the site would be expected as a result of this project.

F. Air Quality:

The proposed expansion would impact receptors and resources within the proposed project area due to an increase in fugitive emissions of particulate matter, PM_{10}, and $PM_{2.5}$ from the expanded length of access and haul roads. Emissions of particulate matter from coal extraction and processing, as well as, related overburden and topsoil material handling are accounted for within the existing emission inventory and would not increase as a result the permit action. Emissions of nitrogen oxide (NO_x), carbon monoxide (CO), volatile organic compounds (VOC), sulfur dioxide (SO_2), and non-criteria pollutants, generated during blasting of various surface and subsurface layers, are also accounted for within the existing air quality permit and would not increase.

Based on ambient concentration determinations of past monitoring and modeling, the representativeness of the current, as well as, proposed mining activity, and the amount of emission increases from the expansion of the access and haul roads any impact is expected to be minor. The potential for impact is further mitigated when considering the dispersion characteristics of the locale, properties of pollutants, and the conditions established in MAQP #1570-07. The Department has determined that the amount of increased particulate emissions resulting from the proposed project would not cause a significant degradation and any impact to air quality from the proposed project would be expected to be minor as a result of the current permit action.

G. Unique Endangered, Fragile, or Limited Environmental Resources:

In an effort to identify any unique endangered, fragile, or limited environmental resources in the area, the Department contacted the Montana Natural Heritage Program, Natural Resource Information System (NRIS). In this case, the area was defined by the section, township, and range of the proposed location with an additional 1-mile buffer zone. Search results identified the following animal species of concern may be present within the search radius:

- Golden Eagle
- Greater Sage-Grouse
- Burrowing Owl
- Red-headed Woodpecker
- Pinyon Jay
- Hoary Bat
- Pallid Bat
- Greater Short-horned Lizard
- Western Hog-nosed Snake
- Milksnake

Based upon the limited information available at this time, the Department is unable to determine the extent of impacts to unique endangered, fragile, or limited environmental resources created by the proposed project. Upon the conclusion and release of the final EIS the impacts to unique endangered, fragile, or limited environmental will be established.

H. Demands on Environmental Resource of Water, Air, and Energy:

The proposed project would necessitate an increase in the demand for environmental resources of water, air, and energy. Based upon the limited information available at this time the Department is unable to determine the extent of additional demands for these elements. Upon completion of the formal EIS the demand impacts on environmental resources of water, air and energy will be addressed.

I. Historical and Archaeological Sites:

According to cultural resource file search conducted by the State Historic Preservation Office (SHPO), there are multiple recorded cultural sites and previously conducted cultural resource inventories. Based on the findings of the initial file search SHPO recommends that a cultural resource inventory be performed on the expansion site.

At this time the Department is not in the position to stipulate a position with respect to the impact of this project on historical and archaeological sites until a formal cultural resource inventory can be accomplished.

J. Cumulative and Secondary Impacts:

With the exception of any consideration to the impacts for which the Department has determined that insufficient information is available (terrestrial and aquatic life and habitats; geology and soil quantity, stability, and moisture; vegetation cover, quantity, and quality; unique endangered, fragile, or limited environmental resource; demands on historical and archaeological sites; environmental resource of water, air, and energy); the overall cumulative and secondary impacts from the proposed project to the physical and biological receptors in the immediate area due to increase emissions of particulate from the proposed expansion would be expected to be minor. Air pollution from the facility would be controlled by Department-determined BACT, as discussed in Section III of the permit analysis, along with the limitations and conditions in MAQP #1570-07. The Department believes that this facility could be expected to operate in compliance with all applicable rules and regulations as outlined within the air quality permit.

8. *The following table summarizes the potential economic and social effects of the proposed project on the human environment. The "no-action" alternative was discussed previous ly.*

Potential Social and Economic Effects							
		Major	Moderate	Minor	None	Unknown	Comments Included
A	Social Structures and Mores				✓		yes
B	Cultural Uniqueness and Diversity				✓		yes
C	Local and State Tax Base and Tax Revenue				✓		yes
D	Agricultural or Industrial Production			✓			yes
E	Human Health			✓			yes
F	Access to and Quality of Recreational and Wilderness Activities			✓			yes
G	Quantity and Distribution of Employment				✓		yes
H	Distribution of Population				✓		yes
I	Demands for Government Services			✓			yes
J	Industrial and Commercial Activity			✓			yes
K	Locally Adopted Environmental Plans and Goals				✓		yes
L	Cumulative and Secondary Impacts			✓			yes

SUMMARY OF COMMENTS ON POTENTIAL ECONOMIC AND SOCIAL EFFECTS: The Department has prepared the following comments.

A. Social Structures and Mores:

The proposed project would not expect a significant disruption to any native or traditional lifestyles or communities (social structures or mores) in the area because the proposed project area is currently undeveloped agricultural or livestock grazing land. Further the expansion area is predominately owned by private entities or individuals. The Department is not aware of any current utilization by native or traditional communities. Therefore no known impact to social structures and mores would be expected.

B. Cultural Uniqueness and Diversity:

As discussed within the aforementioned section the proposed project would not be expected to impact the cultural uniqueness and diversity of the area because the proposed project would be located within area which is currently undeveloped and for the most part under private ownership.

C. Local and State Tax Base and Tax Revenue:

The proposed expansion would not likely result in any increase in production capacity or a need for additional employees; therefore no effect on the local/state tax base or tax revenue would be expected.

D. Agricultural or Industrial Production:

The proposed project would likely displace or otherwise affect agricultural land or practices. Livestock grazing on private lands would require relocation; however, private owners would have understanding of this impact and would have willingly relinquished these rights under the lease contract. Therefore, impact on agricultural or industrial production as a result of the proposed project would be expected to be minor.

E. Human Health:

The proposed project would result in a minor increase in emissions the expansion project. However, MAQP #5707-07 contains limitations and conditions including, but not limited to, the BACT requirements discussed in Section III of the permit analysis, to ensure that the operations would maintain compliance with all applicable rules and standards. These rules and standards are designed to be protective of human health. Any impact to human health from the proposed project would be expected to be minor.

F. Access to and Quality of Recreational and Wilderness Activities:

The majority of the surface lands within the expansion area are under private ownership. A single section and two partial geographic sections are owned by the State of Montana. As a limited area of public land encompasses the mine expansion there would be some impact to access to recreational and wilderness activities. The public lands impacted do not appear to be designated recreational areas with state developed or maintained facilities such as, trails, campsites, day use areas, etc. However, these areas would not be available for public use during the time the area is occupied by Western Energy until completion of the reclamation process. Therefore, minor impacts to access to and quality of recreational and wilderness activities would be expected.

G. Quantity and Distribution of Employment:

According to Western Energy the proposed project would not necessitate the hiring of additional employees, therefore no effect on the quantity and distribution of employment would be expected as a result of the expansion.

H. Distribution of Population:

As no additional employees are expected from this project an impact on the distribution of population would not be expected.

I. Demands for Government Services:

Government services would be required for acquiring the appropriate permits from government agencies and for ongoing interaction with Western Energy. The expansion would not likely increase the need for government service resources beyond the current capacity. As a result of this project demands for government services would be expected to be minor.

J. Industrial and Commercial Activity:

The proposed project would not result in any increase in production from the Western Energy site; however, an expansion of the area of impact of industrial or commercial activity would occur. The geographic expansion into Area F would result in a disturbance of an additional 4,287 acres of land. However, as no additional production would result and any increase in air emissions would result from fugitive emissions from haul roads and access roads. As the majority of the land in under private ownership for which the land owners have willingly relinquished right to any impact to industrial and commercial activity would be expected to be minor as a result of this project.

K. Locally Adopted Environmental Plans and Goals:

The Department is not aware of any locally adopted environmental plans or goals. State and federal air quality standards and air quality plans would apply to proposed site.

L. Cumulative and Secondary Impacts:

Overall, cumulative and secondary impacts from this project would result in a minor to impacts to the economic and social environment in the immediate area. As previously stated, the proposed project would not result in any change to Western Energy personnel and would not result in any increase in ore production at the facility. The Department believes that Western Energy could be expected to operate in compliance with all applicable rules and regulations as outlined in MAQP #1570-07.

Recommendation: No Department-required EIS is recommended.

If an EIS is not required, explain why the EA is an appropriate level of analysis:

The DEQ and OSMRE are conducting a formal Environmental Impact Statement (EIS) for the proposed Western Energy expansion into Area F.

Other groups or agencies contacted or which may have overlapping jurisdiction: Montana Historical Society – State Historic Preservation Office, Natural Resource Information System – Montana Natural Heritage Program, DEQ – MEPA Office, and OSMRE.

Individuals or groups contributing to this EA: Department of Environmental Quality – Air Resources Management Bureau, Montana Historical Society – State Historic Preservation Office, Natural Resource Information System – Montana Natural Heritage Program, DEQ – MEPA

EA prepared by: D. Kuenzli
Date: July 18, 2013

APPENDIX D-2

Montana Air Quality Permit #1483-08 for Areas A/B/D/E.

Air Quality Permit

Issued to: Western Energy Company P.O. Box 99 Colstrip, MT 59323	Permit #1483-08 Modification Request Received: 04/27/01 Department Decision on Modification: 10/05/01 Permit Final: 10/23/01 AFS #: 087-0004

An air quality permit, with conditions, is hereby granted to Western Energy Company (Western Energy), pursuant to Sections 75-2-204 and 211 of the Montana Code Annotated (MCA), as amended, and the Administrative Rules of Montana (ARM) 17.8.701 *et seq.*, as amended, for the following:

SECTION I: Permitted Facilities

A. Plant Location

Western Energy operates a surface coal mine and extraction facility located in Areas A, B, D, and E of the Rosebud Mine west of Colstrip, Montana. The coal handling facilities are located in Areas A and E. Area A is located in all or part of Sections 28-34 of Township 2 North, Range 41 East; Section 36 of Township 2 North, Range 40 East; Section 1 of Township 1 North, Range 40 East; and Sections 3-8 of Township 1 North, Range 41 East of Rosebud County. Area B is located in all or part of Sections 2-5, 7-11, and 17-18 of Township 1 North, Range 41 East and Sections 8-17 of Township 1 North, Range 40 East of Rosebud County. Area D is located in all or part of Sections 19, 29, and 30 of Township 2 North, Range 42 East and Sections 13-15, 22-27, and 34-36 of Township 2 North, Range 41 East of Rosebud County. Area E is located in all or part of Sections 34-35 of Township 2 North, Range 41 East; Section 7 of Township 1 North, Range 42 East; and Sections 1-3 and 11-13 of Township 1 North, Range 41 East of Rosebud County. The list of permitted equipment can be found in Section I of the permit analysis.

B. Current Permit Action

The current permit action is a modification of Permit #1483-07. The Department of Environmental Quality (Department) received a letter, dated April 27, 2001, from Western Energy requesting termination of their ambient air monitoring network. Following the October 9, 1998, permitting guidance statement, the Department reviewed the ambient air monitoring data. In a letter dated May 23, 2001, the Department agreed to Western Energy's request to terminate the ambient monitoring program, effective July 1, 2001. This permit action updates the permit language to reflect the termination of the ambient air monitoring network. Also, this permit action updates the permit format. Permit #1483-08 replaces Permit #1483-07.

SECTION II: Conditions and Limitations

A. Emissions Limitations

1. Annual coal production from Area D shall be limited to 5,900,000 tons per year. Annual coal production from Areas A, B, and D shall be limited to 13,000,000 tons per year (ARM 17.8.710).

2. Western Energy shall not cause visible emissions of greater than 20% opacity to be discharged into the atmosphere from any coal handling, conveying, crushing, processing, storing or loading system averaged over 6 consecutive minutes (ARM 17.8.340).

3. Western Energy shall install and operate a coal dust suppression system or equivalent at the truck dump (ARM 17.8.710).

4. Western Energy shall apply chemical stabilizer to all permanent haul roads. In addition, water sprinkling shall supplement stabilization when necessary (ARM 17.8.710).

5. Western Energy shall contour or shape, as necessary, all uncrushed coal piles in all areas in order to minimize wind erosion (ARM 17.8.710).

6. Western Energy shall revegetate all exposed areas as soon as practical or as required by the Department's Industrial and Energy Minerals Bureau (ARM 17.8.710).

7. Western Energy shall enclose all coal conveyor belts at all transfer points (Areas E and A facilities) except as necessary to allow for maintenance (ARM 17.8.710).

8. Western Energy shall continue the train loadout as presently employed unless Department inspections indicate a problem (ARM 17.8.710).

9. Western Energy shall treat the county road with dehydrated oil or equivalent for a distance of approximately 4 miles west of Highway 39 (ARM 17.8.710).

10. Western Energy shall maintain and operate its mine according to the "Minewide Dust Control Management Plan" except as required otherwise by the above conditions (ARM 17.8.710).

B. Testing Requirements

1. All compliance source tests shall conform to the requirements of the Montana Source Test Protocol and Procedures Manual (ARM 17.8.106).

2. The Department may require testing (ARM 17.8.105).

C. Operational Reporting Requirements

1. Western Energy shall supply the Department with annual production information for all emission points, as required by the Department in the annual emission inventory request. The request will include, but is not limited to, all sources of emissions identified in the emission inventory contained in the permit analysis.

   Production information shall be gathered on a calendar-year basis and submitted to the Department by the date specified in the emission inventory request. Information shall be in units as required by the Department. This information may be used to calculate operating fees, based on actual emissions from the facility, and/or to verify compliance with permit limitations. Western Energy shall submit the annual coal production to the Department by March 1 of each year or with the annual emission inventory (ARM 17.8.505).

2. Western Energy shall notify the Department of any construction or improvement project conducted pursuant to ARM 17.8.705(l)(r), that would include a change in control equipment, stack height, stack diameter, stack flow, stack gas temperature, source location or fuel specifications, or would result in an increase in source capacity above its permitted operation or the addition of a new emission unit.

   The notice must be submitted to the Department, in writing, 10 days prior to start up or use of the proposed de minimis change, or as soon as reasonably practicable in the event of an unanticipated circumstance causing the de minimis change, and must include the information requested in ARM 17.8.705(l)(r)(iv) (ARM 17.8.705).

3. All records compiled in accordance with this permit must be maintained by Western Energy as a permanent business record for at least 5 years following the date of the measurement, must be available at the plant site for inspection by the Department, and must be submitted to the Department upon request (ARM 17.8.710).

D. Ambient Monitoring

1. PM-10 data has been collected at the Western Energy mine since 1992. During the 1992-2000 period, the annual means at all sites were less than 28% of the annual standard. For the 24-hour concentrations, all of the annual, maximum 24-hour values were less than 53% of the 24-hour standard. Therefore, in accordance with the October 9, 1998, monitoring guidance statement developed by the Department, Western Energy may discontinue operation of their ambient air monitoring network.

2. The Department may require Western Energy to conduct additional ambient air monitoring, if necessary (ARM 17.8.710).

Section III: General Conditions

A. Inspection – Western Energy shall allow the Department's representatives access to the source at all reasonable times for the purpose of making inspections or surveys, collecting samples, obtaining data, auditing any monitoring equipment (CEMS, CERMS) or observing any monitoring or testing, and otherwise conducting all necessary functions related to this permit.

B. Waiver - The permit and all the terms, conditions, and matters stated herein shall be deemed accepted if Western Energy fails to appeal as indicated below.

C. Compliance with Statutes and Regulations - Nothing in this permit shall be construed as relieving Western Energy of the responsibility for complying with any applicable federal or Montana statute, rule or standard, except as specifically provided in ARM 17.8.701, *et seq*. (ARM 17.8.717).

D. Enforcement - Violations of limitations, conditions and requirements contained herein may constitute grounds for permit revocation, penalties or other enforcement as specified in Section 75-2-401, *et seq*., MCA.

E. Appeals - Any person or persons jointly or severally adversely affected by the Department's decision may request, within 15 days after the Department renders its decision, upon affidavit setting forth the grounds therefor, a hearing before the Board of Environmental Review (Board). A hearing shall be held under the provisions of the Montana Administrative Procedures Act. The Department's decision on the application is not final unless 15 days have elapsed and there is no request for a hearing under this section. The filing of a request for a hearing postpones the effective date of the Department's decision until the conclusion of the hearing and issuance of a final decision by the Board.

F. Permit Inspection - As required by ARM 17.8.716, Inspection of Permit, a copy of the air quality permit shall be made available for inspection by Department personnel at the location of the permitted source.

G. Permit Fees - Pursuant to Section 75-2-220, MCA, as amended by the 1991 Legislature, failure to pay the annual operation fee by Western Energy may be grounds for revocation of this permit, as required by that Section and rules adopted thereunder by the Board.

H. Construction Commencement - Construction must begin within 3 years of permit issuance and proceed with due diligence until the project is complete or the permit shall be revoked.

Permit Analysis
Western Energy Company - Rosebud Mine - Areas A, B, D and E
Permit #1483-08

I. Introduction/Process Description

A. Permitted Equipment

Western Energy Company (Western Energy) operates the following equipment at Areas A, B, D, and E of the Rosebud Mine.

1. "Coal handling facilities" include, but are not limited to:

    a. Truck dump with hopper at Areas A and E. Note: Mining operations have ended at Area E and the area has been reclaimed. However, the truck dump (tipple) is still located and operated at Area E but it processes coal from Area D.

    b. Three primary crushers with capacities of 1250 ton/hr each; two at Area A and one at Area E. Note: Mining operations have ended at Area E and the area has been reclaimed. However, the primary crusher is still located and operated at Area E but it processes coal from Area D.

    c. Three secondary crushers; two at Area A and one at Area E. Note: Mining operations have ended at Area E and the area has been reclaimed. However, the secondary crusher is still located and operated at Area E but it processes coal from Area D. The secondary crusher at Area E handles approximately 30% of the primary crushed coal that is either used by Colstrip Units 1 and 2 or sold on the spot market. The capacity of the secondary crushers at Area A is approximately the same as at Area E; however, the coal from the Area A is shipped to out-of-state customers.

    d. Partially enclosed conveyor system (Areas A and E). Note: Mining operations have ended at Area E and the area has been reclaimed. However, the conveyor system is still located and operated at Area E but it processes coal from Area D.

    e. One open coal storage pile of crushed coal at Area A, encompassing approximately 3.5 acres and containing an estimated maximum 96,000 tons.

    f. Train loadout facilities with retractable chute located at Areas A and E. The capacity at Area A is 4,000 ton/hr and at Area E it is 1,250 ton/hr. Note: Mining operations have ended at Area E and the area has been reclaimed. However, the train loadout facilities are still located and operated at Area E.

2. Necessary auxiliaries include, but are not limited to: draglines, coal shovels, trucks, front-end loaders, graders, scrapers, dozers, other mobile units, auxiliary and storage facilities, etc., as applicable.

B. Source Description

Western Energy has operated the Rosebud Mine at Colstrip since the late 1960's. Coal mining previously occurred in the area, primarily by the Northern Pacific Railroad. Air Quality Permit #1483 regulates mining operations in Areas A, B, D, and E of the Rosebud mine, while Permit #1570 pertains to Area C.

All areas use standard dragline overburden stripping practices, truck/shovel coal removal, soil salvage and replacement (primarily using scrapers,) overburden and coal drilling and blasting, and coal processing operations. Separate coal processing and handling facilities are located in Areas A and E and include primary and secondary crushing, conveying, and loadout facilities. Note: Mining operations have ended at Area E and the area has been reclaimed. However, the truck dump, primary and secondary crushers, conveyors and train loadout facilities are still located and operated at Area E but they process coal from Area D.

C. Permit History

Permit **#1483** was issued to Western Energy Company on November 22, 1980, for Areas A, B, and E of the Rosebud Mine at Colstrip, Montana.

Permit **#1483A** was issued on September 6, 1985, for the surface mining operations from the new Area D. The coal mining operations in Area D would eventually replace those in Area E. For Area D, Western Energy would maintain approximately the same production rate and serve the same customers as Area E. Area D was expected to have a mine life of 18 years with a total production of 68,500,000 tons. Area D was expected to have an annual production rate of 4,000,000 tons with a maximum of 5,900,000 tons.

Permit **#1483B** was issued on January 6, 1986, to consolidate Permits #1483 and #1483A. The permitting action also modified the ambient air monitoring requirements. Permit #1483B replaced Permits #1483 and #1483A.

Permit **#1483C** was issued on October 5, 1987, to include the advanced coal cleaning process (ACCP) facility. The ACCP facility was a 40 ton/hour demonstration coal drying plant that produced an enhanced fuel from sub-bituminous and lignite coals. Permit #1483C incorporated by reference the conditions and limitations contained in Permit #1483B.

Permit **#1483D** was issued on July 22, 1988, for changes to the ACCP facility. The major change allowed the use of a sulfur stripping system on the “make gas” (fuel gas) prior to combustion. The original process used a nahcolite dry injection (in-duct desulfurization) system. Also, the wet cooling towers replaced an ammonia cycle heat rejection system. Finally, the permit was updated to reflect the format and language used in permits at that time, that included moving the ambient air monitoring requirements from the body of the permit into an attachment to the main permit (thereafter referred to as Attachment 1). Permit #1483D replaced Permit #1483C.

Permit **#1483E** was issued on June 25, 1991, for changes to the ACCP operation. The main change allowed the use of a dry sorbent injection system for SO_2 control instead of the "make gas" (fuel gas) sulfur stripping system. The control efficiency of the dry sorbent injection system was less, so there was a minor increase in emissions. However, the coal input to the ACCP process was limited to 600,000 ton/year by a new permit condition. The emission inventory was re-calculated using updated emission factors. Clarifying language was added to Attachment 1 that required a changeover from TSP to PM-10 ambient monitoring by July 1, 1992. Permit #1483E replaced Permit #1483D.

Permit **#1483-06** was issued on August 1, 1995, for an alteration to the ACCP facility. The changes included the addition of a fines handling system and a truck loadout system. The equipment list, process description, and emission inventory were all updated. Overall, there was an estimated particulate matter increase of 3.4 ton/year. Permit #1483-06 replaced Permit #1483E.

Permit **#1483-07** was issued on November 2, 1996. Western Energy submitted a request on August 26, 1996, to discontinue the use of the dry sorbent injection system for SO_2 control at the ACCP facility. Based on the results of stack tests, Western Energy demonstrated uncontrolled SO_2 emissions were less than 2 ton/year. Western Energy also requested that the ACCP facility be separated from the coal mining operation and regulated under its own permit. Therefore, Western Energy was issued Permit # 2975-00 for the ACCP facility and the mining operation remained under Permit #1483. Permit #1483-07 replaced Permit #1483-06.

D. Current Permit Action

The current permit action is a modification of Permit #1483-07. The Department of Environmental Quality (Department) received a letter, dated April 27, 2001, from Western Energy requesting termination of the ambient air monitoring network. Following the October 9, 1998, permitting guidance statement, the Department reviewed the ambient air monitoring data. In a letter dated May 23, 2001, the Department agreed to Western Energy's request to terminate their ambient monitoring program, effective July 1, 2001. This permit action updates the permit language to reflect the termination of the ambient air monitoring network. Also, this permit action updates the permit format. Permit **#1483-08** replaces Permit #1483-07.

E. Additional Information

Additional information, such as applicable rules and regulations, Best Available Control Technology (BACT) determinations, air quality impacts, and environmental assessments is included in the analysis associated with each change to the permit.

II. Applicable Rules and Regulations

The following are partial explanations of some applicable rules and regulations that apply to the facility. The complete rules are stated in the Administrative Rules of Montana (ARM) and are available upon request from the Department. Upon request, the Department will provide references for locations of complete copies of all applicable rules and regulations or copies where appropriate.

A. ARM 17.8, Subchapter 1 - General Provisions, including, but not limited to:

1. ARM 17.8.101 Definitions: This rule includes a list of applicable definitions used in this chapter, unless indicated otherwise in a specific subchapter.

2. ARM 17.8.105 Testing Requirements. Any person or persons responsible for the emission of any air contaminant into the outdoor atmosphere shall, upon written request of the Department, provide the facilities and necessary equipment (including instruments and sensing devices) and shall conduct tests, emission or ambient, for such periods of time as may be necessary using methods approved by the Department.

3. ARM 17.8.106 Source Testing Protocol. The requirements of this rule apply to any emission source testing conducted by the Department, any source, or other entity as required by any rule in this chapter, or any permit or order issued pursuant to this chapter, or the provisions of the Clean Air Act of Montana, 75-2-101, *et seq*., Montana Code Annotated (MCA).

   Western Energy shall comply with the requirements contained in the Montana Source Test Protocol and Procedures Manual, including, but not limited, using the proper test methods and supplying the required reports. A copy of the Montana Source Test Protocol and Procedures Manual is available from the Department upon request.

4. ARM 17.8.110 Malfunctions. (2) The Department must be notified promptly by telephone whenever a malfunction occurs that can be expected to create emissions in excess of any applicable emission limitation, or to continue for a period greater than 4 hours.

5. ARM 17.8.111 Circumvention. (1) No person shall cause or permit the installation or use of any device or any means that, without resulting in reduction in the total amount of air contaminant emitted, conceals or dilutes an emission of air contaminant that would otherwise violate an air pollution control regulation. (2) No equipment that may produce emissions shall be operated or maintained in such a manner that a public nuisance is created.

B. ARM 17.8, Subchapter 2 - Ambient Air Quality, including, but not limited to:

1. ARM 17.8.204 Ambient Air Monitoring

2. ARM 17.8.210 Ambient Air Quality Standards for Sulfur Dioxide
3. ARM 17.8.211 Ambient Air Quality Standards for Nitrogen Dioxide
4. ARM 17.8.212 Ambient Air Quality Standards for Carbon Monoxide
5. ARM 17.8.213 Ambient Air Quality Standard for Ozone
6. ARM 17.8.214 Ambient Air Quality Standard for Hydrogen Sulfide
7. ARM 17.8.220 Ambient Air Quality Standard for Settled Particulate Matter
8. ARM 17.8.221 Ambient Air Quality Standard for Visibility
9. ARM 17.8.222 Ambient Air Quality Standard for Lead, and
10. ARM 17.8.223 Ambient Air Quality Standard for PM-10.

Western Energy must maintain compliance with the applicable ambient air quality standards.

C. ARM 17.8, Subchapter 3 - Emission Standards, including, but not limited to:

1. ARM 17.8.304 Visible Air Contaminants. This rule requires that no person may cause or authorize emissions to be discharged into the outdoor atmosphere from any source installed after November 23, 1968, that exhibit an opacity of 20% or greater averaged over 6 consecutive minutes.

2. ARM 17.8.308 Particulate Matter Airborne. (1) This rule requires an opacity limitation of 20% for all fugitive emission sources and that reasonable precautions be taken to control emissions of airborne particulate matter. (2) Under this rule, Western Energy shall not cause or authorize the use of any street, road or parking lot without taking reasonable precautions to control emissions of airborne particulate matter.

3. ARM 17.8.309 Particulate Matter Fuel Burning Equipment. This rule requires that no person shall cause, allow or permit to be discharged into the atmosphere particulate matter caused by the combustion of fuel in excess of the amount determined by this rule.

4. ARM 17.8.310 Particulate Matter Industrial Processes. This rule requires that no person shall burn liquid, solid, or gaseous fuel in excess of the amount shown in this rule.

5. ARM 17.8.322, Sulfur Oxide Emissions-Sulfur in Fuel. This rule requires that no person shall cause, allow or permit to be discharged into the atmosphere particulate matter in excess of the amount set forth in this rule.

6. ARM 17.8.324(3) Hydrocarbon Emissions--Petroleum Products. No person shall load or permit the loading of gasoline into any stationary tank with a capacity of 250 gallons or more from any tank truck or trailer, except through a permanent submerged fill pipe, unless such tank is equipped with a vapor loss control device as described in (1) of this rule.

7. ARM 17.8.340 Standard of Performance for New Stationary Sources. This rule incorporates, by reference, 40 CFR 60, Standards of Performance for New Stationary Sources (NSPS). Western Energy is an NSPS affected facility under 40 CFR 60 and is subject to the requirements of the following subparts.

   40 CFR Part 60, Subpart A General Provisions.

   40 CFR Part 60, Subpart Y Coal Preparation Plants. This subpart requires affected facilities with any emissions containing particulate matter to not exhibit greater than 20% opacity. Process operations at this facility that meet the definition of affected facilities include any coal processing and conveying equipment, coal storage systems, or coal transfer and loading systems.

8. ARM 17.8.341 Emissions Standards for Hazardous Air Pollutants. This source shall comply with the standards and provisions of 40 CFR Part 61, as appropriate.

D. ARM 17.8, Subchapter 5 - Air Quality Permit Application, Operation and Open Burning Fees, including but not limited to:

1. ARM 17.8.504 Air Quality Permit Application Fees. This rule requires that an applicant submit an air quality permit application fee concurrent with the submittal of an air quality permit application. A permit application is incomplete until the proper application fee is paid to the Department. The current permit modification is an administrative action; therefore, a permit application and fee were not required.

2. ARM 17.8.505 Air Quality Operation Fees. An annual air quality operation fee must, as a condition of continued operation, be submitted to the Department by each source of air contaminants holding an air quality permit (excluding an open burning permit) issued by the Department. The air quality operation fee is based on the actual or estimated actual amount of air pollutants emitted during the previous calendar year.

   An air quality operation fee is separate and distinct from an air quality permit application fee. The annual assessment and collection of the air quality operation fee, described above, shall take place on a calendar-year basis. The Department may insert into any final permit issued after the effective date of these rules, such conditions as may be necessary to require the payment of an air quality operation fee on a calendar-year basis, including provisions that prorate the required fee amount.

E. ARM 17.8, Subchapter 7 - Permit, Construction and Operation of Air Contaminant Sources, including but not limited to:

1. ARM 17.8.701 Definitions. This rule is a list of applicable definitions used in this chapter, unless indicated otherwise in a specific subchapter.

2. ARM 17.8.704 General Procedures for Air Quality Preconstruction Permitting. This air quality preconstruction permit contains requirements and conditions applicable to

both construction and subsequent use of the permitted equipment.

3. ARM 17.8.705 When Permit Required--Exclusions. This rule requires a facility to obtain an air quality permit or permit alteration if they construct, alter or use any air contaminant sources that have the potential to emit greater than 25 tons per year of any pollutant. Western Energy has the potential to emit greater than 25 tons per year of PM, PM-10, NO_x, SO_2, and VOC; therefore, a permit is required.

4. ARM 17.8.706 New or Altered Sources and Stacks--Permit Application Requirements. This rule requires that a permit application be submitted prior to installation, alteration, or use of a source. The current permit modification is an administrative action; therefore, a permit application is not required.

5. ARM 17.8.707 Waivers. ARM 17.8.706 requires that a permit application be submitted 180 days before construction begins. This rule allows the Department to waive this time limit. The Department hereby waives this time limit.

6. ARM 17.8.710 Conditions for Issuance of Permit. This rule requires that Western Energy demonstrate compliance with applicable rules and standards before a permit can be issued. Also, a permit may be issued with such conditions as are necessary to ensure compliance with all applicable rules and standards. Western Energy demonstrated compliance with all applicable rules and standards as required for permit issuance.

7. ARM 17.8.715 Emission Control Requirements. This rule requires a source to install the maximum air pollution control capability that is technically practicable and economically feasible, except that BACT shall be utilized. The current permit modification is an administrative action that will not increase emissions at this facility and which will not add or alter any sources; therefore, a BACT analysis is not required.

8. ARM 17.8.716 Inspection of Permit. This rule requires that air quality permits shall be made available for inspection by the Department at the location of the source.

9. ARM 17.8.717 Compliance with Other Statutes and Rules. This rule states that nothing in the permit shall be construed as relieving Western Energy of the responsibility for complying with any applicable federal or Montana statute, rule, or standard, except as specifically provided in ARM 17.8.701, *et seq*.

10. ARM 17.8.720 Public Review of Permit Applications. This rule requires that the applicant notify the public by means of legal publication in a newspaper of general circulation in the area affected by the application for a permit. The current permit modification is an administrative action; therefore, a public notice is not required.

11. ARM 17.8.731 Duration of Permit. An air quality permit shall be valid until revoked or modified, as provided in this subchapter, except that a permit issued prior to construction of a new or altered source may contain a condition providing that the

permit will expire unless construction is commenced within the time specified in the permit, that in no event may be less than 1 year after the permit is issued.

12. ARM 17.8.733 Modification of Permit. An air quality permit may be modified for changes in any applicable rules and standards adopted by the Board of Environmental Review (Board) or changed conditions of operation at a source or stack that do not result in an increase of emissions as a result of those changed conditions. A source may not increase its emissions beyond those found in its permit unless the source applies for and receives another permit.

13. ARM 17.8.734 Transfer of Permit. This rule states that an air quality permit may be transferred from one person to another if written notice of Intent to Transfer, including the names of the transferor and the transferee, is sent to the Department.

F. ARM 17.8, Subchapter 8 - Prevention of Significant Deterioration of Air Quality, including, but not limited to:

1. ARM 17.8.801 Definitions. This rule is a list of applicable definitions used in this subchapter.

2. ARM 17.8.818 Review of Major Stationary Sources and Major Modifications--Source Applicability and Exemptions. The requirements contained in ARM 17.8.819 through 17.8.827 shall apply to any major stationary source and any major modification, with respect to each pollutant subject to regulation under the Federal Clean Air Act (FCAA) that it would emit, except as this subchapter would otherwise allow.

   This facility is not a major stationary source since this facility is not a listed source and the facility's potential to emit (excluding fugitive emissions) is below 250 tons per year of any pollutant.

G. ARM 17.8. Subchapter 12 - Operating Permit Program Applicability, including, but not limited to:

1. ARM 17.8.1201 Definitions. (23) Major Source under Section 7412 of the FCAA is defined as any source having:

   a. Potential to emit (PTE) > 100 ton/year of any pollutant;

   b. PTE > 10 ton/year of any one Hazardous Air Pollutant (HAP), PTE > 25 ton/year of a combination of all HAPs, or lesser quantity as the Department may establish by rule; or

   c. Sources with the PTE > 70 ton/year of PM-10 in a serious PM-10 non-attainment area.

2. ARM 17.8.1204 Air Quality Operating Permit Program. (1) Title V of the FCAA amendments of 1990 requires that all sources, as defined in ARM 17.8.1204(1), obtain a Title V Operating Permit. In reviewing and issuing Air Quality Permit #1483-08 for Western Energy, the following conclusions were made:

   a. The facility's PTE is less than 100 ton/year for any pollutant, excluding fugitives.

   b. The facility's PTE is less than 10 ton/year for any one HAP and less than 25 ton/year of all HAPs.

   c. This source is not located in a serious PM-10 non-attainment area.

   d. This facility is subject to a NSPS.

   e. This facility is not subject to any current NESHAP standards.

   f. This source is not a Title IV affected source, nor a solid waste combustion unit.

   g. This source is not an EPA designated Title V source.

   Therefore, a Title V operating permit is not required. However, if minor sources subject to a NSPS are required to obtain a Title V Operating Permit, Western Energy will be required to obtain an operating permit.

III. BACT Determination

A BACT determination is required for each new or altered source. Western Energy shall install on the new or altered source the maximum air pollution control capability that is technically practicable and economically feasible, except that Best Available Control Technology shall be utilized. There was no increase in emissions for the current permit modification and no sources were added or altered. Therefore, a BACT determination was not required.

IV. Emission Inventory

Table 1. Particulate Matter (PM) Emissions[1]

Emission Source	Emission Factor	Units	Control Measure	%Control	Controlled PM (ton/year)
Top Soil Removal	0.38	lb/yd^3	None	0	119.1
Overburden Drilling	1.5	lb/hole	None	0	7.4
Overburden Blasting	37.5	lb/blast	None	0	2.1
Overburden Removal	0.03	lb/yd^3	Minimize Fall Distance	0	883.6
Haul Roads	8	lb/vmt	Chemical Stabilization	85	180.3
Access Roads	3	lb/vmt	Chemical Stabilization	85	182.8
Wind Erosion	0.38	ton/acre-yr	Prompt Revegetation	0	266.0
Coal Drilling	0.22	lb/hole	None	0	3.2
Coal Blasting	26.25	lb/blast	None	0	4.3
Coal Removal	0.0021	lb/ton	Minimize Fall Distance	0	13.7
Coal Dumping	0.01275	lb/ton	Partial Enclosure	90	8.3
Coal Crushing	0.08	lb/ton	Enclosure	95	26.0
Conveyors	0.2	lb/ton	Partial Enclosure	90	130.0
Vehicle Exhaust – Diesel	30.1	lb/1000 gal	None	0	36.2
Vehicle Exhaust – Gas	6.06	lb/1000 gal	None	0	0.4
Total PM – Fugitive & Process					1,863.4

[1] Based on the annual coal production limit for the combined areas of 13,000,000 ton/year.

Table 2. Gaseous Emissions

Pollutant	Ton/Year - controlled
Oxides of Nitrogen	445
Sulfur Dioxide	48
Carbon Monoxide	793
Volatile Organic Compounds	37
The values shown are the total emissions from vehicle exhaust (diesel and gasoline) and explosives detonation. Emission factors and process rates are available from the Department.	

V. Existing Air Quality

Prior to this permitting action, the Department reviewed Western Energy's request, dated April 27, 2001, to terminate the ambient PM-10 monitoring program. The review followed the Department's October 1998 Monitoring Requirements Guidance Statement. The review analyzed the PM-10 data collected at 7 sites at Western Energy's operations since the changeover from TSP samplers in 1992 through 2000. During the 1992-2000 period, the annual means at all sites were less than 28% of the annual standard (50 $\mu g/m^3$). For the 24-hour concentrations, all of the annual, maximum 24-hour values were less than 53% of the 24-hour standard (150 $\mu g/m^3$). The data from Western Energy's air monitoring network indicates relatively low concentrations of PM-10 in the ambient air around their coal mining operation.

VI. Air Quality Impact Analysis

As discussed in Section V, the data from Western Energy's air monitoring network indicates relatively low concentrations of PM-10 in the ambient air around their coal mining operation. There was no increase in emissions for the current permit modification; therefore, modeling is not required for the current permitting action.

VII. Taking or Damaging Implication Analysis

As required by 2-10-101 through 105, MCA, the Department conducted a private property taking and damaging assessment and determined that there are no taking or damaging implications.

VIII. Environmental Assessment

An environmental assessment, required by the Montana Environmental Policy Act, is not required for the current permit modification because it is an administrative action.

Permit Analysis Prepared by: Robert K. Jeffrey
Date: October 2, 2001

APPENDIX D-3 COUNTY LEVEL MONITORING DATA

Table D-3-1. Ambient criteria air pollutant monitoring sites within the air quality analysis area

Site ID	State	County	Lat.	Long.	Active Years	CO	NO_2	O_3	$PM_{2.5}$	PM_{10}	SO_2
30-027-0006	MT	Fergus	47.0485	-109.4553	12 - 16		X	X	X	X	
30-027-9000	MT	Fergus	47.5822	-108.7204	00 - 15						
30-031-0008	MT	Gallatin	45.7727	-111.1783	00 - 11				X		
30-031-0016	MT	Gallatin	44.6614	-111.1059	07 - 11				X		
30-031-0017	MT	Gallatin	44.6570	-111.0896	08 - 15	X					
30-031-0018	MT	Gallatin	45.7937	-111.1649	08 - 11				X		
30-049-9000	MT	Lewis and Clark	46.8261	-111.7116	00 - 15						
30-071-0010	MT	Phillips	48.3175	-107.8625	12 - 16		X	X	X	X	
30-075-0001	MT	Powder River	45.4403	-105.3703	10 - 16		X	X	X	X	
30-083-0001	MT	Richland	47.8034	-104.4856	08 - 16			X	X	X	X
30-085-9000	MT	Roosevelt	48.3079	-105.1029	02 - 15						
30-087-0001	MT	Rosebud	45.3662	-106.4898	10 - 16		X	X	X	X	
30-087-0307	MT	Rosebud	45.6233	-106.6686	97 - 16					X	
30-087-0760	MT	Rosebud	45.6681	-106.5195	81 - 15		X				X
30-087-0761	MT	Rosebud	45.6031	-106.4647	81 - 15		X				X
30-087-0762	MT	Rosebud	45.6483	-106.5572	02 - 15		X				X
30-091-9000	MT	Sheridan	48.4871	-104.4763	99 - 15						
30-111-0066	MT	Yellowstone	45.7866	-108.4588	81 - 16						X
30-111-0085	MT	Yellowstone	45.7804	-108.5115	04 - 11				X		
38-007-0002	ND	Billings	46.8943	-103.3785	99 - 15			X	X		X
38-013-0004	ND	Burke	48.6419	-102.4018	99 - 15		X	X	X	X	X
38-025-0003	ND	Dunn	47.3132	-102.5273	79 - 16		X	X	X	X	X
38-053-0002	ND	McKenzie	47.5812	-103.2995	01 - 16		X	X	X	X	X
38-053-0104	ND	McKenzie	47.5753	-103.9694	81 - 16						X
38-053-0111	ND	McKenzie	47.6056	-104.0177	98 - 16						X
38-105-0003	ND	Williams	48.1528	-103.6395	13 - 16			X	X	X	

Table D-3-1. Ambient criteria air pollutant monitoring sites within the air quality analysis area

Site ID	State	County	Lat.	Long.	Active Years	CO	NO_2	O_3	$PM_{2.5}$	PM_{10}	SO_2
38-105-0103	ND	Williams	48.4089	-102.9081	87 - 16						X
38-105-0105	ND	Williams	48.3927	-102.9107	87 - 16						X
46-033-0132	SD	Custer	43.5576	-103.4839	00 - 15			X	X	X	
46-071-0001	SD	Jackson	43.7456	-101.9412	88 - 15		X	X	X	X	X
46-093-0001	SD	Meade	44.1556	-103.3158	07 - 16			X		X	
46-103-0013	SD	Pennington	44.0835	-103.2696	92 - 13					X	
46-103-0020	SD	Pennington	44.0874	-103.2738	11 - 16		X		X	X	X
46-103-1001	SD	Pennington	44.0784	-103.2282	86 - 16				X	X	
56-003-0002	WY	Big Horn	44.2800	-108.0411	10 - 16			X			
56-003-0003	WY	Big Horn	44.8357	-108.3860	14 - 15		X	X	X	X	
56-005-0011	WY	Campbell	43.8403	-105.3596	12 - 15		X				
56-005-0084	WY	Campbell	43.6389	-105.3698	11 - 16					X	
56-005-0086	WY	Campbell	43.5718	-105.1540	11 - 16					X	
56-005-0087	WY	Campbell	43.6175	-105.1923	11 - 16					X	
56-005-0099	WY	Campbell	43.7578	-105.4914	10 - 16					X	
56-005-0123	WY	Campbell	44.6522	-105.2903	02 - 15		X	X			
56-005-0303	WY	Campbell	43.9010	-105.2505	12 - 16					X	
56-005-0456	WY	Campbell	44.1470	-105.5300	03 - 16		X	X		X	
56-005-0800	WY	Campbell	44.2658	-105.5042	11 - 12				X		
56-005-0802	WY	Campbell	44.1355	-105.4246	01 - 16					X	
56-005-0808	WY	Campbell	44.3944	-105.5304	02 - 16					X	
56-005-0826	WY	Campbell	44.4232	-105.4725	04 - 16					X	
56-005-0841	WY	Campbell	43.9872	-105.3037	08 - 16					X	
56-005-0857	WY	Campbell	44.2772	-105.3756	04 - 12						X
56-005-0869	WY	Campbell	43.5311	-105.2209	02 - 16					X	
56-005-0875	WY	Campbell	43.7022	-105.1992	01 - 16					X	
56-005-0884	WY	Campbell	44.4506	-105.5733	00 - 16					X	
56-005-0885	WY	Campbell	44.0322	-105.3212	91 - 16					X	

Table D-3-1. Ambient criteria air pollutant monitoring sites within the air quality analysis area

Site ID	State	County	Lat.	Long.	Active Years	CO	NO_2	O_3	$PM_{2.5}$	PM_{10}	SO_2
56-005-0886	WY	Campbell	44.1129	-105.3109	02 - 16					X	
56-005-0891	WY	Campbell	43.6483	-105.2133	02 - 16				X	X	
56-005-0892	WY	Campbell	44.0971	-105.3432	03 - 16		X		X	X	
56-005-0893	WY	Campbell	44.0702	-105.4699	08 - 16					X	
56-005-0895	WY	Campbell	44.4001	-105.4512	04 - 16					X	
56-005-0897	WY	Campbell	44.3155	-105.4386	12 - 16					X	
56-005-0898	WY	Campbell	44.1412	-105.4598	13 - 16					X	
56-005-0907	WY	Campbell	43.6233	-105.2133	01 - 13					X	
56-005-0908	WY	Campbell	44.1524	-105.3238	02 - 16					X	
56-005-1002	WY	Campbell	44.2880	-105.5170	10 - 16					X	
56-005-1003	WY	Campbell	44.0184	-105.4048	11 - 16					X	
56-005-1009	WY	Campbell	43.9571	-105.3482	11 - 16					X	
56-005-1877	WY	Campbell	43.6696	-105.2167	08 - 16					X	
56-005-1879	WY	Campbell	44.3781	-105.4214	08 - 16					X	
56-005-1899	WY	Campbell	44.5027	-105.5398	08 - 16				X	X	
56-005-1900	WY	Campbell	43.6142	-105.3868	08 - 16					X	
56-005-1906	WY	Campbell	44.4077	-105.5658	10 - 16					X	
56-005-1915	WY	Campbell	43.7140	-105.3913	08 - 16					X	
56-005-1917	WY	Campbell	43.7556	-105.2706	08 - 16					X	
56-005-2900	WY	Campbell	44.3376	-105.4940	08 - 16					X	
56-005-2901	WY	Campbell	44.3904	-105.5453	13 - 16					X	
56-005-5555	WY	Campbell	44.3437	-105.4033	12 - 16					X	
56-005-6666	WY	Campbell	44.2956	-105.3354	12 - 16					X	
56-009-0008	WY	Converse	42.7964	-105.3618	13 - 16		X	X			
56-009-0009	WY	Converse	43.4254	-105.3886	15 - 16		X		X	X	
56-009-0010	WY	Converse	43.1013	-105.4989	15 - 16		X	X		X	
56-009-0088	WY	Converse	43.4795	-105.2232	09 - 16					X	
56-009-0819	WY	Converse	43.4266	-105.3865	03 - 11				X	X	

Table D-3-1. Ambient criteria air pollutant monitoring sites within the air quality analysis area

Site ID	State	County	Lat.	Long.	Active Years	CO	NO_2	O_3	$PM_{2.5}$	PM_{10}	SO_2
56-009-0850	WY	Converse	43.4610	-105.3313	01 - 16					X	
56-009-0851	WY	Converse	43.4747	-105.3103	97 - 16					X	
56-009-0881	WY	Converse	43.4463	-105.3357	97 - 16					X	
56-013-0099	WY	Fremont	42.5300	-108.7200	07 - 16		X	X	X	X	
56-013-0232	WY	Fremont	43.0817	-107.5494	09 - 16		X	X	X	X	
56-013-0900	WY	Fremont	43.2586	-108.5789	11 - 12				X		
56-013-1003	WY	Fremont	42.8410	-108.7363	87 - 16				X	X	
56-013-6001	WY	Fremont	42.9944	-108.3703	13 - 15	X	X	X			X
56-025-0001	WY	Natrona	42.8511	-106.3251	10 - 16				X	X	
56-025-0100	WY	Natrona	42.8223	-106.3650	13 - 16		X	X			
56-025-2601	WY	Natrona	42.8608	-106.2359	11 - 16		X	X			X
56-029-0001	WY	Park	44.5324	-109.0730	10 - 16				X	X	
56-033-0002	WY	Sheridan	44.8151	-106.9559	85 - 16				X	X	
56-033-0003	WY	Sheridan	44.8055	-106.9762	05 - 12				X		
56-033-1003	WY	Sheridan	44.7955	-106.9586	12 - 16				X	X	
56-035-0097	WY	Sublette	42.9800	-110.3530	11 - 13			X	X	X	
56-035-0099	WY	Sublette	42.7190	-109.7530	05 - 16		X	X		X	
56-035-0100	WY	Sublette	42.7907	-110.0551	05 - 16		X	X		X	
56-035-0101	WY	Sublette	42.8698	-109.8708	09 - 16		X	X	X		
56-035-0700	WY	Sublette	42.4864	-110.0989	11 - 16		X	X	X	X	
56-035-0705	WY	Sublette	42.8705	-109.8610	05 - 12				X		
56-035-9991	WY	Sublette	42.9288	-109.7880	11 - 16			X			
56-039-0008	WY	Teton	43.6708	-110.5995	11 - 16			X			
56-039-1006	WY	Teton	43.4781	-110.7612	07 - 16				X	X	
56-039-1011	WY	Teton	44.5654	-110.4003	96 - 16			X			
56-039-1012	WY	Teton	44.4578	-110.8292	02 - 12	X					
56-039-1013	WY	Teton	44.3731	-110.8308	12 - 16	X					
56-045-0003	WY	Weston	43.8731	-104.1919	12 - 16			X			

Table D-3-1. Ambient criteria air pollutant monitoring sites within the air quality analysis area

Site ID	State	County	Lat.	Long.	Active Years	CO	NO_2	O_3	$PM_{2.5}$	PM_{10}	SO_2
56-045-0004	WY	Weston	43.8499	-104.2043	15 - 16			X	X	X	X
56-045-0800	WY	Weston	43.8454	-104.2051	05 - 16						X

Source: EPAEPA AQS 2016
[a] Only valid data that meets completeness requirements are shown.
Lat. = latitude; Long. = longitude.

Table D-3-2. CO Design Values by County for 2011-2015 [a]

State	County	Site ID	8-hour Design Value (ppm)					8-hour DV Meets NAAQS?	1-hour Design Value (ppm)					1-hour DV Meets NAAQS?
			2011	2012	2013	2014	2015		2011	2012	2013	2014	2015	
Montana	Gallatin	30-031-0017	—	—	—	—	0.6	Yes	—	—	—	—	1.2	Yes
Wyoming	Teton	56-039-1013	—	0.7	0.7	0.5	0.4	Yes	—	1.4	1.9	1	0.8	Yes

Source: EPA AQS 2016
[a] Only valid data that meets completeness requirements are shown.
ppm = parts per million
µg/m^3 = micrograms per cubic meter.

Table D-3-3. NO_2 Annual Monitoring Data and Design Values by County for 2011-2015 [a]

State	County	Site ID	98th Percentile of 1-hour daily maximum NO_2 (ppb)					2015 Valid 1-hour DV (ppb)	1-hour DV Meets NAAQS?	Annual Mean DV (ppb)					Annual DV Meets NAAQS?
			'11	'12	'13	'14	'15			'11	'12	'13	'14	'15	
Montana	Fergus	30-027-0006	—	16	14	13	12	—	—	—	—	1	1	1	Yes
Montana	Phillips	30-071-0010	—	9	6	8	6	—	—	—	—	—	1	1	Yes
Montana	Powder River	30-075-0001	15	10	9	11	9	—	—	—	—	1	—	1	Yes
Montana	Rosebud	30-087-0761	39	48	50	—	—	—	—	3	1	2	—	—	—
North Dakota	Burke	38-013-0004	14	15	13	14	11	—	—	2	2	2	2	2	Yes
North Dakota	Dunn	38-025-0003	8	13	10	11	12	11	Yes	1	2	2	2	2	Yes
North Dakota	McKenzie	38-053-0002	10	9	11	14	12	—	—	1	1	1	2	2	Yes
South Dakota	Jackson	46-071-0001	4	7	6	3	3	4	Yes	1	1	1	1	1	Yes
South Dakota	Pennington	46-103-0020	47	42	39	34	37	37	Yes	8	8	7	7	7	Yes
Wyoming	Big Horn	56-003-0003	—	—	—	32	24	—	—	—	—	—	—	—	—
Wyoming	Campbell	56-005-0011	—	46	52	55	41	49	Yes	—	—	9	10	7	Yes
Wyoming	Fremont	56-013-0099	4	5	5	4	5	5	Yes	1	1	1	1	1	Yes
Wyoming	Natrona	56-025-0100	—	—	34	38	42	—	—	—	—	3	4	5	Yes
Wyoming	Sublette	56-035-0101	31	26	17	21	20	19	Yes	3	3	1	1	1	Yes

Source: EPA AQS 2016
[a] Only valid data that meets completeness requirements are shown.
ppb = parts per billion.

Table D-3-4. O_3 Annual Monitoring Data and Design Values by County for 2011-2015 [a]

State	County	Site ID	4th highest daily maximum 8-hour concentration (ppm)					2015 DV (ppm)	DV Meets NAAQS?
			2011	2012	2013	2014	2015		
Montana	Fergus	30-027-0006	—	0.036	0.054	0.056	0.056	0.055	Yes
Montana	Phillips	30-071-0010	—	0.054	0.053	0.052	0.061	—	—
Montana	Powder River	30-075-0001	0.054	0.056	0.056	0.053	0.057	—	—
Montana	Richland	30-083-0001	—	—	0.056	0.051	0.058	0.055	Yes
Montana	Rosebud	30-087-0001	0.052	0.059	0.056	0.055	0.056	0.055	Yes
North Dakota	Billings	38-007-0002	0.057	0.057	0.057	0.055	0.064	0.058	Yes
North Dakota	Burke	38-013-0004	0.06	0.056	0.059	0.058	0.065	0.06	Yes
North Dakota	Dunn	38-025-0003	0.054	0.057	0.057	0.057	0.063	0.059	Yes
North Dakota	McKenzie	38-053-0002	0.059	0.057	0.059	0.056	0.061	0.058	Yes
North Dakota	Williams	38-105-0003	—	—	0.059	0.056	0.059	0.058	Yes
South Dakota	Custer	46-033-0132	0.06	0.069	0.061	0.057	0.059	0.059	Yes
South Dakota	Jackson	46-071-0001	0.052	0.064	0.062	0.057	0.057	0.058	Yes
South Dakota	Meade	46-093-0001	0.057	0.068	0.063	0.056	0.059	0.059	Yes
Wyoming	Big Horn	56-003-0002	—	0.039	0.064	0.056	0.059	0.059	Yes
Wyoming	Big Horn	56-003-0003	—	—	—	0.049	0.056	—	—
Wyoming	Campbell	56-005-0456	0.062	0.069	0.061	0.059	0.062	0.060	Yes
Wyoming	Converse	56-009-0008	—	—	0.057	0.058	0.06	—	—
Wyoming	Fremont	56-013-0099	0.068	0.067	0.062	0.065	0.062	0.063	Yes
Wyoming	Natrona	56-025-0100	—	—	0.065	0.061	0.06	0.062	Yes
Wyoming	Sublette	56-035-0100	0.075	0.067	0.063	0.062	0.062	0.062	Yes
Wyoming	Teton	56-039-1011	0.066	0.067	0.063	0.06	0.062	0.061	Yes
Wyoming	Weston	56-045-0003	—	0.044	0.067	0.059	0.061	0.062	Yes

Source: EPA AQS 2016
[a] Only valid data that meets completeness requirements are shown.
ppm = parts per million.

Table D-3-5. PM_{10} Annual Monitoring Data and Design Values by County for 2011-2015 [a]

State	County	Site ID	Estimated Number of Exceedances					2015 DV (average estimated exceedances 2013 – 2015)	DV Meets NAAQS?
			2011	2012	2013	2014	2015		
Montana	Fergus	30-027-0006	—	0	0	0	0	0	Yes
Montana	Phillips	30-071-0010	—	0	0	0	1	—	—
Montana	Powder River	30-075-0001	0	0	0	0	1	—	—
Montana	Richland	30-083-0001	0	0	2	0	0	0.7	Yes
Montana	Rosebud	30-087-0001	0	0	0	0	0	—	—
North Dakota	Burke	38-013-0004	0	0	0	0	0	0	Yes
North Dakota	Dunn	38-025-0003	0	0	0	0	0	0	Yes
North Dakota	McKenzie	38-053-0002	0	0	0	0	0	—	—
North Dakota	Williams	38-105-0003	—	—	0	0	0	—	—
South Dakota	Custer	46-033-0132	0	0	0	0	0	0	Yes
South Dakota	Jackson	46-071-0001	0	0	0	0	0	0	Yes
South Dakota	Meade	46-093-0001	0	0	0	0	0	0	Yes
South Dakota	Pennington	46-103-0020	0	0	0	0	1	0.3	Yes
Wyoming	Big Horn	56-003-0003	—	—	—	0	0	—	—
Wyoming	Campbell	56-005-0826	0	0	0	0	1	0.3	Yes
Wyoming	Converse	56-009-0088	0	0	0	0	2.1	0.7	Yes
Wyoming	Fremont	56-013-0232	0	0	0	0	0	0	Yes
Wyoming	Natrona	56-025-0001	0	0	0	0	0	0	Yes
Wyoming	Park	56-029-0001	0	0	0	0	0	—	—
Wyoming	Sheridan	56-033-0002	0	0	0	0	0	0	Yes
Wyoming	Sublette	56-035-0100	0	0	0	0	0	0	Yes
Wyoming	Teton	56-039-1006	0	0	0	0	0	0	Yes
Wyoming	Weston	56-045-0004	—	—	—	—	0	—	—

Source: EPAEPA AQS 2016
[a] Only valid data that meets completeness requirements are shown.

Table D-3-6. $PM_{2.5}$ Annual Monitoring Data and Design Values by County for 2011-2015 [a]

State	County	Site ID	98th Percentile of 24-hour $PM_{2.5}$ ($\mu g/m^3$)					2015 24-hour DV ($\mu g/m^3$)	24-hr DV Meets NAAQS?	Annual Mean ($\mu g/m^3$)					2015 Annual DV ($\mu g/m^3$)	Annual DV Meets NAAQS?
			'11	'12	'13	'14	'15			'11	'12	'13	'14	'15		
MT	Fergus	30-027-0006	—	10.0	10.5	15.8	40.1	22	Yes	—	2.6	3.6	4.3	5.7	4.5	Yes
MT	Gallatin	30-031-0008	30.8	—	—	—	—	—	—	6.2	—	—	—	—	—	—
MT	Phillips	30-071-0010	—	8.2	9.2	16.2	38.6	21	Yes	—	3.3	3.6	4.4	6.7	4.9	Yes
MT	Powder River	30-075-0001	21.4	24.3	15.3	20.3	31.4	22	Yes	6.5	8.5	5.0	6.0	7.4	6.2	Yes
MT	Richland	30-083-0001	14.7	19.3	17.3	19.1	35.4	24	Yes	7.3	8.3	7.1	6.9	7.1	7	Yes
MT	Rosebud	30-087-0001	17.3	28.9	10.9	19.4	26.4	19	Yes	4.5	7.9	4.0	5.5	6.8	5.4	Yes
MT	Yellowstone	30-111-0085	—	—	—	—	20.1	—	—	—	—	—	—	7.8	—	—
ND	Billings	38-007-0002	9.8	11.7	11.7	8.3	29.5	17	Yes	4.1	4.4	4.7	4.5	5.5	4.9	Yes
ND	Burke	38-013-0004	13.7	15.7	14.9	13.6	43.9	24	Yes	7.4	7.2	5.7	4.0	6.9	5.5	Yes
ND	Dunn	38-025-0003	13.9	16.6	13.2	12.6	37.1	21	Yes	6.4	5.8	4.3	4.3	6.6	5.1	Yes
ND	McKenzie	38-053-0002	17	17.4	11.4	11.1	31.7	18	Yes	8.8	7.0	3.6	2.9	3.7	3.4	Yes
ND	Williams	38-105-0003	—	—	22.2	16.6	35.8	25	Yes	—	—	9.6	6.2	5.0	6.9	Yes
SD	Custer	46-033-0132	11.5	14.9	9.4	7.1	21.3	13	Yes	3.7	4.9	3.1	2.4	4.1	3.2	Yes
SD	Jackson	46-071-0001	10	12.9	13.9	11.4	23.3	16	Yes	3.4	4.1	5.3	4.3	4.4	4.7	Yes
SD	Pennington	46-103-0020	13.1	17.1	15.3	15	30.4	20	Yes	4.5	6.3	7.9	6.1	9.5	7.8	Yes
WY	Big Horn	56-003-0003	—	—	—	18.2	14.5	—	—	—	—	—	7.2	8.6	—	—
WY	Campbell	56-005-1899	15.5	17.9	13.7	12.2	21	16	Yes	4.8	5.9	4.8	5.5	2.2	4.2	Yes
WY	Converse	56-009-0009	—	—	—	—	18.5	—	—	—	—	—	—	4.2	—	—

Table D-3-6. $PM_{2.5}$ Annual Monitoring Data and Design Values by County for 2011-2015 [a]

State	County	Site ID	98th Percentile of 24-hour $PM_{2.5}$ (µg/m³)					2015 24-hour DV (µg/m³)	24-hr DV Meets NAAQS?	Annual Mean (µg/m³)					2015 Annual DV (µg/m³)	Annual DV Meets NAAQS?
			'11	'12	'13	'14	'15			'11	'12	'13	'14	'15		
WY	Converse	56-009-0819	10.9	26.5	8	—	—	—	—	3.6	8.0	2.8	—	—	—	—
WY	Fremont	56-013-1003	30.3	24.8	28.5	26.3	20.1	25	Yes	7.8	7.8	7.8	6.7	6.2	6.9	Yes
WY	Natrona	56-025-0001	12.7	17.4	12.5	14.1	14.7	14	Yes	4.5	5.4	4.3	4.6	4.9	4.6	Yes
WY	Park	56-029-0001	11.5	16.4	14.7	9.8	19.4	15	Yes	4.4	5.1	4.3	3.7	4.2	4.1	Yes
WY	Sheridan	56-033-0002	23	18.9	16.7	20	35.8	24	Yes	7.7	8.3	6.7	6.5	7.5	6.9	Yes
WY	Sublette	56-035-0101	—	27.1	12.5	12.1	14.3	13	Yes	—	7.5	4.8	5.4	5.0	5	Yes
WY	Teton	56-039-1006	11.7	25.4	10.7	13.2	14.9	13	Yes	4.6	6.3	4.9	4.3	4.7	4.7	Yes
WY	Weston	56-045-0004	—	—	—	—	22.8	—	—	—	—	—	—	6.8	—	—

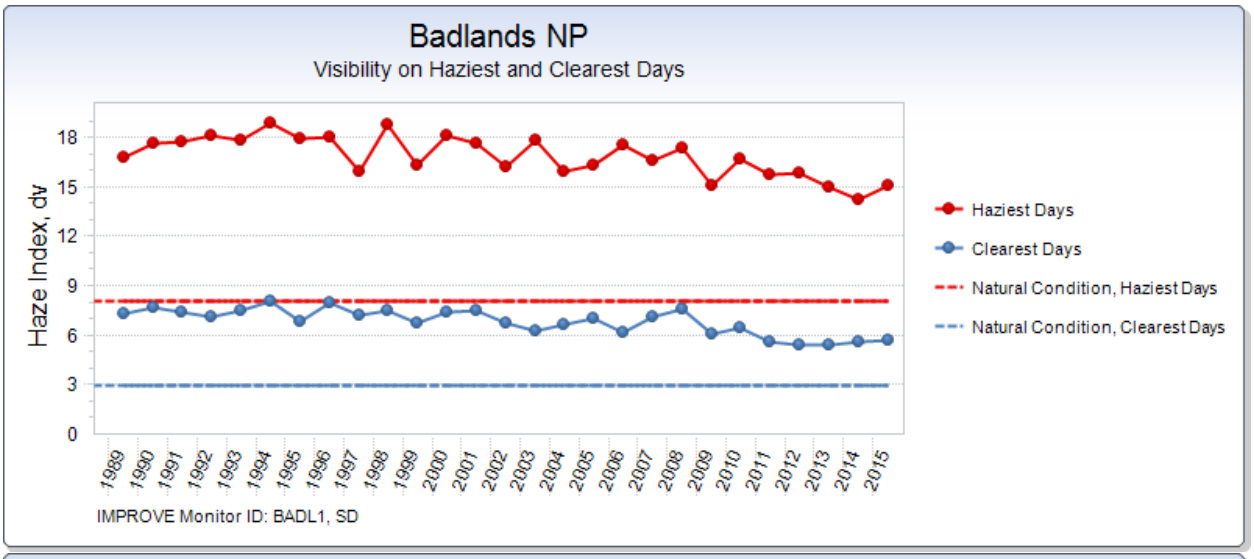
Source: EPAEPA AQS 2016
[a] Only valid data that meets completeness requirementsare shown.
µg/m³ = micrograms per cubic meter.

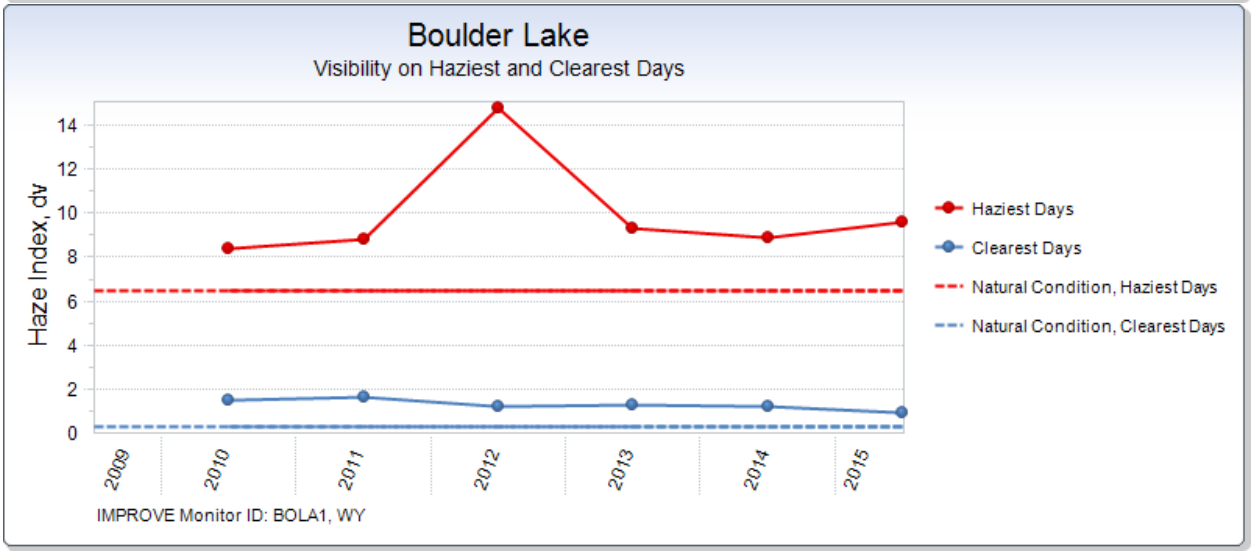
Table D-3-7. SO_2 Annual Monitoring Data and Design Values by County for 2011-2015 [a]

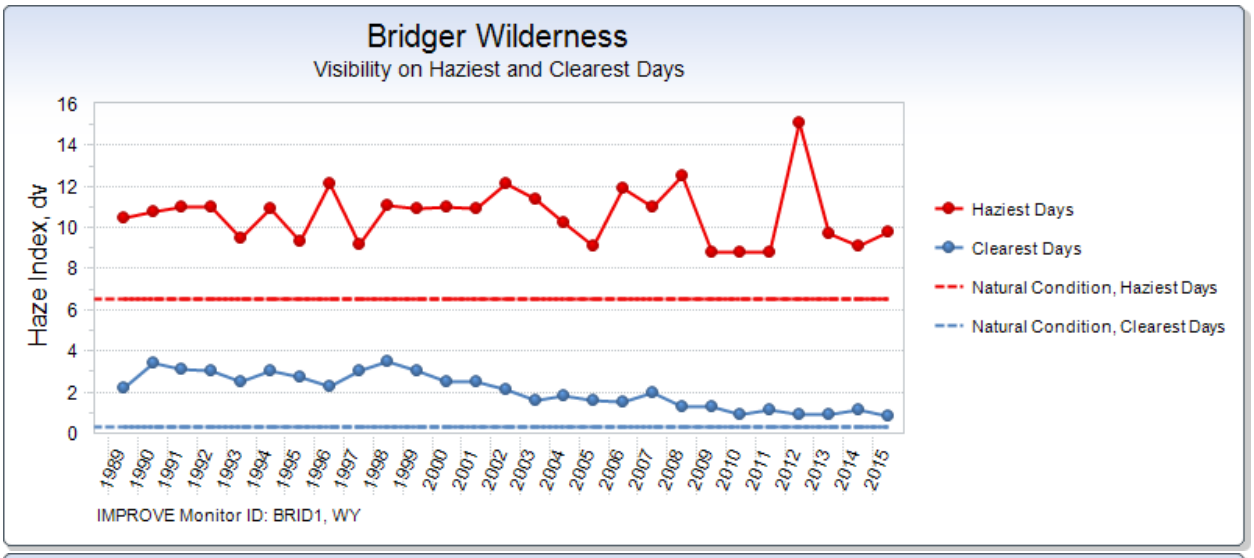
State	County	Site ID	99th Percentile of 1-hour daily maximum SO_2 (ppb)					2015 1-hour DV (ppb)	2015 DV meets NAAQS?
			2011	2012	2013	2014	2015		
Montana	Richland	30-083-0001	6	4	3	5	3	4	Yes
Montana	Yellowstone	30-111-0066	74	70	48	93	48	63	Yes
North Dakota	Billings	38-007-0002	5	6	4	4	5	5	Yes
North Dakota	Burke	38-013-0004	30	24	30	24	22	26	Yes
North Dakota	Dunn	38-025-0003	10	10	6	4	6	6	Yes
North Dakota	McKenzie	38-053-0104	6	6	12	6	7	8	Yes
North Dakota	Williams	38-105-0105	68	161	264	180	74	173	No
South Dakota	Jackson	46-071-0001	6	3	9	1	6	6	Yes
South Dakota	Pennington	46-103-0020	8	10	9	7	4	7	Yes
Wyoming	Campbell	56-005-0857	37	39	37	32	16	28	Yes
Wyoming	Fremont	56-013-6001	—	—	—	3	4	—	—
Wyoming	Natrona	56-025-2601	32	29	38	32	21	31	Yes
Wyoming	Weston	56-045-0800	9	20	6	2	4	4	Yes

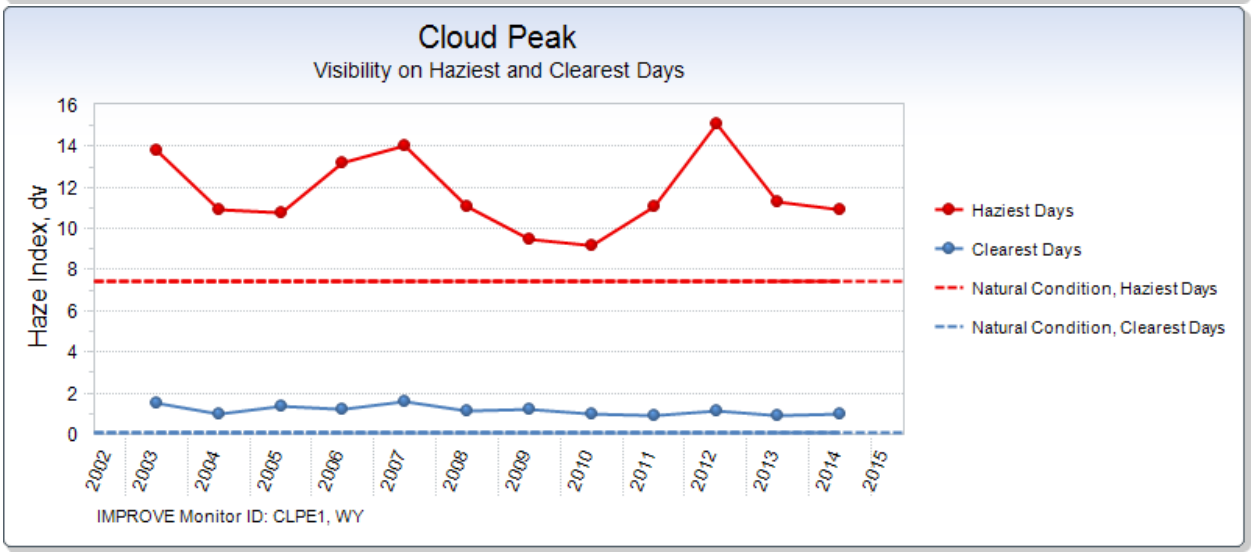
Source: EPA AQS 2016
[a] Only valid data that meets completeness requirements are shown.
ppb = parts per billion.

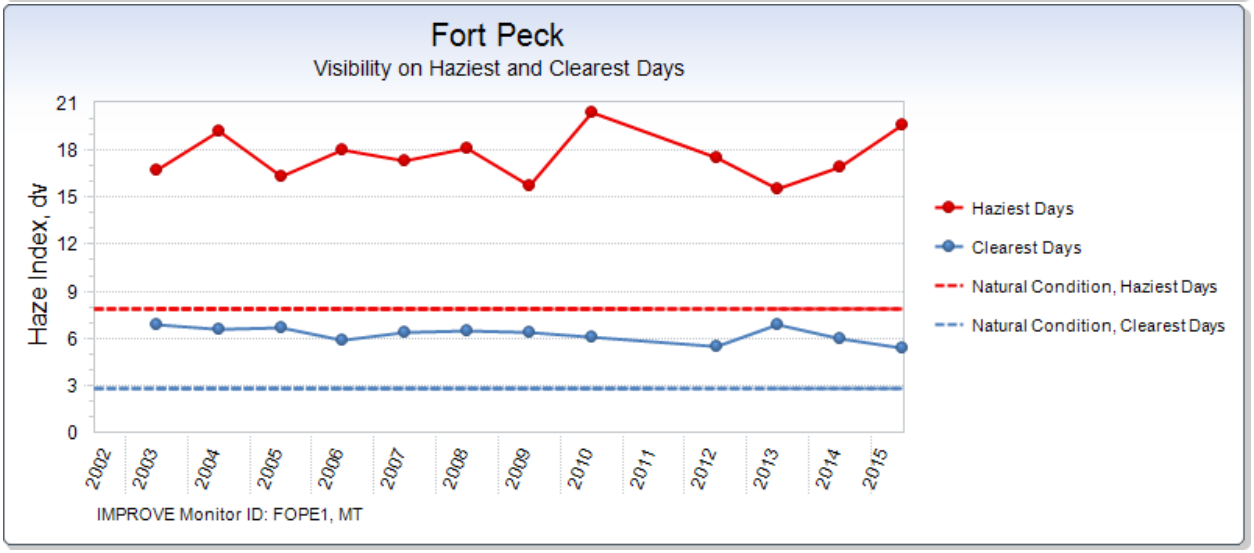
APPENDIX D-4. HISTORIC VISIBILITY TRENDS AT IMPROVE SITES

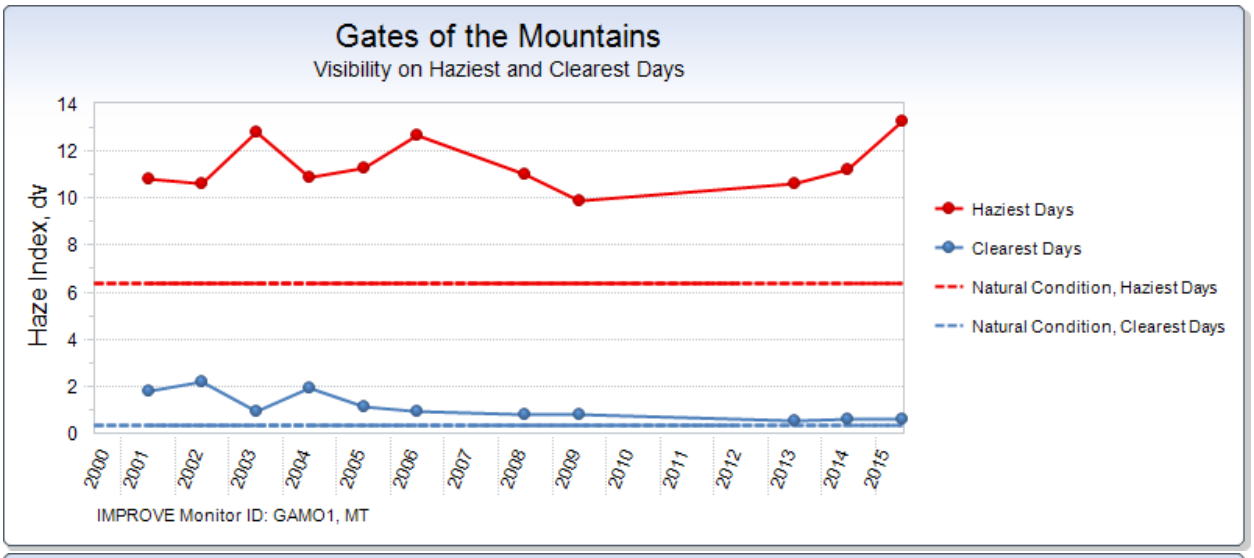


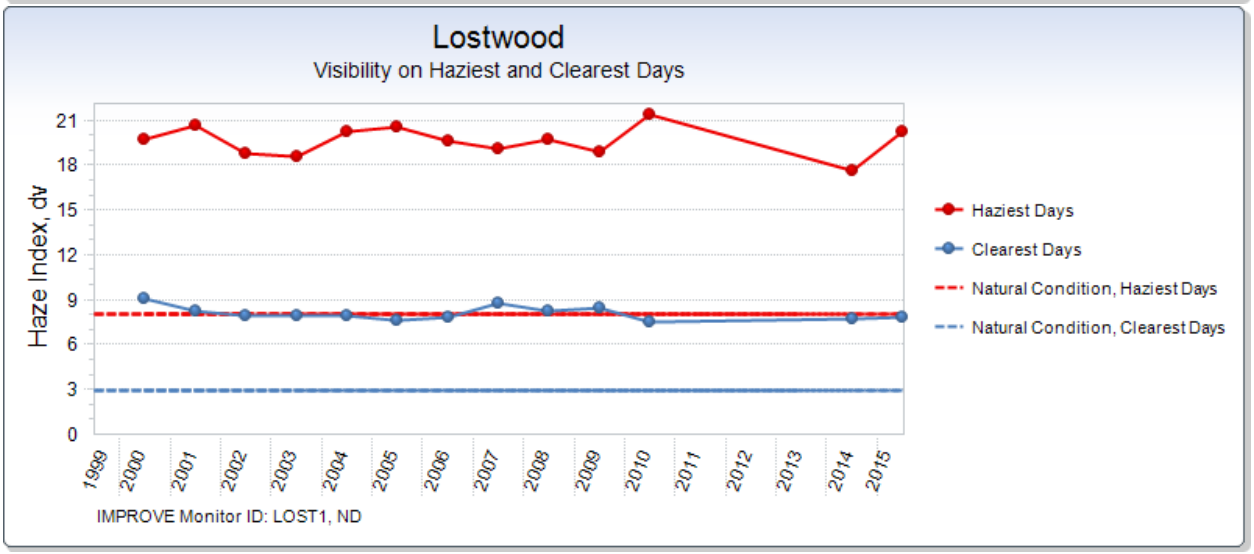


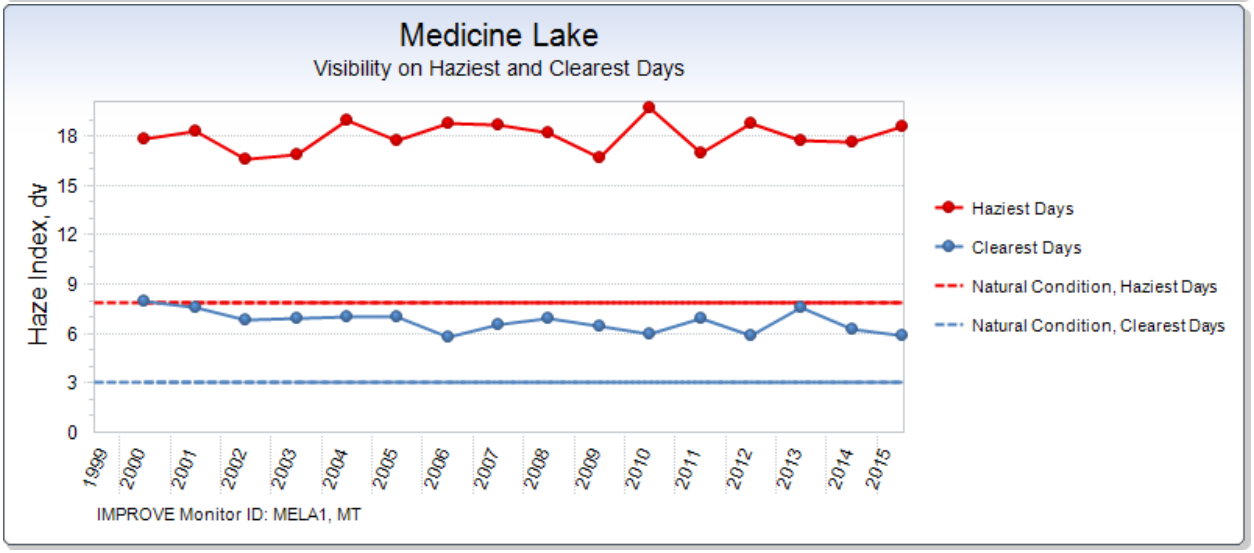

Bridger Wilderness
Visibility on Haziest and Clearest Days
Haze Index, dv
16
14
12
10
8
6
4
2
0
1989
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
IMPROVE Monitor ID: BRID1, WY
Haziest Days
Clearest Days
Natural Condition, Haziest Days
Natural Condition, Clearest Days

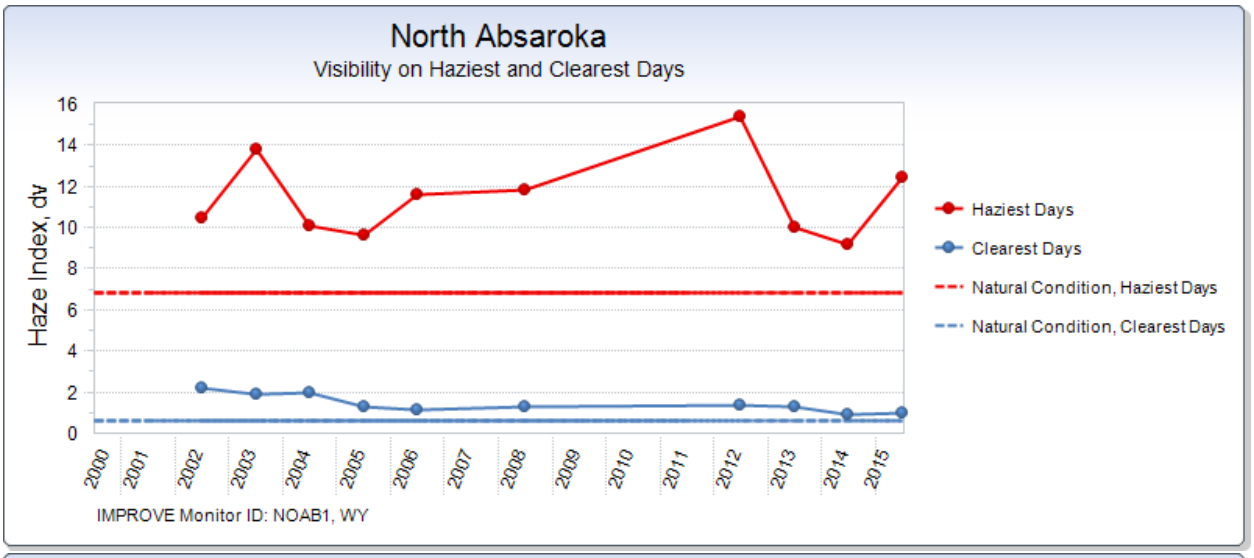

Cloud Peak
Visibility on Haziest and Clearest Days
Haze Index, dv
16
14
12
10
8
6
4
2
0
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
IMPROVE Monitor ID: CLPE1, WY
Haziest Days
Clearest Days
Natural Condition, Haziest Days
Natural Condition, Clearest Days

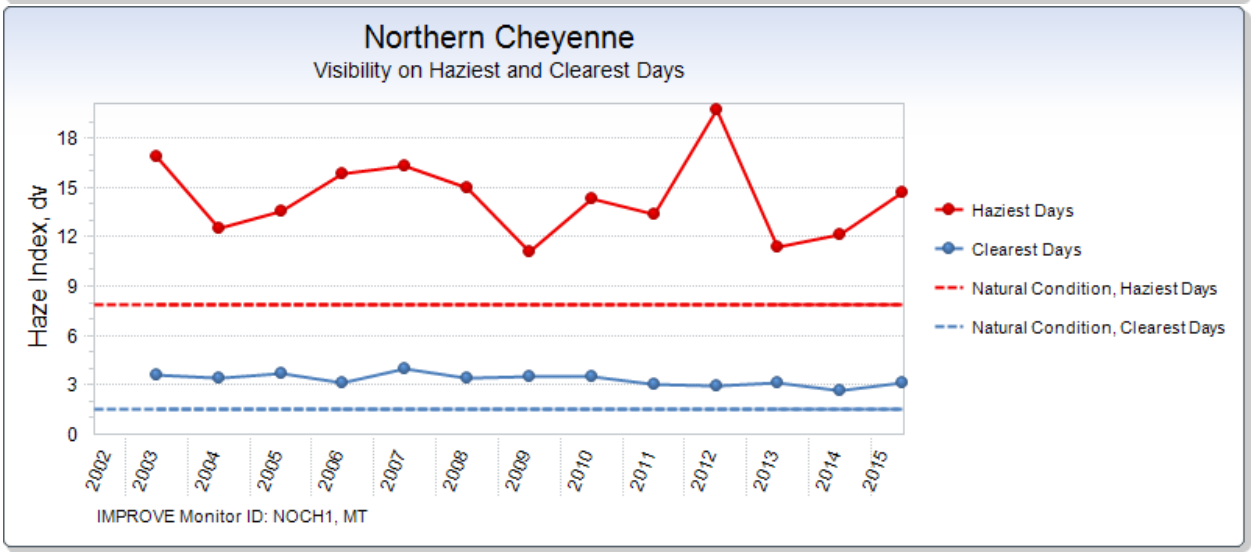

Fort Peck
Visibility on Haziest and Clearest Days
Haze Index, dv
21
18
15
12
9
6
3
0
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
IMPROVE Monitor ID: FOPE1, MT
Haziest Days
Clearest Days
Natural Condition, Haziest Days
Natural Condition, Clearest Days

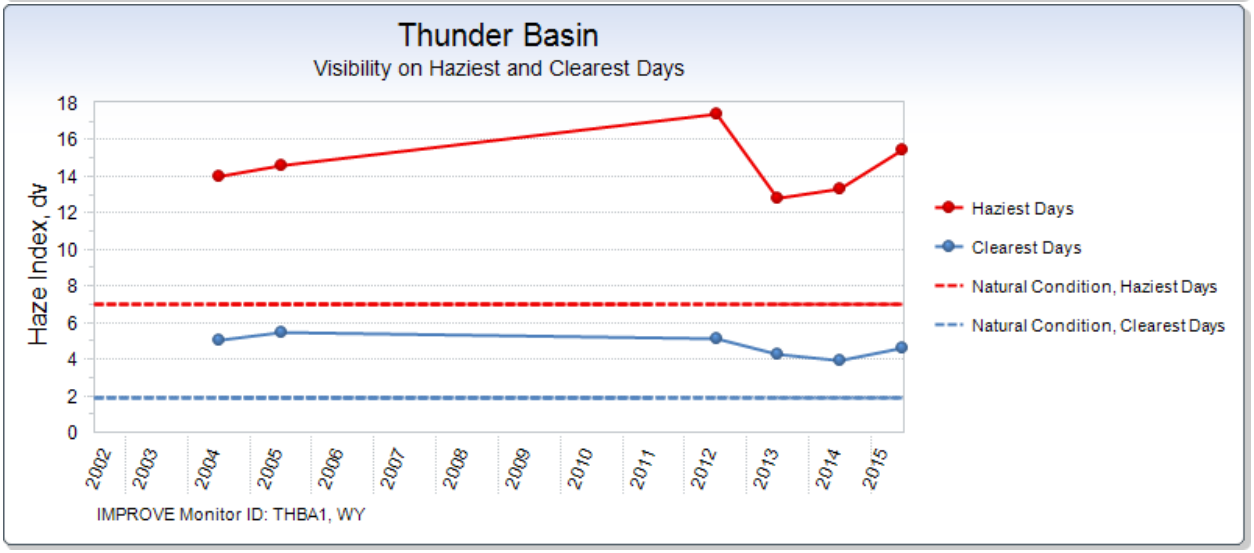

Gates of the Mountains
Visibility on Haziest and Clearest Days
Haze Index, dv
14
12
10
8
6
4
2
0
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
IMPROVE Monitor ID: GAMO1, MT
Haziest Days
Clearest Days
Natural Condition, Haziest Days
Natural Condition, Clearest Days

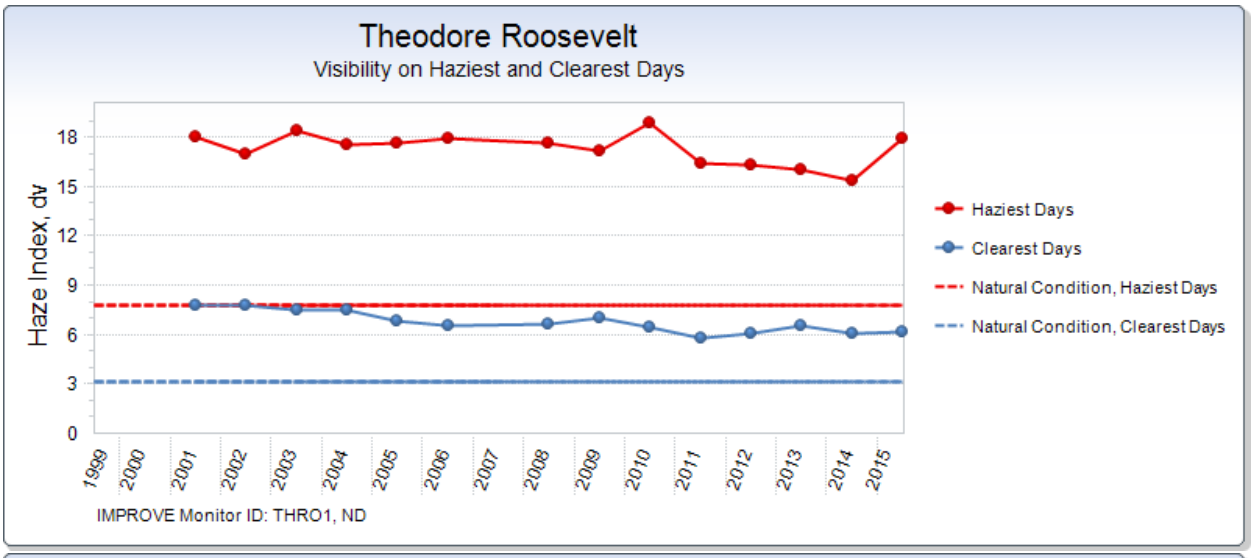

Lostwood
Visibility on Haziest and Clearest Days
Haze Index, dv
21
18
15
12
9
6
3
0
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
IMPROVE Monitor ID: LOST1, ND
Haziest Days
Clearest Days
Natural Condition, Haziest Days
Natural Condition, Clearest Days

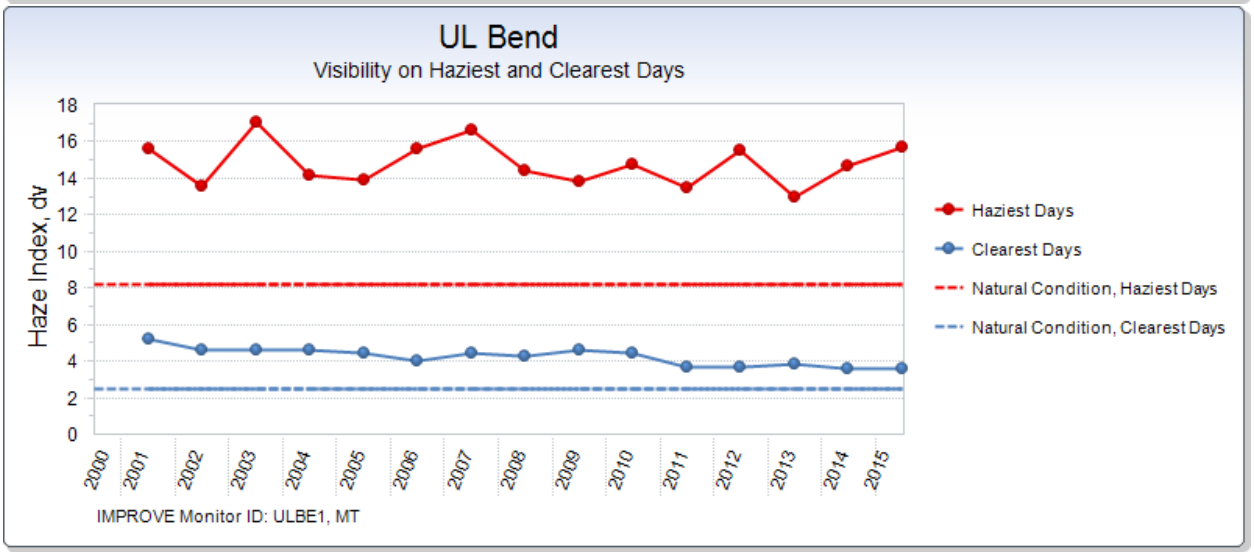

Medicine Lake
Visibility on Haziest and Clearest Days
Haze Index, dv
18
15
12
9
6
3
0
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
IMPROVE Monitor ID: MELA1, MT
Haziest Days
Clearest Days
Natural Condition, Haziest Days
Natural Condition, Clearest Days


North Absaroka
Visibility on Haziest and Clearest Days
Haze Index, dv
16
14
12
10
8
6
4
2
0
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
IMPROVE Monitor ID: NOAB1, WY
Haziest Days
Clearest Days
Natural Condition, Haziest Days
Natural Condition, Clearest Days


Northern Cheyenne
Visibility on Haziest and Clearest Days
Haze Index, dv
18
15
12
9
6
3
0
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
IMPROVE Monitor ID: NOCH1, MT
Haziest Days
Clearest Days
Natural Condition, Haziest Days
Natural Condition, Clearest Days


Thunder Basin
Visibility on Haziest and Clearest Days
Haze Index, dv
18
16
14
12
10
8
6
4
2
0
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
IMPROVE Monitor ID: THBA1, WY
Haziest Days
Clearest Days
Natural Condition, Haziest Days
Natural Condition, Clearest Days


Theodore Roosevelt
Visibility on Haziest and Clearest Days
Haze Index, dv
18
15
12
9
6
3
0
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
IMPROVE Monitor ID: THRO1, ND
Haziest Days
Clearest Days
Natural Condition, Haziest Days
Natural Condition, Clearest Days


UL Bend
Visibility on Haziest and Clearest Days
Haze Index, dv
18
16
14
12
10
8
6
4
2
0
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
IMPROVE Monitor ID: ULBE1, MT
Haziest Days
Clearest Days
Natural Condition, Haziest Days
Natural Condition, Clearest Days

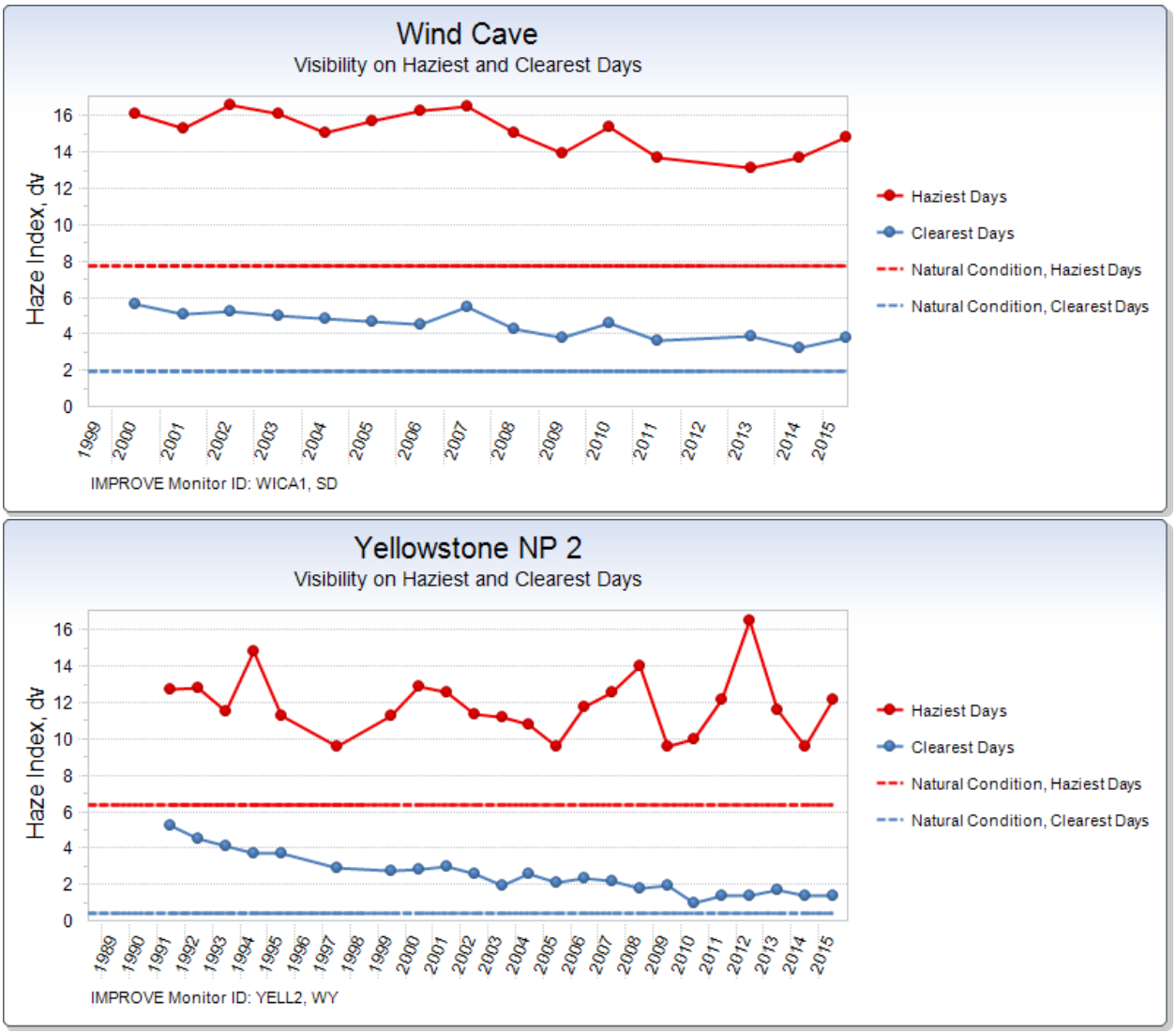


Figure D-4-1. Trends in visibility at several IMPROVE monitoring sites on the haziest and clearest days.

APPENDIX D-5. HISTORIC DEPOSITION TRENDS

Table D-5-1. Historic Deposition at National Trends Network Sites in the Cumulative and Indirect Effects Analysis Area for Air Quality [a,b]

Year	Precip. (cm)	Ca (kg/ha)	Mg (kg/ha)	K (kg/ha)	Na (kg/ha)	NH_4 (kg/ha)	NO_3 (kg/ha)	Inorg. N (kg/ha)	Cl (kg/ha)	SO_4 (kg/ha)	H^+ lab (kg/ha)	H^+ field (kg/ha)
Little Bighorn Battlefield National Monument (MT00)												
2000	27.61	0.60	0.069	0.052	0.105	0.70	2.20	1.04	0.15	1.52	0.01	0.03
2001	19.60	0.37	0.049	0.039	0.074	0.61	1.65	0.84	0.10	1.26	0.01	0.01
2002	25.06	0.55	0.068	0.058	0.075	0.96	2.48	1.31	0.11	1.47	0.01	0.01
2003	33.00	0.45	0.053	0.043	0.063	0.90	2.34	1.23	0.11	1.46	0.01	0.02
2004	32.51	0.65	0.075	0.055	0.127	0.73	2.33	1.09	0.14	1.65	0.01	0.03
2005	43.74	0.60	0.079	0.105	0.114	1.02	2.97	1.46	0.18	2.31	0.02	—
2006	28.89	0.43	0.061	0.069	0.058	0.61	1.71	0.86	0.10	1.24	0.01	—
2007	36.69	0.56	0.073	0.059	0.084	0.85	2.43	1.21	0.16	1.80	0.02	—
2008	36.44	0.65	0.095	0.087	0.095	0.89	2.28	1.21	0.16	1.82	0.01	—
2009	28.48	0.61	0.074	0.048	0.168	1.41	2.19	1.59	0.30	2.10	0.01	—
2010	34.53	0.70	0.093	0.079	0.100	0.93	2.54	1.30	0.17	1.75	0.01	—
2011	50.55	0.63	0.081	0.091	0.101	1.05	2.38	1.35	0.16	1.61	0.02	—
2012	23.04	0.77	0.090	0.083	0.164	0.84	1.58	1.01	0.18	1.14	0.00	—
2013	43.97	0.81	0.110	0.075	0.141	1.27	2.70	1.60	0.22	1.89	0.01	—
2014	41.55	0.51	0.079	0.071	0.100	1.08	2.41	1.39	0.16	1.39	0.02	—
2015	—	—	—	—	—	—	—	—	—	—	—	—
Poplar River (MT96)												
2000	32.08	0.68	0.093	0.112	0.119	1.11	3.16	1.57	0.21	2.42	0.02	0.02
2001	26.26	0.43	0.066	0.045	0.089	0.92	2.50	1.28	0.13	1.88	0.01	0.01
2002	29.18	1.02	0.143	0.105	0.190	1.49	3.55	1.96	0.18	2.87	0.01	0.02
2003	31.95	0.45	0.067	0.042	0.058	1.05	2.34	1.34	0.12	1.69	0.01	0.01
2004	22.33	0.57	0.087	0.047	0.205	0.91	2.13	1.19	0.11	1.81	0.01	0.01
2005	27.00	0.43	0.076	0.065	0.068	1.20	2.34	1.47	0.13	1.99	0.01	—
2006	22.28	0.54	0.080	0.076	0.080	0.93	2.12	1.20	0.11	1.52	0.01	—
2007	39.61	0.70	0.111	0.087	0.079	1.38	2.50	1.64	0.15	2.37	0.01	—
2008	—	—	—	—	—	—	—	—	—	—	—	—
2009	—	—	—	—	—	—	—	—	—	—	—	—
2010	27.83	0.67	0.100	0.053	0.083	0.81	1.99	1.08	0.13	1.67	0.01	—
2011	37.38	0.93	0.131	0.079	0.075	1.67	2.38	1.84	0.13	1.56	0.01	—
2012	25.30	0.62	0.089	0.061	0.071	1.33	2.09	1.51	0.12	1.29	0.00	—
2013	—	—	—	—	—	—	—	—	—	—	—	—
2014	—	—	—	—	—	—	—	—	—	—	—	—
2015	—	—	—	—	—	—	—	—	—	—	—	—

Table D-5-1. Historic Deposition at National Trends Network Sites in the Cumulative and Indirect Effects Analysis Area for Air Quality [a,b]

Year	Precip. (cm)	Ca (kg/ha)	Mg (kg/ha)	K (kg/ha)	Na (kg/ha)	NH_4 (kg/ha)	NO_3 (kg/ha)	Inorg. N (kg/ha)	Cl (kg/ha)	SO_4 (kg/ha)	H^+ lab (kg/ha)	H^+ field (kg/ha)
Harve - Northern Agricultural Research Center (MT98)												
2000	25.90	0.41	0.060	0.057	0.067	0.80	2.18	1.12	0.10	1.52	0.01	0.02
2001	14.40	0.25	0.037	0.045	0.094	0.55	1.45	0.76	0.09	0.90	0.01	0.01
2002	33.55	0.43	0.064	0.067	0.070	0.94	2.27	1.24	0.13	1.57	0.01	0.01
2003	28.43	0.58	0.074	0.114	0.151	0.94	2.26	1.24	0.18	1.43	0.01	0.01
2004	30.78	1.30	0.123	0.295	0.394	1.55	1.99	1.65	0.52	1.64	0.01	0.01
2005	—	—	—	—	—	—	—	—	—	—	—	—
2006	24.82	0.45	0.069	0.084	0.119	0.70	1.86	0.96	0.14	1.29	0.01	—
2007	—	—	—	—	—	—	—	—	—	—	—	—
2008	33.52	0.66	0.101	0.164	0.151	1.27	2.31	1.51	0.21	1.95	0.01	—
2009	26.14	0.45	0.081	0.105	0.120	1.07	1.70	1.22	0.11	1.79	0.01	—
2010	38.59	0.46	0.062	0.069	0.062	0.94	2.12	1.21	0.11	1.23	0.01	—
2011	—	—	—	—	—	—	—	—	—	—	—	—
2012	—	—	—	—	—	—	—	—	—	—	—	—
2013	50.67	0.92	0.162	0.552	0.162	2.90	3.10	2.95	0.25	2.14	0.01	—
2014	34.67	0.53	0.090	0.073	0.083	1.19	2.11	1.40	0.12	1.32	0.01	—
2015	38.46	0.75	0.123	0.085	0.123	1.89	2.73	2.09	0.21	1.59	0.01	—
Theodore Roosevelt National Park - Painted Canyon (ND00)												
2001	35.53	0.75	0.117	0.078	0.185	1.24	3.43	1.74	0.17	2.51	0.02	0.03
2002	30.98	1.42	0.201	0.108	0.214	1.99	4.17	2.49	0.15	2.77	0.00	0.01
2003	42.66	1.50	0.239	0.085	0.124	2.36	4.42	2.84	0.17	3.15	0.01	0.02
2004	27.74	0.52	0.083	0.044	0.114	0.88	2.07	1.15	0.09	1.67	0.01	0.01
2005	48.18	0.96	0.135	0.120	0.222	1.82	4.14	2.35	0.20	3.34	0.01	—
2006	24.33	0.80	0.109	0.085	0.139	1.44	3.11	1.82	0.13	2.15	0.00	—
2007	35.66	1.16	0.164	0.107	0.125	2.02	3.41	2.34	0.19	2.53	0.01	—
2008	26.87	0.84	0.126	0.073	0.102	1.29	2.64	1.60	0.16	1.98	0.01	—
2009	34.31	1.14	0.158	0.103	0.185	1.29	2.63	1.60	0.22	2.07	0.01	—
2010	58.09	1.28	0.163	0.093	0.139	2.11	3.96	2.53	0.22	2.61	0.01	—
2011	—	—	—	—	—	—	—	—	—	—	—	—
2012	—	—	—	—	—	—	—	—	—	—	—	—
2013	—	—	—	—	—	—	—	—	—	—	—	—
2014	—	—	—	—	—	—	—	—	—	—	—	—
2015	30.89	0.94	0.139	0.201	0.312	1.78	2.49	1.94	0.39	1.68	0.00	—
Wind Cave National Park - Elk Mountain (SD04)												
2002	—	—	—	—	—	—	—	—	—	—	—	—
2003	—	—	—	—	—	—	—	—	—	—	—	—
2004	—	—	—	—	—	—	—	—	—	—	—	—
2005	40.89	1.14	0.094	0.143	0.102	1.83	4.69	2.48	0.20	2.93	0.01	—

Table D-5-1. Historic Deposition at National Trends Network Sites in the Cumulative and Indirect Effects Analysis Area for Air Quality [a,b]

Year	Precip. (cm)	Ca (kg/ha)	Mg (kg/ha)	K (kg/ha)	Na (kg/ha)	NH_4 (kg/ha)	NO_3 (kg/ha)	Inorg. N (kg/ha)	Cl (kg/ha)	SO_4 (kg/ha)	H^+ lab (kg/ha)	H^+ field (kg/ha)
2006	28.72	1.13	0.098	0.126	0.098	1.30	3.52	1.80	0.17	1.95	0.01	—
2007	34.42	1.66	0.124	0.138	0.117	2.12	4.61	2.69	0.20	2.74	0.01	—
2008	52.83	2.80	0.227	0.238	0.280	3.13	6.10	3.81	0.36	4.47	0.01	—
2009	50.08	2.48	0.200	0.160	0.200	2.14	4.68	2.72	0.30	3.00	0.01	—
2010	58.71	1.97	0.170	0.200	0.264	3.04	5.29	3.56	0.36	3.48	0.01	—
2011	53.13	1.57	0.138	0.165	0.133	2.30	4.78	2.86	0.27	2.70	0.01	—
2012	35.07	1.14	0.109	0.098	0.123	2.00	3.32	2.31	0.17	1.79	0.00	—
2013	—	—	—	—	—	—	—	—	—	—	—	—
2014	62.20	2.18	0.199	0.317	0.199	2.77	4.78	3.23	0.38	2.64	0.01	—
2015	57.90	1.38	0.139	0.237	0.104	2.92	4.08	3.20	0.30	2.12	0.01	—
Cottonwood (SD08)												
2000	43.18	1.02	0.095	0.095	0.186	2.62	5.69	3.32	0.24	3.31	0.01	0.02
2001	38.89	0.91	0.089	0.086	0.148	2.14	4.68	2.72	0.22	2.93	0.01	0.01
2002	31.44	0.51	0.044	0.047	0.060	1.38	3.20	1.80	0.10	1.89	0.01	0.02
2003	28.60	0.75	0.083	0.083	0.109	2.09	4.20	2.57	0.16	2.74	0.01	0.02
2004	37.22	1.02	0.089	0.216	0.302	2.26	4.56	2.79	0.23	2.68	0.01	0.01
2005	47.49	0.77	0.085	0.104	0.114	2.64	4.54	3.08	0.19	3.02	0.01	—
2006	—	—	—	—	—	—	—	—	—	—	—	—
2007	36.02	0.66	0.068	0.119	0.122	1.97	3.10	2.23	0.17	2.25	0.01	—
2008	59.99	1.52	0.138	0.180	0.240	3.26	5.58	3.80	0.31	3.69	0.01	—
2009	41.89	1.06	0.096	0.084	0.096	2.20	3.96	2.61	0.21	2.33	0.01	—
2010	53.52	0.79	0.070	0.102	0.112	2.36	3.40	2.60	0.21	2.25	0.01	—
2011	50.19	1.03	0.105	0.100	0.141	2.55	4.31	2.96	0.27	2.43	0.01	—
2012	—	—	—	—	—	—	—	—	—	—	—	—
2013	52.12	1.84	0.167	0.167	0.182	3.52	5.57	3.99	0.29	3.09	0.00	—
2014	—	—	—	—	—	—	—	—	—	—	—	—
2015	62.46	1.04	0.112	0.156	0.119	3.80	4.95	4.07	0.27	2.31	0.01	—
Sinks Canyon (WY02)												
2000	40.06	0.87	0.084	0.052	0.116	0.51	2.24	0.90	0.15	1.54	0.02	0.02
2001	22.77	0.57	0.061	0.064	0.123	0.63	2.04	0.95	0.15	1.37	0.01	0.01
2002	32.12	0.96	0.087	0.061	0.202	0.84	2.78	1.28	0.20	1.87	0.01	0.02
2003	37.55	0.74	0.083	0.053	0.090	0.63	1.86	0.91	0.13	1.29	0.01	0.02
2004	53.81	0.93	0.097	0.081	0.231	1.00	3.30	1.52	0.24	2.56	0.03	0.04
2005	40.21	1.02	0.113	0.076	0.197	1.17	3.21	1.64	0.23	2.61	0.02	—
2006	28.57	0.57	0.066	0.051	0.151	0.45	1.71	0.74	0.13	1.27	0.01	—
2007	37.36	0.86	0.090	0.064	0.161	0.68	2.60	1.12	0.15	1.70	0.02	—
2008	45.63	1.61	0.123	0.068	0.183	0.69	1.95	0.98	0.22	1.55	0.01	—
2009	50.28	1.22	0.121	0.070	0.186	0.77	2.30	1.12	0.24	1.66	0.01	—

Table D-5-1. Historic Deposition at National Trends Network Sites in the Cumulative and Indirect Effects Analysis Area for Air Quality [a,b]

Year	Precip. (cm)	Ca (kg/ha)	Mg (kg/ha)	K (kg/ha)	Na (kg/ha)	NH_4 (kg/ha)	NO_3 (kg/ha)	Inorg. N (kg/ha)	Cl (kg/ha)	SO_4 (kg/ha)	H^+ lab (kg/ha)	H^+ field (kg/ha)
2010	53.92	1.52	0.124	0.081	0.253	0.83	2.42	1.19	0.30	1.90	0.01	—
2011	53.16	0.80	0.090	0.064	0.128	0.62	2.01	0.93	0.19	1.40	0.02	—
2012	—	—	—	—	—	—	—	—	—	—	—	—
2013	—	—	—	—	—	—	—	—	—	—	—	—
2014	—	—	—	—	—	—	—	—	—	—	—	—
2015	58.17	0.65	0.081	0.064	0.105	0.91	1.68	1.09	0.15	1.11	0.02	—
Pinedale (WY06)												
2000	—	—	—	—	—	—	—	—	—	—	—	—
2001	—	—	—	—	—	—	—	—	—	—	—	—
2002	—	—	—	—	—	—	—	—	—	—	—	—
2003	20.33	0.41	0.043	0.028	0.081	0.50	1.84	0.80	0.11	1.09	0.01	0.02
2004	36.36	0.76	0.073	0.055	0.182	0.59	2.65	1.05	0.26	1.57	0.02	0.03
2005	34.63	0.73	0.083	0.066	0.163	0.73	2.90	1.22	0.23	2.21	0.02	—
2006	20.05	0.55	0.058	0.084	0.112	0.39	1.86	0.72	0.16	1.09	0.01	—
2007	24.41	0.62	0.068	0.061	0.227	0.59	2.27	0.97	0.17	1.31	0.01	—
2008	28.12	0.75	0.082	0.073	0.188	0.58	2.27	0.97	0.27	1.38	0.01	—
2009	35.18	1.12	0.109	0.077	0.215	0.59	2.02	0.92	0.33	1.37	0.01	—
2010	—	—	—	—	—	—	—	—	—	—	—	—
2011	—	—	—	—	—	—	—	—	—	—	—	—
2012	—	—	—	—	—	—	—	—	—	—	—	—
2013	—	—	—	—	—	—	—	—	—	—	—	—
2014	—	—	—	—	—	—	—	—	—	—	—	—
2015	—	—	—	—	—	—	—	—	—	—	—	—
Yellowstone National Park - Tower Falls (WY08)												
2000	34.20	0.73	0.072	0.099	0.168	0.66	2.19	1.01	0.29	1.29	0.01	0.01
2001	29.71	0.42	0.045	0.059	0.119	0.53	1.67	0.79	0.18	0.91	0.01	0.01
2002	30.54	1.24	0.110	0.140	0.177	0.81	2.13	1.11	0.23	1.10	0.01	0.01
2003	—	—	—	—	—	—	—	—	—	—	—	—
2004	32.27	0.53	0.058	0.610	0.345	0.62	2.05	0.95	0.38	1.18	0.01	0.02
2005	37.78	0.41	0.045	0.072	0.147	0.69	1.83	0.95	0.26	1.14	0.01	—
2006	35.57	0.71	0.089	0.142	0.281	0.78	2.25	1.12	0.30	1.54	0.02	—
2007	34.23	1.32	0.113	0.147	0.113	0.90	2.14	1.18	0.20	1.34	0.01	—
2008	34.45	0.75	0.072	0.096	0.327	0.61	1.43	0.79	0.35	1.07	0.01	—
2009	48.16	1.33	0.120	0.116	0.284	0.83	2.21	1.14	0.35	1.55	0.02	—
2010	—	—	—	—	—	—	—	—	—	—	—	—
2011	—	—	—	—	—	—	—	—	—	—	—	—
2012	47.27	1.42	0.147	0.222	0.402	1.59	2.55	1.81	0.51	1.67	0.01	—
2013	38.66	0.89	0.097	0.116	0.170	1.33	2.50	1.60	0.32	1.57	0.01	—

Table D-5-1. Historic Deposition at National Trends Network Sites in the Cumulative and Indirect Effects Analysis Area for Air Quality [a,b]

Year	Precip. (cm)	Ca (kg/ha)	Mg (kg/ha)	K (kg/ha)	Na (kg/ha)	NH_4 (kg/ha)	NO_3 (kg/ha)	Inorg. N (kg/ha)	Cl (kg/ha)	SO_4 (kg/ha)	H^+ lab (kg/ha)	H^+ field (kg/ha)
2014	—	—	—	—	—	—	—	—	—	—	—	—
2015	—	—	—	—	—	—	—	—	—	—	—	—
Grand Tetons National Park (WY94)												
2011	—	—	—	—	—	—	—	—	—	—	—	—
2012	37.54	1.96	0.188	0.143	0.447	1.07	2.73	1.45	0.50	1.59	0.01	—
2013	—	—	—	—	—	—	—	—	—	—	—	—
2014	58.93	1.23	0.141	0.159	0.389	1.36	2.76	1.68	0.54	1.54	0.02	—
2015	55.72	1.14	0.139	0.134	0.496	1.42	2.91	1.76	0.55	1.74	0.02	—
Newcastle (WY99)												
2000	—	—	—	—	—	—	—	—	—	—	—	—
2001	43.22	1.21	0.099	0.099	0.151	1.74	5.14	2.52	0.22	3.05	0.02	0.02
2002	37.14	1.02	0.089	0.074	0.108	1.57	4.95	2.34	0.19	2.70	0.02	0.01
2003	36.33	0.97	0.087	0.058	0.102	1.17	3.69	1.74	0.16	2.19	0.02	0.02
2004	31.09	1.03	0.090	0.068	0.096	1.18	3.71	1.76	0.16	2.30	0.01	0.02
2005	49.77	1.04	0.095	0.124	0.119	1.56	4.38	2.20	0.23	2.92	0.02	—
2006	34.37	0.90	0.089	0.148	0.096	1.08	3.07	1.53	0.16	2.05	0.01	—
2007	42.34	1.20	0.110	0.123	0.157	1.67	3.98	2.20	0.21	2.83	0.01	—
2008	45.71	1.47	0.128	0.165	0.187	1.74	4.40	2.35	0.29	3.00	0.01	—
2009	39.35	0.93	0.079	0.094	0.102	1.12	2.81	1.50	0.18	1.88	0.01	—
2010	43.36	1.36	0.130	0.130	0.139	1.42	3.00	1.78	0.20	2.51	0.01	—
2011	56.37	1.44	0.135	0.485	0.186	2.86	3.83	3.09	0.33	2.90	0.01	—
2012	28.64	1.20	0.112	0.120	0.126	1.12	2.70	1.48	0.17	1.48	0.00	—
2013	—	—	—	—	—	—	—	—	—	—	—	—
2014	—	—	—	—	—	—	—	—	—	—	—	—
2015	46.02	1.04	0.101	0.101	0.097	1.84	2.95	2.10	0.18	1.61	0.01	—

Source: NADP 2016
[a] Only valid data that meets NTN completeness requirements are shown.
[b] The Gypsum Creek NTN Site (WY98) did not have any valid data for the period 2000-2015 and is not shown.
Ca = calcium.
Cl = chloride.
cm = centimeter(s).
H^+ = free acidity.
K = potassium.
kg/ha = kilogram(s) per hectare.
Mg = magnesium.
Na = sodium.
NH_4 = ammonium.
NO_3 = nitrate.
Precip. = precipitation.
SO_4 = sulfate.

APPENDIX D-6.

Supplemental Information for Cumulative Effects for Air Quality

Table D-6-1. Maximum Future Air Emissions from Existing and Reasonably Foreseeable Areas and Facilities of the Rosebud Mine

Mine Area/Facility	PM_{10}	$PM_{2.5}$	NOx	CO	SO_2	VOC
	(tons / year)					
Area C [1]	641.6	66.7	256.5	302.4	7.9	18.8
Areas A, B [2]	151.4	21.7	88.1	157.0	9.5	7.3
Area D	34.7	3.5	--	--	--	--
Area E	11.3	1.1	--	--	--	--
AM5	207.3	33.1	166.9	297.5	18.0	13.9
Portable Crusher	0.2	0.1	1.9	0.4	0.6	0.1

1. Includes coal production from Area C BLM Lease Modification
2. Includes coal production from AM4, BX and Area B BLM Lease Modification

Table D-6-2. Estimated Future Annual Emissions from Colstrip Units 1 and 2*

Emission Source(s)	PM_{10}	$PM_{2.5}$	NOx	CO	SO_2	VOC
Colstrip Units 1 and 2	(tons / year)					
Boiler - Unit 1	272.23	227.77	3717.15	305.58	2013.15	42.78
Boiler - Unit 2	240.10	200.91	2090.34	269.35	1744.72	37.71
Coal Storage Pile	4.13	0.62	0	0	0	0
Fugitive Dust - Haul Roads	0.11	0	0	0	0	0
Diesel Emergency Generator	0.0177	0.0171	0.56	0.29	0.14	0.0023
On-road Mobile	0.0048	0.0028	0.12	0.89	0.0004	0.19
Non-road Mobile	0.0054	0.0052	0.04	0.86	0.0001	0.04

Source: Montana DEQ Annual Emission Inventory Reporting Records (2015)
* Emissions are rounded to two decimal places, except when additional significant figures are required to highlight differences or to show differences between pollutants

Table D-6-3. (a) Projected Future Emissions from Other Major Regional Point Sources in the Indirect/Cumulative Impacts Analysis Area, and (b) Projected Future Regional Emissions in the Analysis Area

Facility	Latitude	Longitude	NOx	SO_2	PM_{10}	$PM_{2.5}$	VOC
Black Thunder Mine	43.700	-105.290	11726	163	4272	1791	0
Coal Creek Mine	43.968	-105.284	9100	12	334	122	0
Dave Johnston	42.838	-105.777	7664	6993	919	643	107
North Antelope Rochelle Mine	43.532	-105.257	3325	197	2898	932	113
Wyodak Plant	44.288	-105.383	3088	1359	351	285	52
Elk Basin Gas Plant	44.980	-108.843	1281	0	18	18	62
Elk Basin Gas Plant	44.977	-108.838	1239	0	18	18	150
GCC Dacotah	44.087	-103.272	1151	271	33	33	44
Antelope Mine	43.478	-105.342	1083	70	1483	214	41
Hilight-Reno Junction Gas Plant	43.031	-105.147	1010	0	17	17	74
Hilight-Reno Junction Gas Plant	43.843	-105.360	1004	0	17	17	78
MDU - Lewis & Clark Station	47.679	-104.153	863	137	211	134	12
Caballo Mine	44.100	-105.364	791	79	48	48	49
Cordero Rojo Complex	44.029	-105.367	784	79	1441	420	28
Belle Ayr Mine	44.101	-105.365	730	17	939	402	0
378 (name unknown)	48.395	-102.916	697	952	11	11	85
Tioga Gas Plant	48.395	-102.916	675	0	15	15	7
Eagle Butte Mine	44.387	-105.506	648	5	839	196	0
Blaine County #1	48.423	-109.421	548	0	3	0	0
Sycamore	44.250	-105.860	528	0	0	0	1
Neil Simpson Two	44.285	-105.384	522	287	37	37	13
005-0001 (name unknown)	48.423	-109.421	464	0	4	4	25
Phillips 66 Refinery, Billings	45.781	-108.493	462	31	91	75	287
Dry Fork Station	44.388	-105.460	460	888	203	147	45
Rawhide Mine	44.414	-105.460	450	34	305	21	22

Facility	Latitude	Longitude	NOx	SO_2	PM_{10}	$PM_{2.5}$	VOC
Colony West Plant	44.870	-104.161	410	50	94	28	1
WYGEN Station I	44.286	-105.384	407	284	48	35	11
Graymont Western US Inc.	46.328	-111.617	405	93	51	19	0
Rocky Mountain Power	45.764	-107.600	398	389	67	53	16
CHS Inc. Refinery Laurel	45.659	-108.768	398	190	57	44	931
Colony East Plant	44.865	-104.150	390	63	106	27	1
Buckskin Mine	44.442	-105.534	312	32	1047	562	3
Dry Fork Coal Mine	44.370	-105.448	299	16	205	18	12
376 (name unknown)	47.297	-103.098	291	410	10	10	77
Neil Simpson One	44.286	-105.387	282	791	351	347	7
1204 (name unknown)	48.693	-102.922	276	3	9	9	119
Williston Basin Interstate Pipeline Company	44.990	-103.933	276	0	4	4	8
380 (name unknown)	47.592	-104.000	268	158	10	10	81
Beaver Creek Gas Plant	42.846	-108.318	253	0	4	4	88
Wyodak Mine	44.197	-105.488	237	4	229	85	6
WYGEN II	44.291	-105.381	236	315	59	43	13
375 (name unknown)	48.873	-102.546	232	106	6	6	87
Beaver Creek Gas Plant	42.847	-108.314	229	0	2	2	2
Hardin Compressor Station	45.739	-107.546	224	0	0	0	7
383 (name unknown)	47.929	-103.874	224	1	3	3	35
Frannie Lime Plant	44.996	-108.625	223	32	57	22	0
1084 (name unknown)	48.037	-102.352	214	232	5	5	110
Paradise Compressor Station	42.685	-109.809	213	0	6	6	171
Paradise Compressor Station	42.685	-109.804	212	0	6	6	139
Lovell Plant	44.859	-108.225	205	23	87	16	0
Riverton Dome Gas Plant_EPA Permitted	42.939	-108.347	205	0	0	0	12
Fort Buford Compressor Station	47.929	-103.874	201	0	3	3	18
396 (name unknown)	47.252	-102.719	199	4	7	7	43
ExxonMobil Billings Refinery	45.814	-108.433	196	652	194	188	414
267 (name unknown)	48.588	-102.855	194	101	4	4	48
Richardton Ethanol Plant	46.878	-102.297	190	80	177	172	64
Wygen III	44.289	-105.379	185	335	67	49	15
237 (name unknown)	47.064	-103.414	170	1	3	3	59
390 (name unknown)	47.108	-103.324	170	1	3	3	56
Bill	43.162	-105.262	168	1	4	4	11
Spring Creek Mine	45.112	-106.904	164	19	789	86	0
Pete Lien And Sons Inc	44.116	-103.281	161	0	24	8	5
203 (name unknown)	47.252	-102.750	160	2	3	3	36
381 (name unknown)	47.805	-103.428	154	2	3	3	24
025-0003 (name unknown)	46.614	-104.419	151	2	2	2	24
Falcon Compressor Station	42.524	-109.673	149	0	6	6	140
Sidney Sugar Facility	47.717	-104.136	149	19	55	24	1
Falcon Compressor Station	42.525	-109.673	148	0	6	6	107
Western Sugar Cooperative	45.770	-108.500	147	4	12	5	3
Willow Creek Compressor Station	42.921	-106.931	147	0	0	0	76
Blue	47.908	-102.758	147	1	1	1	100
Elk Basin Compressor Station	44.979	-108.841	146	0	2	2	8
Hinsdale	48.393	-107.090	142	1	4	4	9
Colony Plant	44.861	-104.142	140	33	123	24	1
Clar	47.632	-102.603	140	1	2	2	27
1026 (name unknown)	48.353	-103.114	140	1	3	3	57
Elk Basin Compressor Station (CIG)	44.978	-108.841	139	0	2	2	8
Casper Refinery	42.859	-106.243	139	165	45	42	216
Huntley	45.900	-108.298	138	1	4	3	9
Elmore Pit	44.359	-105.378	138	25	6	5	3

Facility	Latitude	Longitude	NOx	SO_2	PM_{10}	$PM_{2.5}$	VOC
Calumet Montana Refining	47.525	-111.290	137	5	41	30	356
Flying Creek-Bridge Draw Compressor Station	44.283	-106.158	136	0	7	7	134
379 (name unknown)	47.934	-103.671	135	1	3	3	256
071-0003 (name unknown)	48.743	-107.631	133	0	2	2	54
Flying Creek-Bridge Draw Compressor Station	44.283	-106.158	133	0	7	7	139
Casper Extraction Plant	42.856	-106.238	129	0	0	0	142
377 (name unknown)	48.038	-102.321	128	149	2	2	33
Williston Basin – Cabin Creek	46.614	-104.419	128	2	3	3	10
Glasgow	48.191	-106.626	126	1	3	3	8
241 (name unknown)	48.084	-103.791	124	1	2	2	26
Sheridan	44.814	-106.951	117	1	3	3	7
Casper Extraction Plant	42.856	-106.237	116	0	0	0	16
085-0006 (name unknown)	48.214	-104.395	112	4	2	2	20
1155 (name unknown)	47.930	-103.874	111	1	2	2	23
Koch Pit (761S)	42.902	-110.107	110	0	6	4	0
Zane	47.639	-102.597	110	1	2	2	50
Absaloka Mine	45.804	-107.079	109	20	458	60	1
1074 (name unknown)	48.035	-102.221	107	1	2	2	23
025-0013 (name unknown)	46.394	-104.285	105	1	4	4	60
200 (name unknown)	48.293	-102.950	105	132	2	2	46
228 (name unknown)	47.869	-102.866	104	146	2	2	38
253 (name unknown)	48.345	-103.787	102	1	1	1	36
1164 (name unknown)	48.113	-102.226	102	1	2	2	23
1163 (name unknown)	48.147	-102.225	102	1	2	2	23
1162 (name unknown)	48.183	-102.226	102	1	2	2	23
Glendive	47.100	-104.716	102	1	3	3	6
246 (name unknown)	47.897	-102.992	93	1	1	1	203
210 (name unknown)	47.638	-103.535	85	1	2	2	395
292 (name unknown)	46.168	-103.532	81	135	3	3	46
Smith Ranch-Highland Operations	43.051	-105.685	80	3	193	24	13
025-0001 (name unknown)	46.384	-104.256	78	202	2	2	67
Casper Asphalt Hot Plant (CT-1523)	42.859	-106.370	77	9	2	0	130
Newcastle Refinery	43.848	-104.214	72	277	83	74	76
Hardin Generating Station	45.729	-107.607	71	1	2	2	4
Lost Cabin Gas Plant	43.278	-107.604	61	0	109	109	0
260 (name unknown)	47.338	-103.557	58	1	2	2	205
227 (name unknown)	47.754	-103.295	53	160	1	1	17
239 (name unknown)	48.030	-102.886	52	125	1	1	16
Decker Mine	45.054	-106.822	47	6	387	41	0
Countertops Inc	44.049	-103.189	36	3	35	35	169
Worland Plant	44.012	-107.981	25	1	159	135	0
Casper Extraction Plant	42.856	-106.236	19	0	0	0	142
Stillwater Mine	45.389	-109.876	16	1	116	33	0
Signal Peak Energy – Bull Mountain Mine	46.270	-108.421	16	0	184	28	0
Elk Basin Gas Plant	44.980	-108.843	15	0	0	0	113
CRH US Trident Plant	45.945	-111.477	13	1	139	64	1
Dave Johnston	42.838	-105.777	10	0	476	276	0
Well Draw Booster Station	42.988	-105.137	8	0	0	0	223
Oregon Basin Gas Plant	44.353	-108.903	7	211	1	1	0
Worland Plant #02	44.023	-107.962	2	0	0	0	135
Halfmoon Battery	44.379	-109.086	2	0	0	0	380
Halfmoon Battery	44.379	-109.086	2	0	0	0	293
1045 (name unknown)	48.113	-103.778	1	0	0	0	194
250 (name unknown)	47.981	-103.662	1	0	0	0	192

Facility	Latitude	Longitude	NOx	SO_2	PM_{10}	$PM_{2.5}$	VOC
240 (name unknown)	48.113	-103.782	1	0	0	0	192
214 (name unknown)	47.380	-103.859	1	0	0	0	192
Montana Sulfur & Chemical	45.814	-108.428	1	1926	1	1	0
Grass Creek Mine	43.921	-108.701	0	0	325	14	0
Great Falls Terminal	47.521	-111.221	0	0	0	0	105

Source: EPA 2025 emissions projection from 2011 National Emissions Inventory (https://www.epa.gov/air-emissions-modeling/2011-version-61-platform) as applied in BLM 2016a and BLM 2016b.

(b)

Emissions Category	Regional Emissions (tons / year)					
	PM_{10}	$PM_{2.5}$	NO_x	CO	SO_2	VOC
Point Source	31,915	15,156	98,418	59,984	37,747	22,254
Low-level Anthropogenic	346,881	51,479	76,566	188,103	9,554	285,519
Low-level Biogenic	0	0	23,418	49,898	0	406,356
Fires	7,822	6,004	2,019	44,573	502	7,060
Total – Anthropogenic	**378,796**	**66,635**	**174,984**	**248,087**	**47,301**	**307,773**
Total – All	**386,618**	**72,639**	**200,421**	**342,559**	**47,804**	**721,189**

Source: BLM 2016a

Table D-6-4. Maximum Annual Future Trace Metal HAP Emissions from Fugitive Coal Dust in Areas A, B, C, and AM5

Metal HAP	Concentration in Coal (ppm)			HAP Emissions (lb / year)		
	Area C	Areas A + B	AM5	Area C	Areas A, B	AM5
Antimony	0.41	0.34	0.49	7.76E-03	8.60E-03	2.35E-02
Arsenic	4.63	0.75	1.71	8.76E-02	1.90E-02	8.20E-02
Beryllium	0.25	0.29	0.53	4.73E-03	7.34E-03	2.54E-02
Cadmium	0.09	0.05	0.06	1.70E-03	1.27E-03	2.88E-03
Chromium	5.23	3.23	4.07	9.90E-02	8.17E-02	1.95E-01
Copper	13.82	5.99	6.73	2.61E-01	1.52E-01	3.23E-01
Lead	3.14	3.97	3.99	5.94E-02	1.00E-01	1.91E-01
Manganese	44.26	80.64	79.35	8.37E-01	2.04E+00	3.80E+00
Mercury	0.17	0.06	0.07	3.22E-03	1.52E-03	3.36E-03
Nickel	19.13	1.32	2.72	3.62E-01	3.34E-02	1.30E-01
Selenium	0.43	0.58	0.68	8.14E-03	1.47E-02	3.26E-02

ppm = parts per million
lb/year = pound(s) per year
1. Moisture-corrected, average concentration from coal sampling data provided by PPL Montana (2014)
2. Aggregate data from Areas C, D, and E

Table D-6-5. Potential Maximum Annual Future Diesel Particulate Matter (DPM) Emissions from Areas A, B, C, and AM5

Mine Area(s)	DPM (tons / year)
Area C [1]	7.6
Areas A + B [2]	7.2
AM5	13.7
Total	**28.6**

1. Includes coal production from Area C BLM Lease Modification
2. Includes coal production from AM4, BX and Area B BLM Lease Modification

Table D-6-6. Annual Nitrogen and Sulfur Deposition due to Cumulative Impacts at Class I

Class I Area	Nitrogen Maximum	Nitrogen Average	Sulfur Maximum	Sulfur Average
	(kg/ha)	(kg/ha)	(kg/ha)	(kg/ha)
Badlands National Park	4.3440	3.6055	0.7892	0.6248
Bridger	1.6034	1.3823	0.6176	0.4103
Fitzpatrick	1.5597	1.2957	0.5757	0.4016
Fort Peck Indian Reservation	6.4179	3.0307	1.0845	0.7461
Gates of the Mountains Wilderness	1.4505	1.3682	0.2912	0.2624
Grand Teton National Park	2.0666	1.3386	0.6178	0.3111
Lostwood National Wildlife Refuge	4.9499	4.4264	2.1462	1.7811
Lostwood Wilderness	5.0380	4.7604	2.1462	2.0851
Medicine Lake (Class I)	7.2281	3.6332	0.9564	0.8945
North Absaroka	1.4853	1.0377	0.4479	0.2984
Northern Cheyenne	2.1564	1.5386	0.8018	0.5347
Teton	1.3102	1.0780	0.4475	0.3090
Theo Roosevelt National Park	4.7562	3.6181	1.0431	0.7531
UL Bend National Wildlife Refuge	2.1556	1.9439	0.5030	0.4596
UL Bend Wilderness	1.9928	1.7442	0.4793	0.4270
Washakie	1.3507	1.0188	0.4420	0.2998
Wind Cave National Park	3.1190	2.7765	0.5581	0.5301
Yellowstone National Park	2.2810	1.1178	0.6066	0.2726
Sensitive Class II Area	**Nitrogen Maximum**	**Nitrogen Average**	**Sulfur Maximum**	**Sulfur Average**
	(kg/ha)	(kg/ha)	(kg/ha)	(kg/ha)
Absaroka-Bear	1.8537	1.1265	0.6081	0.3411
Benton Lake	4.4213	3.1133	0.3442	0.3140
Bighorn Canyon	2.4403	1.5934	0.5527	0.3536
Bowdoin National Wildlife Refuge	3.5949	2.8573	0.5730	0.5436
Devils Tower National Monument	2.4143	2.4143	0.3652	0.3652
Fort Union National Historic Site	3.6798	3.6798	0.8191	0.8191
Halfbreed Lake	1.8538	1.6648	0.2648	0.2470
Lake Zahl National Wildlife Refuge	4.4312	4.2050	0.9664	0.9597
Lee Metcalf	1.3593	1.1470	0.3883	0.2979
Little Bighorn National Monument	1.6940	1.6940	0.2869	0.2869
Medicine Lake (Class II)	7.2281	3.6022	0.9564	0.8932
Stewart Lake	2.9475	2.9475	0.5254	0.5254
UL Bend	2.1556	1.8373	0.5030	0.4399

kg = kilograms. ha = hectare.

Table D-6-7. Change in Haze Index at Class I Areas and Contributions from Direct and Indirect Impacts

Class I Area	Cumulative Change in Haze Index Δdv (98th percentile of daily maximum)	Direct (%)	Indirect (%)	# of Days > 0.5 Δdv		# of Days > 1.0 Δdv	
				Direct	Indirect	Direct	Indirect
Badlands NP	20.1	0.1%	5.8%	0	8	0	2
Bridger	7.8	0.2%	5.6%	0	0	0	0
Fitzpatrick	7.9	0.2%	5.1%	0	0	0	0
Flathead IR	26.4	0.4%	8.3%	0	14	0	7
Gates of Mountains	11.1	0.0%	1.8%	0	0	0	0
Grand Teton NP	13.9	0.0%	1.8%	0	0	0	0
Lostwood NWR	23.7	0.1%	6.8%	0	4	0	1
Lostwood Wilderness	23.7	0.1%	6.4%	0	4	0	1
Medicine Lake (Class I)	26.4	0.2%	7.9%	0	9	0	3
North Absaroka	10.4	0.2%	4.0%	0	0	0	0
North Cheyenne	12.0	4.8%	20.8%	2	96	0	21
Teton	8.2	0.1%	4.0%	0	0	0	0
Theo Roosevelt NP	22.5	0.2%	7.3%	0	11	0	4
UL Bend NWR	19.8	0.2%	5.8%	0	3	0	1
UL Bend Wilderness	19.8	0.2%	5.5%	0	2	0	1
Washakie	12.9	0.1%	2.7%	0	0	0	0
Wind Cave NP	15.5	0.2%	5.4%	0	2	0	0
Yellowstone NP	17.4	0.1%	2.6%	0	0	0	0

Table D-6-8. Change in Haze Index at Class I Areas due to Colstrip Units 3 and 4 in the Montana Federal Implementation Plan (source: EPA, 2012)

Class I Area	98th percentile of daily maximum Δdv For 2006, 2007, 2008		Maximum number of days over 0.5 Δdv for 2006, 2007, 2008	
	Colstrip Unit 3	Colstrip Unit 4	Colstrip Unit 3	Colstrip Unit 4
North Absaroka Wilderness	0.200	0.168	1	1
Theodore Roosevelt National Park	0.498	0.485	7	7
UL Bend National Wildlife	0.471	0.468	6	6
Washakie Wilderness Area	0.223	0.223	2	2
Yellowstone National Park	0.151	0.148	1	1

Source: Modeling Report: Montana Regional Haze Federal Implementation Plan (FIP) Support. https://www.regulations.gov/document?D=EPA-R08-OAR-2011-0851-0035

Table D-6-9. Maximum Annual Average Air Concentration and Annual Deposition of HAPs from total Rosebud Mine fugitive coal dust emissions

Metal HAP	Maximum Annual Average Air Concentration [1] (μg/m^3)	Maximum Deposition Flux [1] (kg/ha-year)
Antimony	1.91E-07	1.66E-04
Arsenic	8.43E-07	7.32E-04
Beryllium	1.80E-07	1.56E-04
Cadmium	2.77E-08	2.41E-05
Chromium	1.78E-06	1.55E-03
Copper	3.49E-06	3.03E-03
Lead	1.79E-06	1.55E-03
Manganese	3.39E-05	2.95E-02
Mercury	3.61E-08	3.13E-05
Nickel	2.25E-06	1.96E-03
Selenium	2.78E-07	2.42E-04

Deposition Flux = Deposition per unit area per unit time
μg/m^3 = micrograms per cubic meter
kg/ha-year = kilogram per hectare per year
1. The annual average concentration and deposition flux of each HAP are calculated using the average concentration in Areas A, B, C, F, and AM5 weighted by the coal fugitive dust emissions of each area.

Table D-6-10. Estimated contribution of Colstrip 3 and 4, and Rosebud Power Plant mercury emissions to regional wet mercury deposition

Year	Annual Precipitation[1]	Mercury Wet Deposition		Contribution of Colstrip 3 and 4 + Rosebud Power Plant to Wet Deposition at Badger Peak
		Measured value at MDN Badger Peak monitor location[1]	Modeled value due to Colstrip 3 and 4 + Rosebud Power Plant at same location[2]	
	(cm)	(µg/m^2-year)	(µg/m^2-year)	(%)
2011	63.02	6.641	0.024	0.36%
2012[3]	22.94	3.833	0.009	0.24%
2013[3]	47.68	5.037	0.020	0.40%
2014	41.02	4.532	0.023	0.51%
2015	39.04	5.989	0.019	0.32%

cm = centimeter; µg/m^2-year = micrograms per square meter per year; % = percent

1. Data from the Mercury Deposition Network (MDN)
2. The modeled mercury wet deposition at the location of the Badger Peak MDN monitor
3. Data from 2012 and 2013 at Badger Peak showed 69% and 70% completeness compared to the 75% recommended completeness criterion.

Table D-6-11. Cumulative Mercury Deposition and Estimated Relative Contribution of Colstrip 3 and 4, and Rosebud Power Plant

Wet + Dry Mercury Annual Deposition Flux		Contribution of Colstrip 3 and 4, and Rosebud Power Plant to Cumulative Mercury Deposition
Cumulative [1]	**Contribution from Colstrip 3 and 4 and Rosebud Power Plant [2]**	
(µg/m^2-year)	(µg/m^2-year)	**(%)**
19 (range of 18-20)	0.20 [3]	1.05%
	1.45 [4]	7.63%

µg/m^2-year = micrograms per square meter per year
% = percentage
1. Midpoint of 18-20 range modeled by Corbitt et al. (2011) for wet + dry annual deposition flux in 2005 (Figure 6 of Corbitt et al.)
2. Modeled annual wet + dry deposition flux from indirect effects due to Colstrip 3 and 4 and Rosebud Power Plant (average over 2011-2015)
3. Modeled wet + dry deposition due to indirect effects at location of Badger Peak MDN site
4. Modeled wet + dry deposition due to indirect effects at location of spatial maximum

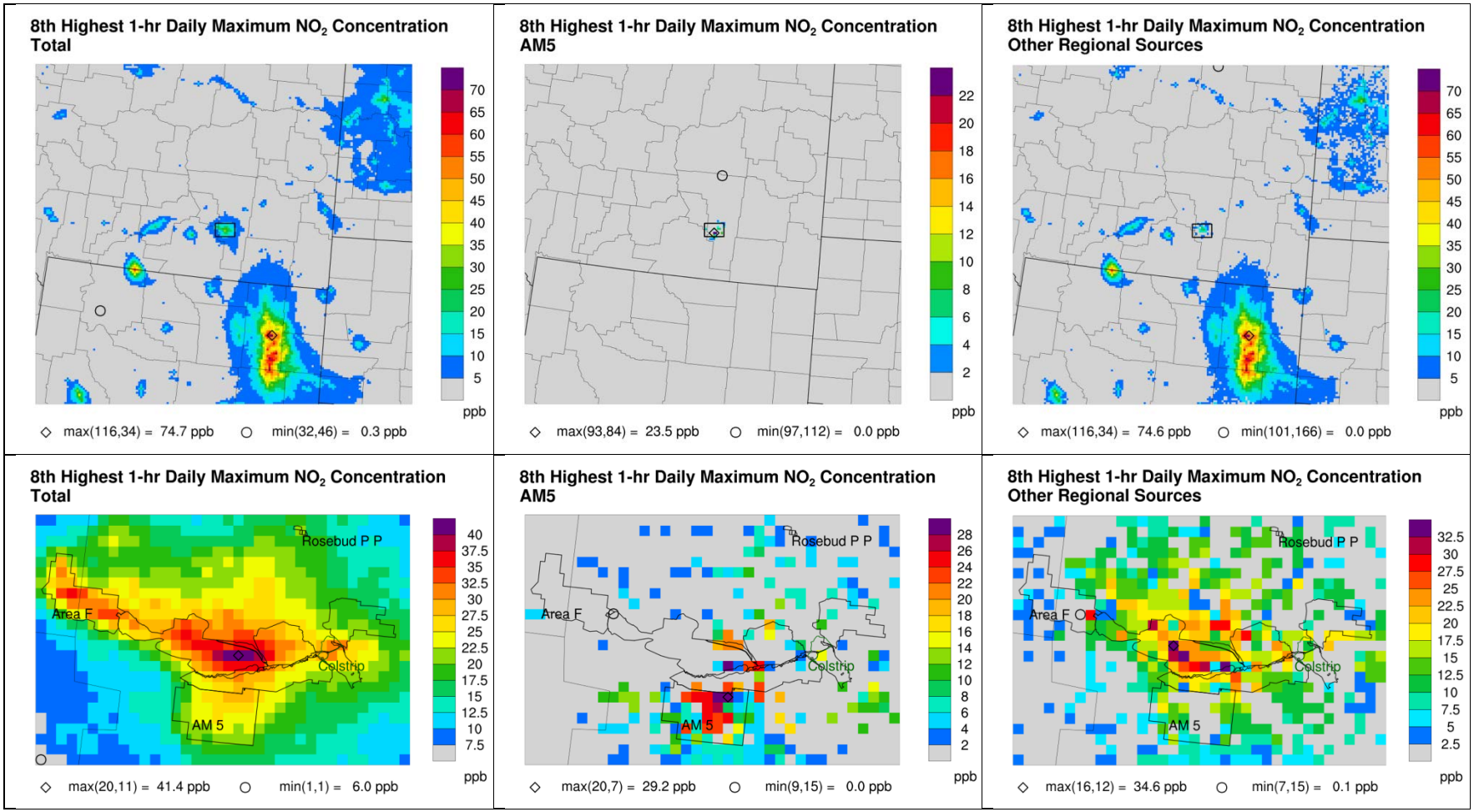


Figure D-6-1. Spatial distribution of cumulative 1-hour NO_2 (left) and contributions from AM5 (middle) and other regional sources (right) within the 4 km (top) and 1 km (bottom) modeling domains, respectively.

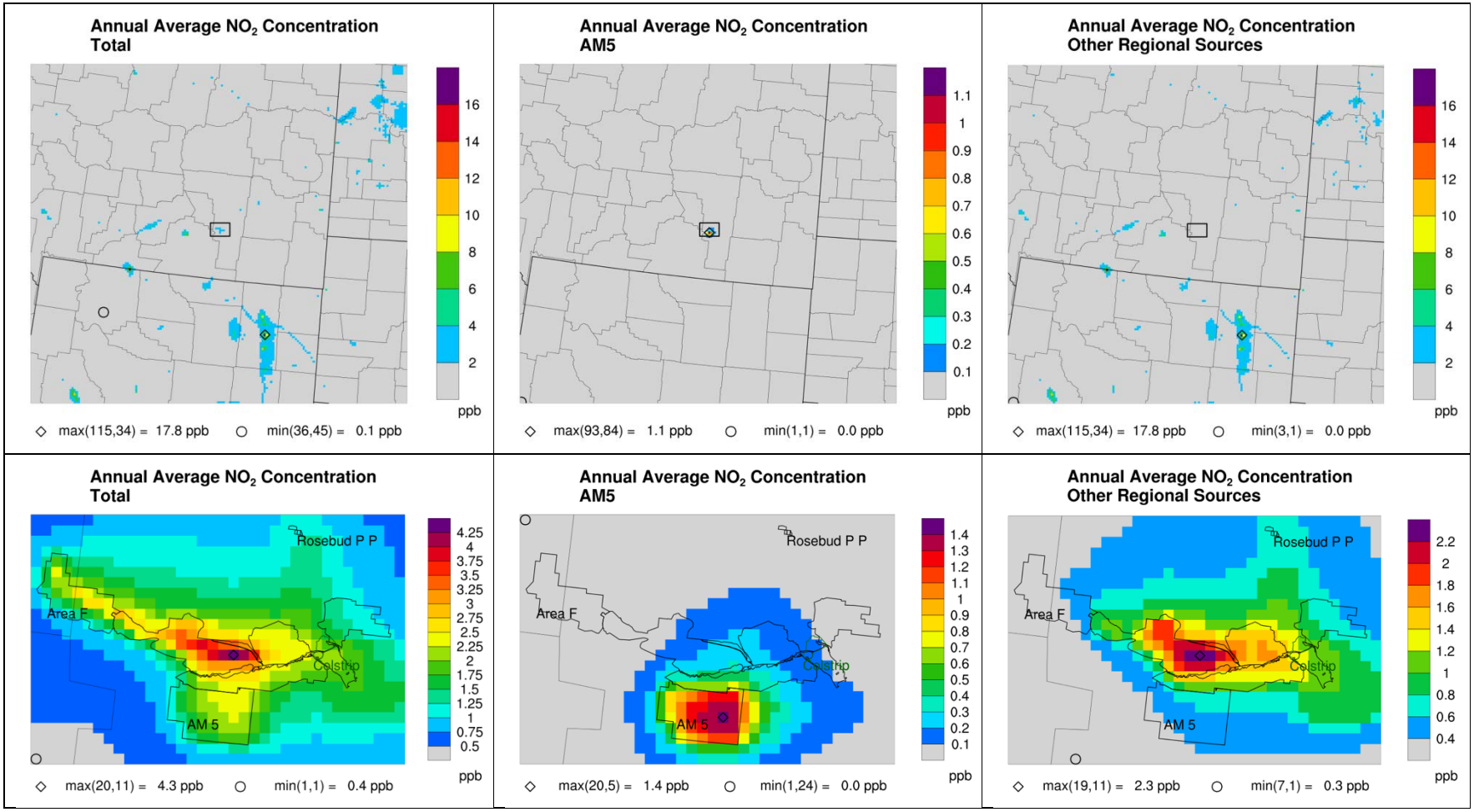


Figure D-6-2. Spatial distribution of cumulative annual average NO_2 (left) and contributions from AM5 (middle) and other regional sources (right) within the 4 km (top) and 1 km (bottom) modeling domains, respectively.

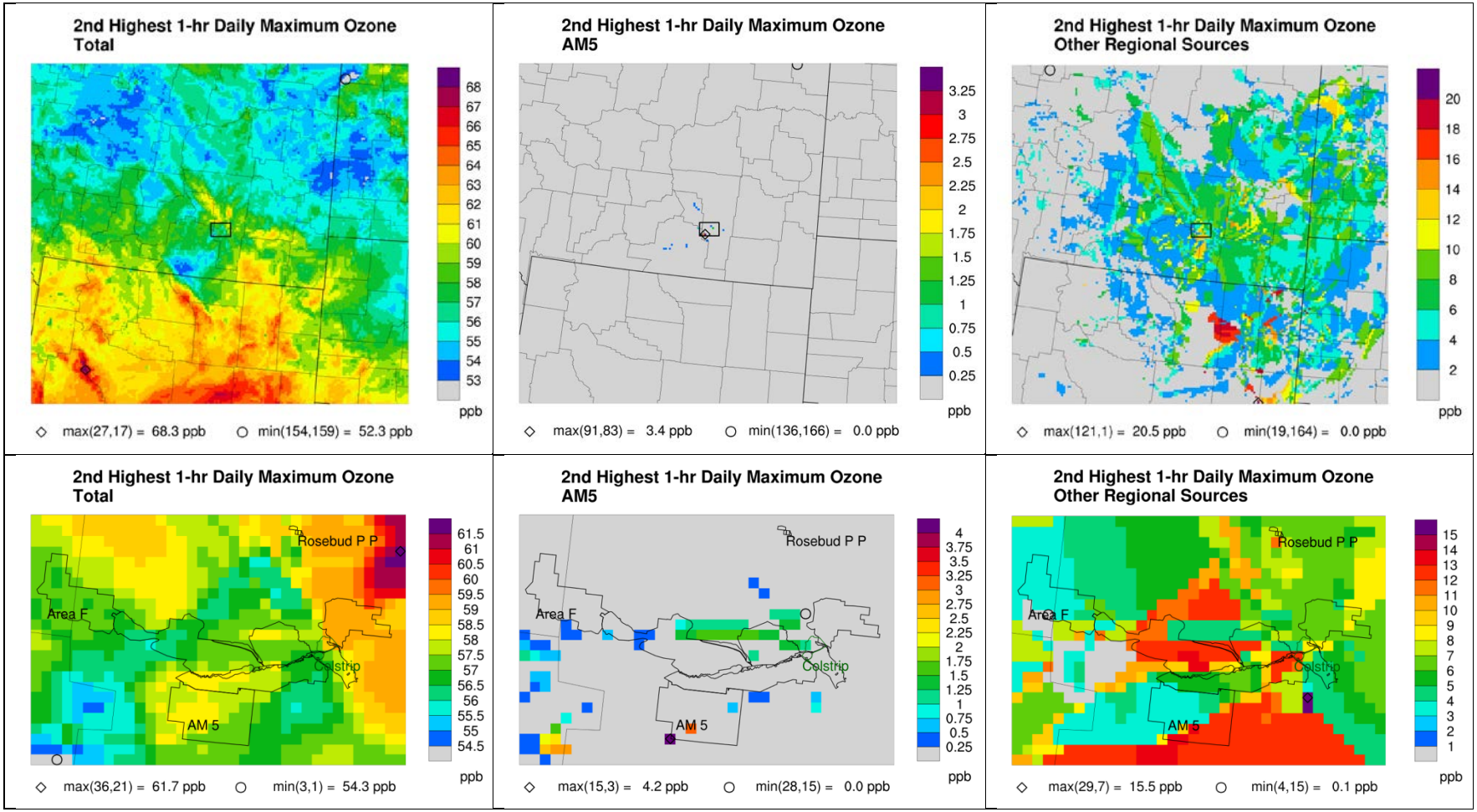


Figure D-6-3. Spatial distribution of cumulative 2nd highest 1-hour O_3 (left) and contributions from AM5 (middle) and other regional sources (right) within the 4 km (top) and 1 km (bottom) modeling domains, respectively.

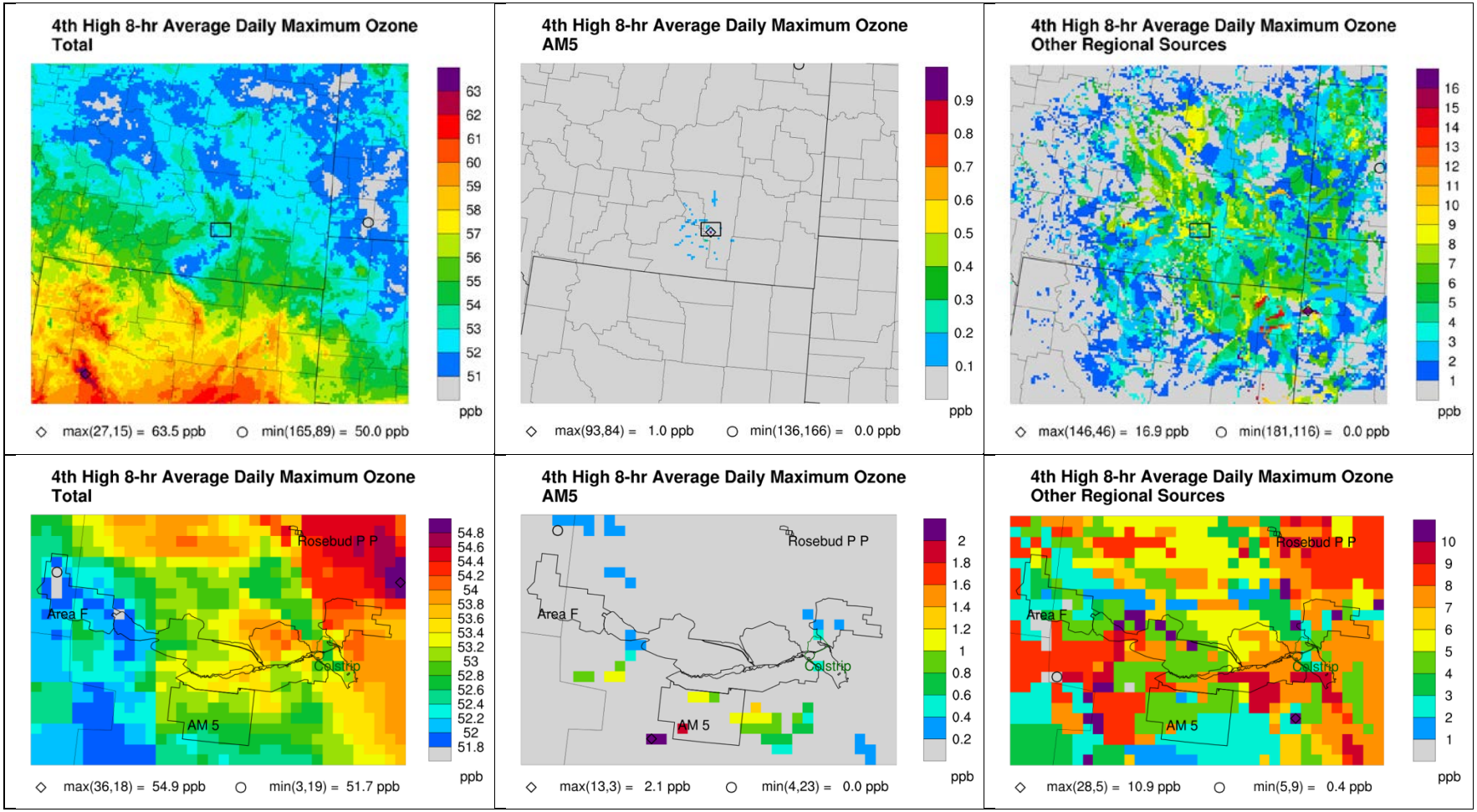


Figure D-6-4. Spatial distribution of cumulative 4th highest 8-hour O_3 (left) and contributions from AM5 (middle) and other regional sources (right) within the 4 km (top) and 1 km (bottom) modeling domains, respectively.

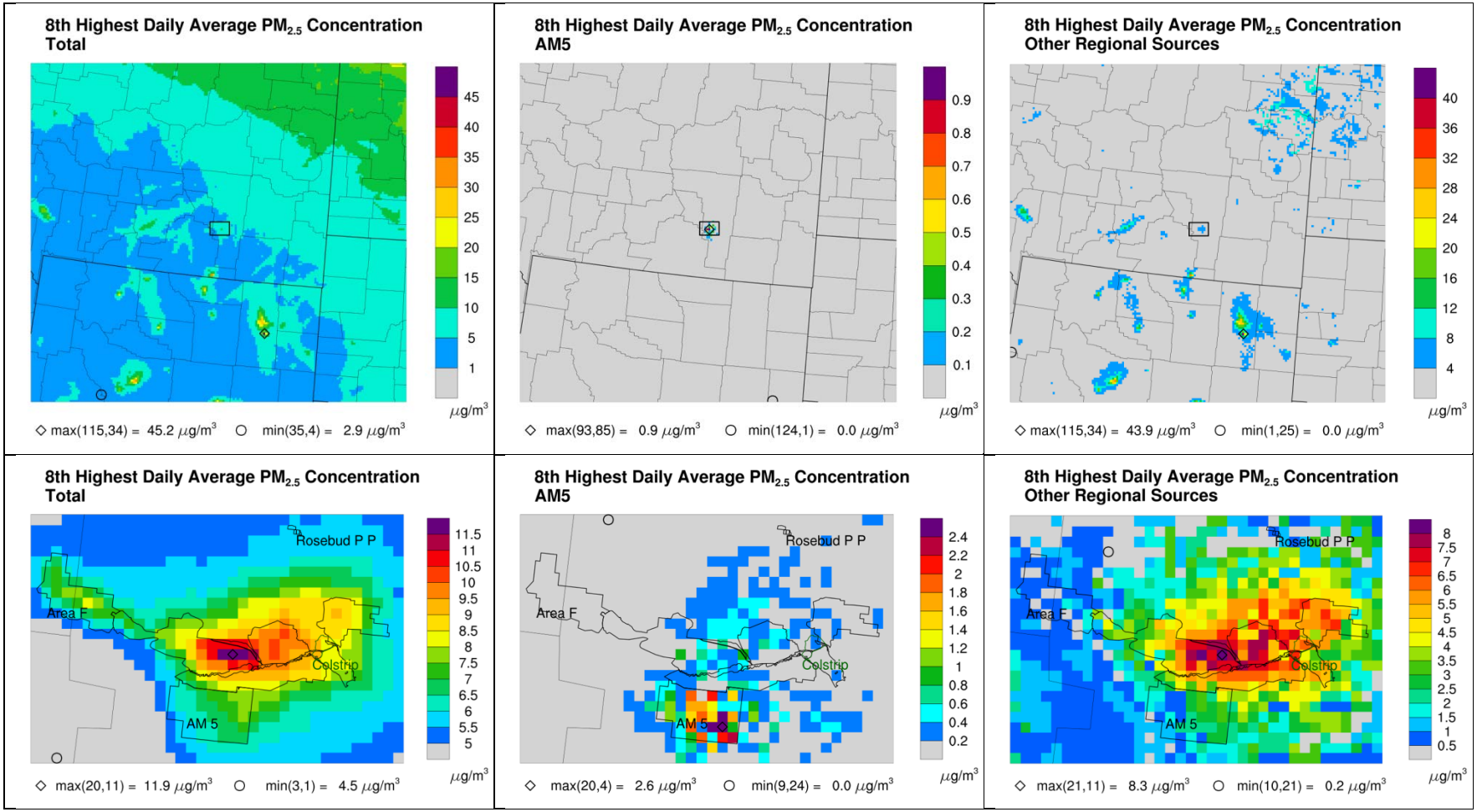


Figure D-6-5. Spatial distribution of cumulative 8th highest daily $PM_{2.5}$ (left) and contributions from AM5 (middle) and other regional sources (right) within the 4 km (top) and 1 km (bottom) modeling domains, respectively.

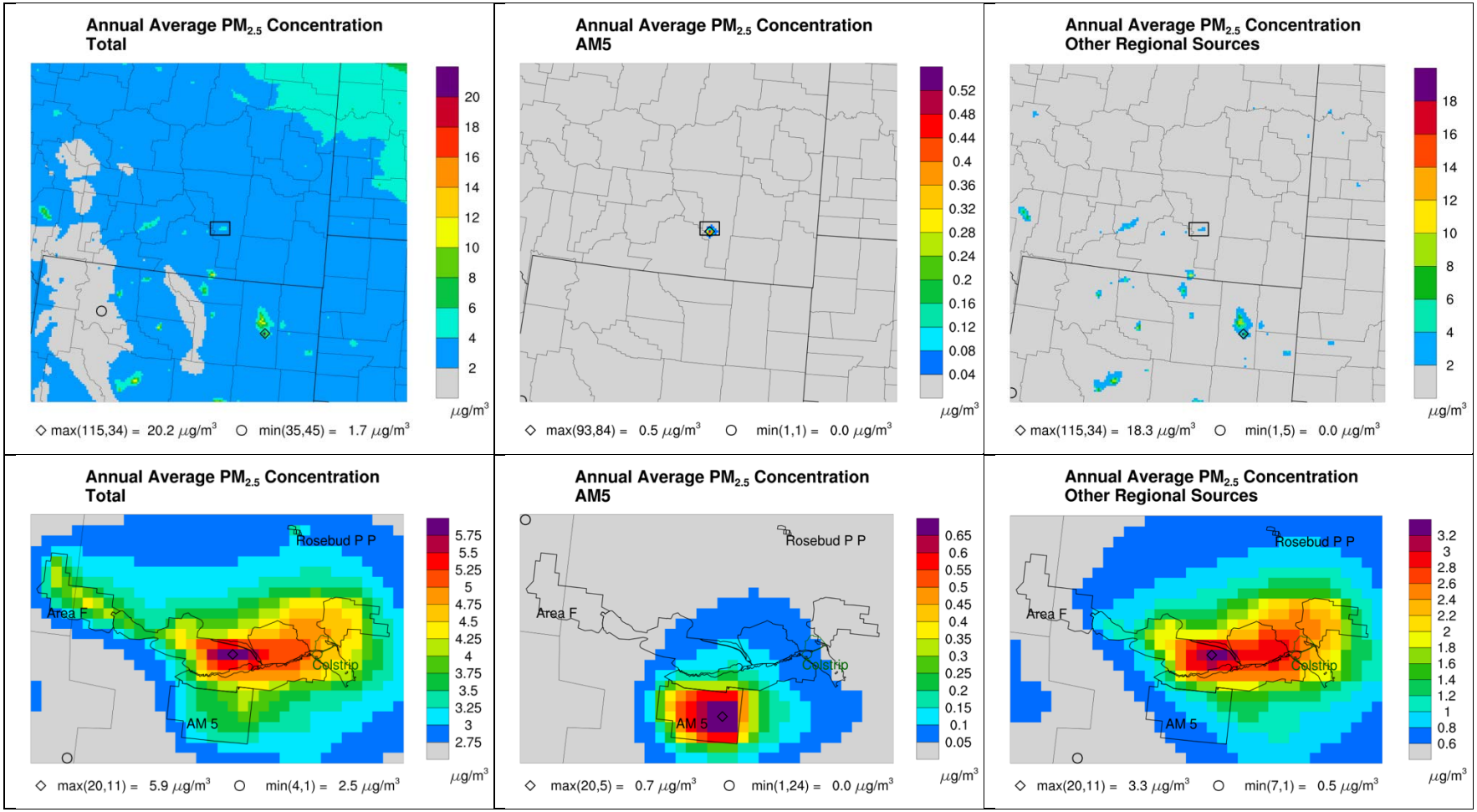


Figure D-6-6. Spatial distribution of cumulative annual average $PM_{2.5}$ (left) and contributions from AM5 (middle) and other regional sources (right) within the 4 km (top) and 1 km (bottom) modeling domains, respectively.

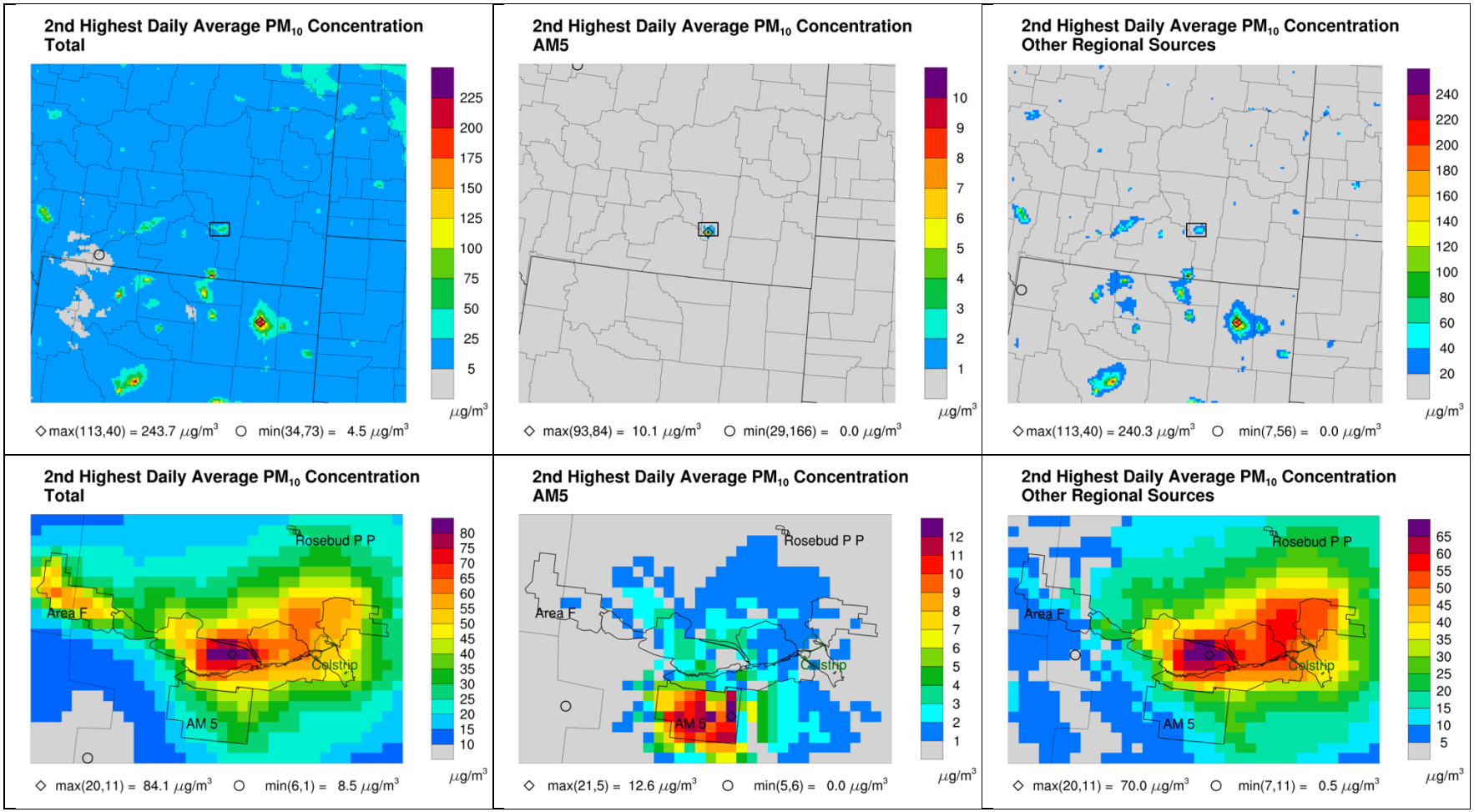


Figure D-6-7. Spatial distribution of cumulative 2nd highest daily PM_{10} (left) and contributions from AM5 (middle) and other regional sources (right) within the 4 km (top) and 1 km (bottom) modeling domains, respectively.

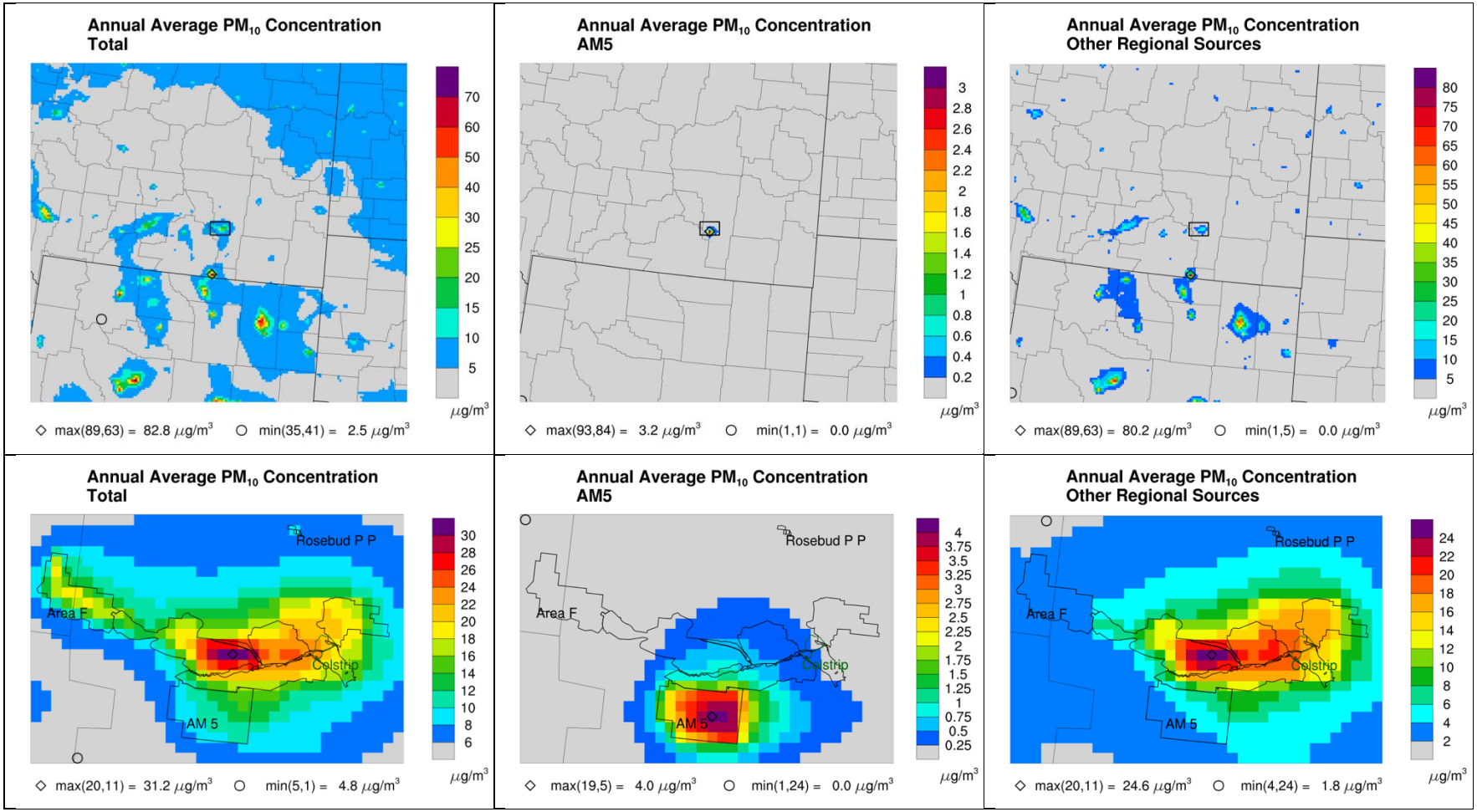


Figure D-6-8. Spatial distribution of cumulative annual average PM_{10} (left) and contributions from AM5 (middle) and other regional sources (right) within the 4 km (top) and 1 km (bottom) modeling domains, respectively.

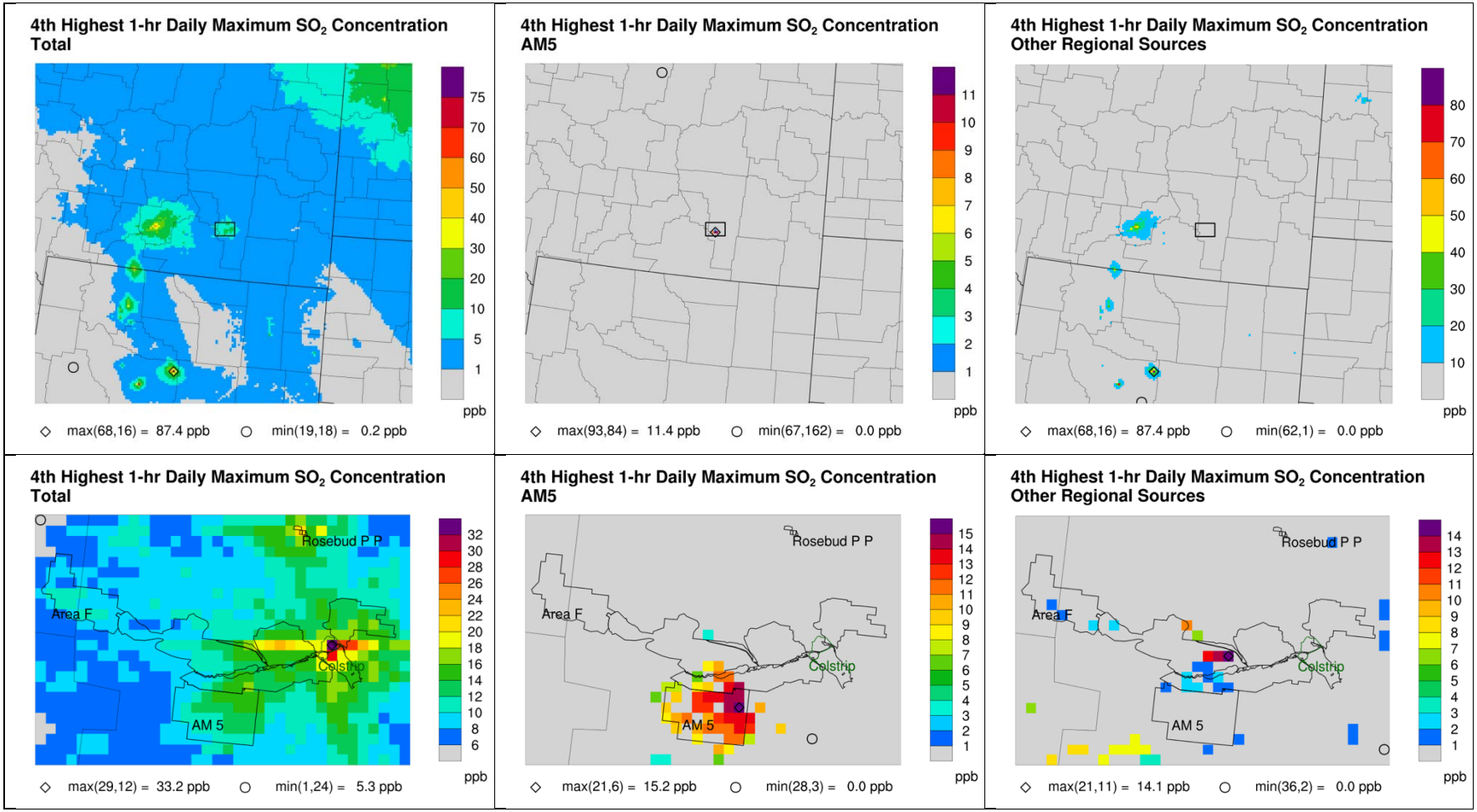


Figure D-6-9. Spatial distribution of cumulative 4th highest 1-hour SO_2 (left) and contributions from AM5 (middle) and other regional sources (right) within the 4 km (top) and 1 km (bottom) modeling domains, respectively.

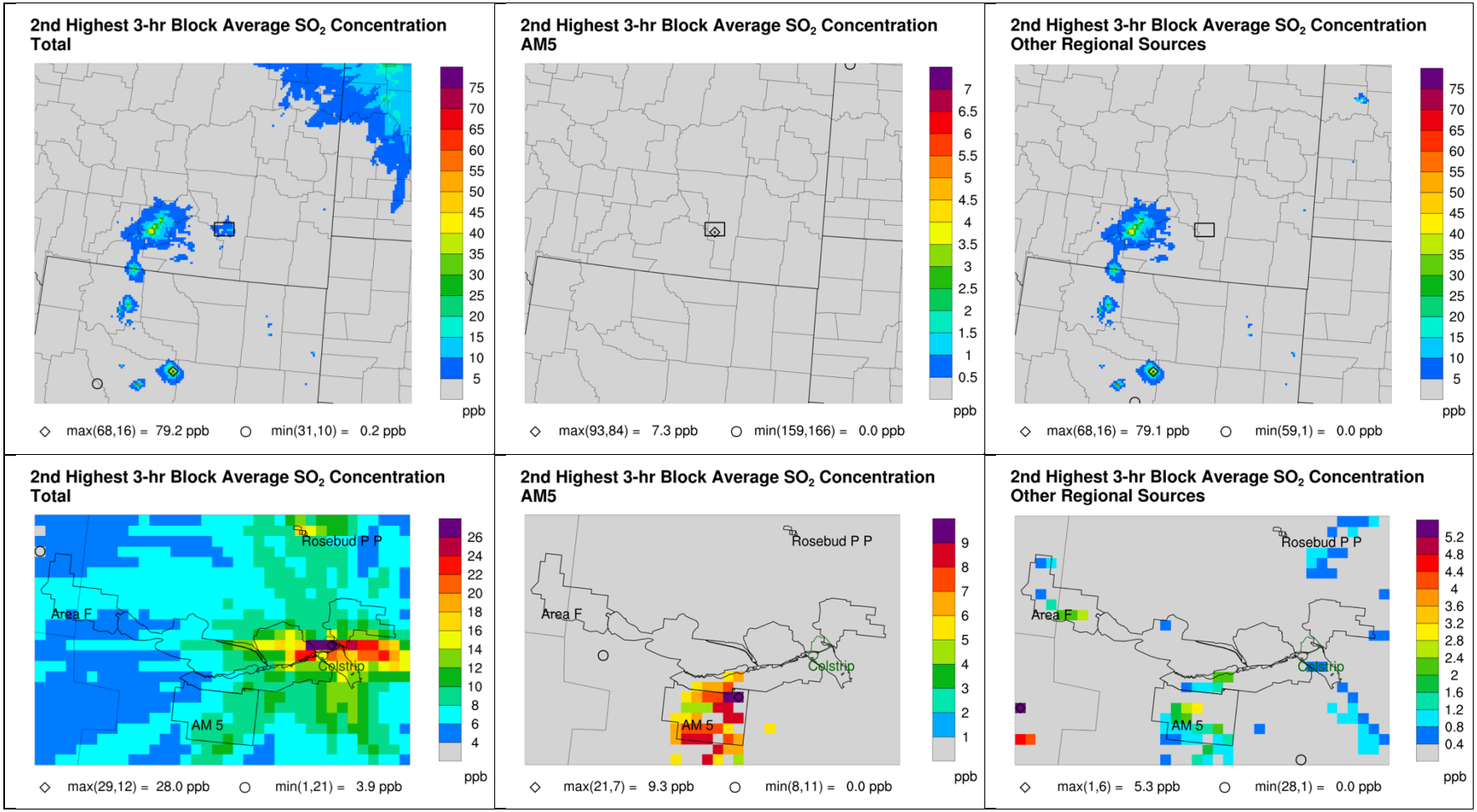


Figure D-6-10. Spatial distribution of cumulative 2nd highest 3-hour SO_2 (left) and contributions from AM5 (middle) and other regional sources (right) within the 4 km (top) and 1 km (bottom) modeling domains, respectively.

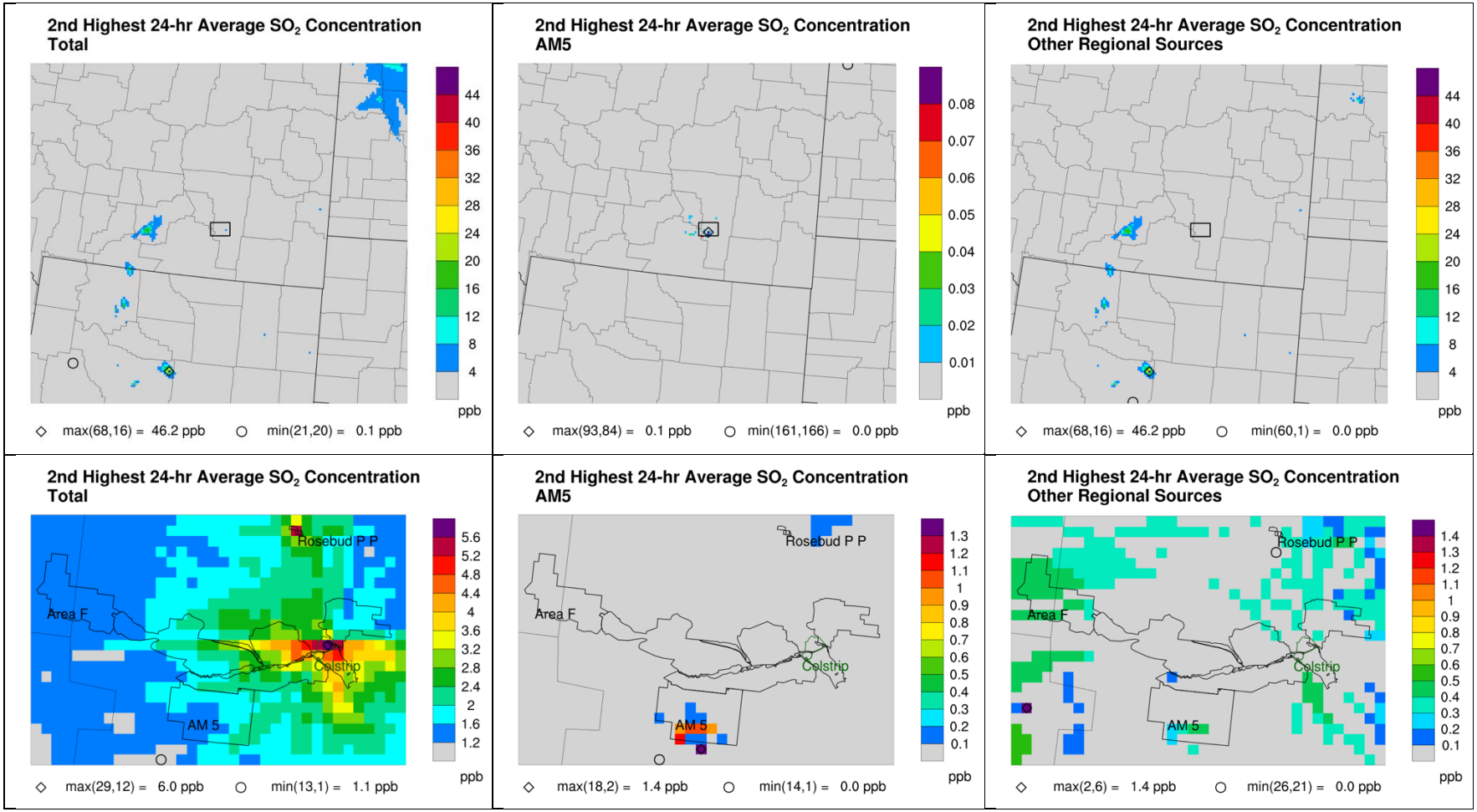


Figure D-6-11. Spatial distribution of cumulative 2nd highest 24-hour SO_2 (left) and contributions from AM5 (middle) and other regional sources (right) within the 4 km (top) and 1 km (bottom) modeling domains, respectively.

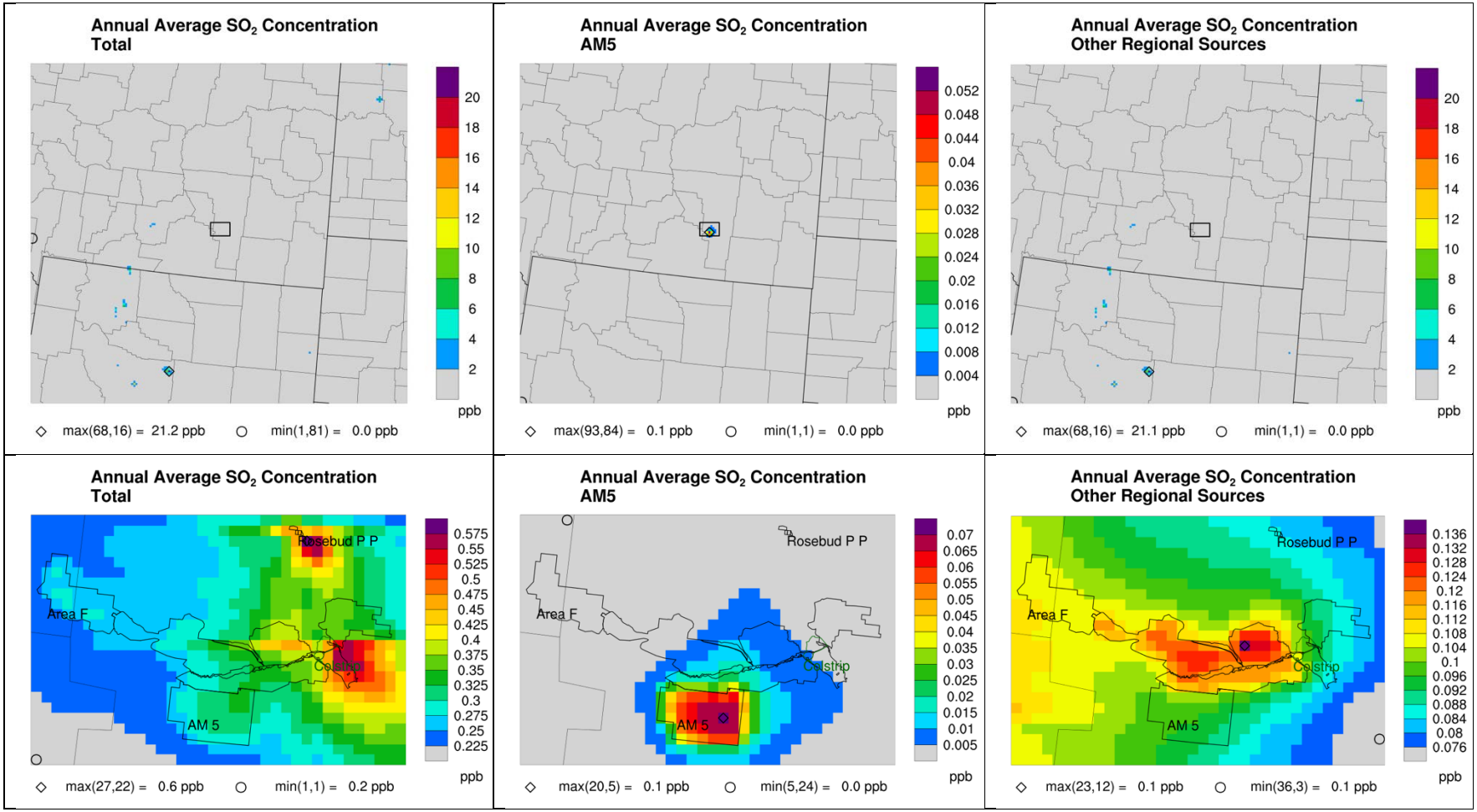


Figure D-6-12. Spatial distribution of cumulative annual average SO_2 (left) and contributions from AM5 (middle) and other regional sources (right) within the 4 km (top) and 1 km (bottom) modeling domains, respectively.

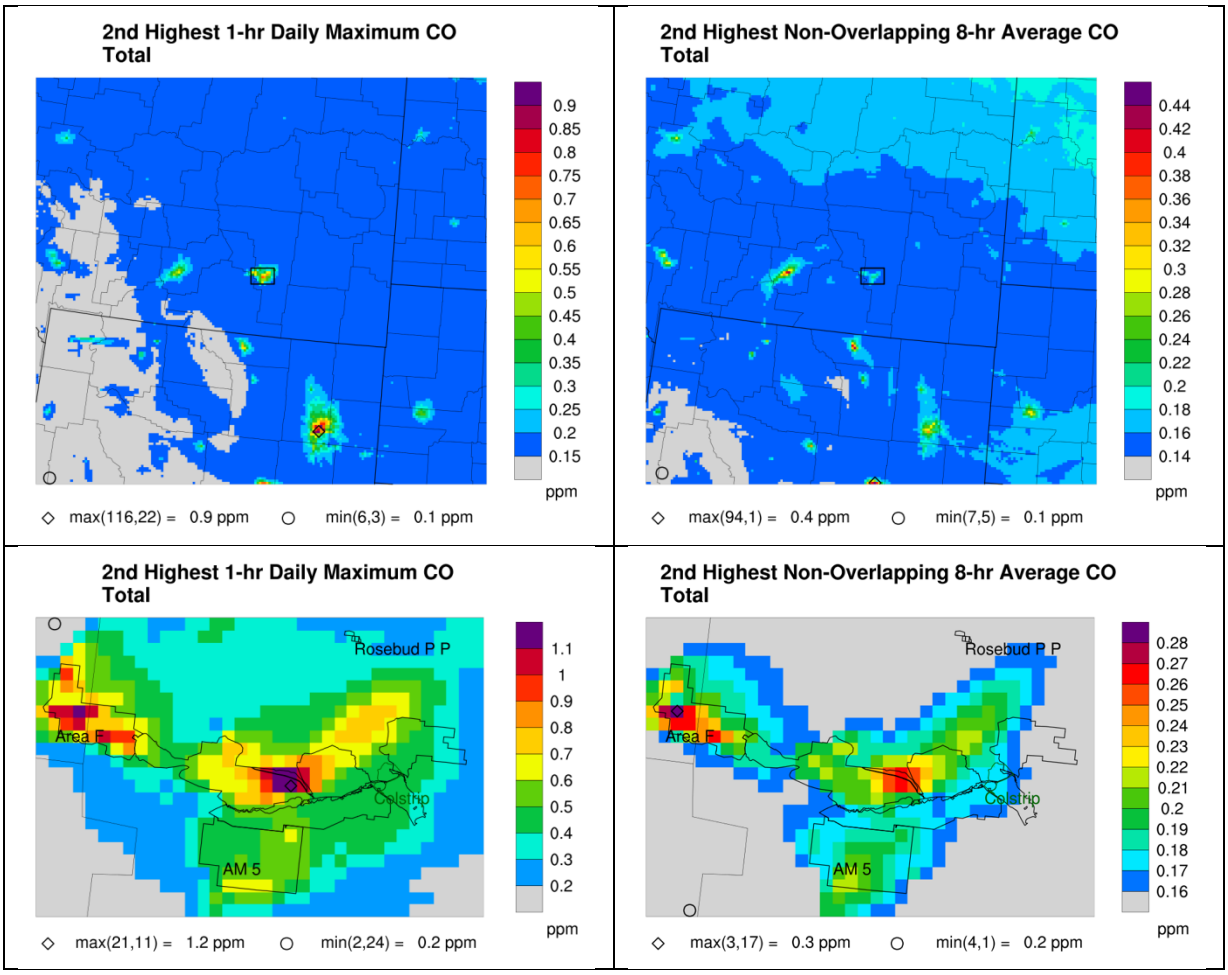


Figure D-6-13. Spatial distribution of cumulative 2nd highest 1-hour (left) and 8-hour (right) CO concentrations within the 4 km (top) and 1 km (bottom) modeling domains, respectively.

Table D-6-12. CAMx modeling results at Nonattainment/Maintenance Areas in Montana and Wyoming within the Air Quality Analysis Area.

(a) Montana

Location	Pollutant	NAAQS Violated	Nonattainment Designation	AQS Site ID	Total (ppb)	Source contribution (ppb)					
						Direct	Indirect	Colstrip 12	AM5	Other Regional Sources	Boundary Conditions
Laurel	SO_2	1971 (24-hr)	March 03, 1978	30-111-0016	6.8	0.0	0.1	0.0	0.0	6.6	0.1
Billings	SO_2	2010 (1-hr)	August 05, 2013	30-111-0066	40.7	0.0	0.0	0.0	0.0	40.7	0.0
Lame Deer	PM_{10}	1987 (24-hr)	November 15, 1990	30-087-0307	17.5	0.0	0.0	0.0	0.2	14.9	2.3

Concentrations may not add up exactly due to rounding.

(b) Wyoming

Location	Pollutant	NAAQS Violated	Nonattainment Designation	AQS Site ID	Total (ppb)	Source contribution (ppb)					
						Direct	Indirect	Colstrip 12	AM5	Other Regional Sources	Boundary Conditions
Sheridan	PM_{10}	1971 (24-hr)	November 15, 1990	56-033-0001	84.9	0.0	0.0	0.0	0.0	82.6	2.1
Sheridan	PM_{10}	1971 (24-hr)	November 15, 1990	56-033-0002	52.1	0.0	0.0	0.0	0.0	48.9	3.0
Sheridan	PM_{10}	1971 (24-hr)	November 15, 1990	56-033-0003	82.5	0.0	0.0	0.0	0.0	79.5	2.8
Sheridan	PM_{10}	1971 (24-hr)	November 15, 1990	56-033-1003	84.9	0.0	0.0	0.0	0.0	82.6	2.1
Upper Green River Basin	O_3	2008 (8-hr)	July 20, 2012	56-035-0097	58.3	0.0	0.0	0.0	0.0	0.0	58.3
Upper Green River Basin	O_3	2008 (8-hr)	July 20, 2012	56-035-0099	59.8	0.0	0.0	0.0	0.0	0.2	59.5
Upper Green River Basin	O_3	2008 (8-hr)	July 20, 2012	56-035-0100	59.4	0.0	0.0	0.0	0.0	0.1	59.4
Upper Green River Basin	O_3	2008 (8-hr)	July 20, 2012	56-035-0101	59.2	0.0	0.0	0.0	0.0	0.3	58.9
Upper Green River Basin	O_3	2008 (8-hr)	July 20, 2012	56-035-0700	59.2	0.0	0.0	0.0	0.0	0.0	59.2

Concentrations may not add up exactly due to rounding

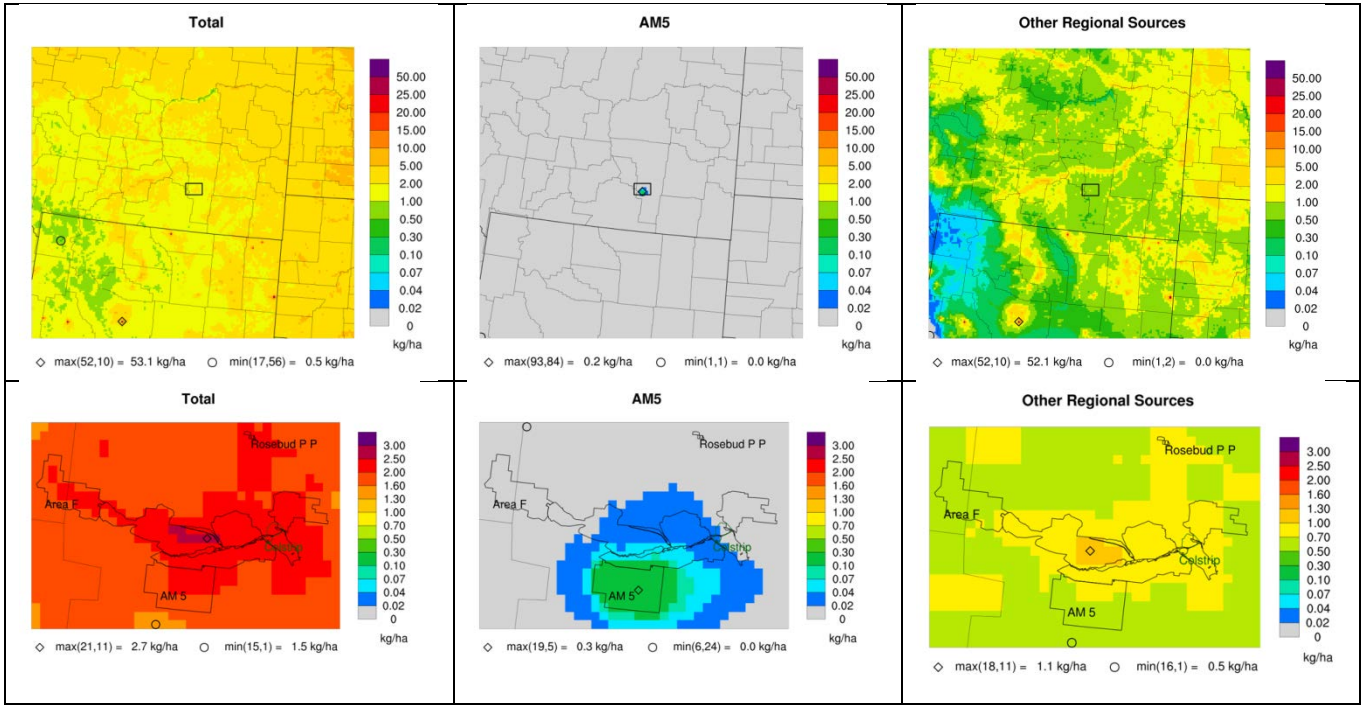


Figure D-6-14. Spatial distribution of annual cumulative nitrogen deposition (left) and contributions from AM5 (middle) and other regional sources (right) within the 4 km (top) and 1 km (bottom) modeling domains, respectively.

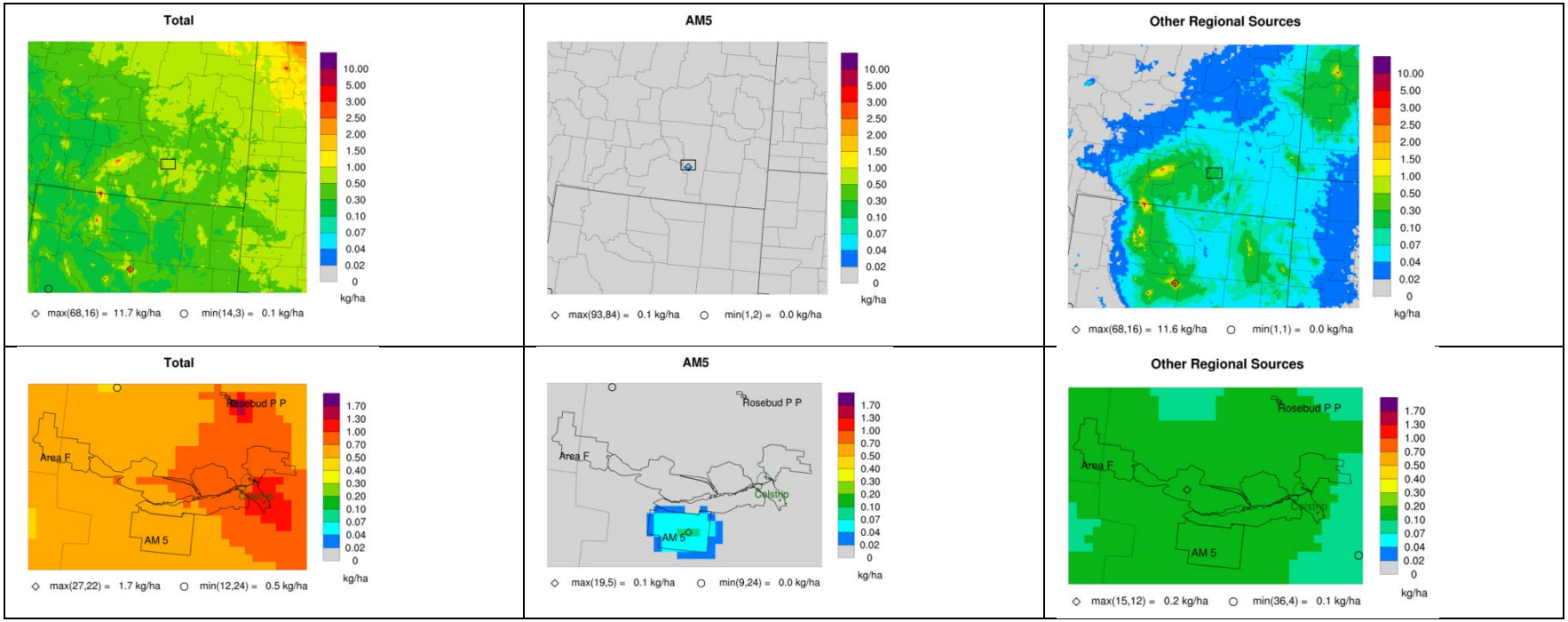


Figure D-6-15. Spatial distribution of annual cumulative sulfur deposition (left) and contributions from AM5 (middle) and other regional sources (right) within the 4 km (top) and 1 km (bottom) modeling domains, respectively.

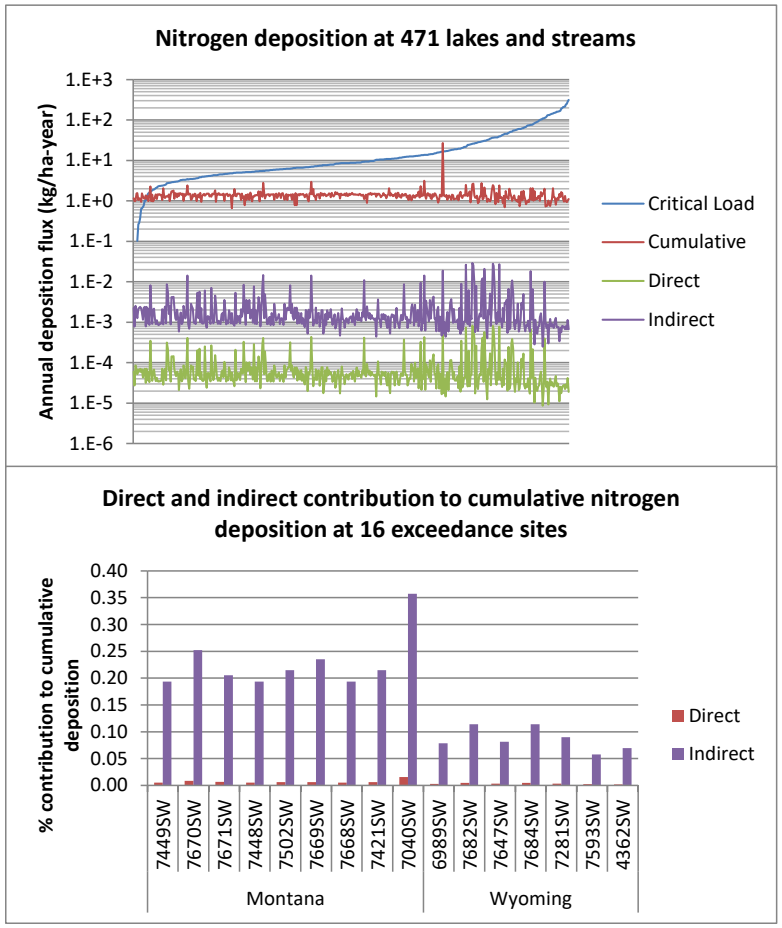


Figure D-6-16. Comparison of cumulative nitrogen deposition to critical loads of nitrogen-based acidity for surface waters (top) and relative contribution of direct and indirect impacts to cumulative deposition at locations with exceedance of the critical load (bottom).

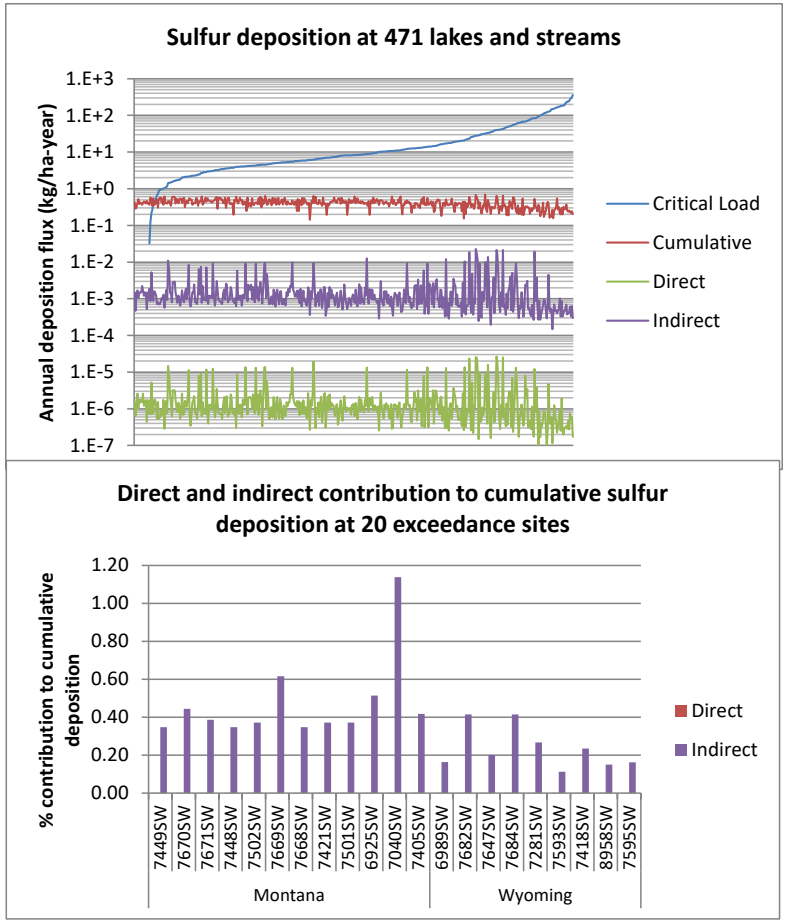


Figure D-6-17. Comparison of cumulative sulfur deposition to critical loads of sulfur-based acidity for surface waters (top) and relative contribution of direct and indirect impacts to cumulative deposition at locations with exceedance of the critical load (bottom).

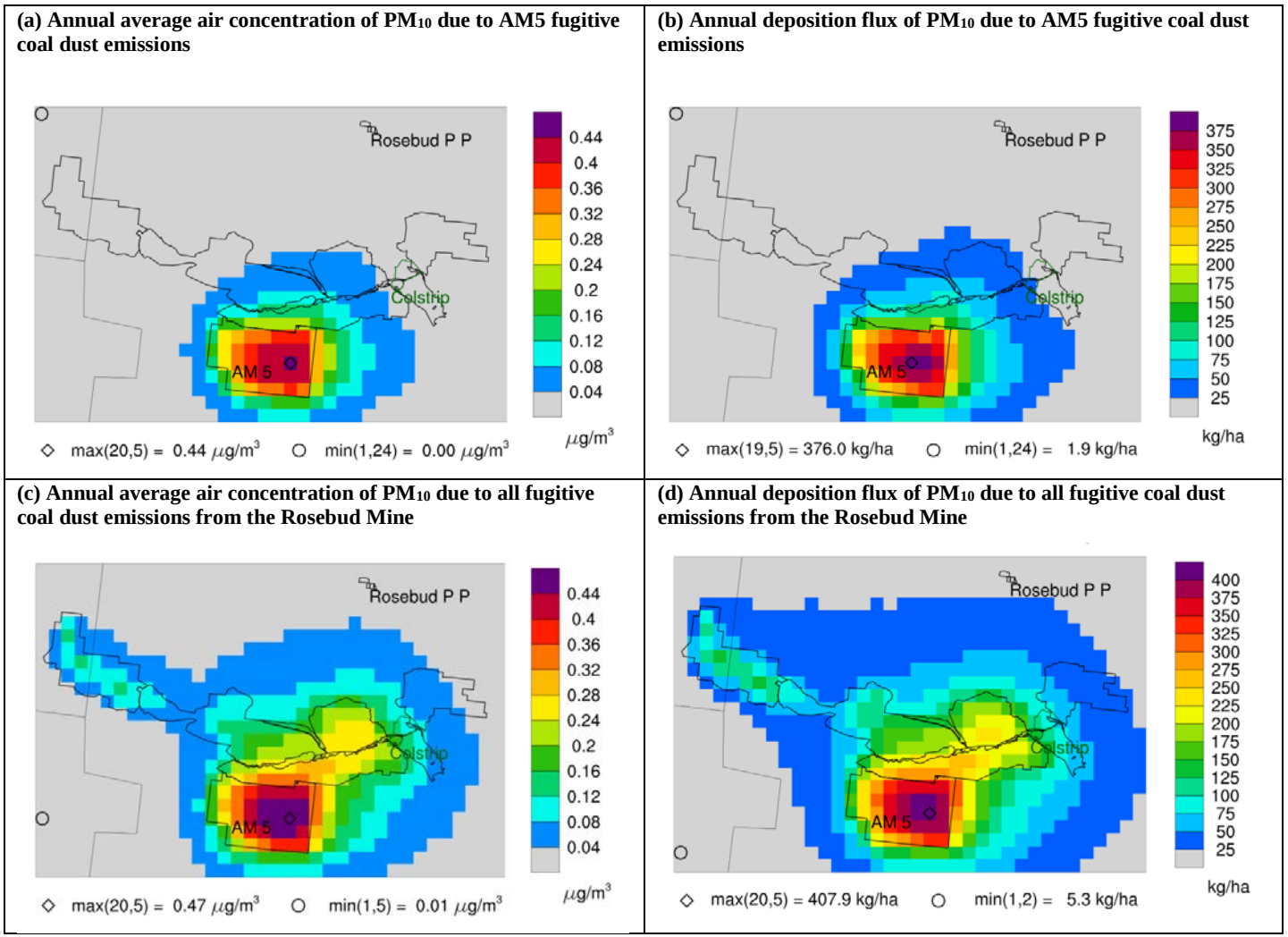
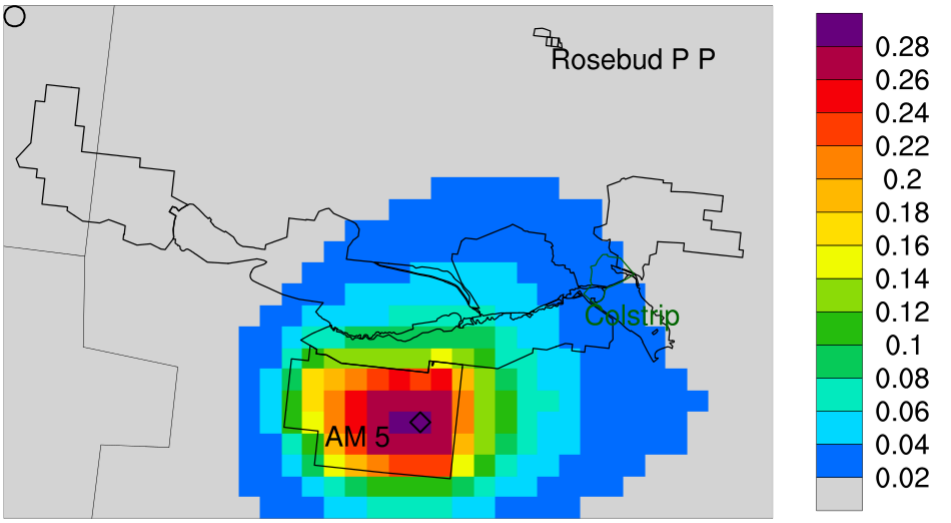


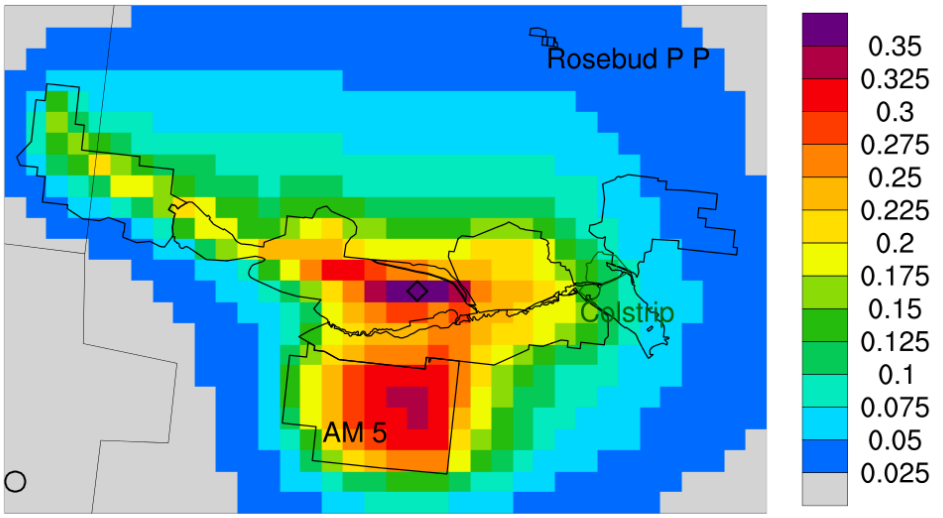
Figure D-6-18. Spatial distribution of the annual average air concentration of PM_{10} (left) and annual deposition of HAP-containing fugitive coal dust (right) due to AM5 emissions (top) and emissions from all coal dust emissions from current and future areas at the Rosebud Mine (bottom).

(a) Annual average air concentration of DPM due to AM5 diesel exhaust emissions



◇ max(20,5) = 0.29 $\mu g/m^3$ ○ min(1,24) = 0.00 $\mu g/m^3$

(c) Annual average air concentration of DPM due to all Rosebud Mine diesel exhaust emissions



◇ max(20,11) = 0.37 $\mu g/m^3$ ○ min(1,2) = 0.01 $\mu g/m^3$

Figure D-6-19. Spatial distribution of annual average DPM air concentrations due to (a) AM5 and (b) total current and future Rosebud Mine diesel exhaust emissions.

APPENDIX D-7.

Supplemental Information, Rosebud Area F Photochemical Model (CAMx) Inputs and Configuration

SUPPLEMENTAL INFORMATION, ROSEBUD AREA F EIS PHOTOCHEMICAL MODEL (CAMx) INPUTS AND CONFIGURATION RAMBOLL, MAY 2018

This supplemental document provides information on the inputs and configuration settings used to perform the photochemical grid modeling (PGM) with the Comprehensive Air Quality Model with Extensions (CAMx) (www.camx.com) in support of the Rosebud Mine Area F Environmental Impact Statement (Rosebud Area F EIS). Additional information on the inputs and configuration is provided in Section 4.3 of the EIS. The modeling performed for the Rosebud Area F EIS relies on data developed for the Bureau of Land Management Montana/Dakotas State Office photochemical grid modeling (BLM-MT/DK PGM) study (Ramboll Environ and Kleinfelder, 2016a).

Modeling Domain

This section provides details on the projection as well as the extent of the horizontal domain definitions for both the 4 km and 1 km horizontal resolution computational domains used for the analysis. The PGM vertical layer structure is based on the definition of the mesoscale meteorological model (Weather Research and Forecast Model, WRF) vertical layers. WRF was run for the BLM-MT/DK study with 37 vertical layer interfaces. A layer averaging scheme was adopted for the PGM simulations whereby multiple WRF layers are combined into one PGM layer to reduce the air quality model computational time, a process referred to as "layer collapsing." As a result of the layer collapsing, the CAMx modeling was performed using a total of 25 vertical layers described below. Description of the model configuration and inputs are provided in subsequent sections; the CAMx FlexiNesting algorithm was used to interpolate the model-ready meteorology and emissions from the 4 km (parent grid) to the 1 km (nested) grid. Project-specific emissions were explicitly provided for the 1 km domain.

Table D-7-1. CAMx Horizontal Modeling Domain Definition

Projection Definition		
Parameters		**Value**
Projection		Lambert-Conformal Conic
Datum		World Geodetic System 1984
Standard Parallel 1		33° latitude N
Standard Parallel 2		45° latitude N
Central Meridian		97° longitude W
Latitude of Origin		40° latitude N
Domain	**Number of Grid Cells**	**Coordinates of Southwestern Corner of Grid (km)**
4 km	186 x 168	-1128, 348
1 km	38 x 26[a]	-773, 679[a]

[a] Includes 'buffer' cells

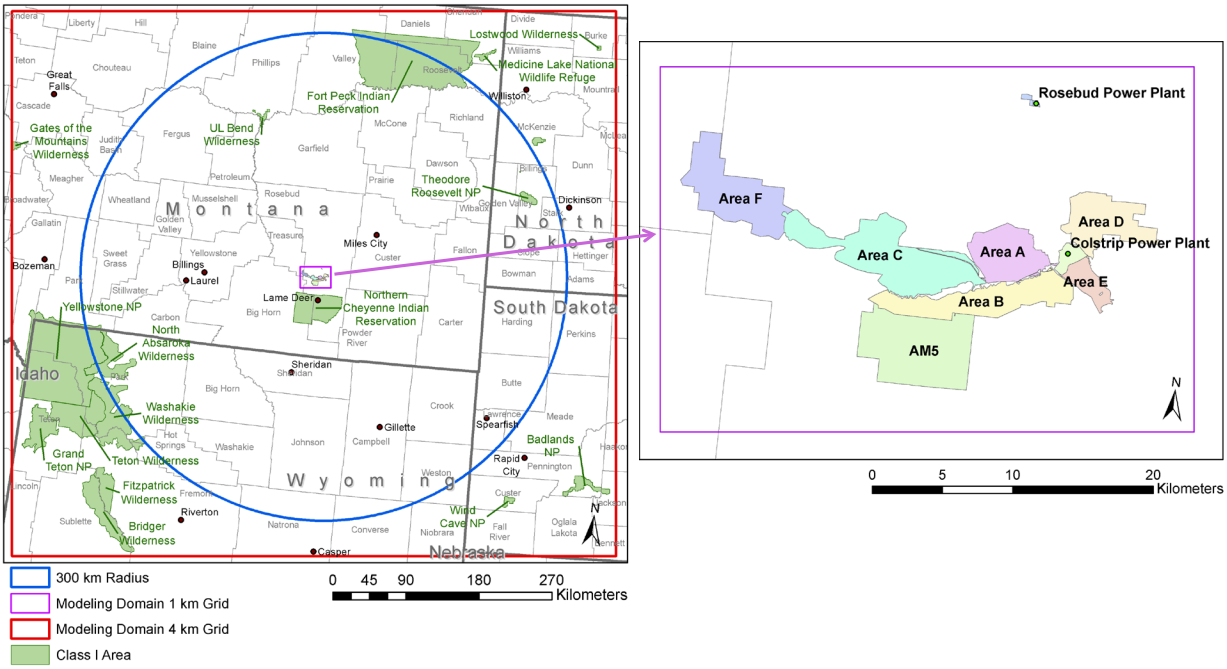


Figure D-7-1. 4 km and 1 km horizontal resolution computational domains used for photochemical modeling assessment of the Area F EIS.

Table D-7-2. Vertical Layer Definitions for CAMx Modeling

WRF Meteorological Model					CAMx Air Quality Model		
WRF Layer	Sigma	Pressure (mb)	Height (m)	Thickness (m)	CAMx Layer	Height (m)	Thickness (m)
37	0.0000	50.00	19260	2055	25	19,260	3,904.90
36	0.0270	75.65	17205	1850			
35	0.0600	107.00	15355	1725	24	15,355.10	3,425.40
34	0.1000	145.00	13630	1701			
33	0.1500	192.50	11930	1389	23	11,929.70	2,569.60
32	0.2000	240.00	10541	1181			
31	0.2500	287.50	9360	1032	22	9,360.10	1,952.20
30	0.3000	335.00	8328	920			
29	0.3500	382.50	7408	832	21	7,407.90	1,591.80
28	0.4000	430.00	6576	760			
27	0.4500	477.50	5816	701	20	5,816.10	1,352.90
26	0.5000	525.00	5115	652			
25	0.5500	572.50	4463	609	19	4,463.30	609.2
24	0.6000	620.00	3854	461	18	3,854.10	460.7
23	0.6400	658.00	3393	440	17	3,393.40	439.6
22	0.6800	696.00	2954	421	16	2,953.70	420.6
21	0.7200	734.00	2533	403	15	2,533.10	403.3
20	0.7600	772.00	2130	388	14	2,129.70	387.6
19	0.8000	810.00	1742	373	13	1,742.20	373.1
18	0.8400	848.00	1369	271	12	1,369.10	271.1
17	0.8700	876.50	1098	177	11	1,098	176.8
16	0.8900	895.50	921	174	10	921.2	173.8
15	0.9100	914.50	747	171	9	747.5	170.9
14	0.9300	933.50	577	84	8	576.6	168.1
13	0.9400	943.00	492	84			
12	0.9500	952.50	409	83	7	408.6	83
11	0.9600	962.00	326	82	6	325.6	82.4
10	0.9700	971.50	243	82	5	243.2	81.7
9	0.9800	981.00	162	41	4	161.5	64.9
8	0.9850	985.75	121	24			
7	0.9880	988.60	97	24	3	96.6	40.4
6	0.9910	991.45	72	16			
5	0.9930	993.35	56	16	2	56.2	32.2
4	0.9950	995.25	40	16			
3	0.9970	997.15	24	12	1	24.1	24.1
2	0.9985	998.58	12	12			
1	1.0000	1000	0				

CAMx Inputs

The photochemical grid modeling performed in support of the Rosebud Area F EIS relies on various inputs developed for the BLM-MT/DK study. In particular:

- CAMx-ready hourly meteorological fields generated by WRFCAMx for the 4 km domain defined for the BLM-MT/DK study were extracted to correspond to the spatial extent of the 4 km domain for this project (defined in the previous section). The modeling simulations invoke the FlexiNesting capabilities of CAMx which provide the 1 km domain with interpolated meteorology from the 4 km parent nest.

- Initial and boundary conditions for this project's 4 km domain are extracted from the available BLM-MT/DK modeling study hourly three-dimensional concentrations. The two-way nesting approach provides concentration from the parent nest to the 1 km domain. The influence of the initial conditions in the modeling results is minimized as the nested 4 km/1 km annual simulations were broken into six 2-month periods with a 10 day spin-up each.

Both the meteorological input data and the three-dimensional concentrations from the BLM-MT/DK study have undergone rigorous model performance evaluation analysis (Ramboll Environ and Kleinfelder, 2015a,b). The CAMx 2012/2013 base case simulation using 2012/2013 emissions and meteorological data were subjected to a model performance evaluation (MPE) by comparing the modeled concentration, visibility and deposition estimates within the 4 km Montana/Dakotas domain with concurrent observations. Details on the CAMx 2012/2013 base case model performance evaluation (MPE) can be found in the BLM-MT/DK PGM Modeling Study MPE report (Ramboll Environ and Kleinfelder, 2015b). The CAMx 2013/2012 base case was evaluated against observed ozone, NO_2, SO_2, total $PM_{2.5}$ mass, individual $PM_{2.5}$ species, PM_{10}, coarse PM, sulfur and nitrogen wet deposition and visibility impairment. Maximum daily average 8-hour (MDA8) ozone concentrations were evaluated at 10 monitoring sites in the Montana/Dakotas region and compared against the ≤±15% bias and ≤35% error ozone model performance goals (USEPA, 1991). All sites met the ozone model performance goal on an annual basis. Four sites did not meet the ozone bias performance goal in quarter 4 when ozone is low. During the important quarters 2 and 3 when ozone is generally higher, all sites achieve the ozone bias and error performance goals except for Malta, Montana whose quarter 3 bias (16%) has an overestimation high enough that it just barely fails to achieve the ozone performance goal (≤±15%).

Model performance for total $PM_{2.5}$ mass was evaluated across the IMPROVE, CSN and FRM monitoring networks and visibility across the IMPROVE network in the Montana/Dakotas 4 km domain using Soccer Plots For most of the months, the model's $PM_{2.5}$ performance achieves the PM performance criteria with many months also achieving the PM performance goals. The exception to this is a winter $PM_{2.5}$ overestimation bias across the IMPROVE network, January underestimation bias across the CSN network and too high January error across the FRM network.

Model performance for visibility indicates that with one exception, the CAMx 2012/2013 base case visibility model performance achieves the PM performance goals and also achieves the ozone performance goals for many months. The exception is for visibility performance in August that has an underestimation bias high enough that the PM performance goal is not achieved, although the PM performance criteria is achieved.

Overall the CAMx 2012/2013 base case mostly achieves the ozone and PM performance goals and criteria and exhibits model performance fairly typical for PGM modeling in the western states. The CAMx 2012/2013 base case was deemed to perform sufficiently well for use in the future year air resource impact assessment.

CAMx Configuration

Table D-7-3. CAMx Model Configurations for Rosebud Area F Photochemical Modeling

Science Options	Configuration	Details
General		
Model Version	CAMx v6.2	
Grid Interaction	Single 4 km and 1 km run using two-way nesting	Flexi-Nesting option invoked to simulate 1km domain
Transport		
Sub-grid-scale Plume Transport	Plume-in-Grid for major NO_X sources in 4/1 km domain	Point sources with NO_X emissions larger than 1 ton/day
Horizontal Diffusion	Spatially varying	Smagorinsky
Vertical Diffusion	CMAQ-like in WRF2CAMx	
Diffusivity Lower Limit	Kz_min = 0.1 m^2/s	cloud and O'Brien 1970 corrections applied to Kz
Chemistry		
Gas Phase Chemistry	CB6r2	Carbon Bond 6 revision 2 (Yarwood et al., 2010)
Aerosol Thermodynamics	ISORROPIA	Nenes et al., 1998; 1999
Secondary Organic Aerosol	SOAP	Strader et al., 1999
Aqueous-Phase Chemistry	RADM	Chang et al., 1987
Deposition Schemes		
Dry Deposition	Zhang dry deposition scheme	Zhang 2001; 2003
Wet Deposition	CAMx -specific formulation	
Numerics		
Gas Phase Chemistry Solver	Euler Backward Iterative (EBI) -- Fast Solver	Hertel et al., 1993
Vertical Advection Scheme	Implicit scheme w/ vertical velocity update (CAMx)	
Horizontal Advection Scheme	Piecewise Parabolic Method (PPM) scheme	Colella and Woodward, 1987
Integration Time Step	Wind speed dependent	Satisfy Courant number stability requirement

Modeled Species

The Carbon Bond 6 revision 2 gas-phase chemistry mechanism used for this project considers up to 90 chemical species including the fate of criteria pollutants (ozone, nitrogen dioxide, carbon monoxide, sulfur dioxide.) Additionally, the model includes up to 20 different organic and inorganic particulate matter species. The particulate matter species are aggregated to estimate impacts on $PM_{2.5}$ and PM_{10} and to estimate their impacts on visibility. The model also provides estimates of deposited gas phase and particulates that are aggregated to account for total nitrogen and sulfur deposition.

Table D-7-4. Species names and descriptions for the Carbon Bond 6 revision 2 mechanism

Species	Description
BZO2	Peroxy radical from OH addition to benzene
C2O3	Acetylperoxy radical
CRO	Alkoxy radical from cresol
CXO3	C3 and higher acylperoxy radicals
EPX2	Peroxy radical from EPOX reaction with OH
HCO3	Adduct from HO2 plus formaldehyde
HO2	Hydroperoxy radical
ISO2	Peroxy radical from OH addition to isoprene
MEO2	Methylperoxy radical
NO3	Nitrate radical
O	Oxygen atom in the O3(P) electronic state
O1D	Oxygen atom in the O1(D) electronic state
OH	Hydroxyl radical
OPO3	Peroxyacyl radical from OPEN
RO2	Operator to approximate total peroxy radical concentration
ROR	Secondary alkoxy radical
TO2	Peroxy radical from OH addition to TOL
XLO2	Peroxy radical from OH addition to XYL
XO2	NO to NO2 conversion from alkylperoxy (RO2) radical
XO2H	NO to NO2 conversion (XO2) accompanied by HO2 production
XO2N	NO to organic nitrate conversion from alkylperoxy (RO2) radical
AACD	Acetic acid
ACET	Acetone
ALD2	Acetaldehyde
ALDX	Propionaldehyde and higher aldehydes
BENZ	Benzene
CAT1	Methyl-catechols
CO	Carbon monoxide
CH4	Methane
CRES	Cresols
CRON	Nitro-cresols
EPOX	Epoxide formed from ISPX reaction with OH
ETH	Ethene
ETHA	Ethane
ETHY	Ethyne
ETOH	Ethanol
FACD	Formic acid
FORM	Formaldehyde

Species	Description
GLY	Glyoxal
GLYD	Glycolaldehyde
H2O2	Hydrogen peroxide
HNO3	Nitric acid
HONO	Nitrous acid
HPLD	hydroperoxyaldehyde
INTR	Organic nitrates from ISO2 reaction with NO
IOLE	Internal olefin carbon bond (R-C=C-R)
ISOP	Isoprene
ISPD	Isoprene product (lumped methacrolein, methyl vinyl ketone, etc.)
ISPX	Hydroperoxides from ISO2 reaction with HO2
KET	Ketone carbon bond (C=O)
MEOH	Methanol
MEPX	Methylhydroperoxide
MGLY	Methylglyoxal
N2O5	Dinitrogen pentoxide
NH3	Ammonia
NO	Nitric oxide
NO2	Nitrogen dioxide
NTR	Organic nitrates
O3	Ozone
OLE	Terminal olefin carbon bond (R-C=C)
OPAN	Peroxyacyl nitrate (PAN compound) from OPO3
OPEN	Aromatic ring opening product (unsaturated dicarbonyl)
PACD	Peroxyacetic and higher peroxycarboxylic acids
PAN	Peroxyacetyl Nitrate
PANX	C3 and higher peroxyacyl nitrate
PAR	Paraffin carbon bond (C-C)
PNA	Peroxynitric acid
PRPA	Propane
ROOH	Higher organic peroxide
SO2	Sulfur dioxide
SULF	Sulfuric acid (gaseous)
TERP	Monoterpenes
TOL	Toluene and other monoalkyl aromatics
XOPN	Aromatic ring opening product (unsaturated dicarbonyl)
XYL	Xylene and other polyalkyl aromatics
NTR1	Simple organic nitrates
NTR2	Multi-functional organic nitrates
ECH4	Emitted methane (to enable tracking seperate from CH4)

Species	Description
XPRP	Operator for organic nitrates from PRPA
XPAR	Operator for organic nitrates from PAR
CRNO	Nitro-cresol oxy radical
CRN2	Nitro-cresol peroxy radical
CRPX	Nitro-cresol hydroperoxide
CAO2	Ring-opening product from methyl catechol

Table D-7-5. List of PM species for the CAMx CF aerosol option with the SOAP organic aerosol module.

Species	Description
PSO4	Sulfate
PNO3	Particulate Nitrate
PNH4	Particulate Ammonium
PH2O	Aerosol Water Content
NA	Sodium
PCL	Particulate Chloride
PEC	Primary Elemental Carbon
FPRM	Fine Other Primary (diameter ≤ 2.5 μm)
FCRS	Fine Crustal (diameter ≤ 2.5 μm)
CPRM	Coarse Other Primary
CCRS	Coarse Crustal
POA	Primary Organic Aerosol
SOA1- SOA7	Secondary Organic Aerosol
SOAH	Non-volatile oxidation products
SOPA	Anthropogenic organic aerosol polymers
SOPB	Biogenic organic aerosol polymers

Table D-7-6. List of species included in estimates of total nitrogen and sulfur deposition

Deposition	Species Included
Nitrogen	NH3, NO3, XO2N, CRON, HNO3, HONO, INTR, N2O5, NO, NO2, NTR, OPAN, PAN, PANX, PNA, NTR1, NTR2, XPRP, XPAR, CRNO, CRN2, CRPX, PNO3, PNH4
Sulfur	SO2, SULF, PSO4

Emissions

Emissions inventories specific to the Alternatives are provided in detail in sections 4.3 and 5.3.2 of the Rosebud Area F EIS and in Section 1 of the Supporting Information for Air Quality

Analysis for this EIS. CAMx is formulated with source attribution technologies, including the Ozone Source Apportionment Technology (OSAT) and the Particulate Source Apportionment Technology (PSAT). These source apportionment techniques in CAMx provide the ability to estimate air quality impacts from direct, indirect, and cumulative effects simultaneously. The CAMx source apportionment tools were used for efficient calculations of air quality impact contributions from different groups of emission sources representing these effects. Section 4.3.1.1 of the DEIS lists the five source groups considered for the CAMx source apportionment modeling.

All other regional emissions sources required to provide the cumulative background needed by photochemical grid assessments were specified using the BLM-MT/DK modeling study (Ramboll Environ and Kleinfelder, 2016b, 2015c). The cumulative emission inventories are intended to be comprehensive and include pollutants from a diverse number of sources. The data for regional emissions from point sources, low-level anthropogenic sources, low-level biogenic sources, and fires were obtained from the BLM-MT/DK 2025/2032 future year modeling platform. The cumulative emission inventories are provided explicitly for modeling for the 4 km domain. For the 1 km domain only the project related inventory (Section 4.3 DEIS) is explicitly provided for the simulations, while the CAMx FlexiNesting capabilities dynamically provide the adequate chemical background by interpolating the 4 km cumulative emissions into the 1 km domain spatial resolution.

Anthropogenic sources include future year emission estimates for oil and gas sources within the BLM-MT/DK planning areas, based on a combination of projections of emissions from existing wells and from reasonably foreseeable development scenarios prepared by the BLM for the planning areas corresponding to each field office in MT, North Dakota, and South Dakota. Future year emissions estimates for non-oil and gas sources were primarily based on the EPA future year emission projections for calendar year 2025 consistent with the 2011 NEI. On-road mobile source emissions were generated using version 2014a of the EPA Motor Vehicle Emissions Simulator (MOVES) model driven by the calendar year 2032 activity data and fleet characteristics. Year 2010 emissions inventories were used for Canada.

Natural sources include biogenic, wildland fire, lightning, and windblown dust emissions, which corresponded to the 2012–2013 base time period used in BLM-MT/DK modeling for meteorological data. Biogenic emissions were calculated using the Model of Emissions of Gases and Aerosols in Nature (MEGAN) model (http://lar.wsu.edu/megan) updated for the western United States in a Western Regional Air Partnership (WRAP)[1] study using 2012/2013 meteorological conditions. Fire emissions were based on the Fire Inventory from the National Center for Atmospheric Research (NCAR) (FINN[2]) inventory for 2012/2013. Lightning emissions were based on the 2012/2013 meteorological data.

Appendix D-6 in the DEIS provides a summary of the major regional point sources (sources with emissions of any criteria pollutant greater than 100 tons/year) from the inventory described above and applied in the CAMx photochemical air quality modeling for the EIS, as well as the total emissions in the analysis area from both low-level (near-ground) and point sources. A detailed description of the regional emissions used in this analysis can be found in the BLM-MT/DK modeling study (Ramboll Environ and Kleinfelder, 2016b, 2015c).

[1] http://www.wrapair2.org/pdf/WGA_BiogEmisInv_FinalReport_March20_2012.pdf
[2] http://bai.acd.ucar.edu/Data/fire/

Chemistry Mechanism

The details of the CB6r2 chemical mechanism used are shown in Table D-7-8 below.

Table D-7-8. Reactions and rate constant expressions for the CB6r2 mechanism. k298 is the rate constant at 298 K and 1 atmosphere using units in molecules/cm3 and 1/s. For photolysis reactions k298 shows the photolysis rate at a solar zenith angle of 60° and height

Number	Reactants and Products	Rate Constant Expression	k298
1	NO2 = NO + O	Photolysis	6.30E-03
2	O + O2 + M = O3 + M	k = 5.68E-34 (T/300)^-2.6	5.78E-34
3	O3 + NO = NO2	k = 1.40E-12 exp(-1310/T)	1.73E-14
4	O + NO + M = NO2 + M	k = 1.00E-31 (T/300)^-1.6	1.01E-31
5	O + NO2 = NO	k = 5.50E-12 exp(188/T)	1.03E-11
6	O + NO2 = NO3	Falloff: F=0.6; n=1 k(0) = 1.30E-31 (T/300)^-1.5 k(inf) = 2.30E-11 (T/300)^0.24	2.11E-12
7	O + O3 =	k = 8.00E-12 exp(-2060/T)	7.96E-15
8	O3 = O	Photolysis	3.33E-04
9	O3 = O1D	Photolysis	8.78E-06
10	O1D + M = O + M	k = 2.23E-11 exp(115/T)	3.28E-11
11	O1D + H2O = 2 OH	k = 2.14E-10	2.14E-10
12	O3 + OH = HO2	k = 1.70E-12 exp(-940/T)	7.25E-14
13	O3 + HO2 = OH	k = 2.03E-16 (T/300)^4.57 exp(693/T)	2.01E-15
14	OH + O = HO2	k = 2.40E-11 exp(110/T)	3.47E-11
15	HO2 + O = OH	k = 2.70E-11 exp(224/T)	5.73E-11
16	OH + OH = O	k = 6.20E-14 (T/298)^2.6 exp(945/T)	1.48E-12
17	OH + OH = H2O2	Falloff: F=0.5; n=1.13 k(0) = 6.90E-31 (T/300)^-0.8 k(inf) = 2.60E-11	5.25E-12
18	OH + HO2 =	k = 4.80E-11 exp(250/T)	1.11E-10
19	HO2 + HO2 = H2O2	k = k1 + k2 [M] k1 = 2.20E-13 exp(600/T) k2 = 1.90E-33 exp(980/T)	2.90E-12
20	HO2 + HO2 + H2O = H2O2	k = k1 + k2 [M] k1 = 3.08E-34 exp(2800/T) k2 = 2.66E-54 exp(3180/T)	6.53E-30
21	H2O2 = 2 OH	Photolysis	3.78E-06
22	H2O2 + OH = HO2	k = 2.90E-12 exp(-160/T)	1.70E-12
23	H2O2 + O = OH + HO2	k = 1.40E-12 exp(-2000/T)	1.70E-15
24	NO + NO + O2 = 2 NO2	k = 3.30E-39 exp(530/T)	1.95E-38
25	HO2 + NO = OH + NO2	k = 3.45E-12 exp(270/T)	8.54E-12
26	NO2 + O3 = NO3	k = 1.40E-13 exp(-2470/T)	3.52E-17
27	NO3 = NO2 + O	Photolysis	1.56E-01
28	NO3 = NO	Photolysis	1.98E-02
29	NO3 + NO = 2 NO2	k = 1.80E-11 exp(110/T)	2.60E-11

Number	Reactants and Products	Rate Constant Expression	k298
30	NO3 + NO2 = NO + NO2	k = 4.50E-14 exp(-1260/T)	6.56E-16
31	NO3 + O = NO2	k = 1.70E-11	1.70E-11
32	NO3 + OH = HO2 + NO2	k = 2.00E-11	2.00E-11
33	NO3 + HO2 = OH + NO2	k = 4.00E-12	4.00E-12
34	NO3 + O3 = NO2	k = 1.00E-17	1.00E-17
35	NO3 + NO3 = 2 NO2	k = 8.50E-13 exp(-2450/T)	2.28E-16
36	NO3 + NO2 = N2O5	Falloff: F=0.35; n=1.33 k(0) = 3.60E-30 (T/300)^-4.1 k(inf) = 1.90E-12 (T/300)^0.2	1.24E-12
37	N2O5 = NO3 + NO2	Falloff: F=0.35; n=1.33 k(0) = 1.30E-3 (T/300)^-3.5 exp(-11000/T) k(inf) = 9.70E+14 (T/300)^0.1 exp(-11080/T)	4.46E-02
38	N2O5 = NO2 + NO3	Photolysis	2.52E-05
39	N2O5 + H2O = 2 HNO3	k = 1.00E-22	1.00E-22
40	NO + OH = HONO	Falloff: F=0.81; n=0.87 k(0) = 7.40E-31 (T/300)^-2.4 k(inf) = 3.30E-11 (T/300)^-0.3	9.77E-12
41	NO + NO2 + H2O = 2 HONO	k = 5.00E-40	5.00E-40
42	HONO + HONO = NO + NO2	k = 1.00E-20	1.00E-20
43	HONO = NO + OH	Photolysis	1.04E-03
44	HONO + OH = NO2	k = 2.50E-12 exp(260/T)	5.98E-12
45	NO2 + OH = HNO3	Falloff: F=0.6; n=1 k(0) = 1.80E-30 (T/300)^-3 k(inf) = 2.80E-11	1.06E-11
46	HNO3 + OH = NO3	k = k1 + k3 [M] / (1 + k3 [M] / k2) k1 = 2.40E-14 exp(460/T) k2 = 2.70E-17 exp(2199/T k3 = 6.50E-34 exp(1335/T)	1.54E-13
47	HNO3 = OH + NO2	Photolysis	2.54E-07
48	HO2 + NO2 = PNA	Falloff: F=0.6; n=1 k(0) = 1.80E-31 (T/300)^-3.2 k(inf) = 4.70E-12	1.38E-12
49	PNA = HO2 + NO2	Falloff: F=0.6; n=1 k(0) = 4.10E-5 exp(-10650/T) k(inf) = 4.80E+15 exp(-11170/T)	8.31E-02
50	PNA = 0.59 HO2 + 0.59 NO2 + 0.41 OH + 0.41 NO3	Photolysis	2.36E-06
51	PNA + OH = NO2	k = 3.20E-13 exp(690/T)	3.24E-12
52	SO2 + OH = SULF + HO2	Falloff: F=0.53; n=1.1 k(0) = 4.50E-31 (T/300)^-3.9 k(inf) = 1.30E-12 (T/300)^-0.7	8.12E-13
53	C2O3 + NO = NO2 + MEO2 + RO2	k = 7.50E-12 exp(290/T)	1.98E-11
54	C2O3 + NO2 = PAN	Falloff: F=0.3; n=1.41 k(0) = 2.70E-28 (T/300)^-7.1 k(inf) = 1.20E-11 (T/300)^-0.9	9.40E-12
55	PAN = NO2 + C2O3	Falloff: F=0.3; n=1.41 k(0) = 4.90E-3 exp(-12100/T) k(inf) = 5.40E+16 exp(-13830/T)	2.98E-04
56	PAN = 0.6 NO2 + 0.6 C2O3 + 0.4 NO3 + 0.4 MEO2 + 0.4 RO2	Photolysis	3.47E-07
57	C2O3 + HO2 = 0.41 PACD + 0.15 AACD + 0.15 O3 + 0.44 MEO2 + 0.44 RO2 + 0.44	k = 5.20E-13 exp(980/T)	1.39E-11

Number	Reactants and Products	Rate Constant Expression	k298
	OH		
58	C2O3 + RO2 = C2O3	k = 8.90E-13 exp(800/T)	1.30E-11
59	C2O3 + C2O3 = 2 MEO2 + 2 RO2	k = 2.90E-12 exp(500/T)	1.55E-11
60	C2O3 + CXO3 = MEO2 + ALD2 + XO2H + 2 RO2	k = 2.90E-12 exp(500/T)	1.55E-11
61	CXO3 + NO = NO2 + ALD2 + XO2H + RO2	k = 6.70E-12 exp(340/T)	2.10E-11
62	CXO3 + NO2 = PANX	k = k(ref) K k(ref) = k(54) K = 1.00E+0	9.40E-12
63	PANX = NO2 + CXO3	k = k(ref) K k(ref) = k(55) K = 1.00E+0	2.98E-04
64	PANX = 0.6 NO2 + 0.6 CXO3 + 0.4 NO3 + 0.4 ALD2 + 0.4 XO2H + 0.4 RO2	Photolysis	3.47E-07
65	CXO3 + HO2 = 0.41 PACD + 0.15 AACD + 0.15 O3 + 0.44 ALD2 + 0.44 XO2H + 0.44 RO2 + 0.44 OH	k = 5.20E-13 exp(980/T)	1.39E-11
66	CXO3 + RO2 = 0.8 ALD2 + 0.8 XO2H + 0.8 RO2	k = 8.90E-13 exp(800/T)	1.30E-11
67	CXO3 + CXO3 = 2 ALD2 + 2 XO2H + 2 RO2	k = 3.20E-12 exp(500/T)	1.71E-11
68	RO2 + NO = NO	k = 2.40E-12 exp(360/T)	8.03E-12
69	RO2 + HO2 = HO2	k = 4.80E-13 exp(800/T)	7.03E-12
70	RO2 + RO2 =	k = 6.50E-14 exp(500/T)	3.48E-13
71	MEO2 + NO = FORM + HO2 + NO2	k = 2.30E-12 exp(360/T)	7.70E-12
72	MEO2 + HO2 = 0.9 MEPX + 0.1 FORM	k = 3.80E-13 exp(780/T)	5.21E-12
73	MEO2 + C2O3 = FORM + 0.9 HO2 + 0.9 MEO2 + 0.1 AACD + 0.9 RO2	k = 2.00E-12 exp(500/T)	1.07E-11
74	MEO2 + RO2 = 0.685 FORM + 0.315 MEOH + 0.37 HO2 + RO2	k = k(ref) K k(ref) = k(70) K = 1.00E+0	3.48E-13
75	XO2H + NO = NO2 + HO2	k = 2.70E-12 exp(360/T)	9.04E-12
76	XO2H + HO2 = ROOH	k = 6.80E-13 exp(800/T)	9.96E-12
77	XO2H + C2O3 = 0.8 HO2 + 0.8 MEO2 + 0.2 AACD + 0.8 RO2	k = k(ref) K k(ref) = k(58) K = 1.00E+0	1.30E-11
78	XO2H + RO2 = 0.6 HO2 + RO2	k = k(ref) K k(ref) = k(70) K = 1.00E+0	3.48E-13
79	XO2 + NO = NO2	k = k(ref) K k(ref) = k(75) K = 1.00E+0	9.04E-12
80	XO2 + HO2 = ROOH	k = k(ref) K k(ref) = k(76) K = 1.00E+0	9.96E-12
81	XO2 + C2O3 = 0.8 MEO2 + 0.2 AACD + 0.8 RO2	k = k(ref) K k(ref) = k(58) K = 1.00E+0	1.30E-11
82	XO2 + RO2 = RO2	k = k(ref) K k(ref) = k(70) K = 1.00E+0	3.48E-13
83	XO2N + NO = 0.5 NTR1 + 0.5 NTR2	k = k(ref) K k(ref) = k(75) K = 1.00E+0	9.04E-12

Number	Reactants and Products	Rate Constant Expression	k298
84	XO2N + HO2 = ROOH	k = k(ref) K k(ref) = k(76) K = 1.00E+0	9.96E-12
85	XO2N + C2O3 = 0.8 HO2 + 0.8 MEO2 + 0.2 AACD + 0.8 RO2	k = k(ref) K k(ref) = k(58) K = 1.00E+0	1.30E-11
86	XO2N + RO2 = RO2	k = k(ref) K k(ref) = k(70) K = 1.00E+0	3.48E-13
87	MEPX + OH = 0.6 MEO2 + 0.6 RO2 + 0.4 FORM + 0.4 OH	k = 5.30E-12 exp(190/T)	1.00E-11
88	MEPX = MEO2 + RO2 + OH	Photolysis	2.68E-06
89	ROOH + OH = 0.54 XO2H + 0.06 XO2N + 0.6 RO2 + 0.4 OH	k = 5.30E-12 exp(190/T)	1.00E-11
90	ROOH = HO2 + OH	Photolysis	2.68E-06
91	NTR1 + OH = NTR2	k = 2.00E-12	2.00E-12
92	NTR1 = NO2	Photolysis	1.06E-06
93	FACD + OH = HO2	k = 4.50E-13	4.50E-13
94	AACD + OH = MEO2 + RO2	k = 4.00E-14 exp(850/T)	6.93E-13
95	PACD + OH = C2O3	k = 5.30E-12 exp(190/T)	1.00E-11
96	FORM + OH = HO2 + CO	k = 5.40E-12 exp(135/T)	8.49E-12
97	FORM = 2 HO2 + CO	Photolysis	1.78E-05
98	FORM = CO + H2	Photolysis	2.38E-05
99	FORM + O = OH + HO2 + CO	k = 3.40E-11 exp(-1600/T)	1.58E-13
100	FORM + NO3 = HNO3 + HO2 + CO	k = 5.50E-16	5.50E-16
101	FORM + HO2 = HCO3	k = 9.70E-15 exp(625/T)	7.90E-14
102	HCO3 = FORM + HO2	k = 2.40E+12 exp(-7000/T)	1.51E+02
103	HCO3 + NO = FACD + NO2 + HO2	k = 5.60E-12	5.60E-12
104	HCO3 + HO2 = 0.5 MEPX + 0.5 FACD + 0.2 OH + 0.2 HO2	k = 5.60E-15 exp(2300/T)	1.26E-11
105	ALD2 + O = C2O3 + OH	k = 1.80E-11 exp(-1100/T)	4.49E-13
106	ALD2 + OH = C2O3	k = 4.70E-12 exp(345/T)	1.50E-11
107	ALD2 + NO3 = C2O3 + HNO3	k = 1.40E-12 exp(-1860/T)	2.73E-15
108	ALD2 = MEO2 + RO2 + CO + HO2	Photolysis	1.76E-06
109	ALDX + O = CXO3 + OH	k = 1.30E-11 exp(-870/T)	7.02E-13
110	ALDX + OH = CXO3	k = 4.90E-12 exp(405/T)	1.91E-11
111	ALDX + NO3 = CXO3 + HNO3	k = 6.30E-15	6.30E-15
112	ALDX = ALD2 + XO2H + RO2 + CO + HO2	Photolysis	6.96E-06
113	GLYD + OH = 0.2 GLY + 0.2 HO2 + 0.8 C2O3	k = 8.00E-12	8.00E-12
114	GLYD = 0.74 FORM + 0.89 CO + 1.4 HO2 + 0.15 MEOH + 0.19 OH + 0.11 GLY + 0.11 XO2H + 0.11 RO2	Photolysis	1.56E-06
115	GLYD + NO3 = HNO3 + C2O3	k = 1.40E-12 exp(-1860/T)	2.73E-15
116	GLY + OH = 1.8 CO + 0.2 XO2 + 0.2 RO2 + HO2	k = 3.10E-12 exp(340/T)	9.70E-12
117	GLY = 2 HO2 + 2 CO	Photolysis	5.50E-05

Number	Reactants and Products	Rate Constant Expression	k298
118	GLY + NO3 = HNO3 + 1.5 CO + 0.5 XO2 + 0.5 RO2 + HO2	k = 1.40E-12 exp(-1860/T)	2.73E-15
119	MGLY = C2O3 + HO2 + CO	Photolysis	1.46E-04
120	MGLY + NO3 = HNO3 + C2O3 + XO2 + RO2	k = 1.40E-12 exp(-1860/T)	2.73E-15
121	MGLY + OH = C2O3 + CO	k = 1.90E-12 exp(575/T)	1.31E-11
122	H2 + OH = HO2	k = 7.70E-12 exp(-2100/T)	6.70E-15
123	CO + OH = HO2	k = k1 + k2 [M] k1 = 1.44E-13 k2 = 3.43E-33	2.28E-13
124	CH4 + OH = MEO2 + RO2	k = 1.85E-12 exp(-1690/T)	6.37E-15
125	ETHA + OH = 0.991 ALD2 + 0.991 XO2H + 0.009 XO2N + RO2	k = 6.90E-12 exp(-1000/T)	2.41E-13
126	MEOH + OH = FORM + HO2	k = 2.85E-12 exp(-345/T)	8.95E-13
127	ETOH + OH = 0.95 ALD2 + 0.9 HO2 + 0.1	k = 3.00E-12 exp(20/T)	3.21E-12
	XO2H + 0.1 RO2 + 0.078 FORM + 0.011 GLYD		
128	KET = 0.5 ALD2 + 0.5 C2O3 + 0.5 XO2H + 0.5 CXO3 + 0.5 MEO2 + RO2 - 2.5 PAR	Photolysis	2.27E-07
129	ACET = 0.38 CO + 1.38 MEO2 + 1.38 RO2 + 0.62 C2O3	Photolysis	2.08E-07
130	ACET + OH = FORM + C2O3 + XO2 + RO2	k = 1.41E-12 exp(-620.6/T)	1.76E-13
131	PRPA + OH = 0.71 ACET + 0.26 ALDX + 0.26 PAR + 0.97 XO2H + 0.03 XO2N + RO2	k = 7.60E-12 exp(-585/T)	1.07E-12
132	PAR + OH = 0.11 ALDX + 0.76 ROR + 0.13 XO2N + 0.11 XO2H + 0.76 XO2 + RO2 - 0.11 PAR	k = 8.10E-13	8.10E-13
133	ROR = 0.2 KET + 0.42 ACET + 0.74 ALD2 + 0.37 ALDX + 0.04 XO2N + 0.94 XO2H + 0.98 RO2 + 0.02 ROR - 2.7 PAR	k = 5.70E+12 exp(-5780/T)	2.15E+04
134	ROR + O2 = KET + HO2	k = 1.50E-14 exp(-200/T)	7.67E-15
135	ROR + NO2 = NTR1	k = 8.60E-12 exp(400/T)	3.29E-11
136	ETHY + OH = 0.7 GLY + 0.7 OH + 0.3 FACD + 0.3 CO + 0.3 HO2	Falloff: F=0.37; n=1.3 k(0) = 5.00E-30 (T/300)^-1.5 k(inf) = 1.00E-12	7.52E-13
137	ETH + O = FORM + HO2 + CO + 0.7 XO2H + 0.7 RO2 + 0.3 OH	k = 1.04E-11 exp(-792/T)	7.29E-13
138	ETH + OH = XO2H + RO2 + 1.56 FORM + 0.22 GLYD	Falloff: F=0.48; n=1.15 k(0) = 8.60E-29 (T/300)^-3.1 k(inf) = 9.00E-12 (T/300)^-0.85	7.84E-12
139	ETH + O3 = FORM + 0.51 CO + 0.16 HO2 + 0.16 OH + 0.37 FACD	k = 9.10E-15 exp(-2580/T)	1.58E-18
140	ETH + NO3 = 0.5 NO2 + 0.5 NTR1 + 0.5 XO2H + 0.5 XO2 + RO2 + 1.125 FORM	k = 3.30E-12 exp(-2880/T)	2.10E-16
141	OLE + O = 0.2 ALD2 + 0.3 ALDX + 0.1 HO2 + 0.2 XO2H + 0.2 CO + 0.2 FORM + 0.01 XO2N + 0.21 RO2 + 0.2 PAR + 0.1 OH	k = 1.00E-11 exp(-280/T)	3.91E-12
142	OLE + OH = 0.781 FORM + 0.488 ALD2 + 0.488 ALDX + 0.976 XO2H + 0.195 XO2 + 0.024 XO2N + 1.195 RO2 - 0.73 PAR	Falloff: F=0.5; n=1.13 k(0) = 8.00E-27 (T/300)^-3.5 k(inf) = 3.00E-11 (T/300)^-1	2.86E-11
143	OLE + O3 = 0.295 ALD2 + 0.555 FORM + 0.27 ALDX + 0.15 XO2H + 0.15 RO2 + 0.334 OH + 0.08 HO2 + 0.378 CO + 0.075	k = 5.50E-15 exp(-1880/T)	1.00E-17

Number	Reactants and Products	Rate Constant Expression	k298
	GLY + 0.075 MGLY + 0.09 FACD + 0.13 AACD + 0.04 H2O2 - 0.79 PAR		
144	OLE + NO3 = 0.5 NO2 + 0.5 NTR1 + 0.48 XO2 + 0.48 XO2H + 0.04 XO2N + RO2 + 0.5 FORM + 0.25 ALD2 + 0.375 ALDX - 1 PAR	k = 4.60E-13 exp(-1155/T)	9.54E-15
145	IOLE + O = 1.24 ALD2 + 0.66 ALDX + 0.1 XO2H + 0.1 RO2 + 0.1 CO + 0.1 PAR	k = 2.30E-11	2.30E-11
146	IOLE + OH = 1.3 ALD2 + 0.7 ALDX + XO2H + RO2	k = 1.05E-11 exp(519/T)	5.99E-11
147	IOLE + O3 = 0.732 ALD2 + 0.442 ALDX + 0.128 FORM + 0.245 CO + 0.5 OH + 0.3 XO2H + 0.3 RO2 + 0.24 GLY + 0.06 MGLY +0.29 PAR + 0.08 AACD + 0.08 H2O2	k = 4.70E-15 exp(-1013/T)	1.57E-16
148	IOLE + NO3 = 0.5 NO2 + 0.5 NTR1 + 0.48 XO2 + 0.48 XO2H + 0.04 XO2N + RO2 + 0.5 ALD2 + 0.625 ALDX + PAR	k = 3.70E-13	3.70E-13
149	ISOP + OH = ISO2 + RO2	k = 2.70E-11 exp(390/T)	9.99E-11
150	ISOP + O = 0.75 ISPD + 0.5 FORM + 0.25 XO2 + 0.25 RO2 + 0.25 HO2 + 0.25 CXO3 + 0.25 PAR	k = 3.00E-11	3.00E-11
151	ISO2 + NO = 0.1 INTR + 0.9 NO2 + 0.673 FORM + 0.9 ISPD + 0.818 HO2 + 0.082 XO2H + 0.082 RO2	k = 2.39E-12 exp(365/T)	8.13E-12
152	ISO2 + HO2 = 0.88 ISPX + 0.12 OH + 0.12 HO2 + 0.12 FORM + 0.12 ISPD	k = 7.43E-13 exp(700/T)	7.78E-12
153	ISO2 + C2O3 = 0.598 FORM + 1 ISPD + 0.728 HO2 + 0.072 XO2H + 0.8 MEO2 + 0.2 AACD + 0.872 RO2	k = k(ref) K k(ref) = k(58) K = 1.00E+0	1.30E-11
154	ISO2 + RO2 = 0.598 FORM + 1 ISPD + 0.728 HO2 + 0.072 XO2H + 0.072 RO2	k = k(ref) K k(ref) = k(70) K = 1.00E+0	3.48E-13
155	ISO2 = HO2 + HPLD	k = 3.30E+9 exp(-8300/T)	2.64E-03
156	ISOP + O3 = 0.6 FORM + 0.65 ISPD + 0.15 ALDX + 0.2 CXO3 + 0.35 PAR + 0.266 OH + 0.2 XO2 + 0.2 RO2 + 0.066 HO2 + 0.066 CO	k = 1.03E-14 exp(-1995/T)	1.27E-17
157	ISOP + NO3 = 0.35 NO2 + 0.65 NTR2 + 0.64 XO2H + 0.33 XO2 + 0.03 XO2N + RO2 + 0.35 FORM + 0.35 ISPD	k = 3.03E-12 exp(-448/T)	6.74E-13
158	ISPD + OH = 0.022 XO2N + 0.521 XO2 + 0.115 MGLY + 0.115 MEO2 + 0.269 GLYD + 0.269 C2O3 + 0.457 OPO3 + 0.117 PAR + 0.137 ACET + 0.137 CO + 0.137 HO2 + 0.658 RO2	k = 5.58E-12 exp(511/T)	3.10E-11
159	ISPD + O3 = 0.04 ALD2 + 0.231 FORM + 0.531 MGLY + 0.17 GLY + 0.17 ACET + 0.543 CO + 0.461 OH + 0.15 FACD + 0.398 HO2 + 0.143 C2O3	k = 3.88E-15 exp(-1770/T)	1.02E-17
160	ISPD + NO3 = 0.717 HNO3 + 0.142 NTR2 + 0.142 NO2 + 0.142 XO2 + 0.142 XO2H + 0.113 GLYD + 0.113 MGLY + 0.717 PAR + 0.717 CXO3 + 0.284 RO2	k = 4.10E-12 exp(-1860/T)	7.98E-15
161	ISPD = 0.76 HO2 + 0.34 XO2H + 0.16 XO2 + 0.34 MEO2 + 0.208 C2O3 + 0.26 FORM +0.24 OLE + 0.24 PAR + 0.17 ACET + 0.128 GLYD + 0.84 RO2	Photolysis	1.60E-05
162	ISPX + OH = 0.904 EPOX + 0.933 OH + 0.067 ISO2 + 0.067 RO2 + 0.029 IOLE +	k = 2.23E-11 exp(372/T)	7.77E-11

Number	Reactants and Products	Rate Constant Expression	k298
	0.029 ALDX		
163	HPLD = OH + ISPD	Photolysis	4.41E-04
164	HPLD + NO3 = HNO3 + ISPD	k = 6.00E-12 exp(-1860/T)	1.17E-14
165	EPOX + OH = EPX2 + RO2	k = 5.78E-11 exp(-400/T)	1.51E-11
166	EPX2 + HO2 = 0.275 GLYD + 0.275 GLY + 0.275 MGLY + 1.125 OH + 0.825 HO2 + 0.375 FORM + 0.074 FACD + 0.251 CO + 2.175 PAR	k = 7.43E-13 exp(700/T)	7.78E-12
167	EPX2 + NO = 0.275 GLYD + 0.275 GLY + 0.275 MGLY + 0.125 OH + 0.825 HO2 + 0.375 FORM + NO2 + 0.251 CO + 2.175 PAR	k = 2.39E-12 exp(365/T)	8.13E-12
168	EPX2 + C2O3 = 0.22 GLYD + 0.22 GLY + 0.22 MGLY + 0.1 OH + 0.66 HO2 + 0.3 FORM + 0.2 CO + 1.74 PAR + 0.8 MEO2 + 0.2 AACD + 0.8 RO2	k = k(ref) K k(ref) = k(58) K = 1.00E+0	1.30E-11
169	EPX2 + RO2 = 0.275 GLYD + 0.275 GLY + 0.275 MGLY + 0.125 OH + 0.825 HO2 + 0.375 FORM + 0.251 CO + 2.175 PAR + RO2	k = k(ref) K k(ref) = k(70) K = 1.00E+0	3.48E-13
170	INTR + OH = 0.63 XO2 + 0.37 XO2H + RO2 + 0.444 NO2 + 0.185 NO3 + 0.104 INTR + 0.592 FORM + 0.331 GLYD + 0.185 FACD + 2.7 PAR + 0.098 OLE + 0.078 ALDX + 0.266 NTR2	k = 3.10E-11	3.10E-11
171	TERP + O = 0.15 ALDX + 5.12 PAR	k = 3.60E-11	3.60E-11
172	TERP + OH = 0.75 XO2H + 0.5 XO2 + 0.25 XO2N + 1.5 RO2 + 0.28 FORM + 1.66 PAR + 0.47 ALDX	k = 1.50E-11 exp(449/T)	6.77E-11
173	TERP + O3 = 0.57 OH + 0.07 XO2H + 0.69 XO2 + 0.18 XO2N + 0.94 RO2 + 0.24 FORM + 0.001 CO + 7 PAR + 0.21 ALDX + 0.39 CXO3	k = 1.20E-15 exp(-821/T)	7.63E-17
174	TERP + NO3 = 0.47 NO2 + 0.28 XO2H + 0.75 XO2 + 0.25 XO2N + 1.28 RO2 + 0.47 ALDX + 0.53 NTR2	k = 3.70E-12 exp(175/T)	6.66E-12
175	BENZ + OH = 0.53 CRES + 0.352 BZO2 + 0.352 RO2 + 0.118 OPEN + 0.118 OH + 0.53 HO2	k = 2.30E-12 exp(-190/T)	1.22E-12
176	BZO2 + NO = 0.918 NO2 + 0.082 NTR2 + 0.918 GLY + 0.918 OPEN + 0.918 HO2	k = 2.70E-12 exp(360/T)	9.04E-12
177	BZO2 + C2O3 = GLY + OPEN + HO2 + MEO2 +RO2	k = k(ref) K k(ref) = k(58) K = 1.00E+0	1.30E-11
178	BZO2 + HO2 =	k = 1.90E-13 exp(1300/T)	1.49E-11
179	BZO2 + RO2 = GLY + OPEN + HO2 + RO2	k = k(ref) K k(ref) = k(70) K = 1.00E+0	3.48E-13
180	TOL + OH = 0.18 CRES + 0.65 TO2 + 0.72 RO2 + 0.1 OPEN + 0.1 OH + 0.07 XO2H + 0.18 HO2	k = 1.80E-12 exp(340/T)	5.63E-12
181	TO2 + NO = 0.86 NO2 + 0.14 NTR2 + 0.417 GLY + 0.443 MGLY + 0.66 OPEN + 0.2 XOPN + 0.86 HO2	k = 2.70E-12 exp(360/T)	9.04E-12
182	TO2 + C2O3 = 0.48 GLY + 0.52 MGLY + 0.77 OPEN + 0.23 XOPN + HO2 + MEO2 + RO2	k = k(ref) K k(ref) = k(58) K = 1.00E+0	1.30E-11

Number	Reactants and Products	Rate Constant Expression	k298
183	TO2 + HO2 =	k = 1.90E-13 exp(1300/T)	1.49E-11
184	TO2 + RO2 = 0.48 GLY + 0.52 MGLY + 0.77 OPEN + 0.23 XOPN + HO2 + RO2	k = k(ref) K k(ref) = k(70) K = 1.00E+0	3.48E-13
185	XYL + OH = 0.155 CRES + 0.544 XLO2 + 0.602 RO2 + 0.244 XOPN + 0.244 OH + 0.058 XO2H + 0.155 HO2	k = 1.85E-11	1.85E-11
186	XLO2 + NO = 0.86 NO2 + 0.14 NTR2 + 0.221 GLY + 0.675 MGLY + 0.3 OPEN + 0.56 XOPN + 0.86 HO2	k = 2.70E-12 exp(360/T)	9.04E-12
187	XLO2 + HO2 =	k = 1.90E-13 exp(1300/T)	1.49E-11
188	XLO2 + C2O3 = 0.26 GLY + 0.77 MGLY + 0.35 OPEN + 0.65 XOPN + HO2 + MEO2 + RO2	k = k(ref) K k(ref) = k(58) K = 1.00E+0	1.30E-11
189	XLO2 + RO2 = 0.26 GLY + 0.77 MGLY + 0.35 OPEN + 0.65 XOPN + HO2 + RO2	k = k(ref) K k(ref) = k(70) K = 1.00E+0	3.48E-13
190	CRES + OH = 0.025 GLY + 0.025 OPEN + HO2 + 0.2 CRO + 0.732 CAT1 + 0.02 XO2N + 0.02 RO2	k = 1.70E-12 exp(950/T)	4.12E-11
191	CRES + NO3 = 0.3 CRO + HNO3 + 0.48 XO2 + 0.12 XO2H + 0.24 GLY + 0.24 MGLY + 0.48 OPO3 + 0.1 XO2N + 0.7 RO2	k = 1.40E-11	1.40E-11
192	CRO + NO2 = CRON	k = 2.10E-12	2.10E-12
193	CRO + HO2 = CRES	k = 5.50E-12	5.50E-12
194	CRON + OH = NTR2 + 0.5 CRO	k = 1.53E-12	1.53E-12
195	CRON + NO3 = NTR2 + 0.5 CRO + HNO3	k = 3.80E-12	3.80E-12
196	CRON = HONO + HO2 + FORM + OPEN	Photolysis	9.45E-05
197	XOPN = 0.4 GLY + XO2H + 0.7 HO2 + 0.7 CO + 0.3 C2O3	Photolysis	5.04E-04
198	XOPN + OH = MGLY + 0.4 GLY + 2 XO2H + 2 RO2	k = 9.00E-11	9.00E-11
199	XOPN + O3 = 1.2 MGLY + 0.5 OH + 0.6 C2O3 + 0.1 ALD2 + 0.5 CO + 0.3 XO2H + 0.3 RO2	k = 1.08E-16 exp(-500/T)	2.02E-17
200	XOPN + NO3 = 0.5 NO2 + 0.5 NTR2 + 0.45 XO2H + 0.45 XO2 + 0.1 XO2N + RO2 + 0.25 OPEN + 0.25 MGLY	k = 3.00E-12	3.00E-12
201	OPEN = OPO3 + HO2 + CO	Photolysis	5.04E-04
202	OPEN + OH = 0.6 OPO3 + 0.4 XO2H + 0.4 RO2 + 0.4 GLY	k = 4.40E-11	4.40E-11
203	OPEN + O3 = 1.4 GLY + 0.24 MGLY + 0.5 OH + 0.12 C2O3 + 0.08 FORM + 0.02 ALD2 + 1.98 CO + 0.56 HO2	k = 5.40E-17 exp(-500/T)	1.01E-17
204	OPEN + NO3 = OPO3 + HNO3	k = 3.80E-12	3.80E-12
205	CAT1 + OH = 0.14 FORM + 0.2 HO2 + 0.5 CRO	k = 5.00E-11	5.00E-11
206	CAT1 + NO3 = CRO + HNO3	k = 1.70E-10	1.70E-10
207	OPO3 + NO = NO2 + 0.5 GLY + 0.5 CO + 0.8 HO2 + 0.2 CXO3	k = 1.00E-11	1.00E-11
208	OPO3 + NO2 = OPAN	k = k(ref) K k(ref) = k(54) K = 1.00E+0	9.40E-12
209	OPAN = OPO3 + NO2	k = k(ref) K k(ref) = k(55)	2.98E-04

Number	Reactants and Products	Rate Constant Expression	k298
		K = 1.00E+0	
210	OPO3 + HO2 = 0.41 PACD + 0.15 AACD + 0.15 O3 + 0.44 ALDX + 0.44 XO2H + 0.44 RO2 + 0.44 OH	k = k(ref) K k(ref) = k(57) K = 1.00E+0	1.39E-11
211	OPO3 + C2O3 = MEO2 + XO2 + ALDX + 2 RO2	k = k(ref) K k(ref) = k(59) K = 1.00E+0	1.55E-11
212	OPO3 + RO2 = 0.8 XO2H + 0.8 ALDX + 1.8 RO2 + 0.2 AACD	k = k(ref) K k(ref) = k(58) K = 1.00E+0	1.30E-11
213	OPAN + OH = 0.5 NO2 + 0.5 GLY + CO + 0.5 NTR2	k = 3.60E-11	3.60E-11
214	PANX + OH = ALD2 + NO2	k = 3.00E-12	3.00E-12
215	NTR2 = HNO3	k = 2.30E-5	2.30E-05
216	ECH4 + OH = MEO2 + RO2	k = 1.85E-12 exp(-1690/T)	6.37E-15

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APPENDIX D-8

Supporting Information for Air Quality Impact Analysis for Rosebud Mine Area F
Draft Environmental Impact Statement (DEIS).

Supporting Information for Air Quality Impact Analysis for Rosebud Mine Area F Draft Environmental Impact Statement (DEIS)

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1. SPATIAL AND TEMPORAL PROFILES OF AREA F EMISSIONS

Fugitive emission sources were treated as area sources in modeling and the spatial extent of each source was assigned to all areas in which the emissions could occur. Stationary sources were treated as point sources in modeling and the location of the source was used, e.g. the latitude and longitude of the center of the coal pile for the emissions from truck dumping of coal. Coal blasting emissions were assumed to occur within the area encompassing all of the proposed Area F mine passes while haul road emissions were assumed to occur on all haul roads. Additional information on the spatial allocation of Area F emission sources is provided in **Table 1**.

For temporal profiles, the typical times of operation provided by Western Energy were used for all mining activities, except for coal and overburden blasting in which blasting records from Area C 2012 Q4 through 2013 Q3 were used. This time period was chosen as it corresponds with the meteorology data used in modeling, and the emissions used for regional sources other than the mine and associated power plants. The emissions associated with wind erosion of disturbed areas were assigned a flat temporal profile as these emissions can occur at any time and are not associated with the operational hours of the mine. Additional information on the temporal allocation of Area F emission sources is shown in **Table 1**.

Table 1. Spatial and temporal profiles of Area F emission sources

Emission Source(s)	Temporal Profile	Spatial Allocation
Topsoil Removal	6am-4:30pm,6pm-4:30am; 5 days a week; 12 months a year	Area F mine passes
Topsoil Dumping	6am-4:30pm,6pm-4:30am; 5 days a week; 12 months a year	Area F Topsoil Piles
Overburden Drilling	24 hours/day; 7 days a week; 12 months a year	Area F mine passes
Overburden Blasting - Cast Blasting	Blast records (q4 2012 – q3 2013)	Area F mine passes
Overburden Removal by Dragline	24 hours/day; 7 days a week; 12 months a year	Area F mine passes
Overburden Handling by Truck/Shovel	6am-4:30pm,6pm-4:30am; 5 days a week; 12 months a year	Area F mine passes
Overburden Dumping	6am-4:30pm,6pm-4:30am; 5 days a week; 12 months a year	Area F overburden stockpiles and scoria pits
Overburden Handling by Bulldozer	6am-4:30pm,6pm-4:30am; 5 days a week; 12 months a year	Area F overburden stockpiles and scoria pits
Haul Roads - Travel	6am-4:30pm,6pm-4:30am; 5 days a week; 12 months a year	Haul roads from Area F to coal truck dump in Area C
Access Roads - Unpaved	6am-4:30pm,6pm-4:30am; 5 days a week; 12 months a year	Area F access roads
Coal Drilling	6am-4:30pm; 5 days a week; 12 months a year	Area F mine passes
Coal Blasting	Blast records (q4 2012 – q3 2013)	Area F mine passes
Coal Removal	6am-4:30pm,6pm-4:30am; 5 days a week; 12 months a year	Area F mine passes
Mobile Sources Diesel Exhaust - Haul/Water Trucks	6am-4:30pm,6pm-4:30am; 5 days a week; 12 months a year	Haul roads from Area F to coal truck dump in Area C
Mobile Sources Diesel Exhaust - Grader	6am-4:30pm,6pm-4:30am; 5 days a week; 12 months a year	Area F mine passes
Mobile Sources Diesel Exhaust - Dozers	6am-4:30pm,6pm-4:30am; 5 days a week; 12 months a year	Area F Disturbance Limit

Explosives	Blast records (q4 2012 – q3 2013)	Area F mine passes
Disturbed Acres - Complete (> 2 Yr.)	Flat	Area F Disturbance Limit
Disturbed Acres - Complete (< 2 Yr.)	Flat	Area F Disturbance Limit
Disturbed Acres - Facilities	Flat	Area F Disturbance Limit
Disturbed Acres - Partial (< 1 Yr.)	Flat	Area F Disturbance Limit
Disturbed Acres - Partial (> 1 Yr.)	Flat	Area F Disturbance Limit
Disturbed Acres - Pits, Peaks, Soil Stripping	Flat	Area F Disturbance Limit
Portable/Stationary Equipment - Gasoline Engines	6pm-4:30am; 5 days a week; 12 months a year	Area F Disturbance Limit
Refuse coal hauling to Rosebud Power Plant	Default	Highway 39 from the Rosebud Mine guard booth to the Rosebud PP
Truck Dump - Coal	6am-4:30pm,6pm-4:30am; 5 days a week; 12 months a year	Latitude / Longitude of center point: 45.85893, -106.69114
Coal Crushing	6am-4:30pm,6pm-4:30am; 5 days a week; 12 months a year	Latitude / Longitude of center point: 45.85877, -106.69111
Coal Conveyors	6am-4:30pm,6pm-4:30am; 5 days a week; 12 months a year	Latitude and longitude of conveyor drop points (1: 45.86121, -106.66172; 2: 45.8742, -106.62997; 3: 45.87594, -106.61982; 4: 45.87588, -106.61004)

2. HAZARDOUS TRACE METAL CONCENTRATIONS IN ROSEBUD MINE COAL

Measured concentrations of hazardous trace metals in coal from the various existing and proposed areas of the Rosebud Mine were provided by PPL Montana (2014), and were used to estimate the impacts of HAPs from fugitive coal dust emissions. The tables below are from Page 5 of Attachment 3-1 (**Table 2**) and Page 2 of Attachment 3-3 (**Table 3**) of this document.

Table 2. Summary of aggregate, moisture corrected concentrations of trace elements in coal from Areas C, D, E (Source: Attachment 3-1 Page 5 of PPL Montana, 2014)

Area	Parameter	Mean	Sdev	Min	Max	# Samples
CDE	Sulfur %	0.79	0.23	0.3	1.77	213
	Ash %	9.40	1.42	4.14	18.36	216
	Btu/LB	8459	209	7365	9182	216
	Moisture %	26.28	1.59	19.38	30.75	217
	Volatile Matter	29.56	1.20	26.70	38.10	217
	Fixed Carbon %	34.76	1.56	25.00	41.30	217
	CaO (% of Ash)	13.01	4.18	3.50	31.63	194
	SiO2 (% of Ash)	41.62	5.44	16.46	58.20	194
	Fe2O3 (% of Ash)	7.53	4.61	2.49	51.96	194
	P2O5 (% of Ash)	0.34	0.15	0.05	0.86	191
	Al2O3 (% of Ash)	15.15	2.12	12.20	25.57	194
	TiO2 (% of Ash)	0.69	0.23	0.08	1.38	191
	MgO (% of Ash)	3.99	1.05	0.49	7.90	194
	SO3 (% of Ash)	12.97	2.48	2.46	20.82	191
	K2O (% of Ash)	0.56	0.35	0.16	2.81	191
	Na2O (% of Ash)	0.43	0.37	0.11	3.14	191
	Antimony	0.41	0.33	0.17	1.50	17
	Arsenic	4.63	2.93	0.84	9.96	17
	Beryllium	0.25	0.12	0.11	0.59	17
	Cadmium	0.09	0.06	0.03	0.29	17
	Chromium	5.23	5.07	0.58	19.43	17
	Copper	13.82	3.20	7.30	19.22	17
	Fluorine	27.31	18.15	6.96	74.78	17
	Germanium	3.25	1.87	0.77	7.83	17
	Lead	3.14	2.14	0.35	9.04	17
	Manganese	44.26	19.64	17.50	86.96	17
	Mercury	0.17	0.05	0.10	0.26	17
	Nickel	19.13	6.96	5.48	35.13	17
	Selenium	0.43	7.73	0.09	1.97	17
	Zinc	9.32	5.59	1.39	21.83	17

Table 3. Summary of moisture corrected concentrations of trace elements in coal from Areas AB, F, G, and FG (Source: Attachment 3-3 Page 2 of PPL Montana, 2014).

Area	Parameter	Average	Std. Dev.	Minimum	Maximum	# Samples
AB	Antimony	0.34	0.03	0.29	0.41	15
F	Antimony	0.30	0.02	0.27	0.32	13
G	Antimony	0.49	0.41	0.29	3.24	67
FG	Antimony	0.46	0.37	0.27	3.24	80
AB	Arsenic	0.75	0.12	0.56	0.95	15
F	Arsenic	0.72	0.07	0.63	0.79	13
G	Arsenic	1.71	2.00	0.64	16.31	67
FG	Arsenic	1.55	1.84	0.63	16.31	80
AB	Beryllium	0.29	0.05	0.24	0.40	15
F	Beryllium	0.28	0.05	0.16	0.32	13
G	Beryllium	0.53	0.76	0.16	5.09	67
FG	Beryllium	0.49	0.70	0.16	5.09	80
AB	Cadmium	0.05	0.01	0.04	0.06	15
F	Cadmium	0.04	0.00	0.03	0.05	13
G	Cadmium	0.06	0.02	0.03	0.12	67
FG	Cadmium	0.06	0.02	0.03	0.12	80
AB	Chromium	3.23	0.47	2.38	3.97	15
F	Chromium	2.56	0.35	2.37	3.16	13
G	Chromium	4.07	2.50	2.39	22.28	67
FG	Chromium	3.83	2.31	2.37	22.28	80
AB	Copper	5.99	0.59	5.56	7.15	15
F	Copper	5.05	0.51	3.96	5.54	13
G	Copper	6.73	1.39	4.77	12.73	67
FG	Copper	6.46	1.29	3.96	12.73	80
AB	Fluorine	28.94	10.00	3.74	43.71	15
F	Fluorine	28.91	2.83	23.73	32.44	13
G	Fluorine	46.71	24.99	14.32	124.92	67
FG	Fluorine	43.81	23.01	14.32	124.92	80
AB	Germanium	NA	NA	NA	NA	NA
F	Germanium	0.79	0.00	0.79	0.79	13
G	Germanium	0.98	1.32	0.79	11.94	80
FG	Germanium	1.02	1.44	0.80	11.94	67
AB	Lead	3.97	0.36	3.18	4.69	15
F	Lead	3.75	0.27	3.24	4.11	13
G	Lead	3.99	0.90	2.47	6.92	67
FG	Lead	3.95	0.83	2.47	6.92	80
AB	Manganese	80.64	34.92	0.13	119.21	15
F	Manganese	70.59	19.10	52.22	126.58	13
G	Manganese	79.35	18.35	43.76	151.97	67
FG	Manganese	77.93	18.47	43.76	151.97	80
AB	Mercury	0.06	0.11	0.02	0.45	15
F	Mercury	0.03	0.01	0.02	0.04	13
G	Mercury	0.07	0.04	0.02	0.22	67
FG	Mercury	0.06	0.04	0.02	0.22	80
AB	Nickel	1.32	0.39	0.79	1.59	15
F	Nickel	0.91	0.30	0.79	1.58	13
G	Nickel	2.72	1.00	1.59	7.96	67
FG	Nickel	2.43	0.93	0.79	7.96	80
AB	Selenuim	0.58	0.07	0.40	0.72	15
F	Selenuim	0.55	0.06	0.47	0.63	13
G	Selenuim	0.68	0.18	0.48	1.59	67
FG	Selenuim	0.66	0.17	0.47	1.59	80
AB	Zinc	2.28	0.94	0.79	3.97	15
F	Zinc	2.19	0.73	1.58	3.96	13
G	Zinc	6.02	6.19	1.59	40.58	67
FG	Zinc	5.40	5.70	1.58	40.58	80

3. ANALYSIS AREA FOR SPECIAL STATUS SPECIES

To establish the analysis area for special status species (see Wildlife section of Environmental Consequences for discussion of special status species) for the impacts of the atmospheric deposition of hazardous air pollutants (HAPs) from indirect effects, the atmospheric dispersion and deposition of selected trace metal HAPs emitted from the combustion of Area F coal in Colstrip Units 3 and 4, and Rosebud Power Plant were modeled with the EPA AERMOD model.

Eight metal HAPs were investigated for air quality impacts and in establishment of the deposition analysis area for special status species for indirect effects because these HAPs are commonly emitted from coal-fired power plants and due to their known relation to the ecological impacts from coal combustion and potential to act as primary ecological risk indicators (EPRI 2009, EPRI 2011). These examined metals were antimony, arsenic, cadmium, chromium, copper, lead, selenium, and mercury.

Overview of AERMOD

AERMOD (version 16216) was used to model the dispersion and deposition of HAPs emitted from Colstrip and Rosebud Power Plants from 2011 to 2015. AERMOD is the preferred air dispersion/deposition model recommended by EPA for source to receptor distances less than 50 kilometers (km). It is the current regulatory near-field dispersion model capable of handling complex source configurations, deposition processes, emission units subject to plume downwash, and the scenarios when emission plumes interact with complex terrain (https://www3.epa.gov/ttn/scram/dispersion_prefrec.htm#aermod).

This AERMOD version incorporates dry and wet deposition algorithms developed by the Argonne National Laboratory (ANL; Wesely, et al., 2002), with modifications and refinements based on peer review, for particulate and gaseous pollutant deposition. Dry particulate deposition is based on the emitted particle size distribution, surface conditions such as land surface type, and hourly meteorology. Wet particulate deposition depends on hourly precipitation and the particle size distribution. The gas deposition algorithms apply land use categories by season to determine gas deposition resistance terms. Diffusivity in air and water (i.e., the rate of movement due to differences in concentrations), cuticular resistance to uptake in leaves (i.e., the resistance to uptake in leaves due to the thin protective film over the leaf), and Henry's Law constant (the Henry's Law solubility constant is the ratio of the concentration of the chemical dissolved in water to its air concentration (typically expressed as partial pressure)) are also used to calculate both wet and dry gaseous pollutant deposition. AERMOD accounts for depletion of mass from the plume caused by both wet and dry removal mechanisms.

Meteorological Data Processing

The general techniques applied in a previous SO_2 modeling study of the Colstrip facility (DEQ 2016f) were followed to prepare meteorological data for AERMOD simulations, except that 2011 and 2015 data were added to the 2012-2014 data used in the aforementioned study. Features of the meteorological data processing included:

- Hourly surface observations, precipitation, and 1-minute Automated Surface Observing System (ASOS) data files were collected from the Frank Wiley Field Airport in Miles City, MT (ID: 24037). The 5-year surface meteorological data files were obtained from the National Climatic Data Center (NCDC) for the period of 2011 to 2015. A wind rose for Frank Wiley Field Airport is shown in **Figure 1** for 2011-2015.

- The upper air sounding data were obtained for the same period from the NOAA Radiosonde Observation Data Archive website (https://esrl.noaa.gov/raobs) for the upper air station at Glasgow International Airport in Glasgow, MT (ID: 94008).

- Land use data surrounding the Miles City Airport anemometer site were processed using AERSURFACE (Version 13016). Following the techniques used by the SO_2 modeling analysis (MDEQ, 2016), surface moisture conditions were based on data at Miles City. Land use surface conditions were calculated on a monthly period and assumed continuous snow cover during winter months for 12 radial sectors, evenly spaced every 30 degrees.

- AERMET (version 16216) was used to process the following datafiles: surface meteorological data from Miles City; upper air sounding data from Glasgow; land use characteristics surrounding Miles City; and the 1-minute ASOS data. The 1-minute data were first processed by AERMINUTE (version 16216) to reduce the number of meteorological hours of calm winds which the AERMOD cannot process resulting in a zero pollutant concentration. Default options were selected for the application of AERMET.

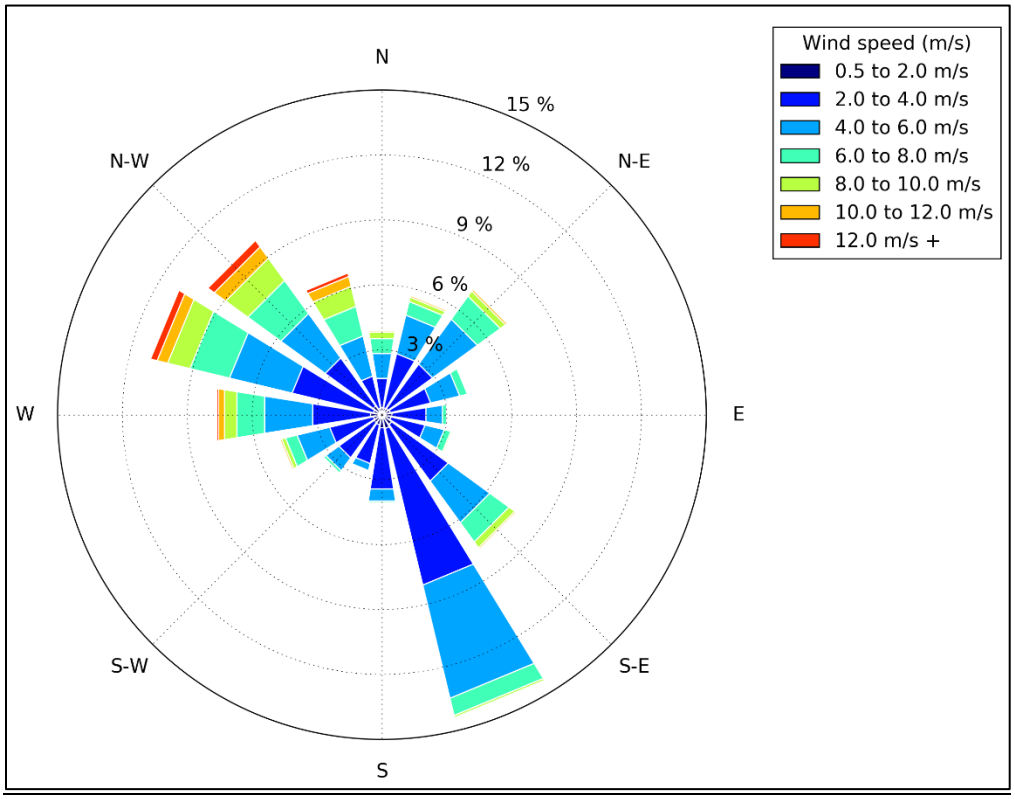

Figure 1. Wind rose for Frank Wiley Field Airport in Miles City, MT (Station ID: 24037) from 2011 to 2015. m/s = meters per second

Particle Size Distribution

In addition to emission rates, the particle size distribution of emissions is required by AERMOD. The particle size distributions used in this study are based on Table 1.1-6, EPA's AP-42 (EPA, 1998), which provides particle size distributions for various boiler types and particulate control methods. For Colstrip Units 3 and 4, the AP-42 particle mass distribution for the scrubber control class was selected because the

scrubber is located downstream of the boiler. Rosebud Power Plant uses a circulating fluidized bed (CFB) boiler with a baghouse to control emissions from the power generation stack. AP-42 does not provide particle size distributions for CFB boilers, and so the dry bottom pulverized coal boiler with a baghouse was selected from AP-42 to represent the Rosebud Power Plant boiler. With the exception of mercury, all of the metals investigated were assumed particulate-bound, and so mass based particle size distributions were used for these compounds in AERMOD (**Table 4**). Mercury is vaporized during combustion and adsorbs onto the surface of particles in the exhaust, and so surface-area based particle size distributions were used for the particulate-bound mercury (HgP) (**Table 5**).

Representative particle diameters are based on the average volumes of the lower and upper limits of each of the particle size category ranges. The particle size distributions in AP-42 are based on the aerodynamic particle diameter as measured by an impactor from stack tests or as measured in ambient air by reference method samplers for PM_{10} and $PM_{2.5}$ (particulate matter ≤ 10 µm diameter and particulate matter ≤ 10 µm diameter, respectively). The aerodynamic particle diameters were modeled with an assumed particle density of 1.0 g/cm^3 (grams per cubic centimeter).

Table 4. Mass based particle size distributions used for emissions of metals except mercury at Colstrip 3 and 4, and Rosebud Power Plant

Particle Size Range	Representative Diameter	Colstrip Power Plant Units 3 and 4		Rosebud Power Plant	
		Cumulative	Differential Mass Fraction*	Cumulative	Differential Mass Fraction*
(µm)	(µm)	(%)	(%)	(%)	(%)
>15	20.00	100	19	100	3
10-15	12.98	81	10	97	5
6-10	8.47	71	9	92	15
2.5-6	4.87	62	11	77	24
1.25-2.5	2.06	51	16	53	22
1.00-1.25	1.14	35	4	31	6
0.625–1.00	0.85	31	11	25	11
<0.625	0.50	20	20	14	14
TOTAL			**100**		**100**

µm = micrometer
% = percentage
* Differential mass fraction is the incremental mass fraction (in percent) in a given size range

Table 5. Surface area based particle size distributions for particulate-bound mercury (HgP) emissions from Colstrip Units 3 and 4, and Rosebud Power Plant

Particle Size Range	Representative Diameter	Colstrip Power Plant Units 3 and 4		Rosebud Power Plant	
		Cumulative	Differential Area Fraction*	Cumulative	Differential Area Fraction*
(µm)	(µm)	(%)	(%)	(%)	(%)
>15	20	100.0	1.4	100.0	0.2
10-15	12.98	98.6	1.1	99.8	0.6

6-10	8.47	97.5	1.5	99.2	2.8
2.5-6	4.87	96.0	3.2	96.4	7.7
1.25-2.5	2.06	92.8	11.2	88.7	16.6
1.00-1.25	1.14	81.6	5.1	72.1	8.2
0.625–1.00	0.85	76.5	18.5	63.9	20.0
<0.625	0.50	58.0	58.0	43.9	43.9
TOTAL			**100.0**		**100.0**

µm = micrometer
% = percentage
* Differential area fraction is the incremental area fraction (in percent) in a given size range

Deposition Parameters

AERMOD "Method 1" was selected for calculations of dry particle deposition of the selected metals and particulate mercury using facility-specific information. According to the EPA guidance, Method 1 should be used when a significant fraction (greater than 10 percent) of the total particulate mass has a diameter of 10 microns (µm) or larger, and the particle size distribution is known. Method 1 requires particle size distribution, particle mass fraction, and particle density as inputs to AERMOD for deposition flux calculations.

Gaseous emissions of elemental mercury and divalent mercury were modeled using the non-default gas deposition options in AERMOD. The gas deposition algorithms in AERMOD require land use characteristics, gas deposition resistance based on seasonal categories, and gas deposition parameters for the diffusivity in air and water, the cuticular resistance to uptake by lipids for leaves, and Henry's Law constant. The modeling parameters for Hg^0 and Hg^{2+} are displayed in **Table 6**.

Table 6. Gas Deposition Parameters for Elemental (Hg^0) and Divalent (Hg^{2+}) Mercury Modeling

Gas Deposition Parameter	Elemental Mercury	Divalent Mercury
Land Use Categories	All Sectors: Rangeland (Category 3)	
Seasonal Categories	Default seasons for regions with snow on ground in winter	
Diffusivity in Air, Da (cm^2/s) (1)	7.23×10^{-2}	6.0×10^{-2}
Diffusivity in Water, Dw (cm^2/s) (1)	6.30×10^{-6}	3.26×10^{-4}
Cuticular resistance to uptake by lipids for individual leaves, rcl ($s \cdot cm^{-1}$) (2)	1.0×10^5	1.0×10^5
Henry's Law constant, H ($Pa \cdot m^3 \cdot mol^{-1}$) (2)	150	6.0×10^{-6}

cm^2/s = centimeters squared per second
$s\ cm^{-1}$ = second per centimeter
$Pa\ m^3\ mol^{-1}$ = Pascals cubic meter per mole

1. Diffusivity in air and water from Lee. S. and T. Keener. 2008. Ohio J Sci 108(4):65-69.
2. Data from page 29 of Wesely et al., 2002.

Building Wake Parameters

EPA's Building Profile Input Program (BPIP) Version 04274 was applied to prepare the necessary data for AERMOD's building wake routines. The taller buildings are about 83 m (meters) high (and lower than the corresponding projected widths). The Good Engineering Practice (GEP) stack height calculated by BPIP for the taller stacks is 208.5 m, less than the actual stack height of 210.9 m. For the purposes of the present analysis, the actual stack height was used in the simulations, not the GEP stack height.

AERMOD Modeling Options

AERMOD was applied in regulatory default mode for particulate deposition except for the application of the non-default gas deposition options for the gas phase mercury analyses. Simulations were performed for each year of the 5-year data set to obtain estimates for annual dry, wet, and total deposition fluxes. The default mode for deposition includes plume depletion by both wet and dry removal mechanisms.

Receptor Network

The receptor grid used in the Colstrip SO_2 modeling (MDEQ, 2016) was expanded as is shown in Figure 2 and **Figure 3**. The receptors in the SO_2 modeling consisted of a series of nested Cartesian grids extending 11.5 km in all directions from the Colstrip facility. No receptors were included within the Colstrip fenceline, the offsite cooling ponds, or at the Rosebud Power Plant, approximately 10 km to the north. The grid used in the deposition analyses was extended to 60 km from the Colstrip facility (or approximately 50 km from the Rosebud Power Plant). The details of the air modeling grids are as follows:

- 50 meter spacing along the Colstrip Power Plant facility fenceline
- 50 meter spacing out 2.5 km from the Colstrip facility
- 100 meter spacing between 2.5 km and 3.5 km from the Colstrip facility
- 250 meter spacing between 3.5 km and 11.5 km from the Colstrip facility
- 500 meter spacing between 11.5 km and 20 km from the Colstrip facility
- 1000 meter spacing between 20 km and 40 km from the Colstrip facility
- 2000 meter spacing between 40 km and 60 km from the Colstrip facility

The grid captures the local terrain near the facility and provides some indication of deposition out to 60 km from the Colstrip Power Plant.

The latest version of AERMAP (Version 11103) was used to extract terrain elevations and critical hill heights for all receptors defined in the combined receptor grid using National Elevation Data (NED) (https://lta.cr.usgs.gov/NED) with a horizontal spacing of 10 m. The combined receptor grid used in the dispersion and deposition modeling analysis is based on North American Datum (NAD) 83 and in Universal Transverse Mercator (UTM) Zone 13.

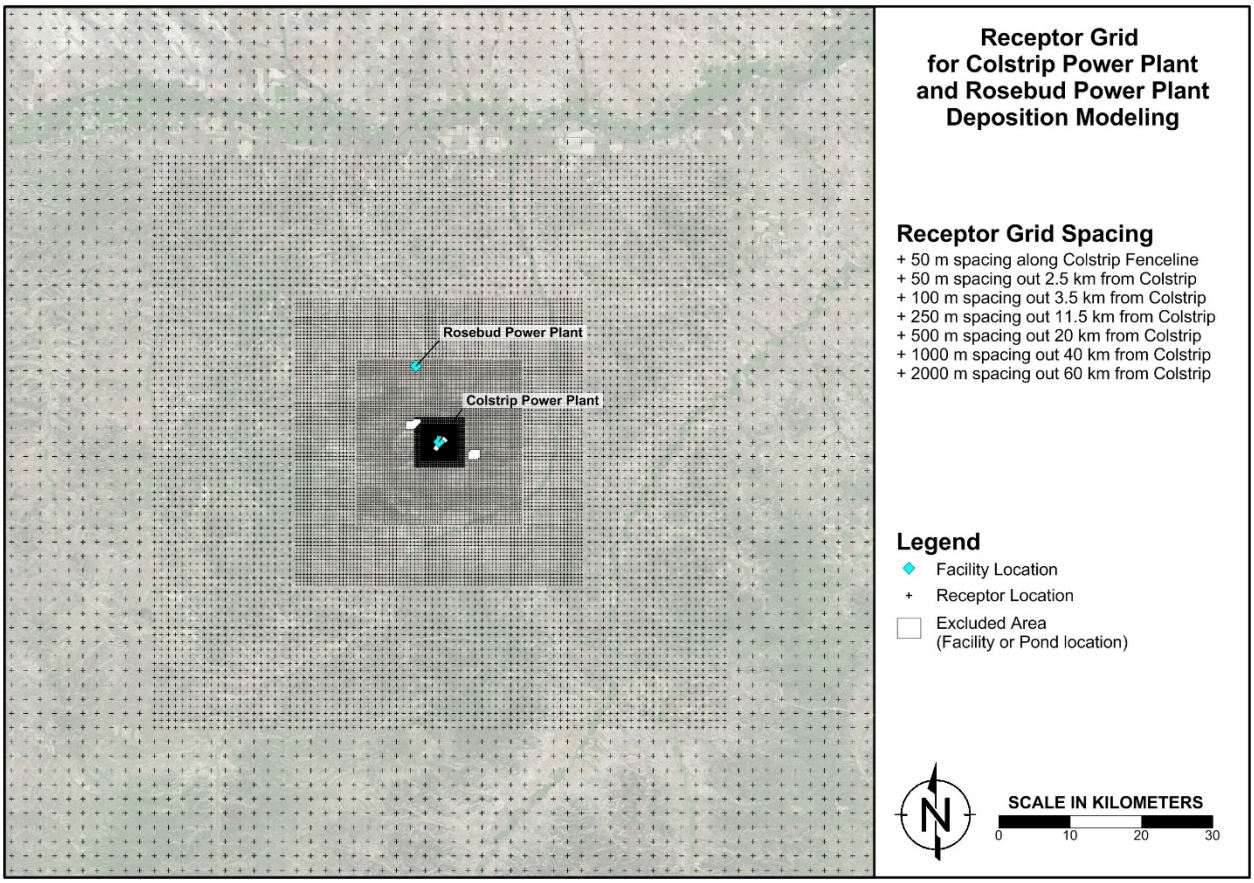

Figure 2. AERMOD Modeling Receptor Grid. m = meters

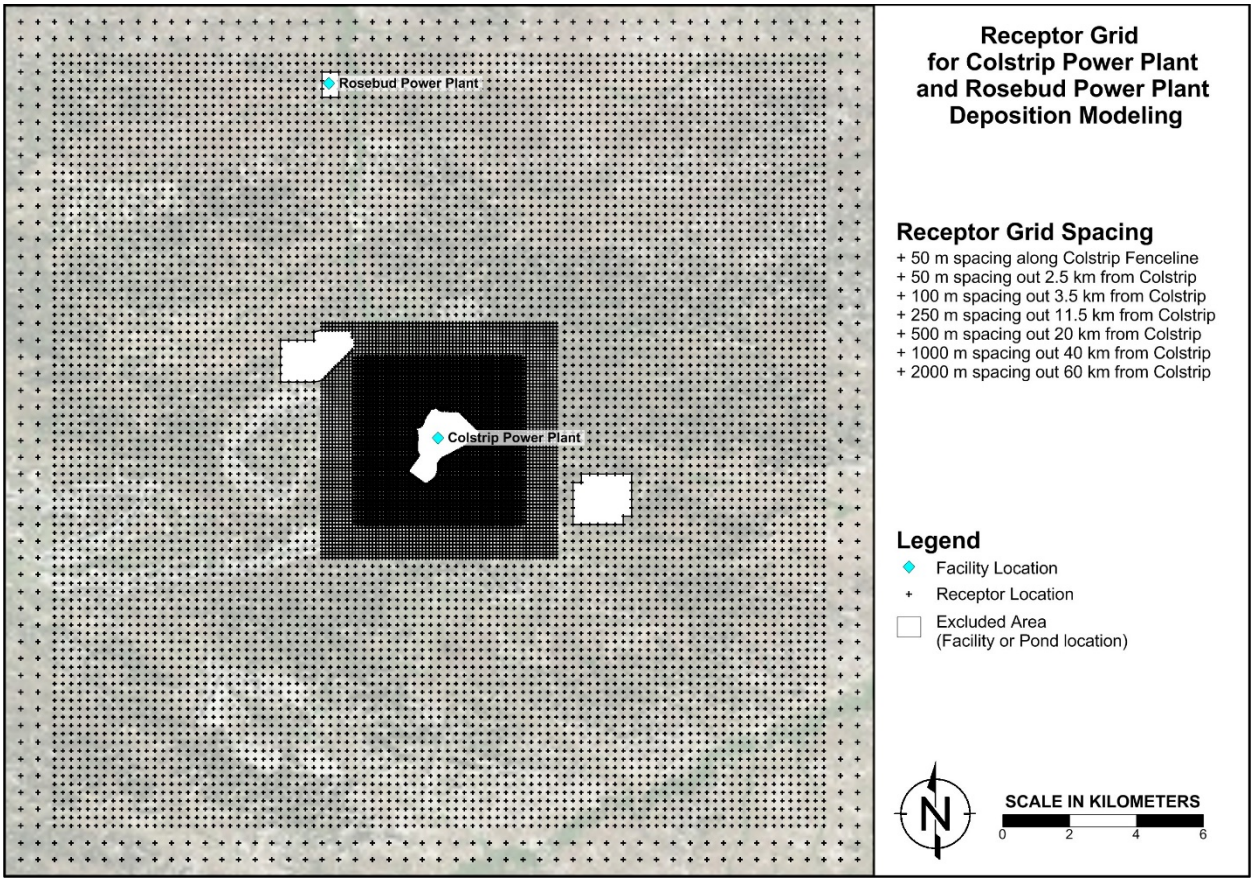

Figure 3. AERMOD Modeling Receptor Grid, Close View. m = meters

Raw soil data from USGS Data series 801.

Soil concentrations were obtained from data collected by the United States Geological Survey (USGS) from 2007 to 2010 (Smith et al., 2013). Surface soil data (0-5 centimeters) of all samples taken within Rosebud and Treasure counties (and within 1 km of their borders) were used to characterize soil concentrations. The soil sampling sites are shown in **Figure 4**, and the measured soil concentrations at each site are shown in **Table 7**.

Table 7. Measured surface soil concentrations (0-5 cm) of selected HAPs in Rosebud County and Treasure County, Montana

SiteID	Antimony	Arsenic	Cadmium	Chromium	Copper	Lead	Selenium	Mercury
	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)
9774	0.62	6.2	0.2	57	20.50	15.7	0.4	0.03
702	0.55	5.0	0.2	35	8.60	14.0	0.2	0.01
10350	1.04	6.7	0.3	45	16.40	17.2	0.2	0.02
2158	1.15	11.5	0.3	61	24.50	20.5	0.7	0.03
4206	1.12	15.4	0.2	47	25.60	20.3	0.7	0.02
12398	0.77	10.7	0.3	48	17.70	17.3	0.8	0.01
10686	0.63	5.4	0.1	24	6.90	15.1	<0.2	0.01
7614	0.64	13.8	0.2	39	11.70	15.2	0.4	0.01
8302	0.62	9.5	<0.1	43	10.70	11.7	0.2	0.03
8894	0.29	3.3	0.2	44	12.40	16.1	0.3	0.01
11710	0.88	9.2	0.3	51	17.90	16.8	0.4	0.02

cm = centimetre, soil depth
mg/kg = milligram per kilogram dry weight in soil

1. Data source: Geochemical and Mineralogical Data for Soils of the Conterminous United States, 2013 http://pubs.usgs.gov/ds/801/

Treasure and Rosebud counties are included as the Rosebud mine and Colstrip and Rosebud Power Plants are located in these counties.

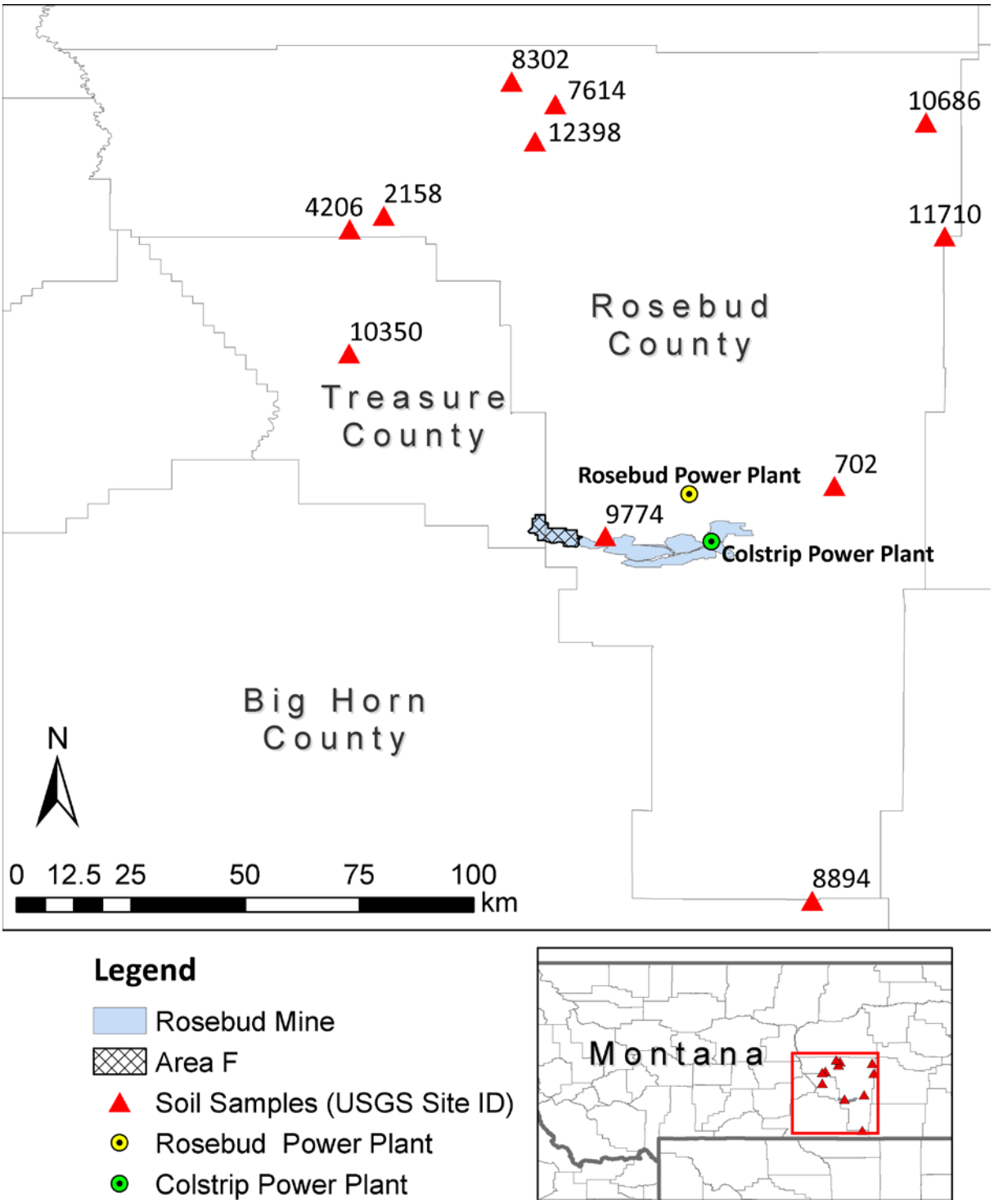

Figure 4. Soil sampling sites from USGS database that provided soil concentrations of the metals of interest. Rosebud and Treasure counties included as they comprise the Power Plants and Rosebud mine. Sampling sites are labelled with the USGS Site ID. km = kilometers

4. DATA FOR ROSEBUD POWER PLANT HAUL TRUCKS USED IN MOVES MODELING

The EPA Motor Vehicle Emissions Simulator (MOVES) model (version 2014a) (www.epa.gov/moves) was used to estimate exhaust emissions from trucks hauling coal from the Rosebud Mine to the Rosebud power plant. Information on these trucks is provided in **Table 8**. The Rosebud power plant owns five (5) trucks. Three out of five trucks are operational on any given day, each delivering approximately 6.5 loads daily – approximately 19.5 loads total Therefore, three-fifths (3/5th) of total emissions from MOVES for the trucks in the table below was used for the haul truck emissions. **Table 9** shows the one-way and round trip haul distances. The maximum round-trip distance of 57.94 km was used to conservatively estimate the emissions from the hauling of waste coal to Rosebud Power Plant.

Table 8. Rosebud Haul Truck Information.

Year	Make	Description	Engine Type
1997	Kenworth	W900 Truck	Cummins N-14
1999	Kenworth	W900 Truck	Cat 3406 B
1995	Kenworth	W900 Truck	Cummins N-14
2001	Kenworth	W900 Truck	Cummins N-14
2001	Kenworth	W900 Truck	Cummins N-14

Source: Email communication from Western Energy, November 21, 2016.

Table 9. Haul Distances from Rosebud Mine to Rosebud Power Plant.

	One Way Haul Distance		Round Trip Distance	
	Miles	Kilometer	Miles	Kilometer
Rosebud Mine Guard Shack to Rosebud Power Plant	8	12.87	16	25.75
Area A	6	9.66	28	45.06
Area B	5	8.05	26	41.84
Area C	10	16.09	36	57.94

5. COUNTIES AND CITIES IN ANALYSIS AREA

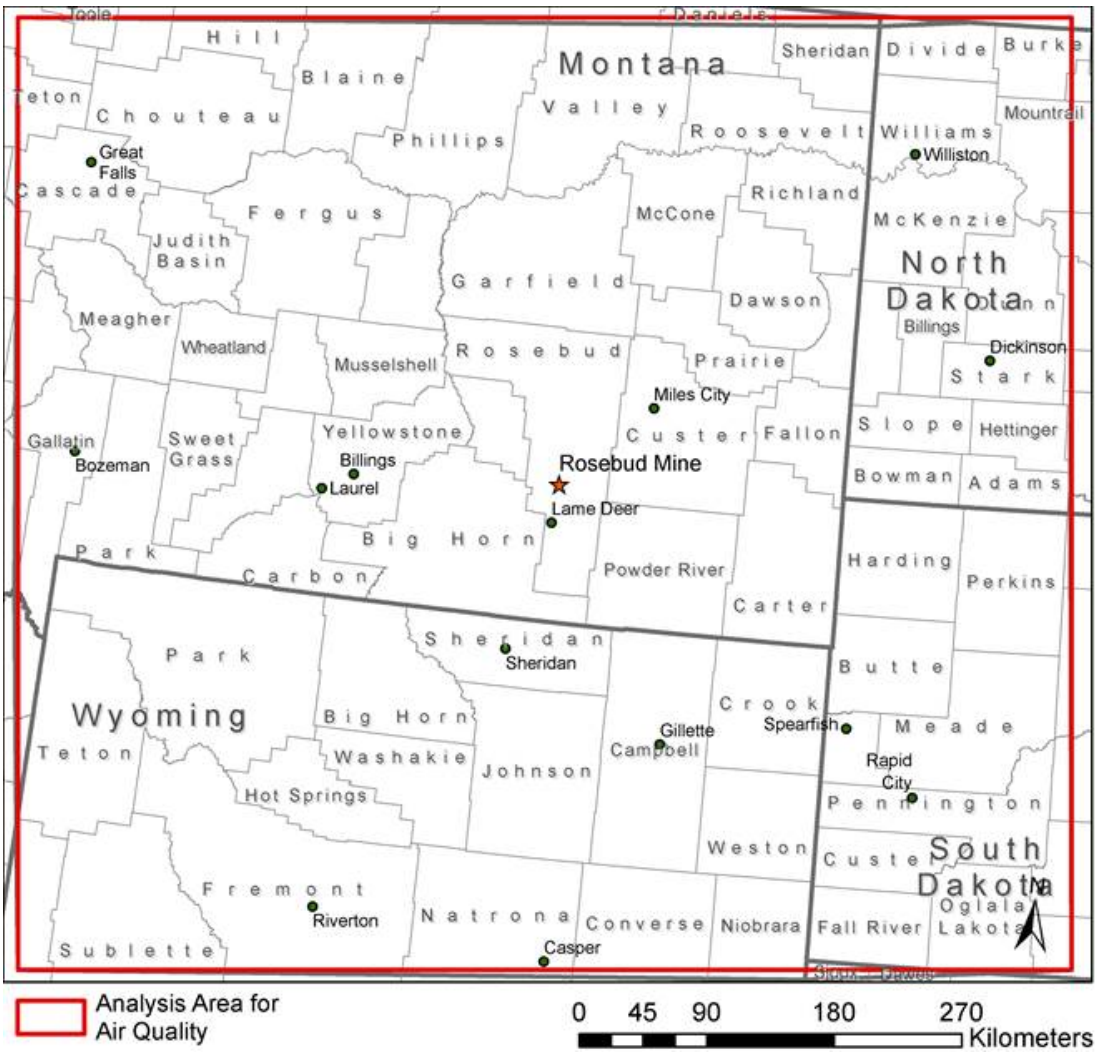

Figure 5. Counties and Selected Cities in Analysis Area.

6. MODELED NITROGEN AND SULFUR DEPOSITION

Cumulative Modeled Future Annual Deposition if Area F is not Approved

The cumulative modeled future annual deposition if Area F is not approved was calculated by summing the CAMx modeled source apportionment contributions from all source groups other than the Direct Source group.

Table 10. Modeled Cumulative Annual Nitrogen and Sulfur Deposition at Class I Areas if Area F is not Approved .

Class I Area	Nitrogen Maximum (kg/ha)	Nitrogen Average (kg/ha)	Sulfur Maximum (kg/ha)	Sulfur Average (kg/ha)
Badlands National Park	4.3437	3.6051	0.7892	0.6248
Bridger	1.6033	1.3823	0.6176	0.4103
Fitzpatrick	1.5596	1.2956	0.5757	0.4016
Fort Peck Indian Reservation	6.4175	3.0305	1.0845	0.7461
Gates of the Mountains Wilderness	1.4504	1.3682	0.2912	0.2624
Grand Teton National Park	2.0665	1.3386	0.6178	0.3111
Lostwood National Wildlife Refuge	4.9498	4.4263	2.1462	1.7811
Lostwood Wilderness	5.0379	4.7603	2.1462	2.0851
Medicine Lake (Class I)	7.228	3.6332	0.9564	0.8945
North Absaroka	1.485	1.0376	0.4479	0.2984
Northern Cheyenne	2.1487	1.5346	0.8014	0.5344
Teton	1.3101	1.078	0.4475	0.309
Theo Roosevelt National Park	4.7556	3.6177	1.0431	0.7531
UL Bend National Wildlife Refuge	2.1551	1.9435	0.503	0.4596
UL Bend Wilderness	1.9923	1.7438	0.4793	0.427
Washakie	1.3505	1.0188	0.442	0.2998
Wind Cave National Park	3.1186	2.7761	0.5581	0.5301
Yellowstone National Park	2.281	1.1178	0.6066	0.2726

Direct Impacts on Deposition from Proposed Action

Figure 6 shows the spatial distribution of the direct impacts on annual total nitrogen and sulfur deposition. Results from the 1 km resolution domain are more representative of impacts due to the mine. The 4 km resolution domain spatial patterns are shown only for comparison. The highest impacts for annual nitrogen and sulfur deposition are 0.5 kg ha^{-1} and 0.1 kg ha^{-1}, respectively, both within Area F. The above results conservatively consider all areas within the mine boundary even though the public do not have access to these areas. Impacts outside Area F decrease with distance. The spatial footprint of nitrogen deposition is larger than that of sulfur deposition due to the slow formation of secondary nitrogen compounds such as HNO_3 from NOx emissions from the mine and their subsequent deposition. The color scales shown were selected to allow for comparison with similar figures for cumulative deposition in Appendix D-6 of the EIS.

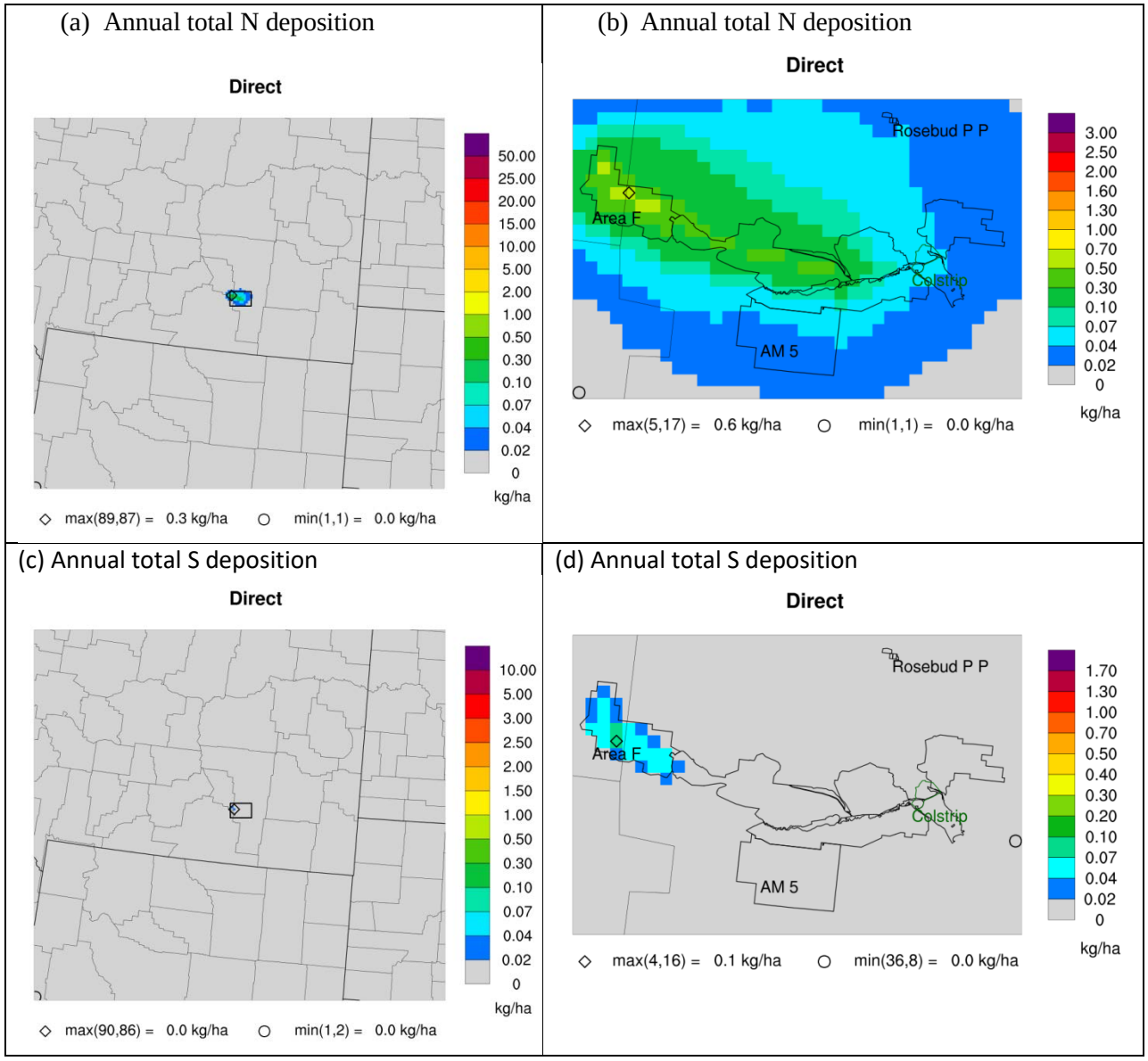

Figure 6. Spatial distribution of direct impacts on annual total nitrogen and sulfur deposition in the 4 km (left) and 1 km (right) resolution modeling domains.

Indirect Impacts on Deposition from Proposed Action

Figure 7 shows the spatial distribution of the indirect impacts on annual total nitrogen and sulfur deposition in the analysis area. The color scales shown were selected to allow for comparison with similar figures for cumulative deposition in Appendix D-6 of the EIS.

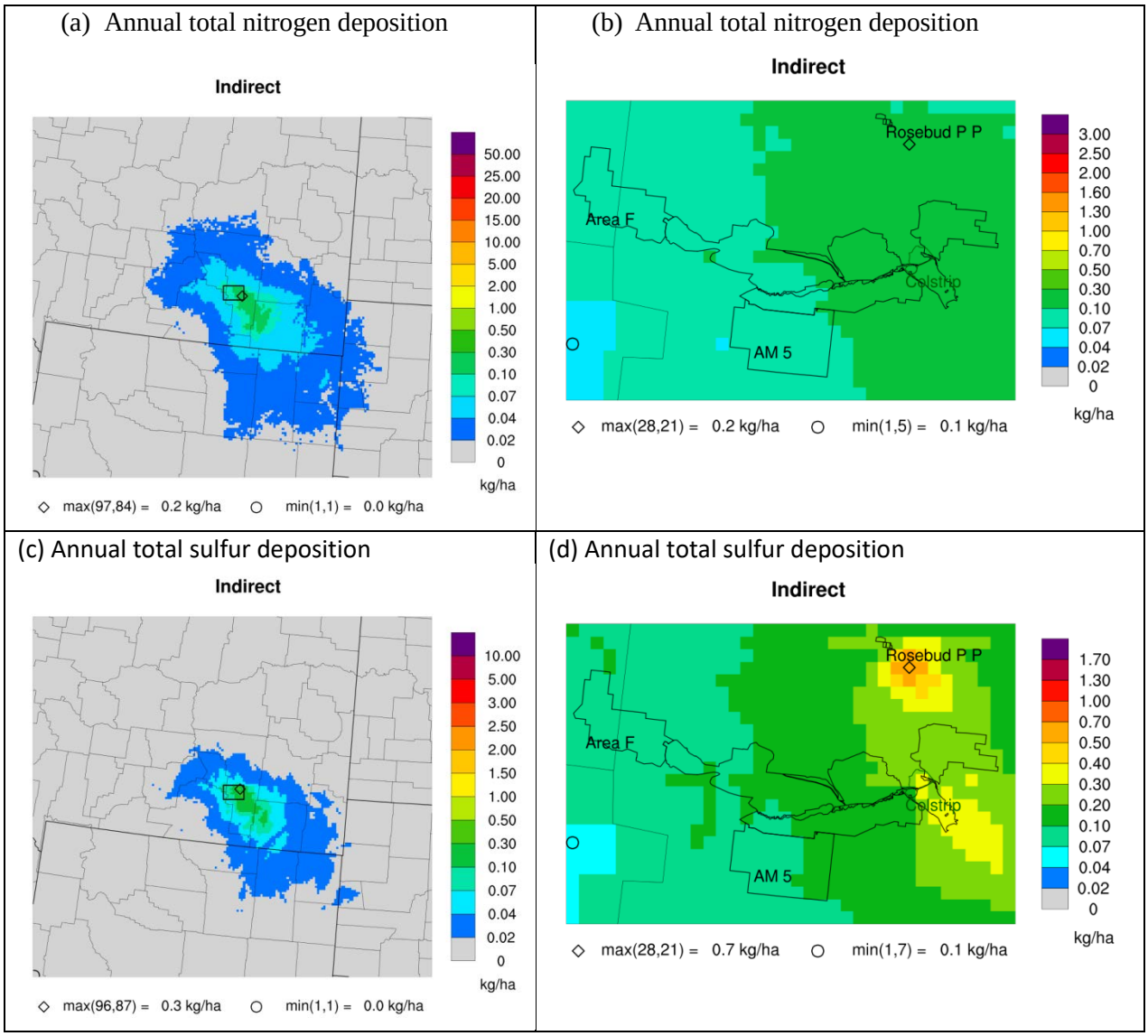

Figure 7. Spatial distribution of indirect impacts on annual total nitrogen and sulfur deposition in the 4 km (left) and 1 km (right) modeling domains.

7. REFERENCES

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Appendix E – List of Surface Water and Ground Water Rights

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Water Rights Number	Source	Priority Date (yr/mo/day)	Owner	Purpose	County	Township and Range	Section	Quarter Section	Reservoir?	Maximum Flow Rate (Gpm)	Maximum Volume (Ac-ft)	Maximum Acreage (Acres)	Well Depth (feet)
42KJ 106490 00	GROUNDWATER	19811230	WPP LLC	STOCK	Treasure	2N38E	25	SESESW	N	5			
42KJ 108264 00	SPRING. UNNAMED TRIBUTARY OF BLACK HANK CREEK	19111231	WPP LLC	STOCK	Rosebud	2N39E	33	NWSWNW	N				
42KJ 108360 00	GROUNDWATER	19650218	GNP LLC	STOCK	Rosebud	2N39E	25	SESWNE	N	3.5			
42KJ 108365 00	SPRING. UNNAMED TRIBUTARY OF UNNAMED TRIBUTARY OF WEST FORK ARMELLS CREEK	19111231	GREAT NORTHERN PROPERTIES LTD PRTNRSHP	STOCK	Rosebud	2N39E	25	SWSENE	N				
42KJ 108368 00	GROUNDWATER	19650218	GREAT NORTHERN PROPERTIES LTD PRTNRSHP	STOCK	Rosebud	2N39E	25	SESWNE	N	3.5			136
42KJ 108369 00	ARMELLS CREEK. WEST FORK	19680705	GREAT NORTHERN PROPERTIES LTD PRTNRSHP	STOCK	Rosebud	2N39E	25	NWSWSW	Y				
42KJ 108370 00	UNNAMED TRIBUTARY OF UNNAMED TRIBUTARY OF WEST FORK ARMELLS CREEK	19680705	GREAT NORTHERN PROPERTIES LTD PRTNRSHP	STOCK	Rosebud	2N39E	25	SWNWNE	Y				
42KJ 108371 00	SPRING. UNNAMED TRIBUTARY OF TRAIL CREEK	19111231	GREAT NORTHERN PROPERTIES LTD PRTNRSHP	STOCK	Treasure	2N38E	1	SWNENW	N				
42KJ 108381 00	GROUNDWATER	19431231	GREAT NORTHERN PROPERTIES LTD PRTNRSHP	STOCK	Rosebud	2N39E	19	SWNESW	N	5			235
42KJ 108385 00	UNNAMED TRIBUTARY OF TRAIL CREEK	19680628	GREAT NORTHERN PROPERTIES LTD PRTNRSHP	STOCK	Treasure	2N38E	1	SENENW	Y				
42KJ 108386 00	SPRING. UNNAMED TRIBUTARY OF TRAIL CREEK	19111231	GREAT NORTHERN PROPERTIES LTD PRTNRSHP	STOCK	Treasure	2N38E	1	SENWNW	N				
42KJ 108387 00	SPRING. UNNAMED TRIBUTARY OF TRAIL CREEK	19111231	GREAT NORTHERN PROPERTIES LTD PRTNRSHP	STOCK	Treasure	2N38E	1	NWSENW	N				
42KJ 108393 00	SPRING. UNNAMED TRIBUTARY OF ROBBIE CREEK	19130610	WPP LLC	STOCK	Treasure	2N38E	13	SWSWSW	N				
42KJ 108394 00	SPRING. UNNAMED TRIBUTARY OF MCCLURE CREEK	19130610	WPP LLC	STOCK	Treasure	2N38E	13	SWSENW	N				
42KJ 108395 00	SPRING. UNNAMED TRIBUTARY OF ROBBIE CREEK	19130610	WPP LLC	STOCK	Treasure	2N38E	13	SESWSE	N				
42KJ 108396 00	SPRING. UNNAMED TRIBUTARY OF MCCLURE CREEK	19111231	WPP LLC	STOCK	Treasure	2N38E	13	NWNENW	N				
42KJ 108397 00	DONLEY CREEK	19680628	WPP LLC	STOCK	Treasure	2N38E	25	SESESW	Y				
42KJ 108399 00	SPRING. UNNAMED TRIBUTARY OF UNNAMED TRIBUTARY OF WEST FORK ARMELLS CREEK	19111231	GREAT NORTHERN PROPERTIES LTD PRTNRSHP	STOCK	Rosebud	2N39E	25	NWSESE	N				
42KJ 108400 00	GROUNDWATER	19591231	GREAT NORTHERN PROPERTIES LTD PRTNRSHP	STOCK	Rosebud	2N39E	29	SWSWNW	N	10			110
42KJ 108401 00	UNNAMED TRIBUTARY OF UNNAMED TRIBUTARY OF WEST FORK ARMELLS CREEK	19680705	WPP LLC	STOCK	Rosebud	2N39E	35	NESWNW	Y				
42KJ 108407 00	SPRING. UNNAMED TRIBUTARY OF UNNAMED TRIBUTARY OF WEST FORK ARMELLS CREEK	19111231	WPP LLC	STOCK	Rosebud	2N39E	35	SWNWSW	N				
42KJ 108513 00	GROUNDWATER	19700226	BNSF RAILWAY CO	STOCK	Rosebud	2N39E	15	NWSENW	N	5			
42KJ 108673 00	SPRING. UNNAMED TRIBUTARY OF MCCLURE CREEK	19111231	WPP LLC	STOCK	Treasure	2N38E	13	SENWNE	N				
42KJ 111926 00	SPRING. UNNAMED TRIBUTARY OF UNNAMED TRIBUTARY OF WEST FORK ARMELLS CREEK	19081231	HOWARD FAMILY REVOCABLE TRUST	STOCK	Rosebud	2N39E	24	SENENW	N				
42KJ 145450 00	UNNAMED TRIBUTARY OF ARMELLS CREEK. WEST FORK	19561231	SALMOND RANCH CO	STOCK	Rosebud	2N39E	3	NWSESW	Y				
42KJ 162796 00	UNNAMED TRIBUTARY OF DONLEY CREEK	19441231	BOOTH LAND & LIVESTOCK CO	STOCK	Rosebud	2N39E	31	SWSESW	Y				
42KJ 162797 00	GROUNDWATER	19500630	BOOTH LAND & LIVESTOCK CO	STOCK	Rosebud	2N39E	31	NWSESW	N	5			
42KJ 162798 00	GROUNDWATER	19500630	BOOTH LAND & LIVESTOCK CO	STOCK	Rosebud	2N39E	31	SESWNE	N	5			220
42KJ 162799 00	GROUNDWATER	19640519	WESTERN ENERGY CO	STOCK	Rosebud	2N39E	27	NWNWSE	N	4.5			156
42KJ 162812 00	SPRING. UNNAMED TRIBUTARY OF DONLEY CREEK	19341231	WESTERN ENERGY CO	STOCK	Rosebud	2N39E	27	SWNWSE	N	3			
42KJ 162813 00	UNNAMED TRIBUTARY OF DONLEY CREEK	19501231	BOOTH LAND & LIVESTOCK CO	STOCK	Rosebud	2N39E	31	SENWSW	Y				
42KJ 162814 00	GROUNDWATER	19571130	WESTERN ENERGY CO	STOCK	Rosebud	2N39E	34	NWSENE	N	9			120
42KJ 162828 00	UNNAMED TRIBUTARY OF DONLEY CREEK	19341231	WESTERN ENERGY CO	STOCK	Rosebud	2N39E	27	NWNWSE	Y				
42KJ 162844 00	SPRING. UNNAMED TRIBUTARY OF UNNAMED TRIBUTARY OF WEST FORK ARMELLS CREEK	19570731	WESTERN ENERGY CO	STOCK	Rosebud	2N39E	26	NESESE	N	6			
42KJ 162845 00	GROUNDWATER	19631231	WESTERN ENERGY CO	STOCK	Rosebud	2N39E	8	NWNENE	N	6			14
42KJ 162850 00	GROUNDWATER	19481231	BOOTH LAND & LIVESTOCK CO	STOCK	Rosebud	2N39E	32	SESESE	N	10			
42KJ 162852 00	SPRING. UNNAMED TRIBUTARY OF DONLEY CREEK	19341231	WESTERN ENERGY CO	STOCK	Rosebud	2N39E	27	SWNWSE	N	3			
42KJ 162853 00	SPRING. UNNAMED TRIBUTARY OF DONLEY CREEK	19431231	BOOTH LAND & LIVESTOCK CO	STOCK	Rosebud	2N39E	31	SWSESW	N				
42KJ 177098 00	ARMELLS CREEK. WEST FORK	19070913	KL RANCH LLC	STOCK	Rosebud	2N39E	2	E2E2	N				
42KJ 177100 00	SPRING. UNNAMED TRIBUTARY OF UNNAMED TRIBUTARY OF WEST FORK ARMELLS CREEK	19140710	KL RANCH LLC	STOCK	Rosebud	2N39E	2	NWNESW	N				
42KJ 177102 00	DONLEY CREEK	19070904	KL RANCH LLC	STOCK	Rosebud	2N39E	14	N2NE	N				
42KJ 177102 00	DONLEY CREEK	19070904	KL RANCH LLC	STOCK	Rosebud	2N39E	14	W2SW	N				
42KJ 177102 00	DONLEY CREEK	19070904	KL RANCH LLC	STOCK	Rosebud	2N39E	14	SWNW	N				
42KJ 177102 00	DONLEY CREEK	19070904	KL RANCH LLC	STOCK	Rosebud	2N39E	14	N2NW	N				
42KJ 177103 00	ARMELLS CREEK. WEST FORK	19090419	KL RANCH LLC	STOCK	Rosebud	2N39E	12	W2W2	N				
42KJ 177107 00	GROUNDWATER	19470807	KL RANCH LLC	STOCK	Rosebud	2N39E	24	NESWSW	N	5			
42KJ 177108 00	SPRING. UNNAMED TRIBUTARY OF UNNAMED TRIBUTARY OF WEST FORK ARMELLS CREEK	19110731	KL RANCH LLC	STOCK	Rosebud	2N39E	24	NESENW	N				
42KJ 177109 00	GROUNDWATER	19590206	KL RANCH LLC	STOCK	Rosebud	2N39E	24	SESESW	N	5			
42KJ 177110 00	GROUNDWATER	19470701	KL RANCH LLC	STOCK	Rosebud	2N39E	22	SWNWSW	N	12			
42KJ 177111 00	GROUNDWATER	19600523	KL RANCH LLC	STOCK	Rosebud	2N39E	12	SWSWSW	N	5			
42KJ 177112 00	GROUNDWATER	19280901	KL RANCH LLC	STOCK	Rosebud	2N39E	12	SWSWSW	N	5			
42KJ 177113 00	GROUNDWATER	19470725	KL RANCH LLC	STOCK	Rosebud	2N39E	10	SWNWNW	N	5			
42KJ 177606 00	GROUNDWATER	19501231	WESTERN ENERGY CO	DOMESTIC	Rosebud	2N39E	26	SESWSE	N	5	1		
42KJ 177607 00	GROUNDWATER	19571130	WESTERN ENERGY CO	DOMESTIC	Rosebud	2N39E	34	NWSENE	N	9	0.6	0.25	120
42KJ 183227 00	SPRING. UNNAMED TRIBUTARY OF TRAIL CREEK	19360430	BOOTH LAND & LIVESTOCK CO	STOCK	Treasure	2N38E	1	NWSWSW	N	5			
42KJ 183228 00	SPRING. UNNAMED TRIBUTARY OF TRAIL CREEK	19360430	BOOTH LAND & LIVESTOCK CO	STOCK	Treasure	2N38E	1	SENWSW	N	5			
42KJ 183229 00	SPRING. UNNAMED TRIBUTARY OF TRAIL CREEK	19360430	BOOTH LAND & LIVESTOCK CO	STOCK	Treasure	2N38E	1	SWNWNW	N	5			
42KJ 183230 00	SPRING. UNNAMED TRIBUTARY OF TRAIL CREEK	19360430	BOOTH LAND & LIVESTOCK CO	STOCK	Treasure	2N38E	1	SWSENE	N	5			
42KJ 183231 00	UNNAMED TRIBUTARY OF TRAIL CREEK	19481231	BOOTH LAND & LIVESTOCK CO	STOCK	Treasure	2N38E	1	SWNENW	Y				
42KJ 183234 00	SPRING. UNNAMED TRIBUTARY OF HORSE CREEK	19361231	BOOTH BROS LAND & LIVESTOCK	STOCK	Treasure	2N38E	10	NWSENW	N	7			
42KJ 183235 00	SPRING. UNNAMED TRIBUTARY OF HORSE CREEK	19470430	BOOTH BROS LAND & LIVESTOCK	STOCK	Treasure	2N38E	10	SESWSE	N	7			
42KJ 183236 00	HORSE CREEK	19361231	BOOTH BROS LAND & LIVESTOCK	STOCK	Treasure	2N38E	14	NWSWNW	Y				
42KJ 183237 00	GROUNDWATER	19361231	BOOTH BROS LAND & LIVESTOCK	STOCK	Treasure	2N38E	14	SWSWNW	N	8			
42KJ 183333 00	GROUNDWATER	19500531	BOOTH LAND & LIVESTOCK CO	STOCK	Rosebud	2N39E	6	NWSWNW	N	8			
42KJ 183334 00	GROUNDWATER	19500531	BOOTH BROS LAND & LIVESTOCK	STOCK	Rosebud	2N39E	6	SWNWNW	N	8			
42KJ 183338 00	GROUNDWATER	19520630	BOOTH BROS LAND & LIVESTOCK	STOCK	Rosebud	2N39E	17	NESWSE	N	8			
42KJ 183339 00	SPRING. UNNAMED TRIBUTARY OF MCCLURE CREEK	19500430	BOOTH BROS LAND & LIVESTOCK	STOCK	Rosebud	2N39E	18	SENWNE	N	8			
42KJ 183348 00	UNNAMED TRIBUTARY OF HORSE CREEK	19530831	BOOTH BROS LAND & LIVESTOCK	STOCK	Treasure	2N38E	22	NWSENE	Y				
42KJ 183350 00	SPRING. UNNAMED TRIBUTARY OF ROBBIE CREEK	19370430	BOOTH BROS LAND & LIVESTOCK	STOCK	Treasure	2N38E	23	NWSENE	N	8			
42KJ 183351 00	ROBBIE CREEK	19370531	BOOTH BROS LAND & LIVESTOCK	STOCK	Treasure	2N38E	26	NWNENW	Y				
42KJ 183352 00	GROUNDWATER	19520831	BOOTH BROS LAND & LIVESTOCK	STOCK	Treasure	2N38E	24	NWSWNW	N	20			
42KJ 183353 00	SPRING. UNNAMED TRIBUTARY OF ROBBIE CREEK	19520831	BOOTH BROS LAND & LIVESTOCK	STOCK	Treasure	2N38E	24	NENWNE	N				
42KJ 183486 00	GROUNDWATER	19500531	BOOTH BROS LAND & LIVESTOCK	STOCK	Rosebud	2N39E	6	NWNWSW	N	8			
42KJ 183492 00	SPRING. UNNAMED TRIBUTARY OF ROBBIE CREEK	19520831	BOOTH BROS LAND & LIVESTOCK	STOCK	Treasure	2N38E	24	NWNWNW	N				
42KJ 183493 00	UNNAMED TRIBUTARY OF HORSE CREEK	19401231	BOOTH BROS LAND & LIVESTOCK	STOCK	Treasure	2N38E	15	SWSESW	Y				
42KJ 183493 00	UNNAMED TRIBUTARY OF HORSE CREEK	19401231	BOOTH BROS LAND & LIVESTOCK	STOCK	Treasure	2N38E	22	NWNENW	Y				
42KJ 183494 00	GROUNDWATER	19470430	BOOTH BROS LAND & LIVESTOCK	STOCK	Treasure	2N38E	15	SESWSW	N	10			
42KJ 183497 00	TRAIL CREEK	19570831	BOOTH BROS LAND & LIVESTOCK	STOCK	Rosebud	2N39E	7	NESENE	Y				
42KJ 183497 00	TRAIL CREEK	19570831	BOOTH BROS LAND & LIVESTOCK	STOCK	Rosebud	2N39E	8	NWSWNW	Y				
42KJ 183498 00	SPRING. UNNAMED TRIBUTARY OF MCCLURE CREEK	19540831	BOOTH BROS LAND & LIVESTOCK	STOCK	Rosebud	2N39E	8	NENWSW	N	8			
42KJ 183499 00	GROUNDWATER	19570430	BOOTH BROS LAND & LIVESTOCK	STOCK	Rosebud	2N39E	7	NESWNE	N	10			
42KJ 183500 00	UNNAMED TRIBUTARY OF TRAIL CREEK	19550430	BOOTH BROS LAND & LIVESTOCK	STOCK	Rosebud	2N39E	7	SWSENW	N				
42KJ 183501 00	TRAIL CREEK	19540831	BOOTH BROS LAND & LIVESTOCK	STOCK	Rosebud	2N39E	7	SWSENW	Y				
42KJ 183501 00	TRAIL CREEK	19540831	BOOTH BROS LAND & LIVESTOCK	STOCK	Rosebud	2N39E	7	SESWNW	Y				

42KJ 183502 00	UNNAMED TRIBUTARY OF TRAIL CREEK	19111015	BOOTH BROS LAND & LIVESTOCK	STOCK	Rosebud	2N39E	6	NESENE	Y				
42KJ 183503 00	UNNAMED TRIBUTARY OF TRAIL CREEK	19111015	BOOTH BROS LAND & LIVESTOCK	STOCK	Rosebud	2N39E	6	NWSWNW	Y				
42KJ 183508 00	SPRING. UNNAMED TRIBUTARY OF BLACK HANK CREEK	19130729	BOOTH BROS LAND & LIVESTOCK	STOCK	Rosebud	2N39E	32	SESWNE	N				
42KJ 183509 00	GROUNDWATER	19360430	BOOTH BROS LAND & LIVESTOCK	STOCK	Rosebud	2N39E	32	NWNWNE	N	8			
42KJ 183510 00	SPRING. UNNAMED TRIBUTARY OF DONLEY CREEK	19270430	BOOTH BROS LAND & LIVESTOCK	STOCK	Rosebud	2N39E	30	SENWSE	N				
42KJ 183511 00	GROUNDWATER	19540831	BOOTH BROS LAND & LIVESTOCK	STOCK	Rosebud	2N39E	28	NWNESW	N	8			
42KJ 183512 00	BLACK HANK CREEK	19560430	BOOTH BROS LAND & LIVESTOCK	STOCK	Rosebud	2N39E	28	NWSWNE	Y				
42KJ 183513 00	DONLEY CREEK	19540831	BOOTH BROS LAND & LIVESTOCK	STOCK	Rosebud	2N39E	28	NWNWNW	Y				
42KJ 183513 00	DONLEY CREEK	19540831	BOOTH BROS LAND & LIVESTOCK	STOCK	Rosebud	2N39E	29	NENENE	Y				
42KJ 183514 00	GROUNDWATER	19560430	BOOTH BROS LAND & LIVESTOCK	STOCK	Rosebud	2N39E	20	SWNWSE	N	6			
42KJ 183532 00	ROBBIE CREEK	19130610	BOOTH BROS LAND & LIVESTOCK	STOCK	Rosebud	2N39E	17	S2	N				
42KJ 19562 00	GROUNDWATER	19780719	KL RANCH LLC	STOCK	Rosebud	2N39E	14	NWNW	N	8	1.5		180
42KJ 25022 00	TRAIL CREEK	19560701	MONTANA. STATE OF BOARD OF LAND COMMISSIONERS	STOCK	Treasure	2N38E	12	SENWNW	Y				
42KJ 28394 00	GROUNDWATER	19800729	BOOTH LAND & LIVESTOCK CO	STOCK	Rosebud	2N39E	31	SENE	N	10	6.72		40
42KJ 30011413	GROUNDWATER	20040712	SALMOND RANCH CO	STOCK	Rosebud	2N39E	11	NESW	N				160
42KJ 30011417	GROUNDWATER	20040712	SALMOND RANCH CO	STOCK	Rosebud	2N39E	5	N2	N				100
42KJ 30044356	GROUNDWATER	20081015	KL RANCH LLC	STOCK	Rosebud	2N39E	12	NWNW	N	10	3.95		220
42KJ 38017 00	SPRING. UNNAMED TRIBUTARY OF HORSE CREEK	19450930	BOOTH LAND & LIVESTOCK CO	STOCK	Treasure	2N38E	34	NWNWNE	N				
42KJ 42782 00	GROUNDWATER	19450415	MONTANA. STATE OF BOARD OF LAND COMMISSIONERS	STOCK	Rosebud	2N39E	16	NWNWSE	N	18			
42KJ 42798 00	GROUNDWATER	19820319	GREAT NORTHERN PROPERTIES LTD PRTNRSHP	STOCK	Rosebud	2N39E	15	NWSENW	N	5	2.25		
42KJ 4389 00	GROUNDWATER	19741211	BOOTH BROS LAND & LIVESTOCK	DOMESTIC/STOCK	Treasure	2N38E	24	SENW	N	10			90
42KJ 44608 00	GROUNDWATER	19480901	BOOTH BROS LAND & LIVESTOCK	STOCK	Treasure	2N38E	26	NWNENE	N	30			225
42KJ 44613 00	SPRING. UNNAMED TRIBUTARY OF TRAIL CREEK	19150101	BOOTH BROS LAND & LIVESTOCK	STOCK	Treasure	2N38E	12	NENESW	N				
42KJ 44616 00	SPRING. UNNAMED TRIBUTARY OF TRAIL CREEK	19400101	BOOTH BROS LAND & LIVESTOCK	STOCK	Treasure	2N38E	11	NENESE	N				
42KJ 44618 00	UNNAMED TRIBUTARY OF TRAIL CREEK	19670501	BOOTH BROS LAND & LIVESTOCK	STOCK	Treasure	2N38E	11	NWNENE	Y				
42KJ 44618 00	UNNAMED TRIBUTARY OF TRAIL CREEK	19670501	BOOTH BROS LAND & LIVESTOCK	STOCK	Treasure	2N38E	11	NENWNE	Y				
42KJ 44621 00	GROUNDWATER	19390501	BOOTH BROS LAND & LIVESTOCK	STOCK	Treasure	2N38E	11	SWSWSW	N	5			
42KJ 44622 00	GROUNDWATER	19560712	BOOTH BROS LAND & LIVESTOCK	STOCK	Rosebud	2N39E	30	NENWSW	N	10			
42KJ 44628 00	ROBBIE CREEK	19500731	BOOTH BROS LAND & LIVESTOCK	STOCK	Treasure	2N38E	26	W2NENW	Y				
42KJ 45734 00	GROUNDWATER	19820415	KL RANCH LLC	STOCK	Rosebud	2N39E	23	SESENW	N	3	1.5		
42KJ 45735 00	GROUNDWATER	19820415	KL RANCH LLC	DOMESTIC	Rosebud	2N39E	12	SWSWSW	N	5	2		
42KJ 46519 00	GROUNDWATER	19820427	WESTERN ENERGY CO	STOCK	Rosebud	2N39E	27	SWSWSW	N	10	3.4		
42KJ 46520 00	GROUNDWATER	19820427	WESTERN ENERGY CO	STOCK	Rosebud	2N39E	34	SENESE	N	10	3.4		
42KJ 47995 00	SPRING. UNNAMED TRIBUTARY OF ARMELLS CREEK. WEST FORK	19500415	MONTANA. STATE OF BOARD OF LAND COMMISSIONERS	STOCK	Rosebud	2N39E	36	NENWSW	N				
42KJ 56479 00	GROUNDWATER	19840618	GREAT NORTHERN PROPERTIES LTD PRTNRSHP	STOCK	Rosebud	2N39E	15	SENESE	N	15	0.5		80
42KJ 58982 00	GROUNDWATER	19850813	KL RANCH LLC	STOCK	Rosebud	2N39E	2	NESW	N	10	0.5		80
42KJ 68059 00	GROUNDWATER	19880223	KL RANCH LLC	STOCK	Rosebud	2N39E	12	NENW	N	12	1.26		51
42KJ 8211 00	MCCLURE CREEK	19400415	MONTANA. STATE OF BOARD OF LAND COMMISSIONERS	STOCK	Rosebud	2N39E	18	SESWNW	Y				

Appendix F – Comments on the DEIS and Responses

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1.1 Introduction

This appendix contains the comments received on the Draft EIS (DEIS) documents and the agencies' responses to those comments.

1.1.1 DEIS Comments

The initial 45-day public comment period for the DEIS began on January 4, 2018 and was published in the *Federal Register*, on agency websites, and in local newspapers. The comment period was extended 15 days by the agencies to March 5, 2018. A public open house and town hall meeting was held in Colstrip, Montana on February 13, 2018.

In total, 5,151 letters/emails, comment sheets, and transcripts were received, including 4,952 form letters.

1.1.2 Comment Coding

Each letter, email, or recorded public hearing comment was given a unique document identification number. All submitted documents were systematically reviewed for content. Substantive comments were coded hierarchically according to sections in the DEIS. Substantive comments are defined as comments that:

- Question the accuracy of the information in the document;
- Question the adequacy of the environmental analysis;
- Propose other alternatives;
- Suggest the need for changes in the DEIS or revisions to one of the alternatives considered in detail; or
- Provide new or additional information relevant to the analysis.

Comments were coded hierarchically according to sections in the DEIS (a list of all comment codes developed for the project is provided in Appendix A).

Comment codes 1000 to 1999 were assigned to issues in Chapter 1, Purpose, Need, and Permitting. Subcategories include purpose and need (1100), existing permits and approvals (1200), and agency authority and actions (1300). Many comments expressed concern about the project's purpose and need or about bonding and financial assurance for reclamation.

Comment codes 2000 to 2999 were assigned to issues in Chapter 2, Alternatives in the DEIS. Comment codes 3000 to 5999 were assigned to issues in Chapter 3, Affected Environment. Comment codes 6000 to 8999 were assigned to issues in Chapter 4, Environmental Consequences. Miscellaneous or general nonsubstantive comments were coded in category 9000. Comments outside the scope of the DEIS were coded in category 9100.

Non-form letters and one example of each of the three form letters (Form A, Form B, and Form C) were coded. Coded comments are included in Appendix B. Coded comments of a more substantive and/or technical nature from one federal agency (U.S. Environmental Protection Agency), seven private and non-governmental groups, and the project proponent (Western Energy Company (WECo)) are included in Section 1.2.

1.1.3 Comment Response

Substantive comments received by individuals and organizations on the DEIS were organized for response according to issue codes. To reduce repetition, similar comments were grouped together and responded to collectively. Responses to substantive comments are organized by issue codes and can be found in Sections 1.2 and 1.3, beginning on page 3. Where appropriate, the text of the Final EIS was revised and the section where the change was made is noted in the response to comments.

The agencies are not required to respond to every comment made by every person. According to NEPA regulations, "all substantive comments received on the draft statement (or summaries thereof where the response has been exceptionally voluminous), should be attached to the final statement whether or not the comment is thought to merit individual discussion by the agency in the text of the statement" (40 CFR 1503.5(b)). Under MEPA regulations, a Final EIS must include "responses to substantive comments received on the draft EIS" (ARM 17.4.619(1)). If the comment resulted in changes to the EIS text, then it is stated in the response, but not all responses required that the

text in the Final EIS be modified. All of the original comments on the DEIS that the agencies received are available for public inspection at the addresses listed in the abstract at the front of the Final EIS.

The agencies appreciate the public's interest in the proposed project and their participation in the EIS process.

1.2 Comments of a More Substantive and/or Technical Nature

Comment letters which contained DEIS comments of a more substantive or technical nature were reproduced and are included in this section. The agencies' responses are presented alongside each comment. These commenters are listed in Table F-1. No comments were received from state agencies or Native American tribes.

Table F-1. Alphabetical list of agency commenters.

Document ID	Commenter
002	Environmental Defense Fund, Montana Environmental Information Center (MEIC), Natural Resource Defense Council, Institute for Policy Integrity, Sierra Club, Union of Concerned Scientists, Western Environmental Law Center, WildEarth Guardians
003	Environmental Protection Agency
004	Gardner, W. Payton
175	Kromkowski, Francis A. (example of form letter A)
009	Northern Plains Resource Council
010	Pfister, Ellen
121	University of Chicago and University of Chicago Law School
014	Western Energy Company
005	Western Environmental Law Center, MEIC, Montana Elders for a Livable Tomorrow, Indian People's Action, 350 Montana, Environment Montana Research & Policy Center, Montana Conservation Voters Education Fund, WildEarth Guardians, Sierra Club

Comment/ Code	Document #002-Environmental Defense Fund and Others	Response
Summary statements - see below for individual comment responses to these statements	March 5, 2018 To: Office of Surface Mining Reclamation and Enforcement, U.S. Department of the Interior **Subject: Comments on the Failure to Use the Social Cost of Greenhouse Gases in the Draft Environmental Impact Statement for Western Energy Rosebud Mine Area F** Submitted by: Environmental Defense Fund, Montana Environmental Information Center, Institute for Policy Integrity at New York University School of Law, Natural Resources Defense Council, Sierra Club, Union of Concerned Scientists, Western Environmental Law Center, WildEarth Guardians[1] This draft environmental impact statement (DEIS), prepared by the Office of Surface Mining and Reclamation Enforcement (OSM), on Western Energy's Rosebud Mine Area F, proposes expanding an existing surface coal mine in Montana that has been in operation since the 1970s, extending its operations by an additional 8 years and producing 70.8 million tons of coal.[2] While the DEIS quantifies the tons of greenhouse gas emissions related to this project, OSM fails to use the social cost of greenhouse gas metric to fully account for the climate effects of these emissions. OSM explicitly chose not to monetize the impact of emissions by using the social costs of greenhouse gases in its analysis for a number of flawed reasons. The agency's refusal is arbitrary and unlawful in light of a growing body of case law holding that failure to monetize a project's costs is impermissible if the agency relies on the project's monetized benefits to justify its action. The refusal is also arbitrary in light of the growing consensus around the appropriate social cost of greenhouse gas values to use in environmental impact statements. These comments explain why each of OSM's reasons for not using the social cost of greenhouse gases in the DEIS fails, and why the DEIS leaves the public and decisionmakers in the dark about the climate effects of the project, in violation of NEPA. Specifically: 1. NEPA requires a "reasonably thorough discussion" and "necessary contextual information" on climate impacts. The social cost of greenhouse gases provides such information, while the mere recitation of so many tons of carbon that will be emitted by the project fails to provide the public and decisionmakers with the required information. Moreover, when an agency monetizes a project's potential benefits—as OSM does here—the potential climate costs must be treated with proportional rigor. 2. The social cost of greenhouse gases metric is appropriate for a project-level EIS with emissions of this magnitude. The metric can be applied to any action that significantly increases greenhouse gas emissions, not just to rulemakings. The uncertainty around factors like catastrophic outcomes that cannot currently be fully monetized is not a reason not to use the metric, but rather a reason to treat available values as lower-bound estimates of the true climate costs of emissions. [1] Our individual organizations may separately submit other comments regarding other aspects of the DEIS. [2] Montana Dept. of Envtl. Quality & Office of Surface Mining Reclamation and Enforcement, *Western Energy Company's Rosebud Mine Area F Draft Environmental Impact Statement* at S-1 (2017) (hereinafter "DEIS").	

Comment/ Code	Document #002-Environmental Defense Fund and Others	Response
Summary statements – see responses below	3. The Interagency Working Group's 2016 estimates of the social cost of greenhouse gases remain the best available values for federal agencies to use in analyses. 4. OSM fails to consider whether and to what extent this permit could increase downstream emissions by increasing the total supply of coal, thereby lowering the commodity's price and increasing demand.	**002-1 Response:** Climate change impacts cannot be predicted with a degree of accuracy that would allow for local project-specific impacts to be characterized. Information about global, national, state, and regional GHG emissions is provided in **Section 3.4.2.3** of the EIS. Proposed Action emissions are evaluated in the context of total U.S. emissions in **Section 4.4.3** and **Section 5.3.3.** As discussed in **Section 4.4.5** of the EIS, direct and indirect GHG emissions resulting from the Proposed Action would contribute incrementally to climate change. The EIS has been revised to remove the following sentence in **Section 4.4.3.1**: "Thus, direct effects of the Proposed Action on climate and climate change would be negligible relative to other sources." The cumulative effects of GHG emissions resulting from the Proposed Action would be the same as the indirect effects. OSMRE quantified direct and indirect GHG emissions resulting from the Proposed Action and alternatives and discussed those emissions in the context of state, regional, national, and global GHG emissions. Total annual projected direct GHG emissions for the project area, calculated using conservative assumptions, comprise a very small fraction—0.0016 percent—of the total 2015 U.S. GHG emissions. Total annual projected indirect GHG (CO2e) emissions would comprise a small fraction—0.19 percent—of the total 2015 U.S. GHG emissions. Moreover, another commenter completed a social cost of carbon analysis (see Comment no. 14), which showed that "Total emission costs for the 19-year time horizon vary by over 40-fold from a low of $319 million to as high as $12.9 billion." While OSMRE does not believe that a social cost of carbon analysis is warranted for this project decision and did not include it in the EIS, as outlined in **Section 4.4.5**, we note that this analysis and its wide margin of error support our conclusion that such analysis was not needed because the social cost of carbon without a full cost-benefit analysis is of very limited utility to the decision maker. GHG emissions are examined for NEPA purposes. Under MEPA, DEQ's analysis of actions is limited to actions which significantly affect the quality of the human environment in Montana. Section 75-1-201(1)(b)(4), MCA. A full-scale carbon budgeting analysis is not required to determine if significant impacts related to GHG emissions are occurring and is outside the scope of this EIS. OSMRE, where appropriate and not overly speculative, included reasonable forecasting as in the case with the Climate discussion in Chapter 4 allowing the decision maker to evaluate potential impacts associated with the Proposed Action using representative or predicted emissions. In *High Country Conservation Advocates v. U.S. Forest Service, 52 F. Supp. 3d 1174 (D.Colo. 2014)*, (https://www.leagle.com/decision/infdco20140630a94) Judge Jackson found that "In effect the agency prepared half of a cost-benefit analysis, incorrectly claimed that it was impossible to quantify the costs, and then relied on the anticipated benefits to approve the project." In the Area F EIS, OSMRE has not completed, in part or in full, a cost-benefit analysis.
002-1 (6312)	**1. NEPA Requires a "Reasonably Thorough Discussion" and "Necessary Contextual Information" on Climate Impacts, Which the Social Cost of Greenhouse Gases Provides** OSM fails to discuss the actual climate impacts of the project, even though it quantifies the tons of greenhouse gas emissions from the mine's present and future operations. OSM neither quantitatively nor qualitatively discusses the damages to which these additional tons of greenhouse gases would contribute. Meanwhile, OSM has monetized effects like hundreds of millions of dollars' worth in annual economic output and royalties,[3] which the agency presents as the "benefits" of the project. Failing to similarly monetize the climate costs of the project is inconsistently arbitrary and deprives the public and decisionmakers of the information and context they need to weigh all the project's potential effects.	
002-1, cont'd	***NEPA Requires Monetizing Climate Effects If Other Costs and Benefits Are Monetized*** NEPA requires "hard look" consideration of beneficial and adverse effects of each alternative option for major federal government actions. The U.S. Supreme Court has called the disclosure of impacts the "key requirement of NEPA," and held that agencies must "consider and disclose the actual environmental effects" of a proposed project in a way that "brings those effects to bear on [the agency's] decisions."[4] Courts have repeatedly concluded that an EIS must disclose relevant climate effects.[5] Though NEPA does not require a formal cost-benefit analysis,[6] agencies' approaches to assessing costs and benefits must be balanced and reasonable. Courts have warned agencies that "[e]ven though NEPA does not require a cost-benefit analysis," an agency cannot selectively monetize benefits in support of its decision while refusing to monetize the costs of its action.[7]	
002-1, cont'd	In *High Country Conservation Advocates v. Forest Service*, the U.S. District Court of Colorado found that it was "arbitrary and capricious to quantify the *benefits* of the lease modifications and then explain that a similar analysis of the *costs* was impossible when such an analysis was in fact possible."[8] The court explained that, to support a decision on coal mining activity, the agencies had "weighed several specific economic benefits—coal recovered, payroll, associated purchases of supplies and services, and royalties," but arbitrarily failed to monetized climate costs using the readily available social cost of [3] DEIS at 599-603. [4] *Baltimore Gas & Elec. Co. v. Natural Res. Def. Council*, 462 U.S. 87, 96 (1983). [5] As the Ninth Circuit has held: "[T]he fact that climate change is largely a global phenomenon that includes actions that are outside of [the agency's] control . . . does not release the agency from the duty of assessing the effects of *its* actions on global warming within the context of other actions that also affect global warming." *Ctr. for Biological Diversity v. Nat'l Highway Traffic Safety Admin.*, 538 F.3d 1172, 1217 (9th Cir. 2008); *see also Border Power Plant Working Grp. v. U.S. Dep't of Energy*, 260 F. Supp. 2d 997, 1028-29 (S.D. Cal. 2003) (failure to disclose project's indirect carbon dioxide emissions violates NEPA). [6] 40 C.F.R. § 1502.23 ("[T]he weighing of the merits and drawbacks of the various alternatives need not be displayed in a monetary cost-benefit analysis."). [7] *High Country Conservation Advocates v. Forest Service*, 52 F. Supp. 3d 1174, 1191 (D. Colo. 2014); *accord. MEIC v. Office of Surface Mining*, 15-106-M-DWM, at 40-46 (D. Mt., August 14, 2017) (holding it was arbitrary for the agency to quantify benefits in an EIS while failing to use the social cost of carbon to quantify costs, as well as arbitrary to imply there would be no effects from greenhouse gas emissions). [8] 52 F. Supp. 3d at 1191. 2	

Comment/ Code	Document #002-Environmental Defense Fund and Others	Response
002-1, cont'd **002-1, cont'd**	carbon protocol.[9] Similarly, in *Montana Environmental Information Center v. Office of Surface Mining* (*MEIC v. OSM*), the U.S. District Court of Montana followed the lead set by *High Country* and likewise held an environmental assessment to be arbitrary and capricious because it quantified the benefits of action (such as employment payroll, tax revenue, and royalties) while failing to use the social cost of carbon to quantify the costs.[10] That decision is particularly salient to this DEIS because that case likewise centered on an OSM-granted coal mine permit in Montana. The permit in that case, for a Signal Peak Energy mine expansion, was for a project that was expected to result in an additional 23.16 million metric tons of greenhouse gases per year (measured in CO_2e);[11] the Western Energy Rosebud Mine Area F expansion proposed in this DEIS would account, directly and indirectly, for more than 12 million metric tons of greenhouse gases per year (CO_2e).[12] The two projects are of comparable magnitudes and both would make significant contributions to global emissions. Both *High Country* and *MEIC v. OSM* were in line with *Center for Biological Diversity v. National Highway Traffic Safety Administration*.[13] In that case, the U.S. Court of Appeals for the Ninth Circuit ruled that, because the agency had monetized other uncertain costs and benefits of its vehicle fuel efficiency standard—like traffic congestion and noise costs—its "decision not to monetize the benefit of carbon emissions reduction was arbitrary and capricious."[14] Specifically, it was arbitrary to "assign[ ] no value to *the most significant benefit* of more stringent [vehicle fuel efficiency] standards: reduction in carbon emissions."[15] When an agency bases a rulemaking on cost-benefit analysis, it is arbitrary to "put a thumb on the scale by undervaluing the benefits and overvaluing the costs."[16] In this DEIS, OSM monetizes the same economic benefits as in *MEIC v. OSM*—hundreds of millions of dollars' worth in annual economic output, taxes, and royalties[17]—and so is required to be consistent in monetizing other significant effects, including climate costs. OSM seemingly tries to skirt the precedent set by *MEIC v. OSM* by identifying these economic benefits as "economic impacts." The DEIS reads, "any increased economic activity, in terms of revenue, employment, labor income, total value added, and output . . . is simply an economic impact, rather than an economic benefit, inasmuch as such impacts might be viewed by another person as negative or undesirable impacts."[18] However, in *MEIC v. OSM*, the District Court of the District of Montana dismissed this same argument as "a distinction without a difference."[19] Tellingly, elsewhere in this DEIS, OSM prominently presents these same impacts as the [9] *Id.* [10] 15-106-M-DWM, at 40-46, Aug. 14, 2017 (also holding that it was arbitrary to imply that there would be zero effects from greenhouse gas emissions). [11] *Id.* at 35. [12] DEIS at 487. [13] Three other cases from different courts that have declined to rule against failures to use the social cost of carbon in NEPA analyses are all distinguishable by the scale of the action or by whether other effects were quantified and monetized in the analysis. *See League of Wilderness Defenders v. Connaughton*, No. 3:12-cv-02271-HZ (D. Ore., Dec. 9, 2014); *EarthReports v. FERC*, 15-1127, (D.C. Cir. July 15, 2016); *WildEarth Guardians v. Zinke*, 1:16-CV-00605-RJ, at 23-24, (D. N.M. Feb. 16, 2017). [14] 538 F.3d 1172, 1203 (9th Cir. 2008). [15] *Id.* at 1199. [16] *Id.* at 1198. [17] DEIS at 602. [18] *Id.* at 491 ("any increased economic activity, in terms of revenue, employment, labor income, total value added, and output, that is expected to occur with the proposed action is simply an economic impact, rather than an economic benefit, inasmuch as such impacts might be viewed by another person as negative or undesirable impacts due to potential increase in local population, competition for jobs, and concerns that changes in population will change the quality of the local community"). [19] *Supra* note 7 at 40, n.9. 3	**002-1 Response continued:** In *Montana Environmental Information Center v. U.S. Office of Surface Mining, Civ. No. 15-106-M-DWM (D. Mont. 2017)*, https://www.elaw.org/US_MEIC_v_OSM_2017, the district court held that although cost-benefit analysis is not required in environmental assessments, OSMRE improperly emphasized the economic benefits of coal production while **completely** excluding any discussion of the costs of GHG emissions. The court stated: "[T]he Mining Plan EA concluded not that the specific effects of greenhouse gas emissions from the expansion would be too uncertain to predict, but that there would in fact be no effects from those emissions, because other coal would be burned in its stead. This conclusion is illogical and places the Enforcement Office's thumb on the scale by inflating the benefits of the action while minimizing its impacts." Id., p. 46. NEPA does not require a cost-benefit analysis of the project such as that described by the commenter. As such, the EIS does not present any economic benefits or costs for any resource. As required by NEPA (see 40 CFR § 1508.14), the socioeconomic impacts are discussed, including a description of the local economy and the project's potential changes to the employment, labor income, and local economic activity. These impacts can be perceived either positively or negatively by the community; however, a positive perception of increased economic activity in an area is very distinct from being an "economic benefit" as defined in economic theory and methodology (Watson et al. 2007, Kotchen 2011)3. Accordingly, this discussion is not a cost-benefit analysis and does not attempt to monetize the benefits of the project. In *Center for Biological Diversity v. NHTSA* (https://scholar.google.com/scholar_case?case=19867343341144823 6&q=Center+for+Biological+Diversity+v.+NHTSA&hl=en&as_sdt=200006&as_vis=1), the 9th circuit held that the NHTSA's EA was markedly deficient in its attempt to justify the refusal to prepare a complete EIS. The agency's FONSI was based primarily on its conclusory assertion — contradicted by evidence in the record — that the Final Rule will have no significant environmental impact because it authorizes CAFE standards that will result in a very small decrease in carbon dioxide emissions. OSMRE discloses the direct and indirect GHG emissions that would result from both the Proposed Action and the No Action Alternatives concluding that both alternatives would contribute incrementally to climate change and the differences between the two alternatives would be negligible. The Proposed Action would extend the duration of indirect GHG emissions from coal combustion by 8 years over the No Action Alternative, but annual GHG emissions from coal combustion are not expected to increase. See **Section 4.4 Climate and Climate Change** in the EIS for more information.

Comment/ Code	Document #002-Environmental Defense Fund and Others	Response
002-1, cont'd 002-1, cont'd 002-1, cont'd 002-1, cont'd	"*[b]enefits*" of the project.[20] Despite OSM's attempts to use terminology to distinguish the impacts it wants to monetize from those impacts it would prefer not to monetize, NEPA regulations group all these impacts under the same category of "effects": economic and social impacts are listed as "effects" alongside ecological and health impacts, and all these effects must be discussed in as much detail as possible in an environmental impact statement.[21] It is arbitrary to apply inconsistent protocols for analysis of some effects compared to others, and to monetize some effects but not others that are equally monetizeable. Moreover, in obligating agencies to take "hard look" at projects' climate impacts, NEPA requires more than simply disclosing the volume of anticipated emissions.[22] As discussed further below, under NEPA, agencies must provide details on discrete effects of a project's impacts within the relevant context. The social cost of greenhouse gases provides this critical information. ***The Social Cost of Greenhouse Gases Reflects the Value of Discrete Climate Damages, and Gives Necessary Context to Climate Damages*** OSM argues that "the SCC [social cost of carbon] protocol does not measure the actual incremental impacts of a project on the environment."[23] This statement reveals a deep misunderstanding of the design and proper application of the social cost of greenhouse gases. Not only is the social cost of greenhouse gas methodology ideally suited for valuing the marginal climate damages of individual projects, but the monetization directly reflects the "actual incremental impacts" of emissions on climate change. Monetization is actually a more useful way under NEPA to present the information to decisionmakers and the public than a qualitative description of discrete effects or a mere tallying of the tons of emissions. The social cost of greenhouse gases directly reflects the discrete effects of climate change.[24] The three integrated assessment models used to calculate the social cost of greenhouse gases together incorporate such damage categories as: agricultural and forestry impacts, coastal impacts due to sea level rise, impacts to the energy and water sectors, impacts from extreme weather events, vulnerable market sectors impacted by changes in energy use, human health impacts including malaria and pollution, outdoor recreation impacts and other non-market amenities, impacts to human settlements and ecosystems, and some catastrophic impacts.[25] Though some important damage categories are currently omitted due to insufficient data and modeling,[26] the integrated assessment models do a reasonable job of capturing many of the discrete climate effects that decisionmakers and the public care about. [20] DEIS at 11 ("The project would provide the following federal, state, and local benefits: An ongoing fuel source (70.8 million tons of coal) for the Colstrip Power Plant (Units 3 and 4) and the Rosebud Power Plant; Continued employment for workers at the mine; An ongoing tax base to federal, state, and local governments; Ongoing royalty payments to mineral resource owners; Continued support to local businesses; An ongoing source of income to Western Energy and its shareholders; Reliable electric power for an additional 8 years."). [21] 40 C.F.R. §1508.8. [22] *Supra* notes 4-5. [23] DEIS at 491. [24] As a comparison, while a carbon price developed for a carbon tax arguably measures the value of a constrained resource (i.e., carbon emission allowances), the integrated assessment models used to calculate the social cost of greenhouse gases directly measures climate damages. [25] See descriptions of the IAMs at pages 6-8 of the Interagency Working Group on the Social Cost of Carbon's 2010 Technical Support Document. [26] Peter Howard, *Omitted Damages: What's Missing from the Social Cost of Carbon* (2014), *available at* http://costofcarbon.org/files/Omitted_Damages_Whats_Missing_From_the_Social_Cost_of_Carbon.pdf. 4	**002-1 Response continued:** See comment response on pages 2 and 3.

Comment/ Code	Document #002-Environmental Defense Fund and Others	Response
002-1, cont'd	Monetizing climate damages provides the informational context required by NEPA, while a purely quantitative estimate of tons or a qualitative description of discrete climate effects like sea-level rise provide little context. Courts review NEPA documents "under an arbitrary and capricious standard," which requires "a reasonably thorough discussion of the significant aspects of the probable environmental consequences," to "foster both informed decisionmaking and informed public participation."[27] In particular, "the impact of greenhouse gas emissions on climate change is precisely the kind of cumulative impact analysis that NEPA requires," and it is arbitrary to fail to "provide the necessary contextual information about the cumulative and incremental environmental impacts."[28]	**002-1 continued:** See comment response on pages 2 and 3.
002-1, cont'd	To "provide the necessary contextual information," economic theory shows that one useful tool is monetization of environmental impacts. As Professor Cass Sunstein has explained, drawing from the work of recent Nobel laureate economist Richard Thaler, a well-documented mental heuristic called "probability neglect" causes people to irrationally reduce small probability risks entirely down to zero.[29] In this case, for example, many decisionmakers and interested citizens would wrongly reduce down to zero the climate risks associated with the 0.0016% of total U.S. emissions that OSM calculates will be emitted directly from the Rosebud Mine project, or the 0.19% emitted indirectly,[30] simply due to the leading zeros before the decimals. Yet the monetized expected cost of the climate risks associated with those same emissions—hundreds of millions of dollars—is less likely overlooked. As the Environmental Protection Agency's website explains, "abstract measurements" of so many tons of greenhouse gases can be rather inscrutable for the public, unless "translat[ed] . . . into concrete terms you can understand."[31] Monetization contextualizes the significance of the additional tons of emissions.	
002-1, cont'd	Similarly, non-monetized effects are often irrationally treated as worthless.[32] On several occasions, courts have struck down administrative decisions for failing to give weight to non-monetized effects.[33] Most relevantly, in *Center for Biological Diversity v. NHTSA*, the U.S. Court of Appeals for the Ninth Circuit found it arbitrary and capricious to give zero value "to the most significant benefit of more stringent [fuel economy] standards: reduction in carbon emissions."[34]	
002-1, cont'd	OSM is required by NEPA to provide enough context to ensure that the public and decisionmakers would not overlook the associated climate risks. Monetization is one way that OSM could provide the necessary context to foster both informed decisionmaking and informed public participation.[35] As the OSM itself has explained in a previous environmental impact statement from 2015, including the social cost of greenhouse gases in a NEPA document "provide[s] further context and enhance[s] the discussion	

[27] *Ctr. for Biological Diversity*, 538 F.3d at 1194 (citations omitted). *See also Montana Envtl. Info. Ctr. v. Office of Surface Mining*, cv 15-106-M-DWM, at 12-13 (D.Mt., Aug. 14, 2017).

[28] *Ctr. for Biological Diversity*, 538 F.3d at 1217; *see also Montana Envtl. Info. Ctr.*, cv 15-106-M-DWM at 45.

[29] Cass R. Sunstein, *Probability Neglect: Emotions, Worst Cases, and Law*, 112 Yale L. J. 61, 63, 72 (2002).

[30] DEIS at 489-490.

[31] EPA, Greenhouse Gas Equivalencies Calculator, https://web.archive.org/web/20180212182940/https:/www.epa.gov/energy/greenhouse-gas-equivalencies-calculator (last updated Sept. 2017).

[32] Richard Revesz, *Quantifying Regulatory Benefits*, 102 Cal. L. Rev. 1424, 1434-35, 1442 (2014).

[33] *See id.* at 1428, 1434.

[34] 538 F.3d at 1199.

[35] While the regulations promulgated by the Council on Environmental Quality to implement NEPA do not require a "monetary cost-benefit analysis," 40 C.F.R. § 1502.23, monetization nevertheless remains an available tool for contextualizing information. As the Council on Environmental Quality has explained, monetization may be "appropriate and relevant" and, in particular, "the Federal social cost of carbon . . . provides a harmonized, interagency metric that can give decision makers and the public useful information for their NEPA review." CEQ, *Final Guidance on Consideration of Greenhouse Gas Emissions and the Effects of Climate Change in National Environmental Policy Act Reviews* 32-33 & fn.86 (2016), *available* at https://obamawhitehouse.archives.gov/sites/whitehouse.gov/files/documents/nepa_final_ghg_guidance.pdf.

5

Comment/ Code	Document #002-Environmental Defense Fund and Others	Response
002-1, cont'd	of climate change impacts in the NEPA analysis."[36] In that 2015 EIS, OSM noted that the social cost of greenhouse gases is representative of "net" climate-induced effects, meaning the estimates take into account both costs and benefits from climate change.[37] OSM's use of the social cost of greenhouse gases in 2015 proves that the metric is readily available and appropriate for NEPA analyses of this type of action. Finally, the social cost of greenhouse gas metric provides useful context even without a full cost-benefit analysis. OSM argues that without a complete cost-benefit analysis, including the so-called "social benefits of energy production" from coal combustion, applying the social cost of greenhouses gases would be inappropriate and inaccurate.[38] OSM is wrong. To begin, while the agency does not define what it means by "the social benefits of energy production," basic economic theory dictates that the value of coal in the marketplace already is the best approximation of how much consumers value the welfare they derive from using the energy generated by coal. And the DEIS already includes several monetized metrics relating to the value of coal in the marketplace. OSM includes a calculation of "economic output" from the project, including about $126 million per year in direct economic output,[39] but it is unclear if this figure reflects the value of coal or is only a measure of income from project-related employment. The DEIS never defines the term "economic output" either. The ambiguity about what that figure measures is particularly problematic because OSM has failed to publish the underlying analysis from BBC Research and Consulting[40] on which the OSM relies for much of its economic assessment. It is therefore impossible for the public to meaningfully review and comment on OSM's calculations of economic output. That said, OSM also calculates $16.6 million in federal and state royalties[41] which, assuming a 12.5% royalty rate on surface coal, would imply an approximate value in the marketplace of the coal produced at around $133 million (a figure fairly close to the direct economic output calculated). In short, the DEIS already contains monetized values relating to the value to consumers of the coal to be mined. Regardless, whether or not an agency attempts to conduct a full cost-benefit analysis, NEPA requires that agencies disclose environmental effects with sufficient detail and context. As this section has explained, simply tallying the volume of emissions fails to give the public and decisionmakers the required information about the magnitude of discrete climate effects from those emissions. The social cost of greenhouse gas metric provides that necessary context. OSM's inadequate transparency regarding the exact economic output from the coal mined cannot serve as a justification for further obscuring the economic and environmental impacts of this proposal by omitting use of the social cost of greenhouse gas metrics. [36] Office of Surface Mining Reclamation and Enforcement, *Final Environmental Impact Statement—Four Corners Power Plant and Navajo Mine Energy Project* at 4.2-26 to 4.2-27 (2015), *available at* https://web.archive.org/web/20180212182839/https:/www.wrcc.osmre.gov/initiatives/fourCorners/documents/FinalEIS/Section 4.2 - Climate Change.pdf. [37] *Id.* at 4.2-25 ("The social cost of carbon (SCC) is a monetization of the effects associated with an incremental increase in carbon emissions. It is intended to quantify climate change-induced effects to net agricultural productivity, human health, property damage from increased flood risk, the value of ecosystem services and other factors."). [38] DEIS at 491. [39] *Id.* at 598. [40] *Id.* at 596 (mentioning reliance on the BBC report); *id.* at 721 (citing as a reference: BBC Research & Consulting (BBC). 2017. IMPLAN Analysis of Economic Effects of the Rosebud Mine with Area F Expansion. Memorandum to ERO Resources Corporation). [41] *Id.* at 602. 6	
002-1, cont'd		**002-1 Response continued:** See comment response on pages 2 and 3. In addition, economic output is disclosed in **Section 4.15.1.2** of the EIS. The $125.5 million in direct economic output is from payroll and the supplies, materials, and services purchased by the Rosebud Mine, not from the sale of coal. **Section 4.15** has been revised to include a definition of economic output. The cited BBC report has been added as Appendix G.

Comment/ Code	Document #002-Environmental Defense Fund and Others	Response
002-2 (6311) 002-2, cont'd 002-2, cont'd 002-2, cont'd	**2. The Social Cost of Greenhouse Gas Metric Is Appropriate for a Project-Level EIS with Emissions of this Magnitude** OSM next offers various arguments against using the social cost of greenhouse gases in this particular EIS. OSM claims that the metric is only appropriate for rulemakings; that there is no way to tell if this action's effects are significant enough to warrant use of the metric; and that the metric measures long-term effects and so applying it to an 8-year mine extension would result in uncertainties. Each of these attacks fundamentally misunderstands the social cost of greenhouse gas metric. First, despite OSM's claims that the social cost of greenhouse gases only apply to rulemakings,[42] the social cost of greenhouse gas methodology is well suited to measure the marginal climate damages of individual projects. These protocols were developed to assess the cost of actions with "marginal" impacts on cumulative global emissions, and the metrics estimate the dollar figure of damages for one extra unit of greenhouse gas emissions. This marginal cost is calculated using integrated assessment models. These models translate emissions into changes in atmospheric greenhouse concentrations, atmospheric concentrations into changes in temperature, and changes in temperature into economic damages. A range of plausible socio-economic and emissions trajectories are used to account for the scope of potential scenarios and circumstances that may actually result in the coming years and decades. The marginal cost is attained by first running the models using a baseline emissions trajectory, and then running the same models again with one additional unit of emissions. The difference in damages between the two runs is the marginal cost of one additional unit. The approach assumes that the marginal damages from increased emissions will remain constant for small emissions increases relative to gross global emissions. In other words, the monetization tools are in fact perfectly suited to measuring the marginal effects of individual projects or other discrete agency actions. In fact, as recently as 2015, OSM reaffirmed in a different EIS that, though the metric was first developed for cost-benefit analysis in federal rulemaking, it was nonetheless useful and appropriate for NEPA analyses.[43] Second, OSM claims there is no impact threshold to characterize the significance of a single action on global climate change.[44] While there may not be a bright-line test for significance, the emissions OSM estimates for this project—hundreds of thousands of tons per year in direct emissions plus several million tons per year in indirect emissions[45]—are clearly significant and warrant monetization. This is especially true since, once emissions have been quantified (as they have been here), the additional step of monetization through application of the Interagency Working Group's 2016 estimates entails nothing more than a simple arithmetic calculation.[46] In *High Country*, the District Court for the District of Colorado found that it was arbitrary for the Forest Service not to monetize the "1.23 million tons of carbon dioxide equivalent emissions [from methane] the West Elk mine emits annually."[47] That suggests that emissions in quantities far below what OSM estimates here are significant and warrant monetization. In *Montana Environmental Information Center*, the District Court for the District of Montana found it was arbitrary for the Office of Surface Mining not [42] *Id.* at 491. [43] Four Corners EIS, *supra* note 36, at 4.2-25. [44] DEIS at 474 ("There are no impact and intensity thresholds available to characterize the significance of the effect of a single action on global climate change."). [45] *Id.* at 487. [46] Agencies simply need to multiply their estimate of tons in each year by the IWG's 2016 values for the corresponding year of emissions (adjusted for inflation to current dollars). If the emissions change occurs in the future, agencies would then discount the products back to present value. [47] 52 F. Supp. 3d at 1191 (quoting an e-mail comment on the draft statement for the quantification of tons). 7	**002-2 Response:** Information about global, national, state, and regional GHG emissions is provided in **Section 3.4.2.3** of the EIS. Proposed Action emissions are evaluated in the context of total U.S. emissions in **Section 4.4.3** and **Section 5.3.3** of the EIS. OSMRE is not required by NEPA to complete a monetary cost-benefit analysis of the project, and we did not include one in this EIS. Unless we produced a complete monetary cost-benefit analysis, which would include both the social costs of the project (including the social costs of carbon) as well as the social benefits of the project (e.g., the monetary benefits of the power generated), inclusion solely of a cost analysis for the social cost of carbon would be contrary to NEPA and create an unbalanced and inaccurate assessment of the project. As such, it would not be useful in facilitating a decision by the authorized official. Another commenter completed a social cost of carbon analysis (see Comment no. 14), which showed that "Total emission costs for the 19-year time horizon vary by over 40-fold from a low of $319 million to as high as $12.9 billion." While OSMRE does not believe that a social cost of carbon analysis is warranted for this project decision and did not include it in the EIS, as outlined in **Section 4.4.5**, we note that this analysis and its wide margin of error support our conclusion that such analysis was not needed because the social cost of carbon without a full cost-benefit analysis is of very limited utility to the decision maker. A full-scale carbon budgeting analysis is not required to determine if significant impacts related to GHG emissions are occurring and is outside the scope of this EIS. OSMRE, where appropriate and not overly speculative, included reasonable forecasting as in the case with the Climate discussion in Chapter 4 allowing the decision maker to evaluate potential impacts associated with the Proposed Action using representative or predicted emissions. GHG emissions are examined for NEPA purposes. Under MEPA, DEQ's analysis of actions is limited to actions which significantly affect the quality of the human environment in Montana. Section 75-1-201(1)(b)(4), MCA.

Comment/ Code	Document #002-Environmental Defense Fund and Others	Response
002-2, cont'd 002-2, cont'd 002-2, cont'd 002-2, cont'd	to monetize the 23.16 million metric tons;[48] the over 12 million metric tons per year at stake here are in the same ballpark. In *Center for Biological Diversity*, the Ninth Circuit found that it was arbitrary for the Department of Transportation not to monetize the 35 million metric ton difference in lifetime emissions from increasing the fuel efficiency of motor vehicles:[49] given the estimated lifetime of vehicles sold in the years 2008-2011 (sometimes estimated at about 15 years on average), this could represent as little two million metric tons per year, well below the annual emissions at stake here. In a recent environmental impact statement from the Bureau of Ocean Energy Management published in August 2017, the agency explained that the social cost of carbon was "a useful measure" to apply to a NEPA analysis of an action anticipated to have a difference in greenhouse gas emissions compared to the no-action baseline of about 25 million metric tons over a 5-year period,[50] or about 5 million metric tons per year. Once again, OSM's estimate for the Rosebud mine project and its downstream emissions is much higher. Under any reasonable social cost of greenhouse gases, the direct and indirect emissions from the Rosebud mine expansion will cause hundreds of millions of dollars in climate damages. Tellingly, OSM had no problem monetizing, for example, the $1,185,100 in induced economic output for the Northern Cheyenne Reservation or the $21,700 in induced output for Treasure County (in addition to millions of dollars estimated for other monetized economic benefits).[51] Certainly, a potential climate cost of hundreds of millions of dollars is also significant, particularly in the context of a document the very purpose of which is to evaluate a project's *environmental* impacts. Finally, OSM argues that because the social cost of carbon protocol was designed to estimate impacts "over long time frames," there are too many "uncertainties associated with assigning a specific and accurate SCC resulting from 8 additional years of operation" at Rosebud mine.[52] This statement misunderstands both the social cost of carbon and the nature of uncertainty around the estimate. While the social cost of greenhouse gases does calculate the economic impacts of climate damages stretching out for several centuries over the lifespan of carbon emissions, the methodology estimates a specific value for the cost of emissions from each individual year. There are year-by-year estimates for the per-ton cost of emissions for each of the 8 additional years of operation at Rosebud mine. As for uncertainty, agencies in general—and OSM in this particular instance—should remember that uncertainty is *not* a reason to abandon the social cost of greenhouse gas methodologies;[53] quite the contrary, uncertainty supports higher estimates of the social cost of greenhouse gases, because most uncertainties regarding climate change entail tipping points, catastrophic risks, and unknown unknowns about the damages of climate change. Because the key uncertainties of climate change include the risk of irreversible catastrophes, applying an options value framework to the regulatory context strengthens the case for ambitious regulatory action to reduce greenhouse gas emissions. There are numerous well-established, rigorous analytical tools available to help agencies characterize and quantitatively assess uncertainty, such as Monte Carlo simulations, and the IWG's social cost of greenhouse gas protocol incorporates those tools. For more details, please see the attached technical appendix on uncertainty. [48] 15-106-M-DWM, at 36-37. [49] 538 F.3d at 1187. [50] BOEM, *Liberty Development and Production Plan Draft EIS* at 3-129, 4,50 (2017) (89,940,000 minus 64,570,000 is about 25 million). [51] DEIS at 601. [52] *Id.* at 491. [53] *Center for Biological Diversity v. NHTSA*, 538 F.3d 1172, 1200 (9th Cir. 2008) ("[W]hile the record shows that there is a range of values, the value of carbon emissions reductions is certainly not zero."). 8	**002-2 Response continued:** The No Action Alternative is described in **Section 2.3** and states that if the mining plan for Area F were not approved, the power plants would continue to operate using coal from the Rosebud Mine until 2030, and may source coal from other mines to generate electricity at the current levels beyond 2030. The BOEM SCC analysis referenced by the commenter builds off the SCC analysis run for a Programmatic EIS covering 2017 –2022 Outer Continental Shelf Oil and Gas Program, which was run to support their larger economic analysis for the program. The values presented in the BOEM Liberty Oil Production Plan vary from 0.622 to 7.69 for the Proposed Action and Alternatives depending on the discount rate and from 0.853 to 10.610 under the No Action Alternative. This demonstrates the high variability of results when completing an SCC analysis, which does not allow the decision maker to use these values when making an informed and reasoned choice among alternatives. The significant differences between the BOEM Liberty Oil Production Plan EIS and this EIS analysis supports OSMRE's decision to not conduct an SCC analysis as explained in **Section 4.4.5** of the EIS. As stated in **Section 3.3.2.4** of the BOEM EIS, "However, the models used to develop SCC estimates, known as integrated assessment models, do not currently include all of the important physical, ecological, and economic impacts of climate change recognized in the climate change literature because of a lack of precise information on the nature of damages and because the science incorporated into these models naturally lags behind the most recent research."

Comment/ Code	Document #002-Environmental Defense Fund and Others	Response
002-3 (6311) 002-3, cont'd 002-3, cont'd	**3. The Interagency Working Group Estimates Remain the Best Available Values for Federal Agencies to Use in Analyses** One of OSM's justifications for not using the social cost of greenhouse gases is the disbandment of the Interagency Working Group on the Social Cost of Greenhouse Gases (IWG) and the withdrawal of the group's guidance on using the social cost of greenhouse gases metric. OSM also claims that the IWG's social cost of greenhouse gases estimates fail to take into account the benefits of coal-generated energy. However, as we explain below, the IWG's social cost of greenhouse gas estimates remain the best available assessments for federal agencies to use in evaluating climate impacts. ***New Executive Order Encourages Continued Monetization of the Social Cost of Greenhouse Gases*** Executive Order 13,783 officially disbanded the IWG and withdrew its technical support documents that underpinned their range of estimates.[54] Nevertheless, Executive Order 13,783 assumes that federal agencies will continue to "monetiz[e] the value of changes in greenhouse gas emissions" and instructs agencies to ensure such estimates are "consistent with the guidance contained in OMB Circular A-4."[55] Consequently, while OSM and other federal agencies no longer benefit from ongoing technical support from the IWG on use of the social cost of greenhouse gases, by no means does the new Executive Order imply that agencies should not monetize important effects in their regulatory analyses or environmental impact statements. In fact, Circular A-4 instructs agencies to monetize costs and benefits whenever feasible.[56] The Executive Order does not prohibit agencies from relying on the same choice of models as the IWG, the same inputs and assumptions as the IWG, the same statistical methodologies as the IWG, or the same ultimate values as derived by the IWG. To the contrary, because the Executive Order requires consistency with Circular A-4, as agencies follow the Circular's standards for using the best available data and methodologies, they will necessarily choose similar data, methodologies, and estimates as the IWG, since the IWG's work continues to represent the best available estimates.[57] The Executive Order does not preclude agencies from using the same range of estimates as developed by the IWG, so long as the agency explains that the data and methodology that produced those estimates are consistent with Circular A-4 and, more broadly, with standards for rational decisionmaking. Similarly, the Executive Order's withdrawal of the CEQ guidance on greenhouse gases does not —and legally cannot—remove agencies' statutory requirement to fully disclose the environmental impacts of greenhouse gas emissions. As CEQ explained in its withdrawal, the "guidance was not a regulation," and "[t]he withdrawal of the guidance does not change any law, regulation, or other legally binding requirement."[58] In other words, when the guidance originally recommended the appropriate use of the social cost of greenhouse gases in environmental impact statements,[59] it was simply explaining that the [54] Exec. Order. No. 13,783 § 5(b), 82 Fed. Reg. 16,093 (Mar. 28, 2017). [55] *Id.* § 5(c). [56] OMB, Circular A-4 at 27 (2003) ("You should monetize quantitative estimates whenever possible."). [57] Richard L. Revesz et al., *Best Cost Estimate of Greenhouse Gases*, 357 SCIENCE 6352 (2017) (explaining that, even after Trump's Executive Order, the social cost of greenhouse gas estimate of around $50 per ton of carbon dioxide is still the best estimate). [58] 82 Fed. Reg. 16,576, 16,576 (Apr. 5, 2017). [59] *See* CEQ, *Revised Draft Guidance on Consideration of Greenhouse Gas Emissions and the Effects of Climate Change in National Environmental Policy Act Reviews* at 16 (Dec. 2014), *available at* https://obamawhitehouse.archives.gov/sites/default/files/docs/nepa_revised_draft_ghg_guidance_searchable.pdf ("When an agency determines it appropriate to monetize costs and benefits, then, although developed specifically for regulatory impact analyses, the Federal social cost of carbon, which multiple Federal agencies have developed and used to assess the costs and benefits of alternatives in rulemakings, offers a harmonized, interagency metric that can provide decisionmakers and the public with some context for meaningful NEPA review. When using the Federal social cost of carbon, the agency should disclose the fact that these estimates vary over time, 9	**002-3 Response:** Executive Order 13783 withdrew the Technical Support Documents upon which the protocol is based and directed agencies to ensure that estimates of the social cost of greenhouse gases "are based on the best available science and economics" and are consistent with the guidance contained in OMB Circular A-4, "including with respect to the consideration of domestic versus international impacts and the consideration of appropriate discount rates" (EO 13783, Section 5(c)). While interim protocols have been developed for use in the rulemaking context, they do not apply to project decisions, so there is no Executive Order requirement to apply the SCC protocol to project decisions. See also response to comment 002-1.

Comment/ Code	Document #002-Environmental Defense Fund and Others	Response
002-3, cont'd 002-3, cont'd 002-3, cont'd 002-3, cont'd 002-3, cont'd	social cost of greenhouse gases is consistent with longstanding NEPA regulations and case law, all of which are still in effect today. Notably, some agencies under the Trump administration have continued to use the IWG estimates even following the Executive Order. For example, in August 2017, the Bureau of Ocean Energy Management called the social cost of carbon "a useful measure" and applied it to analyze the consequences of offshore oil and gas drilling,[60] and in July 2017, the Department of Energy used the Interagency Working Group's 2016 estimates for carbon and methane emissions to analyze energy efficiency regulation, describing the social cost of methane as having "undergone multiple stages of peer review."[61] For more detail on why the IWG's 2016 estimates remain the best values currently available to federal agencies and why the IWG's choice of a central estimate of global damages calculated at a 3% discount rate is appropriate under *Circular A-4*, please see the attached comments on the social cost of greenhouse gases submitted last year to the Bureau of Land Management. ***Omitted Categories of Damages Should Be Discussed Qualitatively*** OSM faults the social cost of carbon for failing to include "all damages or benefits from carbon emissions."[62] Alleged benefits of carbon emissions, such as from increased fertilization, are in fact already included in the IWG's estimates and are probably even overstated in those estimates. Many of the assumptions about climate benefits built into the integrated assessment models used by the IWG are now outdated; for example, recent work demonstrates that the benefits to agriculture from climate change assumed by the developers of FUND are, in fact, far lower.[63] Other research has also shown that the predicted amenity benefits from climate change, like agricultural benefits, are also highly controversial.[64] As for omitted damages, there certainly are key damages, including catastrophic outcomes, that are not yet fully monetized in the IWG's social cost of greenhouse gas estimates. In fact, one reason that IWG published not only "central" estimates but also estimates from the 95th percentile of the distribution was to reflect that omitted damage categories could significantly increase the estimates. As noted above, the social cost of greenhouse gases should be seen as a conservative lower-bound estimate of the greenhouse gas impacts. Even while this metric represents the best and most rigorous effort that the U.S. government has engaged in thus far to realistically quantify the impacts of these emissions, it is very likely to underrepresent the true extent of those impacts. Indeed, we strongly encourage further efforts to make the social cost of greenhouse gases more robust. Nevertheless, the fact that this metric does not capture the entire scope of greenhouse gas impacts does *not* mean that federal agencies should not use it. Rather, agencies should qualitatively discuss any are associated with different discount rates and risks, and are intended to be updated as scientific and economic understanding improves."); *see also* CEQ, *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* at 33 n.86 (Aug. 2016), *available at* https://obamawhitehouse.archives.gov/sites/whitehouse.gov/files/documents/nepa_final_ghg_guidance.pdf. [60] Draft Envtl. Impact Statement: Liberty Development Project at 3-129, 4-246 (Aug. 2017). [61] Energy Conservation Program: Energy Conservation Standards for Walk-In Cooler and Freezer Refrigeration Systems, 82 Fed. Reg. 31,808, 31,811, 31,857 (July 10, 2017). [62] DEIS at 491. [63] F.C. Moore et al., *New science of climate change impacts on agriculture implies higher social cost of carbon*, 8 Nature Communications 1607 (2017). [64] Howard, *Omitted Damages, supra* note 26; W.M. Hannemann, *What Is the Economic Cost of Climate Change?* (2008); D. Maddison & K. Rehdanz, *The impact of climate on life satisfaction*, 70 Ecological Economics 2437-2445 (2011); K. Rehdanz & D. Maddison, *Climate and happiness*, 52 Ecological Economics 111-125 (2005). 10	**002-3 Response continued:** Observed and projected state GHG emissions trends and climate impacts are described in **Sections 3.4.2.3** and **4.4.2.3** of the Draft EIS, respectively, including the impacts of climate change on temperature, precipitation, growing seasons, and irrigation capacity. Due to the complex, global nature of climate change, the ability to quantify potential impacts on particular local resources is limited by the availability of applicable data. Additional information on the projected impacts of climate change on drought, seasonal irrigation capacity, pests, and invasive weeds has been added to **Sections 4.4.2.3** and **5.3.3**. NEPA does not require a cost-benefit analysis of the project such as that described by the commenter. As such, the EIS does not present any economic benefits or costs for any resource. As required by NEPA (see 40 CFR § 1508.14), the socioeconomic impacts are discussed, including a description of the local economy and the project's potential changes to the employment, labor income, and local economic activity. These impacts can be perceived either positively or negatively by the community; however, a positive perception of increased economic activity in an area is very distinct from being an "economic benefit" as defined in economic theory and methodology (Watson et al. 2007, Kotchen 2011)3. Accordingly, this discussion is not a cost-benefit analysis and does not attempt to monetize the benefits of the project. GHG emissions are examined for NEPA purposes. Under MEPA, DEQ's analysis of actions is limited to actions which significantly affect the quality of the human environment in Montana. Section 75-1-201(1)(b)(4), MCA.

Comment/ Code	Document #002-Environmental Defense Fund and Others	Response
002-3, cont'd 002-4 (6303) 002-4, cont'd 002-4, cont'd 002-4, cont'd	significant omitted category of costs or benefits while continuing to use the IWG estimates as a lower bound of the costs of greenhouse gas emissions.[65] **4. OSM Fails to Consider Whether and to What Extent This Permit Could Increase Downstream Emissions** OSM assumes that, regardless of whether this permit for mine expansion is approved, power plants that use coal from the Rosebud mine will continue to operate at the same levels.[66] Consequently, OSM concludes that indirect greenhouse gas emissions will not differ significantly between the proposed action and the no action alternative.[67] OSM further assumes, without analysis, that any coal production from this new permit will ton-for-ton reduce production at other areas of Rosebud mine.[68] These assumptions are problematic and unsupported, and may dramatically underestimate the true downstream emissions caused by this project. Even if OSM is correct that shipping coal from the new permit area to anywhere but local power plants would be uneconomical, other areas of Rosebud mine have, according to OSM, shipped by rail as recently as 2010.[69] If the new permit is able to supply local power plants with coal, the existing areas of the mine will not necessarily decrease their output; instead, those areas could just as easily continue to produce and ship their coal. As OSM admits, the mine and local power plants are not inextricably interdependent: Rosebud can ship to other power plants, and the Colstrip power plant can get coal from other mines.[70] This permit will add 70.8 million tons of coal to the global supply,[71] and this addition could affect prices in ways that ultimately increase demand and emissions. Basic principles of supply and demand predict that increasing the supply of a commodity like coal will lower prices, and that lower prices will lead to increased demand for and consumption of that commodity.[72] If the increased consumption of coal due to the increased supply from the Rosebud mine project comes at the expense of energy conservation or of cleaner energy sources like natural gas and renewables, the end result would be an increase in greenhouse gas emissions. Multiple courts have recognized the need for agencies to assess such demand effects and energy substitution patterns in their environmental impact statements. Most recently, the U.S. Court of Appeals for the Tenth Circuit explained that it is irrational for an agency to fail to consider how, if its action will help increase the supply of fossil fuels, then the price for that commodity will also drop, demand will rise, and greenhouse gas emissions will increase.[73] [65] Howard and Sylvan (2015) and Pindyck (2016) find that that the general consensus is that damages are much higher than IAMs currently show, and as a consequence, so are their corresponding SCC estimates. [66] DEIS at 474, 490. [67] *Id.* at S-24. [68] *Id.* at 595. [69] *Id.* at S-3, 110. [70] *Id.* at 595. [71] *Id.* at S-1. [72] *See* N. Gregory Mankiw, *Principles of Economics* 74–78, 80–81 (5th ed. 2008). [73] *WildEarth Guardians v. Bureau of Land Management*, No. 15-8109 at 24 (10th Cir., Sept. 15, 2017) ("this perfect substitution assumption [is] arbitrary and capricious because the assumption itself is irrational (i.e., contrary to basic supply and demand principles)."). Other courts have also addressed this issue. *See Ctr. for Sustainable Economy v. Jewell*, 779 F.3d 588, 609 (D.C. Cir. 2015) ("forgoing additional leasing on the [outer continental shelf] would cause an increase in the use of substitute fuels such as renewables, coal, imported oil and natural gas, and a reduction in overall domestic energy consumption from greater efforts to conserve in the face of higher prices"); *see also Mid States Coal. for Progress v. Surface Transp. Bd.*, 345 F.3d 520, 549–550 (8th 11	**002-4 Response:** OSMRE discloses downstream GHG emissions in **Section 4.4.3.2** of the EIS. GHG emissions resulting from combustion of coal mined under the Proposed Action would contribute incrementally to climate change. Total annual projected indirect GHG (CO2e) emissions would comprise a small fraction—0.19 percent—of the total 2015 U.S. GHG emissions. The impacts analysis in the EIS is based on the premise that coal from Rosebud Mine will be used at the Colstrip Power Plant to generate electricity as the potential for additional customers to purchase the coal is highly speculative at this time and would not result in information useful to the public or the decision maker. OSMRE does not evaluate the economic effects of leasing federal minerals under the Mineral Leasing Act. The Bureau of Land Management completes that evaluation during the leasing stage. OSMRE's obligations under the Mineral Leasing Act of 1920 are specific to preparing a mining plan decision document under 30 CFR 746. OSMRE is not required to conduct a coal market analysis and/or a cost-benefit analysis (40 CFR 1502.23) and therefore presents the potential impacts using readily available information. **Section 2.3.1** explains the basis for the assumption that selection of the No Action Alternative would not change the operating status of the power plants. Per communication from Western Energy (June 19, 2017), to maintain total annual coal production at current levels while mining coal from Area F under the Proposed Action, coal production from the other existing permitted areas would be reduced accordingly. Please refer to **Table 99 - Projected Annual Coal Production for Rosebud Mine by Area** for more detail. As described in **Section 4.4.3.1**, total annual direct GHG emissions would be expected to increase relative to the existing operations at Area C because of the additional fuels (especially diesel) that would be used by vehicles hauling coal over a longer haul-road distance (i.e., 5 additional miles). Direct GHG emissions would continue at the increased level for 8 additional years compared to the No Action Alternative. As described in **Section 4.4.3.2**, total annual indirect GHG emissions are not expected to increase above current levels as total annual production of coal at Rosebud Mine is not expected to increase. Indirect GHG emissions would continue at the current level for 8 additional years compared to the No Action Alternative. The No Action Alternative is described in **Section 2.3** and states that if the mining plan for Area F were not approved, the power plants would continue to operate using coal from the other permit areas of the Rosebud Mine until 2030, and may source coal from other mines to generate electricity at the current levels beyond 2030. As stated in **Section 5.2.1.9** of the EIS, Western Energy has intermittently shipped coal via railroad in the past (as recently as 2010) but does not have a current contract to ship coal via railway. In addition, there are no foreseeable plans to ship coal by railroad from Area F, if approved, or any of the other operational permit areas at the Rosebud Mine. The commenter does not reference a specific case number for OSMRE to respond to. Assuming the commenter is discussing *WildEarth Guardians v. United States Bureau of Land Management*, 870 F.3d 1222, 1226 (10th Cir. 2017), the court found that BLM was arbitrary and capricious in its determination that the impacts under the Proposed Action and No Action Alternatives would have no appreciable difference. As mentioned above, OSMRE does not evaluate the economic effects of leasing federal minerals under the Mineral Leasing Act. Calculating the change in greenhouse gas emissions resulting from the effects on demand of either approving or not approving individual coal leases would also occur at the leasing stage. In this EIS, OSMRE discloses impacts under the Proposed Action and No Action Alternatives in **Section 4.4, Climate and Climate Change** in the EIS, showing that with the approval from the ASLM, GHGs would be up to approximately 0.9 percent higher on an annual basis under the Proposed Action relative to the No Action alternative. **Section 4.4.3.2** has been revised to remove the following sentence: "However, the change in indirect GHG emissions between the No Action Alternative and the Proposed Action would be negligible because Colstrip Units 3 and 4 would operate under the No Action Alternative as well." A similar revision has been made to the end of **Section 5.3.3**. GHG emissions are examined for NEPA purposes. Under MEPA, DEQ's analysis of actions is limited to actions which significantly affect the quality of the human environment in Montana. Section 75-1-201(1)(b)(4), MCA.

Comment/ Code	Document #002-Environmental Defense Fund and Others	Response
002-4, cont'd 002-4, cont'd	Other agencies' environmental impact statements routinely assess the effects of their approvals on fossil fuel supply, price, demand, energy substitutes, and consequential greenhouse gas emissions. For example, the Bureau of Ocean Energy Management uses sophisticated modeling to calculate the change in greenhouse gas emissions resulting from the effects on demand of either approving or not approving individual oil and gas leases.[74] Under the requirement of NEPA, OSM may not ignore the impact that increased production could have on the availability of coal, the price of coal relative to other energy resources, and the downstream emissions that could result from those changes. Nor may OSM hide behind the excuse that potential future purchases from Rosebud by other entities are "outside the scope of this analysis." OSM must analyze whether this permit approval will change demand for coal in ways that will further increase downstream greenhouse gas emissions, and so increase the total climate costs of the project. Sincerely, Susanne Brooks, Director of U.S. Climate Policy and Analysis, Environmental Defense Fund Tomás Carbonell, Senior Attorney and Director of Regulatory Policy, Environmental Defense Fund Rachel Cleetus, Ph.D., Lead Economist and Climate Policy Manager, Union of Concerned Scientists Denise Grab, Western Regional Director, Institute for Policy Integrity, NYU School of Law* Anne Hedges, Deputy Director, Montana Environmental Information Center Jayni Hein, Policy Director, Institute for Policy Integrity, NYU School of Law* Peter H. Howard, Ph.D., Economic Director, Institute for Policy Integrity, NYU School of Law* Shannon Hughes, Climate Guardian, WildEarth Guardians Benjamin Longstreth, Senior Attorney, Natural Resources Defense Council Martha Roberts, Senior Attorney, Environmental Defense Fund Iliana Paul, Policy Associate, Institute for Policy Integrity, NYU School of Law* Andres Restrepo, Staff Attorney, Sierra Club Richard L. Revesz, Director, Institute for Policy Integrity, NYU School of Law* Jason A. Schwartz, Legal Director, Institute for Policy Integrity, NYU School of Law* Thomas Singer, Senior Policy Advisor, Western Environmental Law Center Jeffrey Shrader, Economics Fellow, Institute for Policy Integrity, NYU School of Law* Peter Zalzal, Director of Special Projects and Senior Attorney, Environmental Defense Fund For any questions regarding these comments, please contact jason.schwartz@nyu.edu. * No part of this document purports to present New York University School of Law's views, if any. **Attached**: Joint Comments to the Bureau of Land Management on the Social Cost of Greenhouse Gases Cir. 2003) ("the increased availability of inexpensive coal will at the very least make coal a more attractive option to future entrants into the utilities market"); *Montana Envtl. Info. Ctr.*, 2017 WL 3480262, at *15 (holding that it was "illogical" for the agency to assume that choosing not to approve federal coal leases would have no effect on coal supply, demand, or consumption, because "other coal would be burned in its stead"); *High Country Conservation Advocates*, 52 F. Supp. 3d at 1197 (recognizing that increased production of coal could affect "the demand for coal relative to other fuel sources, and coal that otherwise would have been left in the ground will be burned" (quotation marks omitted)). [74] Bureau of Ocean Energy Mgmt., Dep't of Interior, *Draft Environmental Impact Statement: Liberty Development Project* at 4-50 (Aug. 2017); *see also* BOEM, *Proposed Final Outer Continental Shelf Oil & Gas Leasing Program 2012-2017*, 110 (2012) (calculating that if the offshore acreage were not leased, 6% of the forgone oil and gas would be replaced by energy conservation). 12	**002-4 continued:** The commenter does not provide specific examples of Bureau of Ocean Energy Management (BOEM) NEPA documents that would allow OSMRE the opportunity to understand the rationale for conducting assessments and modelling as described for the BOEM analyses which are characteristically applied to leasing actions. With regards to coal mining, OSMRE does not evaluate the economic effects of leasing federal minerals under the Mineral Leasing Act. The Bureau of Land Management completes that evaluation during the leasing stage. OSMRE's obligations under the Mineral Leasing Act of 1920 are specific to preparing a mining plan decision document under 30 CFR 746. Calculating the change in GHG emissions resulting from the effects on demand of either approving or not approving individual coal leases would also occur at the leasing stage. OSMRE took a hard look at potential climate change impacts and completed a thorough qualitative and quantitative analysis including calculating potential GHG emissions from mine operations, transportation, and coal combustion; see **Section 4.4** of the EIS. Under MEPA, DEQ's analysis of actions is limited to actions which significantly affect the quality of the human environment in Montana. Section 75-1-201(1)(b)(4), MCA.

Comment/ Code	Document #002-Environmental Defense Fund and Others	Response
Non-substantive text		

Technical Appendix: Uncertainty

Contrary to the arguments made by many opposed to strong federal climate action, uncertainty about the full effects of climate change *raises* the social cost of greenhouse gases and warrants *more* stringent climate policy.[75] Integrated assessment models (IAMs) currently used to calculate the SCC show that the net effect of uncertainty about economic damage resulting from climate change, costs of mitigation, future economic development, and many other parameters raises the SCC compared to the case where models simply use our current best guesses of these parameters.[76] Even so, IAMs still underestimate the impact of uncertainty on the SCC by not accounting for a host of fundamental features of the climate problem: the irreversibility of climate change, society's aversion to risk and other social preferences, option value, and many catastrophic impacts.[77] Rather than being a reason not to take action, uncertainty increases the SCC and should lead to more stringent policy to address climate change.[78]

Types of Uncertainty in the IAMs

IAMs incorporate two types of uncertainty: parametric uncertainty and stochastic uncertainty. Parametric uncertainty covers uncertainty in model design and inputs, including the selected parameters, correct functional forms, appropriate probability distribution functions, and model structure. With learning, these uncertainties should decline over time as more information becomes available.[79] Stochastic uncertainty is persistent randomness in the economic-climate system, including various environmental phenomena such as volcanic eruptions and sun spots.[80] Uncertainties are present in each component of the IAMs: socio-economic scenarios, the simple climate model, the damage and abatement cost functions, and the social welfare function (including the discount rate).[81]

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[75] Peterson (2006) states "Most modeling results show (as can be expected) that there is optimally more emission abatement if uncertainties in parameters or the possibility of catastrophic events are considered." Peterson, S. (2006). Uncertainty and economic analysis of climate change: A survey of approaches and findings. *Environmental Modeling & Assessment*, *11*(1), 1-17.

[76] Tol, R. S. (1999). Safe policies in an uncertain climate: an application of FUND. *Global Environmental Change*, *9*(3), 221-232; Peterson, S. (2006). Uncertainty and economic analysis of climate change: A survey of approaches and findings. *Environmental Modeling & Assessment*, *11*(1), 1-17; Interagency Working Group on the Social Cost of Greenhouse Gases, Technical Update (2016) (hereinafter 2016 TSD).

[77] Pindyck, R. S. (2007). Uncertainty in environmental economics. *Review of environmental economics and policy*, *1*(1), 45-65; Golub, A., Narita, D., & Schmidt, M. G. (2014). Uncertainty in integrated assessment models of climate change: Alternative analytical approaches. *Environmental Modeling & Assessment*, *19*(2), 99-109; Lemoine, D., & Rudik, I. (2017). Managing Climate Change Under Uncertainty: Recursive Integrated Assessment at an Inflection Point. *Annual Review of Resource Economics* 9:18.1-18.26.

[78] *See* cites *supra* note 77.

[79] Learning comes in multiple forms: passive learning of anticipated information that arrives exogenous to the emission policy (such as academic research), active learning of information that directly stems from the choice of the GHG emission level (via the policy process), and learning of unanticipated information (Kann and Weyant, 2000; Lemoine and Rudik, 2017).

[80] Kann, A., & Weyant, J. P. (2000). Approaches for performing uncertainty analysis in large-scale energy/economic policy models. *Environmental Modeling & Assessment*, *5*(1), 29-46; Peterson (2006), *supra* note 75; Golub et al. *supra* note 77.

A potential third type of uncertainty arises due to ethical or value judgements: normative uncertainty. Peterson (2006) *supra* note 75; Heal, G., & Millner, A. (2014). Reflections: Uncertainty and decision making in climate change economics. *Review of Environmental Economics and Policy*, *8*(1), 120-137. For example, there is some normative debate over the appropriate consumption discount rate to apply in climate economics, though widespread consensus exists that using the social opportunity cost of capital is inappropriate (see earlier discussion). Preference uncertainty should be modeled as a declining discount rate over time (see earlier discussion), not using uncertain parameters. Kann & Weyant, *supra* note 80.

[81] Peterson (2006), *supra* note 75; Pindyck (2007), *supra* note 77; Heal & Millner, *supra* note 80.

13

Comment/ Code	Document #002-Environmental Defense Fund and Others	Response
	When modeling climate change uncertainty, scientists and economists have long emphasized the importance of accounting for the potential of catastrophic climate change.[82] Catastrophic outcomes combine several overlapping concepts including unlucky states of the world (i.e., bad draws), deep uncertainty, and climate tipping points and elements.[83] Traditionally, IAM developers address uncertainty by specifying probability distributions over various climate and economic parameters. This type of uncertainty implies the possibility of an especially bad draw if multiple uncertain parameters turn out to be lower than we expect, causing actual climate damages to greatly exceed expected damages. Our understanding of the climate and economic systems is also affected by so-called "deep uncertainty," which can be thought of as uncertainty over the true probability distributions for specific climate and economic parameters.[84] The mean and variance of many uncertain climate phenomena are unknown due to lack of data, resulting in "fat-tailed distributions"—i.e., the tail of the distributions decline to zero slower than the normal distribution. Fat-tailed distributions result when the best guess of the distribution is derived under learning.[85] Given the general opinion that bad surprises are likely to outweigh good surprises in the case of climate change,[86] modelers capture deep uncertainty by selecting probability distributions with a fat upper tail which reflects the greater likelihood of extreme events.[87] The possibility of fat tails increases the likelihood of a "very" bad draw with high economic costs, and can result in a very high (and potentially infinite) expected cost of climate change (a phenomenon known as the dismal theory).[88] Climate tipping elements are environmental thresholds where a small change in climate forcing can lead to large, non-linear shifts in the future state of the climate (over short and long periods of time) through positive feedback (i.e., snowball) effects.[89] Tipping points refer to economically relevant thresholds after which change occurs rapidly (i.e., Gladwellian tipping points), such that opportunities for adaptation and intervention are limited.[90] Tipping point examples include the reorganization of the Atlantic meridional overturning circulation (AMOC) and a shift to a more persistent El Niño regime in the Pacific Ocean.[91] [82] Nordhaus, W. D. (2008). A question of balance: Weighing the options on global warming policies. Yale University Press; Kopp, R. E., Shwom, R. L., Wagner, G., & Yuan, J. (2016). Tipping elements and climate–economic shocks: Pathways toward integrated assessment. *Earth's Future*, *4*(8), 346-372. [83] Kopp et al. (2016), *supra* note 82. [84] *Id.* [85] Nordhaus, W. D. (2009). An Analysis of the Dismal Theorem (No. 1686). Cowles Foundation Discussion Paper; Weitzman, M. L. (2011). Fat-tailed uncertainty in the economics of catastrophic climate change. Review of Environmental Economics and Policy, 5(2), 275-292; Pindyck, R. S. (2011). Fat tails, thin tails, and climate change policy. *Review of Environmental Economics and Policy*, *5*(2), 258-274. [86] Mastrandrea, M. D. (2009). Calculating the benefits of climate policy: examining the assumptions of integrated assessment models. Pew Center on Global Climate Change Working Paper; Tol, R. S. (2012). On the uncertainty about the total economic impact of climate change. *Environmental and Resource Economics*, *53*(1), 97-116. [87] Weitzman (2011), *supra* note 85, makes clear that "deep structural uncertainty about the unknown unknowns of what might go very wrong is coupled with essentially unlimited downside liability on possible planetary damages. This is a recipe for producing what are called 'fat tails' in the extreme of critical probability distributions." [88] Weitzman, M. L. (2009). On modeling and interpreting the economics of catastrophic climate change. The Review of Economics and Statistics, 91(1), 1-19; Nordhaus (2009), *supra* note 85; Weitzman (2011), *supra* note 85. [89] Tipping elements are characterized by: (1) deep uncertainty, (2) absence from climate models, (3) larger resulting changes relative to the initial change crossing the relevant threshold, and (4) irreversibility. Kopp et al. (2016), *supra* note 82. [90] *Id.* [91] *Id.*; Kriegler, E., Hall, J. W., Held, H., Dawson, R., & Schellnhuber, H. J. (2009). Imprecise probability assessment of tipping points in the climate system. *Proceedings of the national Academy of Sciences*, *106*(13), 5041-5046; Diaz, D., & Keller, K. (2016). A potential disintegration of the West Antarctic Ice Sheet: Implications for economic analyses of climate policy. *The American* 14	

Comment/ Code	Document #002-Environmental Defense Fund and Others	Response
	Social tipping points—including climate-induced migration and conflict—also exist. These various tipping points interact, such that triggering one tipping point may affect the probabilities of triggering other tipping points.[92] There is some overlap between tipping point events and fat tails in that the probability distributions for how likely, how quick, and how damaging tipping points will be are unknown.[93] Accounting fully for these most pressing, and potentially most dramatic, uncertainties in the climate-economic system matter because humans are risk averse and tipping points—like many other aspects of climate change—are, by definition, irreversible. *How IAMs and the IWG Account for Uncertainty* Currently, IAMs (including all of those used by the IWG) capture uncertainty in two ways: deterministically and through uncertainty propagation. For the deterministic method, the modeler assumes away uncertainty (and thus the possibility of bad draws and fat tails) by setting parameters equal to their most likely (median) value. Using these values, the modeler calculates the median SCC value. Typically, the modeler conducts sensitivity analysis over key parameters—one at a time or jointly—to determine the robustness of the modeling results. This is the approach employed by Nordhaus in the preferred specification of the DICE model[94] used by the IWG. Uncertainty propagation is most commonly carried out using Monte Carlo simulation. In these simulations, the modeler randomly draws parameter values from each of the model's probability distributions, calculates the SCC for the draw, and then repeats this exercise thousands of times to calculate a mean social cost of carbon.[95] Tol, Anthoff, and Hope employ this technique in FUND and PAGE—as did the IWG (2010, 2013, and 2016)—by specifying probability distributions for the climate and economic parameters in the models. These models are especially helpful for assessing the net effect of different parametric and stochastic uncertainties. For instance, both the costs of mitigation and the damage from climate change are uncertain. Higher costs would warrant less stringent climate policies, while higher damages lead to more stringent policy, so theoretically, the effect of these two factors on climate policy could be ambiguous. Uncertainty propagation in an IAM calibrated to empirically motivated distributions, however, shows that climate damage uncertainty outweighs the effect of cost uncertainty, leading to a stricter policy when uncertainty is taken into account than when it is ignored.[96] This can be seen in the resulting right-skewed distribution of the SCC (see Figure 1 in IWG (2016)) where the mean (Monte Carlo) SCC value clearly exceeds the median (deterministic) SCC value. The IWG was rigorous in addressing uncertainty. First, it conducted Monte Carlo simulations over the above IAMs specifying different possible outcomes for climate sensitivity (represented by a right *Economic Review*, *106*(5), 607-611. See Table 1 of Kopp et al. (2016) *supra* note 82, for a full list of known tipping elements and points. [92] Kriegler et al. (2009), *supra* note 91; Cai, Y., Lenton, T. M., & Lontzek, T. S. (2016). Risk of multiple interacting tipping points should encourage rapid CO2 emission reduction; Kopp et al. (2016) *supra* note 82. [93] Peter Howard, *Omitted Damages: What's Missing from the Social Cost of Carbon* 5 (Cost of Carbon Project Report, 2014), http://costofcarbon.org/; Kopp et al. (2016) *supra* note 82. [94] Nordhaus, W. & Sztorc, P. (2013). DICE 2013: Introduction & User's Manual. Retrieved from Yale University, Department of Economics website: http://www.econ.yale.edu/~nordhaus/homepage/documents/Dicemanualfull [95] In alternative calculation method, the modeler "performs optimization of polices for a large number of possible parameter combinations individually and estimates their probability weighted sum." Golub et al. *supra* note 77. In more recent DICE-2016, Nordhaus conducts a three parameter analysis using this method to determine a SCC confidence interval. Given that PAGE and FUND model hundred(s) of uncertainty parameters, this methodology appears limited in the number of uncertain variables that can be easily specified. [96] Tol (1999), *supra* note 76, in characterizing the FUND model, states, "Uncertainties about climate change impacts are more serious than uncertainties about emission reduction costs, so that welfare-maximizing policies are stricter under uncertainty than under certainty." 15	

Comment/ Code	Document #002-Environmental Defense Fund and Others	Response
	skewed, fat tailed distribution to capture the potential of higher than expected warming). It also used scenario analysis: five different emissions growth scenarios and three discount rates. Second, the IWG (2016) reported the various moments and percentiles—including the 95th percentile—of the resulting SCC estimates. Third, the IWG put in place an updating process, e.g., the 2013 and 2016 revisions, which updates the models as new information becomes available.[97] As such, the IWG used the various tools that economists have developed over time to address the uncertainty inherent in estimating the economic cost of pollution: reporting various measures of uncertainty, using Monte Carlo simulations, and updating estimates as evolving research advances our knowledge of climate change. Even so, the IWG underestimate the SCC by failing to capture key features of the climate problem. ***Current IAMs Underestimate the SCC by Failing to Sufficiently Model Uncertainty*** Given the current treatment of uncertainty by the IWG (2016) and the three IAMs that they employ, the IWG (2016) estimates represent an underestimate of the SCC. DICE clearly underestimates the true value of the SCC by effectively eliminating the possibility of bad draws and fat tails through a deterministic model that relies on the median SCC value. Even with their calculation of the mean SCC, the FUND and PAGE also underestimate the metric's true value by ignoring key features of the climate-economic problem. Properly addressing the limitations of these models' treatment of uncertainty would further increase the SCC. First, current IAMs insufficiently model catastrophic impacts. DICE fails to model both the possibility of bad draws and fat tails by applying the deterministic approach. Alternatively, FUND and PAGE ignore deep uncertainty by relying predominately on the thin-tailed triangular and gamma distributions.[98] The IWG (2010) only partially addresses this oversight by replacing the ECS parameter in DICE, FUND, and PAGE with a fat-tailed, right-skewed distribution calibrated to the IPCC's assumptions (2007), even though many other economic and climate phenomenon in IAMs are likely characterized by fat tails, including climate damages from high temperature levels, positive climate feedback effects, and tipping points.[99] Recent work in stochastic dynamic programming tends to better integrate fat tails – particularly with respect to tipping points (see below) – and address additional aversion to this type of uncertainty (also known as ambiguity aversion); doing so can further increase the SCC under uncertainty.[100] In contrast to their approach to fat tails, the IAMs used by the IWG (2010; 2013; 2016) sometimes address climate tipping points, though they do not apply state-of-the-art methods for doing so. In early versions of DICE (DICE-2010 and earlier), Nordhaus implicitly attributes larger portions of the SCC to tipping points by including certainty equivalent damages of catastrophic events - representing two-thirds to three-quarter of damages in DICE – calibrated to an earlier Nordhaus (1994) survey of [97] IWG (2010). [98] Howard (2014), *supra* note 93. While both FUND and PAGE employ thin tailed distributions, the resulting distribution of the SCC is not always thin-tailed. In PAGE09, the ECS parameter is endogenous, such that the distribution of the ECS has a long tail following the IPCC (2007). *See* Chen, Z., Marquis, M., Averyt, K. B., Tignor, M., & Miller, H. L. (2007). Contribution of working group I to the fourth assessment report of the intergovernmental panel on climate change. *Cambridge, UK and New York: Cambridge University Press, 996p.* Similarly, while Anthoff and Tol do not explicitly utilize fat-tail distributions, the distribution of net present welfare from a Monte Carlos simulation is fat tailed. Anthoff, D., & Tol, R. S. (2014). The Climate Framework for Uncertainty, Negotiation and Distribution (FUND): Technical description, Version 3.8. Available at www.fund-model.org. Explicitly modeling parameter distributions as fat tailed may further increase the SCC. [99] Weitzman (2011), *supra* note 85; Kopp et al. (2016) *supra* note 82. [100] Lemoine, D., & Traeger, C. P. (2016a). Ambiguous tipping points. *Journal of Economic Behavior & Organization, 132*, 5-18; Lemoine & Rudik (2017), *supra* note 77. IAM modelers currently assume that society is equally averse to known unknown and known unknowns. Lemoine & Traeger, *id*. 16	

Comment/ Code	Document #002-Environmental Defense Fund and Others	Response
	experts.[101] In PAGE09, Hope also explicitly models climate tipping points as a singular, discrete event (of a 5% to 25% loss in GDP) that has a probability (which grows as temperature increases) of occurring in each time period.[102] Though not in the preferred versions of the IAMs employed by the IWG, some research also integrates specific tipping points into these IAMs finding even higher SCC estimates.[103] Despite the obvious methodological basis for addressing tipping points, the latest versions of DICE[104] and FUND exclude tipping points in their preferred specifications. Research shows that if these models were to correctly account for the full range of climate impacts—including tipping points—the resulting SCC estimates would increase.[105] The IWG approach also fails to include a risk premium—that is, the amount of money society would require in order to accept the uncertainty (i.e., variance) over the magnitude of warming and the resulting damages from climate change relative to mean damages (IWG, 2010; IWG, 2015)). The mean of a distribution, which is a measure of a distribution's central tendency, represents only one descriptor or "moment" of a distribution's shape. Each IAM parameter and the resulting SCC distributions have differing levels of variance (i.e., spread around the mean), skewness (i.e., a measure of asymmetry), and kurtosis (which, like skewness, is another descriptor of a distribution's tail) as well as means.[106] It is generally understood that people are risk averse in that they prefer input parameter distributions and (the resulting) SCC distributions with lower variances, holding the mean constant.[107] While the IWG assumes a risk-neutral central planner by using a constant discount rate (setting the risk premium to [101] Nordhaus, W. D., & Boyer, J. (2000). Warning the World: Economic Models of Global Warming. MIT Press (MA); Nordhaus, W. D. (2008). A question of balance: Weighing the options on global warming policies. Yale University Press; Howard (2014), *supra* note 93; Kopp et al. (2016) *supra* note 82. [102] Hope (2006) also calibrated a discontinuous damage function in PAGE-99 used by IWG (2010). Howard (2014), *supra* note 93. [103] Kopp et al. (2016) *supra* note 82. [104] For DICE-2013 and DICE-2016, Nordhaus calibrates the DICE damage function using a meta-analysis based on estimates that mostly exclude tipping point damages. Howard, P. H., & Sterner, T. (2016). Few and Not So Far Between: A Meta-analysis of Climate Damage Estimates. *Environmental and Resource Economics*, 1-29. [105] Using FUND, Link and Tol (2010) find that a collapse of the AMOC would decrease GDP (and thus increase the SCC) by a small amount. Earlier modeling of this collapse in DICE find a more significance increase. Keller, K., Tan, K., Morel, F. M., & Bradford, D. F. (2000). Preserving the ocean circulation: implications for climate policy. *Climatic Change*, *47*, 17-43; Mastrandrea, M. D., & Schneider, S. H. (2001). Integrated assessment of abrupt climatic changes. *Climate Policy*, *1*(4), 433-449; Keller, K., Bolker, B. M., & Bradford, D. F. (2004). Uncertain climate thresholds and optimal economic growth. *Journal of Environmental Economics and management*, *48*(1), 723-741. With respect to thawing of the permafrost, Hope and Schaefer (2016), Economic impacts of carbon dioxide and methane released from thawing permafrost. *Nature Climate Change*, *6*(1), 56-59, and Gonzalez-Eguino and Neumann (2016), González-Eguino, M., & Neumann, M. B. (2016). Significant implications of permafrost thawing for climate change control. *Climatic Change*, *136*(2), 381-388, find increases in damages (and thus an increase in the SCC) when integrating this tipping element into the PAGE09 and DICE-2013R, respectively. Looking at the collapse of the West Antarctic Ice sheet, Nicholls et al. (2008) find a potential for significant increases in costs (and thus the SCC) in FUND. Nicholls, R. J., Tol, R. S., & Vafeidis, A. T. (2008). Global estimates of the impact of a collapse of the West Antarctic ice sheet: an application of FUND. *Climatic Change*, *91*(1), 171-191. Ceronsky et al. (2011) model three tipping points (collapse of the Atlantic Ocean Meridional Overturning Circulation, large scale dissociation of oceanic methane hydrates; and a high equilibrium climate sensitivity parameter), and finds a large increase in the SCC in some cases. Ceronsky, M., Anthoff, D., Hepburn, C., & Tol, R. S. (2011). *Checking the price tag on catastrophe: The social cost of carbon under non-linear climate response* (No. 392). ESRI working paper. [106] Golub, A., & Brody, M. (2017). Uncertainty, climate change, and irreversible environmental effects: application of real options to environmental benefit-cost analysis. *Journal of Environmental Studies and Sciences*, 1-8; see Figure 1 in IWG (2016). [107] In other words, society prefers a narrow distribution of climate damages around mean level of damages X to a wider distribution of damages also centered on the same mean of X because they avoid the potential for very high damages even at the cost of eliminating the chance of very low damages. 17	

Comment/ Code	Document #002-Environmental Defense Fund and Others	Response
	zero), this assumption does not correspond with empirical evidence,[108] current IAM assumptions,[109] the NAS (2017) recommendations, nor with the IWG's own discussion (2010) of the possible values of the elasticity of the marginal utility of consumption. Evidence from behavioral experiments indicate that people and society are also averse to other attributes of parameter distributions – specifically to the thickness of the tails of distributions – leading to an additional ambiguity premium (Heal and Millner, 2014).[110] Designing IAMs to properly account for the risk and ambiguity premiums from uncertain climate damages would increase the resulting SCC values they generate. Even under the IWG's current assumption of risk neutrality, the mean SCC from uncertainty propagation excludes the (real) option value of preventing marginal CO_2 emissions.[111] Option value reflects the value of future flexibility due to uncertainty and irreversibility; in this case, the irreversibility of CO2 emissions due to their long life in the atmosphere.[112] If society exercises the option of emitting an additional unit of CO2 emissions today, "we will lose future flexibility that the [mitigation] option gave" leading to possible "regret and…a desire to 'undo'" the additional emission because it "constrains future behavior."[113] Given that the SCC is calculated on the Business as Usual (BAU) emission pathway, option value will undoubtedly be positive for an incremental emission because society will regret this emission in most possible futures. Though sometimes the social cost of carbon and a carbon tax are thought of as interchangeable ways to value climate damages, agencies should be careful to distinguish two categories of the literature. The first is the economic literature that calculates the optimal carbon tax in a scenario where the world has shifted to an optimal emissions pathway. The second is literature that assesses the social cost of carbon on the business-as-usual (BAU) emissions pathway; the world is currently on the BAU pathway, since [108] IWG, 2010, at fn 22; Cai et al., 2016, *supra* note 92, at 521. [109] The developers of each of the three IAMs used by the IWG (2010; 2013; 2016) assume a risk aversion society. Nordhaus and Sztorc, 2013, *supra*; Anthoff, D., & Tol, R. S. (2010). The Climate Framework for Uncertainty, Negotiation and Distribution (FUND): Technical description, Version 3.5. Available at www.fund-model.org; Anthoff, D., & Tol, R. S. (2014). The Climate Framework for Uncertainty, Negotiation and Distribution (FUND): Technical description, Version 3.8. Available at www.fund-model.org; Hope, C. (2013). Critical issues for the calculation of the social cost of CO2: why the estimates from PAGE09 are higher than those from PAGE2002. *Climatic Change*, *117*(3), 531-543. [110] According to Heal and Millner (2014), *supra*, there is an ongoing debate of whether ambiguity aversion is rational or a behavioral mistake. Given the strong possibility that this debate is unlikely to be resolved, the authors recommend exploring both assumptions. [111] Arrow, K. J., & Fisher, A. C. (1974). Environmental preservation, uncertainty, and irreversibility. *The Quarterly Journal of Economics*, 312-319; Dixit, A.K., Pindyck, R.S., 1994. *Investment Under Uncertainty*. Princeton University Press, Princeton, NJ; Traeger, C. P. (2014). On option values in environmental and resource economics. *Resource and Energy Economics*, *37*, 242-252. In the discrete emission case, there are two overlapping types of option value: real option value and quasi-option value. Real option value is the full value of future flexibility of maintaining the option to mitigate, and mathematically equals the maximal value that can be derived from the option to [emit] now or later (incorporating learning) less the maximal value that can be derived from the possibility to [emit] now or never. Traeger, C. P. (2014). On option values in environmental and resource economics. *Resource and Energy Economics*, *37*, 242-252, equation 5. Quasi-option value is the value of future learning conditional on delaying the emission decision, which mathematically equals the value of mitigation to the decision maker who anticipates learning less the value of mitigation to the decision maker who anticipates only the ability to delay his/her decision, and not learning. *Id*. The two values are related, such that real option value can be decomposed into: $\mathrm{DPOV} = \mathbf{Max}\{QOV + SOV - \mathbf{Max}\{NPV, 0\}, 0\} = \mathbf{Max}\{QOV + SOV - \mathrm{SCC}, 0\}$ where DPOV is the real option value, QOV is quasi-option value, SOV is simple option value (the value of the option to emit in the future condition on mitigating now), and NPV is the expected net present value of emitting the additional unit or the mean SCC in our case. *Id*. [112] Even if society drastically reduced CO2 emissions, CO2 concentrations would continue to rise in the near future and many impacts would occur regardless due to lags in the climate system. Pindyck, R. S. (2007). Uncertainty in environmental economics. *Review of environmental economics and policy*, *1*(1), 45-65. [113] Pindyck (2007). 18	

Comment/ Code	Document #002-Environmental Defense Fund and Others	Response
	optimal climate policies have not been implemented. There are currently no numerical estimates of the risk premium and option value associated with an incremental emission on the BAU emissions path. Although there are stochastic dynamic optimization models that implicitly account for these two values, they analyze *optimal,* sequential decision making under climate uncertainty.[114] By nature of being optimization models (instead of policy models), these complex models focus on calculating the optimal tax and not the social cost of carbon, which differ in that the former is the present value of marginal damages on the optimal emissions path rather than on the BAU emissions path.[115] While society faces the irreversibility of emissions on the BAU emissions path when abatement is essentially near zero (i.e., far below the optimal level even in the deterministic problem),[116] the stochastic dynamic optimization model must also account for a potential counteracting abatement cost irreversibility – the sunk costs of investing in abatement technology if we learn that climate change is less severe than expected – by the nature of being on the optimal emissions path that balances the cost of emissions and abatement. In the optimal case, uncertainty and irreversibility of abatement *can theoretically* lead to a lower optimal emissions tax, unlike the social cost of carbon. The difference in the implication for the optimal tax and the SCC means that the stochastic dynamic modeling results are less applicable to the SCC. *What can we learn from new literature on stochastic dynamic programming models?* Bearing in mind the limitations of stochastic dynamic modeling, some new research provides valuable insights that are relevant to calculation of the social cost of greenhouse gases. The new and growing stochastic dynamic optimization literature implies that the IWG's SCC estimates are downward biased. The literature is made up of three models – real option, finite horizon, and infinite horizon models – of which the infinite time horizon (i.e., stochastic dynamic programming (SDP)) models are the most comprehensive for analyzing the impact of uncertainty on optimal sequential abatement policies.[117] Recent computational advancements in SDP are helping overcome the need for strong simplifying assumptions in this literature for purpose of tractability. Traditionally, these simplifications led to unrealistically fast rates of learning – leading to incorrect outcomes – and difficulty in comparing results across papers (due to differing uncertain parameters, models of learning, and model types). Even so, newer methods still only allow for a handful of uncertain parameters compared to the hundreds of uncertain parameters in FUND and PAGE. Despite these limitations, the literature supports the above finding that the SCC, if anything, increases under uncertainty.[118] [114] Kann & Weyant, *supra;* Pindyck (2007), *supra;* Golub et al. (2014), *supra.* [115] Nordhaus (2014) makes this difference clear when he clarifies that "With an optimized climate policy…the SCC will equal the carbon price…In the more realistic case where climate policy is not optimized, it is conventional to measure the SCC as the marginal damage of emissions along the actual path. There is some inconsistency in the literature on the definition of the path along which the SCC should be calculated. This paper will generally define the SCC as the marginal damages along the baseline path of emissions and output and not along the optimized emissions path." Nordhaus, W. (2014). Estimates of the social cost of carbon: concepts and results from the DICE-2013R model and alternative approaches. *Journal of the Association of Environmental and Resource Economists, 1*(1/2), 273-312. [116] On the BAU path, emissions far exceed their optimal level even without considering uncertainty. As a consequence, society is likely to regret an additional emission of CO2 in most future states of the world. Alternatively, society is unlikely to regret current abatement levels unless the extremely unlikely scenarios that there is little to no warming and/or damages from climate change. [117] Kann and Weyant, 2000, *supra;* Pindyck, 2007, *supra;* Golub et al., 2014, *supra.* [118] Kann and Weyant, 2000, *supra;* Pindyck, 2007, *supra;* Golub et al., 2014, *supra;* Lemoine and Rudik, 2017, supra. Comparing the optimal tax to the mean SCC is made further difficult by the frequent use of DICE as the base from which most stochastic dynamic optimization models are built. As a consequence, deterministic model runs are frequently the base of comparison for these models (Lemoine and Rudik, 2017). 19	

Comment/ Code	Document #002-Environmental Defense Fund and Others	Response
	First, uncertainty increases the optimal emissions tax under realistic parameter values and modeling scenarios. While the impact of uncertainty on the optimal emissions tax (relative to the deterministic problem) depends on the uncertain parameters considered, the type of learning, and the model type (real option, finite horizon, and infinite horizon), the optimal tax clearly increases when tipping points or black swan events are included in stochastic optimization problems.[119] For SDP models, uncertainty tends to strengthen the optimal emissions path relative to the determinist case even without tipping points,[120] and these results are strengthened under realistic preference assumptions.[121] Given that there is no counter-balancing tipping abatement cost,[122] the complete modeling of climate uncertainty – which fully accounts for tipping points and fat tails – increases the optimal tax. Uncertainty leads to a stricter optimal emissions policy even if with irreversible mitigation costs, highlighting that the SCC would also increase when factoring in risk aversion and irreversibility given that abatement costs are very low on the BAU emissions path. Second, given the importance of catastrophic impacts under uncertainty (as shown in the previous paragraph), the full and accurate modeling of tipping points and unknown knowns is critical when modeling climate change. The most sophisticated climate-economic models of tipping points – which include the possibility of multiple correlated tipping points in stochastic dynamic IAMs – find an increase in the optimal tax by 100%[123] to 800%[124] relative to the deterministic case without them. More realistic modeling of tipping points will also increase the SCC. Finally, improved modeling of preferences will amplify the impact of uncertainty on the SCC. Adopting Epstein-Zin preferences that disentangle risk aversion and time preferences can significantly increase the SCC under uncertainty.[125] Recent research has shown that accurate estimation of decisions under uncertainty crucially depends on distinguishing between risk and time preferences.[126] By conflating risk and time preferences, current models substantially understate the degree of risk aversion exhibited by most individuals, artificially lowering the SCC. Similarly, adopting ambiguity aversion increase the SCC, [119] The real options literature tends to find an increase in the optimal emissions path under uncertainty relative to the deterministic case (Pindyck, 2007), though the opposite is true when modelers account for the possibility of large damages (i.e., tipping point or black swan events) even with a risk-neutral society (Pindyck, 2007; Golub et al., 2014). Solving finite horizon models employing non-recursive methods, modelers find that the results differ depending on the model of learning – the research demonstrates stricter emission paths under uncertainty without learning (with emission reductions up to 30% in some cases) and the impact under passive learning has a relatively small impact due the presence of sunken mitigation investment costs - except when tipping thresholds are included (Golub et al., 2014). [120] Using SDP, modelers find that uncertainty over the equilibrium climate sensitivity parameter generally increases the optimal tax by a small amount, though the magnitude of this impact is unclear (Golub et al., 2014; Lemoine and Rudik, 2017). Similarly, non-catastrophic damages can have opposing effects dependent on the parameters changed, though emissions appear to decline overall when you consider their uncertainty jointly. [121] Pindyck, 2007; Golub et al., 2017; Lemoine and Rudik, 2017 [122] Pindyck, 2007 [123] Lemoine, D., & Traeger, C. P. (2016b). Economics of tipping the climate dominoes. *Nature Climate Change*. [124] Cai et al., 2016 [125] Cai et al., 2016; Lemoine and Rudik, 2017. The standard utility function adopted in IAMs with constant relative risk version implies that the elasticity of substitution equals the inversion of relative risk aversion. As a consequence, the society's preferences for the intra-generational distribution of consumption, the intergenerational distribution of consumption, and risk aversion hold a fixed relationship. For purposes of stochastic dynamic programming, this is problematic because this assumption conflates intertemporal consumption smoothing and risk aversion. Botzen, W. W., & van den Bergh, J. C. (2014). Specifications of social welfare in economic studies of climate policy: overview of criteria and related policy insights. *Environmental and Resource Economics*, *58*(1), 1-33. By adopting the Epstein-Zinn utility function which separates these two parameters, modelers can calibrate them according to empirical evidence. For example, Cai et al. (2016) replace the DICE risk aversion of 1.45 and elasticity parameter of 1/1.45 with values of 3.066 and 1.5, respectively. [126] James Andreoni & Charles Sprenger, *Risk Preferences Are Not Time Preferences*, 102 Am. Econ. Rev. 3357–3376 (2012). 20	

Comment/ Code	Document #002-Environmental Defense Fund and Others	Response
	but to a much lesser extent than risk aversion.[127] Finally, allowing for the price of non-market goods to increase with their relative scarcity can amplify the positive effect that even small tipping points have on the SCC if the tipping point impacts non-market services.[128] Including more realistic preference assumptions in IAMs would further increase the SCC under uncertainty. Introducing stochastic dynamic modeling (which captures option value and risk premiums), updating the representation of tipping points, and including more realistic preference structures in traditional IAMs will—as in the optimal tax—further increase the SCC under uncertainty. *Conclusion: Uncertainty Raises the Social Cost of Greenhouse Gases* Overall, the message is clear: climate uncertainty is *never* a rationale for ignoring the SCC or shortening the time horizon of IAMs. Instead, our best estimates suggest that increased variability implies a higher SCC and a need for more stringent emission regulations.[129] Current omission of key features of the climate problem under uncertainty (the risk and climate premiums, option value, and fat tailed probability distributions) and incomplete modeling of tipping points imply that the SCC will further increase with the improved modeling of uncertainty in IAMs. [127] Lemoine, D., & Traeger, C. P. (2016b). Economics of tipping the climate dominoes. *Nature Climate Change*.; Lemoine and Rudik, 2017 [128] Typically, IAMs assume constant relative prices of consumption goods. Gerlagh, R., and B.C.C. Van der Zwaan. 2002. "Long-term substitutability between environmental and man-made goods." *Journal of Environmental Economics and Management 44*(2):329-345; Sterner, T., and U.M. Persson. 2008. "An Even Sterner Review: Introducing Relative Prices into the Discounting Debate." *Review of Environmental Economics and Policy 2*(1):61-76. By replacing the standard isoelastic utility function in IAMs with a nested CES utility function following Sterner and Persson (2008), Cai et al. (2015) find that even a relatively small tipping point (i.e., a 5% loss) can substantially increase the SCC in the stochastic dynamic setting. Cai, Y., Judd, K. L., Lenton, T. M., Lontzek, T. S., & Narita, D. (2015). Environmental tipping points significantly affect the cost– benefit assessment of climate policies. *Proceedings of the National Academy of Sciences*, *112*(15), 4606-4611. [129] Golub et al. (2014) states "The most important general policy implication from the literature is that despite a wide variety of analytical approaches addressing different types of climate change uncertainty, none of those studies supports the argument that no action against climate change should be taken until uncertainty is resolved. On the contrary, uncertainty despite its resolution in the future is often found to favor a stricter policy." 21	

Comment/ Code	Document #002-Environmental Defense Fund and Others	Response
Non-substantive text	November 6, 2017 To: Catherine Cook, Acting Division Chief, Fluid Minerals Division, BLM CC: Office of Information and Regulatory Affairs, OIRA_Submission@omb.eop.gov **Docket: RIN 1004-AE54 & Attention: OMB Control Number 1004-0211** Subject: Comments on Proposed Rule, Regulatory Impact Analysis, and Environmental Assessment on the Delay and Suspension of Certain Requirements for Waster Prevention and Resource Conservation **Submitted by:** Environmental Defense Fund, Institute for Policy Integrity at New York University School of Law, Natural Resources Defense Council, Sierra Club, and Union of Concerned Scientists[1] BLM proposes to delay and suspend crucial sections of the 2016 Waste Prevention Rule, which was designed to prevent private industry from wasting natural gas resources owned by the public and to prevent significant methane emissions and the associated costs to public health and the climate. To justify its proposal, BLM manipulates the calculation of forgone benefits from delay—particularly, the calculation of the social cost of methane—in ways completely inconsistent with the best available science, the best practices for economic analysis, and the legal standards for rational decisionmaking. In reality, the suspension rule flunks cost-benefit analysis, and the proposal should not move forward. BLM now argues, less than a year after the Waste Prevention Rule was finalized in November 2016, that its previous analysis had underestimated costs and overestimated benefits, and that the 2016 rule imposes substantial burdens inconsistent with section 1 of Executive Order 13,783.[2] BLM is wrong. As these comments explain, if anything, the 2016 rule *underestimated* the net climate benefits it would provide, because the social cost of methane omits the valuation of crucial climate damages and so is widely regarded as a lower-bound estimate of the full climate benefits of reducing methane emissions. Moreover, Executive Order 13,783 in fact instructs agencies to avoid only unnecessary regulations, but to keep necessary and appropriate regulations for which the benefits justify the costs.[3] The 2016 Waste Prevention Rule's benefits exceed its costs by as much as $200 million per year,[4] and so it is precisely the kind of necessary and appropriate rule that agencies are instructed to preserve. By contrast, the proposed suspension rule only appears to be justified on cost-benefit grounds because BLM has manipulated the economics. These comments make the following main arguments about how BLM failed to appropriately value the social cost of methane and other forgone benefits: • BLM's arbitrarily crabbed 10-year timespan for analysis of the baseline scenario leads the agency to conflate the status quo with future effects and so undercount significant forgone benefits. BLM counts beneficial effects in the year 2027 as unique benefits of its proposed delay, but those same effects would have occurred under the 2016 rule. BLM's calculation of forgone benefits is off by nearly $200 million. [1] Our organizations may separately submit other comments regarding other aspects of the proposed suspension. [2] 82 Fed. Reg. 46,458, 46,459 (Oct. 5, 2017). [3] Exec. Order. 13,783 § 1(a) & (e), 82 Fed. Reg. 16,093 (Mar. 31, 2017). [4] BLM, *Regulatory Impact Analysis for Waste Prevention and Resource Conservation* 111 (2016) [hereinafter 2016 RIA].	

Comment/ Code	Document #002-Environmental Defense Fund and Others	Response
	• BLM wrongly presents an alternative analysis that omits the monetization of the social cost of methane. Under legal standards for rational decisionmaking, agencies must monetize important greenhouse gas effects when their decisions are grounded in cost-benefit analysis. Uncertainty about the full effects of climate change, such as catastrophic damages and tipping points, is not a reason to treat the social cost of methane as zero; rather, uncertainty is a reason to treat current estimates of the social cost of methane as a lower bound. • BLM arbitrarily attempts to limit its valuation of the social cost of methane to domestic-only effects. Not only is a global perspective required under principles of rational decisionmaking, but the methodology and models that BLM uses cannot calculate an accurate domestic-only value. • BLM arbitrarily discounts future climate effects at a 7% discount rate in addition to a 3% rate. Applying a 7% discount rate to inter-generational effects is inconsistent with Circular A-4's requirements to distinguish social discount rates from rates based on private returns to capital; to make plausible assumptions; to adequately address uncertainty, especially over long time horizons; and to rely on the best available economic data and literature. • BLM arbitrarily fails to follow prescribed practices for dealing with uncertainty. Specifically, BLM failed to address uncertainty over the discount rate (by, for example, presenting an estimate at a 2.5% or lower discount rate, or a declining rate) or to address uncertainty over catastrophic damages, tipping points, option value, and risk aversion (by, for example, presenting an estimate at the 95th percentile). By failing to run such sensitivity analyses, BLM overlooks how different (and more plausible) assumptions would change its cost-benefit calculation. • BLM hides behind the label of "interim values" to cherry-pick only those methodological revisions that advance its predetermined goal of a lower social cost of methane. Any update to the Interagency Working Group's 2016 estimates must fully engage with all the most up-to-date literature and with all the recommendations issued by the National Academies of Sciences. • BLM fails to appropriately value unquantified benefits to climate and public health. • BLM's environmental assessment misleadingly reports forgone methane reductions in short tons of methane, rather than in carbon dioxide-equivalent metric tons, and fails to provide necessary context by monetizing the methane emissions. These critical failings completely undercut the justification for the proposed suspension, and it should not move forward. Nevertheless, BLM does make a few appropriate methodological choices that it should continue applying in any future applications of the social cost of methane. Specifically, BLM "relies upon the inputs and modeling developed by the now-disbanded Interagency Working Group for the purposes of providing discrete alternative scenarios that reflect the best available Federal agency estimates of social costs."[5] Indeed, because the Interagency Working Group used the best available data and methodology, it is appropriate for agencies to continue to rely on its methodology and its 2016 estimates. In fact, BLM should have relied more consistently on the Interagency Working Group's inputs and assumptions, and so focused on a global valuation calculation at a 3% or lower discount rate. BLM also explains the virtues of equally weighting the results of the three most peer-reviewed integrated assessment models, to balance out the limitations and omissions of any one model.[6] In any future [5] BLM, *Regulatory Impact Analysis for the Proposed Rule to Suspend or Delay Certain Requirements of the 2016 Waste Prevention Rule* 57 (2017) [hereinafter 2017 RIA]. [6] 2017 RIA at 58. 2	

Comment/ Code	Document #002-Environmental Defense Fund and Others	Response
	applications of the social cost of methane, BLM should continue to rely on the Interagency Working Group's methodology and use multiple peer-reviewed models. That said, BLM has failed to use the most up-to-date versions of those models, and should use the updated models in future calculations, including in any revised analysis of its proposed suspension. 1. BLM Wrongly Misattributes Status Quo Effects to Its Proposal and So Undercounts Important Forgone Benefits BLM compares the baseline scenario's costs and benefits through the year 2026 with the costs and benefits for its preferred one-year delay proposal through the year 2027. This is wrong for two reasons. First, the timespan is too short and so fails to capture all important costs and benefits.[7] And second, the mismatched timespans for the baseline versus the proposal lead BLM to mistake status quo effects in the year 2027 as benefits of its proposal, thus arbitrarily inflating its net benefit calculations. OMB's Circular A-4 requires agencies' regulatory analyses to "cover a period long enough to encompass all the important benefits and costs likely to result from the rule."[8] Ten years is too short a timespan to cover all the important effects likely to result from a rule on methane emissions, especially since some of the requirements of the rule are not scheduled for full implementation until the end of that ten-year period. In the 2016 rule's analysis, while BLM did anticipate that aggregate effects might lessen somewhat after ten years, the agency explained that the methane capture requirements would continue to limit flaring far beyond the first ten years.[9] In fact, BLM's 2016 analysis showed methane reductions slightly but steadily increasing year after year, with no sign of slowing down—let alone stopping—after ten years.[10] Indeed, the final capture requirement was only scheduled to go fully into effect starting in 2026.[11] BLM's faulty cost-benefit justification for its proposed suspension is based on an unexplained and illogical assumption that, under the baseline scenario, the 2016 rule would have suddenly stopped achieving any methane reductions in the year 2027. To calculate the forgone benefits from methane reductions under the proposed suspension, BLM now assumes that the baseline scenario (i.e., the 2016 rule) would have $0 in benefits in the year 2027, while its proposed one-year delay would generate between $12-$35 million in benefits in the year 2027.[12] Through this mathematical sleight of hand, BLM manages to argue that all forgone methane reductions over the years 2017-2027 only represent a loss as low as $300,000 total.[13] Not only do these figures dramatically undercount the social cost of methane by a factor of 10 or more (see the rest of these comments), but the proposed delay's benefits in 2027 are an illusion. There is no reason to think that, under the baseline scenario, the 2016 rule would have suddenly stopped achieving any methane reductions in the year 2027. To the contrary, BLM's analysis shows methane reductions steadily increasing year after year under the 2016 rule. The 2016 rule would most likely produce slightly more methane reductions in the year 2027 than the proposed delay does. [7] The 2016 rule's analysis also used a short, ten-year timespan, but in that case extending the timespan further would have only increased net benefits and strengthened the justification for the already justified rule. Here, by contrast, a proper comparison of appropriately long timespans would reveal that the proposed suspension's cost savings do not justify its forgone benefits. [8] OMB, Circular A-4, at 15 (2003). [9] 2016 RIA at 38. [10] 2016 RIA at 110, tbl. 8-2b. [11] 43 C.F.R. § 3179.7. [12] 2017 RIA at 34, tbl. 4.2d. [13] 2017 RIA at 34, tbl. 4.2d. 3	

Comment/ Code	Document #002-Environmental Defense Fund and Others	Response
	Yet because BLM now artificially cuts off analysis for the baseline after the year 2026 while extending analysis for its proposal through 2027, the agency has caused important forgone benefits to disappear. The real effect of a one-year delay is to eliminate entirely the 2016 rule's first year of benefits. Therefore, a more appropriate way to calculate forgone benefits from a one-year delay would simply subtract the 2016 rule's projected benefits for the year 2017. Specifically, a one-year delay of the 2016 rule forgoes $189 million in methane reduction benefits and $20 million in cost savings,[14] plus unmonetized but important benefits from reducing 250,000 tons of VOCs and 175,000 tons of methane.[15] BLM has undercounted the total monetized forgone climate benefits of its proposed suspension by $187-$188 million. As such, the proposed suspension's economic analysis is misleading and arbitrary, and the economic justification for the proposal crumbles under scrutiny. ## 2. BLM Must Monetize the Social Cost of Methane and Cannot "Omit Monetized Estimates" in Response to Uncertainty In response to uncertainty over the estimate of the social cost of methane, BLM offers "an alternative approach" that "omit[s] monetized estimates of forgone climate benefits" and calculates new net benefit totals that completely ignore any climate effects of the proposed suspension.[16] Including this approach as an equally valid alternative analysis is arbitrary. The monetization of climate effects is required by legal standards for rational decisionmaking, applicable executive orders, and best economic practices. Moreover, the uncertainty around the calculation of the social cost of methane on the whole points toward even higher values of climate damages. Far from providing a reason to treat climate damages as costing $0, uncertainty should encourage even more ambitious policies to reduce methane emissions. *Standards of Rationality Require Attention to and Consistent Treatment of Important Factors* The Supreme Court defined the standard of rationality for agency actions under the Administrative Procedure Act as follows: > Normally, an agency rule would be arbitrary and capricious if the agency has relied on factors which Congress has not intended it to consider, *entirely failed to consider an important aspect of the problem*, offered an explanation for its decision that runs counter to the evidence before the agency, or is so implausible that it could not be ascribed to a difference in view of the product of agency expertise.[17] Furthermore, the Court found that the standard requires agencies to "examine the relevant data and articulate . . . a rational connection between the facts found and the choice made."[18] Under BLM's relevant statutory authority, environmental considerations are an important aspect of the problem of preventing undue waste. For example, the Federal Land Policy and Management Act directs that "the public lands be managed in a manner that will protect the quality of . . . ecological, [14] 2016 RIA at 109, tbl. 8-2a (showing the benefits of the 2016 rule for the year 2017). [15] 2016 RIA at 110, tbls. 8-2b and 8-2c. [16] 2017 RIA at 57. [17] Motor Vehicle Manufacturers Assoc. v. State Farm Mutual Auto. Ins. Co., 463 U.S. 29, 41-43 (1983) (emphasis added); *see also id.* ("[W]e must 'consider whether the decision was based on a consideration of the relevant factors and whether there has been a clear error of judgment.'"). [18] *Id.* 4	

Comment/ Code	Document #002-Environmental Defense Fund and Others	Response
	environmental, air and atmospheric . . . values."[19] Lessees of federal lands are instructed to "use all reasonable precautions to prevent waste of oil or gas developed in the land."[20] To determine what is a reasonable precaution, BLM must consider the full consequences of the waste, including the climate effects.[21] A ruling of the U.S. Court of Appeals for the Seventh Circuit on the use of the social cost of carbon in setting energy efficiency standards is instructive here. In *Zero Zone Inc. v. Department of Energy*, the Seventh Circuit found that "the expected reduction in environmental costs *needs* to be taken into account" for the Department of Energy "[t]o determine whether an energy conservation measure is appropriate under a cost-benefit analysis."[22] In other words, while the Department of Energy's statutory authority did not specifically mention environmental concerns, the court found that environmental concerns were an essential factor in determining appropriate regulations to prevent the wasting of energy.[23] Here, too, BLM needs to consider environmental concerns to determine appropriate regulations to prevent the wasting of oil and gas. The Seventh Circuit ruling continued by addressing petitioners' challenge that the Department of Energy's consideration of the global social cost of carbon was arbitrary: the court held that the agency acted reasonably in monetizing the global climate effects.[24] *Zero Zone* was the second time a federal court of appeals had applied arbitrary and capricious review to require or approve the use of the social cost of greenhouse gases in agency decisionmaking. In *Center for Biological Diversity v. National Highway Traffic Safety Administration*, the U.S. Court of Appeals for the Ninth Circuit ruled that, because the agency had monetized other uncertain costs and benefits of its vehicle fuel efficiency standard, its "decision not to monetize the benefit of carbon emissions reduction was arbitrary and capricious."[25] Specifically, it was arbitrary to "assign[ ] no value to *the most significant benefit* of more stringent [vehicle fuel efficiency] standards: reduction in carbon emissions."[26] Though uncertainty over the calculation produced a range of plausible values, "the value of carbon emissions reduction is certainly not zero."[27] In other words, uncertainty is not an excuse to fail to monetize important effects. Ultimately, the court held that when an agency bases a rulemaking on cost-benefit analysis, it is arbitrary to "put a thumb on the scale by undervaluing the benefits and overvaluing the costs."[28] Two federal district courts have also found the failure to use the social cost of carbon in NEPA analyses to be arbitrary and capricious. In *High Country Conservation Advocates v. Forest Service*, the U.S. District Court for the District of Colorado found that it was "arbitrary and capricious to quantify the *benefits* of the lease modifications and then explain that a similar analysis of the *costs* was impossible when such an [19] 43 U.S.C. § 1701(a)(8). [20] 30 U.S.C. § 225. [21] Furthermore, agencies are instructed to consider all significant direct and indirect effects of regulatory unless prohibited by statute. Exec. Order. 12,866 § 6(a)(3)(C), 58 Fed. Reg. 51,735, 51,741 (Oct. 4, 1993); OMB, Circular A-4 at 26. [22] 832 F.3d 654, 677 (7th Cir. 2016) (emphasis added). [23] Similarly, in 1988, the D.C. Circuit highlighted that the Department of Transportation interprets language on the need to conserve energy as "*requir[ing]* consideration of . . . environmental . . . implications." *Pub. Citizen v. Nat'l Highway Traffic Safety Admin.*, 848 F.2d 256, 263 n.27 (D.C. Cir. 1998) (R.B. Ginsburg, J.) (quoting 42 Fed. Reg. 63,184, 63,188 (Dec. 15, 1977) and adding emphasis to the word *requires*). [24] 832 F.3d at 679. *See also* Sierra Club v. FERC, No. 16-1329, 2017 WL 3597014, at *10 (D.C. Cir. Aug. 22, 2017) (requiring that, on remand, if FERC declines to use the social cost of carbon, the agency must explain and justify why not). [25] 538 F.3d 1172, 1203 (9th Cir. 2008). [26] *Id.* at 1199. [27] *Id.* at 1200. [28] *Id.* at 1198. 5	

Comment/ Code	Document #002-Environmental Defense Fund and Others	Response
	analysis was in fact possible"—specifically, by applying the "social cost of carbon protocol."[29] In *Montana Environmental Information Center v. Office of Surface Mining*, the U.S. District Court for the District of Montana followed the lead set by *High Country* and likewise held an environmental assessment to be arbitrary and capricious because it quantified the benefits of action while failing to use the social cost of carbon to quantify the costs.[30] In short, agencies must monetize important greenhouse gas effects when their decisions are grounded in cost-benefit analysis.[31] Because BLM monetizes the cost savings of delay to justify its proposed suspension, the agency must likewise quantify and monetize the forgone climate benefits using the social cost of greenhouse gases. *A New Executive Order Encourages Continued Monetization of the Social Cost of Greenhouse Gases* Executive Orders 12,866 and 13,563 remain in effect[32] and continue to require agencies to weigh the costs and benefits of significant regulatory actions. In particular, Executive Order 12,866 requires agencies to "select those approaches that maximize net benefits (including potential economic, *environmental, public health* and safety, *and other advantages*; distributive impacts; and equity), unless a statute requires another regulatory approach."[33] For significant regulatory actions, agencies must quantify costs and benefits to the fullest extent feasible.[34] The Interagency Working Group on the Social Cost of Greenhouse Gases was specifically organized to develop a single, harmonized value for all agencies to use in their regulatory impact analyses under Executive Order 12,866.[35] President Trump's Executive Order 13,783, issued March 28, 2017, officially disbanded the Interagency Working Group on the Social Cost of Greenhouse Gases (IWG) and withdrew the technical support documents that underpinned their range of estimates.[36] Nevertheless, Executive Order 13,783 assumes that federal agencies will continue to "monetiz[e] the value of changes in greenhouse gas emissions" and instructs agencies to ensure such estimates are "consistent with the guidance contained in OMB Circular A-4."[37] Consequently, while BLM and other federal agencies no longer have technical guidance [29] 52 F. Supp. 3d 1174, 1191 (D. Colo. 2014). [30] 15-106-M-DWM, at 40-46, Aug. 14, 2017 (also holding that it was arbitrary to imply that there would be zero effects from greenhouse gas emissions). Three cases from different courts have declined to find that specific failures to use the social cost of carbon in NEPA analyses rise to the level of arbitrary and capricious action, but the cases are all distinguishable by the scale of the action or by whether other effects were quantified and monetized in the analysis. *See* League of Wilderness Defenders v. Connaughton, No. 3:12-cv-02271-HZ (D. Ore., Dec. 9, 2014); EarthReports v. FERC, 15-1127, (D.C. Cir. July 15, 2016); WildEarth Guardians v. Zinke, 1:16-CV-00605-RJ, at 23-24, (D. N.M. Feb. 16, 2017). More recently the U.S. Court of Appeals for the District of Columbia Circuit confirmed that NEPA requires a rigorous analysis of climate effects and, in its remand to FERC, required the agency to explain and justify its position if it decides not to use the social cost of carbon. Sierra Club v. FERC, No. 16-1329, 2017 WL 3597014, at *10 (D.C. Cir. Aug. 22, 2017). [31] *See generally* Peter Howard & Jason Schwartz, *Think Global: International Reciprocity as Justification for a Global Social Cost of Carbon*, 42 Columbia J. Envtl. L. 203 (2017) for more on applying standards of rationality to the social cost of carbon. [32] *See* Exec. Order No. 13,777 § 2 (Feb. 24, 2017) (continuing to cite the policies required under Executive Orders 12,866 and 13,563). [33] § 1(a) (Oct. 4, 1993). [34] Exec. Order 12,866 § 6(a)(3)(C)(i). [35] INTERAGENCY WORKING GROUP ON SOCIAL COST OF CARBON, TECHNICAL SUPPORT DOCUMENT: SOCIAL COST OF CARBON FOR REGULATORY IMPACT ANALYSIS UNDER EXECUTIVE ORDER 12,866 (2010). Though note the IWG's estimates are applicable in a wider range of contexts, including environmental impact statements. See *High Country*, *supra*. [36] Exec. Order. No. 13,783 § 5(b), 82 Fed. Reg. 16,093 (Mar. 28, 2017). [37] *Id.* § 5(c). 6	

Comment/ Code	Document #002-Environmental Defense Fund and Others	Response
	directing them to exclusively rely on the IWG's estimates to monetize climate effects, by no means does the new Executive Order imply that agencies should not monetize important effects in their regulatory analyses or environmental impact statements. In fact, Circular A-4 instructs agencies to monetize costs and benefits whenever feasible.[38] The Executive Order does not prohibit agencies from relying on the same choice of models as the IWG, the same inputs and assumptions as the IWG, the same statistical methodologies as the IWG, or the same ultimate values as derived by the IWG. To the contrary, because the Executive Order requires consistency with Circular A-4, as agencies follow the Circular's standards for using the best available data and methodologies, they will necessarily choose similar data, methodologies, and estimates as the IWG, since the IWG's work continues to represent the best available estimates.[39] The new Executive Order does not preclude agencies from using the same range of estimates as developed by the IWG, so long as the agency explains that the data and methodology that produced those estimates are consistent with Circular A-4 and, more broadly, with standards for rational decisionmaking. As explained throughout these comments, the IWG's estimates of the social cost of greenhouse gases are, in fact, already consistent with the Circular A-4 and represent the best existing estimates of the lower bound of the range for the social cost of greenhouse gases. Therefore, the IWG estimates or those of a similar or higher value[40] should be used in regulatory analyses and environmental impact statements. *Uncertainty Raises the Social Cost of Greenhouse Gas Even Higher, and Is Not a Reason to "Omit Monetized Estimates"* BLM cites uncertainty over the calculation of the social cost of methane as support for "an alternative approach" to analysis that would "omit monetized estimates of forgone climate benefits."[41] The first problem with this alternative approach is that BLM attempts to support its argument by taking the work of Robert Pindyck completely out of context. Dr. Pindyck clearly endorses the continued use of the social cost of greenhouse gases. While he is critical of the underlying models, especially for their failure to fully capture catastrophic risks,[42] Pindyck clearly states: [38] OMB, Circular A-4 at 27 (2003) ("You should monetize quantitative estimates whenever possible."). [39] Richard L. Revesz et al., *Best Cost Estimate of Greenhouse Gases*, 357 SCIENCE 6352 (2017) (explaining that, even after Trump's Executive Order, the social cost of greenhouse gas estimate of around $50 per ton of carbon dioxide is still the best estimate). [40] *See, e.g.*, Richard L. Revesz et al., *Global Warming: Improve Economic Models of Climate Change*, 508 NATURE 173 (2014) (explaining that current estimates omit key damage categories and, therefore, are very likely underestimates). [41] 2017 RIA at 57. [42] *See* R.S. Pindyck, *The Climate Policy Dilemma*, 7 Rev. Envtl. Econ. & Pol'y 2193 (2013) (advocating for future research on catastrophic impacts). Pindyck has three main methodological critiques of the IAMs. *See* R.S. Pindyck, *Climate Change Policy: What Do the Models Tell Us?*, 51 J. Econ. Lit. 860 (2013); R.S. Pindyck, *The Use and Misuse of Models for Climate Policy*, 11 Rev. Envtl. Econ. & Pol'y 100 (2017). First, two key components of IAMs—the equilibrium climate sensitivity parameter and damage functions—are ambiguous; this is sometimes referred to as deep uncertainty, Knightian uncertainty, or unknown knowns. Second, the models omit (or insufficiently model) catastrophic impacts. Third, these models are over-reliant over on the opinion of the modelers. However, each of these shortcomings indicates that the current social cost of greenhouse gas estimates are a lower bound. Our Technical Appendix discusses the state-of-the-art literature on uncertainty and ambiguity—including with respect to catastrophic impacts—and shows that addressing both leads to an increase in the SCC. Howard and Sylvan further demonstrate that accounting for the subjective probability of catastrophic impacts further increases the SCC, and that the general opinion of climate experts supports a higher SCC than estimated by IAMs. *Expert Consensus on the Economics of Climate Change* (Policy Integrity Report, 2015). 7	

Comment/ Code	Document #002-Environmental Defense Fund and Others	Response
	> My criticism of [integrated assessment models] should not be taken to imply that, because we know so little, nothing should be done about climate change right now, and instead we should wait until we learn more. **Quite the contrary**. . . . As I have argued elsewhere, even though we don't have a good estimate of the [social cost of carbon], it would make sense to take the Interagency Working Group's $21 (or updated $33) number as a rough and politically acceptable starting point and impose a carbon tax (or equivalent policy) of that amount. This would help to establish that there is a social cost of carbon.[43] Pindyck has further noted the clear consensus among economists that the social cost of greenhouse gases is greater than zero,[44] as well as his personal belief that the real number should be significantly higher than the Interagency Working Group's estimates[45]—as high as $200 per ton of carbon dioxide-equivalent.[46] Furthermore, many well-known economists and climate experts disagree with Pindyck's assessment that current integrated assessment models have limited policy value[47]—an entire body of literature that BLM fails to address. Notably, Marten et al., upon whose work BLM presumably relies,[48] explains that omitting monetized estimates of the social cost of methane implicitly, and unjustifiable, sets the "value at zero."[49] Regardless, it is clear that all of Pindyck's research indicates his main concern is that the estimates of the social cost of greenhouse gases currently in use are too low, not that he thinks agencies should stop trying to monetize climate damages. The second and more important problem with this alternative approach is that uncertainty about the full effects of climate change actually *raises* the social cost of greenhouse gases and warrants *more* stringent climate policy.[50] The integrated assessment models (IAMs) currently used to calculate the social cost of greenhouse gases show that the net effect of uncertainty about economic damage [43] R.S. Pindyck, *Climate Change Policy: What Do the Models Tell Us?*, 51 J. Econ. Lit. 860 (2013). [44] R.S. Pindyck, *Pricing Carbon When We Don't Know the Right Price*, 36 Reg. 43 (2013). [45] *Id.; see also* R.S. Pindyck, *The Social Cost of Carbon Revisited* (Nat'l Bureau of Econ. Res. Working Paper w22807, 2016). [46] R.S. Pindyck, *Pricing Carbon When We Don't Know the Right Price*, 36 Reg. 43 (2013); R.S. Pindyck, *The Social Cost of Carbon Revisited* (Nat'l Bureau of Econ. Res. Working Paper w22807, 2016) (estimating the social cost of carbon as between $100 and $200 per metric ton, based on his own methodology using expert elicitation to capture willingness to pay to avoid catastrophes). Even those estimates should be seen as lower bounds. Pindyck (2016) estimates the average SCC, and not the marginal SCC that IAMs estimate. Given that "we expect the [damage] function to be convex," R.S. Pindyck, *Coase Lecture—Taxes, Targets, and the Social Cost of Carbon*, Economica (2017), the average SCC is less than the marginal SCC. To see this, assume the damage function is represented by a power function $D = f(T) = aT^b$ where D is damages and T is average surface temperature; this is a standard assumption in IAMs. Then, average climate damages are $A = \frac{D}{T} = aT^{b-1}$ and marginal damages are $M = \frac{\partial D}{\partial T} = abT^{b-1}$. We then know that $A < M$ for all T greater than 0 if b>1, which is always true if D is a convex function of *T*. We know this convexity holds according to Pindyck (2015), so we must interpret Pindyck (2016)'s average SCC as a lower bound estimate of the marginal SCC accounting for the subjective probability of catastrophic damages, as measured by expert elicitation. [47] Revesz et al., 2014; Metcalf and Stock, 2017; Revesz et al., 2017; Weyant, 2017. [48] We assume that BLM's starting point for analysis is the IWG's 2016 technical addendum on the social cost of methane, which in turn relies on Marten et al. IWG, *Addendum to Technical Support Document: Application of the Methodology to Estimate the Social Cost of Methane and the Social Cost of Nitrous Oxide* (2016) (citing Marten, A.L., Kopits, E.A., Griffiths, C.W., Newbold, S.C., and A. Wolverton. 2015. Incremental CH4 and N2O Mitigation Benefits Consistent with the U.S. Government's SC-CO2 Estimates. Climate Policy. 15(2): 272-298). [49] Marten, A.L., Kopits, E.A., Griffiths, C.W., Newbold, S.C., and A. Wolverton. 2015. Incremental CH4 and N2O Mitigation Benefits Consistent with the U.S. Government's SC-CO2 Estimates. Climate Policy. 15(2): 272-298. [50] Peterson (2006) states "Most modeling results show (as can be expected) that there is optimally more emission abatement if uncertainties in parameters or the possibility of catastrophic events are considered." Peterson, S. (2006). Uncertainty and economic analysis of climate change: A survey of approaches and findings. *Environmental Modeling & Assessment*, *11*(1), 1-17. 8	

Comment/ Code	Document #002-Environmental Defense Fund and Others	Response
	resulting from climate change, costs of mitigation, future economic development, and many other parameters raises the social cost of greenhouse gases compared to the case where models simply use our current best guesses of these parameters.[51] Even so, IAMs still underestimate the impact of uncertainty by not accounting for a host of fundamental features of the climate problem: the irreversibility of climate change, society's aversion to risk and other social preferences, option value, and many catastrophic impacts.[52] Rather than being a reason not to take action, uncertainty increases the social cost of methane and should lead to more stringent policy to address climate change. A technical appendix attached to these comments more fully details how uncertainty on the whole points toward an even higher social cost of methane. The appendix covers such topics as insufficient modeling of catastrophic outcomes (including unlucky states of the world, deep uncertainty over the probability distributions for specific climate parameters, and tipping points), failure to include a risk premium, exclusion of the real option value of preventing irreversible greenhouse gas emissions, and how the social cost of greenhouse gases would increase with improved modeling of uncertainty. 3. BLM Must Rely on a Global Estimate of the Social Cost of Greenhouse Gases BLM attempts to calculate and bases its proposal's justification on a domestic-only value of the social cost of methane. Not only is it inconsistent with Circular A-4 and best economic practices to fail to estimate the global damages of U.S. greenhouse gas emissions in regulatory analyses, but existing methods for estimating a "domestic-only" value—including BLM's approach—are unreliable, incomplete, and inconsistent with Circular A-4. BLM's domestic-only estimate fails to use models built for the purpose of calculating regional damages, ignores recent literature on significant U.S. climate damages, and fails to reflect international spillovers to the United States, U.S. benefits from foreign reciprocal actions, and the extraterritorial interests of U.S. citizens including financial interests and altruism. *Circular A-4 Requires "Different Emphases . . . Depending on the Nature" of the Regulatory Issue* Since at least 2010, and including some recent agency actions under the Trump administration,[53] federal agencies have based their regulatory decision and NEPA reviews on global estimates of the social cost of greenhouse gases. Though agencies often also disclosed a "highly speculative" range that tried to [51] Tol, R. S. (1999). Safe policies in an uncertain climate: an application of FUND. *Global Environmental Change*, *9*(3), 221-232; Peterson, S. (2006). Uncertainty and economic analysis of climate change: A survey of approaches and findings. *Environmental Modeling & Assessment*, *11*(1), 1-17; IWG, Technical Update of the Social Cost of Carbon for Regulatory Impact Analysis (2016). [52] Pindyck, R. S. (2007). Uncertainty in environmental economics. *Review of environmental economics and policy*, *1*(1), 45-65; Golub, A., Narita, D., & Schmidt, M. G. (2014). Uncertainty in integrated assessment models of climate change: Alternative analytical approaches. *Environmental Modeling & Assessment*, *19*(2), 99-109; Lemoine, D., & Rudik, I. (2017). Managing Climate Change Under Uncertainty: Recursive Integrated Assessment at an Inflection Point. *Annual Review of Resource Economics* 9:18.1-18.26. [53] E.g., Dep't of Energy, Energy Conservation Program: Energy Conservation Standards for Walk-In Cooler and Freezer Refrigeration Systems, 82 Fed. Reg. 31,808, 31,812 (July 10, 2017) ("DOE maintains that consideration of global benefits is appropriate because of the global nature of the climate change problem."); U.S. Dep't of Interior, Bureau of Ocean Energy Mgmt., Draft Envtl. Impact Statement: Liberty Development Project at 3-129, 4-246 (Aug. 2017) (BOEM, Liberty Development Project), *available at* https://cdxnodengn.epa.gov/cdx-enepa-II/public/action/eis/details?eisId= 236901 (calling the global social cost of carbon estimates developed in 2016 by the Interagency Working Group "a useful measure" and applying them to analyze the consequences of offshore oil and gas drilling). 9	

Comment/ Code	Document #002-Environmental Defense Fund and Others	Response
	capture exclusively U.S. climate costs, emphasis on a global value has been recognized as more accurate given the science and economics of climate change, as more consistent with best economic practices, and as crucial to advancing U.S. strategic goals.[54] Opponents of climate regulation have long challenged the global number in court and other forums, and often attempted to use Circular A-4 as support.[55] Specifically, opponents have seized on Circular A-4's instructions to "focus" on effects to "citizens and residents of the United States," while any significant effects occurring "beyond the borders of the United States . . . should be reported separately."[56] Importantly, despite this language and such challenges, the U.S. Court of Appeals for the Seventh Circuit had no trouble concluding that a global focus for the social cost of greenhouse gases was reasonable: > AHRI and Zero Zone [the industry petitioners] next contend that DOE [the Department of Energy] arbitrarily considered the global benefits to the environment but only considered the national costs. They emphasize that the [statute] only concerns "national energy and water conservation." In the New Standards Rule, DOE did not let this submission go unanswered. It explained that climate change "involves a global externality," meaning that carbon released in the United States affects the climate of the entire world. According to DOE, national energy conservation has global effects, and, therefore, those global effects are an appropriate consideration when looking at a national policy. Further, AHRI and Zero Zone point to no global costs that should have been considered alongside these benefits. Therefore, DOE acted reasonably when it compared global benefits to national costs.[57] Circular A-4's reference to effects "beyond the borders" confirms that it is appropriate for agencies to consider the global effects of U.S. greenhouse gas emissions. While Circular A-4 may suggest that most typical decisions should focus on U.S. effects, the Circular cautions agencies that special cases call for different emphases: > [Y]ou cannot conduct a good regulatory analysis according to a formula. Conducting high-quality analysis requires competent professional judgment. ***Different regulations may call for different emphases*** in the analysis, ***depending on the nature and complexity*** of the regulatory issues and the sensitivity of the benefit and cost estimates to the key assumptions.[58] In fact, Circular A-4 elsewhere assumes that agencies' analyses will not always be conducted from purely the perspective of the United States, as one of its instructions only applies "as long as the analysis is conducted from the United States perspective,"[59] suggesting that in some circumstances it is appropriate for the analysis to be global. For example, EPA and the Department of Transportation have [54] *See generally* Howard & Schwartz, *supra* note 31. [55] Ted Gayer & W. Kip Viscusi, *Determining the Proper Scope of Climate Change Policy Benefits in U.S. Regulatory Analyses: Domestic versus Global Approaches*, 10 Rev. Envtl. Econ. & Pol'y 245 (2016) (citing Circular A-4 to argue against a global perspective on the social cost of carbon); *see also, e.g.*, Petitioners Brief on Procedural and Record-Based Issues at 70, in *West Virginia v. EPA*, case 15-1363, D.C. Cir. (filed February 19, 2016) (challenging EPA's use of the global social cost of carbon). [56] Circular A-4 at 15. Note that A-4 slightly conflates "accrue to citizens" with "borders of the United States": U.S. citizens have financial and other interests tied to effects beyond the borders of the United States, as discussed further below. [57] Zero Zone v. Dept. of Energy, 832 F.3d 654, 679 (7th Cir., 2016). [58] Circular A-4 at 3. [59] *Id.* at 38 (counting international transfers as costs and benefits "as long as the analysis is conducted from the United States perspective"). 10	

Comment/ Code	Document #002-Environmental Defense Fund and Others	Response
	adopted a global perspective on the analysis of potential monopsony benefits to U.S. consumers resulting from the reduced price of foreign oil imports following energy efficiency increases.[60] Perhaps more than any other issue, the nature of the issue of climate change requires precisely such a "different emphasis" from the default domestic-only assumption. To avoid a global "tragedy of the commons" that could irreparably damage all countries, including the United States, every nation should ideally set policy according to the global social cost of greenhouse gases.[61] Climate and clean air are global common resources, meaning they are freely available to all countries, but any one country's use—i.e., pollution—imposes harms on the polluting country as well as the rest of the world. Because greenhouse pollution does not stay within geographic borders but rather mixes in the atmosphere and affects climate worldwide, each ton emitted by the United States not only creates domestic harms, but also imposes large externalities on the rest of the world. Conversely, each ton of greenhouse gases abated in another country benefits the United States along with the rest of the world. If all countries set their greenhouse emission levels based on only domestic costs and benefits, ignoring the large global externalities, the aggregate result would be substantially sub-optimal climate protections and significantly increased risks of severe harms to all nations, including the United States. Thus, basic economic principles demonstrate that the United States stands to benefit greatly if all countries apply global social cost of greenhouse gas values in their regulatory decisions and project reviews. Indeed, the United States stands to gain hundreds of billions or even trillions of dollars in direct benefits from efficient foreign action on climate change.[62] In order to ensure that other nations continue to use global social cost of greenhouse gas values, it is important that the United States itself continue to do so.[63] The United States is engaged in a repeated strategic dynamic with several significant players—including the United Kingdom, Germany, Sweden, and others—that have already adopted a global framework for valuing the social cost of greenhouse gases.[64] For example, Canada and Mexico have explicitly borrowed the U.S. estimates of a global social cost of carbon to set their own fuel efficiency standards.[65] For the United States to now depart from this collaborative dynamic by reverting to a domestic-only estimate would undermine the country's long-term interests and could jeopardize emissions reductions underway in other countries, which are already benefiting the United States. For these and other reasons, reliance on a domestic-only valuation is inappropriate. In the past, some agencies have, in addition to the global estimate, also disclosed a "highly speculative" estimate of the domestic-only effects of climate change. In particular, the Department of Energy always includes a chapter on a domestic-only value of carbon emissions in the economic analyses supporting its energy [60] *See* Howard & Schwartz, *supra* note 31, at 268-69. [61] *See* Garrett Hardin, *The Tragedy of the Commons*, 162 Science 1243 (1968) ("[E]ach pursuing [only its] own best interest . . . in a commons brings ruin to all."). [62] Policy Integrity, *Foreign Action, Domestic Windfall: The U.S. Economy Stands to Gain Trillions from Foreign Climate Action* (2015), http://policyintegrity.org/files/publications/ForeignActionDomesticWindfall.pdf [63] *See* Robert Axelrod, *The Evolution of Cooperation* 10-11 (1984) (on repeated prisoner's dilemma games). [64] *See* Howard & Schwartz, *supra* note 31, at Appendix B. [65] *See* Heavy-Duty Vehicle and Engine Greenhouse Gas Emission Regulations, SOR/2013-24, 147 Can. Gazette pt. II, 450, 544 (Can.), *available at* http://canadagazette.gc.ca/rp-pr/p2/2013/2013-03-13/html/sor-dors24-eng.html ("The values used by Environment Canada are based on the extensive work of the U.S. Interagency Working Group on the Social Cost of Carbon."); Jason Furman & Brian Deese, *The Economic Benefits of a 50 Percent Target for Clean Energy Generation by 2025*, White House Blog, June 29, 2016 (summarizing the North American Leader's Summit announcement that U.S., Canada, and Mexico would "align" their SCC estimates). 11	

Comment/ Code	Document #002-Environmental Defense Fund and Others	Response
	efficiency standards; EPA has also often disclosed similar estimates.[66] Such an approach is consistent with Circular A-4's suggestion that agencies should usually disclose domestic effects separately from global effects. However, as we have discussed, reliance on a domestic-only methodology would be inconsistent with both the inherent nature of climate change and the standards of Circular A-4. Consequently, under Circular A-4, BLM should have estimated, and used in its primary analysis, the global social cost of methane. *Benefits and Costs that "Accrue to U.S. Citizens" Are Much Broader Than Effects "within U.S. Borders"* To follow Circular A-4's instruction to analyze all significant effects that "accrue[s] to U.S. citizens," agencies must look beyond "U.S. borders" to a much broader range of climate effects. Circular A-4 instructs to estimate *all* important "opportunity costs," meaning "what individuals are willing to forgo to enjoy a particular benefit."[67] U.S. individuals are willing to forgo money to enjoy benefits or avoid costs from climate effects that occur beyond U.S. borders, and all such significant effects must be captured.[68] **International Spillovers:** First, agencies may not ignore significant, indirect costs to trade, human health, and security likely to "spill over" to the United States as other regions experience climate change damages.[69] Due to its unique place among countries—both as the largest economy with trade- and investment-dependent links throughout the world, and as a military superpower—the United States is particularly vulnerable to effects that will spill over from other regions of the world. Spillover scenarios could entail a variety of serious costs to the United States as unchecked climate change devastates other countries. Correspondingly, mitigation or adaptation efforts that avoid climate damages to foreign countries will radiate benefits back to the United States as well.[70] While the current IAMs provide reliable but conservative estimates of global damages, they currently cannot calculate reliable region-specific estimates, in part because they do not model such spillovers. As climate change disrupts the economies of other countries, decreased availability of imported inputs, intermediary goods, and consumption goods may cause supply shocks to the U.S. economy. Shocks to the supply of energy, technological, and agricultural goods could be especially damaging. For example, when Thailand—the world's second-largest producer of hard-drives—experienced flooding in 2011, U.S. consumers faced higher prices for many electronic goods, from computers to cameras.[71] A recent economic study explored how heat stress-induced reductions in productivity worldwide will ripple through the interconnected global supply network.[72] Similarly, the U.S. economy could experience demand shocks as climate-affected countries decrease their demand for U.S. goods. Financial markets may also suffer as foreign countries become less able to loan money to the United States and as the [66] Howard & Schwartz, *supra* note 31, at 220-21. [67] Circular A-4 at 18. [68] This section draws heavily from Howard & Schwartz (2017), *supra* note 31, and includes passages taken directly from that article (which was written by co-authors of these comments). [69] Indeed, the integrated assessment models used to develop the global SCC estimates largely ignore inter-regional costs entirely. *See* Peter Howard, *Omitted Damages: What's Missing from the Social Cost of Carbon* (Cost of Carbon Project Report, 2014). Though some positive spillover effects are also possible, such as technology spillovers that reduce the cost of mitigation or adaptation, *see* S. Rao et al., *Importance of Technological Change and Spillovers in Long-Term Climate Policy*, 27 ENERGY J. 123-39 (2006), overall spillovers likely mean that the U.S. share of the global SCC is underestimated, *see* Jody Freeman & Andrew Guzman, *Climate Change and U.S. Interests*, 109 COLUMBIA L. REV. 1531 (2009). [70] *See* Freeman & Guzman, *supra* note 69, at 1563-93. [71] *See* Charles Arthur, *Thailand's Devastating Floods Are Hitting PC Hard Drive Supplies*, THE GUARDIAN, Oct. 25, 2011. [72] Leonie Wenz & Anders Levermann, *Enhanced Economic Connectivity to Foster Heat Stress-Related Losses*, SCIENCE ADVANCES (June 10, 2016). 12	

Comment/ Code	Document #002-Environmental Defense Fund and Others	Response
	value of U.S. firms declines with shrinking foreign profits. As seen historically, economic disruptions in one country can cause financial crises that reverberate globally at a breakneck pace.[73] The human dimension of climate spillovers includes migration and health effects. Water and food scarcity, flooding or extreme weather events, violent conflicts, economic collapses, and a number of other climate damages could precipitate mass migration to the United States from regions worldwide, especially, perhaps, from Latin America. For example, a 10% decline in crop yields could trigger the emigration of 2% of the entire Mexican population to other regions, mostly to the United States.[74] Such an influx could strain the U.S. economy and will likely lead to increased U.S. expenditures on migration prevention. Infectious disease could also spill across the U.S. borders, exacerbated by ecological collapses, the breakdown of public infrastructure in poorer nations, declining resources available for prevention, shifting habitats for disease vectors, and mass migration. Finally, climate change is predicted to exacerbate existing security threats—and possibly catalyze new security threats—to the United States.[75] Besides threats to U.S. military installations and operations at home and abroad from flooding, storms, extreme heat, and wildfires,[76] Secretary of Defense Mattis has explained that "Climate change is impacting stability in areas of the world where our troops are operating today."[77] The Department of Defense's 2014 Defense Review declared that climate effects "are threat multipliers that will aggravate stressors abroad such as poverty, environmental degradation, political instability, and social tensions—conditions that can enable terrorist activity and other forms of violence," and as a result "climate change may increase the frequency, scale, and complexity of future missions, including defense support to civil authorities, while at the same time undermining the capacity of our domestic installations to support training activities."[78] As an example of the climate-security-migration nexus, prolonged drought in Syria likely exacerbated the social and political tensions that erupted into an ongoing civil war,[79] which has triggered an international migration and humanitarian crisis.[80] Because of these interconnections, attempts to artificially segregate a U.S.-only portion of climate damages will inevitably result in misleading underestimates. Some experts on the social cost of carbon [73] *See* Steven L. Schwarcz, *Systemic Risk*, 97 GEO. L.J. 193, 249 (2008) (observing that financial collapse in one country is inevitably felt beyond that country's borders). [74] Shuaizhang Feng, Alan B. Krueger & Michael Oppenheimer, *Linkages Among Climate Change, Crop Yields and Mexico-U.S. Cross-Border Migration*, 107 PROC. NAT'L ACAD. SCI. 14,257 (2010). [75] *See* CNA Military Advisory Board, *National Security and the Accelerating Risks of Climate Change* (2014). [76] U.S. Gov't Accountability Office, GAO-14-446 *Climate Change Adaptation: DOD Can Improve Infrastructure Planning and Processes to Better Account for Potential Impacts* (2014); Union of Concerned Scientists, *The U.S. Military on the Front Lines of Rising Seas* (2016). [77] Andrew Revkin, *Trump's Defense Secretary Cites Climate Change as National Security Challenge*, ProPublica, Mar. 14, 2017. [78] U.S. Dep't of Defense, *Quadrennial Defense Review 2014* vi, 8 (2014).; see also U.S. Dep't of Defense, *Report to Congress: National Security Implications of Climate-Related Risks and a Changing Climate* (2015), *available at* http://archive.defense.gov/pubs/150724-congressional-report-on-national-implications-of-climate-change.pdf?source=govdelivery ("Global climate change will have wide-ranging implications for U.S. national security interests over the foreseeable future because it will aggravate existing problems—such as poverty, social tensions, environmental degradation, ineffectual leadership, and weak political institutions—that threaten domestic stability in a number of countries.") [79] *See* Center for American Progress et al., *The Arab Spring and Climate Change: A Climate and Security Correlations Series* (2013); Colin P. Kelley et al., *Climate Change in the Fertile Crescent and Implications of the Recent Syrian Drought*, 112 PROC. NAT'L ACAD. SCI. 3241 (2014); Peter H. Gleick, *Water, Drought, Climate Change, and Conflict in Syria*, 6 WEATHER, CLIMATE & SOCIETY, 331 (2014). [80] *See, e.g.*, *Ending Syria War Key to Migrant Crisis, Says U.S. General*, BBC.COM (Sept. 14, 2015). 13	

Comment/ Code	Document #002-Environmental Defense Fund and Others	Response
	have concluded that, given that integrated assessment models currently do not capture many of these key inter-regional costs, use of the global SCC may be further justified as a proxy to capturing all spillover effects.[81] Though surely not all climate damages will spill back to affect the United States, many will, and together with other justifications, the likelihood of significant spillovers makes a global valuation the better, more transparent accounting of the full range of costs and benefits that matter to U.S. policymakers and the public. **Reciprocal Foreign Actions:** Second, an indirect consequence of the United States using a global social cost of greenhouse gas to justify actions that protect against climate damages is that foreign countries take reciprocal actions that benefit the United States. Circular A-4 requires that the "same standards of information and analysis quality that apply to direct benefits and costs should be applied to ancillary benefits and countervailing risks."[82] Consequently, any attempt to estimate a domestic-only value of the social cost of greenhouse gas must include indirect effects from reciprocal foreign actions. As detailed more in Howard & Schwartz (2017), because the world's climate is a single interconnected system, the United States benefits greatly when foreign countries consider the global externalities of their greenhouse gas pollution and cut emissions accordingly. Game theory predicts that one viable strategy for the United States to encourage other countries to think globally in setting their climate policies is for the United States to do the same, in a tit-for-tat, lead-by-example, or coalition-building dynamic. In fact, most other countries with climate policies already use a global social cost of carbon or set their carbon taxes or allowances at prices above their domestic-only costs, consistent with the global perspective used to date by U.S. agencies to value the cost of greenhouse gases. Both Republican and Democratic administrations have recognized that the analytical and regulatory choices of U.S. agencies can affect the actions of foreign countries, which in turn affect U.S. citizens.[83] According to one study, over the next fifteen years, direct U.S. benefits from global climate policies already in effect could reach over $2 trillion.[84] Any attempt to estimate a domestic-only value of the social cost of greenhouse gases must include such indirect effects from reciprocal foreign actions.[85] **Extraterritorial Interests:** Circular A-4 requires agencies to count all significant costs and benefits, and specifically explains the importance of including "non-use" values like "bequest and existence values": "ignoring these values in your regulatory analysis may significantly understate the benefits and/or costs of regulatory action."[86] Similarly, while Circular A-4 distinguishes altruism from non-use values, the guidance instructs agencies that "if there is evidence of selective altruism, it needs to be considered specifically in both benefits and costs."[87] Many costs and benefits accrue to U.S. citizens from use values, non-use values, and altruism attached to climate effects occurring outside the U.S. borders. [81] *See* Robert E. Kopp & Bryan K. Mignone, Circumspection, Reciprocity, and Optimal Carbon Prices, 120 CLIMATE CHANGE 831, 833 (2013). [82] Circular A-4 at 26. [83] Howard & Schwartz, *supra* note 31, at 232-37 (citing acknowledgement of this phenomenon by both the Bush administration and the Obama administration). [84] Policy Integrity, *Foreign Action, Domestic Windfall: The U.S. Economy Stands to Gain Trillions from Foreign Climate Action* 11 (2015), http://policyintegrity.org/files/publications/ForeignActionDomesticWindfall.pdf [85] Kotchen shows that the optimally strategic social cost of greenhouse gas value will be strictly higher than the domestic value for all countries. Matthew J. Kotchen, *Which Social Cost of Carbon? A Theoretical Perspective* (NBER Working Paper, 2016). [86] Circular A-4 at 22. [87] *Id.* 14	

Comment/ Code	Document #002-Environmental Defense Fund and Others	Response
	U.S. citizens have economic and other interests abroad that are not fully reflected in the U.S. share of global GDP. As explained above, GDP does not reflect significant U.S. ownership interests in foreign businesses, properties, and other assets, as well as consumption abroad including tourism, or even the 8 million Americans living abroad. The United States also has a willingness to pay—as well as a legal obligation—to protect the global commons of the oceans and Antarctica from climate damages. For example, the Madrid Protocol on Environmental Protection to the Antarctic Treaty commits the United States and other parties to the "comprehensive protection of the Antarctic environment," including "regular and effective monitoring" of "effects of activities carried on both within and outside the Antarctic Treaty area on the Antarctic environment."[88] The share of climate damages for which the United States is responsible is not limited to our geographic borders. Similarly, U.S. citizens value natural resources and plant and animal lives abroad, even if they never use those resources or see those plants or animals. For example, the "existence value" of restoring the Prince William Sound after the 1989 Exxon Valdez oil tanker disaster—that is, the benefits derived by Americans who would never visit Alaska but nevertheless felt strongly about preserving the existence of this pristine environment—was estimated in the billions of dollars.[89] Though the methodologies for calculating existence value remain controversial,[90] U.S. citizens certainly have a non-zero willingness to pay to protect rainforests, charismatic megafauna like pandas, and other life and environments existing in foreign countries. U.S. citizens also have an altruistic willingness to pay to protect foreign citizens' health and welfare.[91] This altruism is "selective altruism," consistent with Circular A-4, because the United States is directly responsible for most of the historic emissions contributing to climate change.[92] *Standards of Rational Decisionmaking Require Consideration of Important, Globally Interconnected Climate Costs* The Administrative Procedure Act, as interpreted by the Supreme Court in *State Farm*, requires agencies to consider all "important aspect[s] of the problem" and articulate a rational connection between the facts and the choice made.[93] Two courts of appeals have already applied arbitrary and capricious review to support the use of a global social cost of carbon in setting regulatory standards. In *Center for Biological Diversity v. NHTSA*, the U.S. Court of Appeals for the Ninth Circuit not only held that it was arbitrary not to monetize the greenhouse gas benefits of vehicle efficiency standards, but also approvingly cited a partial consensus [88] Madrid Protocol on Environmental Protection to the Antarctic Treaty (1991), http://www.ats.aq/documents/recatt/Att006_e.pdf [89] RICHARD REVESZ & MICHAEL LIVERMORE, RETAKING RATIONALITY 121 (2008). [90] *Id.* at 129. [91] *See* Arden Rowell, *Foreign Impacts and Climate Change*, 39 Harvard Environmental Law Rev. 371 (2015); Dana, *supra* note 103 (discussing U.S. charitable giving abroad and foreign aid, and how those metrics likely severely underestimate true U.S. willingness to pay to protect foreign welfare). [92] Datablog, *A History of CO_2 Emissions*, THE GUARDIAN (Sept. 2, 2009) (from 1900-2004, the United States emitted 314,772.1 million metric tons of carbon dioxide; Russia and China follow, with only around 89,000 million metric tons each). [93] 5 U.S.C. § 706; *see* Motor Vehicle Manufacturers Assoc. v. State Farm Mutual Auto. Ins. Co., 463 U.S. 29, 41-42 (1983) (applying the standards of review to deregulatory action and concluding that when "rescinding a rule" an agency "is obligated to supply a reasoned analysis for the change beyond that which may be required when an agency does not act in the first instance"). 15	

Comment/ Code	Document #002-Environmental Defense Fund and Others	Response
	among experts around an estimate of "$50 per ton of carbon (or $13.60 per ton CO2),"[94] which, in the year 2006 when the rule was issued, would have been consistent with estimates of a global social cost of carbon.[95] More recently, in *Zero Zone v. Department of Energy*, the Court of Appeals for the Seventh Circuit found, in response to petitioners' challenge that the agency's consideration of the global social cost of carbon was arbitrary, that the agency had acted reasonably in considering the global climate effects.[96] For more details on the justification for a global value of the social cost of greenhouse gases, including the applicable standards of rational decisionmaking, please see Peter Howard & Jason Schwartz, *Think Global: International Reciprocity as Justification for a Global Social Cost of Carbon*, 42 Columbia J. Envtl. L. 203 (2017). Another strong defense of the global valuation as consistent with best economic practices appears in a letter published in a recent issue of *The Review of Environmental Economics and Policy*, co-authored by Nobel laureate Kenneth Arrow.[97] *No Current Methodology for Estimating a "Domestic-Only" Value Is Consistent with Circular A-4* OMB, the National Academies of Sciences, and the economic literature all agree that existing methodologies for calculating a "domestic-only" value of the social cost of greenhouse gases are deeply flawed and result in severe and misleading underestimates. In developing the social cost of carbon, the IWG did offer some such domestic estimates. Using the results of one economic model (FUND) as well as the U.S. share of global gross domestic product ("GDP"), the group generated an "approximate, provisional, and ***highly speculative***" range of 7–23% of the global social cost of carbon as an estimate of the purely direct climate effects to the United States.[98] Yet, as the IWG itself acknowledged, this range is almost certainly an underestimate because it ignores significant, indirect costs to trade, human health, and security that are likely to "spill over" into the United States as other regions experience climate change damages, among other effects.[99] Neither the existing IAMs nor a share of global GDP are appropriate bases for calculating a domestic-only estimate. The IAMs were never designed to calculate a domestic SCC, since a global SCC is the economic efficient value. FUND, like other IAMS, includes some simplifying assumptions: of relevance, FUND and the other IAMs are not able to capture the adverse effects that the impacts of climate change in other countries will have on the United States through trade linkages, national security, migration, and other forces.[100] This is why the IWG characterized the domestic-only estimate from FUND as a "highly speculative" underestimate. Similarly, a domestic-only estimate based on some rigid conception of geographic borders or U.S. share of world GDP will fail to capture all the climate-related costs and [94] 538 F.3d at 1199, 1201. [95] *See* Average Fuel Economy Standards, Passenger Cars and Light Trucks; Model Years 2011-2015, 73 Fed. Reg. 24,352, 24,414 (May 2, 2008) (the National Highway Traffic Safety Administration estimated that $14 per ton of carbon dioxide approximated global benefits). [96] 832 F.3d at 679. [97] Richard Revesz, Kenneth Arrow et al., *The Social Cost of Carbon: A Global Imperative*, 11 REEP 172 (2017). [98] INTERAGENCY WORKING GROUP ON SOCIAL COST OF CARBON, TECHNICAL SUPPORT DOCUMENT: SOCIAL COST OF CARBON FOR REGULATORY IMPACT ANALYSIS UNDER EXECUTIVE ORDER 12,866 at 11 (2010). [99] *Id.* (explaining that the IAMs, like FUND, do "not account for how damages in other regions could affect the United States (e.g., global migration, economic and political destabilization"). [100] *See, e.g.*, Dept. of Defense, *National Security Implications of Climate-Related Risks and a Changing Climate* (2015), *available at* http://archive.defense.gov/pubs/150724-congressional-report-on-national-implications-of-climate-change.pdf?source=govdelivery. 16	

Comment/ Code	Document #002-Environmental Defense Fund and Others	Response
	benefits that matter to U.S. citizens.[101] U.S. citizens have economic and other interests abroad that are not fully reflected in the U.S. share of global GDP. GDP is a "monetary value of final goods and services—that is, those that are bought by the final user—produced in a country in a given period of time."[102] GDP therefore does not reflect significant U.S. ownership interests in foreign businesses, properties, and other assets, as well as consumption abroad including tourism,[103] or even the 8 million Americans living abroad.[104] At the same time, GDP is also over-inclusive, counting productive operations in the United States that are owned by foreigners. Gross National Income ("GNI"), by contrast, defines its scope not by location but by ownership interests.[105] However, not only has GNI fallen out of favor as a metric used in international economic policy,[106] but using a domestic-only SCC based on GNI would make the SCC metrics incommensurable with other costs in regulatory impact analyses, since most regulatory costs are calculated by U.S. agencies regardless of whether they fall to U.S.-owned entities or to foreign-owned entities operating in the United States.[107] Furthermore, both GDP and GNI are dependent on what happens in other countries, due to trade and the international flow of capital. The artificial constraints of both metrics counsel against a rigid split based on either U.S. GDP or U.S. GNI.[108] As a result, in 2015, OMB concluded, along with several other agencies, that "good methodologies for estimating domestic damages do not currently exist."[109] Similarly, the NAS recently concluded that current IAMs cannot accurately estimate the domestic social cost of greenhouse gases, and that estimates based on U.S. share of global GDP would be likewise insufficient.[110] William Nordhaus, the developer of the DICE model, cautioned earlier this year that "regional damage estimates are both incomplete and poorly understood," and "there is little agreement on the distribution of the SCC by [101] A domestic-only SCC would fail to "provide to the public and to OMB a careful and transparent analysis of the anticipated consequences of economically significant regulatory actions." Office of Information and Regulatory Affairs, *Regulatory Impact Analysis: A Primer* 2 (2011). [102] Tim Callen, *Gross Domestic Product: An Economy's All*, IMF, http://www.imf.org/external/pubs/ft/fandd/basics/gdp.htm (last updated Mar. 28, 2012). [103] "U.S. residents spend millions each year on foreign travel, including travel to places that are at substantial risk from climate change, such as European cities like Venice and tropical destinations like the Caribbean islands." David A. Dana, *Valuing Foreign Lives and Civilizations in Cost-Benefit Analysis: The Case of the United States and Climate Change Policy* (Northwestern Faculty Working Paper 196, 2009), http://scholarlycommons.law.northwestern.edu/cgi/viewcontent.cgi?article=1195&context=facultyworkingpapers. [104] Assoc. of Americans Resident Oversees, https://www.aaro.org/about-aaro/6m-americans-abroad. Admittedly 8 million is only 0.1% of the total population living outside the United States. [105] *GNI, Atlas Method (Current US$)*, THE WORLD BANK, http://data.worldbank.org/indicator/NY.GNP.ATLS.CD. [106] *Id.* [107] U.S. Office of Management and Budget & Secretariat General of the European Commission, *Review of Application of EU and US Regulatory Impact Assessment Guidelines on the Analysis of Impacts on International Trade and Development* 13 (2008). [108] Advanced Notice of Proposed Rulemaking on Regulating Greenhouse Gas Emissions Under the Clean Air Act, 73 Fed. Reg. 44,354, 44,415 (July 30, 2008) ("Furthermore, international effects of climate change may also affect domestic benefits directly and indirectly to the extent U.S. citizens value international impacts (e.g., for tourism reasons, concerns for the existence of ecosystems, and/or concern for others); U.S. international interests are affected (e.g., risks to U.S. national security, or the U.S. economy from potential disruptions in other nations)."). [109] In November 2013, OMB requested public comments on the social cost of carbon. In 2015, OMB along with the rest of the Interagency Working Group issued a formal response to those comments. Interagency Working Group on the Social Cost of Carbon, *Response to Comments: Social Cost of Carbon for Regulatory Impact Analysis under Executive Order 12,866* at 36 (July 2015) [hereinafter, OMB 2015 Response to Comments]. [110] National Academies of Sciences, Engineering, and Medicine, *Valuing climate damages: Updating estimation of the social cost of carbon dioxide* at 53 (2017) [hereinafter NAS Second Report]. 17	

Comment/ Code	Document #002-Environmental Defense Fund and Others	Response
	region."[111] In short, any domestic-only estimate will be inaccurate, misleading, and out of step with the best available economic literature, in violation of Circular A-4's standards for information quality. *BLM Relies on Sources that Cannot Accurately Calculate a Domestic-Only Estimate and that Explicitly Caution Against Using Domestic-Only Estimates* BLM reports that its domestic-only estimates are "calculated directly" from the models FUND and PAGE; for the model DICE, BLM simply assumes that U.S. damages are 10% of global damages. BLM thus uses these models in ways they were never designed for—indeed, in ways their designers specifically cautioned against. BLM furthermore fails to assess the most up-to-date literature on U.S. damages and fails to take steps to reflect spillover effects, reciprocal benefits, or U.S. interests beyond our borders. BLM's methodology is deeply flawed. The integrated assessment models used by the agency to calculate the social cost of methane were designed to create global estimates and are best suited for those purposes. The models are limited in how accurately and fully they can estimate domestic values of the social cost of methane. For example, the models make simplifying assumptions about the extent of heterogeneity in crucial parameters like relative prices and discount rates.[112] The models also simplify or ignore completely global spillovers from trade, migration, and other sources.[113] These types of spillovers will not, in many cases, affect the global estimate of climate change damages, but they will change (perhaps dramatically so) the domestic estimates, as detailed below. For example, trade effects will net to zero globally. A decrease in exports by one country must correspond to a decrease in imports for another country.[114] Global estimates will also generally be more accurate than domestic estimates because aggregation of multiple values reduces the error of the overall estimate.[115] Examining the individual models used by the agency to calculate the domestic social cost of methane highlights the current limitations facing calculation of a domestic value of the social cost of greenhouse gases. The agency uses three models: FUND 3.8, PAGE09, and DICE 2010.[116] The FUND model generally estimates domestic damages from climate change by scaling estimates according to gross domestic product or population. For instance, forestry damages are "mapped to the FUND regions assuming that the impact is uniform [relative] to GDP."[117] Similarly, domestic energy consumption changes are a function of gross domestic product, and the authors note that "heating demand is linear in the number of people" in a FUND region.[118] Scaling damages by gross domestic product and population will fail to capture important differences between countries like pre-existing climate, interconnectedness of trade relationships, climate change preparedness, and preferences. These issues are readily apparent in the case of agricultural damage estimates in FUND. Agriculture is one of the most important sectors driving the relatively low damages in the FUND model. Yet, recent [111] William Nordhaus, *Revisiting the Social Cost of Carbon*, 114 PNAS 1518, 1522 (2017). [112] Christian Gollier & James K. Hammitt, *The Long-Run Discount Rate Controversy*, 6 ANNU. REV. RESOUR. ECON. 273–295 (2014) at 287-289. [113] *See generally* Howard & Schwartz (2017), *supra* note 31. [114] *See, e.g.* PAUL R. KRUGMAN, MAURICE OBSTFELD & MARC J. MELITZ, INTERNATIONAL ECONOMICS: THEORY AND POLICY (10 ed. 2015). Such changes could have an effect on overall levels of trade, in turn effecting global damage estimates. [115] *See, e.g.* SIDNEY I RESNICK, A PROBABILITY PATH (2013) at 203. [116] 2017 RIA at 55. [117] DAVID ANTHOFF & RICHARD S. J. TOL, THE CLIMATE FRAMEWORK FOR UNCERTAINTY, NEGOTIATION, AND DISTRIBUTION (FUND), TECHNICAL DESCRIPTION, VERSION 3.8 (2014) at 8. [118] *Id.* at 10. 18	

Comment/ Code	Document #002-Environmental Defense Fund and Others	Response
	evidence on this sector that incorporates cutting-edge estimates of crop yield changes finds that the FUND model substantially understates the agricultural damages from climate change.[119] Particularly for domestic damages, new research shows that FUND dramatically understates the effect of warming on agricultural outcomes globally and for individual countries like the United States.[120] These higher damage estimates come from updates to the relationship between warming and crop yield but also from a more thorough modeling of international trade in agricultural products. The PAGE09 model scales global damages estimates according to regional coastline length, with the IWG noting that, "The [domestic] scaling factor in PAGE09 is based on the length of a region's coastline relative to the EU...Because of the long coastline in the EU, other regions are, on average, less vulnerable than the EU for the same sea level and temperature increase."[121] The model also uses GDP scaling, stating that "other regions lose more or less [output] depending upon their GDP per capita and weights factors."[122] Coast-line length provides a reasonable scaling factor for damages from flooding, coastal storms, and other sea-level rise issues, but it likely understates damages to the United States, where increases in mortality, agricultural losses, and other effects will likely also occur in inland, warm areas of the country.[123] Scaling by gross domestic product has the same limitations noted above in the context of the FUND model. Finally, the author of DICE 2010 has explicitly warned against using a domestic-only value. In a recent article, William Nordhaus states that, "The regional estimates [of the social cost of greenhouse gases] are poorly understood, often varying by a factor of 2 across the three models. Moreover, regional damage estimates are highly correlated with output shares." He later reiterates that "the regional damage estimates are both incomplete and poorly understood."[124] These statements reinforce the conclusion of OMB that "good methodologies for estimating domestic damages do not currently exist."[125] BLM's estimation of the domestic-only social cost of methane ignores "important aspect[s] of the problem" and fails to articulate a rational connection between the data and the choice made, and is therefore arbitrary and capricious in violation of the Administrative Procedure Act.[126] ## 4. BLM Must Rely on a 3% or Lower Discount Rate for Intergenerational Effects—or a Declining Discount Rate Because of the long lifespan of greenhouse gases and the long-term or irreversible consequences of climate change, the effects of today's emissions changes will stretch out over the next several centuries. [119] Frances C Francis C Moore, Uris Lantz C Baldos & Thomas Hertel, *Economic impacts of climate change on agriculture: a comparison of process-based and statistical yield models*, 12 ENVIRON. RES. LETT. 65008 (2017). [120] F. C. Moore et al., *New Science of Climate Change Impacts on Agriculture Implies Higher Social Cost of Carbon*, 1–43 (2017). [121] IWG, 2013 Technical Update to the Social Cost of Carbon, at 10. [122] Chris Hope, *Critical issues for the calculation of the social cost of CO2: why the estimates from PAGE09 are higher than those from PAGE2002*, 117 CLIM. CHANGE 531–543 (2013) at 539. [123] Solomon Hsiang et al., *Economic Damage from Climate Change in the United States*, 1369 SCIENCE. 1362–1369 (2017). [124] William D Nordhaus, *Revisiting the social cost of carbon*, 114 PROC. NATL. ACAD. SCI. U. S. A. 1518–1523 (2017) at 1522. [125] OMB 2015 Response to Comments, *supra* 109. [126] 5 U.S.C. § 706; *see* Motor Vehicle Manufacturers Assoc. v. State Farm Mutual Auto. Ins. Co., 463 U.S. 29, 41-42 (1983) (applying the standards of review to deregulatory action and concluding that when "rescinding a rule" an agency "is obligated to supply a reasoned analysis for the change beyond that which may be required when an agency does not act in the first instance"). 19	

Comment/ Code	Document #002-Environmental Defense Fund and Others	Response
	The time horizon for an agency's analysis of climate effects, as well as the discount rate applied to future costs and benefits, determines how an agency treats future generations. Previously, federal agencies had focused on a central estimate of the social cost of greenhouse gases calculated at a 3% discount rate. BLM now proposes to give equal consideration to estimates calculated at a 7% discount rate, alleging that this is required by Circular A-4.[127] BLM is wrong. Not only does use of a 7% discount rate violate BLM's statutorily required consideration of impacts on future generations, but a 7% rate for intergenerational climate effects is inconsistent with best economic practices, including under Circular A-4. In 2015, OMB explained that "Circular A-4 is a living document. . . . [T]he use of ***7 percent is <u>not</u> considered appropriate*** for intergenerational discounting. There is wide support for this view in the academic literature, and it is recognized in Circular A-4 itself. "[128] While Circular A-4 tells agencies generally to use a 7% discount rate in addition to lower rates for typical rules,[129] the guidance does not intend for default assumptions to produce analyses inconsistent with best economic practices. Circular A-4 clearly supports using lower rates to the exclusion of a 7% rate for the costs and benefits occurring over the extremely long, 300-year time horizon of climate effects. *BLM's Statutory Authority Requires Protecting the Needs of Future Generations; a 7% Discount Rate Ignores Those Future Needs* The statutory authorities for BLM's 2016 waste prevention rule include the Mineral Leasing Act of 1920 and the Federal Land Policy and Management Act of 1976. The Mineral Leasing Act requires the Department of the Interior to "safeguard[ ] the public welfare" including through lease terms for the prevention of environmental harm.[130] The agency may also suspend lease operations "in the interest of conservation of natural resources,"[131] which courts have found includes preventing environmental harms.[132] The Federal Land Policy and Management Act requires the agency to manage public lands in a manner that will "protect the quality of scientific, scenic, historical, *ecological, environmental, air and atmospheric*, water resources, and archeological values."[133] Interior must manage public lands according to the principles of "multiple use,"[134] which is defined to mean > the management of the public lands and their various resource values so that they are utilized in the combination that will best meet the present *and future needs of the American people*; . . . a combination of balanced and diverse resource uses that takes into account the *long-term needs of future generations for renewable and nonrenewable resources, including*, but not limited to, recreation, range, timber, minerals, *watershed, wildlife and fish, and natural scenic*, scientific and historical values; and harmonious and [127] 2017 RIA at 55. [128] OMB 2015 Response to Comments, *supra* note 109, at 36. [129] Circular A-4 at 36 ("For regulatory analysis, you should provide estimates of net benefits using both 3 percent and 7 percent....If your rule will have important intergenerational benefits or costs you might consider a further sensitivity analysis using a lower but positive discount rate in addition to calculating net benefits using discount rates of 3 and 7 percent."). [130] 30 U.S.C. § 187; See Natural Resources Defense Council, Inc. v. Berklund, 458 F. Supp. 925, 936 n.17 (D. DC 1978). [131] 30 U.S.C. § 209. [132] Copper Valley Machine Works v. Andrus, 653 F.2d 595, 601 & nn.7–8 (D.C. Cir. 1981); Hoyl v. Babbitt, 129 F.3d 1377, 1380 (10th Cir. 1997); Getty Oil Co. v. Clark, 614 F. Supp. 904, 916 (D. Wyo. 1985). [133] 43 U.S.C. § 1701(a)(8). [134] 43 U.S.C. § 1702(c), 1732(a). 20	

Comment/ Code	Document #002-Environmental Defense Fund and Others	Response
	coordinated management of the various resources *without permanent impairment of* the productivity of the land and *the quality of the environment . . .*.[135] The statutory text is clear. The Department of the Interior must consider and balance the long-term needs of future generations, including the need to protect environmental and "atmospheric" values. The discount rate determines how federal agencies treat future generations. One billion dollars in climate damages occurring 300 years from now is worth one billion dollars if discounted at a 0% rate; at a 2.5% rate, it is worth just over $600,000; at a 7% rate, it is worth less than $2. In other words, applying a 7% discount rate means society would be willing to spend less than $2 today to prevent $1,000,000,000 in damages from occurring in 300 years. By applying such a discount rate, BLM is effectively ignoring the welfare of future generations of Americans, in violation of the agency's congressional mandate. *A 7% Discount Rate Is Not "Sound and Defensible" or "Appropriate" for Climate Effects* Circular A-4 clearly requires agency analysts to do more than rigidly apply default assumptions: "You cannot conduct a good regulatory analysis according to a formula. Conducting high-quality analysis requires competent professional judgment."[136] As such, analysis must be "based on the best reasonably obtainable scientific, technical, and economic information available,"[137] and agencies must "*[u]**se sound and defensible values*** or procedures to monetize benefits and costs, and ensure that key analytical assumptions are defensible."[138] Rather than assume a 7% discount rate should be applied automatically to every analysis, Circular A-4 requires agencies to justify the choice of discount rates for each analysis: "[S]tate in your report what assumptions were used, *such as . . . the discount rates* applied to future benefits and costs," and explain "clearly how you arrived at your estimates."[139] Based on Circular A-4's criteria, there are numerous reasons why applying a 7% discount rate to climate effects that occur over a 300-year time horizon would be unjustifiable. First, basing the discount rate on the **consumption rate of interest** is the correct framework for analysis of climate effects; a discount rate based on the private return to capital is inappropriate. Circular A-4 does suggest that 7% should be a "default position" that reflects regulations that primarily displace capital investments; however, the Circular explains that "[w]hen regulation primarily and directly affects private consumption . . . *a lower discount rate is appropriate*."[140] The 7% discount rate is based on a private sector rate of return on capital, but private market participants typically have short time horizons. By contrast, climate change concerns the public well-being broadly. Rather than evaluating an optimal outcome from the narrow perspective of investors alone, economic theory requires analysts to make the optimal choices based on societal preferences and social discount rates. Moreover, because climate change is expected to largely affect large-scale consumption, as opposed to capital investment,[141] a 7% rate is inappropriate. [135] 43 U.S.C. § 1702(c). [136] *Id.* at 3. [137] *Id.* at 17. [138] *Id.* at 27. [139] *Id.* at 3. [140] *Id.* at 33. [141] "There are two rationales for discounting future benefits—one based on consumption and the other on investment. The consumption rate of discount reflects the rate at which society is willing to trade consumption in the future for consumption today. Basically, we discount the consumption of future generations because we assume future generations will be wealthier 21	

Comment/ Code	Document #002-Environmental Defense Fund and Others	Response
	In 2013, OMB called for public comments on the social cost of greenhouse gases. In its 2015 Response to Comment document,[142] OMB (together with the other agencies from the IWG) explained that > the consumption rate of interest is the correct concept to use . . . as the impacts of climate change are measured in consumption-equivalent units in the three IAMs used to estimate the SCC. This is consistent with OMB guidance in Circular A-4, which states that when a regulation is expected to primarily affect private consumption—for instance, via higher prices for goods and services—it is appropriate to use the consumption rate of interest to reflect how private individuals trade-off current and future consumption.[143] The Council of Economic Advisers similarly interprets Circular A-4 as requiring agencies to choose the appropriate discount rate based on the nature of the regulation: "[I]n Circular A-4 by the Office of Management and Budget (OMB) the appropriate discount rate to use in evaluating the net costs or benefits of a regulation depends on whether the regulation primarily and directly affects private consumption or private capital."[144] The NAS also explained that a consumption rate of interest is the appropriate basis for a discount rate for climate effects.[145] There is also strong consensus through the economic literature that a capital discount rate like 7% is inappropriate for climate change.[146] Finally, each of the three integrated assessment models upon which BLM bases its analysis—DICE, FUND, and PAGE—uses consumption discount rates; a capital discount rate is thus inconsistent with the underlying models. (See the technical appendix on discounting attached to these comments for more details.) For these reason, 7% is an inappropriate choice of discount rate for the impacts of climate change. Second, **uncertainty over the long time horizon** of climate effects should drive analysts to select a lower discount rate. As an example of when a 7% discount rate is appropriate, Circular A-4 identifies an EPA rule with a 30-year timeframe of costs and benefits.[147] By contrast, greenhouse gas emissions generate than we are and that the utility people receive from consumption declines as their level of consumption increases. . . . The investment approach says that, as long as the rate of return to investment is positive, we need to invest less than a dollar today to obtain a dollar of benefits in the future. Under the investment approach, the discount rate is the rate of return on investment. If there were no distortions or inefficiencies in markets, the consumption rate of discount would equal the rate of return on investment. There are, however, many reasons why the two may differ. As a result, using a consumption rather than investment approach will often lead to very different discount rates." Maureen Cropper, *How Should Benefits and Costs Be Discounted in an Intergenerational Context?*, 183 RESOURCES 30, 33. [142] Note that this document was not withdrawn by Executive Order 13,783. [143] OMB 2015 Response to Comments, *supra* note 109, at 22. [144] Council of Econ. Advisers, *Discounting for Public Policy: Theory and Recent Evidence on the Merits of Updating the Discount Rate* at 1 (CEA Issue Brief, 2017), *available at* https://obamawhitehouse.archives.gov/sites/default/files/page/files/201701_cea_discounting_issue_brief.pdf. In theory, the two rates would be the same, but "given distortions in the economy from taxation, imperfect capital markets, externalities, and other sources, the SRTP and the marginal product of capital need not coincide, and analysts face a choice between the appropriate opportunity cost of a project and the appropriate discount rate for its benefits." *Id.* at 9. The correct discount rate for climate change is the social return to capital (i.e., returns minus the costs of externalities), not the private return to capital (which measures solely the returns). [145] NAS Second Report, *supra* note 110, at 28; see also Kenneth Arrow et al., Is There a Role for Benefit-Cost Analysis in Environmental, Health, and Safety Regulation?, 272 Science 221 (1996) (explaining that a consumption-based discount rate is appropriate for climate change). [146] In addition to the CEA and NAS reports, see, for example, this article by the former chair of the NAS panel on the social cost of greenhouse gases: Richard Newell (2017, October 10). Unpacking the Administration's Revised Social Cost of Carbon. Available at http://www.rff.org/blog/2017/unpacking-administration-s-revised-social-cost-carbon. *See also* Comments from Robert Pindyck, to BLM, on the Social Cost of Methane in the Proposed Suspension of the Waste Prevention Rule (submitted Nov. 5, 2017). [147] Circular A-4 at 34. See also OMB 2015 Response to Comments, *supra* note 109, at 21 ("While most regulatory impact analysis is conducted over a time frame in the range of 20 to 50 years"). 22	

Comment/ Code	Document #002-Environmental Defense Fund and Others	Response
	effects stretching out across 300 years. As Circular A-4 notes, while "[p]rivate market rates provide a reliable reference for determining how society values time within a generation, but for extremely long time periods no comparable private rates exist."[148] Circular A-4 discusses how uncertainty over long time horizons drives the discount rate lower: "the longer the horizon for the analysis," the greater the "uncertainty about the appropriate value of the discount rate," which supports a lower rate.[149] Circular A-4 cites the work of renowned economist Martin Weitzman and concludes that the "certainty-equivalent discount factor corresponds to ***the minimum discount rate having any substantial positive probability***."[150] The NAS makes the same point about discount rates and uncertainty.[151] In fact, as discussed more below and in the technical appendix on discounting, uncertainty over the discount rate is best addressed by adopting a declining discount rate framework. Third, a 7% discount rate **ignores catastrophic risks and the welfare of future generations**. As demonstrated in BLM's graph of the frequency distribution of social cost of methane estimates, the 7% rate truncates the long right-hand tail of social costs relative to the 3% rate's distribution. The long right-hand tail represents the possibility of catastrophic damages. As Pindyck explains in an article that BLM cites prominently, "the possibility of a catastrophic outcome is an essential driver of the [social cost of greenhouse gases]."[152] The 7% discount rate effectively assumes that present-day Americans are barely willing to pay anything at all to prevent medium- to long-term catastrophes. This assumption violates BLM's statutory duty to protect the future needs of Americans. At the same time, the 7% distribution also misleadingly exaggerates the possibility of negative estimates of the social cost of greenhouse gases.[153] A negative social cost of methane implies a discount rate so high that society is willing to sacrifice serious impacts to future generations for the sake of small, short-term benefits (such as slightly and temporarily improved fertilization for agriculture). Again, this assumption contravenes BLM's statutory responsibilities to protect the welfare of future Americans. Fourth, a 7% discount rate would be inappropriate for climate change because it is based on **outdated data and diverges from the current economic consensus**. Circular A-4 requires that assumptions—including discount rate choices—are "based on the best reasonably obtainable scientific, technical, and economic information available."[154] Yet Circular A-4's own default assumption of a 7% discount rate was [148] Circular A-4 at 36. [149] *Id.* [150] *Id.*; *see also* CEA, *supra* note 144, at 9: "Weitzman (1998, 2001) showed theoretically and Newell and Pizer (2003) and Groom et al. (2007) confirm empirically that discount rate uncertainty can have a large effect on net present values. A main result from these studies is that if there is a persistent element to the uncertainty in the discount rate (e.g., the rate follows a random walk), then it will result in an effective (or certainty-equivalent) discount rate that declines over time. Consequently, lower discount rates tend to dominate over the very long term, regardless of whether the estimated investment effects are predominantly measured in private capital or consumption terms (see Weitzman 1998, 2001; Newell and Pizer 2003; Groom et al. 2005, 2007; Gollier 2008; Summers and Zeckhauser 2008; and Gollier and Weitzman 2010)." [151] NAS Second Report, *supra* note 110, at 27. [152] Pindyck, Robert. 2013. "Climate change policy: What do the models tell us?" Journal of Economic Literature, 51(3), 860-872. [153] In the Monte Carlo simulation data, the 7% discount rate doubles the frequency of negative estimates compared to the 3% discount rate simulations, from a frequency of 4% to 8%. [154] CEQ regulations implementing NEPA similarly require that information in NEPA documents be "of high quality" and states that "[a]ccurate scientific analysis . . . [is] essential to implementing NEPA." 40 C.F.R. § 1500.1(b). 23	

Comment/ Code	Document #002-Environmental Defense Fund and Others	Response
	published 14 years ago and was based on data from decades ago.[155] Circular A-4's guidance on discount rates is in need of an update, as the Council of Economic Advisers detailed earlier this year after reviewing the best available economic data and theory: > The discount rate guidance for Federal policies and projects was last revised in 2003. Since then a general reduction in interest rates along with a reduction in the forecast of long-run interest rates, warrants serious consideration for a reduction in the discount rates used for benefit-cost analysis.[156] In addition to recommending a value below 7% as the discount factor based on private capital returns, the Council of Economic Advisers further explains that, because long-term interest rates have fallen, a discount rate based on the consumption rate of interest "should be at most 2 percent,"[157] which further confirms that applying a 7% rate to a context like climate change would be wildly out of step with the latest data and theory. Similarly, recent expert elicitations—a technique supported by Circular A-4 for filling in gaps in knowledge[158]—indicate that a growing consensus among experts in climate economics for a discount rate between 2% and 3%; 5% represents the upper range of values recommended by experts, and few to no experts support discount rates greater than 5% being applied to the costs and benefits of climate change.[159] Based on current economic data and theory, the most appropriate discount rate for climate change is 3% or lower. Fifth, Circular A-4 requires more of analysts than giving all possible assumptions and scenarios equal attention in a sensitivity analysis; if alternate assumptions would fundamentally change the decision, Circular A-4 requires analysts to select the **most appropriate assumptions from the sensitivity analysis**. Circular A-4 indicates that significant intergenerational effects will warrant a special sensitivity analysis focused on discount rates even lower than 3%: > Special ethical considerations arise when comparing benefits and costs across generations. . . It may not be appropriate for society to demonstrate a similar preference when deciding between the well-being of current and future generations. . . If your rule will have important intergenerational benefits or costs you might consider a further sensitivity analysis using a lower [155] The 7% rate was based on a 1992 report; the 3% rate was based on data from the thirty years preceding the publication of Circular A-4 in 2003. Circular A-4 at 33. [156] CEA, *supra* note 144, at 1; *id.* at 3 ("In general the evidence supports lowering these discount rates, with a plausible best guess based on the available information being that the lower discount rate should be at most 2 percent while the upper discount rate should also likely be reduced."); *id.* at 6 ("The Congressional Budget Office, the Blue Chip consensus forecasts, and the Administration forecasts all place the ten year treasury yield at less than 4 percent in the future, while at the same time forecasting CPI inflation of 2.3 or 2.4 percent per year. The implied real ten year Treasury yield is thus below 2 percent in all these forecasts."). [157] *Id.* at 1. [158] Circular A-4 at 41. [159] Howard and Sylvan, *supra* note 42; M.A. Drupp, et al., *Discounting Disentangled: An Expert Survey on the Determinants of the Long-Term Social Discount Rate* (London School of Economics and Political Science Working Paper, May 2015) (finding consensus on social discount rates between 1-3%). Pindyck, in a survey of 534 experts on climate change, finds a mean discount rate of 2.9% in the climate change context and this rate drops to 2.6% when he drops individuals that lack confidence in their knowledge. Pindyck, R. S. (2016). *The social cost of carbon revisited* (No. w22807). National Bureau of Economic Research. Unlike Howard and Sylvan (2016), Pindyck (2016) combines economists and natural scientists in his survey, though the mean constant discount rate drops to 2.7% when including only economists. Again, this further supports the finding that the appropriate discount rate is between 2% and 3%. 24	

Comment/ Code	Document #002-Environmental Defense Fund and Others	Response
	but positive discount rate in addition to calculating net benefits using discount rates of 3 and 7 percent.[160] Elsewhere in Circular A-4, OMB clarifies that sensitivity analysis should not result in a rigid application of all available assumptions regardless of plausibility. Circular A-4 instructs agencies to depart from default assumptions when special issues "call for different emphases" depending on "the sensitivity of the benefit and cost estimates to the key assumptions."[161] More specifically: If benefit or cost estimates depend heavily on certain assumptions, you should make those assumptions explicit and carry out *sensitivity analyses using plausible alternative assumptions*. If the value of net benefits changes from positive to negative (or vice versa) or if the relative ranking of regulatory options changes with alternative plausible assumptions, you should conduct further analysis to determine ***which of the alternative assumptions is more appropriate.***[162] In other words, if using a 7% discount rate would fundamentally change the agency's decision compared to using a 3% or lower discount rate, the agency must evaluate which assumption is most appropriate. Since OMB, the Council of Economic Advisers, the National Academies of Sciences, and the economic literature all conclude that a 7% rate is inappropriate for climate change, agencies should select a 3% or lower rate. BLM's selection of a 7% discount rate cannot be justified as "based on the best reasonably obtainable scientific, technical, and economic information available" and so is inconsistent with best practices for cost-benefit analysis under Circular A-4. *Application of a Declining Discount Rate Is Actionable Under the Current Economic Literature* Circular A-4 contemplates the use of declining discount rates in its reference to the work of Weitzman.[163] As the Council of Economic Advisers explained earlier this year, Weitzman and others developed the foundation for a declining discount rate approach, wherein rates start relatively higher for near-term costs and benefits but steadily decline over time according to a predetermined schedule until, in the very long-term, very low rates dominate due to uncertainty.[164] The National Academies of Sciences' report also strongly endorses a declining discount rate approach.[165] Notably, Marten et al., upon which BLM implicitly relies for developing the methodology for the social cost of methane,[166] also [160] Circular A-4 at 35-36. [161] *Id.* at 3. [162] *Id.* at 42. [163] Circular A-4, at page 36, cites to Weitzman's chapter in Portney & Weyant, eds. (1999); that chapter, at page 29, recommends a declining discount rate approach: "a sliding-scale social discounting strategy" with the rate at 3-4% through year 25; then around 2% until year 75; then around 1% until year 300; and then 0% after year 300. [164] CEA, *supra* note 144, at 9 ("[A]nother way to incorporate uncertainty when discounting the benefits and costs of policies and projects that accrue in the far future—applying discount rates that decline over time. This approach uses a higher discount rate initially, but then applies a graduated schedule of lower discount rates further out in time. The first argument is based on the application of the Ramsey framework in a stochastic setting (Gollier 2013), and the second is based on Weitzman's 'expected net present value' approach (Weitzman 1998, Gollier and Weitzman 2010). In light of these arguments, the governments of the United Kingdom and France apply declining discount rates to their official public project evaluations."). [165] NAS Second Report at 110. [166] *See supra*, explaining how BLM relies on IWG (2016), which in turn relied on Marten et al. (2015). 25	

Comment/ Code	Document #002-Environmental Defense Fund and Others	Response
	note the "agreement that the use of a constant discount rate over long time horizons with uncertain changes in the consumption per capita growth is not theoretically consistent."[167] One possible schedule of declining discount rates was proposed by Weitzman.[168] It is derived from a broad survey of top economists and other climate experts and explicitly incorporates arguments around interest rate uncertainty. Work by Arrow *et al*, Cropper *et al*, and Gollier and Weitzman, among others, similarly argue for a declining interest rate schedule and lay out the fundamental logic.[169] Another schedule of declining discount rates has been adopted by the United Kingdom.[170] The technical appendix on discounting attached to these comments more thoroughly reviews the various schedules of declining discount rates available for agencies to select and explains why agencies not only can but should adopt a declining discount framework to address uncertainty. *A 300-Year Time Horizon Is Required* Related to the choice of discount rate, a 300-year time horizon for analysis of climate effects is required by best economic practices. In 2017, the National Academies of Sciences issued a report stressing the importance of a longer time horizon for calculating the social cost of greenhouse gases. The report states that, "[i]n the context of the socioeconomic, damage, and discounting assumptions, the time horizon needs to be long enough to capture the vast majority of the present value of damages."[171] The report goes on to note that the length of the time horizon is dependent "on the rate at which undiscounted damages grow over time and on the rate at which they are discounted. Longer time horizons allow for representation and evaluation of longer-run geophysical system dynamics, such as sea level change and the carbon cycle."[172] In other words, after selecting the appropriate discount rate based on theory and data (in this case, 3% or below), analysts should determine the time horizon necessary to capture all costs and benefits that will have important net present values at the discount rate. Therefore, a 3% or lower discount rate for climate change implies the need for a 300-year horizon to capture all significant values. NAS reviewed the best available, peer-reviewed scientific literature and concluded that the effects of greenhouse gas emissions over a 300-year period are sufficiently well [167] Marten, A.L., Kopits, E.A., Griffiths, C.W., Newbold, S.C., and A. Wolverton. 2015. Incremental CH4 and N2O Mitigation Benefits Consistent with the U.S. Government's SC-CO2 Estimates. Climate Policy. 15(2): 272-298. [168] Martin L. Weitzman, *Gamma Discounting*, 91 AM. ECON. REV. 260, 270 (2001). Weitzman's schedule is as follows: 1-5 years: 4%; 6-25 years: 3%; 26-75 years: 2%; 76-300 years: 1%; 300+ years: 0% [169] Kenneth J. Arrow et al., *Determining Benefits and Costs for Future Generations*, 341 SCIENCE 349 (2013); Kenneth J. Arrow et al., *Should Governments Use a Declining Discount Rate in Project Analysis?*, REV ENVIRON ECON POLICY 8 (2014); Maureen L. Cropper et al., *Declining Discount Rates*, AMERICAN ECONOMIC REVIEW: PAPERS AND PROCEEDINGS (2014); Christian Gollier & Martin L. Weitzman, *How Should the Distant Future Be Discounted When Discount Rates Are Uncertain?* 107 ECONOMICS LETTERS 3 (2010). [170] Joseph Lowe, H.M. Treasury, U.K., Intergenerational Wealth Transfers and Social Discounting: Supplementary Green Book Guidance 5 (2008), *available at* http://www.hm-treasury.gov.uk/d/4(5).pdf. The U.K. declining discount rate schedule that subtracts out a time preference value is as follows: 0-30 years: 3.00%; 31-75 years: 2.57%; 76-125 years: 2.14%; 126-200 years: 1.71%; 201-300 years: 1.29%; 301+ years: 0.86% [171] NAS Second Report, *supra* note 110, at 78. [172] *Id.* 26	

Comment/ Code	Document #002-Environmental Defense Fund and Others	Response
	established and reliable as to merit consideration in estimates of the social cost of greenhouse gases.[173] 5. BLM Arbitrarily Fails to Follow Prescribed Practices for Dealing with Uncertainty As discussed above, BLM's response to uncertainty is to offer an alternative analysis that omits any monetization of the social cost of methane. This approach is clearly incorrect. BLM is not permitted, under either case law on rational decisionmaking or under OMB guidance on cost-benefit analysis, to simply give up in the face of uncertainty. BLM uses uncertainty as an excuse to present a scenario that does nothing to treat uncertainty with serious analytical rigor. BLM admits that the probability distributions for the social cost of methane feature "long right tails,"[174] but then does nothing to address the catastrophic risks represented by those tails. BLM should have followed the procedures prescribed by Circular A-4 to address uncertainty. As the Interagency Working Group did, BLM should have addressed uncertainty over the discount rate by running a scenario with a 2.5% or lower discount rate, or else a declining discount rate. And BLM should have addressed uncertainty over catastrophic damages, tipping points, option value, and risk aversion by presenting an estimate at the 95th percentile. By failing to run such sensitivity analyses, BLM overlooks how different (and more plausible) assumptions would change its cost-benefit calculation. (Uncertainty in general, as well as uncertainty over the discount rate in particular, are discussed in greater detail in the technical appendices attached to these comments.) *Circular A-4's Prescriptions for Uncertainty* Circular A-4 requires thorough treatment of uncertainty around both values and outcomes,[175] and for especially large or complex matters it recommends a formal probabilistic analysis.[176] Generally, Circular A-4 encourages agencies to disclose the full probability distribution of potential consequences, including both upper and lower bound estimates in addition to central estimates.[177] However, this guidance comes with some caveats. First, this approach to central estimates and the probability distribution "is appropriate as long as society is 'risk neutral' with respect to the regulatory alternatives."[178] But if society is risk averse—as is the case with climate change[179]—different considerations need to be taken into account. Second, in 2011, the Office of Information and Regulatory Affairs interpreted Circular A-4's goal as "not to characterize the full range of *possible* outcomes . . . but rather the range of *plausible* outcomes."[180] Agency analysts must exercise judgment. Finally, as with all [173] Nat'l Acad. Of Sci., *Assessment of Approaches to Updating the Social Cost of Carbon* 49 (2016), at 32. [174] 2017 RIA at 59. [175] Circular A-4, at 42, requires probability distributions for "values as well for each of the outcomes"; the social cost of greenhouse gases is a value with a probability distribution. [176] *Id.* at 41. [177] Circular A-4 at 18, 40; *id.* at 45 ("When you provide only upper and lower bounds (in addition to best estimates), you should, if possible, *use the 95 and 5 percent* confidence bounds."). [178] *Id.* at 42. [179] *See* INTERAGENCY WORKING GROUP ON SOCIAL COST OF CARBON, TECHNICAL SUPPORT DOCUMENT: SOCIAL COST OF CARBON FOR REGULATORY IMPACT ANALYSIS UNDER EXECUTIVE ORDER 12,866 at 11 (2010). [180] Office of Information and Regulatory Affairs, *Regulatory Impact Analysis: A Primer* 2 (2011). This is best understood as drawing the line at insignificant or scientifically unsupported outcomes. By contrast, the low-probability but catastrophic potential outcomes of climate change are highly significant and the scientific literature demands giving them due attention. 27	

Comment/ Code	Document #002-Environmental Defense Fund and Others	Response
	elements of agencies' economic analyses, Circular A-4 stresses that "Your analysis should be credible, objective, realistic, and scientifically balanced."[181] Consequently, while it may be appropriate to disclose the full probability distribution of an uncertainty analysis, it is not appropriate under Circular A-4 to give a low-percentile estimate of the social cost of greenhouse gases equal weight in decision-making with the central and upper-percentile estimates. Giving equal attention to a low-percentile estimate is not "credible, objective, realistic, and scientifically balanced," does not reflect "plausible" scenarios, and would undermine consideration of risk aversion. Instead, a proper and plausible treatment of uncertainty in the context of climate change will support higher estimates of the social cost of greenhouse gases. *A 95th Percentile Value as a Treatment of Uncertainty over Damages* The IWG accounted for uncertainty in numerous rigorous ways. The group modeled the uncertainty over the value of the equilibrium climate sensitivity parameter using the Roe and Baker distribution calibrated to the IPCC reports. Additionally, using well-established analytic tools to capture and reflect uncertainty, including a Monte Carlo simulation to randomly select the equilibrium climate sensitivity parameter and other uncertainty parameters selected by the model developers, the IWG quantitatively modeled the uncertainty underlying how greenhouse gas emissions affect temperature. To further deal with uncertainty, the IWG recommended to agencies a range of four estimates: three central or mean-average estimates at a 2.5%, 3%, and 5% discount rate respectively, and a 95th percentile value at the 3% discount rate. While the IWG's technical support documents disclosed fuller probabilities distributions, these four estimates were chosen by agencies to be the focus for decisionmaking. In particular, application of the 95th percentile value was not part of an effort to show the probability distribution around the 3% discount rate; rather, the 95th percentile value serves as a methodological shortcut to approximate the uncertainties around low-probability but high-damage, catastrophic, or irreversible outcomes that are currently omitted or undercounted in the economic models. The shape of the distribution of climate risks and damages includes a long tail of lower-probability, high-damage, irreversible outcomes due to "tipping points" in planetary systems, inter-sectoral interactions, and other deep uncertainties. Climate damages are not normally distributed around a central estimate, but rather feature a significant right skew toward catastrophic outcomes. In fact, a 2015 survey of economic experts concludes that catastrophic outcomes are increasingly likely to occur.[182] Because the three integrated assessment models that the IWG's methodology relied on are unable to systematically account for these potential catastrophic outcomes, a 95th percentile value was selected instead to account for such uncertainty. There are no similarly systematic biases pointing in the other direction which might warrant giving weight to a low-percentile estimate. Additionally, the 95th percentile value addresses the strong possibility of widespread risk aversion with respect to climate change. The integrated assessment models do not reflect that individuals likely have a higher willingness to pay to reduce low-probability, high-impact damages than they do to reduce the [181] Circular A-4 at 39. [182] Policy Integrity, *Expert Consensus on the Economics of Climate Change* 2 (2015), *available at* http://policyintegrity.org/files/publications/ExpertConsensusReport.pdf [hereinafter *Expert Consensus*] ("Experts believe that there is greater than a 20% likelihood that this same climate scenario would lead to a 'catastrophic' economic impact (defined as a global GDP loss of 25% or more)."). *See also* Robert Pindyck, *The Social Cost of Carbon Revisited* (National Bureau of Economic Research, No. w22807, 2016). 28	

Comment/ Code	Document #002-Environmental Defense Fund and Others	Response
	likelihood of higher-probability but lower impact damages with the same expected cost. Beyond individual members of society, governments also have reasons to exercise some degree of risk aversion to irreversible outcomes like climate change. In short, the 95th percentile estimate attempts to capture risk aversion and uncertainties around lower-probability, high-damage, irreversible outcomes that are currently omitted or undercounted by the models. There is no need to balance out this estimate with a low-percentile value, because the reverse assumptions are not reasonable: • There is no reason to believe the public or the government will be systematically risk seeking with respect to climate change.[183] • The consequences of overestimating the risk of climate damages (i.e., spending more than we need to on mitigation and adaptation) are not nearly as irreversible as the consequences of underestimating the risk of climate damage (i.e., failing to prevent catastrophic outcomes). • Though some uncertainties might point in the direction of lower social cost of greenhouse gas values, such as those related to the development of breakthrough adaptation technologies, the models already account for such uncertainties around adaptation; on balance, most uncertainties strongly point toward higher, not lower, social cost of greenhouse gas estimates.[184] • There is no empirical basis for any "long tail" of potential benefits that would counteract the potential for extreme harm associated with climate change. Moreover, even the best existing estimates of the social cost of greenhouse gases are likely underestimated because the models currently omit many significant categories of damages—such as depressed economic growth, pests, pathogens, erosion, air pollution, fire, dwindling energy supply, health costs, political conflict, and ocean acidification—and because of other methodological choices.[185] There is little to no support among economic experts to give weight to any estimate lower than the 5% discount rate estimate.[186] Rather, even a discount rate at 3% or below likely continues to underestimate the true social cost of greenhouse gases. [183] As a 2009 survey revealed, the vast majority of economic experts support the idea that "uncertainty associated with the environmental and economic effects of greenhouse gas emissions increases the value of emission controls, assuming some level of risk-aversion." *See Expert Consensus, supra* note 182, at 3 (citing 2009 survey). [184] *See* Richard L. Revesz et al., *Global Warming: Improve Economic Models of Climate Change*, 508 NATURE 173 (2014). R. Tol, *The Social Cost of Carbon*, 3 Annual Rev. Res. Econ. 419 (2011) ("[U]ndesirable surprises seem more likely than desirable surprises. Although it is relatively easy to imagine a disaster scenario for climate change—for example, involving massive sea level rise or monsoon failure that could even lead to mass migration and violent conflict—it is not at all easy to imagine that climate change will be a huge boost to human welfare."). [185] *See* Revesz et al., *Global Warming: Improve Economic Models of Climate Change*, *supra* note 184; Peter Howard, *Omitted Damages: What's Missing from the Social Cost of Carbon* (Cost of Carbon Project Report, 2014); Frances C. Moore & Delavane B. Diaz, *Temperature Impacts on Economic Growth Warrant Stringent Mitigation Policy*, 5 NATURE CLIMATE CHANGE 127 (2015) (demonstrating SCC may be biased downward by more than a factor of six by failing to include the climate's effect on economic growth). [186] The existing estimates based on the 5% discount rate already provides a lower-bound; indeed, if anything the 5% discount rate is already far too conservative as a lower-bound. A recent survey of 365 experts on the economics of climate change found that 90% of experts believe a 3% discount rate or lower is appropriate for climate change; a 5% discount rate falls on the extremely high end of what experts would recommend. *Expert Consensus, supra* note 182, at 21; *see also* Drupp, M.A., et al. 29	

Comment/ Code	Document #002-Environmental Defense Fund and Others	Response
	The National Academies of Sciences did recommend that the IWG document its full treatment of uncertainty in an appendix and disclose low-probability as well as high-probability estimates of the social cost of greenhouse gases.[187] However, that does not mean it would be appropriate for individual agencies to rely on low-percentile estimates to justify decisions. While disclosing low-percentile estimates as a sensitivity analysis may promote transparency, relying on such an estimate for decisionmaking—in the face of contrary guidance from the best available science and economics on uncertainty and risk—would not be a "credible, objective, realistic, and scientifically balanced" approach to uncertainty. By not disclosing the social cost of methane at the 95th percentile value, BLM has failed to address uncertainties over catastrophic outcomes, tipping points, risk aversion, and option value, and so has violated the prescriptions of Circular A-4. *A Lower or Declining Discount Rate as a Treatment of Uncertainty* As explained above, BLM should have adopted a declining discount rate. But minimally, BLM should have at least run a scenario at a discount rate lower that 3%.[188] Circular A-4 strongly recommends that, for rules with "important intergenerational benefits or costs," agencies should run a "sensitivity analysis using a lower but positive discount rate."[189] The Interagency Working Group used a 2.5% discount rate to address uncertainty. BLM fails to run the social cost of methane at anything but a 3% and a 7% discount rate, and so has failed to adequately address uncertainty. ## 6. BLM Has Cherry-Picked Methodological Revisions to Advance a Predetermined Goal, Without Engaging in a Holistic Update BLM explains that its estimates of the social cost of methane are simply "interim values" until an improved estimate can be developed.[190] The revisions to the Interagency Working Group's 2016 estimates that BLM made to produce these interim values are all methodologically unsound: ignoring the global values and calculating an inaccurate and incomplete domestic-only estimate; applying the inappropriate 7% discount rate; and failing to disclose a 95th percentile estimate. What links these select revisions together is a common, predetermined goal: lowering the social cost of methane to support deregulation. This is an arbitrary approach to updating the social cost of methane. BLM does not engage with any of the most recent literature on damages (see the technical appendix attached to these comments on damage literature), does not update the underlying models (BLM continues to use DICE-2010, even --- *Discounting Disentangled: An Expert Survey on the Determinants of the Long-Term Social Discount Rate* (London School of Economics and Political Science Working Paper, May 2015) (finding consensus on social discount rates between 1-3%). Only 8% of the experts surveyed believe that the central estimate of the social cost of carbon is below $40, and 69% of experts believed the value should be at or above the central estimate of $40. *Expert Consensus, supra* note 182, at 18. [187] Nat'l Acad. Of Sci., *Assessment of Approaches to Updating the Social Cost of Carbon* 49 (2016) ("[T]he IWG could identify a high percentile (e.g., 90th, 95th) and corresponding low percentile (e.g., 10th, 5th) of the SCC frequency distributions on each graph."). [188] For example, the Council of Economic Advisers suggests that, in lieu of a declining discount rate, it is still appropriate "to pick a flat but somewhat lower discount-rate schedule for projects involving distant costs and benefits." CEA, *supra* note 144, at 9. [189] Circular A-4 at 35-36. [190] 2017 RIA at 25. 30	

Comment/ Code	Document #002-Environmental Defense Fund and Others	Response
	though DICE-2016R has been published[191]), does not move toward a declining discount rate, and does not implement any of the recommendations for improving the social cost of greenhouse gas methodology as articulated by the National Academies of Sciences. Agencies should pursue a holistic update of the social cost of greenhouse gas methodology, but BLM only seems interested in revisions designed to lower the valuation. As such, BLM's interim values are biased and should not be used in analysis. The National Academies of Sciences' reports are attached to these comments, so that BLM might review their recommendations for a holistic update to the methodology. 7. BLM Fails to Appropriately Consider Unquantified Benefits BLM compares its calculation of monetized cost savings against its calculation of monetized forgone benefits and concludes that its proposed suspension will deliver "positive net benefits."[192] The agency also claims to have "estimated all significant costs and benefits."[193] Both of these statements overlook the fact that BLM gives no weight to the unquantified forgone benefits to climate, as well as other unquantified forgone benefits, such as the public health consequences of the additional tons of VOCs that will be emitted under the proposed suspension and the impacts on communities and wildlife from unchecked flaring. Even putting aside BLM's severely manipulated underestimates of the monetized forgone climate benefits, BLM has failed to explain why the proposed suspension's estimated cost savings justify the sum of both the monetized and unmonetized forgone benefits. Experts widely acknowledge that even the best existing estimates of the social cost of greenhouse gases are almost certainly underestimates of true global damages—perhaps severe underestimates.[194] Using different discount rates; selecting different models; applying different treatments to uncertainty, climate sensitivity, and the potential for catastrophic damages; and making other reasonable assumptions could yield very different, and much larger estimates.[195] For example, a 2014 report found current social cost of carbon estimates omit or poorly quantify damages to the following sectors: agriculture, forestry, and fisheries (including pests, pathogens, and weeds, erosion, fires, and ocean acidification); ecosystem services (including biodiversity and habitat loss); health impacts (including Lyme disease and respiratory illness from increased ozone pollution, pollen, and wildfire smoke); inter-regional damages (including migration of human and economic capital); inter-sector damages (including the combined surge effects of stronger storms and rising sea levels); exacerbation of existing non-climate stresses (including the combined effect of the over pumping of groundwater and climate-driven reductions in regional water supplies); socially contingent damages (including increases in violence and other social conflict); decreasing growth rates (including decreases in labor productivity and increases in capital depreciation); weather variability (including increased drought and inland flooding); and catastrophic impacts [191] Nordhaus, W. D. (2017). Revisiting the social cost of carbon. *Proceedings of the National Academy of Sciences*, 201609244. [192] 82 Fed. Reg. at 46,465. [193] 2017 RIA at 26. [194] *See* Richard L. Revesz, Peter H. Howard, Kenneth Arrow, Lawrence H. Goulder, Robert E. Kopp, Michael A. Livermore, Michael Oppenheimer & Thomas Sterner, *Global Warming: Improve Economic Models of Climate Change*, 508 NATURE 173 (2014). [195] *Id.; see also* Joint Comments from Institute for Policy Integrity et al., to Office of Information and Regulatory Affairs, on the Technical Update of the Social Cost of Carbon, OMB-2013-0007-0085, Feb. 26, 2014. 31	

Comment/ Code	Document #002-Environmental Defense Fund and Others	Response
	(including unknown unknowns on the scale of the rapid melting of Arctic permafrost or ice sheets).[196] Circular A-4 requires that "When there are important non-monetary values at stake, you should also identify them in your analysis."[197] Specifically, agencies must "Include a summary table that lists all the unquantified benefits and costs, and use your professional judgment to highlight (e.g., with categories or rank ordering) those that you believe are most important."[198] The Circular cautions that "the most efficient alternative will not necessarily be the one with the largest quantified and monetized net-benefit estimate."[199] BLM must therefore fully disclose the limitations of its social cost of greenhouse gas estimates and include detailed charts of all important, unquantified climate effects. BLM's cursory reference to "impact categories omitted"[200] is insufficient. BLM must then explain why, after giving appropriate weight to all the unquantified climate effects and all the unquantified forgone benefits from VOC emissions, the proposed suspension's cost savings justify its forgone benefits. 8. The Environmental Assessment's Presentation of Methane Emissions Is Misleading BLM's environmental assessment discloses that the proposed suspension will result in forgone methane reductions, and it quantifies the additional short tons of methane that will be emitted as a result: 175,000 short tons.[201] Unfortunately, this presentation of short tons of methane fails to give the public and decisionmakers the necessary context to assess the significance of the climate consequences associated with the forgone emissions reductions. First, to follow the standard practice in discussing the climate effects of non-carbon dioxide greenhouse gases and allow for apples-to-apples comparisons, BLM should have translated the forgone methane reductions into carbon dioxide-equivalent metric tons. BLM attempts to put the forgone methane reductions in context by comparing them to total U.S. methane emissions in 2015, but it lists those emissions in metric tons of carbon dioxide-equivalent (655.7 million).[202] Similarly, BLM presents potential greenhouse gas decreases from reduced transportation in carbon dioxide-equivalents.[203] By comparison, 175,000 short tons of methane look misleadingly small. In fact, the forgone methane reductions due to the proposed suspension will total somewhere between 5 million and 14 million metric tons of carbon dioxide-equivalents, using the latest global warming potentials from the IPCC.[204] [196] Peter Howard, *Omitted Damages: What's Missing from the Social Cost of Carbon* 5 (Cost of Carbon Project Report, 2014), http://costofcarbon.org/. [197] Circular A-4 at 3. [198] *Id.* at 27. [199] *Id.* at 2. [200] 2017 RIA at 59. [201] BLM, Environmental Assessment: Waste Prevention, Production Subject to Royalties, and Resource Conservation Delay, at 16 tbl.4a (2017). [202] *Id.* at 16. [203] *Id.* [204] IPCC Working Group I, Fifth Assessment Report, Climate Change 2013: The Physical Science Basis, Chapter 8: Anthropogenic and Natural Radiative Forcing (2014) at 633, 711-712, 714 (Table 8.7), available at https://www.ipcc.ch/pdf/assessment-report/ar5/wg1/WG1AR5_Chapter08_FINAL.pdf (see the adjustment identified in note B for fossil methane; 85-87 times greater than carbon after 20 years, and 30-36 times greater after 100 years). 32	

Comment/ Code	Document #002-Environmental Defense Fund and Others	Response
	Moreover, BLM should have provided helpful context by monetizing the additional tons that will be emitted under the proposed suspension. Courts review NEPA documents "under an arbitrary and capricious standard," which requires "a reasonably thorough discussion of the significant aspects of the probable environmental consequences," to "foster both informed decisionmaking and informed public participation."[205] In particular, "the impact of greenhouse gas emissions on climate change is precisely the kind of cumulative impact analysis that NEPA requires," and it is arbitrary to fail to "provide the necessary contextual information about the cumulative and incremental environmental impacts."[206] To "provide the necessary contextual information," economic theory shows that one useful tool is monetization of environmental impacts. As Prof. Cass Sunstein has explained, drawing from the work of recent Nobel laureate economist Richard Thaler, a well-documented mental heuristic called "probability neglect" causes people to irrationally reduce small probability risks entirely down to zero.[207] In this case, for example, many decisionmakers and interested citizens would wrongly reduce down to zero the climate risks associated with the 0.61% of total U.S. methane emissions that BLM calculates will be emitted under the proposed suspension, simply due to the leading zero before the decimal. Yet the monetized expected cost of the climate risks associated with those same emissions—about $189 million[208]—is less likely overlooked. As the Environmental Protection Agency's website explains, "abstract measurements" of so many tons of greenhouse gases can be rather inscrutable for the public, unless "translat[ed] . . . into concrete terms you can understand."[209] Monetization contextualizes the significance of the additional tons of emissions. Similarly, non-monetized effects are often irrationally treated as worthless.[210] Courts have begun to strike down administrative decisions for failing to give weight to non-monetized effects.[211] Most relevantly, in *Center for Biological Diversity v. NHTSA*, the U.S. Court of Appeals for the Ninth Circuit found it arbitrary and capricious to give zero value "to the most significant benefit of more stringent [fuel economy] standards: reduction in carbon emissions."[212] BLM is required by NEPA to provide enough context to ensure that the public and decisionmakers would not overlook the associated climate risks. BLM's presentation of so many short tons of methane likely failed to provide such context. Monetization is one way that BLM could provide the necessary context to foster both informed decisionmaking and informed public participation.[213] As BLM's sister agency, the Office of Surface Mining, has explained, including the social cost of greenhouse gases in a NEPA [205] *CBD v. NHTSA*, 538 F.3d 1172, 1194 (9th Cir. 2008) (citations omitted). *See also* Montana Envtl. Info. Ctr. v. Office of Surface Mining, cv 15-106-M-DWM, at 12-13 (D.Mt., Aug. 14, 2017). [206] *CBD*, 538 F.3d at 1217; *see also Montana Envtl. Info. Ctr., supra*, at 45. [207] Cass R. Sunstein, Probability Neglect: Emotions, Worst Cases, and Law 112 Yale L61, 63, 72 (2002). [208] 2016 RIA at 109, tbl. 8-2a (showing the benefits of the 2016 rule for the year 2017). [209] EPA, Greenhouse Gas Equivalencies Calculator, https://www.epa.gov/energy/greenhouse-gas-equivalencies-calculator (last updated Sept. 2017). [210] Richard Revesz, *Quantifying Regulatory Benefits,* 102 Cal. L. Rev. 1424, 1434-35, 1442 (2014). [211] *Id.* at 1428, 1434. [212] 538 F.3d at 1199. [213] While the regulations promulgated by the Council on Environmental Quality to implement NEPA do not require a "monetary cost-benefit analysis," 40 C.F.R. § 1502.23, monetization nevertheless remains an available tool for contextualizing information. As the Council on Environmental Quality has explained, monetization may be "appropriate and relevant" and, in particular, "the Federal social cost of carbon . . . provides a harmonized, interagency metric that can give decision makers and the public useful information for their NEPA review." CEQ, *Final Guidance on Consideration of Greenhouse Gas Emissions and the Effects of Climate Change in National Environmental Policy Act Reviews* 32-33 & fn.86 (2016), *available* at https://obamawhitehouse.archives.gov/sites/whitehouse.gov/files/documents/nepa_final_ghg_guidance.pdf. 33	

Comment/ Code	Document #002-Environmental Defense Fund and Others	Response
	document "provide[s] further context and enhance[s] the discussion of climate change impacts in the NEPA analysis."[214] **9. BLM Appropriately Gives Equal Weight to the Three Most Peer-Reviewed Models, but Should Use the Updated Models** BLM explains that it has relied on "the inputs and modeling developed by the now-disbanded Interagency Working Group for the purposes of providing discrete alternative scenarios that reflect the best available Federal agency estimates of social costs."[215] Indeed, because the Interagency Working Group used the best available data and methodology, it is appropriate for agencies to continue to rely on its methodology and its 2016 estimates. In fact, BLM should have relied more consistently on the Interagency Working Group's inputs and assumptions, and so focused on a global valuation calculation at a 3% or lower discount rate. BLM should also clarify whether its reference point was the Interagency Working Group's 2016 technical addendum on the social cost of methane, based on the work of Marten et al., or if instead BLM used earlier work by the Interagency Working Group on the social cost of carbon and simply adjusted for methane's relative global warming potential. The latter approach is not favored by economists, as it undercounts the true social cost of methane, and BLM would need to justify such a choice and provide an opportunity for public comment on such justification. BLM also explains the virtues of equally weighting the results of the three most peer-reviewed integrated assessment models in order to balance out the limitations and omissions of any one model.[216] In any future applications of the social cost of methane, BLM should continue to rely on the Interagency Working Group's methodology and use multiple peer-reviewed models. That said, BLM has failed to use the most up-to-date versions of those models, and should use the updated models in future calculations, including in any revised analysis of its proposed suspension.[217] *Agencies Should Continue to Rely on the Interagency Working Group's Methodology and Estimates* In 2016, IWG published updated central estimates for the social cost of greenhouse gases: $50 per ton of carbon dioxide, $1440 per ton of methane, and $18,000 per ton of nitrous oxide (in 2017 dollars for year 2020 emissions).[218] Notwithstanding the recent Executive Order disbanding the IWG, the estimates updated by that group in 2016 are still the best estimates of the lower bound of the social cost of greenhouse gases, reflecting current best practices and best scientific and economic literature. Agencies should continue to use estimates of a similar or higher value[219] in their regulatory analyses and environmental impact statements. In particular, when estimating the social cost of greenhouse gases, agencies should use multiple peer-reviewed models, a global estimate of climate damages, and a 3% or lower discount rate for the central estimate. [214] *Final Environmental Impact Statement—Four Corners Power Plant and Navajo Mine Energy Project* at 4.2-26 to 4.2-27 (2015). *Available at* https://www.wrcc.osmre.gov/initiatives/fourCorners/documents/FinalEIS/ Section%204.2%20-%20Climate%20Change.pdf. [215] 2017 RIA at 57. [216] 2017 RIA at 58. [217] 2017 RIA at 58. [218] U.S. Interagency Working Group on the Social Cost of Greenhouse Gases (IWG), "Technical support document: Technical update of the social cost of carbon for regulatory impact analysis under executive order 12866 & Addendum: Application of the methodology to estimate the social cost of methane and the social cost of nitrous oxide" (2016; https://obamawhitehouse.archives.gov/omb/oira/social-cost-of-carbon). [219] *See supra* note 40. 34	

Comment/ Code	Document #002-Environmental Defense Fund and Others	Response
	Any departure from IWG's most recent estimates would require agencies to engage with the complex integrated assessment models and ensure consistency with the most current scientific and economic literature, which overwhelmingly supports a global estimate based on a 3% or lower discount rate. Indeed, since the IWG's estimates omit important damage categories and so are best treated as a lower bound, if anything the social cost of greenhouse gas values used by agencies should be even higher. *Agencies Must Not Rely on a Single Model, but Must Use Multiple, Peer-Reviewed Models* *Circular A-4* requires agencies to use "the best reasonably obtainable scientific, technical, and economic information available. To achieve this, you should rely on peer-reviewed literature, where available."[220] Since the IWG first issued the federal social cost of carbon protocol in 2010, this methodology has relied on the three most cited, most peer-reviewed integrated assessment models (IAMs). These three IAMs—called DICE (the Dynamic Integrated Model of Climate and the Economy[221]), FUND (the Climate Framework for Uncertainty, Negotiation, and Distribution[222]), and PAGE (Policy Analysis of the Greenhouse Effect[223])—draw on the best available scientific and economic data to link physical impacts to the economic damages of each marginal ton of greenhouse gas emissions. As noted previously, each model translates emissions into changes in atmospheric greenhouse gas concentrations, atmospheric concentrations into temperature changes, and temperature changes into economic damages, which can then be adjusted according to a discount rate. These three models have been combined with inputs derived from peer-reviewed literature on climate sensitivity, socio-economic and emissions trajectories, and discount rates. The results of the three models have been given equal weight in federal agencies' estimates and have been run through statistical techniques like Monte Carlo analysis to account for uncertainty. In a 2017 report, the National Academies of Sciences (NAS) recommended future improvements to this methodology. Specifically, over the next five years the NAS recommends unbundling the four essential steps in the IAMs into four separate "modules": a socio-economic and emissions scenario module, a climate change module, an economic damage module, and a discount rate module.[224] Unbundling these four steps into separate modules could allow for easier, more transparent updates to each individual component in order to better reflect the best available science and capture the full range of uncertainty in the literature. These four modules could be built from scratch or drawn from the existing IAMs. Either way, the integrated modular framework envisioned by NAS for the future will require significant time and resource commitments from federal agencies. In the meantime, the NAS has supported the continued near-term use of the existing social cost of greenhouse gas estimates based on the DICE, FUND, and PAGE models, as used by federal agencies to date.[225] In short, DICE, FUND, and PAGE continue to represent the state-of-the-art models. The [220] OMB, Circular A-4, at 17. [221] William D. Nordhaus, *Estimates of the social cost of carbon: concepts and results from the DICE-2013R model and alternative approaches*, 1 JOURNAL OF THE ASSOCIATION OF ENVIRONMENTAL AND RESOURCE ECONOMISTS 1 (2014). [222] David Anthoff & Richard S.J. Tol, THE CLIMATE FRAMEWORK FOR UNCERTAINTY, NEGOTIATION AND DISTRIBUTION (FUND), TECHNICAL DESCRIPTION, VERSION 3.6 (2012), *available at* http://www.fund-model.org/versions. [223] Chris Hope, *The Marginal Impact of CO_2 from PAGE2002: An Integrated Assessment Model Incorporating the IPCC's Five Reasons for Concern*, 6 INTEGRATED ASSESSMENT J. 19 (2006). [224] Nat'l Acad. Sci., Eng. & Medicine, *Valuing Climate Damages: Updating Estimates of the Social Cost of Carbon Dioxide* 3 (2017) [hereinafter "NAS, Second Report"] (recommending an "integrated modular approach"). [225] Specifically, NAS concluded that a near-term update was not necessary or appropriate and the current estimates should continue to be used while future improvements are developed over time. Nat'l Acad. Sci., Eng. & Medicine, *Assessment of* 35	

Comment/ Code	Document #002-Environmental Defense Fund and Others	Response
	Government Accountability Office found in 2014 that the estimates derived from these models and used by federal agencies are consensus-based, rely on peer-reviewed academic literature, disclose relevant limitations, and are designed to incorporate new information via public comments and updated research.[226] In fact, the social cost of greenhouse gas estimates used in federal regulatory proposals and EISs have been subject to over 80 distinct public comment periods.[227] The economics literature confirms that estimates based on these three IAMs remain the best available estimates.[228] In 2016, the U.S. Court of Appeals for the Seventh Circuit held the estimates used to date by agencies are reasonable.[229] Just last month, the District of Montana rejected an agency's Environmental Assessment for failure to incorporate the federal social cost of carbon estimates into its cost-benefit analysis of a proposed mine expansion.[230] Regardless of Executive Order 13,783's withdrawal of the guidance requiring federal agencies to rely on IWG's technical support documents to estimate the social cost of greenhouse gases, IWG's choice of DICE, FUND, and PAGE, its use of inputs and assumptions, and its statistical analysis still represent the state-of-the-art approach based on the best available, peer-reviewed literature. This approach satisfies Circular A-4's requirements for information quality and transparency. Therefore, in complying with the Executive Order's instructions to ensure that social cost of greenhouse gas estimates are consistent with Circular A-4, agencies will necessarily have to rely on models like DICE, FUND, and PAGE, to use the same or similar inputs and assumptions as the IWG, and to apply statistical analyses like Monte Carlo. The unavoidable fact is that DICE, FUND, and PAGE are still the dominant, most peer-reviewed models,[231] and most estimates in the literature continue to rely on those models.[232] Each of these models has been developed over decades of research, and has been subject to rigorous peer review, documented in the published literature. While other models exist, they lack DICE's, FUND's, and PAGE's long history of peer review or exhibit other limitations. For example, the World Bank has created ENVISAGE, which models a more detailed breakdown of market sectors,[233] but unfortunately does not --- *Approaches to Updating the Social Cost of Carbon: Phase 1 Report on a Near-Term Update* 1 (2016) [hereinafter "NAS, First Report"]. [226] Gov't Accountability Office, *Regulatory Impact Analysis: Development of Social Cost of Carbon Estimates* (2014). [227] Howard & Schwartz, *supra* note 31, at Appendix A. [228] *E.g.*, Richard G. Newell et al., *Carbon Market Lessons and Global Policy Outlook*, 343 SCIENCE 1316 (2014); Bonnie L. Keeler et al., *The Social Costs of Nitrogen*, 2 SCIENCE ADVANCES e1600219 (2016); Richard L. Revesz et al., *Global Warming: Improve Economic Models of Climate Change*, 508 NATURE 173 (2014) (co-authored with Nobel Laureate Kenneth Arrow, among others). [229] *Zero Zone*, 832 F.3d at 678-79 (7th Cir. 2016) (finding that the agency "acted reasonably" in using global estimates of the social cost of carbon, and that the estimates chosen were not arbitrary or capricious). [230] *Montana Environmental Information Center*, 2017 WL 3480262, at *12-15, 19. [231] *See* Interagency Working Group on the Social Cost of Carbon, *Response to Comments: Social Cost of Carbon for Regulatory Impact Analysis under Executive Order 12,866* at 7 (July 2015) ("DICE, FUND, and PAGE are the most widely used and widely cited models in the economic literature that link physical impacts to economic damages for the purposes of estimating the SCC."), *citing* Nat'l Acad. Sci., Eng. & Medicine, *Hidden Cost of Energy: Unpriced Consequences of Energy Production and Use* (2010) ("the most widely used impact assessment models"). [232] R.S. Tol, *The Social Cost of Carbon*, 3 Annual Rev. Res. Econ. 419 (2011); T. Havranek et al., *Selective Reporting and the Social Cost of Carbon*, 51 Energy Econ. 394 (2015). [233] World Bank, *The Environmental Impact and Sustainability Applied General Equilibrium (ENVISAGE) Model* (2008), *available at* http://siteresources.worldbank.org/INTPROSPECTS/Resources/334934-1193838209522/Envisage7b.pdf. 36	

Comment/ Code	Document #002-Environmental Defense Fund and Others	Response
	account for non-market impacts and so would omit a large portion of significant climate effects. Models like ENVISAGE are therefore not currently appropriate choices under the criteria of Circular A-4.[234] An approach based on multiple, peer-reviewed models (like DICE, FUND, and PAGE) is more rigorous and more consistent with Circular A-4 than reliance on a single model or estimate. DICE, FUND, and PAGE each include many of the most significant climate effects, use appropriate discount rates and other assumptions, address uncertainty, are based on peer-reviewed data, and are transparent.[235] However, each IAM also has its own limitations and is sensitive to its own assumptions. No model fully captures all the significant climate effects.[236] By giving weight to multiple models—as the IWG did—agencies can balance out some of these limitations and produce more robust estimates.[237] Finally, while agencies should be careful not to cherry-pick a single estimate from the literature, it is noteworthy that various estimates in the literature are consistent with the numbers derived from a weighted average of DICE, FUND, and PAGE—namely, with a central estimate of about $40 per ton of carbon dioxide, and a high-percentile estimate of about $120, for year 2015 emissions (in 2016 dollars, at a 3% discount rate). The latest central estimate from DICE's developers is $87 (at a 3% discount rate);[238] from FUND's developers, $12;[239] and from PAGE's developers, $123, with a high-percentile estimate of $332.[240] In fact, much of the literature suggests that a central estimate of $40 per ton is a very conservative underestimate. A 2013 meta-analysis of the broader literature found a mean estimate of $59 per ton of carbon dioxide,[241] and a soon-to-be-published update by the same author finds a mean estimate of $108 (at a 1% discount rate).[242] A 2015 meta-analysis—which sought out estimates besides just those based on DICE, FUND, and PAGE—found a mean estimate of $83 per ton of carbon dioxide.[243] Various studies relying on expert elicitation[244] from a large body of climate economists and scientists have found mean [234] Similarly, Intertemporal Computable Equilibrium System (ICES) does not account for non-market impacts. *See* https://www.cmcc.it/models/ices-intertemporal-computable-equilibrium-system. Other models include CRED, which is worthy of further study for future use. Frank Ackerman, Elizabeth A. Stanton & Ramón Bueno, *CRED: A New Model of Climate and Development*, 85 ECOLOGICAL ECONOMICS 166 (2013). Accounting for omitted impacts more generally, E.A. Stanton, F. Ackerman, R. Bueno, *Reason, Empathy, and Fair Play: The Climate Policy Gap*, (Stockholm Environment Inst. Working Paper 2012-02), find a doubling of the SCC using the CRED model. [235] While sensitivity analysis can address parametric uncertainty within a model, using multiple models helps address structural uncertainty. [236] *See* Peter Howard, *Omitted Damages: What's Missing from the Social Cost of Carbon* 5 (Cost of Carbon Project Report, 2014), http://costofcarbon.org/. [237] Moore, F., Baldos, U., & Hertel, T. (2017). Economic impacts of climate change on agriculture: a comparison of process-based and statistical yield models. *Environmental Research Letters*. [238] William Nordhaus, *Revisiting the Social Cost of Carbon*, Proc. Nat'l Acad. Sci. (2017) (estimate a range of $21 to $141). [239] D. Anthoff & R. Tol, *The Uncertainty about the Social Cost of Carbon: A Decomposition Analysis Using FUND*, 177 Climatic Change 515 (2013). [240] C. Hope, *The social cost of CO2 from the PAGE09 model*, 39 Economics (2011); C. Hope, *Critical issues for the calculation of the social cost of CO2*, 117 *Climatic Change*, 531 (2013). [241] R. Tol, *Targets for Global Climate Policy: An Overview*, 37 J. Econ. Dynamics & Control 911 (2013). [242] R. Tol, *Economic Impacts of Climate Change* (Univ. Sussex Working Paper No. 75-2015, 2015). [243] S. Nocera et al., *The Economic Impact of Greenhouse Gas Abatement through a Meta-Analysis: Valuation, Consequences and Implications in terms of Transport Policy*. 37 Transport Policy 31 (2015). [244] Circular A-4, at 41, supports use of expert elicitation as a valuable tool to fill gaps in knowledge. 37	

Comment/ Code	Document #002-Environmental Defense Fund and Others	Response
	estimates of $50 per ton of carbon dioxide,[245] $96-$144 per ton of carbon dioxide,[246] and $80-$100 per ton of carbon dioxide.[247] There is a growing consensus in the literature that even the best existing estimates of the social cost of greenhouse gases may severely underestimate the true marginal cost of climate damages.[248] Overall, a central estimate of $40 per ton of carbon dioxide at a 3% discount rate, with a high-percentile estimate of about $120 for year 2015 emissions, is consistent with the best available literature; if anything, the best available literature supports considerably higher estimates.[249] Similarly, a comparison of international estimates of the social cost of greenhouse gases suggests that a central estimate of $40 per ton of carbon dioxide is a very conservative value. Sweden places the long-term valuation of carbon dioxide at $168 per ton; Germany calculates a "climate cost" of $167 per ton of carbon dioxide in the year 2030; the United Kingdom's "shadow price of carbon" has a central value of $115 by 2030; Norway's social cost of carbon is valued at $104 per ton for year 2030 emissions; and various corporations have adopted internal shadow prices as high as $80 per ton of carbon dioxide.[250] *BLM Should Use the Most Updated Models* BLM explains it uses DICE 2010, FUND 3.8, and PAGE 2009.[251] However, not only is DICE 2010 not considered to be a major update of the DICE model,[252] but two major updates have occurred more recently: DICE-2013R[253] and DICE-2016R.[254] In using the outdated DICE 2010, BLM has failed to use the "best available science and economics" as required by Executive Order 13,783, and failed to follow the recommendations of the National Academies of Sciences on updating the integrated assessment models.[255] Updating from DICE 2010 to the most recent model would increase the social cost of [245] Scott Holladay & Jason Schwartz, *Economists and Climate Change* 43 (Inst. Policy Integrity Brief, 2009 (directly surveying experts about the SCC). [246] Peter Howard & Derek Sylvan, *The Economic Climate: Establishing Expert Consensus on the Economics of Climate Change* (Inst. Policy Integrity Working Paper 2015/1) (using survey results to calibrate the DICE-2013R damage function). [247] R. Pindyck, *The Social Cost of Carbon Revisited* (Nat'l Bureau of Econ. Res. No. w22807, 2016) ($80-$100 is the trimmed range of estimates at a 4% discount rate; without trimming of outlier responses, the estimate is $200). [248] *E.g.*, Howard & Sylvan, *supra* note 246; Pindyck, *supra* note 247. The underestimation results from a variety of factors, including omitted and outdated climate impacts (including ignoring impacts to economic growth and tipping points), simplified utility functions (including ignoring relative prices), and applying constant instead of a declining discount rate. *See* Howard, *supra* note 236; Revesz et al., *supra* note 2286; J.C. Van Den Bergh & W.J. Botzen, A Lower Bound to the Social Cost of CO2 Emissions, 4 Nature Climate Change 253 (2014) (proposing $125 per metric ton of carbon dioxide in 1995 dollars, or about $200 in today's dollars, as the lower bound estimate). *See also* F.C. Moore & D.B. Diaz, *Temperature Impacts on Economic Growth Warrant Stringent Mitigation Policy*, 5 Nature Climate Change 127 (2015) (concluding the SCC may be six times higher after accounting for potential growth impacts of climate change). Accounting for both potential impacts of climate change on economic growth and other omitted impacts, S. Dietz and N. Stern find a two- to seven-fold increase in the SCC. *Endogenous growth, convexity of damage and climate risk: how Nordhaus' framework supports deep cuts in carbon emissions*. 125 *The Economic Journal* 574 (2015). [249] Note that the various estimates cited in the paragraph have not all been converted to standard 2017$, and may not all reflect the same year emissions. Nevertheless, the magnitude of this range suggests that $40 per ton of year 2015 emissions is a conservative estimate. [250] *See* Howard & Schwartz, *supra* note 31, at Appendix B. All these estimates are in 2016$. [251] 2017 RIA at 55. [252] *See* Nordhaus, W., & Sztorc, P. (2013). DICE 2013R: Introduction and user's manual. [253] Nordhaus, W. (2014). Estimates of the social cost of carbon: concepts and results from the DICE-2013R model and alternative approaches. *Journal of the Association of Environmental and Resource Economists*, 1(1/2), 273-312. [254] Nordhaus, W. D. (2017). Revisiting the social cost of carbon. *Proceedings of the National Academy of Sciences*, 201609244. [255] *See* National Academies of Sciences, Engineering, and Medicine. (2017). *Valuing climate damages: Updating estimation of the social cost of carbon dioxide*. National Academies Press. Note that the Interagency Working Group was incorrect in 2016 in failing to update the DICE model from DICE-2010 to DICE-2013R, which was available at the time. *Cf.* IWG, 2013 Technical 38	

Comment/ Code	Document #002-Environmental Defense Fund and Others	Response
	greenhouse gases and enable a Monte Carlo simulation (as in FUND and PAGE) to better specify uncertainty.[256] Sincerely, Elly Benson, Staff Attorney, Sierra Club Susanne Brooks, Director of U.S. Climate Policy and Analysis, Environmental Defense Fund Tomás Carbonell, Senior Attorney and Director of Regulatory Policy, Environmental Defense Fund Rachel Cleetus, Ph.D., Lead Economist and Climate Policy Manager, Union of Concerned Scientists Denise Grab, Senior Attorney, Institute for Policy Integrity, NYU School of Law* Peter H. Howard, Ph.D., Economic Director, Institute for Policy Integrity, NYU School of Law* Benjamin Longstreth, Senior Attorney, Natural Resources Defense Council Andres Restrepo, Staff Attorney, Sierra Club Richard L. Revesz, Director, Institute for Policy Integrity, NYU School of Law* Martha Roberts, Senior Attorney, Environmental Defense Fund Jason A. Schwartz, Legal Director, Institute for Policy Integrity, NYU School of Law* Jeffrey Shrader, Economics Fellow, Institute for Policy Integrity, NYU School of Law* Peter Zalzal, Director of Special Projects and Senior Attorney, Environmental Defense Fund For any questions regarding these comments, please contact jason.schwartz@nyu.edu. * No part of this document purports to present New York University School of Law's views, if any. Attached: • Technical Appendix on Uncertainty • Technical Appendix on Discounting • Technical Appendix on Damage Literature • National Academies of Sciences, *Valuing Climate Damages: Updating Estimates of the Social Cost of Carbon Dioxide* (2017) • Peter Howard & Jason Schwartz, *Think Global: International Reciprocity as Justification for a Global Social Cost of Carbon*, 42 Columbia J. Envtl. L. 203 (2017) • Richard L. Revesz et al., *Best Cost Estimate of Greenhouse Gases*, 357 Science 6352 (2017) • Peter Howard & Thomas Sterner, *Few and Not So Far Between: A Meta-analysis of Climate Damage Estimates. Environmental and Resource Economics*, 1-29 (2016). • Peter Howard & Derek Sylvan, *The Economic Climate: Establishing Expert Consensus on the Economics of Climate Change* (Inst. Policy Integrity Working Paper 2015/1) Update (updating the models). *See also* Marten, A.L., Kopits, E.A., Griffiths, C.W., Newbold, S.C., and A. Wolverton. 2015. Incremental CH4 and N2O Mitigation Benefits Consistent with the U.S. Government's SC-CO2 Estimates. Climate Policy. 15(2): 272-298 (anticipating that the models will be continually updated). [256] The update would also increase BLM's calculation of the domestic-only share from 10% to 15%, *see* Nordhaus, W. D. (2017). Revisiting the social cost of carbon. *Proceedings of the National Academy of Sciences*, 201609244. But, as explained *supra* in these comments, a domestic-only value is the wrong framework and is inaccurate. 39	

Comment/ Code	Document #002-Environmental Defense Fund and Others	Response

Technical Appendix: Uncertainty

Contrary to the arguments made by many opposed to strong federal climate action, uncertainty about the full effects of climate change *raises* the social cost of greenhouse gases and warrants *more* stringent climate policy.[257] Integrated assessment models (IAMs) currently used to calculate the SCC show that the net effect of uncertainty about economic damage resulting from climate change, costs of mitigation, future economic development, and many other parameters raises the SCC compared to the case where models simply use our current best guesses of these parameters.[258] Even so, IAMs still underestimate the impact of uncertainty on the SCC by not accounting for a host of fundamental features of the climate problem: the irreversibility of climate change, society's aversion to risk and other social preferences, option value, and many catastrophic impacts.[259] Rather than being a reason not to take action, uncertainty increases the SCC and should lead to more stringent policy to address climate change.[260]

Types of Uncertainty in the IAMs

IAMs incorporate two types of uncertainty: parametric uncertainty and stochastic uncertainty. Parametric uncertainty covers uncertainty in model design and inputs, including the selected parameters, correct functional forms, appropriate probability distribution functions, and model structure. With learning, these uncertainties should decline over time as more information becomes available.[261] Stochastic uncertainty is persistent randomness in the economic-climate system, including various environmental phenomena such as volcanic eruptions and sun spots.[262] Uncertainties are present in each component of the IAMs: socio-economic scenarios, the simple climate model, the damage and abatement cost functions, and the social welfare function (including the discount rate).[263]

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[257] Peterson (2006) states "Most modeling results show (as can be expected) that there is optimally more emission abatement if uncertainties in parameters or the possibility of catastrophic events are considered." Peterson, S. (2006). Uncertainty and economic analysis of climate change: A survey of approaches and findings. *Environmental Modeling & Assessment*, *11*(1), 1-17.

[258] Tol, R. S. (1999). Safe policies in an uncertain climate: an application of FUND. *Global Environmental Change*, *9*(3), 221-232; Peterson, S. (2006). Uncertainty and economic analysis of climate change: A survey of approaches and findings. *Environmental Modeling & Assessment*, *11*(1), 1-17; IWG (2016), *supra* note 218.

[259] Pindyck, R. S. (2007). Uncertainty in environmental economics. *Review of environmental economics and policy*, *1*(1), 45-65; Golub, A., Narita, D., & Schmidt, M. G. (2014). Uncertainty in integrated assessment models of climate change: Alternative analytical approaches. *Environmental Modeling & Assessment*, *19*(2), 99-109; Lemoine, D., & Rudik, I. (2017). Managing Climate Change Under Uncertainty: Recursive Integrated Assessment at an Inflection Point. *Annual Review of Resource Economics* 9:18.1-18.26.

[260] *See* cites *supra* note 259.

[261] Learning comes in multiple forms: passive learning of anticipated information that arrives exogenous to the emission policy (such as academic research), active learning of information that directly stems from the choice of the GHG emission level (via the policy process), and learning of unanticipated information (Kann and Weyant, 2000; Lemoine and Rudik, 2017).

[262] Kann, A., & Weyant, J. P. (2000). Approaches for performing uncertainty analysis in large-scale energy/economic policy models. *Environmental Modeling & Assessment*, *5*(1), 29-46; Peterson (2006), *supra* note 257; Golub et al. *supra* note 259.

A potential third type of uncertainty arises due to ethical or value judgements: normative uncertainty. Peterson (2006) *supra* note 257; Heal, G., & Millner, A. (2014). Reflections: Uncertainty and decision making in climate change economics. *Review of Environmental Economics and Policy*, *8*(1), 120-137. For example, there is some normative debate over the appropriate consumption discount rate to apply in climate economics, though widespread consensus exists that using the social opportunity cost of capital is inappropriate (see earlier discussion). Preference uncertainty should be modeled as a declining discount rate over time (see earlier discussion), not using uncertain parameters. Kann & Weyant, *supra* note 262.

[263] Peterson (2006), *supra* note 257; Pindyck (2007), *supra* note 259; Heal & Millner, *supra* note 262.

40

Comment/ Code	Document #002-Environmental Defense Fund and Others	Response
	When modeling climate change uncertainty, scientists and economists have long emphasized the importance of accounting for the potential of catastrophic climate change.[264] Catastrophic outcomes combine several overlapping concepts including unlucky states of the world (i.e., bad draws), deep uncertainty, and climate tipping points and elements.[265] Traditionally, IAM developers address uncertainty by specifying probability distributions over various climate and economic parameters. This type of uncertainty implies the possibility of an especially bad draw if multiple uncertain parameters turn out to be lower than we expect, causing actualclimate damages to greatly exceed expected damages. Our understanding of the climate and economic systems is also affected by so-called "deep uncertainty," which can be thought of as uncertainty over the true probability distributions for specific climate and economic parameters.[266] The mean and variance of many uncertain climate phenomena are unknown due to lack of data, resulting in "fat-tailed distributions"—i.e., the tail of the distributions decline to zero slower than the normal distribution. Fat-tailed distributions result when the best guess of the distribution is derived under learning.[267] Given the general opinion that bad surprises are likely to outweigh good surprises in the case of climate change,[268] modelers capture deep uncertainty by selecting probability distributions with a fat upper tail which reflects the greater likelihood of extreme events.[269] The possibility of fat tails increases the likelihood of a "very" bad draw with high economic costs, and can result in a very high (and potentially infinite) expected cost of climate change (a phenomenon known as the dismal theory).[270] Climate tipping elements are environmental thresholds where a small change in climate forcing can lead to large, non-linear shifts in the future state of the climate (over short and long periods of time) through positive feedback (i.e., snowball) effects.[271] Tipping points refer to economically relevant thresholds after which change occurs rapidly (i.e., Gladwellian tipping points), such that opportunities for adaptation and intervention are limited.[272] Tipping point examples include the reorganization of the Atlantic meridional overturning circulation (AMOC) and a shift to a more persistent El Niño regime in the [264] Nordhaus, W. D. (2008). A question of balance: Weighing the options on global warming policies. Yale University Press; Kopp, R. E., Shwom, R. L., Wagner, G., & Yuan, J. (2016). Tipping elements and climate–economic shocks: Pathways toward integrated assessment. *Earth's Future*, *4*(8), 346-372. [265] Kopp et al. (2016), *supra* note 264. [266] *Id.* [267] Nordhaus, W. D. (2009). An Analysis of the Dismal Theorem (No. 1686). Cowles Foundation Discussion Paper; Weitzman, M. L. (2011). Fat-tailed uncertainty in the economics of catastrophic climate change. Review of Environmental Economics and Policy, 5(2), 275-292; Pindyck, R. S. (2011). Fat tails, thin tails, and climate change policy. *Review of Environmental Economics and Policy*, *5*(2), 258-274. [268] Mastrandrea, M. D. (2009). Calculating the benefits of climate policy: examining the assumptions of integrated assessment models. Pew Center on Global Climate Change Working Paper; Tol, R. S. (2012). On the uncertainty about the total economic impact of climate change. *Environmental and Resource Economics*, *53*(1), 97-116. [269] Weitzman (2011), *supra* note 267, makes clear that "deep structural uncertainty about the unknown unknowns of what might go very wrong is coupled with essentially unlimited downside liability on possible planetary damages. This is a recipe for producing what are called 'fat tails' in the extreme of critical probability distributions." [270] Weitzman, M. L. (2009). On modeling and interpreting the economics of catastrophic climate change. The Review of Economics and Statistics, 91(1), 1-19; Nordhaus (2009), *supra* note 267; Weitzman (2011), *supra* note 267. [271] Tipping elements are characterized by: (1) deep uncertainty, (2) absence from climate models, (3) larger resulting changes relative to the initial change crossing the relevant threshold, and (4) irreversibility. Kopp et al. (2016), *supra* note 264. [272] *Id.* 41	

Comment/ Code	Document #002-Environmental Defense Fund and Others	Response
	Pacific Ocean.[273] Social tipping points—including climate-induced migration and conflict—also exist. These various tipping points interact, such that triggering one tipping point may affect the probabilities of triggering other tipping points.[274] There is some overlap between tipping point events and fat tails in that the probability distributions for how likely, how quick, and how damaging tipping points will be are unknown.[275] Accounting fully for these most pressing, and potentially most dramatic, uncertainties in the climate-economic system matter because humans are risk averse and tipping points—like many other aspects of climate change—are, by definition, irreversible *How IAMs and the IWG Account for Uncertainty* Currently, IAMs (including all of those used by the IWG) capture uncertainty in two ways: deterministically and through uncertainty propagation. For the deterministic method, the modeler assumes away uncertainty (and thus the possibility of bad draws and fat tails) by setting parameters equal to their most likely (median) value. Using these values, the modeler calculates the median SCC value. Typically, the modeler conducts sensitivity analysis over key parameters—one at a time or jointly—to determine the robustness of the modeling results. This is the approach employed by Nordhaus in the preferred specification of the DICE model[276] used by the IWG. Uncertainty propagation is most commonly carried out using Monte Carlo simulation. In these simulations, the modeler randomly draws parameter values from each of the model's probability distributions, calculates the SCC for the draw, and then repeats this exercise thousands of times to calculate a mean social cost of carbon.[277] Tol, Anthoff, and Hope employ this technique in FUND and PAGE—as did the IWG (2010, 2013, and 2016)—by specifying probability distributions for the climate and economic parameters in the models. These models are especially helpful for assessing the net effect of different parametric and stochastic uncertainties. For instance, both the costs of mitigation and the damage from climate change are uncertain. Higher costs would warrant less stringent climate policies, while higher damages lead to more stringent policy, so theoretically, the effect of these two factors on climate policy could be ambiguous. Uncertainty propagation in an IAM calibrated to empirically motivated distributions, however, shows that climate damage uncertainty outweighs the effect of cost uncertainty, leading to a stricter policy when uncertainty is taken into account than when it is ignored.[278] [273] *Id.*; Kriegler, E., Hall, J. W., Held, H., Dawson, R., & Schellnhuber, H. J. (2009). Imprecise probability assessment of tipping points in the climate system. *Proceedings of the national Academy of Sciences*, *106*(13), 5041-5046; Diaz, D., & Keller, K. (2016). A potential disintegration of the West Antarctic Ice Sheet: Implications for economic analyses of climate policy. *The American Economic Review*, *106*(5), 607-611. See Table 1 of Kopp et al. (2016) *supra* note 264, for a full list of known tipping elements and points. [274] Kriegler et al. (2009), *supra* note 273; Cai, Y., Lenton, T. M., & Lontzek, T. S. (2016). Risk of multiple interacting tipping points should encourage rapid CO2 emission reduction; Kopp et al. (2016) *supra* note 264. [275] Peter Howard, *Omitted Damages: What's Missing from the Social Cost of Carbon* 5 (Cost of Carbon Project Report, 2014), http://costofcarbon.org/; Kopp et al. (2016) *supra* note 264. [276] Nordhaus, W. & Sztorc, P. (2013). DICE 2013: Introduction & User's Manual. Retrieved from Yale University, Department of Economics website: http://www.econ.yale.edu/~nordhaus/homepage/documents/Dicemanualfull [277] In alternative calculation method, the modeler "performs optimization of polices for a large number of possible parameter combinations individually and estimates their probability weighted sum." Golub et al. *supra* note 259. In more recent DICE-2016, Nordhaus conducts a three parameter analysis using this method to determine a SCC confidence interval. Given that PAGE and FUND model hundred(s) of uncertainty parameters, this methodology appears limited in the number of uncertain variables that can be easily specified. [278] Tol (1999), *supra* note 258, in characterizing the FUND model, states, "Uncertainties about climate change impacts are more serious than uncertainties about emission reduction costs, so that welfare-maximizing policies are stricter under uncertainty than under certainty." 42	

Comment/ Code	Document #002-Environmental Defense Fund and Others	Response
	This can be seen in the resulting right-skewed distribution of the SCC (see Figure 1 in IWG (2016)) where the mean (Monte Carlo) SCC value clearly exceeds the median (deterministic) SCC value. The IWG was rigorous in addressing uncertainty. First, it conducted Monte Carlo simulations over the above IAMs specifying different possible outcomes for climate sensitivity (represented by a right skewed, fat tailed distribution to capture the potential of higher than expected warming). It also used scenario analysis: five different emissions growth scenarios and three discount rates. Second, the IWG (2016) reported the various moments and percentiles—including the 95th percentile—of the resulting SCC estimates. Third, the IWG put in place an updating process, e.g., the 2013 and 2016 revisions, which updates the models as new information becomes available.[279] As such, the IWG used the various tools that economists have developed over time to address the uncertainty inherent in estimating the economic cost of pollution: reporting various measures of uncertainty, using Monte Carlo simulations, and updating estimates as evolving research advances our knowledge of climate change. Even so, the IWG underestimate the SCC by failing to capture key features of the climate problem. *Current IAMs Underestimate the SCC by Failing to Sufficiently Model Uncertainty* Given the current treatment of uncertainty by the IWG (2016) and the three IAMs that they employ, the IWG (2016) estimates represent an underestimate of the SCC. DICE clearly underestimates the true value of the SCC by effectively eliminating the possibility of bad draws and fat tails through a deterministic model that relies on the median SCC value. Even with their calculation of the mean SCC, the FUND and PAGE also underestimate the metric's true value by ignoring key features of the climate-economic problem. Properly addressing the limitations of these models' treatment of uncertainty would further increase the SCC. First, current IAMs insufficiently model catastrophic impacts. DICE fails to model both the possibility of bad draws and fat tails by applying the deterministic approach. Alternatively, FUND and PAGE ignore deep uncertainty by relying predominately on the thin-tailed triangular and gamma distributions.[280] The IWG (2010) only partially addresses this oversight by replacing the ECS parameter in DICE, FUND, and PAGE with a fat-tailed, right-skewed distribution calibrated to the IPCC's assumptions (2007), even though many other economic and climate phenomenon in IAMs are likely characterized by fat tails, including climate damages from high temperature levels, positive climate feedback effects, and tipping points.[281] Recent work in stochastic dynamic programming tends to better integrate fat tails – particularly with respect to tipping points (see below) – and address additional aversion to this type of uncertainty (also known as ambiguity aversion); doing so can further increase the SCC under uncertainty.[282] [279] IWG (2010). [280] Howard (2014), *supra* note 275. While both FUND and PAGE employ thin tailed distributions, the resulting distribution of the SCC is not always thin-tailed. In PAGE09, the ECS parameter is endogenous, such that the distribution of the ECS has a long tail following the IPCC (2007). *See* Chen, Z., Marquis, M., Averyt, K. B., Tignor, M., & Miller, H. L. (2007). Contribution of working group I to the fourth assessment report of the intergovernmental panel on climate change. *Cambridge, UK and New York: Cambridge University Press, 996p*. Similarly, while Anthoff and Tol do not explicitly utilize fat-tail distributions, the distribution of net present welfare from a Monte Carlos simulation is fat tailed. Anthoff, D., & Tol, R. S. (2014). The Climate Framework for Uncertainty, Negotiation and Distribution (FUND): Technical description, Version 3.8. Available at www.fund-model.org. Explicitly modeling parameter distributions as fat tailed may further increase the SCC. [281] Weitzman (2011), *supra* note 267; Kopp et al. (2016) *supra* note 264. [282] Lemoine, D., & Traeger, C. P. (2016a). Ambiguous tipping points. *Journal of Economic Behavior & Organization*, *132*, 5-18; Lemoine & Rudik (2017), *supra* note 259. IAM modelers currently assume that society is equally averse to known unknown and known unknowns. Lemoine & Traeger, *id*. 43	

Comment/ Code	Document #002-Environmental Defense Fund and Others	Response
	In contrast to their approach to fat tails, the IAMs used by the IWG (2010; 2013; 2016) sometimes address climate tipping points, though they do not apply state-of-the-art methods for doing so. In early versions of DICE (DICE-2010 and earlier), Nordhaus implicitly attributes larger portions of the SCC to tipping points by including certainty equivalent damages of catastrophic events - representing two-thirds to three-quarter of damages in DICE – calibrated to an earlier Nordhaus (1994) survey of experts.[283] In PAGE09, Hope also explicitly models climate tipping points as a singular, discrete event (of a 5% to 25% loss in GDP) that has a probability (which grows as temperature increases) of occurring in each time period.[284] Though not in the preferred versions of the IAMs employed by the IWG, some research also integrates specific tipping points into these IAMs finding even higher SCC estimates.[285] Despite the obvious methodological basis for addressing tipping points, the latest versions of DICE[286] and FUND exclude tipping points in their preferred specifications. Research shows that if these models were to correctly account for the full range of climate impacts—including tipping points—the resulting SCC estimates would increase.[287] The IWG approach also fails to include a risk premium—that is, the amount of money society would require in order to accept the uncertainty (i.e., variance) over the magnitude of warming and the resulting damages from climate change relative to mean damages (IWG, 2010; IWG, 2015)). The mean of a distribution, which is a measure of a distribution's central tendency, represents only one descriptor or "moment" of a distribution's shape. Each IAM parameter and the resulting SCC distributions have differing levels of variance (i.e., spread around the mean), skewness (i.e., a measure of asymmetry), and kurtosis (which, like skewness, is another descriptor of a distribution's tail) as well as means.[288] It is generally understood that people are risk averse in that they prefer input parameter distributions and [283] Nordhaus, W. D., & Boyer, J. (2000). Warning the World: Economic Models of Global Warming. MIT Press (MA); Nordhaus, W. D. (2008). A question of balance: Weighing the options on global warming policies. Yale University Press; Howard (2014), *supra* note 275; Kopp et al. (2016) *supra* note 264. [284] Hope (2006) also calibrated a discontinuous damage function in PAGE-99 used by IWG (2010). Howard (2014), *supra* note 275. [285] Kopp et al. (2016) *supra* note 264. [286] For DICE-2013 and DICE-2016, Nordhaus calibrates the DICE damage function using a meta-analysis based on estimates that mostly exclude tipping point damages. Howard, P. H., & Sterner, T. (2016). Few and Not So Far Between: A Meta-analysis of Climate Damage Estimates. *Environmental and Resource Economics*, 1-29. [287] Using FUND, Link and Tol (2010) find that a collapse of the AMOC would decrease GDP (and thus increase the SCC) by a small amount. Earlier modeling of this collapse in DICE find a more significance increase. Keller, K., Tan, K., Morel, F. M., & Bradford, D. F. (2000). Preserving the ocean circulation: implications for climate policy. *Climatic Change*, *47*, 17-43; Mastrandrea, M. D., & Schneider, S. H. (2001). Integrated assessment of abrupt climatic changes. *Climate Policy*, *1*(4), 433-449; Keller, K., Bolker, B. M., & Bradford, D. F. (2004). Uncertain climate thresholds and optimal economic growth. *Journal of Environmental Economics and management*, *48*(1), 723-741. With respect to thawing of the permafrost, Hope and Schaefer (2016), Economic impacts of carbon dioxide and methane released from thawing permafrost. *Nature Climate Change*, *6*(1), 56-59, and Gonzalez-Eguino and Neumann (2016), González-Eguino, M., & Neumann, M. B. (2016). Significant implications of permafrost thawing for climate change control. *Climatic Change*, *136*(2), 381-388, find increases in damages (and thus an increase in the SCC) when integrating this tipping element into the PAGE09 and DICE-2013R, respectively. Looking at the collapse of the West Antarctic Ice sheet, Nicholls et al. (2008) find a potential for significant increases in costs (and thus the SCC) in FUND. Nicholls, R. J., Tol, R. S., & Vafeidis, A. T. (2008). Global estimates of the impact of a collapse of the West Antarctic ice sheet: an application of FUND. *Climatic Change*, *91*(1), 171-191. Ceronsky et al. (2011) model three tipping points (collapse of the Atlantic Ocean Meridional Overturning Circulation, large scale dissociation of oceanic methane hydrates; and a high equilibrium climate sensitivity parameter), and finds a large increase in the SCC in some cases. Ceronsky, M., Anthoff, D., Hepburn, C., & Tol, R. S. (2011). *Checking the price tag on catastrophe: The social cost of carbon under non-linear climate response* (No. 392). ESRI working paper. [288] Golub, A., & Brody, M. (2017). Uncertainty, climate change, and irreversible environmental effects: application of real options to environmental benefit-cost analysis. *Journal of Environmental Studies and Sciences*, 1-8; see Figure 1 in IWG (2016). 44	

Comment/ Code	Document #002-Environmental Defense Fund and Others	Response
	(the resulting) SCC distributions with lower variances, holding the mean constant.[289] While the IWG assumes a risk-neutral central planner by using a constant discount rate (setting the risk premium to zero), this assumption does not correspond with empirical evidence,[290] current IAM assumptions,[291] the NAS (2017) recommendations, nor with the IWG's own discussion (2010) of the possible values of the elasticity of the marginal utility of consumption. Evidence from behavioral experiments indicate that people and society are also averse to other attributes of parameter distributions – specifically to the thickness of the tails of distributions – leading to an additional ambiguity premium (Heal and Millner, 2014).[292] Designing IAMs to properly account for the risk and ambiguity premiums from uncertain climate damages would increase the resulting SCC values they generate. Even under the IWG's current assumption of risk neutrality, the mean SCC from uncertainty propagation excludes the (real) option value of preventing marginal CO_2 emissions.[293] Option value reflects the value of future flexibility due to uncertainty and irreversibility; in this case, the irreversibility of CO2 emissions due to their long life in the atmosphere.[294] If society exercises the option of emitting an additional unit of CO2 emissions today, "we will lose future flexibility that the [mitigation] option gave" leading to possible "regret and…a desire to 'undo'" the additional emission because it "constrains future behavior."[295] Given that the SCC is calculated on the Business as Usual (BAU) emission pathway, option [289] In other words, society prefers a narrow distribution of climate damages around mean level of damages X to a wider distribution of damages also centered on the same mean of X because they avoid the potential for very high damages even at the cost of eliminating the chance of very low damages. [290] IWG, 2010, at fn 22; Cai et al., 2016, *supra* note 274, at 521. [291] The developers of each of the three IAMs used by the IWG (2010; 2013; 2016) assume a risk aversion society. Nordhaus and Sztorc, 2013, *supra;* Anthoff, D., & Tol, R. S. (2010). The Climate Framework for Uncertainty, Negotiation and Distribution (FUND): Technical description, Version 3.5. Available at www.fund-model.org; Anthoff, D., & Tol, R. S. (2014). The Climate Framework for Uncertainty, Negotiation and Distribution (FUND): Technical description, Version 3.8. Available at www.fund-model.org; Hope, C. (2013). Critical issues for the calculation of the social cost of CO2: why the estimates from PAGE09 are higher than those from PAGE2002. *Climatic Change*, *117*(3), 531-543. [292] According to Heal and Millner (2014), *supra*, there is an ongoing debate of whether ambiguity aversion is rational or a behavioral mistake. Given the strong possibility that this debate is unlikely to be resolved, the authors recommend exploring both assumptions. [293] Arrow, K. J., & Fisher, A. C. (1974). Environmental preservation, uncertainty, and irreversibility. *The Quarterly Journal of Economics*, 312-319; Dixit, A.K., Pindyck, R.S., 1994. *Investment Under Uncertainty*. Princeton University Press, Princeton, NJ; Traeger, C. P. (2014). On option values in environmental and resource economics. *Resource and Energy Economics*, *37*, 242-252. In the discrete emission case, there are two overlapping types of option value: real option value and quasi-option value. Real option value is the full value of future flexibility of maintaining the option to mitigate, and mathematically equals the maximal value that can be derived from the option to [emit] now or later (incorporating learning) less the maximal value that can be derived from the possibility to [emit] now or never. Traeger, C. P. (2014). On option values in environmental and resource economics. *Resource and Energy Economics*, *37*, 242-252, equation 5. Quasi-option value is the value of future learning conditional on delaying the emission decision, which mathematically equals the value of mitigation to the decision maker who anticipates learning less the value of mitigation to the decision maker who anticipates only the ability to delay his/her decision, and not learning. *Id*. The two values are related, such that real option value can be decomposed into: $\mathrm{DPOV} = \mathbf{Max}\{QOV + SOV - \mathbf{Max}\{NPV, 0\}, 0\} = \mathbf{Max}\{QOV + SOV - \mathrm{SCC}, 0\}$ where DPOV is the real option value, QOV is quasi-option value, SOV is simple option value (the value of the option to emit in the future condition on mitigating now), and NPV is the expected net present value of emitting the additional unit or the mean SCC in our case. *Id*. [294] Even if society drastically reduced CO2 emissions, CO2 concentrations would continue to rise in the near future and many impacts would occur regardless due to lags in the climate system. Pindyck, R. S. (2007). Uncertainty in environmental economics. *Review of environmental economics and policy*, *1*(1), 45-65. [295] Pindyck (2007). 45	

Comment/ Code	Document #002-Environmental Defense Fund and Others	Response
	value will undoubtedly be positive for an incremental emission because society will regret this emission in most possible futures. Though sometimes the social cost of carbon and a carbon tax are thought of as interchangeable ways to value climate damages, agencies should be careful to distinguish two categories of the literature. The first is the economic literature that calculates the optimal carbon tax in a scenario where the world has shifted to an optimal emissions pathway. The second is literature that assesses the social cost of carbon on the business-as-usual (BAU) emissions pathway; the world is currently on the BAU pathway, since optimal climate policies have not been implemented. There are currently no numerical estimates of the risk premium and option value associated with an incremental emission on the BAU emissions path. Although there are stochastic dynamic optimization models that implicitly account for these two values, they analyze *optimal,* sequential decision making under climate uncertainty.[296] By nature of being optimization models (instead of policy models), these complex models focus on calculating the optimal tax and not the social cost of carbon, which differ in that the former is the present value of marginal damages on the optimal emissions path rather than on the BAU emissions path.[297] While society faces the irreversibility of emissions on the BAU emissions path when abatement is essentially near zero (i.e., far below the optimal level even in the deterministic problem),[298] the stochastic dynamic optimization model must also account for a potential counteracting abatement cost irreversibility – the sunk costs of investing in abatement technology if we learn that climate change is less severe than expected – by the nature of being on the optimal emissions path that balances the cost of emissions and abatement. In the optimal case, uncertainty and irreversibility of abatement *can theoretically* lead to a lower optimal emissions tax, unlike the social cost of carbon. The difference in the implication for the optimal tax and the SCC means that the stochastic dynamic modeling results are less applicable to the SCC. *What can we learn from new literature on stochastic dynamic programming models?* Bearing in mind the limitations of stochastic dynamic modeling, some new research provides valuable insights that are relevant to calculation of the social cost of greenhouse gases. The new and growing stochastic dynamic optimization literature implies that the IWG's SCC estimates are downward biased. The literature is made up of three models – real option, finite horizon, and infinite horizon models – of which the infinite time horizon (i.e., stochastic dynamic programming (SDP)) models are the most comprehensive for analyzing the impact of uncertainty on optimal sequential abatement policies.[299] Recent computational advancements in SDP are helping overcome the need for strong simplifying assumptions in this literature for purpose of tractability. Traditionally, these simplifications led to unrealistically fast rates of learning – leading to incorrect outcomes – and difficulty in comparing results [296] Kann & Weyant, *supra;* Pindyck (2007), *supra;* Golub et al. (2014), *supra*. [297] Nordhaus (2014) makes this difference clear when he clarifies that "With an optimized climate policy…the SCC will equal the carbon price…In the more realistic case where climate policy is not optimized, it is conventional to measure the SCC as the marginal damage of emissions along the actual path. There is some inconsistency in the literature on the definition of the path along which the SCC should be calculated. This paper will generally define the SCC as the marginal damages along the baseline path of emissions and output and not along the optimized emissions path." Nordhaus, W. (2014). Estimates of the social cost of carbon: concepts and results from the DICE-2013R model and alternative approaches. *Journal of the Association of Environmental and Resource Economists*, *1*(1/2), 273-312. [298] On the BAU path, emissions far exceed their optimal level even without considering uncertainty. As a consequence, society is likely to regret an additional emission of CO2 in most future states of the world. Alternatively, society is unlikely to regret current abatement levels unless the extremely unlikely scenarios that there is little to no warming and/or damages from climate change. [299] Kann and Weyant, 2000, *supra;* Pindyck, 2007, *supra;* Golub et al., 2014, *supra*. 46	

Comment/ Code	Document #002-Environmental Defense Fund and Others	Response
	across papers (due to differing uncertain parameters, models of learning, and model types). Even so, newer methods still only allow for a handful of uncertain parameters compared to the hundreds of uncertain parameters in FUND and PAGE. Despite these limitations, the literature supports the above finding that the SCC, if anything, increases under uncertainty.[300] First, uncertainty increases the optimal emissions tax under realistic parameter values and modeling scenarios. While the impact of uncertainty on the optimal emissions tax (relative to the deterministic problem) depends on the uncertain parameters considered, the type of learning, and the model type (real option, finite horizon, and infinite horizon), the optimal tax clearly increases when tipping points or black swan events are included in stochastic optimization problems.[301] For SDP models, uncertainty tends to strengthen the optimal emissions path relative to the determinist case even without tipping points,[302] and these results are strengthened under realistic preference assumptions.[303] Given that there is no counter-balancing tipping abatement cost,[304] the complete modeling of climate uncertainty – which fully accounts for tipping points and fat tails – increases the optimal tax. Uncertainty leads to a stricter optimal emissions policy even if with irreversible mitigation costs, highlighting that the SCC would also increase when factoring in risk aversion and irreversibility given that abatement costs are very low on the BAU emissions path. Second, given the importance of catastrophic impacts under uncertainty (as shown in the previous paragraph), the full and accurate modeling of tipping points and unknown knowns is critical when modeling climate change. The most sophisticated climate-economic models of tipping points – which include the possibility of multiple correlated tipping points in stochastic dynamic IAMs – find an increase in the optimal tax by 100%[305] to 800%[306] relative to the deterministic case without them. More realistic modeling of tipping points will also increase the SCC. Finally, improved modeling of preferences will amplify the impact of uncertainty on the SCC. Adopting Epstein-Zin preferences that disentangle risk aversion and time preferences can significantly increase the SCC under uncertainty.[307] Recent research has shown that accurate estimation of decisions under [300] Kann and Weyant, 2000, *supra;* Pindyck, 2007, *supra;* Golub et al., 2014, *supra;* Lemoine and Rudik, 2017, supra. Comparing the optimal tax to the mean SCC is made further difficult by the frequent use of DICE as the base from which most stochastic dynamic optimization models are built. As a consequence, deterministic model runs are frequently the base of comparison for these models (Lemoine and Rudik, 2017). [301] The real options literature tends to find an increase in the optimal emissions path under uncertainty relative to the deterministic case (Pindyck, 2007), though the opposite is true when modelers account for the possibility of large damages (i.e., tipping point or black swan events) even with a risk-neutral society (Pindyck, 2007; Golub et al., 2014). Solving finite horizon models employing non-recursive methods, modelers find that the results differ depending on the model of learning – the research demonstrates stricter emission paths under uncertainty without learning (with emission reductions up to 30% in some cases) and the impact under passive learning has a relatively small impact due the presence of sunken mitigation investment costs - except when tipping thresholds are included (Golub et al., 2014). [302] Using SDP, modelers find that uncertainty over the equilibrium climate sensitivity parameter generally increases the optimal tax by a small amount, though the magnitude of this impact is unclear (Golub et al., 2014; Lemoine and Rudik, 2017). Similarly, non-catastrophic damages can have opposing effects dependent on the parameters changed, though emissions appear to decline overall when you consider their uncertainty jointly. [303] Pindyck, 2007; Golub et al., 2017; Lemoine and Rudik, 2017 [304] Pindyck, 2007 [305] Lemoine, D., & Traeger, C. P. (2016b). Economics of tipping the climate dominoes. *Nature Climate Change*. [306] Cai et al., 2016 [307] Cai et al., 2016; Lemoine and Rudik, 2017. The standard utility function adopted in IAMs with constant relative risk version implies that the elasticity of substitution equals the inversion of relative risk aversion. As a consequence, the society's 47	

Comment/ Code	Document #002-Environmental Defense Fund and Others	Response
	uncertainty crucially depends on distinguishing between risk and time preferences.[308] By conflating risk and time preferences, current models substantially understate the degree of risk aversion exhibited by most individuals, artificially lowering the SCC. Similarly, adopting ambiguity aversion increase the SCC, but to a much lesser extent than risk aversion.[309] Finally, allowing for the price of non-market goods to increase with their relative scarcity can amplify the positive effect that even small tipping points have on the SCC if the tipping point impacts non-market services.[310] Including more realistic preference assumptions in IAMs would further increase the SCC under uncertainty. Introducing stochastic dynamic modeling (which captures option value and risk premiums), updating the representation of tipping points, and including more realistic preference structures in traditional IAMs will – as in the optimal tax – further increase the SCC under uncertainty *Conclusion: Uncertainty Raises the Social Cost of Greenhouse Gases* Overall, the message is clear: climate uncertainty is *never* a rationale for ignoring the SCC or shortening the time horizon of IAMs. Instead, our best estimates suggest that increased variability implies a higher SCC and a need for more stringent emission regulations.[311] Current omission of key features of the climate problem under uncertainty (the risk and climate premiums, option value, and fat tailed probability distributions) and incomplete modeling of tipping points imply that the SCC will further increase with the improved modeling of uncertainty in IAMs. preferences for the intra-generational distribution of consumption, the intergenerational distribution of consumption, and risk aversion hold a fixed relationship. For purposes of stochastic dynamic programming, this is problematic because this assumption conflates intertemporal consumption smoothing and risk aversion. Botzen, W. W., & van den Bergh, J. C. (2014). Specifications of social welfare in economic studies of climate policy: overview of criteria and related policy insights. *Environmental and Resource Economics*, *58*(1), 1-33. By adopting the Epstein-Zinn utility function which separates these two parameters, modelers can calibrate them according to empirical evidence. For example, Cai et al. (2016) replace the DICE risk aversion of 1.45 and elasticity parameter of 1/1.45 with values of 3.066 and 1.5, respectively. [308] James Andreoni & Charles Sprenger, *Risk Preferences Are Not Time Preferences*, 102 AM. ECON. RIV. 3357–3376 (2012). [309] Lemoine, D., & Traeger, C. P. (2016b). Economics of tipping the climate dominoes. *Nature Climate Change*.; Lemoine and Rudik, 2017 [310] Typically, IAMs assume constant relative prices of consumption goods. Gerlagh, R., and B.C.C. Van der Zwaan. 2002. "Long-term substitutability between environmental and man-made goods." *Journal of Environmental Economics and Management 44*(2):329-345; Sterner, T., and U.M. Persson. 2008. "An Even Sterner Review: Introducing Relative Prices into the Discounting Debate." *Review of Environmental Economics and Policy 2*(1):61-76. By replacing the standard isoelastic utility function in IAMs with a nested CES utility function following Sterner and Persson (2008), Cai et al. (2015) find that even a relatively small tipping point (i.e., a 5% loss) can substantially increase the SCC in the stochastic dynamic setting. Cai, Y., Judd, K. L., Lenton, T. M., Lontzek, T. S., & Narita, D. (2015). Environmental tipping points significantly affect the cost– benefit assessment of climate policies. *Proceedings of the National Academy of Sciences*, *112*(15), 4606-4611. [311] Golub et al. (2014) states "The most important general policy implication from the literature is that despite a wide variety of analytical approaches addressing different types of climate change uncertainty, none of those studies supports the argument that no action against climate change should be taken until uncertainty is resolved. On the contrary, uncertainty despite its resolution in the future is often found to favor a stricter policy." 48	

Comment/ Code	Document #002-Environmental Defense Fund and Others	Response

Technical Appendix: Discounting

The Underlying IAMs All Use a Consumption Discount Rate

Employing a consumption discount rate would also ensure that the U.S. government is consistent with the assumptions employed by the underlying IAM models: DICE, FUND, and PAGE. Each of these IAMs employs consumption discount rates calibrated using the standard Ramsey formula (Newell, 2017). In DICE-2010, the elasticity of the pure rate of time preference is 1.5 and an elasticity of the marginal utility of consumption (η) of 2.0. Together with its assumed per capita consumption growth path, the average discount rate over the next three hundred years is 2.4%.[312] However, more recent versions of DICE (DICE-2013R and DICE-2016) update η to 1.45; this implies an increase of the average discount rate over the timespan of the models to between 3.1% and 3.2% depending on the consumption growth path.[313] In FUND 3.8 and (the mode values in) PAGE09, both model parameters are equal to 1.0. Based on the assumed growth rate of the U.S. economy (without climate damages), the average U.S. discount rate in FUND 3.8 is 2.0% over the timespan of the model (without considering climate damages). Unlike FUND 3.8, PAGE09 specifies triangular distributions for both parameters with a pure rate of time preference of between 0.1 and 2 with a mean of 1.03 and an elasticity of the marginal utility of consumption of between 0.5 and 2 with a mean 1.17. Using the PAGE09's mode values (without accounting for climate damages), the average discount rate over the timespan of the models is approximately 3.3% with a range of 1.2% to 6.5%. Rounding up the annual growth rate over the last 50 years to approximately 2%,[314] the range of best estimates of the SDR implied in the short-run by these three models is approximately 3% (PAGE09's mode estimate and FUND 3.8) to 4.4% (DICE-2016), though the PAGE09 model alone implies a range of 1.1% to 6.0% with a central estimate of 3%. The range of potential consumption discount rates in these IAMs is relatively consistent with IWG (2010; 2013; 2016) in the short-run, though the discount rates of the IAMs employed by the IWG decline over time (due to declining growth rates over time) implying a potential upward bias to the IWG consumption discount rates.

A Declining Discount Rate is Justified to Address Discount Rate Uncertainty

A strong consensus has developed in economics that the appropriate way to discount intergenerational benefits is through a declining discount rate (Arrow et al., 2013; Arrow et al., 2014; Gollier & Hammitt, 2014; Cropper et al., 2014).[315] Not only are declining discount rate theoretically correct, they are actionable (i.e., doable given our current knowledge) and consistent with OMB's *Circular A-4*. Perhaps the best reason to adopt a declining discount rate is the simple fact that there is considerable uncertainty around which discount rate to use. The uncertainty in the rate points directly to the need to use a declining rate, as the impact of the uncertainty grows exponentially over time such that the

[312] Due to a slowing of global growth, DICE-2010 implies a declining discount rate schedule of 5.1% in 2015, 3.9% from 2015 to 2050; 2.9% from 2055 to 2100; 2.2% from 2105 to 2200, and 1.9% from 2205 to 2300. This would be a steeper decline if Nordhaus accounted for the positive and normative uncertainty underlying the SDR.

[313] Due to a slowing of global growth, DICE-2016 implies a declining discount rate schedule of 5.1% in 2015, 4.7% from 2015 to 2050; 4.1% from 2055 to 2100; 3.1% from 2105 to 2200, and 2.5% from 2205 to 2300.

[314] According to the World Bank, the average global and United States per capita growth rates were 1.7% and 1.9%, respectively.

[315] Arrow et al. (2014) at 160-161 states that "We have argued that theory provides compelling arguments for using a declining certainty-equivalent discount rate," and concludes the paper by stating "Establishing a procedure for estimating a [declining discount rate] for project analysis would be an improvement over the OMB's current practice of recommending fixed discount rates that are rarely updated."

49

Comment/ Code	Document #002-Environmental Defense Fund and Others	Response
	correct discount rate is not an arithmetic average of possible discount rates.[316] Uncertainty about future discount rates could stem from a number of sources particularly salient in the context of climate change, including uncertainty about future economic growth, consumption, the consumption rate of interest, and preferences. Additionally, economic theory shows that if there is debate or disagreement over which discount rate to use, this should lead to the use of a declining discount rate (Weitzman, 2001; Heal & Millner, 2014). Though, the range of potential discount rates is limited by theory to potential consumption discount rates (see earlier discussion), which is certainly less than 7%. *There is a consensus that declining discount rates are appropriate for intergenerational discounting* Since the IWG undertook its initial analysis and before the most recent estimates of the SCC, a large and growing majority of leading climate economists consensus (Arrow et al., 2013) has come out in favor of using a declining discount rate for climate damages to reflect long-term uncertainty in interest rates. This consensus view is held whether economists favor descriptive (i.e., market) or prescriptive (i.e., normative) approaches to discounting (Freeman et al., 2015). Several key papers (Arrow et al., 2013; Arrow et al., 2014; Gollier & Hammitt, 2014; Cropper et al., 2014) outline this consensus and present the arguments that strongly support the use of declining discount rates for long-term benefit-cost analysis in both the normative and positive contexts. Finally, in a recent survey of experts on the economics of climate change, Howard and Sylvan (2015), found that experts support using a declining discount rate relative to a constant discount rate at a ratio of approximately 2 to 1. Economists have recently highlighted two main motivations for using a declining discount rate, which we elaborate on in what follows. First, if the discount rate for a project is fixed but uncertain, then the certainty-equivalent discount rate will decline over time, meaning that benefits should be discounted using a declining rate.[317] Second, uncertainty about the growth rate of consumption or output also implies that a declining discount rate should be used, so long as shocks to consumption are positively correlated over time.[318] In addition to these two arguments, other motivations for declining discount rates have long been recognized. For instance, if the growth rate of consumption declines over time, the Ramsey rule[319] for discounting will lead to a declining discount rate.[320] [316] Karp (2005) states that mathematical "intuition for this result is that as [time] increases, smaller values of r in the support of the distribution are relatively more important in determining the expectation of e–rt" where r is the constant discount rate." Or as Hepburn et al. (2003) puts it, "The intuition behind this idea is that scenarios with a higher discount rate are given less weight as time passes, precisely because their discount factor is falling more rapidly" over time. [317] This argument was first developed in Weitzman (1998) and Weitzman (2001). [318] *See, e.g.,* Gollier (2009). [319] The Ramsey discount rate equation for the social discount rate is $r = \delta + \eta * g$ where r is the social discount rate, δ is the pure rate of time preference, η is the aversion to inter-generational inequality, and g is the growth rate of per capita consumption. For the original development, *see*, Ramsey, F. P. (1928). A Mathematical Theory of Saving. *The Economic Journal, 38*(152). [320] Higher growth rates lead to higher discounting of the future in the Ramsey model because growth will make future generations wealthier. If marginal utility of consumption declines in consumption, then, one should more heavily discount consumption gains by wealthier generations. Thus, if growth rates decline over time, then the rate at which the future is discounted should also decline. *See, e.g.,* Arrow et al. (2014) at 148. It is standard in IAMs to assume that the growth rate of consumption will fall over time. *See, e.g.,* Nordhaus (2017) at 1519, "Growth in global per capita output over the 1980–2015 period was 2.2% per year. Growth in global per capita output from 2015 to 2050 is projected at 2.1% per year, whereas that to 2100 is projected at 1.9% per year." Similarly, Hope (2011) at 22 assumes that growth will decline. For instance, in the U.S., growth is 1.9% per year in 2008 and declines to 1.7% per year by 2040. Using data provided by Dr. David Anthoff (one of the founders of FUND), FUND assumes that the global growth rate was 1.8% per year from 1980–2015 period, 1.4% per year from 2015 to 2050 and 2015 to 2100, and then dropping to 1.0% from 2100 to 2200 and then 0.7% from 2200 to 2300. 50	

Comment/ Code	Document #002-Environmental Defense Fund and Others	Response
	In the descriptive setting adopted by the IWG (2010), economists have demonstrated that calculating the expected net present value of a project is equivalent to discounting at a declining certainty equivalent discount rate when (1) discount rates are uncertain, and (2) discount rates are positively correlated (Arrow et al., 2014 at 157). Real consumption interest rates are uncertain given that there are no multi-generation assets to reflect long-term discount rates and the real returns to all assets—including government bonds—are risky due to inflation and default risk (Gollier & Hammitt, 2014). Furthermore, recent empirical work analyzing U.S. government bonds demonstrates that they are positively correlated over time; this empirical work has estimated several declining discount rate schedules that the IWG can use (Cropper et al., 2014; 2014; Arrow et al., 2013; Arrow et al., 2014; Jouini and Napp, 2014; Freeman et al. 2015). Currently when evaluating projects, the U.S. government applies the descriptive approach using constant rates of 3% and 7% based on the private rates of return on consumer savings and capital investments. As discussed previously, applying a capital discount rate to climate change costs and benefits is inappropriate (Newell, 2017). Instead, analysis should focus on the uncertainty underlying the future consumption discount rate (Newell, 2017). Past U.S. government analyses (IWG, 2010; IWG, 2013; IWG, 2016) modeled three consumption discount rates reflecting this uncertainty. If the U.S. government correctly returns its focus on multiple consumption discount rates, then the expected net present value argument given above implies that a declining discount rate is the appropriate way to perform discounting. As an alternative, given that the Ramsey discount rate approach is the appropriate methodology in intergenerational settings, the U.S. government could use a fixed, low discount rate as an approximation of the Ramsey equation following the recommendation of Marten et al. (2015); see our discussion on Martin et al. 2015). This is roughly IWG (2010)'s goal for using the constant 2.5% discount rate. If the normative approach to discounting is used in the future (i.e., the current approach of IAMs), economists have demonstrated that an extended Ramsey rule[321] implies a declining discount rate when (1) the growth rate of per capita consumption is stochastic,[322] and (2) consumption shocks are positively correlated over time (or their mean or variances are uncertain) (Arrow et al., 2013; Arrow et al., 2014; Gollier & Hammitt, 2014; Cropper et al., 2014).[323] While a constant adjustment downwards (known as the precautionary effect[324]) can be theoretically correct when growth rates are independent and [321] If the future growth of consumption is uncertainty with mean μ and variance σ^2, an extended Ramsey equation $r = \delta + \eta * \mu - 0.5\eta^2\sigma^2$ applies where r is the social discount rate, δ is the pure rate of time preference, η is the aversion to inter-generational inequality, and g is the growth rate of per capita consumption. Gollier (2012, Chapter 3) shows that we can rewrite the extended discount rate as $r = \delta + \eta * g - 0.5\eta(\eta + 1)\sigma^2$ where g is the growth rate of expected consumption and $\eta + 1$ is prudence. [322] The IWG assumption of five possible socio-economic scenarios implies an uncertain growth path. [323] The intuition of this result requires us to recognize that the social planner is prudent in these models (i.e., saves more when faces riskier income). When there is a positive correlation between growth rates in per capita consumption, the representative agent faces more cumulative risk over time with respect to the "duration of the time spent in the bad state." (Gollier et al., 2008). In other words, "the existence of a positive correlation in the changes in consumption tends to magnify the long-term risk compared to short-term risks. This induces the prudent representative agent to purchase more zero-coupon bonds with a long maturity, thereby reducing the equilibrium long-term rate." (Gollier, 2007). Mathematically, the intuition is that under prudence, the third term in the extended Ramsey equation (*see* footnote 323) is negative, and a "positive [first-degree stochastic] correlation in changes in consumption raises the riskiness of consumption at date T, without changing its expected value. Under prudence, this reduces the interest rate associated to maturity T" (Gollier et al., 2007) by "increasing the strength of the precautionary effect" in the extended Ramsey equation (Arrow et al., 2014; Cropper et al., 2014). [324] The precautionary effect measures aversion to future "wiggles" in consumption (i.e., preference for consumption smoothing) (Traeger, 2014). 51	

Comment/ Code	Document #002-Environmental Defense Fund and Others	Response
	identically distributed (Cropper et al., 2014), empirical evidence supports the two above assumptions for the United States, thus implying a declining discount rate (Cropper et al., 2014; Arrow et al., 2014; IPCC, 2014).[325] We should further expect this positive correlation to strengthen over time due to the negative impact of climate change on consumption, as climate change causes an uncertain permanent reduction in consumption (Gollier, 2009).[326] Several papers have estimated declining discount rate schedules for specific values of the pure rate of time preference and elasticity of marginal utility of consumption (e.g., Arrow et al., 2014), though recent work demonstrates that the precautionary effect increases and discount rates decrease further when catastrophic economic risks (such as the Great Depression and the 2008 housing crisis) are modeled (Gollier & Hammitt, 2014; Arrow et al., 2014). It should be noted that this decline in discount rates due to uncertainty in the global growth path is in addition to that resulting from a declining central growth path over time (Nordhaus, 2014; Marten, 2015).[327] Additionally, a related literature has developed over the last decade demonstrating that normative uncertainty (i.e., heterogeneity) over the pure rate of time preference (δ)—a measure of impatience—also leads to a declining social discount rate (Arrow et al., 2014; Cropper et al., 2014; Freeman and Groom, 2016). Despite individuals differing in their pure rate of time preference (Gollier and Zeckhauser, 2005), an equilibrium (consumption) discount exists in the economy. In the context of IAMs, modelers aggregate social preferences (often measured using surveyed experts) by calibrating the preferences of a representative agent to this equilibrium (Millner and Heal, 2015; Freeman and Groom, 2016). The literature generally finds a declining social discount rate due to a declining collective pure rate of time preference (Gollier and Zeckhauser, 2005; Jouini et al., 2010; Jouini and Napp, 2014; Freeman and Groom, 2016).[328] The heterogeneity of preferences and the uncertainty surrounding economic growth hold simultaneously (Jouini et al., 2010; Jouini and Napp, 2014), leading to potentially two sources of declining discount rates in the normative context. *Declining Rates are Actionable and Time-Consistent* There are multiple declining discount rate schedules from which the U.S. government can choose, of which several are provided in Arrow et al. (2014) and Cropper et al. (2014). One possible declining interest rate schedule for consideration by the IWG is the one proposed by Weitzman (2001).[329] It is [325] Essentially, the precautionary effect increases over time when shocks to the growth rate are positively correlated, implying that future societies require higher returns to face the additional uncertainty (Cropper et al., 2014; Arrow et al., 2014; IPCC, 2014). [326] Due to the deep uncertainty characterizing future climate damages, some analysts argue that the stochastic processes underlying the long-run consumption growth path cannot be econometrically estimated (Weitzman, 2007; Gollier, 2012). In other words, economic damages, and thus future economic growth, are ambiguous. Agents must then form subjectivity probabilities, which may be better interpreted as a belief (Cropper et al., 2014). Again, theory shows that ambiguity leads to a declining discount rate schedule by Jensen's inequality (Cropper et al., 2014). [327] A common assumption in IAMs is that global growth will slow over time leading to a declining discount rate schedule over time; *see* footnote 7. Uncertainty over future consumption growth and heterogeneous preferences (discussed below) would lead to a more rapid decline in the social discount rate. [328] The intuition for declining discount rates due to heterogeneous pure rates of time preference is laid out in Gollier and Zeckhauser (2005). In equilibrium, the least patient individuals trade future consumption to the most patient individuals for current consumption, subject to the relative value of their tolerance for consumption fluctuations. Thus, while public policies in the near term mostly impact the most impatient individuals (i.e., the individuals with the most consumption in the near term), long-run public policies in the distant future are mostly going to impact the most patient individuals (i.e., the individuals with the most consumption in the long-run). [329] Weitzman (2001)'s schedule is as follows: 4% for 1-5 years; 3% for 6-25 years; 2% for 26-75 years; 1% for 76-300 years; and 0% for 300+ years. 52	

Comment/ Code	Document #002-Environmental Defense Fund and Others	Response
	derived from a broad survey of top economists in context of climate change, and explicitly incorporates arguments around interest rate uncertainty.[330] Other declining discount rate schedule include Newell and Pizer (2003); Groom et al. (2007); Freeman et al. (2015). Many leading economists support the United States government adopting a declining discount rate schedule (Arrow et al., 2014; Cropper et al., 2014). Moreover, the United States would not be alone in using a declining discount rate. It is standard practice for the United Kingdom and French governments, among others (Gollier & Hammitt, 2014; Cropper et al., 2014). The U.K. schedule explicitly subtracts out an estimated time preference.[331] France's schedule is roughly similar to the United Kingdom's. Importantly, all of these discount rate schedules yield lower present values than the constant 2.5% discount rate employed by IWG (2010), suggesting that even the lowest discount rate evaluated by the IWG is too high.[332] The consensus of leading economists is that a declining discount rate schedule should be used, harmonious with the approach of other countries like the United Kingdom. Adopting such a schedule would likely increase the SCC substantially from the administration's 3% estimate, potentially up to two to three fold (Arrow et al., 2013; Arrow et al., 2014; Freeman et al., 2015). A declining discount rate motived by discount rate or growth rate uncertainty avoids the time inconsistency problem that can arise if a declining pure rate of time preference (δ) is used. *Circular A-4* cautions that "[u]sing the same discount rate across generations has the advantage of preventing time-inconsistency problems."[333] A time inconsistent decision is one where a decision maker changes his or her plan over time, solely because time has passed. For instance, consider a decision maker choosing whether to make an investment that involves an up-front payment followed by future benefits. A time consistent decision maker would invest in the project if it had a positive net-present value, and that decision would be the same whether it was made 10 years before investment or 1 year before investment. A time inconsistent decision maker might change his or her mind as the date of the investment arrived, despite no new information becoming available. Consider a decision maker who has a declining pure rate of time preference (δ) trying to decide whether to invest in a project that has large up-front costs followed by future benefits. 10 years prior to the date of investment, the decision maker will believe that this project is a relatively unattractive investment because both the benefits and costs would be discounted at a low rate. Closer to the date of investment, however, the costs would be relatively highly discounted, possibly leading to a reversal of the individual's decision. Again, the discount rate schedule is time consistent as long as δ is constant. The arguments provided here for using a declining consumption discount rate are not subject to this time inconsistency critique. First, time inconsistency occurs if the decision maker has a declining pure rate of time preference, not due to a decreasing discount rate term structure.[334] Second, uncertainty [330] Freeman and Groom (2014) demonstrate that this schedule only holds if the heterogeneous responses to the survey were due to differing ethical interpretations of the corresponding discount rate question. A recent survey by Drupp et al. (2015) – which includes Freeman and Groom as co-authors – supports the Weitzman (2001) assumption. [331] The U.K. declining discount rate schedule that subtracts out a time preference value is as follows (Lowe, 2008): 3.00% for 0-30 years; 2.57% for 31-75 years; 2.14% for 76-125 years; 1.71% for 126- 200 years; 1.29% for 201- 300 years; and 0.86% for 301+ years. [332] Using the IWG's 2010 SCC model, Johnson and Hope (2012) find that the U.K. and Weitzman schedules yield SCCs of $55 and $175 per ton of CO_2, respectively, compared to $35 at a 2.5% discount rate. Because the 2.5% discount rate was included by the IWG (2010) to proxy for a declining discount rate, this result indicates that constant discount rate equivalents may be insufficient to address declining discount rates. [333] *Circular A-4* at 35. [334] Gollier (2012) states "It is often suggested in the literature that economic agents are time inconsistent if the term structure of the discount rate is decreasing. This is not the case. What is crucial for time consistency is the constancy of the rate 53	

Comment/ Code	Document #002-Environmental Defense Fund and Others	Response
	about growth or the discount rate avoids time inconsistency because uncertainty is only resolved in the future, after investment decisions have already been made. As the NAS (2017) notes, "One objection frequently made to the use of a declining discount rate is that it may lead to problems of time inconsistency....This apparent inconsistency is not in fact inconsistent....At present, no one knows what the distribution of future growth rates...will be; it may be different or the same as the distribution in 2015. Even if it turns out to be the same as the distribution in 2015, that realization is new information that was not available in 2015."[335] We should note that time-inconsistency is not a reason to ignore heterogeneity (i.e., normative uncertainty) over the pure rate of time preference (δ). If the efficient declining discount rate schedule is time-inconsistent, the appropriate solution is to select the best time-consistent policy. Millner and Heal (2014) do just this by demonstrating that a voting procedure – whereby the median voter determines the collective preference – is: (1) time consistent, (2) welfare enhancing relative to the non-commitment, time-inconsistent approach, and (3) preferred by a majority of agents relative to all other time-consistent plans. Due to the right skewed distribution of the pure rate of time preference and the social discount rate as shown in all previous surveys (Weitzman, 2001; Drupp et al., 2015; Howard and Sylvan, 2015), the median is less than the mean social discount rate (and pure rate of time preference); the mean social discount rate is what holds in the very short-run under various aggregation methods, such as Weitzman (2001) and Freeman and Groom (2015). Combining an uncertain growth rate and heterogeneous preference together implies a declining discount rate starting at a lower value in the short-run. In addition to the reasons discussed earlier in the comments, this is another reason to exclude a discount rate as high as 7%. *There is an economic consensus on the appropriateness of employing a consumption discount rate (and the inappropriateness of a capital discount rate) in the context of climate change* There is a strong consensus among economists that it is theoretically correct to use consumption discount rates in the intergenerational setting of climate change, such as in the calculation of the SCC. Similarly, there is a strong consensus that a capital discount rate is inappropriate according to "good economics" (Newell, 2017).[336] This consensus holds across panels of experts on the social cost of carbon (NAS, 2017); surveys of experts on climate change and discount rates (Weitzman, 2001; Drupp et al., 2015; Howard and Sylvan, 2015; and Pindyck, 2016); the three most commonly cited IAMs employed in calculating the federal SCC; and the government's own analysis (IWG, 2010; CEA, 2017). For more analysis of this issue, see the discussion in the main body our Comments on the inappropriateness using a discount rate premised on the return to capital in intergenerational settings. of impatience, which is a cornerstone of the classic analysis presented in this book. We have seen that this assumption is compatible with a declining monetary discount rate." [335] NAS Second Report, *supra* note 110, at 182. [336] The former co-chair of the National Academy of Sciences' Committee on Assessing Approaches to Updating the Social Cost of Carbon – Richard Newell (2017) – states that "[t]hough the addition of an estimate calculated using a 7 percent discount rate is consistent with past regulatory guidance under OMB *Circular A-4*, there are good reasons to think that such a high discount rate is inappropriate for use in estimating the SCC...It is clearly inappropriate, therefore, to use such modeling results with OMB's 7 percent discount rate, which is intended to represent the historical before-tax return on private capital...This is a case where unconsidered adherence to the letter of OMB's simplified discounting approach yields results that are inconsistent with and ungrounded from good economics." 54	

Comment/ Code	Document #002-Environmental Defense Fund and Others	Response
	Technical Appendix: Damage Literature The Fourth National Climate Assessment was recently published by the U.S. Global Change Research Program.[337] In addition to reviewing that report and the literature on U.S. damages cited therein, BLM must review the following literature, which contains some of the most up-to-date estimates of U.S. damages from climate change. ***Overall Damage Estimates and Review Articles*** Solomon Hsiang et al., *Economic Damage from Climate Change in the United States*, 356 SCIENCE. 1362–1369 (2017). Delavane Diaz & Frances Moore, *Quantifying the economic risks of climate change*, 7 NAT. CLIM. CHANG. 774–782 (2017). Roberto Roson & Martina Sartori, *Estimation of Climate Change Damage Functions for 140 Regions in the GTAP 9 Database*, 1 J. GLOB. ECON. ANAL. 78–115 (2016). Derek Lemoine & Sarah Kapnick, *A top-down approach to projecting market impacts of climate change*, NAT. CLIM. CHANG. 7 (2015). Marshall Burke, Solomon M. Hsiang & Edward Miguel, *Global non-linear effect of temperature on economic production*, 527 NATURE 235–239 (2015). ***Agriculture Damages*** Wolfram Schlenker, *Crop Responses to Climate and Weather: Cross-Section and Panel Models*, *in* CLIMATE CHANGE AND FOOD SECURITY 99–108 (David Lobell & Marshall Burke eds., 2010). David B. Lobell, Wolfram Schlenker & Justin Costa-Roberts, *Climate Trends and Global Crop Production Since 1980*, 333 SCIENCE (80). (2011). Olivier Deschênes & Michael Greenstone, *The Economic Impacts of Climate Change: Evidence from Agricultural Output and Random Fluctuations in Weather: Reply*, 102 AM. ECON. REV. 3761–3773 (2012). Marshall Burke & Kyle Emerick, *Adaptation to Climate Change: Evidence from US Agriculture*, 8 AM. ECON. J. ECON. POLICY 106–140 (2016). Christopher Severen, Christopher Costello & Olivier Deschênes, *A Forward Looking Ricardian Approach: Do Land Markets Capitalize Climate Change Forecasts?*, 22413 NBER WORK. PAP. 46 (2016). Wolfram Schlenker, Michael J. Roberts & David B. Lobell, *US maize adaptability*, 3 NAT. CLIM. CHANG. 690–691 (2013). Wolfram Schlenker & Michael J Roberts, *Nonlinear temperature effects indicate severe damages to U.S. crop yields under climate change.*, 106 PROC. NATL. ACAD. SCI. 15594–8 (2009). Frances C Francis C Moore, Uris Lantz C Baldos & Thomas Hertel, *Economic impacts of climate change on agriculture: a comparison of process-based and statistical yield models*, 12 ENVIRON. RES. LETT. 1–9 (2017). F. C. Moore et al., *New Science of Climate Change Impacts on Agriculture Implies Higher Social Cost of Carbon*, WORK. PAP. 1–43 (2017). [337] https://science2017.globalchange.gov/ 55	

Comment/ Code	Document #002-Environmental Defense Fund and Others	Response
	Forestry Damages Christopher Guo & Christopher Costello, *The value of adaption: Climate change and timberland management*, 65 J. ENVIRON. ECON. MANAGE. 452–468 (2013). ***Effects on Health and Mortality*** Alan Barreca et al., *Adapting to climate change: The remarkable decline in the U.S. temperature-mortality relationship over the 20th century*, 124 NBER WORK. PAP. 46 (2016). Garth Heutel, Nolan H Miller & David Molitor, *Adaptation and the mortality effects of temperature across U.S. climate regions*, No. 23271 NBER WORK. PAP. 58 (2017). Jan C. Semenza et al., *Climate change and microbiological water quality at California beaches*, 9 ECOHEALTH 293–297 (2012). ***Effects on Labor Productivity and Learning*** Joshua Graff Zivin & Matthew MJ Neidell, *Temperature and the allocation of time: Implications for climate change*, 32 J. LABOR ECON. 1–26 (2010). M. Donadelli et al., *Temperature Shocks and Welfare Costs*, J. ECON. DYN. CONTROL (2017). Adam Isen & W Reed Walker, *Heat and Long-Run Human Capital Formation*, 26 (2017). Geoffrey Heal, Jisung Park & Nan Zhong, *Labor Productivity and Temperature*, 1–33 (2017). Joshua Graff Zivin, Solomon Hsiang & Matthew Neidell, *Temperature and human capital in the short- and long-run*, J. ASSOC. ENVIRON. RESOUR. ECON. 694177 (Forthcoming) ***Sea Level Rise*** Mathew E. Hauer, Jason M. Evans & Deepak R. Mishra, *Millions projected to be at risk from sea-level rise in the continental United States*, advance on NAT. CLIM. CHANG. (2016). 56	

Comment/ Code	Document #003-U.S. EPA	Response
	UNITED STATES ENVIRONMENTAL PROTECTION AGENCY REGION 8 1595 Wynkoop Street Denver, CO 80202-1129 Phone 800-227-8917 www.epa.gov/region08 Ref: 8EPR-N FEB 20 2018 David Berry, Regional Director OSMRE Western Region 1999 Broadway, Suite 3320 Denver, Colorado 80202 Dear Director Berry: The U.S. Environmental Protection Agency Region 8 has reviewed the U.S. Department of the Interior Office of Surface Mining Reclamation and Enforcement December 2017 Draft Environmental Impact Statement (EIS) for the Western Energy Company's Rosebud Mine Area F Project (CEQ No. 20170249), pursuant to Section 309 of the Clean Air Act (CAA) and the National Environmental Policy Act (NEPA). The Rosebud Mine Area F open pit coal mine will disturb 4,260 acres near Colstrip, Montana. The coal will be trucked to the existing Colstrip and Rosebud power plants. We appreciate OSMRE's effort to meet with EPA prior to its publishing the notice of availability of the Draft EIS. The visit and the following correspondence were informative and improved our understanding of the proposed project. The EPA is rating the Proposed Action (Alternative 2) as Environmental Concerns – Insufficient Information (EC-2). The description of the EPA's rating system is available at: http://www2.epa.gov/nepa/environmental-impact-statement-rating-system-criteria. The rating is based on: (1) the Draft EIS supporting analyses found in the mine permit application was not available during the Draft EIS review period; (2) the information provided is not adequate to determine that the project reclamation requirements can be met; and (3) the air quality assessment does not provide enough information on the model input assumptions and configuration. Our recommendations to resolve these concerns in the Final EIS are provided for your consideration in the enclosure. We appreciate the opportunity to participate in the review of this project and are committed to working with you as you prepare the Final EIS. If we may provide further explanation of our comments, please contact me at (303) 312-6704, or your staff may contact Shannon Snyder, at (303) 312-6335 or snyder.shannon@epa.gov. Sincerely, Philip S. Strobel Director, NEPA Compliance and Review Program Office of Ecosystems Protection and Remediation Enclosure cc: Nicole Baumann, ERO Resources Corporation	

Comment/ Code	Document #003-U.S. EPA	Response
3-1 (2102) 3-2 (9000) 3-3 (2300) 3-4 (7004) 3-5 (1202) 3-6 (2302)	**ENCLOSURE** *General Comments.* The Draft EIS states the existing Rosebud mine and proposed expansion to Area F delivers between 7.7 and 9.95 metric tons of coal annually to the Colstrip Power Plant, and 300,000 tons of "waste coal" annually to the Rosebud Power Plant. The Colstrip Power Plant has four coal-fired electric generating units that burn low sulfur, subbituminous coal. We note the Draft EIS mentions a 2016 Administrative Order on Consent which requires Units 1 and 2 cease operations by 2022; however, Colstrip Units 3 and 4 would continue to operate. On December 5, 2017, the Washington Utilities and Transportation Commission approved a settlement with Puget Sound Energy that includes an agreement with the Commission that it be financially ready to decommission the remaining units, Units 3 and 4, by 2027. The EPA recommends OSMRE address whether the December 2017 decision affects the proposed project. Throughout the Draft EIS there are references to the mine permit application package (PAP) to support descriptions of the affected environment and subsequent impact analyses. It is difficult to evaluate the information provided in the Draft EIS without access to the supporting analyses found in the PAP. The link to the Montana Department of Environmental Quality website that houses the pending permit application includes only the first page of the application and correspondence between the State and Western Energy. None of the PAP exhibits listed in Appendix A of the Draft EIS appear to be available online. The EPA recommends these documents be made available as soon as possible, and for future projects it be made available during the Draft EIS public review period. The EPA supports the additional environmental protection measures proposed in Alternative 3. The Draft EIS notes these measures are in addition to what is required under the Montana Strip and Underground Mine Reclamation Act. According to the Draft EIS, 8.38 acres of wetlands would be directly impacted by mining activities in the analysis area. In an already arid environment, higher temperatures and lower moisture could impact the success of reestablishing and rehabilitating water dependent riparian ecosystems during reclamation. The additional measures included in Alternative 3: enhancement of wetland habitats, pit water measures, additional groundwater monitoring, and the additional requirements for the wetland mitigation plan (Sections 2.5.2.1 and 2.5.2.2), would protect downslope waterbodies and water dependent riparian ecosystems during active mining and reclamation. *Reclamation.* Adequate financial assurance is key to ensuring that project reclamation requirements are met and that projects do not cause long term environmental impacts. We note from Figure 3 and observations via aerial photography there is a substantial amount of reclamation that will need to take place in the coming years. We recommend including information about financial assurance for the overall reclamation of the Rosebud mine (Section 1.6) in the Final EIS. For example, clarifying in the Final EIS whether there is a separate reclamation bond or insurance policy for each mining area or if the mine is bonded as a whole. In addition, the Draft EIS describes the impact future weather conditions may have on the project area. Long term weather conditions have the potential to either positively or negatively impact the success of surface reclamation and revegetation efforts at the proposed mine expansion. Higher temperatures and lower moisture conditions in particular would pose challenges to reclamation efforts that are important to protecting soils, water and wildlife habitat. The EPA recommends the Final EIS and ROD consider if 2	**3-1 Response:** The December 2017 decision by the Washington Utilities and Transportation Commission does not establish a date upon which Units 3 and 4 will cease operations. The analysis in the EIS uses available information which currently does not provide a known end date for the operation of Units 3 and 4 at the Colstrip Power Plant. **3-2 Response:** The size of the permit application package prevented DEQ from publishing the package in its entirety; however, the package was available upon request and a note on the DEQ website indicated its availability. All PAP documents can be requested at the following DEQ website: http://deq.mt.gov/Public/RequestPublicRecords **3-3 and 3-4 Response:** Potential impacts on surface and ground water resources are disclosed in Section 4.7.4 and Section 4.8.4 of the EIS, respectively. Thank you for your comment. **3-5 Response:** As shown in **Table 5** of the EIS, bonds are currently held for each permit area. **3-6 Response:** Reclamation is an ongoing process of implementation and monitoring. See **Section 2.4.7.4, Proposed Action of the EIS** for monitoring plans (vegetation and wildlife assessment, etc.). The use of predominantly native species in the reclamation plan and reestablishing the community types that are present prior to mining is the best way to ensure that this area succeeds in the future. Any alteration to the water regime for any given growing season would benefit species that are not locally adapted to this region and, therefore, negatively impact reclamation of those communities in the project area and eventually on adjacent undisturbed lands (see **Section 4.10.3.1** in the EIS). The bond release process has multiple avenues to address protecting the landscape from soil loss by both wind and water erosion: ARM 17.24.1116(6)(b)(iv) and ARM 17.24.1116(6)(c)(ii) and (iii). Since those phases cannot be approved if there are soil loss concerns, adjusting the timeframe for holding bonds would not have an impact on reclamation success. Please refer to Section 1.6.4 for a description of the criteria for bond release.

Comment/ Code	Document #003-U.S. EPA	Response
3-6, cont'd (2302)	additional measures to assure that reclamation will be successful are warranted. To address these challenges, OSMRE might consider a longer timeframe before releasing the reclamation bonds, reserving reclamation funds to repair erosion damage from major precipitation events, and supplemental water to reestablish vegetation during drought periods.	
3-7 (6207)	*Air Emissions Mitigation.* We note that in the Draft EIS, the State of Montana's air quality permit has a general clause limiting nitrogen dioxide emissions from blasting on an as needed basis. It is not clear if there are best management practices that would be implemented to comply with the State's air quality permit. We recommend the Final EIS include information and mitigation measures to protect human health from nitrogen dioxide emissions from blasting. Larger nitrogen dioxide emissions from blasting can be visible and are often described as an orange cloud. We have been working with the mining companies in the Powder River Basin in Wyoming to implement mitigation measures to reduce or eliminate nitrogen dioxide clouds, such as reducing the size of cast blasting and avoiding blasting during wet conditions. The measures in Wyoming are largely voluntary, however they have been useful in reducing the size and frequency of the orange cloud to protect travelers and ranchers around the mining areas. For an example of an EIS addressing this issue, please see the BLM Wyoming Wright Area Coal Lease Application EIS. The Final EIS is on the BLM ePlanning website. [1]	**3-7 Response:** The mine is subject to DEQ air quality regulations ARM. 17.8.304 and 17.8.308(1) relating to fugitive particulate matter emissions. Pursuant to ARM 17-8-304, fugitive dust emissions would need to meet an operational visible opacity of standard or 20 percent or less averaged over 6 consecutive minutes. The same 20 percent (6 consecutive minute) average applies to the mine pursuant to ARM 17.8.308(1). MSUMRA requires that all surface areas associated with SCM's operations be stabilized and protected to effectively control air pollution. Section 82-4-231(10)(m), MCA. Operators are required to employ fugitive dust control measures in accordance with 82-4-231(10)(m), MCA, the operator's air quality permit, and applicable federal and state air quality standards (ARM 17.24.761(1); 17.24.311(1)). Monitoring to evaluate the effectiveness of the fugitive dust control practices must also be conducted (ARM 17.24.761(2)). See also **Section 2.4.3.7** in the EIS; all residents and owners are notified prior to blasting. In addition, the air modeling, which included blasting, showed that air impacts were below the NAAQS. NO_2 from blasting can also be associated with excessive dust from blasting. Both are and will be managed under conditions already included in Air Quality Permits that are and will be in place. Enforceable conditions required by ARM 17.8.749, 17.8.752 and 17.8.308, specifically require: h. Conduct blasting operations in such a manner as to minimize emissions, prevent overshooting, provide stemming of holes, and minimize area to be blasted; k. Other control practices which may be determined by the Department to be necessary. These conditions already limit blast conditions at the site by making sure excessive explosive is not being used, providing inert material above the explosive to the top of the bore hole to properly manage the detonation and therefore further allow minimal use of explosive, and to minimize the area of each planned blast. It is fully expected that these conditions, if followed, would prevent conditions described by EPA as an orange cloud. Additionally, conducting blasting operations in such a manner as to minimize emissions also are the conditions largely described and undertaken by Western Energy BMP's including dewatering of blast holes and blasting within a short period of time following hole loading. Finally, as provided for in "k", the Department may determine additional control practices if it determines necessary.
3-8 (6201)	*Air Quality Impact Analysis.* The EPA appreciates the effort and resources used to conduct air quality modeling for the Western Energy Company's Rosebud Mine Area F project. While the air quality monitoring and modeling indicates that adverse air quality impacts would not be expected as a result of the Area F expansion, we note that the air quality assessment does not provide enough information on the model input assumptions and configuration. For future NEPA projects, we are interested in coordinating with you early in the NEPA process to develop a model platform for the air quality assessment. Several federal and state partners have developed a guidance document[2] to assist projects in utilizing available Photochemical Grid Modeling (PGM) platforms in NEPA and other air quality projects. This document could be valuable to consider in future projects to reduce resources and perform a more robust PGM modeling analysis. We are available to discuss this guidance document and our other concerns in more detail, if desired. [1] https://eplanning.blm.gov/epl-front-office/projects/nepa/67033/82290/97260/01WrightCoalVol1.pdf [2] Intermountain-West Data Warehouse – Western State Air Quality Study: http://views.cira.colostate.edu/TSDW/Resources/ProceduralDocuments/FINAL_NEPA_IWDW_Process_Outline_Sept19_2016.pdf 3	**3-8 Response:** Additional information on the model input assumptions and configuration has been included in the EIS. OSMRE will consider coordinating with EPA in the future for air quality analyses.

Comment/ Code	Document #004-W. Peyton Gardner	Response
	004 **Expert Opinion:** W. Payton Gardner 3/5/2018	
4-1 (6602, 6702)	**Subject Matter:** Here I will comment on the hydrology and hydrogeology of the Rosebud mine proposal Area F application permit. In particular I will comment on the effects of Area F expansion on the hydrologic balance, stream flow generation and water quality in the West Fork Armells Creek and the potential for cumulative impacts on the main stem of Armells Creek. In general, mining will remove portions of the Rosebud coal aquifer and replace it with spoils. This will have large impact on: 1) the subsurface structure of the watershed, changing the stream flow generation processes, 2) the quantity and quality of groundwater discharge to the West Fork alluvial system, directly affecting length, duration and quality of surface flow, 3) the existence and location of local wetlands and 4) the long-term salinity flux in the West Fork Armells Creek and the Armells Creek main stem.	**4-1 Response:** Impacts on surface water and groundwater hydrology are discussed in the Draft EIS in **Section 4.7** and **4.8.** Comment Responses 4-3 through 4-13 address the specific topics discussed in this comment.
4-2 (6602, 6702)	**Hydrologic Balance and Stream Flow:** Stream flow is generated from three major sources, 1) Deep Bedrock Groundwater, 2) Shallow Soil Flow and 3) Direct Overland Runoff. The partitioning of water between these reservoirs, and the characteristic of storage and release of water from each reservoir determine the stream response. Stream flow generation and stream flow response will be affect as a result of mining by altering partitioning and storage and release from all three of these reservoirs. Much of the discussion of stream flow generation and hydrologic balance in the EIS refers to surface runoff of precipitation as the major source of streamflow in West Fork Armells Creek (e.g. pg 511 DEIS), and infiltration excess is often invoked as the cause of overland flow initiation. Infiltration excess is a concept where the precipitation rate exceeds the infiltration rate of soil at the surface, thus water ponds at surface and runs off over the surface. This concept was first introduced by Robert Horton in 1933. However, in almost all subsequent watershed hydrology studies, infiltration excess has never been observed. The process most commonly causing overland flow is "saturation excess", where soils become fully saturated to the surface, and then increased precipitation then flows overland to the stream. The difference is subtle but extremely important, since in saturation excess watersheds fill from the bottom up and then spill. Rather than spill during any extreme precipitation event. This explains the hydrograph dynamics observed in the study location, where relatively small precipitation event can cause large responses in spring and early summer, and very low responses in late July to large precipitation events (pg 212 DEIS). The concept of saturation excess is important when considering stream flow response to mining. In order to generate overland flow, the soil above a lower conductivity and porosity bedrock, must fill before overland flow can begin. Where no bedrock exists, as is the case for mined areas, saturation excess will likely never occur greatly limiting overland flow.	**4-2 Response:** Impacts to the quantity of runoff and surface water flow resulting from runoff are discussed in the Draft EIS in **Section 4.7.3.2**. Comment Response 4-3 addresses shallow soil flow and direct overland runoff, and Comment Responses 4-4 through 4-7 address deep bedrock groundwater.
4-3 (6602, 6702)	The vast majority of hydrologic scientific research shows that hydrograph response to precipitation input is due to the saturation and rapid lateral redistribution of soil water through soil flow. It is also being increasing recognized that soil saturation state is tightly coupled to the	**4-3 Response:** Impacts to runoff and surface water flow resulting from runoff are discussed in the Draft EIS in **Section 4.7.3.2**. While spoil may generally have a greater vertical percolation rate than the pre-mine bedrock, spoil has a much lower conductivity and porosity than the soil placed over it. Runoff from reclaimed areas is frequently observed at the Rosebud Mine, and other reclaimed mines, thus it is apparent that the spoil/soil boundary functions similarly to the bedrock/soil boundary hydrologically when producing runoff. Any long-term reductions in runoff resulting from the greater vertical permeability of the spoil are expected to be negligible. Also see Comment Code 6602.

Comment/ Code	Document #004-W. Peyton Gardner	Response
4-4 (6602, 6702) 4-5 (6602, 6702) 4-6 (6602, 6702) 4-7 (6602, 6702)	bedrock beneath it. In general, you must have a lower permeability, lower porosity bedrock underlying a soil zone in order for a soil to saturate and begin lateral flow. By removing the underlying bedrock of the overburden and replacing it with a homogenous spoils zone, lateral soil flow will be drastically reduced at the site. Finally, deep bedrock groundwater discharge supplies water to shallow soils at the toe of the slope, the alluvial system, and base flow of surface water throughout the year. This baseflow discharge is critically important in supply long term storage release to the alluvial system, controlling the antecedent moisture conditions, and the total amount of water needed as input before initiating stream flow. In the study area, the principal component of groundwater discharge to the alluvial system in the Rosebud Coal. This evidenced by the higher continuous transmissivity of this formation, the location of wetlands near Rosebud Coal outcrop, and the water quality of alluvial groundwater, with a median TDS of 3120 mg/l (DEIS pg 264), which much closer to Rosebud (median TDS 2,965 mg/l – DEIS pg 267), than overburden deposits with a median TDS of 4150 mg/l. A simple mass balance mixing calculation using the above median numbers indicates that 86% percent of alluvial water must be derived from a water with the median composition of Rosebud coal. This chemical mass balance is backed up by physical hydrologic calculations. The annual average runoff generated by the study area derived from the USGS gauge is roughly 72 GPM (PHC pg. 11). The total volume of discharge through the Rosebud coal in the study area, which must discharge to the alluvial system, is 100 gpm (DEIS pg 258). Thus, the Rosebud coal discharge account for a significant proportion of the alluvial system discharge. By dewatering and removing the Rosebud coal, a major piece of the long term alluvial budget will be reduced for a least a period of several decades. I calculate an extremely rough minimum replacement period by estimating the volume of water removed by mining 2,179 acres of Rosebud coal (average depth 18.6 ft.). The total water removed is given by: $V_w = \phi * V_t$ Where ϕ is the coal macro porosity, here estimated as 0.10. The time to replace the mined water is estimated as time needed for the total discharge through the Rosebud in the study area (100 gpm DEIS pg 258), here calculated as ~30 years. This is the minimum time required to replace the mined water and does not account losses of storage due to drainage of the Rosebud coal during the mining process. The above calculation indicates that we can expect diminished baseflow and alluvial groundwater levels in West Fork Armells Creek for a minimum of 30 years after mining ceases. Sustained stream flow will only occur when alluvial water levels rise above the channel elevation and are thus strongly affected by the amount and volume of water discharging from the adjacent bedrock and soil into the alluvial system. In fact, the alluvial groundwater and stream water are highly connected and represent roughly the same water. This is evidenced by the very close water quality between alluvial groundwater and stream water (DEIS pg 216-234). Given the above analyses, it is my professional opinion, that the potential for long term impacts on wetlands and streamflow generation from Area F expansion are large. The likely impacts are loss of wetlands in the mined area decades, less frequent discharge in reaches downstream of the mined area, a transition of reaches which border on perennial to intermittent and ephemeral status, a reduction in overall stream flow runoff generation for at least a period of several decades. After spoils water is fully recharged, the stream flow dynamics will be greatly	**4-4 Response**: Bedrock groundwater contributions to streams in the analysis area are discussed in the Draft EIS in Section 3.7.5.2. **4-5 Response**: The hydrologic properties of the Rosebud Coal are described in the Draft EIS in **Section 3.8.2.2** and the conceptual model of groundwater flow in the project area is described in **Section 3.8.3**. The simple two end-member mass balance mixing analysis presented in this comment is not appropriate to determine the source of the alluvial groundwater. In addition to inputs from overburden and the Rosebud Coal in the project area, alluvial groundwater is also sourced from direct precipitation infiltration and infiltration of stream flow from runoff. Additionally, the alluvial material consists of unconsolidated gravel, sand, silt, and clay which can react geochemically with groundwater, altering its chemistry. Without more detailed knowledge of the volume and quality of these additional inputs to the alluvial groundwater and the chemical reactions which occur, there is no way to estimate the proportion of alluvial water which is derived from the Rosebud Coal. The runoff estimate of 72 gpm derived from the USGS gauge is for surface water flow only and does not consider underground flow in the alluvial system. This is only used as an estimate of the surface water runoff from the Area F Permit area and does not include contributions from the portions of the watersheds upstream from Area F (149 acre-feet or ~92 gpm, PAP Appendix O, p.13), or represent an estimate of the total streamflow or alluvial system flux at the downstream permit boundary. The total volume of discharge through the Rosebud Coal was overestimated in the Draft EIS as 100 gpm by using the mean hydraulic conductivity instead of the median. The median is a more accurate predictor of the true central tendency of parameters, such as permeability, which tend to be log-normally distributed. The median transmissivity of the Rosebud Coal is 4 ft^2/d (PAP Appendix B, p. 27), which assuming an average thickness of 18.6 ft, results in a hydraulic conductivity of 0.23 ft/d. This is an order of magnitude lower than the mean value of 2.8 ft/d used to derive the 100 gpm estimate. Using the results of the groundwater model, "the total estimated flow in the Rosebud Coal seam through the proposed Area F mining area is about 15 gpm" (PAP Appendix B, p. 28). The Final EIS will be edited to use the more accurate flow estimate from the PAP. Additionally, not all water which flows through the Rosebud Coal in Area F must discharge to the alluvial system. Discharge to the alluvial system would only occur where the Rosebud Coal subcrops in contact with alluvial deposits. Where the Rosebud Coal subcrops in upland areas, the groundwater discharge is most likely lost to evapotranspiration. When considering all available information, and using the most accurate estimates of flow available, contributions from the Rosebud Coal groundwater to the total alluvial system discharge are most likely minor. **4-6 Response**: It is unclear from the comment how the ~30-year estimate for replacing the mined water is derived. Using the numbers and formula provided results in an estimate of ~25 years for 100 gpm to replace the water stored in an 18.6 ft thick aquifer with a porosity of 0.10 covering 2,179 acres. Volume of water: 2,179 ac * 43,560 ft^2/acre * 18.6 ft * 0.10 * 7.48 gal/ ft^3 = 1,320,564,577 gallons Time to replace: 1,320,564,577 gal / 100 gal/min / 1,440 min/d / 365.25 d/yr = 25.11 years Regardless of the discrepancy in calculations, the Draft EIS (Section 4.8.3.1, p. 531) describes drawdown of groundwater continuing for greater than 50 years and **Section 4.7.3.2** of the Draft EIS describes the impacts on baseflow as long term. **4-7 Response:** The Draft EIS discusses the long-term impacts on wetlands and streams in **Section 4.7.3.2** and **Section 4.11.3.1**. Wetlands and intermittent stream reaches adjacent to mining are anticipated to receive reduced contributions from baseflow until groundwater levels recover.

Comment/ Code	Document #004-W. Peyton Gardner	Response
4-8 (6602, 6702)	changed by the changing the subsurface structure of the watershed. It is not only the topography but the underlying subsurface structure which controls the stream flow response. These effects would be expected to by indefinite and long-term.	**4-8 Response:** Long term impacts to stream flow are discussed in the Draft EIS in **Section 4.7.3.2**.
4-9 (6602, 6702)	**Water Quality Effects:** Soils water has 50-200% higher TDS than Rosebud aquifer water (DEIS pg 519). Once the regional hydrologic gradient has reestablished itself, the main source of baseflow discharge in the study area will flow through the spoils and discharge to the alluvial system. This has major implications for the long-term salinity budget. The long-term effect will be that alluvial groundwater and surface will increase in TDS significantly due to the contribution of spoils water to the watershed budget.	**4-9 Response:** The impacts from changes in groundwater TDS on surface water and alluvial groundwater are discussed in the Draft EIS in **Section 4.7.3.2** and **Section 4.8.3.1**.
4-10 (6602, 6702)	Given the similarity of the TDS in Rosebud, alluvial groundwater and stream water in the study area, it is clear the Rosebud derived water is a dominant control on the water quality of the alluvial system. After mining, the water formerly derived from Rosebud Coal will discharge through spoils and thus have much higher TDS.	**4-10 Response:** The conclusion that Rosebud derived water dominates the alluvial system cannot be supported by similarities in TDS alone. See comment response 4-5. Postmining spoil groundwater quality is described in the Draft EIS in **Section 4.8.3.1**.
4-11 (6602, 6702)	"After nearly 40 years of monitoring, there is no clear indication that TDS concentrations in the spoil have reached equilibrium or have shown decreases. Possible adverse effects of discharges from spoil on the water quality of down slope streams may increase over time. It is not known how long it would take for the quality of water in spoil to eventually improve as soluble salts and metals are flushed from the system." DEIS pg 519 Thus, we can expect long term increases in salinity of alluvial groundwater and stream water to the system.	**4-11 Response:** Long term increases in the salinity of alluvial groundwater and stream water adjacent to mining is discussed in the Draft EIS in **Section 4.7.3.2** and Section **4.8.3.1**.
4-12 (6602, 6702)	Using hydrologic and chemical mass balance calculations, it is clear that Rosebud discharge is a significant and major source of discharge to the basin and accounts for the majority of the run off generation in study area. Using the runoff calculation for the area from the PHC pg 11 and pg 13, Rosebud discharge is equal to >90% of runoff generation in the permit area and >25% of all runoff generation for the entire watershed upstream of the downstream boundary of the permit area. Given that the TDS increase in this component will be at least 50% and up to 200%, that this represents a large source of water to the alluvial system, and the lack of large sources of water and or salinity downstream, it is likely that changes in salinity would be significant at the confluence with the East Fork Armells Creek and effect the main stem of Armells Creek. Certainly, the potential for cumulative impact to the full main stem of Armells Creek should be better quantified and studied.	**4-12 Response:** It is unclear from the comment how the values of >90% and >25% contribution from the Rosebud Coal to runoff generation were derived. Using the values provided or referenced in these comments (Rosebud discharge = 100 gpm, Area F runoff = 72 gpm, upstream runoff = 92 gpm), results in the Rosebud contribution being 139% for the permit area and 61% of the entire watershed at the permit boundary. However, as described in comment response 4-5, these values are not accurate or are applied improperly. Substituting the Rosebud discharge value from the groundwater model of 15 gpm results in values of 21% and 9%. As noted in comment response 4-5, the alluvial groundwater flux is not included in the USGS estimates, thereby underestimating the total alluvial system discharge and overestimating the proportion of the contribution from the Rosebud Coal. When considering all available information, and using the most accurate estimates of flow available, contributions of salinity from the spoil groundwater to alluvial groundwater and surface water downstream near the confluence of West Fork Armells Creek with East Fork Armells Creek would be insignificant.
4-13 (6602, 6702)	The increase in TDS is likely to be long term. Using my minimum refill time, I estimate 30 years to fill one pore volume. It is likely that at least 2 pore volumes must be flushed before the concentration would be expected to start declining assuming no addition of salts from above (DEIS pg 533), which means a minimum of 90 years before concentrations would be expected to start declining. Given the lack of subsurface structure discussed previously, soil flow in the spoils will be downward to the saturated zone thus leaching salts vertically downward through the spoils. Given the low recharge rate <0.4 in/year (Appendix I) this downward leakage of salts would add increase TDS in the spoils water for much longer than a century.	**4-13 Response:** The Draft EIS describes postmine spoil groundwater quality in **Section 4.8.3.1**. Due to the expected long-term changes in water quality within the mine footprint, spoil groundwater quality impacts in the mine footprint were listed as irreversible and irretrievable commitments of resources in the Draft EIS **Section 4.8.5**.

Comment and Code	Document #004-W. Peyton Gardner	Response
4-14 (6602, 6702) 4-15 (6602, 6702)	**Summary:** Mining directly changes the subsurface structure and function of the study area. This will result in long term changes in the stream flow generation and water quality in the West Fork Armells Creek. Wetlands distribution and stream flow duration and timing will be negatively impacted for at least several decades as regional flow re-establishes itself. After this, stream flow dynamics and watershed responses will be permanently altered due to the lack of structure in the spoils hill slopes. As regional flow re-establishes itself, baseflow discharge from the Rosebud Coal, through the spoils aquifer, to the adjacent alluvium will cause a long-term and significant increase in the salinity of water in the West Fork Armells Creek alluvial system. It is likely this increase in salinity will be significant far down stream, impact the main stem of Armells creek and potentially cause cumulative impacts with the salinity increases from mining in the East Fork Armells Creek. **References:** PHC –Appendix O: Probable Hydrologic Consequences Area F (PHC), Western Energy Company, 2017 DEIS – Western Energy Company's Rosebud Mine Area F Draft Environmental Impact Statement (DEIS), Montana Department of Environmental Quality, 2017 Appendix I - Western Energy - Rosebud Mine Ground-Water Model Report for Area F Permit. – Nicklin Earth and Water, 2011	**4-14 Response:** Impacts to wetlands and stream flow were discussed in the Draft EIS in **Section 4.11.3.1** and **Section 4.7.3.2**. Comment responses 4-3 through 4-8 address changes to stream flow. Comment response 4-7 addresses changes to wetlands. **4-15 Response**: Impacts to surface water and groundwater quality are discussed in the Draft EIS in **Section 4.7.3.2** and **Section 4.8.3.1**. Comment responses 4-9 through 4-13 address impacts to water quality in spoil and the alluvial system.

Comment/ Code	Document #175-Kromkowski, Francis (SEE ALSO, FORM C)	Response
	175 Comment [624] submitted 2/15/2018 11:30:51 AM from IP Address 161.7.28.80 Francis, Kromkowski A 1207 Hauser Blvd Helena, MT 59601 Phone: 4064430843 Email: fkromkowski@gmail.com Comment Topic The Rosebud coal mine expansion at the Colstrip plant is a terrible idea Comment Description	
175-1 (2504, 9100)	We can do better than the Rosebud mine expansion. Montana and the Colstrip area have some of the best wind resources in the nation. There is a large transmission line that takes electricity from Colstrip to markets in Washington and Oregon. Those states are extremely concerned about climate change and are demanding clean, renewable electricity instead of coal. The DEIS fails to consider rapidly shifting energy markets and the demand for clean energy. Failure to consider these trends puts Montana at risk.	**175-1 Response:** Thank you for your comment. Analysis of sourcing Montana's energy portfolio is outside of the scope of the Proposed Action.
175-2 (6311)	The Rosebud coal mine expansion at the Colstrip plant is a terrible idea for many, many reasons, including the following: The Colstrip plant is one of the largest sources of greenhouse gasses in the nation, releasing approximately 15 million tons of carbon dioxide into the air each year. All of the coal mined at Rosebud goes to the Colstrip plant and a filthy little waste coal plant nearby. When the coal is burned, it will result in an additional 140 million tons of carbon dioxide going into the atmosphere. Yet the DEIS refused to even consider the cost of climate change. By refusing to provide any estimate of the economic harm this project imposes on the public, the environment, and the economy, the DEIS misleads the public on the climate impacts caused by the expansion.	**175-2 Response:** Under MEPA, DEQ's analysis may not include a review of actual or potential impacts beyond Montana's borders. It may not include actual or potential impacts that are regional, national, or global in nature. Section 75-1-201(2)(a), MCA. However, in accordance with ARM 17.24.627(3), this EIS has been prepared to comply with both NEPA and MEPA. Detailed discussions of GHG emissions in relation to the direct and indirect effects of the proposed Rosebud Mine Expansion are provided in **Section 4.4** and **Section 5.3.3** of the EIS.

Comment/ Code	Document #175-Kromkowski, Francis (SEE ALSO, FORM C)	Response
175-3	The mine has already severely harmed water resources in the area, and the expansion will make matters worse. Existing mining operations have already dewatered parts of a stream, and the remaining water is polluted from mining activities. This expansion will make the existing water quality and quantity problems even worse.	**175-3 Response:** The potential impacts to water resources, including the dewatering of streams, in the area are described in Sections 4.7 and 4.8. Long term and cumulative impact assessments on the quantity and quality of these resources are provided in Sections 5.7 and 5.8 in the EIS. **175-4 Response:** Impacts are predicted on surface water rights and are described in Section 4.9 of the EIS. Water quality monitoring would be conducted post-mining, along with the mitigation of any contamination in order to avoid and minimize impacts to downgradient water users. **175-5 Response:** As required by ARM 17.24.648, Western Energy is required to provide replacement water. Section 82-4-222(1)(m), MCA, requires the applicant to submit a determination of the Probable Hydrologic Consequences (PHC) which includes findings on whether the proposed mining may proximately result in the diminution or interruption of a water supply that is used for domestic, agricultural, industrial or other beneficial use. Section 82-4-222(1)(n) further requires an applicant to provide a plan for monitoring the availability and suitability of both ground and surface waters for current and approved postmining land uses. ARM 17.24.304 requires that an application for an underground coal mining permit include (among other things): a description of alternative water supplies, not to be disturbed by mining, that could be developed to replace water supplies diminished or otherwise adversely impacted in quality or quantity by mining activities so as not to be suitable for the approved postmining land uses. ARM 17.24.304(1)(f)(iii). ARM 17.24.648 (part of MSUMRA) requires that Western Energy replace the water supply of any owner of interest in real property who obtains all or part of his water supply for domestic, agricultural, or other uses from surface or ground water if such supply has been affected by contamination, diminution, or interruption proximately resulting from mine operations. The specific steps for water supply replacement are laid out in 82-4-253(3)(d), MCA, which requires in pertinent part that an operator shall be ordered (in compliance with MCA Ch. 2, Tit. 85) to replace lost water supplies on both an interim (to supply needed water) and a permanent basis with a supply of water in like quantity, quality and duration. The probable source for replacement water is from the Sub-McKay aquifer. The water from the Sub-McKay is comparable to that of the Rosebud. The EIS describes the protection of water rights and sourcing replacement water in Section 2.4.5.3. In fact, the yield from the Sub-McKay is higher and the sodium concentrations are lower than waters from the Rosebud. Information on ground water yields and quality is included in Sections 3.8.2.2 and 3.8.5.5 of the EIS. **175-6 Response:** Financial assurance for the Proposed Action is described in Section 1.6 of the EIS. **175-7 Response:** The criteria and schedule for bond release are outlined in ARM 17.24.1116. Rosebud Mine has two permitted mine areas which are actively being reclaimed in compliance with state requirements. The four stages of bond release and their associated requirements are discussed in **Section 1.6.4** of the EIS. A description of Western Energy's past and existing mine and reclamation operations is provided as **Section 2.2** of the EIS. A recent June 6, 2018 letter from OSMRE responded to an April 2, 2018 WildEarth Guardians (WEG) complaint alleging that Rosebud Mine and other Montana coal mines were failing to meet their reclamation obligations based upon what WEG alleged to be a failure to conduct contemporaneous reclamation and achieve final bond release. DEQ, in a letter to OSMRE dated April 30, 2018 rejected the allegations in WEG's complaint, and OSMRE's June 6, 2018 response to WEG concurred with DEQ and likewise rejected WEG's allegations. As OSMRE's June 6 letter in pertinent part explained: (a) The applicable statutory and regulatory framework does not contemplate instant reclamation or reclamation on an acre-by-acre basis as surface mining proceeds, but instead contemplates that reclamation is supposed to occur "as contemporaneous as practicable." OSMRE Response at 6-7, citing WildEarth Guardians v. Salazar, 880 F. Supp. 2d 77, 91, n. 10 (D.D.C. 2012); see also Sections 82-4-231, 82-4-234 and 82-4-336(2), MCA; ARM 17.24.115; (b) An operator's success at contemporaneous reclamation is primarily measured by the operator's compliance with its permit and reclamation plan, which is developed under the applicable approved regulatory program and not by the status of bond release. OSMRE Response at 7; (c) Under MSUMRA, whether contemporaneous reclamation is occurring is primarily measured by the timeliness of the operator's actions in accordance with permit terms and commitments, including those made in the operator's approved reclamation plan. OSMRE Response at 11, and;
175-4	The expansion is expected to have significant impacts on water rights. The DEIS says that impacts to existing water rights could be ?long-term and negligible to major.? Harmful impacts are expected to persist in aquifers outside of the mining area for decades, and groundwater and surface water rights are expected to return to ?pre-mine conditions many decades after mine closure.? Finally, the DEIS concludes that if the mine expansion impacts someone?s water, the mine owner will replace their water. However, it doesn?t consider whether there is sufficient replacement water available or if the replacement water quality will be similar to what is lost.	
175-5		
175-6	Westmoreland is in serious financial trouble and will likely have to declare bankruptcy in the near future. In the last year its stock dropped from 17.53 per share to 0.68 per share (a 97% drop). The mine has already harmed water resources, failed to meet its reclamation obligations, and can?t be trusted to be around in the near future. This is a sad, but familiar tune for Montana.	
175-7	Only 2.7% of the mine has been fully reclaimed despite the fact that it has been in operation for over 40 years. Mines have an obligation to do ?contemporaneous reclamation? but the Rosebud mine has failed to comply. The government should not let the mine expand and create an even bigger environmental mess when it hasn?t bothered to clean up the mess it already made.	
175-8 (2504, 9100)	We can do better. Montana and the Colstrip area have some of the best wind resources in the nation. There is a large transmission line that takes electricity from Colstrip to markets in Washington and Oregon. Those states are extremely concerned about climate change and are demanding clean, renewable electricity instead of coal. The DEIS fails to consider rapidly shifting energy markets and the demand for clean energy. Failure to consider these trends puts Montana at risk. Say NO to more water and air pollution, water theft, and severe climate impacts from this financially precarious mining operation. Attachments	

Comment/ Code	Document #175-Kromkowski, Francis (SEE ALSO, FORM C)	Response
		(d) Based on available information, there is no reason to believe that, as a factual matter, a violation of contemporaneous reclamation requirements for coal mining operations in Montana, including the Rosebud Mine, is occurring. OSMRE Response at 12. **175-8 Response:** Changes in the balance of Montana's energy market is outside of the scope of the Proposed Action.

Comment/ Code	Document #009-Northern Plains Resource Council	Response
9-1 (summary statements)	009 NORTHERN PLAINS RESOURCE COUNCIL David Berry, Regional Director Office of Surface Mining Reclamation and Enforcement Western Region 1999 Broadway, Suite 3320 Denver, Colorado 80202 Tom Livers, Director Montana Department of Environmental Quality P.O. Box 200901 Helena, Montana 59620-0901 Re: Rosebud Mine Area F EIS Comments February 26, 2018 Dear Mr. Berry and Mr. Livers: On behalf of Northern Plains Resource Council (Northern Plains) and its members, I am submitting the following comments to the Office of Surface Mining Reclamation and Enforcement (OSMRE) and the Montana Department of Environmental Quality (DEQ) in response to the January 4, 2018, draft environmental impact statement (dEIS) on Western Energy's proposed permit expansion into Area F at the existing Rosebud Mine (C2011003F), which surrounds the town of Colstrip, Montana. Northern Plains is a grassroots conservation and family agriculture non-profit organization based in Billings, Montana. Northern Plains organizes Montana citizens to protect our water quality, family farms and ranches, and unique quality of life. Northern Plains is dedicated to providing the information and tools necessary to give citizens an effective voice in decisions that affect their lives. Northern Plains formed in 1972 over the issue of coal strip mining and its impacts on private surface owners who own the land over federal and state mineral reserves as well as the environmental and social impacts of mining and transporting coal. We have many members who live and own ranches in the Colstrip area. Those members' livelihoods depend entirely on clean air and water, native soils and vegetation, and lands that remain intact. The purpose of an EIS is to disclose all the information and analyze and evaluate that information so that the environmental consequences of a project are fully disclosed to the public and for consideration by decision makers. Those consequences (costs) are to be weighed against the benefits of the proposed project in the final analysis. Our comments on the issues and alternatives presented in this dEIS are submitted in order to aid OSMRE and DEQ in this effort. Please ensure that our comments are entered into the public record. In particular, we are concerned that the proposed Area F expansion would not only disrupt and impact the land's surface but would also adversely affect surface and groundwater resources by expanding the mine into a new drainage that is hydrologically distinct from the 220 S. 27th Street, Suite A, Billings, MT 59101 Tel: 406.248.1154 Fax: 406.248.2110 Email: info@northernplains.org www.northernplains.org	**9-1 Response:** Thank you for your comments. Comment responses 9-9 through 9-21 address impacts to water resources and water rights. Reclamation is addressed in comment response 9-22, and connected and cumulative effects are discussed in comment responses 9-23 and 9-24. Westmoreland Coal's financial position is addressed in comment responses 9-25 and 9-26.

Comment/ Code	Document #009-Northern Plains Resource Council	Response
9-1, cont'd	current mined land. Numerous water rights holders would be affected by this proposed expansion. Additionally, Northern Plains and its members have long focused on ensuring that appropriate and adequate reclamation – as promised by the Surface Mining Control and Reclamation Act (SMCRA) – is fully completed. We are particularly concerned about the reclamation (or lack thereof) at the Rosebud Mine. Along with that, the burning of coal and the resultant toxic coal ash waste is a connected and cumulative effect of the proposed action. For more than 20 years toxic coal ash waste has adversely affected our members and others in this area as well as significantly harmed the environment, particularly groundwater resources. Finally, as our comments will explain, Western Energy's parent company, Westmoreland Coal, is in a precariously weak financial position. We are quite concerned that a potential bankruptcy of that company will adversely affect the Rosebud Mine, its workers, and, importantly, reclamation promises. This issue has not been considered or thoroughly analyzed in the dEIS, thus, an informed decision cannot be made on this proposed mine expansion.	**9-2 Response:** Water resources and water rights in the analysis area are discussed in the draft EIS in **Section 3.7**, **Section 3.8**, and **Section 3.9**. **9-3 Response:** Impacts to stream-flow patterns and spring flows are discussed in the draft EIS in **Section 4.7.3.2**. **9-4 Response:** As discussed in **Section 4.7.3.2** of the draft EIS all discharges would comply with applicable MPDES permit effluent limits. Effluent limits are designed to prevent degradation of water quality in compliance with Montana's non-degradation policy.
9-2 (3704)	**Water Resources** Water is a precious resource in this semi-arid region of the state. Ranchers and other residents who live in this area rely on surface waters for irrigation and agricultural production. Shallow aquifers provide water for domestic and livestock use as well as sub-irrigate the agricultural land. Those who live farther from surface water sources rely principally on groundwater wells for their water. Currently there are many maintenance-free springs and seeps in the area that are used by both wildlife and livestock. The water quality of the region is critical to the agricultural health and the operation and survival of area ranches. In the arid western United States, good quality water is a scarce commodity. Poor quality water can rob producers via decreased performance (growth, reproduction) and has resulted in acute illness and death in livestock (and wildlife). Strip mining would alter stream-flow patterns and affect spring flows. Pit inflows would be discharged into the drainages in the area, degrading their water quality. The connectivity of the surface water with groundwater would be disrupted and compromised. Additionally, soils surrounding coal seams and the underground aquifers in coal seams are highly laden with sodium salts. Improper discharge of these sediments and waters will impact the surface water quality.	**9-5 Response:** Impacts to surface water and groundwater are anticipated as discussed in the draft EIS **Section 4.7.3.2** and **Section 4.8.3.1**. Mining and reclamation is designed to minimize disturbance to the hydrologic balance, including groundwater/surface water connections. **9-6 Response:** As described in the draft EIS **Section 3.6.3** overburden sampling included testing for SAR, and no samples exceeded DEQ spoil suitability guidelines. Soils in the analysis area are generally considered nonsodic as described in the draft EIS Section **3.24.3**. As described in **Section 4.7.3.2** of the draft EIS, the mine drainage control plan is designed to prevent discharge of sediments, therefore no impacts to surface water quality for sodium in sediment are anticipated. **9-7 Response:** Surface water quality is described in **Section 3.7.6.1** of the draft EIS. Water quality is generally suitable for livestock use, and evidence of livestock use has been observed at all surface waters in Area F. It is typical to see some exceedances of recommended metals concentrations for livestock use in eastern Montana surface waters.
9-3 (6602) 9-4 (6603) 9-5 (6702) 9-6 (6603)	The tables of data presented of the baseline water quality for various constituents for the project area streams (Trail, McClure, Robbie, Donley, and Black Hank creeks) show generally usable water. There are some metal concentrations that currently exceed recommendations for livestock use. We note that there is no data for cobalt. Strip mining would alter or destroy stream-flow patterns and pit inflows would be discharged into the drainages in the area, degrading their quality. The construction activity necessary to expand the coal strip mine has the potential, despite proposed control measures, to add sediments to the surface waters of the area. How these surface water resources would be reclaimed to like or better water quality conditions following strip mining remains unclear to us.	**Comment Response 9-8** Cobalt is not a contaminant of concern typically associated with coal mining in Montana, thus is not included in DEQ's required monitoring parameter list. **9-9 Response: See comment responses 9-3 and 9-4.**
9-7 (3603)		**9-10 Response:** As described in **Section 4.7.3.2** of the draft EIS, the mine drainage control plan is designed to prevent discharge of sediments. Sediment control measures are continually monitored and maintained by Western Energy Company and inspected by DEQ during monthly compliance inspections.
9-8 (6602) 9-9 (6603) 9-10 (6603) 9-11 (6609)	2	**9-11 Response:** The reclamation plan is described in the draft EIS in **Section 2.4.4**. Measures to protect the hydrologic balance are described in **Section 2.4.5**. Water rights replacement is discussed in **Section 2.4.8.4**, and the wetlands mitigation plan is described in **Section 2.4.8.5**. MSUMRA does not require surface water resources be reclaimed to like or better-quality conditions following mining. See 82-4-228(3) and 82-4-231(10)(c), (k), & (p), MCA.

Comment/ Code	Document #009-Northern Plains Resource Council	Response
9-12 (3604) 9-13 (6607) 9-14 (6707) 9-15 (6607) 9-16 (1202) 9-17 (6811) 9-18 (6810) 9-19 (6810)	There are 53 springs documented in the project area, of which 14 have been monitored. Springs are important sources of water for livestock (as well as wildlife) and require no electricity for pumping, thus, are a valued resource by ranchers. These springs also provide runoff for intermittent and ephemeral streams and pools that support riparian vegetation, which is important if not critical habitat for numerous wildlife species, including amphibians, migratory birds, and a diversity of aquatic life forms especially adapted to these environments. The monitored spring flows range from seepage to as high as 9 gallons/minute. The water quality of these springs is generally good, with those located in the higher portions of the watershed having high quality water. These springs would be adversely impacted by this project (as described below), and, thus, forever lost as a water resource to the ranchers and wildlife in the area. Coal seams are filled with water and function as vital aquifers in this region. Coal strip mines sever and destroy these aquifers. The impacts of this severance can be seen many miles from the mine. Not only do down-gradient wells and springs dry up when the aquifer is severed, but springs and seeps above the mine that are hydrologically tied to the coal-seam aquifers will be drained and will dry up. The dEIS states (page S-26) that "[m]ining of the project area would permanently remove the Rosebud Coal aquifer and result in long-term reduction or elimination of the bedrock ground water contribution to the baseflow in the perennial and intermittent reaches of the major tributaries." Given the failure of existing Western mining operations to restore coal-seam aquifers disturbed by mining, and the failure of most Montana mines to restore water supplies sufficient to gain Phase IV bond release, this to us, is an unacceptable situation (see below for more details). According to the dEIS (page 277) there are 122 surface and groundwater rights on record within and near the project area, nearly all for stockwater use although "a few" are for domestic use. These water rights and the wells or springs they are attached to are critical for the economic livelihoods of area ranchers, many of whom are our members. These water rights must NOT be compromised by the expansion of the Rosebud Mine into Area F. The dEIS states (on page S-27) that "Western Energy will provide a suitable replacement source for any impacted surface or ground water rights" and elsewhere states that the replacement water is to come from the sub-McKay aquifer below the Rosebud coal aquifer (pages 539-545). However, no water quality data is presented to corroborate or prove the statement from Western Energy that "the water quality is comparable to existing water quality of streams, springs, and wells in the area." Residents in the Colstrip area know that when a well is drilled down to the sub-McKay aquifer, there is seepage down the drill hole from the spoil water above in the disturbed Rosebud aquifer. We demand that detailed water quality data on the sub-McKay aquifer be presented to ensure that the replacement water is of comparable water quality to what would be lost by the expansion. We also demand that OSMRE/DEQ establish that accessing this aquifer would not deteriorate its current water-quality status. Additionally, when a water resource that is used/relied upon by another entity (e.g., a rancher) is lost, how will Western Energy ensure that the long-term costs of water replacement are met? If a free-flowing spring is lost, for example, simply drilling a well for water 3	**9-12 Response:** Springs are described in the draft EIS in **Section 3.7.5.1** and **Section 3.7.6.1**. Water quality in springs was variable but generally suitable to support livestock and wildlife use. **9-13 Response:** Impacts to springs are described in the draft EIS in **Section 4.7.3.2**. It is anticipated that 6 springs in the mining area would be eliminated. It is possible that some of these springs may be reestablished following reclamation. Section 82-4-222(1)(m), MCA, requires the applicant to submit a determination of the Probable Hydrologic Consequences (PHC) which includes findings on whether the proposed mining may proximately result in the diminution or interruption of a water supply that is used for domestic, agricultural, industrial or other beneficial use. Section 82-4-222(1)(n) further requires an applicant to provide a plan for monitoring the availability and suitability of both ground and surface waters for current and approved postmining land uses. ARM 17.24.304 requires that an application for an underground coal mining permit include (among other things): "a description of alternative water supplies, not to be disturbed by mining, that could be developed to replace water supplies diminished or otherwise adversely impacted in quality or quantity by mining activities so as not to be suitable for the approved postmining land uses" ARM 17.24.304(1)(f)(iii). The specific steps for water supply replacement are laid out in 82-4-253(3)(d), MCA, which requires in pertinent part that an operator shall be ordered (in compliance with MCA Ch. 2, Tit. 85) to replace lost water supplies on both interim and immediate basis (to replace needed water) and, within a reasonable time on a permanent basis (with a supply of water in like quantity, quality and duration). Additional information will be added to Sections 3.9 and 4.9 of the EIS regarding the process involved with the MT Water Rights Bureau for replacing a water right with a different supply source. **9-14 Response:** The hydrologic properties of the Rosebud and McKay coals are described in the draft EIS in **Section 3.8.2.2**. Coal seams can provide viable water supplies, but thicker sandstones generally are the most dependable and vital aquifers in this region. **9-15 Response:** Springs and seeps upgradient from mining would only be impacted if drawdown from mining extends to their location. There are no upgradient springs in the analysis area which are expected to be impacted by mining. Impacts of removal of the Rosebud Coal on water quantity in downgradient surface water resources is described in the draft EIS in more detail in **Section 4.7.3.2**. **See also comment response 9-13**. **9-16 Response:** Restoration of coal-seam aquifers is not a requirement of MSUMRA. Phase IV bond release requires reclamation of all mine related disturbance in a drainage basin to be completed and past the 10-year responsibility period for Phase III bond release. Phase IV bond release at Montana coal mines is generally not limited by restoration of water supplies, but rather by the location of mine transportation facilities which cross most drainages and must be maintained for the life of the mine. DEQ is not aware of any instances where a mine operator has failed to restore a water supply as required by MSUMRA. **See also comment response 9-13**. **9-17 Response**: Requirements for protection of water resources and right are described in the draft EIS in **Section 3.7.1.1**, **Section 3.8.1.1**, and **3.9.1.1**. According to MSUMRA mines must be designed to prevent material damage, which includes impacting water rights outside the permit area. Water rights within the permit area may be impacted by mining but must be replaced. **See also comment response 9-13**.

Comment/ Code	Document #009-Northern Plains Resource Council	Response
9-19, cont'd 9-20 (6810) 9-19, cont'd 9-21 (1202) 9-21, cont'd	replacement does not take into account the long-term need or costs for pumps and other necessary equipment for the installation, operation, and maintenance of this pumping system nor the cost of electricity to run the equipment. Will Western Energy cover these costs into perpetuity? Finally, if a water source is lost and must be replaced by Western Energy, nowhere in the dEIS is it explained what happens to the water rights status of the lost water resource. We assume this means that replacement water would not have the same water rights standing (seniority) as the original water source, which is just plain wrong. This change in seniority places additional risk and economic strain on existing senior water rights holders that must be accounted for in the agencies' analysis. Much more detailed information is needed in this analysis that explains how expanding the mine into Area F would affect water resources. It appears to us that the mine expansion proposal would result in less reliable water for area residents. It also seems that landowners would have to not only pay the long-term associated costs for any replacement water; they may also lose their senior water rights as well. All of these impacts to the area's water would affect the economic viability of a ranch, not only on a day-to-day basis but also into the future (good water and senior water rights make a ranch more financially attractive should a landowner wish to sell the property). **Reclamation** Under SMCRA, contemporaneous reclamation is supposed to occur at coal strip mines.[1] The purpose of SMCRA is to ensure restoration of the land and hydrology to pre-mine conditions. Under REG-8, OSMRE oversight guidance document, analysis of "reclamation success as measured by bond release" is required. In Montana there are four phases of bond release, with each phase building upon the preceding, successfully completed phase. Final bond release occurs when the permittee has not only successfully established plant communities suitable to the region's climate and post-mining land use on the mine-disturbed lands (Phase III bond release requirements) but has also reclaimed the hydrologic balance within any designated drainage basin. Bond release is the *only* lawful and objective measure to evaluate reclamation success. Without bond release, especially final bond release, there is no proof of successful mine reclamation. There is a woeful lack of evidence of contemporaneous reclamation and/or reclamation success as measured by bond release throughout the West, and this is a significant issue in Montana. Coal strip mines have been operating in Montana for more than 40 years. But as of July 2016, of the 41,809 acres that have been disturbed by coal strip mining operations, only 21,519 acres have achieved Phase I reclamation and bond release, which means that a permittee has completed the backfilling, re-grading, topsoil replacement, re-contouring, and drainage control required for a bonded area. Of particular concern, during this time only 838 acres in all of Montana have achieved Phase IV (final) bond release.[2] [1] 30 U.S.C. 1202(e) (in the Statement and Purpose section of SMCRA, "assure that adequate procedures are undertaken to reclaim surface areas as contemporaneously as possible with the surface coal mining operations") [2] *Cumulative Montana Reclamation Status Table EY-1999 to Present [September 2016]*. Personal communication from OSMRE Program Analyst Frank Bartlett, Oct. 14, 2016. 4	**9-18 Response:** Water quality in the sub-McKay is discussed in the draft EIS in **Section 3.8.5.5** and Table 63 provides detailed water quality data on the sub-McKay. Montana rules for water well contractors require that water supply wells be drilled and constructed to prevent cross-contamination between (ARM 36.21.654). DEQ requires that all monitoring and water supply replacement wells be installed by a licensed well driller. **See also comment response 9-13**. **9-19 Response:** ARM 17.24.301(107) defines replacement to include "provision for an equivalent water delivery system and payment of operation and maintenance costs in excess of customary and reasonable delivery costs for pre-mining water supplies." Thus, if a spring is replaced by a well, replacement would include provision for the additional operation and maintenance costs. **See also comment response 9-13**. The specific steps for water supply replacement are laid out in 82-4-253(3)(d), MCA, which requires in pertinent part that an operator shall be ordered (in compliance with MCA Ch. 2, Tit. 85) to replace lost water supplies on both interim and immediate basis (to replace needed water) and, within a reasonable time on a permanent basis (with a supply of water in like quantity, quality and duration). The operator's unequivocal obligation is to replace a water supply on a permanent basis with a supply of like quantity, quality and duration. **Comment Response 9-20:** It is certainly possible that a more senior water right within the permit area could be lost due to mining. However, according to 82-4-253, MCA, replacement water must be provided in like quantity, quality, and duration as the pre-mining water supply. This means that the replacement source must ensure that the same quantity of water is available at all times as it was before mining. The specific mechanism by which this would be accomplished would be determined on a case-by-case basis. **See also comment response 9-13**. In the context of the federal Surface Mining Control and Reclamation Act of 1977 (SMCRA, 30 U.S.C. § 1201 et seq.), the federal (Interior Department) Interior Board of Land Use Appeals (IBLUA) has explained that the federal Office of Surface Mining Reclamation and Enforcement (OSMRE), when issuing a permit under SMCRA, does not have the authority to determine water rights. As that Board explained, "[t]o hold otherwise would be to require OSMRE to become the adjudicator of water rights claims, a role which it is neither authorized nor qualified to assume." 123 IBLA 195; 1992 IBLA LEXIS 55, 123 IBLA 195; 1992 IBLA LEXIS 55 at [2]. The same is true of DEQ. Replacement of water supplies is required in both the statute and in rule without condition. If a water supply is impacted the mine company must do whatever is necessary to provide replacement water in like quantity, quality, and duration. Western Energy has consistently provided reliable water supplies in reclaimed areas of other Rosebud Mine permit areas which have been used for grazing. DEQ is unaware of any complaints from water rights holders regarding unresolved impacts from the Rosebud Mine on water rights. **9-21 Response:** In a ruling dated June 6, 2018, OSMRE rejected Wild Earth Guardians' claims that contemporaneous reclamation (as that term is defined in MSUMRA) was not occurring at the Rosebud Mine. *See* June 6, 2018 Letter from OSMRE to WildEarth Guardians regarding Citizen Complaint Alleging Violations Related to Reclamation Activities at Coal Mining Operations in the Powder River Basin at pp. 9-11. Contrary to the commenter's contentions, and as OSMRE confirmed in its June 6, 2018 Letter to Wild Earth Guardians, under the Montana Law which governs coal mines such as the Rosebud Mine, reclamation success, including contemporaneous reclamation requirements, is measured primarily by the operator's compliance with its permit requirements and not by Phase IV bond release. *See id.* at 11. (*Response continues on next page.*)

Comment/ Code	Document #009-Northern Plains Resource Council	Response
9-21, cont'd 9-21, cont'd	Of the 19,160 acres disturbed at the Rosebud Mine since 1976 (when Unit 1 of the Colstrip Generation Facility came on line), only 625 acres have achieved Phase III bond release, the benchmark that demonstrates successful and persistent establishment of plant communities suitable to the region's dry climate and post-mining land use. Additionally, the dEIS states that only 436 acres of the Rosebud Mine (about 2% of the lands that have been disturbed by mining) have been released under Phase IV, final, bond release. Phase IV bond release means that the essential hydrologic functions of the disturbed and reclaimed lands have been restored or alternative water sources to replace adversely affected water supplies are provided. (As detailed above, we continue to have significant concerns and questions about the alternative water source proposed.) Northern Plains believes that reclamation at the Rosebud Mine, to date, is a connected and cumulative part of this mine expansion project proposal and must be fully considered and analyzed before any further mine expansion is approved. It is paramount that the progress of Rosebud Mine's reclamation plan, including the mine's ability to cover its current and future reclamation obligations, be considered as part of this mine expansion proposal. Specifically, and, at a minimum, the following must be fully analyzed and evaluated: • The status of reclamation at the Rosebud Mine including, but not limited to, an assessment of bond release at the mine operations (all phases), an assessment of any barriers to bond release, and identification of mine areas eligible for bond release. • A detailed schedule and time frame for achievement of reclamation success for lands and waters at the Rosebud Mine must be analyzed and evaluated. • The direct, indirect, and cumulative impacts of authorizing more land and water (both surface and underground aquifers) for disturbance by coal mining at the Rosebud Mine must be analyzed as well as other mines within the Montana portion of the Powder River Basin (PRB) as connected and cumulative actions. • Significant conditions and/or stipulations to the proposed mine expansion proposal that requires addressing the problems identified with the lack of reclamation and final bond release success must be evaluated. Given the lack of reclamation occurring at other areas of the mine, how does expanding the mine permit area encourage more reclamation and prevent the mine from falling even further behind in its responsibilities under SMCRA? It is our opinion that OSMRE and DEQ must assess the timing of reclamation activities within the proposed mine expansion area and thoroughly consider the impacts of prolonged or untimely reclamation, including re-establishment of vegetation and restoration of water resources. Compounding our concerns about the status of reclamation and its completion is the financial status of Westmoreland Coal (see below). In summary, we believe that OSMRE and DEQ must evaluate an alternative whereby the proposed expansion of the mine into Area F is delayed until such time as the majority of mined lands at the Rosebud Mine have achieved Phase III bond release. 5	**9-21 Response continued:** OSMRE's June 6, 2018 Letter to Wild Earth Guardians specifically rejected identical contentions that Rosebud Mine was not complying with reclamation requirements. *See id.* at 12: "Montana DEQ, as the exclusive regulatory authority for the majority of the mines in its state . . . , reviewed these mines' reclamation operations and found the Absaloka (north operations), Rosebud (Areas A, B, C, D), East Decker, West Decker, and Spring Creek mines are complying with reclamation commitments in accordance with their respectively applicable permit and reclamation plan."

Comment/ Code	Document #009-Northern Plains Resource Council	Response
9-22	**Connected and Cumulative Effects** The National Environmental Policy Act (NEPA) requires, through the Council of Environmental Quality's (CEQ) NEPA implementing regulations, that an agency must analyze any proposal in consideration of other actions that are connected (40 C.F.R. §1508.25(a)(1)) and are cumulative (40 C.F.R. §1508.7, §1508.25 (a)(2)). Connected actions are defined in 40 C.F.R. §1508.25(a)(1)(ii-iii) to include actions that *cannot or will not proceed unless other actions are taken previously or simultaneously* [emphasis added] or are interdependent parts of a larger action and depend on the larger action for their justification. Cumulative impacts are defined in 40 C.F.R. §1508.7 as the impact on the environment which results from the *incremental impact* of the action *when added to* other past, present, and reasonably foreseeable future actions [emphasis added].	**9-22 Response:** Comment noted.
9-23 (8507)	The Burning of the Coal and the Issue of Coal Ash The coal mined at the Rosebud Mine is largely burned at the four coal-fired power plants in Colstrip. Coal ash is a byproduct of burning coal. Coal ash contains health-damaging heavy metals including arsenic, lead, cobalt, selenium, and mercury as well as many other toxic materials. The Colstrip power plants use a wet ash method to handle the coal ash. Water is pumped from the Yellowstone River to Colstrip where it is used in the power plant in the cooling towers and various other plant operations, including mixing the water with the produced coal ash. This slurry is then piped to a series of ponds where the coal ash is settled out and the "clear" water is piped back to the plants for re-use. Coal ash slurry from Colstrip 1 and 2 is stored in coal ash ponds just north of the surge pond. The coal ash ponds for the Colstrip 3 and 4 are piped into the Cow Creek watershed a few miles south of the power plants; Cow Creek is a tributary to Rosebud Creek. From the early 1970s, Northern Plains and its local affiliate, the Rosebud Protective Association, raised concerns about the potential for the coal ash slurry to leak into the shallow aquifers that our members rely on for watering livestock. This contamination of the groundwater would be devastating to agricultural operations and the residents of the town and area. Despite promises from the Montana Power Company (MPC), the original owner of the Colstrip power plants, and the State of Montana that the coal ash ponds would be completely sealed, it was discovered in the late 1990s that the coal ash ponds for Colstrip Units 1 and 2 had leaked and contaminated the wells of homeowners north of town. A lawsuit filed by homeowners and townspeople resulted in monetary damages being paid and requiring PP&L (the corporation that bought out MPC) to pipe water from the Yellowstone River to the Colstrip surge pond and then back to all impacted homeowners. PP&L reserves the right of first refusal to buy any property that comes up for sale. In the early 2000s, it was discovered that the Colstrip Units 3 and 4 ponds were also leaking. This was discovered by a landowner checking water for his cattle. He noticed water that had filled a reservoir that should not have had water in it during that time of year. He tested the 6	**9-23 Response**: Cumulative effects on surface water resources are described in **Section 5.3.6** of the EIS. Cumulative impacts on water quality and quantity were not described as being none to minor. The analysis, described in Appendix I of DEQ's Written Findings for Area B AM4 (DEQ 2015b), used the historical dataset for the Rosebud Mine. The Absaloka Mine is not within the direct or indirect effects analysis area. Discussion on the effects of the Colstrip Power Plant will be updated with current information from DEQ's website.

Comment/ Code	Document #009-Northern Plains Resource Council	Response
9-24, cont'd	water in the reservoir and also tested the water in the well that was used to fill that reservoir. Both were contaminated by the leaking coal ash ponds. Another lawsuit was filed and eventually 1,280 surface acres were forcedly bought that had contaminated water beneath them. Since then, the DEQ and PP&L (and the subsequent owners of the Colstrip Generation Facility, Puget Sound Energy and Talen Energy Corporation) prepared an Administrative Order of Consent for cleaning up this toxic waste. But, this does not negate the fact that the coal ash pond leakage continues. Estimates are that the magnitude of this leakage is between 168 gallons per minute (gpm) to more than 275 gpm (DEQ's estimate). Using DEQ's estimate, this means that 400,000 gallons of contaminated water are leaking into the area's shallow aquifers each day. The plant owners have drilled more than 800 monitoring and pump-back wells in an effort to contain the problem. However, the underground plume of toxic water from the coal ash continues to move and expand. This issue is integrally tied to all the coal mining at the Rosebud Mine, particularly the proposal to expand that mine into Area F. Without serious consideration of the coal ash issue, an expansion of the current mine is only going to exacerbate the issue.	
9-25 (1200)	The Status of Westmoreland Coal Company We are concerned that the uncertain financial future of Western Energy's parent company, Westmoreland Coal, is not being adequately considered in the dEIS. On Feb 11, 2018, Westmoreland Coal Company's stock closed at $0.68/share, down more than $18/share from late 2016. If the stock price stays below $1/share then the New York Stock Exchange will delist the company, adding even more strain to the company's precarious position. Westmoreland is an un-diversified company that has an operating model described as "mine-mouth," i.e., operating coal mines near power plants that need the coal. While in the past this model had insulated Westmoreland Coal from exposure to the volatility of the coal market, other factors are affecting the company today. For the past five years, Westmoreland has been borrowing money to cover the costs of its operations as it is not making enough from selling coal. According to John Hanou of Hanou Energy Consulting LLC, while most Powder River Basin coal producers would see higher production figures in 2017 from 2016, Westmoreland and Contura coal companies would not. Westmoreland Coal's production has dropped from 19.4 million short tons (including 13.1 million short tons at the Rosebud Mine) in 2008 to 12.2 million short tons (including 8.6 million short tons at the Rosebud Mine) in 2017. Westmoreland Coal made several debt-financed acquisitions of new mines in recent years, some of which have closed and others that are facing closure; thus, Westmoreland is burdened with ongoing debt payments. In March of 2017, Forbes Magazine reported[3] that S&P Global Ratings had lowered Westmoreland Coal's corporate credit rating to CCC+ from B, citing its view that the company could be unable to refinance 2018 loan maturities without a significant boost in coal prices and volumes over the next year (neither of which have happened). S&P Global said that its negative outlook reflected its belief that the company does not have sufficient sources of liquidity from its operations and its revolving credit facility to repay its $306 million currently outstanding term loan due December 2018. [3] https://www.forbes.com/sites/spleverage/2017/03/29/leveraged-loans-westmoreland-coal-cut-to-ccc-on-unsustainable-capital-structure/ 7	**9-25 Response:** The financial viability of Westmoreland and its subsidiary, Western Energy Company, is outside the scope of the EIS. In accordance with ARM 17.24.405(7), DEQ cannot issue a permit until the applicant files the required performance bond. The standard applied by the department in determining the amount of performance bond is the estimated cost to the state if it had to perform the reclamation, restoration, and abatement work under the act, the rules adopted thereunder, and the permit (**Section 1.6.1**, Bond Amount in the EIS). All currently permitted areas of the Rosebud Mine are fully bonded for reclamation. Please see **Table 5** in Chapter 2 for bond amounts by permit area and reclamation phase. Table 4 provides permitted and disturbed acres by area. **Table 4** and **Table 5** have been revised in the Final EIS to indicate the percentage of reclamation that has been achieved in each permit area. The EIS provides an overview of reclamation bonding procedures and the criteria for phased bond release in **Section 1.6**, Financial Assurance. If success criteria (**Section 1.6.4**, Bond Release) are not met, the associated bond will not be released, and monitoring will continue. Reclamation and bonding requirements are applicable to the project area, if permitted, and all currently permitted areas of the Rosebud Mine. **Section 1.6** has been revised to clarify that the requirements are applicable to all permit areas, not just the proposed project area.

Comment/ Code	Document #009-Northern Plains Resource Council	Response
9-25, cont'd	Later, in November 2017, SNL reported that S&P Global Ratings again lowered Westmoreland Coal's corporate credit rating (to CCC) citing the operating challenges the company was facing. These challenges include contract terminations, low realized prices due to the decline in demand for coal-fired power generation, and competition from natural gas. S&P Global said that it will be difficult for Westmoreland to refinance its heavy debt load and significant maturities in 2018. We believe that a thorough economic analysis of Westmoreland Coal's financial stability is essential to the "hard look" required under NEPA. We believe that OSMRE and DEQ must consider and evaluate this issue as a connected and cumulative effect of the proposed project as part of their regulatory and legal responsibilities. **Conclusion** The proposed expansion of the Rosebud Mine into Area F is acknowledged in the dEIS to only extend the operational life of the mine by eight (8) years to 2038. A recent Montana Legislative Services Division study (January 2018) completed for the Montana Environmental Quality Council (at the request of the 2017 Montana Legislature) confirms what has been apparent to many for years, "Coal-fired power generation is in decline as inexpensive natural gas and cheaper renewables fuel more electricity production." The Colstrip Generating Station, which burns 85% of the coal mined at the Rosebud Mine is majority owned by entities in the states of Washington and Oregon. The above report states that "Colstrip's future also will be dependent on policies enacted in Washington and Oregon concerning the use of coal-fired generation." The state of Oregon has already decided to require their investor-owned utilities to phase out all electricity generated from coal by 2030. Washington state is also beginning to eliminate coal from its electrical portfolio by requiring all their large utilities to ensure that 15% of their energy comes from renewable sources by 2020. Additionally, the Washington state legislature is currently debating establishing a carbon tax on electricity sources (and there are proposals for ballot initiatives for November 2018 should this legislation fail). Puget Sound Energy (Puget), which has the largest ownership stake in Colstrip, supports the tax and acknowledges that, should it pass, Colstrip's future economic viability would be challenged. In addition, the cities of Seattle and Olympia, Washington, have passed resolutions calling on Puget to stop operating Colstrip by 2025. While the company is obligated to stop operating Colstrip Units 1 and 2 not later than 2022, Puget has also agreed to be financially ready to close Units 3 and 4 by December 2027, having fully depreciated the assets. Puget's settlement puts the end of the "useful life" of Units 3 and 4 at December 31, 2027. While a closure date has not been set, OSMRE and DEQ must take these facts into account when evaluating this proposed expansion project. Northern Plains believes that the environmental consequences of this mine expansion project are significant. Potentially, this expansion might not be needed if the current owners of the Generating Station decide to phase out electricity generated from coal. In such a case, where would the Rosebud Mine sell its coal? The BTU content of Rosebud Mine coal is lower than the BTU content of coal mined at other Montana coal mines (Spring Creek, Decker, Signal Peak), so 8	
9-26 (1103, 8515)		**9-26 Response: See Comment Response 9-25**. Coal mined in Area F would be combusted at the Colstrip Power Plant to generate electricity. Units 1 and 2 at the Colstrip Power Plant will shut down by 2022. Units 3 and 4 at the Colstrip Power Plant do not have a defined shut down date at this time; therefore, the coal mined in Area F would be used to supply Units 3 and 4. The range in annual production provided in **Section 2.2.1**, Past and Existing Production of the EIS varies from year to year, but represents the typical annual production volumes. As discussed in **Section 2.2.6**, Life of Operations, the Rosebud Mine has three active pit areas. Area A is expected to be mined until 2022 (Peterson 2016b). Area B, as currently permitted, is expected to be mined until 2030 (Peterson 2016b). Area C is expected to be mined until 2022 (Peterson 2016b). Areas A, B, and C are expected to account for 50 percent of the total output of the mine until 2019 and 40 percent of the total output until 2022 (the last year of active mining for Areas A and C) (Peterson 2016a). Without the addition of the proposed project or Area B AM5, the operational life of the Rosebud Mine would be expected to end in 2030 (see also **Figure 3**).

Comment/ Code	Document #009-Northern Plains Resource Council	Response
9-26, cont'd	it is unlikely this coal would be saleable elsewhere if it is not used at Colstrip. A recent economic analysis article discussing Westmoreland Coal (attached) points out that while the company's business strategy has worked for years, today that strategy is challenged by many factors including cheap natural gas and environmental legislation. According to Cowen analyst Amer Tiwana, "replacing lost customers is extremely challenging . . . [as the] economic transport of mined coal is a virtual impossibility." The OSMRE and DEQ review must include a realistic and detailed analysis of other markets for Rosebud coal, not simply assume that they exist. As less and less coal is used for electrical generation and as more and more electricity entities and customers are switching to natural gas and renewable energy sources, there is less reason to permit new coal mines. A thorough analysis of market demand is essential to the "hard look" required under NEPA before any project is approved. Not only is this required under NEPA, but it is good decision making. Such an analysis is only fair to the mine workers and the community of Colstrip. The change in energy sources and use will continue across the nation, and mine workers and communities need to begin planning for the transition. Again, a thorough analysis of Westmoreland Coal's financial stability is essential to the "hard look" required under NEPA before any project is approved. Such an analysis would also be useful to the mine workers and the community of Colstrip. A logical and obvious impact of opening or expanding a mine is that mine's closure. As we have explained in our comments above, these are not "normal" times in the energy world, and, if Westmoreland Coal goes into bankruptcy or, worse, disappears as a company, the workers and community of Colstrip will have an even harder time with transition. That is not fair, and we believe that it is incumbent upon the state and federal government to include additional scrutiny of Westmoreland Coal's economic stability and bond and credit ratings, as well as beginning to look at what economic transition for the Colstrip area might mean.	
9-27 (6707, 1202, 1300)	This proposed mine expansion would permanently remove the Rosebud coal aquifer - an aquifer that currently sustains working ranches, which are also part of the area's economic base. The proposed mine expansion, if granted, ignores the lack of significant reclamation at the current mine. As stewards of our public resources, both OSMRE and DEQ have an obligation to protecting the water resources of this area as well as to ensuring that reclamation of the Rosebud Mine proceeds in a faster manner than it currently is happening. Reclamation is required and must be completed in order to fulfill legal mandates under SMCRA. Sincerely, Becky Mitchell Becky Mitchell Chair, Northern Plains Resource Council attachment (1) 9	**9-27 Response:** See **Comment Responses 9-14** through **9-21**, which address impacts to the Rosebud coal aquifer and water rights. Contemporaneous reclamation at the Rosebud Mine is addressed in **Comment Response 9-22**.

Comment/ Code	Document #009-Northern Plains Resource Council	Response

2/5/2018 MI: Westmoreland Coal may show how minemouth model can go wrong

Westmoreland Coal may show how minemouth model can go wrong

EXCLUSIVE

Thursday, January 18, 2018 3:22 PM ET

By Taylor Kuykendall

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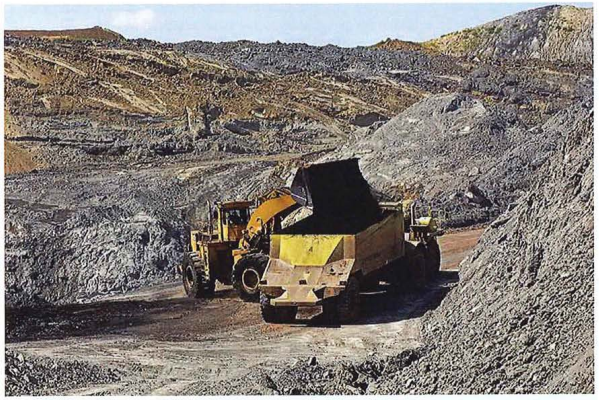


Surface-mined coal is loaded into a truck at the Dakota Westmoreland Corp. coal mine in Beulah, N.D. Production at the mine has sharply declined after one customer elected not to renew its contract with the coal company, which bases its business model on mining coal near the power plant customers it serves.

Source: Associated Press

For years, Westmoreland Coal Co. (/web/client?auth=inherit#company/profile?KeyProductLinkType=2&id=4063977) has touted the viability of its minemouth model of building coal mines near the power plants that need them, but factors working against coal generation have called the model into question.

During a period of financial hardship for nearly everyone in the coal industry in 2015, BMO Capital Markets analyst David Gagliano said people were approaching him with the "perfectly legitimate question" of whether anything in coal was even investable anymore. He called Westmoreland a different kind of coal company and rated the company at "outperform."

The observations (/web/client?auth=inherit#news/article?KeyProductLinkType=2&id=33710618) reinforced comments from then-CEO Keith Alessi, who likened the company's low stock price valuation to a "theater of the absurd. (/web/client?auth=inherit#news/article?KeyProductLinkType=2&id=34435206)"

At the time, Westmoreland's stock was trading over $15 per share, and Gagliano set a price target at $20. The stock fell, though it nearly recovered to the target price in late 2016, only to plummet through 2017. Westmoreland stock opened at $1.14 on the NYSE on Jan. 18, 2018.

https://www.snl.com/web/client?auth=inherit#news/article?id=43237218 1/5

Comment/ Code	Document #009-Northern Plains Resource Council	Response
	2/5/2018 MI: Westmoreland Coal may show how minemouth model can go wrong "The business strategy seemed to be successful over the past several years as the company seemed relatively well insulated from the decline of thermal coal prices. However, pressure from cheap natural gas and environmental legislation appears to have caught up with Westmoreland," Cowen analyst Amer Tiwana wrote in a Jan. 18 note. "By our estimates, Westmoreland will be losing buyers of roughly 14 million tons by 2026, with the majority of that tonnage reduction realized by the end of 2022." Coal production from Westmoreland's Beulah mine in North Dakota has already dropped significantly, after a customer elected not to renew its contract in May 2016. Toward the end of the same year, the company closed (/web/client?auth=inherit#news/article?KeyProductLinkType=2&id=37837185) its Jewett lignite coal mine in Texas after losing a contract to a customer that opted to buy Powder River Basin coal instead, Tiwana noted. A major New Mexico customer, the San Juan plant, is retiring two units (/web/client?auth=inherit#news/article?KeyProductLinkType=2&id=43133451) that could reduce coal tonnage from Westmoreland by over 3 million tons. Another coal-fired power plant that touted (/web/client?auth=inherit#news/article?KeyProductLinkType=2&id=33874757) the advantages of a minemouth model, Longview Power LLC (/web/client?auth=inherit#company/profile?KeyProductLinkType=2&id=4280112)'s coal-fired facility in West Virginia, recently ran into an issue in which the mine operated by its sister company encountered geological issues that will cause it to be shut down. That plant, however, was able to sign a contract (/web/client?auth=inherit#news/article?KeyProductLinkType=2&id=43094296) with a nearby longwall coal operation to replace its supply. Westmoreland's business model has been built on the minemouth model, in which the coal plants and mine are close to one another, so transporting the coal is cheap and sometimes even done by conveyor belt or dedicated rail. The model also allows the company to lock in longer-term contracts with customers. The company operates 11 coal mines in the U.S., the majority of which are minemouth, but that presents unique challenges as well. "Due to [Westmoreland]'s mine-mouth strategy, replacing lost customers is extremely challenging," Tiwana said. "Several of the power plants that Westmoreland supplies have been retired and several more are slated to retire over the coming years. The company's minemouth business model compounds the issue as many of the mines are not near any rail networks or waterways, making economic transport of mined coal a virtual impossibility." Tiwana also wrote that the company's capital structure is "no longer tenable" as it was predicated on about $250 million in annual EBITDA. That figure is expected to fall to about $200 million in 2018 and could go even lower as further plant retirements occur in 2020 and beyond, he said. Westmoreland has been focused on delevering (/web/client?auth=inherit#news/article?KeyProductLinkType=2&id=35666165) its balance sheet and announced the sale (/web/client?auth=inherit#news/article?KeyProductLinkType=2&id=41546799) in 2017 of a power facility asset and negotiations to sell one of its Canadian mining operations. The company has been working to soothe fears (/web/client?auth=inherit#news/article?KeyProductLinkType=2&id=42765082) of a potential bankruptcy, and one analyst said as recently as November 2017 that management had been "adamant they have no reason or need to file for bankruptcy anytime soon," although analysts have slashed (/web/client?auth=inherit#news/article?KeyProductLinkType=2&id=42471496) price targets for the company. S&P Global Ratings recently lowered (/web/client?auth=inherit#news/article?KeyProductLinkType=2&id=42683745) its corporate credit rating on Westmoreland based on substantial doubt that the company will stay in compliance with certain debt covenants. At the end of the year, Kevin Paprzycki stepped down as the company's CEO. Westmoreland did not immediately respond to a request for comment, but on its third-quarter conference call, CFO Gary Kohn said the fourth quarter is generally the seasonally strongest and assured analysts it was working on optimizing its capital structure. "We continue to believe in the long-term value potential for Westmoreland," Kohn said. "The steps ... we've taken to further streamline and fortify the business are beginning to yield our results. Our commitment to exceeding on our value-creating catalyst has set us up for strong fourth-quarter cash generation. We look forward to further updating you on our progress in the months ahead." *S&P Global Ratings and S&P Global Market Intelligence are owned by S&P Global Inc.* https://www.snl.com/web/client?auth=inherit#news/article?id=43237218 2/5	

Comment/ Code	Document #010-Pfister	Response
	010 March 5, 2018 ATTN: Western Energy Area F EIS Comments	
10-1 (8501)	After perusing most of this document, I wonder why Westmoreland is applying for this area as an extension to the Rosebud Mine in Rosebud County, Montana given the financial condition of the company as reflected in its stock price and the projections of the future length of life of the power plant which the mine supplies. I am even more bemused by the company's actions in applying for an additional permit to mine even more land in the AM5 permit extension for area B which has an acreage ranging from 15000 acres approximately to 6000 some acres extending mining out another 25 years from 2018. Taken together these are huge extensions of this mine. These actions point out one of the failures of the reclamation law which allows huge swaths of land to be taken incrementally with a finding of FONSI on a piece here and there, but in the end great damage is done without ever tallying up what it is. Perhaps Westmoreland hopes that with huge permits for the future, they can borrow more money to keep operating today. The problem for them will be finding a market.	**10-1 Response:** The financial viability of Westmoreland and its subsidiary, Western Energy Company, is outside the scope of the EIS. In accordance with ARM 17.24.405(7), DEQ cannot issue a permit until the applicant files the required performance bond. The standard applied by the department in determining the amount of performance bond is the estimated cost to the state if it had to perform the reclamation, restoration, and abatement work under the act, the rules adopted thereunder, and the permit (Section 1.6.1, Bond Amount in the EIS). All currently permitted areas of the Rosebud Mine are fully bonded for reclamation. The fundamental purpose of a bonding requirement is to ensure that reclamation will be completed in the event that mine operator defaults on its reclamation obligations. See Section 82-4-223, MCA; *Pa. Fed'n of Sportsmen's Clubs, Inc. v. Kempthorne*, 497 F.3d 337, 353 (3d Cir. 2007). In a ruling dated June 6, 2018, OSMRE rejected Wild Earth Guardians' claims that contemporaneous reclamation (as that term is defined in MSUMRA) was not occurring at the Rosebud Mine. *See* June 6, 2018 Letter from OSMRE to WildEarth Guardians regarding Citizen Complaint Alleging Violations Related to Reclamation Activities at Coal Mining Operations in the Powder River Basin at pp. 9-11. Contrary to the commenter's contentions, and as OSMRE confirmed in its June 6, 2018 Letter to Wild Earth Guardians, under the Montana Law which governs coal mines such as the Rosebud Mine, reclamation success, including contemporaneous reclamation requirements, is measured primarily by the operator's compliance with its permit requirements and not by Phase IV bond release. *See id.* at 11. OSMRE's June 6, 2018 Letter to Wild Earth Guardians specifically rejected identical contentions that Rosebud Mine was not complying with reclamation requirements. *See id.* at 12: "Montana DEQ, as the exclusive regulatory authority for the majority of the mines in its state . . ., reviewed these mines' reclamation operations and found the Absaloka (north operations), Rosebud (Areas A, B, C, D), East Decker, West Decker, and Spring Creek mines are complying with reclamation commitments in accordance with their respectively applicable permit and reclamation plan."
10-2 (1202) 10-3 (6904)	By permitting the mining of Area F, the State is committing that area to a very long term of submarginal functioning after the mining act. Nothing will reach pre-mining capabilities---not the waters and not the soils and probably not the vegetation. The vegetation mixes are native, but not very diverse, as can be seen from the lists of native plants vs proposed plantings. Unless very special measures are taken, plants like Ponderosa Pine and skunk bush sumac may re-establish themselves very slowly if at all on mined land. One thing that has been evident in its absence in reclaimed areas is the brushy draws that are a feature of the Lame Deer-Colstrip area. I did not see any evidence of a plan to restore them in Area F. I noticed that the big 4 for sub-forbes on reclaimed areas for Area F are the same "el cheapo" four that Signal Peak has used over here in the Bulls. They are notable for not having much food value and a fairly short life span.	**10-2 Response:** Comment responses 10-4 through 10-6 address comments on water. Comments response 10-7 addresses soils. Comment responses 10-3 and 10-8 address vegetation. **10-3 Response:** Impacts resulting from the proposed project and its alternatives are described for vegetation and soils in Sections 4.10 and 4.24, respectively. The cumulative effects analysis in this EIS considered Area B AM5 as a reasonably foreseeable future action (Section 5.2.2.7); vegetation and soils cumulative effects are described in Sections 5.4.9 and 5.4.23, respectively. Characteristic plant communities and range conditions for soil types are listed in "Soil Survey of Rosebud County Area and Part of Big Horn County, Montana, Part I" and is available in pdf format at https://www.nrcs.usda.gov/Internet/FSE_MANUSCRIPTS/montana/rsbdMT1996/rsbdMT1996-Part%20I.pdf. Characteristic vegetation for Lame Deer soils are listed in "Soil Survey of Rosebud County Area and Part of Big Horn County, Montana, Part II" and is available in pdf format at https://www.nrcs.usda.gov/Internet/FSE.../montana/.../rsbdMT1996 Part%20II.pdf. More detailed species lists of plant communities for various range conditions, or grazing intensities, are described in the Ecological Site Descriptions available at https://efotg.sc.egov.usda.gov/
10-4 (8500)	Apparently the water in Area F over all is not that great for livestock pre-mining. Post mining it will be even less suitable. The question is will it be so degraded in quality that raising livestock in the area will be a really questionable venture. After	Proposed seed mixes for reclamation are described in Appendix C. Six seed mixtures will be used in reclamation based on existing community type (lowlands, uplands, conifer, mixed-shrub grass, mixed shrub-forb and shrub, and shrub complex). These mixes consist of 33 grass, 8 shrub, and 20 forb varieties. Conifer tubelings are planned for the conifer reclamation type (Section 2.4.4.8, Revegetation Plan). The upland and conifer communities make up the majority of the native vegetation communities that would be disturbed by mining operations. The conifer seed mixture contains big sagebrush and skunkbush sumac seed.

Comment/ Code	Document #010-Pfister	Response
10-5 (6605) 10-6 (8505, 6605) 10-7 (3903, 5103) 10-8 (8302) 10-9 (8507, 8510, 8524) 10-10 (6805)	40 years Western Energy/Westmoreland has not experimented with let alone discovered a method to conduct the water from the Rosebud seam across mined areas preserving its quality from the pollution of the overburden. For this EIS it is acceptable policy to mix the overburden any which way and dump it back in the pit devil take the hindmost. Some of the sulfate readings on the Area F water now are high enough that cattle could be having trouble. If they are much higher after mining, the readings could reach the level of causing paralysis. Sulfate also ties up what copper livestock may have causing diarrhea leading to death in extreme cases. NRCS (Natural Resources and Conservation Service, USDA) has a new set of soils based on the soils found in the Lame Deer area and the Little Wolf Mountains. Our soils in the Bulls are now counted in that group. NRCS normally has groupings of grasses, shrubs and forbes that grow under various grazing use scenarios. However, they have not yet made the determinations for the plant associations on the Lame Deer soils. Their notes tell one to go to their local NRCS office to find out about the plant associations, but when one does, the local office has no idea. If Area F and AM5 are permitted, they will have a large impact on those soils and plant associations. It will be like clear-cutting the prairie with such large naked areas that other native plants will have a hard time reinvading the area to achieve a true balance. There are other factors such as the underground fungal connections that unmined areas have that will be years and years re-establishing and which are part of having a thriving diverse and native plant community. I did not see anything relating to the disturbing water in Area F and how the Absaloka Mine might have affected water in the area already. Certainly the permitting of Area F and the Area B South Extension will significantly damage the water around the northern base of the Little Wolf Mountains and change plants and soils. I noticed that at times Westmoreland will be responsible for replacing lost water rights, but no specific steps or methods for water recovery are mentioned. It is a lot easier for someone in Denver or Helena to make that statement than it is for a landowner on the ground to figure out what to do between them and the mining company.	**10-3 Response continued:** The mixed shrub-forb and shrub mixture and the shrub complex mixture also contain seeds for several shrub species. Seeds from native trees (including ponderosa pine), shrubs, and forbs not commercially available will be collected at the field and sent to a greenhouse for propagation for use in reclamation (see Appendix C). Additionally, the 2015 Revegetation Monitoring Report shows 21 native grasses, 55 native forbs, 12 native shrubs, and 5 native trees, demonstrating that species adjacent to reclamation will invade (Western Energy Company's Rosebud Mine Revegetation Monitoring - 2015). As stated in the EIS (Section 4.10.3), reclamation would include restoring skunkbush sumac and conifer communities. In addition, more acreage of those communities is proposed for post-mining reestablishment than what would be impacted by the project. Reclamation on Rosebud mining permits has demonstrated ponderosa pine and skunkbush sumac have reestablished (Western Energy Company's Rosebud Mine Revegetation Monitoring - 2015). **10-4 Response:** Surface water quality in Area F is described in the draft EIS in Section 3.7.6 including Tables 42 through 54. Groundwater quality is described in Section 3.8.5 including Tables 59 through 63. Table 41 contains recommended water quality concentration limits for livestock. Sections 4.7.3.2 and 4.8.3.1 describe impacts on surface water and groundwater, respectively. Water quality in spoil at the Rosebud Mine is shown in Table 132. If a water supply became unsuitable for cattle use, Western Energy would provide a replacement water supply. **10-5 Response:** There is no practical method to convey groundwater around or through the backfilled mine pit without contacting spoil. The overburden at Area F has been sampled, and no toxic- or acid-forming materials have been identified which require special handling (draft EIS Section 2.4.3.8). **10-6 Response:** Relatively high concentrations of sulfate are frequently observed in both surface water and groundwater in southeast Montana. Impacts on surface water and groundwater quality are described in the draft EIS in Sections 4.7.3.2 and 4.8.3.1, respectively. If a water supply became unsuitable for cattle use, Western Energy would provide a replacement water supply. The sub-McKay groundwater proposed as the most likely replacement water source has sulfate concentrations lower than most other water sources in the area and well below livestock use guideline values. **10-7 Response:** Impacts on soils are described in Section 4.24 of the EIS. As described in Section 2.4.3.6, Soil Removal and Stockpiling, much of the stripped soil will be hauled directly to areas to be reclaimed, which would minimize the time for microorganisms (including fungi) to reestablish. The loss of microorganisms in soil stored for prolonged periods could lower plant diversity and vigor, but eventually would invade reclaimed soil (within a few years to more than a decade, depending on soil conditions). Under Alternative 3 (see Section 2.5.2.3, Reclamation in the EIS), a DEQ-approved locally available organic amendment, such as a grass mulch, would be incorporated into the upper 4 inches of respread soil on small acreage problem areas (i.e., areas lacking sufficient organic matter, areas with limited vegetative cover, or areas susceptible to erosion) to improve nutrient content and increase the organic matter level to 1 percent by volume. **10-8 Response: See Comment Response 10-3.** **10-9 Response:** The Absaloka Mine is listed in the draft EIS Section 5.2.1.6 as a related past and present action and Section 5.2.2.7 as a related future action. The Absaloka Mine is located in the Sarpy Creek drainage, thus has no cumulative impacts on surface water with Area F, which is in the West Fork Armells Creek drainage. The groundwater divide along the Little Wolf Mountains and the distance between the Absaloka Mine and Area F prevent any cumulative groundwater quality or quantity impacts. **10-10 Response:** Comment responses 10-4 through 10-6 address comments on water. Comments response 10-7 addresses soils. Comment responses 10-3 and 10-8 address vegetation. Section 82-4-222(1)(m), MCA, requires the applicant to submit a determination of the Probable Hydrologic Consequences (PHC) which includes findings on whether the proposed mining may proximately result in the diminution or interruption of (*Response continues on next page.*)

Comment/ Code	Document #010-Pfister	Response
10-11 (8501, 8502)	The rationale for this permit on Area F gives the lie to the application for a permit on AM5 extension. What on earth is going on with Westmoreland? The regulators need to determine that before they commit land to destruction for the next 40 years. Submitted by: Ellen Pfister P. O. Box 330 Shepherd, MT 59079---406-947-5931	**10-10 cont'd:** a water supply that is used for domestic, agricultural, industrial or other beneficial use. Section 82-4-222(1)(n) further requires an applicant to provide a plan for monitoring the availability and suitability of both ground and surface waters for current and approved postmining land uses. ARM 17.24.304 requires that an application for an underground coal mining permit include (among other things): a description of alternative water supplies, not to be disturbed by mining, that could be developed to replace water supplies diminished or otherwise adversely impacted in quality or quantity by mining activities so as not to be suitable for the approved postmining land uses. ARM 17.24.304(1)(f)(iii). ARM 17.24.648 (part of MSUMRA) requires that Western Energy replace the water supply of any owner of interest in real property who obtains all or part of his water supply for domestic, agricultural, or other uses from surface or ground water if such supply has been affected by contamination, diminution, or interruption proximately resulting from mine operations. The specific steps for water supply replacement are laid out in 82-4-253(3)(d), MCA, which requires in pertinent part that an operator shall be ordered (in compliance with MCA Ch. 2, Tit. 85) to replace lost water supplies on both interim basis with needed water and on a permanent basis with a supply of water in like quantity, quality and duration. **10-11 Response: See Comment Response 10-1.**

Comment/ Code	Document #121-University of Chicago	Response
	From: Templeton, Mark **To:** western-energy-area-f-eis; lsholar@osmre.gov **Cc:** Templeton, Mark; Weinstock, Robert **Subject:** University of Chicago Comments on Western Energy Area F Draft EIS **Date:** Monday, March 5, 2018 10:50:51 AM **Attachments:** Greenstone EPIC Abrams Clinic comment on proposed new permit area C2011003F.pdf To whom it may concern: On behalf of Professor Michael Greenstone, the Energy Policy Institute at the University of Chicago ("EPIC"), and the Abrams Environmental Law Clinic at the University of Chicago Law School, I respectfully submit these comments regarding the December 2017 Draft Environmental Impact Statement ("DEIS") by the U.S. Department of Interior: Office of Surface Mining Reclamation and Enforcement ("Office of Surface Mining" or "OSMRE") for the proposed new permit area C2011003F, Area F at Rosebud Mine ("Rosebud expansion"). I would appreciate it if you would confirm receipt of this email. Also, please note that contrary to the Federal Register notice, it does not appear to be possible to submit the comments at http://svc.mt.gov/deq/publiccomment/ at present. Sincerely yours, Mark Templeton Mark N. Templeton * Clinical Professor of Law and Director, Abrams Environmental Law Clinic * University of Chicago Law School * 6020 South University Avenue, Chicago, IL 60637 * direct tel. 773-702-6998 * fax 773-702-2063 * http://www.law.uchicago.edu/faculty/templeton * The preceding email message may be confidential or protected by the attorney-client, attorney work-product, or common-interest privilege. It is not intended for transmission to, or receipt by, any unauthorized persons.	

Comment/ Code	Document #121-University of Chicago	Response
	THE UNIVERSITY OF CHICAGO ABRAMS ENVIRONMENTAL LAW CLINIC OF THE UNIVERSITY OF CHICAGO LAW SCHOOL March 5, 2018 ATTN: OSMRE, Rosebud Mine Area F EIS C/O Logan Sholar Office of Surface Mining Reclamation and Enforcement, Western Region 1999 Broadway, Suite 3320 Denver, CO 80202 ATTN: Western Energy Area F EIS C/O: Nicole Bauman ERO Resources Corporation 1842 Clarkson Street Denver, CO 80218 **Re: Comments on Draft Environmental Impact Statement by the U.S. Department of the Interior: Office of Surface Mining Reclamation and Enforcement for Proposed New Permit Area C2011003F, Area F, at Rosebud Mine** **Comments sent via e-mail only** On behalf of Professor Michael Greenstone, the Energy Policy Institute at the University of Chicago ("EPIC"), and the Abrams Environmental Law Clinic at the University of Chicago Law School, I respectfully submit these comments regarding the December 2017 Draft Environmental Impact Statement ("DEIS") by the U.S. Department of Interior: Office of Surface Mining Reclamation and Enforcement ("Office of Surface Mining" or "OSMRE") for the proposed new permit area C2011003F, Area F at Rosebud Mine ("Rosebud expansion"). Professor Greenstone is the Milton Friedman Professor in Economics at the College, and the Harris School of Public Policy, as well as the Director of the interdisciplinary Energy Policy Institute at the University of Chicago (EPIC) and the Energy & Environment Lab at the University of Chicago Urban Labs.[1] He previously served as the Chief Economist for President Obama's Council of Economic Advisers, and on the Secretary of Energy's Advisory Board. Professor Greenstone also previously directed the Brookings Institution's Hamilton Project, which studies policies to promote economic growth, and has since joined its Advisory Council. He is an elected member of the American Academy of Arts and Sciences and editor of the Journal of Political Economy. He earned his Ph.D. from Princeton University. He has worked extensively on the Clean Air Act and examined its impacts on air quality, manufacturing activity, [1] For a full biography and list of qualifications and publications, please see https://www.michaelgreenstone.com/. THE ARTHUR O. KANE CENTER FOR CLINICAL LEGAL EDUCATION 6020 SOUTH UNIVERSITY AVENUE / CHICAGO, ILLINOIS 60637-2786 (773) 702-9611 / FAX: (773) 702-2063 / www.law.uchicago.edu/mandel	

Comment/ Code	Document #121-University of Chicago	Response
Summary statements - see below for individual comment responses to these statements	housing prices, and human health to assess its benefits and costs. He is currently leading large-scale projects to estimate the economic and social costs of climate change, including through the Climate Impact Lab initiative,[2] and to identify efficient approaches to mitigating these costs. When Professor Greenstone was serving as Chief Economist for the Council of Economic Advisers, he co-led the interagency process to develop a government-wide approach to evaluating the costs and benefits of the release of greenhouse gases (GHGs) into the atmosphere. This process led to what is commonly known as the Social Cost of Carbon (SCC), a method of quantifying the impacts of GHGs. As discussed further below, the Interagency Working Group on the Social Cost of Carbon (IWG) included subject-matter experts from six federal agencies and six offices from the Executive Office of the President of the United States. In developing its estimates, it used consensus-based decision making, relied on existing academic literature and models, and took steps to disclose limitations and incorporate new information.[3] EPIC seeks to confront energy and environmental challenges by using a cross-cutting approach that links the University of Chicago's renowned economists with leading thinkers in policy and law, business, big data, engineering and natural and physical sciences through the University and at partner institutes such as the Marine Biological Lab and Argonne National Lab.[4] The Abrams Environmental Law Clinic seeks to solve some of the most pressing environmental problems through advocacy and litigation at the local, state and federal levels.[5] **I. OVERVIEW** This comment responds to and refutes each of the justifications that OSMRE provides for its refusal to undertake an SCC analysis in the Rosebud expansion DEIS. As a threshold matter, this comment first reminds OSMRE of its obligation under NEPA to take a sufficiently "hard look" at the Rosebud expansion's environmental impacts, which requires a complete analysis of the project's climate costs through a tool like the SCC methodology. Then, turning to each of OSMRE's reasons for rejecting the SCC, this comment first explains that OSMRE is not relieved of its responsibility to consider the costs of carbon emissions when undertaking a cost-benefit analysis merely because that analysis is contained in a DEIS rather than a "rulemaking." Second, and relatedly, OSMRE cannot ignore the SCC as the best available tool to calculate costs associated with carbon dioxide emissions simply because the current administration withdrew [2] The Climate Impact Lab combines experts from the University of California, Berkeley, the Energy Policy Institute at the University of Chicago (EPIC), Rhodium Group and Rutgers University. EPIC provides core financial and administrative support for the Lab. *See* Energy Policy Institute at the University of Chicago, *Social Cost of Carbon*, https://epic.uchicago.edu/research/centers/climate-impact-lab. [3] *See generally* U.S. Gov't Accountability Office, GAO-14-663, Regulatory Impact Analysis: Development of Social Cost of Carbon Estimates (2014), http://www.gao.gov/assets/670/665016.pdf [hereinafter U.S. GAO Social Cost of Carbon Estimates]. [4] *See* Energy Policy Institute at the University of Chicago, https://epic.uchicago.edu/about. [5] *See* Abrams Environmental Law Clinic, The University of Chicago Law School, http://www.law.uchicago.edu/clinics/environmental. 2	

Comment/ Code	Document #121-University of Chicago	Response
Summary statements cont'd **121-1 (6311 & 6312)** **121-1, cont'd**	guidance documents related to the SCC. Such executive actions do not impact OSMRE's statutory mandate under NEPA to take a "hard look" at the environmental impacts of the Rosebud expansion. Third, the Rosebud expansion DEIS violates NEPA case law because it quantifies benefits but does not quantify costs. In conclusion, the SCC remains the best method for fulfilling OSMRE's obligation to take a hard look at the climate change impacts of the proposed action. **II. OSMRE CANNOT TAKE THE REQUISITE "HARD LOOK" AT THE ROSEBUD EXPANSION'S ENVIRONMENTAL IMPACTS WITHOUT PROPERLY ACCOUNTING FOR CLIMATE COSTS.** OSMRE's refusal to undertake a complete analysis of the Rosebud expansion's foreseeable climate impacts violates NEPA's "hard look" requirement. OSMRE acknowledges in its DEIS that coal mining and combustion impose costs on society by contributing to climate change,[6] but the agency ultimately refused to use the SCC protocol for quantifying climate-related costs on grounds that: (i) the Rosebud expansion is not a "rulemaking for which the protocol was originally developed;" (ii) Executive Order 13,783 disbanded the IWG and withdrew the SCC guidance; (iii) the agency did not undertake a cost-benefit analysis in its DEIS; and (iv) quantification of costs is unnecessary because the DEIS does not quantify benefits.[7] By rejecting the SCC protocol in its DEIS, OSMRE failed to take a sufficiently "hard look" at the foreseeable climate impacts of the Rosebud expansion and therefore violated NEPA's twin aims of informed decision-making and an informed public.[8] **a. OSMRE cannot satisfy NEPA's "hard look" requirement without undertaking a complete analysis of the Rosebud expansion's environmental impacts based on high quality information, like the SCC.** To satisfy NEPA's "hard look" requirement, agencies must to "the fullest extent possible . . . take into proper account a complete analysis of the project's environmental impacts."[9] Pursuant to both CEQ regulations and Ninth Circuit precedent, a complete environmental analysis is one that relies on "high-quality information" to assess a project's "direct, indirect, and [6] *See* Mont. Dept. of Environmental Quality & U.S. Dept. of Interior, Office of Surface Mining Reclamation & Enforcement, Western Energy Area F Draft Environmental Impact Statement, Proposed New Permit Area C2011003F (Dec. 2017), at 157 (discussing how coal combustion contributes to climate change) [hereinafter Rosebud expansion DEIS] [7] Rosebud Expansion DEIS, *supra* at 491. [8] *See N. Plains Res. Council v. Surface Transp. Bd.*, 668 F.3d 1067, 1085. (9th Cir. 2011) ("NEPA aims (1) to ensure that agencies carefully consider information about significant environmental impacts and (2) to guarantee relevant information is available to the public.") [9] *City of Davis v. Coleman*, 521 F.2d 661, 675 (9th Cir. 1975) (internal quotations omitted). 3	**121-1 Response:** The "hard look" that NEPA requires is a reasoned analysis containing quantitative or detailed qualitative information. OSMRE satisfied the hard look requirement by evaluating best available information and completing a thorough qualitative and quantitative analysis including calculating potential greenhouse gas emissions from mine operations, transportation, export, and coal combustion. In addition, our GHG emissions overestimate the emissions likely to be reduced under the No Action alternative. The assumptions inherent in the SCC tool compound this problem because it is effectively overestimating an overestimate of global coal consumption, which makes it too speculative to be useful to the decision maker and the public. OSMRE does not believe that the SCC tool would provide OSMRE with the best available information when disclosing the impacts of climate change or other pertinent environmental information, because of the uncertainty surrounding the methodology. OSMRE's decision not to use the SCC was not arbitrary or capricious. Although the EIS does discuss the socioeconomic impacts, including revenue, OSMRE is not required by NEPA to complete a monetary cost-benefit analysis of the project, and we did not include one in this EIS. Unless we produced a complete monetary cost-benefit analysis, which would include both the social costs of the project (including the social costs of carbon) as well as the social benefits of the project (e.g., the monetary benefits of the power generated), inclusion solely of a cost analysis for the social cost of carbon would be contrary to NEPA and create an unbalanced and inaccurate assessment of the project. As such, it would not be useful in facilitating a decision by the authorized official. Moreover, another commenter completed a social cost of carbon analysis (see Comment no. 14), which showed that "Total emission costs for the 19-year time horizon vary by over 40-fold from a low of $319 million to as high as $12.9 billion." While OSMRE does not believe that a social cost of carbon analysis is warranted for this project decision and did not include it in the EIS, as outlined in **Section 4.4.5**, we note that this analysis and its wide margin of error support our conclusion that such analysis was not needed because the social cost of carbon without a full cost-benefit analysis is of very limited utility to the decision maker. OSMRE takes its responsibility of satisfying NEPA's "hard look" requirement seriously. The "hard look" required by NEPA means making use of all relevant data and detailed information available, applying sound science and economic principles, as well as considering all methodologies available. OSMRE, where appropriate and not overly speculative, included reasonable forecasting as in the case of the Climate discussion in Chapter 4 allowing the decision maker to evaluate potential impacts associated with the Proposed Action using representative or predicted emissions.

Comment/ Code	Document #121-University of Chicago	Response
8505 121-1, cont'd	cumulative" environmental impacts.[10] NEPA requires agencies to engage in these comprehensive and data-driven analyses in order to "force agencies to take a hard look at [the] environmental consequences" of their actions.[11] In addition, NEPA requires agencies to disclose such environmental consequences so that an "informed public [can] comment on proposed action and any choices or alternatives that might be pursued with less environmental harm."[12] An agency's requisite "hard look" must include "quantified or detailed information" about the project's cumulative impacts.[13] For a mining project, like Rosebud, the CO2 emissions resulting from the project would contribute to global climate-change impacts and are therefore cumulative and must be quantified or detailed. This "cumulative impact analysis" must be "more than perfunctory": it must provide a "useful analysis of the cumulative impacts of past, present, and future projects."[14] As the Ninth Circuit made clear in *Northern Plains Resource Council*, "general statements about possible effects and some risk do not constitute a hard look absent a justification regarding why more definitive information could not be provided." *Id.* When an agency shirks its responsibility to undertake a complete analysis of a project's climate impacts by ignoring "high-quality" information and offering only general statements about the project's climate consequences—as OSMRE did here—that agency undermines NEPA's foundational "hard look" requirement. **b. Endorsed by federal courts, the SCC provides the very "high-quality information" that NEPA's "hard look" requirement demands** The IWG took a comprehensive, expert-based approach to measuring the global, long-lasting, and system-wide impacts from carbon dioxide in the atmosphere. It included subject-matter experts from six federal agencies and six offices from the Executive Office of the President of the United States.[15] In developing its estimates, the IWG used consensus-based decision making, relied on accurate scientific analysis, and took steps to disclose limitations and incorporate new information.[16] To calculate the SCC, (1) integrated assessment models (IAMs) compute future emissions scenarios by projecting future economic growth, population change, and technology development; (2) the resulting emissions projections are used to develop climate trajectories; (3) the resulting predicted temperature changes are inputted into damage functions, which estimate the harms from a changing climate; and (4) the resulting cumulative damages are [10] *See Lands Council v. Powell*, 395 F.3d 1019 (9th Cir. 2005) (citing CEQ regulations); *N. Plains Res. Council*, 668 F.3d at 1072, 1076 (explaining the standard for a legally sufficient EIS); *see also* 40 C.F.R. § 1500.1(b) (2008). [11] *See Lands Council*, 395 F.3d at 1027. [12] *Id.* [13] *N. Plains Res. Council*, 668 F.3d at 1076. [14] *Id.* at 1076. [15] The U.S. Department of Agriculture was among the federal agencies involved in the IWG process. *See* Interagency Working Group on Social Cost of Greenhouse Gases, Technical Update of the Social Cost of Carbon for Regulatory Impact Analysis Under Executive Order 12866 (2016) [hereinafter Technical Update of the SCC]. [16] *See generally*, U.S. GAO Social Cost of Carbon Estimates, *supra* note 3. 4	**121-1 Response continued – 8505:** See comment response on page 3. In addition, the GHG emissions of the region's fossil fuel projects are discussed under No Action in **Section 4.4.2.3** of the EIS. OSMRE determined that the analysis of indirect effects on climate change would also address the potential cumulative impacts on climate change so there is no separate cumulative effects analysis for impacts on climate change in the EIS. Climate change impacts are discussed in general in **Sections 3.4** and **4.4**. GHG emissions are examined for NEPA purposes. Under MEPA, DEQ's analysis of actions is limited to actions which significantly affect the quality of the human environment in Montana. Section 75-1-201(1)(b)(4), MCA. **121-1 Response continued:** See comment response on page 3.

Comment/ Code	Document #121-University of Chicago	Response
121-1, cont'd	discounted to put them in present value terms.[17] This robust process produced an estimate of the monetary costs to society of emitting an additional ton of CO_2 into the atmosphere. To date, the IWG's SCC protocol is the most rigorously scrutinized and widely used estimation of the marginal costs of climate change. As described above, the process to produce the SCC was robust. Since the SCC was developed, it has been cited in many academic studies,[18] implemented by states and other nations,[19] and used in more than 80 regulatory rulemakings.[20] Put simply, the SCC protocol is precisely the sort of "high-quality" environmental information that agencies are required to consider when undertaking a complete analysis of, and "hard look" at, a project's environmental impacts.	**121-1 Response continued:** See comment response on page 3.
121-1, cont'd	Prior to the development of the SCC,[21] federal agencies lacked a definitive numerical measure of the impacts of climate change associated with particular increments of greenhouse gas emission, and courts found agencies to be in violation of NEPA when they failed to account for climate change. In *Center for Biological Diversity v. National Highway Traffic Safety Administration*,[22] for example, the court faulted the National Highway Traffic Safety Administration for failing to employ a quantifiable cost for carbon when the agency conducted a quantified consideration of costs and benefits. The court found that such a failure was equivalent to pricing impacts at $0, an obviously irrational position and an impermissible methodology under NEPA, which requires agencies to consider all impacts of pollutants, including carbon dioxide.[23] Subsequent to the development of the SCC, federal courts assessing whether agencies have satisfied NEPA's hard look requirement have found that the IWG's SCC is an appropriate method for determining climate costs. For example, this past summer, a federal district court in Montana vacated a different OSMRE environmental analysis for its failure to properly account for the project's climate costs.[24] Like the DEIS at issue here, *Montana Environmental* [17] The original SCC estimate was calculated based on the value of a US dollar in 2007, but more recent estimates represent the cost per ton in 2016 and 2017 US dollars. [18] *See, e.g.*, Geoffrey M. Heal & Antony Millner, *Agreeing to Disagree on Climate Policy*, 111 PROC. OF THE NAT'L. ACAD. OF SCI. OF THE U.S. OF AM. 3695 (2014), http://www.jstor.org/stable/23770774; Richard S. J. Tol, *The Social Cost of Carbon*. 3 ANN. REV. OF RESOURCE ECON. 419 (2011), http://www.jstor.org/stable/43202706; Cass R. Sunstein, *On Not Revisiting Official Discount Rates: Institutional Inertia and the Social Cost of Carbon*, 104 AM. ECON. REV. 547 (2014), http://www.jstor.org/stable/42920996. [19] "Governments around the world have recognized the credibility of the United States government's social cost of carbon. For example, it has been adopted by the governments of California, Illinois, Minnesota, Maine, New York, and Washington, as well as Canada and Mexico." *See* At What Cost? Examining the Social Cost of Carbon: Hearing Before the H. Comm. on Sci., Space, and Tech., Subcomm. on Env't, Subcomm. on Oversight 115th Cong. 5(2017) (statement of Michael Greenstone) [hereinafter Greenstone Congressional Testimony]. [20] *See, e.g.*, Peter Howard & Jason Schwartz, *Think Global: International Reciprocity as Justification for a Global Social Cost of Carbon*, 42 COLUM. J. OF ENVTL. L. 203, 270 (2017) (listing regulatory proceedings that apply the SCC or the Social Cost of Methane (SCM)). [21] *See* U.S. GAO Social Cost of Carbon Estimates, *supra* note 3. [22] 538 F.3d 1172 (9th Cir. 2008). [23] *Id.* at 1200. [24] *Mont. Envtl. Info. Ctr. v. Office of Surface Mining*, No. CV 15-106-M-DWM, 2017 WL 3480262 (D. Mont. Aug. 14, 2017). 5	**121-1 Response continued:** See comment response on page 5. In addition, in *Center for Biological Diversity v. National Highway Traffic Safety (NHTSA)* (https://scholar.google.com/scholar_case?case=19867343341144823 6&q=Center+for+Biological+Diversity+v.+NHTSA&hl=en&as_sdt=200006&as_vis=1), the 9th circuit held that the NHTSA's EA was markedly deficient in its attempt to justify the refusal to prepare a complete EIS. The agency's FONSI was based primarily on its conclusory assertion — contradicted by evidence in the record — that the Final Rule will have no significant environmental impact because it authorizes CAFE standards that will result in a very small decrease in carbon dioxide emissions. OSMRE discloses the direct and indirect GHG emissions that would result from both the Proposed Action and the No Action alternatives concluding that both alternatives would contribute incrementally to climate change and the differences between the two alternatives would be negligible. The Proposed Action would extend the duration of indirect GHG emissions from coal combustion by 8 years over the No Action alternative, but annual GHG emissions from coal combustion are not expected to increase. See **Section 4.4 Climate and Climate Change** in the EIS for more information.

Comment/ Code	Document #121-University of Chicago	Response
121-1, cont'd 121-1, cont'd 121-1, cont'd	*Information Center* involved an environmental analysis that OSMRE prepared for a proposed mine expansion at Montana's Bull Mountain mine. Upon vacating OSMRE's environmental analysis in that case, the court explained that OSMRE violated NEPA when it monetized the project's economic benefits but not the costs of the increased carbon emissions that would result from the mine expansion.[25] Although the court did not specify how the agency must quantify costs of such carbon emissions, it accepted plaintiff's contention that the SCC is such "a tool… available to do so."[26] The U.S. Court of Appeals for the Seventh Circuit reached a similar result in a different context in *Zero Zone, Inc. v. United States Department of Energy* when it upheld the SCC as a valid metric for appropriately considering climate costs in a decision made by the U.S. Department of Energy.[27] Another court *required* the use of the SCC in a coal-lease expansion situation similar to the one here. In *High Country Conservation Advocates v. United States Forest Service ("High Country")*, the U.S. District Court for the District of Colorado held that agencies must use the SCC in a cost-benefit analysis, absent a rational justification to the contrary.[28] As explained in Section III.c *infra*, the Rosebud expansion DEIS should be understood as conducting a cost-benefit analysis since OSMRE quantifies and discusses the project's direct and indirect economic benefits. Such an analysis squarely requires using the SCC according to the federal court in *High Country*.[29] **c. To satisfy NEPA's "hard look" requirement, OSMRE must provide "quantified" and "detailed information" about a project's climate consequences through a tool like the SCC.** Even if OSMRE maintains its flawed argument that its DEIS does *not* quantify benefits (see discussion infra Section III.c.), OSMRE's refusal to undertake a complete analysis of the Rosebud expansion's climate impacts through a tool like the SCC still violates NEPA. Pursuant to CEQ regulations and Ninth Circuit precedent, OSMRE's Rosebud DEIS must be based on "high quality information" and contain "quantified or detailed information" about, and a "useful analysis" of, the project's cumulative climate impacts.[30] OSMRE's Rosebud DEIS contains no such analysis. The climatic models and comparisons to national GHG emissions that do appear in the Rosebud DEIS do not provide the kind of complete or useful analysis that NEPA requires. Despite stating that the Rosebud expansion will extend the life of the mine by at least eight years, [25] *Mont. Envtl. Info. Ctr. v. Office of Surface Mining*, No. CV 15-106-M-DWM, 2017 WL 3480262, at *11-*13 (D. Mont. Aug. 14, 2017). [26] *Id.* at *12. [27] 832 F.3d 654, 678–79 (7th Cir. 2016) (ruling that the U.S. Department of Energy's "determination of [the] SCC was neither arbitrary nor capricious."). [28] 52 F. Supp.3d 1174, 1190–93 (D. Colo. 2014). [29] *See* Section II. *infra*. [30] *See N. Plains Res. Council*, 668 F.3d at 1076. 6	**121-1 Response continued:** See comment response on page 3. In addition, in *Montana Environmental Information Center v. U.S. Office of Surface Mining, Civ. No. 15-106-M-DWM (D. Mont. 2017)*, https://www.elaw.org/US_MEIC_v_OSM_2017, the district court held that although cost-benefit analysis is not required in environmental assessments, OSMRE improperly emphasized the economic benefits of coal production while **completely** excluding any discussion of the costs of GHG emissions. The court stated: "[T]he Mining Plan EA concluded not that the specific effects of greenhouse gas emissions from the expansion would be too uncertain to predict, but that there would in fact be no effects from those emissions, because other coal would be burned in its stead. This conclusion is illogical and places the Enforcement Office's thumb on the scale by inflating the benefits of the action while minimizing its impacts." Id., p. 46. NEPA does not require a cost-benefit analysis of the project such as that described by the commenter. As such, the EIS does not present any economic benefits or costs for any resource. As required by NEPA (see 40 CFR § 1508.14), the socioeconomic impacts are discussed, including a description of the local economy and the project's potential changes to the employment, labor income, and local economic activity. These impacts can be perceived either positively or negatively by the community; however, a positive perception of increased economic activity in an area is very distinct from being an "economic benefit" as defined in economic theory and methodology (Watson et al. 2007, Kotchen 2011). Accordingly, this discussion is not a cost-benefit analysis and does not attempt to monetize the benefits of the project. **121-1 Response continued:** See comment response on page 3. In *High Country Conservation Advocates v. U.S. Forest Service, 52 F. Supp. 3d 1174 (D.Colo. 2014)*, (https://www.leagle.com/decision/infdco20140630a94) Judge Jackson found that "In effect the agency prepared half of a cost-benefit analysis, incorrectly claimed that it was impossible to quantify the costs, and then relied on the anticipated benefits to approve the project." In the Area F EIS, OSMRE has not completed, in part or in full, a cost-benefit analysis. NEPA does not require a cost-benefit analysis of the project. As such, the EIS does not present any economic benefits or costs for any resource. As required by NEPA (see 40 CFR § 1508.14), the socioeconomic impacts are discussed, including a description of the local economy and the project's potential changes to the employment, labor, income, and local economic activity. These impacts can be perceived either positively or negatively by the community; however, a positive perception of increased economic activity in an area is very distinct from being an "economic benefit" as defined in economic theory and methodology (Watson et al. 2007, Kotchen 2011). **121-1 Response continued:** See comment response on page 3. In addition, a detailed analysis of GHG emissions in relation to the proposed Rosebud Mine expansion is provided in **Section 4.4** of the EIS. Historic GHG emissions production and climate trends are discussed in **Section 3.4.2**. Discussions of projected global, national, and regional GHG emission trends and climate change impacts are provided in **Section 4.4** and **Section 5.3.3**. GHG emissions are examined for NEPA purposes. Under MEPA, DEQ's analysis of actions is limited to actions which significantly affect the quality of the human environment in Montana. Section 75-1-201(1)(b)(4), MCA.

Comment/ Code	Document #121-University of Chicago	Response
121-1, cont'd (6301)	produce 70.8 million additional tons of coal, and emit an additional 675,568 tons of carbon dioxide into the atmosphere, OSMRE concludes that the project's direct, indirect, and cumulative impacts on climate change will be "negligible."[31] The only information OSMRE relies on in reaching this conclusion is a comparison of national carbon dioxide emissions and the Rosebud expansion's projected carbon dioxide emissions.[32] According to OSMRE, the fact that 675,568 tons of carbon dioxide is only a fraction of total U.S. GHG emissions provides sufficient evidence that the Rosebud expansion will produce only negligible climate consequences. Not only is this conclusion substantively inaccurate, but it is also based upon a bare-bones analysis that does not allow OSMRE or the public to make an informed decision about the Rosebud expansion. In other words, OSMRE's existing analysis of the Rosebud expansion's climate impacts amounts to nothing more than "general statements about possible effects and some risk," which does "not constitute a hard look absent a justification regarding why more definitive information could not be provided."[33]	**121-1 Response continued – 6301:** See comment response on page 3. OSMRE concluded in the Draft EIS that direct and indirect GHG emissions resulting from the Proposed Action would contribute incrementally to climate change (**Sections 4.4.3.1** and **4.4.3.2**). Regional, national, and global historical climate change trends are discussed in **Section 3.4.2.3**, and projected county, state, regional, national, and global climate change trends are discussed in **Sections 4.4.2.1** through **4.4.2.3**. The state of climate science does not allow any given level of emissions from an individual project to be tied back to a quantifiable effect on climate change. The EIS has been revised to remove the following sentence in **Section 4.4.3.1**: "Thus, direct effects of the Proposed Action on climate and climate change would be negligible relative to other sources." OSMRE quantified direct and indirect GHG emissions resulting from the Proposed Action and alternatives and discussed those emissions in the context of state, regional, national, and global GHG emissions in **Sections 4.4.3.1** and **4.4.3.2**. Total annual projected direct GHG emissions for the project area, calculated using conservative assumptions, comprise a very small fraction—0.0016 percent—of the total 2015 U.S. GHG emissions. Total annual projected indirect GHG (CO2e) emissions would comprise a small fraction—0.19 percent—of the total 2015 U.S. GHG emissions. The EIS has been revised to remove this sentence from **Section 4.4.3.2**: "However, the change in indirect GHG emissions between the No Action alternative and the Proposed Action would be negligible because the Colstrip Power Plant is considered to operate under the No Action alternative even in the absence of mining at the project area." GHG emissions are examined for NEPA purposes. Under MEPA, DEQ's analysis of actions is limited to actions which significantly affect the quality of the human environment in Montana. Section 75-1-201(1)(b)(4), MCA.
121-1, cont'd	Just as it did in its environmental analysis of the Bull Mountain mine expansion, OSMRE again seeks to ignore the consequences of the increased carbon emissions that will result from the Rosebud mine expansion in violation of NEPA's hard-look requirement. In its now-vacated Bull Mountain environmental assessment , OSMRE refused to provide quantified or detailed information about the project's climate impacts based in part on its conclusion that the project's resultant carbon dioxide emissions would be a "small percentage of the US total."[add cite]. OSMRE here relies on that same rationale to avoid providing the public with a quantified and detailed assessment of the Rosebud expansion's climate consequences. If such a conclusory and incomplete analysis was insufficient to satisfy the NEPA requirements for the environmental assessment at issue in Bull Mountain, then surely that same level of analysis cannot satisfy NEPA's far more demanding requirements for the environmental impact statement at issue here.	**121-1 Response continued:** See comment response on pages 3 and 4.
121-1, cont'd	As this comment makes clear, the SCC is an available tool that would provide the requisite high quality information about the Rosebud expansion's climate impacts. Indeed, the very purpose of the SCC is to enable agencies to quantify the climate impacts of their actions in order to make more informed decisions. Therefore, by ignoring the SCC, OSMRE has failed to satisfy NEPA's "hard look" requirement and contravened NEPA's twin aims of informing agency decision-making and informing the public of a project's environmental consequence.	**121-1 Response continued:** See comment response on pages 3 and 4.
121-2 (6311 & 6312)	**III. OSMRE's Proffered Reasons for Not Using the SCC Are Flawed.** **a. OSMRE's Position that the SCC is only Relevant to Rulemakings Is a Distinction without Difference that Courts Have Rejected** As noted in Section II infra, NEPA's "hard look" standard requires OSMRE to use "high-quality" environmental information in its Rosebud DEIS regardless of the fact that EISs are not [31] Rosebud expansion DEIS, *supra* at 34-35, 41, 489, 680. [32] *Id.* at 489, 680. [33] *N. Plains Res. Council*, 668 F.3d at 1076. 7	**121-2 Response:** See 121-1 response on page 3. In addition, Executive Order 13783 withdrew the Technical Support Documents upon which the protocol was supported by and directed agencies to ensure that estimates of the social cost of greenhouse gases "are based on the best available science and economics" and are consistent with the guidance contained in OMB Circular A-4, "including with respect to the consideration of domestic versus international impacts and the consideration of appropriate discount rates" (EO 13783, Section 5(c)). While interim protocols have been developed for use in the rulemaking context, they do not apply at the project-level, and there is no Executive Order requirement to apply the SCC protocol to project decisions. The SCC as outlined in now withdrawn Technical Support Documents would not present values showing all associated costs and benefits of a project and therefore does not provide a meaningful and accurate cost-benefit analysis.

Comment/ Code	Document #121-University of Chicago	Response
121-2, cont'd	rulemakings. See *Lands Council*, 395 F.3d at 1031. When preparing an EIS, agencies must, to "the fullest extent possible . . . take into proper account a complete analysis of the project's environmental impacts." *City of Davis*, 521 F.2d at 675. Whether the SCC was first contemplated for use in rulemakings and not project-level EISs does not answer the fundamental question of whether applying the SCC is necessary here for OSMRE to take a sufficiently "hard look" at the Rosebud expansion's climate impacts. As the court explained in *High Country*, OSMRE's statements about the SCC's origins as a rulemaking device "do not explain why [the] agenc[y] believe[s] the protocol [is] inaccurate or not useful in this instance."[34] Even if the SCC began as a tool for rulemaking, agencies have used the SCC in other contexts like project level EISs to measure the environmental impacts of greenhouse gases. As one example, the Bureau of Reclamation used the SCC to measure the impacts of carbon dioxide emissions from a coal-fired power plant in the Navajo Generating Station-Kayenta Mine Complex Project FEIS.[35] That EIS applied multiple discount rates and looked at "SCC estimation results between the proposed action, reasonable alternatives, and no action alternative for a reasoned analysis of alternatives."[36] In addition, the U.S. Environmental Protection Agency (US EPA), which reviews EISs by other federal agencies and otherwise assists CEQ in coordinating NEPA reviews,[37] has endorsed the use of the SCC outside the rulemaking context.[38] Thus, OSMRE's argument that the SCC was designed for rulemakings has no bearing on the fact that OSMRE should have used the methodology in its Rosebud DEIS. **b. That the Trump Administration Withdrew SCC Guidance Documents Does Not Relieve OSMRE of Its Legal Obligations to Use the SCC.** Like its reliance on the irrelevant distinction between rulemakings and EISs, OSMRE's argument that it need not consider the SCC because the current administration withdrew certain guidance documents[39] is fundamentally flawed. NEPA requires the use of "high-quality" information, regardless of the views of any presidential administration regarding NEPA's requirements or whether the SCC constitutes (or does not constitute) high quality information. Elections do not change the state of scientific or economic knowledge. The SCC's represents "high-quality" information that is integral to a [34] *See High Country* 52 F. Supp.3d at 1192. [35] Bureau of Reclamation, Navajo Generating Station-Kayenta Mine Complex Project FEIS (2016). [36] *See How Did Federal Environmental Impact Statements Address Climate Change in 2016*, Sabin Center for Climate Change Law, Columbia Law School (Feb. 2017) 17. [37] *See* U.S. Environmental Protection Agency, EPA Review Process under Section 309 of the Clean Air Act, https://www.epa.gov/nepa/epa-review-process-under-section-309-clean-air-act. [38] *See* Sarah E. Light, *NEPA's Footprint: Information Disclosure as a Quasi–Carbon Tax on Agencies*, 87 TUL. L. REV. 511, 545-46 (2013). [39] Exec. Order No. 13,783, 82 Fed. Reg. 16,093 (Mar. 28, 2017). 8	**121-2 Response continued**: As stated earlier, NEPA does not require a cost-benefit analysis (40 C.F.R. § 1502.23), although NEPA does require consideration of "effects" that include "economic" and "social" effects (40 C.F.R. 1508.8(b)). Without a complete monetary cost-benefit analysis, which would include the social benefits of the proposed action to society as a whole and other potential costs and positive benefits, inclusion solely of an SCC cost analysis would be unbalanced, potentially inaccurate, and not useful in facilitating an authorized officer's decision. Any increased economic activity, in terms of revenue, employment, labor income, total value added, and output, that is expected to occur with the proposed action is simply an economic impact, rather than an economic benefit, inasmuch as such impacts might be viewed by another person as negative or undesirable impacts due to potential increase in local population, competition for jobs, and concerns that changes in population will change the quality of the local community. Economic impact is distinct from "economic benefit" as defined in economic theory and methodology, and the socioeconomic impact analysis required under NEPA is distinct from cost-benefit analysis, which is not required. According to the now withdrawn SCC Technical Support Document, "[t]he purpose of the "social cost of carbon" (SCC) estimates presented here is to allow agencies to incorporate the social benefits of reducing carbon dioxide (CO2) emissions into cost-benefit analyses of regulatory actions that have small, or "marginal," impacts on cumulative global emissions." The SCC tool is to be used as part of the overall cost-benefit analysis required for a Regulatory Impact Analysis. OSMRE is not required to complete a cost-benefit analysis under CEQ's NEPA Implementing Regulations (40 CFR 1502.23). **121-2 Response continued**: See 121-2 comment response above, starting on page 8. In addition, as previously stated, NEPA's "hard look" requirement is meant to ensure a reasoned and complete analysis containing quantitative or detailed qualitative information upon which the decision maker can base a reasoned decision that evaluates best available information and quantifying or qualitatively discussing the potential impacts presented by the alternatives. NEPA does not require a specific tool for analyzing the options and OSMRE does not believe that the SCC tool would provide it with the best available information to disclose the impacts of climate change or other pertinent environmental information. Its decision not to use the SCC was not arbitrary or capricious. (*Response continues on next page.*)

Comment/ Code	Document #121-University of Chicago	Response
121-2 cont'd	"complete analysis" and requisite "hard look" at the Rosebud expansion's environmental impacts under NEPA. Moreover, President Trump's executive order on energy that disbanded the IWG and withdrew its work on the SCC[40] also directed agencies to look to OMB Circular A-4 for guidance on these kinds of issues, and Circular A-4 itself provides instructions to agencies, in terms similar to NEPA, that compel using the SCC in decision-making of all types.[41] Like NEPA, Circular A-4 is intended to promote informed and transparent decision-making using the best available information. First, Circular A-4, like NEPA, requires high-quality information: "A good analysis provides specific references to all sources of data, appendices with documentation of models (where necessary), and the results of formal sensitivity and other uncertainty analyses."[42] Second, Circular A-4, like NEPA, encourages transparency: "A good analysis is transparent. It should be possible for a qualified third party reading the report to see clearly how you arrived at your estimates and conclusions."[43] The SCC is a widely-known and well-established analytical tool to present climate damages associated with particular carbon-dioxide emissions that qualified third parties already understand. The SCC aids decision-making because it represents "high-quality" environmental information that contributes to a complete analysis of the project's environmental impacts.[44] [40] To the extent to which efforts arise to revise the calculation of the SCC, such efforts should be holistic and should rely on the best available scientific information. For example, the National Academy of Sciences, Engineering, and Medicine—an organization of experts who review critically the work of other experts—recommended ways to improve the SCC. The NAS provided guidance on "improving the scientific basis, characterization of uncertainty, and transparency of the SC-CO~2 estimation framework," and specifically recommends taking an integrated modular approach to draw more readily from continued scientific research and following a three-step process to update the SCC every five years. Within the suggested modular approach, the NAS recommended processes that could improve the scientific basis, transparency, and uncertainty characterization of each module. Thus, any attempt to modify the IWG's original SCC should be holistic, address each aspect of the methodology, and rely on the best available scientific information. *See generally* National Academies of Sciences, Engineering, and Medicine, VALUING CLIMATE DAMAGES: UPDATING ESTIMATION OF THE SOCIAL COST OF CARBON DIOXIDE (2017), https://doi.org/10.17226/24651. [41] Executive Order No. 13,783 also includes instructions to use the best available scientific and economic information that closely parallel the language found in the NEPA case law and the procedures used by the IWG in developing the SCC. *See* Exec. Order No. 13,783, 82 Fed. Reg. at 16,093 ("It is also the policy of the United States that necessary and appropriate environmental regulations comply with the law, are of greater benefit than cost, when permissible, achieve environmental improvements for the American people, and are developed through transparent processes that employ the best available peer-reviewed science and economics."); *id. at* 16,095 ("Review of Estimates of the Social Cost of Carbon, Nitrous Oxide, and Methane for Regulatory Impact Analysis. (a) In order to ensure sound regulatory decision making, it is essential that agencies use estimates of costs and benefits in their regulatory analyses that are based on the best available science and economics."). [42] *See* Office of Management and Budget, Circular A-4, at 3 (Sept. 17, 2003). [43] *Id.* [44] When an agency adheres to Circular A-4 and employs the SCC, it should properly apply Circular A-4 and use lower discount rates. [CITE.] An appropriate discount rate should match the structure of payoffs that climate mitigation provides. Thus, if the payoffs from climate change mitigation tend to appear predictably, as they do for holding a diversified portfolio of stocks, then the appropriate discount may be something like the average return for the stock market. However, if the payoffs tend to appear in leaner economic times, then a lower discount rate should be applied. For instance, investments in gold generated a 3.3 percent rate of return of the last 48 years, whereas investments in the stock market generated 5.3 percent returns. *See* LBMA Gold Price: Daily Prices, 9	**121-2 Response continued**: Moreover, the Presidential Order issued on March 28, 2017, withdrew the Technical Support Document and Technical Update documents related to the SCC tool as they were no longer representative of government policy. The Order also stated that "[i]n order to ensure sound regulatory decision making, it is essential that agencies use estimates of costs and benefits in their regulatory analyses that are based on the best available science and economics." And that "[e]ffective immediately, when monetizing the value of changes in greenhouse gas emissions resulting from regulations, including with respect to the consideration of domestic versus international impacts and the consideration of appropriate discount rates, agencies shall ensure, to the extent permitted by law, that any such estimates are consistent with the guidance contained in OMB Circular A-4 of September 17, 2003 (Regulatory Analysis), which was issued after peer review and public comment and has been widely accepted for more than a decade as embodying the best practices for conducting regulatory cost-benefit analysis." OSMRE, however, is not completing a cost-benefit analysis for a regulatory impact analysis and therefore is not required to use the SCC tool. In sum, the SCC tool, as the commenter states, presents potential climate damages. It does not present a full cost-benefit analysis and therefore it is not a complete picture of the costs and benefits of the project. While interim protocols have been developed for use in the rulemaking context, they do not apply to project decisions, and there is no Executive Order requirement to apply the SCC protocol to project decisions.

Comment/ Code	Document #121-University of Chicago	Response
121-2, cont'd	**c. The Rosebud Expansion DEIS Violated NEPA Because It Quantified Benefits but not Costs.** As a justification for not using the SCC, the Rosebud expansion DEIS states that "NEPA does not require cost-benefit analysis and the agency did not undertake one here." This attempted justification is ineffective because OSMRE actually did quantify benefits, though it labeled them "impacts" rather than benefits. Playing a game with words does not change what OSMRE actually did—it quantified purported benefits—and does not obviate OSMRE's legal obligations under NEPA to quantify costs if it quantifies benefits. Incomplete analysis by any other name still smells as foul.[45] http://fred.stlouisfed.org/release?rid=256 (calculate real average annual return of gold from 1968–2016); Online Data Robert Shiller, http://www.econ.yale.edu/~shiller/data.htm (calculate real average return of S&P 500 with dividends). Despite the lower rate of return, investors continue to hold gold because it insures them against catastrophic risks in other markets; for example, during the Great Recession, the stock market dropped by 53 percent, whereas the price of gold increased by 14 percent. *See* S&P Dow Jones Indices, http://www.spindices.com/ (calculate percent change from start of recession (December 2007) to lowest point (3/9/2009); Dow Jones Commodity Index Gold, http://us.spindices.com/indices/commodities/dow-jonescommodity-index-gold (calculate percent change over same time period). In this case, gold acted akin to insurance—it helped investors hedge their exposure to major risks. And because investors dislike risk, they pay more—in the form of lower rates of return—to avoid it. Because climate change poses substantial and substantially uncertain risks, agencies should use a lower discount rate to hedge against potentially significant future damages. A low discount rate is appropriate in light of the possibilities that continued carbon emissions will cause temperatures to increase rapidly, sea levels to rise quickly, physical "tipping points" to occur suddenly, or dramatic human responses to these changes that include mass migration and international conflict. The case for using a low discount rate to determine the SCC is, in many respects, similar to the case for investing in gold, or for purchasing life, fire, and other insurance policies that protect against major disruptive events. The above is consistent with Circular A-4, which endorses a low discount rate when analyzing uncertain or intergenerational costs and benefits, such as climate-related impacts. According to OMB, "uncertainty about the appropriate value of the discount rate" for regulatory actions with intergenerational effects over a longer time horizon supports using rates different and lower than three or seven percent. Circular A-4 concludes that, to set a discount rate that "treat[s] all generations equally" and avoids devaluing the "welfare of future generations" relative to the current generation, an appropriate discount rate for actions with such uncertain, long-term costs and benefits is from "1 to 3 percent per annum." *See* Michael Greenstone, *What Financial Markets Can Teach Us About Managing Climate Risks*, N.Y. TIMES, Apr. 4, 2017, https://nyti.ms/2nT4t9o; Greenstone Congressional Testimony, *supra* note 19. In addition, the government now estimates that long-term government bonds will generate an annual real rate of return of approximately 0.7 percent. And, current OMB guidance documents reflect the fact that the risk-free discount rate has fallen toward zero. *See* 2017 Discount Rates for OMB Circular A-94 (OMB Dec. 12, 2016). The result is that the Circular A-4 guidance would appear to recommend using a risk-free discount rate of less than one percent. [45] *See* William Shakespeare, Romeo and Juliet, Act II Sc. II ("What's in a name? That which we call a rose / By Any Other Name would smell as sweet"). 10	**121-2 Response continued:** See 121-2 comment response on pages 8 and 9. Again, NEPA does not require a cost-benefit analysis of the project such as that described by the commenter. As such, the Area F EIS does not present any economic benefits or costs for any resource. As required by NEPA (*see* 40 CFR § 1508.14), the socioeconomic impacts are discussed, including a description of the local economy and the project's potential changes to the employment, labor income, and local economic activity. These impacts can be perceived either positively or negatively by the community; however, a positive perception of increased economic activity in an area is very distinct from being an "economic benefit" as defined in economic theory and methodology (Watson et al. 2007, Kotchen 2011). Accordingly, this discussion is not a cost-benefit analysis and does not attempt to monetize the benefits of the project. As such, it is not necessary to monetize the costs of the project as the commenter suggests. The EIS does, however, discuss the economies of the local counties and the Mine's payroll, local business transactions, infrastructure investments, community foundation contributions, coal board grant eligibility and awards, royalties and taxes in **Sections 3.15 and 4.15** of the EIS. These values are presented to disclose to the public what contribution the Mine has to the local economies and any associated impacts under the Proposed and No Action Alternative. The EIS does not present the taxes paid by the Mine as benefits. This methodology is common when analyzing potential socioeconomic impacts in a NEPA analysis. Because a cost-benefit analysis was not conducted, using the SCC tool would not present the public or the decision maker with all cost and benefits associated with the Project. Therefore, including the SCC tool analysis would skew the public and decision makers' perception of impacts.

Comment/ Code	Document #121-University of Chicago	Response
121-2, cont'd	**i. When agencies quantify benefits, NEPA requires that agencies quantify costs as well** An agency that quantifies the *benefits* of a proposed government action must also include and quantify the *costs* of the action—including costs associated with GHG emissions—in its analysis.[46] Courts have consistently held that failing to quantify costs when a tool is available to do so constitutes an arbitrary and capricious agency action under NEPA.[47] In *Sierra Club v. Sigler*, the U.S. Court of Appeals for the Fifth Circuit expanded on why quantification of both costs and benefits is necessary: "If an agency were permitted to cite possible benefits in order to promote a project, [] yet avoid citation of accompanying costs . . . the cost-benefit analysis in the EIS would be reduced to a sham: such a 'cost-benefit analysis' would always be tipped in favor of benefits." It is clear, then, that imbalanced EISs mislead agencies and the public regarding the effects of a proposed project and therefore falsely support the approval of projects that may not have proceeded if the relevant parties had known of the project's adverse environmental effects. Biased analyses of this sort are contrary to the purposes of NEPA—to ensure considered decision-making and public engagement—and run afoul of the standards courts apply in reviewing agency actions under NEPA. OSMRE knows full well that this semantic maneuvering is insufficient to escape its obligations under NEPA because a federal court in the District of Montana recently informed OSMRE that NEPA does not permit agencies to cloak economic benefits by calling them "economic impacts" instead. As described in I.B *supra*, the District Court of Montana, in *Montana Environmental Information Center*, rejected an OSMRE environmental assessment that included quantified socioeconomic benefits, but did not quantify the costs.[48] In that case, OSMRE conducted a "socioeconomic analysis of the Coal Lease" that "estimated annual production of up to 10 million tons [of] clean coal" at a "sales price of $11.79 per short ton" resulting in a contribution of "$23,816,000 million [sic] annually in tax revenues to the states."[49] [46] *See*, e.g., *Sierra Club v. Sigler*, 695 F.2d 957, 979 (5th Cir. 1983) ("However, once the Corps *chose* to trumpet the benefits of bulk cargo activities in the EIS as a 'selling point' for the oil project, it rendered a decision that these activities were imminent. NEPA therefore requires full disclosure and analysis of their costs. .... The Corps cannot tip the scales of an EIS by promoting possible benefits while ignoring their costs. Simple logic, fairness, and the premises of cost-benefit analysis, let alone NEPA, demand that a cost-benefit analysis be carried out objectively. There can be no "hard look" at costs and benefits unless all costs are disclosed."); *Ctr. for Biological Diversity v. Nat'l Highway Traffic Safety Admin.*, 538 F.3d 1172, 1198 (9th Cir. 2008) (stating that agencies "cannot put a thumb on the scale by undervaluing the benefits and overvaluing the costs of more stringent standards") [47] *See*, e.g., *High Country Conservation Advocates v. United States Forest Service*, 52 F. Supp.3d 1174, 1191 (D. Colo. 2014) ("[i]t was [] arbitrary and capricious to quantify the benefits of the lease modifications and then explain that a similar analysis of the costs was impossible when such an analysis was in fact possible and was included in an earlier draft EIS."); *Mont. Envtl. Info. Ctr. v. Office of Surface Mining*, No. CV 15-106-M-DWM, 2017 WL 3480262, at *12 (D. Mont. Aug. 14, 2017). [48] 2017 WL 3480262. [49] *Id.* at 13. 11	**121-2 Response continued:** See 121-2 comment response above on page 10. In sum, NEPA does not require a cost-benefit analysis of the project such as that described by the commenter. As such, the Area F EIS does not present any economic benefits or costs for any resource. As required by NEPA (see 40 CFR § 1508.14), the socioeconomic impacts are discussed, including a description of the local economy and the project's potential changes to the employment, labor income, and local economic activity. These impacts can be perceived either positively or negatively by the community; however, a positive perception of increased economic activity in an area is very distinct from being an "economic benefit" as defined in economic theory and methodology (Watson et al. 2007, Kotchen 2011). Accordingly, this discussion is not a cost-benefit analysis and does not attempt to monetize the benefits of the project. As such, it is not necessary to monetize the costs of the project as the commenter suggests.

Comment/ Code	Document #121-University of Chicago	Response
121-2, cont'd	In a 2015 FONSI on the project, OSMRE also noted that the project would produce "gainful employment at the mine, royalty and tax revenues."[50] OSMRE did not employ the SCC to quantify the costs of the project, leading to an imbalanced assessment. As a result, the court agreed with the plaintiffs' contention that it was "arbitrary and capricious to quantify the benefits of an action while failing to quantify the costs of the action even though such an analysis was possible."[51] In reaching this conclusion, the court rejected OSMRE's argument that "an economic impact assessment [can] be distinguished from a cost-benefit analysis."[52] The court reasoned that OSMRE's attempt at line drawing amounted to a "distinction without a difference."[53] **ii. The Rosebud expansion DEIS quantifies benefits but does not quantify costs** The Rosebud expansion DEIS quantifies benefits of the project in its "Socioeconomic Conditions" analysis, but fails to quantify the costs of associated increases in greenhouse gas emissions.	**121-2 Response continued:** See 121-2 comment responses on pages 10 and 11.
121-2, cont'd	In striking parallel to the *Montana Environmental Information Center* case, OSMRE here quantifies the economic impacts that will stem from the mine expansion, but does not quantify the costs imposed by the carbon emissions the expansion will cause. For example, when discussing the direct economic impacts of the mine, the DEIS states: "Under the No Action alternative, the Rosebud Mine would be expected to operate until 2030, supporting 280 direct jobs and $87.9 million in annual direct economic output. Under Alternatives 2 and 3, mine life would be extended by 8 years, continuing to support the 280 direct jobs and $87.9 million in annual direct economic output." The Rosebud DEIS goes on to quantify the indirect and induced economic impacts of the project, which include employment, economic output, and tax revenue. Those were the very same categories of economic "impact" set forth in the environmental assessment at issues in *Montana Environmental Information Center*. Even more striking, OSMRE puts forth here the same argument as to why this one-sided quantification is permissible that the court rejected in *Montana Environmental Information Center*. The DEIS here states that "any increased economic activity, in terms of revenue, employment, labor income, total value added, and output, that is expected to occur with the proposed action is simply an economic impact, rather than an economic benefit, inasmuch as such impacts might be viewed by another person as negative or undesirable impacts . . . Economic impact is distinct from 'economic benefit' as defined in economic theory and methodology." [50] *Id.* [51] Id. [52] *Id.* at 13 n. 9. The court also distinguished a recent case that OSMRE pointed to as favorable precedent. The court discussed *League of Wilderness Defenders/Blue Mountains Biodiversity Project v. Connaughton*, 2014 WL 6977611 (D. Or. Dec., 9, 2014) and concluded it was inapposite because that case "did not involve a quantitative analysis of either the benefits or the costs." [53] *Id.* 12	**121-2 Response continued:** See 121-2 comment responses on pages 10 and 11.

Comment/ Code	Document #121-University of Chicago	Response
121-2, cont'd 121-2, cont'd	However, as the District Court of Montana stated, the line that OSMRE draws between "economic impact" and "economic benefit" is a distinction without a difference. The socioeconomic impact analysis should be understood as a "benefits" calculation. First, the list of "impacts" offered by OSMRE in both cases contains most of the economic factors that would be counted as benefits that in a traditional cost-benefit analysis for this project. Second, the analysis excludes the potential negative economic impacts from the project from the list (such as increase in traffic, diminished economic activity associated with recreation, or increased health care and lost labor costs resulting from higher local air pollution). It is misleading to call the investigation a "socioeconomic impact analysis" when it ignores all economic impacts that would be readily considered negative. Therefore, as the District of Montana concluded in *Montana Environmental Information Center*, quantification of these economic impacts is the quantification of the benefits of the project in everything but name. OSMRE also argues that a socioeconomic impact analysis is required under NEPA, and therefore, the economic output and employment benefits they include are properly part of any complete NEPA analysis. OSMRE states: "the socioeconomic impact analysis required under NEPA is distinct from cost-benefit analysis, which is not required."[54] This argument by OSMRE, however, mischaracterizes the role that the socioeconomic impact analysis plays within NEPA analysis: Socioeconomic impact analyses are required under NEPA only insofar the socioeconomic impacts addressed are interrelated with physical environment impacts. The point of that NEPA requirement is that agencies should not tout purely economic benefits of projects. The Supreme Court, in *Metropolitan Edison Co. v. People Against Nuclear Energy* held that NEPA only requires the preparation of an EIS to address socioeconomic impacts when there is a socio-economic impact that is "proximately related to a change in the physical environment."[55] Reaching a similar conclusion, CEQ's NEPA regulations state, "When an environmental impact statement is prepared and economic or social and natural or physical environmental effects are interrelated, then the environmental impact statement will discuss all of these effects on the human environment."[56] Thus NEPA regulations and case law indicate that the purpose of the socioeconomic impact section is not to simply to list the general socioeconomic benefits of the proposed project, but to provide a space for agencies to address concerns about socioeconomic impacts that issue from, but are not identical to, the physical environment impacts that triggered the need for an EIS.[57] [54] DEIS at 491. [55] See *Metropolitan Edison Co. v People Against Nuclear Energy*, 460 US 766 (1983). See also, for example, *Breckinridge v. Rumsfeld*, 537 F.2d 864 (6th Cir 1976) (stating that "NEPA is not a national employment act" and finding that employment changes are not sufficient to trigger an EIS). Although the requirement of an EIS is not at issue in this case, the holding is based on the idea that these sorts of economic concerns are only relevant to NEPA when the socio-economic changes are directly tied to physical environmental impacts. [56] 40 C.F.R 1508.14. [57] An example of such a socioeconomic impact meriting treatment in an EIS might be economic losses experienced by local businesses that rely on tourism related to outdoor recreation on the relevant public lands that are being considered for resource extraction instead of tourism. 13	**121-2 Response continued:** See 121-2 comment responses on pages 10 and 11. In sum, as required by NEPA (*see* 40 CFR 1508.14), the socioeconomic impacts are discussed, including a description of the local economy and the project's potential changes to the employment, labor income, and local economic activity. These impacts can be perceived either positively or negatively by the community; however, a positive perception of increased economic activity in an area is very distinct from being an "economic benefit" as defined in economic theory and methodology (Watson et al. 2007, Kotchen 2011). Accordingly, this discussion is not a cost-benefit analysis and does not attempt to monetize the benefits of the project. As such, it is not necessary to monetize the costs of the project as the commenter suggests. 40 CFR 1508.14 states that the Human Environment includes the people's relationship to the environment including economic and social effects. OSMRE discloses the socioeconomic portion of the "Human Environment" in terms of jobs, payroll, population, housing, and local government facilities and services in **Sections 3.15 and 4.15** of the EIS. These analyses disclose to the public the interrelated impacts of the Proposed and No Action on the Human Environment in compliance with the NEPA Implementing Regulations. For all the reasons provided, OSMRE does not agree that the best tool for fulfilling the goals of NEPA is the SCC for this specific project. As discussed, the potential for an "unbalanced" EIS, coupled with erroneous assumptions resulting in the misuse of the SCC, weigh against its use here.

Comment/ Code	Document #121-University of Chicago	Response
121-2, cont'd (7401)	Therefore, situated in this context, it is clear that OSMRE is misusing the socioeconomic impact section of the NEPA analysis. The analysis "trumpets" select economic benefits of the project, which, in many cases, are not "interrelated" to the environmental impacts within the meaning of the CEQ guidelines. Meanwhile, OSMRE ignores other socioeconomic impacts which do bear an obvious interrelation with the physical environment. In fact, the aim of SCC is to capture the diverse range of socioeconomic impacts that are caused by, and therefore interrelated with, climate change. By eschewing an SCC analysis, the Rosebud expansion DEIS excludes, among others, impacts on "agriculture, coastal areas (due to sea level rise), 'other vulnerable market sectors' (based primarily on changes in energy use), human health (based on climate-related diseases, such as malaria and dengue fever, and pollution), non-market amenities (based on outdoor recreation), and human settlements and ecosystems."[58] The impacts are squarely interrelated with environmental impacts and therefore clearly required under NEPA. OSMRE cannot reasonably claim that a socioeconomic impact analysis is required while refusing the specific socioeconomic impacts that case law and the CEQ regulations say must be considered.	**121-2 continued – 7401 Response:** See 121-2 comment responses on pages 10, 11 and 13. In addition, the sociogenic topics discussed in the analysis (**Section 4.15, Socioeconomic Conditions**) are those that are interrelated with and relevant to the proposed project, including the effects that the proposed action would have on the social and economic environment, including direct, indirect, and induced. The proposed action would result in environmental, social, and economic effects. Without the proposed action, the economic effects (tax revenues, jobs, induced effects, etc.) would not occur.
121-2, cont'd		**121-2 continued:** See 121-2 comment response on page 8.
121-3 (6311)	**IV. Ultimately, the SCC is the best tool for fulfilling the goals of NEPA** OSMRE argues that including the quantified values of the SCC would create an "unbalanced" EIS.[59] The reference to "balance" is irrelevant to the obligation of agencies to consider the environmental impacts under NEPA. The SCC is best tool available for furthering NEPA's twin aims of informed decision-making and an informed public.[60] Further, NEPA encourages the use of quantified measurements of environmental impact when they are available. The U.S. Court of Appeals for the D.C. Circuit has held that an agency is prohibited from substituting "qualitative assessments for well-established quantitative methods whenever it deems such substitutions convenient."[61] Thus when there exists a well-established quantitative tool like the SCC—which more than 80 agency decisions have relied on[62]—courts hold that an agency should use it. [58] IWG 2010 Report at 6. [59] DEIS at 491. [60] *See Robertson v. Methow Valley Citizens Council*, 490 U.S. 332, 356 (1989). [61] Ctr. for Sustainable Econ. v. Jewell, 779 F.3d 588, 612 (D.C. Cir. 2015). [62] *See, e.g.*, Howard & Schwartz, *Think Global*, 42 COLUM. J. OF ENVTL. L. at 270 (2017) *supra* note 12 14	**121-3 Response:** See 121-1 comment response on page 3. Again, NEPA does not require a specific tool for analyzing the options and OSMRE does not believe that the SCC tool would provide it with the best available information to disclose the impacts of climate change or other pertinent environmental information. Its decision not to use the SCC was not arbitrary or capricious. In sum, the SCC tool, as the commenter states, presents potential climate damages. It does not present a full cost-benefit analysis and therefore it is not a complete picture of the costs and benefits of the Proposed Action. Further, the SCC, as outlined, would not present values showing all associated costs and benefits of a project and therefore would not provide a meaningful analysis for the project.

Comment/ Code	Document #121-University of Chicago	Response
	For these reasons, OSMRE should reevaluate its positions laid out in the DEIS and employ an SCC analysis to complete a scientifically, economically, and legally sound final EIS before deciding whether to approve the Rosebud expansion. Respectfully submitted on behalf of Prof. Greenstone, EPIC, and the Abrams Environmental Law Clinic, Mark N. Templeton Clinical Professor of Law Director, Abrams Environmental Law Clinic University of Chicago Law School 15	

Comment/ Code	Document #014-Western Energy Company	Response
14-1 (1101)	**WESTERN ENERGY COMPANY - *Rosebud Mine*** **A Subsidiary of WESTMORELAND COAL COMPANY** *P.O. BOX 99 • 138 ROSEBUD LANE • COLSTRIP, MT 59323* *(406) 748-5100* March 5, 2018 Office of Surface Mining, Reclamation and Enforcement Western Region Office 1999 Broadway St., Suite 3320 Denver, CO 80202-3050 Email: lscholar@osmre.gov VIA EMAIL TO: western-energy-area-f-eis@eroresources.com. **RE: Western Energy Company's Rosebud Mine Area F Draft Environmental Impact Statement Comments** Dear Mr. Sholar: This letter provides Western Energy Company's formal public comments on the Rosebud Mine Area F Draft Environmental Impact Statement (the "Draft EIS"). As the permit applicant, Western Energy appreciates the thorough and comprehensive analysis provided by the Office of Surface Mining Reclamation and Enforcement ("OSMRE") in coordination with the Montana Department of Environmental Quality ("DEQ") and U.S. Bureau of Land Management ("BLM") for Western Energy's proposed Area F mine expansion. Western Energy submits comments on several issues to provide additional information in support of OSMRE's National Environmental Policy Act ("NEPA") approach and request limited refinement or clarification of some areas of the Draft EIS. Western Energy requests that this comment letter, attachments, and referenced materials be included as part of the administrative record in this matter. **I. Purpose and Need** The Council on Environmental Quality ("CEQ") NEPA implementing regulations provide that a purpose and need statement "shall briefly specify the underlying purpose and need to which the agency is responding in proposing the alternatives including the proposed action." 40 C.F.R. § 1502.13 (emphasis added); 43 C.F.R. § 46.420(a). When an agency is tasked with considering whether to issue a permit, the purpose and need should reflect both the statutory objectives of the agency as well as the goals of the private applicant. *Protect Our Communities Foundation v. Jewell*, 825 F.3d 571, 579-80 (9th Cir. 2016). OSMRE's articulation of the purpose and need in Chapter 1 includes all of the appropriate elements and accurately reflects its statutory mission, the DEQ's regulatory	**14-1 Response:** The agencies believe that the scope and organization of the purpose, need, and benefits statements presented in the EIS are appropriate pursuant to the Secretary's authority under the Mineral Leasing Act, SMCRA and by DEQ's authority under MSUMRA.

Comment/ Code	Document #014-Western Energy Company	Response
	authority, and Western Energy's goals. However, Western Energy suggests that the statement be reorganized to first highlight the agency's purpose and need, followed by DEQ's and Western Energy's goals and objectives for Area F. Please consider our recommended revised purpose and need statement below: **1.3.1 Purpose** OSMRE's purpose, per its statutory and regulatory obligations (30 CFR 746), for the Area F review is to consider and make a recommendation to the ASLM (in the form of a MPDD) to approve, disapprove, or conditionally approve the proposed federal surface-mining plan for the project area (see Section 1.4.1.1, Office of Surface Mining Reclamation and Enforcement). The ASLM will decide, taking into consideration OSMRE's recommendation, whether the mining plan is approved, disapproved, or approved with conditions. DEQ's purpose is to review and make a decision on Western Energy's surface mine operating permit application under MSUMRA, Section 82-4- 221 et seq., MCA (see Section 1.4.1.2, Montana Department of Environmental Quality). **1.3.2 Need** The OSMRE need for the action is to exercise its responsibility under the Surface Mining Control and Reclamation Act (SMCRA) Public Law 95-87, Title I, Section 102 to "assure that the coal supply essential to the Nation's energy requirements, and to its economic and social well-being is provided and strike a balance between protection of the environment and agricultural productivity and the Nation's need for coal as an essential source of energy." OSMRE is also obligated to consider under what conditions to allow Western Energy the opportunity to exercise its valid existing rights (VER) granted by BLM under federal coal lease M82186 to access and mine undeveloped federal coal resources located in the project area. The DEQ need for the action is to analyze the potential environmental impacts from the project in order to make a more fully informed decision prior to approval or disapproval of the permit application under Section 82-4-227, MCA. DEQ is responsible for ensuring that when there may be significant environmental impacts, a Final EIS is completed and published at least 15 days prior to the release of DEQ's written findings on the permit application. Western Energy's need for the Area F project permit approval is to access additional coal reserves to allow for continued operations needed to fulfill contractual obligations to its customers, the Colstrip and Rosebud Power Plants. Western Energy also requires approval to develop federal coal under valid existing lease M82186 and privately held leases (G-002 and G-002-A) for coal resources located in the project area. -2-	

Comment/ Code	Document #014-Western Energy Company	Response
	The purpose of the Area F project permit, which will secure an ongoing source of fuel for the Colstrip Power Plant (Units 3 and 4) and the Rosebud Power Plant, is also to promote domestic energy independence and a reliable source of power supply to the power plants' customers for at least eight years. Continued mine operations will also allow for continued employment and support to hundreds of local families, will support the federal, state, and local governments through tax payments, and ensure an ongoing royalty revenue stream to the federal and state governments, as well as the private coal owners.	
14-2 (2000)	**II. Range of Alternatives** OSMRE has considered an adequate range of reasonable alternatives that reflect OSMRE's, DEQ's, and Western Energy's purpose and need, and are consistent with OSMRE's NEPA obligations. Pursuant to 40 C.F.R. § 1502.14(a), OSM describes accurately why seven additional alternatives were not carried forward for detailed analysis (Section 2.6). In addition to the reasons set out in OSMRE's Draft EIS, Western Energy offers the following information regarding technical and economic feasibility that further support OSMRE's decision to eliminate the below alternatives.	**14-2 Response:** Thank you for your comment.
14-3 (2507)	• Private Coal Alternative—As OSMRE stated, mining just the private coal, which occurs in checkerboard sections interspersed with federal coal, would limit the recovery of the private coal, leave all of the federal coal (which is already leased) in place, and not reduce in any meaningful way the impacts of coal mining. First, mining only private coal would require a number of expensive and smaller box cuts to avoid disturbing the federal coal resource. The setbacks from the federal coal would leave large wedges of private coal in place and require Western Energy to forego recovery of over half of the private coal. *See* Draft EIS at 109. This situation would make mining the private coal alone economically infeasible and would also violate DEQ's regulations for coal recovery and conservation. ARM 17.24.322. Second, Western Energy holds a valid coal lease for Area F and the private coal alternative would not fulfill the purpose and need for the permit to allow Western Energy to develop those resources, pursuant to reasonable environmental controls. BLM regulations also require full recovery of the coal. 30 C.F.R. § 816.59. Finally, developing only the private coal will not avoid impacts to the surface of federally interspersed sections. For instance, the wildlife habitat value of federal sections will still be affected and noise and visual impacts will still occur. Thus, detailed consideration of the -3-	**14-3 Response:** Western Energy supplemental information for alternatives dismissal has been added, as appropriate.

Comment/ Code	Document #014-Western Energy Company	Response
	private coal alternative is unreasonable where it provides no environmental benefit, is economically infeasible, and contrary to the purpose and need.	
14-4 (2500)	• Underground Mine Alternative—In addition to all of the reasons cited by OSMRE for eliminating the underground mine alternative, underground mining gives rise to safety concerns that are not currently present at the Rosebud Mine. Underground mining is subject to inherent risks of roof and rib instability that must be constantly managed to ensure miner safety. At this time, the geological conditions of the coal seam have not been evaluated to understand whether underground mining can occur safely pursuant to accepted mine engineering principles.	**14-4 Response:** Western Energy supplemental information for the Underground Mine Alternative dismissal has been added to the EIS.
14-5 (2503)	• Transporting Coal to International Ports—Western Energy agrees that what happens to the coal after it is produced from Area F may be an indirect effect of the permit approval, but is not part of the proposal and not subject to alternatives formulation. Thus, consideration of impacts of transporting coal to western terminals for international sale is not an "alternative" that should be included for detailed consideration. Nor are the impacts of coal transport an indirect effect of the Area F permit, as sale to foreign ports is not reasonably foreseeable at this time. However, Western Energy has not foreclosed consideration of sale of Rosebud Area F coal to other than the Rosebud and Colstrip Power Plants at some future point in time. To the extent Western Energy seeks in the future to sell coal to other buyers, whether domestic or international, and the sale necessitates construction of a coal load-out or rail facility requiring federal approval, Western Energy will engage with OSMRE and the BLM to obtain the necessary permits. The scope of the necessary environmental review would be determined at that time.	**14-5 Response:** The agencies disagree that transport of Area F coal to western terminals should not be considered as an alternative (and in this case, was dismissed from further consideration). The language in the EIS has been altered to reflect the fact that Western Energy may consider this at a future date; however, there is no current proposal to ship the coal.
14-6 (2501)	• Smaller Mine Alternative—Western Energy agrees that an alternative that would approve a smaller mine permit area for a shorter duration is not a reasonable alternative. Depending on the size of the smaller permit area, Western Energy would run into the same concerns as with the private coal alternative, i.e., box cuts would be required and coal that would otherwise be recoverable would be left in place. Further, Western Energy sought the entirety of the Area F permit area at this time because its mining plan calls for a coordinated and sequential mining of Area F. If Western Energy had sought to permit a smaller portion of Area F, with the intention of seeking permits for other portions of Area F as mining progressed, it would have been vulnerable to concerns that the analysis was being intentionally segmented to avoid environmental review of the entirety of Western -4-	**14-6 Response:** Western Energy supplemental information for a smaller permit area has been added, as appropriate.

Comment/ Code	Document #014-Western Energy Company	Response
	Energy's mining plan for Area F. One comprehensive analysis is necessary, both for purposes of environmental review and given the realities of Western Energy's mining plan.	
14-7 (2302) **14-8 (2200)**	In addition to the alternatives eliminated from detailed consideration, Western Energy notes that many of the mitigation elements of Alternative 3 are beyond OSMRE's or DEQ's authority to impose. While Western Energy appreciates the formulation of this third alternative for purposes of impact analysis and comparison, Western Energy asks that OSMRE carefully consider the scope of its authority when choosing its preferred alternative in the Final EIS and making its final decision in the Record of Decision. Western Energy asks that OSMRE choose Alternative 2, and to the extent it chooses Alternative 3, not impose any mitigation requirements that are not required by law.	**14-7 Response:** Thank you for your comment. It is correct to state that DEQ cannot impose measures on any permit, in this case, the operating permit for the project area, as part of the MEPA review process beyond what is required for compliance with MSUMRA and other state statutes, 75-1-201(4)(a), MCA. However, and although not required by law, the Secretary may impose additional conditions on the mining plan, pursuant to the Secretary's authority under the Mineral Leasing Act 30 CFR 746.13. **14-8 Response:** See comment above.
	III. Social Cost of Carbon	
14-9 (6311)	In Section 4.4.5, the Draft EIS provides sufficient information for the agency to make an informed evaluation of the significance of greenhouse gas emissions attributable to the project based upon the estimates of those emissions as a percentage of national, state, and regional emissions. To that end, Western Energy suggests that OSMRE revise Section 4.4.1.2 to develop and identify appropriate impact and intensity thresholds with which to evaluate the significance of the quantitative assessment of greenhouse gas emissions.	**14-9 Response:** There are no rigorous thresholds available to quantify the intensity of potential impacts from an individual project on climate change, which is a worldwide phenomenon. OSMRE determined that the disclosure of GHG emissions at the project, regional, national, and global levels is appropriate for the impacts analysis in the EIS.
14-10 (6311)	Western Energy concurs with the agency's assessment of the challenges of applying the Social Cost of Carbon Protocol to individual projects. Nevertheless, to afford the agency such informational value as the Protocol may provide, Western Energy commissioned Tim Considine of the University of Wyoming to perform the analysis and submits the analysis in the attached report entitled Reliability of Greenhouse Gas Emission Cost Estimates for Rosebud Mine Area F. As Dr. Considine notes, if one were to use the protocol EPA recently developed in support of its position on the Clean Power Plan, the computation would yield lower costs. In either case, the calculations are based on mathematical models that are highly simplified representations of complex climate systems and the world economy. The results are very sensitive to key parameters that are highly uncertain at best. Further, the calculations assume the absence of a competitive market that would replace the coal currently combusted at the Colstrip and Rosebud Plants with coal from other mines, an assumption that is contradicted by OSM's analysis and Dr. Considine's report. Thus, the costs reflected in the outcome of the calculations are neither practical nor useful. Further, experts from both the prior administration and the current administration have said that this sort of analysis should not be used for individual projects.	**14-10 Response:** Please refer to **Section 4.4.5, Social Cost of Carbon** in the EIS for OSMRE's determination regarding application of the Social Cost of Carbon protocol for the Area F project. The report referred to is attached to the Western Energy comments for reference.
	IV. Water Resource Impacts	
	A. General Comments	
	-5-	

Comment/ Code	Document #014-Western Energy Company	Response
14-11 (3601) 14-12 (3701) 14-13 (3601) 14-14 (3601)	Regulatory Framework. Section 3.7.1.1, which provides the Regulatory Framework for water resources, would benefit from a discussion of Montana's statutory provisions as they apply to water bodies that naturally exceed the water quality standard. As noted in Section 3.7.6, the water quality presented "represents largely natural conditions that have been minimally affected by man-made disturbances within or upstream of the project area." A discussion of how the natural conditions impact the water quality standards applicable in the analysis area, for both surface and groundwater, would be helpful. OSMRE should consider a reference to MCA 75-5-306 which provides that, "[i]t is not necessary that wastes be treated to a purer condition than the natural condition of the receiving stream as long as the minimum treatment requirements established under [Montana water quality provisions] are met." The Draft EIS's description in Section 3.7.1.1 (at 200) should also include a more complete description of the regulations governing classification and permit limits for discharges to ephemeral streams. In particular, the current description omits mention of Montana's regulation that expressly exempts ephemeral streams from standards ordinarily applied to streams that are classified as "C-3." ARM 17.30.637(4) provides that "ephemeral streams are subject to" provisions governing treatment and operations standards, mixing zones, sampling methods, radiological criteria and bioassay procedures, "***but not to the specific water quality standards of ARM 17.30.620 through 17.30.629.***" Thus, this Montana regulation makes the provisions that ordinarily govern C-3 streams inapplicable. Under the provision, ARM 17.30.629(1) would not apply to ephemeral streams. More precisely, Montana regulations exempt ephemeral streams from that language that generally governs C-3 streams: "[w]aters classified C-3 are to be maintained suitable for bathing, swimming, and recreation, and growth and propagation of non-salmonid fishes and associated aquatic life, waterfowl, and furbearers." Thus, the limits for C-3 waters contained in Table 40 of the Draft EIS would not apply to discharges to ephemeral streams. This exemption is sensible. Montana regulations avoid the application of standards intended to protect fish and other aquatic life that do not live in dry streambeds. Ephemeral streams are dry for most of the year and, consequently, DEQ has not applied these regulatory limits to ephemeral streams. Indeed, this has been Montana's approach to ephemeral streams for nearly four decades. And, the Draft EIS incorrectly asserts that, "DEQ has applied the water quality standards applicable to non-ephemeral C-3 waters to all surface water bodies that are classified as C-3 waters, regardless of whether the surface waters meet the definition of ephemeral stream." In fact, the dominant practice of DEQ has been to exempt ephemeral streams from these standards. Were it otherwise, DEQ would violate its own regulations. Unless ARM 17.30.637(4) is rescinded through a proper rulemaking, any water discharge to an ephemeral stream is properly exempted from the standards otherwise applied to streams classified as C-3. At page 200, the Draft EIS discusses the court's decision in *Mont. Envtl. Info. Ctr. et al. v. Mont. Dept. of Envtl. Quality et al.*, Case No. DA 18-0110 (Mont. S. Ct. Feb. 20, 2018). The Draft EIS's passage correctly notes that the decision at issue is not final. -6-	**14-11 and 14-12 Response: Section 3.7.1.1, Surface Water Regulatory Framework** of the EIS has been reviewed numerous times by DEQ regulators and by OSMRE. The agencies believe the section adequately discusses pertinent regulations to protect surface water quality. **14-13 and 14-14 Response:** Discussion has been added to **Section 3.7.1.1, Classifications and Standards** regarding water quality standards for ephemeral streams in the project area that would apply if Judge Seeley's opinion is overturned.

Comment/ Code	Document #014-Western Energy Company	Response
14-15 (3601)	Indeed, the decision is now the subject of an appeal to the Montana Supreme Court. Western Energy suggests including the following discussion of the ephemeral standards that would be applicable, should the *MEIC v. MDEQ* Order be overturned, for addition between the first and second paragraphs under "Classification and Standards" on page 200 of the Draft EIS: > Should the Judge Seeley opinion noted above be appealed and overturned, the standards provided in Table 40 would only apply to perennial and intermittent streams, ponds and springs. Ephemeral streams, which are defined in Admin. R. Mont. 17.30.602(10) as "a stream or part of a stream which flows only in direct response to precipitation in the immediate watershed or in response to the melting of a cover of snow and ice and whose channel bottom is always above the local water table," would be subject to general treatment and general operation standards, but would not be subject to the specific water quality standards listed in Table 40.	**14-15 Response: See Comment Response 14-13 and 14-14.**
14-16 (3604)	Defining Ephemeral, Intermittent, and Perennial Flow. Throughout the Draft EIS references to the hydrologic conditions of ephemeral, intermittent, and perennial flow may confuse the reader. A clarification should accompany each reference including statements such as: • Hydrologically, normal flow characteristic progression starts as ephemeral in the upper reaches of tributaries and in headwater reaches (especially in prairie streams). This is characterized by dry streambeds with occasional spring or seep that issues and flows for a limited reach then absorbs into the substrate. Ephemeral streams only flow in response to precipitation based runoff (i.e., snowmelt or rainfall). There is no baseflow for ephemeral reaches and the local groundwater table is perennially below the channel bottom. This flow progression leads to intermittent at the transitional portion of a reach between ephemeral and perennial flows and is characterized by the local groundwater table higher than the channel bottom for a portion of the year. Finally, the flow progression leads to perennial flow which can typically be characterized as flow with a perennial baseflow above the channel bottom, i.e., the local groundwater table is higher than the channel bottom perennially. • The overall hydrologic condition of the drainage basins in the project area is ephemeral with the possible exception of lower Robbie Creek. This section exhibits possible intermittent flow but would need further investigation to determine true flow characteristics. • "Perennial flow" as stated in the document is the flow related to segments where springs or seeps issue and flow for a limited reach before absorbing into the substrate. This is typical in an ephemeral drainage as drainage channels carve through relatively impermeable geologic strata. -7-	**14-16 Response:** The MCA definitions of ephemeral, intermittent, and perennial flows have been added to **Section 3.7.5** of the EIS.

Comment/ Code	Document #014-Western Energy Company	Response
14-17 (3604)	Properly defining and applying the definitions of ephemeral, intermittent, and perennial flow is particularly important, for instance, in Section 3.7.5.2, in which the current text could be misinterpreted as stating that entire reaches are of one sort of hydrologic flow condition or another. The definition from MCA § 82-4-203 should also be included in Section 3.7.5.2.	**14-17 Response: See Comment Response 4-16.**
14-18 (3604)	In another example, in Section 3.7.6.1, the Draft EIS states, "This location represents surface water quality at a location where flow is perennial or near-perennial." What is "near-perennial? It is not defined. Intermittent may have been more appropriate. *See also* Section 3.8.2.3 (Springs), which should also apply consistent definitions.	**14-18 Response:** The comment is correct that "near-perennial," used in the 2013 Wetland Delineation Report, was not defined in that report or the DEIS. The term "near-perennial" was deleted from the EIS, and the sentence was replaced to say that "springs or seeps in the analysis area that support wetlands flow all or nearly all the time."
14-19 (3704)	The Rosebud Coal "Aquifer." Throughout the Draft EIS there is a discussion of the Rosebud Coal "aquifer." Aquifer is defined by MCA § 82-4-203 as: > any geologic formation or natural zone beneath the earth's surface that contains or stores water and transmits it from one point to another in quantities that permit or have the potential to permit economic development as a water source. The term "aquifer" should be tempered with the understanding that although the Rosebud Coal is a water bearing stratum, due to its low hydraulic conductivity and transmissivity, it is not widely used as a source of groundwater in the area. Typical sources of groundwater are the alluvium and Sub-McKay aquifers.	**14-19 Response:** The Rosebud Coal has been described as an aquifer as early as 1977 by Van Voast and others and both the Rosebud and McKay Coals have been used as a rural water supply in the area for a substantial time. Because of the coals' relatively shallow depth, adequate hydraulic conductivity, and lack of other water sources, the coals have been historically used for stock watering and, in some cases, domestic purposes. As the comment notes, MSUMRA defines the term "aquifer." The Rosebud Coal meets the MSUMRA definition of an aquifer in some locations. Questions pertaining to the hydraulic conductivity and transmissivity of the Rosebud Coal aquifer and the beneficial uses of the Rosebud Coal aquifer pertain to issues of impact analysis rather than resource identification. No changes were made to the Final EIS with respect to this issue.
	B. Specific Comments and Recommended Edits Impacts of Removing the Rosebud Coal "Aquifer." Throughout the groundwater impact analysis and in the Summary, the Draft EIS assumes that removal of the Rosebud Coal aquifer will result in a long-term reduction or elimination of contributions to baseflow that affects springs and streams. For instance, the Summary at 26 states that "Mining of the project area would permanently remove the Rosebud Coal aquifer and result in long-term reduction or elimination of the bedrock ground water contribution to baseflow in the perennial and intermittent reaches of the major tributaries." In Section 4.8.3.1, the Draft EIS states: "The postmining effects on ground water quantity would include the following . . . [r]emoval of the Rosebud Coal aquifer within the project area." Draft EIS at 531. In Section 4.9.3.2, the Draft EIS states that "Rosebud springs would no longer exist and overburden and clinker springs would not be affected." Draft EIS at 543.	
14-20 (6702)	These statements are incomplete because they omit discussion of the replacement aquifer to the Rosebud Coal aquifer. During mining, overburden is removed (and typically cast into the previously open pit as spoil) to expose the Rosebud Coal seam. This seam is then extracted leaving a void that will be filled with the overburden from the next pass as spoil. This is a removal of the Rosebud Coal aquifer and replacement with the spoils aquifer. Recharge in the spoils aquifer will begin as early as immediately following coal extraction and continue as mining progresses away to each successive pit. -8-	**14-20 Response:** The spoils that would replace the Rosebud Coal aquifer may or may not fit the MSUMRA definition of an aquifer, depending on their degree of saturation. The spoils would not function in the same manner as the coals because of the lack of stratification and fracturing within the coals that currently controls ground water flow, however the horizontal transmissivity of the spoil is expected to be similar to that of the Rosebud Coal. The water quality of the spoils in the permit area in the near term may also prevent spoils ground water from being used for the same beneficial uses as the coal ground water. No changes were made to the Final EIS.

Comment/ Code	Document #014-Western Energy Company	Response
14-21 (6702)	Springs may return to the same locations as premining even though the aquifer source has been removed and replaced. During mining, care is taken to disturb as little as possible, including the geologic structure below the coal and in the areas adjacent to the active pits. This allows the recharged spoil aquifer, in many instances, to reproduce flow patterns and quantities similar to the Rosebud Coal aquifer. The text at S-26 should be revised to say: Mining of the project area would permanently remove and replace the Rosebud Coal aquifer with a spoils aquifer in the mining pit areas. Due to both, the extended amount of time that it may take to recharge the spoils aquifer and the possible change in flow patterns in the spoils aquifer, there may be a long-term reduction or elimination of the bedrock ground water contribution to baseflow in the perennial and intermittent reaches of the major tributaries.	**14-21 Response:** There is no evidence that springs would redevelop at the same locations after mining is complete. Some springs may develop in the spoils post-mining, but their locations would be impossible to predict. Many of the springs that are the result of ground water discharge at the northern extent of the coal are unlikely to redevelop. The Final EIS has been edited to clarify that it is possible that some springs would develop in the spoils post-mining.
14-22 (6702)	The text in Section 4.8.3.1 and Section 4.9.3.2, should state, "The removal and replacement of the Rosebud Coal aquifer with a spoils aquifer in the mine pit areas may result in a temporary or permanent loss of those springs whose water supply was the Rosebud Coal. Any overburden or clinker spring that is sourced by, or issues from overburden or clinker that, through mining, is removed or replaced with spoil may be affected. All other overburden or clinker springs would not be affected."	**14-22 Response:** Based on the definition of the term "aquifer," provided in MSUMRA, the spoils may or may not qualify as an aquifer, depending on their degree of saturation. The water quantity of ground water in the spoils for a significant amount of time may prevent its "economic development." No changes were made to the Final EIS.
14-23 (3601) 14-24 (3601) 14-25 (3704)	Western Energy's MPDES Permit. In both Sections 1.4.1.2 and 5.2.1.7, the Draft EIS references the incorrect effective version of Montana Pollution Discharge Elimination Permit ("MPDES") permit MT-0023965 for the Rosebud Mine. The 2012 version of this permit was the subject of litigation that resulted in a court order remanding the permit to DEQ for a rewrite. ARM 17.30.1313 states: The conditions of an expired permit continue in force until the effective date of a new permit if: (a) the permittee has submitted a timely application under ARM 17.30.1322, which is a complete application for a new permit; (b) the department, through no fault of the permittee, does not issue a new permit with an effective date under ARM 17.30.1378 on or before the expiration date of the previous permit. Per ARM 17.30.1313, the effective version of MPDES permit MT-0023965 is the 1999 version. This section should be updated to reflect the effective permit. Groundwater Management. Section 2.4.5.1 describing groundwater flow should be expanded to include the following: -9-	**14-23 and 14-24 Response:** The sections of the EIS referenced in the comment have been updated in the Final EIS regarding Western Energy's MPDES permit.

Comment/ Code	Document #014-Western Energy Company	Response
14-25 (3704) Cont.	Groundwater in the active mining and reclamation areas is an extremely complex system. Groundwater levels can be influenced by climate, recharge from lateral influences, evapotranspiration, active mine operations, pit dewatering, staging water for dust control, MPDES discharges, seasonal variability, geology, etc. The conclusions regarding the groundwater levels in the Rosebud Coal are: (1) Recharge from various sources contributes to the groundwater level in the Rosebud Coal; (2) Mining will affect some of these sources by varying degrees in a variety of ways during different stages of the mining process; (3) In each active pit the groundwater will be pumped to the base of Rosebud Coal during coal extraction; (4) Once mining progresses, the pit may be filled with spoil, used as a water staging area, or be left unfilled for some time; and (5) Regardless of what happens after an active pit is mined, the active pit may begin to experience recharge from as many as several sources as early as immediately.	**14-25 Response: Section 2.4.5.1** describes the management of ground water encountered in the mine pits. Detailing the sources that contributed to the resulting ground water is addressed in **Sections 3.8.3, 3.8.5.3**, and **4.7.3.2**. Detailing the sources that contribute to ground water deviates from the intention of the section referenced in the comment. No changes were made to the Final EIS.
14-26 (3601)	Pond, Spillway Requirements. The document states: "Ponds designed for a 25-year, 24-hour storm or greater would be considered full retention ponds, and a spillway would not be designed or constructed." But ARM 17.24.639(7)(b) states: "Sedimentation ponds having embankments must be constructed to provide containment of runoff from a 25-year, 24-hour precipitation event, or greater event as specified by the department, with no spillway required . . . ." Thus, the regulation does not require that ponds constructed for the 25-year, 24-hour precipitation event be full retention ponds, but they do not require a spillway. Spillways can be constructed in accordance with ARM 17.24.639 making these detention ponds.	**14-26 Response:** The section referenced in the comment has been modified to say that the sediment ponds would be designed in accordance with ARM 17.24.639.
14-27 (6702)	Post-mining Springs. The Draft EIS states that "After mining ceased, pre-mine flow conditions would not return to springs whose aquifer sources were removed." Draft EIS at 509, 556. In reality, postmining, springs may return to the same locations as pre-mining even though the aquifer source has been removed and replaced. During mining, care is taken to disturb as little as possible, including the geologic structure below the coal and in the areas adjacent to the active pits. This allows the recharged spoil aquifer, in many instances, to reproduce flow patterns and quantities similar to the Rosebud Coal aquifer. Consider rewording the Final EIS to say, "After mining ceased, pre-mine flow conditions may return to springs whose aquifer sources were removed and replaced."	**14-27 and 14-28 Response:** If the water source of a spring is removed, the pre-mine flow conditions of a spring would not return after mining ceased. After mining, springs sourced from spoil may develop in low areas in the PMT, which could include locations near or at the former locations of pre-mining springs. The Final EIS has been edited to clarify that it is possible that some springs would develop in the spoils post-mining. See also response to Comment 14-21.
14-28 (6707)	Similarly, in the discussion of the irreversible and irretrievable commitment of resources in Section 4.7.5, the Draft EIS claims that "the loss of water to the springs in the project area whose source of water supply was the Rosebud Coal, which likely would result in the loss of these springs and associated wetlands." Draft EIS at 524. Consider revising the bullet item to say: "the removal and replacement of the Rosebud Coal aquifer with a spoils aquifer in the mine pit areas may result in a temporary or permanent loss of those springs and associated wetlands whose water supply was the Rosebud Coal." -10-	

Comment/ Code	Document #014-Western Energy Company	Response
14-29 (6702)	Finally, in discussing impacts to groundwater, the Draft EIS provides that "As a result, it is unlikely that springs would redevelop at locations similar to those of existing springs." Draft EIS at 531. Although this statement may be true for springs/seeps that are sourced by overburden, those sourced by Rosebud Coal may redevelop. As stated above, these springs may return to the same locations as premining even though the aquifer source has been removed and replaced. Please consider revising the language as follows: "The removal and replacement of the Rosebud Coal aquifer with a spoils aquifer in the mine pit areas may result in a temporary or permanent loss of those springs whose water supply was the Rosebud Coal."	**14-29 Response:** See response to comment 14-21.
14-30 (6702)	Groundwater Contribution to Robbie and Donley Creeks. The Draft EIS provides that > Ground water contributions to stream flow from the reclaimed area would eventually return to Robbie and Donley Creeks, but as described in Section 4.8, Water Resources – Ground Water, the rate of flow at these locations would be less because there would no longer be discharge from the Rosebud Coal and, due to the nature of the spoil, discharge from the spoil would likely be less than previously occurred from the Rosebud Coal." Draft EIS at 510-11. This statement gives undue weight to the quantity of water that is contributed by the Rosebud Coal which is replaced by spoil. First, the transmissivity of the Rosebud Coal is similar to the transmissivity of the spoil, i.e., flow rates through the Rosebud coal would be similar to flow rates through the spoil. Second, the increase in the quantity of alluvial groundwater flow from the Rosebud Coal or spoil is relatively small compared to the quantity from other sources (runoff, alluvial groundwater from upstream, evapotranspiration). Third, this is further exacerbated when discussing surface water in ephemeral systems. Ephemeral systems are influenced most by precipitation-based, episodic, and flashy runoff.	**14-30 Response:** The Final EIS has been revised to reflect the uncertainty in possible changes in flow post-mining. The statement here of "would" has been replaced with "could."
14-31 (6702)	Direct Impacts to Groundwater. Section 4.8.3.1 includes misstatements relating to groundwater impacts. First, the Draft EIS states: "The Western Energy ground water model also indicated that where the interburden between the Rosebud Coal and the McKay Coal is relatively thin, approximately 40 feet or less, dewatering and removal of the Rosebud Coal would induce upward flow from the McKay Coal into the pits." Draft EIS at 527. Due to the low transmissivity and hydraulic conductivity of the interburden and McKay Coal, the *"upward flow"* is negligible as described and has not been observed in other areas of the mine. The more likely cause of the reduction of water quantity in the McKay Coal is the reduction of recharge. The Draft EIS should be revised to say: "The Western Energy ground water model also indicated that where the interburden between the Rosebud Coal and the McKay Coal is relatively thin, approximately 40 feet or less, dewatering and removal of the Rosebud Coal would induce drawdown in the McKay Coal." Second, the Draft EIS claims that -11-	**14-31 Response:** Either subtle upwards flow from the McKay to the pit, or a reduction in subtle downward flow from the Rosebud to the McKay, or some combination of both could explain the drawdown observed in the McKay as a result of mining. Regardless of why the heads in the McKay and deeper units decrease during mining, they appear to do so, and they are predicted to recover post-mining. The Final EIS has been revised as suggested in this comment.

Comment/ Code	Document #014-Western Energy Company	Response
	Removal of the Rosebud Coal aquifer by mining would eliminate recharge to the alluvium of the major channels within the permit boundary for a long period. Ground water that currently discharges at the edge of the coal to the alluvium would be intercepted by pit dewatering during mining and would discharge to the reclaimed spoil placed in the pits during mining. Until the spoil is resaturated, Rosebud Coal ground water would not reach the major drainages."	
14-32 (6702)	Draft EIS at 531. This statement generalizes the removal of the Rosebud Coal aquifer. Removal of the Rosebud Coal will only occur within the project area which will induce localized drawdown. The Rosebud Coal will not be mined outside this area. The entirety of the aquifer will not be removed.	**14-32 Response:** The EIS has been revised to make it clear that removal of the coal would eliminate recharge to the alluvium from the portion of the coal that would be removed.
14-33 (6702)	Also, this statement is incomplete as it omits the replacement aquifer to the Rosebud Coal aquifer. During mining, overburden is removed (and typically cast into the previously open pit as spoil) to expose the Rosebud Coal seam. This seam is then extracted leaving a void that will be filled with the overburden from the next pass as spoil. This is a removal of the Rosebud Coal aquifer and replacement with the spoils aquifer. Recharge in the spoils aquifer will begin as early as immediately following coal extraction and continue as mining progresses away to each successive pit.	**14-33 Response:** See responses to comments 14-21 and 14-22.
14-34 (6702)	Further, as discussed earlier, this statement gives undue weight to the quantity of water that is contributed by the Rosebud Coal which is replaced by spoil. Consider revising this discussion to state: Removal and replacement of the Rosebud Coal aquifer with a spoils aquifer in the area of the mine pits, may reduce or eliminate the limited recharge contribution from this source to the alluvium of the major channels within the permit boundary for a long period. Ground water that currently discharges at the edge of the coal to the alluvium may be intercepted by pit dewatering during mining and may discharge to the reclaimed spoil placed in the pits during mining.	**14-34 Response:** DEQ and OSMRE determined that the statements made in the EIS regarding the quantity of water that is contributed by the Rosebud Coal is accurate, and no changes were made to the EIS.
14-35 (6702)	For the same reasons, the language at 536 that states, "As a result of mining, it is possible that downgradient alluvial water quality could change as a result of eliminating the recharge from the Rosebud Coal," should be revised to say, "Due to the limited contribution from the Rosebud Coal and the replacement spoil groundwater and the significant contribution from other sources, it is unlikely that downgradient alluvial water quality could change."	**14-35 Response:** The Final EIS was edited to clarify that changes in alluvial groundwater quality are likely to be limited to the alluvium near the spoil.
14-36 (6605)	Groundwater Impacts to Surface Water Quality. Western Energy also suggests that OSMRE include additional context in the discussion of ground water impacts to surface water quality. Draft EIS at 519. For example, the analysis states that where -12-	**14-36 Response: Section 4.7.3.2** of the EIS acknowledges that the quality of spoil ground water in other areas mined by Western Energy is highly variable, so it is difficult to predict to what extent discharge from the spoil in the analysis area would affect surface water quality, and if changes in water quality due to discharge from the spoil would be separable from natural water quality variability. .

Comment/ Code	Document #014-Western Energy Company	Response
14-36 (6605) Cont.	ground water is the major or only source of surface water, the impacts will exceed water quality standards. As a factual and legal matter, this statement is not necessarily correct. Based on experience elsewhere in the mine, Western Energy expects that natural levels of salinity vary greatly and that the stream currently exceeds water quality standards. Also, because water from the alluvium does not come from a point source, Western Energy expects that non-degradation standards would not apply in any event.	
14-37 (6603)	Further, a discussion of the applicable Electrical Conductivity ("EC") and Sodium Adsorption Ratio ("SAR") standards for Rosebud Creek could be added to Section 3.7.1.1, along with discussion of the natural condition of Rosebud Creek for those parameters and how that impacts the water quality standards. In this case, Western Energy anticipates that the analysis would demonstrate that Area F will not give rise to a measurable increase in EC or SAR in Rosebud Creek.	**14-37 Response:** The EIS describes effects on the water quality of Rosebud Creek, which would occur only as a result of deposition of coal combustion emissions. The EIS does not state that there would be an increase in EC or SAR.
14-38 (6603)	Impacts to Ponds. The discussion of impacts on ponds is unclear. It suggests that for ponds fed by stormwater runoff, the water quality may improve and that for ponds fed by springs, the water quality may degrade. The analysis also provides that "[t]he water quality of all of the ponds may degrade" due to a reduction of inflows. Draft EIS at 520. Given the replacement ponds and the conclusion that they would have water quality "similar to existing ponds," a "long-term and moderate" impact does not seem appropriate. *Id.*	**14-38 Response:** The section referenced in the comment describes why the various effects would occur. If a stock pond were to become unusable either during or after mining due to flow or water quality changes, a suitable replacement source would be provided by Western Energy, so the impact would be moderate and short-term. However, not all ponds in the project area would be replaced, so impacts may be long-term.
14-39 (7102)	Impacts to Aquatic Life. The analysis of impacts to stream water indicates that "[g]rowth and propagation of aquatic life may be lost in reaches adjacent to mining which become ephemeral," but the context of the analysis really seems to indicate that the aquatic life may be temporarily impacted. Draft EIS at 511. Consider replacing the word "lost" with "temporarily impacted."	**14-39 Response:** The effects analysis for aquatic life is appropriate as disclosed in **Section 4.12.3.1** of the EIS.
14-40 (7005)	Wetland Impacts. The analysis of irreversible and irretrievable commitment of resources regarding wetlands indicates that wetlands will be permanently affected by mining activities, but does not include discussion of mitigation measures taken to replace and improve area wetlands. Draft EIS at 561. Some mitigation or replacement will occur and should be acknowledged.	**14-40 Response:** While mitigation measures replace wetland functions in a different location, the wetlands in those specific locations would be permanently lost. The characterization of impacts is appropriate.
	V. Other Resource Chapters/Impact Analyses	
	A. Resource Topography	
14-41 (6103)	In the impact analysis on page 425 (Section 4.2.3.2), 505 (Section 4.6.3.2), 506 (Section 4.6.5) and in the summary of impacts in Table S-1 (at S-24), the Draft EIS states that "Differential erosion of backfilled areas and unmined drainage basins would result in topographic inversion of the analysis area; these impacts would be long-term, major, and adverse." This statement is an erroneous, gross exaggeration of the erosion potential. Differential erosion on the scale described is not reasonable. An extreme example of the effect, or lack thereof, of differential erosion is evidenced by the existence of spoil peaks from historic mining near Colstrip. These spoil peaks were placed in the 1920's with no stabilization measures and are still intact. Current reclamation laws require stabilization	**14-41 Response**: The topographic inversion discussion was not in reference to spoil peaks from historic mining, but rather the indirect impacts from placing nonlithified spoils in the mined-out pits that are then more easily erodible than the lithified sedimentary rocks comprising the surrounding nonmined areas. The discussion was about long-term impacts, thousands of years in the future, when continued erosion exposes the spoils. Erosion of the landscape is a reasonably foreseeable natural occurrence that happens at a slow rate and would affect topography. The action of burying more easily erodible spoils in place of lithified rock would alter the related rates of erosion between the two materials and have an impact on future topography. The Final EIS has been edited to clarify that this impact would take thousands of years to manifest.
	-13-	

Comment/ Code	Document #014-Western Energy Company	Response
	measures that minimize erosion potential. Included in the permit application, Western Energy submitted WEPP modeling that provides a basis that post-mining erosion potential is equal to or less than pre-mine erosion potential.	
	B. Fish and Wildlife Resources	
14-42 (7103)	The indirect effects analysis for fish and wildlife purports to address only trace-metal deposition issues, but in reality, other types of indirect effects to wildlife are fully addressed under the "direct effects" analysis. For instance, the "direct impacts" section addresses animal displacement to less suitable habitat resulting in lower survival and reproduction rates. Draft EIS at 565. Please consider reorganizing the impact analysis to better identify indirect impacts and avoid the conclusion that the indirect effects analysis relates solely to trace-metal deposition. For special status species, please also clarify that the indirect effects analysis is not limited to just trace-metal deposition but considers other types of indirect effects that are currently described in the "direct effects" analysis. Draft EIS at 326.	**14-42 Response:** The direct and indirect impacts sections of the EIS have been revisited and reorganized, as appropriate.
	C. Air Quality	
14-43 (3203)	The air quality analysis generally reflects a very robust analysis of air quality impacts, but the description of the analysis in the text could in certain cases be clarified and refined. For example, the description of how baseline air quality was analyzed should better explain how mobile sources within the mine and fugitive dust were accounted for the in the modeling and analysis. Draft EIS at 136. Similarly, even though the analysis was completed, the description of what sources are included in the direct impact analysis does not clearly state that transportation of the coal from the mine to the power plant is included. While references are made to conveyors, the text should be revised to clarify that the referenced conveyors include the ones that transport the coal to the Colstrip Power Plant. Further, the air quality analysis relies heavily on the "Supporting Information for Air Quality Impact Analysis for Rosebud Mine Area F DEIS" prepared by Ramboll Environ. Please include that document in the Appendix to the EIS.	**14-43 Response:** Additional information is provided in the Baseline Air Quality section.
14-44 (6202)		**14-44 Response:** Additional information is provided in the Environmental Consequences section.
	D. Socioeconomic Conditions	
14-45 (7401)	Similar to other resource sections, the socioeconomic conditions section establishes impact and intensity thresholds against which to evaluate the impact of the proposed action and alternatives. Those thresholds are referenced in the discussion of impacts common to all alternatives (retirement of Units 1 and 2, and the eventual closure of the mine), but are not discussed in the remainder of the section. The relative differences of economic impacts as between the alternatives should be identified throughout the remainder of the section with reference to the established impact and intensity thresholds.	**14-45 Response:** The socioeconomic analysis in the Final EIS has been expanded as suggested.
	E. Environmental Justice	
	-14-	

Comment/ Code	Document #014-Western Energy Company	Response
14-46 (7502)	The Draft EIS states that, because the mine will close eventually, the environmental justice impacts of the no action alternative (which would result in job loss for communities subject to environmental justice analysis) would be "long-term, negligible and adverse." Draft EIS at 606. "Negligible" impacts for purposes of the environmental justice analysis are those are low levels that "would not have appreciable effects on minority of low-income populations." Draft EIS at 605. This conclusion dramatically undervalues the benefit of eight years of employment in terms of wealth accumulation, acquisition of skills and experience, and the simple ability to plan for next steps.	**14-46 Response:** Environmental justice impacts have been revisited and revised in the Final EIS.
14-47 (9003)	**VI. Minor Comments and Edits** Please consider the following additional edits to the Draft EIS. Explanation is provided where the purpose of the proposed change is not self-evident.	**14-47 Response:** Changes have been made to the Final EIS, as appropriate.

Page, paragraph, line	Proposed change or edit	Explanation (if appropriate)
S-17, 6th paragraph, 5th line; 53, paragraph 5, first sentence; 621, 4th paragraph, 1st sentence	The 4.2 mile Horse Creek Road relocation is in the northeast/north-central portion of the permit area not the northwest/north-central portion as it states in the document.	
9, 3rd paragraph, first sentence; 33, 3rd paragraph, 5th line	Delete the words "although some coal from Area A is transported by haul truck" from the sentence "The Rosebud Mine delivers between 7.7 and 9.95 million tons of coal annually to the Colstrip Power Plant primarily by covered conveyors (shown on Figure 2), ~~although some coal from Area A is transported by haul truck~~." Delete the sentence: Some coal from Area A is also transported to the Colstrip Power Plant by haul truck.	No coal is transported to the Colstrip Power Plant by haul truck. Area C coal is transported to a coal crusher in Area C and Areas A and B coal is transported to a coal crusher in Area A. After being crushed, the coal from both crushers fall onto a covered conveyor belt that transports the coal to the Colstrip Power Plant. The only direct coal haulage by haul truck is to the Rosebud Power Plant.

-15-

Comment/ Code	Document #014-Western Energy Company	Response
14-47 (9003) Cont.		**14-47 Response continued:** Changes have been made to the Final EIS, as appropriate.

Page, paragraph, line	Proposed change or edit	Explanation (if appropriate)
12, Table 1,	Change "To allow Western Energy to mine federal coal leases" to "To evaluate application by Western Energy to mine federal coal leases."	
19, first paragraph, 4th line; 87, Figure 11; 659, first paragraph, last sentence	There are inconsistencies in the discussion and figure describing MPDES permit application MT-0031828. The current and complete version of the permit application are contained in the May 8, 2017 letter to DEQ regarding "Revision to Permit Application Per Mine Permit Application Deficiency #5 Responses".	
30, 5th paragraph, first sentence; 34, 2nd paragraph, first line	Revise the text as follows: "Currently, three active ~~pits~~ mine areas at the Rosebud Mine operate under permits issued by DEQ: Area A (4,262 acres, permit C1986003A), Area B (6,231 acres, permit C1984003B), and Area C (9,382 acres, permit C1985003C) (Chapter 1, Figure 2)." Change text to read: "As discussed above, the Rosebud Mine has three other active ~~pits~~ mine areas."	Each mine area includes more than one active pit.
54, second paragraph, last sentence	The Draft EIS states: "No mining-related activities other than surveying and monitoring would be completed north of the county road until the relocation is approved and constructed." As there are two phases to the Horse Creek Road relocation there needs to be a note clarifying whether this statement applies to one or both phases of the relocation. Also, there is ambiguity as to whether the statement "north of the county road" refers to the existing county road or the proposed realignment. Please clarify.	
84, second heading	Change "Singing" to "Signing."	
89, 2nd paragraph,	The Draft EIS states: "During mining, soil stockpiles from known clinker zones would	

-16-

Comment/ Code	Document #014-Western Energy Company	Response
14-47 (9003) Cont.		**14-47 Response continued:** Changes have been made to the Final EIS, as appropriate.
14-48 (3604)		**14-48 Response:** The description of flow conditions at CG-101 and in Robbie Creek in the analysis area have been adequately and accurately described in the EIS.

Page, paragraph, line	Proposed change or edit	Explanation (if appropriate)
second sentence	be replaced…" This statement needs clarification, i.e. what is being *"replaced."*	
100, 4th paragraph, first line	Change "MAQP" to "MQAP."	
123, 2nd paragraph	Revise the text as follows: "Specific federal and state regulatory requirements related to topography concern the reclamation of the post-mine area to ~~preexisting topographic conditions~~ approximate original contours."	The regulatory requirement was incorrectly stated.
170, 3rd paragraph, 3rd line	Change "this EA" to "this EIS."	
172, third paragraph, second sentence	Replace reference to this "EA" with "EIS."	
186, 4th paragraph, last sentence	The Draft EIS states: "Coal from the Rosebud Mine is transported to the power plants by haul truck via county and state roads." Revise to state: "Coal from the Rosebud Mine is transported to the Colstrip Power Plant by conveyor systems and to the Rosebud Power Plant by haul truck via county and state roads."	
211, last paragraph	Although the portion of Robbie Creek near CG-101 may exhibit intermittent or perennial flow conditions, there is not enough evidence to extrapolate this hydrologic condition to other stretches in the vicinity. The setting of CG-101 should also be described.	
323-324, Section 3.12.6.2	Castle Rock Lake is a source of fish and should be discussed here. The following is a list of discussions in the EIS regarding Castle Rock Lake: ▪ Fish consumption advisory is discussed in sections 3.5.2.4, 3.7.6.2, 4.7.3.3 ▪ Recreation is discussed in section 3.5.3.3 in the "Land Use" portion, section 3.18.2.2, 4.17.3.1	

-17-

Comment/ Code	Document #014-Western Energy Company	Response
14-47 (9003) Cont.		**14-47 Response continued:** Changes have been made to the Final EIS.

Page, paragraph, line	Proposed change or edit	Explanation (if appropriate)
	▪ Public water supply is discussed in Section 3.15.4.5 ▪ Water quality is discussed in section 4.5.3.2 • General characteristics are discussed in section 5.3.6.	
325, second paragraph, last sentence	The sentence begins with "Modification," but should read "Adverse modification."	Adverse modification is the Endangered Species Act standard discussed here.
340, last 2 paragraphs	These paragraphs discuss the Montana Executive Order establishing core and connectivity areas for greater sage-grouse and affirmatively states that Area F is not within one of those designated areas. The same affirmative statement should be included for BLM—i.e., that Area F is not within a priority habitat management area identified in the BLM Miles City Resource Management Plan.	
430, last paragraph, second sentence 623, second paragraph, second sentence	Revise as follows: If approved, the project area would extend the lifetime and total disturbance area of the Rosebud Mine, but would not increase annual coal production. Instead project area coal would ~~replace coal production of~~ reduce the rate at which coal is mined from the existing mine permit areas (Section 1.3, Purpose, Need, and Benefits and Section 2.4.1, Permit and Disturbance Areas) and would utilize existing mine operations and support facilities (Section 2.2.1)." Similarly revise the following: "As project area coal would ~~be replacing coal~~ reduce the rate at which coal is mined from other permit Areas (see Figure 3), haul truck traffic would not be expected to contribute significantly to the existing volume on SH 39."	There is ambiguity in use of the word *"replace"*. Coal from the project area would be mined in conjunction with coal being mined in existing mine permit areas. This would not abandon coal in existing mine areas, but rather reduce the rate at which coal is mined from existing mining areas.

-18-

Comment/ Code	Document #014-Western Energy Company	Response
14-47 (9003) Cont.		**14-47 Response continued:** Changes have been made to the Final EIS.

Page, paragraph, line	Proposed change or edit	Explanation (if appropriate)
669, 3rd paragraph, last sentence	Similarly, revise the following: "As in the case of the project area, AM5 and the lease modifications would not increase emissions of Areas A, B, D, and E beyond the currently permitted limits and would instead ~~replace~~ reduce the rate of production from other areas of the mine."	
495, 4th paragraph, second sentence	Revise as follows: "These would be monitored and replaced if they failed to meet ~~quarter~~ water quality standards for human consumption."	
515, 2nd paragraph, second to last sentence	The Draft EIS provides, "Spoil in the designed postmine drainages would be covered by several feet of topsoil and vegetated, so there would be no exposed spoil." As is discussed in Section 2.4.4.8 under "Conifer", no soil areas (bare spoil) may be left as it is a suitable medium for different vegetative growth.	
533, last sentence	Refers to Section 1.3.5, but likely should refer to Section 4.8.5.	
542, last paragraph, first sentence	The reference to 4,300-acre disturbance should be 4,260-acre disturbance.	
652, first paragraph	Should the discussion of sediment impacts in this paragraph be included in the discussion of direct, as opposed to indirect, effects?	
682, 3rd paragraph, 5th line	The text states that "municipal and residential drinking water in the area comes from aquifers." Please resolve inconsistency with Section 3.7.6.2.	Section 3.7.6.2 states that the city of Colstrip uses water from Castle Rock Lake, which is water piped from the Yellowstone River, for municipal water supply. There are a few instances where domestic water is sourced from wells.

-19-

Comment/ Code	Document #014-Western Energy Company	Response
14-47 (9003) Cont.		**14-47 Response continued:** Changes have been made to the Final EIS.

Page, paragraph, line	Proposed change or edit	Explanation (if appropriate)
686, 3rd paragraph, bullet list	Please revise for accuracy as follows: "Impacts on stream and spring flow and quality are described for the following watersheds near the city of Colstrip (see Figure 117): • Cow Creek watershed due to mining in Areas D and E • East Fork Armells Creek watershed due to mining in Areas A, B, ~~and~~ C, and D • Lee Coulee watershed due to mining in Area B and the Big Sky Mine • Miller Coulee watershed due to the Big Sky Mine • Pony Creek and Spring Creek watersheds due to mining in Area D • Rosebud Creek watershed due to mining in Areas B, D and E (and the Big Sky Mine) • Stocker Creek watershed due to mining in Areas A and C • West Fork Armells Creek watershed due to mining in Area C"	East Fork Armells Creek watershed includes Areas A, B, C, and D. Rosebud Creek watershed includes Lee Coulee therefore Areas B, D, and E. Stocker Creek watershed includes Areas A and C.
Sections 5.3.14 and 5.3.22	These sections discuss the land use of reclaimed lands but should be expanded to native (undisturbed) lands. During mining the land that is not in the active areas of the mine may be used for livestock grazing, including native and reclaimed lands.	
708, 6th paragraph, lines 2-3	This section may contain a typographical error when stating "29-kilometer radius around the power plants". All other analyses contained a 32-kilometer area.	

-20-

Comment/ Code	Document #014-Western Energy Company	Response
	VII. Conclusion Thank you for considering Western Energy's comments on the Rosebud Mine Area F Draft EIS. If you have any questions about these comments, please contact me. Sincerely, Russell Batie PE Engineering Manager Western Energy Company Rosebud Mine Phone: (406) 748-5179 Fax: (406) 748-5202 rbatie@westmoreland.com Enclosures: Considine, Timothy "Reliability of Greenhouse Gas Emission Cost Estimates for Rosebud Mine Area F" -21-	

Comment/ Code	Document #014-Western Energy Company	Response
	Reliability of Greenhouse Gas Emission Cost Estimates for Rosebud Mine Area F Timothy J. Considine* The proposed Rosebud Mine Area F (RMAF) extension entails costs and benefits. The benefits include additional jobs, tax revenues, income, and output from the extension. On the other hand, the project may incur costs associated with greenhouse gas emissions. These environmental costs, however, are difficult to identify and quantify. Western Energy Company produces coal that is shipped via conveyer systems to the Colstrip power plant and haul truck to the Rosebud power plant, which are owned by separate companies. If the RMAF extension was disallowed other coal producers would supply coal via rail or truck transportation. In this case, the cost of coal to the power plants would increase and so would the cost of electricity. Under cost-based rate of return regulation of electric power, these costs would be passed on to electricity customers. While there would be a small demand response and reduction in emissions as a consequence, additional transportation services to deliver coal from more distant locations would increase emissions. If the more expensive power is sold in wholesale power markets, the coal power plants could face lower operating rates to the extent that they are in direct competition with alternative sources of power, such as wind and natural gas generators. The net effect on emissions is unclear. Likewise, if the mine extension were allowed, Western Energy Company would continue supplying coal to the Colstrip and Rosebud power plants and carbon emissions would remain at current levels. Hence, the net effect on carbon emissions from the proposed mine extension is unknown but likely quite small and perhaps close to zero. In the unlikely event that these outcomes do not hold, it is conceivable that greenhouse gas emissions could increase. What follows is an estimation of the costs these emissions could impose on society based on this unlikely assumption that the Rosebud Mine Area F extension mine would increase greenhouse gas emissions (GHG). To estimate these costs, the annual output of carbon dioxide and methane emissions from the mine extension would be multiplied by their respective per unit emission costs. These unit costs are known as the social costs of carbon (SCC) and methane (SCM) respectively. However, unlike jobs, wages, taxes and royalties, these social costs are not observable. Instead, economists use mathematical models to estimate the social cost of these GHG emissions. These models are highly simplified representations of complex climate systems and the world economy. Moreover, the results are very sensitive to key parameters, which are at best highly uncertain. * The author is a Distinguished Professor of Energy Economics with the School of Energy Resources and the Department of Economics at the University of Wyoming. This analysis is supported with funding provided by Holland & Hart LLP and Western Energy Company. The views and analysis here reflects those of the author and are not necessarily those of the University of Wyoming, Holland and Hart LLP, or Western Energy Company.	

Comment/ Code	Document #014-Western Energy Company	Response
	Reliability of Greenhouse Gas Emission Costs – page 2 The chosen discount rate, which involves subjective judgment, is one of the most significant sources of uncertainty. The chosen boundary for the analysis also has a big impact, with global estimates of SCC and SCM far higher than those for individual nations. This letter provides an illustration of how estimates of greenhouse emission costs for the Rosebud Mine Area F extension are affected by these two factors. The analysis finds that GHG costs for the mine extension vary by more than a factor of 40. This enormous variation in the GHG costs casts considerable doubt on the practicality and usefulness of estimating the social cost of greenhouse gas emissions for this project. *The Discount Rate* Any damages that may be associated with human-caused climate change occur decades and centuries into the future. As a result, the annual rate at which those damages are discounted has a very significant impact on the SCC and SCM. For instance, the Interagency Working Group on Social Cost of Greenhouse Gases (2016) summarizes simulations from three economic-climate models by Hope (2013), Narita (2010), and Nordhaus (2013) and finds that the global social cost of carbon is between $11 and $36 per ton of carbon emissions in 2015 for 5% and 3% discount rates respectively. There is considerable disagreement on the discount rate for climate change policy evaluations according to Goulder and Williams (2012). Advocates of aggressive policies to reduce greenhouse gas emissions argue that the discount rate should be 1.4% to achieve a 3% annual reduction in greenhouse gas emissions. On the other hand, Nordhaus (2014) argues for a much higher discount rate of 4.3%. In contrast, the discount rate used by private business to evaluate investment projects is even higher. Project evaluations in the private sector use an observable market based rate of return. The long-term inflation adjusted average rate of return on the Standard and Poor 500 stock index is 7% according to Connerly (2017). Indeed, the Office of Management and Budget (2003) recommends, "For regulatory analysis, you should provide estimates of net benefits using both 3 percent and 7 percent," OMB (2003, page 34). *Global versus Domestic* There are also wide differences between domestic and global estimates for SCC and SCM. For example, assuming a 3% discount rate, the domestic SCC for the United States is between $3 and $8 dollars per ton according to the Institute for Energy Research (2017). The Office of Management and Budget (2003) provides guidelines for project evaluation and states: "Your analysis should focus on benefits and costs that accrue to citizens and residents of the United States," (OMB, 2003, page 15). *Social Costs for Carbon* The Environmental Protection Agency (2017) recently completed a cost-benefit analysis of the Clean Power Plan following the OMB (2003) regulatory analysis guidelines using discount rates of 3% and 7%. They also estimated benefits for the world and for the United States. The SCC for the 3% rate is from Interagency Working Group on Social Cost of Greenhouse Gases (2016). The estimates assuming the 7% discount rate and the estimated domestic SCC are based upon the ratios reported by the Environmental Protection Agency (EPA 2017, Appendix C, page 168).	

Comment/ Code	Document #014-Western Energy Company	Response

The social cost of carbon at the global and domestic level for 3% and 7% discount rates are presented in Table 1 for the duration of RMAF, which is from 2018 through 2036. The global SCC under the 7% discount rate is between $5 and $9 per metric ton in 2016 dollars (see column 2, Table 1). In contrast, the global SCC assuming a 3% discount rate is between $46 and $65 per metric ton. The corresponding estimates for the domestic SCC are considerably lower, from $1 to $1.6 per ton under the 7% discount rate and between $6 and $9 per ton with the 3% discount rate.

Table 1: Social cost of carbon in 2016 dollars per metric ton

Annual Social Cost of Carbon Values in 2016$ / metric ton CO_2				
	Global		Domestic	
Year	7% Rate	3% Rate	7% Rate	3% Rate
2018	$5.27	$46.29	$1.00	$6.49
2019	$5.51	$47.45	$1.05	$6.65
2020	$5.75	$48.62	$1.09	$6.81
2021	$5.99	$48.62	$1.14	$6.81
2022	$6.23	$49.78	$1.18	$6.98
2023	$6.47	$50.95	$1.23	$7.14
2024	$6.71	$52.07	$1.28	$7.30
2025	$6.94	$53.24	$1.32	$7.45
2026	$7.18	$54.36	$1.36	$7.61
2027	$7.33	$55.51	$1.39	$7.77
2028	$7.48	$56.67	$1.42	$7.93
2029	$7.48	$56.67	$1.42	$7.93
2030	$7.64	$57.83	$1.45	$8.10
2031	$7.79	$58.98	$1.48	$8.26
2032	$7.94	$60.14	$1.51	$8.42
2033	$8.10	$61.30	$1.54	$8.58
2034	$8.25	$62.45	$1.57	$8.74
2035	$8.40	$63.61	$1.60	$8.91
2036	$8.55	$64.77	$1.63	$9.07

Social Costs for Methane

While methane does not last as long in the atmosphere as carbon dioxide, it has a relatively more powerful greenhouse gas warming effect. There are two approaches to estimating the social costs of methane emissions. The first converts methane emissions to CO_2 equivalents and then uses the SCC. Using a modified integrated assessment model developed by Nordhaus (2014) and a simple climate model, Marten and Newbold (2011) argue that this approach can under-estimate the social costs of methane by up to 35%. The second approach uses a direct estimate of the social cost of methane, which was first developed by Marten and Newbold (2011) and refined later by Marten et al. (2015). Kreutzer and Dayaratna (2015) use the Marten and Newbold (2011) models to estimate the global social cost of methane under 3% and 7% discount rates. The EPA (2017b) estimates the domestic social cost of methane under these discount rates.

The global and domestic social cost of methane for 3% and 7% discount rates are presented in Table 2 for the duration of RMAF. The global SCM under the 7% discount

Comment/ Code	Document #014-Western Energy Company	Response

rate is between $356 and $692 per metric ton in 2016 dollars (see column 2, Table 1). In contrast, the global SCM assuming a 3% discount rate is between $1,289 and $2,189 per metric ton. The corresponding estimates for the domestic SCM are considerably lower, from $52 to $98 per ton under the 7% discount rate and between $170 and $284 per ton with the 3% discount rate. While the social costs for methane are much higher than the corresponding estimates for the social costs of carbon, the volume of methane emissions are much smaller than carbon dioxide emissions.

Table 2: Social cost of methane in 2016 dollars per metric ton

Annual Social Cost of Methane Values in 2016$ / metric ton CH_4				
	Global		Domestic	
Year	7% Rate	3% Rate	7% Rate	3% Rate
2018	$356.14	$1,289.92	$52.00	$170.00
2019	$373.32	$1,340.12	$53.00	$170.00
2020	$390.56	$1,390.33	$55.00	$180.00
2021	$408.73	$1,440.53	$57.56	$186.50
2022	$427.13	$1,491.45	$60.15	$193.09
2023	$445.36	$1,541.68	$62.72	$199.60
2024	$463.62	$1,591.91	$65.29	$206.10
2025	$480.82	$1,638.45	$67.71	$212.12
2026	$499.08	$1,688.56	$70.28	$218.61
2027	$517.35	$1,738.68	$72.86	$225.10
2028	$535.65	$1,788.80	$75.43	$231.59
2029	$553.96	$1,838.92	$78.01	$238.08
2030	$572.29	$1,889.03	$80.59	$244.57
2031	$592.32	$1,939.15	$83.41	$251.05
2032	$612.32	$1,989.27	$86.23	$257.54
2033	$632.28	$2,039.38	$89.04	$264.03
2034	$652.21	$2,089.50	$91.85	$270.52
2035	$672.10	$2,139.62	$94.65	$277.01
2036	$691.97	$2,189.74	$97.45	$283.50

Social Greenhouse Gas Emissions for the Rosebud Mine Area F

The social costs of greenhouse gas emissions from the Rosebud Mine Area F are estimated by multiplying the estimates for the SCC and SCM by emission levels estimated by Montana Department of Environmental Quality (2017). There are direct emissions from coal extraction and indirect emissions from electricity production. Total emissions of CO2 are 12.299 million metric tons per year from 2018 through 2029 and drop slightly with lower coal production in 2030. Methane emissions follow a similar track falling from 4 to 3.5 thousand metric tons per year in 2030 (see Table 3).

The social costs of greenhouse gas emissions from the Rosebud Mine Area F are calculated by multiplying the estimated total emission levels reported in Table 3 by the SCC and SCM estimates reported in Tables 1 and 2. The results are listed in Table 4. The global annual emission costs are between $66 and $107 million under the 7% discount rate and between $571 and $800 million with the 3% discount rate assumption (see Table 4). In contrast, the annual emission costs assuming domestic benefits apply are between $12 and $20 million with the 7% discount rate and from $80 and $112 million assuming

Comment/ Code	Document #014-Western Energy Company	Response

Rosebud Mine Area F – page 5

the 3% discount rate (see Table 2). Total emission costs for the 19-year time horizon vary by over 40-fold from a low of $319 million to as high as $12.9 billion (see Table 4)

Table 3: Direct, Indirect, and Total Emissions in thousand metric tons

	Direct		Indirect		Total	
Year	CO2	CH4	CO2	CH4	CO2	CH4
2018	37.3	2.7	12,192	1.3	12,229	4.0
	.	.	.	.	.	.
	.	.	.	.	.	.
2029	37.3	2.7	12,192	1.3	12,229	4.0
2030	32.6	2.2	12,192	1.3	12,224	3.5
2031	32.6	2.2	12,192	1.3	12,224	3.5
2032	32.6	2.2	12,192	1.3	12,224	3.5
2033	32.6	2.2	12,192	1.3	12,224	3.5
2034	32.6	2.2	12,192	1.3	12,224	3.5
2035	32.6	2.2	12,192	1.3	12,224	3.5
2036	32.6	2.2	12,192	1.3	12,224	3.5

Table 4: Estimated Greenhouse Gas Emission Costs in millions of 2016 dollars

	Global		Domestic	
Year	7% Rate	3% Rate	7% Rate	3% Rate
2018	$66	$571	$12	$80
2019	$69	$586	$13	$82
2020	$72	$600	$14	$84
2021	$75	$600	$14	$84
2022	$78	$615	$15	$86
2023	$81	$629	$15	$88
2024	$84	$643	$16	$90
2025	$87	$658	$16	$92
2026	$90	$672	$17	$94
2027	$92	$686	$17	$96
2028	$94	$700	$18	$98
2029	$94	$700	$18	$98
2030	$95	$714	$18	$100
2031	$97	$728	$18	$102
2032	$99	$742	$19	$104
2033	$101	$757	$19	$106
2034	$103	$771	$19	$108
2035	$105	$785	$20	$110
2036	$107	$799	$20	$112
Totals	$1,689	$12,956	$319	$1,813

Comment/ Code	Document #014-Western Energy Company	Response
	Reliability of Greenhouse Gas Emission Costs – page 6 *Conclusion* Western Energy Company supplies coal to nearby electric power generating companies via conveyors, avoiding long-distance transportation of coal from other sources. If the proposed development of Rosebud Mine Area F were not allowed, greenhouse gas emissions could increase due to diesel emissions from rail or truck transportation of the replacement coal. Hence, the Rosebud Mine Area F mine extension would not increase greenhouse gas emissions because the mine is already producing and shipping coal to electricity producers, if it didn't, someone else would. Nevertheless, if one were to believe the contrary, the estimated social costs of greenhouse emissions vary by over 40-fold depending upon the choice of the discount rate and geographic boundaries. Because the results vary so dramatically and are based on such dubious assumptions, the calculation of the social costs of carbon emissions from the Rosebud Mine Area F is neither practical nor useful. *References* Connerly, B. (2017) "The long-term rate of return on investment looks lower," Forbes, August 4. Environmental Protection Agency (2017) "Regulatory impact analysis for the review of the clean power plan: Proposal," https://www.epa.gov/sites/production/files/2017-10/documents/ria_proposed-cpp-repeal_2017-10.pdf Environmental Protection Agency (2017b) "Oil and natural gas sector – new source performance standards, national emission standards for hazardous air pollutants, and control techniques guidelines" Memorandum Docket for rulemaking (EPA-HQ-OAR-2010-0505), https://www.epa.gov/sites/production/files/2017-11/documents/oilgas_memo_proposed-stay_2017-10.pdf Goulder, L. and R. Williams (2012) "The choice of discount rate for climate change policy evaluations," Climate Change Economics, Vol. 3, No. 4, 1-18. Kreutzer, D. and K. Dayaratna (2015) "Another useless epa regulation that'll cost americans more money," Daily Signal, December 3, http://dailysignal.com/2015/12/03/another-useless-epa-regulation-thatll-cost-americansmore-money/. Hope, C. (2013) "Critical issues for the calculation of the social cost of CO_2: why the estimates from PAGE09 are higher than those from PAGE2002," Climatic Change 117: 531–543. Interagency Working Group on Social Cost of Greenhouse Gases (2016) "Technical support document: technical update of the social cost of carbon for regulatory impact analysis under executive order 12866." United States Government, https://www.epa.gov/sites/production/files/2016-12/documents/sc_co2_tsd_august_2016.pdf	

Comment/ Code	Document #014-Western Energy Company	Response
	Rosebud Mine Area F – page 7 Institute for Energy Analysis (2017) "Explaining IERs position on the social cost of carbon," https://instituteforenergyresearch.org/analysis/clarifying-iers-position-social-cost-carbon/ Marten, A. and S. Newbold (2011) "Estimating the social cost of Non-CO_2 GHG emissions: Methane and nitrous oxide," Working Paper # 11-01, January, https://www.epa.gov/sites/production/files/2014-12/documents/estimating_the_social_cost_of_non-co2_ghg_emissions_0.pdf Marten, A., E. Kopits, C. Griffiths, S. Newbold, A. Wolverton (2015) "Incremental CH4 and N2) mitigation benefits consistent with the US governments SC-CO2 estimates," Climate Policy, 15:2, 272-298. Montana Department of Environmental Quality (2017) "Western Energy Company Rosebud Mine Area F draft environmental impact statement," https://www.wrcc.osmre.gov/initiatives/westernEnergy/documents/WesternEnergy_RosebudMineAreaF_EIS.pdf Narita, D., R. S. J. Tol and D. Anthoff. (2010) "Economic costs of extratropical storms under climate change: an application of FUND," Journal of Environmental Planning and Management 53(3): 371-384. Nordhaus, W. (2014) "Estimates of the social cost of carbon: concepts and results from the dice-2013r model and alternative approaches," Journal of the Association of Environmental and Resource Economists 1(1/2): 273-312. Office of Management and Budget (2003) "Circular A4," https://www.whitehouse.gov/sites/whitehouse.gov/files/omb/circulars/A4/a-4.pdf	

Comment/ Code	Document #005-Sierra Club	Response
	Western Environmental Law Center * Montana Environmental Information Center * Montana Elders for a Livable Tomorrow * Indian People's Action * 350 Montana * Environment Montana Research & Policy Center * Montana Conservation Voters Education Fund * WildEarth Guardians * Sierra Club March 5, 2018 ATTN: Western Energy Area F EIS C/O: Nicole Bauman ERO Resources Corporation 1842 Clarkson Street Denver, CO 80218 Comments submitted electronically to http://svc.mt.gov/deq/publiccomment and via email to western-energy-area-f-eis@eroresources.com Exhibits submitted on CD via U.S.P.S. to ERO Resources **RE: Western Energy Area F EIS** Dear Ms. Bauman: These comments are submitted on behalf of the Western Environmental Law Center (WELC), Montana Environmental Information Center (MEIC), Montana Elders for a Livable Tomorrow (MELT), Indian People's Action, Environment Montana Research & Policy Center, 350 Montana, Montana Conservation Voters Education Fund, WildEarth Guardians, and the Sierra Club, (collectively, "Citizens"). The Citizens have previously submitted comments to the U.S. Office of Surface Mining (OSM) and the Montana Department of Environmental Quality (MDEQ) regarding the present mine expansion. Those comments are attached and incorporated by reference herein.[1] For the foregoing reasons OSM and MDEQ's (collectively referred to as OSM throughout these comments) draft environmental impact statement (DEIS) is legally insufficient and we request OSM reject the proposed expansion in favor of the No Action alternative. **TABLE OF CONTENTS** INTRODUCTION ..... 3 CITIZENS GROUPS ..... 4 I. OSM VIOLATED NEPA BY USING PURPOSE AND NEED STATEMENTS THAT ARE INAPPROPRIATE, INCOMPLETE, AND INCONSISTENT WITH CONTROLLING STATUTORY PURPOSES. ..... 6 [1] WELC Scoping Comments on Rosebud Area F Expansion, submitted on behalf of MEIC and Sierra Club (Oct. 11, 2013). Attachment 1. 1 | Page MEIC et al. Rosebud Area F DEIS Comments	

Comment/ Code	Document #005-Sierra Club	Response
	II. OSM FAILED TO ADEQUATELY ANALYZE AND DISCLOSE CLIMATE CHANGE IMPACTS. 11 A. The DEIS Fails to Adequately Describe Climate Change Impacts. ..... 12 B. OSM Should Use Carbon Budgets to Assess Climate Impacts. ..... 15 C. OSM's Excuses for Not Utilizing the Social Cost of Carbon to Evaluate Climate Change Impacts are Invalid. ..... 20 1. "The SCC Protocol Does Not Measure The Actual Incremental Impacts Of A Project On The Environment." DEIS at 491. ..... 21 2. "The SCC Protocol Does Not Include All Damages Or Benefits From Carbon Emissions [And] Without A Complete Monetary Cost-Benefit Analysis, Which Would Include The Social Benefits Of Energy Production To Society As A Whole And Other Potential Positive Benefits, Inclusion Solely Of An SCC Analysis Would Be Unbalanced, Potentially Inaccurate, And Not Useful." DEIS at 491. ..... 22 3. "Based On Emission Estimates For Coal Combustion, SCC Calculations Can Quickly Rise To Large Values; However, Specific Threshold Levels For The Determination Of Significance Can Vary Depending On Numerous Project Factors." DEIS at 491. ..... 24 4. "Given The Uncertainties Associated With Assigning A Specific And Accurate SCC Resulting From 8 Additional Years Of Operation Under The Area F Permit (C2011003F) And A New Federal Mining Plan, And That The SCC Protocol And Similar Models Were Developed To Estimate Impacts Of Regulations Over Long Time Frames, This DEIS Quantifies Direct And Indirect GHG Emissions And Evaluates These Emissions In The Context Of Global, U.S., State, And Regional GHG Emission Inventories As Discussed In DEIS, Section 4.4.3." DEIS at 491. ..... 25 5. "Economic Impact Is Distinct From 'Economic Benefit' As Defined In Economic Theory And Methodology, And The Socioeconomic Impact Analysis Required Under NEPA Is Distinct From Cost-Benefit Analysis, Which Is Not Required." DEIS at 491. ..... 26 III. OSM FAILED TO ADEQUATELY ANALYZE EXISTING AND POTENTIAL IMPACTS TO WATER QUALITY AND QUANTITY. ..... 28 A. The Scope of the Analysis Is Improperly Narrow. ..... 28 B. Failure to Disclose Raw Data or Utilize Accurate Science. ..... 31 C. Failure to Analyze Cumulative and Connected Actions. ..... 34 D. Failure to Adequately Analyze Water Impacts. ..... 35 E. Failure to Analyze Cumulative Effects on Water Resources. ..... 39 IV. WESTMORELAND FAILED TO COMPLY WITH SMCRA AND OSM VIOLATED NEPA BY FAILING TO DISCLOSE ONGOING RECLAMATION ISSUES AT THE MINE. ..... 41 A. OSM Failed to Adequately Disclose and Analyze the Mine's Failure to Meet Contemporaneous Reclamation Requirements. ..... 42 V. OSM FAILED TO ADEQUATELY ANALYZE AIR QUALITY IMPACTS. ..... 47 2 | Page MEIC et al. Rosebud Area F DEIS Comments	

Comment/ Code	Document #005-Sierra Club	Response
5-1 (2100)	A. OSM Failed to Assess Air Quality Impacts Related to NAAQS. ..... 47 1. OSM Failed to Assess and Analyze Particular Matter Impacts. ..... 47 2. OSM Failed to Assess Air Quality Impacts for SO2 Emissions..... 48 B. OSM Failed to Address Toxic Orange Clouds from Blasting. ..... 49 C. OSM Failed to Adequately Analyze Direct, Indirect, And Cumulative Impacts to Air Quality. ..... 50 D. OSM Failed to Assess Impacts From Export and Transportation of Coal. ..... 50 E. OSM Failed to Fully Analyze and Assess Cumulative Impacts. ..... 51 VI. OSM FAILED TO CONSIDER OPERATION OF THE COLSTRIP COAL-FIRED POWER PLANT A "CONNECTED ACTION" AS REQUIRED BY NEPA. ..... 51 A. Coal Combustion Emissions Are Significant and Harmful to the Community. ..... 52 B. OSM Failed to Assess the Mercury Emissions from the Mine. ..... 55 VII. OSM FAILED TO ADEQUATELY ANALYZE OR DISCLOSE IMPACTS FROM COAL ASH DISPOSAL PONDS. ..... 56 VIII. OSM Failed to Address Opportunities to Ease the Transition Away From Reliance On Fossil Fuels for Coal Miners and Affected Communities. ..... 58 A. OSM Failed to Recognize and Plan for the Closure of Rosebud Mine and How the Closure Will Affect the Surrounding Community. ..... 58 B. OSM Failed to Consider Available Alternative Economic Opportunities..... 59 C. OSM Mislead the Public by Touting the Economic Benefits of the Proposal While Ignoring the Reality that Coal Production Hurts Low Income Communities..... 61 D. OSM Failed to Consider Resources Available for Economic Diversification. ..... 61 IX. OSM FAILED TO ANALYZE ANY CLEAN ENERGY ALTERNATIVES. ..... 63 A. Montana-Based Clean Energy Should Be Considered as an Alternative. ..... 63 X. OSM FAILED TO ADEQUATELY ANALYZE IMPACTS TO CULTURAL RESOURCES AND FAILED TO MEET FEDERAL CULTURAL RESOURCES CONSULTATION REQUIREMENTS. 67 CONCLUSION..... 68 **INTRODUCTION** As explained in detail below, the Rosebud Mine Area F DEIS analyzing and disclosing the impacts of mining and burning 70.8 million tons of coal is legally insufficient. OSM should reject the proposal in favor of the No Action alternative. With more than 700 coal mines in the U.S., this proposal would rank in the top 2 percent of U.S. coal mines in terms of annual output. Before OSM can proceed with approving this project, it must first prepare an environmental 3 | Page MEIC et al. Rosebud Area F DEIS Comments	**5-1 Response**: Thank you for your comments. Comments in support of Alternative 1 – No Action Alternative are noted.

Comment/ Code	Document #005-Sierra Club	Response
5-2 (1004)	analysis that adequately analyzes and discloses the full range of environmental impacts, as required by the Montana Environmental Policy Act (MEPA) and National Environmental Policy Act (NEPA). OSM and DEQ only held on public hearing in Colstrip Montana on this expansion. Citizen organizations across the state, including the Montana Environmental Information Center, Sierra Club, 350 Montana, WildEarth Guardians, Montana Elders for a Livable Tomorrow, Montana Public Interest Research Group, Western Environmental Law Center, and Montana Conservation Voters, held their own public hearing on the expansion in Missoula on February 15. 70 people participated in the hearing. Some people submitted only written comments, while others provided oral comments, including Dr. Steve Running, a climate scientist and a member of the Nobel Peace Prize committee of the International Panel on Climate Change. All speakers and written comments opposed the expansion due to inadequate analysis of such issues as climate change, the social cost of carbon, water quality and quantity, air quality, and the failure to consider cleaner energy alternatives.[2] These comments address the following flaws in OSM's analysis: improper statement of purpose and need; failure to consider connected and cumulative actions; failure to consider reasonable alternatives; failure to take a hard look at the project's direct, indirect, and cumulative impacts on water, air, cultural resources, and climate; and failure to consider the unfulfilled reclamation obligations at the mine and the mine owners' financial status. CITIZENS GROUPS The Montana Environmental Information Center (MEIC) is a 501(c)(3) nonprofit organization founded in 1973 with approximately 5,000 members throughout the United States and the State of Montana. MEIC is dedicated, in part, to the preservation and enhancement of the natural resources and natural environment of Montana and to the gathering and disseminating of information concerning the protection and preservation of the human environment through education of its members and the general public concerning their rights and obligations under local, state, and federal environmental protection laws and regulations. MEIC is also dedicated, in part, to assuring that federal officials comply with and fully uphold the laws of the United States that are designed to protect and enhance the environment from pollution. MEIC and its members have intensive, long-standing recreational, aesthetic, scientific, professional, and spiritual interests in the responsible production and use of energy, the reduction of greenhouse (GHG) pollution as a means to ameliorate our climate crisis, and the land, air, water, and community impacted by climate change. MEIC submits these comments on its own behalf and on behalf of its adversely affected members. Montana Elders for a Livable Tomorrow (MELT) is a nonprofit organization of senior citizens in western Montana with lifetimes of experience in industry, academia, wildlife management, [2] A transcript of the hearing is included as Attachment 2. 4 | Page MEIC et al. Rosebud Area F DEIS Comments	**5-2 Response:** Comment noted. OSMRE and DEQ jointly hosted a public open house and town hall meeting in Colstrip, Montana, on February 13, 2018. The public comment period for the Draft EIS opened on January 5, 2018 and closed on March 5, 2018 throughout which time OSMRE and DEQ accepted public and agency comments on the Draft EIS.

Comment/ Code	Document #005-Sierra Club	Response
	government, medicine and civil and political action. MELT's goal is to leave to future generations a more livable world than the one we are on a path to creating. For MELT, protecting the quality of health, air, water, and land is a moral and ethical issue. MELT's top concern is the negative impact that the fossil fuel industry is having on these essential issues, in Montana and around the globe. Indian People's Action works in Montana urban areas to reach out and empower Native Americans to address the social, economic, environmental and racial inequities that shape their lives. Indian People's Action works on multiple fronts: native rights, anti-discrimination, and the injustice in the justice system. Environment Montana Research & Policy Center is dedicated to protecting the air, water, and open spaces in America's last best place. We investigate problems, craft solutions, educate the public and decision makers, and help Montanans make their voices heard in local, state, and national debates over the quality of our environment and our lives. 350 Montana is a Montana-based organization that works to reduce atmospheric CO2 concentrations to 350 ppm by implementing strategic actions and advocating policies to end fossil fuel burning with the greatest urgency. We envision a rapid conversion to a 100 percent renewable global energy system using wind, water, and solar. We work with the global grassroots climate movement to achieve these goals and safeguard Earth's life-support systems. Montana Conservation Voters Education Fund (MCVEF) is a non-profit organization dedicated to involving citizens in our democratic process. MCVEF was founded in 1999 by a steering committee of dedicated leaders and staff from groups seeking a response to attacks on environmental laws in the state. Today, MCVEF shines a spotlight on the votes and actions of elected officials – from the Courthouse to Congress – affecting clean air and water, open spaces, wildlife, and public health. MCVEF works for responsible stewardship of Montana's incredible natural assets by providing voter participation services to over 35,000 conservationists. WildEarth Guardians is a west-wide nonprofit environmental organization dedicated to protecting and restoring the wildlife, wild places, and wild rivers of the American West. Through its Climate and Energy Program, WildEarth Guardians advocates for cleaner energy and works to ensure the impacts of fossil fuel development are minimized to protect the Earth's climate and natural resources. Guardians, its members, and staff members use the lands in and near Rosebud Mine for recreational, scientific, and aesthetic purposes, including wildlife observation. Guardians and its members have an interest in preserving their ability to enjoy such activities in the future. Guardians submits these comments on behalf of itself and its members who have an interest in reducing greenhouse gas emissions and maintaining these Montana lands. 5 | Page MEIC et al. Rosebud Area F DEIS Comments	

Comment/ Code	Document #005-Sierra Club	Response
	Sierra Club is America's oldest and largest grassroots environmental organization. Sierra Club is dedicated to exploring, enjoying, and protecting the wild places of the Earth; to practicing and promoting the responsible use of the Earth's resources and ecosystems; to educating and enlisting humanity to protect and restore the quality of the natural and human environment; and to using all lawful means to carry out these objectives.	
5-3 (1100)	**I. OSM VIOLATED NEPA BY USING PURPOSE AND NEED STATEMENTS THAT ARE INAPPROPRIATE, INCOMPLETE, AND INCONSISTENT WITH CONTROLLING STATUTORY PURPOSES.** Environmental analyses prepared under NEPA must state the purpose and need of the underlying government action. 40 C.F.R. § 1502.13 ("The statement shall briefly specify the underlying purpose and need to which the agency is responding in proposing the alternatives including the proposed action."). "An agency may not define the objectives of its action in terms so unreasonably narrow that only one alternative from among the environmentally benign ones would accomplish the goals of the agency's action, and the EIS would become a foreordained formality." *Friends of Southeast's Future v. Morrison*, 153 F.3d 1059, 1066 (9th Cir. 1998). Similarly, a purpose and need statement may not "adopt[] private interests to draft a narrow purpose and need statement that excludes alternatives that fail to meet specific private objectives." *Nat'l Parks & Conservation Ass'n v. BLM*, 606 F.3d 1058, 1072 (9th Cir. 2009). Instead, the agency must draft the purpose and need statement in light of "the views of Congress" from "the agency's statutory authorization to act, as well as other congressional directives." *Citizens Against Burlington, Inc. v. Busey*, 938 F.2d 190, 196 (D.C. Cir. 1991).	**5-3 Response**: MEPA and its implementing rules, ARM 17.4.614(1), require that any EIS prepared by a state agency include a description of the purpose and benefits of the proposed project. **Section 1.3.3, Benefits** of the EIS has been consolidated in the Final EIS to eliminate redundancies and was revised to include additional benefits raised in public comments.
5-4 (1101)	Here, OSM's statement of purpose and need is legally flawed. First, the agency frames the purpose unreasonably narrowly as "to allow continued operations at the Rosebud Mine by permitting and developing a new surface-mine permit area known as permit Area F." DEIS at S-9. This is just a statement of Western Energy's interest in mining the coal. With such a narrowly drawn statement of purpose and need, it is a foreordained conclusion that OSM will determine that the only way to provide Western Energy with authorization to "continue operations at the Rosebud Mine" is to approve the mining expansion. This is precisely what the Ninth Circuit condemned in *National Parks & Conservation Association*, and it is inconsistent with NEPA. *See also Van Abbema v. Fornell*, 807 F.2d 633, 638 (7th Cir. 1986) ("At the outset we note that the evaluation of 'alternatives' mandated by NEPA is to be an evaluation of alternate means to accomplish the *general* goal of an action; it is not an evaluation of the alternative means by which a particular applicant can reach his goals.").	**5-4 Response**: As described in NEPA, the purpose and need are used to define the range of alternatives analyzed in an EIS (40 CFR 1502.13). Each agency's statutory authorities and policies determine its underlying purpose and need. It is appropriate to "consider the needs and goals of the parties involved in the application or permit as well as the public interest" (43 CFR 46.420(a)(2)). MEPA and its implementing rules, ARM 17.4.617(1), require that any EIS prepared by a state agency include a description of the purpose and benefits of the proposed project. The purpose, need, and benefits of the Proposed Action are described in **Section 1.3** of the EIS. The scope of the purpose, need, and benefits statements presented in the EIS are appropriate and determined by OSMRE's authorities under SMCRA and by DEQ's authority under MSUMRA. See **Section 1.4.1.1, Office of Surface Mining and Reclamation** and **Section 1.4.1.2, Montana Department of Environmental Quality** for a discussion of each agency's respective authorities. Reasonably foreseeable actions are included in **Section 5.2.2**.
5-4, cont'd	The stated need for the mine is similarly narrowly defined, "Western Energy is required to obtain a surface-mine operating permit … and approval of a federal surface-mine plan … for the project area in order to access additional coal reserves needed to fulfill contractual obligations to its customers, the Colstrip and Rosebud Power Plants." DEIS at S-9. This described need for the Area F expansion is fundamentally flawed because it ignores Western Energy's existing 6 | Page MEIC et al. Rosebud Area F DEIS Comments	The following revisions were made to **Section 1.3** in response to public comments: • The Draft EIS erroneously cited ARM 17.4.614(1); this citation was updated to ARM 17.4.617(1) in the Final EIS. • The list of benefits was consolidated in the Final EIS to eliminate redundancies and was revised to include additional benefits raised in public comments. • A benefit specific to WECo was eliminated from the list of benefits: "~~an ongoing source of income to Western Energy and its shareholders~~."

Comment/ Code	Document #005-Sierra Club	Response
	ability to fulfill those contracts absent the expansion, ignores the duration of existing contractual obligations, and ignores present and predicted market trends.	
5-5 (1103)	Western Energy's Rosebud Mine currently produces the most expensive coal in the Powder River Basin due to decades of least cost mining and the associated increase in stripping ratios.[3] It is highly likely that coal from the Rosebud Mine would be uneconomic to customers outside of the Colstrip region. In fact, in 2010 a contract between Rosebud Mine and Minnesota Power was cancelled due to uneconomic contract terms.[4] Because of the Colstrip plant's location directly adjacent to the Rosebud Mine, there are minimal transportation costs in transporting the coal to the Colstrip coal-fired power plant. However, because of cost-plus contracts that Western Energy has with the owners of the Colstrip plant, the additional costs of Rosebud coal are passed onto the owners of Colstrip.[5] As these costs rise, the utilities and their regulatory commissions will continue to re-assess their energy portfolios, and weigh the costs of competing resources. This will put increasing pressure on the owners of Colstrip.	**5-5, 5-7 Response**: The federal action before OSMRE is to recommend to the Assistant Secretary of Lands and Minerals Management (ASLM), approval, approval with conditions, or disapproval of the proposed federal mining plan (**Section 1.4.1.1, Office of Surface Mining and Reclamation** of the EIS). There is no requirement under existing regulations that would necessitate OSMRE to make a determination regarding the marketability of the coal to be mined in the proposed mining plan prior to making the recommendation to the ASLM. Similarly, the state action before DEQ is to review and to make a decision on Western Energy's surface-mine operating permit application under MSUMRA, Section 82-4-221 et seq., MCA (see **Section 1.4.1.2, Montana Department of Environmental Quality**). There is no requirement under existing regulations that would necessitate DEQ to make a determination regarding the marketability of the coal to be mined under the operating permit.
5-6 (1101)	While the owners notified Westmoreland that the contract for Units 1 and 2 will terminate three years early and end in 2019, the contract for coal for Units 3 and 4 will also terminate at the end of 2019, according to Westmoreland's 10-K report.[6] The DEIS purpose statement that the Area F expansion is necessary to fulfill Westmoreland's contract with the Colstrip plant owners is fiction. That contract will expire long before existing permitted coal reserves are used. Westmoreland will need to prove it has negotiated a new contract with new terms before this purpose statement can be considered accurate. OSM's estimated timeline for mining at Area F assumes an operating life of nineteen years, to approximately 2038. This estimate ignores the increasingly strong likelihood that Colstrip will retire well before 2038 due to economic, environmental, legal, and political considerations.	In the Draft EIS, combustion of coal from the Rosebud Mine at the Colstrip Power Plant and the Rosebud Power Plant was described in **Section 1.2.2, Coal Combustion**. The discussion was general and meant to provide an overview of power plant operations. In the Final EIS, subsections were updated, as applicable, to address developments that have occurred since the Draft EIS was prepared, but the discussion was left general in nature. It is important to note that operations of the power plants are independent of Rosebud Mine operations (see discussion regarding connected actions under NEPA in **Section 1.5.2.2, Scoping Issues Eliminated from Detailed Analysis**). The No Action alternative, described in **Section 2.3** of the EIS, analyzes the potential impacts of not mining Area F coal. For each resource analyzed in Chapter 4, there is a section describing the potential impacts of the No Action alternative if that were to be selected.
5-7 (1103)	The six utilities that own the Colstrip plant are facing increasing economic pressure to retire the plant. Natural gas, and increasingly renewable energy and energy storage, are directly competing with coal-fired power, resulting in a rapid slate of coal plant retirements that is	**5-6 Response: See Comment Response 5-4 on page 6.**

[3] John T. Boyd Company, *Powder River Basin Coal Resources and Cost Study* (Sept. 2011). Attachment 3. (Prepared for Xcel Energy.)
[4] Westmoreland Coal Company, Inc. SEC Form 8-K (Nov. 11, 2010) http://westmoreland.com/wp-content/uploads/2014/01/Form_8-K_Filed_on_November_11_20101.pdf. Attachment 4.
[5] Westmoreland Coal Company, SEC Form 10-K, (Dec. 31, 2016) at 13 https://www.sec.gov/Archives/edgar/data/106455/000010645517000012/wlb-123116_10k.htm. Attachment 5.
[6] *Id.*

Comment/ Code	Document #005-Sierra Club	Response
5-8 (1101)	predicted to continue and accelerate.[7] In 2018 an additional 15 gigawatts of coal-fired power will retire.[8] Colstrip is not unique or shielded from these pressures. Puget Sound Energy, based in Washington State and the largest owner of the Colstrip complex, recently reached an agreement to depreciate the Colstrip plant by 2027, which was approved by the Washington Utilities and Transportation Commission.[9] This agreement will help to facilitate the closure of the plant at a much earlier date than previously planned. Additionally, Governor Inslee of Washington proposed a carbon tax during the 2018 legislative session at $20 per ton.[10] Puget Sound Energy offered its support for the legislation. Although the bill recently failed, a citizens group in Washington is currently planning to introduce a ballot initiative that would require a tax on carbon.[11] In 2016, the Oregon Legislature passed a law that requires the utility to depreciate the Colstrip Plant by 2030, and prevents the sale of electricity generated from coal by 2030, with a potential five-year grace period.[12] This will impact both Portland General Electric and PacifiCorp, as Portland General Electric is a 20 percent owner of both Units 3 and 4, and PacifiCorp is a 10 percent owner of both Units 3 and 4. In February, Portland General Electric told investors that it will be out of Colstrip by 2030.[13] Avista, a 15 percent owner of both Units 3 and 4 at Colstrip, is currently being purchased by Canada utility Hydro One, with the sale recently approved by the Federal Energy Regulatory Commission. Hydro One has strategically retired all of its coal assets in Ontario, and it is unlikely Hydro One will once again assume the risk of continuing to operate a coal plant. Westmoreland states that the need for permitting Area F is to "fulfill contractual obligations to its customers, the Colstrip and Rosebud Power Plants." DEIS at 11. However, the volume of annual coal production projected by Westmoreland is greatly inflated. Table 99 projects that from 2019-2021 the Rosebud Mine will produce approximately 10.6 million tons of coal. Notably, this is 1-2 million tons more than the previous seven years of coal production from 2011-2017. Prior to 2011, Westmoreland sold coal to Minnesota, and so the Rosebud Mine had [7] Institute for Energy Economics and Financial Analysis, *U.S. Coal: More Market Erosion is on the Way* (2018). Attachment 6. [8] Id. [9] Washington Utilities and Transportation Commission, Final Order 08 Approving and Adopting Settlement Stipulation. (Dec. 5, 2017). Attachment 7. [10] http://thehill.com/homenews/state-watch/368317-washington-governor-proposes-new-carbon-tax. Attachment 8. [11] https://yeson732.org/. Attachment 9. [12] http://insideenergy.org/2016/03/03/oregon-says-no-to-coal-fired-electricity/. Attachment 10. [13] Portland General Electric Powerpoint, "Investor Presentation," BAML Conference (March 1, 2018). Attachment 11. 8 | Page MEIC et al. Rosebud Area F DEIS Comments	**5-8 Response: See Comment Response 5-4 on page 6.**

Comment/ Code	Document #005-Sierra Club	Response
5-9 (1103) 5-9, cont'd	a higher production volume. However, the export of coal to Minnesota proved uneconomic, and now the Rosebud Mine no longer exports coal and is exclusively dedicated to the Colstrip facility and the small waste coal plant nearby. That waste coal facility, Colstrip Energy Limited Partnership, is a qualifying facility under the federal Public Utilities Regulatory Policy Act of 1978 (PURPA). Montana's largest utility, NorthWestern Energy, signed a contract for power with this electricity provider in the early 1990's. That contract expires in 2024,[14] and NorthWestern has indicated that it is not interested in continuing that contract as it is the highest cost power supply in NorthWestern Energy's portfolio.[15] Colstrip Energy Limited Partnership obtains about 250,000 tons of coal from Western Energy each year. That demand is very likely to disappear when the PURPA contract ends in 2024. From 2022-2031, Westmoreland predicts that the mine will produce, for most years, 8.7 million tons of coal. This decline in production is apparently a result of the closure of Units 1-2 in 2022. However, this projected volume is greater than five of the past seven years, when all units at the plant were running. The retirement of Units 1-2 represents approximately 1/3 of the capacity of the Colstrip power plant and the loss in sales of approximately 2.3 million tons of coal annually, or greater than 25 percent of the annual production at the Rosebud Mine. Westmoreland does not specify where this new volume of production will go or why it is needed. Additionally, in July of 2016 Westmoreland was notified by the owners of Colstrip 1-2 that its coal supply agreement will end three years earlier, at the end of 2019. The graph below combines data from the DEIS, the Montana Department of Environmental Quality, and NorthWestern Energy, to demonstrate that the DEIS grossly inflates the demand for additional coal in coming years. [14] NorthWestern Energy, "The 2015 Electricity Supply Resource Procurement Plan," at 8-14 (2015). Attachment 12. [15] Montana Public Service Commission, "NorthWestern Energy, Residential Electric Rates and Electricity Supply (Through June 2015)," at 9 (2015). Attachment 13. 9 | Page MEIC et al. Rosebud Area F DEIS Comments	**5-9 Response**: Coal mined in Area F would be combusted at the Colstrip Power Plant to generate electricity. Units 1 and 2 at the Colstrip Power Plant will shut down by 2022. Units 3 and 4 at the Colstrip Power Plant do not have a defined shut down date at this time; therefore, the coal mined in Area F would be used to supply Units 3 and 4. The range in annual production provided in **Section 2.2.1, Past and Existing Production** of the EIS varies from year to year but represents the typical annual production volumes. As discussed in **Section 2.2.6, Life of Operations**, the Rosebud Mine has three active pit areas. Area A is expected to be mined until 2022 (Peterson 2016b). Area B, as currently permitted, is expected to be mined until 2030 (Peterson 2016b). Area C is expected to be mined until 2022 (Peterson 2016b). Areas A, B, and C are expected to account for 50 percent of the total output of the mine until 2019 and 40 percent of the total output until 2022 (the last year of active mining for Areas A and C) (Peterson 2016a). Without the addition of the proposed project or Area B AM5, the operational life of the Rosebud Mine would be expected to end in 2030 (see also Figure 3). The federal action before OSMRE is to recommend to the Assistant Secretary of Lands and Minerals Management (ASLM), approval, approval with conditions, or disapproval of the proposed federal mining plan (**Section 1.4.1.1, Office of Surface Mining and Reclamation** of the EIS). There is no requirement under existing regulations that would necessitate OSMRE to make a determination regarding the marketability of the coal to be mined in the proposed mining plan prior to making the recommendation to the ASLM. Similarly, the state action before DEQ is to review and to make a decision on Western Energy's surface-mine operating permit application under MSUMRA, Section 82-4-221 et seq., MCA (see **Section 1.4.1.2, Montana Department of Environmental Quality**). There is no requirement under existing regulations that would necessitate DEQ to make a determination regarding the marketability of the coal to be mined under the operating permit. In the Draft EIS, combustion of coal from the Rosebud Mine at the Colstrip Power Plant and the Rosebud Power Plant was described in **Section 1.2.2, Coal Combustion**. It is important to note that operations of the power plants are independent of Rosebud Mine operations (see discussion regarding connected actions under NEPA in **Section 1.5.2.2, Scoping Issues Eliminated from Detailed Analysis**).

Comment/ Code	Document #005-Sierra Club	Response

Rosebud Mine Annual Production (tons/year)						
Year	Areas A-B2	Area C3	Area F	AM5	Total	CELP 1py coal*
2001					11,246,730	no data
2002					10,015,036	no data
2003					11,034,262	no data
2004					12,664,823	no data
2005					13,376,542	no data
2006					12,583,084	no data
2007					12,583,084	267,276
2008					13,052,713	248,686
2009					10,331,684	242,423
2010**					12,231,389	279,142
2011					8,784,828	213,696
2012					8,018,098	246,225
2013					8,234,130	279,169
2014					9,018,465	266,007
2015					9,671,003	268,186
2016					8,812,478	273,657
2017					6166140*	
2018	2,466,100	3,483,050	4,000,000	0	9,949,150	
2019	2,574,300	3,483,050	4,000,000	0	10,057,350	
2020	2,468,700	2,786,440	4,000,000	1,393,220	10,648,360	
2021	2,516,300	2,786,440	4,000,000	1,393,220	10,695,960	
2022	1,217,300	1,741,525	4,000,000	1,741,525	8,700,350	
2023	0	1,741,525	4,000,000	1,741,525	7,483,050	
2024**	0	1,741,525	4,000,000	1,741,525	7,483,050	
2025	0	766,271	4,000,000	3,483,050	8,249,321	
2026	0	0	4,000,000	4,876,270	8,876,270	
2027	0	0	4,000,000	4,876,270	8,876,270	
2028	0	0	4,000,000	4,876,270	8,876,270	
2029	0	0	4,000,000	4,876,270	8,876,270	
2030	0	0	4,000,000	4,876,270	8,876,270	
2031	0	0	4,000,000	4,876,270	8,876,270	
	11,242,700	18,529,826		40,751,685		
DEIS Projected Annual Coal Production (tons/year)						
*data collected from MDEQ Air Emissions Inventory						
**Contract for 1.5 mt/yr with Minnesota Power ends						
***CELP Contract with NWE ends on 7/30/2024 according to NWE 2015 IRP						

10 | Page
MEIC et al. Rosebud Area F DEIS Comments

Comment/ Code	Document #005-Sierra Club	Response
5-10 (1200) 5-11 (6301) 5-11, cont'd 5-11 cont'd	Westmoreland's stock has dropped from over $17 per share a year ago to $0.54 for the week of March 1, 2018.[16] Westmoreland appears to be headed toward bankruptcy as a result of debt coming due and the closure of coal plants fed by Westmoreland mines across the country.[17] Much of the mine has yet to be reclaimed despite the mine operating for nearly 50 years. DEIS at 32. The MDEQ holds $165 million in outstanding bonds for Westmoreland's Rosebud Mine.[18] In 2016 a court found the mine's MPDES permit to be inadequate yet no new MPDES permit has been proposed.[19] As discussed in later sections, water quality and quantity issues plague the mine. OSM should not approve this massive mine expansion until Westmoreland is in a sound financial position and can demonstrate it can and will reclaim existing operations and effectively address outstanding water quality and quantity issues. Anything less will likely result in the mine becoming the obligation of the government and taxpayers to address for decades to come. **II. OSM FAILED TO ADEQUATELY ANALYZE AND DISCLOSE CLIMATE CHANGE IMPACTS.** Climate change is having and will increasingly have significant environmental and economic impacts in the project area. These impacts are described in the most recent U.S. National Climate Assessment (NCA)[20] and the Montana Climate Assessment (MCA),[21] and important impacts in the project area are described below. The DEIS fails to recognize the majority of these impacts and fails to conduct any analysis of how they will affect socioeconomic conditions in the project area. For the set of reasons we discuss below, the agency has refused to analyze, quantify, or monetize the negative impacts of the Proposed Action on climate change. Yet as shown in the National Climate Assessment and the Montana Climate Assessment, all Montanans will experience environmental effects from a changing climate. Further, the DEIS itself recognizes that climate change will be incrementally exacerbated by marginal additional emissions from the Proposed Action. *See* DEIS S-24, Table S-1 "Direct and indirect greenhouse gas emissions would contribute incrementally to climate change." OSM had at its disposal the Social Cost of Carbon (SCC), a tool which reflects the best available science, the best practices for economic analysis, and the legal standards for rational decision making.[22] The SCC remains the best information tool available to provide decision [16] https://finance.yahoo.com/quote/wlb?ltr=1. Attachment 14. [17] Seeking Alpha, Steer Clear of This Indebted Company (May 3, 2017). Attachment 15. [18] Chart provided by MDEQ to MEIC on Dec. 7, 2017. Attachment 16. [19] *MEIC v. DEQ*, CDV 2012-1075, Mar. 4, 2016. Attachment 17. [20] https://nca2014.globalchange.gov/report. Attachment 18. [21] http://montanaioe.org/mca. Attachment 19. [22] Interagency Working Group on Social Cost of Greenhouse Gases, Social Cost of Carbon for Regulatory Impact Analysis Under Executive Order 12866, (2010). Attachment 20. Interagency Working Group on Social Cost of Greenhouse Gases, Technical Support Document: Technical Update of the Social Cost of Carbon for Regulatory Impact Analysis Under Executive Order 12866 (2016) Attachment 21. 11 | Page MEIC et al. Rosebud Area F DEIS Comments	**5-10 Response**: The financial viability of Westmoreland and its subsidiary, Western Energy Company, is outside the scope of the EIS. In accordance with ARM 17.24.405(7), DEQ cannot issue a permit until the applicant files the required performance bond. The standard applied by the department in determining the amount of performance bond is the estimated cost to the state if it had to perform the reclamation, restoration, and abatement work under the act, the rules adopted thereunder, and the permit (**Section 1.6.1, Bond Amount** in the EIS). All currently permitted areas of the Rosebud Mine are fully bonded for reclamation. Please see **Table 5** in Chapter 2 for bond amounts by permit area and reclamation phase. **Table 4** provides permitted and disturbed acres by area. **Table 4** and **Table 5** have been revised in the Final EIS to indicate the percentage of reclamation that has been achieved in each permit area. The EIS provides an overview of reclamation bonding procedures and the criteria for phased bond release in **Section 1.6, Financial Assurance**. If success criteria (**Section 1.6.4, Bond Release**) are not met, the associated bond will not be released, and monitoring will continue. Reclamation and bonding requirements are applicable to the project area, if permitted, and all currently permitted areas of the Rosebud Mine. **Section 1.6** has been revised to clarify that the requirements are applicable to all permit areas, not just the proposed project area. **5-11 Response**: Information about global, national, state, and regional GHG emissions is provided in **Section 3.4.2.3** of the EIS. Proposed Action emissions are evaluated in the context of total U.S. emissions in **Section 4.4.3** and **Section 5.3.3**. OSMRE is not required by NEPA to contain a monetary cost-benefit analysis of the project, and we did not include one in this EIS. Unless we produced a complete monetary cost-benefit analysis, which would include both the social costs of the project (including the social costs of carbon) as well as the social benefits of the project (e.g., the monetary benefits of the power generated), inclusion solely of a cost analysis for the social cost of carbon would be contrary to NEPA and create an unbalanced and inaccurate assessment of the project. As such, it would not be useful in facilitating a decision by the authorized official. Another commenter completed a social cost of carbon analysis (see Comment no. 14), which showed that "Total emission costs for the 19-year time horizon vary by over 40-fold from a low of $319 million to as high as $12.9 billion." While OSMRE does not believe that a social cost of carbon analysis is warranted for this project decision and did not include it in the EIS, as outlined in **Section 4.4.5**, we note that this analysis and its wide margin of error support our conclusion that such analysis was not needed because the social cost of carbon without a full cost-benefit analysis is of very limited utility to the decision maker. GHG emissions are examined for NEPA purposes. Under MEPA, DEQ's analysis of actions is limited to actions which significantly affect the quality of the human environment in Montana. Section 75-1-201(1)(b)(4), MCA.

Comment/ Code	Document #005-Sierra Club	Response
5-12 (6302)	makers and the public information about the monetary damages from the environmental impacts associated with climate change, which would be exacerbated by project emissions. However, the agency chose not to use this tool. **A. The DEIS Fails to Adequately Describe Climate Change Impacts.** Much like the United States in general, the number of days with hot temperatures is projected to largely increase across the Great Plains region even under scenarios in which greenhouse gas (GHG) emissions are reduced. Days with temperatures over 100 °F are projected to double in the north and quadruple in the south, with similar increases in nights with temperatures higher than 80°F[23]. Increasing temperatures will result in warmer winters and a longer growing season, but will also create increases in surface water losses. DEIS at 482. Maximum air temperature is projected to increase in all months, with the largest and most significant predicted changes in summer (July and August). DEIS at482. The National Climate Assessment (NCA) contains a detailed analysis of regional impacts of climate change throughout the United States, including the northern plains region.[24] The NCA makes clear that the impacts of climate change are already being felt throughout the mountains and plains of Montana. Climate change is causing and is predicted to continue to cause warmer water temperatures in streams and rivers and low summer flows. Hotter temperatures and earlier spring snowmelt is also causing and expected to continue to cause longer and more damaging wildfire seasons.[25] These impacts to natural systems are, in turn, harming important sectors of Montana's economy, including agriculture and outdoor recreation.[26] [27] For example, higher temperatures and water shortages have harmed and are projected to continue to harm the agricultural sectors of the state's economy. Additionally, climate change is threatening and is projected to continue to threaten public health, causing, for example, increased spread of vectorborne diseases such as West Nile virus, hantavirus, Lyme disease, and Rocky Mountain spotted fever. Climate change is also causing more frequent extreme weather events and flooding in the region.[28] [23] Melillo *et al.* (2014). Attachment 22. [24] U.S. Global Change Research Program, Third National Climate Assessment, Climate Change Impacts in the United States. Attachment 23. [25] *Id.* [26] Tom Power, The Impact of Climate Change on Montana's Outdoor Economy, (Dec. 2015). Attachment 24. [27] Tom Power, The Impact of Climate Change on Montana's Agricultural Economy, (Feb. 2016). Attachment 25. [28] National Climate Assessment Great Plains Region. Attachment 26. 12 | Page MEIC et al. Rosebud Area F DEIS Comments	**5-12 Response**: Observed and projected state GHG emissions trends and climate impacts are described in **Sections 3.4.2.3** and **4.4.2.3** of the Draft EIS, respectively, including the impacts of climate change on temperature, precipitation, growing seasons, and irrigation capacity. Under MEPA, DEQ's analysis of actions is limited to actions which significantly affect the quality of the human environment in Montana. Section 75-1-201(1)(b)(4), MCA.

Comment/ Code	Document #005-Sierra Club	Response
5-12, cont'd	A climate assessment for Montana has also been conducted by Montana State University, the University of Montana, and the Montana Institute on Ecosystems. The Montana Climate Assessment (MCA) provides a more detailed look at the impacts from climate change that are already being experienced across the state and impacts that are expected in the future.[29] Current changes include: Annual average temperatures, including daily minimums, maximums, and averages, have risen across the state between 1950 and 2015. The increases range between 2.0-3.0°F (1.1-1.7°C) during this period.[30] Despite no historical changes in average *annual* precipitation between 1950 and 2015, there have been changes in average *seasonal* precipitation over the same period.[31] Montana is projected to continue to warm in all geographic locations, seasons, and under all emission scenarios throughout the 21st century. By mid-century, Montana temperatures are projected to increase by approximately 4.5-6.0°F (2.5-3.3°C) depending on the emission scenario. By the end-of-century, Montana temperatures are projected to increase 5.6-9.8°F (3.1-5.4°C) depending on the emission scenario. These state-level changes are larger than the average changes projected globally and nationally.[32] Across the state, precipitation is projected to increase in winter, spring, and fall; precipitation is projected to decrease in summer. The largest increases are expected to occur during spring in the southern part of the state. The largest decreases are expected to occur during summer in the central and southern parts of the state.[33] The Montana Climate Assessment also presented findings on climate impacts that Montana can expect in the future. Water resources are at risk from rising temperatures that will reduce snowpack, shift historical patterns of streamflow, and likely result in additional stress on Montana's water supply, particularly during summer and early fall.[34] Specifically, • Montana's snowpack has declined over the observational record (i.e., since the 1930s) in mountains west and east of the Continental Divide; this decline has been most pronounced since the 1980s. Warming temperatures over the next century, especially during spring, are likely to reduce snowpack at mid and low elevations. [29] Montana Climate Assessment, Climate Change in Montana, *available at* http://montanaclimate.org/ (last visited Feb. 23, 2018). Attachment 27. [30] Id. [31] Id. [32] Id. [33] Id. [34] Montana Climate Assessment, Water and Climate Change in Montana. Attachment 28. 13 | Page MEIC et al. Rosebud Area F DEIS Comments	

Comment/ Code	Document #005-Sierra Club	Response

5-13 (6300)	• Historical observations show a shift toward earlier snowmelt and an earlier peak in spring runoff. Projections suggest that these patterns are very likely to continue into the future as temperatures increase.
	• Earlier onset of snowmelt and spring runoff will reduce late-summer water availability in snowmelt-dominated watersheds.
	• Groundwater demand will likely increase as elevated temperatures and changing seasonal availability of traditional surface-water sources (e.g., dry stock water ponds or inability of canal systems to deliver water in a timely manner) force water users to seek alternatives.
	• The MCA also found that rising temperatures will exacerbate persistent drought periods that have been a natural part of Montana's climate. Specifically:
	  ○ Multi-year and decadal-scale droughts have been, and will continue to be, a natural feature of Montana's climate; rising temperatures will likely exacerbate drought when and where it occurs; and
	  ○ Changes in snowpack and runoff timing will likely increase the frequency and duration of drought during late summer and early fall.
	• The MCA also forecasts that climate change will negatively affect Montana agriculture.[35] Impacts include:
	  ○ Decreasing mountain snowpack will continue to lead to decreased streamflow and less reliable irrigation capacity during the late growing season. Reduced irrigation capacity will have the greatest impact on hay, sugar beet, malt barley, market garden, and potato production across the state; and
	  ○ Increases in temperature will allow winter annual weeds, such as cheatgrass, to increase in distribution and frequency in winter wheat cropland and rangeland. Their spread will result in decreased crop yields and forage productivity as well as increased rangeland wildfire frequency.
	
	The impacts of climate change that are currently occurring in this part of Montana are well documented in these climate assessments and are projected to worsen. OSM's failure to consider the context in which its action is proposed is arbitrary and capricious. *Kern v. BLM*, 284 F.3d 1062, 1072 (9th Cir. 2002) ("Reasonable forecasting and speculation is . . . implicit in NEPA, and we must reject any attempt by agencies to shirk their responsibilities under NEPA by labeling any and all discussion of future environmental effects as 'crystal ball inquiry.") (quoting *Scientists' Inst. for Pub. Info., Inc. v. Atomic Energy Comm'n*, 481 F.2d 1079, 1092 (D.C.Cir.1973)).[36]
	
	[35] Montana Climate Assessment, Agriculture and Climate Change in Montana. Attachment 29.
	[36] WELC Comments to OSM regarding Bull Mountain No. 1 Federal Mining Plan Modification Environmental Assessment (Nov. 21, 2014). Attachment 30.
	
	14 | Page
	MEIC et al. Rosebud Area F DEIS Comments
		5-13 Response: Detailed discussions of GHG emissions and climate change trends are discussed in relation to the proposed Rosebud Mine expansion are provided in **Section 3.4.2, Section 4.4**, and **Section 5.3.3** of the EIS for NEPA purposes. Observed climate trends are discussed in the EIS in **Section 3.4.2.3**, and this includes a discussion on climate trends in Montana. Projected state and regional climate trends and impacts are discussed in **Section 4.4.2.3**. Under MEPA, DEQ's analysis of actions is limited to actions which significantly affect the quality of the human environment in Montana. Section 75-1-201(1)(b)(4), MCA.

Comment/ Code	Document #005-Sierra Club	Response
5-14 (6311) 5-14, cont'd 5-14, cont'd 5-15 (6312)	**B. OSM Should Use Carbon Budgets to Assess Climate Impacts.** OSM must consider the urgent need to cut carbon emissions to combat climate change in accordance with our international commitments and scientific consensus regarding the urgent need to dramatically reduce greenhouse gas emissions in the very near term. One of the measuring standards available to the agency for analyzing the magnitude and severity of OSM-related fossil fuel emissions is by applying those emissions to the remaining global carbon budget. A "carbon budget" offers a cap on the remaining stock of greenhouse gasses that can be emitted while still keeping global average temperature rise below scientifically-backed warming thresholds—beyond which climate change impacts may result in severe and irreparable harm to the biosphere and humanity. Utilizing carbon budgets would offer OSM a methodology for analyzing how the proposed mine expansion and the continued coal combustion from the Rosebud Mine may affect the country's ability to meet its national and international greenhouse gas emission reduction targets. As the Department of Interior recently explained, a "central objective to the BLM's reform effort for the Federal coal program is consideration of the effect of the program on, and alternatives for alignment with, US climate goals."[37] The fact that President Trump ordered the Department of Interior to abandon that review on political grounds does not relieve OSM and other federal agencies of the obligation to take a hard look at the climate impacts of their decisions, including by examining how agency decisions align with U.S. climate objectives. Here OSM has made no attempt to align its decision with still-binding U.S. climate reduction goals, nor has OSM assessed the severity of its emissions by discussing the diminishing U.S. carbon budget. NEPA regulations mandate that federal agencies, "shall discuss any inconsistency of a proposed action with any approved State or local plan and laws (whether or not federally sanctioned)," 40 C.F.R. § 1506.2(d), and require agencies to address "possible conflicts between the proposed action and the objectives of Federal, regional, State, and local (and in the case of a reservation, Indian tribe) land use plans, policies and controls for the area concerned." 40 C.F.R. § 1502.16(c). In order to take the hard look at this issue as NEPA requires, OSM must acknowledge and address the extent to which the Proposed Action conflicts with our national emissions reduction goals and international climate commitments, including internationally-agreed upon carbon budgets. Here, OSM has not even mentioned, much less utilized, carbon budgets as a means to address the climate impacts of OSM's decision on the Rosebud Area F expansion. [37] Department of Interior, Federal Coal Program Programmatic EIS Scoping Report at 6-13. Attachment 31. 15 | Page MEIC et al. Rosebud Area F DEIS Comments	**5-14 Response**: Information about global, national, state, and regional GHG emissions is provided in Section 3.4.2.3 of the EIS. Proposed Action emissions are evaluated in the context of total U.S. emissions in Section 4.4.3 and Section 5.3.3. A full-scale carbon budgeting analysis is not required to determine if significant impacts related to GHG emissions are occurring and is outside the scope of this EIS. OSMRE, where appropriate and not overly speculative, included reasonable forecasting as in the case with the Climate discussion in Chapter 4 allowing the decision maker to evaluate potential impacts associated with the Proposed Action using representative or predicted emissions. GHG emissions are examined for NEPA purposes. Under MEPA, DEQ's analysis of actions is limited to actions which significantly affect the quality of the human environment in Montana. Section 75-1-201(1)(b)(4), MCA. In addition, the U.S. ratified the Paris Climate Agreement in September 2016 and the U.S. document entered into force on November 4, 2016. The agreement is considered a "treaty" under international law, but only certain provisions are legally binding and the agreement does not include binding emission targets (CCES 2017). Under U.S. law, U.S. participation in an international agreement can be terminated by a president, acting on executive authority, or by an act of Congress, regardless of how the United States joined the agreement. However, the Paris Agreement specifies that a party may not withdraw from the agreement within the first 3 years following its entry into force (CCES 2017). In 2017, President Trump announced his intention to withdraw from the Paris Agreement. Under Article 28 of the Agreement, a country cannot formally provide written notification of withdrawal until three years from the date the Agreement entered into force for a Party (November 4, 2019 for the United States). Article 28 goes on to state that… "Any such withdrawal shall take effect upon expiry of one year from the date of receipt by the Depositary of the notification of withdrawal, or on such later date as may be specified in the notification of withdrawal."

Comment/ Code	Document #005-Sierra Club	Response
5-15, cont. (6312)	A coalition of prominent climate experts, policymakers, and corporate leaders warns in the top scientific journal *Nature* that keeping the global temperature rise below 2 °C, as set out in the Paris Climate Agreement, will be impossible without major changes in the next three years.[38,39] The Paris Climate Agreement remains legally binding to the United States and is an international commitment that will require urgent action before 2020 to honor. As explained in these recent studies, this timeline will make it possible to attain the UN Sustainable Development goals set out in 2015.[40] Pushing back the year of peak emissions just five years to 2025 will make it infeasible to transform the global economy in time to forestall the devastating impacts of climate change.[41] Using climate models, scientists have estimated the quantity of allowable global emissions to remain within a global temperature increase of 2 °C or lower compared to pre-industrial temperatures.[42] This is our remaining global carbon budget, which has been estimated at around 1000 gigatons of CO_2 ($GtCO_2$),[43] or at most, 1050 $GtCO_2$ this century.[44] A lower bound for the carbon budget has been estimated at only 150 $GtCO_2$, also over the next century.[45] By 2013, cumulative carbon emissions had amounted to 1970 $GtCO_2$.[46] In other words, when looking at cumulative carbon emissions since pre-industrial levels, we have less than one-third of aggregate carbon emissions remaining before we will see a 2 °C temperature rise, and this is the most conservative estimate, giving us only a 67 percent chance of reaching the goal according to the largest carbon budget estimate available.[47] In its DEIS, OSM failed to even mention the concept of a global carbon budget, nor the urgency of keeping global emissions within a strict carbon budget that is consistent with our international commitments.	**5-15 Response: See Comment Response 5-14 on page 15.**
5-15, cont'd	The 1 °C of global warming humans have caused since the late 19th century has already led to appreciable and alarming impacts on the environment: > Global temperature and sea levels keep rising, reaching record highs once again in 2016. Global sea ice cover reached a record low, and mountain glaciers and the huge ice sheets in Greenland [38] *See* Christiana Figueres et al., *Three Years to Safeguard Our Climate*, 546 NATURE 593, 593 (2017). Attachment 32. [39] *See* Chris Mooney, *These Experts Say We Have Three Years to Get Climate Change Under Control. And They're the Optimists.*, WASH. POST, Jun. 29, 2017. Attachment 33. [40] *See id.* [41] Figueres at 595. [42] Renaud Gignac & H. Damon Matthews, *Allocating a 2 °C Cumulative Carbon Budget to Countries*, 10 ENVTL. RES. LETTERS 1, 1 (2015). Attachment 34. [43] *Id.* at 3. [44] Figueres at 594. [45] *Id.* [46] Gignac and Matthews at 3. [47] *See id.* 16 | Page MEIC et al. Rosebud Area F DEIS Comments	

Comment/ Code	Document #005-Sierra Club	Response
5-16 (6312)	and Antarctica are on a trajectory of accelerating mass loss. More and more people are suffering from increasing and often unprecedented extreme weather events, both in terms of casualties and financial losses.[48] Controlling global warming to a 2 °C increase is difficult enough, but in reality, keeping warming at or below 1.5 °C is ideal, since greater increases in temperature are associated with a higher chance of "crossing critical tipping points where major and largely irreversible changes…are triggered."[49] Achieving just the 2 °C target requires immediate action and leaves no room for continued coal leasing on federal lands. Experts have made projections of where the world must be in 2020 to keep global temperature rise below 2 °C. Within the energy sector, all coal plants will need to be in the process of retirement, and no new coal plants can be approved.[50] Leasing a federal coal mine with climate impacts reaching to 2027 and beyond is inconsistent with where the United States must be by 2020 in order to meet our climate commitments. Our current global rate of carbon emissions is highly unsustainable. At our current rate of emissions of 39 $GtCO_2$ emitted each year, we could reach the lower bound for the world's estimated carbon budget in just four years, and the mid-point estimate would be reached within fifteen years.[51] Even the current intended Nationally Determined Contributions ("(I)NDCs") pursuant to the Paris Climate Agreement are insufficient to meet the 2 °C goal.[52,53] Deliberate climate leadership is needed, and needed now. Scientific simulations have shown that to fulfill the Paris Climate Agreement, "the effort required to close the gap between current conditional (I)NDCs and the 2 °C goal [falls] solely to the G8 and China."[54] Moreover, experts indicate moving away from coal by 2020 is not only necessary but achievable. Demand for coal will have peaked by 2020.[55] In addition, [m]ost governments and investors increasingly realize that there is no room for new coal-fired power plants in the emissions [48] Chloe Revill & Victoria Harris, *2020: The Climate Turning Point* (2017), available at http://www.mission2020.global/2020%20The%20Climate%20Turning%20Point.pdf (last visited Feb. 28, 2018). Attachment 35. [49] *See id.* at 3. [50] *See* Figueres et al., *supra* at 594. [51] *See* Revill & Harris, *supra* at 4. [52] *See* Yann Robious du Pont et al., *Equitable Mitigation to Achieve the Paris Agreement Goals*, 7 Nature Climate Change at 6 (2017). Attachment 36. [53] *See also* Gignac & Matthews, *supra* at 8 (finding a strong suggestion that "current national emission pledges are not consistent with the stated 2 °C target"). [54] *Id.* [55] Revill & Harris, *supra* at 9. 17 | Page MEIC et al. Rosebud Area F DEIS Comments	**5-16 Response**: The U.S. ratified the Paris Climate Agreement in September 2016 and the U.S. document entered into force on November 4, 2016. The agreement is considered a "treaty" under international law, but only certain provisions are legally binding and the agreement does not include binding emission targets (CCES 2017). Under U.S. law, U.S. participation in an international agreement can be terminated by a president, acting on executive authority, or by an act of Congress, regardless of how the United States joined the agreement. However, the Paris Agreement specifies that a party may not withdraw from the agreement within the first 3 years following its entry into force (CCES 2017). In 2017, President Trump announced his intention to withdraw from the Paris Agreement. Under Article 28 of the Agreement, a country cannot formally provide written notification of withdrawal until three years from the date the Agreement entered into force for a Party (November 4, 2019 for the United States). Article 28 goes on to state that… "Any such withdrawal shall take effect upon expiry of one year from the date of receipt by the Depositary of the notification of withdrawal, or on such later date as may be specified in the notification of withdrawal." **See also Comment Response 5-14 on page 15.**

Comment/ Code	Document #005-Sierra Club	Response
	> budget implied by the Paris Agreement temperature limits: emissions from existing power plants alone would exceed the cost-optimal carbon budget by 114 percent. Most governments are also beginning to recognize that reliance on coal (and gas) exposes their economy to price volatility on the global coal markets and decreases their energy security. These considerations, combined with increasing cost competitiveness of renewables, means that investment in new fossil fuel generation capacity is slackening off.[56] Furthermore, the United States bears a disproportionately large share of the blame for anthropogenic climate change. The United States' historical emissions debt (the difference between how much we should have been emitting based on population size and actual emissions) is extremely large. In fact, since 1960, "[t]he United States is a clear leader among debtor countries, with historical CO_2 emissions that have consistently exceeded the world per-capita average" and carries the largest share of both carbon (CO_2) and climate (also including methane, nitrous oxide, and sulfur dioxide) debt.[57] In terms of countries that bear the greatest responsibility for anthropogenic climate change, the United States easily tops the list. In the period from 1990–2010, the United States alone was responsible for 32 percent of global climate debt.[58] The country with the next greatest impact during the same period was Russia, which was responsible for only 10 percent of emissions, much lower by comparison.[59] In total, our carbon debt by the year 2013 surmounted 100 $GtCO_2$, compared to just 3.1 $GtCO_2$ owed by France.[60] In any future global discussions about who bears the responsibility for climate change, such as the costs of mitigation, the United States could be expected to pay a significant amount relative to other debtor nations,[61] potentially to climate creditor nations such as India.[62] > In the extreme case of the United States, [fully accounting for both past and future inequalities] would entail both: (1) at least a 90 percent reduction in emissions by 2050, relative to 2005; and (2) an additional accounting for the more than 150 Gt CO_2 carbon debt that will have accrued against the United States by that time. And neither of these conditions are trivial. The US [56] *Id.* (citations omitted). [57] H. Damon Matthews, *Quantifying Historical Carbon and Climate Debts Among Nations*, 6 NATURE CLIMATE CHANGE 60, 60 (2015). Attachment 37. [58] *Id.* [59] *Id.* [60] Gignac & Matthews, *supra* at 5. [61] *See* Mathews, *supra* at 63. [62] *See id.* at 60. 18 | Page MEIC et al. Rosebud Area F DEIS Comments	

Comment/ Code	Document #005-Sierra Club	Response
	> EPA's own estimates of the social cost of carbon range vary widely, from $11 to almost $100 per tonne of CO_2 emitted, based on various assumptions of the future cost and discount rate of climate damages associated with emissions. Even at the very lowest end of this cost range, the United States' current cumulative carbon debt of 100 Gt CO_2 is valued at more than a trillion dollars. [63] Several other published studies have estimated the United States' portion of the global carbon budget based on various principles, each of which offers OSM a viable option for better evaluating the impact of the emissions from its decision to authorize the Belle Ayr North project. These studies allocate the remaining global carbon budget across countries based on factors including equity and economics. Estimates of the U.S. carbon budget reported by the four studies discussed below range from 34 $GtCO_2$ to 158 $GtCO_2$, depending on the temperature target used by the study (1.5 °C versus 2 °C), the likelihood of meeting the temperature target (50 percent or 66 percent probability), the equity principles used to allocate the global budget among nations, and whether a cost-optimal model was employed. Using a non-precautionary 50 percent probability of limiting global warming to 2 °C, Raupach et al. (2014) estimated the U.S. carbon budget at 158 $GtCO_2$ based on a "blended" approach of sharing principles for allocating the global carbon budget across nations.[64] The "blended" approach is midway between a non-equity "inertia" approach in which sharing is based on current emissions, and an "equity" approach in which sharing is based on population and provides for equal per-capita emissions across countries. Using a more precautionary 66 percent probability of keeping warming below 2 °C, Peters et al. (2015) estimated the U.S. carbon budget at 34 $GtCO_2$ under an equity approach and 123 $GtCO_2$ under an inertia approach.[65] Similarly using a 66 percent probability of keeping warming below 2 °C, Gignac et al. (2015) estimated the U.S. carbon budget at 78 to 97 $GtCO_2$, based on a contraction and convergence framework, in which all countries adjust their emissions over time to achieve equal per-capita emissions.[66] Although the contraction and convergence framework corrects present emissions [63] Gignac & Matthews, *supra* at 6 (citations omitted). [64] Raupach, Michael et al., Sharing a quota on cumulative carbon emissions, 4 Nature Climate Change 873 (2014) at Supplementary Figure 7. Attachment 38. [65] Peters, Glen P. et al., Measuring a fair and ambitious climate agreement using cumulative emissions, 10 Environmental Research Letters 105004 (2015). Attachment 39. [66] Gignac and Matthews, *supra*. In a contraction and convergence approach, national emissions are allowed to increase or decrease for some period of time until they converge to a point of equal per capita emissions across all regions at a given year, at which point all countries are entitled to the same annual per capita emissions. 19 | Page MEIC et al. Rosebud Area F DEIS Comments	

Comment/ Code	Document #005-Sierra Club	Response
	inequities among countries over a specified time frame, it does not account for inequities stemming from historical emissions differences. When accounting for historical responsibility, Gignac et al. (2015) estimated that the United States has an additional cumulative carbon debt through 2013 of 100 $GtCO_2$. Du Pont et al. (2017) averaged across five IPCC-AR5 sharing principles (capability, equal per capita, greenhouse development rights, equal cumulative per capita, and constant emissions ratio) to estimate the U.S. carbon budget through 2100.[67] Using a 66 percent probability of keeping warming below 2 °C, du Pont et al. (2017) estimated the U.S. carbon budget at 104 $GtCO_2eq$ (equal to ~ 69 $GtCO_2$) based on a cost-optimal model. Du Pont et al. (2017) further estimated the U.S. carbon budget at 57 $GtCO_2eq$ (equal to ~ 38 $GtCO_2$) for a 50 percent chance of returning global average temperature rise to 1.5 °C by 2100, which is the only target among the four studies just discussed that is consistent with the "well below 2 °C" temperature target of the Paris Agreement.	
5-17 (6312)	Under any scenario, the remaining U.S. carbon budget consistent with limiting global average temperature rise to 1.5 °C or 2 °C is quite small and is rapidly being consumed. Keeping in mind considerations of both equity and future costs, the United States must place cutting CO_2 emissions as a pressing national priority to sustain its leadership role in the international landscape, which leaves no place for continued coal mine leasing on federal lands. OSM must take the threat of climate change seriously in light of the overwhelming research and evidence presented by climate experts. At a minimum, OSM must address this recent scholarship on the concept of carbon budgeting, and evaluate how the direct and indirect greenhouse gas emissions associated with the Rosebud Mine affect the remaining available carbon budget.	**5-17, 5-18 Response**: Information about global, national, state, and regional GHG emissions is provided in **Section 3.4.2.3** of the EIS. Proposed Action emissions are evaluated in the context of total U.S. emissions in **Section 4.4.3** and **Section 5.3.3**. OSMRE is not required by NEPA to contain a monetary cost-benefit analysis of the project, and we did not include one in this EIS. Unless we produced a complete monetary cost-benefit analysis, which would include both the social costs of the project (including the social costs of carbon) as well as the social benefits of the project (e.g., the monetary benefits of the power generated), inclusion solely of a cost analysis for the social cost of carbon would be contrary to NEPA and create an unbalanced and inaccurate assessment of the project. As such, it would not be useful in facilitating a decision by the authorized official. Another commenter completed a social cost of carbon analysis (see Comment no. 14), which showed that "Total emission costs for the 19-year time horizon vary by over 40-fold from a low of $319 million to as high as $12.9 billion." While OSMRE does not believe that a social cost of carbon analysis is warranted for this project decision and did not include it in the EIS, as outlined in **Section 4.4.5**, we note that this analysis and its wide margin of error support our conclusion that such analysis was not needed because the social cost of carbon without a full cost-benefit analysis is of very limited utility to the decision maker.
5-18 (6311)	**C. OSM's Excuses for Not Utilizing the Social Cost of Carbon to Evaluate Climate Change Impacts are Invalid.**	
5-18, cont'd	OSM's assertion that it does not have tools to assess climate impacts from its decision is incorrect. The social cost of carbon – a tool created by federal agencies and generally accepted in the scientific community – could be used here, as it would allow OSM to quantify and disclose the harm caused by that the project's carbon dioxide emissions. The social cost of carbon provides a metric for estimating the economic damage, in dollars, of each incremental ton of carbon dioxide emitted into the atmosphere. NEPA specifically requires federal agencies to analyze and disclose the environmental effects of their actions, including "ecological . . . aesthetic, historic, cultural, economic [and] health" impacts. 40 C.F.R. § 1508.8. Where "information relevant to reasonably foreseeable significant adverse impacts cannot be obtained because the overall costs of obtaining it are exorbitant or the means to obtain it are not known," NEPA regulations direct agencies to evaluate a project's impacts "based upon theoretical approaches or research methods generally accepted in the scientific community." 40 C.F.R. § 1502.22(b)(4). The social cost of carbon is based on generally [67] Du Pont et al., *supra*. 20 | Page MEIC et al. Rosebud Area F DEIS Comments	A full-scale carbon budgeting analysis is not required to determine if significant impacts related to GHG emissions are occurring and is outside the scope of this EIS. OSMRE, where appropriate and not overly speculative, included reasonable forecasting as in the case with the Climate discussion in Chapter 4 allowing the decision maker to evaluate potential impacts associated with the Proposed Action using representative or predicted emissions. GHG emissions are examined for NEPA purposes. Under MEPA, DEQ's analysis of actions is limited to actions which significantly affect the quality of the human environment in Montana. Section 75-1-201(1)(b)(4), MCA.

Comment/ Code	Document #005-Sierra Club	Response
5-19 (6312) 5-19, cont'd	accepted research methods and years of peer-reviewed scientific and economic studies. It is a simple tool that is easy for federal agencies to use and easy for the public to understand. Putting a dollar figure on each ton of CO_2 emitted as a result of a federal project places climate impacts in a context that both decision makers and the public can readily comprehend. The social cost of carbon is backed by years of peer reviewed scientific and economic research, it is designed to be updated to reflect the most up-to-date information, and it has already been used by federal agencies in both rulemaking decisions and project-level reviews under NEPA. As explained below, each of OSM's excuses for not utilizing the social cost of carbon is invalid. 1. ***"The SCC Protocol Does Not Measure The Actual Incremental Impacts Of A Project On The Environment."*** **DEIS at 491.** The DEIS states that climate change will be incrementally exacerbated by marginal additional emissions from the Proposed Action, but OSM nonetheless refuses to use the tools available to assess the impact of each incremental ton of carbon dioxide emissions.[68] The Interagency Working Group (IWG), which created the SCC, speaks directly to the importance of calculating marginal (i.e., additional) carbon emissions, stating that the "purpose of the SCC estimates presented here is to make it possible for agencies to incorporate the social benefits from reducing carbon dioxide emissions into cost-benefit analyses of regulatory actions that have small, or 'marginal,' impacts on cumulative global emissions." The same holds true when agencies use the SCC in NEPA analysis.[69] The DEIS further contradicts the assertion that the SCC does not measure the incremental impacts of the project on the environment, stating that "the SCC protocol estimates economic damages associated with an increase in carbon dioxide emissions – typically expressed as a one metric ton increase in a single year — and includes, but is not limited to, potential changes in net agricultural productivity, human health, and property damages from increased flood risk over hundreds of years." DEIS at 491. The SCC also encompasses climate impacts on ecosystem services. While the EIS quantifies the increase in GHG emissions that would result from operation of the mine for an additional 8 years, it impermissibly turns a blind eye to the availability and applicability of the SCC for monetizing these emissions. [68] "Direct and indirect greenhouse gas emissions would contribute incrementally to climate change." DEIS S-24 Table S-1. Summary Comparison of Direct and Indirect Environmental Impacts [69] *See, e.g.*, Mark Templeton and Michael Greenstone, Objection to "Record of Decision, Federal Coal Lease Modifications COC-1362 & COC-67232" (Oct. 23, 2017). Attachment 40. 21 | Page MEIC et al. Rosebud Area F DEIS Comments	**5-19 Response: See Comment Response 5-11 on page 11.**

Comment/ Code	Document #005-Sierra Club	Response
5-20 (6311)	2. ***"The SCC Protocol Does Not Include All Damages Or Benefits From Carbon Emissions [And] Without A Complete Monetary Cost-Benefit Analysis, Which Would Include The Social Benefits Of Energy Production To Society As A Whole And Other Potential Positive Benefits, Inclusion Solely Of An SCC Analysis Would Be Unbalanced, Potentially Inaccurate, And Not Useful."*** **DEIS at 491.** In Section 4.4.5 of the DEIS, OSM claims that it is not required to perform a cost-benefit analysis and has not done so, but then goes on to argue that the SCC falls short because it does not internalize all costs or benefits, the very nature of such an analysis. They can't have it both ways. The decision not to conduct a cost-benefit analysis does not invalidate use of the SCC for what it was designed to do; i.e. allow "the dollar cost figure arrived at based on the SCC calculation represents the value of damages avoided if, ultimately, there is no increase in carbon emissions." DEIS at 491. Likewise, OSM cannot dismiss the SCC because it does not address "the social benefits of energy production to society as a whole and other positive benefits." DEIS at 491. If the agency wanted to look at those benefits by conducting a cost-benefit analysis it could have done so and included those benefits in the analysis. Further, by failing to consider the costs of GHG emissions from the mine expansion, the agency's analysis effectively assumes a price of carbon that is $0. *Ctr. for Biological Diversity v. Nat'l Highway Traffic Safety Admin.*, 538 F.3d 1172, 1200 (9th Cir. 2008) (noting that while there is a range potential social cost figures, "the value of carbon emissions reduction is certainly not zero"). Assuming that there are no negative environmental or monetary impacts from climate change contradicts scientific evidence and is misleading. Indeed, the private sector is increasingly monetizing climate costs in order to factor them into investment decisions. For example, many companies are pricing carbon; i.e., monetizing the negative impacts of marginal GHG emissions, in order to include those costs when forecasting the profitability of projects. > More than 430 companies globally have implemented internal carbon pricing. Internal carbon pricing acts as a screening tool [and] when used as a shadow price in investment decisions, offers better understanding of potential impacts of externalities on project profitability. [A critical part of carbon pricing is] evaluating social and economic externalities such as potential environmental damage due to greenhouse gas (GHG) emissions.[70] [70] World Resources Institute India, *Corporates, Cost of Carbon and Internalising Externalities*, (March 09, 2016), available at http://wri-india.org/blog/corporates-cost-carbon-and-internalising-externalities (last visited Feb. 28, 2018). Attachment 41. 22 | Page MEIC et al. Rosebud Area F DEIS Comments	**5-20 Response: See Comment Response 5-11 on page 11.**

Comment/ Code	Document #005-Sierra Club	Response
	Moody's Investors Services recently warned investors in the tax-exempt bond market about the increasing risks from climate change to the creditworthiness of state and local borrowers. > The growing effects of climate change, including climbing global temperatures, and rising sea levels, are forecast to have an increasing economic impact on US state and local issuers. This will be a growing negative credit factor for issuers. Climate shocks or extreme weather events have sharp, immediate and observable impacts on an issuer's infrastructure, economy and revenue base, and environment. As such, we factor these impacts into our analysis of an issuer's economy, fiscal position and capital infrastructure.[71]	
5-21 (6312)	OSM's obligation to analyze the costs associated with GHG emissions through NEPA was directly affirmed by the court in *High Country Conservation Advocates v. U.S. Forest Service*, 52 F. Supp. 3d 1174 (D.Colo. 2014). In his decision, Judge Jackson identified the IWG's SSC protocol as a tool to "quantify a project's contribution to costs associated with global climate change." *Id.* at 1190. To fulfill this mandate, the agency must disclose the "ecological[,] . . . economic, [and] social" impacts of the Proposed Action. 40 C.F.R. § 1508.8(b). Judge Jackson further explained that while there is a "wide range of estimates about the social cost of GHG emissions . . . neither the BLM's economist nor anyone else in the record appears to suggest the cost is as low as $0 per unit. Yet by deciding not to quantify the costs at all, the agencies effectively zeroed out the cost in its quantitative analysis." *Id.* at 1192.	**5-21 Response**: In *High Country Conservation Advocates v. U.S. Forest Service, 52 F. Supp. 3d 1174 (D.Colo. 2014)*, (https://www.leagle.com/decision/infdco20140630a94) Judge Jackson found that "In effect the agency prepared half of a cost-benefit analysis, incorrectly claimed that it was impossible to quantify the costs, and then relied on the anticipated benefits to approve the project." In the Area F EIS, OSMRE has not completed, in part or in full, a cost-benefit analysis. **See also Comment Response 5-11 on page 11.**
5-22 (6311)	Inclusion of an SCC analysis would be neither unbalanced nor inaccurate. In the absence of other indicators of negative socioeconomic impacts from increased GHG emissions, the SCC would provide a necessary balancing with estimation of the positive economic impacts identified in the EIS. NEPA requires that agencies use the best available scientific information for the assessment of climate impacts. The SCC represents the best tool available for accurately estimating future damages from climate change. Quantification of these dollar estimates of future damages from climate change is essential to informing decision makers and the public in the consideration of alternatives. The 2017 EO further directed that when monetizing the value of changes in GHG emissions resulting from regulations, agencies follow the guidance contained in OMB Circular A-4 of September 17, 2003. [71] Moody's Investor Services, Global Credit Research, *Climate change is forecast to heighten US exposure to economic loss placing short- and long-term credit pressure on US states and local governments*, (Nov. 28, 2107), available at https://www.moodys.com/research/Moodys-Climate-change-is-forecast-to-heighten-US-exposure-to--PR_376056 (last visited Feb. 28, 2018). Attachment 42. 23 | Page MEIC et al. Rosebud Area F DEIS Comments	**5-22 Response**: Information about global, national, state, and regional GHG emissions is provided in **Section 3.4.2.3** of the EIS. Proposed Action emissions are evaluated in the context of total U.S. emissions in **Section 4.4.3** and **Section 5.3.3**. OSMRE is not required by NEPA to contain a monetary cost-benefit analysis of the project, and we did not include one in this EIS. Unless we produced a complete monetary cost-benefit analysis, which would include both the social costs of the project (including the social costs of carbon) as well as the social benefits of the project (e.g., the monetary benefits of the power generated), inclusion solely of a cost analysis for the social cost of carbon would be contrary to NEPA and create an unbalanced and inaccurate assessment of the project. As such, it would not be useful in facilitating a decision by the authorized official. Another commenter completed a social cost of carbon analysis (see Comment no. 14), which showed that "Total emission costs for the 19-year time horizon vary by over 40-fold from a low of $319 million to as high as $12.9 billion." While OSMRE does not believe that a social cost of carbon analysis is warranted for this project decision and did not include it in the EIS, as outlined in **Section 4.4.5**, we note that this analysis and its wide margin of error support our conclusion that such analysis was not needed because the social cost of carbon without a full cost-benefit analysis is of very limited utility to the decision maker. GHG emissions are examined for NEPA purposes. Under MEPA, DEQ's analysis of actions is limited to actions which significantly affect the quality of the human environment in Montana. Section 75-1-201(1)(b)(4), MCA.

Comment/ Code	Document #005-Sierra Club	Response
	3. ***"Based On Emission Estimates For Coal Combustion, SCC Calculations Can Quickly Rise To Large Values; However, Specific Threshold Levels For The Determination Of Significance Can Vary Depending On Numerous Project Factors."*** **DEIS at 491.** OSM's reasoning here for not conducting an SCC analysis is baseless.	
5-22, cont'd	The "large values" referenced in this reason are nowhere calculated in the DEIS, but such calculations are easily done, and do indeed lead to large values. The direct emissions from mining estimated at 122,559 metric tons carbon equivalent per year over the eight years of additional production would carry a social cost of carbon of $53.4 million, while the indirect CO_2e combustion emissions of 12,281,509 tons per year from the Colstrip and Rosebud power plants would carry an SCC of $5,355 million over eight years.[72]	
5-22, cont'd	Do these values meet "threshold levels?" With regard to threshold levels for determining significance, the DEIS identifies threshold levels for mandatory reporting under the EPA GHG Reporting Program and for permitting requirements under the GHG Tailoring Rule. DEIS at 155. It does not however identify any thresholds values of significance for GHG climate impact analysis under NEPA, and there are none. In fact, the DEIS acknowledges that "There are no impact and intensity thresholds available to characterize the significance of the effect of a single action on global climate change; as such, no thresholds are presented here." DEIS at 474.	
5-22, cont'd	Here, the DEIS may be misusing the guidance on threshold values in OMB Circular A-4 regarding non-quantified benefits. OMB advises: > It will not always be possible to express in monetary units all of the important benefits and costs … If the non-quantified benefits and costs are likely to be important, you should carry out a "threshold" analysis to evaluate their significance. Threshold or "break-even" analysis answers the question, "How small could the value of the non-quantified benefits be (or how large would the	

[72] *Id.* Interagency Working Group on Social Cost of Greenhouse Gases (2016), Table A1: Annual SC- CO_2Values: 2010-2050 (2007$/metric ton CO_2), p. 25. Values for the period of mine expansion at 3 percent discount rate:
2031 $51
2032 $52
2033 $53
2034 $54
2035 $55
2036 $56
2037 $57
2038 $58

Comment/ Code	Document #005-Sierra Club	Response
	value of the non-quantified costs need to be) before the rule would yield zero net benefits?"[73]	
5-22, cont'd (6311)	OMB guides agencies here to compare the possible value of non-quantified costs and benefits against monetized costs and benefits. The DEIS does not attempt this analysis, either by weighing potential non-quantified benefits against the monetized social costs of carbon, or by comparing potential non-quantified costs against the benefits that result from the project. Again, OSM cannot hide behind a threshold analysis that they have failed to conduct.	
5-22, cont'd	Finally, the DEIS contains no information on "numerous project factors" which could presumably set the proposed alternative below a non-existent threshold. Basing the failure to conduct an SCC analysis on undefined factors that would influence a non-existent threshold value defies comprehension.	
	4. ***"Given The Uncertainties Associated With Assigning A Specific And Accurate SCC Resulting From 8 Additional Years Of Operation Under The Area F Permit (C2011003F) And A New Federal Mining Plan, And That The SCC Protocol And Similar Models Were Developed To Estimate Impacts Of Regulations Over Long Time Frames, This DEIS Quantifies Direct And Indirect GHG Emissions And Evaluates These Emissions In The Context Of Global, U.S., State, And Regional GHG Emission Inventories As Discussed In DEIS, Section 4.4.3."*** **DEIS at 491.**	
5-23 (6301)	Quantifying project GHG emissions and comparing them to emissions at other scales does not constitute an analysis. Further, even if the DEIS did "evaluate" project GHG emissions in comparison to global, U.S., state, and regional emission inventories, this would still ignore the fact that all marginal emissions contribute to climate change.[74] The conclusion that total annual projected GHG emissions for the project area would comprise a very small fraction of total 2015 U.S. GHG emission is completely irrelevant. DEIS at 469. It is the marginal (i.e., incremental) contribution, not the relative contribution, that OSM is responsible for analyzing.	**5-23 Response**: OSMRE has determined that the disclosure of direct and indirect project GHG emissions framed within the context of state, regional, national, and global GHG emissions is the most appropriate way to inform the decision maker and public on potential impacts to climate change from GHG emissions. OSMRE acknowledges that impacts of climate change cannot be determined on a local scale due to the complex nature of climate change itself; therefore, it is appropriate to compare to state, regional, national, and global scales. Please see **Section 4.4, Climate and Climate Change** in the EIS for a full discussion of potential impacts from the Proposed Action and alternatives. **Section 5.3.3** discloses potential cumulative impacts on climate and climate change beyond those discussed in relation to indirect impacts in **Section 4.4**. GHG emissions are examined for NEPA purposes. Under MEPA, DEQ's analysis of actions is limited to actions which significantly affect the quality of the human environment in Montana. Section 75-1-201(1)(b)(4), MCA.
5-23, cont'd	Furthermore, notwithstanding its claims to do otherwise, the DEIS fails to "evaluate these emissions in the context of global, U.S., state, and regional GHG emission inventories." DEIS at 491. The "analysis" presented by OSM is limited to statements that "the projected maximum annual emissions for the project area comprise 0.0016 percent of total U.S. GHG emissions in 2015 of 6,586.7 MMtCO2e," DEIS at 489, and "the indirect GHG emissions would contribute incrementally to climate change. However, total projected indirect GHG (CO2e) emissions would comprise a small fraction—0.19 percent—of the total 2015 U.S. GHG emissions." DEIS at 490. And contrary to its assertion, OSM did not provide any information on global, state, or regional GHG inventories.	

[73] Office of Management and Budget, Circular A-4 (Sept. 17, 2003). Attachment 43.
[74] "The project area GHG emissions would contribute incrementally to climate change." DEIS at 489.

25 | Page
MEIC et al. Rosebud Area F DEIS Comments

Comment/ Code	Document #005-Sierra Club	Response
5-24 (6311) 5-24, cont'd 5-24, cont'd (also 7401)	OSM's reasoning for not conducting an SCC analysis also implies that the SCC was developed to consider impacts over longer time periods than those that apply to the project. However, again, the DEIS contradicts OSM's reasons for not conducting an SCC analysis: "GHGs have the potential to remain in the atmosphere for long periods of time (from tens to hundreds of years) and to travel long distances." DEIS at 156-57. Finally, uncertainty in the SCC has been thoroughly addressed by the Interagency Working Group on Social Cost of Greenhouse Gases,[75] and the National Academy of Sciences.[76] Courts have consistently rejected uncertainty as a valid reason for foregoing an assessment of climate impacts. *See, e.g.*, *Ctr. for Biological Diversity v. Nat'l Highway Traffic Safety Admin.*, 538 F.3d 1172, 1200 (9th Cir. 2008). Courts have also found that NEPA requires agencies to place a value on climate impacts despite a range of possible values. *Id.* By utilizing a range of discount rates and models employing thousands of different scenarios, the IWG established a range of possible values that encompass uncertainty. The range and types of uncertainty described by the IWG are more well-defined and far narrower than the uncertainty about the monetary costs of climate change that existed before the SCC was developed to provide consistency across Federal agencies. 5. ***"Economic Impact Is Distinct From 'Economic Benefit' As Defined In Economic Theory And Methodology, And The Socioeconomic Impact Analysis Required Under NEPA Is Distinct From Cost-Benefit Analysis, Which Is Not Required."*** **DEIS at 491.** The DEIS attempts to draw a distinction between positive and negative economic impacts and economic costs and benefits. It claims that its NEPA analysis examines the former, as required, but does not include the latter which is not required, thus relieving it of any obligation to analyze the SCC which it claims is the province of cost-benefit analysis. However, in *Montana Environmental Information Center*, the court concluded that the technical distinction between economic impacts and benefits "is a distinction without a difference where, as here, the economic benefits of the action were quantified while the costs were not." *MEIC* Order at 40 n.9. *MEIC v. OSM*, 2017 WL 3480262 at * 13 n.9 (D. Mont. 2017). It is simply not permissible to quantitatively estimate positive project economic impacts while ignoring negative impacts. The DEIS identifies positive economic impacts from the Proposed Action in terms of increased economic activity – government revenue, employment, labor income, total value added, and output. And while the agency identifies several possible impacts that could have negative consequences, including an increase in local population, competition for jobs, and changes in population that could change the quality of the local community, DEIS at 491, it made no effort to analyze or monetize these or other readily identifiable negative [75] Interagency Working Group on Social Cost of Greenhouse Gases (2016). [76] National Academy of Sciences, Valuing Climate Damages: Updating Estimation of the Social Cost of Carbon Dioxide (2017). Attachment 44. 26 | Page MEIC et al. Rosebud Area F DEIS Comments	**5-24 Response: See Comment Response 5-11 on page 11.**

Comment/ Code	Document #005-Sierra Club	Response
5-25 (6301)	impacts, including the environmental impacts from climate change identified by official government climate assessments, on various sectors of the economy. The DEIS goes to great lengths to monetize the economic benefits expected from the project. In the Executive Summary, OSM reports that The project would provide the following federal, state, and local benefits: • an ongoing fuel source (70.8 million tons of coal) for the Colstrip Power Plant Units 3 and 4 and the Rosebud Power Plant; • continued employment for workers at the mine; • an ongoing tax base to federal, state, and local governments; • ongoing royalty payments to mineral resource owners; • continued support to local businesses; • an ongoing source of income to Western Energy and its shareholders; and • reliable electric power for an additional eight years. DEIS at S-9 to S-10. However, the DEIS has little to say about negative economic impacts from the Proposed Action, including impacts from climate change. While current science does not allow direct attribution of climate impacts to the region from the incremental emissions from the project, the DEIS concedes that these emissions will contribute to future climate change, and it is clear that climate change will have substantial negative economic impacts in the region. The DEIS states that coal mining and agriculture both play major roles in Big Horn County's economy, and that "Rosebud County's traditional major industries of coal mining, the railroad, and agriculture remain the driving forces of the area's economy. Treasure County's principal industries are farming and ranching." DEIS at S-21. The NCA and the MCA identified numerous environmental impacts from climate change that are expected to have negative effects on agriculture in the region, but no attempt to quantify such impacts was made in the DEIS, other than to observe that "ongoing drought conditions in southeastern Montana have also impacted the county's agricultural sector." DEIS at 356. Conversely, precise forecasts of positive economic impacts from continued mine operation were developed and quantified across multiple measures of economic benefits, including direct, indirect, and induced economic output. • Under the No Action alternative, the Rosebud Mine would be expected to operate until 2030, supporting 280 direct jobs and $87.9 million in annual direct economic output. Under Alternatives 2 and 3, mine life would be extended by eight years, continuing to support the 280 direct jobs and $87.9 million in annual direct economic output. DEIS at 598. • In the No Action alternative, the Rosebud Mine would be expected to operate until 2030, supporting 37 indirect jobs and $9 million in annual indirect economic output. In 27 | Page MEIC et al. Rosebud Area F DEIS Comments	**5-25 Response**: Observed and projected state GHG emissions trends and climate impacts are described in **Sections 3.4.2.3** and **4.4.2.3** of the Draft EIS, respectively, including the impacts of climate change on temperature, precipitation, growing seasons, and irrigation capacity. Due to the complex, global nature of climate change, the ability to quantify potential impacts on particular local resources is limited by the availability of applicable data. Additional information on the projected impacts of climate change on drought, seasonal irrigation capacity, pests, and invasive weeds has been added to **Sections 4.4.2.3** and **5.3.3**. NEPA does not require a cost-benefit analysis of the project such as that described by the commenter. As such, the EIS does not present any economic benefits or costs for any resource. As required by NEPA (see 40 CFR § 1508.14), the socioeconomic impacts are discussed, including a description of the local economy and the project's potential changes to the employment, labor income, and local economic activity. These impacts can be perceived either positively or negatively by the community; however, a positive perception of increased economic activity in an area is very distinct from being an "economic benefit" as defined in economic theory and methodology (Watson et al. 2007, Kotchen 2011). Accordingly, this discussion is not a cost-benefit analysis and does not attempt to monetize the benefits of the project. GHG emissions are examined for NEPA purposes. Under MEPA, DEQ's analysis of actions is limited to actions which significantly affect the quality of the human environment in Montana. Section 75-1-201(1)(b)(4), MCA.

Comment/ Code	Document #005-Sierra Club	Response
	Alternatives 2 and 3, mine life would be extended by eight years, continuing to support the 37 indirect jobs and $9 million in annual indirect economic output over this time. DEIS at 599. • Under the No Action alternative, the Rosebud Mine would be expected to operate until 2030, supporting 53 induced jobs and $5.8 million in annual induced economic output. Under Alternatives 2 and 3, mine life would be extended by eight years, continuing to support the 53 induced jobs and $5.8 million in annual induced economic output over this time. DEIS at 600. Once an agency had trumpeted the benefits of a project, and done so with precise economic quantification, NEPA also required it to calculate and consider the costs. *MEIC v. OSM* at * 13-15. However, here OSM refuses to give the same quantitative consideration to the costs of the Proposed Action. An agency that quantifies the positive impacts of a proposed government action must also include and quantify the negative impacts—including impacts associated with GHG emissions. To the greatest extent possible, an EIS must analyze positive and negative impacts in comparable terms. However, OSM's assessment is impermissibly tipped in favor of the positive impacts. In *Montana Environmental Information Center*, a case about coal lease modifications, the court held impermissible an EIS that qualitatively discussed climate change and quantified the amount of greenhouse gas emissions in tons but then failed to monetize the climate impacts of those emissions, where a tool like the SCC had been available. *Id.* Again, the DEIS fails entirely to identify, no less perform, a quantitative analysis or to monetize any negative economic impacts from the Proposed Action, including economic damages from climate change. In the absence of an analysis of more specific economic damages from climate change in the region, the SCC, which reflects the best available science, best practices for economic analysis, and legal standards for rational decision making, remains the best tool available for providing information about negative economic impacts from climate change due to marginal project GHG emissions for consideration by decision makers and the public. The agency has violated its obligations under NEPA by failing to assess properly the negative impacts from extending the life of the mine by eight years. **III. OSM FAILED TO ADEQUATELY ANALYZE EXISTING AND POTENTIAL IMPACTS TO WATER QUALITY AND QUANTITY.** **A. The Scope of the Analysis Is Improperly Narrow.**	
5-26 (6000) **5-27 (6604)**	An EIS must consider the direct, indirect, and cumulative impacts of the action, along with connected, similar, and cumulative actions. 40 C.F.R. § 1508.25. Here, the DEIS fails to take a hard look at important impacts to water resources. The DEIS fails to consider any impacts to the Yellowstone River or aquatic life in the Yellowstone River from the power plants' water intake on the Yellowstone River. The DEIS recognizes that continued mining in Area F will lead to 28 | Page MEIC et al. Rosebud Area F DEIS Comments	**5-26 Response:** The direct and indirect impacts are described in Chapter 4 of the EIS. Cumulative impacts are described in Chapter 5 of the EIS. **5-27 Response:** The Yellowstone River is not included in the direct, indirect, or cumulative effects analysis areas – see **Section 3.7.1.2**, and water quantity impacts to the Yellowstone River as a result of power plant cooling operations were not analyzed in the EIS. During preparation of the EIS, OSMRE determined that water quality effects due to coal combustion at the Colstrip and Rosebud Power Plants would not be expected to be measurable and disclosed the rationale for why they would not be measurable in **Section 4.7.3.3** of the EIS. In addition, although this EIS discloses potential indirect impacts of emissions related to coal combustion at the power plants, neither power plant is considered a connected action to the proposed project (**Section 2.5.2.2**, Scoping Issues Eliminated from Detailed Analysis). Climate change is addressed in **Section 3.4.1.2** of the EIS. A description of precipitation and climate change is provided in the context of surface water in **Section 3.7.2**.

Comment/ Code	Document #005-Sierra Club	Response
5-27, cont'd (6604)	continued operations of the Colstrip Generating Station, which will in turn, require continued water withdrawals from the Yellowstone River. It is certainly foreseeable that if the coal is mined and burned at the power plant, the power plant will make additional water withdrawals over the next 19 years. The power plant cannot operate without water. The power plant consumes an enormous amount of water annually, approximately 27,000 acre feet. This consumes a significant amount of the water flow from the Yellowstone River at Forsythe. Indeed, in recent years, the power plant has seen reduced flows affect its ability to obtain water for the plant, to the point that Colstrip's mayor asked residents to minimize their use of water.[77] Subsequently, the plant operators moved their water intake farther into the river to gain access to more water during summer low flows. The cooling water intakes are potentially a	
5-27, cont'd	significant impact on water quantity in the Yellowstone, especially during low flows, and also on water ecology, and water users, especially given anticipated reductions in flows from the worsening impacts of climate change.	
5-28 (7103)	In its initial EIS for the Colstrip plan, the Montana Department of Health and Environmental Sciences determined that the significant water withdrawals from the Yellowstone for the power plant would lead to more erratic water temperatures, including higher maximum temperatures and longer periods of freezing.[78] This, the Department concluded, would affect fish in the river by altering growth and reproduction, growth rates of aquatic plants and algae, and would affect diversity of fish in the river.[79] The water withdrawals will also lead to increased concentration of pollutants in the river due to the reduced amount of dilution.[80] This may affect concentrations of coliforms, dissolved oxygen, pH, turbidity, temperature, residues, sediment and settleable solids, toxics, and nutrients.[81] This is a problem because the Montana Department of Environmental Quality already considers this portion of the creek to be impaired and not fully	**5-28 Response: See Comment Response 5-27 on previous page.**
5-29 (6605)	supporting its designated use for supporting aquatic life.[82] In particular, the river is impaired for a host of different pollutants including copper, lead, total dissolved solids, zinc, pH, nitrite + nitrate, and sediment.[83] Continued water withdrawals will only worsen these water pollution problems. This is particularly the case here given that additional factors will worsen these pollution problems.	**5-29 Response:** Coal mining is listed as an unconfirmed source of impairment to lower East Fork Armells Creek (a tributary to the Yellowstone River) in the reach from the mine shops to the mouth (Final 2018 Water Quality Integrated Report and 303(d) List). The direct and indirect impacts of the mine on East Fork Armells Creek are described in **Sections 4.7.3.2** and **4.7.3.3** in the EIS. Coal mining is not identified as a source of impairment for upper East Fork Armells Creek, which flows through the mine itself. While the commenter cites to a 1973 EIS for the proposition that the Rosebud Mine will adversely impact downstream waters, data gathered and analyzed since that time shows that the monitored water quality in East Fork Armells Creek downstream of the Rosebud Mine and upstream of the town of Colstrip, existing the permit area has lower specific conductance, TDS and nitrate-nitrite concentrations than samples taken downstream of the mine in Colstrip where East Fork Armells Creek is subject to multiple non-mining anthropogenic impacts.

[77] Associate Press, Colstrip Seeks to Limit Water Use to Help Coal Plant (Aug. 23, 2016). Attachment 45.
[78] Mont. Dep't of Health and Envtl. Sciences, Environmental Impact Statement on the Proposed Montana Power Company Electrical Generating Plant at Colstrip, Montana (1973). Attachment 46.
[79] *Id.*
[80] *Id.*
[81] *Id.*
[82] Mont. Dep't of Envtl. Quality, Water Quality Standards Attainment Record, Yellowstone River, Cartersville Dam to Powder River (2018), Attachment 47; Mont. Dep't of Envtl. Quality, Water Quality Standards Attainment Record, Yellowstone River, Big Horn to Cartersville Diversion Dam (2018). Attachment 48.
[83] *Id.*

29 | Page
MEIC et al. Rosebud Area F DEIS Comments

Comment/ Code	Document #005-Sierra Club	Response
5-30 (6300) 5-31 (6400) 5-32 (8507, 8508) 5-33 (6605)	First, the impacts of climate change are predicted to reduce summer low flows in the Yellowstone.[84] Climate change is already causing decreased mountain snowpack in Montana, which in turn affects summer stream flows.[85] Continued warming due to continued GHG emissions will only continue to reduce snow pack and summer stream flows.[86] Climate change, caused by continued GHG pollution from fossil fuel operations, like the Colstrip plant, is worsening summer droughts in Montana, like the brutal "flash drought" from last summer.[87] The Yellowstone River is expected to have significant reduced stream flows from July to October by 2040.[88] These predictions may be conservative, as low summer flows are already affecting operations of the power plant: Talen, the plant operator, has recently applied to install a weir in the Yellowstone River to increase the water level because it is having trouble operating its water pumps during low flows.[89] As summer season water becomes more scarce because of climate change, more water users will put additional demand on water rights in the Yellowstone River, causing still further water reductions.[90] Second, pollution from the mine and power plant to East Fork Armells Creek is just going to add to the already harmful pollution problem in the Yellowstone. The Montana Department of Environmental Quality has determined that East Fork Armells Creek is impaired for a host of pollutants, which the power plant and mine are contributing to, as noted in the DEIS and in the assessment records.[91] Indeed, OSM and the Montana Department of State Lands predicted that coal mining at the adjacent Big Sky Mine would cause a measurable increase in salinity downstream at the mouth of Rosebud Creek (5 percent) with the Yellowstone River, which would also affect the already impaired waters of the Yellowstone.[92] This anticipated increase in salinity will only increase with the massive strip-mining expansion in the Area B Extension (AM5) of the Rosebud Mine. The EIS for Area F must consider the cumulative impacts to the Yellowstone from each of the proposed mining expansions. OSM and the DEQ cannot simply dismiss these potentially significant cumulative impacts without actually studying them.[93] Moreover, it is clear that the power plant itself adds pollution to the Yellowstone River that worsens its impairment. The DEIS notes at [84] Montana Institute for Ecosystems, 2017 Montana Climate Assessment. Attachment 49. [85] *Id.* [86] *Id.* [87] *Id.* [88] *Id.* [89] *See* Talen, Application for Fill Permit (Aug. 2016). Attachment 50. [90] Montana Instit. for Ecosystems, 2017 Montana Climate Assessment. [91] Mont. Dep't of Envtl. Quality, Water Quality Standards Attainment Report East Fork Armells Creek (2018). Attachment 51. [92] US Office of Surface Mining, Montana Department of State Lands, Final Environmental Impact Statement Peabody Big Sky Mine—Area B, Rosebud County, Montana (1988) Attachment 52; Montana Dep't of State Lands, Written Findings Big Sky Mine, Lee Coulee, Area B (1988) Attachment 53. [93] *See, e.g.*, Expert Disclosure of Payton Gardner, Ph.D. (2017) Attachment 54; Supplemental Rebuttal Expert Disclosure of Payton Gardner, Ph.D., (2018) Attachment 55. 30 | Page MEIC et al. Rosebud Area F DEIS Comments	**5-30 Response:** Climate change in the area of analysis is described in the EIS in Chapter 3, Section 3.4. **5-31 Response:** Any effects of the Colstrip and Rosebud Power Plant deposition on the water quality of the four tributaries are not likely to be detectable in the Yellowstone River due to dilution (see **Section 4.7.3.3** in the EIS). See also **Comment Response 5-29**. **Section 4.7** of the EIS describes Surface Water resources. **5-32 Response:** The cumulative impacts to surface water resources are discussed in **Section 5.3.6**. The impacts associated with mining in Areas A through E at the Rosebud Mine and the Big Sky Mine are described in Appendix I of the Written Findings for Area B AM4 (DEQ 2015b). In general, mine-related activities have not rendered surface or ground waters unsuitable for listed beneficial uses. **5-33 Response: See Comment Response 5-27.**

Comment/ Code	Document #005-Sierra Club	Response
5-33, cont'd	page 522 that nitrogen deposition from the power plant is 6 percent of total atmospheric nitrogen deposition east of the power plant.[94] The Yellowstone River east of the power plant is impaired and not meeting water quality standards because of nitrate/nitrite (as well as lead, copper, and zinc).[95] Given the already impaired status of the river, the DEIS's statement that additional pollution deposition from the Costrip power plants "would not adversely affect water quality" is unsupported.	
5-34 (7103)	The potential water quantity and water quality (and cumulative) impacts of the operation to the Yellowstone River also raises concerns about impacts to threatened and endangered species. The area is also habitat for Pallid Sturgeon, as the lower Yellowstone River provides probably the best sturgeon spawning habitat in the state, which is the primary focus of the U.S. Fish and Wildlife Service. *See Defenders of Wildlife v. COE*, 2017 WL 2869415 (D. Mont. July 5, 2017). This habitat will be critical for the survival of sturgeon in Montana over the next two decades, which is the planned operation time of the proposed expansion.[96] Worse, as noted, continued water withdrawals from the power plant will be exacerbated by decreased summer flows due to the worsening impacts of climate change (due to continued burning of coal and other fossil fuels) and because of additional pollution loading from East Fork Armells Creek. The recovery plan notes that climate change may threaten sturgeon due to "reduced late-season flows," especially in the upper Missouri River basin.[97]	**5-34 Response:** The Proposed Action would have no effect on the pallid sturgeon because there is no suitable habitat in the direct effects analysis area. The small streams in the analysis area do not provide suitable habitat for pallid sturgeon; therefore, the proposed project would have no effect on this species. The nearest pallid sturgeon populations are located 60 miles from the Colstrip Power Plant. Discussion of the pallid sturgeon habitat within the Proposed Action analysis area is included in **Sections 4.13.3.2** and **4.13.3.5** of the EIS.
5-35 (9000)	**B. Failure to Disclose Raw Data or Utilize Accurate Science.** NEPA requires agencies to provide the raw data on which it relies to the public. The CEQ regulations state that, to comply with NEPA, an agency "must insure that environmental information is available to public officials and citizens before decisions are made and before actions are taken. The information must be of high quality. Accurate scientific analysis, expert agency comments, and public scrutiny are essential to implementing NEPA." 40 C.F.R. § 1500.1(b). To fulfill NEPA's public disclosure requirements, the agency must provide to the public "the underlying environmental data" from which the Forest Service develops its opinions and arrives at its decisions. *See Idaho Sporting Cong. v. Thomas,* 137 F.3d 1146, 1150 (9th Cir.1998), *overruled on other grounds by Lands Council v. McNair,* 537 F.3d 981 (9th Cir.2008) (en banc). Alternately, the agency may	**5-35 Response:** In accordance with 40 CFR § 1502.21, some materials have been incorporated by reference to cut down on bulk. The references cited in the EIS are listed in Chapter 7 (References). Reference materials may be obtained online. Additionally, sample data collected for baseline and monitoring studies are available to the public from DEQ's Coal Program. This data includes raw field data sampling sheets.

[94] Mont. Dep't of Health and Envtl. Sciences, Environmental Impact Statement on the Proposed Montana Power Company Electrical Generating Plant at Colstrip, Montana (1973), *supra* (noting that "the Yellowstone River" "will be altered in a number of ways" by operations of the mine power plant complex). Attachment 56.
[95] Mont. Dep't of Envtl. Quality, Water Quality Standards Attainment Record, Yellowstone River, Cartersville Dam to Powder River (2018), *supra*.
[96] FWS, Revised Recovery Plan for the Pallid Sturgeon (2014). Attachment 57.
[97] *Id.*

Comment/ Code	Document #005-Sierra Club	Response
5-35, cont'd	incorporate publicly available data underlying the EIS by reference. 40 C.F.R. § 1502.21; *see Jones v. Nat'l Marine Fisheries Serv.,* 741 F.3d 989, 998 (9th Cir.2013). To incorporate underlying data by reference, the agency must cite the source in the EIS and briefly describe the content. 40 C.F.R. § 1502.21. A source may be incorporated by reference only if "it is reasonably available for inspection by potentially interested persons within the time allowed for comment." *Id.; see also* 40 C.F.R. § 1502.24 (requiring the agency to "make explicit reference by footnote to the scientific and other sources relied upon for conclusions in the [EIS]").	**5-36 Response:** The data described on page 522 of the EIS describes atmospheric nitrogen deposition from the Colstrip and Rosebud Power Plants. Atmospheric deposition is described in **Section 3.3.5.3** of the EIS. The conclusion that impacts from the mine and power plant are insignificant is based on comparison of stream deposition specifically from these sources in comparison to stream deposition from all atmospheric sources. The long-term monitoring data for nitrogen deposition is publicly available online from the National Atmospheric Deposition Program (NADP) and from the EPA's CASTNET. The area of deposition of coal combustion emissions in soil and surface water around the two powerplants is described in **Section 4.3** of the EIS and Air Quality Monitoring data, including county-level data, is tabulated in Appendix D of the EIS. Historic deposition trends for national network sites are provided in tables in Appendix D-5.
5-36 (3603)	*WildEarth Guardians v. Montana Snowmobile Ass'n*, 790 F.3d 920, 925 (9th Cir. 2015). Here, the DEIS repeatedly refers to pollution sampling information, e.g., nitrogen sampling data from multiple creeks near Colstrip (DEIS at 522). On the basis of this sampling data, the DEIS concludes that various impacts from the mine and power plant will not be significant. The public must be able to scrutinize this data. Accordingly, OSM and DEQ must make the underlying sampling data available to the public in a useable format.	**5-37 Response:** Springs and seeps in the direct effects analysis area are discussed in **Section 3.7.5.1** and baseline data for the relevant springs in Area F have been incorporated into Appendix B of the EIS. These data are part of the permit application and fulfill the requirements of ARM 17.24.304. They are available to the public from the DEQ Coal Program.
5-37 (3603) 5-38 (3603) 5-39 (6603) 5-40 (6605)	There is a similar lack of baseline information. The DEIS presents monitoring information for only a small fraction of the springs present in the project area. Similarly, there is no clear delineation of where the creeks in the project area are intermittent or the extent of ground water discharge. Under NEPA and MSUMRA, neither OSM nor DEQ can approve the Area F expansion without this baseline information. Mont. Code Ann. § 82-4-222(1)(m); *Great Basin Res. Watch v. Bureau of Land Mgmt.*, 844 F.3d 1095, 1101 (9th Cir. 2016) ("Establishing appropriate baseline conditions is critical to any NEPA analysis."). Here, the DEIS states at page 518 that there is no baseline information by which to measure the impacts of water pollution from the other portions of the Rosebud Mine. This is simply inaccurate. The Montana Department of Environmental Quality and OSM have documented water quality changes in East Fork Armells Creek for approximately two decades. In 1998, DEQ wrote to OSM that "the 40 percent increase in the alluvial aquifer observed upstream of Colstrip does in fact appear to be directly associated with mining activity."[98] More recently, DEQ hydrologists have stated under oath that they "had observed an increase in EC [electrical conductivity], sulfates, and chlorides in this [upper] segment of East Fork Armells Creek" and that "[m]ining operations in Area A were identified as a potential source of chlorides due to the use of magnesium chloride for salting access roads located within and adjacent to the mine plan area."[99] In fact, DEQ has repeatedly stated that East Fork Armells Creek is impaired for not meeting water quality standards and has repeatedly identified the strip-mine as a potential source of this pollution.[100] [98] Letter from Dan Erbs, Montana Department of Environmental Quality, to Har Gloe, US Office of Surface Mining (Oct. 1, 1998). Attachment 58. [99] Affidavit of Emily Hinz (July 22, 2016). Attachment 59. [100] Mont. Dep't of Environmental Quality, Water Quality Standards Attainment Report, East Fork Armells Creek headwaters to mine shop area (2018). Attachment 60. Mont. Dep't of Envtl. 32 | Page MEIC et al. Rosebud Area F DEIS Comments	**5-38 Response:** The available baseline data preceding the development of Areas A, B, C, D and E were inadequate to determine any possible mine impacts associated with those areas from natural variation, due to changes in sampling methodology and updated detection limits since the 1970's. This is discussed in **Section 4.7.3.2** of the EIS. **5-39 Response:** This letter refers to an increase in the TDS of the East Fork Alluvial Aquifer. The mechanism identified for the increase upstream of Colstrip was determined to be the capture and containment of fresh water (as precipitation and snowmelt) in mine ponds rather than discharge from mine spoil water seeping into the alluvial aquifer. As mining progresses and reclamation occurs, the containment of surface waters will be phased out and TDS impacts associated with containment will be eliminated. It should also be noted that the 2018 Water Quality Standards Attainment Record for East Fork Armells Creek headwaters to the mine shop area (Attachment 60 to this letter) indicates that no data analysis could be located to support the information that is quoted in this letter to OSMRE. See also **Comment Response 5-6**. **5-40 Response:** Western Energy no longer uses magnesium chloride for salting access roads due to the runoff of excess salts. Other potential sources for elevated chloride include alluvial inputs from leakage of the power plant's pond and monitored MPDES discharges. See also Comment Response 5-44. The Section 303(d) List includes multiple sources of impairment for East Fork Armells Creek. Coal mining is listed as one of the sources of impairment to lower East Fork Armells Creek (a tributary to the Yellowstone River) in the reach from Colstrip to the mouth. Coal mining is not listed as source of impairment to upper East Fork Armells Creek. (Final 2018 Water Quality Integrated Report and 303(d) List).

Comment/ Code	Document #005-Sierra Club	Response
5-41 (6603) 5-42 (3704)	In prior assessment reports, DEQ wrote: "The affects upon flow from the huge mine pits is unknown, and the mine is continually moving and expanding. Where the mine has not obliterated the channel the stream habitat is not impaired; however, taking into account the mass amount of surrounding land disturbance, the overall habitat is at least moderately impaired. A huge open pit mine cutting through a stream channel is clear evidence of impairment."[101] While DEQ has made obvious efforts to attempt to walk back its prior determinations that the creek is impaired and that mining may be a cause, the water problems continue to multiple. Previously, DEQ determined that the lower portion of East Fork Armells Creek was impaired for salinity (specific conductance and total dissolved solids), nitrate/nitrite, and total nitrogen.[102] DEQ listed coal mining as a potential source of the salinity problems.[103] When DEQ reviewed the stream again in 2017, it again determined that the creek was impaired, but this time for aluminum, iron, nitrate/nitrite, total nitrogen, and phosphorous.[104] Again, DEQ noted that "coal mining" may be a source of the impairment. It is thus quite clear that there is no water quality baseline information to show changes from pre-mine conditions to current conditions. It is well established that agencies cannot rely on incorrect data or assumptions. *NRDC v. U.S. Forest Serv.*, 421 F.3d 797, 811 (9th Cir. 2005). At bottom, NEPA requires agencies to tell the public the truth about the environmental impacts before the agencies make any decisions. Here, DEQ and OSM have to tell the public the truth about the impacts to water from the Rosebud Mine. Since the mine has been operating, pollution has been increasing. Moreover, it is the type of pollution—sulfate, chlorides, and salinity—that one would expect from a strip-mine. The agencies must present this information to the public. On a related note of accurate science, it appears that there is a concerted effort to refrain from calling the Rosebud coal aquifer an aquifer.[105] It is disconcerting that the regulatory authorities tasked with protecting the environment and the public seem so intent on creating a skewed baseline, apparently to minimize the scope of any impacts down the road. In contrast with these statements from DEQ and OSM, the mine applicant, WECO, itself has recognized that the Rosebud Coal is an aquifer: "[T]he Rosebud coal and McKay coal . . . have considerable areal extent and lateral continuity, have local areas of moderate water yields, and *are considered to* Quality, Water Quality Standards Attainment Report East Fork Armells Creek, mine shop to mouth, (2018). Attachment 61. [101] Mont. Dep't of Envtl. Quality, Water Quality Standards Attainment Record, East Fork Armells Creek headwaters to Colstrip (2014) Attachment 62. Mont. Dep't of Envtl. Quality, Water Quality Standards Attainment Record, East Fork Armells Creek Colstrip to mouth (2014) Attachment 63. [102] Mont. Dep't of Envtl. Quality, Water Quality Standards Attainment Record, East Fork Armells Creek Colstrip to mouth (2014). [103] *Id.* [104] Mont. Dep't of Envtl. Quality, Water Quality Standards Attainment Report East Fork Armells Creek, mine shop to mouth (2018). [105] Email from DEQ to OSM (June 20, 2016). Attachment 64. 33 | Page MEIC et al. Rosebud Area F DEIS Comments	**5-40 Response continued:** The Water Quality Standards Report for East Fork Armells Creek from the headwaters to the mine shops (included as Attachment 60) does not cite the mine as the source of impairment for the beneficial use of Aquatic Life in this upper reach. The latest assessment report does not change any impairment listings, but corrects erroneous language about the potential sources. Agriculture is the listed potential source of impairment to the beneficial use of Aquatic Life from the headwaters to the mine shop. The direct and indirect impacts of the mine on East Fork Armells Creek are described in **Sections 4.7.3.2** and **4.7.3.3** in the EIS. See also **Comment Response 5-29**. **5-41 Response:** Coal mining is currently listed as one of the potential sources of impairment to Lower East Fork Armells Creek. See also **Comment Response 5-29**. Upper East Fork Armells Creek (from the mine shops to the mouth) was recently listed as impaired for aluminum, iron, nitrate/nitrite, total nitrogen and phosphorous, but coal mining has not been listed as a source of impairment (2018 Water Quality Integrated Report and 303(d) List). The information contained in the 2014 Assessment Record which attributed the impairment of aquatic life use in East Fork Armells Creek to alteration of streamside vegetative cover caused by surface coal mining was, in fact, incorrect, since mining adjacent East Fork Armells Creek, which began in 1992, actually never got closer than three hundred feet (300') to the stream channel. With respect to biological data, an updated macroinvertebrate survey in 2014 empirically demonstrated that a diverse community of macroinvertebrates, consisting of taxa commonly found in eastern Montana prairie streams, was present in Upper East Fork Armells Creek and that taxa richness was similar to that which was present in the 1970s. 30 years of nitrogen monitoring data shows mining expanded at the Rosebud Mine without any correlating annual increases in nitrate/nitrite in stream samples (which would indicate that mining was the source of nitrite/nitrate exceedances). The data instead show decreasing concentrations of nitrogen. Water quality data have been collected for nearly 40 years and have been incorporated into Appendix B of the EIS. **Sections 5.3.6** (Surface Water) and **5.3.7** (Ground Water) of the EIS describe the cumulative impacts on water quality; these include impacts caused by mining. Water quality data, including the analytical results monitoring well samples, is also included in Appendix B (Hydrology) with the Area F Permit Application (Appendix B of the EIS). **5-42 Response:** The Rosebud coal is an aquifer under MSUMRA as it meets the definition of 82-4-203(5) MCA. While the Rosebud coal is in fact an extensive, water-bearing unit, it predominantly has very low transmissivity. Without the ability to readily conduct water, the Rosebud coal is unable to produce water as an aquifer would in some locations. However, the Rosebud coal is a discontinuous unit with variations in transmissivity. Regions with higher transmissivity are present and do generate moderate water yields. Such water is variable in quality but is less mineralized than waters derived from lower geologic strata.

Comment/ Code	Document #005-Sierra Club	Response
5-42, cont'd	*be significant aquifers in the Colstrip area*."[106] Indeed, DEQ and OSM have long recognized the Rosebud coal aquifer as an aquifer, bearing some of the highest quality water in the area: "Some of the best quality groundwater in the Rosebud Mine area is found in the *Rosebud coal aquifer*."[107] DEQ's prior CHIA for Area B states: "There are four near-surface geologic units that are considered aquifers within or adjacent to the application area of the Area B amendment: alluvium, *Rosebud coal*, McKay coal, and Sub-McKay. . . . The Rosebud and McKay coal aquifers encompass a larger areal extent than the alluvial aquifers and, although characterized by generally low and variable transmissivity *are regionally important sources of water for domestic and stock purposes*." The only class I groundwater identified in the area is in the Rosebud coal aquifer.[108] While DEQ and OSM may not wish to disclose to the public that WECo intends to destroy what may be the largest aquifer with the highest quality water in the area; NEPA however requires the regulatory authorities to reveal this destruction.	
5-43 (3704)		**5-43 Response:** The largest aquifer with the highest quality of water in the area is contained in sandstone units below the McKay Coal. The Rosebud Coal aquifer is only removed within the mined area footprint.
	C. Failure to Analyze Cumulative and Connected Actions.	
5-44 (8502)	As noted, the scope of an EIS must include cumulative and connected actions. Cumulative actions are actions that could result in significant cumulative effects. Connected actions include actions that are interdependent parts of a larger action or depend on a larger action for their justification. 40 C.F.R. § 1508.25(a)(1)-(2). Here, the massive Area B Extension operation is both a connected and cumulative action, which must be fully considered in the EIS. Additionally, the Absaloka Mine is a cumulative action that should also be considered. The DEIS states that mining operations in the Area F expansion will continue for 19 years. The mine expansion is intended to provide coal to Units 3 and 4 of the Colstrip power plant through 2040. It is also clear from the DEIS that in order for the power plant to continue operations through 2040, the mine will also have to expand into the Area B Extension (AM5). DEIS at 25 (figure 3). Accordingly, the Area F and Area B Extension operations are interdependent parts of a larger action (operation of the power plant through 2040) and they depend on the larger action (the power plant) for their justification. Accordingly, the two actions may not be analyzed in piecemeal fashion, but rather must be evaluated in the same environmental impact statement. Further, actions are cumulative if they will result in cumulatively significant impacts. There is little question that the massive expansions in Area F and Area B Extension will have cumulatively significant impacts. Each action will result in additional cumulative impacts to water resources, including the Yellowstone River and groundwater resources throughout the area. This in turn will result in significant stress on the ecology of the area, given that the ecology of the area (including vegetation, aquatic life, and wildlife) all depend on the limited aquatic resources in the area, which the mine is inexorably destroying. Additionally, because the coal from each expansion will be burned at the Colstrip power plant, they will result in significant cumulative impact—the cumulative impacts of burning nearly 200 million tons of coal. This includes cumulative air emissions (like GHGs), and also cumulative water impacts,	**5-44 Response:** Cumulative impact analysis of water resources in Armells Creek, Sarpy Creek and Rosebud Creek watersheds is provided in **Sections 5.3.6, 5.3.7,** and **5.3.8**. The Yellowstone River has not been included in this analysis. Chapter 5 of the EIS describes the cumulative impacts on vegetation (**Section 5.3.9**), fish and wildlife (**Section 5.3.11**) and other resources identified. The cumulative impacts on air and water are described in **Section 5.3** of the EIS. The cumulative impacts of coal combustion at both power plants are described in **Section 5.2.2.5** and are assumed to occur regardless of the source of coal for combustion. The area of cumulative impact analysis for the PAP includes streams that may be affected by changes in flow and/or changes in water quality. This includes all of Armells Creek watershed, and parts of Rosebud Creek and Sarpy Creek watersheds, which may be impacted. There would be no cumulative interaction of groundwater or surface water from Area B Extension (AM5) and Area F as a groundwater divide separates them.

[106] W. Energy Co., Area F permit application, App. B. Attachment 65.
[107] *E.g.*, Mont. Dep't of State Lands & U.S. Office of Surface Mining, Final EIS Western Energy Company's Rosebud Mine Area C, Block 1 (1982). Attachment 66.
[108] W. Energy Co., Area F permit application, App. B. Attachment 67.

34 | Page
MEIC et al. Rosebud Area F DEIS Comments

Comment/ Code	Document #005-Sierra Club	Response
5-44, cont'd	including continued cumulative large water withdrawals from the Yellowstone, continued cumulative pollution impacts from coal waste disposal at the plant, continued cumulative impacts from air pollution deposition, and continued cumulative downstream pollution impacts to the Yellowstone River. The Absaloka Mine is also a cumulative action that must be included in the scope of the analysis for the Area F expansion. The Area F expansion and the Absaloka Mine will both have cumulative impacts on Sarpy Creek. Ground water from coal aquifers are some of the most important sources of water in both creeks and reductions in groundwater availability from both retention ponds and drawdown from strip-mining will reduce the amount of water downstream in each creek, especially during the summer low flow times.[109] **D. Failure to Adequately Analyze Water Impacts.**	**5-44 Response continued:** Loss of groundwater contributions to stream flow due to mine operations and dewatering would be mitigated by reclamation and wetland development (as described in the PAP) in order to reestablish the hydrologic balance and minimize cumulative impacts. Drawdown in areas which are hydraulically connected to the alluvium will cause decreases in groundwater flow to the alluvium. Reductions in flow to the alluvium can only occur if water is present in the alluvium, but saturated portions of alluvium are limited in both thickness and extent. Thus, the relative significance of such depletions will likely be relatively small. There was no evidence of basin wide changes in flow of Armells Creek as measured at USGS Station 06294995 from 1975 to 1996 despite mining adjacent to East Fork Armells Creek and it is unlikely that mining near West Fork Armells Creek will cause changes in the water budget. Any reductions in baseflow to Armells Creek may be locally notable, though on a larger scale, including farther downstream, any affects would be indiscernible from the natural variability of upper ephemeral stream reaches. Any cumulative impacts on project area water quality would occur downstream of the confluence of the East and West Forks of Armells Creek, however, at that distance from the mine, any possible adverse impacts on baseflow water quality would have long-term negligible impacts.
5-45 (6602, 6702)	The DEIS improperly limits its analysis of water quantity impacts to the upper portion of the West Fork Armells Creek watershed and the larger Armells Creek watershed. The DEIS at page 515 acknowledges that the strip-mining process will dewater the alluvium. However, the DEIS does not assess how these impacts will manifest themselves farther down in the watershed. It is clear that groundwater is a critical component to streamflow.[110] "Most water derived in watersheds comes from subsurface sources. . . . Recent peer reviewed research by the leading hydrologic journals has definitively shown that groundwater discharge is a significant component of stream flow generation in many different systems worldwide."[111] This dewatering of the stream will have downstream impacts that must be analyzed. DEQ and OSM did this in 1983, when they determined that mining would reduce flow in the alluvial aquifer by 10 acre feet per year, resulting in a 14 percent reduction in flow in the East Fork Armells Creek/Stocker Creek drainage.[112] Clearly there will be a cumulative impact from strip-mining on stream flow in Armells Creek downstream of the confluence of the East and West Forks. Further, any reduction in flow beyond 10 percent will violate Montana water quality standards and is not permissible. *See Save Our Cabinets v. U.S. Dep't of Agric.*, No. CV-16-53-M-DWM, ___ F. Supp. 3d ___ (D. Mont. May 5, 2017); 33 U.S.C. § 1323(a); ARM 17.30.715(1). This problem is particularly acute because the DEIS admits that after strip-mining dewaters the alluvium and that the discharge to streams will not recover for (vaguely) "many decades." DEIS at 515. On this latter point, it is important that DEQ and OSM provide some actual numbers about how long it will take for stream flow to recover—will it take 100 years? 200 years? What does "many decades" mean? One study has concluded that strip-mining a coal aquifer will result in "significant deterioration of surface water quality on the long term" and that the "deterioration [109] *See, e.g.*, Clancey, Master's Thesis, Fish and Aquatic Invertebrates in Sarpy Creek Montana (1978). Attachment 68. [110] Supplemental Rebuttal Expert Disclosure of Payton Gardner, Ph.D., (2018). Attachment 69. [111] *Id.* [112] Letter from Erbs to Gloe, *supra*; Mont. Dep't of State Lands & U.S. Office of Surface Mining, Final EIS Western Energy Company's Rosebud Mine Area C, Block 1 (1982). Attachment 70. 35 | Page MEIC et al. Rosebud Area F DEIS Comments	**5-45 Response:** Appendix I-B of the PAP includes the applicant's groundwater model report, which indicates that the maximum residual drawdown 50 years after mining concludes would be about 20 feet. Full recovery of pre-mine discharge is likely to take more than "decades" given this. Appendix O of the PAP describes the extent and duration of postmine reductions in alluvial groundwater. Groundwater quantity is addressed in Appendix O, section 3.3.1. In Area F simulated flow from bedrock to the alluvium at 50 years post mining is roughly 10 percent lower than simulated pre-mine flow (PAP, Appendix O). It is estimated that 50 years post-mining, the alluvial groundwater flow in Black Hank Creek and the upper portions of Donley and Robbie Creek will be approximately 5-12 percent lower than pre-mine flow (PAP, Appendix I-B). Eventually, once the emplaced spoil becomes re-saturated, ground water may resume discharging to alluvium along the major drainages. Recharge to the alluvial groundwater system should return to pre-mine conditions as natural surface water flows are reestablished and groundwater levels recover following mining. Detailed information on the timing, extent and duration of drawdown in the alluvium is included in the PAP in Appendices O and I. The Commenter's contention that alleged dewatering of East Fork Armells and Stocker Creeks from mining will violate Montana Water Quality Standards is misguided and incorrect, and the Commenter's reliance on *Save Our Cabinets v. USDA*, (254 F. Supp. 3d 1241, 1250 (D. Mont. 2017) to support such contentions is misplaced. *Save Our Cabinets* involved point source discharges which were subject to nondegradation standards. *See id.* at 1270. *Save Our Cabinets* does not, as the Commenter contends, stand for the proposition that "any reduction in flow beyond 10 percent will violate Montana water quality standards." ARM 17.30.715(1)(a) instead exempts "activities that would increase or decrease . . . the 7-day, 10-year flow by less than 10%" as insignificant changes in water quality which are not required to undergo nondegradation review. Effects on groundwater from mining, however, are the result of non-point source discharges which are not subject to nondegradation review. *See* Sections 75-5-317(2)(b) and 75-5-103(29), MCA. It is not possible to provide an exact time estimate for recovery of the ground water table and the return of ground water discharge to streams because Western Energy's ground water model's maximum time step was 50 years post-mining and longer-term predictions are not reliable. Full recovery of the ground water table would occur more than 50 years after mining.

Comment/ Code	Document #005-Sierra Club	Response
5-45, cont'd	will last for centuries."[113] Indeed, even WECo's retained expert, Michael Nicklin, Ph.D., has admitted that recover of water levels will take centuries, not decades: "Non-alluvial wells will take a long period of time to recover, probably on the order of hundreds of years."[114] Again, NEPA requires agencies to tell the environmental truth to the public and not mask it in vague language.	**5-45 Response continued:** Nicklin testified in August 2017 that non-alluvial wells in the vicinity of AM4 "will take a long period of time to recover, probably on the order of hundreds of years." Alluvial groundwater levels, on the other hand, recover quickly after mining moves away from the stream, as observed in existing Rosebud Mine monitoring data. Additional discussion will be added to Section 4.7 and 4.8 on ground water table and stream flow recovery. The slow recovery of shallow strata, non-alluvial wells is not likely to have a significant impact because there is limited use of such wells as water sources. Water quantity (yield) and quality are better for wells tapping the Sub-McKay.
5-46 (6602)	Similarly, it is unclear from the DEIS that surface water resources will ever be restored, at least not on any human time scale. DEQ may not approve the Area F expansion unless the coal company, Western Energy Company, can affirmatively demonstrate that the land it intends to strip mine can be reclaimed. ARM 17.24.405(6)(a). The DEIS is not consistent on this point, but it analysis raises significant doubts that reclamation is possible. For example, the DEIS equivocates significantly about whether the intermittent to perennial streams in the project area that receive baseflow from the Rosebud coal aquifer will ever be reclaimed: "Although stream flows may be restored to conditions similar to pre-mine flows, stream flow from the upstream areas of the tributaries may be reduced or may not flow through the reclaimed area because the vertical percolation rate in the spoil would be greater than in the overburden." DEIS at 515. The second half of the sentence tends to contradict the first half, i.e., stream flows "may be restored" but at the same time "stream flow . . . may not flow through the reclaimed area." Then the DEIS states bluntly that "where fairly flat, there may be no flow after reclamation." DEIS at 515. This apparent contradiction may have resulted from ongoing efforts in editing to minimize or understate the impacts to water quantity from strip mining. Indeed, the DEIS originally identified the following irreversible commitment of resources: "the loss of surface flow in Area F stream tributaries due to infiltration into the more permeable spoils."[115] This language was removed in order to avoid suggesting that the mining operation would violate the requirement of SMCRA and MSUMRA that the mine must be designed to prevent material damage to the hydrologic balance.[116] It was edited to the much more moderate and vague statement in the DEIS that "reduced stream flow in the reclaimed stream channels because of the permeability of the spoil material is higher than the undisturbed native material."[117] Notably, this edit was not based on any empirical analysis, but rather a legal conclusion—i.e., that to be permitted, the mine must be designed to prevent material damage. But that puts the cart before the horse. Both SMCRA and MSUMRA and NEPA require that legal determinations be based on sound evidence, not that conclusory legal conclusions substitute for lack of scientific evidence. It also appears that there was a concerted effort to minimize discussion of the impacts to wetlands in an effort to "provide language for both sides of the [113] William Woessner, et al., *The Impacts of Coal Strip Mining on the Hydrologic System of the Northern Great Plains: Case Study of Potential Impact on the Northern Cheyenne Reservation*, 43 Journal of Hydrology 445 (1979) Attachment 71. [114] Intervenor-Respondents' Expert Witness Disclosure of Michael Nicklin (Aug. 30, 2017). Attachment 72. [115] *See* Email from DEQ to OSM (June 20, 2016). Attachment 73. [116] *Id.* [117] *Id.* 36 | Page MEIC et al. Rosebud Area F DEIS Comments	**5-46 Response:** Section 4.8 of the EIS details the recovery of streams after mining is completed. Where springs and alluvium source water to intermittent and perennial stream reaches, groundwater contributions to streamflow would be reduced during mining. Once spoils were to re-saturate, groundwater contributions to stream flow could return to pre-mine flows given sufficient time. However, because of the hydraulic properties of the spoils (compared to coal or overburden), infiltration and patterns in groundwater recharge and flow to stream reaches would shift. Specific *locations* of ground water discharge and perennial or intermittent flow in creeks would be different than pre-mine, but they would exist. This would result in downstream restoration of streams and streamflow, though water may not be flowing in stream reaches in the reclaimed area. The drainages in West Fork Armells Creek function as hydraulic sinks to groundwater. (See EIS Appendix B, PAP-Appendix I). Water that infiltrates to groundwater is a reduction in surface water. Spoil has a higher permeability than undisturbed strata, thus greater infiltration will cause greater reductions in surface flow. The language in the EIS was modified for clarity.

Comment/ Code	Document #005-Sierra Club	Response
5-47 (7003) 5-48 (6603) 5-49 (6706, 6802)	issues," which apparently was intended to mean that any suggestions that impacts would be permanent would have to be removed. Elsewhere, the DEIS, at 526, recognizes that the Rosebud coal aquifer "is the primary contributor of ground water" to wetlands in intermittent and perennial drainages in the West Fork Armells Creek drainage. Further, removing the coal, would cause the groundwater to flow away from the creeks and wetlands and into the spoils. DEIS at 526. Thus, it appears that mining is going to dewater the streams. On the other hand, there is no discussion or analysis of any measures that WECo may take to restore this lost stream flow. All the DEIS states is that after "many decades" (or centuries[118]) when ground water levels naturally recover groundwater discharges to surface water may begin, though potentially at different locations. DEIS at 515. Worse, the water that may return to the streams will likely be bad and will violate water quality standards: "TDS, sulfate, alkalinity, calcium, sodium, nitrate+nitrite, magnesium, and manganese concentrations in streams below the spoil may increase *and exceed* nitrate+nitrite and total nitrogen standards, and recommended limits for the other parameters for livestock, other ruminants, and aquatic life when and where ground water discharge is the major or only source of water to streams . . . . cattle and wildlife can adapt to higher TDS concentrations, but there may be chronic adverse health effects." DEIS at 519. These conditions may not change until more than "one or two pore volumes of water" pass through the spoils, DEIS at 533, a process which will likely take many centuries or even millennia.[119] The only mitigation measure identified for this long-term destruction of water resources in the project area is that WECo "would be required to replace any water supply" from sub-McKay sandstones. DEIS at 526, 532. DEQ, however, has flatly admitted under oath that it does not believe that it had legal authority to replace flowing streams with pumped groundwater.[120] WECo's own hydrology consultant has identified this same obstacle to reclaiming lost stream flow.[121] Indeed, OSM recognized the same dilemma in its 2015 environmental assessment for the AM3 expansion of the Bull Mountains Mine. Notably, neither WECo, nor DEQ, nor OSM has presented any evidence that such replacement water is legally and physically available.[122] Moreover, even if use of such replacement water were legally and physically possible, it is simply not credible that WECo is going to replace any water supplies over the course of multiple centuries and potentially millennia. There is no indication that [118] William Woessner, et al., *The Impacts of Coal Strip Mining on the Hydrologic System of the Northern Great Plains: Case Study of Potential Impact on the Northern Cheyenne Reservation*, 43 Journal of Hydrology 445 (1979). Attachment 74. Intervenor-Respondents' Expert Witness Disclosure of Michael Nicklin (Aug. 30, 2017). Attachment 75. [119] *Id.* [120] Deposition of Martin Van Oort (May 5, 2017). Attachment 76. [121] Nicklin Earth & Water, Groundwater Model: Bull Mountains Mine No. 1 (March 2013). Attachment 77. [122] Notably, unlike the Rosebud coal aquifer, the sub-McKay sandstones identified for replacement water supplies are not continuous, but instead likely fluvial channels. Romeo Flores et al., *Coal Deposition in Fluvial Paleoenvironments of the Paleocene Tongue River Member of the Fort Union Formation*, 31 Soc'y of Economic Paleontologists and Minerologists 169 (1981). Attachment 78. 37 | Page MEIC et al. Rosebud Area F DEIS Comments	**5-47 Response:** Flow toward the spoils would occur during mining and be restored to the creeks and wetlands postmining. Western Energy has developed a wetland mitigation plan to accommodate for the loss of wetland functions and values from the proposed project. The plans for Wetland Mitigation are discussed in **Section 2.4.8.5** of the EIS. **5-48 Response:** Western Energy is required to provide replacement water in the event that waters become unsuitable for their beneficial uses. **Section 4.9.3.3** of the EIS describes Replacement Water Sources. More fundamentally, under MSUMRA's material damage standard, material damage to the hydrologic balance is assessed at the level of the hydrologic unit, and violations of water quality standards or impacts to beneficial uses outside the permit area are prohibited. Sections 82-4-227(3), 82-4-203(25) and (32), MCA; ARM 17.24.301(31). **5-49 Response:** ARM 17.24.304 requires that an application for an underground coal mining permit include (among other things), "a description of alternative water supplies, not to be disturbed by mining, that could be developed to replace water supplies diminished or otherwise adversely impacted in quality or quantity by mining activities so as not to be suitable for the approved postmining land uses. . . "ARM 17.24.304(1)(f)(iii) (emphasis supplied). The Montana DNRC (and not DEQ) is the state agency charged with issuing new water use permits and determining, inter alia, whether water is "legally available." See Section 85-2-311, MCA. *Confederated Salish & Kootenai Tribes v. Clinch*, 2007 MT 63, P35, 336 Mont. 302, 318 (2007); *see also Confederated Salish & Kootenai Tribes v. Clinch*, 1999 MT 342, P14-P15, 297 Mont. 448, 453-454 (1999). In the context of the federal Surface Mining Control and Reclamation Act of 1977 (SMCRA, 30 U.S.C. § 1201 et seq.), the federal (Department of the Interior) Interior Board of Land Use Appeals (IBLUA) has explained that OSMRE, when issuing a permit under SMCRA, does not have the authority to determine water rights. As that Board explained, "[t]o hold otherwise would be to require OSMRE to become the adjudicator of water rights claims, a role which it is neither authorized nor qualified to assume." 123 IBLA 195; 1992 IBLA LEXIS 55, 123 IBLA 195; 1992 IBLA LEXIS 55 at [2]. Like OSMRE, DEQ is neither authorized nor qualified to determine water rights within the context of MSUMRA, and MSUMRA does not require DEQ to determine the "legally availability" of replacement water sources. Accordingly, by its plain language, ARM 17.24.304(1)(f)(iii) does not (and as a matter of law, could not) require DEQ to make a determination as to legal availability of replacement water sources. ARM 17.24.304(1)(f)(iii) instead requires DEQ to identify sources which "could" be used for replacement purposes. "Could" is defined in the dictionary alternately as simple past tense of "can" or as an auxiliary verb to express possibility, conditional possibility or ability. The latter definition applies with respect to ARM 17.24.304(1)(f)(iii), which addresses a future contingent event in terms of conditional probability. This is what the law requires.

Comment/ Code	Document #005-Sierra Club	Response
5-50 (6602, 6603)	WECo has made any financial assurances of such future reclamation. Indeed, it seems highly likely that WECo is going to go bankrupt in the next year if not sooner. Not only does this fail to affirmatively demonstrate that reclamation "can be accomplished," ARM 17.24.405(6)(c), it affirmatively demonstrates the opposite: that reclamation of streams and wetlands *cannot* be accomplished, which precludes DEQ or OSM from issuing an approval of this proposal. *Id.*; *see also* 30 C.F.R. § 746.13 - .14. This latter point raises additional problems. If the strip-mine expansion will violate water quality standards by dewatering intermittent and perennial creeks, OSM may not approve the expansion. 33 U.S.C. § 1323(a); *Save Our Cabinets v. United States Dep't of Agric.*, 254 F. Supp. 3d 1241, 1253 (D. Mont. 2017), and *Cent. Sierra Envtl. Res. Ctr. v. Stanislaus Nat'l Forest*, No. 117CV00441LJOSAB, 2018 WL 746381 (E.D. Cal. Feb. 7, 2018). The DEIS acknowledges that intermittent and perennial portions of multiple tributaries of West Fork Armells Creek (Trail, McClure, Robbie, and Donley Creeks) will be eliminated. Removing the water from a creek necessarily prevents any use of the creek, violating water quality standards. *PUD No. 1 of Jefferson Cty. v. Washington Dep't of Ecology*, 511 U.S. 700, 70 (1994). There is no question that complete dewatering of these intermittent to perennial creeks will violate nondegradation standards. *See* ARM 17.30.715(1) (reduction of just ten percent flow may result in violation nondegradation standard). It is also possible (though the DEIS does not address the issue) that dewatering of these streams will result in significant reduction in flows farther downstream in West Fork Armells Creek and Armells Creek. The DEIS further acknowledges that additional water quality violations will result from the increased pollution when the streams eventually regain discharges (albeit polluted discharges) from the spoils. The expected increases nitrate+nitrite will certainly contribute to the downstream impairment of Armells Creek for such pollutants. Additionally, the reduction of fresh water due to settling ponds (which concentrate pollutants, as the DEIS admits) and by removal of discharges of Class I water to the alluvium of these creeks from the Rosebud coal aquifer will additionally tend to cause pollution concentrations in the watershed to increase, worsening the water quality impairments downstream.[123] The mine expansion's expected violation of water quality standards also precludes DEQ from issuing a certificate under 33 U.S.C. § 1341(a) that the mine expansion will comply with water quality standards. *See Alabama Rivers All. v. F.E.R.C.*, 325 F.3d 290 (D.C. Cir. 2003) (change in flow triggers section 401 certification requirement).	**5-50 Response:** In the event that intermittent and perennial stream reaches received a reduction in water supply due to dewatering during mine operations, stock ponds would be constructed in the project area during reclamation. **Section 4.9.3.3** of the EIS covers replacement water sources. The Commenter incorrectly equates the effects on a "portion" of a stream with the elimination of existing uses from an entire stream reach. The Commenter also disregards that MSUMRA prohibits material damage (such as the elimination of an existing use at the level of a hydrologic unit) outside the permit area. Sections 82-4-227(3), 82-4-203(25) and (32), MCA; ARM 17.24.301(31). And, as noted in Comment Response 5-47, the Commenter mistakenly asks OSM and DEQ to apply a "point source" nondegradation standard (alleged reductions in streamflow by 10%) to a nonpoint source activity. The water quality in the backfilled spoils would be poor quality for a long time after mining. The quality of spoil water quality in Areas A, B, and C indicate it will may take more than 40 years postmining for waters to return to equilibrium. Discussion of this irreversible commitment of resources is addressed in Section 1.3.5 in the EIS. With respect to the Commenter's claims that increases in nitrite+nitrate are "expected", see **Comment Response 5-41**.
5-51 (6610)	Similarly, the impacts to water quality in the receiving streams and in the lower portions of the watershed must be assessed prior to DEQ's issuance of a discharge permit for the mine expansion. The agencies assert that issuance of the discharge permit will occur subsequent to the approval of the mine expansion. This is impermissible piecemealing of the project. As noted above, agencies may not segment their NEPA analyses. 40 C.F.R. §§ 1508.25, 27(b)(7). Here, it is clear that the mine expansion cannot occur without a discharge permit. Further, no there is [123] Expert Disclosure of Payton Gardner, Ph.D. (2017); Supplemental Rebuttal Expert Disclosure of Payton Gardner, Ph.D., (2018); D.J. Dollhopf et al., Selective Placement of Strip Mine Overburden in Montana (1981). Attachment 79. 38 | Page MEIC et al. Rosebud Area F DEIS Comments	The Section 401 certification is issued by a state when a Federal permit is required for operator discharge into any navigable waters. Since it is not required for the proposed action, no certification is necessary. **5-51 Response:** NEPA does not require an agency evaluate the likelihood that the NPDES permit will issue. *Confederated Tribes of the Grand Ronde Cmty. v. Jewell*, 75 F. Supp. 3d 387, 424 (D.C. Cir. 2014). Nor does NEPA "demand the presence of a fully developed plan that will mitigate environmental harm before an agency can act." *Id.* See **Comment Response 5-44** regarding the extent of impacts to the watershed.

Comment/ Code	Document #005-Sierra Club	Response
5-51 (Cont.)	reason to issue a discharge permit without the mine approval. This situation is no different from the logging operation and the road to the logging operation, which the Ninth Circuit said could not be segmented in *Thomas v. Peterson*, 753 F.2d 754 (9th Cir. 1985). In any event, DEQ's decision not to issue a discharge permit, along with its decision on the mine expansion, prevents the agency from reaching any rational conclusion about whether the mine expansion will violate water quality standards.	
5-52 (6601)	The DEIS does not address the most recent peer-reviewed science regarding sulfate levels that will be harmful to livestock. The most recent science shows that concentrations greater than 1000 mg/L are harmful to livestock.[124]	**5-52 Response:** The reference provided indicates that "Cattle offered water containing 2,500 mg SO_4/L showed no changes in feed or water consumption. The animals consumed an average of 3.9 kg of hay, 3.1 kg concentrate, and 33.1 kg water per day, suggesting this level as a safe tolerable limit."
5-53 (8507, 8508)	**E. Failure to Analyze Cumulative Effects on Water Resources.** The DEIS's assessment of cumulative effects to water resources does not satisfy NEPA. The entire analysis is only five pages in length and consists of little more than sweeping generalizations that the past and future actions at the mine and power plants will have "similar impacts" and will lead to "cumulative impacts to surface water hydrology that would range from minor to major." DEIS at 687. Regarding groundwater, the DEIS also contains very broad and very general statements that impacts of the various areas of the Rosebud Mine (and Big Sky Mine) would have none to minor impacts on water quality and quantity. DEIS at 688. This is plainly not enough. As multiple OSM scientists noted in reviewing drafts of the DEIS, the cumulative impacts analysis largely ignores a huge historical dataset of information about groundwater and surface water quality and quantity at the Rosebud Mine: "At a minimum, the available water monitoring datasets for the other areas of the Rosebud Mine (Areas A, B, C etc.) need to be analyzed along with the Area F data to determine cumulative impacts. I don't know what our story would be if we avoided this and someone were to challenge us on it given that a historic dataset exists, some analysis is no doubt already done in the CHIA, PHC, and other documents, and there isn't significant costs (drilling wells, etc.) associated with obtaining this data. I've never seen an EA or EIS released where we didn't at least look at other sections of a mine to determine cumulative impacts."[125] Another OSM scientist noted: "The cumulative impacts discussion throughout Ch. 3 does not address all the actions presented in Section 3.4. In general the cumulative impacts discussion needs to be expanded throughout to comprehensively address all cumulative impacts."[126] Further, there is no basis, without an actual assessment, to support the conclusion that the cumulative impacts to water quality and quantity will be none to minor. The DEIS notes that groundwater contribution from the Rosebud coal is a significant source of stream flow in the basin. This accords with leading science on the issue.[127] Moreover, the DEIS also acknowledges that the mine expansion will [124] M.F. Raisbeck, et al. "Water Quality for Wyoming Livestock & Wildlife" (2008). Attachment 142. [125] Email from OSM to DEQ (Apr. 20, 2016). Attachment 80. [126] Emails from OSM to DEQ (June 15, 2016). Attachment 81. [127] Expert Disclosure of Payton Gardner, Ph.D. (2017); Supplemental Rebuttal Expert Disclosure of Payton Gardner, Ph.D., (2018). 39 | Page MEIC et al. Rosebud Area F DEIS Comments	**5-53 Response:** The DEIS's assessment is written to comply with 40 C.F.R. 1502.2, "Environmental impact statements shall be kept concise and shall be no longer than absolutely necessary to comply with NEPA." Cumulative effects to surface water resources are described in Section 5.3.6 of the EIS. Cumulative impacts to water quality and quantity were not described as being none to minor. The analysis used the historical dataset for the Rosebud Mine. A portion of Area C drains to the West Fork Armells Creek and then to the Armells Creek drainages. The remainder of the mine drains to the East Fork Armells Creek and Rosebud Creek drainages. Monitoring data for West Fork Armells creek does not include a large set of historical data. However, the Groundwater Model incorporates other mine areas and historical datasets aided model calibration.

Comment/ Code	Document #005-Sierra Club	Response
5-53, cont'd	contribute a host of pollutants to a watershed that DEQ has already determined to be impaired due to excessive pollution from the other cumulative sources of pollution in the watershed. It is not at all apparent how adding more pollution to an already impaired system will result in anything less than major impacts, especially given that the impacts to the watershed from the mining operation will likely continue for centuries or millennia.[128] It is also clear that DEQ and OSM can conduct a detailed, quantitative analysis of the water quantity and water quality impacts downstream from mining, because the agencies did this for the Area B expansion of the Big Sky Mine.[129] Of course, that analysis determined that there would be noticeable impacts to water quality and water quantity far downstream from the mining operation. Accordingly, the agencies' decision not to include any quantitative analysis—even though the information for such an analysis was readily available—is inconsistent with NEPA. As the Ninth Circuit has explained: "To 'consider' cumulative effects, some quantified or detailed information is required. Without such information, neither the courts nor the public, in reviewing the [agency's] decisions, can be assured that the [agency' provided the hard look that it is required to provide." *Neighbors of Cuddy Mountain v. U.S. Forest Serv.*, 137 F.3d 1372, 1379–80 (9th Cir. 1998).	**5-53 Response continued:** For a detailed quantitative analysis on the water quality and quantity downstream, please refer to the PAP (EIS, Appendix B); the groundwater modeling report (Appendix I-B) and the PHC (Appendix O) describe the long-term impacts to alluvial water quantity and quality.
5-54 (6703, 8508)	In addition to the foregoing inadequacy, the cumulative impacts analysis both contains incorrect information and omits other critical information. Regarding the former, the DEIS discounts cumulative impacts from the Colstrip power-plant's leaking ash ponds on the basis that the plant uses a "closed-loop system." DEIS at 685. Yet, elsewhere the DEIS acknowledges that "seepage from the ponds has occurred, resulting in measurable impacts on groundwater beneath the plant site and on nearby surface water in East Fork Armells Creek. DEIS at 521. Even though DEQ in its assessment of East Fork Armells Creek refuses to acknowledge that the impairment of the creek is due in part to the power-plant, it does at least note that the stream is impaired for nutrients and metals.[130] There is clearly a problem here related to the cumulative impacts of the massive strip-mining and coal burning energy complex in Colstrip. The agencies cannot simply ignore this problem by asserting, incorrectly, that the power plant does not contribute pollution to the watershed. Furthermore, given that the impacts from the mining operation are going to continue to play out over hundreds or thousands of years (though the benefits of the operation will be exhausted in ten years), the agencies must consider the cumulative effects that will result from the worsening crisis of climate change	**5-54 Response:** While a closed loop system, leakage has occurred as is discussed in the EIS.
5-55 (8505)		**5-55 Response:** The effects associated with climate change are described in the EIS in **Section 4.4**.

[128128] William Woessner, et al., *The Impacts of Coal Strip Mining on the Hydrologic System of the Northern Great Plains: Case Study of Potential Impact on the Northern Cheyenne Reservation*, 43 Journal of Hydrology 445 (1979); Intervenor-Respondents' Expert Witness Disclosure of Michael Nicklin (Aug. 30, 2017).

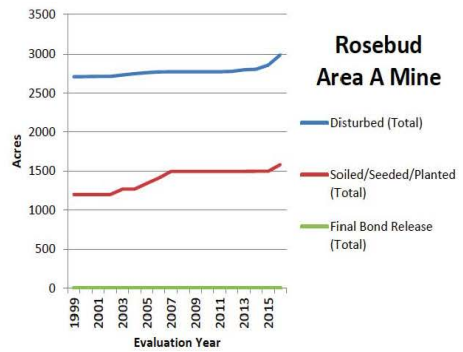
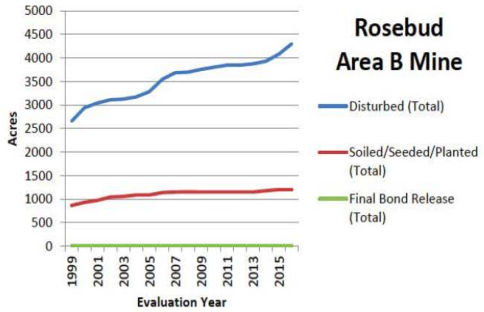
[129] US Office of Surface Mining, Montana Department of State Lands, Final Environmental Impact Statement Peabody Big Sky Mine—Area B, Rosebud County, Montana (1988); Attachment 82.Montana Dep't of State Lands, Written Findings Big Sky Mine, Lee Coulee, Area B (1988). Attachment 83.

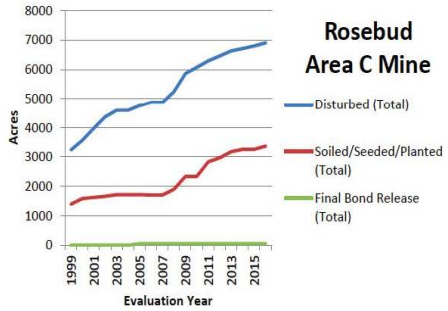
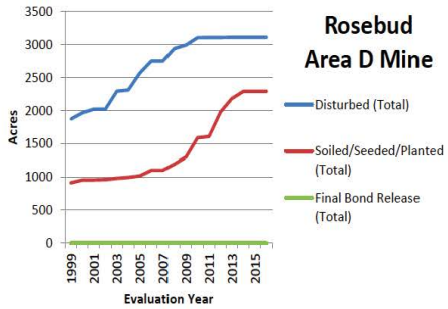
[130] Mont. Dep't of Envtl. Quality, Water Quality Standards Attainment Report East Fork Armells Creek, mine shop to mouth (2018). Attachment 84.

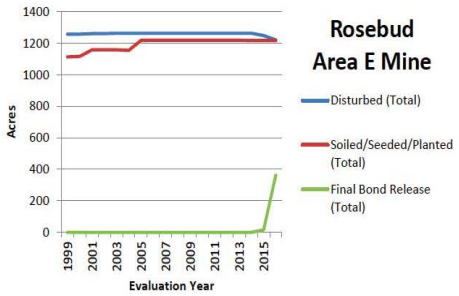
Comment/ Code	Document #005-Sierra Club	Response
5-55, cont'd 5-56 (7102) 5-57 (6602, 6702) 5-58 (1202) 5-58, cont'd	(which the mine and power plant certainly contribute to, as the DEIS acknowledges (but minimizes)). It is predicted that climate change will result in significant water stress in the summer months, due to warmer temperatures and earlier spring runoff.[131] Moreover, there is no assessment of aquatic health and the impacts from mining. The evidence shows that East Fork Armells Creek is in poor health and that this may well be a result of the impacts to water quality and water quantity from coal strip-mining and the power plant.[132] Compared to the East Fork of Sarpy Creek, the East Fork of Armells Creek has a notably different community of aquatic life and has failed aquatic life metrics, when East Fork Sarpy's Creek has not. It seems inescapable that continued large scale strip-mining in the watershed will only worsen the already unsupportable situation. The Clean Water Act, SMCRA, and MSUMRA prohibit DEQ or OSM from approving the proposed strip-mine expansion in these circumstances. In summary, the DEIS fails to adequately analyze and disclose impacts to water quantity and water quantity, as required by NEPA. The attached expert report of Dr. Payton Gardner, who holds a Ph.D. in geophysics, explains in detail that the DEIS, among other errors, (1) fails to adequately examine impacts to intermittent creeks, which will not be capable of reclaiming after mining is complete; (2) analyzes an impact area that is unrealistically constrained; and (3) fails to adequately examine impacts to the Yellowstone River.[133] **IV. WESTMORELAND FAILED TO COMPLY WITH SMCRA AND OSM VIOLATED NEPA BY FAILING TO DISCLOSE ONGOING RECLAMATION ISSUES AT THE MINE.** We are further concerned over whether compliance with the Surface Mining Control and Reclamation Act ("SMCRA") is assured during review of the DEIS. The Department of the Interior has a duty to ensure that mining authorized under a mining plan is compliant with SMCRA. While OSM usually defers to state permitting processes, regardless of the permitting process, where there is evidence of SMCRA violations, OSM may not recommend approval of the proposal, and similarly, Department of Interior may not approve the plan. *See* 30 U.S.C. § 1273(c). Here, we have serious concerns whether Westmoreland is complying with its reclamation requirements at Rosebud Mine, as required by Westmoreland's mining plan. In that case, if reclamation is not indeed occurring, then OSM has the obligation to not recommend approval of the proposal of additional mining within Area F. [131] Montana Instit. for Ecosystems, 2017 Montana Climate Assessment; US Global Change Research Program, Climate Science Special Report (2017). Attachment 85. [132] Sean Sullivan & Wease Bollman, A Re-evaluation of 2014 Biological Data from East Fork Armells Creek (2017). Attachment 86. Expert Disclosure of Sean Sullivan (2017). Attachment 87. Supplemental Rebuttal Expert Disclosure of Sean Sullivan (2018). Attachment 88. [133] W. Payton Gardner, Expert Report on the Rosebud Area F Expansion DEIS (2018). This expert report will be separately submitted. 41 | Page MEIC et al. Rosebud Area F DEIS Comments	**5-56 Response:** Possible cumulative impacts on fish and wildlife are listed in **Section 5.3.11** in the EIS. Sarpy Creek is on the current MT 303(d) list (DEQ 2016c) as impaired for aquatic life; grazing and non-irrigated crop production identified as probable sources. It is likely that this influences aquatic life in the creek. **5-57 Response:** Intermittent stream reaches adjacent to mining are anticipated to receive reduced contributions from baseflow until groundwater levels recover. Postmining discharge from spoil to streams may also result in changes in water quality compared to pre-mining. The EIS discusses the long-term impacts to intermittent creeks in **Section 4.7.3.2**. It is possible post-mining, the location of perennial or intermittent flow in the creeks may change due to the change in water source (from Rosebud Coal to spoil). **5-58 Response:** A recent June 6, 2018 letter from OSMRE responded to an April 2, 2018 WildEarth Guardians (WEG) complaint alleging that Rosebud Mine and other Montana coal mines were failing to meet their reclamation obligations based upon what WEG alleged to be a failure to conduct contemporaneous reclamation and achieve final bond release. DEQ, in a letter to OSMRE dated April 30, 2018 rejected the allegations in WEG's complaint, and OSMRE's June 6, 2018 response to WEG concurred with DEQ and likewise rejected WEG's allegations. As OSMRE's June 6 letter in pertinent part explained: (a) The applicable statutory and regulatory framework does not contemplate instant reclamation or reclamation on an acre-by-acre basis as surface mining proceeds, but instead contemplates that reclamation is supposed to occur "as contemporaneous as practicable." OSMRE Response at 6-7, citing *WildEarth Guardians v. Salazar*, 880 F. Supp. 2d 77, 91, n. 10 (D.D.C. 2012); see also Sections 82-4-231, 82-4-234 and 82-4-336(2), MCA; ARM 17.24.115; (b) An operator's success at contemporaneous reclamation is primarily measured by the operator's compliance with its permit and reclamation plan, which is developed under the applicable approved regulatory program and not by the status of bond release. OSMRE Response at 7; (c) Under MSUMRA, whether contemporaneous reclamation is occurring is primarily measured by the timeliness of the operator's actions in accordance with permit terms and commitments, including those made in the operator's approved reclamation plan. OSMRE Response at 11, and; (d) Based on available information, there is no reason to believe that, as a factual matter, a violation of contemporaneous reclamation requirements for coal mining operations in Montana, including the Rosebud Mine, is occurring. OSMRE Response at 12.

Comment/ Code	Document #005-Sierra Club	Response
	A. OSM Failed to Adequately Disclose and Analyze the Mine's Failure to Meet Contemporaneous Reclamation Requirements.	
5-58, cont'd	Mining plans may not be approved, nor may OSM recommend approval, without first demonstrating that a mining operation will comply with SMCRA. 30 U.S.C. § 207(c); *see also* 30 C.F.R. § 740.5(a) (referring to Mineral Leasing Act "operation and reclamation plan" in defining "mining plan"). As applied to the Rosebud Area F DEIS, the failure to ensure contemporaneous reclamation, or to meet other SMCRA obligations in relation to mining at Rosebud, violates SMCRA, which obstructs OSM from recommending approval.	
5-58, cont'd	In determining whether to approve, disapprove, or conditionally approve a mining plan, the Secretary relies upon a recommendation from OSM that must be based upon, at a minimum: ▪ Compliance with the NEPA, 42 U.S.C. § 4321, *et seq.*; ▪ Compliance with other federal laws and regulations besides SMCRA; ▪ The findings and recommendations of other federal agencies and the public; ▪ The findings and recommendations of the state permitting agency; ▪ The SMCRA permit application package submitted by the company; and ▪ Any findings and recommendations made by OSMRE with regards to the mining of coal on federal lands.	
5-58, cont'd	In reviewing a mining operation proposal, OSM must consider SMCRA requirements, which includes a plan for how the mining operation will reclaim its land, as required by 30 C.F.R. § 810, *et seq*. *See, e.g.*, 30 C.F.R. § 780.18(a) (requiring that applications contain plans showing how operators will comply with performance standards). Section 508 requires operators, for example, to restore agricultural productivity to the land, restore pre-mining hydrologic conditions, and eliminate highwalls, among other things.	
5-58, cont'd	In Montana, the state's cooperative expressly states that OSM is responsible for "[r]eviewing the appropriate portions of the PAP [permit application package] for compliance with the non-delegable responsibilities of the Secretary pursuant to SMCRA." 30 C.F.R. § 926.30, Art. VI(B)(2)(a)(2). Thus, under the state's agreement, OSM is charged with reviewing permit application packages to assess compliance with non-delegable authorities under SMCRA, which includes the review and approval of mining plans. The agreement also reserves the right of the state "to amend or rescind any requirements of [a] permit to conform with any terms or conditions imposed by the Secretary in the approval of a mining plan." 30 C.F.R. § 926.30, Article VI(C)(3).	
5-58, cont'd	Where a mining plan fails to adequately ensure things like contemporaneous reclamation, the Secretary needs to either reject the mining plan, or approve it with modifications to ensure compliance with SMCRA. 30 C.F.R. § 816.100.	
	42 | Page MEIC et al. Rosebud Area F DEIS Comments	

Comment/ Code	Document #005-Sierra Club	Response
5-58, cont'd	Under SMCRA, reclamation of surface mining operations must proceed "as contemporaneously as practicable" with mining. 30 C.F.R. § 817.100. While SMCRA does not define "as contemporaneously as practicable," historically, OSM has defined contemporaneous reclamation to mean a 1-to-1 ratio of mined lands to reclaimed lands. Further, OSM's oversight guidance (REG-8) requires analysis of "reclamation success as measured by bond release." As such, performance bond for permit areas are the principal means by which OSM enforces the statute's reclamation mandate. 30 U.S.C. § 1259(a). Here, correspondence from OSM indicated awareness and concern that contemporaneous reclamation had not been in-fact occurring at Rosebud, stating:	
5-58, cont'd	> [O]ver time not much of the defined reclamation process actually appears to have taken place in any of the initial areas of A, B, or C. These pits all remain open with little evidence in the backfilled spoil that significant amounts of grading has taken place, nor can I see evidence that any seeding has been done to the extent it is successful and visible from photographs. There are vast areas in all of the open pits where the dragline arcs remain very prominent.	
5-58, cont'd	> My concern is that what is proposed in Area F will again undergo the extremely slow reclamation process I see exists now at this mining operation. Granted there is blending from the various pits, but miles of open pits w/ little evidence of focused reclamation disturbs me. I'd like to see this new area begin with a serious attempt at more contemporaneous reclamation.[134]	
5-58, cont'd	Westmoreland has "little evidence of focused reclamation," so much so that OSM's mining engineer warns that she would "like to see [Area F] begin with a serious attempt at more contemporaneous reclamation."[135] Here, where evidence is obvious as to Westmoreland's lackluster attempts at reclamation, OSM is required to ensure compliance with SMCRA, and the Secretary is obligated to reject the plan, or approve it with modifications. What further concerns us is the report filed in 2016 that OSM had visited Area C and D of Rosebud Mine and determined that "WECo and the MT DEQ take PMT very seriously."[136] This report further lauds Rosebud's Phase IV reclamation for Area E, of 347 acres, without the context that the mine is 25,455 acres and 347 reclaimed acres actually does not mean much.[137] Based on OSM's 2016 site visit, and the email from OSM, it would appear that OSM is aware that Westmoreland is not meeting its reclamation requirements, but attempting to divert attention from the "miles of open pits."[138] [134] Email from Karen Jass to Nicole Bauman (July 26, 2016). Attachment 89. [135] Id. [136] *Id.* at 12 [137] Id. [138] *Id.* 43 | Page MEIC et al. Rosebud Area F DEIS Comments	

Comment/ Code	Document #005-Sierra Club	Response
5-58, cont'd	Our concerns are bolstered by the fact that there has been absolutely no final bond release for any acres of Rosebud Area A, Area B, Area C, and Area D, and only nominal final bond release at Area E. OSM's own oversight reports confirm this. Below are the charts from the agency's end-of-year 2016 report on reclamation progress in Montana:   44 | Page MEIC et al. Rosebud Area F DEIS Comments	**5-58 Response continued**: All currently permitted areas of the Rosebud Mine are fully bonded for reclamation. MSUMRA includes requirements for contemporaneous reclamation in ARM 17.24.501(6): "Backfilling and grading must be kept current with mining operations." To be considered current, backfilling and grading must meet the requirements outlined in ARM 17.24.501(6), including maintaining the required limits on the number of spoil ridges, completing backfilling and grading within two years of coal removal, and meeting the approved post-mine topography. Please see **Table 5** in Chapter 2 of the EIS for bond amounts by permit area and reclamation phase. **Table 4** provides permitted and disturbed acres by area. **Table 4** and **Table 5** have been revised in the Final EIS to indicate the percentage of reclamation that has been achieved in each permit area. The EIS provides an overview of reclamation bonding procedures and the criteria for phased bond release in **Section 1.6, Financial Assurance**. If success criteria (**Section 1.6.4, Bond Release**) are not met, the associated bond will not be released, and monitoring will continue. Reclamation and bonding requirements are applicable to the project area, if permitted, and all currently permitted areas of the Rosebud Mine. **Section 1.6** has been revised to clarify that the requirements are applicable to all permit areas, not just the proposed project area. The EIS **Glossary** has been revised to include a definition of "contemporaneous reclamation." A performance bond cost estimate for the Proposed Action is provided in Western Energy's PAP, Exhibit G. If the permit application is approved, the final performance bond calculation would be made by DEQ (with federal concurrence) in accordance with ARM 17.24.1102, and Western Energy would need to submit the performance bond prior to issuing the permit. The performance bond would be in the form of a surety bond or a collateral bond (see ARM 17.24.1105).

Comment/ Code	Document #005-Sierra Club	Response
5-58, cont'd	  45 | Page MEIC et al. Rosebud Area F DEIS Comments	

Comment/ Code	Document #005-Sierra Club	Response
		
5-58, cont'd	These charts confirm that Westmoreland has made utterly no progress toward permanent reclamation at Areas A, B, C, and D, and only nominal progress at Area E. Although OSM may claim that sufficient acres are being backfilled, regraded, and reseeded, the number of acres backfilled, regraded, and reseeded does not reflect the number of acres that have been permanently reclaimed. Further, we are concerned that the pace of disturbance for Areas A, B, and C appears to be greatly exceeding the pace of backfilling, regarding, and reseeding. OSM cannot approve an expansion into Area F unless and until Westmoreland's ongoing operations come into compliance with contemporaneous reclamation requirements. This is not just an issue in Colstrip, Montana. Across the state, only half of the lands that have been disturbed for mining have been reclaimed to the point of establishing vegetation.[139] To date 41,809 acres have been disturbed, and of that disturbance, 838 acres (2.0 percent) have received Montana Phase IV bond release.[140]	
5-58, cont'd	We have serious concerns that Westmoreland is not complying with its mining plan requirements, and thus not able to comply with SMCRA. Because of this, OSM has full authority to not recommend approval of the proposal, and similarly, Interior has full authority to not approve the plan. *See* 30 U.S.C. § 1273(c). [139] Office of Surface Mining Reclamation and Enforcement, Annual Evaluation Report for the Regulatory Program Administered by the Development of Environmental Quality (Sept. 2016). Attachment 90. [140] *Id.* 46 | Page MEIC et al. Rosebud Area F DEIS Comments	

Comment/ Code	Document #005-Sierra Club	Response
Summary Statements – see individual comment responses below	**V. OSM FAILED TO ADEQUATELY ANALYZE AIR QUALITY IMPACTS.** The DEIS fails to adequately analyze and assess the impacts of extended coal mining at Rosebud Mine on air quality. We are particularly concerned over the impacts of mining an additional 70.8 million tons of coal to NAAQS for ozone, particulate matter ("PM"), and nitrogen dioxide ("NO2"). OSM was required to specifically address all emissions sources, impacts of fugitive emissions, and NO2 emissions associated with extraction processes. OSM was additionally required not only to quantify emissions from Rosebud and Colstrip power plants but to also assess their impacts on the surrounding environment, and analyze how the Area F proposal would contribute to such an impact on air quality. Here, OSM failed to assess PM impacts, leaving out the crucial connection between the proposal and the impact, and failing to meet the deep analysis that NEPA requires. Further, OSM failed to fully assess air quality impacts as it relates to NAAQS, particularly SO2 emissions. Moreover, OSM failed to analyze and assess the foreseeable impacts of emissions from blasting, and toxic orange clouds. Finally, OSM failed to consider Colstrip a connected action, and failed to address the significant impacts of the coal's eventual combustion properly. **A. OSM Failed to Assess Air Quality Impacts Related to NAAQS.**	
Summary Statements	NEPA is our "basic national charter for protection of the environment." 40 C.F.R. § 1500.1(a). The law requires federal agencies to fully consider the environmental implications of their actions, considering "high quality" information, "accurate scientific analysis," "expert agency comments," and "public scrutiny," prior to making decisions. 40 C.F.R. § 1500.1(b). This consideration is meant to "foster excellent action," meaning decisions that are well informed and that "protect, restore, and enhance the environment." 40 C.F.R. § 1500.1(c). Here, OSM fell short of these requirements. ***1. OSM Failed to Assess and Analyze Particular Matter Impacts.***	
5-59 (6201)	OSM was required to assess the impacts of emissions and pollutants as it relates to class areas. The Clean Air Act provides a national goal for visibility for Class I areas: "prevention of any future, and the remedying of any existing, impairment of visibility in Class I areas which impairment results from manmade air pollution." 42, U.S.C. § 7401 *et seq.* (1970). The current regulatory program addresses visibility impairment from "fine particles" in these areas that are "reasonably attributable" to sources like pollution resulting from coal operations. *See* 64 Fed. Reg. 35,714 (July 1, 1999). The national visibility goal calls for addressing regional haze from manmade pollution, such as coal mining. *See e.g., State of Maine v. Thomas*, 874 F.2d 883, 885 (1st Cir. 1989). In Montana, the following areas have been designated as Class I areas: • National Parks: Glacier and Yellowstone; • National Wilderness Areas: Anaconda-Pintler, Bob Marshall, Cabinet Mountains, Gates of the Mountains, Medicine Lake, Mission Mountains, Red Rock Lakes, Scapegoat, Selway-Bitterroot, and UL Bend; and 47 | Page MEIC et al. Rosebud Area F DEIS Comments	**5-59 Response**: Existing conditions in the analysis area for air quality are described in **Section 3.3**. The analysis of potential direct, indirect, and cumulative impacts on air quality is described in **Sections 4.3.3.1, 4.3.3.2**, and **5.3.2**, respectively. The analysis was based on modeling that helped to determine whether emissions from the Proposed Action would contribute to exceedances of national and state standards for ambient air quality. The EIS concludes that no exceedances of ambient air quality standards are expected directly, indirectly, or cumulatively because of the Proposed Action, and impacts on air quality would be negligible to moderate and adverse.

Comment/ Code	Document #005-Sierra Club	Response
5-59, cont'd	• Native American Reservations: Northern Cheyenne, Flathead, and Fort Peck. [141] Despite the reported data and its reference to Class I areas in the DEIS, the analysis and assessment of air quality impacts does not even attempt to analyze actual impacts to air quality. Instead, the DEIS only compares emissions data to the national averages. DEIS at 444. Here, the DEIS indicates that Rosebud County's average daily concentrations of PM2.5 are 7.4 µm/m^3, which are admittedly lower than NAAQS limits, but higher than the national average. Fine PM (including sulfates, nitrates, organic carbon, elemental carbon, and soil dust) can cause serious health effects and mortality in humans, while also contributing to adverse environmental effects such as acid deposition and eutrophication. Even where average concentrations meet NAAQS standards, the impacts on the health of the community and environment must be analyzed, not just in the immediate mining area, as briefly discussed here, but in the surrounding community. *See, e.g.*, DEIS at 248 (indicating that most air quality issues impact those employed in the mine without analysis on surrounding community).	**5-59 Response continued**: The impact analysis showed that cumulative impacts for PM_{10} in the direct impacts analysis area are well below the NAAQS for daily PM_{10}. The contribution of direct and indirect impacts on modeled daily PM_{10} are negligible (less than $1x10^{-4}$ µg/m^3) in the only county in Montana in which the modeled daily PM_{10} exceeded the NAAQS, as discussed in **Section 5.3.2.2** of the EIS. AQS monitors operated within the cumulative and indirect impacts analysis area are shown in **Figure 16** and listed in **Table D-3-1** of Appendix D-3. Western Energy established a $PM_{2.5}$ monitor at the northern end of the project area in February 2013 and would continue to monitor at this location when mining commences in the project area.
5-59, cont'd	OSM's analysis of the impacts of the proposed lease modifications on ambient PM_{10} concentrations indicates that mining activities at the Rosebud Mine will contribute to PM_{10} very near the level of the current NAAQS. In prior comments related to this proposal, we requested OSM scrutinize whether there are receptors that are, in fact, publicly accessible, to assure an accurate and valid analysis and assessment of impacts to PM_{10} concentrations. In prior comments, we indicated that this level of impact is of significant concern, and the DEIS failed to disclose how PM_{10} emissions will be effectively limited to ensure that the NAAQS are not exceeded.	
5-60 (6203)	2. ***OSM Failed to Assess Air Quality Impacts for SO2 Emissions.*** OSM was required to, and failed, to assess impacts related to NAAQS. Montana has 13 official nonattainment areas, three of which violate standards for more than one pollutant, PM being the most common cause of nonattainment in Montana. Montana has designated Billings as an "area of concern" for SO_2 monitoring.[142] Billings is approximately 108 miles (174km) from the Rosebud Mine, well within the 300km area designated for analysis.	**5-60 Response**: Impacts for PM and SO_2 were analyzed in the analysis area. Project impacts due to the Proposed Action were estimated to be minimal in the areas of nonattainment in Montana. Billings is not in a direction that would have its CO or SO_2 nonattainment areas be impacted from the Colstrip facility based on typical meteorology. See **Figure 15** in the EIS.
5-60, cont'd	Aside from this measurement, we are concerned that current monitoring for the area is not even occurring. In reviewing EPA's Air Quality Data monitoring, the closest active air quality monitoring station is 30 miles away, on the Northern Cheyenne Reservation, and only measures [141] Montana Department of Environmental Quality, *Citizens' Guide to Air Quality in Montana: Understanding Air Quality*, available at http://deq.mt.gov/Air/airmonitoring/citguide/understanding (last visited Feb. 23, 2018). Attachment 91. [142] Montana State Sulfur Dioxide Nonattainment Areas, available at: http://deq.mt.gov/Portals/112/Air/AirQuality/Documents/Planning/airmaps/BillingsDioxideMap.pdf (last visited Feb. 23, 2018). Attachment 92. 48 | Page MEIC et al. Rosebud Area F DEIS Comments	

Comment/ Code	Document #005-Sierra Club	Response
5-60, cont'd	SO_2. While there is an SO_2 monitor at the Rosebud Mine, it has not been active since 1990, and since then, new 1-hour SO_2 NAAQS has been enacted.[143]	**5-60 Response continued**: Air quality modeling was performed as discussed in the DEIS (see section numbers provided below) to determine whether emissions from the Proposed Action would result in exceedances of the NAAQS or MAAQS. The analysis of the potential direct, indirect, and cumulative air quality impacts is described in the context of the NAAQS and MAAQS in **Sections 4.3.3.1, 4.3.3.2**, and **5.3.2.2**, respectively. In the direct impacts analysis area, the modeled cumulative concentrations were all below the NAAQS and MAAQS and, thus, no exceedances of ambient air quality standards are predicted in the project area, and direct impacts on air quality would be adverse and negligible to minor. The modeled exceedances of the NAAQS and MAAQS in the larger indirect/cumulative impacts analysis area occurred far away from the project area and the contributions of the Proposed Action to these exceedances are predicted to be very small and adverse.
5-60, cont'd	OSM was required to undertake appropriate analysis to ensure that emissions from the mine are not contributing to ozone exceedances, which is a problematic requirement when monitoring stations are not even in the area. The DEIS indicates that high SO_2 averages are only found far away from the project area (in Fremont County, Wyoming). DEIS at 672. However, this data does not measure whether there are exceedances in the project area, and therefore the agency cannot say whether their impacts are adverse.	
	B. OSM Failed to Address Toxic Orange Clouds from Blasting.	
5-61 (6201)	In addition to our concerns over the impacts of the mining to NAAQS for ozone and particulate matter, we are especially concerned over the impacts of nitrogen dioxide, which is produced during blasting. OSM was required to specifically address all emissions sources, particularly those that are not explicitly permitted by the State of Montana (like blasting emissions).	**5-61 Response**: Emissions are considered from a variety of sources including blasting. See **Table 100** in Chapter 4 of the EIS. The mine is subject to DEQ air quality regulations ARM. 17.8.304 and 17.8.308(1) relating to fugitive particulate matter emissions. Pursuant to ARM 17-8-304, fugitive dust emissions would need to meet an operational visible opacity of standard or 20 percent or less averaged over 6 consecutive minutes. The same 20 percent (6 consecutive minute) average applies to the mine pursuant to ARM 17.8.308(1). MSUMRA requires that all surface areas associated with SCM's operations be stabilized and protected to effectively control air pollution. Section 82-4-231(10)(m), MCA. Operators are required to employ fugitive dust control measures in accordance with 82-4-231(10)(m), MCA, the operator's air quality permit, and applicable federal and state air quality standards (ARM 17.24.761(1); 17.24.311(1)). Monitoring to evaluate the effectiveness of the fugitive dust control practices must also be conducted (ARM 17.24.761(2)).
5-61, cont'd	Here, Area F mining will include the blasting of topsoil and overburden. *See, e.g.*, DEIS at 397 (indicating blasting occurs 1-3 days per week, with overburden blasting 4-6 times per month). Blasting often produces orange clouds of NO_2. The current 1-hour standard for NO_2 is 100 parts per billion. *See* 40 C.F.R. § 50.11(b). The orange color in a toxic cloud after blasting indicates a high concentration of nitrogen dioxide. When inhaled, nitrogen dioxide becomes nitric acid as it encounters moisture in the lungs, and can cause respiratory problems, lung damage, and can even result in death. Toxic orange clouds from blasting at Rosebud have been documented in the past, and need to be accounted for as a reasonably foreseeable impact.[144]	See also **Section 2.4.3.7** in the EIS; all residents and owners are notified prior to blasting. In addition, the air modeling, which included blasting, showed that air impacts were below the NAAQS. NO_2 from blasting can also be associated with excessive dust from blasting. Both of these are and would be managed under conditions already included in Air Quality Permits that are and would be in place. Enforceable conditions required by ARM 17.8.749, 17.8.752 and 17.8.308, specifically require: h. Conduct blasting operations in such a manner as to minimize emissions, prevent overshooting, provide stemming of holes, and minimize area to be blasted; k. Other control practices which may be determined by DEQ to be necessary. These conditions already limit blast conditions at the site by making sure excessive explosive is not being used, providing inert material above the explosive to the top of the bore hole to properly manage the detonation and therefore further allow minimal use of explosive, and to minimize the area of each planned blast. It is fully expected that these conditions, if followed, would prevent conditions described by EPA as an orange cloud. Additionally, conducting blasting operations in such a manner as to minimize emissions also are the conditions largely described and undertaken by Western Energy BMP's including dewatering of blast holes and blasting within a short period of time following hole loading. Finally, as provided for in "k", DEQ may determine additional control practices if it is determined necessary.
5-61, cont'd	Here, OSM indicated that blasting accounts for the majority of fugitive dust emissions. DEIS at 445. However, the DEIS indicates that cumulative nitrogen deposition is below the critical load, a negligible fraction, and that emissions generated during blasting would not increase as a result of the Proposed Action. DEIS at 887. OSM may believe its monitoring of emissions from blasting is adequate, however, even OSM has determined that there is inadequate regulation of nitrogen dioxide emissions related to blasting at surface coal mines. *See* [145] Even so, it cannot be said that an untouched piece of land, when blasted, will not contribute to the increase in emissions from blasting.	

[143] AirData Air Quality Monitors at Rosebud Mine, available at: https://epa.maps.arcgis.com/apps/webappviewer/index.html?id=5f239fd3e72f424f98ef3d5def547eb5&extent=-146.2334,13.1913,-46.3896,56.5319. Attachment 93.
[144] East of Billings, "Photos: Hazardous Gas Clouds from Coal Mine Blasting in Southeastern Montana"(Feb. 4, 2014), available at: http://www.eastofbillings.com/photos-hazardous-gas-clouds-from-coal-mine-blasting-in-southeastern-montana/. Attachment 94.
[145] 80 Fed. Reg. 9256 (Feb. 20 2015). Attachment 95.

Comment/ Code	Document #005-Sierra Club	Response
5-61, cont'd	A proper analysis must provide evidence showing that OSM will meet its obligations to ensure that its actions do not lead to violations of federal air quality standards, as required by the FLPMA, 43 U.S.C. § 1712(c)(8). **C. OSM Failed to Adequately Analyze Direct, Indirect, And Cumulative Impacts to Air Quality.**	
5-62 (6201)	To fulfill the goals of NEPA, OSM was required to analyze the "effects" of their actions to the human environment in an EIS. 40 C.F.R. § 1502.16(d). To this end, OSM was required to analyze the "direct," "indirect," and "cumulative" effects of its actions, and assess their significance. 40 C.F.R. §§ 1502.16(a), (b), and (d). "Direct effects" are those "caused by the action and occur at the same time and place." 40 C.F.R. § 1508.8(a). "Indirect effects" are "caused by the action and are later in time or farther removed in distance, but are still reasonably foreseeable . . . [and] may include growth inducing effects." 40 C.F.R. § 1508.8. Cumulative impacts are "the impact[s] on the environment which result[] from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions, regardless of what agency (Federal or non-Federal) or person undertakes such actions." *Id.* § 1508.7.	**5-62 Response**: Existing conditions in the analysis area for air quality are described in **Section 3.3**. The analysis of potential direct, indirect, and cumulative impacts on air quality is described in **Sections 4.3.3.1, 4.3.3.2**, and **5.3.2**, respectively. The analysis was based on modeling that helped to determine whether emissions from the Proposed Action would contribute to exceedances of national and state standards for ambient air quality. The EIS concludes that no exceedances of ambient air quality standards are expected directly, indirectly, or cumulatively because of the Proposed Action, and impacts on air quality would be negligible to moderate and adverse.
5-63 (8504)	OSM was obligated to conduct a full analysis of reasonably foreseeable coal combustion, coal transport, and coal export impacts on air quality. 40 C.F.R. § 1508.25(c). Its failure to do so caused the analysis to be insufficient under NEPA. 42 U.S.C. § 4332(2)(C). While OSM did collect information and disclosed emissions and sources, it failed to analyze the significance of the impacts and how they would affect the human environment, as required under NEPA. 40 C.F.R. § 1208.8. **D. OSM Failed to Assess Impacts From Export and Transportation of Coal.**	**5-63 Response**: A detailed analysis of air quality impacts of coal combustion (at the Colstrip and Rosebud Plants) is provided in **Section 4.3.3** of the EIS including their significance. The effects of coal transport (from the mine to the Colstrip and Rosebud Power Plants) are also included in the modeling used for the impact assessment. Under MEPA, DEQ's analysis of actions is limited to actions that significantly affect the quality of the human environment in Montana, Section 75-1-201(1)(b)(4), MCA. In addition, there are no foreseeable plans to ship coal by railroad or export coal from Area F, if approved, or any of the other operational permit areas at the Rosebud Mine.
5-64 (6202, 6402)	OSM must analyze and disclose the indirect impacts from coal transportation to comply with NEPA's clear mandates. NEPA not only requires consideration of indirect effects, 40 C.F.R. § 1508.8(b), but further provides that agencies must address "any adverse environmental effects that cannot be avoided should the proposal be implemented." 42 U.S.C. § 4332(c)(ii).	**5-64 Response**: Using data from the **Air Quality** analysis (see **Sections 3.3** and **4.3**), the risk from DPM is localized and most likely to affect those working in proximity of heavy machinery. As described in **Section 3.5, Public Health and Safety**, the miners at Rosebud Mine are protected under MSHA, and the mine is obligated to comply with MSHA and OSHA, which include standards for protecting miner health and safety (see specifically **Section 3.5.1.1, Regulatory Framework** and **Section 3.5.1.2, Analysis Area**). The air quality model indicates that DPM would drop off sharply outside of the immediate project area; therefore, risk to the public and sensitive receptors would be low due to limited exposure time and extent (see **Air Quality** in **Section 4.5.3.1**). PM is expected to remain below NAAQS and MAAQS thresholds in the indirect impacts analysis area (see **Air Quality** in **Section 4.5.3.2**).
5-64, cont'd	Here, the DEIS acknowledged that exhaust of the diesel equipment at the mine release toxic emissions, but stopped short of fully analyzing the impacts of those emissions on the human environment, and whether they were significant. DEIS at 137. Specifically, the DEIS Table 36 indicated there was an issue with exposure of fugitive dust and emissions from vehicle traffic, however, it was vaguely described as "[e]xacerbation and increased susceptibility for sensitive populations through direct contact with criteria pollutants, HAPs, and COPCs." DEIS at 174. For such a significant impact on the environment, this is not very descriptive as to what the population may expect. The DEIS later connects elevated Diesel PM exposure to lung cancer and cardiovascular health responses, but minimizes their significance by saying that more modern trucks have less-harmful diesel emissions (while assuming the decision maker will make the connection that Westmoreland purchased modern trucking equipment without actually saying so). *See id.* 50 | Page MEIC et al. Rosebud Area F DEIS Comments	The air quality analysis indicates that DPM emissions and fugitive coal dust are largely confined to the project area and to Area C (see the **Hazardous Air Pollutants** discussion in **Section 4.3.3.1** and **Figures 77** and **78**). Air concentrations of DPM and PM from coal dust drops off precipitously at the mine boundary, and neither are detectible in the vicinity of Colstrip. Based on this information, the **Public Health** analysis considers DPM and PM from coal dust where exposure is likely to occur (i.e., in the project area boundary and immediate vicinity). The analysis acknowledges both the health risks associated with exposure to DPM and PM from coal dust (see **Section 3.5.2.2, Primary Contaminants and Exposure Pathways**) and discusses the nature and likelihood of potential exposure to DPM and PM from coal dust (see the **Air Quality** and **Community Health** discussions in **Section 4.5.3.1, Direct Impacts**.

Comment/ Code	Document #005-Sierra Club	Response
5-64, cont'd	Here, 300,000 tons of coal are hauled annually from the mine to the Rosebud power plant, via haul trucks, daily. DEIS at 10. An increase in mining production from Area F coal will surely have health and environmental impacts, especially as it relates to coal transport from the mine to Rosebud Power Plant. For example, as the DEIS indicated, diesel exhaust is carcinogenic and is associated with heart disease, lung diseases, and cancer. DEIS at 178. OSM was required to assess impacts that result from these trips, including CO_2 emissions emitted during transportation, diesel PM emissions, and air quality impacts from coal trains, and vehicle traffic. While OSM acknowledged that fugitive coal dust and exhaust may be linked to health issues, the connection was general, and not specific to Rosebud, and Area F, falling short of full analysis. *Id.* Further, OSM denied the full impact of emissions of $PM_{2.5}$, stating that while "it is possible" that respiratory and cardiovascular issues could result from their inhalation, "most cases" were caused by "other variables" such as "diet, inactivity, and adult smoking rates." *Id.* Further, it is unclear as to how emissions other than PM emissions from haul roads will impact the surrounding environment. DEIS § 3.5.3.2.1. To fully analyze the impacts of air pollution, OSM must investigate the significance of an additional 19 years of transporting coal mined from Area F.	**5-64 Response continued**: Air quality impacts due to emissions from a variety of sources have been analyzed including PM emissions from haul roads in **Section 4.3.3** of the EIS. Emissions due to coal transport from the mine to the Rosebud Power Plant were included in the air quality modeling and did not contribute to any exceedance of public health standards or National and Montana Ambient Air Quality Standards that would result in adverse impacts on the environment.
5-65 (8504, 8505)	**E. OSM Failed to Fully Analyze and Assess Cumulative Impacts.** OSM was required to analyze and assess the cumulative impacts of the region's additional fossil fuel projects. The DEIS acknowledged other coal mines that are in current operation (Signal Peak, Spring Creek, Big Sky, Absaloka, and Decker coal mines) but indicated they were "not expected to influence or be influenced by the proposed Area F permitting action." DEIS at 658. Further, while OSM acknowledged the additional expansions at Rosebud, their analysis failed to investigate as to whether these expansions would cause significant impacts on air quality or climate change. *See* DEIS at 661 ("Western Energy has applied to BLM for a lease by modification to federal coal lease MTM 80697. The pending lease by modification includes two tracts within existing permit areas of the Rosebud Mine and would affect 160 acres total. The Area B tract is about 60 acres, and the Area C tract is about 100 acres"). To comply with the hard look that NEPA requires, OSM must analyze and assess the cumulative impacts of the region's additional fossil fuel projects on air quality and climate change, and not simply list them.	**5-65 Response**: The air quality impacts of the region's additional fossil fuel projects are included in the cumulative air quality modeling discussed in **Section 5.3.2** of the EIS. The GHG emissions of the region's fossil fuel projects are discussed under No Action in **Section 4.4.2.3**. Climate change impacts are discussed in general in **Sections 3.4** and **4.4**, for NEPA purposes. Under MEPA, DEQ's analysis of actions is limited to actions that significantly affect the quality of the human environment in Montana, Section 75-1-201(1)(b)(4), MCA.
Summary statement	**VI. OSM FAILED TO CONSIDER OPERATION OF THE COLSTRIP COAL-FIRED POWER PLANT A "CONNECTED ACTION" AS REQUIRED BY NEPA.** OSM was required to consider the full impacts of combustion of coal from Colstrip Station and Rosebud Power Plant, but violated NEPA by failing to consider operations at the Colstrip plant a connected action. 40 C.F.R. § 1508.25(a), (c). To allow for meaningful discussion of the potential environmental effects of a Proposed Action, NEPA requires agencies to consider all "connected actions" in a single EIS. NEPA's implementing regulations define "connected actions" as actions that "are closely related" to the action under review because the actions: 51 | Page MEIC et al. Rosebud Area F DEIS Comments	

Comment/ Code	Document #005-Sierra Club	Response
	(i) Automatically trigger other actions which may require environmental impact statements; (ii) Cannot or will not proceed unless other actions are taken previously or simultaneously; and (iii) Are interdependent parts of a larger action and depend on the larger action for their justification. 40 C.F.R. § 1508.25(a)(1).	
5-66 (1001)	Here, OSM erroneously labeled Colstrip an independent action from the approval of the Area F Permit and the Rosebud Mine. *See* DEIS at 661 (stating that the DEIS assumes the power plants will find a new source of coal when coal from the Rosebud Mine is no longer available, calling their operations independent from Rosebud). This is incorrect. Here, the sole purpose of the expansion into Area F is to fuel the Colstrip Power Plant.[146] The Colstrip Power Plant cannot be an independent action because it cannot exist without the Rosebud Mine because its Title V operating permit under the Clean Air Act prohibits it from burning coal that is not from the Rosebud seam.[147] Further supported, the DEIS admits that all coal currently produced by the mine is consumed locally at the Colstrip and Rosebud Power Plants. DEIS at S-3.	**5-66 Response**: As described in **Section 1.4.1.1, Office of Surface Mining Reclamation and Enforcement, Applicable Statutes and Regulations, NEPA, Connected Actions** of the EIS, OSMRE evaluated the project and the Colstrip Power Plant (which would also apply to the Rosebud Power Plant) as potentially connected actions. OSMRE concluded that "Area F and the power plants are not connected actions because the power plant[s] are existing operational facilities, and no pending actions or reasonably foreseeable future actions are currently proposed for the power plant[s]. Therefore, Area F is the only proposed action and, as such, is not connected to a currently existing and operational power plant facility, regardless of the power plant facility's physical location" (OSMRE 2014a). Based on this guidance, direct effects of the power plants and analysis as connected actions under NEPA were not given further consideration in the EIS. Effects from the two power plants are considered indirect effects in the EIS analyses.
5-66, cont'd	Agencies are required to analyze coal combustion impacts from mine expansion decisions, such as this, when "(1) 'but for' the proposed expansion, the coal-combustion impacts would not occur and (2) the coal-combustion impacts are reasonably foreseeable." *Diné Citizens Against Ruining Our Environment v. U.S. Office of Surface Mining Reclamation and Enforcement*, No. 12-cv-01275, slip op. at 13 (D. Colo. March 2, 2015) (*citing* 40 U.S.C. § 1508.8 and *Utahns for Better Transp. v. U.S. Dep't of Transp.*, 305 F.3d 1152, 1176 (10th Cir. 2002)). Here, it is foreseeable that the additional coal will be burned to generate electricity, as without the addition of the project, the operational life of the Rosebud Mine would be expected to end in 2030. DEIS at 1. In this case, OSM must analyze the coal combustion impacts from additional mining of over 70.8 million tons of coal, as indicated in the proposal, as it relates to health impacts. *See, e.g.*, *Sierra Club v. Marsh*, 769 F.2d 868, 878-79 (1st Cir. 1985) (agency had to consider effects of private development on island because purpose of federal project to construct causeway and port was to enable such private development on island).	
	A. Coal Combustion Emissions Are Significant and Harmful to the Community.	
5-67 (6401)	Emissions resulting from Area F coal are significant, harmful, and not sufficiently analyzed in this DEIS. The Colstrip Power Plant is one of the largest sources of industrial pollution in the	

[146] OSM, Scoping Newsletter 2 (Sept. 2013) 78 Fed. Reg. 52,967, 52,967-68 (Aug. 27, 2013). Attachment 96.
[147] Montana Department of Environmental Quality, Air Quality Operating Permit OP0513-09 at 5 (Sept. 2013). Attachment 97.

52 | Page
MEIC et al. Rosebud Area F DEIS Comments

Comment/ Code	Document #005-Sierra Club	Response
5-67, cont'd	nation.[148] Until it is decommissioned, Colstrip will emit approximately 300 million tons of CO_2, with about half of the emissions coming from Area F coal.[149] Every year, Colstrip's smokestacks emit nearly double the amount of carbon pollution released during the 1980 Mt. St. Helens volcanic eruption.[150]	
5-67, cont'd	When burned, coal releases SO_2, NOx, PM, VOCs, mercury, and CO_2, associated with damaging effects on human health, causing premature mortality, bronchitis, asthma, cardiac, coronary obstructive pulmonary disease, heart disease problems, and emergency room visits. The Clean Air Task Force collected data related to health impacts of coal plants across the country in 2012.[151] The Colstrip Power Plant was responsible for: Premature Deaths: 18 Heart Attacks: 28 Asthma Attacks: 310 Hospital Admissions: 13 Chronic Bronchitis: 11 Asthma ER Visits: 18	**5-67 Response**: The statistics provided by the Clean Air Task Force (http://www.catf.us/fossil/problems/power_plants/) are consistent with the discussion under **Demographics and Sensitive Populations** in **Section 4.5.3.2**. The impacts from the action alternatives (Proposed Action and Alternative 3) would be comparable to those under the No Action alternative as the Colstrip Power Plant would continue to operate at the same level of output under both alternatives. Both action alternatives would extend the life of the mine and resulting impacts by 8 years compared to the No Action alternative.
5-68 (6402)	These impacts were required to be identified, evaluated, and quantified in the EIS. The DEIS acknowledges that health in the area surrounding the mine is poor, and collected data on adverse health effects in the surrounding counties. DEIS at 184. However, the DEIS also considers the impacts of air pollution "negligible." DEIS at 682 ("[T]he power plants' contribution to the area's environmental health is long-term, minor to moderate, and adverse, to which the Proposed Action would contribute negligibly."). The DEIS also acknowledges that the major concern in the area is inhalation of PM, but does not consider it impacted by the proposal. DEIS at 183. This is indeed a significant concern, as the World Health Organization has reported that long-term exposure to PM leads to a reduction in life expectancy from cardiopulmonary mortality.[152] Inhalation of PM is associated with increased risk of multiple	**5-68 Response:** Using data from the **Air Quality** analysis (see **Sections 3.3** and **4.3**), the risk from DPM is localized and most likely to affect those working in proximity of heavy machinery. As described in **Section 3.5, Public Health and Safety**, the miners at Rosebud Mine are protected under MSHA, and the mine is obligated to comply with MSHA and OSHA, which include standards for protecting miner health and safety (see specifically **Section 3.5.1.1, Regulatory Framework** and **Section 3.5.1.2, Analysis Area**). The air quality model indicates that DPM would drop off sharply outside of the immediate project area; therefore, risk to the public and sensitive receptors would be low due to limited exposure time and extent (see **Air Quality** in **Section 4.5.3.1**). PM is expected to remain below NAAQS and MAAQS thresholds in the indirect impacts analysis area (see **Air Quality** in **Section 4.5.3.2**).

[148] Environmental Integrity Project, Dirty Kilowatts: America's Most Polluting Power Plants 7 (July 2007). Attachment 98.
[149] 78 Fed. Reg. at 52,967-68 (stating that Area F will supply 3.5 to 4 million tons annually to plant for 19 years). Attachment 99.
[150] Clean Air Task Force, Power Plants, Montana, available at: http://www.catf.us/fossil/problems/power_plants/existing/map.php?state=Montana. Attachment 100.
[151] Clean Air Task Force, Power Plants, available at: http://www.catf.us/fossil/problems/power_plants/. Attachment 101.
[152] World Health Organization, "Outdoor Air Pollution", Global Health Observatory, available at: http://www.who.int/gho/phe/outdoor_air_pollution/en/index.html. Attachment 102.

53 | Page
MEIC et al. Rosebud Area F DEIS Comments

Comment/ Code	Document #005-Sierra Club	Response
5-68, cont'd	types of cancer.[153] PM from coal dust may also contain traces of the heavy metals, such as lead, mercury, chromium, and uranium that are toxic to the human nervous system, especially to children, causing decreases in birth weight, growth rate, and increased intellectual development problems.[154]	
5-69 (6401)	While the DEIS also acknowledged Rosebud County's high rate of asthma, the third-highest rate in Montana, it does not go so far as to connect the asthma rates to coal combustion emissions and PM. *See* DEIS at 681 (stating it "may" affect air quality, but in the next sentence, noted that the mine contributes economically to "public health resources."). Further, a recent report made the connection between chronic exposure to air pollution and the functioning of children's brain.[155] This report stated that we are only now realizing how toxins not only affect the lungs but also impact "emotional development, autism ADHD, and mental health."[156] Further, a recent study in the journal *Nature* found a new toxin existing in coal combustion emissions.[157] The study notes that in the U.S., scrubbers capture the toxin, reducing its prevalence. However, there is no monitoring of this particular harmful toxin, which contributes to the estimated 3 million air-pollution related deaths worldwide.[158]	**5-69 Response**: The EIS is not intended to make causal statements about chronic disease when uncertainty is present and multiple variables are unknown, nor does it discount the link between PM and respiratory illness. The analysis under **Demographics and Sensitive Populations** in **Section 4.5.3.2** concludes that sensitive receptors, including those with asthma and respiratory illness, would be adversely impacted by both the Proposed Action and Alternative 3, but that these effects would be comparable to those under the No Action alternative as the Colstrip plant would continue to operate at the same level of output under all alternatives. Both action alternatives would extend the life of the mine and resulting impacts by 8 years compared to the No Action alternative. The connection between childhood brain development and mental health and air pollution has not been analyzed in the context of the Rosebud Mine area and, therefore, studies and data are not available for reference in the EIS. With regard to new toxins present in coal fire plant emissions, where no monitoring or regulatory oversight is in place, the power plants would continue operation under all alternatives at the same level of output, although the duration would be 8 years longer under the proposed action and Alternative 3. Selection of either action alternative would not result in impacts on these emissions.

[153] Pope III CA, Burnett RT, Thun MJ, et al., "Lung Cancer, Cardiopulmonary Mortality, and Long-Term Exposure to Fine Particulate Air Pollution," Journal of the American Medical Association; 287(9):1132– 1141, (2002). Attachment 103.

[154] H. Hu, Human Health and Heavy Metals Exposure. In: McCally M, ed. Life Support: The Environment and Human Health (2002). Attachment 104.

[155] Gineski, S., "Geographic and social disparities in exposure to air neurtoxicants at U.S. Public Schools", available at: https://www.sciencedirect.com/science/article/pii/S0013935117317188. Attachment 105.

[156] *Id. See* Oliver Milman, "Air Pollution: Black, Hispanic and poor students most at risk from toxins- study," The Guardian (Feb. 1, 2018), available at: https://www.theguardian.com/education/2018/feb/01/schools-across-the-us-exposed-to-air-pollution-hildren-are-facing-risks. Attachment 106. While this article focused mainly on east-coast cities that have been heavily polluted by industrial emissions, the study covered 90,000 schools across the United States and made the general observation that ambient neurotoxins are a serious threat, especially to children, and manifest in ways we have not recognized in past analysis.

[157] Yi Yan, *et al.*, *Discovery and ramifications of incidental Magnéli phase generation and release from industrial coal-burning*, NATURE COMMUNICATIONS (2017), available at: https://www.nature.com/articles/s41467-017-00276-2. Attachment 107.

[158] Eric Roston, "Coal Plants Might be More Toxic Than We Thought", Bloomberg News (Aug. 8, 2017), available at: https://www.bloomberg.com/news/articles/2017-08-08/coal-plants-might-be-even-more-toxic-than-we-thought. Attachment 108.

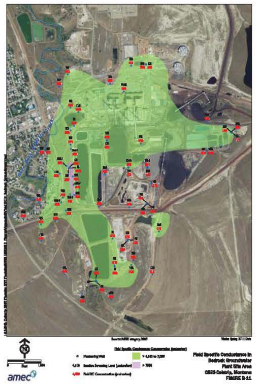
Comment/ Code	Document #005-Sierra Club	Response
5-69, cont'd	Similarly, while the DEIS addressed the general health of the region, the analysis stopped short of making the connection to Colstrip, or impacts from extraction. OSM violated NEPA by failing to fully address the climate implications of 19 additional years of these significant emissions. **B. OSM Failed to Assess the Mercury Emissions from the Mine.**	
5-71 (3203)	We are further concerned that OSM did not fully analyze the impacts of mercury emissions as it relates to mining additional coal from Area F. Here, the DEIS indicates that while analysis and data collection occur for wet mercury deposition, monitoring is not occurring for dry deposition. *See* DEIS at 676 (noting that there are no mercury deposition monitors near Colstrip). Here, where information regarding reasonably foreseeable significant impacts is lacking, OSM must gather and include the information in order to ensure a complete environmental impact statement unless the costs of obtaining the data are exorbitant or the means of obtaining it are not known. *See* 40 C.F.R. § 1502.22(a). In this case, the information necessary for an adequate analysis of air quality impacts is lacking, meaning OSM has an obligation to gather the data and utilize it in the DEIS. The cost of obtaining the information is not exorbitant and clearly the means of obtaining the data are known. To meet the hard look requirement under NEPA, both dry and wet deposition monitors need to be accounted for.	**5-71 Response:** Unlike wet mercury deposition monitoring, dry deposition monitoring is very uncommon because the direct measurement of Hg dry deposition is technically challenging compared to wet deposition. Moreover, modeling presented in **Section 5.3.2.2** of the EIS shows that the fraction of wet plus dry deposition due to the Colstrip and Rosebud Power Plants is small relative to total deposition due to all cumulative sources. The agencies believe that the commenter is suggesting that new wet mercury sampling locations should be added closer to Colstrip. The release height of the Colstrip Power Plant stacks tends to produce mercury deposition (as Hg^0) as a regional pollutant, and the existing mercury monitoring sites (network) maintained at a national level are the most appropriate to indicate possible contributions from Colstrip for Hg^0. Further, at a local level for Hg^{2+} and HgP, if mercury deposition were occurring, that would be indicated by mercury contamination in local waterways, which has not been found as discussed in the EIS. Finally, new sampling stations for mercury would provide little value as no baseline would be available, and that is why relying on existing long-term monitoring data and other resources, such as water, for drawing conclusions around mercury are the most appropriate.
5-72 (7103)	Further, while OSM indicated that the effects of cumulative mercury from additional mining in Area F are relatively small, mercury is a toxin that bioaccumulates, so any addition of mercury may become more harmful. *See* DEIS at 677 ("the contribution of indirect effects to cumulative mercury deposition is relatively small, less than 8 percent in the vicinity of Colstrip, and 1 percent or less farther away"). As atmospheric mercury is produced from the combustion of coal at power plants, it releases mercury into the air where it is then deposited by precipitation into water bodies, where micro-organisms convert it to methyl mercury, a particularly toxic form, at which point it becomes biomagnified through the food chain.[159] Thus, regardless of how much is emitted at once, it becomes harmful, and so the level of analysis should not dismiss the amount of mercury it deems negligible, without analyzing its biocumulative effect.	**5-72 Response**: See **Section 4.3.3.2, Indirect Impacts of Coal Combustion, Deposition Analysis Area for Special Status Species due to Indirect Combustion Impacts**. Air modeling of mercury deposition due to the Colstrip and Rosebud power plants showed that the fraction of their contribution is small relative to all cumulative sources. Background levels of mercury are higher than the highest amount produced by the power plants in the air quality modeling. **Section 4.12.3.2, Indirect Impacts**, in the Fish and Wildlife portion of the EIS, describes that the trace concentrations from deposition, even when combined with naturally occurring background concentrations, do not exceed wildlife ecological screening thresholds for the majority of metals. One exception is that the ecological soil-screening level (Eco-SSL) for mercury does slightly exceed the Eco-SSLs for birds (0.013 mg/kg). However, the background values for mercury (0.023mg/kg) also slightly exceed the bird ecological screening values, which could result in impacts on birds in the analysis area.
5-72, cont'd	This is especially important to analyze the impacts on the neighboring community. While OSM touts the economic benefits of the coal combustion, it does little to acknowledge the externalities that are placed on the same community. This hard look analysis is exactly what is required by NEPA. For example, as a potent neurotoxin, mercury can be passed in utero through maternal blood levels to the developing fetus.[160] The toxic effects on children can include delayed developmental milestones, reduced neurological test scores, and cerebral	

[159] U.S. Fish and Wildlife Service, Biological Opinion for the Four Corners Power Plant and Navajo Mine Energy Project 72-73 (April 8, 2015). Attachment 109.
[160] Clean Air Task Force, "Non-CO_2 Pollution from Coal", available at: http://www.catf.us/fossil/problems/nonco2/ (last visited Feb. 23, 2018). Attachment 110.

55 | Page
MEIC et al. Rosebud Area F DEIS Comments

Comment/ Code	Document #005-Sierra Club	Response
5-72, cont'd	palsy.[161] Further, according to the EPA, coal-fired power plants are the largest human source of mercury emissions in the United States.[162] As such, until its impacts are fully analyzed, including a monitoring of dry deposition, OSM cannot consider approval of this additional coal from Area F. **VII. OSM FAILED TO ADEQUATELY ANALYZE OR DISCLOSE IMPACTS FROM COAL ASH DISPOSAL PONDS.**	
5-73 (6705)	The DEIS provides a cursory and insufficient analysis of the Colstrip coal-fired generating station (CGS) impact on ground and surface water. The CGS is within the cumulative impact area for the proposed Area F expansion. The DEIS dismisses the impact that the leaking coal ash impoundments have had and will continue to have on East Fork Armells (EFA) creek. The coal ash impoundments have been leaking since they were originally built starting in 1975. There are three coal ash impoundment areas associated with the Colstrip coal-fired generating station (CGS). The Plant Site impoundment area consists of about a dozen impoundments of various ages, sizes, and lining systems. The Plant Site is adjacent to EFA and these impoundments have contributed to the impairment of EFA.	**5-73 Response**: The plant site ash ponds historically lost water to ground water. The current operation is described as a closed-loop system and contaminated ground water is being captured and removed (**Section 4.8.3.2** of the EIS). Newer information from DEQ's Colstrip Steam Electric Station Coal Ash Ponds website (http://deq.mt.gov/DEQAdmin/mfs/ColstripSteamElectricStation) has been reviewed and added to **Section 4.7.3.3** of the EIS with regard to effects on ground and surface water.
5-73, cont'd	In recent years, Talen Energy, the operator of CGS, provided MDEQ with numerous maps and documentation on the Plant Site impoundments' on EFA. Documents such as the map below show the extent of contamination from the ash ponds in relation to the town of Colstrip and EFA. (EFA is the stream outlined in blue between the plant and the town of Colstrip.) Similar maps were created by Talen's consultant for other pollutants such as boron, salts, sulfate, and more.[163] Each map generated shows the contamination plume extending beyond EFA as demonstrated by one of the maps below.	

[161] *Id.*
[162] Environmental Protection Agency, "Mercury and Air Toxic Standards", available at: https://www.epa.gov/mats/cleaner-power-plants (last visited Feb. 23, 2018). Attachment 111.
[163] Plant Site Report, Appendix A Plume Maps, (December 2012) (prepared by Hydrometrics for PPL Montana). Attachment 112.

Comment/ Code	Document #005-Sierra Club	Response
		
5-73, cont'd	In 2012, MDEQ finalized an enforcement order, known as an administrative order on consent (AOC), for contamination of ground and surface water by the CGS coal ash ponds. DEQ and Talen are still analyzing the extensive impacts and developing a remedy for the Plant Site, as well as the other two coal ash disposal areas. No remedy has been approved and no timeline for cleanup has been adopted.[164]	
5-73, cont'd	The Plant Site ash ponds system is better defined as a sieve than the "closed-loop" waste disposal system referred to in the DEIS. The coal ash disposal system has failed to contain the toxic waste generated by the CGS. As a result, millions of gallons of contaminated wastewater enter the aquifer each year. The term "closed-loop" does not mean that contamination does not reach ground and surface water. Leakage of the following contaminants have been recently quantified and projected: boron, calcium, chloride, cobalt, lithium, manganese, molybdenum, potassium, selenium, sodium, sulfate, and total dissolved solids.[165] These pollutants are indicative of other pollutants leaking from the ash ponds into the groundwater from the Plant Site ash ponds, but the list is by no means exhaustive.	
5-73, cont'd	The DEIS relies on outdated information regarding leakage from the Plant Site coal ash ponds. The only reference data on the leakage from the Plant Site was a 2015 report prepared by	

[164] Revised Remedy Evaluation Report Plant Site, Mass Discharge Calculations for Ponds: Colstrip Steam Electric Station, Colstrip, MT (Dec. 2017) (prepared by Geosyntec consultants). Attachment 113.
[165] Revised Remedy Evaluation Report. Appendix I. Mass Discharge Calculations for Ponds (prepared by Geosyntec). Attachment 114.

Comment/ Code	Document #005-Sierra Club	Response
5-73, cont'd	Hydrometrics. Since that time there have been numerous studies on the Plant Site coal ash ponds and the impact or potential impact on surface and groundwater resources such as EFA. Since 2015, Talen Energy has submitted, and MDEQ has reviewed, the following reports on the Plant Site and the existing and potential impacts to ground and surface water quality. Each of the following reports are located on DEQ's website and available for download:[166]Plant Site remedy evaluation report (November 2016); Cleanup Criteria and Risk Assessment Report (June 2017); Revised Cleanup Criteria and Risk Assessment Report (November 2017); Facility Closure Plans (July 2017); MDEQ comments on Talen's Facility Closure Plans; and an updated Background Screening Level Report full of figures, tables, and appendices describing the background level of various toxins and potentially harmful substances (October 2017). Each of these reports contains numerous updated studies and analyses of the coal ash impoundments' effects on EFA. While too large to include with these comments, they are readily available to DEQ, the agency that is preparing this DEIS. These updated impact reports should have been included to provide a more relevant, contemporary, and complete analysis of this pollution source in order to provide a better understanding of the cumulative impacts of mining expansion on area water resources.	
5-74 (6603)	The DEIS discusses how concentrations of some pollutants have increased at existing areas of the mine and could harm ground and surface water. DEIS at 519. Many of these same pollutants are present in the leaking ash ponds at the Plant Site including total dissolved solids (TDS), sulfate, calcium, sodium, magnesium, and manganese.[167] For example, from 2014 through 2025 Talen Energy predicts the Plant Site ash ponds will leak 1,452 kg/day of TDS into groundwater. This is equivalent to 584 tons of TDS entering the groundwater adjacent to EFA creek each year. While there are some capture wells to intercept some of the pollutants, some of the pollutants from the ash ponds have reached the stream or are continuing to migrate to EFA. Some increase in the concentrations of these pollutants is likely to occur but the DEIS has failed to consider the cumulative impact on surface water quality and quantity in the area. In sum, the cursory reference to the impacts that the coal ash ponds are having on the watershed are insufficient to provide downstream water users and the public with enough information to fully understand the impacts of the proposed expansion at the Rosebud Mine.	**5-74 Response**: Coal ash waste is analyzed under indirect and cumulative effects of coal combustion in the EIS. Indirect impacts of coal ash waste are disclosed in **Sections 4.5.3.2, 4.9.3.4**, and **4.21.3.2**. Cumulative impacts of coal ash waste are disclosed in **Section 5.3.20** – "Cumulative impacts as a result of Alternatives 2 and 3 from the use of CCR at the Rosebud Mine would be short-term, negligible, and adverse due to the small quantities used, the monitoring conducted that recognize adverse impacts, and the reclamation that would be conducted in areas where CCR was used. Cumulative impacts as a result of Alternatives 2 and 3 from the combustion of project area coal and the storage of the associated CCR at the power plants and associated storage facilities would be short-term, negligible, and adverse due to the relatively small proportion of project area coal generated CCR relative to the total amount of CCR already generated at the power plants from non-project area coal."
5-75 (7400)	**VIII. OSM Failed to Address Opportunities to Ease the Transition Away From Reliance On Fossil Fuels for Coal Miners and Affected Communities.** **A. OSM Failed to Recognize and Plan for the Closure of Rosebud Mine and How the Closure Will Affect the Surrounding Community.** OSM must recognize the inevitable closure of Rosebud Mine, especially in light of Colstrip Power Plant's eventual closure. The closure of Rosebud Mine, and other mines, is a reality that [166] All reports listed can be found at http://deq.mt.gov/DEQAdmin/mfs/ColstripSteamElectricStation. [167] Revised Remedy Evaluation Report Plant Site. Appendix I. Attachment 115. 58 | Page MEIC et al. Rosebud Area F DEIS Comments	**5-75 Response**: The reclamation plan outlines the procedures for post-mine reclamation in **Section 2.4.4**. The socioeconomic impacts of mine closure are outlined in **Section 4.15.2**. MSUMRA and SMCRA do not require post-closure plans for the surrounding community.

Comment/ Code	Document #005-Sierra Club	Response
	the coal industry must grapple with. According to the Mine Safety and Health Administration, coal is slowly dying; the number of coal jobs in Montana dropped from 1,329 to 1,196 in 2016 (a 10 percent drop) and to 1,112 in 2017 (an additional 7 percent decrease).[168]	
5-76 (7400)	The Rosebud Mine is currently permitted for 25,576 acres, with virtually all of the coal being shipped to the Colstrip coal-fired power plant. Colstrip Power plant will be closing two of its four electricity generating units by 2022, which means less coal would be needed from Rosebud. OSM was required to consider the ample opportunities available for economic growth in lieu of coal mining. In considering alternative economic activity, OSM was required to consider the many resources that are available to support economic diversification and transition in the region.	**5-76 Response:** At present, there are not existing or reasonably foreseeable projects or proposals that would require this topic to be analyzed in the EIS. Analysis of the effects of transition and development assistance is outside of the scope of the EIS. A discussion of the employment by industry and the diversity of employment industries in the region is in **Section 3.15.3.2**. At present, there are not existing or reasonably foreseeable projects or proposals for clean energy activity, tourism, and economic diversification in the region. In all three counties, "Agriculture, forestry, fishing and hunting, and mining" is a major employment sector, while "Arts, entertainment, and recreation; Accommodation and food services" jobs account for substantially fewer jobs. The largest employment sector in Rosebud County is "Educational services; Health care and social assistance." As discussed in **Section 4.15.2.5,** many of the jobs in this sector are supported by tax revenues.
5-76, cont'd	OSM was obligated to address the level of economic activity that could be created by energy efficiency, renewable energy development, decommissioning, reclamation and restoration, education and training, and tourism. They were required to adequately quantify the socioeconomic impacts of the Proposed Action, and compare those results using comparable data and modeling for the alternatives we have proposed. It was also necessary for OSM to conduct qualitative analysis to capture important, but hard to quantify, socioeconomic factors such as a cleaner environment, reduced health risk, and access to energy resources.	
5-76, cont'd	In addressing the socioeconomics of the proposal, the DEIS focused on the added public benefits, while ignoring the realities of the market. *See* DEIS at 681 (stating that while the proposal and continued mining "may" affect air quality, mine contributes economically to "public health resources" and is a benefit to the community).	
	B. OSM Failed to Consider Available Alternative Economic Opportunities.	
5-76, cont'd	OSM failed to consider other alternative sources of job opportunities in the area, besides mining. This ignores reality. Coal extraction is not the only economic opportunity available for Montana residents, especially in Colstrip, where the mine is located. Coal mining jobs do not make up a huge segment of the Montana employment sector. Health care-related jobs were the top employer in Montana in 2016, according to the state Department of Labor and Industry, with 66,427 jobs compared to coal's 1,285 the same year.[169]	
	[168] Holly Michels, "As Coal Production Declines, Montana Sees Drop in Coal Jobs, Plans for More," Missoulian (June 11, 2017), available at: http://missoulian.com/news/state-and-regional/as-coal-production-declines-montana-sees-drop-in-coal-jobs/article_e4d8c572-bf48-578e-b1e7-0b020a83e589.html. Attachment 116. [169] *Id.*	
	59 | Page MEIC et al. Rosebud Area F DEIS Comments	

Comment/ Code	Document #005-Sierra Club	Response
5-76, cont'd	It is a false narrative that coal mining drives the economy in coal-producing regions; employment in extractive industries, including oil, gas, coal, and timber in Montana accounts for only 5 percent of earnings for workers within this state.[170]	
5-76, cont'd	There are many new areas of economic growth: the development of renewable energy resources, decommissioning and clean-up activities of old mines and generating stations, new infrastructure investment, education and job training, and tourism have the potential to provide positive socioeconomic benefits to Montana residents. As one news media source recently reported, there's potential for a hydrogen fuel production faculty, renewables, a sugar beet facility, and a municipal waste facility.[171]	
5-76, cont'd	Here, the DEIS acknowledges the additional areas of economic possibility and job-growth, including outdoor recreation. DEIS at 372 (listing "hunting, fishing, boating, hiking, golfing, canoeing, bird-watching, rock-hounding, photography, and dinosaur fossil digging"). Several outdoor recreation areas could see more tourism, especially the Bighorn River, Bighorn Canyon National Recreation Area, Custer National Forest, Makoshika State Park, Little Bighorn Battlefield National Monument, and Pompeys Pillar National Monument. See *Id.* These areas may see an uptick in annual visitation, especially as the Department of Interior's National Park Service has proposed raising the per-vehicle fee at Yellowstone, Grand Teton, and Glacier National Parks (among others) in the region.[172]	
5-76, cont'd	Renewables development also comes with far fewer negative socioeconomic impacts than the current coal-based economy. As a recent report on the economic consequences of coal leasing found, "[t]he environmental degradation associated with mining will tend to displace those economic activities that thrive on attractive natural and social environments."[173]	
5-77 (7400)	Decades of coal mining and dumping of toxic coal ash waste have contaminated the area around Rosebud Mine. Westmoreland is required to undertake full and comprehensive decommissioning, reclamation, and restoration of Rosebud, including groundwater cleanup and facility salvage efforts. Reclamation and decommissioning efforts will take many years and create a substantial number of jobs. A trained and experienced Rosebud cleanup workforce	**5-77 Response:** The reclamation plan outlines the procedures for post-mine reclamation in **Section 2.4.4**. The socioeconomic impacts of mine closure are outlined in **Section 4.15.2**. MSUMRA and SMCRA do not require post-closure plans for the surrounding community.

[170] Headwaters Economics, Montana's Economy, Public Lands, and Economic Advantage (2017), available at https://headwaterseconomics.org/wp-content/uploads/Montana-Economy-Report.pdf. (last visited February 1, 2018). Attachment 117.
[171] Holly Michels, *supra*.
[172] National Park Service, "National Park Service Proposes Targeted Fee Increases at Parks to Address Maintenance Backlog," available at: https://parkplanning.nps.gov/projectHome.cfm?parkID=442&projectID=75576. Attachment 118.
[173] Power Consulting, *The Economic Consequences of the Federal Coal Leasing Program: Improving the Quality of the Economic Analysis*, (July 2016). Attachment 119.

Comment/ Code	Document #005-Sierra Club	Response
5-77, cont'd	could expand into other nearby areas with similar mining reclamation needs. OSM was required to identify the cleanup liabilities accruing to the facilities covered by the Proposed Actions and quantify the economic value of cleanup activities in terms of resources, jobs, income, tax revenues, and other socioeconomic variables. **C. OSM Mislead the Public by Touting the Economic Benefits of the Proposal While Ignoring the Reality that Coal Production Hurts Low Income Communities.**	
5-78 (7403)	A 2012 report found that despite major energy projects and developments in the region, economic well-being on the Northern Cheyenne Reservation declined.[174] The report, *Coal Blooded: Putting Profits Before People*, investigates the overall toxicity of emissions or 'dirtiness' of coal plants, and combines emissions ratings with demographic data to rank a coal plant's effect on neighboring communities. While this report is a bit dated, its findings are still true today. In coal communities, we see homeownership in decline, poverty increased, and high unemployment rates. OSM must address whether this long-term economic impact is true for the communities and surrounding counties near the Rosebud Mine.	**5-78 Response**: Socioeconomic impacts are disclosed in **Section 4.15** in the EIS.
	D. OSM Failed to Consider Resources Available for Economic Diversification.	
5-79 (7400)	A recent study examined the potential for coal workers to transition to jobs in the solar industry.[175] For example, an operations engineer in the coal industry could retrain to be a manufacturing technician in solar and expect about a 10 percent salary increase. Similarly, explosive workers, ordinance handlers, and blasters in the coal industry could use their sophisticated safety experience and obtain additional training to become commercial solar technicians and earn about 11 percent more on average. Most coal workers could not simply walk into a solar job; they would need some retraining. But certain positions required less training—for example, a structural engineer in the coal industry would not need additional schooling to work as one in the solar industry. And for some coal employees, the retraining would only amount to a short course or on-the-job training.	**5-79 Response: See Comment Response 5-76.**
5-79, cont'd	OSM must consider the impacts of the Proposed Actions on these important drivers of the regional economy. The federal government offers transition and economic development assistance through many programs run by different agencies. Congress requested more than $9 billion to support economic diversification in coal communities; employment and training services for workers displaced from the coal economy; the health and retirement security of	

[174] National Association for the Advancement of Colored People, Coal Blooded: Putting Profits Before People (2002). Attachment 120.
[175] Joshua Learn, "What If All U.S. Coal Workers Were Retrained to Work in Solar?," Harvard Business Review (August 2016), available at https://hbr.org/2016/08/what-if-all-u-s-coal-workers-were-retrained-to-work-in-solar (last visited Feb. 5, 2018). Attachment 121; *See* also Edward Louie and Joshua Pierce, *Retraining Investment for U.S. Transition from Coal to Solar Photovoltaic Employment*, ENERGY ECONOMICS (2016). Attachment 122.

Comment/ Code	Document #005-Sierra Club	Response
5-79, cont'd	coal miners and their families; the reclamation and redevelopment of abandoned mine lands; and the deployment of carbon capture and sequestration technology.[176]	
5-79, cont'd	Montana received $4.6 million in July from the Power Plus grants for a coal workforce transition, including in the Rosebud area.[177] $2 million was immediately put toward workforce transition in coal impacted communities in Montana.[178] Rosebud Mine is in one of the coal impacted counties that are eligible for funding and the state is already creating a grant funding program, taking funding requests at the beginning of 2018.[179] The funding will be distributed to unions and educational institutions to retrain workers for jobs for which they already have appropriate skills.	
5-79, cont'd	Other states are creating similar grants to assist the transition of communities impacted by extractive industries. For example, Colorado provides grants to communities through its Energy/Mineral Impact Assistance Grant Fund. Colorado Department of Local Affairs, Colorado Energy/Mineral Impact Assistance Fund (2017).[180] Additionally, the Colorado Energy Impact Assistance Act has been proposed and would allow investor-owned utilities to use financing mechanisms to cushion the rate of impacts of plant retirements and channel bond proceeds to "provide transition assistance for Colorado workers and communities directly affected by the retirement of the facilities (transition assistance)."[181] The bill defines transition assistance as the:	
5-79, cont'd	> Payment of retraining costs, including costs of apprenticeship programs and skilled worker retraining programs, for and financial assistance to directly displaced Colorado facility workers, compensation to Colorado local governments for lost property tax revenue directly resulting from the retirement of a facility, and similar payments, job retraining, assistance, and compensation for directly displaced Colorado workers and	

[176] Fact Sheet: Administration Announces New Economic and Workforce Development Resources for Coal Communities through POWER Initiative (August 2016). Attachment 123.
[177] US gives Montana $4.6 million for retraining coal workers" The Seattle Times, (Aug. 1, 2017), available at: https://www.seattletimes.com/business/us-gives-montana-4-6-million-for-retraining-coal-workers/ (last visited Feb. 23, 2018). Attachment 124.
[178] "Governor Bullock Secures over $4.6-Million for the Community of Colstrip", State of Montana Website, (Aug. 1, 2017), available at: http://news.mt.gov/governor-bullock-secures-over-46-million-for-the-community-of-colstrip (last visited Feb. 23, 2018). Attachment 125. ("Part of the money will go toward building a workforce for reclamation projects, including cleaning up ash ponds near the Colstrip power plant and reclaiming coal mines.").
[179] *Id*.
[180] Colorado Transition Funding, available at: https://www.colorado.gov/pacific/dola/energymineral-impact-assistance-fund-eiaf, (last visited February 18, 2018). Attachment 126.
[181] Colorado Energy Impact Assistance Act, available at https://leg.colorado.gov/bills/hb17-1339, (last visited Feb. 23, 2018) Attachment 127.

Comment/ Code	Document #005-Sierra Club	Response
5-79, cont'd	local governments in areas that produce fuel used in the retired facility directly resulting from the elimination of the need for fuel at the facility.[182]	
5-79, cont'd	Further, such investor-owned utility support for impacted communities has already occurred in Nevada, where the Nevada Power Company has agreed to pay the Moapa Band of Paiutes $4.3 million for "supplemental environmental projects or equivalent projects that the Moapa Paiutes may choose," including a community wellness center, purchase of water rights, environmental monitoring, and technical assistance for post-closure activities. *Moapa Band of Paiute Indians v. Nevada Power Co.,* Order Granting Joint Motion to Approve Settlement, *2:13-cv-01417-JAD-NJK* (D.Nev. 2015).	
5-80 (7400)	Currently, Westmoreland does not seem to have set aside any funds to help their workers transition when Rosebud Mine inevitably shuts down. The DEIS has also not indicated that it has set aside funds for transition.	**5-80 Response: See Comment Response 5-77.**
5-80, cont'd	Transition assistance has allowed communities to move beyond the boom and bust economies of coal mining. OSM has an obligation to consider the socioeconomic impacts from clean energy activity, clean-up, increased tourism, and other non-fossil fuel sectors, and identify resources that are available to support economic diversification and transition.	
5-81 (2405)	**IX. OSM FAILED TO ANALYZE ANY CLEAN ENERGY ALTERNATIVES.** In analyzing alternative courses of action or approaches, the DEIS fails to consider the reasonable alternative of electricity being generated from clean energy sources such as wind and solar. The final EIS should consider clean energy as either a separate alternative and/or as part of the impact analysis for the three proposed alternatives.	**5-81 Response:** As described in **Section 2.6.7, Alternative Energy Generation,** renewable or alternative energy generation or conservation was eliminated from detailed study because such an alternative would be inconsistent with the purpose and need for the action. As described in **Section 1.3** of the EIS, the purpose and need is predicated upon DEQ review of an application for a plan of operations for a surface mine and OSMRE review of a federal surface mining plan (to be included as part of the approved surface mining permit). The federal action before OSMRE is to recommend to the ASLM, approval with conditions, or disapproval of the proposed federal mining plan (**Section 1.4.1.1, Office of Surface Mining and Reclamation**). There is no requirement under existing regulations that would necessitate OSMRE to make a determination regarding the marketability of the coal to be mined in the proposed mining plan prior to making the recommendation to the ASLM. Similarly, the state action before DEQ is to review and to make a decision on Western Energy's surface mine operating permit application under MSUMRA, Section 82-4-221 et seq., MCA (see **Section 1.4.1.2, Montana Department of Environmental Quality**). There is no requirement under existing regulations that would necessitate DEQ to make a determination regarding the marketability of the coal to be mined under the operating permit. Pursuant to 75-1-220(1), MCA, DEQ cannot include an alternative facility or an alternative to the proposed project itself unless the project is a state-sponsored project (which the Proposed Action is not).
5-81, cont'd	**A. Montana-Based Clean Energy Should Be Considered as an Alternative.** According to the DEIS, under NEPA "an alternative is any reasonable course of action, other than the Proposed Action, that would still meet the identified purpose and need." DEIS at 29. Further the DEIS states, "Under MEPA, 'alternative' means an alternative approach or course of action that would appreciably accomplish the same objectives or results as the Proposed Action; design parameters, mitigation, or controls other than those incorporated into a Proposed Action by an applicant or by an agency prior to preparation of the EIS; or no action or denial per ARM 17.4.603(2). In accordance with ARM 17.4.603(2)(b), DEQ is 'required to consider only alternatives that are realistic, technologically available, and that represent a course of action that bears a logical relationship to the proposal being evaluated.'" DEIS at 29.	
5-81, cont'd	The DEIS identifies the purpose of the Proposed Action as, "… to allow continued operations at the Rosebud Mine by permitting and developing a new surface-mine permit area, known as proposed permit Area F." DEIS at 10. However, this is an extremely narrow interpretation of the	

[182] *Id.* at 2-3.

63 | Page
MEIC et al. Rosebud Area F DEIS Comments

Comment/ Code	Document #005-Sierra Club	Response
5-81, cont'd	purpose of the mine expansion because it fails to acknowledge the practical circumstances of the Rosebud Mine. The mine only sells its coal to the immediately adjacent Colstrip Power Plant and Rosebud Power Plant. The mine does not sell its coal to any other customer and there are no proposals to change this. This is a distinguishing characteristic of the Rosebud Mine that is not found at all coal mines, many of which are able to sell coal to multiple customers for potentially multiple uses. Instead, the Rosebud Mine only sells to the Colstrip Power Plant and Rosebud Power Plant, both of which only burn coal to produce electricity and for no other purpose. Therefore, there is only one practical purpose for mining coal at the Rosebud Mine: the generation of electricity at the adjacent power plants. To say the purpose of the Proposed Action is merely "continued operations at the Rosebud Mine" ignores the reality that there is no other reason to mine the coal other than burning it to generate electricity.	
5-81, cont'd	OSM must evaluate alternatives that would continue to meet electrical demand but do so using forms of energy other than coal. Our electrical grid functions by substituting different sources of electricity (coal, gas, wind, solar, etc.) for one another as prices change. Here, alternatives exist that are realistic, technologically available, technically feasible within the project time frame, and economically feasible in relation to the Proposed Action.	
5-81, cont'd	Electricity can be generated from multiple sources, including wind and solar. Both of these clean energy sources meet the criteria for being a reasonable alternative to coal-generated electricity.	
5-81, cont'd	Wind and solar are realistic sources of electricity. In 2016, wind accounted for about 6 percent of electricity production in the United States while solar accounted for about 1 percent.[183] In some states, this penetration is much higher. For example, Iowa and Kansas each generated about 36 percent of their electricity from wind in 2017 while California generated approximately 15 percent from solar.[184]	
5-81, cont'd	Wind and solar are technologically available. As of 3Q 2017, approximately 85,000 megawatts of wind energy and 49,000 megawatts of solar energy had been installed in the United States.[185,186] In Montana, over 700 MW of wind has been installed, representing only about 1	

[183] US Energy Information Administration; https://www.eia.gov/energyexplained/index.cfm?page=electricity_in_the_united_states. Attachment 128.
[184] U.S. EIA, Electric Power Monthly (February 2017), Tables 1.3.B, 1.14.B, 1.17B. https://www.eia.gov/electricity/monthly/ . Attachment 129.
[185] SEIA. https://www.seia.org/us-solar-market-insight. Attachment 130.
[186] AWEA. https://www.awea.org/wind-energy-facts-at-a-glance. Attachment 131.

Comment/ Code	Document #005-Sierra Club	Response
	percent of the technically available wind power capacity.[187] Meanwhile, in 2017 Montana's installed solar energy grew by almost 400 percent.[188]	
5-81, cont'd	Wind and solar are technically feasible within the time frame of the Proposed Action. The DEIS notes, "at the current rate of production, the operational life of the mine would be extended by 8 years. Without the addition of the project, the operational life of the Rosebud Mine would be expected to end in 2030." DEIS at 1. Using either eight years or 20 years (2018 to 2030 plus eight years) as the Proposed Action time frame, wind or solar facilities of significant size could be completed. For example, the 189-megawatt Rim Rock Wind Farm near Shelby, MT was completed in 14 months.[189]	
5-81, cont'd	Wind and solar are economically feasible compared to the Proposed Action. From 2008 to 2015, the cost of utility-scale wind energy has dropped 41 percent while utility-scale solar has declined 64 percent.[190] The 2017 Levelized Cost of Energy Analysis from the respected financial analyst firm Lazard found that both wind and solar are now lower cost resources than coal.[191] Montana's wind resource in particular is of superb quality and quantity, creating highly competitive economics for wind. For example, customers of NorthWestern Energy, Montana's largest electric utility, pay almost half as much for electricity from the Judith Gap, MT 135-megawatt wind facility ($32.11 per megawatt hour) compared to the Colstrip coal-fired power plant ($64.55 per megawatt hour).[192]	
5-81, cont'd	Eastern Montana generally, as well as the geographic area near the Proposed Action site, are particularly good locations for wind energy development.[193] In fact, multiple large wind projects have been proposed for the area.[194]	
	[187] U.S. DOE. https://windexchange.energy.gov/maps-data/321. Attachment 132. [188] Billings Gazette. http://billingsgazette.com/news/state-and-regional/montana-quadruples-solar-energy-capacity-in-one-year/article_6d88ac58-cc83-54c9-9387-7dba356faa50.html. Attachment 133. [189] https://www.power-technology.com/projects/rim-rock-wind-farm-montana/. Attachment 134. [190] U.S. DOE. https://www.energy.gov/eere/downloads/revolutionnow-2016-update. Attachment 135. [191] https://www.lazard.com/perspective/levelized-cost-of-energy-2017/. Attachment 136. [192] http://meic.org/wp-content/uploads/2016/03/2015.02-NorthWestern-Electric-Rate-Graphs.pdf. Attachment 137. [193] https://windexchange.energy.gov/maps-data/71. Attachment 138. [194] Mud Springs, https://everpower.com/mud-springs-mt/. Attachment 139. And Orion http://billingsgazette.com/news/state-and-regional/montana/montana-s-largest-wind-farm-quietly-develops-northeast-of-colstrip/article_35f5dee1-175c-57f6-b778-dd9054bb8238.html. Attachment 140.	
	65 | Page MEIC et al. Rosebud Area F DEIS Comments	

Comment/ Code	Document #005-Sierra Club	Response
5-81, cont'd	The potential loss or gain of clean energy benefits bear a logical relationship with the Proposed Action and should be considered in the analysis of alternatives.	
5-81, cont'd	The distinguishing characteristics of the Rosebud Mine and its associated power plants should be taken into account when analyzing the impact of alternatives. The Rosebud Mine only sells its coal to the Colstrip and Rosebud Power Plants, which only produce electricity. This electricity is then put on the Colstrip Transmission System in order to be transmitted to its end use customers. While transmission lines do not treat coal electrons differently than wind electrons, they nevertheless have a finite capacity for the amount of electrons that can be carried. When coal electricity is put onto a transmission line it reduces the available capacity for wind and solar electricity to utilize that line. Conversely, if coal electricity is <u>not</u> put onto a transmission line, there is greater capacity available for clean energy to utilize that line. Because the only practical result of the Proposed Action is the generation of coal-fired electricity, which is then put onto the Colstrip Transmission System, which reduces transmission capacity for clean energy projects, the analysis of alternatives should include the impact of the loss or gain of the benefits clean energy projects provide.	
5-81, cont'd	Wind developer interest in the Proposed Action region not only arises because of the region's high-quality wind resource, but also because of the potential to utilize the Colstrip Transmission System to sell electricity to out-of-state customers. Without access to transmission lines, a power plant for out-of-state consumption cannot be built. Unfortunately, the existing transmission paths that Montana exports electricity through are almost fully congested.[195] Furthermore, constructing new transmission lines is an expensive and difficult endeavor. Combined, these factors make any available transmission capacity highly valuable and critical to the construction of new clean energy projects. Were the Proposed Action to be approved, then a reasonable consequence would be the loss of benefits that would otherwise accrue from clean energy projects. Conversely, the No Action alternative should include analysis of the benefits gained from clean energy projects.	
5-81, cont'd	Clean energy projects like wind and solar produce benefits that mirror and indeed go beyond those identified by the DEIS from the Proposed Action. The benefits from the Proposed Action are described in 1.3.3, entitled "Benefits," as: • An ongoing fuel source (70.8 million tons of coal) for the Colstrip Power Plant (Units 3 and 4) and the Rosebud Power Plant; • Continued employment for workers at the mine; • An ongoing tax base to federal, state, and local governments; • Ongoing royalty payments to mineral resource owners; • Continued support to local businesses; • An ongoing source of income to Western Energy and its shareholders; and [195] ETIC Report page 15: http://leg.mt.gov/content/Publications/Environmental/2010-energy-policy.pdf. Attachment 141. 66 | Page MEIC et al. Rosebud Area F DEIS Comments	

Comment/ Code	Document #005-Sierra Club	Response
	• Reliable electric power for an additional 8 years. Comparatively, the benefits of clean energy projects not only replicate the Proposed Action benefits but also include even more. These include:	
5-81, cont'd	• Employment for workers; • An ongoing tax base to federal, state, and local governments; • Land lease payments to local land owners; • Support to local businesses; • An ongoing source of income to the project developer and its shareholders; • Reliable electric power for 20 to 25 years (and perhaps considerably longer due to the inexhaustible nature of wind and solar energy); • No air or water pollution during operation; and • No environmental cleanup after the life of the project (in fact, due to the passage of HB 216 in the 2017 Montana legislative session, wind facilities are now required to post decommissioning and remediation bonds). The loss or gain of these benefits should be included when analyzing the impact of alternatives.	
5-82 (7301)	**X. OSM FAILED TO ADEQUATELY ANALYZE IMPACTS TO CULTURAL RESOURCES AND FAILED TO MEET FEDERAL CULTURAL RESOURCES CONSULTATION REQUIREMENTS.** OSM's Area F DEIS failed to follow the tribal consultation process mandated by federal law or adequately disclose impacts to tribal cultural resources in the DEIS. According to the DEIS:	**5-82 Response: Section 4.14** in the EIS includes a comprehensive analysis of impacts on cultural resources in accordance with applicable federal requirements including Section 106 of the National Historic Preservation Act and the National Environmental Policy Act. Under the Proposed Action, surface disturbance from mining and wetland mitigation activity may result in disturbance or destruction of historic properties located within the analysis area, and these impacts would be long-term, major, and adverse. Adverse impacts would be resolved through both a property-specific Memorandum of Agreement and a long-term PA stipulating measures for continued Section 106 compliance. See **Section 6.1.3** in the EIS for a description of the tribal consultation process. OSMRE has met the reasonable and good faith effort mandate to consider potential effects on historic properties under Section 106 of the NHPA by undertaking efforts to identify historic properties within the area of potential effect (intensive pedestrian survey) and by affording the SHPO and interested tribes to provide comment. OSMRE initiated consultation with three tribes that claim cultural affiliation with the region of Montana where Area F is located. OSMRE has continued to consult with tribes, including resolution of adverse effects for affected properties. The three tribes did not respond to consultation efforts.
5-82, cont'd	Section 106 mandates that consultation occur among the State Historic Preservation Officer (SHPO), the Advisory Council on Historic Preservation (ACHP), Native American tribes traditionally associated with the affected land, and other "interested parties" to consider effects on historic properties from the undertaking (see Section 106 Consultation below) ... OSMRE is responsible for consultation with SHPO and for NHPA compliance, which requires consulting with ACHP and interested parties including Native American tribes who claim cultural affiliation with the affected lands in order to maintain government-to-government consultation responsibilities. As part of Section 106 consultation, OSMRE would disclose potential effects on historic properties on lands with federal minerals. DEIS at 344-345. The DEIS goes on to state:	
5-82, cont'd	Ethnohistoric information suggests the presence of several modern tribes in the area by this period including the Shoshone, Crow, Northern Cheyenne, Kiowa, and Kiowa-Apache (Reher 1979). . . Major tribes that occupied the region during the Historic period included the Crow, Shoshone, Lakota (western, or Teton Sioux), Nakota (central, or 67 | Page MEIC et al. Rosebud Area F DEIS Comments	

Comment/ Code	Document #005-Sierra Club	Response
	Yanktonai Sioux), Cheyenne, Blackfeet, Gros Ventre, Arapaho, and Kiowa, among others (Waldman 1985; Kooistra et al. 1993).	
5-82, cont'd	DEIS at 350. Despite acknowledging the presence of multiple Native American tribes, when it comes to actual consultation, OSM states that it has only made attempts to consult with three reservations. According to the DEIS: OSMRE has initiated tribal consultation with the Northern Cheyenne, Fort Peck Assiniboine and Sioux tribes, and Crow tribes regarding the identification and effects on TCPs and archeological sites of significance to the tribes.	
5-83 (7310)	DEIS at 350. OSM has failed to even attempt to consult with tribes that it acknowledges have historical and cultural tries to Area F. Without the required consultation, Tribal Historical Preservations Officers had no opportunity to dispatch monitors or surveyors to take part in any cultural resource surveys. OSM provides no explanation as to why it only chose to involve three Montana tribes in the 106 process, which must be corrected, acknowledged, and addressed as part of the NEPA process.	**5-83 Response**: See **Section 6.1.3** in the EIS for a description of the tribal consultation process that OSMRE has conducted thus far. OSMRE provided opportunities for the Crow, Northern Cheyenne, and Fort Peck Assiniboine and Sioux Tribes to identify sites of religious or cultural significance. OSMRE initiated consultation with the Apache, Blackfeet Nation, Eastern Shoshone, Kiowa, and Oglala Sioux (Lakota) Nations on June 6, 2018
5-83, cont'd	Furthermore, there was no discussion of attempts to interview local families or elders from local tribes about the impacted area, as would be normally conducted as "good faith effort" under Section 106. Many of the ranch families in the area have been in place since the 1880s. Just to the south of the area of potential effect (APE), the Northern Cheyenne tribe still occupies land that they have lived on for hundreds of years. Local knowledge of historical and cultural sites should not be ignored. OSM violated NEPA by failing to adequately gather data on cultural resources, and compounded this error by failing to consult with appropriate Native American tribes and other affected communities to identify and analyze impacts to cultural resources. To correct these egregious omissions that rob the public and agency decision makers of valuable information, OSM must reinitiate consultation in compliance with the requirements of federal law and then must prepare and recirculate for public comment a supplemental DEIS that adequately discloses and analyzes the cultural resource impacts.	
	CONCLUSION	
Summary statement	For all of the reasons listed above, the Rosebud Area F expansion DEIS is legally deficient. Moreover, the proposed expansion would exacerbate climate change and needlessly pollute our air and water. We urge OSM and Montana DEQ to reject the proposed Rosebud Area F expansion in favor of the No Action alternative.	
	68 | Page MEIC et al. Rosebud Area F DEIS Comments	

Comment/ Code	Document #005-Sierra Club	Response
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1.3 Comments from Individuals and Organizations

A complete list of commenters, including those who submitted form letters, is included in the project record and available for public inspection at the addresses listed in the abstract at the front of the Final EIS.

Substantive comments received by individuals and organizations on the DEIS were organized for response according to chapter or resource topic and then further organized by issue codes. In the response tables, substantive comments or "representative quotes" were taken from individual letters and have been copied verbatim into the "Comment" column (please note that comments have not been altered in any way to correct errors in grammar, spelling, punctuation, etc.). To reduce repetition, similar comments were grouped together and responded to collectively. Where similar comments are grouped, the agencies' response follows the last comment in that group.

1.3.1 Chapter 1

Topic	Code and Issue	Document ID	Page Number	Comment
1000 NEPA/MEPA Process	1001 Power plants should be analyzed as connected actions under NEPA/MEPA	336	1	Because of the contractual relationship between the mine and the coal plant, these 140 million tons of CO_2 are a direct impact of this project not an indirect impact and be considered as such in the Final EIS.
		Response: As described in **Section 1.4.1.1, Office of Surface Mining Reclamation and Enforcement, Applicable Statutes and Regulations, NEPA, Connected Actions** of the EIS, OSMRE evaluated the project and the Colstrip Power Plant (which would also apply to the Rosebud Power Plant) as potentially connected actions. OSMRE concluded that "Area F and the power plants are not connected actions because the power plant[s] are existing operational facilities, and no pending actions or reasonably foreseeable future actions are currently proposed for the power plant[s]. Therefore, Area F is the only proposed action and, as such, is not connected to a currently existing and operational power plant facility, regardless of the power plant facility's physical location" (OSMRE 2014a). Based on this guidance, direct effects of the power plants and analysis as connected actions under NEPA were not given further consideration in the EIS. Effects from the two power plants are considered indirect effects in the EIS analyses.			
	1004 Comment about the public meeting	219	1	I attended the Citizen's Hearing in Missoula, MT on February 15.
		Response: Comment noted.		
1000 NEPA/MEPA Process	1005 Comment about the public comment period	245	1	On behalf of Northern Plains Resource Council and our members around the state of Montana, I respectfully request the U.S. Office of Surface Mining extend by 60 days the period for public comment on the draft environmental impact statement (DEIS) for Western Energy Company's expansion at the Rosebud Strip Mine Area F. Due to the length and detail of the 947-page DEIS, I believe an additional 60 days are needed to fully address the technical information contained within the document. The closest hard copy available to the public is 30 minutes from the proposed expansion site and not available for checkout. Many of our members are working ranchers and farmers and will require more time to examine the DEIS.
		246	1	I respectfully request that DEQ extend by 30 days the period for public comment on the draft environmental impact statement (DEIS) for Western Energy Company's expansion at the Rosebud Strip Mine Area F. Due to the length and detail of the 947-page DEIS, which took years to create, we believe an additional 30 days are needed to address the information contained within the document. The closest hard copy available to the public is 30 minutes from the proposed expansion site and not available for checkout. Many of our members are working ranchers and farmers and will require more time to examine the DEIS in light of winter conditions and calving season.
		247	1	On behalf of the Montana Environmental Information Center (MEIC) and the Sierra Club, I respectfully request that the Montana Department of Environmental Quality extend by 30 days the period for the public to comment on the draft environmental impact statement (DEIS) for Western Energy Company's Rosebud Strip Mine Area F released on January 4, 2018. This extension of time is necessary to assure the full public involvement in the review process mandated by the National Environmental Policy Act (NEPA) and the Montana Environmental Policy Act (MEPA). The DEIS on Area F was in the works for seven years. The document consists of 972 pages of data, analysis, explanation, tables and figures. Our organizations would like to fully participate and provide useful information to the department for review. Forty-five days is simply not sufficient for the public to review the documents, obtain experts to review technical materials, and submit comments.
		332	1	But to add the Rosebud coal mine is adding insult to injury, especially since no reasonable science-based EIS was and done and citizens' input is largely avoided and consciously prevented among those who this mine would adversely affect.
		342	2	I am floored about the lack of due process in the draft EIS, including lack of opportunities for public comment. This is a time when government agencies need to follow the law, and to include public input and engagement.

Topic	Code and Issue	Document ID	Page Number	Comment
				Response: Public involvement opportunities during the DEQ and OSMRE scoping periods were described in the Draft EIS in **Section 1.5, Public Scoping Outreach**. These opportunities were also summarized in **Section 6.1.1, Public Comment Process**, which has been updated in the Final EIS to include a description of public outreach and opportunities to comment on the Draft EIS. OSMRE and DEQ conducted a 60-day public comment period on the Draft EIS. The initial 45-day public comment period on the Draft EIS began on January 4, 2018, and was noticed in the *Federal Register*, on agency websites, in legal notices, and in local newspapers. At the request of the Northern Plains Resource Council and Montana Environmental Information Center, the comment period was extended by the agencies to March 5, 2018 (a 15-day extension). OSMRE and DEQ jointly hosted a public open house and town hall meeting in Colstrip, Montana, on February 13, 2018.

Topic	Code and Issue	Document ID	Page Number	Comment
1100 Purpose and Need	1100 General comment about P&N	56	1	The Colstrip Power Plant depends on Western Energy coal for generation of electricity serving the state of Montana. For the next decade or two, alternative electrical generation will not meet the capacity and reliability needs of Montana electrical customers. Without the mine expansion the Colstrip Power Plant will be forced to reduce or cease electrical production, putting the reliability and availability of the electrical supply in Montana at risk.
		63	1	Until the proper infrastructure is in place for additional sources of power, A loss of coal fired power would harm Montana.
		64	1	Renewables like wind and hydro-electric are great yet we need to include coal and natural gas in the mix to provide the low cost power that we all want and use for things like this electronic reply and to maintain the standard of living we have come to appreciate.
		71	1	The Colstrip Area F (Rosebud Mine) will increase the ability to provide low-cost electricity using an efficient and reliable fuel source for decades or even generations to come.
		81	1	Support for this project provides stability to the electric grid and to the entire area.
		206	1	Coal is a cheap efferent source of electricity and is needed for us all to live and grow in Montana.
		209	1	Renewables cannot or will not meet our present or future demand for electricity. The facts don't lie they are only producing 3.2% of current demand. Therefore we must continue to permit coal for steam generation as well as permitting all other reliable energy sources.
		210	1	With record breaking snow and plunging temperatures, we need affordable electric heat.
		221	1	We need coal in Montana and we need coal-fired electricity for our national security.
		225	1	Also the state budget would benefit substantially from the sale of coal. It would provide good paying jobs that would benefit the state from income taxes as well as keeping many people off welfare lines.
		229	1	In order to provide robust energy security and economic well-being in rural areas, coal mining must be considered as a feasible solution and product in our energy portfolio. If natural gas prices become more volatile, how will this affect lower income families? Renewables and battery technology has a long way to go until constant baseline power is delivered.

Topic	Code and Issue	Document ID	Page Number	Comment
		240	1	Coal is necessary for much more than just energy. We are going to need a lot of coal to produce the amount of steel necessary to rebuild our military and our infrastructure. With new tariffs on imported steel coupled with increase in demand, it will benefit us greatly to produce our own steel.
		248	2	Finally, coal is a reliable, low-cost energy source. There is no doubt the world needs more energy, and we need to make that energy cleaner. Clean coal technology, including carbon capture, utilization, and sequestration (CCUS), by far holds the most promise for meeting those twin problems. However, the United States has not been a leader in developing CCUS technology to the extent that we should be. To help spur that technology, we need to increase the demand for coal and develop more coal. Only with CCUS can we address climate change while still meet the increasing energy demands in the future.
		Response: MEPA and its implementing rules, ARM 17.4.614(1), require that any EIS prepared by a state agency include a description of the purpose and benefits of the proposed project. **Section 1.3.3, Benefits** of the EIS has been consolidated in the Final EIS to eliminate redundancies and was revised to include additional benefits raised in public comments. See also, response to comment 1101.		
1100 Purpose and Need	1101 Purpose and need is not clear or misstated	196	1	The DEIS concerning the Area F expansion appears to me to be flawed, first, because it mistakenly double-counts several of the benefits of coal extraction and use (e.g., fuel source? PLUS electric power?); and second, because it ignores the severe long-term environmental costs of coal extraction and use not to mention that it fails to acknowledge that expansion is essentially unnecessary in light of the probable lifetimes of the concerned power plants.
		Response: The following revisions were made to **Section 1.3** in response to public comments: • The Draft EIS erroneously cited ARM 17.4.614(1); this citation was updated to ARM 17.4.617(1) in the Final EIS. • The list of benefits was consolidated in the Final EIS to eliminate redundancies and was revised to include additional benefits raised in public comments. • A benefit specific to WECo was eliminated from the list of benefits: "~~an ongoing source of income to Western Energy and its shareholders~~."		
	1103 Demand for coal	11	1	The Rosebud mine fuels the Colstrip power plant, which is slated to shut down in the 2020's. Already, the mine has sufficient reserves to fuel Colstrip until it shuts down. There is absolutely no need to authorize an expansion of this mine.
		235	1	It doesn't make sense for the Rosebud Mine to not have enough available coal to supply the needs of the Colstrip and Rosebud power plants.
		Response: Coal mined in Area F would be combusted at the Colstrip Power Plant to generate electricity. Units 1 and 2 at the Colstrip Power Plant will shut down by 2022. Units 3 and 4 at the Colstrip Power Plant do not have a defined shut down date at this time; therefore, the coal mined in Area F would be used to supply Units 3 and 4. The range in annual production provided in **Section 2.2.1, Past and Existing Production** of the EIS varies from year to year, but represents the typical annual production volumes. As discussed in **Section 2.2.6, Life of Operations**, the Rosebud Mine has three active pit areas. Area A is expected to be mined until 2022 (Peterson 2016b). Area B, as currently permitted, is expected to be mined until 2030 (Peterson 2016b). Area C is expected to be mined until 2022 (Peterson 2016b). Areas A, B, and C are expected to account for 50 percent of the total output of the mine until 2019 and 40 percent of the total output until 2022 (the last year of active mining for Areas A and C) (Peterson 2016a). Without the addition of the proposed project or Area B AM5, the operational life of the Rosebud Mine would be expected to end in 2030 (see also Figure 3).		
		228	1	However, the impacts suggest negligible impact on climate change and that direct and indirect greenhouse gasses would contribute incrementally to climate change. This finding fails to recognize the market forces of coal as a commodity and the relative ease at which coal is transported, especially in the Powder River Basin, which is laden with low cost coal deposits, actively mined in a number of mines by a number of competing companies.
		228	1	Instead, it is quite possible that existing coal mines would compete to provide low cost coal to Colstrip, merely shifting the tonnage from a Montana operation to a Wyoming or other Montana coal operation.

Topic	Code and Issue	Document ID	Page Number	Comment
				Response: The federal action before OSMRE is to recommend to the Assistant Secretary of Lands and Minerals Management (ASLM), approval, approval with conditions, or disapproval of the proposed federal mining plan (**Section 1.4.1.1, Office of Surface Mining and Reclamation** of the EIS). There is no requirement under existing regulations that would necessitate OSMRE to make a determination regarding the marketability of the coal to be mined in the proposed mining plan prior to making the recommendation to the ASLM. Similarly, the state action before DEQ is to review and to make a decision on Western Energy's surface-mine operating permit application under MSUMRA, Section 82-4-221 et seq., MCA (see **Section 1.4.1.2, Montana Department of Environmental Quality**). There is no requirement under existing regulations that would necessitate DEQ to make a determination regarding the marketability of the coal to be mined under the operating permit.

Topic	Code and Issue	Document ID	Page Number	Comment
1200 Bonding and Financial Assurance	1200 Comment about Westmoreland/WECo's financial stability and ability to pay for reclamation	Form Letter A	1	Your proposal would open the door for 70 million tons of publicly owned coal to be mined by Westmoreland, a company on the verge of bankruptcy.
		Form Letter C	2	Westmoreland is in serious financial trouble and will likely have to declare bankruptcy in the near future. In the last year its stock dropped from 17.53 per share to 0.68 per share (a 97% drop). The mine has already harmed water resources, failed to meet its reclamation obligations, and can't be trusted to be around in the near future.
		11	1	Your proposal would open the door for 70 million tons of publicly owned coal to be mined by Westmoreland, a company on the verge of bankruptcy.
		213	2	Westmoreland is in serious financial trouble and will likely have to declare bankruptcy in the near future. In the last year its stock dropped from 17.53 per share to 0.68 per share (a 97% drop). The mine has already harmed water resources, failed to meet its reclamation obligations, and can't be trusted to be around in the near future.
		218	2	Westmoreland is in serious financial trouble and will likely have to declare bankruptcy in the near future. In the last year its stock dropped from 17.53 per share to 0.68 per share (a 97% drop).
		219	1	And, Westmoreland is likely to declare bankruptcy in the near future due to serious financial problems. So, once again, Montana taxpayers would be left with the major responsibility to clean up the mess. Expanding the mining operation knowing that Montanans will face the results of nonexistent or shoddy cleanup by Westmoreland is not acceptable.
		239	1	As for the people saying Westmoreland is going bankrupt and that's why we shouldn't get more permits, what they aren't taking into account is that these reclamation costs have already been set aside in restricted accounts so the reclamation will get done whether they go belly up or not.
		Response: The financial viability of Westmoreland and its subsidiary, Western Energy Company, is outside the scope of the EIS. In accordance with ARM 17.24.405(7), DEQ cannot issue a permit until the applicant files the required performance bond. The standard applied by DEQ in determining the amount of performance bond is the estimated cost to the state if it had to perform the reclamation, restoration, and abatement work under MSUMRA, the rules adopted thereunder, and the permit (**Section 1.6.1, Bond Amount** in the EIS). All currently permitted areas of the Rosebud Mine are fully bonded for reclamation. Please see **Table 5** in Chapter 2 for bond amounts by permit area and reclamation phase. **Table 4** provides permitted and disturbed acres by area. **Table 4** and **Table 5** have been revised in the Final EIS to indicate the percentage of reclamation that has been achieved in each permit area. The EIS provides an overview of reclamation bonding procedures and the criteria for phased bond release in **Section 1.6, Financial Assurance**. If success criteria (**Section 1.6.4, Bond Release**) are not met, the associated bond will not be released, and monitoring will continue. Reclamation and bonding requirements are applicable to the project area, if permitted, and all currently permitted areas of the Rosebud Mine. **Section 1.6** has been revised to clarify that the requirements are applicable to all permit areas, not just the proposed project area.			

Topic	Code and Issue	Document ID	Page Number	Comment
1200 Bonding and Financial Assurance	1202 Comment about bond release status/reclamation status of other permit areas of the Rosebud Mine	Form Letter C	2	Only 2.7% of the mine has been fully reclaimed despite the fact that it has been in operation for over 40 years. Mines have an obligation to do 'contemporaneous reclamation' but the Rosebud mine has failed to comply.
		213	2	Only 2.7% of the mine has been fully reclaimed despite the fact that it has been in operation for over 40 years. Mines have an obligation to do 'contemporaneous reclamation' but the Rosebud mine has failed to comply. The government should not let the mine expand and create an even bigger environmental mess when it hasn't bothered to clean up the mess it already made.
		218	2	The mine has already harmed water resources, failed to meet its reclamation obligations, and can't be trusted to be around in the near future.
		218	2	Only 2.7% of the mine has been fully reclaimed despite the fact that it has been in operation for over 40 years. Mines have an obligation to do 'contemporaneous reclamation' but the Rosebud mine has failed to comply. The government should not let the mine expand and create an even bigger environmental mess when it hasn't bothered to clean up the mess it already made.
		219	1	The reclamation issue is a case in point. Despite the fact that the Rosebud Mine has been in operation for more than 40 years, Westmoreland has reclaimed only 2.7% of the mine despite its obligation to do 'contemporaneous reclamation'
		219	1	And, Westmoreland is likely to declare bankruptcy in the near future due to serious financial problems. So, once again, Montana taxpayers would be left with the major responsibility to clean up the mess. Expanding the mining operation knowing that Montanans will face the results of nonexistent or shoddy cleanup by Westmoreland is not acceptable.
		226	1	Why is a bond not being secured from Westmoreland for the known damages to water & reclamation efforts that are needed?
		331	1	Why would any sane person/entity approve an expansion at a site that has completed less than 3% of the required contemporaneous reclamation? Westmoreland is teetering on bankruptcy – we should take away their credit card and not expand the liabilities for Montana taxpayers.
		341	1	They will not do the reclamation.
		347	1	The law requires "contemporaneous reclamation," yet only 2.7 % of the Rosebud Mine has been reclaimed. Authorizing more mining at a mine operation that is breaking the law is wrong.
		Response: All currently permitted areas of the Rosebud Mine are fully bonded for reclamation. MSUMRA includes requirements for contemporaneous reclamation in ARM 17.24.501(6): "Backfilling and grading must be kept current with mining operations." To be considered current, backfilling and grading must meet the requirements outlined in ARM 17.24.501(6), including maintaining the required limits on the number of spoil ridges, completing backfilling and grading within two years of coal removal, and meeting the approved post-mine topography. Please see **Table 5** in Chapter 2 of the EIS for bond amounts by permit area and reclamation phase. **Table 4** provides permitted and disturbed acres by area. **Table 4** and **Table 5** have been revised in the Final EIS to indicate the percentage of reclamation that has been achieved in each permit area. The EIS provides an overview of reclamation bonding procedures and the criteria for phased bond release in **Section 1.6, Financial Assurance**. If success criteria (**Section 1.6.4, Bond Release**) are not met, the associated bond will not be released, and monitoring will continue. Reclamation and bonding requirements are applicable to the project area, if permitted, and all currently permitted areas of the Rosebud Mine. **Section 1.6** has been revised to clarify that the requirements are applicable to all permit areas, not just the proposed project area. The EIS **Glossary** has been revised to include a definition of "contemporaneous reclamation." A performance bond cost estimate for the Proposed Action is provided in Western Energy's PAP, Exhibit G. If the permit application is approved, the final performance bond calculation would be made by DEQ (with federal concurrence) in accordance with ARM 17.24.1102, and Western Energy would need to submit the performance bond prior to issuing the permit. The performance bond would be in the form of a surety bond or a collateral bond (see ARM 17.24.1105).			

Topic	Code and Issue	Document ID	Page Number	Comment
		25	1	It has been my observation that the employees of the Western Energy Company have done a very good job of maintaining the environment while providing coal deliveries to power plants via a covered conveyor system. As dedicated as Western Energy is to supply coal to the Power Plants, I believe their greatest asset resides in their efforts of reclaiming the land after the coal has been removed. It is impressive to view the reclaimed land!
		27	1	Western Energy has demonstrated decades of successful land stewardship and reclamation of mined land in Areas A, B, C, D and E.
		28	1	They have received numerous awards for reclamation and currently have several thousand acres in the bond release stage. I have personally seen the effects of their reclamation and find their work leaves the land in a better condition than it was before mining.
		32	1	The Rosebud Mine is a great steward of the land.
		32	1	The improvements made since Northern Pacific owned the mine is phenomenal. It is evident that the mine is going above and beyond in stewardship of the land. There is no doubt that would continue with this expansion.
		33	1	Rosebud mine has proven to be a very good steward of the environment and I see no reason this would change.
		34	1	They do an excellent job at the mine. And the land that is done being mined looks better than it did before mining.
		41	1	This mine has shown great respect for the areas it has already mined and reclaimed.
		43	1	This mine has followed all reclamation since the inception of then1976 regulation.
		44	1	This mine has followed all reclamation since the inception of the 1976 regulation.
		51	1	I've seen first hand the work that they do and they do a wonderful job at reclamation. There is more wildlife on the reclamation sites than on existing untouched land.
		55	1	I have witnessed how Western Energy has taken care of the land they have mined and returned it to its natural state since I was a child.
		58	1	Westmoreland is a responsible mining company with an exemplary reclamation process and record.
		61	1	The Rosebud Mine has been safely and productively mining for decades and has an excellent environmental record and has receive various awards for their reclamation of previously mined land.

Topic	Code and Issue	Document ID	Page Number	Comment
		62	1	The Rosebud Mine has been safely and productively mining for decades and has an excellent environmental record and has receive various awards for their reclamation of previously mined land.
		64	1	The employees of the mine and Westmoreland have proven they can mine responsibly and rehabilitate the mined land to a sustainable landform for future use.
		79	1	The proposed mine activity is an extension of an existing operation with a long history of not only meeting the legal requirements to adequately protect the environment but also developing more effective reclamation techniques and wildlife management systems. I distinctly remember providing mine tours to many members of the general public and virtually every time they would point to areas we had previously reclaimed and ask if we could ever restore the mined land to that pristine condition because the reclaimed areas were so impressive.
		80	1	Rosebud mines reclamation is proof, to anyone willing to take a tour, that their stewardship of the land has been exemplary; even to the point of improving grazing land for local ranchers. Wildlife is flourishing and water is clean. Please expand and help these eastern Montana communities survive.
		117	2	I have personally walked the reclaimed lands at the Rosebud Mine, and I love what I see. I have walked it multiple times in different times of the year, and as a person who has studied environmental science, probably not as much as you have, but a little, and as a person who lives right near the mine in the city of Colstrip, I can tell you that I am extremely satisfied and extremely happy with the way that they treat the land that I hold so dear.
		199	1	I have had the good fortune to visit the Rosebud mine and am fully familiar with . . . the outstanding work they do minimizing their impact on the environment and completing award winning reclamation in areas once mining has been completed.
		204	1	The mining company has done outstanding reclamation in it past mining endeavors.
		227	1	This mine has been recognized for its land stewardship and leads all mines in its efforts on reclamation.
		233	1	I am proud to say that Rosebud Mine continues to not only be a good steward of the land, but continues to focus on the positive reclamation of the mined lands. Many of the reclaimed lands that are back in ranching produce much higher yields of crops and support more animals than the land did before mining. Rosebud takes justifiable pride in its reclamation activities.
		255	1	For many years, this area has been mined, successful with no major environmental issues.
		260	1	As you likely know, the Western Energy Company has a reputation for their excellent reclamation efforts. I have provided plant tours for the public for many years. Weather permitting, I take those persons to the top of the units to look out over the surrounding area. I have never had one of those persons correctly guess which areas are reclaimed and which are natural.
		Response: Thank you for your comment. Comments are noted.		

Topic	Code and Issue	Document ID	Page Number	Comment
1300 Agency Authority and Actions	1300 General comment about agency authority	35	1	I believe the decision for this should be made by those who live and work in or around Colstrip, or by those who are directly affected. I don't believe people who do not live here or who are not effected by this decision should have anything to do with the decision making process.
		Response: OSMRE and DEQ's legal authorities and responsibilities, as well as their respective decision processes, are described in **Section 1.4, Agency Authority and Action** of the EIS.		

1.3.2 Chapter 2

Topic	Code and Issue	Document ID	Page Number	Comment
2000 Issues and Development of Alternatives	2001 Comment about key issues	247		It is simply not reasonable to expect the public to become fully informed about the myriad issues in a DEIS that is nearly 1,000 pages in length and then submit informed comments.
		Response: The Executive Summary of the EIS, which is 32 pages, provides an overview of the Proposed Action and alternatives, the affected resources, and expected environmental impacts. OSMRE and DEQ conducted a 60-day public comment period on the Draft EIS. The initial 45-day public comment period on the Draft EIS began on January 4, 2018 and was noticed in the *Federal Register*, on agency websites, in legal notices, and in local newspapers. At the request of the Northern Plains Resource Council and Montana Environmental Information Center, the comment period was extended by the agencies to March 5, 2018 (a 15-day extension). OSMRE and DEQ jointly hosted a public open house and town hall meeting in Colstrip, Montana, on February 13, 2018.			

Topic	Code and Issue	Document ID	Page Number	Comment
2100 Alternative 1 No Action	2100 Substantive comment in support	Form Letter A	1	The Rosebud mine fuels the Colstrip power plant, which is slated to shut down in the 2020's. Already, the mine has sufficient reserves to fuel Colstrip until it shuts down.
		Response: Thank you for your comments. Comments in support of Alternative 1 – No Action Alternative are noted.		

Topic	Code and Issue	Document ID	Page Number	Comment
2200 Alternative 2 Proposed Action	2200 Substantive comment in support	Form Letter B	1	The EIS has analyzed all aspects of the environmental impacts of the project and has not determined any adverse effects within a reasonable proximity to the project. Both the water quality and the air quality analyses indicate that there will be no violations of the standards for air and water. The analyses indicate no endangered species impacts have been identified in or near the project area. The benefits of the proposal will be the continued employment of over 800 workers in the mine and power plants. Economic benefits over the life of the project include tax revenues to local, State and Federal governments, royalty payments to the federal government and private interests, local business support and the most reliable electric power supply within the region. A 2010 economic study conducted by a University of Montana Economist concluded the benefits of the mine and power plants to the state of Montana exceeds $500 million annually. For all these reasons, I support Alternative Two of the Draft Environmental Impact Statement, which is Western Energy Company's proposed new permit area known as Area F at the existing Rosebud Mine.
		8	1	Coal serves as a source for baseload power as Montana continues to diversify its energy portfolio, and the EIS of this project does not indicate any reason for this project not to proceed.
		27	2	For all these reasons, I support Alternative Two of the Draft Environmental Impact Statement, which is Western Energy Company's proposed new permit area known as Area F at the existing Rosebud Mine
		28	1	Based on these facts alone I would encourage the permit be issued as soon as possible.

Topic	Code and Issue	Document ID	Page Number	Comment
		33	1	Allowing the expansion of this mine would be very beneficial to Montana and Rosebud county. Please allow this vvc expansion.
		41	1	I am writing in support of the Rosebud Mine Expansion of Area F. This expansion will not only allow the continuation of many jobs at the mine, but will also continue mining in the area in an environmentally supportive way.
		50	1	It should stay open, and I am in support of the expansion of the Mine at Coal Strip.
		60	1	As a life long Montana resident and rancher I support the expansion of WECo Area F expansion.
		74	1	The extension of the current mine area makes sense, given the proximity to generation facilities and the fact that all infrastructure is already in place.
		77	1	Coal production is important and should be supported.
		78	1	I support the rosebud coal because it offers good middle class jobs with benefits. Coal mining in Montana also supports Montana people. Money that is paid into the coal severance fund that pays for teacher pension, infrastructure and what ever else Montana needs.
		80	1	To expand the mine would mean a robust economy for the entire state of Montana with a direct positive impact for Rosebud County and the local communities that live within the borders. I fully support the expansion of Area F - it would be a crime against the state to deny.
		80	1	Rosebud mines reclamation is proof, to anyone willing to take a tour, that their stewardship of the land has been exemplary; even to the point of improving grazing land for local ranchers. Wildlife is flourishing and water is clean. Please expand and help these eastern Montana communities survive.
		81	1	Continued economic operation of the Colstrip Power Plants is essential for the entire area. The operation of the mine and the power plants provides hundreds of jobs, millions of tax and royalty dollars, as well as stable, economic electricity to Montana and the entire area.
		82	1	Approving the EIS for Western Energy's Rosebud mine's Area F not only helps the Colstrip community, but it helps the State of Montana. The state needs the tax revenue and if Montana continues to take long periods of time to work through EIS's and EA's it hinders the ability for companies to stay profitable.
		87	1	I am in favor of expanding Rosebud Coal Mine's area. Both the mine and the power plant are economic benefits not only to the local area but the entire state of Montana. Over the past 20 years the coal industry as made significant advances in environmental standards. I think with all the improvements the mine should be allowed to expand and maintain the current economic benefits to our state.
		90	1	I am writing in support of the Rosebud Mine expansion. The benefits of this mine and the expansion are much needed to support Montana, the residents of Colstrip and surrounding areas and to provide this resource nationally as well as globally.
		91	1	I in favor of the approval of the Rosebud mine expansion. This is needed for the good of our community, county, and the state of Montana.

Topic	Code and Issue	Document ID	Page Number	Comment
		92	1	I am writing today in support of the Rosebud Mine Expansion Area F permit. Not only would this be a plus for Colstrip but for the State of Montana as well. The coal industry brings in valuable dollars to the state through the tax base but also from workers that spend this money throughout the state.
		96	2	Thus, Southeastern Development is very supportive and confident that this project will be mutually beneficial to all parties if approved, and so we ask you for that approval.
		97	1	I just wanted to say I'm for opening up the Area F and mining it and providing jobs for our community and our families here, so I'm all for here. Tax money for our state. I just wanted to say I'm for it.
		98	2	So, I just ask for your support to go forward and okay this permit, and it'd be good for everybody.
		100	1	I am in support of the permit for Area F of the mine.
		101	1	I support the development of Area F. . . My family depends on Western Energy and the Area F expansion. The reason that I and the other 63 enrolled members work for Western Energy is the company provided health insurances, a 401K, and good wages that are not available through the other employers in rural Montana. Through the mine, we are able to support our families and community in a way that we would not otherwise be able to do.
		102 and 103	1	I'd just like to speak in support of this and the expansion of this mine permit to support our area and our state, our nation. I strongly support the expansion of the Rosebud Mine.
		105	1	And I think that it would do the community well, as well as all of the workers, all the people in the state of Montana to pass this permit.
		106	2	The approval of this expansion area, expansion Area F, will definitely provide security to the miners that I represent, the people of the Colstrip community, to their families and the surrounding communities.
		107	2	The expansion of the Rosebud Mine is critical to the Colstrip community and to good-paying Montana jobs. I stand in strong support alongside the local community in moving the expansion forward.
		109	2	It is my professional opinion that the Rosebud Mine workers can handle any and all environmental situations that would arise in the permitting of new Area F. For those reasons, along with the need for a clean, reliable source of coal for the continued operation of Units 3 and 4, I support the Area F expansion at the Rosebud Mine. It is my professional opinion that the Rosebud Mine workers can handle any and all environmental situations that would arise in the permitting of new Area F. For those reasons, along with the need for a clean, reliable source of coal for the continued operation of Units 3 and 4, I support the Area F expansion at the Rosebud Mine.
		113	1	For all of the above listed reasons, we hope that you will join us in supporting Alternative Two of the draft EIS.
		118	2	Without the mine expansion, we will not have the powerplant or, of course, the mine. And I think it's very beneficial to the community and the state with the amount of taxes that come into our city, our county and our state. I'd just like to show my support.

Topic	Code and Issue	Document ID	Page Number	Comment
		119	2	Expanding the mine continues the ability of Colstrip to provide affordable energy and protects good-paying jobs for hard-working Montanans.
		120	3	I would propose you approve Alternative 2 and issue the new permit.
		127	1	I support responsible coal development. And the relief able energy it produces. I also work at the mine and know that they do a great job on reclamation.
		126	1	I'm for this expansion. It appears that this can be done within the rules and guide lines. It's good for Montanans' and it is good for Montana.
		123	3	This is extremely important for the future of our community, for our state, and I encourage the passage of this permitting process.
		135	1	I think we should mine area F. It is good paying jobs and tax money for the state.
		138	1	I am in favor of expanding the Rosebud mine, area F draft EIS. The impact in favor of coal and energy are vital to our country. Please allow this to pass.
		140	1	I am writing in support of the Rosebud Mine Expansion of Area F. This expansion will not only allow the continuation of many jobs at the mine, but will also continue mining in the area in an environmentally supportive way.
		144	1	Again nothing will be negatively affected according to the EIS. I am in full support.
		145	1	I am in support of the Rosebud EIS, as the approval will continue to provide good paying jobs for the residents of Colstrip, MT and provide revenues for the State of Montana of over $500M annually, as concluded by the University of Montana economic study.
		200	1	Low environmental impact combined with the positive economic benefit is I winner for the whole state.
		204	1	I support the area F mine extension as it will provide coal for reliable affordable electrical power.
		208	1	I agree with the findings of the Draft EIS relative to the very limited environmental impacts of the Rosebud Mine Expansion, and would add the following comments.
		205	1	Allowing this permit will allow jobs to continue, taxes to be paid, and the moral of the surrounding communities to improve. People ..... we have to think about people and the positive impact this will have on our friends & neighbors. We also have to think about local & state government and the financial aspect of allowing this permit. Like it or not Montana DEPENDS on Coal, whether it be for jobs, financing government, or just turning on the heat & lights. Move this permit forward, so Montana can keep moving forward.

Topic	Code and Issue	Document ID	Page Number	Comment
		211	1	Coal mining in Montana is important it provides jobs for many I think this should go through with no problems.
		222	1	I am writing in support of the Proposed Alternative, as recommended in this EIS, the employees of the Rosebud mine, the residents of Colstrip and all those that benefit from reliable, low cost electricity generated by the Colstrip power plant.
		248	1	Moreover, the coal Western Energy is proposing to mine is, in part, publicly owned. The public deserves to reap the benefits of those valuable coal resources. In Montana, many of our public services depend on revenues derived from federal natural resource royalties-one half of which are returned to the state. That's all the more reason to approve of the Proposed Action in order that the federal and state taxpayers receive the value they are due.
		253	2	I am in support of this permit being issued. I have lived in Colstrip for over 30 years and have witnessed WECo being a responsible mining company and neighbor.
		Response: Thank you for your comments. Comments in support of Alternative 2 are noted.		
2200 Alternative 2 Proposed Action	2201 Substantive comment against	Form Letter A	1	I am writing to object to your plans to bail out a failing mining company and approve an expansion of the Rosebud coal mine in Montana.
		215	1	Say NO to more water and air pollution, water theft, and severe climate impacts from this financially precarious mining operation.
		213 and 218	1	This mine expansion is a terrible idea for innumerable reasons
		219	1	I am writing to express my strong opposition to massive coal mine expansion at the Rosebud Mine which feeds the Colstrip Power plant.
		224	2	There is no need for an expansion to the Rosebud mine.
		217	2	It is reprehensible that officials sworn to protect the citizens of the United States would even consider this enormous coal mine expansion. This proposal is nothing short of deliberate intent to destroy that, which all life depends on, for the unsustainable enrichment of a few narcissistic, sociopathic, entities infected by the sickness of greed and must be stopped immediately.
		320	1	There are many reasons to oppose this request. Utilities that rely on coal-based energy are trying to wean themselves from this source of energy. The company has only minimally complied with its duty to reclaim the lands it already mines. Water quality in the analysis area will worsen and water rights will almost certainly be compromised in an arid area of Montana where water itself is a precious comoodity. Promises to supply water to people whose water sources are impacted do not guarantee that the water will be of the same quality. Montana has a long history of broken promises when it comes to mining companies. Because we have been so directly affected we do not forget this history . . . Please reject this request from Westmoreland.
		323	1	I strongly urge to NOT expand the mine. The expansion is a short-sighted plan that favors monetary gains over long term environmental health.
		326	1	The expansion of this coal mine (Rosebud Mine Area F) is a terrible idea if we humans are to survive as a species and our “earth mother” is to be able to sustain us in the future! We must turn away from fossil fuels.

Topic	Code and Issue	Document ID	Page Number	Comment
		327	1	Don't permit the expansion of the Rosebud Mine. Keep coal in the ground! Coal is in the past. Renewable energy is in the future.
		328	1	Expanding the Rosebud Mine is a terrible idea and incredibly short-sided.
		329	1	Please deny the expansion. No expansion until reclamation is done.
		330	1	It's hard to understand discussion of an expansion of the Colstrip plant when the reclamation of the existing plant is so pitiful. The impacts on water quality are well known and will only get worse with any mine expansion. My objection also hinges on the oversight in the EIS of the social costs of mining, shipping, and burning of more coal.
		334	1	The Rosebud Coal mine should be gradually phase out, not expanded
		337	1	I oppose the expansion of the Rosebud Coal Mine because the last thing Montana needs is greater fossil fuel extraction and the degradation of our water, air, and greater natural environment.
		343	2	We oppose the expansion of the Rosebud mine; we value this planet because our lives depend on it.
		344	1	I am opposed to the expansion of the Rosebud coal mine due to the disastrous environmental consequences for the local community, state, wildlife, water.
		345	2	I strongly oppose this expansion of the Rosebud Mine, because if we continue to rely on coal we may soon see disastrous consequences in our beautiful state, our proud country, and our one-of-kind mother earth.
		340	1	Coal is a public health hazard, an environmental disaster, and a climate chaos enhancer . . . Deny expansion of the Rosebud Coal mine.
		Response: Thank you for your comments. Comments opposed to the Proposed Action are noted.		

Topic	Code and Issue	Document ID	Page Number	Comment
2400 New Alternatives	2400 Suggested new alternative not previously analyzed or dismissed	Form Letter A	1	Instead of rubber-stamping more mining, please focus on ensuring full and final reclamation of the Rosebud mine, on providing resources to communities to help develop economic alternatives to coal
		Response: An alternative that provides resources to communities to help develop economic alternatives to coal would not meet the purpose and need of the Proposed Action. All currently permitted areas of the Rosebud Mine are fully bonded for reclamation. Please see **Table 5** in Chapter 2 of the EIS for bond amounts by permit area and reclamation phase. **Table 4** provides permitted and disturbed acres by area. **Table 4** and **Table 5** have been revised in the Final EIS to indicate the percentage of reclamation that has been achieved in each permit area. The EIS provides an overview of reclamation bonding procedures and the criteria for phased bond release in **Section 1.6, Financial Assurance**. Pursuant to 75-1-220(1), MCA, DEQ cannot include an alternative facility or an alternative to the proposed project itself.			

Topic	Code and Issue	Document ID	Page Number	Comment
2500 Alternatives Considered but Dismissed	2504 Comment suggesting alternative energy generation	Form Letter A	1	Instead of rubber-stamping more mining, please focus on ensuring full and final reclamation of the Rosebud mine, on providing resources to communities to help develop economic alternatives to coal, and consider ways to promote local clean energy development.
		Form Letter B	2	Montana and the Colstrip area have some of the best wind resources in the nation. There is a large transmission line that takes electricity from Colstrip to markets in Washington and Oregon. Those states are extremely concerned about climate change and are demanding clean, renewable electricity instead of coal. The DEIS fails to consider rapidly shifting energy markets and the demand for clean energy.
		213	2	Montana and the Colstrip area have some of the best wind resources in the nation. There is a large transmission line that takes electricity from Colstrip to markets in Washington and Oregon. Those states are extremely concerned about climate change and are demanding clean, renewable electricity instead of coal. The DEIS fails to consider rapidly shifting energy markets and the demand for clean energy. Failure to consider these trends puts Montana at risk.
		215	1	Montana and the Colstrip area have some of the best wind resources in the nation. There is a large transmission line that takes electricity from Colstrip to markets in Washington and Oregon. Those states are extremely concerned about climate change and are demanding clean, renewable electricity instead of coal. The DEIS fails to consider rapidly shifting energy markets and the demand for clean energy. Failure to consider these trends puts Montana at risk.
		217	1	A publication by the Natural Resource Defense Council (NRDC), reported that Montana has an abundant share of renewable energy just waiting to be harvested. With it comes sustainable energy, jobs, and revenues that will replace what coal once provided (Cohen). This report stems from a Harvard study which found Montana's wind potential as being 307 times greater than the state's electricity usage. In addition, the study states that, with our attainable 3,750 MW of wind capacity alone, we can achieve tens of thousands of construction jobs, 1,050 permanent jobs, $56 million in annual property tax revenue, and $152 million per year in ongoing positive economic impact on local communities (NRDC).
		218	2	We can do better. Montana and the Colstrip area have some of the best wind resources in the nation. There is a large transmission line that takes electricity from Colstrip to markets in Washington and Oregon. Those states are extremely concerned about climate change and are demanding clean, renewable electricity instead of coal. The DEIS fails to consider rapidly shifting energy markets and the demand for clean energy. Failure to consider these trends puts Montana at risk.
		219	2	Retrain Colstrip miners to work in better paying fields such as solar and wind energy.
		224	2	It’s time for industry to extract energy from the wind and the sun and other renewables.
		226	1	Why is Montana not keeping up and capitalizing on wind and solar energy as Iowa is?
		226	2	Please explore alternatives to this disastrous mine expansion - the DEQ should recommend alternative sources of energy generation, such as solar and wind that would offer less environmental impact and be sustainable for our future economy and planet.
		333	1	We need to switch from fossil fuels to clean energy now. Colstrip would be a good area for wind or solar energy projects which would support jobs in that area.

Topic	Code and Issue	Document ID	Page Number	Comment
				Response: As described in **Section 2.6.7, Alternative Energy Generation,** renewable or alternative energy generation or conservation was eliminated from detailed study because such an alternative would be inconsistent with the purpose and need for the action. As described in **Section 1.3** of the EIS, the purpose and need is predicated upon DEQ review of an application for a plan of operations for a surface mine and OSMRE review of a federal surface mining plan (to be included as part of the approved surface mining permit). The federal action before OSMRE is to recommend to the ASLM, approval with conditions, or disapproval of the proposed federal mining plan (**Section 1.4.1.1, Office of Surface Mining and Reclamation**). There is no requirement under existing regulations that would necessitate OSMRE to make a determination regarding the marketability of the coal to be mined in the proposed mining plan prior to making the recommendation to the ASLM. Similarly, the state action before DEQ is to review and to make a decision on Western Energy's surface mine operating permit application under MSUMRA, Section 82-4-221 et seq., MCA (see **Section 1.4.1.2, Montana Department of Environmental Quality**). Pursuant to 75-1-220(1), MCA, DEQ cannot include an alternative facility or an alternative to the proposed project itself unless the project is a state-sponsored project (which the Proposed Action is not).

1.3.3 Air Quality

Topic	Code and Issue	Document ID	Page Number	Comment
6200 Air Quality	6202 Comment about direct impacts	27	1	water quality and the air quality analyses indicate that there will be no violations of the standards for air and water.
		43	1	It is my understanding that there are no water or air quality issues.
		44	1	It is my understanding that there are no water or air quality issues.
		126	1	It appears to me that air and water quality will not be adversely affected in any great means in accordance of the law.
		222		Both the water quality and the air quality analyses indicate that there will be no violations of the standards for air and water.
		Response: Thank you for your comment. Please refer to **Section 4.3, Air Quality** and **Sections 3.7** through **3.9** (Water Resources) of the EIS for disclosure of expected effects.		

1.3.4 Climate and Climate Change

Topic	Code and Issue	Document ID	Page Number	Comment
3300 Climate and Climate Change	3302 Comment about analysis area	226	1	I would like to know why the DEQ is not looking at the area of climate change in relation to this proposed Rosebud Mine Expansion? Why is the DEQ not considering the greenhouse gases that will contribute to this world wide problem?
		Response: Detailed discussions of greenhouse gas (GHG) emissions and climate change in relation to the proposed Rosebud Mine Expansion are provided in **Section 4.4** and **Section 5.3.3** of the EIS for NEPA purposes. Under MEPA, DEQ's analysis of actions is limited to actions which significantly affect the quality of the human environment in Montana. Section 75-1-201(1)(b)(4), MCA.		
	3303 Comment about baseline data	213	1	The Colstrip plant is one of the largest sources of greenhouse gasses in the nation, releasing approximately 15 million tons of carbon dioxide into the air each year.
		218		The Colstrip plant is one of the largest sources of greenhouse gasses in the nation, releasing approximately 15 million tons of carbon dioxide into the air each year.
		Response: A discussion of GHG emissions from the Colstrip Plant is provided in **Section 3.4.2.5, Affected Environment** of the EIS for NEPA purposes. Under MEPA, DEQ's analysis of actions is limited to actions which significantly affect the quality of the human environment in Montana. Section 75-1-201(1)(b)(4), MCA.		
	3304 Comment about affected environment	16	10	The Colstrip plant alone emits 14,281,357 metric tons of carbon dioxide, followed by 69,182 metric tons of nitrous oxide (N2O) and 39,897 metric tons of methane (CH4) per year. Colstrip makes up 85.5% of pollution in the state of Montana. Acid rain is caused when sulfur and nitrogen oxides mix with atmospheric water, resulting in acidic rain falling to earth. With such high pollution in Colstrip, this is a major concern. However, acid rain is actually unlikely due to the low sulfur content of Powder River Basin coal.
		16	12	Research has shown that Colstrip is the 3rd largest producer of C02 emissions in the U.S., at 16 million metric tons of greenhouse gases annually.
		224	1	Into the new millennium, Colstrip is one of the largest sources of Carbon air pollution in the United States, pumping fifteen million tons of CO2 into the atmosphere each year.
		Response: A detailed discussion of GHG emissions from the Colstrip Power Plant is provided in **Section 3.4.2.5** of the EIS for NEPA purposes. Under MEPA, DEQ's analysis of actions is limited to actions which significantly affect the quality of the human environment in Montana. Section 75-1-201(1)(b)(4), MCA.		

Topic	Code and Issue	Document ID	Page Number	Comment
6300 Climate and Climate Change	6300 Suggested new analysis	226	2	The DEQ should be subject to legal recourse by public citizens for their omission in not addressing climate change in this EIS.
		Response: Detailed discussions of GHG emissions and climate change trends are discussed in relation to the proposed Rosebud Mine expansion are provided in **Section 3.4.2, Section 4.4**, and **Section 5.3.3** of the EIS for NEPA purposes. Observed climate trends are discussed in the EIS in **Section 3.4.2.3**, and the discussion on climate trends in Montana begins on page 163 of the EIS. Projected state and regional climate trends and impacts are discussed in **Section 4.4.2.3**. Under MEPA, DEQ's analysis of actions is limited to actions which significantly affect the quality of the human environment in Montana. Section 75-1-201(1)(b)(4), MCA.		

Topic	Code and Issue	Document ID	Page Number	Comment
6300 Climate and Climate Change	6302 Comment about direct impacts	40	1	Colstrip's carbon footprint is small compared to any major city, and the power and economic benefits are tremendous.
		Response: Thank you for your comment. GHG emissions are examined for NEPA purposes. Under MEPA, DEQ's analysis of actions is limited to actions which significantly affect the quality of the human environment in Montana. Section 75-1-201(1)(b)(4), MCA.		
	6303 Comment about indirect impacts	Form Letter C	1	The Colstrip plant is one of the largest sources of greenhouse gasses in the nation, releasing approximately 15 million tons of carbon dioxide into the air each year. All of the coal mined at Rosebud goes to the Colstrip plant and a filthy little waste coal plant nearby. When the coal is burned, it will result in an additional 140 million tons of carbon dioxide going into the atmosphere.
		Response: Detailed discussions of GHG emissions in relation to the direct and indirect effects of the proposed Rosebud Mine Expansion are provided in **Section 4.4** and **Section 5.3.3** of the EIS. GHG emissions are examined for NEPA purposes. Under MEPA, DEQ's analysis of actions is limited to actions which significantly affect the quality of the human environment in Montana. Section 75-1-201(1)(b)(4), MCA.		
		213	1	When the coal is burned, it will result in an additional 140 million tons of carbon dioxide going into the atmosphere. Yet the DEIS refused to even consider the cost of climate change. By refusing to provide any estimate of the economic harm this project imposes on the public, the environment, and the economy, the DEIS misleads the public on the climate impacts caused by the expansion.
		Response: Information about global, national, state, and regional GHG emissions is provided in **Section 3.4.2.3** of the EIS. Proposed Action emissions are evaluated in the context of total U.S. emissions in **Section 4.4.3** and **Section 5.3.3.** OSMRE is not required by NEPA to contain a monetary cost-benefit analysis of the project, and we did not include one in this EIS. Unless we produced a complete monetary cost-benefit analysis, which would include both the social costs of the project (including the social costs of carbon) as well as the social benefits of the projects (e.g., the monetary benefits of the power generated), inclusion solely of a cost analysis for the social cost of carbon would be contrary to NEPA and create an unbalanced and inaccurate assessment of the project. As such, it would not be useful in facilitating a decision by the authorized official. Another commenter completed a social cost of carbon analysis (see Comment no. 14), which showed that "Total emission costs for the 19-year time horizon vary by over 40-fold from a low of $319 million to as high as $12.9 billion." While OSMRE does not believe that a social cost of carbon analysis is warranted for this project decision and did not include it in the EIS, as outlined in **Section 4.4.5**, we note that this analysis and its wide margin of error support our conclusion that such analysis was not needed because the social cost of carbon without a full cost-benefit analysis is of very limited utility to the decision maker. GHG emissions are examined for NEPA purposes. Under MEPA, DEQ's analysis of actions is limited to actions which significantly affect the quality of the human environment in Montana. Section 75-1-201(1)(b)(4), MCA.		
		228	1	However, the impacts suggest negligible impact on climate change and that direct and indirect greenhouse gasses would contribute incrementally to climate change. This finding fails to recognize the market forces of coal as a commodity and the relative ease at which coal is transported, especially in the Powder River Basin, which is laden with low cost coal deposits, actively mined in a number of mines by a number of competing companies.
		Response: Per communication with Western Energy, there are no foreseeable plans to ship coal by railroad from Area F, if approved, or any of the other active permit areas at the Rosebud Mine. The analysis in the EIS was completed under the premise that all coal from Area F, if approved, and the other active permit areas at Rosebud Mine are transported by trucks to a conveyor belt carrying coal to the Colstrip Power Plant with the exception of a comparably small amount of waste coal that is transported by truck to the Rosebud Power Plant. See **Section 2.2.5** for a description of coal transport from the mine to the power plants. OSMRE does not evaluate the economic effects of leasing federal minerals under the Mineral Leasing Act. The Bureau of Land Management completes that evaluation during the leasing stage. OSMRE's obligations under the Mineral Leasing Act of 1920 are specific to preparing a mining plan decision document under 30 CFR 746. OSMRE is not required to conduct a coal market analysis and/or a cost-benefit analysis (40 CFR 1502.23) and therefore presents the potential impacts using readily available information.		
		12	1	The largest single source of carbon dioxide pollution west of the Mississippi and you call that negligible?

Topic	Code and Issue	Document ID	Page Number	Comment
				Response: OSMRE has determined that the disclosure of direct and indirect project GHG emissions framed within the context of state, regional, national, and global GHG emissions is the most appropriate way to inform the decision maker and public of potential impacts on climate change from GHG emissions. OSMRE acknowledges that impacts of climate change cannot be determined on a local scale due to the complex nature of climate change itself; therefore, it is appropriate to compare to state, regional, national, and global scales. Please see **Section 4.4, Climate and Climate Change**, for a full discussion of potential impacts from the Proposed Action and alternatives. **Section 5.3.3** discloses potential cumulative impacts on climate and climate change beyond those discussed in relation to indirect impacts in **Section 4.4**. The total projected direct and indirect GHG emissions would comprise less than 0.002 percent and less than 0.2 percent, respectively, of the total 2015 U.S. GHG emissions. The EIS has been revised to remove the following sentence in **Section 4.4.3.1**: "Thus, direct effects of the Proposed Action on climate and climate change would be negligible relative to other sources." GHG emissions are examined for NEPA purposes. Under MEPA, DEQ's analysis of actions is limited to actions which significantly affect the quality of the human environment in Montana. Section 75-1-201(1)(b)(4), MCA.

Topic	Code and Issue	Document ID	Page Number	Comment
6310 Social Cost of Carbon	6310 Comment about social cost of carbon	213	1	When the coal is burned, it will result in an additional 140 million tons of carbon dioxide going into the atmosphere. Yet the DEIS refused to even consider the cost of climate change. By refusing to provide any estimate of the economic harm this project imposes on the public, the environment, and the economy, the DEIS misleads the public on the climate impacts caused by the expansion.
		219	2	The draft EIS is woefully inadequate. It does not address the greenhouse gas issue at all. Burning and mining coal is a filthy, toxic business. In the draft EIS, there is no consideration of collateral damage to our land, our air, our food and our water supply. And, there is no consideration for the cost to human health increased heart disease, asthma and cancer.
		329	1	It is ridiculous that the draft EIS refuses to even consider the cost of climate change.
		346	1	The EIS does not fully address the impacts of added carbon from the expansion by assuming that the coal produced would be magically cancelled out by reducing coal from elsewhere. This is just crazy logic!
		347	1	The EIS fails to properly analyse the social cost of carbon.
		Response: Climate change impacts cannot be predicted with a degree of accuracy that would allow for local project-specific impacts to be characterized. Information about global, national, state, and regional GHG emissions is provided in **Section 3.4.2.3** of the EIS. Potential impacts on climate change from indirect GHG emissions resulting from combustion of coal mined under the Proposed Action are disclosed in **Section 4.4.3** and **Section 5.3.3**. Potential impacts on human health from indirect GHG emissions resulting from combustion of coal mined under the Proposed Action are disclosed in **Section 4.5.3.2**. GHG emissions are examined for NEPA purposes. Under MEPA, DEQ's analysis of actions is limited to actions which significantly affect the quality of the human environment in Montana. Section 75-1-201(1)(b)(4), MCA. OSMRE is not required by NEPA to contain a monetary cost-benefit analysis of the project, and we did not include one in this EIS. Unless we produced a complete monetary cost-benefit analysis, which would include both the social costs of the project (including the social costs of carbon) as well as the social benefits of the project (e.g., the monetary benefits of the power generated), inclusion solely of a cost analysis for the social cost of carbon would be contrary to NEPA and create an unbalanced and inaccurate assessment of the project. As such, it would not be useful in facilitating a decision by the authorized official. Another commenter completed a social cost of carbon analysis (see Comment no. 14), which showed that "Total emission costs for the 19-year time horizon vary by over 40-fold from a low of $319 million to as high as $12.9 billion." While OSMRE does not believe that a social cost of carbon analysis is warranted for this project decision and did not include it in the EIS, as outlined in **Section 4.4.5**, we note that this analysis and its wide margin of error support our conclusion that such analysis was not needed because the social cost of carbon without a full cost-benefit analysis is of very limited utility to the decision maker. Per communication from Western Energy (June 19, 2017), to maintain total annual coal production at current levels while mining coal from Area F under the Proposed Action, coal production from the other existing permitted areas would be reduced accordingly. Please refer to **Table 99 - Projected Annual Coal Production for Rosebud Mine by Area** for more detail. As described in **Section 4.4.3.1**, total annual direct GHG emissions would be expected to increase relative to the existing operations at Area C as a result of the additional fuels (especially diesel) that would be used by vehicles hauling coal over a longer haul-road distance (i.e., 5 additional miles). Direct GHG emissions would continue at the increased level for 8 additional years compared to the No Action Alternative. As described in **Section 4.4.3.2**, total annual indirect GHG emissions are not expected to increase above current levels as total annual production of coal at Rosebud Mine is not expected to increase. Indirect GHG emissions would continue at the current level for 8 additional years compared to the No Action Alternative. The No Action Alternative is described in **Section 2.3** and states that if the mining plan for Area F were not approved, the power plants would continue to operate using coal from the other permit areas of the Rosebud Mine until 2030, and may source coal from other mines to generate electricity at the current levels beyond 2030.			

Topic	Code and Issue	Document ID	Page Number	Comment
6310 Social Cost of Carbon	6311 Suggested analysis for social cost of carbon	Form Letter C	1	the DEIS refused to even consider the cost of climate change. By refusing to provide any estimate of the economic harm this project imposes on the public, the environment, and the economy, the DEIS misleads the public on the climate impacts caused by the expansion.
		218	1	When the coal is burned, it will result in an additional 140 million tons of carbon dioxide going into the atmosphere. Yet the DEIS refused to even consider the cost of climate change. By refusing to provide any estimate of the economic harm this project imposes on the public, the environment, and the economy, the DEIS misleads the public on the climate impacts caused by the expansion.
		Response: Information about global, national, state, and regional GHG emissions is provided in **Section 3.4.2.3** of the EIS. Proposed Action emissions are evaluated in the context of total U.S. emissions in **Section 4.4.3** and **Section 5.3.3**. OSMRE is not required by NEPA to contain a monetary cost-benefit analysis of the project, and we did not include one in this EIS. Unless we produced a complete monetary cost-benefit analysis, which would include both the social costs of the project (including the social costs of carbon) as well as the social benefits of the project (e.g., the monetary benefits of the power generated), inclusion solely of a cost analysis for the social cost of carbon would be contrary to NEPA and create an unbalanced and inaccurate assessment of the project. As such, it would not be useful in facilitating a decision by the authorized official. Another commenter completed a social cost of carbon analysis (see Comment no. 14), which showed that "Total emission costs for the 19-year time horizon vary by over 40-fold from a low of $319 million to as high as $12.9 billion." While OSMRE does not believe that a social cost of carbon analysis is warranted for this project decision and did not include it in the EIS, as outlined in **Section 4.4.5**, we note that this analysis and its wide margin of error support our conclusion that such analysis was not needed because the social cost of carbon without a full cost-benefit analysis is of very limited utility to the decision maker. A full-scale carbon budgeting analysis is not required to determine if significant impacts related to GHG emissions are occurring and is outside the scope of this EIS. OSMRE, where appropriate and not overly speculative, included reasonable forecasting as in the case with the **Climate** discussion in Chapter 4 allowing the decision maker to evaluate potential impacts associated with the Proposed Action using representative or predicted emissions. GHG emissions are examined for NEPA purposes. Under MEPA, DEQ's analysis of actions is limited to actions which significantly affect the quality of the human environment in Montana. Section 75-1-201(1)(b)(4), MCA.			

Topic	Code and Issue	Document ID	Page Number	Comment
8500 Cumulative Impacts Analysis	8505 Climate and Climate Change Cumulative Impacts	177	1	It is simply a mistake to prepare an EIS for an expanded coal mine that does not include a proper analysis of the climatic effect of the carbon dioxide emissions from the burning of that coal.
		Response: The GHG emissions of the region's fossil fuel projects are discussed under No Action in **Section 4.4.2.3** of the EIS. Climate change impacts are discussed in **Sections 3.4** and **4.4**. GHG emissions are examined for NEPA purposes. Under MEPA, DEQ's analysis of actions is limited to actions which significantly affect the quality of the human environment in Montana. Section 75-1-201(1)(b)(4), MCA.		

1.3.5 Public Health and Safety

Topic	Code and Issue	Document ID	Page Number	Comment
3400 Public Health and Safety	3404 Comment about affected environment	55	1	As a nurse I have not witnessed any adverse health effects that could be attributed solely to the mine. Of all of the NOWCAP pulmonary function tests I have performed on area employees and residents not one shows any disease processes that can be attributed solely to coal mining in our area.
		199	1	I have had the good fortune to visit the Rosebud mine and am fully familiar with the exemplary approach they take to ensuring the health and safety of their workers and stakeholders
		139	1	Our community does not have any days that are bad with air quality. Our students in the schools are healthy.
		Response: Thank you for your comment. Existing conditions, including baseline data used for analysis, are described **in Section 3.5, Public Health and Safety**.		
		16	12	The drinking water in Colstrip Montana has passed with no violations of the water quality standards in EPA and MQS, however as mining continues, concerns about public health rise.
		Response: The drinking water and water for livestock in the project area and surrounding communities currently meets Clean Water Act (CWA) and Montana Water Quality Standards (see **Tables 37** and **38**, **Section 3.5.2.4, Surface and Ground Water Quality** under **Public Health and Safety**). The Rosebud Mine will be required to comply with all standards outlined by the Clean Water Act and Montana Numeric Water Quality Standards, in accordance with their permit. If violations of water quality standards take place, the mine operators would be required to mitigate and remediate the violations, and are subject to penalties for violating the terms of the permit.		
		16	11	The Colstrip mine has created many health problems as the fly ash ponds leak more every day. Harsh chemicals in these ponds create problems within the testes, kidneys, intestines, brain and skin, and can cause various cancers. The exposure to chemicals in the air has also created longterm health effects such as asthma that can develop at all ages.
		Response: While Rosebud County has higher levels of mortality from some chronic diseases, including cancers (see **Community Health** discussion in **Section 3.5.3.3, Social Characteristics**), the causes of disease are not clearly linked to chemicals found in fly ash at the Rosebud Mine. (SOURCE: http://www.healthdata.org/sites/default/files/files/county_profiles/US/2015/County_Report_Rosebud_County_Montana.pdf.)		
		16	11	Boron and arsenic, both known carcinogens, are currently found in the Colstrip ground water due to fly ash contamination. (3)
		Response: Boron and arsenic are both present in low concentrations in the McKay and Sub-McKay aquifers. It is likely that these occur naturally and are not the result of fly ash from the Rosebud Mine operations. Both are present in surface waters and ground water at levels well below the lowest water quality standard or recommended concentration for livestock (see **Tables 42** through **54** in **Section 3.7, Water Resources – Surface Water** and **Tables 59** through **63** in **Section 3.8, Water Resources – Ground Water**). The lowest water quality standard concentration for boron is 30 mg/L. Boron in ground water in the McKay Coal aquifer ranges between 0.10 and 0.81 mg/L. Boron in the Sub-McKay aquifer ranges between 0.18 and 1.3 mg/L. The lowest water quality standard for arsenic is 0.01 mg/L. Arsenic in the Sub-McKay aquifer ranges between 0.00007 and 0.003 mg/L. Arsenic in ground water in the Sub-McKay aquifer ranges between <0.00007 and 0.015 mg/L. At these concentrations, risk to human health is not likely. While there have been exceedances for arsenic in overburden areas, ground water concentrations overall remain within acceptable limits.		

Topic	Code and Issue	Document ID	Page Number	Comment
6400 Public Health	6402 Comment about direct impacts	221	1	This expansion will not affect public health.
		Response: Thank you for your comment. The EIS discloses public health and safety impacts in **Section 4.5**.		
	6403 Comment about indirect impacts	47	1	Failure to approve the expansion would have a devastating effect on our entire community and threaten a local government entity that is all about promoting the health of our community.
		Response: Thank you for your comment. The EIS discloses public health and safety impacts in **Section 4.5**.		

1.3.6 Water Resources – Surface Water

Topic	Code and Issue	Document ID	Page Number	Comment
3600 Water Resources - Surface Water	3604 Comment about affected environment	215	1	The mine has already severely harmed water resources in the area, and the expansion will make matters worse. Existing mining operations have already dewatered parts of a stream, and the remaining water is polluted from mining activities. This expansion will make the existing water quality and quantity problems even worse.
		213	1	The mine has already severely harmed water resources in the area, and the expansion will make matters worse. Existing mining operations have already dewatered parts of a stream, and the remaining water is polluted from mining activities. This expansion will make the existing water quality and quantity problems even worse.
		Response: The effects on surface water resources are described in **Section 4.7** and **Section 5.3.6** of the EIS. This includes descriptions of effects on surface water from existing and past mine operations in the area (**Section 5.3.6**).		

Topic	Code and Issue	Document ID	Page Number	Comment
6600 Water Resources - Surface Water	6601 Comment about analysis methods	222	1	Both the water quality and the air quality analyses indicate that there will be no violations of the standards for air and water.
		Response: The EIS does not state that there would be no violations of water quality standards. The EIS states in **Section 4.7** that it would take many decades for the hydrologic balance to be reestablished after site reclamation, that ground water discharge to streams similar to existing conditions would not return for many decades until the ground water table returned to near pre-mine conditions, and that it would not be possible to completely restore the pre-mine hydrologic balance in the direct effects analysis area after mining due to removal and replacement of the Rosebud Coal and overburden with spoil.		
	6602 Comment about direct impacts to surface water hydrology	Form Letter C	1	Existing mining operations have already dewatered parts of a stream, and the remaining water is polluted from mining activities. This expansion will make the existing water quality and quantity problems even worse.
		16	6	The environmental effects to surface water at the Rosebud Mine can be separated into two main categories which include contamination and changes in flow direction to the two main watersheds which are Armells Creek and Rosebud Creek.
		27	1	The Area F mine plan had been designed to have minimal impact on the ephemeral drainages within the mining area.
		306	1	The Area F mine plan had been designed to have minimal impact on the ephemeral drainages within the mining area.
		Response: The effects on surface water resources in the analysis area (delineated in **Section 3.7.1.2**) are described in **Section 4.7** and **Section 5.3.6** of the EIS. **Section 4.7.3.2** describes reclamation and how surface water resources would be restored to the extent possible, but also how they would be changed after mining and reclamation.		
	6603 Comment about direct impacts to surface water quality	Form Letter C	1	Existing mining operations have already dewatered parts of a stream, and the remaining water is polluted from mining activities. This expansion will make the existing water quality and quantity problems even worse.
		16	6	The environmental effects to surface water at the Rosebud Mine can be separated into two main categories which include contamination and changes in flow direction to the two main watersheds which are Armells Creek and Rosebud Creek.
		16	6	The excess water drained from the open pits is used for dust suppression and the bulk is dumped into the smaller ephemeral streams. This can temporarily increase erosion and contribute high sediment loads to these watersheds.

Topic	Code and Issue	Document ID	Page Number	Comment
		27	1	The Area F mine plan had been designed to have minimal impact on the ephemeral drainages within the mining area.
		44	1	It is my understanding that there are no water or air quality issues.
		43	1	It is my understanding that there are no water or air quality issues.
		218		The mine has already severely harmed water resources in the area, and the expansion will make matters worse. Existing mining operations have already dewatered parts of a stream, and the remaining water is polluted from mining activities. This expansion will make the existing water quality and quantity problems even worse.
		Response: The effects on surface water resources in the analysis area (delineated in **Section 3.7.1.2**) during and after mining are described in **Section 4.7** and **Section 5.3.6** of the EIS. Pit water would not be discharged directly into the drainages in the area. Pit dewatering is described in **Section 2.4.5.2**. All discharges from the proposed mining areas to state surface waters would be required to comply with applicable MPDES permit effluent limits.		
6600 Water Resources - Surface Water	6604 Comment about indirect to surface water hydrology	16	6	The increased erosion and sedimentation then has the added effect of changing the flow course of these ephemeral streams. The impacts to both streams and springs then effects water availability for local agriculture.
		Response: The effects on surface water resources in the analysis area (delineated in **Section 3.7.1.2**) during and after mining are described in **Section 4.7** and **Section 5.3.6** of the EIS. Possible effects on stream flow in the West Fork Armells is described in **Section 4.7.3.2** of the EIS.		
	6610 Comment about regulatory compliance	27	1	Water quality and the air quality analyses indicate that there will be no violations of the standards for air and water.
		Response: The EIS does not state that there would be no violations of water quality standards. See also, response to comment 6601.		

1.3.7 Water Resources – Ground Water

Topic	Code and Issue	Document ID	Page Number	Comment
3700 Water Resources - Ground Water	3704 Comment about affected environment	16	11	Boron and arsenic, both known carcinogens, are currently found in the Colstrip groundwater due to fly ash contamination.
		16	12	The drinking water in Colstrip Montana has passed with no violations of the water quality standards in EPA and MQS, however as mining continues, concerns about public health rise.
		Response: The current status of the Colstrip ground water around the Power Plant is described in **Section 4.8.3.2**.		

Topic	Code and Issue	Document ID	Page Number	Comment
6700 Water Resources - Ground Water	6702 Comment about direct impacts to ground water hydrology	16	4	There is a current plan proposed to expand the Rosebud Mine by 6,476 acres, with 4,260 acres of disturbance. Mining of the project area would permanently remove the Rosebud Coal aquifer and result in long-term reduction or elimination of the bedrock ground water contribution. Drawdown may affect existing water users of the Rosebud Coal aquifer. Mining would permanently remove springs in the project area whose ground water source is either the Rosebud Coal or overburden that would be removed.
		Response: The direct impacts of removing the Rosebud Coal are described in **Section 4.8.3.1** of the EIS.		
6700 Water Resources - Ground Water	6703 Comment about direct impacts to ground water quality	Form Letter C	1	Harmful impacts are expected to persist in aquifers outside of the mining area for decades, and groundwater and surface water rights are expected to return to pre-mine conditions many decades after mine closure.
		16	4	There is a current plan proposed to expand the Rosebud Mine by 6,476 acres, with 4,260 acres of disturbance. Mining of the project area would permanently remove the Rosebud Coal aquifer and result in long-term reduction or elimination of the bedrock ground water contribution Drawdown may affect existing water users of the Rosebud Coal aquifer. Mining would permanently remove springs in the project area whose ground water source is either the Rosebud Coal or overburden that would be removed.
		16	6	When overburden is removed and massive open pits are created, the natural groundwater flow patterns that feed surficial springs are cut off completely.
		16	6	Geologic formations within mine sites can naturally contain heavy metals, radionuclides, and other dissolved solids. These contaminants can slowly leach into groundwater sources, however this natural process is greatly accelerated by open pit mining as these formations are fractured and mixed.
		219	1	Water resources have already been severely compromised by the existing mine. Harmful impacts are expected to persist in aquifers outside the mining area for decades, and it is expected that groundwater and surface water rights will take many decades to return to pre-mine conditions after the mine's closure. There is no real guarantee that there will be sufficient water to replace someone's water in the event of expansion or that the water will be of similar quality to what had been lost. So, if the expansion happens, water quality and quantity problems will go from bad to worse.
		Response: The direct impacts of removing the Rosebud Coal are described in **Section 4.8.3.1** of the EIS, including direct impacts on ground water quality. **Section 4.9** states that any existing water rights impacted by mining would be replaced by Western Energy. Because ground water inflow into a mined pit from the Rosebud Coal is diffuse, there is no practical way to capture this water for diversion to another location.		

Topic	Code and Issue	Document ID	Page Number	Comment
6700 Water Resources - Ground Water	6704 Comment about indirect impacts to ground water hydrology	16	6	The groundwater in the area flows to the lowest point: the pit. This creates what is known as a cone of depression and significantly lowers the water table. Replacement of overburden does not correct this problem as it is impossible to recreate the original stratigraphy.
		Response: As discussed in **Section 4.8.3.1** of the EIS, the spoils would eventually resaturate and would likely convey ground water from the upgradient unmined coal to the downgradient unmined coal in a similar manner as the removed coal. The more localized ground water flow paths in the overburden that relied on perching of ground water low permeability strata would likely not develop in the more homogeneous spoils.		
	6705 Comment about indirect impacts to ground water quality	16	11	The Colstrip mine area contains nine fly ash ponds which cover 800 acres and leak about 660,000 gallons of contaminated water into the ground each day. Over the past 30 years, the fly ash ponds have collectively leaked about six billion gallons of contaminated water into the Colstrip aquifer. Although new fly ash ponds are lined to prevent leakage, the problem persists due to continued lining failures.
		Response: The plant site ash ponds historically lost water to ground water. The current operation is described as a closed-loop system and contaminated ground water is being captured and removed **(Section 4.8.3.2** of the EIS).		
	6706 Comment about effectiveness of environmental protection measures	219	1	Water resources have already been severely compromised by the existing mine. Harmful impacts are expected to persist in aquifers outside the mining area for decades, and it is expected that groundwater and surface water rights will take many decades to return to pre-mine conditions after the mine's closure. There is no real guarantee that there will be sufficient water to replace someone's water in the event of expansion or that the water will be of similar quality to what had been lost. So, if the expansion happens, water quality and quantity problems will go from bad to worse.
		Response: Based on testing data, there appears to be adequate replacement water in formations below the McKay Coal. Regardless of the source, Western Energy is required to replace any water supply impacted by mining. ARM 17.24.648(1). An operator must replace any interrupted water supply immediately on a temporary basis and further provide the needed water and within a reasonable time, and ultimately replaces any lost supply "in like quality, quantity, and duration, if the loss is caused by the strip-mining or underground-coal-mining operation." Section 82-4-253(3)(d), MCA.		

1.3.8 Water Resources – Water Rights

Topic	Code and Issue	Document ID	Page Number	Comment
6800 Water Resources - Water Rights	6802 Comment about direct impacts to water rights during active mining	Form Letter C	1	The expansion is expected to have significant impacts on water rights. The DEIS says that impacts to existing water rights could be long-term and negligible to major.
		219	1	There is no real guarantee that there will be sufficient water to replace someone's water in the event of expansion or that the water will be of similar quality to what had been lost.
		Response: The effects on water rights in the direct effects analysis area and indirect effects analysis area are described in **Sections 4.9** and **5.3.8** of the EIS. ARM 17.24.648 (part of the rules implementing MSUMRA) requires that Western Energy replace the water supply of any owner of interest in real property who obtains all or part of his water supply for domestic, agricultural, or other uses from surface or ground water if such supply has been affected by contamination, diminution, or interruption proximately resulting from mine operations. It is required by 82-4-253, MCA, that replacement water will be of like quality, quantity, and duration to the water lost. As stated **in Section 4.9.3.3**, possible sources of replacement water would likely be ground water pumped from the unmined areas of the Rosebud Coal aquifer west and south of the project area, the McKay Coal aquifer, or the Sub-McKay aquifer, and the water quality of these aquifers is comparable to the existing quality of the streams, springs, and wells in and near the project area.		
	6803 Comment about direct impacts to water rights postmining	Form Letter C	1	Harmful impacts are expected to persist in aquifers outside of the mining area for decades, and ground water and surface water rights are expected to return to pre-mine conditions many decades after mine closure.
		Response: The effects on water rights in the direct effects analysis area and indirect effects analysis area are described in **Sections 4.9** and **5.3.8** of the EIS. The effects on aquifers in and near the mining area are described in **Sections 4.8** and **5.3.7**. ARM 17.24.648 requires that Western Energy replace the water supply of any owner of interest in real property who obtains all or part of his water supply for domestic, agricultural, or other uses from surface or ground water if such supply has been affected by contamination, diminution, or interruption proximately resulting from mine operations.		
	6804 Comment about indirect impacts to water rights	16	6	The increased erosion and sedimentation then has the added effect of changing the flow course of these ephemeral streams. The impacts to both streams and springs then effects water availability for local agriculture.
		Response: The effects on water rights in the direct effects analysis area and indirect effects analysis area are described in **Section 4.9** of the EIS and the effects on stream flow are described in **Section 4.7**. If a surface water right were to become unusable for agricultural use due to flow changes, a suitable replacement source would be provided by Western Energy.		

Topic	Code and Issue	Document ID	Page Number	Comment
	6805 Comment about effectiveness of environmental protection measures	213	1	Finally, the DEIS concludes that if the mine expansion impacts someone's water, the mine owner will replace their water. However, it doesn't consider whether there is sufficient replacement water available or if the replacement water quality will be similar to what is lost.
		218	1	Finally, the DEIS concludes that if the mine expansion impacts someone's water, the mine owner will replace their water. However, it doesn't consider whether there is sufficient replacement water available or if the replacement water quality will be similar to what is lost.
		Response: The specific steps for water supply replacement are laid out in 82-4-253, MCA. The EIS states in **Section 4.9** that possible sources of replacement water would likely be ground water pumped from the unmined areas of the Rosebud Coal aquifer west and south of the project area, the McKay Coal aquifer, or the Sub-McKay aquifer. The most likely source may be the Sub-McKay aquifer because it generally yields more water than the coal aquifers. The water quality of these aquifers is comparable to the existing quality of the streams, springs, and wells in and near the project area. All of these aquifers would produce water if developed. MSUMRA requires the applicant to provide "a description of alternative water supplies, not to be disturbed by mining that could be developed to replace water supply diminished or otherwise adversely impacted in quality or quantity by mining activities so as not to be suitable for the approved postmining land uses." Approximate yields in Sub-McKay wells range from 3.5 to 35 gpm, which should be sufficient for stock and domestic-water use. In addition, water could also be delivered by truck or pipeline from other areas, and stock ponds would be constructed in the project area during reclamation Additional information was added to **Sections 3.9** and **4.9** of the EIS regarding the process involved with the MT Water Rights Bureau for replacing a water right with a different supply source.			
	6810 Comment about replacement water sources	Form Letter C	1	Finally, the DEIS concludes that if the mine expansion impacts someone's water, the mine owner will replace their water. However, it doesn't consider whether there is sufficient replacement water available or if the replacement water quality will be similar to what is lost.
		213	1	Finally, the DEIS concludes that if the mine expansion impacts someone's water, the mine owner will replace their water. However, it doesn't consider whether there is sufficient replacement water available or if the replacement water quality will be similar to what is lost.
		226	1	Stating Westmoreland will replace the polluted water is an absurd prospect. If this is possible then I think the DEQ should point to an example of how this works.
		Response: ARM 17.24.648 (part of MSUMRA) requires that Western Energy replace the water supply of any owner of interest in real property who obtains all or part of his water supply for domestic, agricultural, or other uses from surface or ground water if such supply has been affected by contamination, diminution, or interruption proximately resulting from mine operations. Additional information will be added to **Sections 3.9** and **4.9** of the EIS regarding the process involved with the MT Water Rights Bureau for replacing a water right with a different supply source. Additional information will also be added to **Sections 3.9** and **4.9** regarding covering the costs of water supply replacements in perpetuity and how replacing a water supply with an exempt well would avoid the issue of water rights seniority.			

1.3.9 Fish and Wildlife

Topic	Code and Issue	Document ID	Page Number	Comment
7100 Fish and Wildlife Resources	7102 Comment about direct impacts	57	1	Coal is currently mined without disturbing the wildlife in the area and the reclamation process restores previously mined lands to a condition equal to or better than the original state. In most cases, post mine reclamation increases the economic viability of the land while improving the quality of habitat for many wild species.
		143	1	As an engineering intern I was able to see beyond the fence into a community of earnest, hardworking, conscientious people. I came away from my experiences being struck by how every long term decision was not only guided towards reclamation, but also returning the property to productive farm land and a thriving natural habitat.
		255	1	Wildlife flourishes & the reclaimed land is productive.
		Response: Impacts on wildlife were analyzed in the EIS (see **Section 4.12, Fish and Wildlife Resources**). The Reclamation Plan is discussed in the EIS in **Section 2.4.4, Reclamation Plan** and impacts from reclamation are analyzed within each resource section in **Chapter 4**.		

1.3.10 Special Status Species

Topic	Code and Issue	Document ID	Page Number	Comment
4200 Special Status Species	4204 Comment about affected environment	6	1	However this EIS fails to consider several other species which are federally listed as endangered or threatened which range nearby, or even in the project area. Specifically this EIS fails to consider both the Least Tern (Sterna antillarum) and the Piping Plover (Charadrius melodus). In fact both the Least Tern and Piping Plover are not mentioned once throughout the entire document.
		Response: Federally listed threatened and endangered (T&E) species analyzed in the EIS were based on the U.S. Fish and Wildlife Service (Service) *Information for Planning and Consultation* (IPAC) database. The website provides lists of T&E species that could potentially occur in specific project areas. According to the IPAC database, the only species that potentially occur in Big Horn, Rosebud, and Treasure Counties are the black-footed ferret, pallid sturgeon, northern long-eared bat, and whooping crane. OSMRE determined that the project would have "no effect" on the least tern or piping plover. The nearest confirmed breeding locations of the least tern is more than 60 miles from the project area. Similarly, the nearest piping plover populations are located along the Missouri River about 100 miles north of the project area. Since known populations of both species are located outside of the project area and are not listed on the Service IPAC website as occurring in Big Horn, Rosebud, or Treasure County, the least tern and piping plover were not addressed in the EIS. See **Section 6.1.2, Section 7 Consultation Process with the U.S. Fish & Wildlife Service** in the EIS.			
	4205 Suggested species for Section 7 consultation	6	1	The Least Tern was listed as endangered in Federal Register 21792; May 28, 1985, throughout most of its range. As the Least Tern breeds between May and August, with nesting in June and July that makes the summer months the most important for this species. The Natural Heritage Map Viewer, maintained by the Montana Government shows that during this crucial part of the year, the Least Tern's Summer range covers a large portion of land in Rosebud Country, including Rosebud, Colstrip, and much of the 32 kilometers of indirect impacts. It breeds and nests in sandy soils along rivers. One of the major causes of decline for the Least Tern are improper management of flow on rivers where the Tern breeds. For that reason river maintenance is very important for this species' survival. In section 4.11.3.1 Direct Impacts Riparian Zones this EIS states that approximately 46 acres of riparian habitat... occur along drainages that would have reduced flow due to mining activities. This combination of flow change concurring with summer breeding range makes this project directly impact the Least Tern. This impact needs to be addressed and evaluated.
		6	1	The Piping Plover was listed as threatened in Federal Register 50733; December 11, 1985, throughout its entire range, except the Great Lakes. The Piping Plover is thought to breed along the Yellowstone River which passes directly through Rosebud County, with tributaries very near to the project area. Like the Least Tern, the Piping Plover has decreased due to human induced changes along the rivers which they breed and therefore would potentially impacted by this project. Impacts on The Piping Plover have not been considered.
		Response: Federally listed T&E species analyzed in the EIS were based on the Service IPAC database. The website provides lists of T&E species that could potentially occur in specific project areas. According to the IPAC database, the only species that potentially occur in Big Horn, Rosebud, and Treasure Counties are the black-footed ferret, pallid sturgeon, northern long-eared bat, and whooping crane. OSMRE determined that the project would have "no effect" on the least tern or piping plover. The nearest confirmed breeding locations of the least tern is more than 60 miles from the project area. Similarly, the nearest piping plover populations are located along the Missouri River about 100 miles north of the project area. Since known populations of both species are located outside of the project area and are not listed on the Service IPAC website as occurring in Big Horn, Rosebud, or Treasure Counties, the least tern and piping plover were not addressed in the EIS. See **Section 6.1.2, Section 7 Consultation Process with the U.S. Fish & Wildlife Service** in the EIS.			

Topic	Code and Issue	Document ID	Page Number	Comment
7200 Special Status Species	7202 Comment about direct impacts	27	1	The analyses indicate no endangered species impacts have been identified in or near the project area.
		44	1	No adverse affects to endangered species.
		43	1	No adverse affects to endangered species.
		222	1	The analyses indicate no endangered species impacts have been identified in or near the project area.
		Response: A detailed discussion of anticipated direct and indirect effects resulting from the Proposed Action and alternatives is in **Section 4.13, Special Status Species**.		
	7208 Comment about regulatory compliance	6	1	In conclusion, both the Least Tern and Piping Plover require sand bars clear of plant-life and section 4.11.3.1 Direct Impacts Riparian Zones of this EIS states that Loss of hydrology to wetland and riparian areas often leads to an increase in noxious and nonnative species along drainages. Although hydrology would be returned during reclamation, it could take decades before the wetland/riparian communities return to pre-mine conditions.
		6	2	This impact, along with potential take of these species, is not acknowledge or evaluation for its effect on these species and therefore this EIS is incomplete.
		Response: Federally listed T&E species analyzed in the EIS were based on the Service IPAC database. The website provides lists of T&E species that could potentially occur in specific project areas. According to the IPAC database, the only species that potentially occur in Big Horn, Rosebud, and Treasure Counties are the black-footed ferret, pallid sturgeon, northern long-eared bat, and whooping crane. OSMRE determined that the project would have "no effect" on the least tern or piping plover. The nearest confirmed breeding locations of the least tern is more than 60 miles from the project area. Similarly, the nearest piping plover populations are located along the Missouri River about 100 miles north of the project area. Since known populations of both species are located outside of the project area and are not listed on the Service IPAC website as occurring in Big Horn, Rosebud, or Treasure Counties, the least tern and piping plover were not addressed in the EIS. See **Section 6.1.2, Section 7 Consultation Process with the U.S. Fish & Wildlife Service** in the EIS.		

1.3.11 Cultural and Historic Resources

Topic	Code and Issue	Document ID	Page Number	Comment
7300 Cultural and Historic Resources	7304 Comment about effectiveness of environmental protection measures	125	1	The Programmatic Agreement concerning cultural resources fails entirely to address the protection of rock art sites, even though several such sites lie within the area of potential impact. The PA presents limited excavation as the only treatment option for sites that are in the way of the proposed mining. It should be obvious that excavation is not an option for rock art sites. Rock art sites further require protection from the seismic effects of blasting and large equipment operation and from the effects of dust deposits covering, and blasting debris scouring, the rock surface containing rock art. These potential impacts need to be assessed and addressed in detail in the PA or DEIS.
		Response: See **Section 3.14.1.1, Regulatory Framework** in the EIS for a description of the programmatic agreement (PA) and other state and federal requirements for protection of cultural resources. While the PA may not specifically address rock art sites and potential treatment methods, the PA stipulates for the drafting of an evaluation plan, which will provide specific treatment measures for properties requiring mitigation, including rock art sites. Parties to the PA will have an opportunity to comment on the evaluation plan, including the Montana SHPO and interested tribes, at which time consulting parties may provide specific measures to avoid, minimize, or mitigate affected rock art sites.			
	7310 Comment about Section 106 consultation process	125	1	That tribal offices failed to reply to your single attempt at contacting them does not mean that the APE contains no sacred sites or traditional cultural properties, as the DEIS suggests. Despite the proximity of the project to the Crow and Northern Cheyenne reservations, no attempt was made to interview tribal historians or to conduct ethnographic research into historic and current use of and beliefs about the project area by Indian people. The project area lies within the historic territories of the Blackfoot, Lakota, Shoshone, Kiowa-Apache, and Kiowa nations, as well; however, no attempt was made to involve their representatives in the process or to research their historic presence in the area. This deficiency needs to be corrected before the final EIS is issued.
		Response: See **Section 6.1.3** in the EIS for a description of the tribal consultation process that OSMRE has conducted thus far. OSMRE provided opportunities for the Crow, Northern Cheyenne, and Fort Peck Assiniboine and Sioux Tribes to identify sites of religious or cultural significance. OSMRE initiated consultation with the Apache, Blackfeet Nation, Eastern Shoshone, Kiowa, and Oglala Sioux (Lakota) Nations on June 6, 2018.			
	7311 Comment about Programmatic Agreement	125	1	Rock art sites are considered sacred places by many Crow, Assiniboine, Lakota, Nakoda, Eastern Shoshone, and Northern Cheyenne people. Such places may continue to be regarded as spiritually or historically important to members of these tribes even if the rock art is eroded and difficult to see. The PA should have included representatives of the Crow, Fort Peck, and Northern Cheyenne tribes as signatories. It appears that only a minimal effort was made to contact these tribes and include them in the process and that no attempt was made to discern existing attitudes about rock art sites within the project area.
		Response: See **Section 3.14.1.1, Regulatory Framework** in the EIS for a description of the PA and OSMRE's consultation requirements. While the contacted tribes did not respond to OSMRE regarding participation in the PA, Stipulation 10 of the PA allows new stakeholders to enter the Section 106 process and request consultation at any time. The PA is attached in Appendix H for reference. See **Section 6.1.3, Tribal Consultation Process** in the EIS for a description of OSMRE's consultation efforts with the Crow, Northern Cheyenne, and Fort Peck Assiniboine and Sioux Tribes.			

1.3.12 Socioeconomics

Topic	Code and Issue	Document ID	Page Number	Comment
4400 Socioeconomic Conditions	4404 Comment about affected environment	123	2	And I can tell you that they are, and have been over these many years, have been an extremely responsible company in the operation of their mine. They're following the rules and regulations of the state of Montana, and also have been very responsive back into the community of Colstrip, and certainly to the workers that provide this valuable service of the mining operation.
		131	1	Coal has paid for our public education and infrastructure.
		139	1	Our community is all about COAL. This is what we do. Our schools are tied directly to the mine and the power plant. I teach the children of the men and women who work in Colstrip.
		229	1	As our population continues to crowd urban centers, rural economies are shrinking. The Rosebud mine is an economic engine that allows for prosperity in an area that is threatened with net negative migration away from the area.
		Response: Thank you for your comment. Existing socioeconomic conditions are described in **Section 3.15**.		

Topic	Code and Issue	Document ID	Page Number	Comment
7400 Socioeconomic Conditions	7402 Comment about current effects (through 2021) of Rosebud Mine operations (socioeconomic)	36	1	Montana needs to protect and further industry in our great state! Coal employs thousands of hard working Montanans and this expansion will employ even more.
		55	1	We have a wonderful parks and recreation department because of the foresight of Western Energy Officials in the early 80's. We are blessed with well funded schools because of the tax base the mine provides for our community and county. Both of these things contribute more to the health, wellness and economic potential of our community, and state as a whole.
		55		We have also been blessed with many Coal Board grants to help fund our infrastructure needs over the years. Please keep in mind that the funding for the Coal Board does not originate from the Legislature, but the mine's coal severance tax. The amount of money that pours into counties with coal mining greatly helps offset the costs of living in a rural area with very little economic, tourism, and recreation opportunities.
		145	1	I am in support of the Rosebud EIS, as the approval will continue to provide good paying jobs for the residents of Colstrip, MT and provide revenues for the State of Montana of over $500M annually, as concluded by the University of Montana economic study.
		142	1	We also need the steady and good paying jobs these mines provide in a low income area of Montana that has been hit hard by Washington State Lawmakers.
		141	1	Keeping the Rosebud Mine operating is not only important to the country's energy dominance but also to the economy of eastern Montana. The miners are some of the best paid employees in the state and their dollars turnover several times in the Montana economy. It's also a way of keeping local people supporting their local communities.

Topic	Code and Issue	Document ID	Page Number	Comment
		131		Coal has paid for our public education and infrastructure.
		129	1	The taxes and money it gives to our state and community are vital.
		126	1	The impact on the local and state economy is very large. It's easy to look at this directly with workers their taxes and the taxes the state of Montana receives. The hard part to measure is the indirect affect this could have on freight (railroads), subcontractors and suppliers.
		123	2	And I can tell you that they are, and have been over these many years, have been an extremely responsible company in the operation of their mine. They're following the rules and regulations of the state of Montana, and also have been very responsive back into the community of Colstrip, and certainly to the workers that provide this valuable service of the mining operation.
		123	2	What happens in Colstrip is extremely valuable and important all the way across the state and throughout the Pacific Northwest.
		137	1	The financial impact of these activities benefits the local communities and the entire state. The taxes generated from these activities support schools and communities through the state. The various jobs that are both directly and indirectly tied to these activities also add to the financial stability of the state.
		140	1	This expansion will not only allow the continuation of many jobs at the mine, but will also continue mining in the area in an environmentally supportive way. This mine has shown great respect for the areas it has already mined and reclaimed. It will also help continue a community that without the expansion will become a ghost town, since the coal is used as source for creation of the electricity provided by the power plant. This power supplies much needed energy to a number states and thousands of individuals. Our grid does not currently have other sources to replace this much needed energy. Also, if this expansion is not improved not only will the community of Colstrip and its hard working residence lose their jobs and homes, but the citizens of Montana will lose a huge tax base. At a time when we are looking at stifling cuts I for one do not want to remove one of our largest income revenues.
		303	1	In my estimation, Colstrip provides 1200 high-paying jobs, 400 at the power plant, 400 at the mine and an additional 400 in the form of contract laborers, pipefitters, boilermakers, electricians, truck drivers, mechanics, sales people, service people, trainers, crane operators and environmental and consulting engineers.
		303	1	The Colstrip Power Plant is a mouth-of-mine plant resulting in virtually no railroad transportation costs for shipping the coal to the plant making the cost of producing electrical power as inexpensive as it can be. This is Montana's coal being used to produce electrical power for use by Montanans to improve the life of the all the state's residents, either directly by providing high-end employment and affordable electricity, or indirectly by providing tax revenue and cascading patronization of other businesses by employees that live and work in Colstrip.
		Response: Thank you for your comments. Socioeconomic impacts are disclosed in **Section 4.15** in the EIS.		

Topic	Code and Issue	Document ID	Page Number	Comment
7400 Socioeconomic Conditions	7403 Comment about long-term (post-2022) effects of Rosebud Mine operations (socioeconomic)	27	1	Continuing the mining into Area F will have long-term economic benefit to Montana, the Northern Cheyenne Nation and United States.
		37	1	If we want to see Montana become independently prosperous then we need to allow industry such as coal. We should do our due diligence to be certain that things our done safely and responsibly but we need these jobs. I hear all the time how there is no good career fields in Montana but that is because we keep letting out of staters block industry from coming to our state. If we want good careers this is how we get them! The United States is built on industry! If we get the good paying blue collar jobs coming into our state we will begin to see the high paying white collar jobs, tech jobs, and more. We have to build the frame work for a strong economy, and that frame work starts with good high paying industrial careers.
		39	1	The Public Benefit from Royalties, Salaries and Taxes Collected will be Substantial: The 70 plus million tons of coal, including nearly 34 million tons of federal coal, must be given substantial positive consideration. The future revenue is needed to fund public programs that have recently been under financial stress in Montana.
		40	1	Coal is vital to this area. The jobs are high paying and the benefits are excellent. Coal is a large part of Montana's economy.
		41	1	Also, if this expansion is not improved not only will the community of Colstrip and its hard working residence lose their jobs and homes, but the citizens of Montana will lose a huge tax base. At a time when we are looking at stifling cuts I for one do not want to remove one of our largest income revenues.
		43	1	The benefits include employment for over 800 workers in the mine and power plant in Colstrip alone. Also the benefit of tax revenue.
		44	1	The benefits include employment for over 800 workers in the mine and power plant in Colstrip alone. Also the benefit of tax revenue.
		46	1	The expansion will continue to provide economic benefits to Rosebud County and the State if Montana. This economic benefit includes the state's public schools.
		47	1	Without this expansion the mine will run out of coal options and devastate the company and employees.
		47	1	Failure to approve the expansion would have a devastating effect on our entire community and threaten a local government entity that is all about promoting the health of our community.
		82	1	Also not allowing the Area F expansion will be a huge precedent set against the coal industry in Montana and will make it difficult for all coal companies to stay solvent. Which will impact the amount of money the State has to operate with.
		113	1	With all but a fraction of the coal mined in Montana being converted to electricity, expanding the Rosebud Mine will benefit energy consumers here in Montana, and across the country. The coal that Area F would make available for development will not only benefit energy consumers, but will directly support 800 jobs in the mine and power plants. By adding 6,746 acres to the Rosebud Mine, the Area F expansion will open up approximately 70 million tons of coal to be used as fuel for Rosebud Power Plant and Colstrip Units 3 and 4. This addition of additional fuel will extend the life of the mine by an estimated 8 years. As a result, not only will the mine continue to be a source of jobs and economic activity locally, but the mine and power plants will continue to contribute to our federal, state, and local tax base for years to come.

Topic	Code and Issue	Document ID	Page Number	Comment
		120	1	Ultimately approving this permit, it is about people, all right. It's about the 400 jobs at the mine.
		129	1	The taxes and money it gives to our state and community are vital.
		306	1	Continuing the mining into Area F will have long-term economic benefit to Montana, the Northern Cheyenne Nation and United States. Montana has no way to replace this tax revenue that funds so much of the state budget.
		Response: Thank you for your comment. Socioeconomic impacts are disclosed in **Section 4.15** in the EIS.		

Topic	Code and Issue	Document ID	Page Number	Comment
7400 Socioeconomic Conditions	7404 Comment about induced effects of the Rosebud Mine (induced jobs/$ output)	22	1	The community, county and State needs this to go through. This will go a long ways in helping out. We need the jobs, taxes and economic benefit this will provide.
		24	1	I am in support of the expansion as it will have a great economic impact on our state and town. Keeping people in work with little to no negative environmental impact. A win win for our state and town
		27	1	Continuing the mining into Area F will have long-term economic benefit to Montana, the Northern Cheyenne Nation and United States.
		28	1	The benefits to the economy of the entire region would be dramatically reduced if this permit is not granted.
		29	1	It would be a real boost to are town that is already struggling.
		32	1	Colstrip as a City, Rosebud as a County and the State of Montana would all benefit from this expansion. We need the coal, the people in this area need good paying jobs and the tax benefits to the whole state would be good for all of us.
		33	1	Allowing the expansion of this mine would be very beneficial to Montana and Rosebud county. Please allow this vvc expansion.
		36	1	If we want our state to prosper then our people need good high paying careers and coal offers that.
		37	1	If we want to see Montana become independently prosperous then we need to allow industry such as coal. We should do our do diligence to be certain that things our done safely and responsibly but we need these jobs. I hear all the time how there is no good career fields in Montana but that is because we keep letting out of staters block industry from coming to our state. If we want good careers this is how we get them! The United States is built on industry! If we get the good paying blue collar jobs coming into our state we will begin to see the high paying white collar jobs, tech jobs, and more. We have to build the frame work for a strong economy, and that frame work starts with good high paying industrial careers.
		39	1	The Public Benefit from Royalties, Salaries and Taxes Collected will be Substantial: The 70 plus million tons of coal, including nearly 34 million tons of federal coal, must be given substantial positive consideration. The future revenue is needed to fund public programs that have recently been under financial stress in Montana.
		40	1	Coal is vital to this area. The jobs are high paying and the benefits are excellent. Coal is a large part of Montana's economy.
		41	1	Also, if this expansion is not improved not only will the community of Colstrip and its hard working residence lose their jobs and homes, but the citizens of Montana will lose a huge tax base. At a time when we are looking at stifling cuts I for one do not want to remove one of our largest income revenues.
		43	1	The benefits include employment for over 800 workers in the mine and power plant in Colstrip alone. Also the benefit of tax revenue.
		44	1	The benefits include employment for over 800 workers in the mine and power plant in Colstrip alone. Also the benefit of tax revenue.

Topic	Code and Issue	Document ID	Page Number	Comment
		44	1	The 2010 economic study done by the University of Montana shows the mine and power plants exceed $500 million annually in benefits to the State of Montana.
		46	1	The expansion will support well-paying union and professional jobs and pump tax dollars into a state economy desperately in need of it.
		47	1	Without this expansion the mine will run out of coal options and devastate the company and employees.
		50	1	The mine provides badly need and reasonably priced energy to Montana Families, Agriculture and Businesses.
		50	1	The mine also supports many families in this area, as it provides good paying jobs. Businesses and tax revenues are also supported by the Mine.
		51	1	Eastern MT needs these jobs.
		52	1	This mine provides the employment and tax base for the local community, county and to some extent the State of Montana.
		53	1	This expansion will continue to employ the workers that are committed to this area.
		54	1	Coal is vital to support our local economy, our state economy, energy independence as well as my business and the livelihoods of all the local Colstrip employees we employ.
		55	1	We have a wonderful parks and recreation department because of the foresight of Western Energy Officials in the early 80's. We are blessed with well funded schools because of the tax base the mine provides for our community and county. Both of these things contribute more to the health, wellness and economic potential of our community, and state as a whole.
		55	1	We have also been blessed with many Coal Board grants to help fund our infrastructure needs over the years. Please keep in mind that the funding for the Coal Board does not originate from the Legislature, but the mine's coal severance tax. The amount of money that pours into counties with coal mining greatly helps offset the costs of living in a rural area with very little economic, tourism, and recreation opportunities.
		58	1	The positive impact that coal mining has in Montana is huge, not only employing direct miners with excellent paying jobs and benefits, but also a very large sector of support jobs, increased tax revenue for local, county, state, and federal coffers, community building and improvement projects, and most importantly, an affordable, stable source of fuel for electricity generation.
		60	1	We depend heavily on the revenue generated by the Rosebud mine and other coal mines in the state.
		61	1	Neighboring states will also benefit from this approval along with the $500 million estimated annual benefits for MT.

Topic	Code and Issue	Document ID	Page Number	Comment
		62	1	Neighboring states will also benefit from this approval along with the $500 million estimated annual benefits for MT.
		64	1	The mine provides employment, the power plant provides reliable power and together they provide a sustainable tax base for Montana.
		65	1	The jobs created by the Area F expansion will crucially help out Montana's current economic situation. Keep the power on and the money flowing, so that small industrial communities can continue to thrive.
		67	1	The state of MT and the United States as a whole needs coal as a part of a healthy economy, the economic value far exceeds any risks from continuing to mine coal at Rosebud and the various agencies that receive revenue from this coal being mined will not be able to provide their services to the level they are now without this coal being mined.
		69	1	This expansion provides stable high paying jobs that support many in the surrounding communities and will benefit us all for years to come.
		71	1	addition to heating homes and lighting businesses, coal provides a steady income, benefits, and jobs to hard-working Montanans. The economy of Eastern Montana is benefited greatly by Colstrip and would continue to be so with the approval of the EIS for the Rosebud Mine.
		73	1	This power plant and coal mine are vital to the community of Coalstrip, MT. As well, they help support communities around them. For every 1 mining job, 11 other jobs are created in the community. Keep the plant and the miners going to keep the community going.
		77	1	The economic consequences on consumers and businesses of continued restrictions will be significant in terms of increased electrical costs and reduced revenues for rural communities.
		78	1	I support the rosebud coal because it offers good middle class jobs with benefits. Coal mining in Montana also supports Montana people. Money that is paid into the coal severance fund that pays for teacher pension, infrastructure and what ever else Montana needs.
		80	1	To expand the mine would mean a robust economy for the entire state of Montana with a direct positive impact for Rosebud County and the local communities that live within the boarders. I fully support the expansion of Area F - it would be a crime against the state to deny.
		81	1	Continued economic operation of the Colstrip Power Plants is essential for the entire area. The operation of the mine and the power plants provides hundreds of jobs, millions of tax and royalty dollars, as well as stable, economic electricity to Montana and the entire area.
		82	1	Approving the EIS for Western Energy's Rosebud mine's Area F not only helps the Colstrip community, but it helps the State of Montana. The state needs the tax revenue and if Montana continues to take long periods of time to work through EIS's and EA's it hinders the ability for companies to stay profitable.
		87	1	I am in favor of expanding Rosebud Coal Mine's area. Both the mine and the power plant are economic benefits not only to the local area but the entire state of Montana. Over the past 20 years the coal industry as made significant advances in environmental standards. I think with all the improvements the mine should be allowed to expand and maintain the current economic benefits to our state.
		90	1	I am writing in support of the Rosebud Mine expansion. The benefits of this mine and the expansion are much needed to support Montana, the residents of Colstrip and surrounding areas and to provide this resource nationally as well as globally.

Topic	Code and Issue	Document ID	Page Number	Comment
		91	1	I in favor of the approval of the Rosebud mine expansion. This is needed for the good of our community, county, and the state of Montana.
		92	1	I am writing today in support of the Rosebud Mine Expansion Area F permit. Not only would this be a plus for Colstrip but for the State of Montana as well. The coal industry brings in valuable dollars to the state through the tax base but also from workers that spend this money throughout the state.
		113	1	The revenue that Area F would generate would be both far reaching and irreplaceable. Tax revenue from coal reaches every corner of our state and helps fund critical local infrastructure, schools, and essential government services.
		120	1	Ultimately approving this permit, it is about people, all right . . . It's about 400 jobs between the two power plants. We're talking about 800 Montana jobs and a beautiful Montana town that I love living in.
		120	2	You know, coal mines in Montana are taxed at 15% of your top line revenue. . . 15% of our revenue goes straight to Helena. I would like to see that continue for another 20 or so years.
		123	3	But you take a look at what has occurred as a result of all the mining activities that occurred in Colstrip and the state of Montana and take a look at the valuable benefits that have occurred as a result of this that affects all across the state.
		126	1	The impact on the local and state economy is very large. It's easy to look at this directly with workers their taxes and the taxes the state of Montana receives. The hard part to measure is the indirect affect this could have on freight (railroads), subcontractors and suppliers.
		137	1	The financial impact of these activities benefits the local communities and the entire state. The taxes generated from these activities support schools and communities through the state. The various jobs that are both directly and indirectly tied to these activities also add to the financial stability of the state.
		139	1	Our community is all about COAL. This is what we do. Our schools are tied directly to the mine and the power plant. I teach the children of the men and women who work in Colstrip. We must find a way to keep our community moving forward. Our State needs the revenue that is made possible from mining and power generation.
		140	1	This expansion will not only allow the continuation of many jobs at the mine, but will also continue mining in the area in an environmentally supportive way. This mine has shown great respect for the areas it has already mined and reclaimed. It will also help continue a community that without the expansion will become a ghost town, since the coal is used as source for creation of the electricity provided by the power plant. This power supplies much needed energy to a number states and thousands of individuals. Our grid does not currently have other sources to replace this much needed energy. Also, if this expansion is not improved not only will the community of Colstrip and its hard working residence lose their jobs and homes, but the citizens of Montana will lose a huge tax base. At a time when we are looking at stifling cuts I for one do not want to remove one of our largest income revenues.
		141	1	Keeping the Rosebud Mine operating is not only important to the country's energy dominance but also to the economy of eastern Montana. The miners are some of the best paid employees in the state and their dollars turnover several times in the Montana economy. It's also a way of keeping local people supporting their local communities.
		142	1	We also need the steady and good paying jobs these mines provide in a low income area of Montana that has been hit hard by Washington State Lawmakers.
		144	1	This expansion will benefit a large number of people, a community, tax revenues and Local businesses.

Topic	Code and Issue	Document ID	Page Number	Comment
		145	1	I am in support of the Rosebud EIS, as the approval will continue to provide good paying jobs for the residents of Colstrip, MT and provide revenues for the State of Montana of over $500M annually, as concluded by the University of Montana economic study.
		155	1	Besides their commitment to good stewardship they also are committed to paying very well to their employee base which in turn supports the surrounding communities. Even as a small businessman based in Golden Co they have had a positive impact here by supporting my living wage with their purchase of the products we sell through the new owner of my previous company, to support their first class operation.
		156	1	The number of jobs at the Rosebud mine, and the jobs throughout the state that exist due to working with the Rosebud mine are quite extensive and provide income tax revenue to the state.
		158	1	We depend on customers such as Rosebud Mine to keep those thousands of high paying jobs.
		159	1	The continued mining of coal will keep over 800 jobs in Rosebud County and provide millions of tax dollars for the state of Montana.
		160	1	because of employment here we are able to provide for our families an contribute the local economies an buy a home in the community.
		161	1	benefits from the mining operations at Colstrip in terms of jobs...To limit this mining operation would hamper economic development of the small town as well.
		163	1	The mine has does wonderful things for the community...It will more the impact the community of colstrip but also the state if Montana and many other businesses
		164	1	It provides great jobs, help maintain communities and families as well as the ability of a significant revenue to the state.
		166	1	It will keep the much need jobs in the local area as well as indirect jobs.
		168	1	We certainly do not want to reduce the good jobs available in these very rural areas.
		170	1	The city of Colstrip needs this economic stability it will provide as well as many vendors that rely on this economic revenue source.
		176	1	Not only does it protect the jobs of the employees that are currently working, it will also help bring more jobs to those in need. The non expansion of the mine does not only effect the mine itself, but the lively hood of the entire community and it's businesses.
		182	1	Please allow our community to thrive with good paying jobs!!!

Topic	Code and Issue	Document ID	Page Number	Comment
		195	1	More development will create more basic economic wealth, more high paying jobs, and more revenues for local, state, and federal coffers.
		200	1	Low environmental impact combined with the positive economic benefit is I winner for the whole state.
		202	1	The surface mine and the two power plants it supports have provided family supporting jobs in Montana an surrounding border states.
		204	1	It will also provide numerous jobs and help support Montana.
		205	1	Allowing this permit will allow jobs to continue, taxes to be paid, and the moral of the surrounding communities to improve. People ..... we have to think about people and the positive impact this will have on our friends & neighbors. We also have to think about local & state government and the financial aspect of allowing this permit. Like it or not Montana DEPENDS on Coal, whether it be for jobs, financing government, or just turning on the heat & lights. Move this permit forward, so Montana can keep moving forward.
		210	1	We need the tax revenues to help offset the costs for low income families.
		211	1	Coal mining in Montana is important it provides jobs for many i think this should go through with no problems.
		220	1	As we seek good paying jobs through local resources, mining coal around the Colstrip area is a Great Source.
		221	1	It will improve the economy of Eastern Montana.
		222	1	The benefits of the proposal will be the continued employment of over 800 workers in the mine and power plants. Economic benefits over the life of the project include, tax revenues to local, State and Federal governments, royalty payments to the federal government and private interests, local business support and the most reliable electric power supply within the region.
		225	1	Also the state budget would benefit substantially from the sale of coal. It would provide good paying jobs that would benefit the state from income taxes as well as keeping many people off welfare lines.
		228	2	Western Energy operations are providing safe, good paying jobs with wages that are well above the State of Montana average and by any measure, are considered living wage jobs.
		228	2	Furthermore, the tax revenue generated by this operation is critical to a variety of vital Montana services, distributing important revenues to libraries, state parks and a host of other tax dependent organizations.
		230	1	They have taken pride in working within all the regulations, and have gone beyond that in giving back to the community (directly through salaries and taxes, but also indirectly like supporting the schools, wildlife organizations)

Topic	Code and Issue	Document ID	Page Number	Comment
		231	1	They have taken pride in working within all the regulations, and have gone beyond that in giving back to the community (directly through salaries and taxes, but also indirectly like supporting the schools, wildlife organizations)
		232	1	This mining operation and the adjacent power plant provide a much needed economic boost for this rural area of Montana with tax revenues and good paying jobs.
		234	1	Rosebud Mine is an integral component of the western coal fields and losing such a wonderful operation would be a tragic blow to the miners, the localities that benefit from the royalties, the railroads, the mining supply vendors and the indirect service companies.
		235	1	The mine is a major employer in the Colstrip area and not having enough available local coal to fuel the power plants would force them to obtain coal elsewhere having a devastating economic impact on the community of Colstrip.
		236	1	The continued employment of approximately 800 people coupled with tax revenue to local and state governments make far outweigh any possible environmental opposition to the project.
		237	1	This will allow for the continue employment of 350 mine workers and a similar number of employees at the power plant. The Western Energy Colstrip mine contributes significant coal severance and gross proceeds taxes to state and local governments.
		239	1	Our city, county and state need the tax revenue to continue to operate at the level they currently do. The money that comes from our gross proceeds tax, property tax and other taxes puts a huge amount of money into the city of Colstrip, Rosebud County and the State of Montana and also the federal government.
		248	1	Morevoer, the coal Western Energy is proposing to mine is, in part, publicly owned. The public deserves to reap the benefits of those valuable coal resources. In Montana, many of our public services depend on revenues derived from federal natural resource royalties-one half of which are returned to the state.
		248	1	Those royalty payments are just the tip of the iceberg when it comes to taxes paid by developing those resources. Mining coal will also produce tax revenue in the form of property, personal income, payroll, and corporate taxes.
		253	1	Additionally, low cost fuel is a key element in providing low cost energy for Montana and the surrounding states.
		255	1	On the other side of the coin, the continued economic benefit will not only help the local economy but the State & region as it has done so for many years.
		266	2	This area is also required to keep electricity at the lowest cost for all people, especially the low income people who benefit from low cost energy.
		267	2	Colstrip has provided thousands of jobs and millions of dollars to the State of Montana for all types of Montana needs. Colstrip will continue to supply jobs, taxes to Montana, and most importantly, low cost power, that renewable energy cannot begin to provide for our economy for our way of life.
		Response: Thank you for your comments. Socioeconomic impacts are disclosed in **Section 4.15** in the EIS.		

1.3.13 Recreation

Topic	Code and Issue	Document ID	Page Number	Comment
4700 Recreation	4704 Comment about affected environment	98	2	Our reclamation is second to none. In fact, the elk kind of like it. Through Western Energy's gracious hunting program, a lot of us are given the opportunity to hunt those animals.
		Response: Thank you for your comment. As described in **Section 3.18.2.1, Rosebud Mine** in the EIS, Western Energy does allow public access to hunt on inactive areas of the mine.		

1.3.14 Solid and Hazardous Waste

Topic	Code and Issue	Document ID	Page Number	Comment
8500 Cumulative Impacts Analysis	8521 Solid and Hazardous Waste cumulative impacts	99	1	We take care of our oils better and antifreeze. All of that is recycled now or sold to somebody who uses an oil heater. But it's just cleaner now than it ever was.
		Response: Specific reference to antifreeze handling was not made in the EIS. **Section 4.24.3.2** discusses impacts on soil resources from oil and gas spills. The care in handling and recycling these materials is noted as well as the improved cleanliness of those actions.		

1.3.15 Land Use

Topic	Code and Issue	Document ID	Page Number	Comment
8200 Land Use	8204 Comment about direct impacts to adjacent land uses (ranching and grazing)	143	1	As an engineering intern I was able to see beyond the fence into a community of earnest, hardworking, conscientious people. I came away from my experiences being struck by how every long term decision was not only guided towards reclamation, but also returning the property to productive farm land and a thriving natural habitat.
		Response: Thank you for your comment. The EIS discloses impacts on existing land use in **Section 4.23, Land Use**. Land use impacts are anticipated to occur to Cropland, Fish and Wildlife Habitat, Grazing Land, and Pastureland.		

1.3.16 Cumulative Impacts Analysis

Topic	Code and Issue	Document ID	Page Number	Comment
8500 Cumulative Impacts Analysis	8500 Comment about Past and Present Actions	39	1	The production rate and mining methods will remain relatively unchanged. The increase in permit area looks to be only approximately of the existing permit area. It also appears the vast majority of the facilities will remain unchanged.
		208	1	The Mine has operated for many years in a manner that is environmentally sensitive and minimizes environmental impacts. The mine has received many awards for environmental stewardship, and has been an industry leader in mined land reclamation.
		222	1	Coal has been mined at Colstrip for over 90 years. The Northern Pacific Railway established the city of Colstrip and its associated mine in the 1920s to access coal from the Fort Union Formation. The Rosebud Mine operation began production in 1968. In 2001, Westmoreland purchased the Rosebud Mine; its subsidiary, Western Energy, continues to operate the mine today. Throughout that time, coal has been mined in a responsible manner and in compliance with applicable environmental regulations.
		Response: Past and current mining at the Rosebud Mine (**Section 5.2.1.6, Mining**), including reclamation, was included in the cumulative effects analysis. The EIS also discloses in **Section 2.2.2, Existing Operating Permits, Disturbance, and Reclamation**, the amount of permitted and disturbed acreage for each existing permit area (**Table 4**) and the amount of the reclamation bond and phased bond release status for each existing permit area (**Table 5**).		
		218	1	The Colstrip plant is one of the largest sources of greenhouse gasses in the nation, releasing approximately 15 million tons of carbon dioxide into the air each year.
		208	1	The expansion is not likely to affect power plant emissions. If coal is not available from the Rosebud Mine, equivalent amounts of coal can readily be obtained from other sources, particularly from the mines in the vicinity of Gillette WY. Plant emissions will be roughly the same regardless of the source of the coal.
		Response: Past, present, and future coal combustion at the Colstrip Power Plant was considered in the cumulative effects analysis (see **Section 5.3.3 Climate and Climate Change**).		

1.3.17 Non-substantive or Outside the Scope of Analysis

Topic	Code and Issue	Document ID	Page Number	Comment
9000 Other Issues	9002 Nonsubstantive	Documents submitted with no substantive comments: 1, 104, 108, 111, 112, 114, 115, 116, 11, 11, 12, 16, 21, 26, 27, 28, 72, 93, 147, 148, 150, 152, 153, 154, 157, 165, 167, 169, 171, 172, 173, 174, 178, 179, 181, 183, 88, 58, 30, 31, 32, 34, 49, 48, 45, 42, 38, 66, 59, 214, 212, 219, 224, 238, 201, 198, 194, 191, 190, 188, 186, 134, 132, 130, 128, 124, 146, 322, 324, 325, 335, 338, 339		
	9100 Comment about issues outside EIS scope	16	3	A coal power plant located in Colstrip, Montana has proposed to build a new terminal. This terminal if built would be the largest in North America greenhouse gas emissions.
		16	13	A coal power plant located in Colstrip, Montana has proposed to build a new terminal. This terminal if built would be the largest in North American greenhouse gas emissions.
		Response: Comments noted.		
		217	1	The health impacts of coal mining are serious enough that after carefully reviewing data published in peer-reviewed medical journals, over a hundred Oregon physicians wrote a statement to Governor Kithabar in response to a proposal which would allow the removal and exportation of more than 150 million tons of coal a year from the Powder River Basin. In this statement, they requested that he call for and examine both a comprehensive Health Impact Assessment (to include cumulative effects) and a programmatic Environmental Impact Statement before any coal export facility, infrastructure or related transport is approved by any Oregon State agency (Physicians).
		16	14	There have been seven new export terminals proposed in recent years. These terminals were located in Grays Harbor, Longview near the Columbia River, and Cherry Point in Washington; Port Westward, Coos Bay, Port of Morrow in Oregon; and Oakland, California.
		Response: Comments noted.		
		16	8	Additionally, if generators 3 and 4 were to be taken offline, it would require approximately 801 GE 1.85 MW wind turbines or 5,924 acres of solar arrays to meet the current output of these coal-fired generators (Suncyclopedia, General Electric Wind 2018).
		92	1	Being green is not the answer for all of the environmental issues, I believe there is a responsible balance. Wind power and solar power take up multiple acres of prime farm land which cannot be used to produce crops. It has also been shown without subsidizing wind or solar this energy would not be cost effective.
		133	1	Wind and solar are not dependable or affordable. Put money into carbon recapture
		Response: Comments noted.		
		16	9	In 2003, 57 residents of Colstrip filed a $25 million lawsuit against the owning corporations of the plant for groundwater and well water contamination. In 2008, the lawsuit was settled and $25 million was paid to residents for property value loss and property loss. However, none of the money was set aside for cleanup, and it is unclear how much each of the corporations paid.
		16	9	Leaking coal ash ponds with corrupted rubber linings caused the water contamination in Colstrip. Two disposal ponds will be converted to a nonliquid disposal system in the future. This and other mitigation strategies will play a significant role in cleaning up the contaminated Colstrip groundwater and may minimize future pollution.
		Response: Comments noted.		

Appendix G – BBC IMPLAN Analysis

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MEMORANDUM

To: Nicole Bauman, ERO Resources Corporation

From: Doug Jeavons, BBC Research & Consulting

Re: IMPLAN Analysis of Economic Effects of the Rosebud Mine with Area F Expansion (including Economic Effects from Colstrip Generating Station)

Date: February 13, 2017

To provide a more complete picture of the potential economic ramifications of the proposed Area F expansion of the Rosebud Mine, BBC Research & Consulting (BBC) was asked to conduct an IMPLAN analysis to quantify the regional economic effects from mine operations. BBC was also requested to analyze the regional economic effects from operations of the nearby Colstrip electric generating station, which receives all of the coal it uses to produce electricity from the Rosebud Mine (and is the mine's only customer).

The Rosebud coal mine is located in southeastern Montana. The mine's operations are primarily located in Rosebud County, with a portion of the mineable area extending into Treasure County.

BBC's analysis focuses on the current economic effects of these facilities, which are projected to remain approximately the same through 2021, and the longer term effects of these facilities from 2022 through 2037. The distinction between the current economic effects and the longer term effects is that two of the four electric generating units at Colstrip (Unit 1 and Unit 2) are expected to be retired in 2022. The retirement of these units is anticipated to reduce Colstrip's capacity (currently 2,094 MW), and annual electric generation (currently about 17,000 GWh) by about 30 percent. Retirement of the units is also expected to reduce coal production at the Rosebud Mine by approximately 30 percent, from about 10 million tons per year to about 7 million tons per year.

Methods for the Analysis

BBC used the IMPLAN regional economic modeling system to estimate the direct, indirect, and induced regional economic effects from the Rosebud Mine and the Colstrip Generating Station. IMPLAN is an input-output model, originally developed by the U.S. Forest Service that is now widely used for impact analysis by public and private sector economists throughout the United States. Input-output analysis is a means of examining relationships within an economy between businesses and between businesses and final consumers. The analysis captures all monetary market transactions for consumption in a given period. The resulting mathematical

representation allows examination of the effect of a change in one or more economic activities on an entire economy with all other factors being constant. Input-output analysis also provides multipliers, which are used to estimate indirect and induced effects, or secondary effects.

In an input-output analysis, direct effects refer to the initial round of spending from the activity being studied (e.g., the payroll, and supplies, materials, and services purchased by the Rosebud Mine). Indirect effects refer to the economic activity which results from the purchase of goods and services by the other local businesses that receive payments from the directly affected operation (in this case, the Rosebud Mine). Induced effects refer to the economic activity which results from the purchase of household goods and services by employees of the mine and the indirectly affected businesses. Together, indirect and induced effects are sometimes referred to as "secondary" economic impacts, or "multiplier effects."

The IMPLAN model captures only the "backward linkages" (the interconnection of an industry to other industries from which it purchases its inputs in order to produce its output) from mine operations due to the mine's purchases, payroll, and other local expenditures. In this analysis, however, "forward linkages" from the mine are also important. The Rosebud Mine is the primary fuel supplier to the Colstrip Generating Station. The Colstrip Generating Station is the largest industrial facility in Montana and one of the largest coal-fired power plants in the western United States.

To examine both the "backward linkages" and the "forward linkages" from the Rosebud Mine, BBC conducted separate IMPLAN analyses of the regional economic effects from mine operations and the regional economic effects from operations of the power plant. In this report, we initially present the regional economic effects from the mine, since the permitting decision would directly affect future mine operations. BBC then discusses the regional economic effects from the power plant, which may or may not be substantially affected by the mine permitting decision. Since the IMPLAN estimates of the economic contribution from the power plant include the economic effects from the operation of the mine (a "backward linkage" from the power plant), BBC removed the estimated economic contribution from the mine from the overall economic contribution of the power plant in order to assess the *additional* regional economic effects from the Colstrip Generating Station (and to avoid double counting the economic effects from the two facilities).

The IMPLAN model that BBC constructed for this analysis included Rosebud County, Big Horn County, and Treasure County, which are the three local counties most affected by mine operations. BBC used IMPLAN's multiregional analysis capabilities (based on estimated trade flows between the counties) to model how mine activities, primarily based in Rosebud County, affect the economies in the other two counties.

The IMPLAN model provides information on economic activity (employment, labor compensation, output, and other metrics) for the coal-mining sector in Rosebud County in 2012. Employment and production at the Rosebud Mine vary from year to year. During 2015, a total of 450 people worked at the mine for some portion of the year, and at the end of the year the mine had 397 employees (Peterson 2016). Given the impossibility of accurately forecasting year-to-

year variability in mine employment, for purposes of this analysis we assumed constant employment of 400 workers from years 2017 through 2021.

BBC was also asked to estimate the effects of mine operations on two nearby tribes, the Northern Cheyenne Reservation located primarily in Rosebud County and the Crow Reservation located in Big Horn County. IMPLAN does not have data files specific to tribal reservations; however, IMPLAN zip code data were used to construct economic models that approximate the reservation boundaries. Potential economic effects on the tribes were estimated by applying the overall economic effects on each major sector in the relevant county to the proportion of the county's economic sector estimated to be located within the reservation based on the zip code-based model of the tribal economy. For example, if the mine's operations were estimated to support 20 jobs in retail trade in Rosebud County and the Northern Cheyenne Reservation was estimated to contain 30 percent of the retail trade jobs in Rosebud County, the estimated effect on retail trade within the Northern Cheyenne Reservation was 20 jobs x 30 percent = 6 jobs.

Because of the limited impacts within Big Horn County (described later), the economic effects within the Crow Reservation were assumed to be negligible and were not calculated. The Northern Cheyenne Reservation is expected to experience more considerable economic impacts because of its proximity and relation to the mine.

Estimated Current Effects on Regional Economy (2017 through 2021)

Direct effects from mine operations. The direct effects of the Rosebud Mine are the employment and output directly related to the mine's production. Since the Rosebud Mine is based in Rosebud County, all direct effects are assumed to occur in that county.

BBC estimates that Rosebud Mine operations from 2017 through 2021 would support an annual average of approximately 400 direct jobs and $125 million in annual direct economic output.

Based on the Northern Cheyenne Reservation's share of the Rosebud County economy, almost 140 jobs and $26 million in direct economic output are estimated to occur within the Northern Cheyenne Reservation. The approach of estimating the effects on the Northern Cheyenne Reservation on the basis of the Reservation's share of the overall Rosebud County economy is the best available method using the IMPLAN model, but may overstate the direct effects on the Reservation. In 2014, Western Energy reported that between 15 and 20 percent of its current employees were members of the tribe – which would suggest that actual direct effects on the tribal economy may be approximately one half the size of the estimates derived from the IMPLAN results (Email from Richard Spang at Western Energy, December 13, 2014).

Figure 1.
Direct Effects by Location (Dollars in Thousands)

Source: IMPLAN and BBC Research & Consulting, 2016

	Employment	Total Output
Rosebud County	400	$125,530
Big Horn County	0	$0
Treasure County	0	$0
Total	**400**	**$125,530**
Northern Cheyenne Reservation	140	$25,627

Indirect effects from mine operations. Indirect effects (described earlier in the *Methods for the Analysis* section) occur beyond the geographic boundaries of the direct effects and impact the larger economic region as a whole. The estimated current indirect economic effects on the region from the Rosebud Mine are shown in Figure 2.

Indirect effects also likely occur outside of the three-county regional economic study area used in this analysis – particularly in Yellowstone County, which includes the City of Billings. Billings is the largest city and the primary regional trade center in southeastern Montana. The effects beyond the three-county study area are not captured in this analysis.

Figure 2.
Indirect Effects by Location (Dollars in Thousands)

Source: IMPLAN and BBC Research & Consulting, 2016

	Employment	Total Output
Rosebud County	49	$12,055
Big Horn County	2	$420
Treasure County	3	$417
Total	**54**	**$12,892**
Northern Cheyenne Reservation	17	$2,461

BBC estimates that the Rosebud Mine currently supports approximately 54 indirect jobs, 17 of which occur within the Northern Cheyenne Indian Reservation. The mine also generates approximately $13 million annually in indirect economic output in the region.

Induced effects from mine operations. Figure 3 shows the estimated induced effects (described in the *Methods for the Analysis* section) of current Rosebud Mine operations within Rosebud, Big Horn, and Treasure counties and within the Northern Cheyenne Reservation.

Figure 3.
Induced Effects by Location (Dollars in Thousands)

Source: IMPLAN and BBC Research & Consulting, 2016

	Employment	Total Output
Rosebud County	76	$8,295
Big Horn County	0	$36
Treasure County	0	$31
Total	**76**	**$8,362**
Northern Cheyenne Reservation	27	$1,693

The Rosebud Mine is estimated to currently support approximately 76 induced jobs and $8 million in annual induced output across the three-county study area.

Total regional effects from mine operations. The total regional economic impact of the mine is the combination of the direct, indirect, and induced impacts. The majority of the economic effects occur at or near the mine; and Rosebud County is estimated to experience the largest economic impacts. However, since indirect and induced spending occurs across the larger regional economy, both Big Horn County and Treasure County experience some economic effects due to mine operations (Figure 4).

Figure 4.
Total Annual Economic Effects by Location (Dollars in Thousands)

Source: IMPLAN and BBC Research & Consulting, 2016

	Employment	Total Output
Rosebud County	525	$145,880
Big Horn County	2	$456
Treasure County	3	$448
Total	**530**	**$146,785**
Northern Cheyenne Reservation	183	$29,782

The Rosebud Mine is estimated to currently support about 530 direct, indirect, and induced jobs throughout the three-county region and to stimulate about $147 million in annual economic output within the region. About 183 of these jobs and approximately $30 million of the annual total output are estimated to occur within the Northern Cheyenne Reservation. Economic impacts on the Crow Reservation were not calculated given the small economic impacts estimated to occur within Big Horn County compared with Rosebud County.

Current effects of mine operations on government revenues. Another important component of the mine's economic effects are the resulting fiscal revenues provided to local governments, the state of Montana and the federal government. BBC estimated the direct fiscal contributions from the Rosebud Mine based on 2012 data provided by Western Energy. By 2017, taxes and other direct revenues from the mine were assumed to increase by between 15

percent (Resource Indemnity Trust revenues) and 32 percent (Rosebud County property taxes) based on projections provided by Western Energy (Western Energy, MineEconomicDataRequest spreadsheet, 2016).

The Rosebud Mine is estimated to provide approximately $71 million in annual direct revenues to Rosebud County, the state of Montana and the federal government, as summarized in Figure 5. These revenues include federal and state payroll and income taxes, severance taxes, resource indemnity trusts, gross proceeds taxes, and property taxes. State and federal royalties also provide substantial revenue.

As shown in Figure 5, the Rosebud Mine is estimated to directly generate approximately $43 million in annual state revenues in 2017. Local governments and the federal government are projected to receive approximately $10 million and $17 million, respectively, in annual taxes and royalties.

Figure 5.
Direct Governmental Revenues from the Rosebud Mine (Dollars in Thousands)

Source: Western Energy Company and BBC Research and Consulting, 2016

	Local Governments	State of Montana	Federal Government
Taxes	$10,600	$34,829	$8,920
Royalties		$8,299	$8,299
Total	**$10,600**	**$43,128**	**$17,219**

In addition to the direct fiscal impacts, the indirect and induced economic activity generated by the mine throughout the region produces additional tax revenues. These effects include payroll and income taxes, property taxes and other fees. Induced fiscal effects are relatively small because there are no sales taxes in Montana that capture revenues from the induced increase in household spending.

As shown in Figure 6, the indirect and induced effects, combined with the direct effects shown in Figure 5, are estimated to generate approximately $11 million, $44 million, and $19 million in annual revenues in 2017 for local governments, the state of Montana, and the federal government, respectively.

Figure 6.
Total Annual Governmental Revenues from Mine Operations (Dollars in Thousands)

Source: IMPLAN and BBC Research & Consulting, 2016

	Local Governments	State of Montana	Federal Government
Indirect	$128	$421	$785
Induced	$96	$315	$589
Subtotal	$224	$735	$1,373
Direct	$10,600	$43,128	$17,219
Total	**$10,824**	**$43,863**	**$18,592**

***Additional* Current Regional Economic Effects from Operations of Colstrip Generating Facility.** As noted previously, the Colstrip Generating Facility purchases all of the coal produced by the Rosebud Mine. Colstrip currently produces approximately 17,000 GWh of electrical energy per year and directly employs about 400 workers.

In total, BBC estimates that Colstrip operations currently support about $934 million dollars in annual economic output across the three county region, and approximately 1,617 jobs. However, some of this output and jobs reflects the supporting operations of the Rosebud Mine described earlier. Figure 7 summarizes the current *additional* effects from Colstrip operations on annual economic output and employment in the three county region. The data shown in Figure 7 were adjusted to exclude the economic effects of the mine, reported previously in Figure 4.

Figure 7.
***Additional* Economic Effects from Colstrip Generating Station (Dollars in Thousands)**

Note: Excludes economic effects from mine operations shown previously in Figure 4.

Source: IMPLAN and BBC Research & Consulting, 2016

	Employment	Total Output
Direct	400	$680,000
Indirect	452	$80,790
Induced	235	26444
Total	**1,087**	**$787,234**

Colstrip operations also produce substantial federal, state and local tax revenues. In total (including the mine), Colstrip operations are estimated to produce nearly $110 million per year in revenues for state, local and the federal government. Figure 8 also depicts the *additional* contribution to government revenues from Colstrip operations, excluding the annual government revenues from mine operations reported previously in Figure 6. The additional contribution of Colstrip operations to state, local and the federal government (excluding the mine) is estimated to be approximately $36.5 million per year.

Figure 8.
***Additional* Government Revenues from Colstrip Generating Station (Dollars in Thousands)**

Source: IMPLAN and BBC Research & Consulting, 2016

	Total Revenues	Revenues from Mine	Net Additional Revenues from Colstrip
State and Local Governments	$64,128	$54,687	$9,441
Federal Government	$45,632	$18,592	$27,040
Total	**$109,760**	**$73,279**	**$36,481**

Projected Effects on Regional Economy Under Proposed Action (2022 through 2037)

As discussed near the beginning of this memorandum, Colstrip Unit 1 and Colstrip Unit 2 are expected to be retired from operation in 2022. Those retirements are expected to reduce the Colstrip Generating Station's capacity and energy generation by approximately 30 percent, with corresponding effects on output, employment and other metrics. Under the Proposed Action, it is anticipated that the Rosebud Mine will continue to provide the coal needed by Colstrip after the retirements, but mine production is expected to decrease from about 10 million tons per year under current conditions to about 7 million tons per year. The reduction in coal production is expected to reduce mine revenues, employment and other metrics by approximately 30 percent from current conditions.

Projected regional economic effects from mine operations (2022-2037). Figure 9 depicts the projected economic effects from operations of the Rosebud Mine after the retirement of Colstrip Unit 1 and Colstrip Unit 2. As shown in Figure 9, the reduction in mine production following the retirement of the two units at Colstrip is projected to reduce the mine's total contribution to regional employment to about 371 jobs (compared to 530 jobs at present). The mine's contribution to total regional economic output is also projected to decrease, from about $147 million per year at present to about $103 million per year after 2021.

Figure 9. Projected Annual Economic Effects from Mine Operations after 2021 (Dollars in Thousands)

Source: IMPLAN and BBC Research & Consulting, 2016

	Employment	Total Output
Rosebud County	368	$102,116
Big Horn County	1	$319
Treasure County	2	$314
Total	**371**	**$102,749**
Northern Cheyenne Reservation	128	$20,847

Projected effects of mine operations on government revenues (2022-2037). Figure 10 depicts the projected government revenues supported by operations of the Rosebud Mine after the retirement of Colstrip Unit 1 and Colstrip Unit 2. The reduction in mine production after 2021 is projected to reduce the mine's total contribution to government revenues from about $74 million per year at present to about $51 million per year.

Figure 10.
Projected Annual Governmental Revenues from Mine Operations after 2021
(Dollars in Thousands)

Source: IMPLAN and BBC Research & Consulting, 2016

	Local Governments	State of Montana	Federal Government
Indirect	$90	$294	$549
Induced	$67	$220	$412
Subtotal	$157	$515	$961
Direct	$7,420	$30,189	$12,053
Total	**$7,577**	**$30,704**	**$13,014**

Projected *additional* economic effects from Colstrip operations (2022-2037). The additional contribution to the regional economy from the operation of the Colstrip Generating Station (net of the economic contribution from the mine) will also be reduced after two of the generating units are retired in 2022. As depicted in Figure 11, Colstrip's contribution to regional employment (net of the contribution from the mine) is projected to decline to about 761 jobs after 2021. The generating station's contribution to annual regional economic output is projected to decline to about $551 million per year.

Figure 11.
***Additional* Economic Effects from Colstrip Generating Station after 2021**
(Dollars in Thousands)

Note: Excludes economic effects from mine operations shown previously in Figure 4.

Source: IMPLAN and BBC Research & Consulting, 2016

	Employment	Total Output
Direct	280	$476,000
Indirect	316	$56,553
Induced	165	18511
Total	**761**	**$551,064**

After Colstrip Units 1 and 2 are retired, the generating station will produce less revenue for local, state and federal governments than current operations. As shown in Figure 12, the additional contribution of Colstrip's operations to total government revenues (net of revenues produced by the mine)is projected to decline to about $25 million per year.

Figure 12.
***Additional* Government Revenues from Colstrip Generating Station after 2021**
(Dollars in Thousands)

Source: IMPLAN and BBC Research & Consulting, 2016

	Total Revenues	Revenues from Mine	Net Additional Revenues from Colstrip
State and Local Governments	$44,889	$38,281	$6,609
Federal Government	$31,942	$13,014	$18,928
Total	**$76,832**	**$51,295**	**$25,537**

Appendix H – Programmatic Agreement

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PROGRAMMATIC AGREEMENT
AMONG
THE OFFICE OF SURFACE MINING RECLAMATION AND ENFORCEMENT, THE MONTANA HISTORIC PRESERVATION OFFICER, MONTANA DEPARTMENT OF ENVIRONMENTAL QUALITY, BUREAU OF LAND MANAGEMENT, AND WESTERN ENERGY COMPANY
REGARDING
THE MANAGEMENT OF HISTORIC PROPERTIES AT THE ROSEBUD MINE, AREA F

The Office of Surface Mining Reclamation and Enforcement (OSMRE), an office of the United States Department of the Interior, the Montana State Historic Preservation Officer (SHPO), an agency of the State of Montana, and Montana Department of Environmental Quality (MDEQ) a department of the State of Montana, the Bureau of Land Management Miles City Field Office (BLM) and with the concurrence of Western Energy Company (WECo), a subsidiary of Westmoreland Coal Company, collectively the "Consulting Parties," enter into this Programmatic Agreement (Agreement). This Agreement describes OSMRE, SHPO, BLM, WECo., and MDEQ's respective obligations for establishing measures and procedures to protect or preserve sites with cultural or religious significance known or discovered within the proposed boundaries of Rosebud Mine Area F permit described below and for the purpose of demonstrating that OSMRE has afforded the Advisory Council on Historic Preservation (Council) an opportunity to comment on the proposed Area F mining activities at the Rosebud mine and their effects on these historic properties, and that the OSMRE has taken into account the effects of the undertaking on these historic properties. The Consulting Parties enter this Agreement for the purpose of continuing phased identification and evaluation of historic properties, application of criteria of adverse effects, and resolution of adverse effects within Area F, pursuant to 36 CFR § 800.4(b)(2), § 800.5(a)(3), and § 800.6. This Agreement supersedes the "Memorandum of Agreement for Recovery of Significant Information in the Area F Permit Area, Western Energy's Rosebud Mine, Rosebud County, Montana, pursuant to 36 CFR § 800.6(a)" (MOA), executed April 1, 2015, pursuant to Stipulation 8 within that MOA.

RECITAL PARAGRAPHS

WHEREAS, WECo has submitted an application for a coal mine operating permit (No. C2011003F) for its proposed Area F expansion of the Rosebud Mine for review by MDEQ for compliance with Montana Strip and Underground Mine Reclamation Act (MSUMRA) (§§ 82-4-201 through 82-4-254, MCA); and

WHEREAS, OSMRE is charged with administration of the Surface Mining Control and Reclamation Act of 1977 (SMCRA) and is the federal agency responsible for coordinating compliance and consultation of responsible federal agencies for the purposes of the National Environmental Policy Act (NEPA), and Section 106 of National Historic Preservation Act of 1966 (54 U.S.C. § 300101 et seq. and 36 CFR Part 800) (NHPA), and other federal laws applicable to mining of federal coal; and

WHEREAS, SHPO is the Montana agency authorized to establish standards, procedures, and guidelines and provide recommendations based thereon when required by statute or rule for protection and preservation of properties with historic, religious, and cultural values among other things; and

WHEREAS, MDEQ is authorized to permit and regulate surface and underground coal mine operations and otherwise administer MSUMRA, an approved state program under § 503 of SMCRA, and Montana's Cooperative Agreement with the United States Department of the Interior (30 CFR Part 926) for permitting the mining of federal coal in Montana; and

WHEREAS, BLM is the federal agency whose undertaking is the decision whether to approve the Resource Recovery and Protection Plans (R2P2) for federal coal, and as such, must comply with Section 106; therefore, is a signatory party to this agreement; and

WHEREAS, WECo proposes, in its application for a surface coal mine operating permit to commence in or after 2017 mining currently unforeseen acreage within the proposed 6,746-acre Area F permit area, during the nineteen years of operations, that includes both private and federally leased coal located exclusively on private land. The proposed Area F permit area is located in Rosebud and Treasure Counties, Montana, Township 2 North, Range 38 and 39 East, and Township 1 North, Range 39 East (Attachment A); and

WHEREAS, MDEQ, as part of its permitting action, and OSMRE, as part of its undertaking, the Mine Plan Decision Recommendation (MPD) to the Assistant Secretary of Lands and Minerals Management (Under the Mineral Leasing Act), are preparing a joint Environmental Impact Statement (EIS) pursuant to The National Environmental Policy Act (NEPA), and this EIS will also fulfill MDEQ's obligations under the Montana Environmental Policy Act (MEPA); and

WHEREAS, the Consulting Parties have invited WECo as a signatory party in this Agreement; and

WHEREAS, this Agreement shall apply to all activities, including short-term construction and long-term operation, mining, reclamation and all related activities authorized and associated with the Area F permit, MPD, and R2P2; and

WHEREAS, the Consulting Parties agree that the Area of Potential Effect (APE) under the NHPA is encompassed by the mining permit boundary, which can be seen in Attachment A, and may include within the boundary: surface coal mining and related activities, reclamation activities, and mining infrastructure; and

WHEREAS, the Consulting Parties agree that identification of historic properties has been conducted pursuant to 36 CFR § 800.4, and that the assessment of adverse effects pursuant to 36 CFR § 800.5(a)(3) and resolution of adverse effects pursuant to 36 CFR § 800.6 beyond the mining plan for the first five years shall be deferred under the terms specified in this Agreement.

WHEREAS, the Consulting Parties have previously agreed to resolve adverse effects for 24RB2339, 24RB2438, 24RB958, and 24RB2334, which are eligible for the National Register of

Historic Places (NRHP) within the APE and will be impacted during the first five years of operations using the Council's "Recommended Approach for Consultation on the Recovery of Significant Information from Archaeological Sites," published in the Federal Register on May 18, 1999; and

WHEREAS, OSMRE and MDEQ have determined that the additional 20 properties (the Affected Properties), which include 2 districts and 18 sites within the APE are eligible or potentially eligible for the NRHP and may be impacted beyond the first five years of operations:

24TE119/24RB2090 [district], 24TE142, 24TE159, 24RB290, 24RB959, 24RB2053 [district], 24RB2070, 24RB2300, 24RB2307, 24RB2309, 24RB2310, 24RB2311, 24RB2314, 24RB2333, 24RB2337, 24RB2338, 24RB2352, 24RB2354, 24RB2436, 24RB2437; and

WHEREAS, OSMRE and MDEQ have determined that the proposed mining operations at WECo's proposed Area F may have an "adverse effect" upon the Affected Properties; and

WHEREAS, the Consulting Parties acknowledge that it may not be economically feasible to avoid disturbance of the Affected Properties and any new discoveries in the course of mining operations; and

WHEREAS, OSMRE and MDEQ have consulted with the SHPO pursuant to 36 CFR Part 800; and

WHEREAS, OSMRE has consulted with the Indian Tribes that may attach religious or cultural importance to the affected properties regarding the results of the cultural resource inventories and proposed resolution of adverse effects and the Indian Tribes have raised no objection, documented in Attachment B; and

NOW, THEREFORE in consideration of the foregoing, the Consulting Parties agree that the following stipulations, including the proposed treatments, are appropriate for the Affected Properties, and that the proposed treatments constitute reasonable measures to mitigate the effects caused by mining activities, and further agree and mutually covenant in accordance with their respective authorities to implement the mitigation measures described below in any mine operation permit or mine plan approval for Area F:

The parties agree that for the purposes of this Agreement:

"Archeological Evaluation Plan" means a plan describing how a site will be evaluated for eligibility to the NRHP and the appropriate data recovery plan identified.

"Data recovery" means mitigation through archaeological excavation according to plans developed through consultation.

"New discovery" means a cultural resource site not identified in previous studies that is yet to be evaluated as a historic property.

"Treat" means mitigation through standard archeological treatment, or expedited treatment as described in this Agreement.

1. Resource Protection

All eligible or potentially eligible sites, whether known or unknown, will be treated in accordance with the "Standard Archeological Treatment," requirements described below. Where timing is critical, the Consulting Parties may mutually agree to expedite treatment plans for such sites.

Known Resources:

WECo must protect from disturbance, and where appropriate, mark with avoidance signs, the known eligible or potentially eligible cultural resource sites identified in the Recital Paragraphs, including the Affected Properties, within the permit area that have not been treated and cleared for disturbance by MDEQ in conjunction with OSMRE.

New Discoveries:

The Consulting Parties agree that WECo shall have the responsibility to promptly report new discoveries of potential historic properties to MDEQ, that MDEQ shall promptly transmit any such report to OSMRE and SHPO. All post-review discoveries will be treated as eligible and shall be afforded full protection (avoidance) until determined not eligible or an approved treatment plan is completed for those sites determined to be eligible for both standard and expedited treatment.

Possible Human Burials:

No human remains, associated or unassociated funerary objects or sacred objects, or objects of cultural patrimony as defined in the Native American Graves Protection and Repatriation Act (NAGPRA) (25 U.S.C. 3001), are expected to be encountered in the course of mining activities. However, should human remains be encountered work will immediately stop until disposition of the remains are determined through applicable State and Federal regulations, including the Montana Human Skeletal Remains and Burial Site Protection Act (HSRBSPA) and/or NAGPRA;

2. Standard Archeological Treatment: For any eligible or potentially eligible sites that are known or discovered in the course of mining activities, or for any areas subsequently amended into this permit, the following treatment will be required of the respective Consulting Party and the WECo:

(A) WECo will submit a detailed archeological evaluation plan prepared by a qualified contractor to MDEQ, for further distribution to OSMRE and SHPO, for any required treatment of archeological sites, sufficiently in advance of proposed disturbance to facilitate review and approval. These plans will include the overall research plan for each site, specific excavation (or other treatment, as appropriate) methods and standards to be followed, and reporting and curation plans.

(B) OSMRE and SHPO will review any archeological evaluation plan or treatment plan and provide comments to MDEQ within 30 days. If OSMRE requires additional time due to tribal consultation, OSMRE will provide notice to MDEQ and MDEQ will extend the OSMRE comment period.

(C) Upon approval of the archeological evaluation plan(s), WECo will be notified by MDEQ, and will execute the approved plan. If OSMRE or SHPO require modifications to any plans, MDEQ will notify WECo of those changes and WECo will implement the modified plans.

(D) Upon completion of approved field work, WECo will submit a report briefly describing the results of the field work, and a statement of confidence that the completed investigations have met the requirements of the recovery plan to MDEQ. WECo will submit this report within 60 days after the completion of the field work, unless the parties agree to an alternate deadline. MDEQ will review this report and forward it to OSMRE and SHPO, who will provide any recommendations or comments to MDEQ.

(E) A final report fully detailing the results of the data recovery effort and mitigation procedures will be submitted to MDEQ by WECo no later than two years following the completion of the field work. MDEQ, will provide a copy of this report to OSMRE and SHPO for review and comment. MDEQ will also provide a final copy of this report to BLM after acceptance by SHPO.

(F) For both the field work completion report and the final report, revisions to the report(s) may be necessary, based on review by the Consulting Parties.

(G) The information gathered during the data recovery that is not prohibited from disclosure by law may be disseminated to professional peers through papers, lectures, site displays, and other similar means. Copies of this information will also be provided upon request to such institutions as museums, libraries, schools in the local community, and to the Montana University System.

(H) Resolution of Adverse Effects to either of the two historic districts (24TE119/24RB2090 and 24RB2053) intersecting Area F shall be met by

mitigating the specific associated sites that are affected in accordance with the aforementioned procedures.

(I) If any Indian Tribe that has previously not participated in this Agreement prior to execution enters the process pursuant to Stipulation 10, OSMRE will conduct government to government consultation, providing the interested Indian Tribe 30 days to comment. OSMRE will consider any comments received.

3. Expedited Treatment: For any new discovery in which WECo determines that the time required for standard archeological treatment would disrupt a mine plan or production schedule and that times consistent with 36 CFR § 800.13(b)(3) are more appropriate. WECo will suspend activities within 100 feet of the discovery until treatment is completed and MDEQ and OSMRE may authorize WECo to use the following expedited treatment option:

(A) WECo shall notify both MDEQ and OSMRE the nature of the potential historic property upon discovery. WECo will include in the notification a recommendation as to the potential NRHP eligibility of the site/property in question, as well as an expedited plan for any additional evaluation and appropriate treatment for the site. These plans will include the overall research plan for each site, specific excavation (or other treatment, as appropriate) methods and standards to be followed, and reporting and curation plans.

If any Indian Tribe that has previously not participated in this Agreement prior to execution enters the process pursuant to Stipulation 10, OSMRE will conduct government to government consultation, providing the interested Indian Tribe 48 hours to comment. OSMRE will consider any comments received.

Upon notification of a new discovery, MDEQ will consult SHPO within 48 hours regarding the NRHP eligibility and proposed actions to resolve adverse effects. SHPO will respond by providing comments on eligibility and resolution of adverse effects within 48 hours of the notification. OSMRE will notify MDEQ within 96 hours of notification from WECo if any modifications are required based on federal agency review.

WECo will submit a report within 60 days to MDEQ, who will send copies to the OSMRE and SHPOfor review and comment. If OSMRE or SHPO request revision to the report, MDEQ will notify WECo. WECo, if necessary, shall submit the final revised report within 30 days upon notice of revision from MDEQ. MDEQ will also provide a final copy of this report to BLM after acceptance by the SHPO.

(B) In the event that the discovery involves human burial remains or materials, the provisions of the HSRBSPA and, where applicable, NAGPRA, shall still apply.

4. WECo shall submit an annual report summarizing cultural resource-related activities within the Area F permit area, as amended, by March 31 of each year to MDEQ, who will send copies to OSMRE, BLM, and SHPO.

5. Modification, amendment, or termination of this agreement, including changes to the Area F permit, shall be accomplished by the signatories in the same manner as this Agreement. OSMRE will follow standard 36 CFR Part 800 procedures until the Agreement is amended by consensus of the Consulting Parties, or if consensus is not reached, after the Council is invited to comment.

6. Any Consulting Party may request that this Agreement be modified, amended, or terminated, whereupon the parties will consult to consider the request. Should any member of the public object to any activity undertaken pursuant to this agreement, OSMRE will consult with the objecting party.

7. Disputes regarding the performance under this Agreement shall be resolved by the Consulting Parties. If they cannot agree regarding the dispute, any one of the signatories may request the participation of the Council to assist in the resolution, pursuant to 36 CFR 800.9. OSMRE will provide a final decision regarding the performance dispute.

8. This Agreement shall be in effect for the period of time beginning upon execution, during preparation of state and federal decisions, and the period of 19 years from the potential permit issuance date in 2017 through 2036. The Consulting Parties may extend this Agreement through amendment.

9. Execution of this Agreement by the OSMRE, MDEQ, BLM, SHPO and implementation of its terms evidences that OSMRE has afforded the Council an opportunity to comment on the proposed Area F mining activities at the Rosebud mine and their effects on these historic properties, the Council has declined participation and that the OSMRE has taken into account the effects of the undertaking on historic properties.

10. Any Indian tribe may request consultation with OSMRE at any time during the duration of mining and reclamation operations on Area F.

11. The signatories below affirm that they are authorized to execute and bind their respective agencies to the terms of this Agreement.

UNITED STATES OFFICE OF SURFACE MINING, RECLAMATION AND ENFORCEMENT

By: Elizabeth Shaeffer Date: 3·6·2017
Elizabeth Shaeffer, Branch Manager, Field Operations Branch, Western Region

MONTANA STATE HISTORIC PRESERVATION OFFICER

By: _____ Date: _____
Mark Baumler, State Historic Preservation Officer

MONTANA DEPARTMENT OF ENVIRONMENTAL QUALITY

By: _____ Date: _____
Bureau Chief, Coal and Opencut Mining Bureau

BUREAU OF LAND MANAGEMENT, EASTERN MONTANA/DAKOTAS DISTRICT

By: _____ Date: _____
District Manager

Invited Signatory:

WESTERN ENERGY COMPANY

By: _____ Date: _____

UNITED STATES OFFICE OF SURFACE MINING, RECLAMATION AND ENFORCEMENT

By: _____ Date: _____
Elizabeth Shaeffer, Branch Manager, Field Operations Branch, Western Region

MONTANA STATE HISTORIC PRESERVATION OFFICER

By: Mark Baumler Date: 3/8/2017
Mark Baumler, State Historic Preservation Officer

MONTANA DEPARTMENT OF ENVIRONMENTAL QUALITY

By: _____ Date: _____
Administrator, Permitting and Compliance Division

BUREAU OF LAND MANAGEMENT, EASTERN MONTANA/DAKOTAS DISTRICT

By: _____ Date: _____
District Manager

Invited Signatory:

WESTERN ENERGY COMPANY

By: _____ Date: _____

OSMRE/DOI
MAR 07 2017
Received

UNITED STATES OFFICE OF SURFACE MINING, RECLAMATION AND ENFORCEMENT

By: _____ Date: _____
Elizabeth Shaeffer, Branch Manager, Field Operations Branch, Western Region

MONTANA STATE HISTORIC PRESERVATION OFFICER

By: _____ Date: _____
Mark Baumler, State Historic Preservation Officer

MONTANA DEPARTMENT OF ENVIRONMENTAL QUALITY

By: _____ Date: 3/8/2017
Bureau Chief, Coal and Opencut Mining Bureau

BUREAU OF LAND MANAGEMENT, EASTERN MONTANA/DAKOTAS DISTRICT

By: _____ Date: _____
District Manager

Invited Signatory:

WESTERN ENERGY COMPANY

By: _____ Date: _____

UNITED STATES OFFICE OF SURFACE MINING, RECLAMATION AND ENFORCEMENT

By: _____ Date: _____
Elizabeth Shaeffer, Branch Manager, Field Operations Branch, Western Region

MONTANA STATE HISTORIC PRESERVATION OFFICER

By: _____ Date: _____
Mark Baumler, State Historic Preservation Officer

MONTANA DEPARTMENT OF ENVIRONMENTAL QUALITY

By: _____ Date: _____
Bureau Chief, Coal and Opencut Mining Bureau

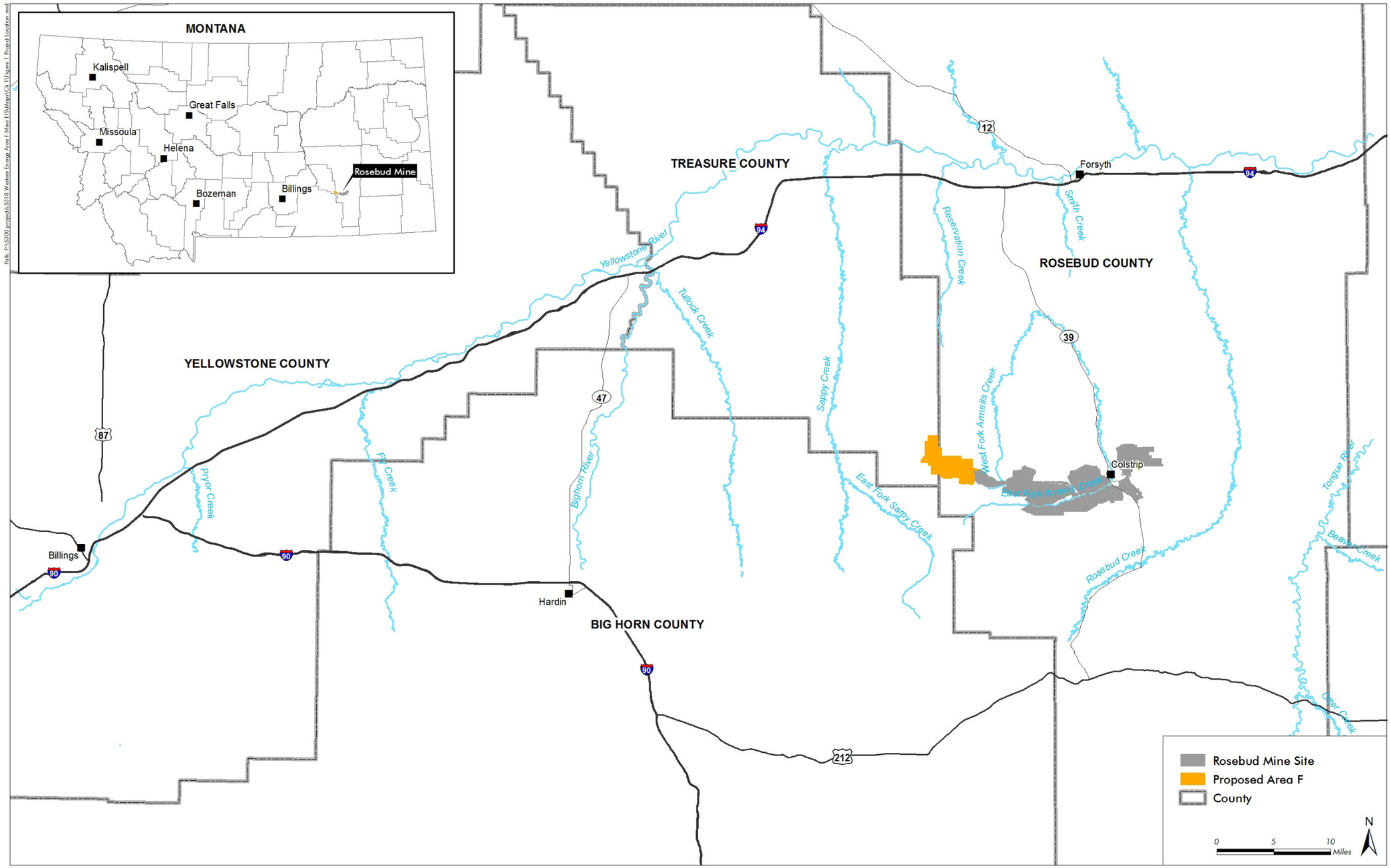
BUREAU OF LAND MANAGEMENT, EASTERN MONTANA/DAKOTAS DISTRICT

By: Diane M Friez Date: 3/27/2017
District Manager

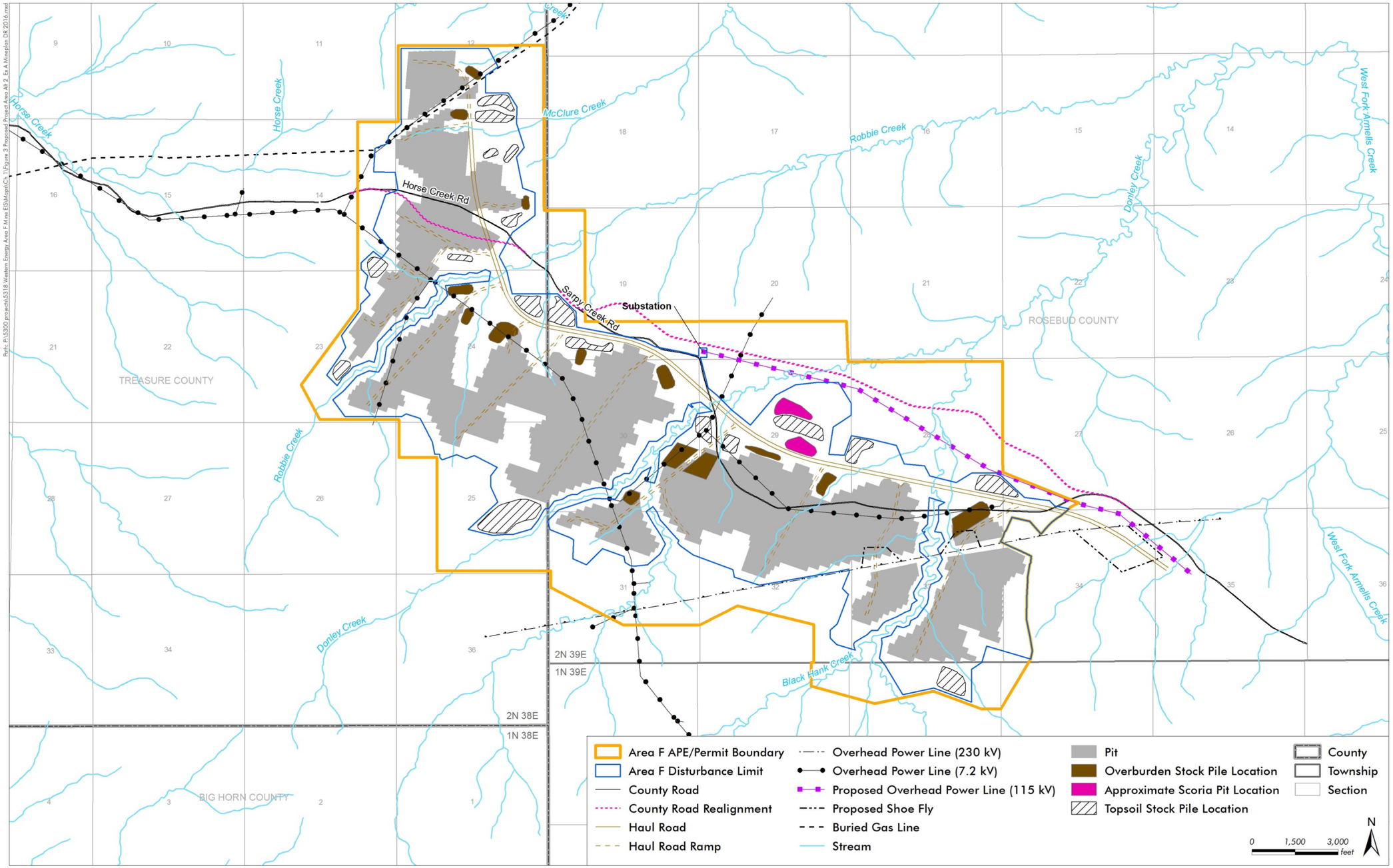
Invited Signatory:

WESTERN ENERGY COMPANY

By: _____ Date: 3/15/17



Map 1 - General Project Location



Map 2 - Rosebud Area F Area of Potential Effects

Attachment B: List of Indian Tribes Invited by Lead Federal Agency to Participate in Consultation for the Rosebud Mine, Area F

INDIAN TRIBES INVITED TO PARTICIPATE IN CONSULTATION		INITIAL PLANNING NOTIFICATION AND CONSULTATION INVITATION DATE	RESOLUTION OF ADVERSE EFFECTS NOTIFICATION AND CONSULTATION INVITATION REQUEST DATE
1	Crow Tribe	April 14, 2014	January 6, 2015
2	Fort Peck Assiniboine and Sioux Tribes	April 14, 2014	January 6, 2015
3	Northern Cheyenne	April 14, 2014	January 6, 2015
4	Apache	June 6, 2018	June 6, 2018
5	Blackfeet Nation	June 6, 2018	June 6, 2018
6	Eastern Shoshone	June 6, 2018	June 6, 2018
7	Kiowa	June 6, 2018	June 6, 2018
8	Oglala Sioux	June 6, 2018	June 6, 2018

OSMRE received no responses to any of the notification and consultation invitation letters. No tribe has raised objections to date of execution of this Agreement.