APPENDIX C. AIR QUALITY TECHNICAL SUPPORT DOCUMENT

SECTION 1 AIR QUALITY ANALYSIS

1.1 INTRODUCTION

This draft Air Quality Technical Support Document (AQTSD) summarizes analyses performed to quantify potential air quality impacts from the proposed action and alternatives for the Moxa Arch Area (MAA) Infill Gas Development (Project). The methodologies used in the analysis were originally defined in an air quality impact assessment protocol (Modeling Protocol) prepared by the Natural Resource Group, Inc. (NRG) (2006) with input from the Bureau of Land Management (BLM) and project stakeholders. The AQTSD reviews the study methodologies and summarizes the findings of the air quality impact modeling analyses performed. The location of the MAA in south-central Wyoming required the examination of both the Project and cumulative source impacts in Wyoming, northwestern Colorado, and northeastern Utah within a defined study area (Figure 1-1). The analysis area includes the area surrounding the proposed Project Area and the following federal Prevention of Significant Deterioration (PSD) Class I areas: Bridger Wilderness Area, Fitzpatrick Wilderness Area, Grand Teton National Park, Mount Zirkel Wilderness Area, Teton Wilderness Area, Washakie Wilderness Area, and Dinosaur National Monument (Federal Class II, Colorado Class I). These areas were identified as sensitive areas of concern by project stakeholders.

Impacts analyzed include those on air quality and air quality related values (AQRVs) resulting from air emissions from: (1) project sources within the MAA; (2) non-project, state-permitted and reasonably foreseeable future action (RFFA) sources within the study domain; and (3) non-project, reasonably foreseeable development (RFD) within the study domain. Predicted pollutant concentrations were compared to applicable ambient air quality standards and PSD increments, and were used to assess potential impacts to AQRVs, including visibility (regional haze) and acid deposition.

This document is organized as follows:

- In Section 1, a list of tasks performed for the study is presented.
- In Section 2, the methods used in developing the Project emission inventory as well as the cumulative emissions are described.
- In Sections 3 and 4, respectively, descriptions of the near-field and far-field air quality and AQRV impact assessment methodologies and impacts are provided.
- In Section 5, the ozone (O_3) modeling analyses is presented.
- In Section 6, references are given.

This draft AQTSD presents results of the air quality and AQRV impacts at the far-field Class I areas as estimated by the CALPUFF modeling system. Processing of the CALPUFF modeling results for the far-field Class II areas is ongoing and will be presented, along with the regional ozone assessment, in future drafts of the AQTSD. Because of the size of the files associated with the project, cumulative emissions inventories, and the sources excluded from analysis, they are not included in this copy of the AQTSD but can be requested directly from the administrative record for the Expanded MAA Natural Gas Development Project Draft Environmental Impact Statement (DEIS) project.

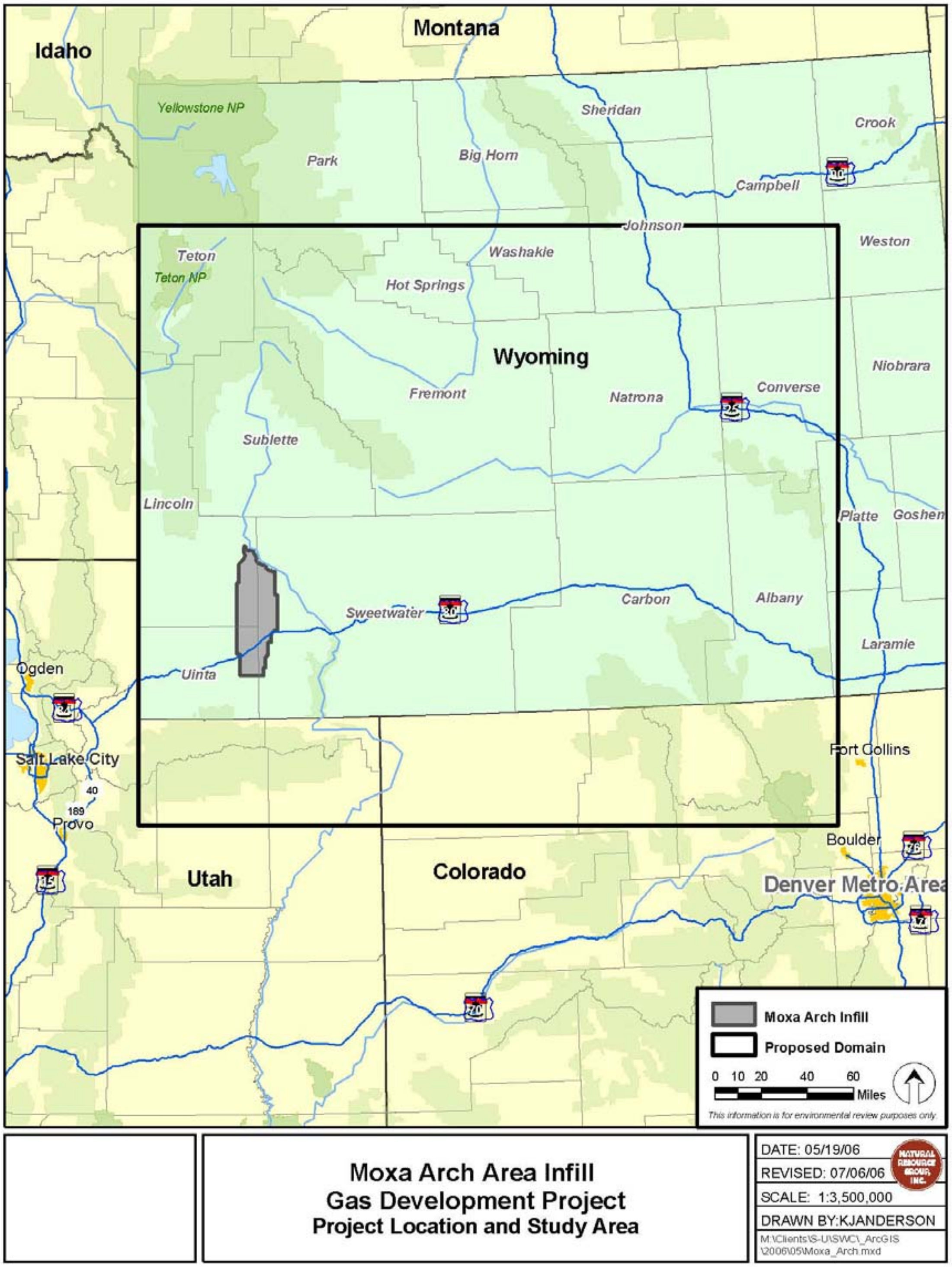


Figure 1-1. Moxa Arch Infill Drilling Project location and air quality study area.

1.2 AIR QUALITY ANALYSIS TASKS

The air quality analysis addressed the impacts on ambient air quality and AQRVs resulting from (1) air emissions from construction and production activities proposed in the MAA from all alternatives, including the No Action Alternative, and (2) air emissions from other documented regional emissions sources within the study area. Ambient air quality impacts were quantified and compared to applicable state and federal standards, and AQRV impacts (impacts on visibility [regional haze] and acid deposition) were quantified and compared to applicable thresholds as defined in the Federal Land Managers' (FLMs') Air Quality Related Values Workgroup (FLAG), Interagency Workgroup on Air Quality Modeling (IWAQM) guidance documents (FLAG 2000; IWAQM 1998), and other state and federal agency guidance.

The following tasks were performed for air quality and AQRVs impact assessment:

- *Project Air Emissions Inventory* - Development of an air pollutant emissions inventory for the Project.
- *Regional Air Emissions Inventory* - Development of an air pollutant emissions inventory for other regional sources not represented by background air quality measurements, including state-permitted sources, RFFA, and RFD.
- *Project Near-Field Analysis* - Assessment of near-field air quality concentration impacts resulting from activities proposed within the MAA.
- *Regional Near-Field Analysis* - Assessment of near-field air quality concentration impacts resulting from activities proposed within the MAA in combination with other existing and proposed regional compressor stations.
- *In-Field Cumulative Analysis* - Assessment of concentration impacts within the MAA resulting from the project and other regional sources inventoried under the “Regional Air Emissions Inventory” task above.
- *Mid-Field Cumulative Analysis* - Assessment of mid-field visibility impacts to regional communities resulting from the Project and other regional sources.
- *Far-Field Direct Project Impact Analysis* - Assessment of far-field air quality concentration and AQRV impacts resulting from proposed Project activities.
- *Far-Field Direct Project Impact Analysis* - Assessment of far-field ozone concentration impacts resulting from proposed Project activities.
- *Far-Field Cumulative Impact Analysis* - Assessment of far-field air quality concentration and AQRV impacts resulting from activities proposed within the MAA combined with other regional sources inventoried under second item above.
- *Far-Field Cumulative Impact Analysis* - Assessment of far-field ozone impacts resulting from activities proposed within the MAA combined with other regional sources inventoried under second item above.

SECTION 2 EMISSIONS INVENTORY

2.1 PROJECT EMISSIONS

The Proposed Action includes the development of up to 1,861 natural gas wells, all of which could be developed on individual well pads. Criteria pollutant and hazardous air pollutant (HAP) emissions were inventoried for construction activities, production activities, and ancillary facilities. Criteria pollutants included nitrogen oxides (NO_x), carbon monoxide (CO), sulfur dioxide (SO_2), volatile organic compounds (VOCs), particulate matter less than 10 microns in diameter (PM_{10}), and particulate matter less than 2.5 microns in diameter ($PM_{2.5}$). HAPs consisted of n-hexane; benzene, toluene, ethylbenzene, and xylene (BTEX); and formaldehyde.

All emission calculations were completed in accordance with Wyoming Department of Environmental Quality – Air Quality Division (WDEQ-AQD) oil and gas guidance (WDEQ-AQD 2001) in effect at the time the inventory was conducted, stack test data, Environmental Protection Agency's (EPA's) AP-42, or other accepted engineering methods. Additions to WDEQ-AQD Oil and Gas Production Facility Emission Control and Permitting Requirements for the Moxa Arch and Pinedale Anticline Gas Fields were approved by the Air Quality Team on July 28, 2004. The additional guidance became effective upon approval and applies to all wells reported to WOGCC after the approval date of July 28, 2004. The additional guidance revised emission control requirements and permitting process currently utilized under WDEQ-AQD Notice of Intent (NOI)/Presumptive Best Available Control Technology (P-BACT) permitting processes.

2.1.1 Construction Emissions

Construction activities are a source of primarily criteria pollutants. Emissions would occur from well pad and resource road construction and traffic, rig-move/drilling and associated traffic, completion/testing and associated traffic, pipeline installation and associated traffic, and wind erosion during construction activities. Generally, construction and drilling activities take 2-3 weeks followed by 3-5 weeks of completion, testing, and pipeline construction activities.

Well pad and resource road emissions would include fugitive PM_{10} and $PM_{2.5}$ emissions from two sources: (1) construction activities; and (2) traffic to and from the construction site. Other criteria pollutant emissions would occur from diesel combustion in haul trucks and heavy construction equipment. On resource roads, water would be used for fugitive dust control, resulting in an assumed control efficiency of 50%.

After the pad is prepared, rig-move/drilling would begin. Emissions would include fugitive dust from unpaved road travel to and from the drilling site and emissions from diesel drilling engines. Emissions from well completion and testing would include fugitive PM_{10} and $PM_{2.5}$ from traffic and emissions from haul trucks and other transport vehicles. Also, wind erosion emissions from disturbed areas would occur. During the completion phase, gas and condensate are both vented to the atmosphere and combusted (flared). Emissions from the venting of natural gas include HAPs and VOCs. Flaring emissions from the combustion of natural gas and condensate include nitrogen oxides, carbon monoxide, sulfur dioxide, VOCs, and HAPs.

Pollutant emissions would also occur from pipeline installation activities, including general construction activities, travel to and from the pipeline construction site, and diesel combustion from on-site construction equipment.

Fugitive dust (PM_{10} and $PM_{2.5}$) would occur during well pad, road, and pipeline construction due to wind erosion on disturbed areas.

Table 2-1 shows a summary of single-well construction emissions for both straight and directionally drilled wells. Construction emission calculation details will be provided in future versions of this AQTSD, including all emission factors, input parameters, and assumptions.

Table 2-1. Single-well Construction Emissions Summary for Drilled Wells.

AERMOD* Source ID	PM_{10}	$PM_{2.5}$		NO_x	SO_2		CO
	lb per hour	lb per hour	ton per year	ton per year	lb per hour	ton per year	lb per hour
Drill Rig	3.66	3.66	0.409	5.26	2.83	0.32	6.26
Flare	0.32	0.32	0.01	0.069	0.025	0.00060	15.73
Generator	0.06	0.06	0.00	0.068	0.27	0.013	1.08
Pad Construction	1.48	0.41	0.39	0.082	0.99	0.008	2.81
Compressor Construction	0.87	0.27	0.120	0.058	0.77	0.006	2.09
Roads (fugitive and exhausts)	11.52	1.63	0.17	0.12	1.12	0.014	3.77
Wind Erosion—Drill Pad	20.77	8.31	36.39	--	--	--	--
Wind Erosion---Compressor	11.33	4.53	19.85	--	--	--	--
Wind Erosion---Roads	26.44	10.57	46.31	--	--	--	--
Total Emmissions From All Sources	76.45	29.76	103.649	5.657	6.005	0.3616	31.74

*Aermod is the EPA's proposed dispersion model.

2.1.2 Production Emissions

Field production equipment and operations would be a source of criteria pollutants and HAPs, including BTEX, n-hexane, and formaldehyde. Pollutant emission sources during field production would include:

- combustion engine emissions and dust from road travel to and from well sites;
- diesel combustion emissions from haul trucks;
- combustion emissions from well site heaters;
- fugitive HAP/VOC emissions from well site equipment leaks;
- condensate storage tank flashing and flashing control;
- glycol dehydrator still vent flashing;
- wind erosion from well pad disturbed areas;
- emissions from central and wellhead compressors; and
- natural gas-fired reciprocating internal combustion compressor engines.

Fugitive PM_{10} and $PM_{2.5}$ emissions would occur from road travel and wind erosion from well pad disturbances. Criteria pollutant emissions would occur from diesel combustion in haul trucks traveling in the field during production.

Heaters required at each well site include an indirect heater, a dehydrator reboiler heater, and a separator heater. Heater emissions for all pollutants were calculated using AP-42.

HAPs and VOC emissions would occur from fugitive equipment leaks (i.e., valves, flanges, connections, pump seals, and opened lines). Condensate storage tank flashing and glycol dehydrator still vent flashing emissions also would include VOC/HAP emissions. Emissions from these sources were provided by the Operators. Total production emissions of criteria pollutants and HAPs occurring from a single well are presented in Table 2-2. Detailed production emission calculations will be provided in future versions of this AQTSD, including all emission factors, input parameters, and assumptions.

Table 2-2. Single-Well Production Emissions Summary.

Traffic Emissions[1]			Production Emissions [2]		Total Emissions	
Pollutant	**(tpy)**	**(lb/hr)**	**(tpy)**	**(lb/hr)**	**(tpy)**	**(lb/hr)**
NO_x	0.2	---	0.171	---	0.391	--
CO	--	2.8	---	0.119	--	2.99
SO_2	2.3	0.4	0.012	0.033	2.312	0.433
PM_{10}	--	1.44	--	0.02	--	1.46
$PM_{2.5}$	0.10	0.13	0.067	0.082	0.093	0.212
VOC	0.3	0.4	3.984	1.44	4.284	1.840
Benzene	--	--	0.16	0.37	0.16	0.37
Toluene	--	--	0.545	0.124	0.545	0.124
Ethylbenzene	--	--	0.045	0.010	0.045	0.010
Xylene	--	--	0.526	0.120	0.526	0.120
n-hexane	--	--	0.073	0.017	0.073	0.017

[1] Includes emissions from all traffic associated with full-field production. PM_{10} and $PM_{2.5}$ emissions.
[2] Includes emissions from indirect heater, separator heater, dehydrator heater, and dehydrator flashing, and fugitive HAP/VOC.

For the near-field modeling discussed in Section 3, a hypothetical well pad configuration was constructed assuming maximum potential emissions. To be conservative, it was assumed that one central compressor (50,000 hp) and one wellhead compressor, which are assumed to occur every 32 wells (200 hp), could occur on the hypothetical well pad. The emissions from these two sources are shown in Table 2-3. For the far-field modeling discussed in Section 4, the central compressors and wellhead compressors were conceptually distributed across the MAA based on the density of the wells assumed in the various alternatives.

Table 2-3. Maximum Compressor Production Emissions (tpy).

Pollutant	Central Compressor	Wellhead Compressor
NO_x	482.80	1.931
CO	965.61	10.57
SO_2	0.966	.004
PM_{10}	0.573	0.128
$PM_{2.5}$	0.573	0.128
VOC	482.80	1.931

2.1.3 Total Field Emissions

Annual emissions in the MAA for the Proposed Action, Alternative A – No Action, and Alternative C and are shown in Table 2-4. The analysis assumes that emissions from Alternative B would be no greater than predicted for Alternative C. Emissions assume construction and production occurring simultaneously in the field and include one year of maximum construction emissions plus one year of production at maximum emission rates.

Construction emissions were based on well construction, drilling, drilling traffic, completion traffic, and completion flaring. Well construction emissions were based on the number of wells constructed per year and the type of well constructed. Drilling, drilling traffic, completion traffic, and completion flaring were based on the number of wells developed per year. As a conservative assumption, completion flaring operations were assumed to occur at all of the wells under construction, and compression was included. Production emissions were calculated based on the total number of producing wells in the field. Total producing wells were equal to the difference in number of wells proposed and the number of wells constructed per year.

Table 2-4. Estimated MAA Infill Drilling Project maximum annual in-field emissions summary - construction and production.

Alternative	Annual Develop-ment Rate per year	Pollutant	Annual Construction Emissions (tpy)	Total Producing wells	Annual Production Emissions (tpy)	Total Emissions (tpy)
Alternative C	207	PM_{10}	385	5,165	662	1047
		$PM_{2.5}$	143		400	543
		NO_x	847		3730	4577
		SO_2	20		26	46
		CO	240		4390	4630
		VOCs	952		13328	14281
Proposed Action	186	PM_{10}	370	1,861	64	434
		$PM_{2.5}$	186		50	236
		NO_x	1005		2473	3477
		SO_2	62		8	70
		CO	188		4341	4529
		VOCs	854		6204	7059
Alternative A -No Action	100	PM_{10}	289	100	56	345
		$PM_{2.5}$	115		18	133
		NO_x	821		301	1123
		SO_2	18		3	22
		CO	229		192	421
		VOCs	512		1393	1905

2.2 CUMULATIVE EMISSIONS INVENTORY

An emissions inventory of industrial sources within the Project's regional modeling domain was prepared for use in the cumulative air quality analysis. The modeling domain included portions of Wyoming, Colorado, Utah, and Idaho (see Figure 2-1 and Figures 4-1 and 4-2). Industrial sources and oil and gas wells permitted within a defined time frame (January 1, 2001 through June 30, 2006) through state air quality regulatory agencies and state oil and gas permitting agencies were first researched. The subset of these sources, which had begun operation as of the inventory end-date, was classified as state permitted sources, and those not yet in operation were classified as reasonably foreseeable future action (RFFA) sources. Also included in the regional inventory were industrial sources proposed under National Environmental Policy Act (NEPA) in the states of Wyoming and Colorado. The developed portions of these projects were assumed to be either included in monitored ambient background or included in the state-permitted source inventory. The underdeveloped portions of projects proposed under NEPA were classified as reasonably foreseeable development (RFD) sources. In accordance with understanding between the BLM and the Air Quality Team, RFD was defined as: (1) the NEPA-authorized but not yet developed portions of Wyoming and Colorado NEPA projects; and (2) not yet authorized NEPA projects for which air quality analyses were in progress and for which emissions had been quantified. These source categories are described in Sections 2.2.1 through 2.2.4 below.

Sources of VOC, PM_{10}, NO_X, and SO_2 emissions within the study area (the CALPUFF/CALMET modeling domain), were inventoried.

2.2.1. EXISTING INVENTORY

Emissions data for sources proposed and operating during the time period that overlaps the Project inventory time-frame and June 30, 2006 were based in part on the Jonah Infill Environmental Impact Statement (EIS), which is a recent cumulative inventory that has been completed as part of a NEPA project in southwest Wyoming. The end-date of the Jonah Infill EIS study is June 30, 2003.

2.2.2 PERMITTED SOURCES

In addition to sources inventoried as part of the Jonah Infill EIS, newly permitted and/or authorized projects through June 30, 2006 were included in the modeling. The cumulative emissions inventory for the Project included emissions sources that:

- Are located within the study area;
- Emit NO_x, SO_2, or $PM_{10}/PM_{2.5}$;
- Began operation or were permitted on or before June 30, 2006; and
- Were permitted on or after July 1, 2006, but are not yet operating (inventoried as RFFA as described in Section 2.2.4).

Actual emissions were used if a minimum of one year of actual data are available. Otherwise, potential-to-emit (maximum permitted) emission rates were used. Emissions decreases were included only if the decrease occurs at a major source and if the decrease was verifiable by WDEQ-AQD. Non-oil and gas sources operating under permit waivers were not inventoried due to their small quantities of emissions. Oil and gas waivers were examined based on emission threshold criteria. Each source was either included as a production site (3 tpy total emissions) or assumed to be included in permitted wells totals obtained for the oil and gas permitting authority. Mobile source emissions not directly resulting from the proposed action, as well as biogenic sources, urban sources, and other non-industrial emission sources, were assumed to be included in monitored background concentrations and were not included in this analysis.

2.2.3. WOGCC/COGCC/UDNR-DOGM/IOGCC Sources

A list of well drilling permits issued between June 30, 2003, and June 30, 2006 was compiled using permit data obtained from WOGCC, COGCC, UDNR-DOGM, and IOGCC. Emissions were calculated by estimating well emissions. Individual well emissions were multiplied by the number of wells installed during the study period in each county within the study area.

2.2.4. RFD and RFFA

Data for RFD and RFFA sources were used in conjunction with well drilling permit data. For the purposes of this project, RFFA was defined as a source that possesses an unexpired air permit issued on or after July 1, 2003, but is not yet operating. The primary source of RFFA information was state permit records obtained through a file data search.

RFD is defined as (1) air emissions from the undeveloped portions of authorized NEPA projects, and (2) air emissions from not-yet-authorized NEPA projects (if emissions were quantified when modeling for the MAA commenced). RFD information was obtained from final NEPA air quality analysis documents that were submitted to BLM for planned project development. Undeveloped portions of these authorized projects were obtained from BLM records tracking project development to determine total wells or other equipment yet undeveloped. For instance, for an authorized gas field development area for which 2,000 wells were projected but only 250 wells had been developed as of the inventory end-date of this study, 250 wells would be included under permitted source inventory and the remaining 1,750 would be considered RFD. RFD information from not-yet-authorized projects was obtained from contractors working on ongoing air quality analyses for NEPA projects.

Full development of proposed projects inventoried as RFD may or may not coincide with full development of the Project. As a result, the inclusion of RFD in the cumulative analysis may result in overly conservative impact estimates. To ensure "reasonable, but conservative" analysis results for all stages of Project development, the cumulative modeling analysis was performed both with and without RFD sources. A map showing NEPA RFD project areas that were examined in this study, as defined in the paragraph above is presented in Figure 2-1. All development areas were reviewed for inclusion, and those projects with significant pollutant emissions during production activities were included as RFD. To ensure a timely, complete modeling analysis, only development authorized through the inventory end-date of June 30, 2006, or quantified as of the beginning of the modeling analysis, was included in the Project analysis.

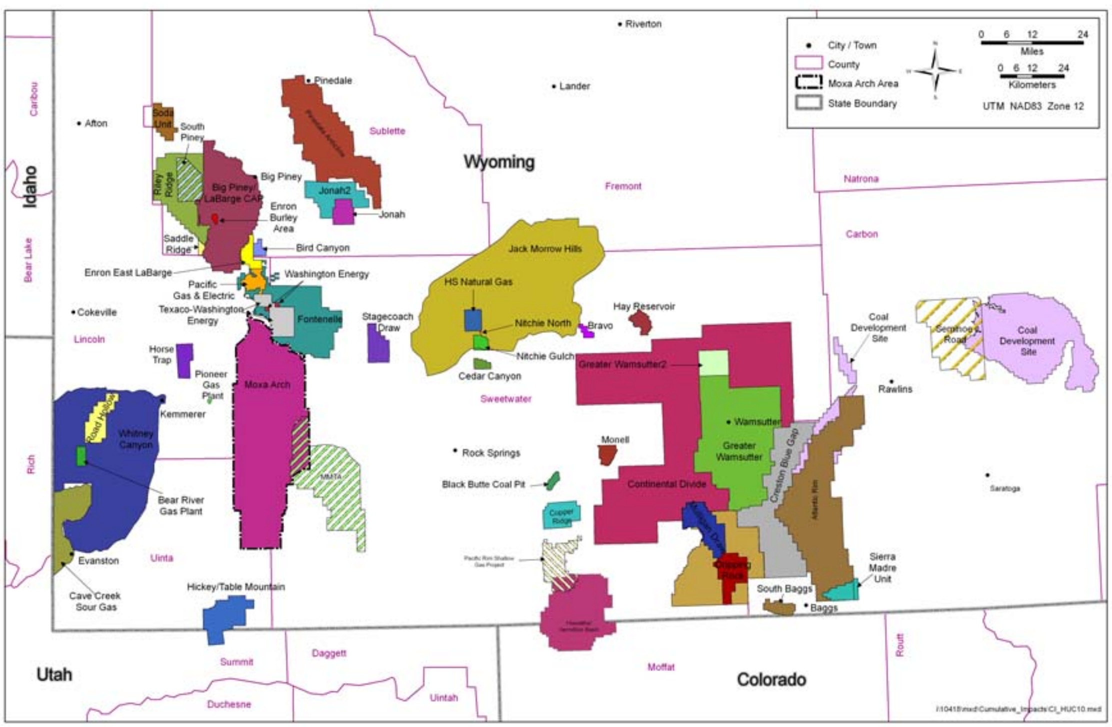


Figure 2-1. Map of the regional inventory area and NEPA project areas.

SECTION 3 NEAR-FIELD MODELING ANALYSIS

3.1 MODELING METHODOLOGY

A near-field ambient air quality impact analysis was performed to quantify the maximum air quality impacts for criteria pollutants (PM_{10}, $PM_{2.5}$, CO, NO_2, SO_2) and HAPs (BTEX, n-hexane, and formaldehyde) that could occur within and near the MAA. These impacts would result from emissions associated with Project construction and production activities, and are compared to applicable ambient air quality standards and significance thresholds. All modeling analyses were performed in accordance with the Modeling Protocol (NRG 2006) with input from the BLM and members of the Air Quality Team, including the EPA, Forest Service, and WDEQ-AQD.

The EPA's recommended guideline dispersion model (EPA 2005) for near-source impacts, AERMOD (version 02222), was used to assess near-field impacts of criteria pollutants PM_{10}, $PM_{2.5}$, CO, NO_2, SO_2, and to estimate short-term and long-term HAP impacts. This version of AERMOD uses the PRIME building downwash algorithms which are the most recent "*state of science*" algorithms for modeling applications where aerodynamic building downwash is a concern. One year of meteorological data was used with the AERMOD dispersion model to estimate these pollutant impacts. Various construction and production activities were modeled to provide for a complete range of impacts for different alternatives and activities. To model the magnitude and duration of emissions from each Project phase (i.e., construction or production), emissions activity was examined to determine the maximum emissions scenario for each pollutant. Representative scenarios of construction and development were developed to maximize any potential impacts. For example, although the Project proposes to use existing compression capacity in the area, a large central compressor with one wellhead compressor nearby was assumed in the near-field analysis.

3.2 METEOROLOGICAL DATA

One year of surface meteorological data, collected in the Jonah area from January 1999 through January 2000, was used in the analysis. A wind rose for these data is presented in Figure 3-1.

The Jonah meteorology data included hourly surface measurements of wind speed, wind direction, standard deviation of wind direction (sigma theta), and temperature. These data were processed using the AERMET preprocessor to produce a dataset compatible with the AERMOD dispersion model. AERMET was used to combine the Jonah surface measurements with twice daily upper-air meteorological sounding data from Riverton, Wyoming cloud cover data collected at Big Piney, Wyoming, and solar radiation measurements collected at Pinedale, Wyoming.

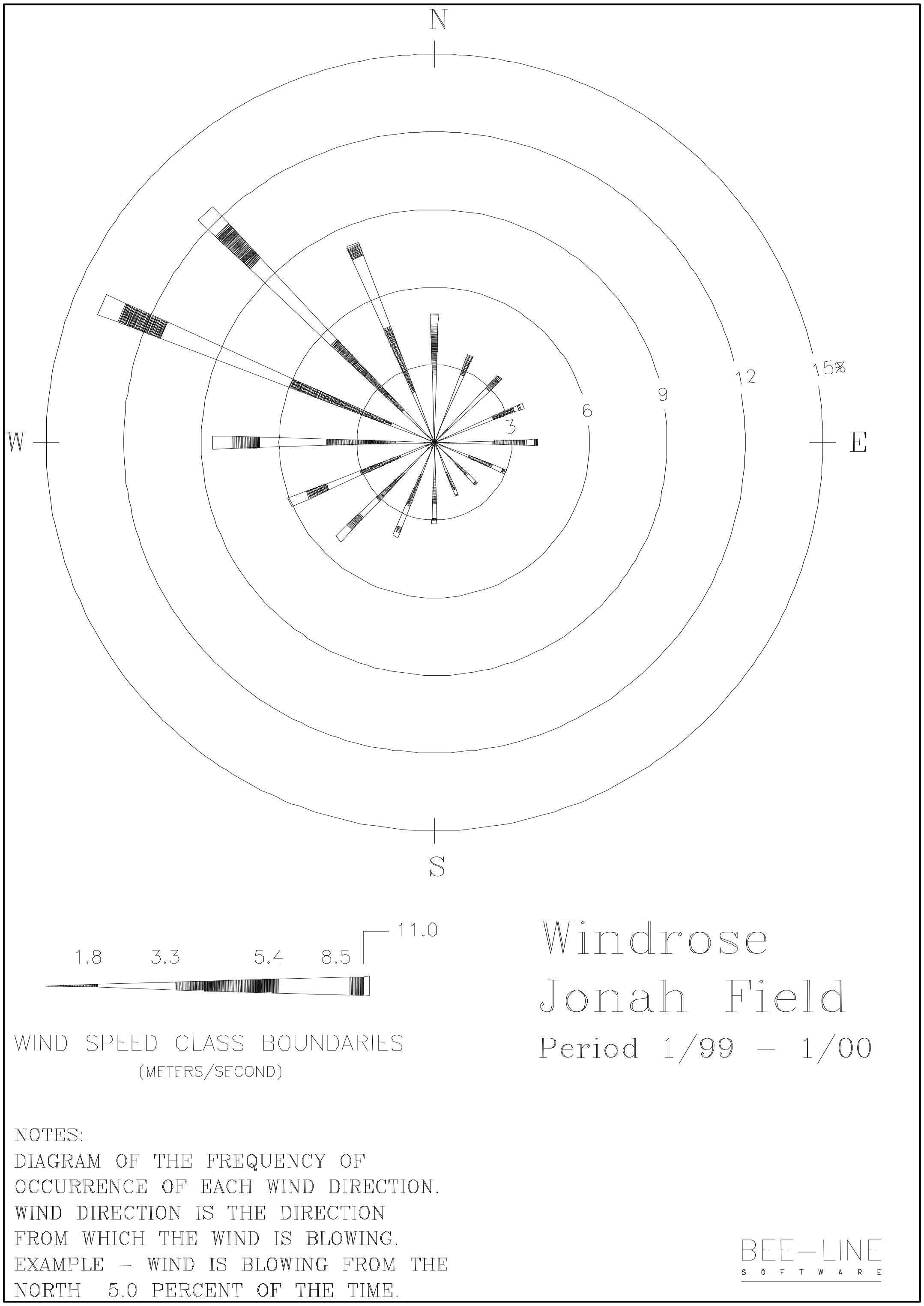


Figure 3-1. Wind Rose for use in near-field modeling for the Project.

3.3 BACKGROUND POLLUTANT CONCENTRATIONS

Background concentration data collected for criteria pollutants at regional monitoring sites were added to concentrations modeled in the near-field analysis to establish total pollutant concentrations for comparison to ambient air quality standards. Table 3-1 shows the most representative monitored regional background concentrations available for criteria pollutants as recommended by WDEQ-AQD in an e-mail from Darla Potter (WDEQ-AQ) to Michele Easley (BLM) dated August 8, 2006.

Table 3-1. Near-Field Analysis Background Ambient Air Quality Concentrations (Micrograms per Cubic Meter [$\mu g/m^3$]).

Pollutant	Averaging Period	Measured Background Concentration
CO[1]	1-hour 8-hour	2,229 1,148
NO_2[2]	Annual	3.4
O_3[3]	1-hour 8-hour	169 147
PM_{10}[4]	24-hour Annual	48 25
$PM_{2.5}$[4]	24-hour Annual	15 5
SO_2[5]	3-hour 24-hour Annual	29 18 5

1 Data collected at Rifle and Mack, Colorado, in conjunction with proposed oil shale development during 1980's (Colorado Deparment of Public Health and Environment [CDPHE] 1996).

2 Data collected at Green River Basin Visibility Study site, Green River, Wyoming, during period January-December 2001 (Air Resource Specialists [ARS] 2002).

3 Data collected at Green River Basin Visibility Study site, Green River, Wyoming, during period June 10, 1998, through December 31, 2001 (ARS 2002).

4 Data collected by WDEQ/AQD at Rock Springs, Wyoming for 2005.

5 Data collected at Craig Power Plant site and oil shale areas from 1980-1984 (CDPHE 1996).

3.4 CRITERIA POLLUTANT IMPACT ASSESSMENT

The near-field criteria pollutant impact assessment was performed to estimate maximum potential impacts of PM_{10}, $PM_{2.5}$, NO_2, SO_2, and CO from project emissions sources including well site and compressor station emissions. Maximum predicted concentrations in the vicinity of project emissions sources were compared with the Wyoming Ambient Air Quality Standards (WAAQS), Colorado Air Quality Standards (CAAQS), National Ambient Air Quality Standards (NAAQS), and applicable PSD Class II increments, as shown in Table 3-2. This analysis compared potential air quality impacts from Project alternatives to applicable ambient air quality standards and PSD increments. The comparisons to the PSD Class I and II increments are intended to evaluate a threshold of concern for potential impacts, and do not represent a regulatory PSD increment comparison. Such a regulatory analysis is the responsibility of the state air quality agency (under EPA oversight) and would be conducted during the permitting process.

Table 3-2. Ambient Air Quality Standards and Class II PSD Increments for Comparison to Near-Field Analysis Results (μg/m[3]).

Pollutant/Averaging Time	Ambient Air Quality Standards				PSD Class II Increment	Class II Significance Level
	National	Wyoming	Colorado	Utah and Idaho		
Carbon monoxide (CO)						
1-hour	40,000	40,000	40,000	40,000	--	2,000
8-hour	10,000	10,000	10,000	10,000	--	500
Nitrogen dioxide (NO_2)						
Annual	100	100	100	100	25	1
Ozone (O_3)						
1-hour	235	235	235	235	--	--
8-hour	157	157	--	157	--	--
PM_{10}						
24-hour	150	150	150	150	30	5
$PM_{2.5}$						
24-hour	35	35	--	65	NA	--
Annual	15	15	--	15	NA	--
Sulfur dioxide (SO_2)						
3-hour	1,300	1,300	700[5]	1,300	512	25
24-hour	365	260	100[5]	365	91	5
Annual	80	60	15[5]	80	20	1

The EPA's proposed guideline dispersion model, AERMOD, was used to model the near-field concentrations of PM_{10}, $PM_{2.5}$, CO, NO_2, and SO_2. AERMOD was run using one year of AERMET preprocessed meteorology data following all regulatory default switch settings. Because PM_{10}, $PM_{2.5}$, NO_2, and SO_2 emissions would be present during both the access road/well pad construction phase of field development and the production phase, these emissions sources were modeled under both scenarios to determine compliance with the PM_{10}/ $PM_{2.5}$ WAAQS and NAAQS. Carbon monoxide and NOx emissions, primarily from compressor stations, would be greatest during well production.

3.4.1 Construction Emissions

Maximum localized PM_{10}/$PM_{2.5}$, CO, NO_2, and SO_2 impacts would result from well pad and road construction activities and from wind. A conservative case assumption was made to locate a central compressor station nearby. Model receptors were placed at 100-meter (m) intervals beginning 200 m from the edge of the well pad and road. Flat terrain was assumed for each modeling scenario. Figure 3-2 presents the configurations used to model each well pad and resource road scenario. Volume sources were used to represent emissions from roads, and area sources were used for pads and compressor construction areas. AERMOD was used to model each scenario 12 times, once at each of twelve 30º rotations, to ensure that impacts from all directional layout configurations and meteorological conditions were assessed. Wind erosion emissions were modeled for all hours where the wind speed exceeded a threshold velocity defined by emissions calculations performed using AP-42 Section 13.2.5, Industrial Wind Erosion (EPA 2004).

Table 3-3 presents the maximum modeled PM_{10}/$PM_{2.5}$ concentrations for each well pad scenario. When the maximum modeled concentration was added to representative background concentrations, it was demonstrated that PM_{10} and $PM_{2.5}$ concentrations for all scenarios comply with the WAAQS and NAAQS for criteria pollutants modeled and proposed standards for $PM_{2.5}$. (Note: The second highest value was used for the newly proposed 24 hour $PM_{2.5}$ standard. In some of the scenarios the highest value exceeded the standard, but the proposed standard is applicable for those exceedance values that are over the 98 percentile of 24-hour $PM_{2.5}$ concentrations averaged over 3 years. Therefore, the second high gives more than an appropriate cushion for compliance.)

Emissions associated with temporary construction activities do not consume PSD Increment; therefore, temporary PM_{10} emissions from well pad and road construction are excluded from increment consumption analyses.

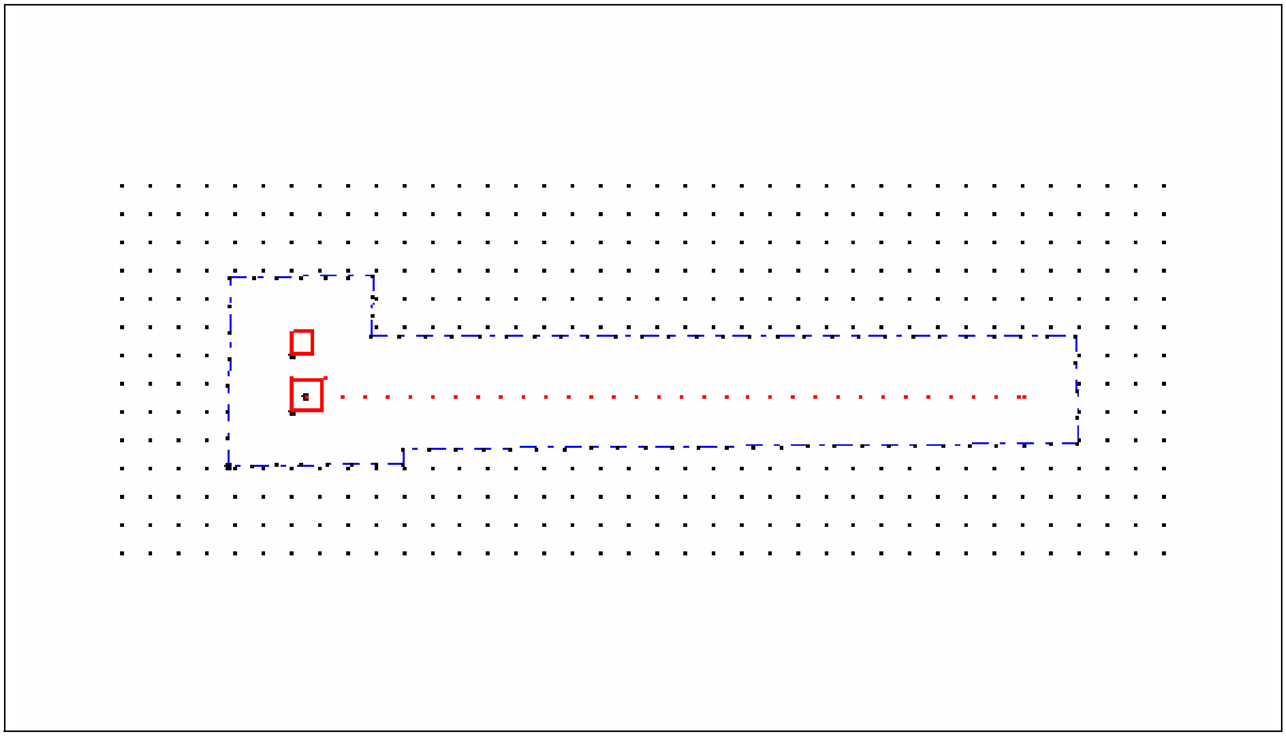


Figure 3-2. Representative Receptor Grid for Construction Emissions (fence line in blue, red boxes and dots are locations of area/volume and point source emissions).

Table 3-3. Maximum Modeled Construction Concentrations, MAA Infill Drilling Project.

Pollutant	Averaging Time	Modeled Value ug/m3	Background Value ug/m3	Total Value ug/m3	WAAQS NAAQS ug/m3	Compliance
$PM_{2.5}$[1]	24 hr	16.7	15	32	35	Y
$PM_{2.5}$	annual	0.86	7.8	9	15	Y
PM_{10}[2]	24 hr	54.4	48	102	150	Y
PM_{10}	annual	2.77	25	28	50	Y
NO_x	annual	1.66	3.4	5	100	Y
CO[2]	1 hr	4,304	2,229	6,533	40,000	Y
CO[2]	8 hr	599	1,148	1,747	10,000	Y
SO_2[2]	3 hr	522	29	551	1300	Y
SO_2[2]	24 hr	81.9	18	100	260	Y
SO_2	annual	0.1	5	5	80	Y

[1] New $PM_{2.5}$ standard used. Because the standard applies to the 98% of 24 hour concentrations measured over a three year average, the second modeled maximum was used

[2] Second highest value was used because the value is not to be exceeded more than once per year

3.4.2 Production Emissions

Emissions from production activities (well site and compression) would result in the maximum near-field PM_{10}/ $PM_{2.5}$, SO_2, NO_2, and CO concentrations. Analyses were performed to quantify the maximum NO_2 impacts that could occur within and near the MAA using the emissions from the existing in-field compressor station and well emissions, anticipated future compression expansions, and proposed Project alternatives. Proposed well emissions include those from well site heaters, truck traffic, and from a water disposal well engine. Although no increases to compression are proposed as part of the Project, a central compressor station was placed in the modeling area as a conservative assumptions.

The AERMOD model is considered appropriate only out to 50 kilometers (km). The MAA, however, exceeds that distance and, as such, a unique modeling approach had to be developed. Modeling analyses were performed to estimate near-field criteria pollutant concentrations for the Proposed Action, Alternative A, and Alternative C. Alternative B was not specifically modeled but results would be expected to be the same or less as for Alternative C. Figures 3-4 through 3-6 illustrate all components of modeled alternatives. For the Proposed Action, the well spacing was 12 wells per square mile (Figure 3-4). The well spacing was 8 wells per square mile for the No Action alternative (Figure 3-5). The well spacing was 16 wells per square mile for Alternative C (Figure 3-6). These spacing requirements represent the maximum number of wells expected for each scenario.

A representative modeling area of one square mile was selected to locate the sources for each alternative. Drill rigs and compressors were identified as point sources (red dots in Figures 3-4 through 3-6) and other well production activities (heaters, flares, fugitive dust) were identified as area sources (red squares in Figures 3-4 through 3-6). Emissions provided in Section 2.1.2 for well site heaters and truck tail pipe emissions were modeled using 105-m-spaced area sources placed in a representative square mile section in the MAA. Point sources were used for modeling all compressor station emissions. To be conservative, the representative square mile was designed to be adjacent to the town of Granger.

The receptor grid points were selected every 25 m along the fence line of the compressors and every 100 m from a distance of 200 m around the area sources. The modeling domain was extended out to 50 km (the expected range of AERMOD). AERMAP was used to determine receptor height parameters from digitized elevation map (DEM) data. To define the terrain in the area surrounding Granger, 88 DEM files were used. Aerodynamic building downwash parameters were considered for each compressor station and drill rig.

The AERMOD model was used to predict maximum NO_x impacts for modeled. Maximum modeled NO_2 concentrations were determined by multiplying maximum predicted NO_x concentrations by 0.75, in accordance with EPA's Tier 2 NO_x to NO_2 conversion method (EPA 2003a).

Maximum predicted pollutant concentrations are given in Table 3-4. As shown in Table 3-4, direct modeled pollutant concentrations from project sources are below the PSD Class II Increment for all pollutants. In addition, when these impacts are combined with representative background concentrations, they are below the applicable WAAQS and NAAQS.

Table 3-4. Maximum Modeled Production Concentrations by Alternative.

Scenario Modeled	Pollutant	Averaging Time	Modeled Value ug/m^3	Back-ground Value ug/m3	Total Value ug/m3	WAAQS NAAQS ug/m^3	Com-pliance
Alternatives B and C	$PM_{2.5}$	24 hr	18.9	15	34	35	Y
	$PM_{2.5}$	annual	1.39	7.8	9	15	Y
	PM_{10}	24 hr	100.8	48	149	150	Y
	PM_{10}	annual	3.6	25	29	50	Y
	NO_x	annual	42	3.4	60	100	Y
	CO	1 hr	2,683	2,229	4,912	40,000	Y
	CO	8 hr	1,446	1,148	2,594	10,000	Y
	SO_2	3 hr	79.3	29	108	1300	Y
	SO_2	24 hr	21.1	18	39	260	Y
	SO_2	annual	5.1	5	18	80	Y
Proposed Action	$PM_{2.5}$	24 hr	18.9	15	34	35	Y
	$PM_{2.5}$	annual	1.39	7.8	9	15	Y
	PM_{10}	24 hr	100.8	48	149	150	Y
	PM_{10}	annual	3.6	25	29	50	Y
	NO_x	annual	22.8	3.4	34	100	Y
	CO	1 hr	1,861	2,229	4,090	40,000	Y
	CO	8 hr	944	1,148	2,092	10,000	Y
	SO_2	3 hr	78.5	29	108	1300	Y
	SO_2	24 hr	17.2	18	35	260	Y
	SO_2	annual	4.2	5	9	80	Y
Alternative A – No Action	$PM_{2.5}$	24 hr	18.9	15	34	35	Y
	$PM_{2.5}$	annual	1.39	7.8	9	15	Y
	PM_{10}	24 hr	100.8	48	149	150	Y
	PM_{10}	annual	3.6	25	29	50	Y
	NO_x	annual	7	3.4	13	100	Y
	CO	1 hr	1,232	2,229	3,461	40,000	Y
	CO	8 hr	240	1,148	1,388	10,000	Y
	SO_2	3 hr	70.8	29	100	1300	Y
	SO_2	24 hr	17.5	18	36	260	Y
	SO_2	annual	3.6	5	9	80	Y

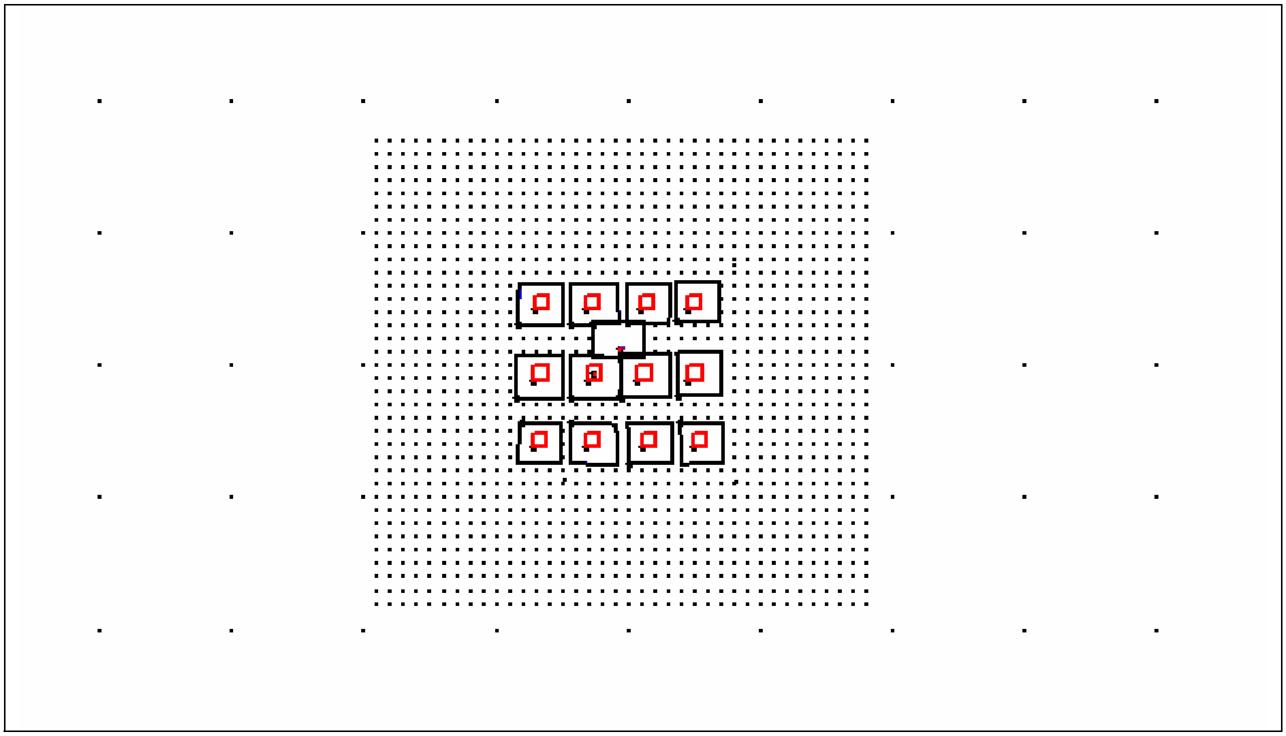


Figure 3-4. Representative receptor grid for the Proposed Action.

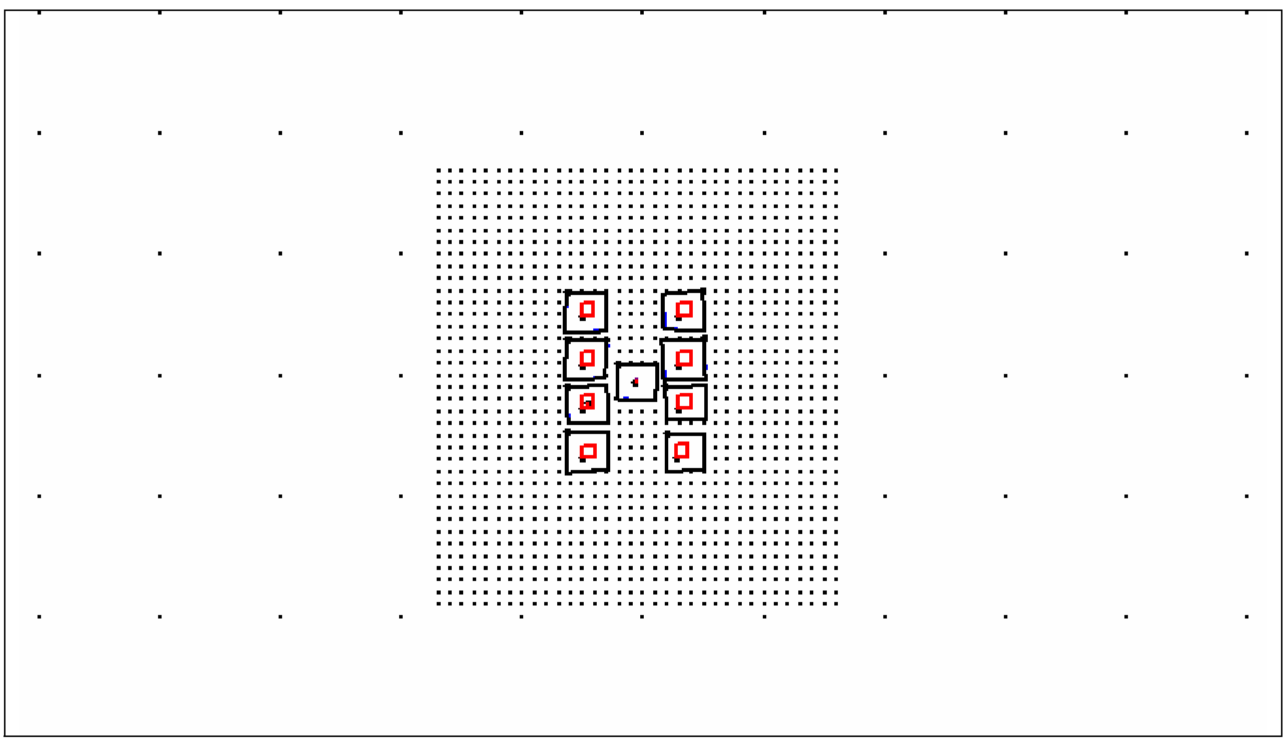


Figure 3-5. Representative receptor grid for Alternative A – No Action.

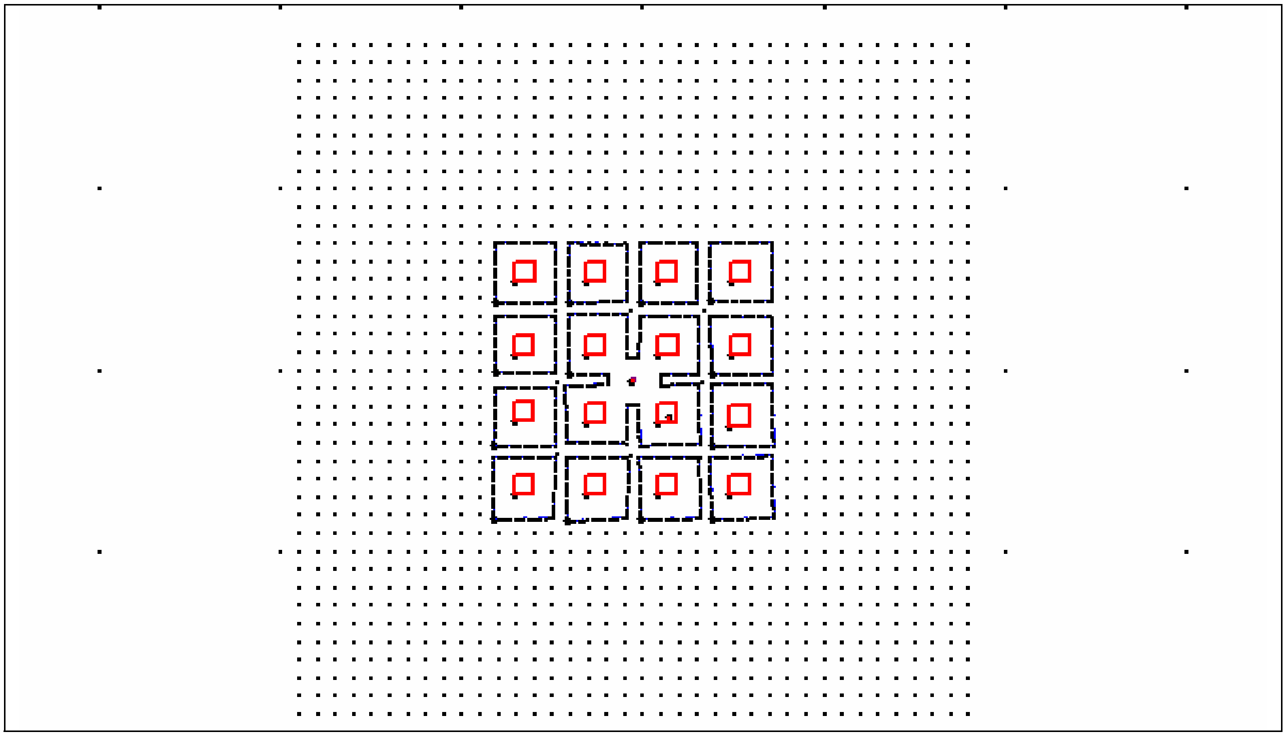


Figure 3-6. Representative receptor grid for Alternatives B and C.

3.5 HAP IMPACT ASSESSMENT

Using the same representative areas, AERMOD was used to determine HAP impacts in the immediate vicinity of the MAA emission sources for short-term (acute) exposure assessment and at the nearest residences at Granger, Wyoming to the MAA for calculation of long-term risk. Sources of HAPs include well-site fugitive emissions (BTEX and n-hexane), completion flaring and venting (BTEX and n-hexane), and compressor station combustion emissions (formaldehyde). Because maximum field-wide annual emissions of HAPs occur during the production phase, only HAP emissions from production were analyzed for long-term risk assessment. Short-term exposure assessments were performed for production HAP emissions using various well densities, and for an individual well construction completion (venting and flaring) event.

Four modeling scenarios were developed for modeling short-term (1-hour) and long term (1-year) HAPs (BTEX, and n-hexane) from well-site emissions. These scenarios were developed to represent the complete range of well densities proposed for the Proposed Action and alternatives. The purpose of modeling this range of well density was to determine the maximum HAP short-term (1-hour) impacts that could occur within and near the MAA. Area sources were used for modeling the well-site fugitive HAP emissions. The HAP emissions for wells with uncontrolled VOC emissions were used. Terrain receptors were spaced evenly at 100 m and at a maximum distance of 200 m from a well, throughout the representative section. The source and receptor layouts used for the short-term HAP modeling are presented in Figures 3-4 through 3-6.

Receptor grids using 100-m spacing were placed at the nearest residential locations along the town of Granger of the MAA. Receptor elevations were determined from U.S. Geological Survey (USGS) DEM data using AERMAP.

Reference Exposure Levels (RELs) are defined as concentrations at or below which no adverse health effects are expected. Because no RELs are available for ethylbenzene and n-hexane, the available

Immediately Dangerous to Life or Health (IDLH) values were used. These REL and IDLH values are determined by the National Institute for Occupational Safety and Health (NIOSH) and were obtained from EPA's Air Toxics Database (EPA 2002). Modeled short-term HAP concentrations are compared to REL and IDLH values in Table 3-5. As shown in Table 3-5 the maximum predicted short-term and long term HAP impacts within and near the MAA would be below the REL or IDLH values under all Project alternatives.

Table 3-5. Maximum Modeled 1-Hour HAP Concentrations, Moxa Arch Infill Drilling Project.

Scenario Modeled	Pollutant	Averaging Time	Max Modeled Value ug/m^3	Granger Modeled Value ug/m^3	RfC Value ug/m3	REL/IDLH Value ug/m3	Com-plianc e
Alts B and C	Benzene	1 hr	16.5	7.71		1,300	Y
	Benzene	Annual	0.35	0.07	30		Y
	Ethylbenzene	1 hr	4.5	2.08		35,000	Y
	Ethylbenzene	Annual	0.1	0.02	1,000		Y
	Formaldehyde	1 hr	91.5	10.5		94	Y
	Formaldehyde	Annual	3.2	0.28	9.8		Y
	N-Hexane	1 hr	7.6	3.55		39,000	Y
	N-Hexane	Annual	0.16	0.032	200		Y
	Toluene	1 hr	55.4	25.87		37,000	Y
	Toluene	Annual	1.19	0.24	400		Y
	Xylene	1 hr	55.5	25.9		22,000	Y
	Xylene	Annual	1.15	0.23	430		Y
Proposed Action	Benzene	1 hr	14.4	10.26		1,300	Y
	Benzene	Annual	0.28	0.053	30		Y
	Ethylbenzene	1 hr	3.89	2.08		35,000	Y
	Ethylbenzene	Annual	0.08	0.015	1,000		Y
	Formaldehyde	1 hr	91.5	10.5		94	Y
	Formaldehyde	Annual	3.2	0.28	9.8		Y
	N-Hexane	1 hr	6.6	4.72		39,000	Y
	N-Hexane	Annual	0.13	0.024	200		Y
	Toluene	1 hr	48.1	34.39		37,000	Y
	Toluene	Annual	0.96	0.18	400		Y
	Xylene	1 hr	46.59	33.29		22,000	Y
	Xylene	Annual	0.93	0.175	430		Y
Alt A - No Action	Benzene	1 hr	15.2	4.1		1,300	Y
	Benzene	Annual	0.246	0.03	30		Y
	Ethylbenzene	1 hr	4.1	1.1		35,000	Y
	Ethylbenzene	Annual	0.069	0.009	1,000		Y
	Formaldehyde	1 hr	91.5	10.5		94	Y
	Formaldehyde	Annual	3.2	0.28	9.8		Y
	N-Hexane	1 hr	7	1.88		39,000	Y
	N-Hexane	Annual	0.112	0.015	200		Y
	Toluene	1 hr	51.1	13.73		37,000	Y
	Toluene	Annual	0.836	0.11	400		Y
	Xylene	1 hr	49.4	13.29		22,000	Y
	Xylene	Annual	0.809	0.109	430		Y

Additional modeling analyses with AERMOD were performed to quantify the maximum short term HAP (BTEX and n-hexane) concentrations that could potential occur from well site completion venting and flaring and compression. For wells that require these activities, it is estimated that venting operations could last up to 4 hours and flaring could last up to 80 hours. A single area source was used for modeling completion venting and flaring and a single point source was used for modeling compression. Beginning at a distance of 200 m from each source, 100-m spaced receptors were used. The results of these modeling analyses indicated that from all operations short-term HAP concentration would be below the REL or IDLH values.

Long-term (annual) modeled HAP concentrations at the nearest residence are compared to Reference Concentrations for Chronic Inhalation (RfCs). A RfC is defined by EPA as the daily inhalation concentration at which no long-term adverse health effects are expected. RfCs exist for both non-carcinogenic and carcinogenic effects on human health (EPA 2002). The maximum predicted annual HAP concentrations at the nearest residential area (Granger) are compared to the corresponding non-carcinogenic RfC in Table 3-5. As shown in Table 3-5 the maximum predicted long-term (annual) HAP impacts at the nearest residence locations at Granger would be below the RfCs for all analyzed alternatives. In addition, formaldehyde impacts at Granger are shown to be below the RfC thresholds when Project source impacts are combined with regional source impacts.

Long-term exposures to emissions of suspected carcinogens (benzene and formaldehyde) were evaluated based on estimates of the increased latent cancer risk over a 70-year lifetime. This analysis presents the potential incremental risk from these pollutants, and does not represent a total risk analysis. The cancer risks were calculated using the maximum predicted annual concentrations and EPA's chronic inhalation unit risk factors (URF) for carcinogenic constituents

Estimated cancer risks were evaluated based on the Superfund National Oil and Hazardous Substances Pollution Contingency Plan (EPA 1993), where a cancer risk range of 1 x 10-6 to 1 x 10-4 is generally acceptable. Two estimates of cancer risk are presented: 1) a most likely exposure (MLE) scenario; and 2) a maximum exposed individual (MEI) scenario. The estimated cancer risks are adjusted to account for duration of exposure and time spent at home.

The adjustment for the MLE scenario is assumed to be 9 years, which corresponds to the mean duration that a family remains at a residence (EPA 1993). This duration corresponds to an adjustment factor of 9/70 = 0.13. The duration of exposure for the MEI scenario is assumed to be 60 years (i.e., the life of project [LOP]), corresponding to an adjustment factor of 60/70 = 0.86. A second adjustment is made for time spent at home versus time spent elsewhere. For the MLE scenario, the at-home time fraction is 0.64 (EPA 1993), and it is assumed that during the rest of the day the individual would remain in an area where annual HAP concentrations would be one-quarter as large as the maximum annual average concentration. Therefore, the final MLE adjustment factor is (0.13) x [(0.64 x 1.0) + (0.36 x 0.25)] = 0.0949. The MEI scenario assumes that the individual is at home 100% of the time, for a final MEI adjustment factor of (0.86 x 1.0) = 0.86.

For each constituent, the cancer risk is computed by multiplying the maximum predicted annual concentration by the URF and by the overall exposure adjustment factor. The cancer risks for both constituents are then summed to provide an estimate of the total inhalation cancer risk.

The modeled long-term risk from benzene and formaldehyde are shown in Table 3-6 for all scenarios. For each scenario, the maximum predicted formaldehyde concentration representative of cumulative impacts was used. Under the MLE scenario, the estimated cancer risk associated with long-term exposure to benzene and formaldehyde is below 1 x 10-6 for all cases. Under the MEI analyses, for each modeling scenario, the incremental risk for formaldehyde is less than 1 x 10-6, and both the incremental risk for benzene and the combined incremental risk fall on the lower end of the cancer risk range of 1 x 10-6 to 1 x 10-4.

Table 3-6. Long-term Modeled MLE and MEI Cancer Risk Analyses, MAA Infill Drilling Project. Total risk is calculated here; however, the additive effects of multiple chemicals are not fully understood and this should be taken into account when viewing these results.

Scenario Modeled	Pollutant	Averaging Time	Modeled Value ug/m^3	Unit Risk Value ug/m3	Exposure Adjust-ment MLE ug/m^3	Exposure Adjust-ment MEI ug/m^3	Cancer Risk MLE	Cancer Risk MEI
Alternatives B and C	Benzene	Annual	0.07	7.8E-06	0.0949	0.86	5.2E-08	4.7E-07
	Formalde-hyde	Annual	0.28	1.3E-05	0.0949	0.86	3.5E-07	3.1E-06
Proposed Action	Benzene	Annual	0.05	7.8E-06	0.0949	0.86	3.7E-08	3.4E-07
	Formalde-hyde	Annual	0.28	1.3E-05	0.0949	0.86	3.5E-07	3.1E-06
Alternative A-No Action	Benzene	Annual	0.03	7.8E-06	0.0949	0.86	2.2E-08	2.0E-07
	Formalde-hyde	Annual	0.28	1.3E-05	0.0949	0.86	3.5E-07	3.1E-06

SECTION 4 FAR-FIELD ANALYSIS

The far-field analysis quantifies potential air quality and AQRV impacts at Class I and Class II areas away from the Project due to air pollutant emissions of NOx, SO2, PM10, and PM2.5 from the development of the Project. The analyses were performed using the CALMET/CALPUFF modeling system to predict air quality impacts from the Project and cumulative sources at far-field PSD Class I and sensitive Class II areas. A separate analysis was performed to assess the effects of the Project's and cumulative sources' NO_X, VOC and CO emissions on ozone concentrations that is discussed in Section 5. The following are the Class I and sensitive Class II receptor areas analyzed in the far-field modeling:

- Bridger Wilderness Area (Class I);
- Fitzpatrick Wilderness Area (Class I);
- Grand Teton National Park (Class I);
- Mount Zirkel Wilderness Area (Class I);
- Teton Wilderness Area (Class I);
- Washakie Wilderness Area (Class I);
- Bridger Butte (Class II);
- Dinosaur National Monument (Federal Class II, Colorado Class I).
- Gros Ventre Wilderness (Class II);
- Wind River Roadless Area (Class II);

Predicted pollutant concentrations at these areas were compared to applicable national and state ambient air quality standards and PSD Class I and Class II increments and were used to assess potential impacts to AQRVs, which include visibility (regional haze) and acid (Sulfur and Nitrogen) deposition. In addition, analyses were performed for the following seven lakes designated as acid sensitive located within Class I and Class II areas to assess potential lake acidification from acid deposition impacts:

- Deep Lake in the Bridger Wilderness Area;
- Black Joe Lake in the Bridger Wilderness Area;
- Hobbs Lake in the Bridger Wilderness Area;
- Upper Frozen Lake in the Bridger Wilderness Area;
- Lazy Boy Lake in the Bridger Wilderness Area;
- Ross Lake in the Fitzpatrick Wilderness Area;
- Lower Saddlebag Lake in the Popo Agie Wilderness Area;

4.1 MODELING METHODOLOGY

The far-field ambient air quality and AQRV impact assessment quantifies the potential maximum pollutant impacts at Class I areas and sensitive Class II areas in the vicinity of the Project resulting from construction, drilling and production emissions for the proposed Project and alternatives. The study was performed in accordance with the following recent guidance sources:

- Direct guidance provided by representatives of the BLM, WDEQ-AQD, U.S. Fish and Wildlife Service (FWS), the National Park Service (NPS), and the Forest Service.
- Guideline on Air Quality Models, 40 Code of Federal Regulations (C.F.R.), Part 51, Appendix W.
- IWAQM Phase 2 Summary Report and Recommendations for Modeling Long Range Transport Impacts, EPA-454/R-98-019, Office of Air Quality Planning and Standards, December 1998 (IWAQM 1998).
- FLM - FLAG, Phase I Report, December 2000 (FLAG 2000).
- Memorandum from EPA on the regulatory default settings for CALPUFF modeling (Atkinson and Fox 2006).

A Modeling Protocol was prepared prior to conducting the analyses (NRG 2006) and distributed for review. The procedures in the Modeling Protocol were followed in the far-field modeling analyses, with one major exception. During the course of the study, the CALMET/CALPUFF far-field modeling assignment was transferred from NRG to ENVIRON. As ENVIRON had already developed CALMET modeling inputs for the WDEQ PSD NO_2 Increment Consumption Study (ENVIRON 2007). Therefore, rather than following the NRG Modeling Protocol to develop new CALMET modeling inputs, ENVIRON adapted the WDEQ PSD NO_2 Increment Consumption Study CALMET modeling inputs for use in the Project's far-field modeling.

As stated in the Modeling Protocol (NRG, 2006), the recently released latest version of the CALMET/CALPUFF modeling system (CALPUFF Version 6.0 dated April 14, 2006) was used to generate meteorological fields and calculate ambient concentrations and AQRV impacts for three years: 2001, 2002 and 2003.

The CALMET/CALPUFF modeling domain used in the far-field modeling is shown in Figure 4-1, along with the locations of the surface and upper-air meteorological and surface precipitation sites within and near the modeling domain. The CALMET meteorological model was run using meteorological data generated by the mesoscale meteorological (MM5) meteorological model.

Air emissions of NO_x, SO_2, PM_{10}, and $PM_{2.5}$ from production wells, construction, drilling and compressors for the various project alternatives and cumulative emissions from other sources, including all currently operating, proposed, and Reasonable Future Development (RFD) emissions sources within the modeling domain, were modeled. A description of the emissions inventory procedures is described in Section 2 of this AQTSD with the detailed inventory provided in appendices. The processing of these emissions sources for input to the CALPUFF model is described in Section 4.4.4.

CALPUFF output was post-processed with POSTUTIL and CALPOST to estimate: (1) concentrations for comparison to ambient standards and Class I and II PSD Increments; (2) wet and dry deposition amounts for comparison to sulfur (S) and nitrogen (N) deposition thresholds and to calculate acid neutralizing capacity (ANC) for sensitive water bodies; and (3) light extinction for comparison to visibility impact thresholds in Class I and sensitive Class II areas. A discussion of the post-processing methodology to be used is provided in Section 4.5.

4.2 PROJECT MODELING SCENARIOS

The Proposed Action includes a proposal for 1,861 new wells in the MAA. Maximum field-wide emissions for operation and construction were determined and reflect the last year of field development. This year is year 10 for the Proposed Action, year 25 for Alternatives B and C, and year 7 for the No Action alternative. This maximum emissions scenario conservatively assumes that both production emissions (producing well sites and operational ancillary equipment including compressor stations) and construction emissions (drill rigs and associated traffic) occur simultaneously throughout the year.

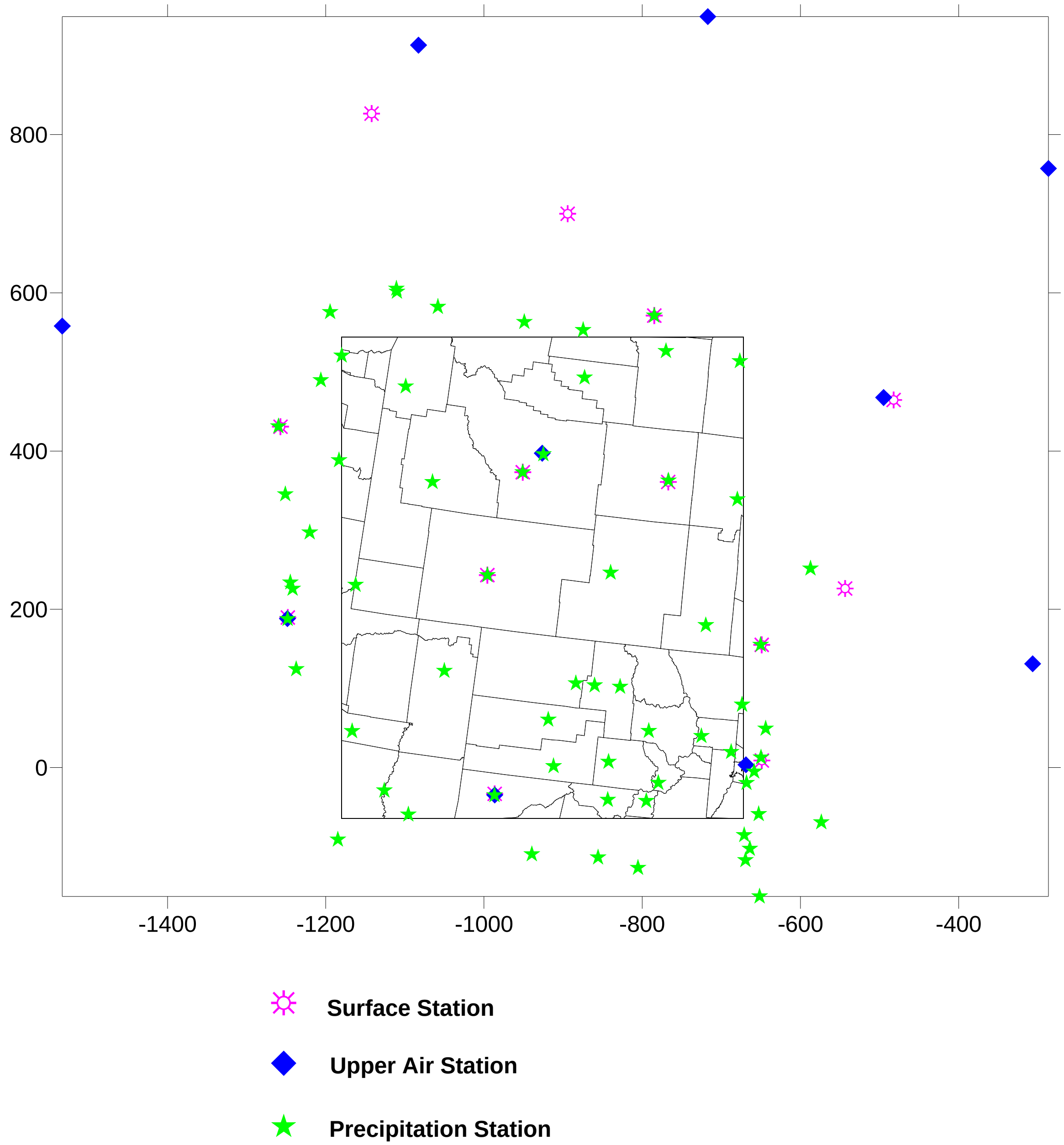


Figure 4-1. CALMET/CALPUFF domain for the Moxa Arch Infill Project showing locations of surface and upper-air meteorological and surface precipitation monitoring sites used in the modeling.

Compression was assumed to operate at 100% of fully permitted capacity. The maximum field-wide emissions scenarios for the three scenarios are summarized in Tables 2-1 through 2-4. The emissions used to develop these field-wide scenarios are described in Section 2.

4.3 METEOROLOGICAL MODEL INPUT AND OPTIONS

CALMET was used to develop wind fields and other meteorological data for the study area within the modeling domain given in Figures 4-1 and 4-2.

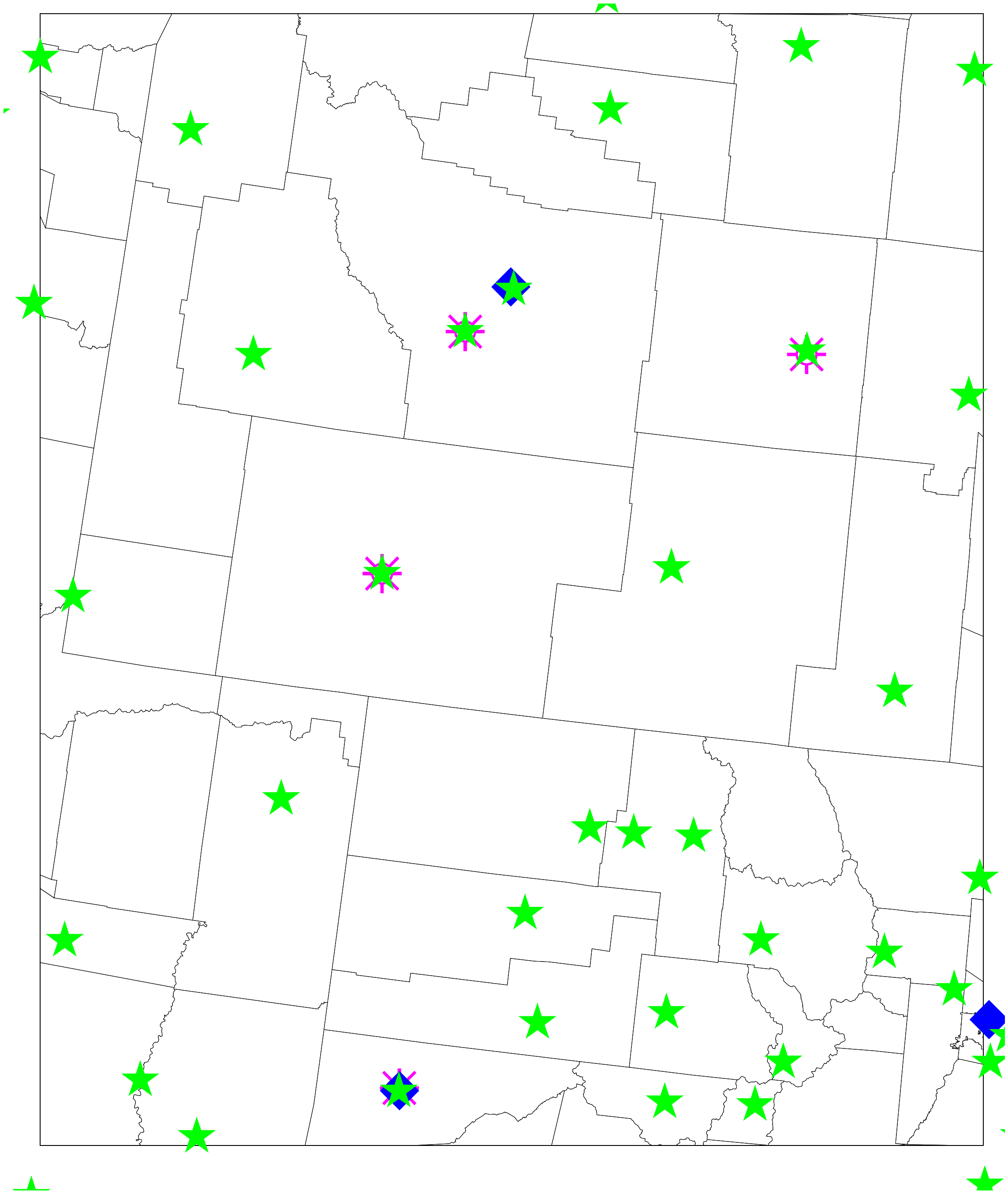


Figure 4-2. Close up of CALMET/CALPUFF domain for the Moxa Arch Infill Project showing locations of surface and upper-air meteorological data and surface precipitation data within the modeling domain. Symbols used for this figure are identical to those for Figure 4-1.

4.3.1 CALMET Geophysical and Meteorological Input Data

The CALMET modeling incorporated regional MM5 model output fields at 12 km and data from 13 surface meteorological stations, 64 precipitation stations, and 10 upper-air meteorological stations.

The uniform horizontal grid was processed to 4 km resolution using a Lambert Conformal Conical (LCC) projection defined with a central longitude/latitude at (-97°, 40°) and first and second latitude parallels at 33° and 45°. The modeling domain consists of 127 by 152 4 km grid cells, and covers the project area and Class I areas and other sensitive Class II areas with at least a 50 km buffer zone beyond the closest receptors in each receptor region. The total area of the modeling domain is 508 km by 608 km. Eleven vertical layers were specified with layer interfaces at 20 m, 100 m, 200 m, 350 m, 500 m, 750 m, 1,000 m, 2,000 m, 3,000 m, 4,000 m, 4,500 m above ground level (AGL).

The 12 km MM5 data used as input to CALMET were specified to be used as the initial guess field (IPROG=14). CALMET then performs a Step 1 procedure that includes accounting for diagnostic wind model effects using the 4 km terrain and land use data to simulate blocking and deflection, channeling, slope flows, etc. For 2001 and 2003, ENVIRON performed 12 km MM5 modeling over a domain centered on Wyoming for the WDEQ PSD NO_2 Increment Consumption Study (ENVIRON, 2007). For 2001, the 12 km MM5 simulation was run using a one-way nesting inside of a 36 km MM5 simulation of the continental U.S. domain that was performed for EPA and used in the Clean Air Interstate Rule (CAIR) development (McNally 2003). For 2003, the 12 km MM5 simulation was nested in a 2003 continental United States 36 km MM5 simulation performed by the Midwest Regional Planning Organization (Baker, 2004a,b). The 2002 12 km MM5 simulation was performed by the Western Regional Air Partnership (WRAP) to support regional haze modeling in the western United States (Kemball-Cook, et al. 2004).

In Step 2 of the CALMET modeling, CALMET incorporates the surface and upper-air meteorological observations in the Step 1 wind fields. Locations of the surface and upper-air meteorological stations and surface precipitation stations used in the analysis are shown in Figures 4-1 and 4-2.

USGS 1:250,000-Scale Land Use and Land Cover (LULC) data, and USGS 1-degree DEM data were used for land use and terrain data in the development of the CALMET wind fields.

4.3.2 CALMET Modeling Options

The CALMET modeling system has numerous options that need to be specified. These options were defined following EPA-recommended regulatory default options as given by Atkinson and Fox (2006), with some exceptions explained below. Table 4-1 lists the EPA-recommended regulatory default options and the option definitions used in this study. Deviations from EPA-recommended defaults are indicated by bold in Table 4-1 and are as follows:

- The EPA-recommended default is to not use any MM5 data (IPROG=0); whereas, for the Project's CALMET modeling, 12 km MM5 data was specified as input for all three years of modeling (IPROG=14). Use of MM5 data is believed to produce more representative CALMET meteorological fields and is encouraged by FLMS and EPA.
- The maximum mixing height for the Project's MM5 modeling is higher (4,500 m AGL) than the EPA-recommended regulatory default value (3,000 m AGL). Although a 3,000 m AGL maximum mixing height may be appropriate for the eastern U.S., mixing heights are higher in the western U.S. In their CALPUFF BART Modeling Protocol the Colorado Department of Health and Environment (2005) present evidence that higher mixing heights are needed in the West so a maximum mixing height for this study was adopted consistent with their findings.

Table 4-1. CALMET options used in the Project's far-field modeling and comparison with EPA regulatory default settings as given by Atkinson and Fox (2006) (deviations from EPA recommended defaults are indicated by bold text).

Variable	Description	EPA Default	Project Values
GEO.DAT	Name of Geophysical data file	GEO.DAT	GEO.DAT
SURF.DAT	Name of Surface data file	SURF.DAT	SURF.DAT
PRECIP.DAT	Name of Precipitation data file	PRECIP.DAT	PRECIP.DAT
NUSTA	Number of upper air data sites	User Defined	10
UPN.DAT	Names of NUSTA upper air data files	UPN.DAT	UPN.DAT
IBYR	Beginning year	User Defines	User Defines
IBMO	Beginning month	User Defines	User Defines
IBDY	Beginning day	User Defines	User Defines
IBHR	Beginning hour	User Defines	User Defines
IBTZ	Base time zone	User Defines	User Defines
IRLG	Number of hours to simulate	User Defines	User Defines
IRTYPE	Output file type to create (must be 1 for CALPUFF)	1	1
LCALGRD	Are w-components and temperature needed?	T	T
NX	Number of east-west grid cells	*ES*	127
NY	Number of north-south grid cells	User Defines	152
DGRIDKM	Grid spacing	User Defines	4 km
XORIGKM	Southwest grid cell X coordinate	User Defines	-1,180.0.
YORIGKM	Southwest grid cell Y coordinate	User Defines	-64.
IUTMZN	UTM Zone	User Defines	NA
LLCONF	When using Lambert Conformal map coordinates, rotate winds from true north to map north?	F	F
XLAT1	Latitude of 1st standard parallel	**30**	**33.**
XLAT2	Latitude of 2nd standard parallel	**60**	**45.**
RLON0	Longitude used if LLCONF = T	**90**	**-97.**
RLAT0	Latitude used if LLCONF = T	**40**	**40.**
NZ	Number of vertical Layers	User Defines	11
ZFACE	Vertical cell face heights (NZ+1 values)	User Defines	0., 20, 100, 200, 350, 500, 750, 1000, 2000, 3000, 4000, 4500
LSAVE	Save met. Data fields in an unformatted file?	T	T
IFORMO	Format of unformatted file (1 for CALPUFF)	1	1
NSSTA	Number of stations in SURF.DAT file	User Defines	13
NPSTA	Number of stations in PRECIP.DAT	User Defines	64
ICLOUD	Is cloud data to be input as gridded fields? 0=No)	0	0
IFORMS	Format of surface data (2 = formatted)	2	2
IFORMP	Format of precipitation data (2= formatted)	2	2
IFORMC	Format of cloud data (2= formatted)	2	2

Variable	Description	EPA Default	Project Values
IWFCOD	Generate winds by diagnostic wind module? (1 = Yes)	1	1
IFRADJ	Adjust winds using Froude number effects? (1= Yes)	1	1
IKINE	Adjust winds using Kinematic effects? (1 = Yes)	0	0
IOBR	Use O'Brien procedure for vertical winds? (0 = No)	0	0
ISLOPE	Compute slope flows? (1 = Yes)	1	1
IEXTRP	Extrapolate surface winds to upper layers? (-4 = use similarity theory and ignore layer 1 of upper air station data)	-4	-4
ICALM	Extrapolate surface calms to upper layers? (0 = No)	0	0
BIAS	Surface/upper-air weighting factors (NZ values)	NZ*0	NZ*0
IPROG	Using prognostic or MM-FDDA data? (0 = No)	**0**	**14**
LVARY	Use varying radius to develop surface winds?	*F*	*F*
RMAX1	Max surface over-land extrapolation radius (km)	User Defines	30.
RMAX2	Max aloft over-land extrapolations radius (km)	User Defines	60.
RMAX3	Maximum over-water extrapolation radius (km)	User Defines	60.
RMIN	Minimum extrapolation radius (km)	0.1	0.1
RMIN2	Distance (km) around an upper air site where vertical extrapolation is excluded (Set to –1 if IEXTRP = ±4)	4	4
TERRAD	Radius of influence of terrain features (km)	User Defines	10.
R1	Relative weight at surface of Step 1 field and obs	User Defines	6.0
R2	Relative weight aloft of Step 1 field and obs	User Defines	12.0
DIVLIM	Maximum acceptable divergence	5.E-6	5.E-6
NITER	Max number of passes in divergence minimization	50	50
NSMTH	Number of passes in smoothing (NZ values)	2,4*(NZ-1)	2,4*(NZ-1)
NINTR2	Max number of stations for interpolations (NA values)	99	99
CRITFN	Critical Froude number	1	1
ALPHA	Empirical factor triggering kinematic effects	0.1	0.1
IDIOPT1	Compute temperatures from observations (0 = True)	0	0

Variable	Description	EPA Default	Project Values
ISURFT	Surface station to use for surface temperature (between 1 and NSSTA)	User Defines	1
IDIOPT2	Compute domain-average lapse rates? (0 = True)	0	0
IUPT	Station for lapse rates (between 1 and NUSTA)	User Defines	1
ZUPT	Depth of domain-average lapse rate (m)	200	200
IDIOPT3	Compute internally initial guess winds? (0 = True)	0	0
IUPWND	Upper air station for domain winds (-1 = 1/r**2 interpolation of all stations)	-1	-1
ZUPWND	Bottom and top of layer for 1st guess winds (m)	1,1000	1,1000
IDIOPT4	Read surface winds from SURF.DAT? (0 = True)	0	0
IDIOPT5	Read aloft winds from UPn.DAT? (0 = True)	0	0
CONSTB	Neutral mixing height B constant	1.41	1.41
CONSTE	Convective mixing height E constant	0.15	0.15
CONSTN	Stable mixing height N constant	2400	2400
CONSTW	Over-water mixing height W constant	0.16	0.16
FCORIOL	Absolute value of Carioles parameter	1.E-4	1.E-4
IAVEZI	Spatial averaging of mixing heights? (1 = True)	1	1
MNMDAV	Max averaging radius (number of grid cells)	1	1
HAFANG	Half-angle for looking upwind (degrees)	30	30
ILEVZI	Layer to use in upwind averaging (between 1 and NZ)	1	1
DPTMIN	Minimum capping potential temperature lapse rate	0.001	0.001
DZZI	Depth for computing capping lapse rate (m)	200	200
ZIMIN	Minimum over-land mixing height (m)	50	50
ZIMAX	Maximum over-land mixing height (m)	3000	4500
ZIMINW	Minimum over-water mixing height (m)	50	50
ZIMAXW	Maximum over-water mixing height (m)	3000	4500
IRAD	Form of temperature interpolation (1 = 1/r)	1	1
TRADKM	Radius of temperature interpolation (km)	500	500
NUMTS	Max number of stations in temperature interpolations	5	5
IAVET	Conduct spatial averaging of temperature? (1 = True)	**1**	**0**
TGDEFB	Default over-water mixed layer lapse rate (K/m)	-0.0098	-0.0098
TGDEFA	Default over-water capping lapse rate (K/m)	-0.0045	-0.0045

Variable	Description	EPA Default	Project Values
JWAT1	Beginning landuse type defining water	999	999
JWAT2	Ending landuse type defining water	999	999
NFLAGP	Method for precipitation interpolation (2= 1/r**2)	2	2
SIGMAP	Precip radius for interpolations (km)	100	100
CUTP	Minimum cut off precip rate (mm/hr)	0.01	0.01
SSn	NSSTA input records for surface stations	User Defines	13
Usn	NUSTA input records for upper-air stations	User Defines	10
PSn	NPSTA input records for precipitations stations	User Defines	64

4.4 DISPERSION MODEL INPUT AND OPTIONS

The CALPUFF model was used to model Project-specific and cumulative emissions of NOx, SO2, fine particulate matter (PMF) and coarse particulate matter (PMC). CALPUFF was run using the EPA-recommended default control file switch settings (Atkinson and Fox, 2006) for almost all parameters. Table 4-2 displays the CALPUFF options selected for Project modeling. Deviations from EPA-recommended defaults are indicated in bold and discussed below. Chemical transformations were modeled using the MESOPUFF II chemistry mechanism for conversion of SO2 to sulfate (SO4) and NOx to nitric acid (HNO3) and nitrate (NO3). Each of these pollutant species was included in the CALPUFF model runs. NOx, HNO3, and SO2 were modeled with gaseous deposition, and SO4, NO3, PMF ($PM_{2.5}$), and PMC (PM2.5-10) were modeled using particle deposition. Total PM10 impacts were determined in the post-processing of modeled impacts, as discussed in Section 4.5.

4.4.1 Background Chemical Species

The CALPUFF chemistry algorithms require hourly measurements of background ozone and constant estimates of background ammonia concentrations for the conversion of SO2 and NO_X to sulfates and nitrates, respectively. Background ozone data for the 2001, 2002, and 2003 meteorology modeling years were specified for seven stations within or near the modeling domain:

- Pinedale, Wyoming
- Centennial, Wyoming
- Yellowstone National Park, Wyoming
- Craters of the Moon National Park, Idaho
- Highland, Utah
- Thunder Basin, Wyoming
- Rocky Mountain National Park, Colorado

Hourly ozone data from these stations were used in the CALPUFF modeling, with a default value of 44.7 parts per billion (ppb) used for hours when the hourly ozone from these seven sites are missing, as discussed in the Modeling Protocol (NRG 2006). Additional observed ozone data are available in the urban Denver, Colorado and Salt Lake City, Utah areas; however, these data are not representative of rural conditions where the sources and receptors of interest reside. Figure 4-3 displays the locations of the ozone monitoring sites in and near the CALMET/CALPUFF modeling domain used in the CALPUFF modeling.

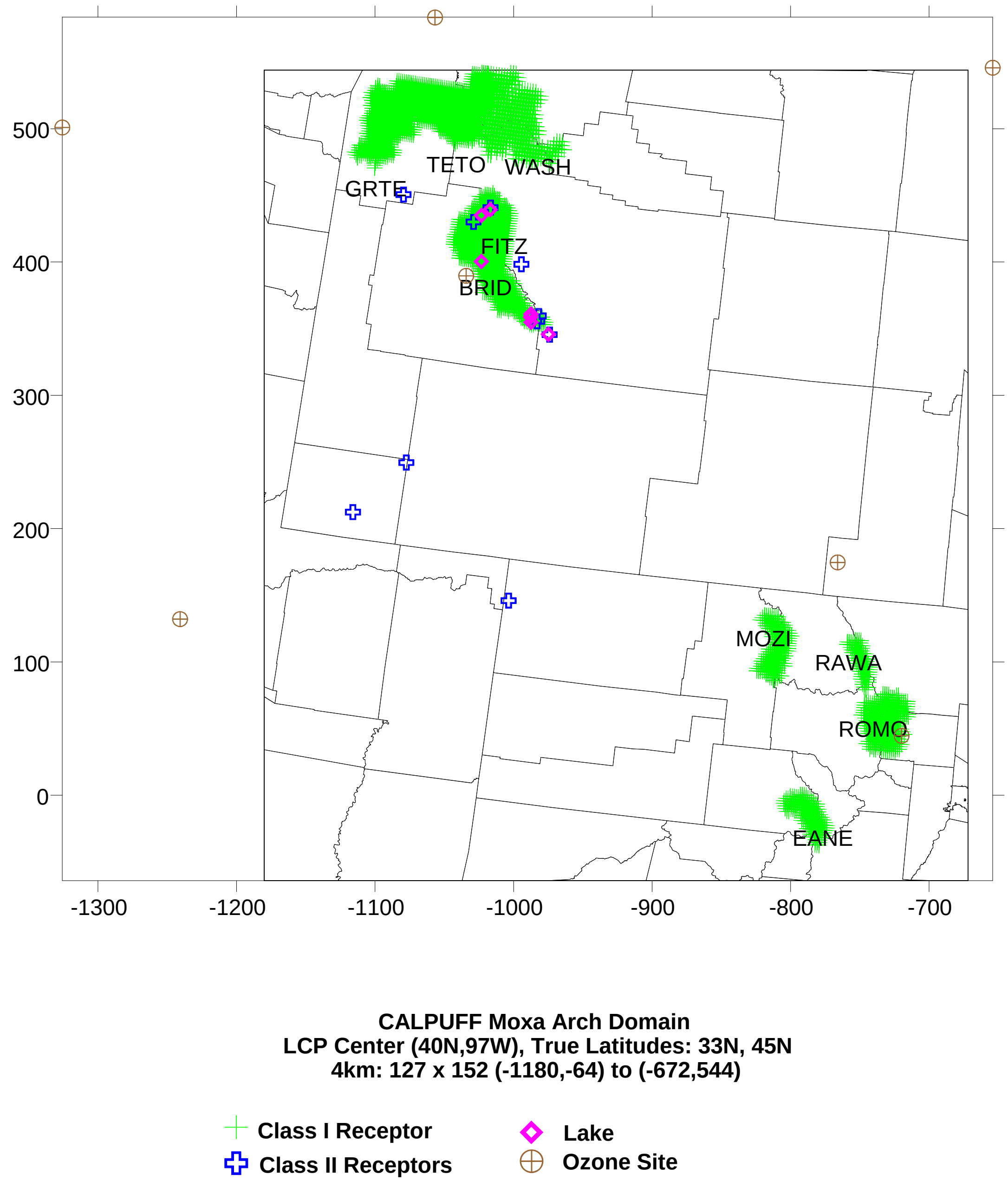


Figure 4-3. Locations of ozone monitoring sites, Class I area receptors, Class II area receptors and sensitive lake receptors within and around the Project's CALMET/CALPUFF modeling domain (ozone monitoring sites located outside the range of this map are plotted on the border).

Table 4-2. CALPUFF options used in the Project's far-field Class I and II area modeling and comparison of EPA regulatory modeling default values (Atkinson and Fox, 2006), deviations from EPA recommended defaults are indicated by bold text.

Variable	Description	EPA Default	Project Values
METDAT	CALMET input data filename	CALMET.DAT	CALMET.DAT
PUFLST	Filename for general output from CALPUFF	CALPUFF.LST	CALPUFF.LST
CONDAT	Filename for output concentration data	CONC.DAT	CONC.DAT
DFDAT	Filename for output dry deposition fluxes	DFLX.DAT	DFLX.DAT

Variable	Description	EPA Default	Project Values
WFDAT	Filename for output wet deposition fluxes	WFLX.DAT	WFLX.DAT
VISDAT	Filename for output relative humidities (for visibility)	VISB.DAT	VISB.DAT
METRUN	Do we run all periods (1) or a subset (0)?	0	0
IBYR	Beginning year	User Defined	User Defined
IBMO	Beginning month	User Defined	User Defined
IBDY	Beginning day	User Defined	User Defined
IBHR	Beginning hour	User Defined	User Defined
IRLG	Length of runs (hours)	User Defined	User Defined
NSPEC	Number of species modeled (for MESOPUFF II chemistry)	**5**	**7**
NSE	Number of species emitted	**3**	**4**
MRESTART	Restart options (0 = no restart), allows splitting runs into smaller segments	**0**	**2 or 3**
METFM	Format of input meteorology (1 = CALMET)	1	1
AVET	Averaging time lateral dispersion parameters (minutes)	60	60
MGAUSS	Near-field vertical distribution (1 = Gaussian)	1	1
MCTADJ	Terrain adjustments to plume path (3 = Plume path)	3	3
MCTSG	Do we have subgrid hills? (0 = No), allows CTDM-like treatment for subgrid scale hills	0	0
MSLUG	Near-field puff treatment (0 = No slugs)	0	0
MTRANS	Model transitional plume rise? (1 = Yes)	1	1
MTIP	Treat stack tip downwash? (1 = Yes)	1	1
MSHEAR	Treat vertical wind shear? (0 = No)	0	0
MSPLIT	Allow puffs to split? (0 = No)	0	0
MCHEM	MESOPUFF-II Chemistry? (1 = Yes)	1	1
MWET	Model wet deposition? (1 = Yes)	1	1
MDRY	Model dry deposition? (1 = Yes)	1	1
MDISP	Method for dispersion coefficients (3 = PG & MP)	3	3
MTURBVW	Turbulence characterization? (Only if MDISP = 1 or 5)	3	3
MDISP2	Backup coefficients (Only if MDISP = 1 or 5)	3	3
MROUGH	Adjust PG for surface roughness? (0 = No)	0	0
MPARTL	Model partial plume penetration? (0 = No)	1	1
MTINV	Elevated inversion strength (0 = compute from data)	0	0
MPDF	Use PDF for convective dispersion? (0 = No)	0	0
MSGTIBL	Use TIBL module? (0 = No) allows treatment of subgrid scale coastal areas	0	0
MREG	Regulatory default checks? (1 = Yes)	1	1
CSPECn	Names of species modeled (for MESOPUFF II, must be SO2, SO4, NOx, HNO3, NO3)	User Defined	SO2, SO4, NOx, HNO3, NO3, PMF, PMC
Specie	Manner species will be modeled	User Defined	SO2, SO4,

Variable	Description	EPA Default	Project Values
Names			NOX, NO3, HNO3, PMF, PMC
Specie Groups	Grouping of species, if any.	User Defined	
NX	Number of east-west grids of input meteorology	User Defined	127
NY	Number of north-south grids of input meteorology	User Defined	152
NZ	Number of vertical layers of input meteorology	User Defined	11
DGRIDKM	Meteorology grid spacing (km)	User Defined	4
ZFACE	Vertical cell face heights of input meteorology	User Defined	0., 20, 100, 200, 350, 500, 750, 1000, 2000, 3000, 4000, 4500
XORIGKM	Southwest corner (east-west) of input meteorology	User Defined	-1180.0
YORIGIM	Southwest corner (north-south) of input meteorology	User Defined	-64.
IUTMZN	UTM zone	User Defined	NA
XBTZ	Base time zone of input meteorology	User Defined	7
IBCOMP	Southwest of Xindex of computational domain	User Defined	1
JBCOMP	Southwest of Y-index of computational domain	User Defined	34
IECOMP	Northeast of Xindex of computational domain	User Defined	127
JECOMP	Northeast of Y- index of computational domain	User Defined	152
LSAMP	Use gridded receptors (T -= Yes)	F	F
IBSAMP	Southwest of Xindex of receptor grid	User Defined	NA
JBSAMP	Southwest of Y-index of receptor grid	User Defined	NA
IESAMP	Northeast of Xindex of receptor grid	User Defined	NA
JESAMP	Northeast of Y-index of receptor grid	User Defined	NA
MESHDN	Gridded receptor spacing = DGRIDKM/MESHDN	1	NA
ICON	Output concentrations? (1 = Yes)	1	1
IDRY	Output dry deposition flux? (1 = Yes)	1	1
IWET	Output wet deposition flux? (1 = Yes)	1	1
IVIS	Output RH for visibility calculations (1 = Yes)	1	1
LCOMPRS	Use compression option in output? (T = Yes)	T	T
ICPRT	Print concentrations? (0 = No)	0	0
IDPRT	Print dry deposition fluxes (0 = No)	0	0
IWPRT	Print wet deposition fluxes (0 = No)	0	0
ICFRQ	Concentration print interval (1 = hourly)	1	1
IDFRQ	Dry deposition flux print interval (1 = hourly)	1	1
IWFRQ	Wet deposition flux print interval (1 = hourly)	1	1

Variable	Description	EPA Default	Project Values
IPRTU	Print output units (1 = g/m**3; g/m**2/s)	1	1
IMESG	Status messages to screen? (1 = Yes)	1	1
Output Species	Where to output various species	User Defined	Default
LDEBUG	Turn on debug tracking? (F = No)	F	F
Dry Gas Dep	Chemical parameters of gaseous deposition species	User Defined	Default
Dry Part. Dep	Chemical parameters of particulate deposition species	User Defined	Default
RCUTR	Reference cuticle resistance (s/cm)	30.	30.
RGR	Reference ground resistance (s/cm)	10.	10.
REACTR	Reference reactivity	8	8
NINT	Number of particle-size intervals	9	9
IVEG	Vegetative state (1 = active and unstressed)	1	1
Wet Dep	Wet deposition parameters	User Defined	Default
MOZ	Ozone background? (1 = read from ozone.dat)	1	1
BCKO3	Ozone default (ppb) (Use only for missing data)	***80***	***44.7***
BCKNH3	Ammonia background (ppb)	**10**	**1.0**
RNITE1	Nighttime SO2 loss rate (%/hr)	0.2	0.2
RNITE2	Nighttime NOx loss rate (%/hr)	2	2
RNITE3	Nighttime HNO3 loss rate (%/hr)	2	2
SYTDEP	Horizontal size (m) to switch to time dependence	550.	550.
MHFTSZ	Use Heffter for vertical dispersion? (0 = No)	0	0
JSUP	PG Stability class above mixed layer	5	5
CONK1	Stable dispersion constant (Eq. 2.7-3)	0.01	0.01
CONK2	Neutral dispersion constant (Eq. 2.7-4)	0.1	0.1
TBD	Transition for downwash algorithms (0.5 = ISC)	0.5	0.5
IURB1	Beginning urban landuse type	10	10
IURB2	Ending urban landuse type	19	19

IWAQM (2000) recommends three values for background ammonia concentrations: 10.0 ppb for grasslands, 1.0 ppb for arid lands, and 0.5 ppb for forested lands. Most of the Class I and sensitive Class II receptor areas for the far-field modeling are in forested areas. However, the project itself and some areas in between the receptor areas are more arid and grassland. Consequently, the mid-level background ammonia concentration of 1.0 ppb was used.

4.4.2. Deviations from EPA-Recommended Default Options

As noted by the bold in Table 4-2, several CALPUFF options deviated from EPA-recommended default settings as reported by Atkinson and Fox (2006). First, the EPA-recommended default does not include any PM species, whereas we include both fine (PMF) and coarse (PMC) PM species. Consequently, there are 2 more emitted (5) and modeled (7) species than in the EPA recommendations (3 and 5, respectively). Second, a background ozone value of 44.7 ppb was specified, which is more representative of average conditions in southwestern Wyoming than the EPA-recommended 80 ppb default value. Finally, the EPA-recommended default value for ammonia is 10.0 ppb that, according to IWAQM (2000), is representative of grasslands. Because our receptors are primarily forested land

(0.5 ppb), and there is a lot of arid land in the region (1.0 ppb), we selected the mid-range background ammonia value (1.0 ppb).

4.4.3 Model Receptors

The NPS has posted receptors for Class I areas that should be used for CALPUFF model applications at which the concentration, deposition, and AQRV impacts are calculated. The NPS Class I area receptors were downloaded from their website and converted to the LCC coordinate system used in the Project's CALPUFF modeling. Discrete receptors were specified for the far-field Class II areas and the seven acid-sensitive lakes. Figure 4-3 displays the locations of the Class I and II area and sensitive lake receptors used in the Project's CALPUFF modeling.

4.4.4 Emissions Processing

CALPUFF source parameters were determined for all Project and regional source emissions of NOx, SO2, PMF, and PMC. Project sources were input to CALPUFF using 4 km^2 area sources at 4 km spacing placed throughout the Project Area to idealize project well operation and construction emissions. For each of the three alternatives, the required number of wells was randomly distributed throughout the Project Area. (Note that the Project area for Alternative C is slightly larger than those of the Proposed Action and No Action alternatives). Once the wells had been located in the Project Area, the wells were assigned to a particular grid cell of the CALPUFF modeling domain, and the emissions for each grid cell was taken to be the sum of the emissions from all wells within that 4 km grid cell. The exact location of the well head compressors is not yet known; therefore, well head compressors were sited within the Project Area based on the randomly chosen well locations. Because it was assumed that there are 30 well head compressors for every 1000 wells, groups of 33 wells were formed, and a well head compressor was placed in the centroid of each group of 33 wells. Once a well head compressor had been located within a 4 km^2 grid cell, the emissions from that well head compressor were added to those of the project wells within that grid cell. Figure 4-4 displays the relationship between the well locations for the Projects Proposed Action alternative and the Class I area receptors used in the CALPUFF modeling.

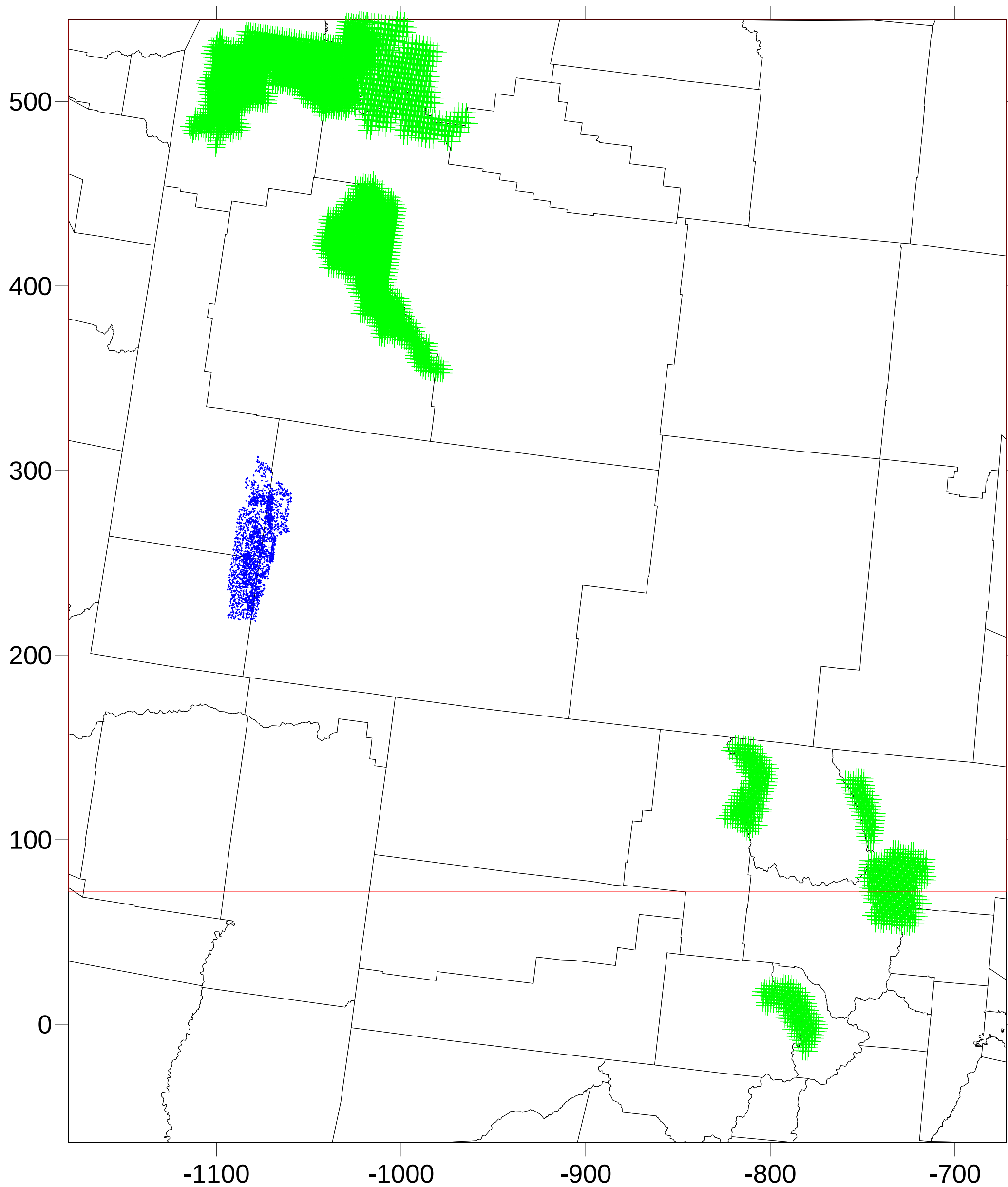
Point sources were used to represent central compressor stations. Compressor station emissions are provided in Table 2-3. Stack parameters for the central compressor stations were based on those used in the Jonah Infill Project and are shown in Table 4-3.

Table 4-3. Central Compressor Station Stack Parameters.

Stack Height	Stack Height	Temperature	Exit Velocity
0.515 m	10.97 m	730 K	40.48 m/s

Field-wide emissions scenarios for each alternative are summarized in Table 2-4. Figures 4-5 through 4-7 show the randomly chosen well sites for each scenario, their idealization as 4 km area sources, and the locations of well head compressors and central compressor stations.

Non-project regional emissions were input to CALPUFF using point sources to represent state-permitted and RFFA sources. The source parameters used in modeling included all state-permitted and RFFA sources. CALPUFF requires stack parameters (stack diameter and height, exit velocity, and exit temperature) for all point sources. Where stack parameters were not supplied in the state inventories, default stack parameters based on the Atlantic Rim Air Quality Technical Support Document, Appendix C, Table C7 were used. These parameters are shown in Table 4-4. Both state-permitted sources and RFFA emissions were supplied for Wyoming; for Utah and Colorado, only state-permitted sources were supplied.



CALPUFF Moxa Arch Domain
LCP Center (40N,97W), True Latitudes: 33N, 45N

4km: 127 x 152 (-1180,-64) to (-672,544)

Figure 4-4. CALMET (black border) and CALPUFF (red border) modeling domains. Well locations for the proposed action are shown as blue crosses and Class I area receptors are shown as green crosses.

Table 4-4. Default Stack Parameters for cumulative sources with missing stack parameter data.

Stack Height	Stack Height	Temperature	Exit Velocity
0.51 m	9.82 m	633.80 K	30.08 m/s

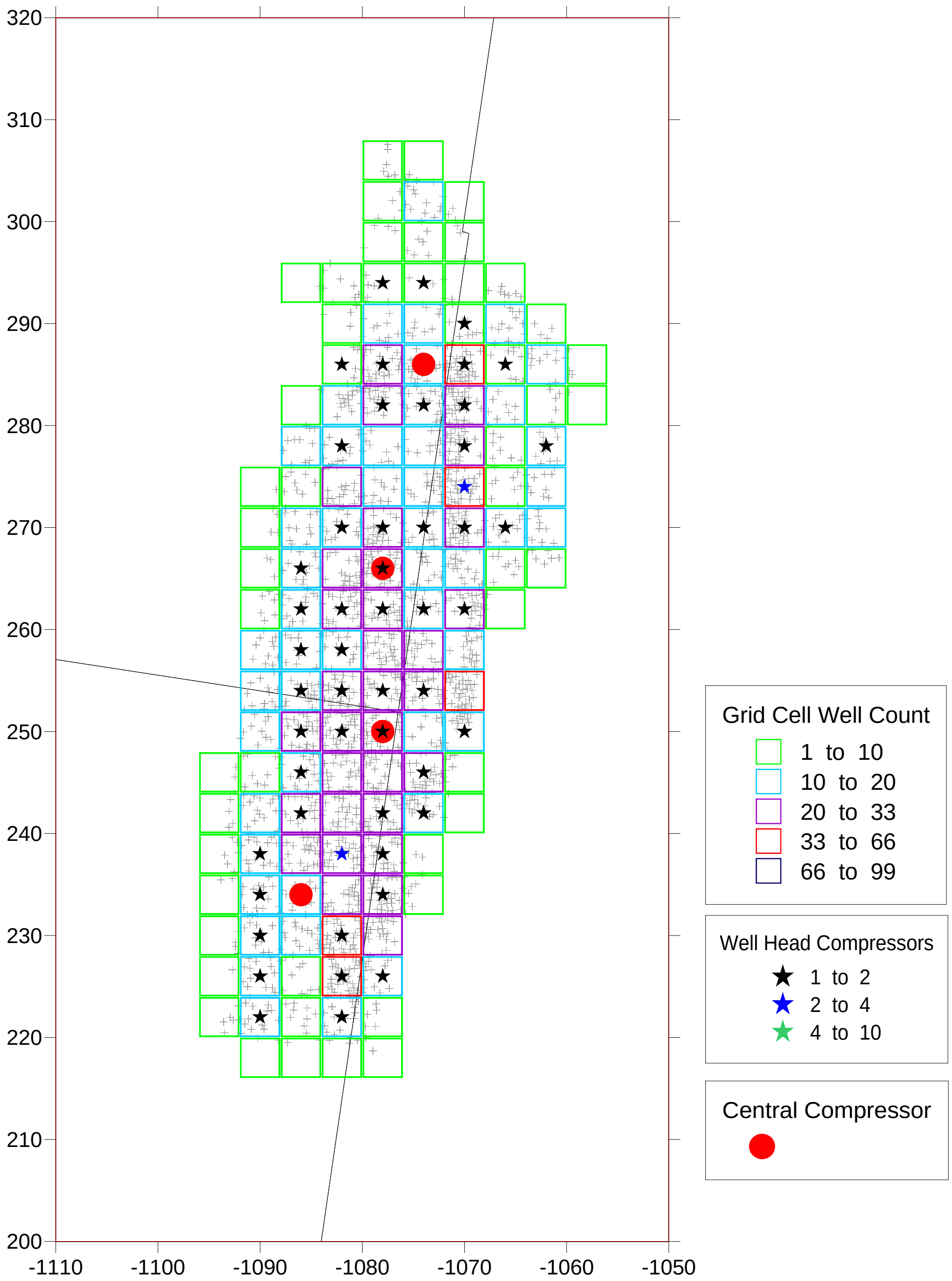


Figure 4-5. Map of Proposed Action showing location of well sites (grey crosses), well head compressors, and central compressor stations. Boxes show idealized area sources that are used to represent the emissions from the well construction and operation activities.

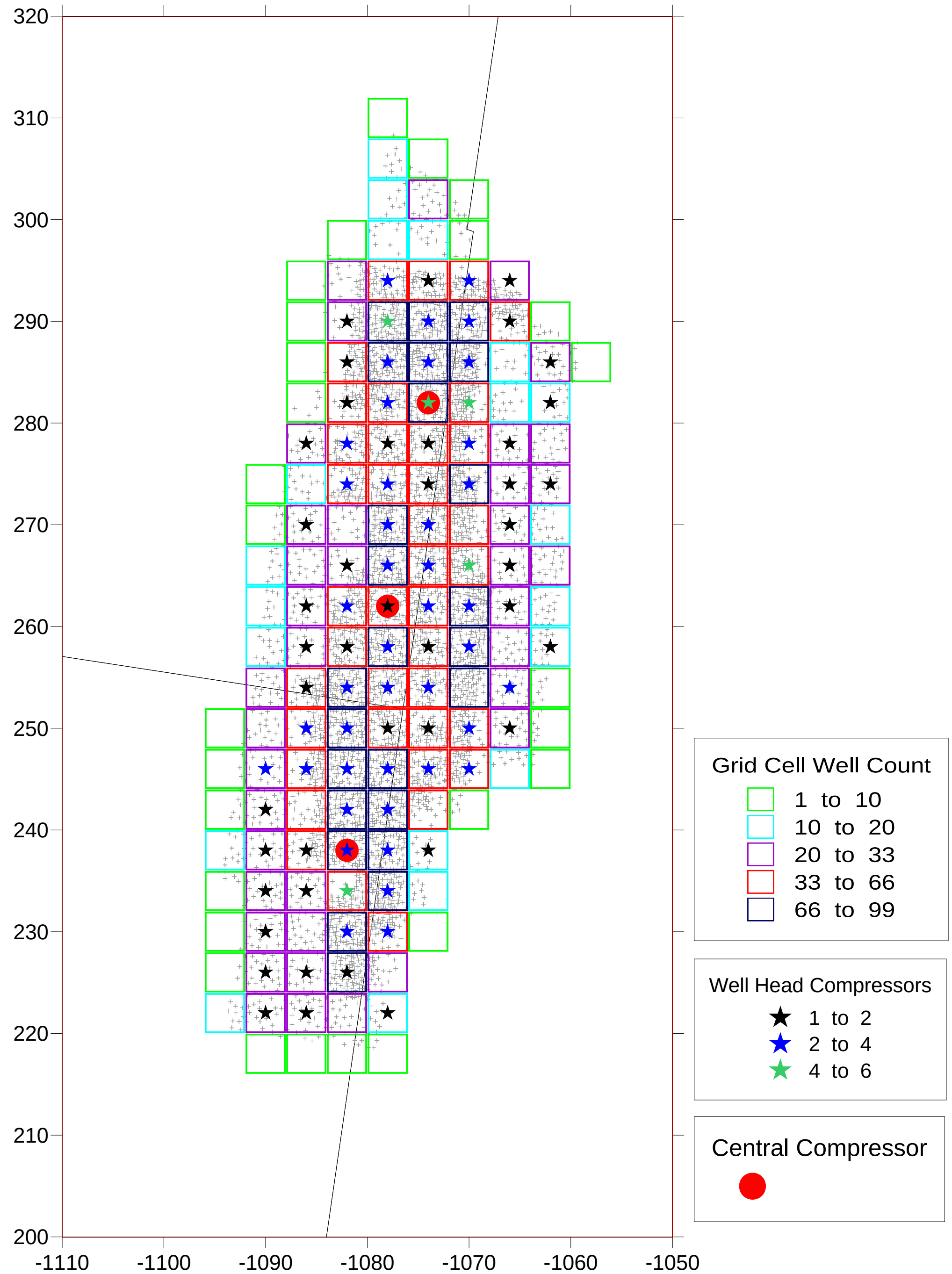


Figure 4-6. Map of Alternative C showing location of well sites (grey crosses), well head compressors, and central compressor stations. Boxes show idealized area sources that are used to represent the emissions from the well construction and operation activities.

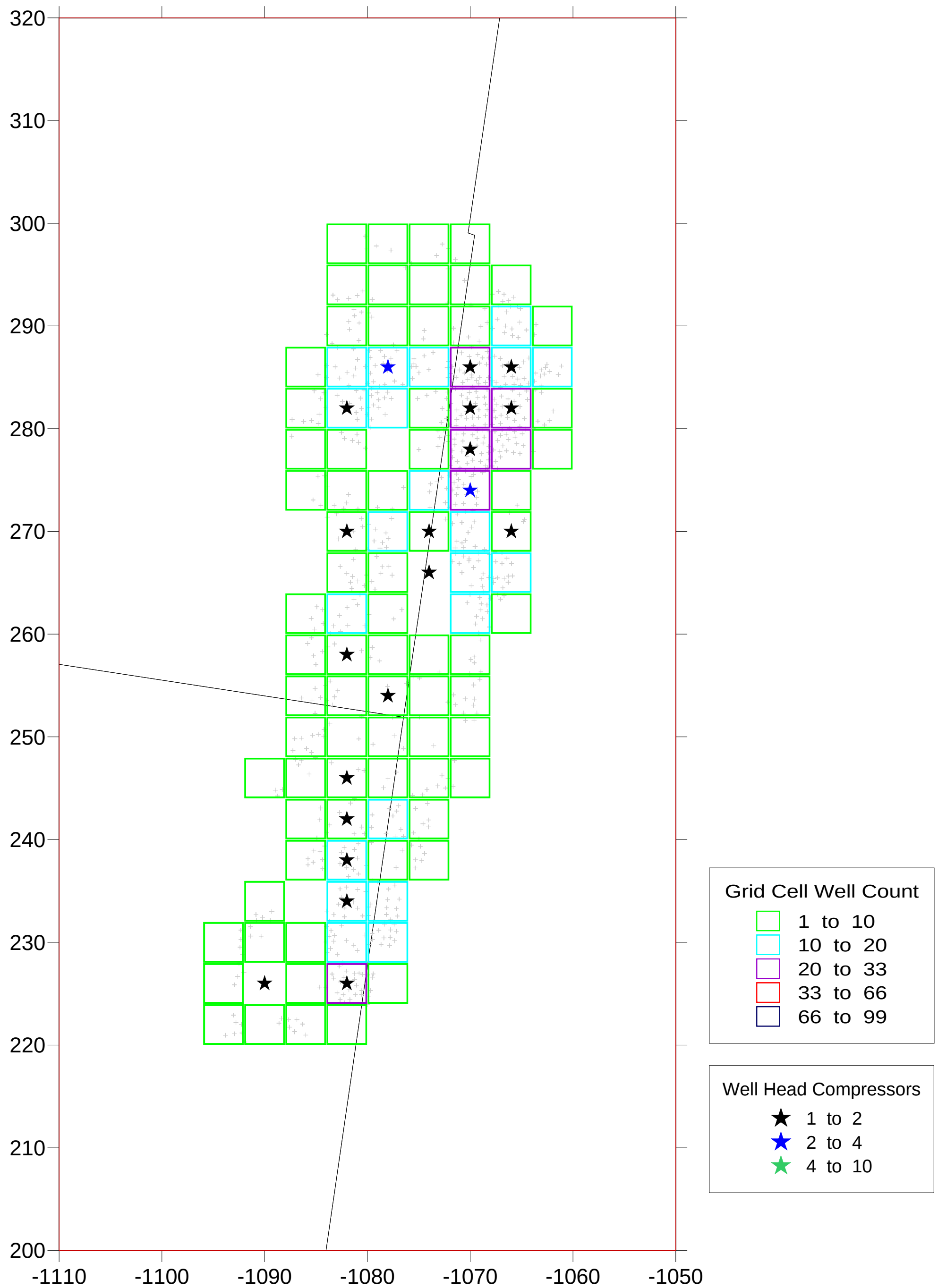


Figure 4-7. Map of Alternative A- No Action scenario showing location of well sites (grey crosses), well head compressors, and central compressor stations. Boxes show idealized area sources that are used to represent the emissions from the well construction and operation activities.

State of Wyoming-permitted and RFFA sources that did not have specific coordinates (i.e. no latitude/longitude or UTM easting/northing coordinate pair was present for that source) were sited at the center of the section if township, range, and section data were available. For cases where no coordinates were given and no township, range, and section data were present, the source was located at the county centroid if county information was given. There were four sources for which no location data of any kind were available, and these sources were placed at the centroid of Sweetwater County.

The Wyoming cumulative emission inventory contains 1,254 state-permitted and RFFA sources. A 3-year simulation with such a large number of sources places prohibitive computational demands on CALPUFF given the number of receptors, the domain size, and the time constraints of the project. Therefore, the number of sources input in CALPUFF that represent the permitted and RFFA sources in Wyoming was reduced by treating emissions from all permitted and RFFA sources with the classification "*production site*" in the same manner as those of the Project well sites. The 901 Wyoming permitted and RFFA production site sources were plotted as 4 km by 4 km area sources, and emissions sources from the remainder of the source classifications were treated as point sources.

RFD emissions were modeled using area sources developed as a best fit to the respective Project Area. The area source definitions for the RFD emissions are shown in Figure 4-8. County-wide well sites were also modeled as area sources, with the counties idealized as polygons suitable for input to CALPUFF. The idealization of the county areas is shown in Figure 4-9.

4.5 POST-PROCESSING PROCEDURES AND BACKGROUND AIR QUALITY DATA

4.5.1 Criteria Pollutants

Ambient air concentration data collected at monitoring sites in the region provide a measure of background conditions in existence during the most recent available time period. Regional monitoring-based background values for criteria pollutants (PM_{10}, $PM_{2.5}$, CO, NO_x, and SO_2) were collected at monitoring sites in Wyoming and northwestern Colorado and are presented in Table 4-5. Ambient air background concentrations were added to modeled pollutant concentrations (expressed in micrograms per cubic meter [$\mu g/m^3$]) to arrive at total ambient air quality impacts for comparison to NAAQS, WAAQS, (CAAQS, and Utah Ambient Air Quality Standards (UAAQS). These background values are based on an e-mail from Darla Potter of WDEQ to Michele Easley of BLM dated August 8, 2006 that supersede the background values given in the Modeling Protocol (NRG 2006).

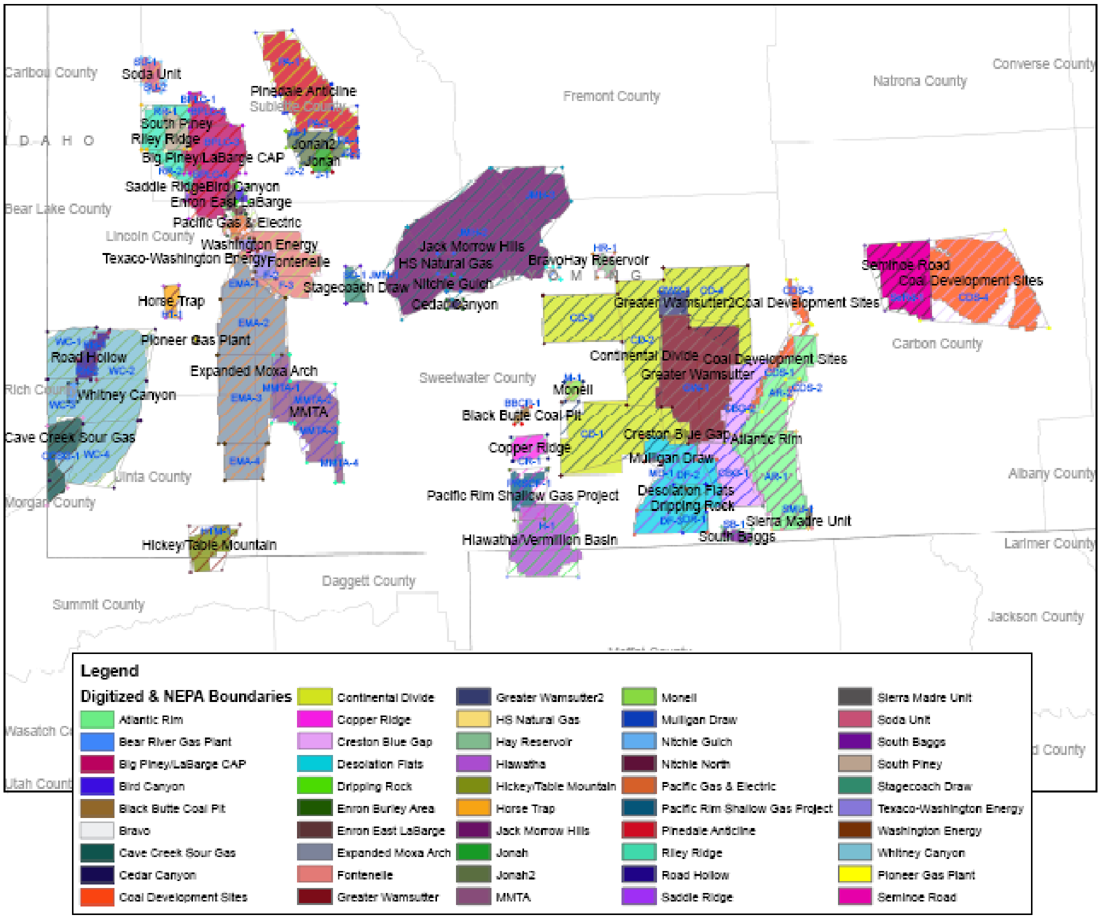


Figure 4-8. Far-field modeling area source idealization of RFD Project areas. This is a preliminary map that shows all NEPA project areas in the modeling domain, and includes project areas that have already been fully developed or will not be developed, and were therefore excluded from the RFD emission inventory for the MAA.

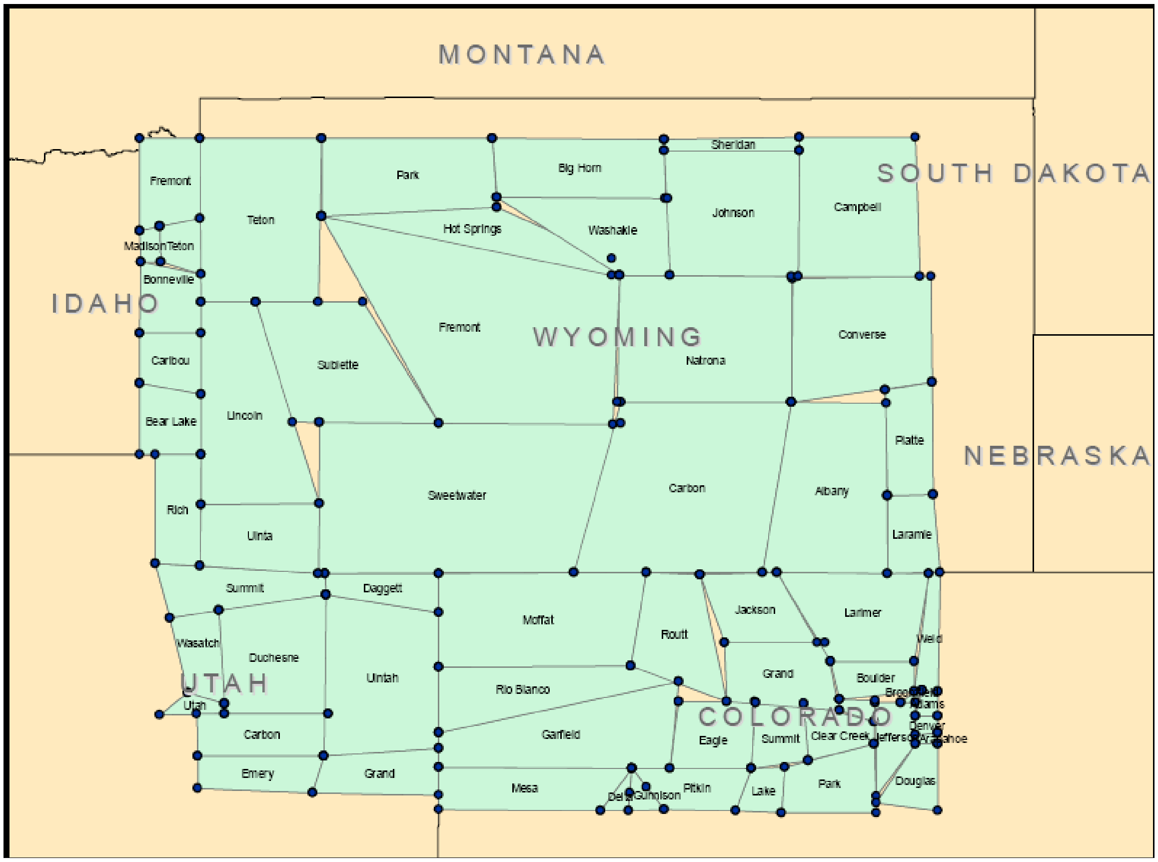


Figure 4-9. Far-field modeling area source idealization of county well site emissions.

Table 4-5. Far-Field Analysis Background Ambient Air Quality Concentrations.

Pollutant	Averaging Period	Measured Background Concentration ($\mu g/m^3$)
Carbon monoxide (CO)[1]	1-hour 8-hour	2,229 1,148
Nitrogen dioxide (NO_2)[2]	Annual	3.4
Ozone (O_3)[3]	1-hour 8-hour	-- 147
PM_{10}[4]	24-hour Annual	48 25
$PM_{2.5}$[4]	24-hour Annual	22 11
Sulfur dioxide (SO_2)[5]	3-hour 24-hour Annual	29 18 5

1 Data collected by Rifle and Mack, Colorado in conjunction with proposed oil shale development during early 1980's (CDPHE, 1996).
2 Data collected at Green River Basin Visibility Study site, Green River, Wyoming, during period January-December 2001 (ARS 2002).
3 Data collected at Green River Basin Visibility Study site, Green River, Wyoming, during period June 10, 1998, through December 31, 2001 (ARS, 2002).
4 Data collected at Green River Basin Visibility Study site, Green River, Wyoming January-December 1997-1999, WDEQ.
5 Data collected at Craig Power Plant site and oil shale areas from 1980-1984 (CDPHE 1996)

4.5.2 Visibility

The proposed visibility analysis differs from previous Wyoming NEPA cumulative air quality impact studies in its update of visibility background to include the most current data available at the time of the Modeling Protocol (NRG 2006). The analysis also used representative monitoring data collected from the Interagency Modeling of Protected Visual Environment (IMPROVE) network for the time period (2000 to 2004) coinciding with the time period that will be used to establish “baseline conditions” under the EPA Regional Haze Rule (EPA, 2003a). Monitored visibility background data that have undergone Quality Assurance (QA)/Quality Control (QC) are currently available through December 31, 2004.

Three separate methods were used for the light extinction analysis using FLAG and IMPROVE background visibility data. Two methods which follow recent CALPUFF modeling guidance for Best Available Retrofit Technology (BART) analyses developed for the Visibility Improvement State and Tribal Association of the Southeast (VISTAS) RPO were also used (VISTAS 2006). Because natural background data are provided for Federal Class I areas only, data from the nearest Federal Class I area were used for the sensitive Class II areas. The natural background visibility data, in units of inverse megameters (Mm^{-1}) that were used with the FLAG visibility analysis (Method 1) for each area analyzed are shown in Table 4-6.

The IMPROVE method uses reconstructed IMPROVE aerosol total extinction data. The IMPROVE background visibility data are provided as reconstructed aerosol total extinction data, based on the quarterly mean of the 20% cleanest days measured at the Bridger and North Absaroka Wilderness Areas and Yellowstone National Park IMPROVE sites for the 5-year period, years 2000 through 2004, as shown in Table 4-7 (Method 2). These 5 years are defined as baseline condition years for tracking progress under *Guidance for Tracking Progress Under the Regional Haze Rule (EPA 2003a)*. The IMPROVE method also uses monthly relative humidity factors as provided in the *Guidance for Estimating Natural Visibility Conditions Under the Regional Haze Rule*.

Visibility data from the Bridger Wilderness Area IMPROVE site were used for the Bridger, Fitzpatrick, Gros Ventre, and Wind River Roadless Aresa. Visibility data from the Yellowstone National Park IMPROVE site were used for the Teton Wilderness Area and for Grand Teton and Yellowstone National Parks. Data from the North Absaroka site were used for the North Absaroka and Washakie Wilderness Areas. Monthly relative humidity data were available for the Bridger, Fitzpatrick, Teton, and Washakie Wilderness Areas, and for Grand Teton and Yellowstone National Parks. Relative humidity data for the Bridger Wilderness Area were used for the Gros Ventre and Wind River Roadless Area analyses.

The two BART screening methods (Method 3a and 3b) used the background visibility data provided in Appendix B of the *Guidance for Estimating Natural Visibility Conditions Under the Regional Haze Rule* (EPA, 2003b). Method 3b used the best days background visibility condition and Method 3a used the annual average background. These background data given in deciview (dv) units are shown in Table 4-8. The BART methods require monthly relative humidity factors as provided in the *Guidance for Estimating Natural Visibility Conditions Under the Regional Haze Rule*. Because the background visibility and relative humidity data are provided for Federal Class I areas only, data from the nearest Federal Class I area were used for the sensitive Class II areas.

Table 4-6. FLAG Report Background Extinction Values (FLAG, 2000) used in the Method 1 visibility assessment.

Site	Season	Hygroscopic (Mm^{-1})	Non-hygroscopic (Mm^{-1})
Bridger Wilderness Area (also used for Popo Agie Wilderness Area, Wind River Roadless Area, and mid-field Wyoming regional community locations; Boulder, Cora, and Pinedale)	Winter	0.6	4.5
	Spring	0.6	4.5
	Summer	0.6	4.5
	Fall	0.6	4.5
Fitzpatrick Wilderness Area	Winter	0.6	4.5
	Spring	0.6	4.5
	Summer	0.6	4.5
	Fall	0.6	4.5
North Absaroka Wilderness Area	Winter	0.6	4.5
	Spring	0.6	4.5
	Summer	0.6	4.5
	Fall	0.6	4.5
Teton Wilderness Area	Winter	0.6	4.5
	Spring	0.6	4.5
	Summer	0.6	4.5
	Fall	0.6	4.5
Washakie Wilderness Area	Winter	0.6	4.5
	Spring	0.6	4.5
	Summer	0.6	4.5
	Fall	0.6	4.5
Grand Teton National Park (Also used for Gros Ventre Wilderness area)	Winter	0.6	4.5
	Spring	0.6	4.5
	Summer	0.6	4.5
	Fall	0.6	4.5
Yellowstone National Park	Winter	0.6	4.5
	Spring	0.6	4.5
	Summer	0.6	4.5
	Fall	0.6	4.5

Table 4-7. IMPROVE Background Aerosol Extinction Values (CIRA 2006) used in the Method 2 visibility assessment.

IMPROVE Site	Quarter	Hygroscopic (Mm^{-1})	Non-hygroscopic (Mm^{-1})
Bridger	1	0.775	1.233
	2	1.565	3.283
	3	1.791	4.965
	4	0.704	1.192
North Absaroka	1	0.774	1.565
	2	1.326	2.249
	3	1.360	4.931
	4	0.600	1.368
Yellowstone	1	1.104	1.588
	2	1.453	2.983
	3	1.550	5.414
	4	0.738	1.544

Table 4-8. Default Natural Conditions (EPA, 2003b).

Site	Annual Average (dv)	Best Days (dv)
Bridger Wilderness	4.52	1.96
Fitzpatrick Wilderness	4.53	1.97
North Absaroka Wilderness	4.53	1.97
Teton Wilderness	4.53	1.97
Washakie Wilderness	4.53	1.97
Grand Teton National Park	4.53	1.97
Yellowstone National Park	4.56	2.00

[1] Default natural conditions from Appendix B (EPA 2003b)

4.5.3 Lake Chemistry

The most recent lake chemistry background ANC data were obtained from the FLMs for each sensitive in the study area. The 10th percentile lowest ANC values were calculated for each lake following procedures provided from the Forest Service. The ANC values proposed for use in this analysis and the number of samples used in the calculation of the 10th percentile lowest ANC values is provided in Table 4-9.

4.6 CLASS I AREA FAR-FIELD AIR QUALITY AND AQRV IMPACT ASSESSMENT

CALPUFF modeling was performed to compute direct impacts for the Project and to estimate cumulative impacts from the Project and other regional emission sources. The analyzed alternatives represent maximum emissions scenarios that included the last year of field development at the maximum annual construction activity rate combined with nearly full-field production. Regional emission inventories for existing state-permitted RFFA and RFD sources, as described in Section 2, were modeled in combination with each Project alternative to estimate cumulative impacts for: (1) the Proposed Action; (2) Alternative C; and (3) Alternative A - No Action. Note that a fourth alternative is being analyzed (Alternative B); however, this alternative would have the same or less air emissions as Alternative C so did not require a separate air modeling analysis. Also, since the RFD sources are highly speculative, a scenario was analyzed that consists of the project alternatives plus all cumulative emissions less the RFD sources.

Table 4-9. Background ANC Values for Acid Sensitive Lakes (USFS, 2006).

Wilderness Area	Lake	Latitude (Deg-Min-Sec)	Longitude (Deg-Min-Sec)	10th Percentile Lowest ANC Value (µeq/l)[1]	Number of Samples	Monitoring Period
Bridger	Black Joe	42º44'22"	109º10'16"	67.1	67	1984-2005
Bridger	Deep	42º43'10"	109º10'15"	59.7	64	1984-2005
Bridger	Hobbs	43º02'08"	109º40'20"	69.9	71	1984-2005
Bridger	Lazy Boy	43º19'57"	109º43'47"	10.8	3	1997-2004
Bridger	Upper Frozen	42º41'08"	109º09'38"	6.0	8	1997-2005
Fitzpatrick	Ross	43º22'41"	109º39'30"	53.7	49	1988-2005
Popo Agie	Lower Saddlebag	42º37'24"	108º59'38"	55.2	48	1989-2005

[1]µeq/l = microequivalents per liter

For each far-field sensitive area, CALPUFF-modeled concentration impacts were post-processed with POSTUTIL and CALPOST to derive: (1) concentrations for comparison to ambient standards (WAAQS, CAAQS, UAAQS, and NAAQS) and PSD Class I and II Increments; (2) deposition rates for comparison to sulfur and nitrogen deposition thresholds and to calculate changes to ANC at sensitive lakes; and (3) light extinction changes for comparison to visibility impact thresholds.

4.6.1 Far-Field Concentration Impacts

The CALPOST and POSTUTIL post-processors were used to summarize concentration impacts of NO2, SO2, PMF, and PMC at PSD Class I and sensitive PSD Class II areas. Predicted impacts are compared to applicable ambient air quality standards, PSD Class I and Class II increments, and significance levels. Table 4-10 lists the ambient standards and PSD Class I and II increments that the estimated concentration impacts due to the Project alone and the Project plus cumulative emissions will be compared against.

PM10 concentrations were computed by adding predicted CALPUFF concentrations of PMF, PMC, SO4 and NO3, whereas PM2.5 concentrations were calculated as the sum of modeled PMF, SO4, and NO3 concentrations.

4.6.1.1 Class I Area Far-Field Concentration Results

The maximum predicted concentrations of NO2, SO2, PM10, and PM2.5 at any receptor within each of the PSD Class I areas for each modeled Project alternative are shown in Tables 4-11a-c. The highest estimated concentration impacts at any Class I area and any Project alternative occur for Alternative C at the Bridger Wilderness area. Most of the impacts are 1% or less of the PSD Class I area increments. The largest impact is for 24-hour PM10 where Alternative C is estimated at values ~6% of the PSD Class I area increment at Bridger. The far-field results demonstrate that the maximum air quality impacts for the Proposed Action and all alternatives would not exceed any PSD Class I increment at any Class I area.

Table 4-10. Ambient Air Quality Standards and Class I and II PSD Increments for comparison to fair-field model estimates.

Pollutant / Averaging Time	Ambient Air Quality Standards (μg/m^3)				PSD Increment (μg/m^3)	
	National	**Wyoming**	**Colorado**	**Utah**	**Class II**	**Class I**
Carbon Monoxide (CO)						
1-hour[1]	40,000	40,000	40,000	40,000	--	--
8-hour[1]	10,000	10,000	10,000	10,000	--	--
Nitrogen Dioxide (NO_2)						
Annual[2]	100	100	100	100	25	2.5
Ozone (O_3)						
1-hour	--	--	235	235	--	--
8-hour[3]	157	157	--	157	--	--
PM_{10}						
24-hour[1]	150	150	150	150	30	4
Annual[2]	50	50	50	50	17	8
$PM_{2.5}$						
24-hour[1]	65	65	--	65	--	--
Annual [4]	15	15	--	15	--	--
Sulfur Dioxide (SO_2)						
3-hour[1]	1,300	1,300	700[5]	1,300	512	2
24-hour[1]	365	260	100[5]	365	91	5
Annual[2]	80	60	15[5]	80	20	25

1 No more than one exceedance per year.
2 Annual arithmetic mean.
3 Average of annual fourth-highest daily maximum 8-hour average.
4 Annual arithmetic mean
5 Category III Incremental standards (increase over established baseline).

Table 4-11a. CALPUFF estimated PSD pollutant concentrations impacts at Class I areas for the Moxa Arch Infill Drilling Project Proposed Action.

Species and Averaging Time	PSD Class I Area Increment (μg/m³)	Concentration Estimates (μg/m³)					
		BRID	FITZ	GRTE	MOZI	TETO	WASH
2001							
SO_2 Annual	2.00	0.0006	0.0002	0.0001	0.0002	0.0000	0.0001
SO_2 24-Hour*	5.00	0.0077	0.0035	0.0015	0.0022	0.0010	0.0009
SO_2 3-Hour*	25.00	0.0261	0.0113	0.0067	0.0171	0.0037	0.0039
PM_{10} Annual	4.00	0.0115	0.0040	0.0017	0.0036	0.0013	0.0013
PM_{10} 24-Hour*	8.00	0.1602	0.0720	0.0433	0.0638	0.0314	0.0269
NO_2 Annual	2.50	0.0125	0.0022	0.0006	0.0021	0.0003	0.0003
2002							
SO_2 Annual	2.00	0.0004	0.0001	0.0001	0.0002	0.0000	0.0001
SO_2 24-Hour*	5.00	0.0058	0.0021	0.0029	0.0020	0.0012	0.0017
SO_2 3-Hour*	25.00	0.0217	0.0092	0.0153	0.0066	0.0051	0.0089
PM_{10} Annual	4.00	0.0074	0.0029	0.0015	0.0048	0.0010	0.0012
PM_{10} 24-Hour*	8.00	0.1093	0.0571	0.0395	0.0569	0.0260	0.0253
NO_2 Annual	2.50	0.0062	0.0015	0.0010	0.0025	0.0003	0.0004
2003							
SO_2 Annual	2.00	0.0004	0.0001	0.0000	0.0002	0.0000	0.0000
SO_2 24-Hour*	5.00	0.0066	0.0019	0.0011	0.0018	0.0011	0.0009
SO_2 3-Hour*	25.00	0.0369	0.0128	0.0060	0.0078	0.0044	0.0086
PM_{10} Annual	4.00	0.0070	0.0028	0.0011	0.0043	0.0009	0.0010
PM_{10} 24-Hour*	8.00	0.1315	0.0803	0.0327	0.0476	0.0225	0.0353
NO_2 Annual	2.50	0.0071	0.0019	0.0005	0.0021	0.0004	0.0006

* Highest second high at any monitor in the Class I area.

Table 4-11b. CALPUFF estimated PSD pollutant concentrations impacts at Class I areas for the MAA Project Alternatives B and C.

Species and Averaging Time	PSD Class I Area Increment (μg/m³)	BRID	FITZ	GRTE	MOZI	TETO	WASH
			Concentration Estimates (μg/m³)				
2001							
SO_2 Annual	2.00	0.0005	0.0002	0.0000	0.0001	0.0000	0.0000
SO_2 24-Hour*	5.00	0.0069	0.0031	0.0013	0.0018	0.0008	0.0008
SO_2 3-Hour*	25.00	0.0230	0.0095	0.0055	0.0142	0.0033	0.0034
PM_{10} Annual	4.00	0.0318	0.0110	0.0044	0.0089	0.0034	0.0034
PM_{10} 24-Hour*	8.00	0.4359	0.1884	0.1021	0.1378	0.0756	0.0663
NO_2 Annual	2.50	0.0262	0.0046	0.0012	0.0040	0.0006	0.0007
2002							
SO_2 Annual	2.00	0.0003	0.0001	0.0001	0.0002	0.0000	0.0000
SO_2 24-Hour*	5.00	0.0052	0.0019	0.0025	0.0017	0.0011	0.0014
SO_2 3-Hour*	25.00	0.0184	0.0087	0.0131	0.0055	0.0043	0.0072
PM_{10} Annual	4.00	0.0201	0.0079	0.0040	0.0118	0.0026	0.0032
PM_{10} 24-Hour*	8.00	0.3153	0.1334	0.0949	0.1274	0.0660	0.0620
NO_2 Annual	2.50	0.0127	0.0031	0.0020	0.0047	0.0006	0.0008
2003							
SO_2 Annual	2.00	0.0003	0.0001	0.0000	0.0002	0.0000	0.0000
SO_2 24-Hour*	5.00	0.0056	0.0017	0.0010	0.0016	0.0009	0.0008
SO_2 3-Hour*	25.00	0.0297	0.0108	0.0049	0.0065	0.0038	0.0076
PM_{10} Annual	4.00	0.0194	0.0077	0.0030	0.0107	0.0024	0.0027
PM_{10} 24-Hour*	8.00	0.3426	0.2067	0.0837	0.1288	0.0586	0.0953
NO_2 Annual	2.50	0.0146	0.0039	0.0011	0.0041	0.0008	0.0013

* Highest second high at any monitor in the Class I area.

Table 4-11c. CALPUFF estimated PSD pollutant concentrations impacts at Class I areas for the Moxa Arch Infill Drilling Project No Action Alternative.

Species and Averaging Time	Concentration Estimates (μg/m³)						
	PSD Class I Area Increment (μg/m³)	BRID	FITZ	GRTE	MOZI	TETO	WASH
2001							
SO_2 Annual	2.00	0.0002	0.0000	0.0000	0.0000	0.0000	0.0000
SO_2 24-Hour*	5.00	0.0025	0.0009	0.0004	0.0005	0.0002	0.0002
SO_2 3-Hour*	25.00	0.0071	0.0028	0.0017	0.0043	0.0009	0.0010
PM_{10} Annual	4.00	0.0053	0.0017	0.0006	0.0012	0.0005	0.0005
PM_{10} 24-Hour*	8.00	0.0755	0.0274	0.0138	0.0153	0.0103	0.0092
NO_2 Annual	2.50	0.0036	0.0006	0.0001	0.0004	0.0001	0.0001
2002							
SO_2 Annual	2.00	0.0001	0.0000	0.0000	0.0000	0.0000	0.0000
SO_2 24-Hour*	5.00	0.0016	0.0007	0.0008	0.0005	0.0003	0.0004
SO_2 3-Hour*	25.00	0.0060	0.0029	0.0040	0.0019	0.0013	0.0024
PM_{10} Annual	4.00	0.0032	0.0012	0.0006	0.0016	0.0004	0.0005
PM_{10} 24-Hour*	8.00	0.0578	0.0145	0.0136	0.0157	0.0102	0.0090
NO_2 Annual	2.50	0.0017	0.0004	0.0002	0.0005	0.0001	0.0001
2003							
SO_2 Annual	2.00	0.0001	0.0000	0.0000	0.0000	0.0000	0.0000
SO_2 24-Hour*	5.00	0.0017	0.0006	0.0003	0.0005	0.0003	0.0003
SO_2 3-Hour*	25.00	0.0088	0.0028	0.0015	0.0017	0.0012	0.0023
PM_{10} Annual	4.00	0.0031	0.0012	0.0005	0.0015	0.0004	0.0004
PM_{10} 24-Hour*	8.00	0.0533	0.0307	0.0123	0.0166	0.0091	0.0151
NO_2 Annual	2.50	0.0019	0.0005	0.0001	0.0005	0.0001	0.0002

* Highest second high at any monitor in the Class I area.

Table 4-12 (a-c) displays the maximum estimated PSD pollutant concentrations at Class I areas due to the various Project alternatives plus the Cumulative Emissions inventory and compares them to the PSD Class I increments. The highest estimated impacts occur for the Bridger Wilderness Area in the Cumulative Emissions plus Alternative C scenario, with impacts as follows:

- Less than 1% of the PSD Class I increments for annual, 24-hour and 3-hour SO_2 concentrations;
- Less than 3% and 20% of the PSD Class I area increments for annual and 24-hour $PM_{10,}$ respectively; and
- Less than 8% of the PSD Class I area increment for annual $NO_{2.}$

Table 4-12 (a-c) shows that the estimated air quality impacts due to any of the Project alternatives plus the cumulative emissions would not exceed any PSD Class I area increment at any Class I area.

Table 4-12a. CALPUFF estimated PSD pollutant concentrations impacts at Class I areas for the Proposed Action plus the cumulative emissions.

Species and Averaging Time	PSD Class I Area Increment (μg/m^3)	Concentration Estimates (μg/m^3)					
		BRID	FITZ	GRTE	MOZI	TETO	WASH
2001							
SO_2 Annual	2.00	0.0025	0.0008	0.0004	0.0018	0.0003	0.0003
SO_2 24-Hour*	5.00	0.0270	0.0081	0.0062	0.0244	0.0050	0.0046
SO_2 3-Hour*	25.00	0.0934	0.0236	0.0311	0.0707	0.0168	0.0204
PM_{10} Annual	4.00	0.1001	0.0374	0.0145	0.0593	0.0102	0.0098
PM_{10} 24-Hour*	8.00	1.2271	0.4663	0.4342	0.7103	0.2525	0.2299
NO_2 Annual	2.50	0.1797	0.1028	0.0113	0.0305	0.0049	0.0043
2002							
SO_2 Annual	2.00	0.0019	0.0007	0.0004	0.0024	0.0002	0.0003
SO_2 24-Hour*	5.00	0.0191	0.0116	0.0085	0.0262	0.0051	0.0056
SO_2 3-Hour*	25.00	0.1101	0.0373	0.0496	0.0900	0.0155	0.0160
PM_{10} Annual	4.00	0.0691	0.0292	0.0096	0.0558	0.0066	0.0076
PM_{10} 24-Hour*	8.00	0.9061	0.5574	0.2323	0.4752	0.1711	0.1681
NO_2 Annual	2.50	0.1571	0.1085	0.0089	0.0345	0.0043	0.0049
2003							
SO_2 Annual	2.00	0.0018	0.0007	0.0003	0.0024	0.0002	0.0003
SO_2 24-Hour*	5.00	0.0217	0.0077	0.0053	0.0239	0.0039	0.0059
SO_2 3-Hour*	25.00	0.0800	0.0255	0.0202	0.0848	0.0154	0.0195
PM_{10} Annual	4.00	0.0814	0.0308	0.0084	0.0638	0.0064	0.0070
PM_{10} 24-Hour*	8.00	1.2909	0.4071	0.2610	0.5391	0.1096	0.1203
NO_2 Annual	2.50	0.1686	0.1032	0.0097	0.0343	0.0048	0.0058

* Highest second high at any monitor in the Class I area.

Table 4-12b. CALPUFF estimated PSD pollutant concentrations impacts at Class I areas for Alternative C plus the cumulative emissions.

Species and Averaging Time	**PSD Class I Area Increment (µg/m³)**			**Concentration Estimates (µg/m³)**			
		BRID	**FITZ**	**GRTE**	**MOZI**	**TETO**	**WASH**
2001							
SO_2 Annual	2.00	0.0025	0.0008	0.0004	0.0018	0.0003	0.0003
SO_2 24-Hour*	5.00	0.0271	0.0079	0.0062	0.0240	0.0050	0.0046
SO_2 3-Hour*	25.00	0.0908	0.0232	0.0307	0.0679	0.0164	0.0199
PM_{10} Annual	4.00	0.1153	0.0443	0.0171	0.0639	0.0123	0.0120
PM_{10} 24-Hour*	8.00	1.5332	0.5516	0.4538	0.7113	0.2579	0.2329
NO_2 Annual	2.50	0.1901	0.1051	0.0119	0.0321	0.0052	0.0046
2002							
SO_2 Annual	2.00	0.0019	0.0007	0.0003	0.0024	0.0002	0.0003
SO_2 24-Hour*	5.00	0.0188	0.0115	0.0080	0.0261	0.0051	0.0052
SO_2 3-Hour*	25.00	0.1083	0.0369	0.0483	0.0892	0.0155	0.0151
PM_{10} Annual	4.00	0.0799	0.0342	0.0122	0.0614	0.0082	0.0095
PM_{10} 24-Hour*	8.00	1.0171	0.6205	0.3753	0.4783	0.1889	0.2255
NO_2 Annual	2.50	0.1628	0.1101	0.0099	0.0365	0.0046	0.0053
2003							
SO_2 Annual	2.00	0.0018	0.0006	0.0003	0.0024	0.0002	0.0003
SO_2 24-Hour*	5.00	0.0216	0.0077	0.0053	0.0238	0.0038	0.0058
SO_2 3-Hour*	25.00	0.0759	0.0245	0.0201	0.0847	0.0154	0.0178
PM_{10} Annual	4.00	0.0923	0.0356	0.0103	0.0695	0.0079	0.0087
PM_{10} 24-Hour*	8.00	1.3535	0.4082	0.2624	0.5408	0.1414	0.1561
NO_2 Annual	2.50	0.1758	0.1052	0.0101	0.0363	0.0052	0.0064

* Highest second high at any monitor in the Class I area.

Table 4-12c. CALPUFF estimated PSD pollutant concentrations impacts at Class I areas for the No Action alternative plus cumulative emissions.

Species and Averaging Time	PSD Class I Area Increment (μg/m^3)	BRID	FITZ	GRTE	MOZI	TETO	WASH
			Concentration Estimates (μg/m^3)				
2001							
SO_2 Annual	2.00	0.0022	0.0007	0.0003	0.0017	0.0003	0.0003
SO_2 24-Hour*	5.00	0.0251	0.0074	0.0061	0.0224	0.0049	0.0045
SO_2 3-Hour*	25.00	0.0831	0.0219	0.0268	0.0629	0.0153	0.0179
PM_{10} Annual	4.00	0.0955	0.0350	0.0134	0.0571	0.0094	0.0091
PM_{10} 24-Hour*	8.00	1.2192	0.4378	0.4064	0.7101	0.2378	0.2283
NO_2 Annual	2.50	0.1728	0.1011	0.0110	0.0289	0.0047	0.0040
2002							
SO_2 Annual	2.00	0.0017	0.0006	0.0003	0.0023	0.0002	0.0003
SO_2 24-Hour*	5.00	0.0179	0.0098	0.0067	0.0252	0.0047	0.0041
SO_2 3-Hour*	25.00	0.1026	0.0365	0.0413	0.0861	0.0152	0.0125
PM_{10} Annual	4.00	0.0657	0.0274	0.0088	0.0531	0.0060	0.0069
PM_{10} 24-Hour*	8.00	0.8737	0.5311	0.2110	0.4734	0.1637	0.1469
NO_2 Annual	2.50	0.1533	0.1073	0.0084	0.0326	0.0041	0.0046
2003							
SO_2 Annual	2.00	0.0016	0.0006	0.0002	0.0023	0.0002	0.0002
SO_2 24-Hour*	5.00	0.0215	0.0061	0.0045	0.0233	0.0036	0.0047
SO_2 3-Hour*	25.00	0.0677	0.0230	0.0186	0.0838	0.0149	0.0151
PM_{10} Annual	4.00	0.0780	0.0291	0.0078	0.0613	0.0059	0.0064
PM_{10} 24-Hour*	8.00	1.2741	0.4066	0.2513	0.5375	0.0972	0.1150
NO_2 Annual	2.50	0.1633	0.1017	0.0094	0.0327	0.0045	0.0053

* Highest second high at any monitor in the Class I area.

Table 4-13 (a-c) displays the maximum estimated PSD pollutant concentrations at Class I areas from the project alternatives plus the cumulative emissions inventory without RFD sources. The PSD Class I increments are also shown in Table 4-13. The highest estimated impacts from cumulative emissions without RFD sources plus any Project alternative occur at the Bridger and Mount Zirkel Wilderness Areas for Alternative C, with impacts as follows:

- Less than 1% of the PSD Class I increments for annual, 24-hour and 3-hour SO_2 concentrations;
- Less than 2% and 9% of the PSD Class I area increments for annual and 24-hour $PM_{10,}$ respectively; and
- Less than 6% of the PSD Class I area increment for annual $NO_{2.}$

Table 4-13 (a-c) shows that the estimated air quality impacts due to any of the Project alternatives plus the cumulative emissions without RFD sources would not exceed any PSD Class I area increment at any Class I area. As expected, the impacts are slightly less than for the case with the RFD sources included in the cumulative emission inventory (Tables 4-12 [a-c]).

Table 4-13a. CALPUFF estimated PSD pollutant concentrations impacts at Class I areas for the Proposed Action plus the cumulative emissions without RFD sources.

Species and Averaging Time			Concentration Estimates (μg/m³)				
	PSD Class I AreaIncrement (μg/m³)	BRID	FITZ	GRTE	MOZI	TETO	WASH
2001							
SO_2 Annual	2.00	0.0016	0.0005	0.0002	0.0013	0.0002	0.0002
SO_2 24-Hour*	5.00	0.0150	0.0062	0.0040	0.0184	0.0037	0.0038
SO_2 3-Hour*	25.00	0.0606	0.0201	0.0154	0.0633	0.0129	0.0152
PM_{10} Annual	4.00	0.0473	0.0229	0.0083	0.0547	0.0062	0.0060
PM_{10} 24-Hour*	8.00	0.5781	0.2583	0.1887	0.7103	0.1462	0.1313
NO_2 Annual	2.50	0.1506	0.0978	0.0084	0.0290	0.0038	0.0036
2002							
SO_2 Annual	2.00	0.0012	0.0004	0.0002	0.0018	0.0002	0.0002
SO_2 24-Hour*	5.00	0.0166	0.0072	0.0079	0.0190	0.0039	0.0035
SO_2 3-Hour*	25.00	0.0997	0.0306	0.0401	0.0716	0.0132	0.0110
PM_{10} Annual	4.00	0.0374	0.0191	0.0054	0.0499	0.0042	0.0050
PM_{10} 24-Hour*	8.00	0.3904	0.3100	0.1167	0.4199	0.1084	0.0906
NO_2 Annual	2.50	0.1424	0.1049	0.0067	0.0324	0.0033	0.0040
2003							
SO_2 Annual	2.00	0.0009	0.0003	0.0001	0.0018	0.0001	0.0002
SO_2 24-Hour*	5.00	0.0152	0.0058	0.0030	0.0211	0.0028	0.0041
SO_2 3-Hour*	25.00	0.0476	0.0198	0.0138	0.0842	0.0108	0.0146
PM_{10} Annual	4.00	0.0383	0.0183	0.0043	0.0577	0.0037	0.0040
PM_{10} 24-Hour*	8.00	0.5873	0.2452	0.0949	0.5391	0.0640	0.0677
NO_2 Annual	2.50	0.1492	0.0991	0.0072	0.0321	0.0038	0.0046

Table 4-13b. CALPUFF estimated PSD pollutant concentrations impacts at Class I areas for Alternative C plus the cumulative emissions without RFD sources.

Species and Averaging Time	PSD Class I Area Increment (µg/m^3)	Concentration Estimates (µg/m^3) BRID	FITZ	GRTE	MOZI	TETO	WASH
2001							
SO_2 Annual	2.00	0.0015	0.0005	0.0002	0.0013	0.0002	0.0002
SO_2 24-Hour*	5.00	0.0149	0.0061	0.0038	0.0180	0.0037	0.0038
SO_2 3-Hour*	25.00	0.0606	0.0199	0.0138	0.0604	0.0129	0.0148
PM_{10} Annual	4.00	0.0631	0.0299	0.0110	0.0593	0.0083	0.0081
PM_{10} 24-Hour*	8.00	0.7387	0.3386	0.2682	0.7112	0.1598	0.1439
NO_2 Annual	2.50	0.1609	0.1002	0.0089	0.0306	0.0041	0.0039
2002							
SO_2 Annual	2.00	0.0012	0.0004	0.0002	0.0017	0.0001	0.0002
SO_2 24-Hour*	5.00	0.0164	0.0070	0.0075	0.0189	0.0037	0.0035
SO_2 3-Hour*	25.00	0.0979	0.0302	0.0387	0.0707	0.0132	0.0110
PM_{10} Annual	4.00	0.0483	0.0240	0.0079	0.0555	0.0058	0.0070
PM_{10} 24-Hour*	8.00	0.4352	0.3403	0.2175	0.4257	0.1242	0.1418
NO_2 Annual	2.50	0.1475	0.1065	0.0076	0.0344	0.0036	0.0045
2003							
SO_2 Annual	2.00	0.0009	0.0003	0.0001	0.0017	0.0001	0.0002
SO_2 24-Hour*	5.00	0.0148	0.0058	0.0029	0.0211	0.0028	0.0040
SO_2 3-Hour*	25.00	0.0463	0.0177	0.0138	0.0841	0.0108	0.0138
PM_{10} Annual	4.00	0.0493	0.0232	0.0062	0.0634	0.0052	0.0057
PM_{10} 24-Hour*	8.00	0.6598	0.2671	0.1158	0.5408	0.0936	0.1289
NO_2 Annual	2.50	0.1553	0.1011	0.0076	0.0340	0.0043	0.0052

Table 4-13c. CALPUFF estimated PSD pollutant concentrations impacts at Class I areas for the No Action Alternative plus cumulative emissions without RFD sources.

Species and Averaging Time	PSD Class I Area Increment ($\mu g/m^3$)	BRID	FITZ	GRTE	MOZI	TETO	WASH
			Concentration Estimates ($\mu g/m^3$)				
2001							
SO_2 Annual	2.00	0.0012	0.0004	0.0001	0.0012	0.0001	0.0002
SO_2 24-Hour*	5.00	0.0144	0.0059	0.0032	0.0164	0.0035	0.0038
SO_2 3-Hour*	25.00	0.0606	0.0180	0.0114	0.0514	0.0128	0.0131
PM_{10} Annual	4.00	0.0427	0.0206	0.0072	0.0525	0.0054	0.0052
PM_{10} 24-Hour*	8.00	0.5774	0.2261	0.1495	0.7101	0.1400	0.1293
NO_2 Annual	2.50	0.1445	0.0962	0.0080	0.0274	0.0036	0.0034
2002							
SO_2 Annual	2.00	0.0010	0.0004	0.0002	0.0016	0.0001	0.0002
SO_2 24-Hour*	5.00	0.0152	0.0064	0.0058	0.0180	0.0030	0.0032
SO_2 3-Hour*	25.00	0.0922	0.0284	0.0325	0.0677	0.0131	0.0110
PM_{10} Annual	4.00	0.0341	0.0173	0.0045	0.0472	0.0036	0.0043
PM_{10} 24-Hour*	8.00	0.3121	0.2860	0.1095	0.4166	0.1010	0.0744
NO_2 Annual	2.50	0.1394	0.1038	0.0060	0.0306	0.0031	0.0038
2003							
SO_2 Annual	2.00	0.0007	0.0003	0.0001	0.0016	0.0001	0.0001
SO_2 24-Hour*	5.00	0.0137	0.0057	0.0024	0.0203	0.0026	0.0038
SO_2 3-Hour*	25.00	0.0463	0.0176	0.0134	0.0829	0.0108	0.0121
PM_{10} Annual	4.00	0.0349	0.0167	0.0037	0.0552	0.0032	0.0034
PM_{10} 24-Hour*	8.00	0.5800	0.2438	0.0884	0.5368	0.0545	0.0577
NO_2 Annual	2.50	0.1448	0.0976	0.0070	0.0305	0.0035	0.0041

The CALPUFF-estimated maximum concentration increment due to any alternative with the cumulative emissions at any Class I area were combined with the existing maximum background concentrations (see Table 4-5) in the region to obtain a Total estimated concentrations that is compared against the NAAQS, WAAQS, UAAQS, and CAAQS in Table 4-14. The maximum CALPUFF-estimated impact due to any Project Alternative plus the cumulative sources always occurs at the Bridger Class I Area and always occurs for Alternative C. Table 4-14 clearly shows that when the Project plus the cumulative source impacts at any Class I area are added to the maximum background concentrations to obtain a total concentration, they do not exceed any federal or state ambient air quality standards.

In summary, the modeling results indicate that, for the Proposed Action, Alternative C, and No Action Project alternatives, neither direct Project impacts nor Project impacts taken together with cumulative source impacts would exceed any air quality standards (WAAQS, UAAQS, CAAQS, and NAAQS) or PSD Class I area increments. The PSD demonstrations are for informational purposes only and do not constitute a regulatory PSD increment consumption analysis.

Table 4-14. Comparison of maximum existing background concentrations (Table 4-5) plus maximum estimated impacts at any Class I area due to any Project Alternative plus cumulative sources, with federal and state ambient air quality standards.

Pollutant / Averaging Time	Ambient Air Quality Standards ($\mu g/m^3$)				Estimated Impact ($\mu g/m^3$)		
	National	Wyoming	Colorado	Utah	Total	Bckgd[1]	Incmnt[2]
Nitrogen Dioxide (NO_2)							
Annual	100	100	100	100	**3.6**	3.4	0.19
PM_{10}							
24-hour	150	150	150	150	**53**	48	5.07
Annual	50	50	50	50	**27**	25	1.53
$PM_{2.5}$							
24-hour	65	65	--	65	**27**	22	5.07
Annual	15	15	--	15	**13**	11	1.53
Sulfur Dioxide (SO_2)							
3-hour	1,300	1,300	700[5]	1,300	**31**	29	1.53
24-hour	365	260	100[5]	365	**18**	18	0.03
Annual	80	60	15[5]	80	**5**	5	0.003

1 Maximum current background concentration in the region (Table 4-5)

2 Maximum Cumulative Emissions Plus Project increment concentration at any Class I area for any of the modeling years (occurs a Bridger Wilderness Area and for 2001)

4.6.1.2 Class II Area Far-Field Concentration Results

The maximum predicted concentrations of NO2, SO2, PM10, and PM2.5 at any receptor within each of the sensitive PSD Class II receptor areas for each modeled Project alternative are shown in Table 4-15 (a-c). The highest estimated concentration impacts at any Class II area and any Project alternative occur for Alternative C at the Bridger Butte area. No PSD Class II increment is exceeded at any Class II area for any of the three modeled scenarios.

Table 4-16 displays the maximum estimated PSD pollutant concentrations at any receptor within each of the Class II areas due to the various Project alternatives plus the cumulative emissions inventory and compares them to the PSD Class II increments and Proposed SIL. The highest estimated impacts due to the cumulative emissions plus any Project alternative occurs for the Bridger Butte Area and the cumulative plus Alternative C, with impacts as follows:

- Less than 1% of the PSD Class II increments for annual, 24-hour and 3-hour SO_2 concentrations;
- Less than 2% and 16% of the PSD Class II area increments for annual and 24-hour $PM_{10,}$ respectively; and
- Less than 2% of the PSD Class II area increment for annual $NO_{2.}$

With the addition of the cumulative emissions to the three Project scenario emissions, the proposed SIL are not exceeded for any site during the three year modeling period. These results show that the maximum air quality impacts from the Proposed Action or any of the alternatives, taken together with the cumulative emission inventory, would not exceed any PSD Class II increment at any Class II area.

In Table 4-17 (a-c), the maximum estimated PSD pollutant concentrations at any receptor within each of the Class II areas due to the various Project alternatives plus the cumulative emissions inventory without RFD sources are displayed and compared to the PSD Class II increments and Proposed SIL. As in the case in which the RFD was included in the cumulative emission inventory, the estimated air quality impacts due to any of the Project alternatives plus the cumulative emissions would not exceed any PSD Class II area increment at any Class II area, nor would they exceed the Proposed SIL. Comparison of Tables 4-16 and 4-17 shows that the impacts on Class II areas are slightly smaller when the effects of the RFD sources are removed.

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Table 4-15a. CALPUFF estimated PSD pollutant concentrations impacts at Class II areas for the Proposed Action.

Species and Averaging Time	Class II Area Thresholds		CALPUFF at Class II Areas								
	Proposed SIL ($\mu g/m^3$)	PSD Increment ($\mu g/m^3$)	Bridger Butte	Deep Lake	Dinosaur National	Gros Ventre Wilderness	Lazy Boy Lake	Roadless Area	Ross Lake	Saddlebag Lake	Upper Frozen Lake
2001											
SO_2 Annual	1	20.00	0.0075	0.0003	0.0006	0.0001	0.0001	0.0001	0.0001	0.0004	0.0003
SO_2 24-Hour*	5	91.00	0.1435	0.0025	0.0079	0.0023	0.0018	0.0017	0.0012	0.0054	0.0034
SO_2 3-Hour*	25	512.00	0.4591	0.0082	0.0262	0.0092	0.0088	0.0071	0.0062	0.0156	0.0100
PM_{10} Annual	1	17.00	0.1184	0.0058	0.0128	0.0027	0.0026	0.0029	0.0019	0.0085	0.0068
PM_{10} 24-Hour*	5	30.00	2.0556	0.0542	0.2261	0.0729	0.0580	0.0461	0.0410	0.1139	0.0695
NO_2 Annual	1	25.00	0.2790	0.0037	0.0127	0.0014	0.0012	0.0010	0.0006	0.0076	0.0051
2002											
SO_2 Annual	1	20.00	0.0048	0.0002	0.0006	0.0001	0.0001	0.0001	0.0001	0.0003	0.0002
SO_2 24-Hour*	5	91.00	0.0510	0.0027	0.0054	0.0021	0.0018	0.0011	0.0016	0.0049	0.0036
SO_2 3-Hour*	25	512.00	0.1963	0.0104	0.0180	0.0149	0.0059	0.0046	0.0052	0.0166	0.0123
PM_{10} Annual	1	17.00	0.0799	0.0047	0.0110	0.0018	0.0019	0.0027	0.0016	0.0062	0.0052
PM_{10} 24-Hour*	5	30.00	1.0053	0.0832	0.1381	0.0406	0.0386	0.0584	0.0329	0.0920	0.0848
NO_2 Annual	1	25.00	0.1716	0.0021	0.0146	0.0012	0.0009	0.0009	0.0007	0.0038	0.0027
2003											
SO_2 Annual	1	20.00	0.0042	0.0002	0.0006	0.0001	0.0001	0.0001	0.0001	0.0003	0.0002
SO_2 24-Hour*	5	91.00	0.0849	0.0018	0.0052	0.0015	0.0023	0.0010	0.0016	0.0029	0.0023
SO_2 3-Hour*	25	512.00	0.2366	0.0089	0.0173	0.0090	0.0088	0.0082	0.0060	0.0148	0.0103
PM_{10} Annual	1	17.00	0.0719	0.0037	0.0135	0.0020	0.0020	0.0020	0.0015	0.0053	0.0042
PM_{10} 24-Hour*	5	30.00	1.5269	0.0597	0.2157	0.0537	0.0533	0.0415	0.0398	0.0713	0.0686
NO_2 Annual	1	25.00	0.1517	0.0021	0.0130	0.0012	0.0013	0.0008	0.0008	0.0043	0.0029

* Highest second high at any monitor in the Class I area.

Table 4-15b. CALPUFF estimated PSD pollutant concentrations impacts at Class II areas for Alternative C.

Species and Averaging Time	Class II Area Thresholds		CALPUFF at Class II Areas								
	Pro-posed SIL (μg/m^3)	PSD Increment (μg/m^3)	Bridger Butte	Deep Lake	Dino-saur National	Gros Ventre Wilderness	Lazy Boy Lake	Roadless Area	Ross Lake	Saddle-bag Lake	Upper Frozen Lake
2001											
SO_2 Annual	1	20.00	0.0054	0.0002	0.0004	0.0001	0.0001	0.0001	0.0001	0.0004	0.0003
SO_2 24-Hour*	5	91.00	0.1002	0.0021	0.0055	0.0022	0.0015	0.0015	0.0010	0.0046	0.0029
SO_2 3-Hour*	25	512.00	0.3315	0.0067	0.0187	0.0081	0.0077	0.0059	0.0053	0.0136	0.0087
PM_{10} Annual	1	17.00	0.2593	0.0157	0.0286	0.0072	0.0071	0.0078	0.0052	0.0233	0.0185
PM_{10} 24-Hour*	5	30.00	4.6561	0.1462	0.4982	0.1834	0.1558	0.1111	0.0995	0.2895	0.1899
NO_2 Annual	1	25.00	0.4550	0.0075	0.0200	0.0030	0.0025	0.0020	0.0012	0.0156	0.0105
2002											
SO_2 Annual	1	20.00	0.0035	0.0002	0.0005	0.0001	0.0001	0.0001	0.0001	0.0002	0.0002
SO_2 24-Hour*	5	91.00	0.0365	0.0024	0.0044	0.0017	0.0015	0.0010	0.0013	0.0041	0.0031
SO_2 3-Hour*	25	512.00	0.1452	0.0095	0.0144	0.0135	0.0053	0.0044	0.0047	0.0138	0.0102
PM_{10} Annual	1	17.00	0.1764	0.0126	0.0261	0.0049	0.0050	0.0072	0.0043	0.0165	0.0139
PM_{10} 24-Hour*	5	30.00	2.0478	0.1854	0.3130	0.0981	0.0997	0.1349	0.0828	0.2150	0.1889
NO_2 Annual	1	25.00	0.2817	0.0042	0.0244	0.0024	0.0019	0.0019	0.0014	0.0077	0.0055
2003											
SO_2 Annual	1	20.00	0.0031	0.0002	0.0005	0.0001	0.0001	0.0001	0.0001	0.0002	0.0002
SO_2 24-Hour*	5	91.00	0.0614	0.0015	0.0041	0.0014	0.0020	0.0009	0.0014	0.0024	0.0020
SO_2 3-Hour*	25	512.00	0.1784	0.0075	0.0135	0.0080	0.0074	0.0067	0.0050	0.0124	0.0083
PM_{10} Annual	1	17.00	0.1559	0.0099	0.0307	0.0055	0.0056	0.0053	0.0041	0.0145	0.0115
PM_{10} 24-Hour*	5	30.00	3.2085	0.1437	0.4640	0.1466	0.1370	0.1035	0.1073	0.1717	0.1657
NO_2 Annual	1	25.00	0.2422	0.0042	0.0216	0.0025	0.0027	0.0016	0.0016	0.0086	0.0058

* Highest second high at any monitor in the Class I area.

Table 4-15c. CALPUFF estimated PSD pollutant concentrations impacts at Class II areas for the No Action Alternative.

Species and Averaging Time	Class II Area Thresholds		CALPUFF at Class II Areas								
	Proposed SIL (μg/m³)	PSD Increment (μg/m³)	Bridger Butte	Deep Lake	Dinosaur National	Gros Ventre Wilderness	Lazy Boy Lake	Roadless Area	Ross Lake	Saddlebag Lake	Upper Frozen Lake
2001											
SO_2 Annual	1	20.00	0.0015	0.0001	0.0001	0.0000	0.0000	0.0000	0.0000	0.0001	0.0001
SO_2 24-Hour*	5	91.00	0.0278	0.0007	0.0014	0.0007	0.0005	0.0005	0.0003	0.0014	0.0009
SO_2 3-Hour*	25	512.00	0.0841	0.0024	0.0048	0.0026	0.0021	0.0018	0.0017	0.0043	0.0029
PM_{10} Annual	1	17.00	0.0467	0.0025	0.0043	0.0011	0.0011	0.0012	0.0008	0.0037	0.0030
PM_{10} 24-Hour*	5	30.00	0.8113	0.0227	0.0654	0.0264	0.0219	0.0165	0.0152	0.0494	0.0317
NO_2 Annual	1	25.00	0.0607	0.0010	0.0026	0.0003	0.0003	0.0003	0.0001	0.0021	0.0014
2002											
SO_2 Annual	1	20.00	0.0010	0.0001	0.0001	0.0000	0.0000	0.0000	0.0000	0.0001	0.0001
SO_2 24-Hour*	5	91.00	0.0121	0.0008	0.0013	0.0006	0.0004	0.0003	0.0004	0.0013	0.0011
SO_2 3-Hour*	25	512.00	0.0388	0.0028	0.0040	0.0044	0.0019	0.0015	0.0016	0.0044	0.0037
PM_{10} Annual	1	17.00	0.0317	0.0019	0.0040	0.0007	0.0007	0.0010	0.0006	0.0025	0.0021
PM_{10} 24-Hour*	5	30.00	0.3667	0.0222	0.0404	0.0182	0.0135	0.0140	0.0121	0.0344	0.0291
NO_2 Annual	1	25.00	0.0386	0.0005	0.0030	0.0003	0.0002	0.0002	0.0002	0.0010	0.0007
2003											
SO_2 Annual	1	20.00	0.0008	0.0000	0.0001	0.0000	0.0000	0.0000	0.0000	0.0001	0.0001
SO_2 24-Hour*	5	91.00	0.0160	0.0004	0.0011	0.0005	0.0006	0.0003	0.0005	0.0007	0.0006
SO_2 3-Hour*	25	512.00	0.0434	0.0021	0.0039	0.0026	0.0023	0.0018	0.0016	0.0033	0.0026
PM_{10} Annual	1	17.00	0.0265	0.0015	0.0045	0.0009	0.0009	0.0008	0.0006	0.0023	0.0018
PM_{10} 24-Hour*	5	30.00	0.4959	0.0190	0.0577	0.0246	0.0272	0.0145	0.0164	0.0232	0.0220
NO_2 Annual	1	25.00	0.0314	0.0005	0.0027	0.0003	0.0003	0.0002	0.0002	0.0011	0.0007

Table 4-16a. CALPUFF estimated PSD pollutant concentrations impacts at Class II areas for the Proposed Action plus the cumulative emissions.

Species and Averaging Time	Class II Area Thresholds		CALPUFF at Class II Areas								
	Pro-posed SIL ($\mu g/m^3$)	PSD Incre-ment ($\mu g/m^3$)	Bridger Butte	Deep Lake	Dino-saur National	Gros Ventre Wild-erness	Lazy Boy Lake	Roadless Area	Ross Lake	Saddle-bag Lake	Upper Frozen Lake
2001											
SO_2 Annual	1	20.00	0.0100	0.0012	0.0021	0.0007	0.0006	0.0007	0.0005	0.0019	0.0014
SO_2 24-Hour*	5	91.00	0.1546	0.0105	0.0216	0.0097	0.0084	0.0087	0.0067	0.0129	0.0101
SO_2 3-Hour*	25	512.00	0.4725	0.0321	0.0709	0.0297	0.0219	0.0234	0.0234	0.0503	0.0329
PM_{10} Annual	1	17.00	0.1434	0.0347	0.0370	0.0316	0.0268	0.0233	0.0176	0.0453	0.0397
PM_{10} 24-Hour*	5	30.00	2.3484	0.2648	0.4382	0.5200	0.6078	0.2438	0.3903	0.2888	0.3335
NO_2 Annual	1	25.00	0.3507	0.0481	0.2145	0.0396	0.0570	0.0505	0.0204	0.0511	0.0545
2002											
SO_2 Annual	1	20.00	0.0078	0.0011	0.0032	0.0005	0.0005	0.0007	0.0004	0.0016	0.0012
SO_2 24-Hour*	5	91.00	0.1105	0.0137	0.0581	0.0157	0.0065	0.0110	0.0063	0.0153	0.0137
SO_2 3-Hour*	25	512.00	0.2537	0.0419	0.1607	0.0654	0.0246	0.0477	0.0266	0.0633	0.0541
PM_{10} Annual	1	17.00	0.1043	0.0344	0.0478	0.0179	0.0179	0.0227	0.0135	0.0428	0.0379
PM_{10} 24-Hour*	5	30.00	1.2158	0.3356	0.5054	0.2665	0.2418	0.3051	0.1923	0.4387	0.3759
NO_2 Annual	1	25.00	0.2378	0.0513	0.2980	0.0261	0.0525	0.0546	0.0202	0.0500	0.0564
2003											
SO_2 Annual	1	20.00	0.0070	0.0009	0.0026	0.0005	0.0004	0.0005	0.0004	0.0013	0.0010
SO_2 24-Hour*	5	91.00	0.1299	0.0080	0.0328	0.0086	0.0058	0.0061	0.0057	0.0126	0.0078
SO_2 3-Hour*	25	512.00	0.3474	0.0186	0.1105	0.0268	0.0177	0.0276	0.0142	0.0450	0.0210
PM_{10} Annual	1	17.00	0.0898	0.0280	0.0442	0.0214	0.0193	0.0183	0.0126	0.0357	0.0317
PM_{10} 24-Hour*	5	30.00	1.6411	0.2942	0.4360	0.3027	0.2799	0.2544	0.1748	0.4726	0.3509
NO_2 Annual	1	25.00	0.2091	0.0477	0.3357	0.0353	0.0528	0.0491	0.0192	0.0480	0.0535

Table 4-16b. CALPUFF estimated PSD pollutant concentrations impacts at Class II areas for Alternative C plus the cumulative emissions.

Species and Averaging Time	Class II Area Thresholds		CALPUFF at Class II Areas								
	Proposed SIL ($\mu g/m^3$)	PSD Increment ($\mu g/m^3$)	Bridger Butte	Deep Lake	Dinosaur National	Gros Ventre Wilderness	Lazy Boy Lake	Roadless Area	Ross Lake	Saddlebag Lake	Upper Frozen Lake
2001											
SO_2 Annual	1	20.00	0.0079	0.0012	0.0019	0.0007	0.0006	0.0007	0.0004	0.0018	0.0014
SO_2 24-Hour*	5	91.00	0.1113	0.0104	0.0214	0.0097	0.0083	0.0087	0.0066	0.0127	0.0100
SO_2 3-Hour*	25	512.00	0.3488	0.0314	0.0696	0.0297	0.0213	0.0230	0.0231	0.0503	0.0327
PM_{10} Annual	1	17.00	0.2842	0.0446	0.0529	0.0362	0.0313	0.0282	0.0209	0.0601	0.0515
PM_{10} 24-Hour*	5	30.00	4.8156	0.2781	0.6092	0.6060	0.6252	0.2462	0.4140	0.4118	0.3379
NO_2 Annual	1	25.00	0.5267	0.0519	0.2218	0.0412	0.0583	0.0515	0.0211	0.0591	0.0599
2002											
SO_2 Annual	1	20.00	0.0064	0.0011	0.0031	0.0005	0.0005	0.0007	0.0004	0.0015	0.0012
SO_2 24-Hour*	5	91.00	0.1032	0.0133	0.0567	0.0157	0.0064	0.0109	0.0061	0.0152	0.0134
SO_2 3-Hour*	25	512.00	0.2280	0.0403	0.1594	0.0654	0.0245	0.0474	0.0261	0.0619	0.0533
PM_{10} Annual	1	17.00	0.2008	0.0423	0.0629	0.0210	0.0210	0.0272	0.0162	0.0531	0.0466
PM_{10} 24-Hour*	5	30.00	2.2583	0.4099	0.6417	0.3020	0.3014	0.3560	0.2470	0.4782	0.4097
NO_2 Annual	1	25.00	0.3479	0.0534	0.3078	0.0273	0.0535	0.0555	0.0209	0.0539	0.0592
2003											
SO_2 Annual	1	20.00	0.0059	0.0008	0.0025	0.0005	0.0004	0.0005	0.0003	0.0013	0.0010
SO_2 24-Hour*	5	91.00	0.1077	0.0077	0.0318	0.0086	0.0054	0.0060	0.0057	0.0126	0.0077
SO_2 3-Hour*	25	512.00	0.2785	0.0178	0.1100	0.0254	0.0171	0.0246	0.0142	0.0433	0.0202
PM_{10} Annual	1	17.00	0.1738	0.0342	0.0614	0.0249	0.0228	0.0216	0.0151	0.0450	0.0390
PM_{10} 24-Hour*	5	30.00	3.3227	0.3275	0.6171	0.3605	0.3228	0.2552	0.1967	0.5241	0.3886
NO_2 Annual	1	25.00	0.2995	0.0498	0.3442	0.0367	0.0542	0.0499	0.0200	0.0524	0.0564

Table 4-16c. CALPUFF estimated PSD pollutant concentrations impacts at Class II areas for the No Action Alternative plus the cumulative emissions.

Species and Averaging Time	Class II Area Thresholds		CALPUFF at Class II Areas								
	Pro-posed SIL ($\mu g/m^3$)	PSD Incre-ment ($\mu g/m^3$)	Bridger Butte	Deep Lake	Dino-saur National	Gros Ventre Wilde	Lazy Boy Lake	Roadless Area	Ross Lake	Saddle-bag Lake	Upper Frozen Lake
2001											
SO_2 Annual	1	20.00	0.0041	0.0010	0.0016	0.0006	0.0005	0.0006	0.0004	0.0016	0.0012
SO_2 24-Hour*	5	91.00	0.0723	0.0101	0.0210	0.0097	0.0076	0.0085	0.0066	0.0120	0.0098
SO_2 3-Hour*	25	512.00	0.2161	0.0280	0.0665	0.0297	0.0201	0.0224	0.0187	0.0503	0.0309
PM_{10} Annual	1	17.00	0.0716	0.0314	0.0286	0.0300	0.0252	0.0216	0.0164	0.0405	0.0359
PM_{10} 24-Hour*	5	30.00	1.1062	0.2645	0.3322	0.5106	0.5717	0.2422	0.3597	0.2869	0.3329
NO_2 Annual	1	25.00	0.1324	0.0454	0.2044	0.0386	0.0562	0.0498	0.0200	0.0455	0.0508
2002											
SO_2 Annual	1	20.00	0.0040	0.0010	0.0028	0.0005	0.0004	0.0006	0.0004	0.0014	0.0011
SO_2 24-Hour*	5	91.00	0.0804	0.0124	0.0538	0.0157	0.0059	0.0092	0.0053	0.0144	0.0124
SO_2 3-Hour*	25	512.00	0.1552	0.0387	0.1576	0.0652	0.0241	0.0455	0.0234	0.0577	0.0511
PM_{10} Annual	1	17.00	0.0561	0.0316	0.0407	0.0168	0.0167	0.0210	0.0125	0.0391	0.0348
PM_{10} 24-Hour*	5	30.00	0.6204	0.3222	0.4277	0.2665	0.2232	0.2960	0.1661	0.4220	0.3624
NO_2 Annual	1	25.00	0.1049	0.0498	0.2864	0.0252	0.0519	0.0539	0.0197	0.0472	0.0544
2003											
SO_2 Annual	1	20.00	0.0037	0.0007	0.0021	0.0004	0.0004	0.0004	0.0003	0.0011	0.0008
SO_2 24-Hour*	5	91.00	0.0626	0.0067	0.0288	0.0080	0.0042	0.0058	0.0055	0.0124	0.0076
SO_2 3-Hour*	25	512.00	0.2129	0.0173	0.1084	0.0242	0.0148	0.0156	0.0142	0.0370	0.0174
PM_{10} Annual	1	17.00	0.0444	0.0259	0.0352	0.0203	0.0181	0.0171	0.0117	0.0327	0.0292
PM_{10} 24-Hour*	5	30.00	0.6282	0.2848	0.2777	0.2816	0.2770	0.2539	0.1747	0.4576	0.3400
NO_2 Annual	1	25.00	0.0887	0.0461	0.3253	0.0345	0.0519	0.0485	0.0186	0.0449	0.0513

Table 4-17a. CALPUFF estimated PSD pollutant concentrations impacts at Class II areas for the Proposed Action plus the cumulative emissions without RFD sources.

Species and Averaging Time	Class II Area Thresholds		CALPUFF at Class II Areas								
	Pro-posed SIL ($\mu g/m^3$)	PSD Incre-ment ($\mu g/m^3$)	Bridger Butte	Deep Lake	Dino-saur National	Gros Ventre Wilde	Lazy Boy Lake	Roadless Area	Ross Lake	Saddle-bag Lake	Upper Frozen Lake
2001											
SO_2 Annual	1	20.00	0.0095	0.0008	0.0018	0.0003	0.0003	0.0004	0.0003	0.0013	0.0009
SO_2 24-Hour*	5	91.00	0.1502	0.0095	0.0209	0.0062	0.0048	0.0077	0.0048	0.0127	0.0097
SO_2 3-Hour*	25	512.00	0.4630	0.0278	0.0668	0.0220	0.0150	0.0186	0.0135	0.0503	0.0315
PM_{10} Annual	1	17.00	0.1349	0.0207	0.0321	0.0169	0.0161	0.0150	0.0107	0.0253	0.0230
PM_{10} 24-Hour*	5	30.00	2.2094	0.1478	0.3950	0.2863	0.2816	0.1382	0.2075	0.1544	0.1614
NO_2 Annual	1	25.00	0.3450	0.0445	0.2127	0.0307	0.0540	0.0486	0.0190	0.0442	0.0496
2002											
SO_2 Annual	1	20.00	0.0071	0.0008	0.0029	0.0003	0.0003	0.0004	0.0003	0.0011	0.0008
SO_2 24-Hour*	5	91.00	0.1090	0.0116	0.0571	0.0110	0.0044	0.0083	0.0044	0.0136	0.0117
SO_2 3-Hour*	25	512.00	0.2434	0.0369	0.1604	0.0399	0.0121	0.0362	0.0101	0.0571	0.0490
PM_{10} Annual	1	17.00	0.0950	0.0222	0.0401	0.0096	0.0113	0.0152	0.0084	0.0261	0.0239
PM_{10} 24-Hour*	5	30.00	1.1317	0.2936	0.3998	0.1450	0.1856	0.2218	0.1572	0.3435	0.2952
NO_2 Annual	1	25.00	0.2329	0.0480	0.2954	0.0209	0.0500	0.0527	0.0185	0.0441	0.0522
2003											
SO_2 Annual	1	20.00	0.0064	0.0005	0.0024	0.0002	0.0002	0.0003	0.0002	0.0008	0.0006
SO_2 24-Hour*	5	91.00	0.1298	0.0075	0.0324	0.0048	0.0038	0.0054	0.0049	0.0121	0.0077
SO_2 3-Hour*	25	512.00	0.3473	0.0186	0.1092	0.0164	0.0127	0.0167	0.0130	0.0403	0.0210
PM_{10} Annual	1	17.00	0.0838	0.0161	0.0385	0.0109	0.0115	0.0113	0.0073	0.0194	0.0178
PM_{10} 24-Hour*	5	30.00	1.6337	0.1745	0.3660	0.1570	0.1655	0.1574	0.0938	0.2578	0.2054
NO_2 Annual	1	25.00	0.2056	0.0437	0.3332	0.0270	0.0502	0.0477	0.0178	0.0412	0.0482

Table 4-17b. CALPUFF estimated PSD pollutant concentrations impacts at Class II areas for Alternative C plus the cumulative emissions without RFD sources.

Species and Averaging Time	Class II Area Thresholds		CALPUFF at Class II Areas								
	Pro-posed SIL ($\mu g/m^3$)	PSD Increment ($\mu g/m^3$)	Bridger Butte	Deep Lake	Dino-saur National	Gros Ventre Wilder-ness	Lazy Boy Lake	Roadless Area	Ross Lake	Saddle-bag Lake	Upper Frozen Lake
2001											
SO_2 Annual	1	20.00	0.0074	0.0008	0.0016	0.0003	0.0003	0.0004	0.0003	0.0012	0.0009
SO_2 24-Hour*	5	91.00	0.1077	0.0094	0.0208	0.0060	0.0047	0.0077	0.0048	0.0125	0.0097
SO_2 3-Hour*	25	512.00	0.3394	0.0276	0.0649	0.0217	0.0149	0.0180	0.0126	0.0503	0.0309
PM_{10} Annual	1	17.00	0.2757	0.0306	0.0480	0.0214	0.0206	0.0199	0.0140	0.0401	0.0347
PM_{10} 24-Hour*	5	30.00	4.8099	0.1928	0.5947	0.3594	0.2886	0.1885	0.2133	0.3149	0.2394
NO_2 Annual	1	25.00	0.5210	0.0483	0.2200	0.0323	0.0553	0.0496	0.0196	0.0522	0.0550
2002											
SO_2 Annual	1	20.00	0.0058	0.0007	0.0028	0.0003	0.0003	0.0004	0.0003	0.0011	0.0008
SO_2 24-Hour*	5	91.00	0.1017	0.0113	0.0557	0.0110	0.0043	0.0082	0.0044	0.0134	0.0114
SO_2 3-Hour*	25	512.00	0.2216	0.0364	0.1591	0.0399	0.0121	0.0359	0.0100	0.0557	0.0482
PM_{10} Annual	1	17.00	0.1915	0.0300	0.0551	0.0127	0.0144	0.0197	0.0111	0.0364	0.0326
PM_{10} 24-Hour*	5	30.00	2.1741	0.3481	0.5843	0.2023	0.2452	0.2984	0.2119	0.3703	0.3482
NO_2 Annual	1	25.00	0.3430	0.0501	0.3052	0.0221	0.0510	0.0536	0.0192	0.0480	0.0550
2003											
SO_2 Annual	1	20.00	0.0052	0.0005	0.0022	0.0002	0.0002	0.0003	0.0002	0.0008	0.0006
SO_2 24-Hour*	5	91.00	0.1076	0.0073	0.0314	0.0048	0.0038	0.0054	0.0049	0.0121	0.0077
SO_2 3-Hour*	25	512.00	0.2784	0.0178	0.1087	0.0162	0.0126	0.0137	0.0127	0.0386	0.0201
PM_{10} Annual	1	17.00	0.1678	0.0223	0.0557	0.0144	0.0150	0.0146	0.0099	0.0286	0.0250
PM_{10} 24-Hour*	5	30.00	3.3153	0.2373	0.5905	0.2323	0.1894	0.1639	0.1556	0.3092	0.2572
NO_2 Annual	1	25.00	0.2960	0.0458	0.3417	0.0283	0.0516	0.0485	0.0186	0.0456	0.0511

Table 4-17c. CALPUFF estimated PSD pollutant concentrations impacts at Class II areas for the No Action Alternative plus the cumulative emissions without RFD sources.

Species and Averaging Time	Class II Area Thresholds		CALPUFF at Class II Areas								
	Pro-posed SIL (μg/m^3)	PSD Increment (μg/m^3)	Bridger Butte	Deep Lake	Dino-saur National	Gros Ventre Wilder-ness	Lazy Boy Lake	Roadless Area	Ross Lake	Saddle-bag Lake	Upper Frozen Lake
2001											
SO_2 Annual	1	20.00	0.0035	0.0006	0.0013	0.0003	0.0003	0.0004	0.0002	0.0010	0.0007
SO_2 24-Hour*	5	91.00	0.0636	0.0090	0.0202	0.0059	0.0043	0.0075	0.0046	0.0118	0.0094
SO_2 3-Hour*	25	512.00	0.2157	0.0270	0.0606	0.0213	0.0148	0.0159	0.0116	0.0495	0.0304
PM_{10} Annual	1	17.00	0.0631	0.0174	0.0237	0.0153	0.0145	0.0133	0.0095	0.0205	0.0192
PM_{10} 24-Hour*	5	30.00	0.9817	0.1380	0.2755	0.2769	0.2762	0.1366	0.1920	0.1425	0.1543
NO_2 Annual	1	25.00	0.1267	0.0418	0.2026	0.0296	0.0531	0.0479	0.0186	0.0386	0.0459
2002											
SO_2 Annual	1	20.00	0.0033	0.0006	0.0024	0.0002	0.0002	0.0004	0.0002	0.0009	0.0007
SO_2 24-Hour*	5	91.00	0.0786	0.0103	0.0528	0.0100	0.0040	0.0075	0.0041	0.0123	0.0104
SO_2 3-Hour*	25	512.00	0.1549	0.0348	0.1573	0.0397	0.0117	0.0340	0.0092	0.0515	0.0460
PM_{10} Annual	1	17.00	0.0467	0.0193	0.0330	0.0085	0.0102	0.0135	0.0074	0.0224	0.0208
PM_{10} 24-Hour*	5	30.00	0.4866	0.2812	0.2978	0.1327	0.1572	0.1948	0.1303	0.2789	0.2566
NO_2 Annual	1	25.00	0.1000	0.0465	0.2838	0.0201	0.0493	0.0520	0.0180	0.0413	0.0502
2003											
SO_2 Annual	1	20.00	0.0030	0.0004	0.0019	0.0002	0.0002	0.0002	0.0001	0.0006	0.0005
SO_2 24-Hour*	5	91.00	0.0625	0.0064	0.0284	0.0045	0.0036	0.0051	0.0047	0.0119	0.0075
SO_2 3-Hour*	25	512.00	0.2122	0.0164	0.1071	0.0146	0.0125	0.0117	0.0117	0.0351	0.0173
PM_{10} Annual	1	17.00	0.0384	0.0140	0.0296	0.0098	0.0103	0.0101	0.0065	0.0164	0.0153
PM_{10} 24-Hour*	5	30.00	0.5673	0.1651	0.2637	0.1497	0.1629	0.1570	0.0936	0.2428	0.1946
NO_2 Annual	1	25.00	0.0852	0.0421	0.3229	0.0261	0.0492	0.0471	0.0172	0.0381	0.0461

Table 4-18. Comparison of maximum existing background concentrations (Table 4-5) plus maximum estimated impacts at any Class II area from Project Alternatives plus cumulative sources with federal and state ambient air quality standards.

Pollutant / Averaging Time	Ambient Air Quality Standards (μg/m³)				Estimated Impact (μg/m³)		
	National	Wyoming	Colorado	Utah	Total	Bckgd[1]	Incmnt[2]
Nitrogen Dioxide (NO_2)							
Annual	100	100	100	100	**8.2**	3.4	4.8
PM_{10}							
24-hour	150	150	150	150	**56**	48	7.8
Annual	50	50	50	50	**27**	25	1.8
$PM_{2.5}$							
24-hour	65	65	--	65	**23**	15	7.8
Annual	15	15	--	15	**6.8**	5	1.8
Sulfur Dioxide (SO_2)							
3-hour	1,300	1,300	700[5]	1,300	**30**	29	0.73
24-hour	365	260	100[5]	365	**18**	18	0.23
Annual	80	60	15[5]	80	**5**	5	0.065

3 Maximum current background concentration in the region (Table 4-5)
4 Maximum Cumulative Emissions Plus Project increment concentration at any Class I area for any of the modeling years (occurs at Moxa Class II Area and for 2002)

The CALPUFF-estimated maximum concentration increment due to any alternative with the cumulative emissions at any Class II area were combined with the existing maximum background concentrations (see Table 4-5) in the region to obtain a Total estimated concentrations that is compared against the NAAQS, WAAQS, UAAQS, and CAAQS in Table 4-18. The maximum CALPUFF-estimate impact due to any Project Alternative plus the cumulative sources always occurs at the Bridger Butte Class II Area and always occurs for Alternative C. Table 4-18 clearly shows that when the Project plus the cumulative source impacts at any Class II area are added to the maximum background concentrations to obtain a total concentration, federal or state ambient air quality standards would not be exceeded.

In summary, the modeling results indicate that, for the Proposed Action, Alternative C, and No Action, neither direct Project impacts nor Project impacts taken together with cumulative source impacts would exceed any air quality standards (WAAQS, UAAQS, CAAQS, and NAAQS) or PSD Class II area increments. The PSD demonstrations are for informational purposes only and do not constitute a regulatory PSD increment consumption analysis.

4.6.2 Sulfur and Nitrogen Deposition

Maximum predicted sulfur and nitrogen deposition impacts were estimated for each Project alternative and cumulative source scenarios. The POSTUTIL utility was used to estimate total S and N fluxes from CALPUFF predicted wet and dry fluxes of SO2, SO4, NOx, NO3, and HNO3. Note that the nitrogen associated with ammonium (NH_4) that is assumed to be bound to SO_4 and NO_3 was also included in the nitrogen deposition. CALPOST was then used to summarize the annual sulfur and nitrogen deposition values from the POSTUTIL program. The maximum total annual sulfur and nitrogen deposition at any receptor in each Class I and Class II area was reported. Predicted direct project impacts were compared to the NPS Deposition Analysis Thresholds (DATs) for total nitrogen and sulfur deposition in the western U.S., which are defined as 0.005 kg/ha-yr for both nitrogen and sulfur. Total deposition impacts from project alternatives, regional sources, and background values were also compared to Forest Service levels of concern, defined as 5 kg/ha-yr for sulfur and 3 kg/ha-yr for nitrogen (Fox et al. 1989). It is understood that the Forest Service no longer considers these levels to be protective; however, in the absence of alternative FLM-approved values, comparisons with these values were made. The maximum predicted total annual nitrogen and sulfur deposition impacts at Class I areas for the different Project alternatives are given in Table 4-19, whereas the maximum total annual nitorgen and sulfur deposition due to the project alternatives combined with the cumulative emissions are provided in Table 4-20. Modeling results for the Project and the Proposed Action and No Action alternatives indicate that there is no direct Project total nitrogen or sulfur deposition impacts above the NPS western DAT (0.005 kg/ha/yr) at any Class I area. For Alternative C, the maximum nitrogen deposition at the Bridger Class I area just barely exceeds (0.006-0.007 kg/ha/yr) the NPS DAT (0.005 kg/ha/yr) for the three years of modeling (Table 4-19b), but is below the DATs at other Class I areas.

For the project alternatives plus the cumulative emissions, the estimated sulfur deposition is below the NPS DAT for all three years of modeling at all Class I areas. The total nitrogen deposition at several of the Class I areas and years exceeds the NPS DAT due to the project alternatives combined with cumulative emissions. The maximum estimated annual nitrogen at any Class I area for the Project plus cumulative emissions occurs at the Bridger Class I area for 2001 with values of 0.031, 0.034, and 0.029 kg/ha/yr estimated for the Proposed Action, Alternative C, and No Action alternatives (combined with Cumulative Emissions). Although these maximum nitrogen deposition impacts are above the NPS DAT, they are approximately a factor of 100 lower than the Forest Service 3.0 kg/ha/yr level of concern.

When RFD emissions are removed from the cumulative inventory (Table 4-21), the sulfur deposition remains below the NPS DAT for all years and all Class I areas. The total nitrogen deposition at the Bridger, Fitzpatrick, and Mount Zirkel Class I areas exceeds the NPS DAT for all years and all three scenarios. Maximum estimated annual nitrogen (0.0286 kg/ha/yr) occurs at Bridger during 2001 for Alternative C. All maximum nitrogen deposition values are approximately a factor of 100 lower than the Forest Service 3.0 kg/ha/yr level of concern.

Table 4-19a. Maximum Nitrogen and Sulfur deposition (kg/ha/yr) in the Bridger, Fitzpatrick, Grand Teton, Mount Zirkel, Teton, and Washakie Class I areas for three year CALPUFF modeling for the Proposed Action.

Total Deposition	Nitrogen	Sulfur
FS Threshold	***3.000***	***3.000***
NPS DAT	***0.005***	***0.005***
Bridger		
2001	0.003323	0.000182
2002	0.002946	0.000159
2003	0.002731	0.000158
Fitzpatrick		
2001	0.001457	0.000088
2002	0.001497	0.000077
2003	0.001350	0.000081
Grand Teton		
2001	0.000992	0.000058
2002	0.001019	0.000054
2003	0.000832	0.000051
Mount Zirkel		
2001	0.002068	0.000130
2002	0.001840	0.000107
2003	0.002646	0.000155
Teton		
2001	0.001324	0.000067
2002	0.000931	0.000051
2003	0.001229	0.000083
Washakie		
2001	0.001373	0.000070
2002	0.000956	0.000054
2003	0.001431	0.000094

Table 4-19b. Maximum Nitrogen and Sulfur deposition (kg/ha/yr) in the Bridger, Fitzpatrick, Grand Teton, Mount Zirkel, Teton, and Washakie Class I areas for three year CALPUFF modeling for Alternative C.

Total Deposition	N	S
FS Threshold	*3.000*	*3.000*
NPS DAT	*0.005*	*0.005*
Bridger		
2001	0.006745	0.000158
2002	0.005914	0.000138
2003	0.005531	0.000138
Fitzpatrick		
2001	0.002941	0.000077
2002	0.003000	0.000068
2003	0.002754	0.000069
Grand Teton		
2001	0.001998	0.000051
2002	0.002037	0.000047
2003	0.001652	0.000043
Mount Zirkel		
2001	0.003983	0.000108
2002	0.003505	0.000087
2003	0.004985	0.000127
Teton		
2001	0.002668	0.000059
2002	0.001824	0.000044
2003	0.002469	0.000072
Washakie		
2001	0.002775	0.000061
2002	0.001888	0.000048
2003	0.002883	0.000081

Table 4-19c. Maximum Nitrogen and Sulfur deposition (kg/ha/yr) in the Bridger, Fitzpatrick, Grand Teton, Mount Zirkel, Teton, and Washakie Class I areas for three year CALPUFF modeling for the No Action alternative.

Total Deposition	N	S
FS Threshold	*3.000*	*3.000*
NPS DAT	*0.005*	*0.005*
Bridger		
2001	0.000886	0.000050
2002	0.000775	0.000044
2003	0.000716	0.000043
Fitzpatrick		
2001	0.000379	0.000024
2002	0.000375	0.000021
2003	0.000353	0.000022
Grand Teton		
2001	0.000250	0.000016
2002	0.000259	0.000015
2003	0.000218	0.000013
Mount Zirkel		
2001	0.000477	0.000031
2002	0.000429	0.000025
2003	0.000616	0.000037
Teton		
2001	0.000336	0.000018
2002	0.000243	0.000014
2003	0.000328	0.000023
Washakie		
2001	0.000351	0.000019
2002	0.000255	0.000015
2003	0.000388	0.000026

Table 4-20a. Maximum Nitrogen and Sulfur deposition (kg/ha/yr) in the Bridger, Fitzpatrick, Grand Teton, Mount Zirkel, Teton, and Washakie Class I areas for three year CALPUFF modeling for the Proposed Action and Cumulative Emissions.

Total Deposition	N	S
FS Threshold	*3.000*	*5.000*
NPS DAT	*0.005*	*0.005*
Bridger		
2001	0.030590	0.000905
2002	0.028162	0.000876
2003	0.029676	0.000762
Fitzpatrick		
2001	0.016638	0.000398
2002	0.018862	0.000442
2003	0.016587	0.000383
Grand Teton		
2001	0.005481	0.000249
2002	0.005434	0.000252
2003	0.005085	0.000233
Mount Zirkel		
2001	0.013974	0.001357
2002	0.014172	0.001367
2003	0.017248	0.001758
Teton		
2001	0.006530	0.000350
2002	0.004609	0.000233
2003	0.005073	0.000277
Washakie		
2001	0.006298	0.000358
2002	0.005085	0.000247
2003	0.005877	0.000299

Table 4-20b. Maximum Nitrogen and Sulfur deposition (kg/ha/yr) in the Bridger, Fitzpatrick, Grand Teton, Mount Zirkel, Teton, and Washakie Class I areas for three year CALPUFF modeling for Alternative C and Cumulative Emissions.

Total Deposition	N	S
FS Threshold	*3.000*	*5.000*
NPS DAT	*0.005*	*0.005*
Bridger		
2001	0.033630	0.000881
2002	0.030816	0.000854
2003	0.032293	0.000742
Fitzpatrick		
2001	0.018122	0.000387
2002	0.020363	0.000432
2003	0.017991	0.000374
Grand Teton		
2001	0.006471	0.000242
2002	0.006447	0.000245
2003	0.005847	0.000227
Mount Zirkel		
2001	0.015889	0.001335
2002	0.015815	0.001348
2003	0.019587	0.001730
Teton		
2001	0.007746	0.000342
2002	0.005501	0.000226
2003	0.006258	0.000266
Washakie		
2001	0.007681	0.000349
2002	0.006017	0.000240
2003	0.007329	0.000286

Table 4-20c. Maximum Nitrogen and Sulfur deposition (kg/ha/yr) in the Bridger, Fitzpatrick, Grand Teton, Mount Zirkel, Teton, and Washakie Class I areas for three year CALPUFF modeling for the No Action alternative and Cumulative Emissions.

Total Deposition	N	S
FS Threshold	***3.000***	***5.000***
NPS DAT	***0.005***	***0.005***
Bridger		
2001	0.028638	0.000773
2002	0.026251	0.000762
2003	0.027780	0.000647
Fitzpatrick		
2001	0.015561	0.000335
2002	0.017746	0.000386
2003	0.015590	0.000331
Grand Teton		
2001	0.004748	0.000207
2002	0.004676	0.000214
2003	0.004568	0.000204
Mount Zirkel		
2001	0.012382	0.001259
2002	0.012775	0.001286
2003	0.015218	0.001640
Teton		
2001	0.005634	0.000301
2002	0.003920	0.000196
2003	0.004223	0.000220
Washakie		
2001	0.005298	0.000307
2002	0.004384	0.000208
2003	0.004834	0.000231

Table 4-21a. Maximum Nitrogen and Sulfur deposition (kg/ha/yr) in the Bridger, Fitzpatrick, Grand Teton, Mount Zirkel, Teton, and Washakie Class I areas for three year CALPUFF modeling for the Proposed Action and Cumulative Emissions with no RFD sources.

Total Deposition	N	S
FS Threshold	***3.000***	***3.000***
NPS DAT	***0.005***	***0.005***
BRID		
2001	2.59E-02	5.65E-04
2002	2.40E-02	6.00E-04
2003	2.47E-02	4.43E-04
FITZ		
2001	1.48E-02	2.57E-04
2002	1.65E-02	2.75E-04
2003	1.47E-02	2.22E-04
GRTE		
2001	4.18E-03	1.59E-04
2002	4.19E-03	1.61E-04
2003	3.74E-03	1.55E-04
MOZE		
2001	1.18E-02	9.80E-04
2002	1.19E-02	1.01E-03
2003	1.44E-02	1.27E-03
TETO		
2001	5.00E-03	2.44E-04
2002	3.67E-03	1.51E-04
2003	3.91E-03	1.80E-04
WASH		
2001	4.91E-03	2.52E-04
2002	4.02E-03	1.72E-04
2003	4.48E-03	1.90E-04

Table 4-21b. Maximum Nitrogen and Sulfur deposition (kg/ha/yr) in the Bridger, Fitzpatrick, Grand Teton, Mount Zirkel, Teton, and Washakie Class I areas for three year CALPUFF modeling for Alternative C and Cumulative Emissions with no RFD sources.

Total Deposition	N	S
FS Threshold	***3.000***	***3.000***
NPS DAT	***0.005***	***0.005***
BRID		
2001	2.86E-02	5.43E-04
2002	2.66E-02	5.78E-04
2003	2.73E-02	4.23E-04
FITZ		
2001	1.63E-02	2.46E-04
2002	1.80E-02	2.66E-04
2003	1.61E-02	2.13E-04
GRTE		
2001	5.17E-03	1.52E-04
2002	5.20E-03	1.54E-04
2003	4.50E-03	1.48E-04
MOZE		
2001	1.37E-02	9.58E-04
2002	1.36E-02	9.95E-04
2003	1.67E-02	1.24E-03
TETO		
2001	6.23E-03	2.35E-04
2002	4.56E-03	1.44E-04
2003	5.09E-03	1.69E-04
WASH		
2001	6.29E-03	2.43E-04
2002	4.95E-03	1.66E-04
2003	5.93E-03	1.77E-04

Table 4-21c. Maximum Nitrogen and Sulfur deposition (kg/ha/yr) in the Bridger, Fitzpatrick, Grand Teton, Mount Zirkel, Teton, and Washakie Class I areas for three year CALPUFF modeling for the No Action alternative and Cumulative Emissions with no RFD sources.

Total Deposition	N	S
FS Threshold	***3.000***	***3.000***
NPS DAT	***0.005***	***0.005***
BRID		
2001	2.39E-02	4.44E-04
2002	2.21E-02	4.86E-04
2003	2.28E-02	3.35E-04
FITZ		
2001	1.37E-02	1.93E-04
2002	1.54E-02	2.20E-04
2003	1.37E-02	1.70E-04
GRTE		
2001	3.45E-03	1.17E-04
2002	3.44E-03	1.21E-04
2003	3.30E-03	1.18E-04
MOZE		
2001	1.02E-02	8.83E-04
2002	1.05E-02	9.33E-04
2003	1.24E-02	1.15E-03
TETO		
2001	4.10E-03	1.95E-04
2002	2.98E-03	1.14E-04
2003	3.06E-03	1.23E-04
WASH		
2001	3.91E-03	2.01E-04
2002	3.32E-03	1.34E-04
2003	3.43E-03	1.22E-04

The maximum predicted total annual nitrogen and sulfur deposition impacts at Class II areas for the different Project alternatives are given in Tables 4-22 a-c. For the Proposed Action alone, the estimated sulfur deposition is below the NPS DAT for all Class II areas (Note that the NPS DATs were developed for Class I areas, their competitions against deposition in Class II areas are provided as information only.). The estimated nitrogen deposition exceeds the NPS DAT for the Bridger Butte and Dinosaur National Monument Areas, with the deposition at Bridger Butte reaching a maximum value of 0.0329 kg/ha/yr, or approximately 1% of the Forest Service 3.0 kg/ha/yr level of concern. In Alternative C, the NPS DAT is exceeded for nitrogen at Bridger Butte, Dinosaur National Monument, and Lower Saddlebag Lake, but deposition levels remain below the Forest Service 3.0 kg/ha/yr level of concern. For the No Action alternative, the NPS DAT is exceeded only at Bridger Butte during 2001.

For the Project alternatives plus the cumulative emissions (Table 4-23 a-c), the estimated sulfur deposition is below the NPS DAT for all sites and all years. The total nitrogen deposition at all Class II areas and all modeling years due to all the Project alternatives combined with Cumulative Emissions exceeds the NPS DAT. The maximum estimated annual nitrogen at any Class II area occurs for the project alternatives plus cumulative emissions at the Dinosaur National Monument Class II area for 2003 with values of 0.0745 kg/ha/yr, 0.0782 kg/ha/yr, and 0.0704 kg/ha/yr estimated for the Proposed Action, Alternative C, and No Action alternatives (combined with Cumulative Emissions). These values correspond to approximately 3% of the Forest Service 3.0 kg/ha/yr level of concern.

When RFD sources are removed from the Cumulative Emissions inventory (Table 4-24), the estimated sulfur deposition remains below the NPS DAT. For nitrogen, the NPS DAT are exceeded for all sites and all years for the Proposed Action and Alternative C, and for all sites except Gros Ventre Wilderness for the No Action alternative. As in the previous case, the maximum values for all three years occur at the Dinosaur National Monument (0.0734 kg/ha/yr, 0.0770 kg/ha/yr, and 0.0692 kg/ha/yr for the Proposed Action, Alternative C, and No Action alternatives, respectively). The Forest Service 3.0 kg/ha/yr level of concern is not exceeded for any project alternative plus cumulative emissions, less the RFD sources for nitrogen or sulfur.

Table 4-22a . Maximum Nitrogen and Sulfur deposition (kg/ha/yr) in the Class II areas for three year CALPUFF modeling for the Proposed Action.

Total Deposition	N	S
FS Threshold	***3.000***	***3.000***
NPS DAT	***0.005***	***0.005***
BRB		
2001	3.29E-02	1.40E-03
2002	2.17E-02	9.76E-04
2003	2.09E-02	8.80E-04
DEE		
2001	1.99E-03	1.23E-04
2002	2.32E-03	1.30E-04
2003	1.81E-03	1.15E-04
DIN		
2001	4.62E-03	2.81E-04
2002	4.88E-03	2.55E-04
2003	5.23E-03	2.74E-04
GEO		
2001	1.35E-03	6.84E-05
2002	1.16E-03	6.15E-05
2003	1.09E-03	6.13E-05
LAZ		
2001	1.10E-03	6.33E-05
2002	1.20E-03	6.27E-05
2003	1.15E-03	6.66E-05
ROA		
2001	1.24E-03	8.21E-05
2002	1.40E-03	7.44E-05
2003	1.06E-03	6.30E-05
ROS		
2001	8.98E-04	5.46E-05
2002	1.08E-03	5.64E-05
2003	1.04E-03	6.62E-05
SAD		
2001	2.71E-03	1.54E-04
2002	2.74E-03	1.54E-04
2003	2.29E-03	1.40E-04
UPP		
2001	2.24E-03	1.34E-04
2002	2.45E-03	1.37E-04
2003	2.00E-03	1.24E-04

Table 4-22b. Maximum Nitrogen and Sulfur deposition (kg/ha/yr) in the Class II areas for three year CALPUFF modeling for Alternative C.

Total Deposition	N	S
FS Threshold	***3.000***	***3.000***
NPS DAT	***0.005***	***0.005***
BRB		
2001	5.35E-02	1.01E-03
2002	3.56E-02	7.00E-04
2003	3.40E-02	6.47E-04
DEE		
2001	3.98E-03	1.05E-04
2002	4.65E-03	1.14E-04
2003	3.65E-03	9.91E-05
DIN		
2001	7.71E-03	2.06E-04
2002	8.41E-03	1.91E-04
2003	8.86E-03	2.02E-04
GEO		
2001	2.75E-03	6.00E-05
2002	2.33E-03	5.34E-05
2003	2.26E-03	5.37E-05
LAZ		
2001	2.23E-03	5.50E-05
2002	2.41E-03	5.45E-05
2003	2.35E-03	5.74E-05
ROA		
2001	2.48E-03	7.11E-05
2002	2.81E-03	6.52E-05
2003	2.17E-03	5.51E-05
ROS		
2001	1.81E-03	4.73E-05
2002	2.16E-03	4.90E-05
2003	2.10E-03	5.66E-05
SAD		
2001	5.47E-03	1.33E-04
2002	5.49E-03	1.32E-04
2003	4.62E-03	1.21E-04
UPP		
2001	4.50E-03	1.15E-04
2002	4.92E-03	1.19E-04
2003	4.02E-03	1.08E-04

Table 4-22c. Maximum Nitrogen and Sulfur deposition (kg/ha/yr) in the Class II areas for three year CALPUFF modeling for the No Action alternative.

Total Deposition	N	S
FS Threshold	***3.000***	***3.000***
NPS DAT	***0.005***	***0.005***
BRB		
2001	7.18E-03	2.89E-04
2002	4.90E-03	2.10E-04
2003	4.36E-03	1.79E-04
DEE		
2001	5.12E-04	3.30E-05
2002	6.03E-04	3.69E-05
2003	4.66E-04	3.12E-05
DIN		
2001	9.92E-04	6.00E-05
2002	1.04E-03	5.53E-05
2003	1.09E-03	5.86E-05
GEO		
2001	3.48E-04	1.91E-05
2002	3.05E-04	1.67E-05
2003	3.03E-04	1.73E-05
LAZ		
2001	2.91E-04	1.74E-05
2002	3.14E-04	1.71E-05
2003	3.03E-04	1.79E-05
ROA		
2001	3.18E-04	2.20E-05
2002	3.48E-04	2.06E-05
2003	2.83E-04	1.74E-05
ROS		
2001	2.37E-04	1.48E-05
2002	2.80E-04	1.54E-05
2003	2.77E-04	1.76E-05
SAD		
2001	7.07E-04	4.20E-05
2002	7.12E-04	4.22E-05
2003	5.93E-04	3.78E-05
UPP		
2001	5.80E-04	3.63E-05
2002	6.39E-04	3.87E-05
2003	5.13E-04	3.37E-05

Table 4-23a. Maximum Nitrogen and Sulfur deposition (kg/ha/yr) in the Class II areas for 3-year CALPUFF modeling for the Proposed Action and Cumulative Emissions.

Total Deposition	N	S
FS Threshold	*3.000*	*3.000*
NPS DAT	*0.005*	*0.005*
BRB		
2001	4.37E-02	2.04E-03
2002	3.30E-02	1.92E-03
2003	3.13E-02	1.67E-03
DEE		
2001	1.30E-02	6.11E-04
2002	1.53E-02	6.60E-04
2003	1.29E-02	5.38E-04
DIN		
2001	5.05E-02	9.02E-04
2002	6.48E-02	1.30E-03
2003	7.45E-02	1.26E-03
GEO		
2001	1.32E-02	3.78E-04
2002	1.02E-02	3.45E-04
2003	1.14E-02	3.35E-04
LAZ		
2001	1.15E-02	3.34E-04
2002	1.20E-02	3.24E-04
2003	1.07E-02	2.97E-04
ROA		
2001	1.08E-02	3.87E-04
2002	1.33E-02	4.47E-04
2003	1.07E-02	3.65E-04
ROS		
2001	6.84E-03	3.00E-04
2002	8.18E-03	2.97E-04
2003	6.45E-03	2.72E-04
SAD		
2001	1.61E-02	8.16E-04
2002	1.77E-02	8.58E-04
2003	1.53E-02	6.81E-04
UPP		
2001	1.44E-02	6.64E-04
2002	1.64E-02	7.00E-04
2003	1.42E-02	5.78E-04

Table 4-23b. Maximum Nitrogen and Sulfur deposition (kg/ha/yr) in the Class II areas for 3-year CALPUFF modeling for Alternative C and Cumulative Emissions.

Total Deposition	N	S
FS Threshold	*3.000*	*3.000*
NPS DAT	*0.005*	*0.005*
BRB	6.43E-02	1.64E-03
2001	4.69E-02	1.64E-03
2002	4.44E-02	1.43E-03
2003		
DEE	1.49E-02	5.93E-04
2001	1.77E-02	6.43E-04
2002	1.48E-02	5.23E-04
2003		
DIN	5.36E-02	8.27E-04
2001	6.84E-02	1.23E-03
2002	7.82E-02	1.18E-03
2003		
GEO	1.46E-02	3.69E-04
2001	1.14E-02	3.37E-04
2002	1.26E-02	3.28E-04
2003		
LAZ	1.26E-02	3.26E-04
2001	1.32E-02	3.16E-04
2002	1.19E-02	2.88E-04
2003		
2003		
ROA	1.20E-02	3.76E-04
2001	1.47E-02	4.38E-04
2002	1.18E-02	3.57E-04
2003		
ROS	7.76E-03	2.92E-04
2001	9.26E-03	2.89E-04
2002	7.51E-03	2.62E-04
2003		
SAD	1.89E-02	7.95E-04
2001	2.05E-02	8.37E-04
2002	1.77E-02	6.63E-04
2003		
UPP	1.66E-02	6.45E-04
2001	1.89E-02	6.83E-04
2002	1.63E-02	5.61E-04
2003	6.43E-02	1.64E-03

Table 4-23c. Maximum Nitrogen and Sulfur deposition (kg/ha/yr) in the Class II areas for three year CALPUFF modeling for the No Action alternative and Cumulative Emissions.

Total Deposition	N	S
FS Threshold	***3.000***	***3.000***
NPS DAT	***0.005***	***0.005***
BRB		
2001	1.79E-02	9.27E-04
2002	1.61E-02	1.15E-03
2003	1.47E-02	9.64E-04
DEE		
2001	1.15E-02	5.21E-04
2002	1.36E-02	5.66E-04
2003	1.16E-02	4.55E-04
DIN		
2001	4.68E-02	6.81E-04
2002	6.10E-02	1.10E-03
2003	7.04E-02	1.04E-03
GEO		
2001	1.22E-02	3.28E-04
2002	9.37E-03	3.01E-04
2003	1.06E-02	2.91E-04
LAZ		
2001	1.07E-02	2.88E-04
2002	1.11E-02	2.79E-04
2003	9.89E-03	2.48E-04
ROA		
2001	9.87E-03	3.27E-04
2002	1.23E-02	3.93E-04
2003	9.95E-03	3.20E-04
ROS		
2001	6.18E-03	2.60E-04
2002	7.38E-03	2.56E-04
2003	5.69E-03	2.23E-04
SAD		
2001	1.41E-02	7.04E-04
2002	1.57E-02	7.47E-04
2003	1.36E-02	5.80E-04
UPP		
2001	1.27E-02	5.66E-04
2002	1.46E-02	6.02E-04
2003	1.28E-02	4.87E-04

Table 4-24a. Maximum Nitrogen and Sulfur deposition (kg/ha/yr) in the Class II areas for three year CALPUFF modeling for the Proposed Action and Cumulative Emissions with no RFD.

Total Deposition	N	S
FS Threshold	***3.000***	***3.000***
NPS DAT	***0.005***	***0.005***
BRB		
2001	4.27E-02	1.91E-03
2002	3.18E-02	1.77E-03
2003	3.02E-02	1.47E-03
DEE		
2001	1.08E-02	4.19E-04
2002	1.29E-02	4.61E-04
2003	1.06E-02	3.40E-04
DIN		
2001	4.96E-02	7.78E-04
2002	6.37E-02	1.16E-03
2003	7.34E-02	1.13E-03
GEO		
2001	9.86E-03	1.98E-04
2002	7.90E-03	2.05E-04
2003	8.44E-03	1.85E-04
LAZ		
2001	9.85E-03	2.02E-04
2002	1.02E-02	2.01E-04
2003	9.10E-03	1.70E-04
ROA		
2001	9.51E-03	2.75E-04
2002	1.12E-02	2.80E-04
2003	9.22E-03	2.25E-04
ROS		
2001	5.67E-03	2.01E-04
2002	6.67E-03	1.88E-04
2003	5.21E-03	1.69E-04
SAD		
2001	1.28E-02	5.46E-04
2002	1.44E-02	6.02E-04
2003	1.23E-02	4.38E-04
UPP		
2001	1.18E-02	4.47E-04
2002	1.37E-02	4.85E-04
2003	1.16E-02	3.59E-04

Table 4-24b. Maximum Nitrogen and Sulfur deposition (kg/ha/yr) in the Class II areas for three year CALPUFF modeling for Alternative C and Cumulative Emissions with no RFD.

Total Deposition	N	S
FS Threshold	***3.000***	***3.000***
NPS DAT	***0.005***	***0.005***
BRB		
2001	6.33E-02	1.52E-03
2002	4.57E-02	1.49E-03
2003	4.34E-02	1.23E-03
DEE		
2001	1.28E-02	4.02E-04
2002	1.52E-02	4.45E-04
2003	1.24E-02	3.24E-04
DIN		
2001	5.27E-02	7.03E-04
2002	6.72E-02	1.10E-03
2003	7.70E-02	1.06E-03
GEO		
2001	1.13E-02	1.89E-04
2002	9.07E-03	1.97E-04
2003	9.61E-03	1.77E-04
LAZ		
2001	1.10E-02	1.94E-04
2002	1.14E-02	1.93E-04
2003	1.03E-02	1.61E-04
ROA		
2001	1.07E-02	2.64E-04
2002	1.26E-02	2.71E-04
2003	1.03E-02	2.17E-04
ROS		
2001	6.58E-03	1.94E-04
2002	7.75E-03	1.81E-04
2003	6.27E-03	1.59E-04
SAD		
2001	1.56E-02	5.25E-04
2002	1.71E-02	5.80E-04
2003	1.46E-02	4.19E-04
UPP		
2001	1.41E-02	4.29E-04
2002	1.61E-02	4.67E-04
2003	1.36E-02	3.42E-04

Table 4-24c. Maximum Nitrogen and Sulfur deposition (kg/ha/yr) in the Class II areas for three year CALPUFF modeling for the No Action alternative and Cumulative Emissions with no RFD.

Total Deposition	**N**	**S**
FS Threshold	***3.000***	***3.000***
NPS DAT	***0.005***	***0.005***
BRB		
2001	1.69E-02	8.05E-04
2002	1.50E-02	1.00E-03
2003	1.37E-02	7.65E-04
DEE		
2001	9.32E-03	3.30E-04
2002	1.12E-02	3.68E-04
2003	9.25E-03	2.56E-04
DIN		
2001	4.60E-02	5.57E-04
2002	5.99E-02	9.63E-04
2003	6.92E-02	9.11E-04
GEO		
2001	8.86E-03	1.48E-04
2002	7.04E-03	1.61E-04
2003	7.65E-03	1.40E-04
LAZ		
2001	9.04E-03	1.56E-04
2002	9.33E-03	1.55E-04
2003	8.26E-03	1.21E-04
ROA		
2001	8.59E-03	2.15E-04
2002	1.02E-02	2.26E-04
2003	8.44E-03	1.79E-04
ROS		
2001	5.00E-03	1.61E-04
2002	5.87E-03	1.47E-04
2003	4.45E-03	1.20E-04
SAD		
2001	1.08E-02	4.34E-04
2002	1.24E-02	4.90E-04
2003	1.06E-02	3.36E-04
UPP		
2001	1.02E-02	3.50E-04
2002	1.19E-02	3.87E-04
2003	1.01E-02	2.68E-04

4.6.3 Acid Neutralizing Capacity Calculations for Sensitive Lakes

The CALPUFF-estimated annual deposition fluxes of sulfur and nitrogen at sensitive lake receptors were used to estimate the change in ANC. The change in ANC was calculated following the January 2000, USDA Forest Service Rocky Mountain Region's *Screening Methodology for Calculating ANC Change to High Elevation Lakes, User's Guide* (USDA Forest Service 2000). The predicted changes in ANC are compared with the USDA Forest Service's Level of Acceptable Change (LAC) thresholds of 10% for lakes with ANC values greater than 25 microequivalents per liter (μeq/l) and 1 μeq/l for lakes with background ANC values of 25 μeq/l or less. Of the lakes in the study area identified by the USDA Forest Service as acid sensitive, Upper Frozen and Lazy Boy lakes are considered extremely acid sensitive as they have ANC values of les than 25 μeq/l (6 μeq/l and 10.8 μeq/l, respectively, see Table 4-9). However, at the time of the writing of this preliminary draft AQTSD we did not have the Watershed Area for the Lazy Boy lake so could not perform the ANC calculations for that one lake. These calculations will be updated in subsequent drafts of this AQTSD.

ANC calculations were performed for each of the Project alternatives plus cumulative emissions, with the results presented in Tables 4-25 a-c. For the five sensitive lakes that start with 10% ANC values above 25 μeq/l, for which a change in ANC above 10% is a concern, the maximum changes in ANC are estimated to range from 0.4% to 1.4% so the deposition impacts from direct Project and cumulative emissions would not contribute significantly to an increase in acidification at any of the five sensitive lakes with starting 10% ANC > 25 μeq/l. The Upper Frozen and Lazy Boy lakes are the only lakes starting with 10% ANC < 25 μeq/l for which a change in ANC greater than 1 μeq/l may be a cause for concern. The estimated change in ANC at these two lakes range from 0.14 to 0.61 μeq/l for the project alternatives plus cumulative emission scenarios. Thus the Project's Proposed Action, Alternative C, or No Action alternatives plus the cumulative emissions are estimated to have no adverse impact on lake acidity at any lake in the region.

Table 4-25a. Lake Acid Neutralizing Capacity (ANC) calculations for the Proposed Action plus cumulative emissions.

Lake	10% ANC (ueq/l)	Sample Size	Anu Avg Precip(in)	Ds(kg/ha/yr)	Dn(kg/ha/yr)	ANC(o)(eq)	Hdep(eq)	% ANC change	ANC change in ueq/l
Black Joe	67.1	67	9.3	0.000599	0.015094	94515.709	992.837	1.050	0.472249
Deep	59.7	64	9.3	0.000628	0.015917	19369.556	241.120	1.245	0.497923
Hobbs	69.9	71	9.3	0.000435	0.019802	32414.271	422.400	1.303	0.610295
Lazy Boy	10.8	3	9.3	0.000299	0.008625	3418.576	126.951	3.714	0.268713
Upper Frozen	6.0	8	9.3	0.000679	0.017249	615.344	82.589	13.422	0.539551
Ross	53.7	49	10	0.000290	0.007330	407127.570	2413.327	0.593	0.213272
Lower Saddlebag	55.2	48	30	0.000781	0.016483	43681.802	190.057	0.435	0.160915

Table 4-25b. Lake Acid Neutralizing Capacity (ANC) calculations for Alternative C plus cumulative emissions.

Lake	10% ANC (ueq/l)	Sample Size	Anu Avg Precip(in)	Ds(kg/ha/yr)	Dn(kg/ha/yr)	ANC(o)(eq)	Hdep(eq)	% ANC change	ANC change in ueq/l
Black Joe	67.1	67	9.3	0.000582	0.017198	94515.709	1125.690	1.191	0.535442
Deep	59.7	64	9.3	0.000611	0.018132	19369.556	273.326	1.411	0.564430
Hobbs	69.9	71	9.3	0.000425	0.021408	32414.271	455.822	1.406	0.658584
Lazy Boy	10.8	3	9.3	0.000291	0.009708	1111.037	46.252	4.163	0.301233
Upper Frozen	6	8	9.3	0.000661	0.019650	615.344	93.626	15.215	0.611652
Ross	53.7	49	10	0.000282	0.008347	407127.570	2734.519	0.672	0.241657
Lower Saddlebag	55.2	48	30	0.000760	0.019095	43681.802	218.780	0.501	0.185234

Table 4-25c. Lake Acid Neutralizing Capacity (ANC) calculations for the No Action plus cumulative emissions.

Lake	10% ANC (ueq/l)	Sample Size	Anu Avg Precip(in)	Ds(kg/ha/yr)	Dn(kg/ha/yr)	ANC(o)(eq)	Hdep(eq)	% ANC change	ANC change in ueq/l
Black Joe	67.1	67	9.3	0.000509	0.013547	94515.709	889.533	0.941	0.423112
Deep	59.7	64	9.3	0.000534	0.014293	19369.556	216.129	1.116	0.446316
Hobbs	69.9	71	9.3	0.000376	0.018650	32414.271	397.206	1.225	0.573894
Lazy Boy	10.8	3	9.3	0.000255	0.007841	1111.037	37.441	3.370	0.243849
Upper Frozen	6	8	9.3	0.000579	0.015492	615.344	74.051	12.034	0.483770
Ross	53.7	49	10	0.000247	0.006592	407127.570	2166.498	0.532	0.191459
Lower Saddlebag	55.2	48	30	0.000672	0.014570	43681.802	167.821	0.384	0.142089

4.6.4 Visibility

The CALPUFF model-predicted concentration impacts at far-field PSD Class I receptors were post-processed with CALPOST to estimate potential impacts to visibility (regional haze) for each analyzed alternative and cumulative sources for comparison to visibility impact thresholds. CALPOST estimated visibility impacts from predicted concentrations of PMC, PMF, SO4, and NO3 using the original IMPROVE reconstructed mass extinction equation (Malm, et al., 2000) as recommended by FLAG (2000) and EPA (2003a,b).

Change in atmospheric light extinction relative to background conditions is used to measure regional haze. Analysis thresholds for atmospheric light extinction are set forth in FLAG (2000) report results as a percent change in light extinction over Natural Background Conditions. The thresholds of concern are defined as 5% and 10% changes over the reference background visibility for projects sources alone and cumulative source impacts, respectively. Visibility impacts have also been expressed as a change in dv over Natural Background where a 1.0 and 0.5 change in dv is essentially numerically equivalent to a 10% and 5% change in extinction over Natural Background. The BLM considers a 1.0 dv change as a significant adverse impact; however, there are no applicable local, state, tribal, or federal regulatory visibility standards. Note that a 10% change in extinction and a 1.0 change in dv over natural conditions are almost equivalent metrics.

4.6.4.1 Visibility Assessment Methods

As discussed in Section 4.5.2, several visibility assessment methods were used to analyze the potential visibility impacts due to the Project alone for its various alternatives and the Project plus the cumulative emissions. These methods differ on what background Natural Conditions are used (FLAG, IMPROVE, or EPA Default) and whether hourly (MVISBK=2) or monthly (MVISBK=6) relative humidity adjustment factors [f(RH)] are used. The methods analyzed were as follows:

Method 1 -- FLAG Monthly f(RH) and FLAG Seasonal Natural Conditions: Method 1 uses the FLAG (2000) default monthly average f(RH) factors that are built into CALPOST (MVISBK=6) and the FLAG seasonal background conditions listed in Table 4-6.

Method 2 – FLAG Monthly f(RH) and IMPROVE Natural Conditions: Method 2 uses the same FLAG default monthly average f(RH) values but for Natural Conditions uses data from the IMPROVE sites and the Best 20% days from the 2000-2004 5-year baseline.

Method 3a – FLAG Monthly f(RH) and EPA Default Annual Natural Conditions: Method 3a uses the same f(RH) as in Methods 1 and 2 only is using the EPA Default Annual Average Natural Conditions (EPA, 2003b).

Method 3b – FLAG Monthly f(RH) and EPA Default Annual Natural Conditions: Method 3b uses the same f(RH) as in Methods 1 and 2 only is using the EPA Default Best 20% Days Natural Conditions (EPA, 2003b).

Method 4 -- FLAG Hourly f(RH) and FLAG Seasonal Natural Conditions: Method 4 uses the FLAG (2000) hourly average f(RH) factors that are built into CALPOST (MVISBK=2) and the FLAG seasonal background conditions listed in Table 4-6.

4.6.4.2 Visibility Impacts on Class I Areas due to the Project Alternatives Alone

Table 4-26 (a-e) lists the CALPUFF-estimated visibility impacts at the Class I areas due to the various Project alternatives using the five calculation methods described above. The BLM considers a 1.0

change in dv (approximately a 10% change in extinction) to be an adverse impact. Only the No Action alternative has all of its visibility impacts below the 0.5 dv and 1.0 dv change significance thresholds at all Class I Areas. For both the Proposed Action and Alternative C, there are days with estimated changes in extinction above both the 0.5 dv and 1.0 dv change visibility thresholds of concern using the various methods. The largest visibility impacts are estimated to occur at the Bridger Class I area. For example, using Method 3a to estimate the visibility impacts for the Proposed Action and Alternative C, the 1 dv visibility threshold is estimated to be exceeded at Bridger for 2 and 13 days, respectively, for the three years of modeling; the 0.5 dv visibility threshold is estimated to be exceeded at Bridger for 9 and 43 days. The Proposed Action alternative estimates between 1 and 3 days across 3 years at Bridger (0.09% to 0.3% of the time) exceed the 1.0 dv threshold using the 4 methods. Similar results for Alternative C range from 2 to 23 days (0.2% to 2.0% of the time). Across the 2001-2003 period, between 1 and 10 days exceed the 0.5 dv threshold at Bridger using various methods for the Proposed Action. For Alternative C, the 0.5 dv threshold is exceeded between 7 and 39 days across all years at Bridger. The largest visibility impacts are estimated using Method 3b that compares the change in extinction against the EPA default Natural Conditions for the best 20% days.

Proposed New FLAG guidance is reported to be adopting the 98th percentile visibility impact, which would be the 8th highest value in a year and the 22nd highest value in 3 years. None of the Project alternatives have a 98th percentile visibility impact greater than 1.0 dv at any Class I area across all 3 years of modeling.

Table 4-26a. CALPUFF-estimated visibility impacts on Class I areas for the various Project alternatives along using Method 1 -- FLAG Monthly f(RH) with FLAG Seasonal Background.

	Proposed Action			**Alternative C**			**Alternative A - No Action**		
	#Days ≥ 0.5 dv	**# Days ≥ 1.0 dv**	**Max (dv)**	**#Days ≥ 0.5 dv**	**# Days ≥ 1.0 dv**	**Max (dv)**	**#Days ≥ 0.5 dv**	**# Days ≥ 1.0 dv**	**Max (dv)**
BRID									
2001	3	1	1.028	18	5	2.096	0	0	0.309
2002	1	1	1.098	5	1	2.186	0	0	0.256
2003	1	0	0.65	9	2	1.253	0	0	0.216
FITZ									
2001	0	0	0.42	3	0	0.871	0	0	0.114
2002	1	0	0.751	1	1	1.457	0	0	0.16
2003	0	0	0.334	2	0	0.67	0	0	0.097
GRTE									
2001	0	0	0.282	1	0	0.579	0	0	0.082
2002	0	0	0.162	0	0	0.336	0	0	0.047
2003	0	0	0.154	0	0	0.31	0	0	0.043
MOZI									
2001	0	0	0.253	1	0	0.515	0	0	0.088
2002	0	0	0.286	1	0	0.553	0	0	0.06
2003	0	0	0.231	0	0	0.454	0	0	0.053
TETO									
2001	0	0	0.194	0	0	0.393	0	0	0.047
2002	0	0	0.12	0	0	0.236	0	0	0.04
2003	0	0	0.097	0	0	0.21	0	0	0.029
WASH									
2001	0	0	0.144	0	0	0.288	0	0	0.037
2002	0	0	0.19	0	0	0.409	0	0	0.093
2003	0	0	0.135	0	0	0.298	0	0	0.043

Table 4-26b. CALPUFF-estimated visibility impacts on Class I areas for the various Project alternatives along using Method 2 -- FLAG Monthly f(RH) with IMPROVE Seasonal Background.

	Proposed Action			**Alternative C**			**Alternative A - No Action**		
	#Days ≥ 0.5∈dv	**# Days ≥ 1.0∈dv**	**Max (dv)**	**#Days ≥ 0.5dv**	**# Days ≥ 1.0dv**	**Max (dv)**	**#Days ≥ 0.5dv**	**# Days ≥ 1.0∈dv**	**Max (dv)**
BRID									
2001	1	0	0.706	14	1	1.463	0	0	0.21
2002	1	1	1.217	4	1	2.408	0	0	0.284
2003	0	0	0.444	8	0	0.864	0	0	0.146
FITZ									
2001	0	0	0.286	1	0	0.597	0	0	0.077
2002	1	0	0.833	1	1	1.611	0	0	0.178
2003	0	0	0.227	0	0	0.457	0	0	0.065
GRTE									
2001	0	0	0.272	1	0	0.559	0	0	0.079
2002	0	0	0.156	0	0	0.315	0	0	0.042
2003	0	0	0.123	0	0	0.254	0	0	0.034
MOZI									
2001	0	0	0.287	2	0	0.582	0	0	0.099
2002	0	0	0.222	0	0	0.415	0	0	0.043
2003	0	0	0.253	0	0	0.467	0	0	0.059
TETO									
2001	0	0	0.187	0	0	0.379	0	0	0.045
2002	0	0	0.118	0	0	0.231	0	0	0.039
2003	0	0	0.083	0	0	0.189	0	0	0.028
WASH									
2001	0	0	0.159	0	0	0.317	0	0	0.04
2002	0	0	0.207	0	0	0.446	0	0	0.101
2003	0	0	0.149	0	0	0.329	0	0	0.047

Table 4-26c. CALPUFF-estimated visibility impacts on Class I areas for the various Project alternatives along using Method 3a -- FLAG Monthly f(RH) with EPA Default Annual Natural Conditions.

	Proposed Action			Alternative C			Alternative A - No Action		
	#Days ≥ 0.5 dv	# Days ≥ 1.0 dv	Max (dv)	#Days ≥ 0.5 dv	# Days ≥ 1.0 dv	Max (dv)	#Days ≥ 0.5 dv	# Days ≥ 1.0 dv	Max (dv)
BRID									
2001	6	1	1.219	24	7	2.464	0	0	0.369
2002	1	1	1.313	7	2	2.589	0	0	0.308
2003	2	0	0.774	12	4	1.484	0	0	0.258
FITZ									
2001	1	0	0.501	4	1	1.034	0	0	0.137
2002	1	0	0.9	2	1	1.734	0	0	0.193
2003	0	0	0.398	2	0	0.796	0	0	0.116
GRTE									
2001	0	0	0.336	1	0	0.689	0	0	0.099
2002	0	0	0.194	0	0	0.39	0	0	0.054
2003	0	0	0.188	0	0	0.376	0	0	0.052
MOZI									
2001	0	0	0.294	2	0	0.597	0	0	0.102
2002	0	0	0.326	1	0	0.629	0	0	0.069
2003	0	0	0.266	1	0	0.521	0	0	0.061
TETO									
2001	0	0	0.232	0	0	0.468	0	0	0.056
2002	0	0	0.141	0	0	0.277	0	0	0.049
2003	0	0	0.115	0	0	0.251	0	0	0.034
WASH									
2001	0	0	0.171	0	0	0.341	0	0	0.045
2002	0	0	0.229	0	0	0.491	0	0	0.112
2003	0	0	0.16	0	0	0.353	0	0	0.051

Table 4-26d. CALPUFF-estimated visibility impacts on Class I areas for the various Project alternatives along using Method 3b -- FLAG Monthly f(RH) with EPA Default Best 20% days Natural Conditions.

	Proposed Action			Alternative C			Alternative A – No Action		
	#Days ≥ 0.5 dv	# Days ≥ 1.0 dv	Max (dv)	#Days ≥ 0.5 dv	# Days ≥ 1.0 dv	Max (dv)	#Days ≥ 0.5 dv	# Days ≥ 1.0 dv	Max (dv)
BRID									
2001	10	1	1.548	39	13	3.08	0	0	0.474
2002	3	1	1.665	11	2	3.231	0	0	0.396
2003	6	0	0.988	17	6	1.877	0	0	0.332
FITZ									
2001	1	0	0.642	5	1	1.316	0	0	0.176
2002	1	1	1.148	3	1	2.188	0	0	0.249
2003	1	0	0.512	3	2	1.017	0	0	0.149
GRTE									
2001	0	0	0.432	3	0	0.882	0	0	0.127
2002	0	0	0.25	2	0	0.501	0	0	0.07
2003	0	0	0.242	0	0	0.484	0	0	0.067
MOZI									
2001	0	0	0.378	2	0	0.764	0	0	0.131
2002	0	0	0.419	2	0	0.804	0	0	0.089
2003	0	0	0.342	3	0	0.668	0	0	0.078
TETO									
2001	0	0	0.298	1	0	0.6	0	0	0.073
2002	0	0	0.182	0	0	0.356	0	0	0.063
2003	0	0	0.149	0	0	0.323	0	0	0.044
WASH									
2001	0	0	0.22	0	0	0.438	0	0	0.058
2002	0	0	0.294	1	0	0.63	0	0	0.144
2003	0	0	0.206	0	0	0.453	0	0	0.065

Table 4-26e. CALPUFF-estimated visibility impacts on Class I areas for the various Project alternatives along using Method 4 -- FLAG Hourly f(RH) with FLAG Seasonal Background.

	Proposed Action			**Alternative C**			**Alternative A – No Action**		
	#Days ≥ 0.5 dv	**# Days ≥ 1.0 dv**	**Max (dv)**	**#Days ≥ 0.5 dv**	**# Days ≥ 1.0 dv**	**Max (dv)**	**#Days ≥ 0.5 dv**	**# Days ≥ 1.0 dv**	**Max (dv)**
BRID									
2001	2	0	0.845	17	3	1.757	0	0	0.255
2002	2	1	1.345	5	2	2.624	0	0	0.317
2003	1	0	0.609	10	1	1.276	0	0	0.192
FITZ									
2001	0	0	0.369	3	0	0.838	0	0	0.121
2002	1	0	0.939	2	1	1.781	0	0	0.196
2003	0	0	0.364	2	0	0.772	0	0	0.106
GRTE									
2001	0	0	0.399	1	0	0.806	0	0	0.113
2002	0	0	0.153	0	0	0.316	0	0	0.041
2003	0	0	0.164	0	0	0.35	0	0	0.053
MOZI									
2001	0	0	0.432	2	0	0.811	0	0	0.088
2002	1	0	0.581	3	1	1.087	0	0	0.121
2003	0	0	0.414	1	0	0.795	0	0	0.093
TETO									
2001	0	0	0.251	1	0	0.503	0	0	0.06
2002	0	0	0.124	0	0	0.254	0	0	0.038
2003	0	0	0.122	0	0	0.245	0	0	0.034
WASH									
2001	0	0	0.176	0	0	0.349	0	0	0.047
2002	0	0	0.137	0	0	0.277	0	0	0.055
2003	0	0	0.126	0	0	0.275	0	0	0.039

4.6.4.3 Visibility Impacts on Class I Areas due to the Cumulative Emissions plus the Project Alternatives

Table 4-27 (a-e) lists the visibility impacts for the cumulative emissions plus the proposed Project for the various Project alternatives. As noted for the case above when only the Project emissions were considered, the largest impacts occur at the Bridger Wilderness Areas. With the Cumulative Emissions added to the project emissions, all of the Project alternatives produce days that exceed the 1.0 dv threshold using all methods. For example, using Method 1, the 1.0 change in dv threshold is estimated to be exceeded for 94 days, 106 days, and 89 days for the cumulative emissions plus Proposed Action, Alternative C, and No Action alternative at the Bridger Wilderness Areas, which represents 9%, 10% and 8% of the days during the 3 years of modeling. Using Method 3b, the 1.0 change in dv threshold is estimated to be exceeded for 145 days, 162 days, and 140 days for the cumulative emissions plus Proposed Action, Alternative C, and No Action alternative at the Bridger Wilderness Areas, representing 13%, 15% and 13% of the days during the 2001-2003.

Table 4-27a. CALPUFF-estimated visibility impacts on Class I areas for the Cumulative Emissions plus the various Project alternatives along using Method 1 -- FLAG Monthly f(RH) with FLAG Seasonal Background.

	Proposed Action			**Alternative C**			**Alternative A - No Action**		
	#Days ≥ 0.5 dv	**# Days ≥ 1.0 dv**	**Max (dv)**	**#Days ≥ 0.5 dv**	**# Days ≥ 1.0 dv**	**Max (dv)**	**#Days ≥ 0.5 dv**	**# Days ≥ 1.0 dv**	**Max (dv)**
BRID									
2001	78	45	3.912	87	50	4.183	74	42	3.787
2002	57	22	2.548	60	24	3.432	51	22	2.004
2003	48	27	3.989	54	32	4.135	46	25	3.952
FITZ									
2001	29	8	1.915	33	11	2.193	27	8	1.841
2002	13	3	2.329	18	3	2.825	12	3	2.031
2003	23	7	1.821	26	7	1.84	19	7	1.803
GRTE									
2001	12	4	1.706	16	4	1.726	12	4	1.686
2002	5	1	1.147	8	1	1.205	4	1	1.113
2003	4	0	0.671	6	0	0.731	3	0	0.669
MOZI									
2001	5	0	0.791	8	0	0.994	4	0	0.646
2002	11	1	1.402	19	1	1.641	7	1	1.201
2003	6	0	0.91	9	0	0.994	5	0	0.839
TETO									
2001	9	2	1.279	9	3	1.295	8	2	1.262
2002	2	1	1.037	3	1	1.085	2	1	1
2003	0	0	0.439	2	0	0.54	0	0	0.39
WASH									
2001	5	0	0.903	6	0	0.917	5	0	0.888
2002	2	1	1.047	3	1	1.097	1	1	1.007
2003	1	0	0.561	2	0	0.614	1	0	0.53

Table 4-27b. CALPUFF-estimated visibility impacts on Class I areas for the Cumulative Emissions plus the various Project alternatives along using Method 2 -- FLAG Monthly f(RH) with IMPROVE Seasonal Background.

	Proposed Action			**Alternative C**			**Alternative A**		
	#Days ≥ 0.5 dv	**# Days ≥ 1.0dv**	**Max (dv)**	**#Days ≥ 0.5dv**	**# Days ≥ 1.0dv**	**Max (dv)**	**#Days ≥ 0.5dv**	**# Days ≥ 1.0∈dv**	**Max (dv)**
BRID									
2001	74	39	4.148	82	45	4.281	71	37	4.142
2002	48	18	2.803	54	20	3.76	44	17	2.21
2003	47	24	4.359	51	26	4.516	45	22	4.299
FITZ									
2001	23	5	2.067	27	6	2.086	23	4	2.047
2002	10	2	2.564	13	3	3.103	7	2	2.104
2003	20	7	1.666	23	7	1.67	20	7	1.664
GRTE									
2001	9	3	1.648	12	3	1.668	9	3	1.629
2002	3	0	0.853	5	0	0.897	2	0	0.827
2003	2	0	0.649	3	0	0.721	1	0	0.602
MOZI									
2001	4	0	0.893	7	2	1.12	3	0	0.684
2002	7	1	1.018	14	1	1.195	6	0	0.869
2003	6	1	1.026	12	1	1.12	4	0	0.946
TETO									
2001	6	1	1.235	8	2	1.25	5	1	1.218
2002	2	0	0.745	2	0	0.78	2	0	0.719
2003	0	0	0.423	1	0	0.521	0	0	0.371
WASH									
2001	5	0	0.991	6	1	1.006	4	0	0.975
2002	2	0	0.807	2	0	0.846	1	0	0.776
2003	0	0	0.44	1	0	0.6	0	0	0.404

Table 4-27c. CALPUFF-estimated visibility impacts on Class I Areas for the Cumulative Emissions plus the various Project alternatives along using Method 3a -- FLAG Monthly f(RH) with EPA Default Annual Natural Conditions.

	Proposed Action			Alternative C			Alternative A		
	#Days ≥ 0.5 dv	# Days ≥ 1.0 dv	Max (dv)	#Days ≥ 0.5 dv	# Days ≥ 1.0 dv	Max (dv)	#Days ≥ 0.5 dv	# Days ≥ 1.0 dv	Max (dv)
BRID									
2001	86	53	4.533	94	59	4.837	82	49	4.427
2002	62	29	3.009	67	32	4.023	58	28	2.377
2003	55	37	4.655	62	37	4.821	53	32	4.592
FITZ									
2001	34	12	2.252	40	14	2.573	32	11	2.147
2002	19	4	2.751	21	4	3.324	17	4	2.386
2003	29	9	2.142	31	12	2.165	27	9	2.122
GRTE									
2001	14	6	2.01	19	6	2.033	14	6	1.987
2002	9	1	1.309	12	1	1.375	7	1	1.27
2003	4	0	0.768	9	0	0.844	4	0	0.766
MOZI									
2001	7	0	0.915	14	2	1.147	6	0	0.748
2002	17	1	1.585	22	1	1.852	11	1	1.359
2003	9	1	1.051	17	2	1.147	7	0	0.97
TETO									
2001	9	3	1.512	10	3	1.531	9	2	1.492
2002	4	1	1.228	6	1	1.284	3	1	1.185
2003	2	0	0.523	3	0	0.643	0	0	0.47
WASH									
2001	6	2	1.061	7	2	1.078	6	2	1.044
2002	3	1	1.24	3	1	1.299	2	1	1.194
2003	1	0	0.674	3	0	0.737	1	0	0.637

Table 4-27d. CALPUFF-estimated visibility impacts on Class I areas for the Cumulative Emissions plus various Project alternatives along using Method 3b - FLAG Monthly f(RH) with EPA Default Best 20% days Natural Conditions.

	Proposed Action			Alternative C			Alternative A		
	#Days ≥ 0.5 dv	**# Days ≥ 1.0 dv**	**Max (dv)**	**#Days ≥ 0.5 dv**	**# Days ≥ 1.0 dv**	**Max (dv)**	**#Days ≥ 0.5 dv**	**# Days ≥ 1.0 dv**	**Max (dv)**
BRID									
2001	101	66	5.541	109	72	5.895	96	64	5.416
2002	79	38	3.737	85	46	4.943	72	36	2.974
2003	69	41	5.683	81	44	5.876	66	40	5.61
FITZ									
2001	48	18	2.823	54	24	3.213	41	18	2.695
2002	25	7	3.429	29	9	4.116	22	7	2.986
2003	34	14	2.689	35	17	2.717	30	12	2.665
GRTE									
2001	24	9	2.527	27	10	2.555	20	7	2.498
2002	12	2	1.66	15	3	1.742	9	2	1.612
2003	10	0	0.981	14	1	1.078	8	0	0.978
MOZI									
2001	19	2	1.166	24	3	1.458	12	0	0.955
2002	23	2	2.002	30	5	2.332	21	1	1.721
2003	20	4	1.337	24	4	1.457	12	1	1.235
TETO									
2001	12	5	1.913	16	6	1.936	11	5	1.888
2002	8	2	1.56	10	2	1.63	5	2	1.506
2003	6	0	0.67	8	0	0.823	6	0	0.602
WASH									
2001	10	4	1.351	11	4	1.371	6	3	1.329
2002	6	1	1.575	7	2	1.648	5	1	1.517
2003	6	0	0.862	8	0	0.942	4	0	0.815

Table 4-27e. CALPUFF-estimated visibility impacts on Class I areas for the Cumulative Emissions plus the various Project alternatives along using Method 4 -- FLAG Hourly f(RH) with FLAG Seasonal Background.

	Proposed Action			Alternative C			Alternative A		
	#Days ≥ 0.5 dv	# Days ≥ 1.0 dv	Max (dv)	#Days ≥ 0.5 dv	# Days ≥ 1.0 dv	Max (dv)	#Days ≥ 0.5 dv	# Days ≥ 1.0 dv	Max (dv)
BRID									
2001	74	42	5.74	82	51	6.041	73	38	5.583
2002	50	25	3.313	54	27	4.092	49	24	3.257
2003	50	31	4.44	54	34	4.564	48	28	4.394
FITZ									
2001	26	7	2.689	34	9	3.032	22	6	2.507
2002	17	6	2.93	20	6	3.443	15	6	2.879
2003	25	10	1.432	27	11	1.448	24	10	1.417
GRTE									
2001	13	4	1.998	16	5	2.217	11	4	1.992
2002	8	1	1.48	9	1	1.551	6	1	1.438
2003	7	1	1.192	9	1	1.2	4	1	1.189
MOZI									
2001	8	1	1.485	14	3	1.826	6	1	1.162
2002	15	2	2.759	19	5	3.168	12	2	2.391
2003	15	2	1.306	17	2	1.591	11	1	1.229
TETO									
2001	8	3	1.501	9	3	1.52	8	2	1.482
2002	5	2	1.195	6	2	1.255	4	1	1.15
2003	2	0	0.557	5	0	0.585	2	0	0.557
WASH									
2001	5	2	1.097	6	3	1.113	5	2	1.079
2002	4	1	1.271	5	1	1.333	4	1	1.221
2003	2	0	0.558	5	0	0.654	1	0	0.504

4.6.4.4 Visibility Impacts on Class I Areas due to the Cumulative Emissions plus the Project Alternatives without RFD

Table 4-28 (a-e) lists the visibility impacts for the cumulative emissions without the RFD sources plus the proposed Project for the various Project alternatives. For all three project scenarios, the 1.0 change in 1 dv threshold is exceeded for at least three Class I areas for all five calculation methods. Using Method 3b, the method that shows the largest impact, the 1.0 dv threshold is estimated to be exceeded for 103 days, 123 days, and 95 days for the cumulative emissions plus Proposed Action, Alterantive C, and No Action alternative at the Bridger Wilderness Area, representing 9%, 11% and 9% of the days during 2001-2003.

Table 4-28a. CALPUFF-estimated visibility impacts on Class I areas for the Cumulative Emissions plus the various Project alternatives without RFD sources using Method 1 -- FLAG Monthly f(RH) with FLAG Seasonal Background.

	Proposed Action			Alternative C			Alternative A		
	#Days ≥ 0.5 dv	# Days ≥ 1.0 dv	Max (dv)	#Days ≥ 0.5 dv	# Days ≥ 1.0 dv	Max (dv)	#Days ≥ 0.5 dv	# Days ≥ 1.0 dv	Max (dv)
BRID									
2001	63	21	2.767	70	31	3.052	57	21	2.76
2002	40	10	1.971	49	13	2.973	37	9	1.738
2003	39	18	3.296	42	22	3.453	37	15	3.236
FITZ									
2001	19	2	1.389	25	4	1.686	15	2	1.244
2002	7	3	1.927	10	3	2.446	5	2	1.487
2003	13	2	1.201	17	3	1.221	12	2	1.182
GRTE									
2001	6	1	1.203	9	2	1.224	6	1	1.183
2002	3	0	0.776	5	0	0.836	3	0	0.742
2003	0	0	0.409	0	0	0.484	0	0	0.394
MOZI									
2001	2	0	0.607	5	0	0.843	0	0	0.472
2002	5	1	1.045	13	1	1.293	2	0	0.836
2003	5	0	0.669	8	0	0.833	4	0	0.577
TETO									
2001	3	0	0.898	4	0	0.915	3	0	0.881
2002	2	0	0.726	2	0	0.776	2	0	0.689
2003	0	0	0.307	0	0	0.41	0	0	0.262
WASH									
2001	3	0	0.638	4	0	0.652	2	0	0.623
2002	1	0	0.741	3	0	0.792	1	0	0.7
2003	0	0	0.376	0	0	0.458	0	0	0.344

Table 4-28b. CALPUFF-estimated visibility impacts on Class I areas for the Cumulative Emissions plus the various Project alternatives without RFD sources using Method 2 -- FLAG Monthly f(RH) with IMPROVE Seasonal Background.

	Proposed Action			Alternative C			Alternative A		
	#Days ≥ 0.5 dv	# Days ≥ 1.0 dv	Max (dv)	#Days ≥ 0.5 dv	# Days ≥ 1.0 dv	Max (dv)	#Days ≥ 0.5 dv	# Days ≥ 1.0 dv	Max (dv)
BRID									
2001	57	19	2.91	71	24	2.912	54	17	2.909
2002	36	8	2.175	40	9	3.263	31	7	1.678
2003	33	15	3.613	36	18	3.782	29	15	3.548
FITZ									
2001	12	1	1.409	17	3	1.429	11	1	1.388
2002	4	2	2.126	7	2	2.692	4	1	1.644
2003	9	3	1.239	13	3	1.243	8	3	1.237
GRTE									
2001	6	1	1.162	8	2	1.182	6	1	1.142
2002	1	0	0.574	2	0	0.619	1	0	0.549
2003	0	0	0.404	0	0	0.477	0	0	0.356
MOZI									
2001	3	0	0.685	4	0	0.951	0	0	0.489
2002	3	0	0.755	7	0	0.937	2	0	0.602
2003	4	0	0.755	8	0	0.912	4	0	0.652
TETO									
2001	3	0	0.867	3	0	0.883	2	0	0.85
2002	1	0	0.52	1	0	0.556	0	0	0.493
2003	0	0	0.296	0	0	0.395	0	0	0.246
WASH									
2001	3	0	0.701	4	0	0.717	3	0	0.685
2002	1	0	0.569	2	0	0.637	1	0	0.537
2003	0	0	0.328	1	0	0.504	0	0	0.268

Table 4-28c. CALPUFF-estimated visibility impacts on Class I areas for the Cumulative Emissions plus the various Project alternatives without RFD sources using Method 3a -- FLAG Monthly f(RH) with EPA Default Annual Natural Conditions.

	Proposed Action			**Alternative C**			**Alternative A**		
	#Days ≥ 0.5 dv	**# Days ≥ 1.0 dv**	**Max (dv)**	**#Days ≥ 0.5 dv**	**# Days ≥ 1.0 dv**	**Max (dv)**	**#Days ≥ 0.5 dv**	**# Days ≥ 1.0 dv**	**Max (dv)**
BRID									
2001	71	35	3.234	84	42	3.56	66	31	3.226
2002	50	18	2.339	59	21	3.497	41	17	2.049
2003	43	20	3.868	52	25	4.047	42	17	3.799
FITZ									
2001	24	4	1.641	31	7	1.986	21	2	1.463
2002	12	4	2.285	18	4	2.887	11	3	1.77
2003	17	4	1.421	22	5	1.445	13	4	1.399
GRTE									
2001	7	1	1.424	11	2	1.448	6	1	1.399
2002	3	0	0.887	8	0	0.956	3	0	0.849
2003	0	0	0.474	2	0	0.57	0	0	0.452
MOZI									
2001	6	0	0.702	10	0	0.974	2	0	0.547
2002	10	1	1.184	17	1	1.462	4	0	0.948
2003	6	0	0.774	10	0	0.954	5	0	0.669
TETO									
2001	6	1	1.066	6	1	1.086	5	1	1.045
2002	2	0	0.863	3	0	0.921	2	0	0.819
2003	0	0	0.368	0	0	0.489	0	0	0.316
WASH									
2001	5	0	0.751	6	0	0.768	4	0	0.734
2002	1	0	0.88	3	0	0.941	1	0	0.832
2003	0	0	0.452	2	0	0.541	0	0	0.414

Table 4-28d. CALPUFF-estimated visibility impacts on Class I areas for the Cumulative Emissions plus various Project alternatives without RFD sources using Method 3b -- FLAG Monthly f(RH) with EPA Default Best 20% days Natural Conditions.

	Proposed Action			**Alternative C**			**Alternative A**		
	#Days ≥ 0.5 dv	**# Days ≥ 1.0 dv**	**Max (dv)**	**#Days ≥ 0.5 dv**	**# Days ≥ 1.0 dv**	**Max (dv)**	**#Days ≥ 0.5 dv**	**# Days ≥ 1.0 dv**	**Max (dv)**
BRID									
2001	90	45	4.007	97	56	4.395	82	41	3.998
2002	63	27	2.928	71	35	4.321	58	27	2.574
2003	53	31	4.76	64	32	4.971	49	27	4.679
FITZ									
2001	33	10	2.072	42	11	2.497	31	8	1.852
2002	19	5	2.863	23	5	3.592	16	5	2.232
2003	26	6	1.799	29	10	1.829	23	5	1.773
GRTE									
2001	14	4	1.803	20	4	1.834	11	3	1.773
2002	6	1	1.132	10	1	1.219	4	1	1.083
2003	3	0	0.608	7	0	0.731	3	0	0.58
MOZI									
2001	10	0	0.898	20	2	1.24	8	0	0.701
2002	17	1	1.503	24	2	1.85	14	1	1.208
2003	12	0	0.988	20	3	1.215	8	0	0.855
TETO									
2001	9	2	1.356	10	3	1.381	8	2	1.331
2002	3	1	1.101	6	1	1.175	2	1	1.045
2003	0	0	0.472	3	0	0.627	0	0	0.406
WASH									
2001	5	0	0.96	6	0	0.982	5	0	0.938
2002	3	1	1.122	4	1	1.199	2	1	1.062
2003	1	0	0.58	4	0	0.693	1	0	0.532

Table 4-28e. CALPUFF-estimated visibility impacts on class I areas for the Cumulative Emissions plus the various Project alternatives without RFD sources using Method 4 - FLAG Hourly f(RH) with FLAG Seasonal Background.

	Proposed Action			Alternative C			Alternative A		
	#Days ≥ 0.5 dv	**# Days ≥ 1.0 dv**	**Max (dv)**	**#Days ≥ 0.5 dv**	**# Days ≥ 1.0 dv**	**Max (dv)**	**#Days ≥ 0.5 dv**	**# Days ≥ 1.0 dv**	**Max (dv)**
BRID									
2001	64	24	4.12	69	33	4.473	58	22	3.935
2002	39	16	3.112	44	18	3.555	35	15	3.055
2003	38	18	3.795	42	23	3.927	35	15	3.745
FITZ									
2001	17	2	1.972	22	3	2.341	15	2	1.772
2002	13	5	2.388	16	5	3.002	13	5	2.047
2003	14	0	0.934	21	0	0.996	12	0	0.919
GRTE									
2001	7	3	1.414	11	3	1.578	6	2	1.391
2002	4	1	1.002	7	1	1.077	3	0	0.958
2003	2	0	0.726	5	0	0.734	1	0	0.723
MOZI									
2001	4	1	1.154	10	1	1.507	3	0	0.821
2002	10	1	2.122	15	3	2.557	9	1	1.729
2003	8	1	1.067	14	2	1.424	5	0	0.825
TETO									
2001	5	1	1.064	5	2	1.084	4	1	1.044
2002	3	0	0.846	3	0	0.908	2	0	0.799
2003	0	0	0.382	0	0	0.439	0	0	0.367
WASH									
2001	5	0	0.784	6	0	0.801	4	0	0.766
2002	3	0	0.906	3	0	0.971	2	0	0.855
2003	0	0	0.423	1	0	0.519	0	0	0.368

4.6.4.5 Visibility Impacts at Class II Areas due to the Project Alternatives Alone

Table 4-29 (a-e) lists the CALPUFF-estimated visibility impacts at the Class II areas due to the various Project alternatives using the five calculation methods described above. Due to the Project alone, each alternative has days that exceed the 0.5 dv and 1.0 dv thresholds. The Class II area experiencing the largest and most frequent impacts is Bridger Butte. Across the different methods, the Proposed Action alternative exceeds the 1.0 dv threshold between 18 and 47 days across 3 years at Bridger Butte, and exceeds the 0.5 dv threshold between 30 days and 56 days. Similar results for Alternative C range from 33 days to 54 days for the 1.0 dv threshold and 47 days to 69 days for the 0.5 dv threshold. For Method 1, the Bridger Butte area exceeds the 0.5 dv threshold on 127 days, 169 days, and 44 days during the 2001-2003 period for the Proposed Action, Alternative C, and No Action scenarios, corresponding to 12%, 15% and 4% of days during the 3-year period.

Table 4-29a. CALPUFF-estimated visibility impacts on Class II areas for the various Project alternatives along using Method 1 - FLAG Monthly f(RH) with FLAG Seasonal Background.

	Proposed Action			**Alternative C**			**Alternative A**		
	#Days ≥ 0.5 dv	**# Days ≥ 1.0dv**	**Max (dv)**	**#Days ≥ 0.5 dv**	**# Days ≥ 1.0dv**	**Max (dv)**	**#Days ≥ 0.5 dv**	**# Days ≥ 1.0dv**	**Max (dv)**
BRB									
2001	48	35	4.56	56	46	6.12	22	7	1.646
2002	45	29	2.702	64	43	4.085	11	0	0.799
2003	34	19	3.83	49	33	5.175	11	2	1.491
DEE									
2001	0	0	0.207	0	0	0.435	0	0	0.068
2002	1	0	0.956	3	1	1.849	0	0	0.215
2003	0	0	0.278	1	0	0.566	0	0	0.074
DIN									
2001	6	0	0.703	11	5	1.36	0	0	0.192
2002	0	0	0.493	6	0	0.948	0	0	0.122
2003	5	0	0.794	14	4	1.393	0	0	0.191
GRO									
2001	0	0	0.316	2	0	0.72	0	0	0.109
2002	0	0	0.166	0	0	0.315	0	0	0.046
2003	0	0	0.259	2	0	0.556	0	0	0.083
LAZ									
2001	0	0	0.265	2	0	0.547	0	0	0.079
2002	0	0	0.17	0	0	0.338	0	0	0.042
2003	0	0	0.3	1	0	0.641	0	0	0.087
ROA									
2001	0	0	0.226	1	0	0.515	0	0	0.076
2002	1	0	0.713	1	1	1.379	0	0	0.134
2003	0	0	0.233	0	0	0.46	0	0	0.072
ROS									
2001	0	0	0.201	0	0	0.454	0	0	0.063
2002	0	0	0.159	0	0	0.314	0	0	0.038
2003	0	0	0.197	0	0	0.419	0	0	0.053
SAD									
2001	0	0	0.45	7	0	0.953	0	0	0.153
2002	1	0	0.707	3	1	1.378	0	0	0.173
2003	0	0	0.318	2	0	0.646	0	0	0.083
UPP									
2001	0	0	0.243	2	0	0.515	0	0	0.088
2002	1	0	0.896	3	1	1.733	0	0	0.206
2003	0	0	0.301	2	0	0.614	0	0	0.08

Table 4-29b. CALPUFF-estimated visibility impacts on Class II areas for the various Project alternatives along using Method 2 -- FLAG Monthly f(RH) with IMPROVE Seasonal Background.

	Proposed Action			Alternative C			Alternative A		
	#Days ≥ 0.5 dv	# Days ≥ 1.0 dv	Max (dv)	#Days ≥ 0.5 dv	# Days ≥ 1.0 dv	Max (dv)	#Days ≥ 0.5 dv	# Days ≥ 1.0 dv	Max (dv)
BRB									
2001	48	34	4.971	58	45	6.631	23	7	
2002	41	23	2.801	56	37	3.445	6	0	
2003	30	18	4.203	47	28	5.628	9	2	
DEE									
2001	0	0	0.223	0	0	0.456	0	0	
2002	1	1	1.06	2	1	2.04	0	0	
2003	0	0	0.188	0	0	0.386	0	0	
DIN									
2001	4	0	0.793	11	3	1.401	0	0	
2002	0	0	0.39	6	0	0.711	0	0	
2003	4	0	0.828	14	4	1.498	0	0	
GRO									
2001	0	0	0.311	1	0	0.637	0	0	
2002	0	0	0.162	0	0	0.329	0	0	
2003	0	0	0.176	0	0	0.379	0	0	
LAZ									
2001	0	0	0.18	0	0	0.372	0	0	
2002	0	0	0.181	0	0	0.349	0	0	
2003	0	0	0.204	0	0	0.437	0	0	
ROA									
2001	0	0	0.153	0	0	0.351	0	0	
2002	1	0	0.792	1	1	1.526	0	0	
2003	0	0	0.158	0	0	0.313	0	0	
ROS									
2001	0	0	0.136	0	0	0.309	0	0	
2002	0	0	0.161	0	0	0.298	0	0	
2003	0	0	0.175	0	0	0.384	0	0	
SAD									
2001	0	0	0.381	3	0	0.785	0	0	
2002	1	0	0.785	2	1	1.524	0	0	
2003	0	0	0.216	0	0	0.463	0	0	
UPP									
2001	0	0	0.272	1	0	0.557	0	0	
2002	1	0	0.994	2	1	1.914	0	0	
2003	0	0	0.205	0	0	0.419	0	0	

Table 4-29c. CALPUFF-estimated visibility impacts on Class II areas for the various Project alternatives along using Method 3a -- FLAG Monthly f(RH) with EPA Default Annual Natural Conditions.

	Proposed Action			Alternative C			Alternative A		
	#Days ≥ 0.5 dv	# Days ≥ 1.0 dv	Max (dv)	#Days ≥ 0.5 dv	# Days ≥ 1.0 dv	Max (dv)	#Days ≥ 0.5 dv	# Days ≥ 1.0 dv	Max (dv)
BRB									
2001	50	38	5.298	61	49	7.035	26	9	1.942
2002	50	33	3.16	65	47	4.728	16	0	0.949
2003	40	23	4.441	49	34	5.988	14	4	1.762
DEE									
2001	0	0	0.248	3	0	0.519	0	0	0.081
2002	1	1	1.145	3	1	2.196	0	0	0.259
2003	0	0	0.332	2	0	0.675	0	0	0.089
DIN									
2001	8	0	0.813	12	6	1.551	0	0	0.221
2002	2	0	0.566	8	1	1.084	0	0	0.14
2003	6	0	0.909	17	6	1.589	0	0	0.22
GRO									
2001	0	0	0.377	2	0	0.855	0	0	0.13
2002	0	0	0.203	0	0	0.383	0	0	0.056
2003	0	0	0.309	3	0	0.661	0	0	0.101
LAZ									
2001	0	0	0.317	2	0	0.65	0	0	0.095
2002	0	0	0.203	0	0	0.403	0	0	0.051
2003	0	0	0.358	1	0	0.762	0	0	0.104
MOX									
2001	148	80	4.703	219	155	6.587	55	17	1.677
2002	157	94	6.806	223	168	8.8	70	26	2.872
2003	116	63	6.213	198	121	8.809	46	15	3.43
ROA									
2001	0	0	0.27	1	0	0.614	0	0	0.091
2002	1	0	0.856	2	1	1.645	0	0	0.162
2003	0	0	0.279	1	0	0.548	0	0	0.086
ROS									
2001	0	0	0.24	1	0	0.541	0	0	0.075
2002	0	0	0.191	0	0	0.375	0	0	0.046
2003	0	0	0.235	0	0	0.499	0	0	0.063
SAD									
2001	1	0	0.537	10	1	1.131	0	0	0.184
2002	1	0	0.849	5	1	1.644	0	0	0.209
2003	0	0	0.38	4	0	0.769	0	0	0.099
UPP									
2001	0	0	0.29	9	0	0.614	0	0	0.105
2002	1	1	1.074	3	1	2.061	0	0	0.249
2003	0	0	0.36	3	0	0.731	0	0	0.096

Table 4-29d. CALPUFF-estimated visibility impacts on Class II areas for the various Project alternatives along using Method 3b - FLAG Monthly f(RH) with EPA Default Best 20% days Natural Conditions.

	Proposed Action			Alternative C			Alternative A		
	#Days ≥ 0.5 dv	**# Days ≥ 1.0 dv**	**Max (dv)**	**#Days ≥ 0.5 dv**	**# Days ≥ 1.0 dv**	**Max (dv)**	**#Days ≥ 0.5 dv**	**# Days ≥ 1.0 dv**	**Max (dv)**
BRB									
2001	54	44	6.428	66	52	8.406	32	14	2.442
2002	56	38	3.919	69	54	5.767	24	3	1.209
2003	46	28	5.433	51	42	7.219	17	8	2.221
DEE									
2001	0	0	0.319	9	0	0.666	0	0	0.105
2002	2	1	1.455	3	1	2.754	0	0	0.333
2003	0	0	0.426	3	0	0.863	0	0	0.115
DIN									
2001	8	3	1.038	15	7	1.961	0	0	0.284
2002	4	0	0.725	14	2	1.379	0	0	0.181
2003	8	3	1.159	20	6	2.008	0	0	0.283
GRO									
2001	0	0	0.484	8	1	1.091	0	0	0.168
2002	0	0	0.261	0	0	0.492	0	0	0.073
2003	0	0	0.398	4	0	0.846	0	0	0.13
LAZ									
2001	0	0	0.407	2	0	0.832	0	0	0.122
2002	0	0	0.261	1	0	0.518	0	0	0.065
2003	0	0	0.46	4	0	0.973	0	0	0.134
MOX									
2001	180	104	5.738	249	181	7.9	76	32	2.116
2002	181	111	8.148	241	194	10.372	91	40	3.573
2003	149	81	7.476	224	140	10.382	56	23	4.24
ROA									
2001	0	0	0.347	3	0	0.786	0	0	0.118
2002	1	1	1.092	2	1	2.077	0	0	0.209
2003	0	0	0.359	2	0	0.702	0	0	0.111
ROS									
2001	0	0	0.309	1	0	0.694	0	0	0.097
2002	0	0	0.245	0	0	0.481	0	0	0.059
2003	0	0	0.302	2	0	0.64	0	0	0.082
SAD									
2001	4	0	0.688	16	4	1.437	0	0	0.236
2002	2	1	1.084	7	2	2.075	0	0	0.269
2003	0	0	0.488	4	0	0.983	0	0	0.128
UPP									
2001	0	0	0.373	15	0	0.786	0	0	0.135
2002	2	1	1.365	3	1	2.588	0	0	0.32
2003	0	0	0.462	4	0	0.934	0	0	0.124

Table 4-29e. CALPUFF-estimated visibility impacts on Class II areas for the various Project alternatives along using Method 4 -- FLAG Hourly f(RH) with FLAG Seasonal Background.

	Proposed Action			Alternative C			Alternative A		
	#Days ≥ 0.5 dv	# Days ≥ 1.0 dv	Max (dv)	#Days ≥ 0.5 dv	# Days ≥ 1.0 dv	Max (dv)	#Days ≥ 0.5 dv	# Days ≥ 1.0 dv	Max (dv)
BRB									
2001	47	35	5.358	57	44	7.004	24	11	2.17
2002	44	23	3.55	63	41	5.157	10	2	1.102
2003	36	22	4.906	47	34	6.205	14	5	2.042
DEE									
2001	0	0	0.252	1	0	0.556	0	0	0.077
2002	1	1	1.272	2	1	2.404	0	0	0.288
2003	0	0	0.243	0	0	0.498	0	0	0.067
DIN									
2001	5	1	1.045	10	4	1.858	0	0	0.235
2002	3	0	0.676	8	2	1.217	0	0	0.149
2003	7	1	1.185	17	5	2.095	0	0	0.262
GRO									
2001	0	0	0.335	2	0	0.753	0	0	0.114
2002	0	0	0.156	0	0	0.325	0	0	0.05
2003	0	0	0.305	2	0	0.651	0	0	0.099
LAZ									
2001	0	0	0.324	1	0	0.728	0	0	0.099
2002	0	0	0.215	0	0	0.423	0	0	0.053
2003	0	0	0.366	1	0	0.775	0	0	0.105
ROA									
2001	0	0	0.304	1	0	0.684	0	0	0.102
2002	1	0	0.935	2	1	1.765	0	0	0.176
2003	0	0	0.187	0	0	0.387	0	0	0.054
ROS									
2001	0	0	0.274	1	0	0.609	0	0	0.084
2002	0	0	0.204	0	0	0.4	0	0	0.049
2003	0	0	0.241	1	0	0.51	0	0	0.064
SAD									
2001	0	0	0.327	7	0	0.706	0	0	0.134
2002	1	0	0.95	5	1	1.82	0	0	0.234
2003	0	0	0.279	2	0	0.561	0	0	0.079
UPP									
2001	0	0	0.254	1	0	0.56	0	0	0.078
2002	1	1	1.184	4	1	2.243	0	0	0.274
2003	0	0	0.279	2	0	0.545	0	0	0.073

4.6.4.6 Visibility Impacts on Class II Areas due to the Cumulative Emissions plus the Project Alternatives

Table 4-30 (a-e) lists the visibility impacts on Class II areas for the cumulative emissions plus the proposed Project for the various Project alternatives. The largest and most frequent impacts are estimated to occur at Bridger Butte, but impacts exceeding the 0.5 dv and 1.0 dv thresholds are found at all sites for at least two of the modeling years for all alternatives. Using Method 1, the 1.0 change in dv threshold is estimated to be exceeded for 102 days, 134 days, and 39 days for the cumulative emissions plus Proposed Action, Alternative C, and No Action alternative at the Bridger Butte Class II area representing 9%, 12%, and 4% of the days during 2001-2003. For Alternative C, the number of days exceeding 1.0 dv change ranges from 121 days to 197 days across the different methods for the 3-year modeling period.

Table 4-30a. CALPUFF-estimated visibility impacts on Class II areas for the Cumulative Emissions plus the various Project alternatives along using Method 1 -- FLAG Monthly f(RH) with FLAG Seasonal Background.

	Proposed Action			Alternative C			Alternative A		
	#Days ≥ 0.5dv	# Days ≥ 1.0dv	Max (dv)	#Days ≥ 0.5dv	# Days ≥ 1.0dv	Max (dv)	#Days ≥ 0.5dv	# Days ≥ 1.0dv	Max (dv)
BRB									
2001	54	40	5.187	64	50	6.659	39	20	2.335
2002	55	37	3.295	68	47	4.603	33	9	1.637
2003	45	25	4.187	49	37	5.485	22	10	1.94
DEE									
2001	21	2	1.053	30	5	1.154	17	2	1.052
2002	16	5	2.309	22	5	3.093	13	4	1.665
2003	12	4	2	15	5	2.02	10	3	1.987
DIN									
2001	19	7	1.576	25	9	1.996	11	2	1.26
2002	28	7	1.783	35	9	2.061	21	6	1.542
2003	24	8	1.554	31	11	2.101	17	2	1.365
GRO									
2001	25	10	2.518	28	12	2.541	22	10	2.496
2002	13	0	0.898	16	0	0.979	12	0	0.854
2003	16	5	2.121	19	7	2.365	15	3	2.004
LAZ									
2001	13	6	2.115	14	7	2.368	11	5	1.98
2002	5	1	1.832	6	2	1.882	4	1	1.793
2003	12	2	1.256	13	3	1.258	10	2	1.256
ROA									
2001	13	1	1.298	13	1	1.558	11	1	1.163
2002	8	3	2.387	9	3	2.953	8	2	1.9
2003	9	2	1.101	12	2	1.111	8	2	1.092
ROS									
2001	8	3	1.426	9	3	1.65	8	3	1.337
2002	5	1	1.737	5	1	1.788	4	1	1.697
2003	4	0	0.708	6	0	0.709	3	0	0.707
SAD									
2001	35	3	1.126	42	9	1.41	25	3	1.118
2002	23	7	1.822	26	8	2.424	21	6	1.65
2003	13	6	2.224	17	8	2.264	12	5	2.201
UPP									
2001	26	4	1.288	38	5	1.292	22	3	1.285
2002	18	5	2.125	23	6	2.869	16	4	1.518
2003	13	6	2.047	16	7	2.072	12	6	2.031

Table 4-30b. CALPUFF-estimated visibility impacts on Class II areas for the Cumulative Emissions plus the various Project alternatives along using Method 2 -- FLAG Monthly f(RH) with IMPROVE Seasonal Background.

	Proposed Action			Alternative C			Alternative A		
	#Days ≥ 0.5 dv	# Days ≥ 1.0 dv	Max (dv)	#Days ≥ 0.5 dv	# Days ≥ 1.0 dv	Max (dv)	#Days ≥ 0.5 dv	# Days ≥ 1.0 dv	Max (dv)
BRB									
2001	53	41	5.64	60	50	7.201	38	19	2.571
2002	51	30	3.081	64	42	3.805	27	4	1.18
2003	40	19	4.587	49	32	5.958	19	6	2.149
DEE									
2001	17	1	1.166	25	1	1.169	14	1	1.165
2002	11	3	2.543	11	6	3.394	11	2	1.839
2003	11	6	2.214	12	6	2.236	10	6	2.2
DIN									
2001	14	5	1.762	21	10	2	10	1	1.418
2002	23	4	1.288	34	7	1.494	17	1	1.11
2003	24	5	1.746	29	12	2.053	20	1	1.535
GRO									
2001	22	8	2.781	26	11	2.805	21	7	2.756
2002	9	0	0.871	10	1	1.027	7	0	0.788
2003	10	3	1.455	14	3	1.629	10	3	1.372
LAZ									
2001	12	3	2.079	15	3	2.099	11	3	2.058
2002	4	1	1.273	5	1	1.309	3	1	1.245
2003	11	1	1.391	12	1	1.392	10	1	1.39
ROA									
2001	8	1	1.029	11	2	1.078	7	1	1.021
2002	8	1	2.628	11	1	3.242	7	1	2.096
2003	9	2	1.224	10	2	1.236	9	2	1.215
ROS									
2001	6	2	1.51	7	3	1.528	5	2	1.491
2002	3	1	1.206	3	1	1.242	1	1	1.177
2003	3	0	0.786	4	0	0.787	2	0	0.785
SAD									
2001	30	1	1.247	37	3	1.325	23	1	1.238
2002	16	5	2.011	23	7	2.667	14	5	1.735
2003	12	6	2.459	16	6	2.503	10	6	2.434
UPP									
2001	24	1	1.425	32	4	1.43	20	1	1.423
2002	12	3	2.342	15	7	3.151	11	3	1.678
2003	12	6	2.265	14	6	2.293	12	6	2.248

Table 4-30c. CALPUFF-estimated visibility impacts on Class II areas for the Cumulative Emissions plus the various Project alternatives along using Method 3a -- FLAG Monthly f(RH) with EPA Default Annual Natural Conditions.

	Proposed Action			**Alternative C**			**Alternative A**		
	#Days ≥ 0.5 dv	**# Days ≥ 1.0 dv**	**Max (dv)**	**#Days ≥ 0.5 dv**	**# Days ≥ 1.0 dv**	**Max (dv)**	**#Days ≥ 0.5 dv**	**# Days ≥ 1.0 dv**	**Max (dv)**
BRB									
2001	56	44	6	68	53	7.628	44	24	2.762
2002	59	42	3.836	71	53	5.308	42	12	1.864
2003	48	27	4.842	51	41	6.333	28	14	2.284
DEE									
2001	27	5	1.26	40	7	1.367	24	4	1.258
2002	22	8	2.732	25	9	3.635	18	7	1.981
2003	14	7	2.353	19	8	2.376	14	6	2.338
DIN									
2001	21	8	1.803	28	11	2.267	15	2	1.452
2002	34	7	2.029	41	13	2.34	26	7	1.757
2003	33	8	1.787	38	13	2.386	22	5	1.571
GRO									
2001	28	14	2.946	32	16	2.972	26	13	2.92
2002	15	3	1.063	18	4	1.181	13	1	1.001
2003	19	8	2.532	21	9	2.817	18	7	2.394
LAZ									
2001	19	7	2.482	25	7	2.774	17	6	2.327
2002	7	2	2.156	11	2	2.214	5	2	2.11
2003	15	3	1.499	22	5	1.5	15	3	1.498
ROA									
2001	17	2	1.536	21	3	1.839	15	2	1.378
2002	12	4	2.822	15	5	3.475	11	3	2.256
2003	12	2	1.305	17	3	1.317	10	2	1.295
ROS									
2001	10	3	1.684	13	3	1.945	10	3	1.566
2002	5	1	2.046	5	2	2.105	4	1	1.999
2003	8	0	0.849	10	0	0.85	5	0	0.848
SAD									
2001	45	10	1.347	49	16	1.667	38	6	1.337
2002	28	8	2.165	36	8	2.864	25	7	1.947
2003	21	7	2.611	24	8	2.657	20	7	2.584
UPP									
2001	34	8	1.537	43	14	1.543	28	5	1.535
2002	24	7	2.518	27	8	3.378	21	7	1.808
2003	18	8	2.407	20	9	2.436	17	7	2.389

Table 4-30d. CALPUFF-estimated visibility impacts on Class II areas for the Cumulative Emissions plus various Project alternatives along using Method 3b -- FLAG Monthly f(RH) with EPA Default Best 20% days Natural Conditions.

	Proposed Action			**Alternative C**			**Alternative A**		
	#Days ≥ 0.5 dv	**# Days ≥ 1.0 dv**	**Max (dv)**	**#Days ≥ 0.5 dv**	**# Days ≥ 1.0 dv**	**Max (dv)**	**#Days ≥ 0.5 dv**	**# Days ≥ 1.0 dv**	**Max (dv)**
BRB									
2001	64	48	7.233	75	55	9.071	48	32	3.441
2002	67	45	4.722	76	58	6.439	45	22	2.347
2003	49	36	5.901	53	47	7.612	34	20	2.86
DEE									
2001	43	11	1.598	55	18	1.732	37	11	1.597
2002	27	9	3.404	37	11	4.485	26	9	2.491
2003	22	9	2.945	25	10	2.973	18	9	2.926
DIN									
2001	30	11	2.272	37	16	2.841	22	4	1.838
2002	47	16	2.549	54	24	2.929	41	11	2.215
2003	42	13	2.252	51	21	2.985	38	8	1.986
GRO									
2001	35	20	3.664	38	22	3.695	32	18	3.632
2002	20	8	1.352	21	9	1.5	19	7	1.275
2003	24	9	3.163	26	12	3.508	22	9	2.996
LAZ									
2001	31	9	3.103	37	11	3.456	29	9	2.914
2002	15	3	2.705	19	5	2.776	12	3	2.65
2003	23	6	1.897	25	7	1.898	21	4	1.895
ROA									
2001	22	8	1.941	34	8	2.316	21	6	1.746
2002	16	5	3.513	19	5	4.294	14	5	2.827
2003	18	4	1.654	20	4	1.67	15	4	1.642
ROS									
2001	16	4	2.125	20	5	2.447	13	4	1.98
2002	8	2	2.571	10	2	2.643	7	2	2.514
2003	15	2	1.083	17	4	1.084	13	2	1.082
SAD									
2001	49	19	1.707	62	30	2.104	44	14	1.694
2002	39	13	2.715	51	21	3.564	34	11	2.449
2003	27	12	3.258	35	14	3.314	24	10	3.226
UPP									
2001	49	15	1.944	59	21	1.95	43	11	1.94
2002	36	11	3.146	43	14	4.179	29	10	2.278
2003	24	10	3.01	29	13	3.046	21	9	2.988

Table 4-30e. CALPUFF-estimated visibility impacts on Class II areas for the Cumulative Emissions plus the various Project alternatives along using Method 4 -- FLAG Hourly f(RH) with FLAG Seasonal Background.

	Proposed Action			Alternative C			Alternative A		
	#Days ≥ 0.5 dv	# Days ≥ 1.0 dv	Max (dv)	#Days ≥ 0.5 dv	# Days ≥ 1.0 dv	Max (dv)	#Days ≥ 0.5 dv	# Days ≥ 1.0 dv	Max (dv)
BRB									
2001	54	40	5.925	62	48	7.487	39	22	2.942
2002	54	36	4.198	66	46	5.712	33	9	2.122
2003	42	29	5.305	50	37	6.572	28	13	2.569
DEE									
2001	23	2	1.218	32	2	1.449	19	2	1.216
2002	19	7	3.025	22	7	3.984	16	6	2.9
2003	16	4	1.638	17	5	1.656	14	3	1.626
DIN									
2001	24	6	2.662	29	9	3.358	14	1	1.973
2002	28	10	2.737	34	13	3.18	23	9	2.311
2003	31	9	2.261	36	14	2.916	22	6	1.695
GRO									
2001	23	12	2.96	27	13	2.986	23	10	2.933
2002	13	2	1.111	14	2	1.193	11	1	1.057
2003	19	4	2.322	21	8	2.611	18	4	2.172
LAZ									
2001	11	5	3.076	13	5	3.384	10	5	2.905
2002	10	2	2.453	10	2	2.518	10	2	2.401
2003	14	2	1.207	16	3	1.263	12	2	1.205
ROA									
2001	14	1	1.696	15	1	2.026	11	1	1.519
2002	10	5	3.09	12	5	3.764	10	5	2.482
2003	9	0	0.969	12	0	0.979	9	0	0.962
ROS									
2001	7	3	1.987	9	3	2.27	7	3	1.827
2002	7	2	2.342	7	2	2.407	6	1	2.289
2003	7	0	0.889	8	0	0.952	5	0	0.853
SAD									
2001	29	6	1.328	41	12	1.353	26	5	1.316
2002	24	8	3.384	27	11	3.458	24	8	3.328
2003	17	6	1.981	21	7	2.129	13	6	1.914
UPP									
2001	26	2	1.483	36	4	1.49	24	1	1.48
2002	23	7	2.99	24	8	3.691	20	7	2.939
2003	17	5	1.661	20	5	1.685	15	5	1.647

4.6.4.7 Visibility Impacts on Class II Areas due to the Cumulative Emissions plus the Project Alternatives Without RFD Sources

Table 4-31 (a-e) lists the visibility impacts for the cumulative emissions plus the proposed Project for the various Project alternatives without the RFD sources. Maximum impacts in terms of magnitude and frequency are felt at Bridger Butte. Using Method 1, the 1.0 change in dv threshold is estimated to be exceeded for 98 days, 132 days, and 29 days for the cumulative emissions plus Proposed Action, Alternative C, and No Action alternative at the Bridger Butte Class II Area, representing 9%, 12%, and 3% of the days during the 3 years of modeling. Thus, the cumulative emissions without RFD plus each of the alternatives are estimated to have an adverse impact on visibility at a Class II area.

Table 4-31a. CALPUFF-estimated visibility impacts on Class II areas for the Cumulative Emissions plus the various Project alternatives without RFD sources using Method 1 -- FLAG Monthly f(RH) with FLAG Seasonal Background.

	Proposed Action			**Alternative C**			**Alternative A**		
	#Days ≥ 0.5dv	**# Days ≥ 1.0dv**	**Max (dv)**	**#Days ≥ 0.5dv**	**# Days ≥ 1.0dv**	**Max (dv)**	**#Days ≥ 0.5dv**	**# Days ≥ 1.0dv**	**Max (dv)**
BRB									
2001	53	39	5.122	63	49	6.603	37	16	2.262
2002	53	35	3.162	66	46	4.486	29	4	1.402
2003	43	24	4.136	49	37	5.436	21	9	1.877
DEE									
2001	11	0	0.721	20	0	0.95	8	0	0.679
2002	9	5	1.868	13	5	2.686	8	2	1.317
2003	9	1	1.484	10	1	1.505	8	1	1.47
DIN									
2001	18	6	1.562	22	9	1.872	11	2	1.254
2002	27	6	1.652	33	7	1.933	20	6	1.407
2003	24	8	1.521	30	11	2.08	16	1	1.23
GRO									
2001	18	2	1.8	21	4	1.824	16	2	1.775
2002	7	0	0.71	10	0	0.81	4	0	0.654
2003	8	1	1.276	10	1	1.542	8	1	1.149
LAZ									
2001	9	2	1.484	11	2	1.754	8	2	1.341
2002	3	1	1.221	4	1	1.274	3	1	1.179
2003	6	0	0.809	7	0	0.899	4	0	0.808
ROA									
2001	4	0	0.973	6	1	1.241	2	0	0.834
2002	5	1	1.985	5	2	2.573	5	1	1.477
2003	4	0	0.756	7	0	0.767	3	0	0.747
ROS									
2001	4	1	1.004	5	1	1.238	3	0	0.92
2002	2	1	1.203	3	1	1.257	2	1	1.16
2003	0	0	0.48	2	0	0.59	0	0	0.471
SAD									
2001	16	0	0.766	31	1	1.253	8	0	0.698
2002	12	5	1.578	19	6	2.075	9	2	1.548
2003	9	3	1.417	14	3	1.46	8	2	1.392
UPP									
2001	16	0	0.818	28	0	0.953	9	0	0.816
2002	9	5	1.724	13	5	2.497	8	3	1.324
2003	9	1	1.492	13	2	1.519	8	1	1.476

Table 4-31b. CALPUFF-estimated visibility impacts on Class II areas for the Cumulative Emissions plus the various Project alternatives without RFD sources using Method 2 -- FLAG Monthly f(RH) with IMPROVE Seasonal Background.

	Proposed Action			Alternative C			Alternative A		
	#Days ≥ 0.5 dv	# Days ≥ 1.0 dv	Max (dv)	#Days ≥ 0.5 dv	# Days ≥ 1.0 dv	Max (dv)	#Days ≥ 0.5 dv	# Days ≥ 1.0 dv	Max (dv)
BRB									
2001	53	39	5.122	63	49	6.603	36	16	2.477
2002	53	35	3.162	66	46	4.486	23	2	1.084
2003	43	24	4.136	49	37	5.436	18	6	2.079
DEE									
2001	11	0	0.721	20	0	0.95	5	0	0.754
2002	9	5	1.868	13	5	2.686	9	2	1.321
2003	9	1	1.484	10	1	1.505	6	1	1.632
DIN									
2001	18	6	1.562	22	9	1.872	10	1	1.411
2002	27	6	1.652	33	7	1.933	14	1	1.011
2003	24	8	1.521	30	11	2.08	17	1	1.384
GRO									
2001	18	2	1.8	21	4	1.824	12	1	1.967
2002	7	0	0.71	10	0	0.81	1	0	0.531
2003	8	1	1.276	10	1	1.542	4	0	0.776
LAZ									
2001	9	2	1.484	11	2	1.754	5	1	1.377
2002	3	1	1.221	4	1	1.274	1	0	0.812
2003	6	0	0.809	7	0	0.899	2	0	0.896
ROA									
2001	4	0	0.973	6	1	1.241	3	0	0.725
2002	5	1	1.985	5	2	2.573	6	1	1.633
2003	4	0	0.756	7	0	0.767	4	0	0.833
ROS									
2001	4	1	1.004	5	1	1.238	3	1	1.029
2002	2	1	1.203	3	1	1.257	1	0	0.798
2003	0	0	0.48	2	0	0.59	1	0	0.517
SAD									
2001	16	0	0.766	31	1	1.253	4	0	0.775
2002	12	5	1.578	19	6	2.075	11	3	1.373
2003	9	3	1.417	14	3	1.46	7	3	1.545
UPP									
2001	16	0	0.818	28	0	0.953	5	0	0.905
2002	9	5	1.724	13	5	2.497	10	2	1.217
2003	9	1	1.492	13	2	1.519	7	1	1.638

Table 4-31c. CALPUFF-estimated visibility impacts on Class II areas for the Cumulative Emissions plus the various Project alternatives without RFD sources using Method 3a - FLAG Monthly f(RH) with EPA Default Annual Natural Conditions.

	Proposed Action			**Alternative C**			**Alternative A**		
	# Days ≥ 0.5 dv	**# Days ≥ 1.0 dv**	**Max (dv)**	**# Days ≥ 0.5 dv**	**# Days ≥ 1.0 dv**	**Max (dv)**	**# Days ≥ 0.5 dv**	**# Days ≥ 1.0 dv**	**Max (dv)**
BRB									
2001	54	44	5.928	67	53	7.567	40	19	2.662
2002	56	42	3.684	70	52	5.178	38	10	1.599
2003	46	27	4.785	51	40	6.278	26	12	2.21
DEE									
2001	18	0	0.858	28	1	1.128	13	0	0.815
2002	12	5	2.218	18	5	3.167	10	4	1.559
2003	11	1	1.753	14	3	1.778	10	1	1.737
DIN									
2001	20	7	1.796	26	10	2.128	13	2	1.445
2002	31	6	1.881	40	12	2.197	24	6	1.605
2003	28	8	1.733	34	13	2.362	20	3	1.417
GRO									
2001	20	6	2.118	26	9	2.146	17	4	2.09
2002	8	0	0.859	13	0	0.979	8	0	0.791
2003	11	1	1.536	15	3	1.85	9	1	1.384
LAZ									
2001	12	2	1.752	12	2	2.065	9	2	1.584
2002	6	1	1.444	6	2	1.507	5	1	1.395
2003	6	0	0.969	11	1	1.066	4	0	0.968
ROA									
2001	9	1	1.154	11	1	1.47	9	0	0.991
2002	7	3	2.355	12	3	3.038	6	2	1.76
2003	5	0	0.899	9	0	0.913	5	0	0.889
ROS									
2001	5	2	1.19	6	2	1.464	4	2	1.081
2002	3	1	1.423	3	2	1.486	2	1	1.373
2003	2	0	0.572	5	0	0.702	2	0	0.561
SAD									
2001	27	0	0.911	40	5	1.483	17	0	0.838
2002	20	6	1.863	25	7	2.46	16	5	1.828
2003	13	3	1.675	15	6	1.725	10	3	1.645
UPP									
2001	20	0	0.981	29	1	1.132	13	0	0.978
2002	17	5	2.05	21	6	2.949	14	4	1.567
2003	11	2	1.763	15	6	1.795	10	2	1.744

Table 4-31d. CALPUFF-estimated visibility impacts on Class II areas for the Cumulative Emissions plus various Project alternatives without RFD sources using Method 3b - FLAG Monthly f(RH) with EPA Default Best 20% days Natural Conditions.

	Proposed Action			**Alternative C**			**Alternative A**		
	# Days ≥ 0.5 dv	**# Days ≥ 1.0 dv**	**Max (dv)**	**# Days ≥ 0.5 dv**	**# Days ≥ 1.0 dv**	**Max (dv)**	**# Days ≥ 0.5 dv**	**# Days ≥ 1.0 dv**	**Max (dv)**
BRB									
2001	61	47	7.151	74	55	9.003	46	31	3.32
2002	64	42	4.543	74	58	6.289	43	18	2.02
2003	49	35	5.834	53	47	7.55	31	15	2.771
DEE									
2001	30	3	1.094	39	7	1.433	19	2	1.04
2002	21	6	2.781	26	8	3.927	18	6	1.97
2003	14	5	2.21	20	7	2.241	11	4	2.191
DIN									
2001	26	9	2.263	36	15	2.671	21	4	1.829
2002	44	14	2.368	52	20	2.755	36	9	2.028
2003	39	12	2.186	48	20	2.956	33	7	1.794
GRO									
2001	27	11	2.659	30	14	2.694	23	8	2.625
2002	16	2	1.096	17	5	1.248	14	1	1.011
2003	15	6	1.942	18	9	2.331	14	4	1.754
LAZ									
2001	16	4	2.209	26	6	2.595	15	4	2.002
2002	8	2	1.829	14	2	1.906	7	2	1.768
2003	13	2	1.234	18	4	1.357	11	2	1.233
ROA									
2001	17	1	1.467	22	3	1.859	14	1	1.261
2002	12	5	2.947	15	5	3.772	12	5	2.219
2003	12	2	1.146	17	2	1.163	9	2	1.133
ROS									
2001	11	3	1.511	15	3	1.853	9	3	1.376
2002	6	2	1.802	6	2	1.88	5	1	1.74
2003	7	0	0.732	8	0	0.898	3	0	0.719
SAD									
2001	40	4	1.161	50	15	1.876	27	2	1.069
2002	27	8	2.345	38	11	3.076	23	7	2.303
2003	19	6	2.114	28	8	2.176	16	6	2.077
UPP									
2001	34	5	1.249	48	12	1.438	26	3	1.246
2002	24	7	2.575	30	8	3.666	20	7	1.98
2003	19	6	2.223	22	8	2.261	14	6	2.199

Table 4-31e. CALPUFF-estimated visibility impacts on Class II areas for the Cumulative Emissions plus the various Project alternatives without RFD sources using Method 4 -- FLAG Hourly f(RH) with FLAG Seasonal Background.

	Proposed Action			**Alternative C**			**Alternative A**		
	# Days ≥ 0.5 dv	**# Days ≥ 1.0 dv**	**Max (dv)**	**# Days ≥ 0.5 dv**	**# Days ≥ 1.0 dv**	**Max (dv)**	**# Days ≥ 0.5 dv**	**# Days ≥ 1.0 dv**	**Max (dv)**
BRB									
2001	52	39	5.906	61	46	7.471	37	21	2.917
2002	51	32	4.057	65	45	5.591	28	7	1.818
2003	40	27	5.247	50	35	6.515	26	12	2.493
DEE									
2001	15	0	0.918	22	1	1.204	13	0	0.791
2002	12	6	2.791	15	6	3.485	9	6	2.741
2003	9	1	1.19	13	2	1.209	7	1	1.177
DIN									
2001	22	5	2.456	28	8	3.166	13	1	1.752
2002	25	8	2.517	30	11	2.969	21	8	2.081
2003	29	9	2.07	33	13	2.737	19	5	1.45
GRO									
2001	17	4	2.141	20	6	2.169	16	4	2.112
2002	6	0	0.863	8	0	0.947	5	0	0.808
2003	11	1	1.431	12	1	1.747	8	1	1.268
LAZ									
2001	8	2	2.18	11	2	2.516	6	2	1.993
2002	7	2	1.67	8	2	1.74	6	1	1.614
2003	7	0	0.782	8	1	1.079	3	0	0.779
ROA									
2001	6	1	1.287	11	1	1.632	5	1	1.104
2002	7	5	2.589	9	5	3.296	7	5	1.949
2003	4	0	0.666	5	0	0.675	3	0	0.658
ROS									
2001	5	2	1.406	5	2	1.706	3	2	1.237
2002	5	1	1.65	5	2	1.72	4	1	1.593
2003	1	0	0.577	4	0	0.709	1	0	0.541
SAD									
2001	21	0	0.842	30	2	1.061	13	0	0.829
2002	15	7	3.2	20	8	3.275	11	6	3.143
2003	11	2	1.455	15	5	1.611	8	2	1.384
UPP									
2001	16	0	0.949	26	1	1.196	14	0	0.946
2002	14	6	2.816	16	6	3.234	9	6	2.765
2003	10	2	1.184	14	3	1.251	9	2	1.169

SECTION 5 REGIONAL OZONE ASSESSMENT

5.1 INTRODUCTION

The proposed Project will result in an increase in emissions of nitrogen oxide, VOC, and carbon monoxide that are precursors to ozone. Ozone is typically formed in the atmosphere due to a series of complex chemical reactions involving VOC and NOx in the presence of sunlight usually on hot stagnant sunny days (note that recent relatively high ozone events in southwestern Wyoming have occurred on cold winter days with snow cover). The chemistry of ozone formation is complex and highly nonlinear and needs to account for the presence of all sources. The current NAAQS for ozone is defined as the three year average of the fourth highest daily maximum 8-hour ozone concentration with a threshold of 0.08 ppm (or 85 ppb). The state of Wyoming has also adopted a state standard for 8-hour ozone (WAAQS) that is the same as the federal standard (NAAQS). Recent ozone measurements in southwestern Wyoming have raised concerns regarding its future attainment status. Measured ozone concentrations from the Jonah monitoring site in Sublette County, Wyoming have recorded an average fourth highest 8-hour ozone concentration during the 2005-2006 two-year monitoring period of 0.071 ppm (71 ppb). This is particularly a concern because the Clean Air Science Advisory Committee (CASAC) has recently recommended that EPA should lower the 8-hour ozone standard to 0.070 ppm. Thus, the effect of the Project, and other cumulative emissions in the region, on ozone concentrations needs to be assessed.

In the past, ozone impacts due to proposed new sources have been evaluated using the Scheffe Tables (Scheffe 1988). Scheffe Tables consist of a lookup table of maximum potential incremental ozone production estimates from a source based on VOC/NOx emissions. The ozone increment from the source is added to the maximum measured background ozone and is compared against the ozone NAAQS to determine whether the new source(s) could potentially cause an exceedance of the ozone standard. However, the Scheffe Tables are designed for maximum 1-hour ozone, and their developer (Dr. Richard Scheffe of the EPA Office of Air Quality and Planning Standards) has opposed their continued use, so alternative approaches are needed to address ozone issues in an EIS.

EPA modeling guidance for 8-hour ozone modeling recommends the use of Eulerian photochemical grid models (PGMs) to address ozone issues (EPA 2007; 2006; 1999; 1991). This is in contrast to Lagrangian plume models that are typically used to model the impacts due to a small number of sources, as was done in the near-field (AERMOD) and far-field (CALPUFF) modeling for the Project discussed in Sections 3 and 4, respectively. PGMs model the emissions from all sources (e.g., on-road and non-road mobile, point, area, biogenic, and other sources) which is necessary to simulate ozone formation. PGMs divide the modeling domain into an array of grid cells and require three-dimensional meteorological fields, gridded emissions, boundary conditions (i.e., transported pollutants from outside of the modeling domain), and other inputs. PGMs can incorporate state-of-science chemistry, transport, dispersion and deposition processes. To assess the potential impacts from the addition of new emission sources (e.g., the proposed Project and cumulative emissions) using PGMs, two simulations are typically performed:[1] (1) a base case and (2) a scenario where the new emissions are added to the base case. The difference in the two PGM simulations is the resultant incremental ozone impact due to the new sources.

There has been a reluctance to use PGMs for NEPA and PSD assessments of air quality and AQRV impacts from a single source or small group of sources due to the increased data (e.g., all sources are

[1] Note that some PGMs incorporate source apportionment as a diagnostic probing tool that can track the ozone formation due to separate groups of sources within a single simulation.

modeled) and computational requirements of PGMs. However, for ozone modeling, use of PGMs is recommended by EPA (EPA, 2007; 006; 1999; 1991) and is the most reliable modeling approach.

In this section, the application of a PGM to assess the potential ozone impacts due to emissions from the Project and cumulative sources in the study area is described.

5.2 OZONE MODELING APPROACH

Prior to performing the ozone modeling of the Project and cumulative emissions, a Modeling Protocol was prepared that detailed the assumptions, models, databases, and how the results would be interpreted. The Protocol was presented to BLM and the cooperating agencies (Tai and Morris 2007; SWCA 2006) for review.

5.2.1 Model Selection

The followingtwo main photochemical grid models are currently being used to address 8-hour ozone issues:

- The Community Multi-scale Air Quality (CMAQ) modeling system (Byun and Ching, 1999) developed by EPA is publicly available free of charge from the CMAS Center (http://www.cmascenter.org/); and
- The Comprehensive Air-quality Model with extensions (CAMx) that was developed by ENVIRON (2006) can also be downloaded free of charge (www.camx.com).

Both CMAQ and CAMx are current state-of-science models capable of simulating ozone formation due to new sources, such as those being considered in this application. For this study, the CAMx model was selected for the following reasons:

- CAMx includes algorithms for enhancing photolysis rates due to the presence of snow on the ground, which is important because some of the highest ozone measurements recorded in southwestern Wyoming have occurred in the winter when snow is present.
- CALMET meteorological data can be processed for input to CAMx, whereas CMAQ is designed to run solely off meteorological data from MM5 or WRF – the MM5 and WRF prognostic models have difficulty in simulating stagnant conditions because they try to organize the simulated flows; and, therefore, overestimate wind speeds during periods of light winds. On the other hand, stagnant observations that are input into CALMET will be reflected in the CALMET wind fields.
- CAMx incorporates two-way grid nesting that allows concentrations to feed back and forth between coarse and fine grids, whereas CMAQ only supports one-way grid nesting that only allows concentrations to flow from the coarser to the finer grids, but not vice versa. Thus, CAMx is able to more cost –effectively estimate ozone impacts over a larger area.
- CAMx includes a flexi-nesting feature that allows for the run time interpolation of coarse grid data to finer grids that is not available in CMAQ.
- CAMx is easier to use and more flexible.

5.2.2 Selection of a Modeling Period and Development of Modeling Databases

The ozone issue in southwestern Wyoming is complicated by the fact that elevated ozone levels have been recorded in the winter, which is in contrast to most areas whose highest ozone events occur during the summer. Consequently, the concept of an ozone season is difficult to define for the region. Thus, it was decided to simulate an entire year to be sure to capture all potential high ozone conditions in the region.

Developing an annual PGM database from scratch is quite labor and time intensive. Fortunately, the WRAP has developed 2002 annual PGM modeling databases for the continental U.S. (Tonnesen et al., 2005; 2006) that can be adapted to assess the potential ozone impacts of the proposed Project as well as the other cumulative emissions sources in southwestern Wyoming, northeastern Utah, and northwestern Colorado. Thus, the 2002 annual period was selected due to the ability to leverage off of the WRAP modeling databases.

5.2.3 Development of a 2002 Ozone Modeling Database

The WRAP annual 2002 modeling database for the CAMx model was adapted for simulating ozone formation due to emissions from the Project and cumulative emissions in southeastern Wyoming and vicinity.

5.2.3.1 Modeling Domains and Grid Resolution

The WRAP developed a 2002 modeling database with a 12 km western U.S. modeling domain nested within a 36 km continental U.S. domain (Tonnesen et al. 2005; 2006). For simulating ozone formation from the Project and cumulative emissions in Wyoming and surrounding states, a higher resolution grid is needed, and is more consistent with EPA guidance (EPA 2007; 2006; 1999; 1991). Thus, a 12/4 km two-way nested grid modeling domain was defined for simulating ozone due to emissions from the Project and cumulative emissions as depicted in Figure 5-1. To define boundary conditions (BCs) for the Project's 12/4 km modeling domain (i.e., the assumed concentrations along the lateral boundaries of the 12 km grid shown in Figure 5-1), a 2002 Base Case simulation was performed for the WRAP 36 km continental U.S. domain and the results processed to generate hourly BC inputs for the 12/4 km domain (Figure 5-1). The resulting 36/12/4 km modeling domain used is shown in Figure 5-2 with one-way grid nesting between the 36 km and 12 km grids and two-way grid nesting between the 12 km and 4 km grids. Table 5-1 gives the definitions of the 36/12/4 km grid used in the Project's ozone modeling.

Table 5-1. Grid definitions used in the Project's ozone modeling based on a Lambert Conformal Conic (LCC) projection with origin at (-97, 45) and true latitudes at (33, 45).

Grid	X-Offset (km)	Y-Offset	NX	NY
36 km	-2,736.0	-2,088.0	148	112
12 km	-1,452.0	-192.0	89	86
4 km	-1,192.0	140.0	83	83

The same vertical layer structure used by WRAP was used in this study (Tonnesen et al. 2005; 2006). The WRAP vertical layer structure consists of 19 vertical layers from the surface to 100 mb (approximately 15 km AGL, with a surface layer that is approximately 35 m thick.

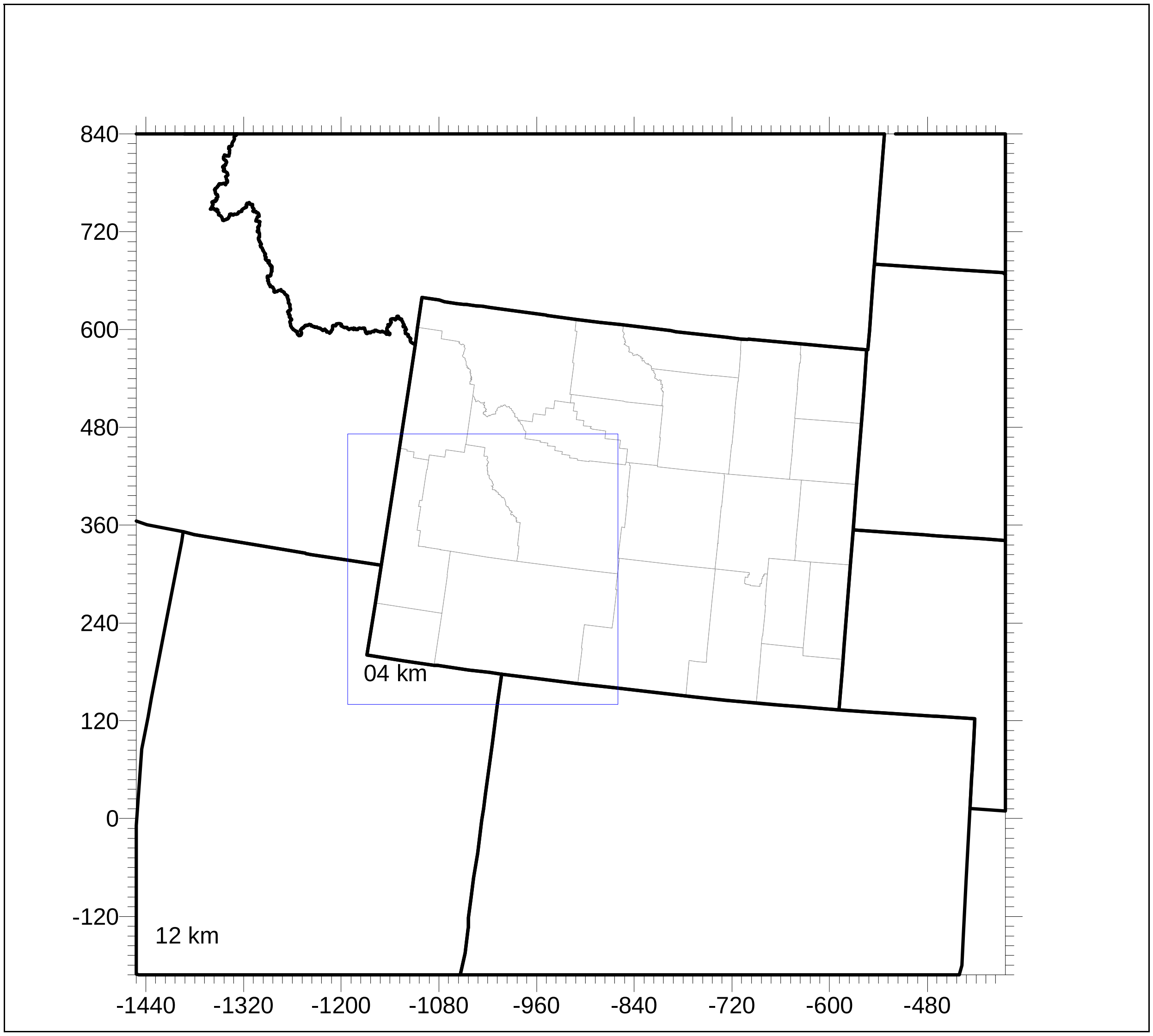


Figure 5-1. 2002 12/4 km two-way grid nested modeling domain used for the Project and cumulative emissions.

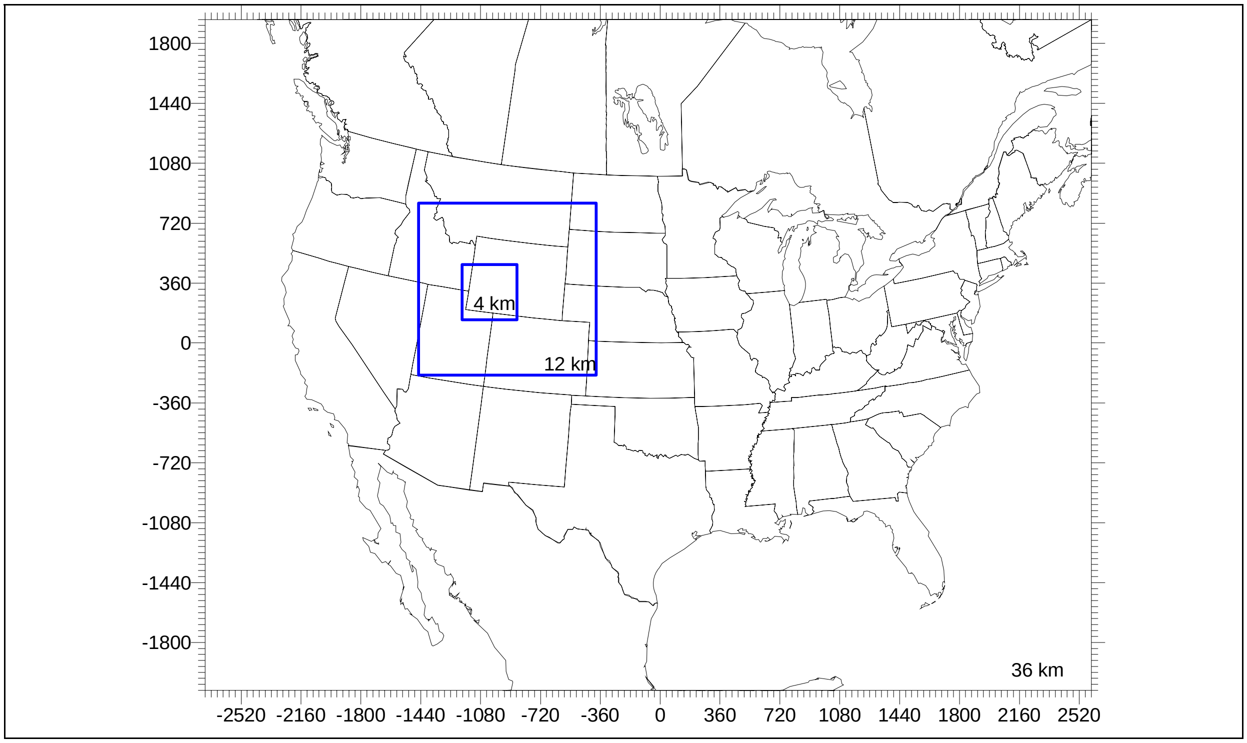


Figure 5-2. 2002 36/12/4 km ozone modeling domain for the Project and cumulative sources, one-way grid nesting was used between the 36 and 12 km grids, whereas two-way grid nesting was used between the 12 and 4 km grids.

5.2.3.2 Meteorological Inputs

The CAMx meteorological inputs for the 36 km and 12 km grids were based on the WRAP 36 km and 12 km MM5 simulations, respectively (Kemball-Cook et al. 2004). The MM5CAMx preprocessor was used to process and reformat the MM5 output for hourly meteorological inputs into CAMx for the 36 km and 12 km grids over the 2002 annual period.

For the 4 km grid, the CALMET model was used to generate wind and temperature fields for layers below approximately 3,000 m AGL. For winds above approximately 3,000 AGL and other meteorological variables, the 12 km MM5 output were interpolated to 4 km and processed for input into CAMx.

For the 4 km wind field below 3,000 m AGL, CALMET was run in a similar manner as discussed in Section 4. For the initial guess field, 12 km MM5 data was provided as input into CALMET, which applied the diagnostic wind effects and then integrated the surface and upper-air meteorological observations into the fields. There were two main reasons that CALMET was used for the 4 km wind fields rather than just interpolating the 12 km MM5 data onto the 4 km grid:

- The MM5 and other prognostic models have difficulty in simulating stagnant conditions, as discussed above. Such stagnant limited mixing conditions are believed to be important for producing elevated ozone in southwestern Wyoming.
- The CALMET model would introduce 4 km terrain effects through its diagnostic wind model that would not be present in the 12 km MM5 data.

Note that another alternative would be to run the MM5 model at 4 km for the 4 km modeling domain and the 2002 annual modeling period. However, this would still not address the difficulty in MM5's simulations of stagnant flow conditions and would result in serious schedule and resource issues in the study.

Figure 5-3 displays the Project's 12/4 km modeling domain and the locations of the surface and upper-air meteorological monitoring sites used in the 4 km CALMET simulation. Also shown in Figure 5-3 are the locations of the seven CASTNet ozone monitoring sites used in the ozone model performance evaluation that is discussed in Section 5.3.2.

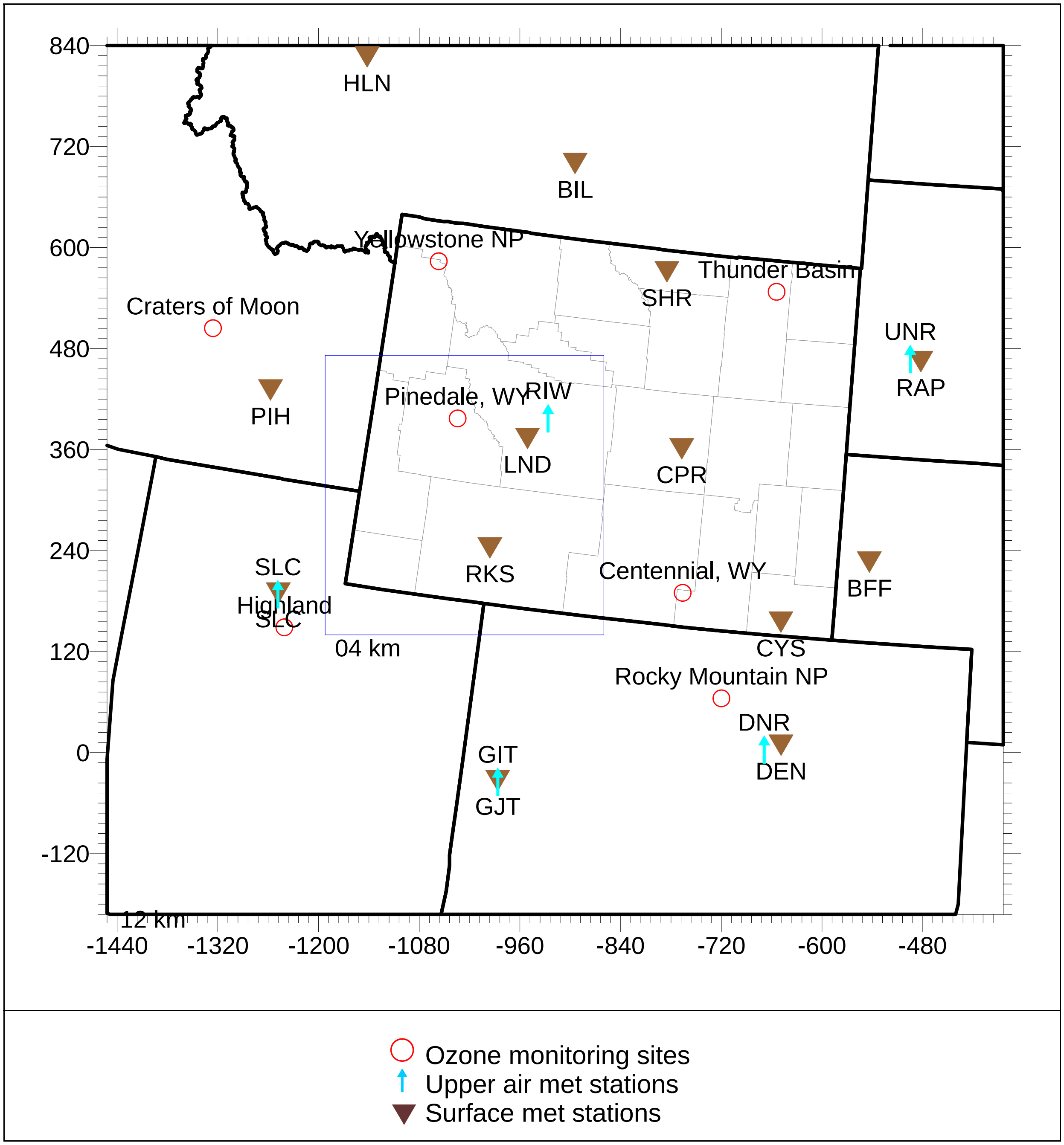


Figure 5-3. 2002 12/4 km modeling domain showing locations of surface and upper-air meteorological monitoring sites and the seven ozone monitoring sites.

5.2.3.2 Emission Inputs

Two emission scenarios were generated for ozone modeling: (1) a 2002 Base Case emissions scenario, and (2) a 2002 scenario with the base case plus the Project and Cumulative Emissions. For the Project, emissions for the Proposed Action alternative were used in the Project plus Cumulative Emissions scenario.

The emission inputs for the 2002 Base Case modeling were based on the WRAP 2002 36 km Base02b emission scenario. For the 2002 36 km CAMx simulation used to define the BCs for the 12/4 km domain, the WRAP Base02b 36 km emissions were used. For the 2002 Base Case emissions scenario and the 12 km domain, the WRAP Base02b 36 km emissions were mapped to the 12 km grid and windowed to match the 12 km grid domain. The 4 km 2002 Base Case emissions were obtained by flexi-nesting the 12 km emissions. Flexi-nesting interpolates the surface gridded 12 km emissions to the 4 km grid and treats point source emissions at the grid resolution where the point source resides (e.g., 4 km).

Area source emissions for the Project and cumulative emissions were first gridded to the 4 km grid. Then, they were input into CAMx as point sources with locations at the center of the 4 km grid cell in which they are located. Project and cumulative point sources were input as point sources in CAMx. A key component in the processing of the Project and cumulative emissions was the speciation of the VOC emissions into the CB05 chemical mechanism. For each source, an SCC code was assigned so that it could be cross-referenced to the correct VOC speciation profile in the emissions modeling.

Figure 5-4 displays the 2002 Base Case low-level gridded and elevated point source emissions for the 12/4 km modeling domain. The low-level gridded emissions include on-road mobile, non-road mobile, area, biogenic, and low-level point sources. The fact that the 2002 Base Case emissions were based on the WRAP 36 km emissions is clearly evident in the low-level emissions (Figure 5-4b). The urban areas of Denver, Colorado and Salt Lake City, Utah are clearly evident in the 2002 Base Case emissions displays.

Figure 5-5 displays the elevated point source emissions for the Project plus cumulative emissions scenario. Because emissions from the Project and cumulative sources were all represented as point sources so they can be treated by the high resolution 4 km grid, then the low-level gridded emissions for the Project plus cumulative emissions scenario are the same as the 2002 Base Case (Figure 5-4a). Figure 5-6 displays the difference between the Project and cumulative emissions and the 2002 Base Case emission scenarios. Cumulative emissions from the Project are clearly evident, along with cumulative emissions in the Pinedale/Jonah, Continental Divide, and other project areas. The higher resolution representative of the Project and cumulative emissions is also clearly evident in Figure 5-6.

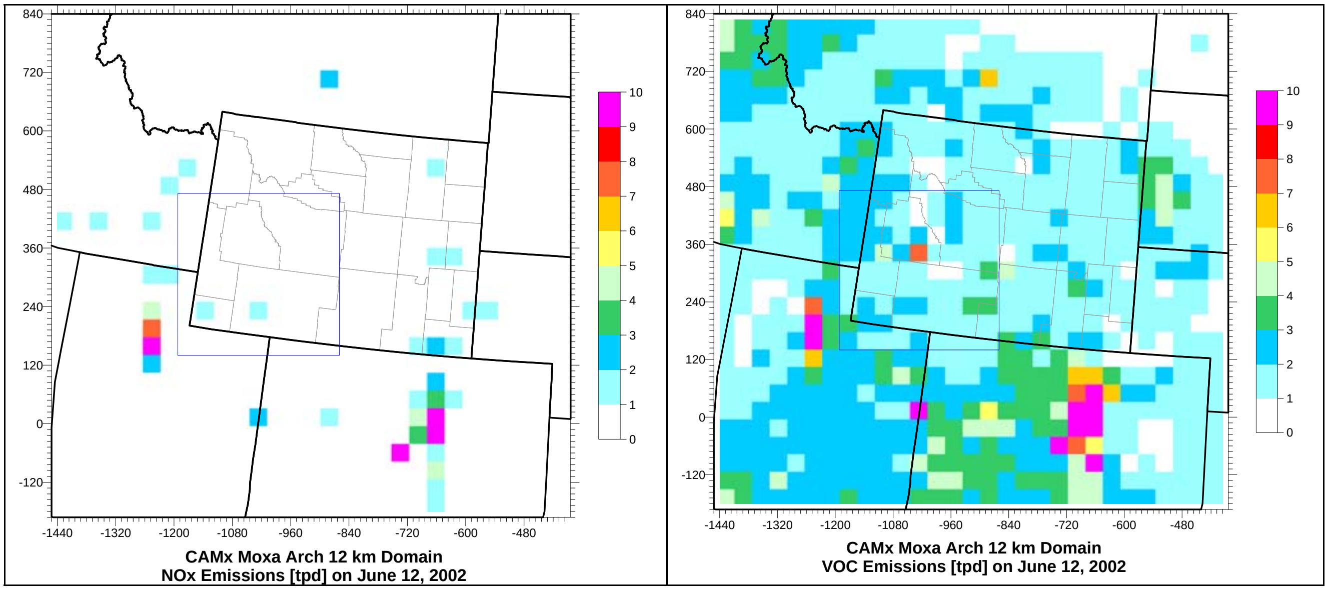


Figure 5-4a. Surface layer gridded NOx (left) and VOC (right) emissions (on-road and non-road mobile, area, biogenic and low-level point sources) for the 2002 Base Case emissions scenario (tons per day).

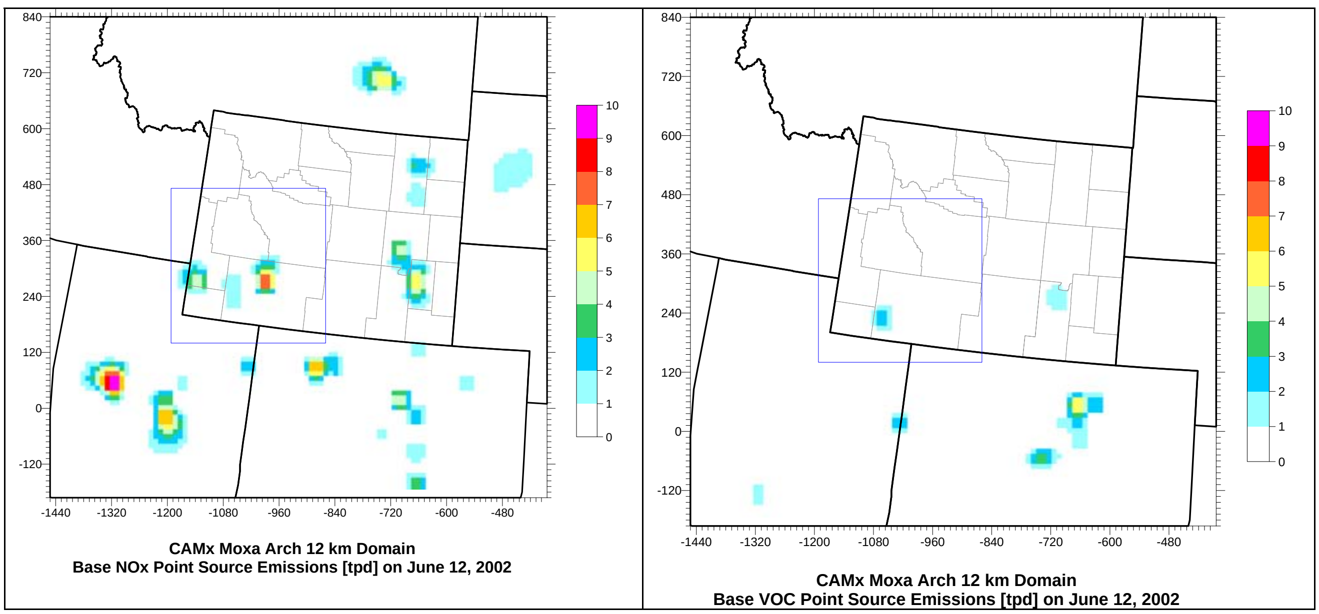


Figure 5-4b. Elevated point source NOx (left) and VOC (right) emissions for the 2002 Base Case emissions scenario (tons per day).

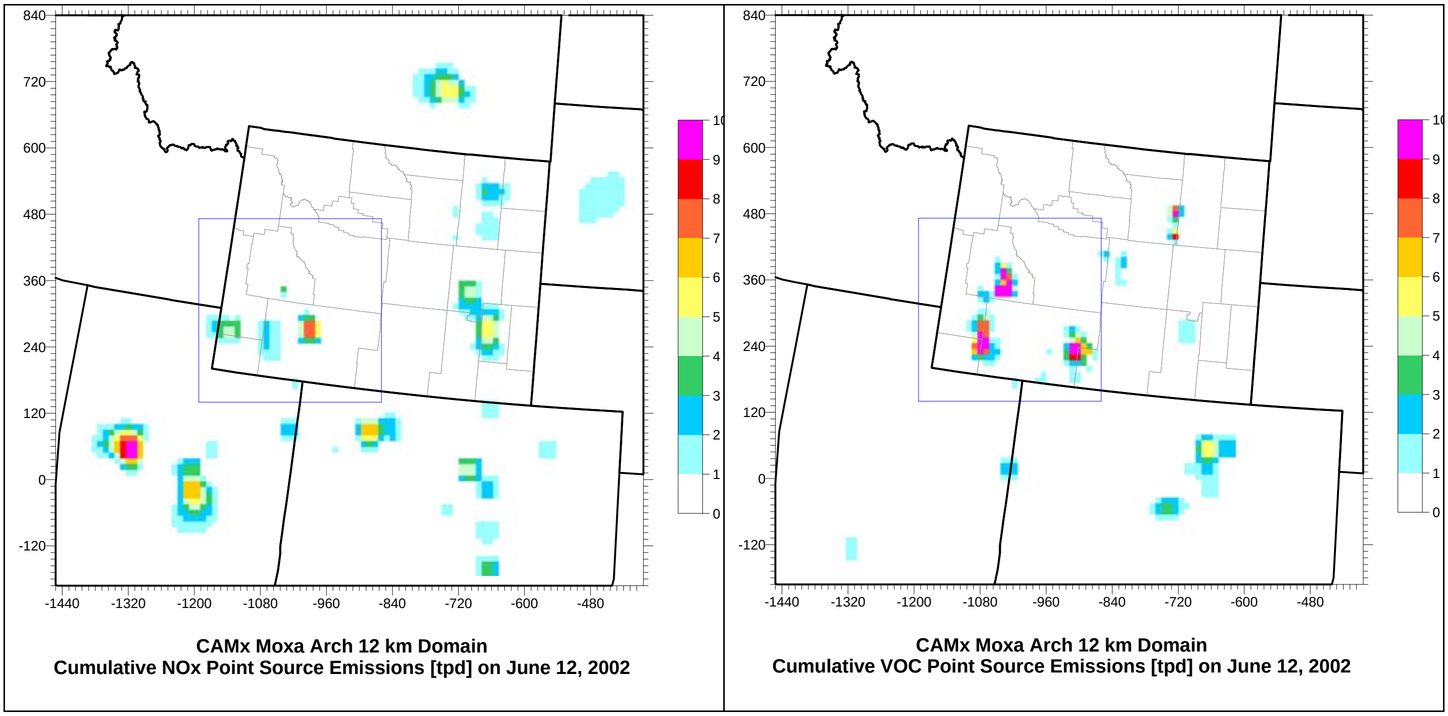


Figure 5-5. Elevated point source NOx (left) and VOC (right) emissions for the Project plus Cumulative emissions scenario (tons per day).

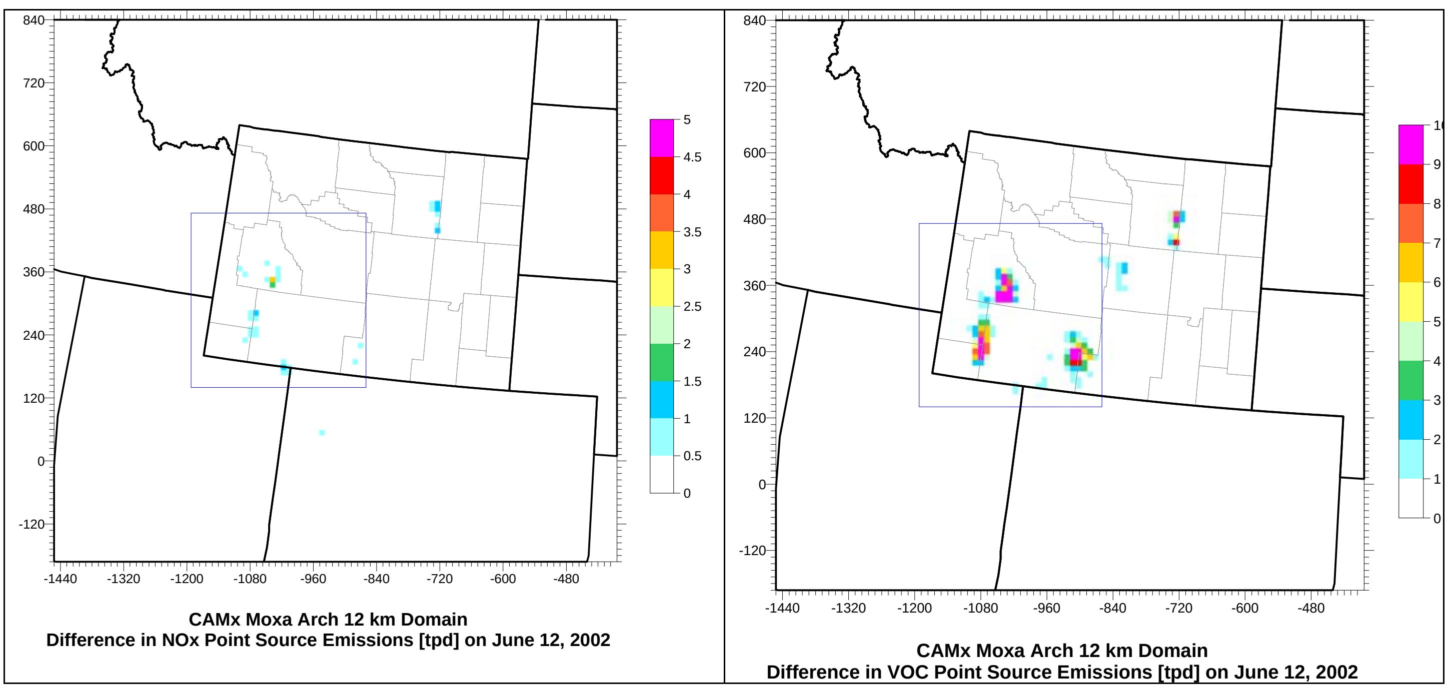


Figure 5-6. Differences in elevated point source NOx (left) and VOC (right) emissions for the Project plus Cumulative minus the 2002 Base Case emissions scenario (tons per day).

5.2.3.3 CAMx Model Options

CAMx model options specified for this application include the following:

- Use of the latest CB05 chemical mechanism.
- CMC fast chemistry solver.
- PPM advection solver.
- No Plume-in-Grid (PiG) algorithm.
- CAMx was run in the ozone-only mode (i.e., the PM chemistry was turned off to speed up the simulations as there is little feedback from PM to ozone chemistry).

5.3 2002 BASE CASE MODELING RESULTS

Using the hourly BCs generated from the 2002 36 km CAMx simulation and WRAP 2002 Base02b emissions, a 2002 12/4 km Base Case simulation was performed.

5.3.1 Comparison of Modeled versus Observed Peak 2002 Ozone Concentrations

The ozone standard is expressed as the three-year average of the fourth highest daily maximum ozone concentration at a monitor. Consequently, the model's ability to predict the highest ozone concentrations at an ozone monitor is of particular concern, particularly the fourth highest 8-hour ozone concentrations. Figures 5-7 and 5-8 display the spatial distribution of the fourth highest model estimated daily maximum 8-hour ozone concentration during the 2002 modeling year on the 4 km and 12 km modeling domains, respectively. Also shown in Figures 5-7 and 5-8 are the fourth highest observed daily maximum 8-hour ozone concentrations that are plotted at the location of the monitoring site. The model estimated fourth highest daily maximum ozone concentrations in the 4 km domain range from 50 ppb to 84 ppb, with the highest values occurring in northeastern Utah and northwestern Colorado, with the lowest values occurring near Palisades Reservoir, Idaho on the Wyoming-Idaho border. However, most of the model-estimated fourth highest daily maximum 8-hour ozone concentrations are in the 60 ppb to 80 ppb range. At the location of the Pinedale monitoring site, where the fourth-highest observed value of 73 ppb is recorded, the modeled value appears to be ~70 ppb. Note that the model estimates slightly higher ozone in the higher terrain of the Wind River Range than is recorded at the Pinedale monitoring site.

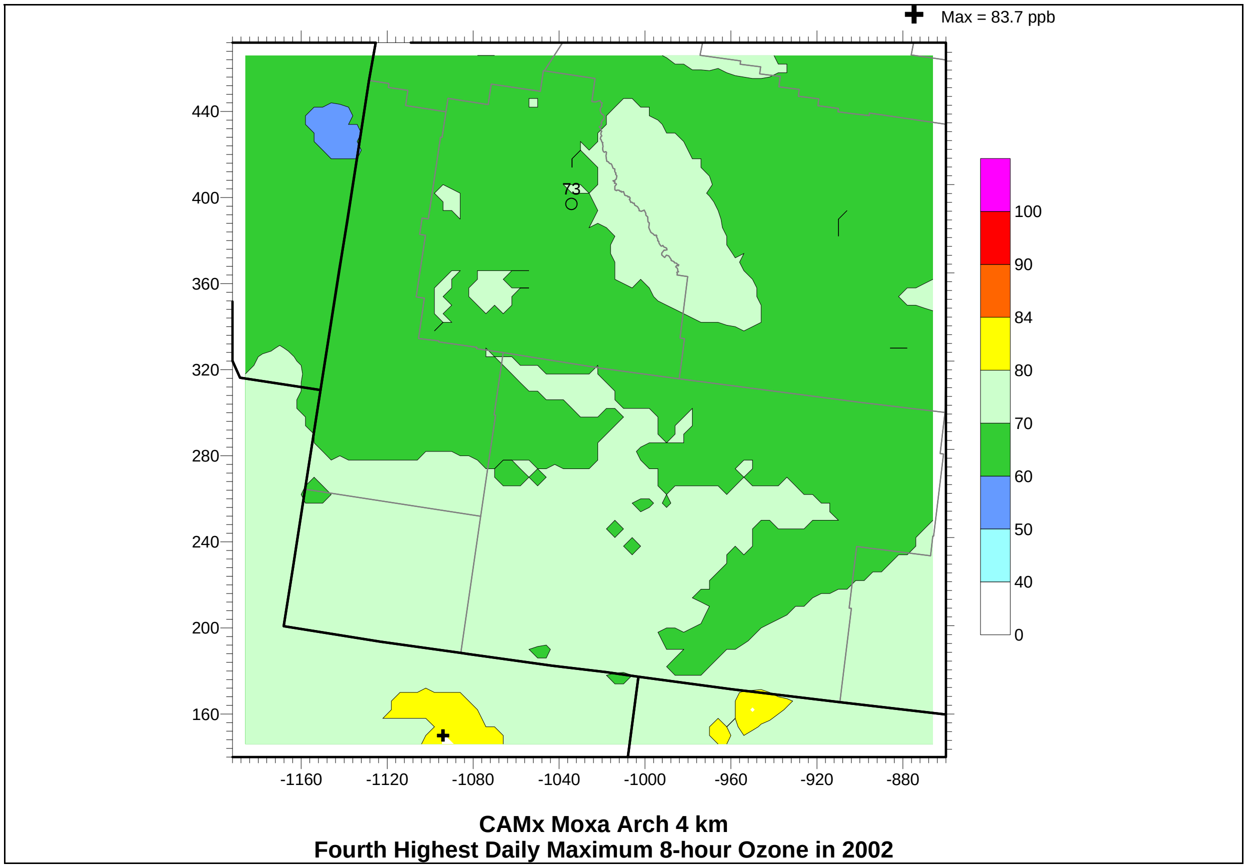


Figure 5-7. Model estimated fourth highest daily maximum 8-hour ozone concentration in the 4 km grid for the 2002 Base Case with superimposed observations.

In the 12 km grid, the maximum fourth-highest model-estimated daily maximum 8-hour ozone concentrations occur in the Salt Lake City, Utah and Denver, Colorado areas. This is consistent with the observed fourth-highest daily maximum 8-hour ozone concentrations that recorded values of 82 ppb at the Highland monitor south of Salt Lake City and 87 ppb at the Rocky Mountain National Park monitor northwest of Denver. The spatial distributions of the predicted and observed 4th highest daily maximum 8-hour ozone concentrations are consistent with one another, with the possible exception of the Yellowstone National Park monitor in northeastern Wyoming; the model estimates an isolated increase in ozone near Yellowstone; whereas, the monitored value is the lowest in the domain (67 ppb).

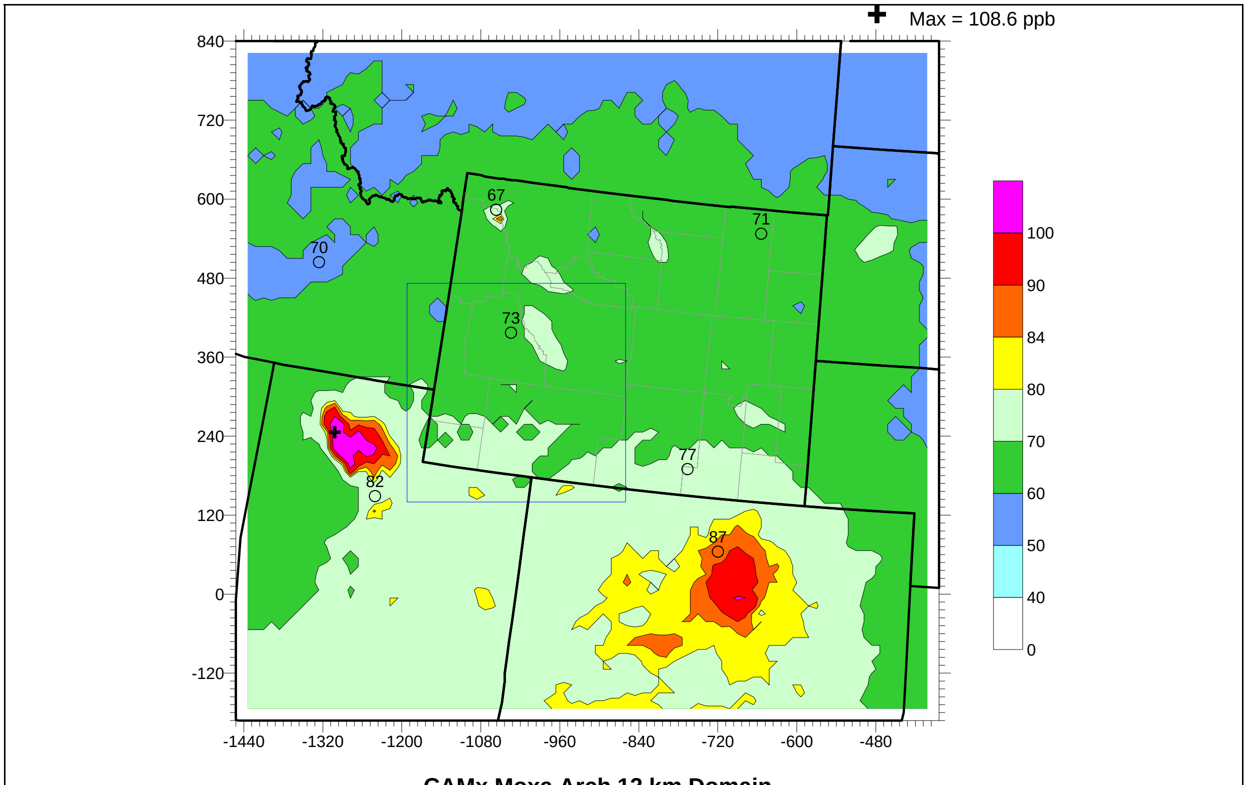


Figure 5-8. Model estimated fourth highest daily maximum 8-hour ozone concentration in the 12 km grid for the 2002 Base Case with superimposed observations.

The four highest modeled and observed daily maximum 8-hour ozone concentrations at the Pinedale and Centennial monitors during 2002 are shown in Table 5-2a. When performing 8-hour ozone projections, EPA recommends using the highest modeled daily maximum 8-hour ozone concentration near (within 15 km) the monitor, so the four highest modeled maximum values near the monitor were compared with the four highest observed values in Table 5-2b. There is agreement between the modeled and observed four highest daily maximum 8-hour ozone concentrations at the two monitors, with differences at the monitors ranging from -1.4% to -6.7% for Pinedale and -1.5% to -3.8% for Centennial. The agreement with the four highest observed daily maximum 8-hour ozone concentrations is even better when looking at the modeled maximum near the monitor with agreement ranging from -4.7% to +2.0% at Pinedale and -0.2% to -1.6% for Centennial.

Table 5-2a. Comparison of four highest predicted and observed daily maximum 8-hour ozone concentrations at the Pinedale and Centennial monitoring sites for 2002.

Rank	Observed (ppb)	Predicted (ppb)	Difference (%)
Pinedale Monitor			
1st High	76.50	75.46	-1.4%
2nd High	76.41	71.27	-6.7%
3rd High	72.94	70.70	-3.1%
4th High	72.69	68.69	-5.5%
Centennial Monitor			
1st High	79.13	76.48	-3.3%
2nd High	79.00	76.01	-3.8%
3rd High	77.94	75.61	-3.0%
4th High	76.66	75.51	-1.5%

Table 5-2b. Comparison of four highest predicted and observed daily maximum 8-hour ozone concentrations at the Pinedale and Centennial monitoring sites for 2002 using maximum modeled values near (< 15 km) the monitoring sites.

Rank	Observed (ppb)	Predicted (ppb)	Difference (%)
Pinedale Monitor			
1st High	76.50	78.01	+2.0%
2nd High	76.41	72.85	-4.7%
3rd High	72.94	72.70	-0.3%
4th High	72.69	72.06	-0.9%
Centennial Monitor			
1st High	79.13	78.29	-1.1%
2nd High	79.00	77.75	-1.6%
3rd High	77.94	76.80	-1.5%
4th High	76.66	76.47	-0.2%

5.3.2 Statistical Ozone Model Performance Evaluation

The modeled surface ozone concentrations estimates were compared against the observed ozone concentrations from the seven CASTNet monitoring sites shown in Figure 5-3 using graphical and statistical performance measures. Particular emphasis was placed on ozone model performance at the Pinedale CASTNet site because that was the only site located within the 4 km domain and because it lies between the Project and the Bridger Class I area. The ozone model performance at the Centennial CASTNet that lies just east of the 4 km domain was analyzed separately.

Figures 5-9 and 5-10 compare time series of predicted and observed daily maximum 8-hour ozone concentrations for 2002 at the Pinedale and Centennial ozone monitors sites, respectively. Although there is a lot of a day-to-day variation between the modeled and observed 8-hour ozone concentrations, the model generally matches the magnitudes of the observed values on average for most of the year until around August, when the modeled values start to become lower than observed. In particular, the model fails to capture the relatively high observed ozone at the end of August 2002. The modeled lowest 8-hour ozone days appear to be lower (~30 ppb) than the lowest observed days (~40 ppb), but the ozone magnitudes on the highest modeled days (~75 ppb) matches the observed magnitudes well, although there appears to be less modeled high days than observed, which is due to the August-December 2002 underestimation period. The reasons why the model begins an underestimation tendency in August is unclear.

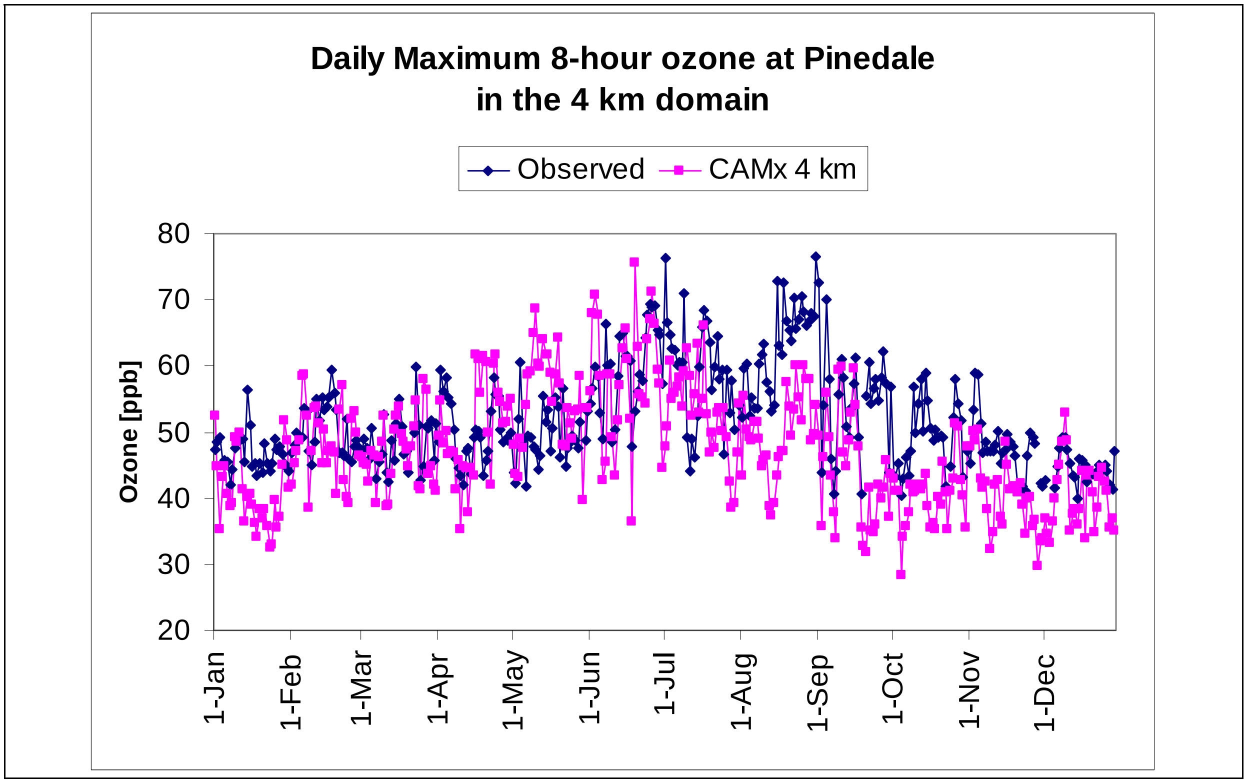


Figure 5-9. Comparisons of predicted and observed daily maximum 8-hour ozone concentrations (ppb) at the Pinedale CASTNet site.

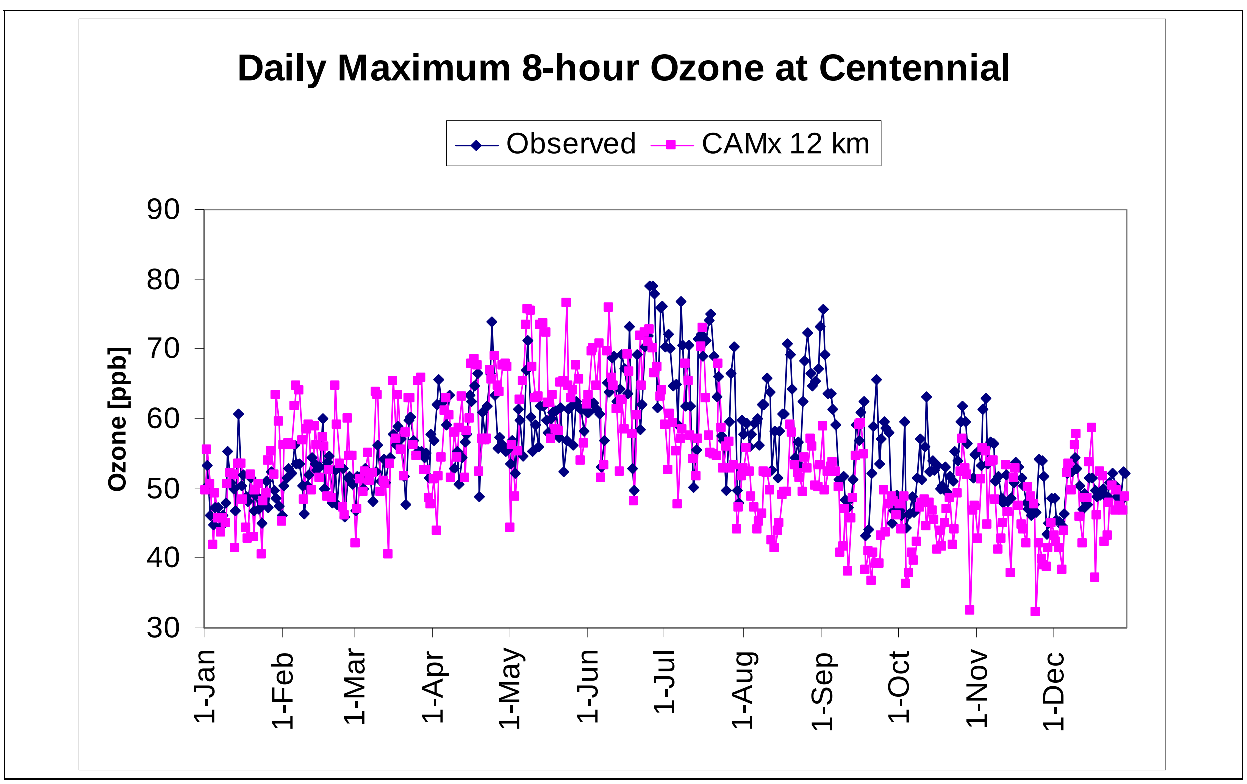


Figure 5-10. Comparisons of predicted and observed daily maximum 8-hour ozone concentrations (ppb) at the Centennial CASTNet site.

EPA has developed the following model performance goals for 1-hour ozone statistical measures (EPA 1991):

- Mean Normalized Bias (MNB) $\leq \pm 15\%$
- Mean Normalized Gross Error (MNGE) $\leq$ 35%

Figure 5-11 and 5-12 display the MNB and MNGE ozone performance metrics using the daily maximum 8-hour ozone concentrations by month for the, respectively, 4 km and 12 km modeling grids using “Soccer Plots”. Soccer Plots plot the MNB statistical performance measure on the x-axis and MNGE metric on the y-axis with a box around the MNB $\leq \pm 15\%$ and MNGE $\leq$ 35% performance goals. When the monthly symbol falls within the box, EPA’s MNB and MNGE model performance goals are achieved. For 7 months of 2002, the monthly model performance statistics within the 4 km domain (i.e., the Pinedale ozone monitor) achieve EPA’s MNB and MNGE performance goals. For the months of January, February, August, September and October, the MNB is below -15%, so does not achieve EPA’s performance goal for this metric, although the MNGE metric goal (< 35%) is achieved by a fair margin (~20%) for all months. The worst performing month is August (-23% MNB), which is consistent with the Pinedale time series shown in Figure 5-9.

Better ozone model performance metrics are seen across the 12 km modeling domain within only two months (August and September) with MNB performance metric not achieving EPA’s goals (Figure 5-11).

The comparisons of the predicted and observed 8-hour ozone concentrations presented in Figures 5-8 through 5-11 are for daily maximum 8-hour ozone concentrations paired in time (by day) and space (at the ozone monitor). When projecting 8-hour ozone concentrations, EPA guidance recommends using the daily maximum 8-hour ozone concentrations “near the monitor” to account for the fact that there may be small spatial displacements in the modeled ozone fields. In the 1999 EPA draft 8-hour ozone modeling guidance, EPA recommended that predicted 8-hour ozone concentrations near the monitor should be within $\pm$20% of the observed value on a majority of the days.

EPA guidance for making 8-hour ozone projections defines “near the monitor” as being within approximately 15 km. This turns out to be an array of 7 x 7 grid cells for the 4 km grid and 3 x 3 grid cells for the 12 km grid. The next issue is which model-estimated daily maximum 8-hour ozone concentration to match up with the observed value at the monitor, which is examined three ways:

Spatial Paired: Select the model estimated daily maximum 8-hour ozone concentrations at the monitor, as was done in the discussion above.

Maximum Value: Select the maximum model estimated daily maximum ozone concentrations in the array of cells (7 x 7 for 4 km and 3 x 3 for 12 km) centered on the monitor. This approach is identical to how modeled 8-hour ozone concentrations are selected for projecting 8-hour ozone concentrations.

Closest Value: Select the modeled daily maximum 8-hour ozone concentrations near the monitor that best matches the observed value.

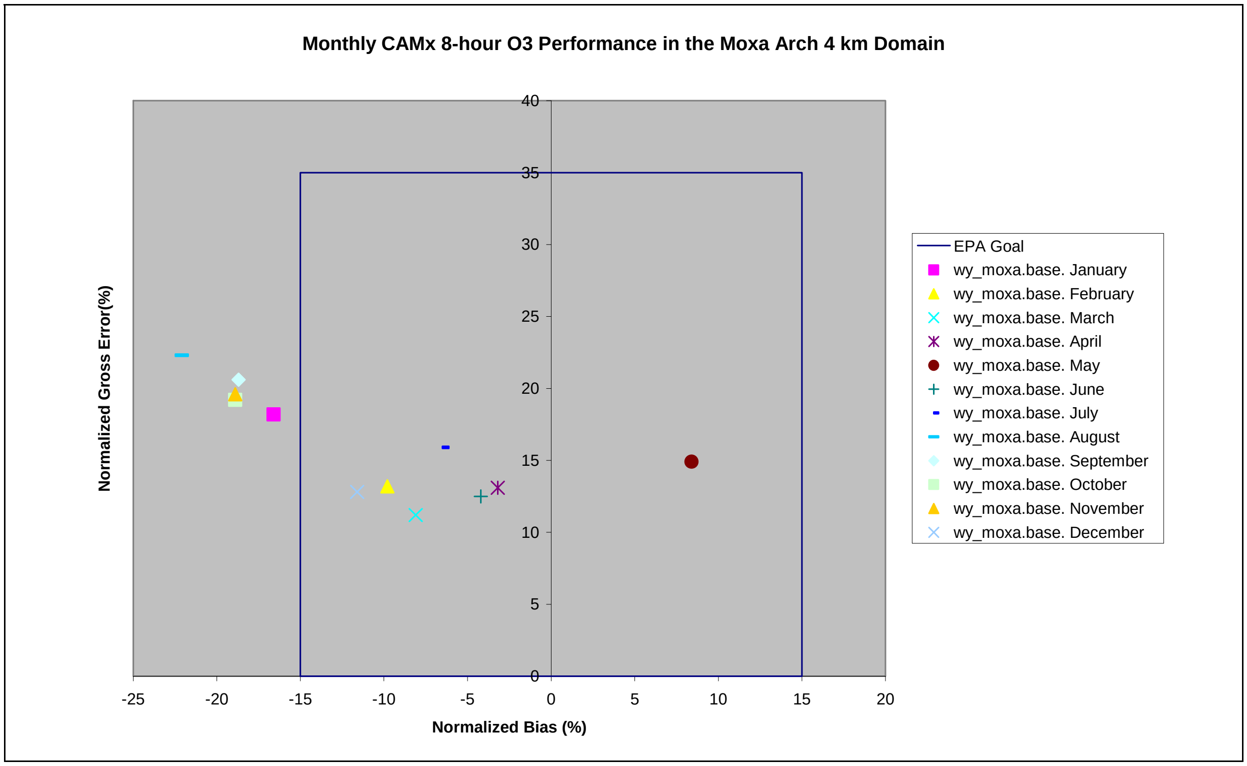


Figure 5-11. Soccer Plots of the monthly MNB versus MNGE for daily maximum 8-hour ozone concentrations in the 4 km grid (i.e., Pinedale monitoring site).

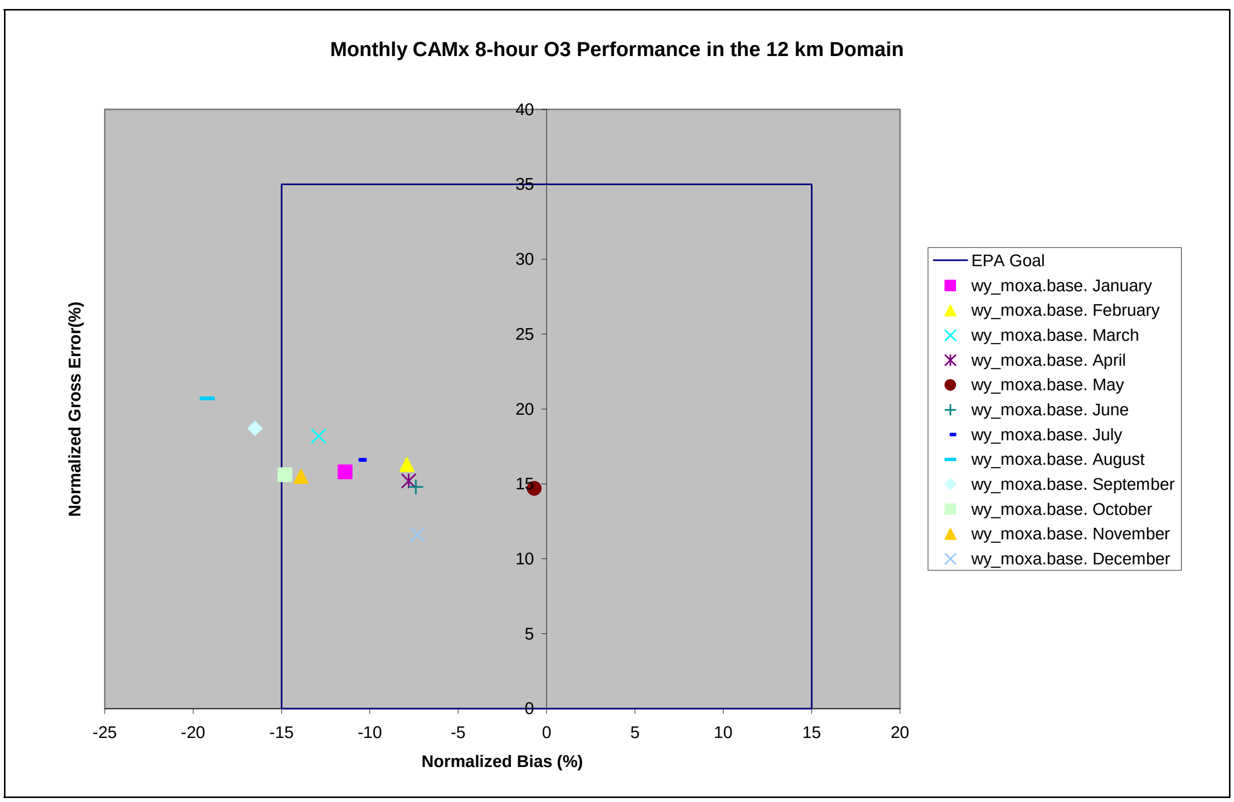


Figure 5-12. Soccer Plots of the monthly MNB versus MNGE for daily maximum 8-hour ozone concentrations in the 12 km grid (i.e., 7 CASTNet sites).

Figure 5-13 displays the comparisons of the predicted and observed 8-hour ozone concentrations in a scatter plot for these three methods of matching the modeled values with the observed values at the Pinedale monitoring site. The 1:1 line of perfect agreement is a solid line and predicted/observed pairs within the dotted lines are within ±20% of each other. Also shown in Figure 5-13 are the Quantile-Quantile (Q-Q) plots of the frequency distribution of the annual predicted and observed daily maximum 8-hour ozone concentrations. The closer the Q-Q plots are to the 1:1 sold line indicates how well the annual frequency distribution of the predicted and observed daily maximum 8-hour ozone concentrations matches each other. The Q-Q plots of predicted and observed daily maximum 8-hour ozone concentrations at the Pinedale monitor show the model under-predicting at low ozone concentrations but for the mid-level and higher ozone values matching much better, albeit with a slight underestimation tendency.

Figure 5-14 displays the same information as Figure 5-13 but for the Centennial monitor. Again, a vast majority of the modeled daily maximum 8-hour ozone concentrations are within 20% of the observed value on the same day and the Q-Q plots indicate that the modeled and observed daily maximum 8-hour ozone concentrations in 2002 have a very similar frequency distribution, albeit with the modeled values slightly lower.

A comparison of the predicted and observed daily maximum ozone concentrations across all seven sites in the 12 km domain is given in Figure 5-15. When looking at the maximum modeled value near the monitor (Figure 5-14, middle), there are a few days with extremely high modeled values (~100 ppb) but lower observed values (~40 ppb). These days occur at the Yellowstone NP monitor and are due to a highly localized modeled ozone spike (see Figure 5-8), the cause of which is unknown.

At the Pinedale monitoring site, the predicted daily maximum 8-hour ozone value near the monitor is within ±20% of the observed value on 74%, 78%, and 89% of the days during 2002 depending on whether the Spatially Paired, Maximum or Nearest value is used (Table 5-3). Similar numbers for the Centennial site are 84%, 85%, and 89% and for all the ozone monitoring sites 72%, 74%, and 84%. Thus, the model is predicting daily maximum 8-hour ozone concentrations near the monitor to within ±20% of the observed value most of the time.

Table 5-3. Summary of modeled daily maximum 8-hour ozone concentrations within 20% of the observed value on the same day at the Pinedale and Centennial monitors, across all 7 monitors in the 12 km domain and for the Spatial Paired, Maximum and Nearest predicted value near the monitor.

	Spatially Paired	**Maximum Value**	**Nearest Value**
Pinedale 4 km (357 days)			
Within ±20%	74%	78%	89%
> +20%	6%	12%	2%
< -20%	20%	10%	9%
Centennial 12 km (359 days)			
Within ±20%	84%	85%	89%
> +20%	4%	6%	2%
< -20%	12%	9%	9%
12 km All Sites (2,287 days)			
Within ±20%	72%	78%	84%
> +20%	4%	8%	2%
< -20%	23%	14%	14%

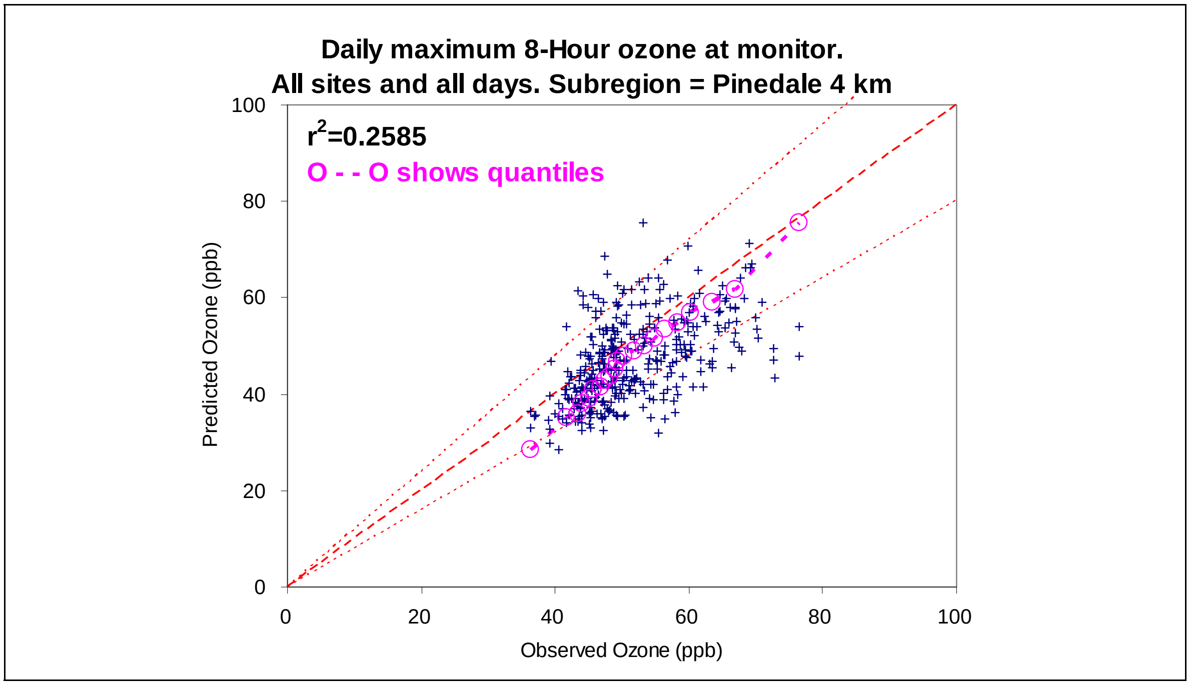


Figure 5-13a. Comparison of predicted and observed daily maximum 8-hour ozone concentrations at the Pinedale monitor using the Spatial Paired modeled value near the monitor.

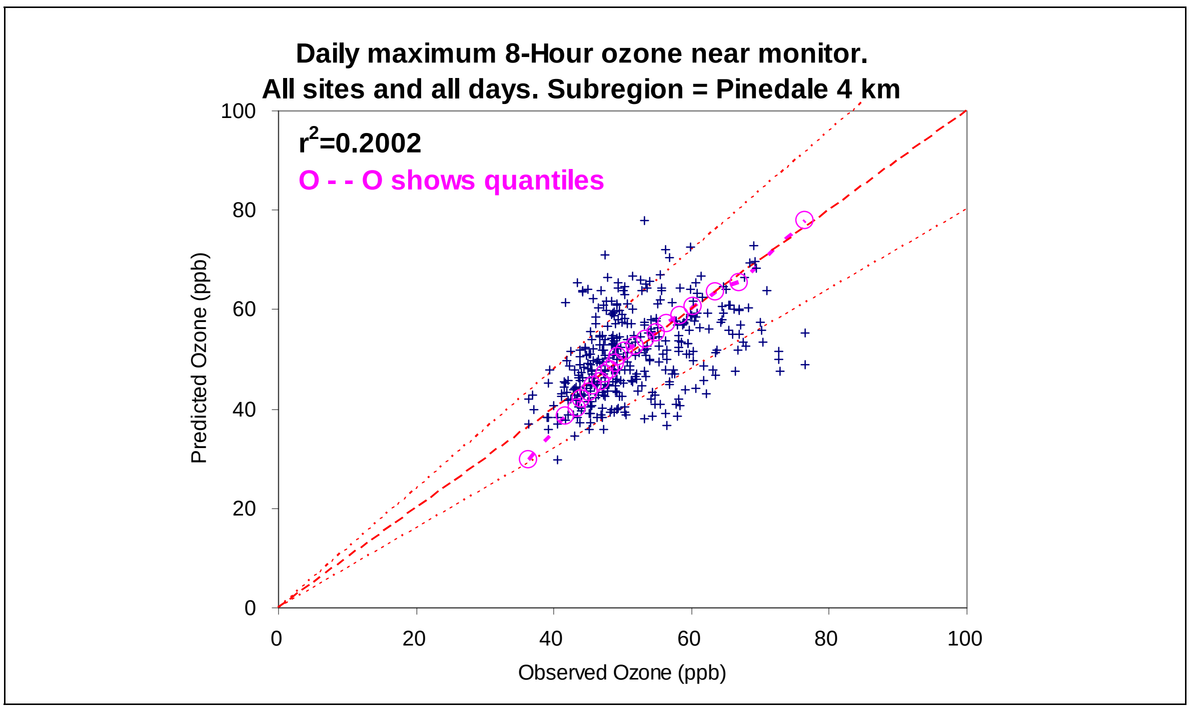


Figure 5-13b. Comparison of predicted and observed daily maximum 8-hour ozone concentrations at the Pinedale monitor using the Maximum modeled value near the monitor.

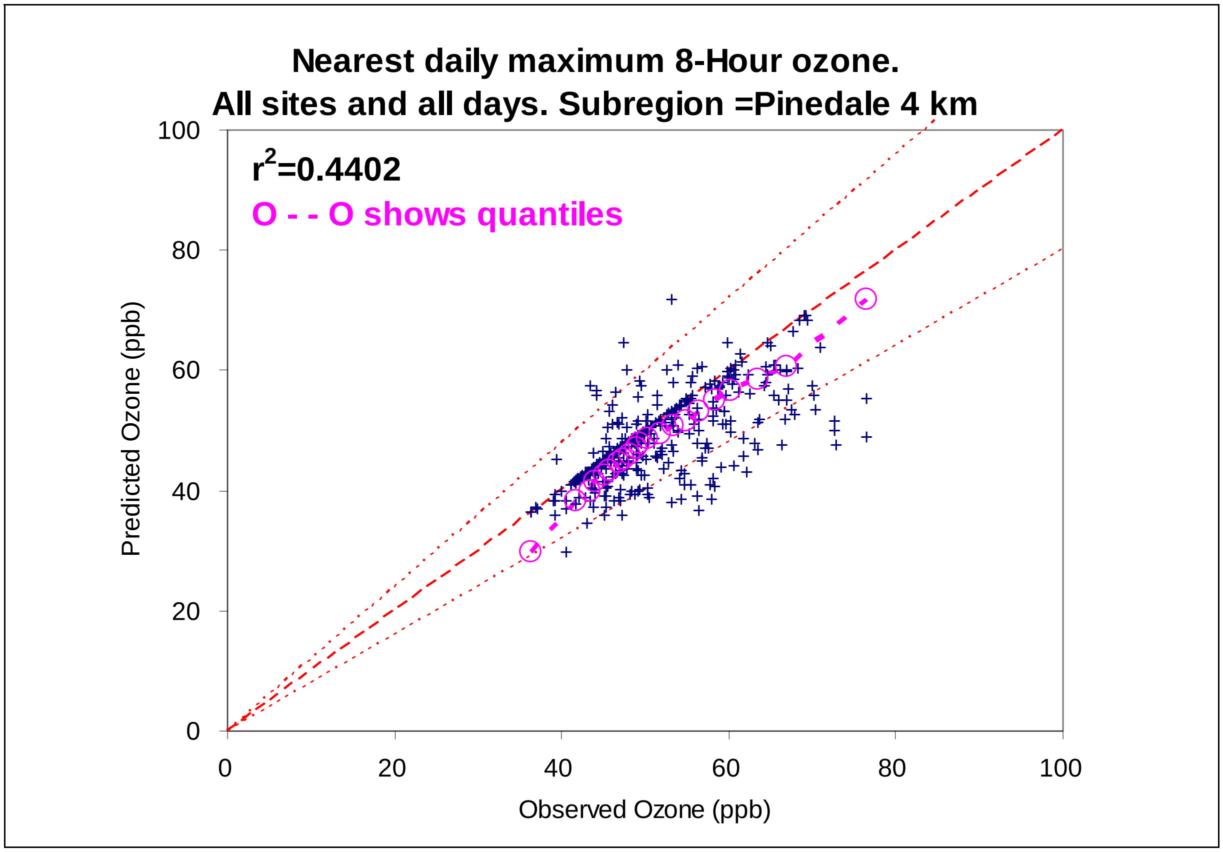


Figure 5-13c. Comparison of predicted and observed daily maximum 8-hour ozone concentrations at the Pinedale monitor using the Closest modeled value near the monitor.

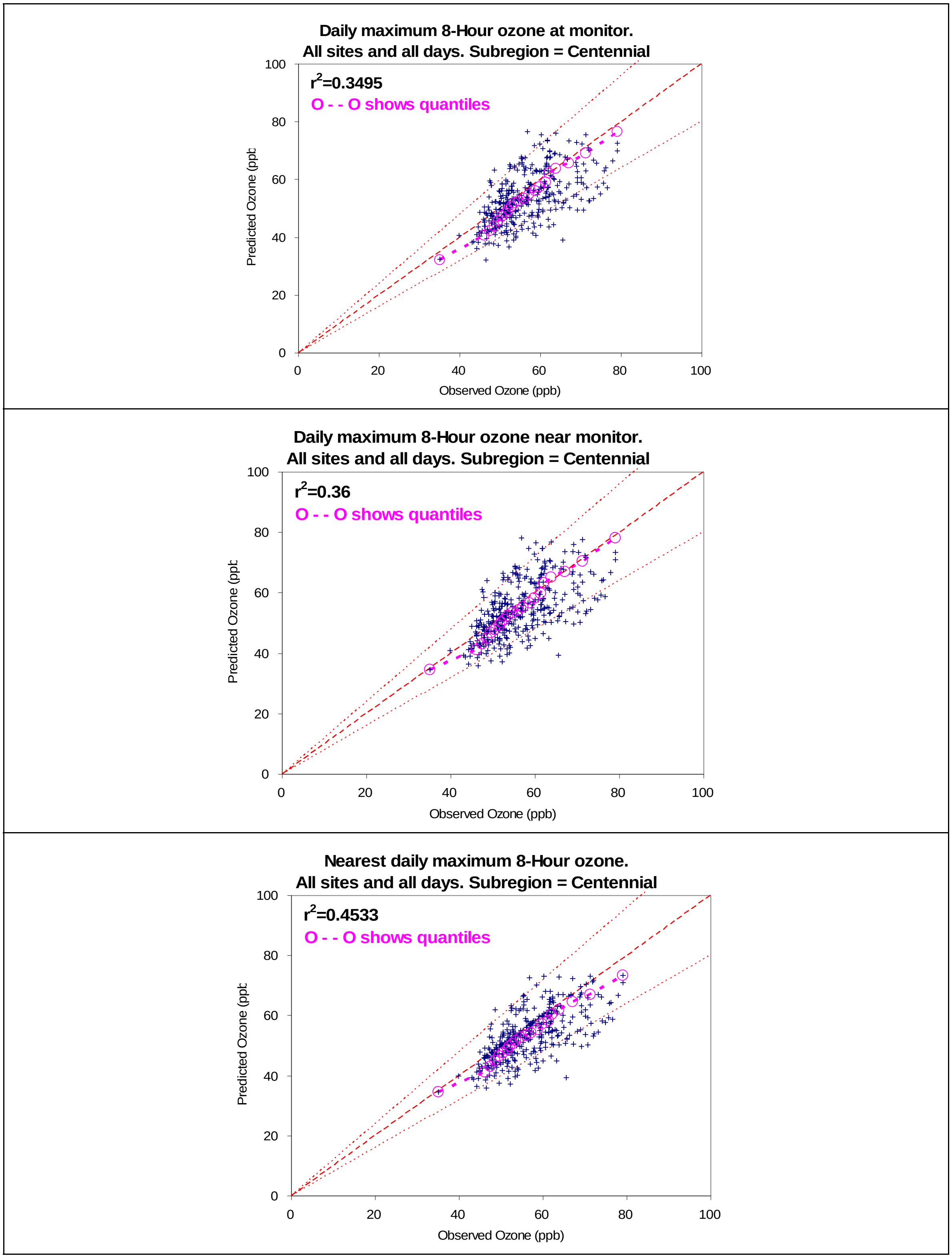


Figure 5-14. Comparison of predicted and observed daily maximum 8-hour ozone concentrations at the Centennial monitor using the Spatially Paired (top), Maximum (middle) and Closest (bottom) modeled value near the monitor.

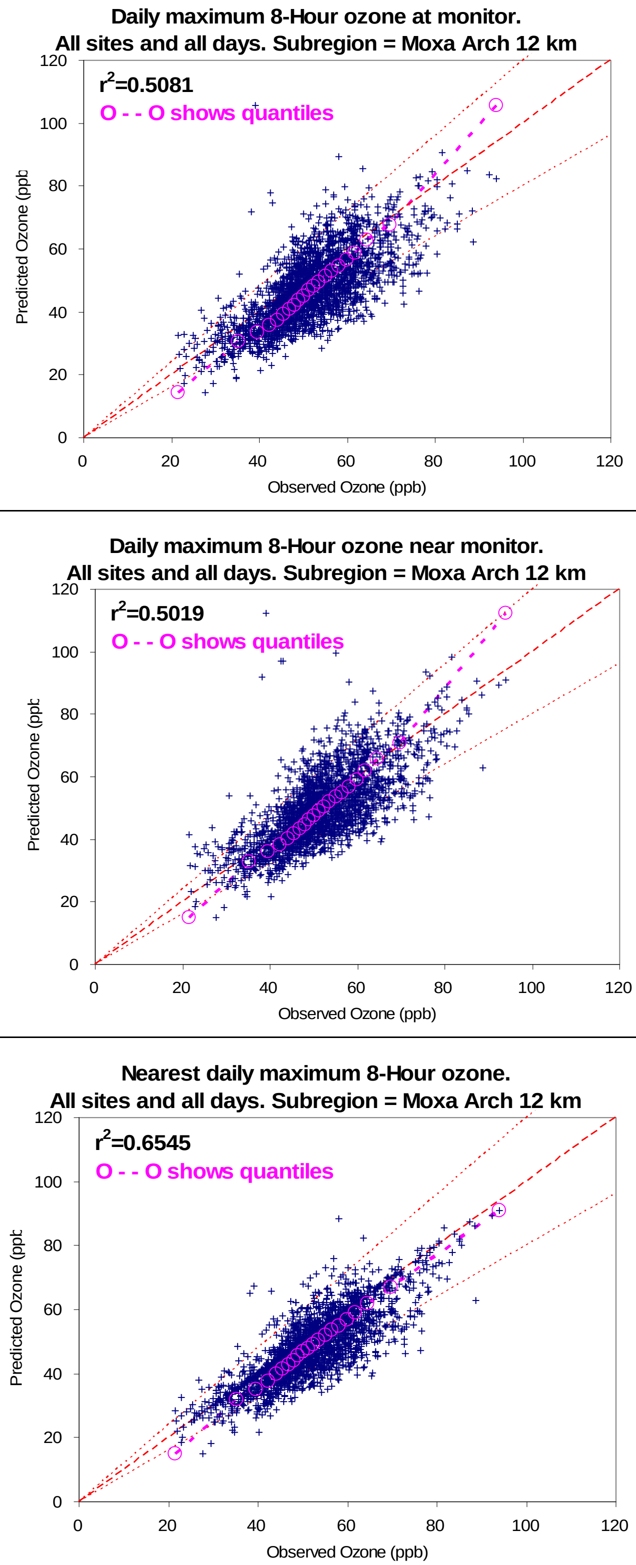


Figure 5-15. Comparison of predicted and observed daily maximum 8-hour ozone concentrations across 7 monitors in the 12 km grid using the Spatially Paired (top), Maximum (middle) and Closest (bottom) modeled value near the monitor.

5.3.3 Ozone Model Performance Evaluation Conclusions

The CAMx 2002 12/4 base case simulation reproduces the observed ozone to within EPA's performance goals, although with a small underestimation bias. The observed highest ozone concentrations at the Pinedale and Centennial CASTNet monitors in southwestern Wyoming are generally reproduced by the model to within $\pm$5%. On a day-by-day basis, the observed daily maximum ozone concentrations are replicated by the model to within $\pm$20% for a vast majority of the modeling days. Thus, the model appears to be reliable enough to perform an assessment of the potential ozone impacts of the Project and cumulative emissions.

5.4 OZONE IMPACT ASSESSMENT

The impact of the Project and other new sources in the region (cumulative emissions) on ozone concentrations were analyzed in two ways. The first approach follows EPA's guidance for projecting future year ozone concentrations for determining attainment of the ozone NAAQS (EPA, 2007). The second approach uses the modeled absolute model predictions and compares the modeled fourth highest 8-hour ozone concentration estimates with the 8-hour ozone NAAQS.

5.4.1 Results using EPA Guidance Ozone Projection Approach

EPA guidance for projecting 8-hour ozone concentrations recommends using the model in a relative sense to scale the observed 8-hour ozone Design Values (EPA 2007). These model scaling factors are a ratio of the future-year to current-year modeled 8-hour ozone concentrations and are called relative response factors (RRFs). The future-year Design Value (DVF) is obtained from the current-year Design Value as follows:

DVF = DFC x RRF

The RRFs are defined as the ratio of the average 8-hour ozone concentrations near the monitor for the future-year to the current-year model simulation for all days in which the current-year modeled 8-hour ozone value is greater than a threshold. EPA recommends using a threshold value of 70 ppb to 85 ppb. By near the monitor, EPA means within approximately 15 km.

The EPA projection approach was modified slightly to address the data sparse and relatively lower (compared to urban locations) ozone conditions of southwest Wyoming and include an additional level of conservatism as follows:

- RRFs and 8-hour ozone projections were performed for every grid cell in the 12/4 km modeling domain using modeling results in each grid cell.
- A threshold of 70 ppb was used (i.e., RRFs for a grid cell is based on the ratio of the average daily maximum 8-hour ozone concentrations for the Cumulative Emissions to Base Case emissions scenario when the Base Case ozone is 70 ppb or greater).
- The observed starting point for the 8-hour ozone projections in every grid cell of the 12/4 km domain was the 75 ppb maximum 8-hour ozone background concentrations provided by WDEQ-AQD (Table 4-5).

The WDEQ-AQD 75 ppb maximum background 8-hour ozone value was used rather than the actual observed 8-hour ozone Design Values in this projection approach because of the sparse ozone network in this region of the country. Even for the Jonah ozone monitor that has recorded 8-hour ozone concentrations approaching the ozone NAAQS has only 2 years of data so an 8-hour ozone Design Value cannot be calculated because 3 years of valid data.

5.4.1.1 Projected 8-Hour Ozone Near the Project

The spatial distribution of estimated daily maximum 8-hour ozone concentrations near the Project due to emissions from the Project's Proposed Action Alternative and Cumulative Emissions are shown in Figure 5-16. Using a 75 ppb background ozone concentration and the EPA-recommended RRF projection approach, the maximum estimated daily maximum 8-hour ozone concentrations near the Project is 76.6 ppb, which is below the 8-hour ozone standard of 84 ppb. Thus, the proposed Project and other Cumulative Emissions in the area are not projected to violate the 8-hour ozone standard near the Project.

5.4.1.2 Projected 8-Hour Ozone in 12/4 km Domain

The projected 8-hour ozone concentrations in the 4 km and 12 km modeling domains using the EPA guidance projection approach are shown in Figure 5-17. The maximum projected 8-hour ozone concentration is 77.6 ppb and 77.3 ppb in the 4 km and 12 km domains, respectively. These values are below the ozone NAAQS and demonstrate that the proposed Project and other Cumulative Emissions would not cause a violation of the ozone NAAQS.

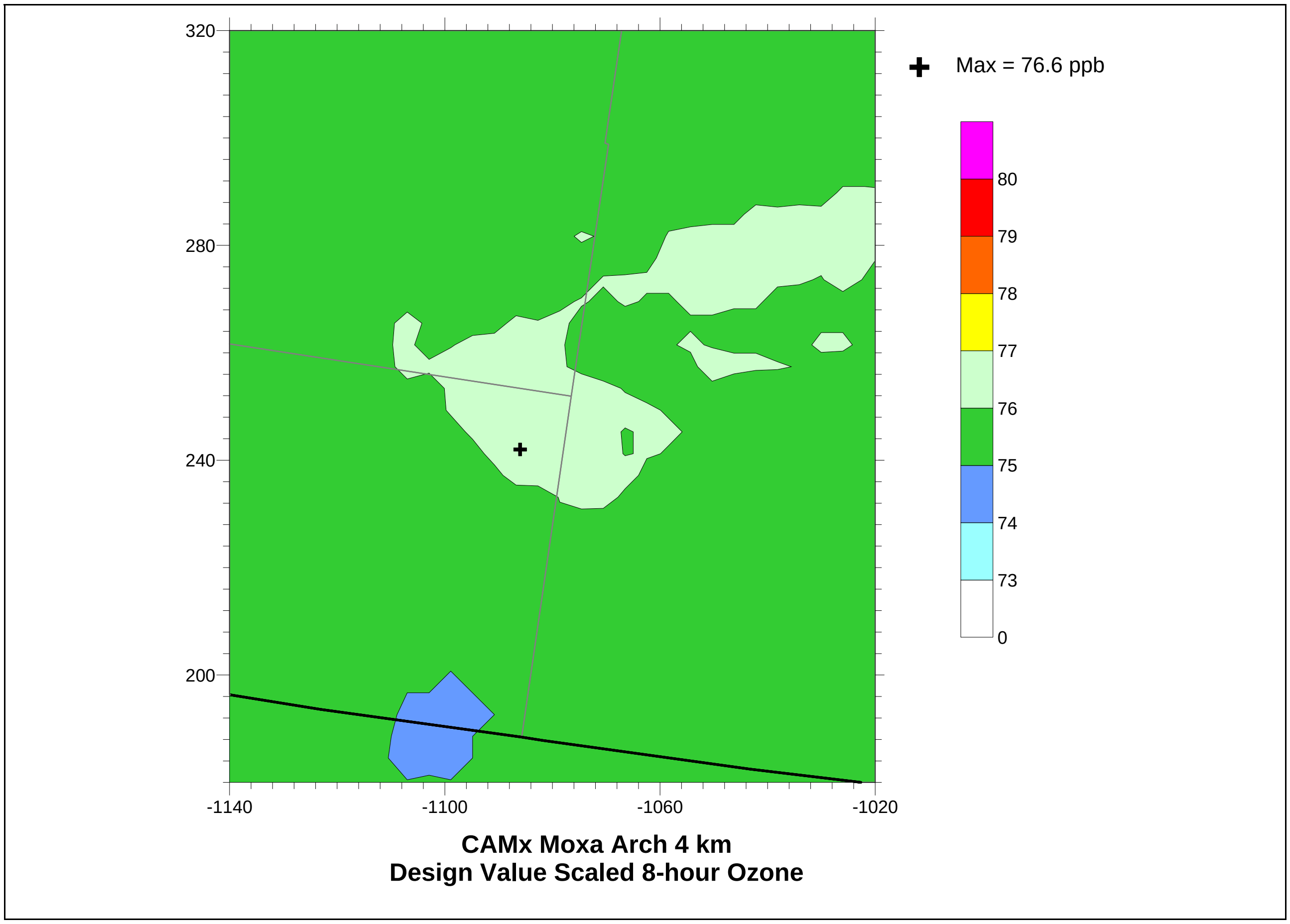


Figure 5-16. Projected daily maximum 8-hour ozone concentrations near the Project for the Project plus Cumulative Emissions scenario using the EPA Guidance RRF projection approach.

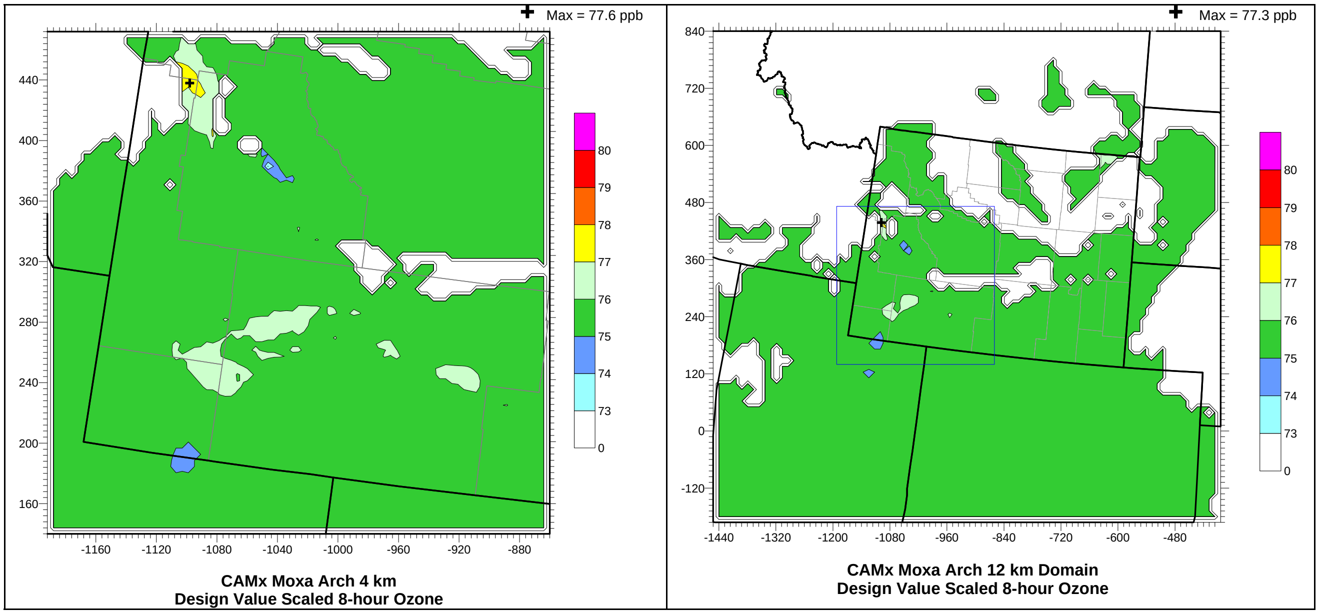


Figure 5-17. Projected daily maximum 8-hour ozone concentrations in the 4 km (left) and 12 km (right) modeling domains for the Project plus Cumulative Emissions scenario using the EPA Guidance RRF projection approach.

5.4.2 Absolute Modeling Results

The second approach used for assessing the potential ozone impacts from the Project and other new sources in the region is to analyze the absolute modeled concentrations for the Project plus Cumulative Emissions scenario.

5.4.2.1 Absolute Ozone Results Near the Project

Figure 5-18 displays the fourth highest daily maximum 8-hour ozone concentrations near the Project estimated by the CAMx model for the Project plus Cumulative Emissions scenario. The estimated peak 8-hour ozone concentration near the project is 77.8 ppb, which is below the ozone NAAQS of 85 ppb.

Figure 5-19 displays the estimated incremental 8-hour ozone concentration near the Project due to new emissions from the Project plus Cumulative Emission sources. These incremental ozone estimates were obtained by taking the difference between the fourth highest daily maximum ozone concentrations for the Project plus Cumulative Emissions simulation and the fourth highest 8-hour ozone concentrations from the 2002 Base Case simulation. The fourth highest 8-hour ozone concentrations in the vicinity of the Project are estimated to increase from 0 ppb to 2.5 ppb, with the maximum increase occurring southeast of the Project.

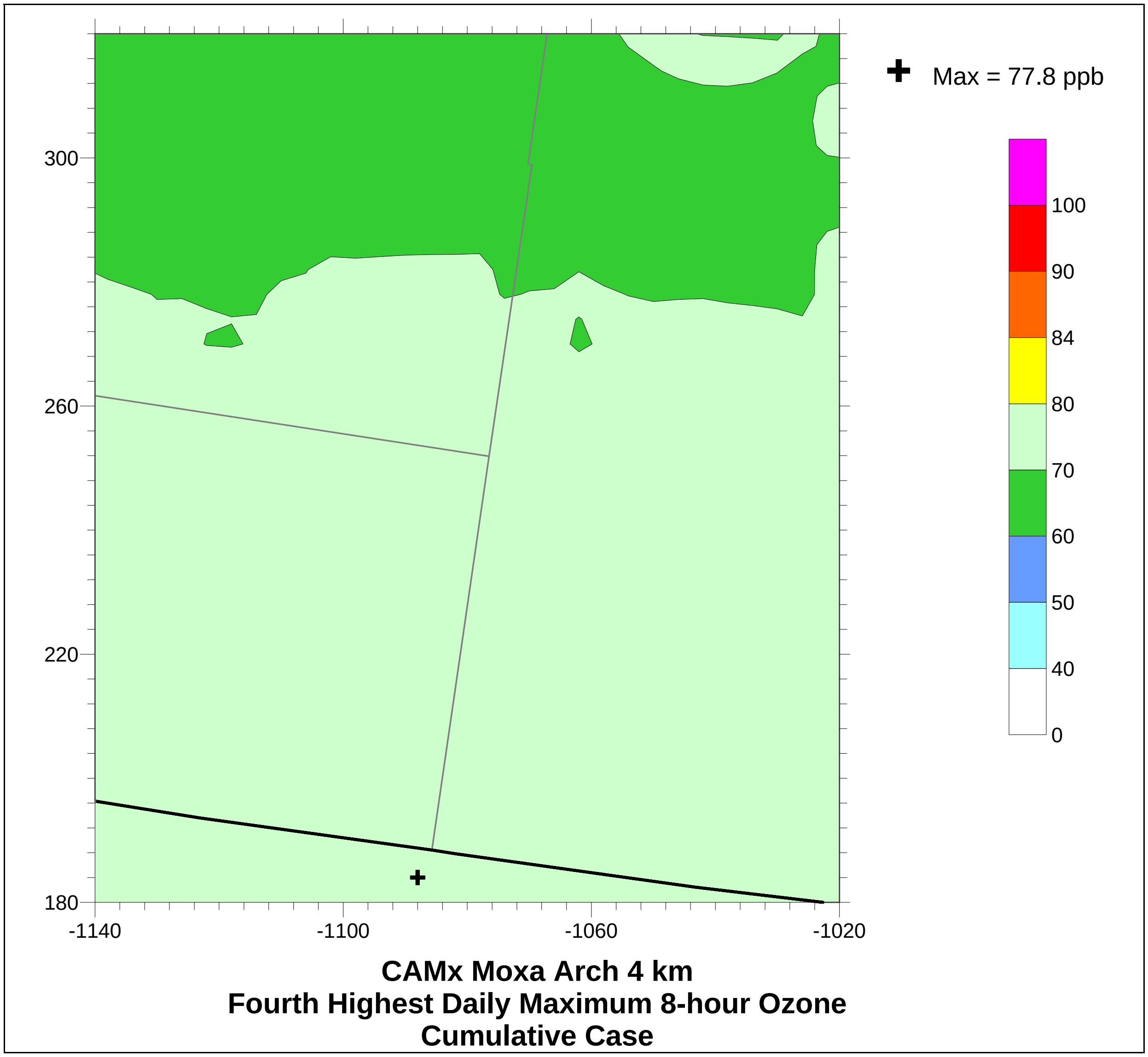


Figure 5-18. Estimated fourth highest daily maximum 8-hour ozone concentrations near the Project for the Project plus Cumulative Emissions scenario for the absolute modeling results method.

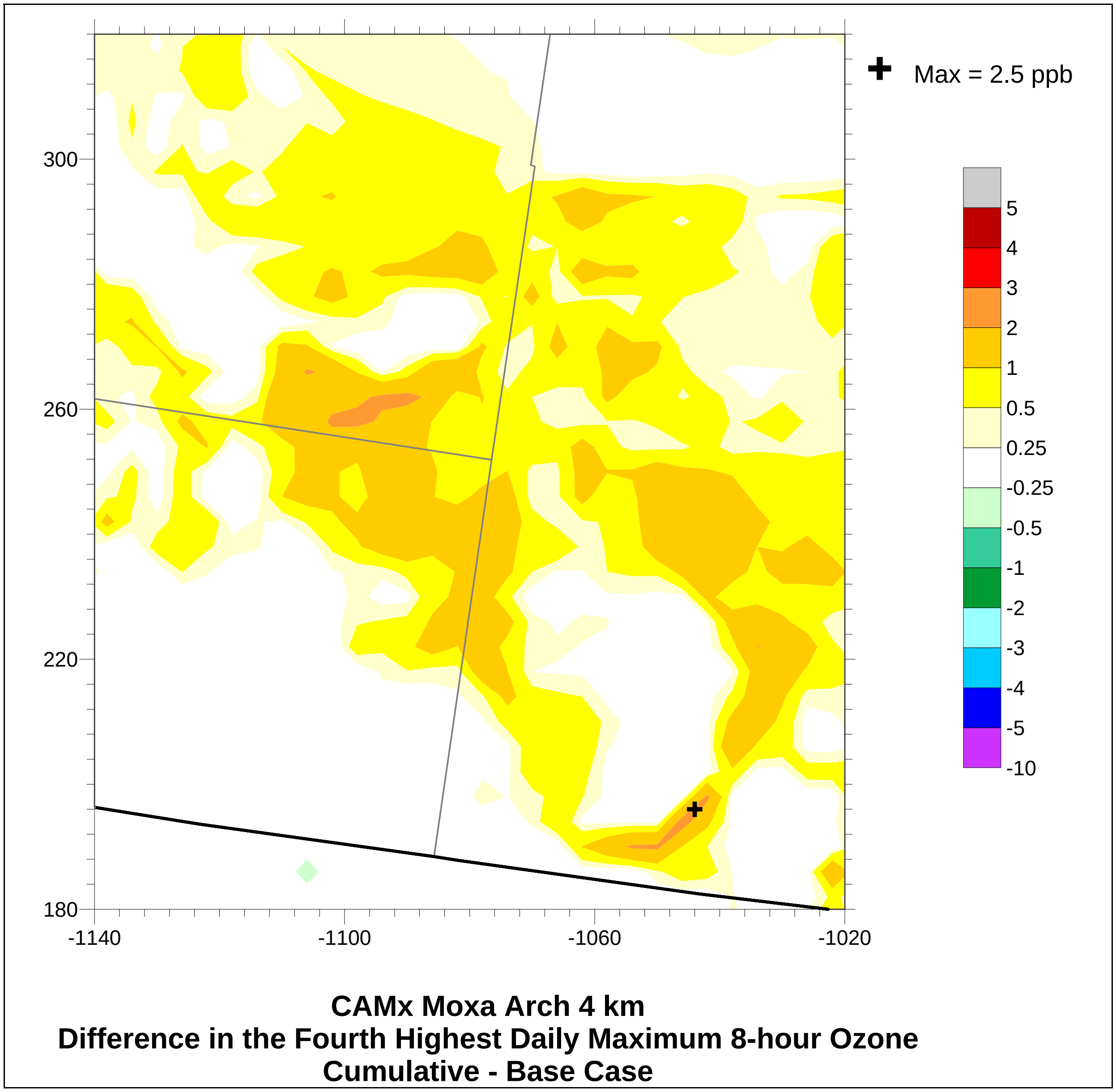


Figure 5-19. Estimated incremental 8-hour ozone concentrations due to emissions from the Project plus Cumulative Emissions scenario near the Project location for the absolute modeling results method.

5.4.2.2 Absolute Ozone Results in 12/4 km Domain

Figure 5-18 displays the estimated fourth highest daily maximum 8-hour ozone concentrations in the 4 km and 12 km domains for the Project plus Cumulative Emissions scenario. The maximum estimated 8-hour ozone concentration in the 4 km domain is 83.8 ppb, which occurs in northeastern Colorado, south of the Project and other new sources. In fact, the maximum 8-hour ozone concentrations for the 2002 Base Case were 83.7 ppb, which occurred in northeastern Utah (see Figure 5-8). All estimated fourth highest 8-hour ozone concentrations in the 4 km domain are less than the 8-hour ozone NAAQS of 85 ppb.

In the 12 km grid, the fourth highest estimated ozone concentration exceeds the 8-hour ozone NAAQS only in the Denver, Colorado and Salt Lake City, Utah urban plumes. Note that when doing ozone modeling of urban areas, finer grid resolution is used because using coarse grid resolution may overestimate urban ozone concentrations by overstating the dilution of urban NOx and mixing it with the rural biogenic VOC emissions.

The incremental ozone formed in the 4 km and 12 km domains due to the Project and other Cumulative Emissions are shown in Figure 5-20. In the 4 km grid, the maximum estimated ozone increase is 14.5 ppb and occurs in the Pinedale/Jonah area. In the 12 km domain, the maximum ozone increase is 5.1 ppb and also occurs in the Pinedale/Jonah area. These results illustrate the need for using a 4 km grid for ozone modeling of the new sources.

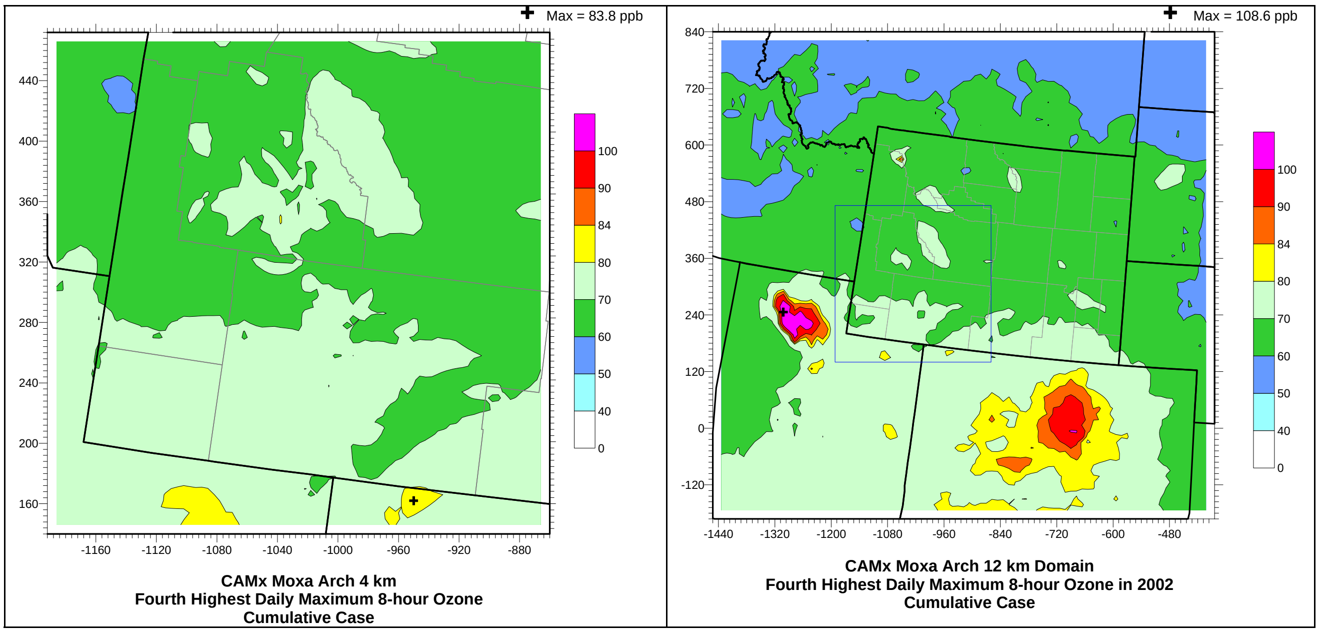


Figure 5-20. Estimated fourth highest daily maximum 8-hour ozone concentrations in the 4 km (left) and 12 km (right) domain for the Project plus Cumulative Emissions scenario.

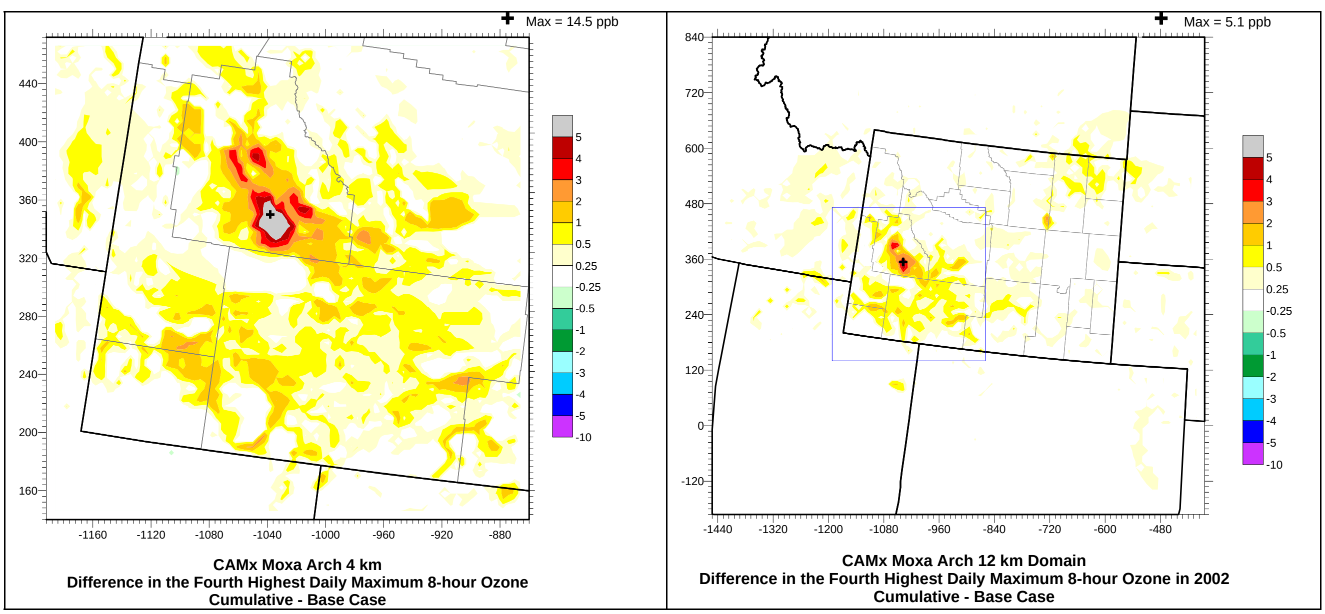


Figure 5-21. Estimated incremental 8-hour ozone concentrations due to emissions from the Project plus Cumulative Emissions scenario in the 4 km (left) and 12 km (right) domains.

5.4.3 Incremental Ozone Impact Sensitivity Analysis

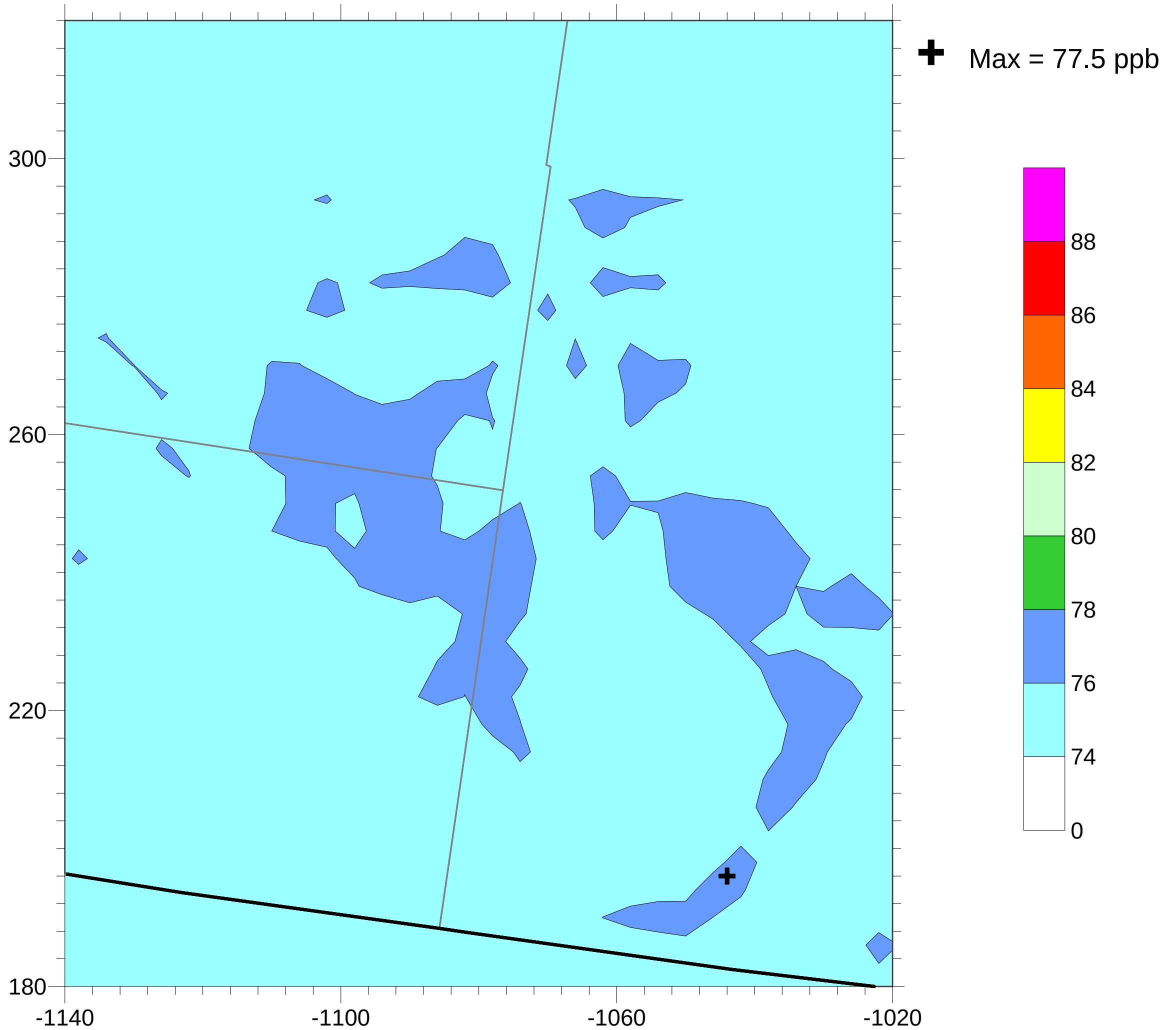
In this section a sensitivity analysis is performed that adds the spatially varying maximum incremental 8-hour ozone contribution due the Moxa Arch Project and cumulative sources to the maximum background 8-hour ozone contribution in Wyoming that was provided by the WDEQ-AQD. Because the maximum incremental concentrations due to the Project And cumulative emissions and maximum background 8-hour ozone background concentration occurs at different locations and time periods, the 8-hour concentration estimates obtained by adding them together would greatly overstate any expected actual ozone values, which is why this is referred to as a sensitivity analysis rather than the an 8-hour ozone projection. The maximum background 8-hour ozone values provided by the WDEQ (147 μg/m3 or 75 ppb) is based on observed ozone during the Green River Visibility The study that occurred during 1998-2001 (ARS, 2002) so is not even concurrent with the time period of the CAMx modeling (2002). Because of the discrepencies in the two datasets, these results are discussed only in this Technical Support Document and are not included in the DEIS.

5.4.3.1 Ozone Sensitivity Analysis Near the Project

Near the Project, the addition of the maximum incremental ozone contribution due to the Project plus cumulative emissions to the maximum 75 ppb background ozone provided by the WDEQ-AQD produces a peak ozone value of 77.5 ppb that occurs to the southeast of the project and is below the 8-hour ozone NAAQS (Figure 5-22).

5.4.3.2 Ozone Sensitivity Analysis in the 4 km and 12 km Domains

Figure 5-23 displays the spatial distribution of 8-hour ozone concentrations in the 4 km and 12 km domains that results from adding the maximum incremental ozone due the Project and cumulative emissions to an assumed 75 ppb background value. In the 12 km domain the maximum 8-hour ozone concentrations produced by this sensitivity analysis is 80.1 ppb. In the 4 km domains the maximum 8-hour ozone concentration produced by the sensitivity analysis is 89.5 ppb. Note that this is not a projected exceedance of the 8-hour ozone NAAQS because of the very conservative nature of this sensitivity analysis where we add a maximum incremental ozone concentration that occurred in one location and time to a maximum background ozone that occurred at a different location and time so produces a much higher ozone that would be expected to occur. However, it does identify an area southwest of the Wind River Range where ozone should be evaluated in more detail.



CAMx Moxa Arch 4 km
Difference in the Fourth Highest Daily Maximum 8-hour Ozone
Cumulative - Base Case + Background

Figure 5-22. Addition of the maximum incremental ozone concentrations due to the Project plus Cumulative Emissions to an assumed maximum 75 ppb background near the Project.

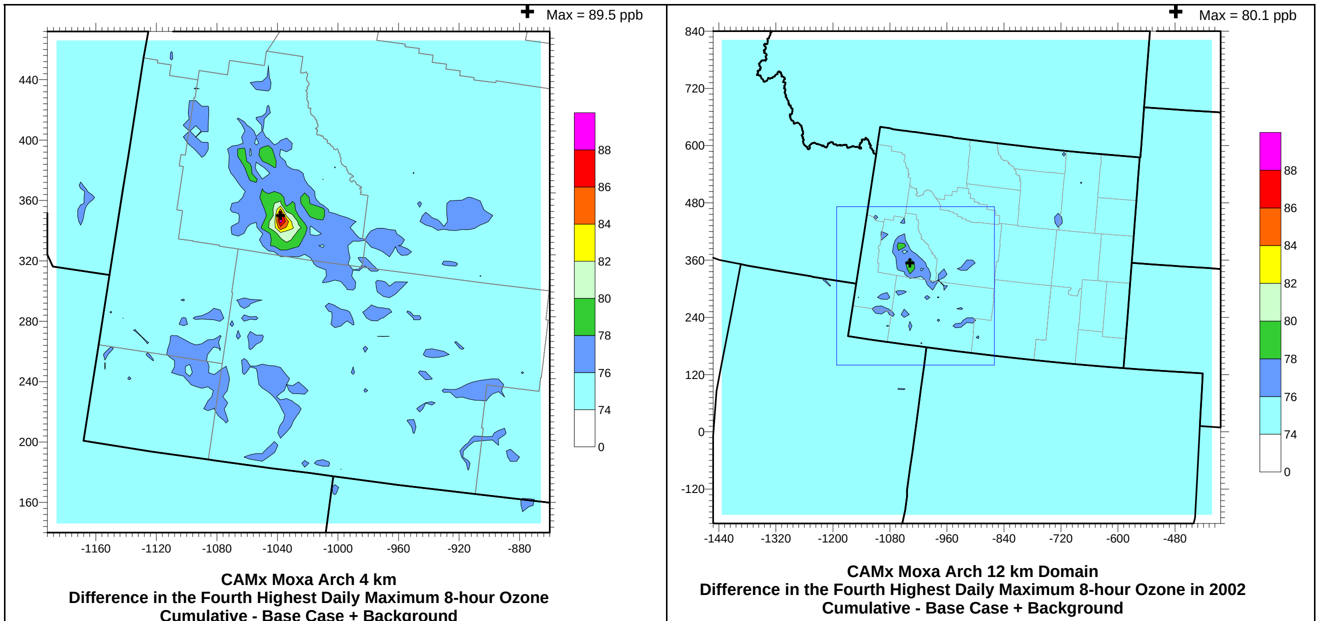


Figure 5-23. Incremental 8-hour ozone concentrations due to the Project plus Cumulative Emissions added to an assumed 75 ppb ozone background in the 4 km (left) and 12 km (right) grids.

5.5 Conclusions of Ozone Modeling Analysis

Table 5-4 summarizes the maximum estimated 8-hour ozone concentrations near the Project and in the 4 km grid domain using the EPA RRF projection approach and the absolute model predictions and the 2002 Base Case and Project and Cumulative Emissions annual CAMx simulations. Using these two projection techniques the maximum 8-hour ozone concentrations are projected to be below the 8-hour ozone NAAQS.

Table 5-4. Maximum projected 8-hour ozone concentrations near the Project and in the 4 km grid domain due to Base Case emissions plus the Project and Cumulative Emissions and comparisons with the NAAQS.

Domain	8-Hour Ozone NAAQS (ppb)	Projected Maximum 8-Hour Ozone (ppb)	
		EPA Guidance Approach	Absolute Model Predictions
Near the Project	85	76.6	77.8
4 km Domain	85	77.6	83.8

The Project and Cumulative Emissions CAMx simulation only evaluated the Proposed Action. Alternatives A, B, and C were not run with CAMx. The No Action Alternative has emissions that are much lower than the Proposed Action with NOx and VOC emissions that are 26% and 7% of the Proposed Action, respectively. Thus the No Action alternative would have lower ozone than the Proposed Action alternative so would also not jeopardize compliance with the 8-hour ozone NAAQS.

Alternative C has NOx and VOC emissions that are, respectively, 1.96 and 2.30 times the Proposed Action alternative emissions. The maximum ozone increment near the Project due to the Proposed Action alternative was 2.5 ppb. Assuming the larger of the NOx/VOC emissions increase for Alternative C (2.30) gives an estimate of the ozone increment of 5.75 ppb (2.3 x 2.5). When added to the 75 ppb maximum background, a conservative \ maximum 8-hour ozone concentration of 80.8 ppb is obtained, which is below the 8-hour ozone NAAQS. The ozone formation is non-linear; therefore, the 2.30 factor is uncertain. However, it is our best and likely conservative estimate of the effects of emissions from Alternative C on ozone concentrations in the area, and still leads to ozone that is below the 8-hour ozone NAAQS. Ozone formation for Alternative B would not be greater than that for Alternative C and thus would also be expected to be below the 8-hour ozone NAAQS.

SECTION 6 REFERENCES

Atkinson, D. and T. Fox. 2006. *Dispersion Coefficients for Regulatory Air Quality Modeling in CALPUFF*. Memorandum from U.S. EPA/OAQPS to Kay T. Prince, EPA Region 4. March 16.

Air Resource Specialists. 2002. Green River Basin Visibility Study. Monitored Air Quality Data. Air Resource Specialists, Fort Collins, Colorado.

Baker, K. 2004a. Summer MM5 Performance. Midwest Regional Planning Organization. (http://www.ladco.org/tech/photo/present/MPE_MM5_summer.pdf). November.

Baker, K. 2004b. Monthly Rainfall Evaluation. Midwest regional Planning Organization. (http://www.ladco.org/tech/photo/present/rainfall_eval.pdf). November.

Bureau of Land Management. 1983. Riley Ridge Natural Gas Project Air Resources Technical Report. U.S. Department of Interior, Bureau of Land Management, Kemmerer Field Office, Kemmerer, Wyoming, in cooperation with Environmental Research and Technology Inc.

_______. 1988. Pinedale Resource Management Plan Record of Decision. U.S. Department of Interior, Bureau of Land Management, Pinedale Resource Area, Rock Springs District, Rock Springs, Wyoming.

_______. 1990. Record of Decision and Approved Resource Management Plan for the Great Divide Resource Area. U.S. Department of Interior, Bureau of Land Management, Great Divide Resource Area, Rawlins District. Rawlins, Wyoming.

_______. 1997. Record of Decision and Green River Resource Management Plan. U.S. Department of Interior Bureau of Land Management, Green River Resource Area, Rock Springs District, Rock Springs, Wyoming.

_______. 1999a. Pinedale Anticline Oil and Gas Exploration and Development Project Draft Environmental Impact Statement-Technical Report. U.S. Department of Interior, Bureau of Land Management, Pinedale Field Office, Pinedale, Wyoming, in cooperation with U.S. Forest Service, U.S. Army Corps of Engineers, and State of Wyoming.

_______. 1999b. Continental Divide/Wamsutter II and South Baggs Natural Gas Development Projects, Environmental Impact Statement, Air Quality Impact Assessment, Technical Support Document, Volume II, Far-Field Analysis. U.S. Department of Interior, Bureau of Land Management, Rock Springs Field Office, Rock Springs, Wyoming, in cooperation with Earth Tech, Inc., Concord, Massachusetts.

_______. 2003. Desolation Flats Natural Gas Exploration and Development Project - Technical Support Documents for the Ambient Air Quality Impact Analysis. U.S. Department of Interior Bureau of Land Management in cooperation with Buys & Associates, Inc.

______. 2005. Jonah Infill Project – Technical Support Document for the Ambient Air Quality Impact Analysis. U.S. Department of Interior Bureau of Land Management, Pinedale Field Office, in cooperation with TRC.

Colorado Department of Public Health and Environment. 1996. Rifle and Mack, Colorado in conjunction with proposed oil shale development during early 1980's.

Colorado Department of Public Health and Environment. 2005. CALMET/CALPUFF BART Protocol for Class I federal Area Individual Source Attribution Visibility Impairment Modeling Analysis. Colorado Department of Public Health and Environment, Air Pollution Control Division, Denver, Colorado. October 24.

Cooperative Institute for Research in the Atmosphere. 2003. Interagency Monitoring of Protected Visual Environments (IMPROVE) summary data provided by Scott Copeland, Cooperative Institute for Research in the Atmosphere, Colorado State University, February 2006.

Earth Tech. 2001. The Southwest Wyoming Regional CALPUFF Air Quality Modeling Study Final Report. Earth Tech, Inc., Concord, Massachusetts. February 2001.

_______. 2003. CALMET/CALPUFF Air Quality Modeling System. Earth Tech, Inc., Concord, Massachusetts.

ENVIRON. 2007. Southwest Wyoming NO_2 PSD Increment Consumption Modeling: Final Results. Prepared for Wyoming Department of Environmental Quality, Cheyenne, Wyoming. Prepared by ENVIRON International Corporation, Novato, California. April 6.

Environmental Protection Agency. 1993. Superfund's Standard Default Exposure Factors for the Central Tendency and Reasonable Maximum Exposure. Preliminary Review Draft.

_______. 1995. Compilation of Air Pollutant Emission Factors (AP-42), Vol. 1, Stationary Point and Area Sources, Fifth Edition. Office of Air Quality Planning and Standards, Research Triangle Park, North Carolina.

_______. 2003a. Guidance for Tracking Progress Under the Regional Haze Rule. Office of Air Quality Planning and Standards, Research Triangle Park, North Carolina.

_______. 2003b. Guidance for Estimating Natural Visibility Conditions Under the Regional Haze Rule. Office of Air Quality Planning and Standards, Research Triangle Park, North Carolina.

_______. 2005. Air Toxics Database. Dose-Response Assessment for Assessing Health Risks Associated With Exposure to Hazardous Air Pollutants, Table 2. Office of Air Quality Planning and Standards (OAQPS). Technology Transfer Network Air Toxics Website. <http://www.epa.gov/ttn/atw/toxsource/table2.html>. Data accessed October 20, 2006.

_______. 2005. "Regional Haze Regulations and Guidelines for Best Available Technology (BART) Determinations". Fed. Reg./Vol. 70, No. 128/Wed. July 6, 2005, Rules and Regulations, pp. 39104-39172. 40 CFR Part 51, FRL-7925-9, RIN AJ31.

Federal Land Managers' Air Quality Related Values Workgroup. 2000. Federal Land Managers' Air Quality Related Values Workgroup (FLAG) Phase I Report. U.S. Forest Service-Air Quality Program, National Park Service-Air Resources Division, U.S. Fish and Wildlife Service-Air Quality Branch. December 2000.

Fox, Douglas, Ann M. Bartuska, James G. Byrne, Ellis Cowling, Rich Fisher, Gene E. Likens, Steven E. Lindberg, Rick A. Linthurst, Jay Messer, and Dale S. Nichols. 1989. A Screening Procedure to Evaluate Air Pollution Effects on Class I Wilderness Areas. General Technical

Report RM-168. U.S.D.A. Forest Service, Rocky Mountain Forest and Range Experiment Station, Fort Collins, Colorado. 36 pp.

Gas Research Institute. 1999. GRI-HAPCalc® Version 3.01. Gas Research Institute. Des Plaines, Illinois.

Interagency Workgroup on Air Quality Modeling. 1998. Interagency Workgroup on Air Quality Modeling (IWAQM) Phase 2 Summary Report and Recommendations for Modeling Long Range Transport Impacts. EPA-454/R-98-019. Office of Quality Planning and Standards. U.S. EPA, Research Triangle Park, North Carolina. December 1998.

Kemball-Cook, S., Y. Jia, C. Emery, R. Morris, Z. Wang and G. Tonnesen. 2004. 2002 Annual MM5 Simulation to Support WRAP CMAQ Visibility Modeling for the Section 308 SIP/TIP – MM5 Sensitivity Simulations to Identify a More Optimal MM5 Configuration for Simulating Meteorology in the Western United States. Western Regional Air Partnership, Regional Modeling Center. December 10. (http://pah.cert.ucr.edu/aqm/308/reports/mm5/MM5SensitivityRevRep_Dec_10_2004.pdf).

National Park Service. 2001. Guidance on Nitrogen and Sulfur Deposition Analysis Thresholds. National Park Service and U.S. Fish and Wildlife Service. National Park Service Air Resources Division. <http://www.aqd.nps.gov/ard/flagfree/2001>, Data accessed July 2003.

Natural Resource Group, Inc. 2006. Air Quality Impact Assessment Protocol, Moxa Arch Infill Drilling Project, Lincoln, Unita, and Sweetwater Counties, Wyoming. Natural Resource Group, inc., Denver, Colorado. December.

McNally, D.E. 2003. Annual Application of MM5 for Calendar Year 2001. Prepared for U.S. EPA, Office of Air Quality and Planning Standards. Prepared by Alpine Geophysics, Arvada, CO.

Scire, J.S., D.G. Strimaitis, R.J. Yamartino. 2000a. "A User's Guide for the CALPUFF Dispersion Model." Earth Tech, Concord, MA, January 2000.

Scire, J.S., F. Robe, F.E. Fernau, R.J. Yamartino. 2000b. "A User's Guide for the CALMET Meteorological Model." Earth Tech, Concord, MA, January 2000.

U.S.D.A. Forest Service. 2000. Screening Methodology for Calculating ANC Change to High Elevation Lakes, User's Guide. U.S. Department of Agriculture (USDA) Forest Service, Rocky Mountain Region. January 2000.

_______. 2006. Unpublished. Lake water chemistry data provided by Terry Svalberg, USDA Forest Service, February 2006.

Visibility Improvement State and Tribal Association of the Southeast. 2006. Protocol for the Application of the CALPUFF Model for Analyses of Best Available Retrofit Technology (BART), Revision 2. Visibility Improvement State and Tribal Association of the Southeast (VISTAS), March 2006.

Wyoming Department of Environmental Quality. 2001. Oil and Gas Production Facilities Chapter 6, Section 2 Permitting Guidance, Wyoming Department of Environmental Quality-Air Quality Division. June 1997 with revisions through August 2001.

_______. 2003. Wyoming's Long Term Strategy for Visibility Protection, 2003 Review Report. Appendix E, Visibility Monitoring Data Assessment. Wyoming Department of Environmental Quality-Air Quality Division (WDEQ-AQD).