Additional Air Quality Impact Assessment to Support the Little Snake Field Office Draft Resource Management Plan and Environmental Impact Statement, Moffat, Routt, and Rio Blanco Counties, Colorado

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ADDITIONAL AIR QUALITY IMPACT ASSESSMENT TO SUPPORT THE LITTLE SNAKE FIELD OFFICE DRAFT RESOURCE MANAGEMENT PLAN AND ENVIRONMENTAL IMPACT STATEMENT, MOFFAT, ROUTT, AND RIO BLANCO COUNTIES, COLORADO

Lead Agency: U.S. Department of the Interior, Bureau of Land Management

Type of Action: Administrative

Jurisdiction: Portions of Moffat, Routt, and Rio Blanco Counties

Abstract: The BLM published a Notice of Availability on February 9, 2007, (*Federal Register* 72:27 pp 6284–6285) for the *Draft Little Snake Resource Management Plan and Environmental Impact Statement (RMP/EIS)* for the Little Snake Field Office, located in northwest Colorado. The notice announced the 90-day public comment period, which closed on May 16, 2007. The RMP provides a framework to guide subsequent management decisions on approximately 1.3 million acres of BLM-administered public lands and 1.1 million acres of subsurface mineral estate. The Draft RMP/EIS analyzed four alternatives, including continuation of present management (Alternative A) and three other alternatives, including a Preferred Alternative (Alternative C), that provide a variety of management choices ranging from restricting management actions or development to actively mitigating the effects of resource management actions or development. However, as described in BLM's Notice of Intent (NOI) to Prepare Additional Air Quality Analysis Information for the Little Snake Field Office Draft RMP/EIS (published December 19, 2007, in the *Federal Register* 72:243 pg 71944), "During the public comment period, the [U.S.] Environmental Protection Agency [EPA], in consultation with BLM, identified areas where additional air quality information would improve the existing analysis in the Draft EIS. As a result, the BLM is preparing an additional air quality analysis. When the additional air quality analysis has been completed, the BLM will present the information for public review and comment. At that time, BLM will only accept comments from the public pertaining to the new air quality information."

This hypothetical air quality impact assessment for the Little Snake Draft RMP/EIS was conducted to provide additional air quality assessment for the Draft EIS and to demonstrate how future quantitative air pollutant dispersion modeling analysis could be performed once project-specific oil and gas developments are proposed. The CALPUFF-lite modeling approach, combined with several conservative oil and gas construction and production operating assumptions, make the assessment results conservative (likely to over-predict potential air quality and air quality-related value impacts). Even so, no impact-significance thresholds were exceeded other than a potential 0 to 2 days greater than a 1.0 deciview (dv) "just noticeable change" in visibility at the mandatory federal prevention of significant deterioration (PSD) Class I Mount Zirkel Wilderness Area under Alternatives A/B/C. This predicted impact is 0 to 1 day greater than a 1.0 dv "just noticeable change" in visibility under Alternative D.

Further information regarding this hypothetical air quality impact assessment can be obtained from the address below. Comments will be accepted for 45 days following the date that the EPA publishes the notice of filing of this document in the *Federal Register*. Comments should be sent to the following addresses:

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EXECUTIVE SUMMARY

This Additional Air Quality Impact Assessment document provides a summary of the results of the air dispersion modeling analyses and emissions inventories for the *Bureau of Land Management (BLM) Little Snake Field Office Draft Resource Management Plan (RMP)/Environmental Impact Statement (EIS).* The BLM Little Snake Field Office administers approximately 1.3 million acres public lands and 1.1 million acres of subsurface mineral estate in Moffat, Routt, and Rio Blanco Counties, Colorado. The Draft RMP/EIS analyzed four alternatives, including continuation of present management (Alternative A) and three other alternatives, including a Preferred Alternative (Alternative C), that provide a variety of management choices ranging from restricting management actions or development to actively mitigating the effects of resource management actions or development. This hypothetical air quality impact assessment for the Little Snake Draft RMP/EIS was conducted to provide additional air quality assessment for the Draft EIS and to demonstrate how future quantitative air pollutant dispersion modeling analysis could be performed once project-specific oil and gas developments are proposed.

This document discusses the modeling methodologies used and analyses performed for assessment of air quality-related values and far-field impacts from the RMP. The conclusions regarding the modeling results within the Little Snake Field Office RMP are summarized as follows:

- The modeling results indicate that for the Alternative A/B/C and Alternative D scenarios, impacts would not exceed any air quality standards (Colorado Ambient Air Quality Standards [CAAQS] and National Ambient Air Quality Standards [NAAQS]) or prevention of significant deterioration [PSD] increments. (The PSD demonstrations are for informational purposes only and do not constitute a regulatory PSD increment consumption analysis.)
- The highest predicted concentrations resulting from development in the Resource Management Plan Planning Area (RMPPA) occur in Dinosaur National Monument for all alternatives.
- For total nitrogen or sulfur deposition impacts, modeling results for Alternatives A/B/C and Alternative D indicate there are no direct deposition impacts above the U.S. Forest Service (USFS) levels of concern. The maximum nitrogen deposition impacts are approximately a factor of 100 lower than the USFS 3.0 kilograms (kg)/hectares (ha)/year level of concern.
- Neither Alternatives A/B/C nor Alternative D is estimated to have an adverse impact on lake acidity at any lake in the region.
- For visibility impacts using the screening method analysis, no days were predicted to exceed a 1.0 deciview (dv) "just noticeable change" at either the Flat Tops or Eagles Nest Class I areas. Under Alternative A/B/C, the 1.0 dv threshold was exceeded at the Dinosaur Class II area on 0 to 5 days (1.4 percent), and 0 to 2 days (0.5 percent) at the Mount Zirkel Class I area. For Alternative D, 0 to 3 days (0.8 percent) were predicted to exceed 1.0 dv at the Dinosaur Class II area, and 0 to 1 day (0.3 percent) at the Mount Zirkel Class I Area.
- Although the background conditions included in the additional air quality assessment reflect observed impacts from cumulative air pollutant emission sources, this type of assessment is not able to address other reasonably foreseeable future activities. However, cumulative impacts have been analyzed in the Draft EIS and are discussed in Section 5.5 of this document. It is projected that the Little Snake RMP Alternatives A/B/C and D would bring a maximum increase of 15 and 11 tons/year sulfur dioxide (SO_2) to the region, respectively. These increases are approximately 0.2 percent of the SO_2 existing reduction from the nearby Hayden and Craig Power Plants. The Little Snake RMP Alternatives A/B/C and D are projected to increase nitrogen oxide (NOx) emissions in the RMPPA by 1,066 and 825 tons/year, respectively. These increases are approximately 8 percent of the total emissions reduction at both power plants. Thus, as total SO_2 and NOx emissions in the Little Snake RMPPA are lowered in the future, cumulative air quality and air quality-related values (AQRV) will be reduced from historic levels.

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ACRONYMS AND ABBREVIATIONS

APD	Application for Permit to Drill
AGL	Above Ground Levels
APCD	Air Pollution Control Division (Colorado)
ANC	Acid neutralizing capacity
AQRV	Air Quality Related Value
BACT	Best Available Control Technology
BART	Best Available Retrofit Technology
BLM	Bureau of Land Management
BMP	Best Management Practice
CAA	Clean Air Act
CAAQS	Colorado Ambient Air Quality Standards
CDPHE	Colorado Department of Health and Environment
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
CO	Carbon Monoxide
COA	Condition of Approval
Dv	Deciview
EIS	Environmental Impact Statement
EPA	Environmental Protection Agency
FLAG	Federal Land Mangers' Air Quality Related Values Workgroup
f(RH)	Light scattering enhancement factor
FWS	Fish and Wildlife Service
ha	Hectares
HNO_3	Nitric Acid
hp	Horsepower
ISC/AERMOD	Industrial Source Complex/American Meteorological Society/Environmental Protection Agency Regulatory Model
IWAQM	Interagency Workgroup on Air Quality Modeling
Kg	Kilogram
km	Kilometer
LAC	Level of Acceptable Change
LAER	Lowest Achievable Emissions Rate
LOC	Levels of Concern
LSFO	Little Snake Field Office
m	Meter
MBtu	Million British Thermal units
MSL	Mean Sea Level
NAAQS	National Ambient Air Quality Standards
NEPA	National Environmental Policy Act
NO_3	Nitrate
NO_2	Nitrogen dioxide
NO_x	Nitrogen oxides
NOA	Notice of Availability
NOI	Notice of Intent
NPS	National Park Service
O_3	Ozone
PM	Particulate Matter
$PM_{2.5}$	Particulate matter less than 2.5 microns

PM_{10}	Particulate matter less than 10 microns
PMC	Particulate Matter Coarse
PMF	Particulate Matter Fine
Ppb	Parts per billion
PSD	Prevention of Significant Deterioration
RFD	Reasonably Foreseeable Development
RMP	Resource Management Plan
RMPPA	Resource Management Plan Planning Area
SIP	State Implementation Plan
SO_2	Sulfur Dioxide
SO_4	Sulfate
USDA	United States Department of Agriculture
USFS	United States Forest Service
WRCC	Western Regional Climate Center
μeq/l	microequivalents per liter
$\mu g/m^3$	micrograms per cubic meter

1.0 INTRODUCTION

1.1 BACKGROUND

On November 11, 2004, the Bureau of Land Management (BLM) published a Notice of Intent (NOI) (*Federal Register* 69:22 pp 67604–67606) to prepare a Resource Management Plan (RMP) and associated Environmental Impact Statement (EIS) for the Little Snake Field Office, located in northwest Colorado. The RMP will provide a framework to guide subsequent management decisions on approximately 1.3 million acres of BLM-administered public lands and 1.1 million acres of subsurface mineral estate. The BLM has worked with a broad range of interested parties to identify management decisions that are best suited to local, regional, and national needs and concerns.

Based on comments provided by the general public and interested agencies at three scoping meetings, as well as consultation with formal cooperating agencies (Moffat County, the Colorado Department of Natural Resources, the U.S. Fish and Wildlife Service, the City of Steamboat Springs, and the Juniper Water Conservancy District), the BLM published a Notice of Availability (NOA) on February 9, 2007, (*Federal Register* 72:27 pp 6284–6285) for the Draft Little Snake Field Office RMP/EIS. The NOA described the 90-day public comment period (which closed on May 16, 2007) and identified the process for future meetings and other public involvement activities.

The Draft RMP/EIS (BLM 2007) described both existing air quality conditions (Chapter 3, Affected Environment, Draft EIS Pages 3-9 through 3-15) and potential air quality impacts (Chapter 4, Affected Environment, Draft EIS Pages 4-4 through 4-9). As stated in the Draft EIS "A qualitative emission comparison approach was selected for the Little Snake Field Office RMP air quality analysis" … "however, when specific activities are proposed at the implementation stage, a more quantitative analysis would be required." The analysis methodology was described in detail in Appendix I, "Air Quality Technical Support Document." All of these documents are available online at <http://www.blm.gov/co/st/en/fo/lsfo/plans/rmp_revision.html>.

The basis for comparing potential air quality impacts among alternative management practices using potential total air pollutant emissions was also stated in the Draft EIS. "Emissions calculations were based on the best available engineering data and assumptions; air, visibility, and emission inventory procedures; and professional and scientific judgment; however, assumptions were used when specific data or procedures were unavailable. Limitations are associated with a qualitative approach; however, given the uncertainties with the number, nature, and specific location of future sources and activities, this emission comparison approach is defensible and provides a sound basis for comparing alternatives" (Draft EIS Page 4-5). This analysis approach is consistent with Council on Environmental Quality (CEQ) regulations directing the preparation of the EIS, especially the process to be used when there is incomplete or unavailable information (40 Code of Federal Regulation [CFR] 1502.22), such as if reasonably foreseeable locations of potential future oil and gas operations are unknown. The complete CEQ regulations are available online at <http://www.nepa.gov/nepa/regs/ceq/toc_ceq.htm>.

The BLM uses qualitative air pollutant emissions inventories to compare potential air quality impacts among alternatives when information necessary to perform quantitative air pollutant dispersion modeling is neither available nor reasonably foreseeable. This information includes activity descriptions (such as anticipated well pad construction equipment use, drilling rig engine types, and operating conditions), facility designs, appropriate air pollutant emission factors (such as Environmental Protection Agency's [EPA] AP-42 "*Compilation of Air Pollutant Emission Factors,*" equipment manufacturers' data), site-specific topography (terrain elevations), meteorology (including winds, temperatures, precipitation, and stability conditions), and site-specific activity locations. When this information is available, such as for the Hiawatha Regional Energy Project (a proposed natural gas development project located in part within Moffat County, Colorado), a detailed quantitative air pollutant dispersion modeling analysis is commonly prepared, and potential air quality impacts are described in the EIS.

Both qualitative air pollutant emissions analyses and quantitative air pollutant dispersion modeling analyses have been used by the BLM throughout the West in documents similar to the Little Snake Field Office RMP/EIS, subject to applicable CEQ regulations for implementing the National Environmental Policy Act of 1969 (NEPA). The BLM is confident the qualitative air pollutant emissions analyses presented in the Draft Little Snake Field Office RMP/EIS is also appropriate and adequate. Therefore, the information presented in Chapters 3 and 4 of the Draft EIS has not been modified and remains appropriate as the basis for guiding subsequent management decisions. Changes made to the Draft RMP/EIS, including the addition of the assessment presented in this document as an appendix, are listed in Section 6.0 of this document.

However, as described in BLM's NOI to Prepare Additional Air Quality Analysis Information for the Little Snake Field Office Draft RMP/EIS (published December 19, 2007, in the *Federal Register* 72:243 pg 71944), "During the public comment period, the [U.S.] Environmental Protection Agency [EPA], in consultation with the BLM, identified areas where additional air quality information would improve the existing analysis in the Draft EIS. As a result, the BLM is preparing an additional air quality analysis. When the additional air quality analysis has been completed, the BLM will present the information for public review and comment. At that time, the BLM will only accept comments from the public pertaining to the new air quality information."

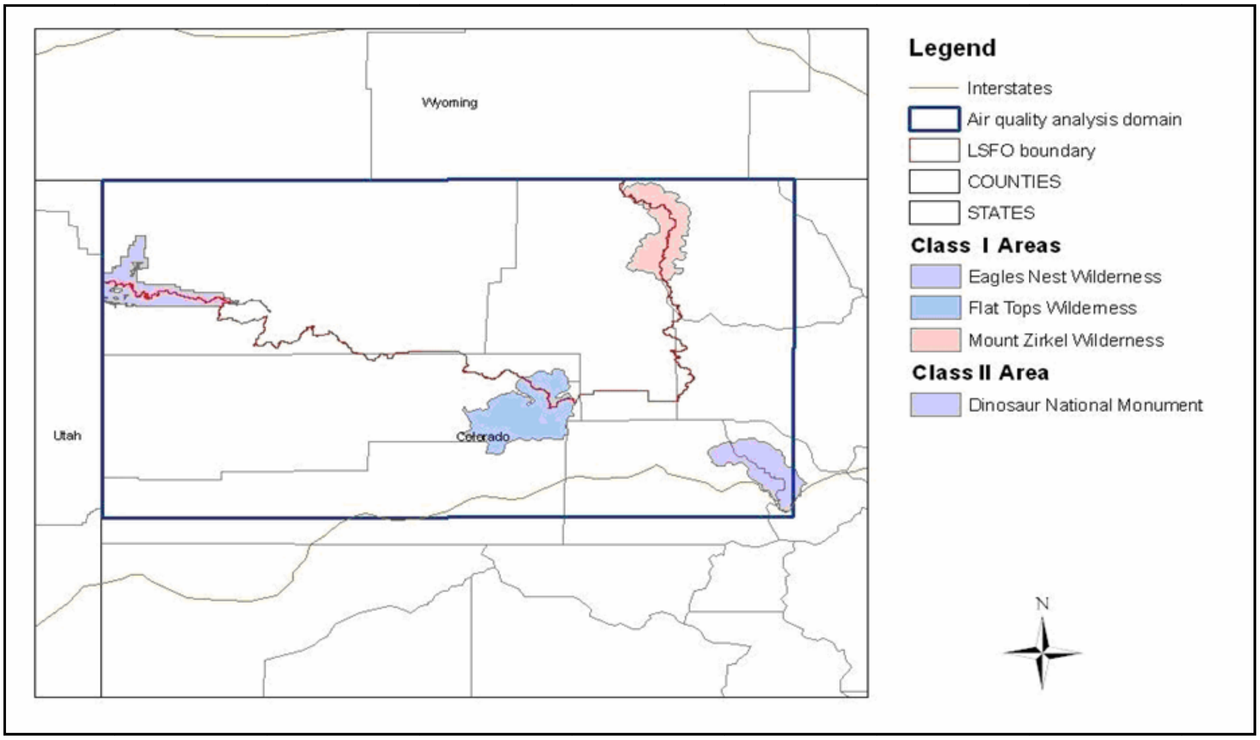
This Additional Air Quality Impact Assessment represents the "Additional Air Quality Analysis Information" described in BLM's December 19, 2007, NOI and is based on an *Air Quality Impact Assessment Technical Support Document, Little Snake Resource Management Plan, Moffat, Routt and Rio Blanco Counties, Colorado,* prepared for the BLM by Environ International Corporation (2008). Both documents are available online at <http://www.blm.gov/co/st/en/fo/lsfo/plans/rmp_revision.html>.

This Additional Air Quality Impact Assessment was prepared to summarize and present the results of modeling analyses used to quantify hypothetical air quality impacts from the proposed Little Snake Field Office RMP. An Air Quality Impact Assessment Protocol (Protocol) that identified the methodology for quantifying potential air quality impacts was initially prepared before the study initiation to ensure that the approach, input data, and computation methods were acceptable to the BLM, and that other interested parties had the opportunity to review the Protocol and provide input before the study was initiated.

1.2 SCOPE OF ANALYSIS

The RMP planning area's (RMPPA) location in northwest Colorado required the examination of the RMP's impacts within a defined study area (modeling domain) (Figure1-1). The analysis area includes the area surrounding the proposed RMPPA and all or a portion of the Flat Tops, Mount Zirkel, and Eagles Nest Wilderness Areas, as well as Dinosaur National Monument. Impacts analyzed included those on air quality and air quality-related values (AQRV) resulting from air emissions resulting from hypothetical oil and gas development activities within the RMPPA, as proposed under the various alternatives presented in the Draft RMP/EIS. Only the far-field air quality and AQRV impacts of the Little Snake RMP sources are presented. It was not necessary to quantify near-source ambient air quality impacts for Little Snake RMP because they are similar to those already determined for other oil and gas development projects in the region (e.g., Hiawatha and Moxa Arch).

Figure 1-1. Little Snake RMP Area and Air Quality Analysis Domain



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

- Air Emission Inventory
  - Development of an air pollutant emission inventory for hypothetical oil and gas development activities assumed in the RMPPA. The emission inventory included criteria pollutant emissions for construction activities, production activities, and ancillary facilities.
- Far-Field Direct Project Impact Analysis
  - Assessment of far-field air quality concentration and AQRV impacts resulting from assumed oil and gas development activities in the RMPPA. The far-field ambient air quality and AQRV impact assessment was performed to quantify the maximum predicted pollutant impacts at Class I areas and a sensitive Class II area within the study area resulting from assumed construction, drilling, and production emissions.
- Far-Field Cumulative Impact Analysis
  - Qualitative assessment of far-field air quality concentration and AQRV impacts resulting from activities proposed within the RMPPA combined with other regional sources.

The modeling results are summarized in this document. The Air Quality Protocol Document is found in Appendix A. The technical details of the analysis are found in the Air Quality Technical Support Document (Appendix B).

2.0 OVERVIEW OF OIL AND GAS DEVELOPMENT ALTERNATIVES

The Little Snake Field Office RMP/EIS would not directly authorize additional oil and gas development but is intended to identify areas that would be available for future oil and gas leasing, subject to additional NEPA analysis. Two alternative scenarios were performed, based on the oil and gas emissions inventory reported in the publicly available Draft Little Snake Field Office RMP/EIS. The first scenario assumed that approximately 3,031 new oil and gas wells on federal lands could be drilled under Alternatives A, B, and C. The second scenario assumed that approximately 2,273 new oil and gas wells on federal lands could be drilled under Alternative D (75 percent of the Preferred Alternative).

2.1 ALTERNATIVE C, PREFERRED ALTERNATIVE

A BLM land use plan does not authorize oil and gas development, but it does identify areas that would be available for future oil and gas leasing. For analysis purposes, the Reasonable Foreseeable Development (RFD) Scenario (BLM 2005) anticipated that over the next 20 years approximately 3,031 oil and gas wells would be drilled in the Little Snake RMPPA under the Preferred Alternative (Alternative C) in addition to wells that currently exist in the RMPPA. The same number of wells also applies to the No Action Alternative (A) and Alternative B.

For all alternatives, it is assumed that the additional wells would be drilled conventionally, i.e., with vertical well bores. All proposed wells are anticipated to be drilled during an approximate 20-year period. The average life of a well is expected to be 40 years.

2.2 ALTERNATIVES EVALUATED

In addition to the Preferred Alternative C discussed in Section 2.1, several other alternatives are analyzed in the RMP. These alternatives are summarized below. However, only two model runs were required to address all alternatives, because the well numbers proposed under only one alternative (Alternative D) differed from the Preferred Alternative (C).

2.2.1 Alternative A, No Action

Although this alternative proposes different land uses, it would have the same number of wells as the Preferred Alternative (C), and for the purposes of the air quality impacts analysis is identical to the Preferred Alternative.

2.2.2 Alternative B

Although this alternative proposes different land uses, it would have the same number of wells as the Preferred Alternative (C), and for the purposes of the air quality impacts analysis is identical to the Preferred Alternative.

2.2.3 Alternative D, Action With Resource Protection

An alternative with lower development than the Preferred Alternative is included in this analysis (Alternative D). For this alternative, it is anticipated that 2,273 wells for the RMPPA would be developed (this scenario is 75 percent of the Preferred Alternative).

3.0 AIR QUALITY MODEL AND INPUT PARAMETERS

The far-field ambient air quality and AQRV impact assessment was performed to quantify the hypothetical maximum pollutant impacts at Class I areas and a sensitive Class II area within the study area resulting from construction, drilling, and production emissions for the Little Snake RMP alternatives. The procedures in the Modeling Protocol (Appendix A) were followed in the CALPUFF-lite modeling analyses.

The purpose of the CALPUFF analyses was to quantify hypothetical air quality and AQRV impacts at nearby Class I and sensitive Class II areas from assumed oil and gas activities within the RMPPA, resulting from assumed air pollutant emissions of nitrogen oxide (NOx), sulfur dioxide (SO_2), particulate matter less than 10 microns in diameter (PM_{10}), and particulate matter less than 2.5 microns in diameter ($PM_{2.5}$). The analyses were performed using the CALPUFF-lite modeling system (referred to hereafter as "CALPUFF"). The Class I and sensitive Class II receptor areas analyzed in the far-field modeling included—

- Mount Zirkel Wilderness Area (Class I)
- Eagles Nest Wilderness Area (Class I)
- Flat Tops Wilderness Area (Class I)
- Dinosaur National Monument (federal Class II, Colorado area designated with the same SO_2 increment as federal Class I).

Air pollutant concentrations predicted at these areas were compared to applicable national and state ambient air quality standards and prevention of significant deterioration (PSD) Class I increments. Also, potential impacts to AQRVs, which include visibility (regional haze) and atmospheric deposition (sulfur and nitrogen), were assessed. In addition, analyses were performed for sensitive lakes located within the Class I areas to assess potential lake acidification from acid deposition impacts. These lakes are—

- Long Lake Reservoir in the Mount Zirkel Wilderness Area
- Seven Lakes in the Mount Zirkel Wilderness Area
- Lower Ned Wilson Lake Packtrail Pothole in the Flat Tops Wilderness Area
- Upper NWL Packtrail Pothole, Flat Tops Wilderness
- Ned Wilson Lake in the Flat Tops Wilderness Area
- Ned Wilson Spring in the Flat Tops Wilderness Area
- Upper Ned Wilson Lake in the Flat Tops Wilderness Area
- Trappers Lake in the Flat Tops Wilderness Area
- Booth Lake in the Eagles Nest Wilderness Area
- Upper Willow Lake in the Eagles Nest Wilderness Area.

3.1 MODELING METHODOLOGY

The far-field ambient air quality and AQRV impact assessment was performed to quantify the potential maximum pollutant impacts on Class I areas and a sensitive Class II area, which could result from construction, drilling, and production emissions for the draft Little Snake Field Office RMP alternatives. A Modeling Protocol (Appendix A) was prepared in coordination with the BLM and EPA Region 8 before conducting the analyses (Booz Allen Hamilton 2007). The procedures in the Modeling Protocol were followed in the CALPUFF modeling analyses.

Because of the similarity between other oil and gas development projects and hypothetical assumptions from the draft Little Snake Field Office RMP, the near-field air quality impact assessment from the Moxa

Arch and Hiawatha projects are also relevant to the draft Little Snake Field Office RMP; therefore, only the far-field air quality and AQRVs were addressed in this assessment.

Based on an agreement with EPA Region 8, CALPUFF (IWAQM 1998; Earth Tech 2001b and 2002) was used to assess impacts, using a single SAMSON meteorological database and discrete downwind receptors. The study was performed using the following recent and relevant guidance sources:

- *Guideline on Air Quality Models*, 40 Code of Federal Regulations (CFR), Part 51, Appendix W
- Phase 2 of the Interagency Workgroup on Air Quality Modeling (IWAQM 1998)
- Guide for Applying the EPA Class I Screening Methodology with the CALPUFF Modeling System (Earth Tech 2001b; 2002)
- Federal Land Managers—Air Quality Related Values Workgroup (FLAG), Phase I Report, December 2000 (FLAG 2000).

The CALPUFF modeling approach is intended to be a conservative screening approach.

Air pollutant emissions of NO_x, SO_2, PM_{10}, and $PM_{2.5}$ from production wells, construction, drilling, and compressors for the draft RMP alternatives were modeled. A description of the emissions inventory procedures and assumptions is provided in Appendix B. The processing of these emissions sources for input to CALPUFF-lite modeling system (referred to hereafter as "CALPUFF") is described in Section 3.4.4.

CALPUFF outputs were post-processed to estimate (1) concentrations for comparison to ambient standards and Class I increments, (2) wet and dry deposition amounts for comparison to sulfur and nitrogen deposition thresholds and to calculate potential changes in 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.

3.2 FAR-FIELD ANALYSIS

3.2.1 Dispersion Model Inputs

For the most part, CALPUFF was run using the EPA-recommended default control file switch settings. Appendix B displays the CALPUFF options selected for the project's modeling; deviations from EPA-recommended defaults are indicated and discussed below. Chemical transformations were modeled using the MESOPUFF II chemical mechanism for conversion of SO_2 to sulfate (SO_4) and NOx to nitric acid (HNO_3) and nitrate (NO_3). Each of these pollutant species was included in the CALPUFF model runs. Gaseous deposition of NOx, HNO_3, and SO_2 was modeled, as was particle deposition of SO_4, NO_3, $PM_{2.5}$, and PM_{10}.

Several CALPUFF options deviated from EPA-recommended default settings. First, the EPA-recommended default configuration does not include any PM species, whereas this analysis included both fine $PM_{2.5}$ (PMF) and coarse PM_{10} (PMC) species. Consequently, this analysis includes 2 more emitted and modeled species than in the EPA recommendations (5 and 7 used versus 3 and 5 EPA-recommended, respectively). Finally, the EPA-recommended default value for ammonia is 10.0 parts per billion (ppb), which is representative of grasslands. The selected background ammonia value of 1.0 ppb was based on ammonia measurements in the region from the Mt. Zirkel Visibility Study (see Appendix B for more details).

3.2.2 Meteorological Fields

The meteorological data used were measured in Rock Springs, Wyoming, (Rock Springs surface; Lander Hunt Field upper air) for the years 1985 and 1987–1990 as provided to EPA Region 8 personnel from the Colorado Department of Public Health and Air Pollution Control Division (CDPHE-APCD). The data were processed with the CPRAMMET program.

3.2.3 Model Domain and Receptors

The modeling analysis area (Figure 3-1) consisted of a 250-kilometer (km) by 170-km domain that includes the Little Snake RMPPA, Class I, and other sensitive areas. A single mixing layer was used in the vertical with the single hourly wind speed measured at the anemometer height scaled to "stack-top" as in ISC/AERMOD (Industrial Source Complex/American Meteorologial Society/Environmental Protection Agency Regulatory Model). The *Guide to CALPUFF-lite* recommends putting the top of layer 1 above the maximum expected mixing height and suggests values of 3,000 meters (m) to 5,000 m AGL (Earth Tech 2001b and 2002). CDPHE performed an analysis to determine the maximum mixing heights in Colorado for its BART CALPUFF modeling and concluded that a 3,000 m above ground level (AGL) was too low and used the mixing height maximum of 4,500 m AGL (CDPHE 2005). Given these results, a layer 1 top (i.e., cell face 2) of 5,000 m AGL was used in this hypothetical modeling analysis.

Discrete receptors were located throughout the PSD Class I Eagles Nest, Mount Zirkel, and Flat Tops wilderness areas, based on values provided by the U.S. Forest Service (USFS). Additional receptors were placed along the boundary and at elevated points within the Dinosaur National Monument. Discrete receptors were also located at sensitive lake locations identified by the USFS. The locations of the receptors used are shown in Figure 3-1, and distance and direction are shown in Tables 3-1 and 3-2.

Table 3-1. Approximate Distance and Direction to Class I and Other Sensitive Areas

Class I / Sensitive Areas	Distance from LS RMPPA	Direction from LS RMPPA
Eagles Nest Wilderness	30 km	Southeast
Flat Tops Wilderness	Adjacent	Southeast
Mount Zirkel Wilderness	Adjacent	East
Dinosaur National Monument	Adjacent	Southwest

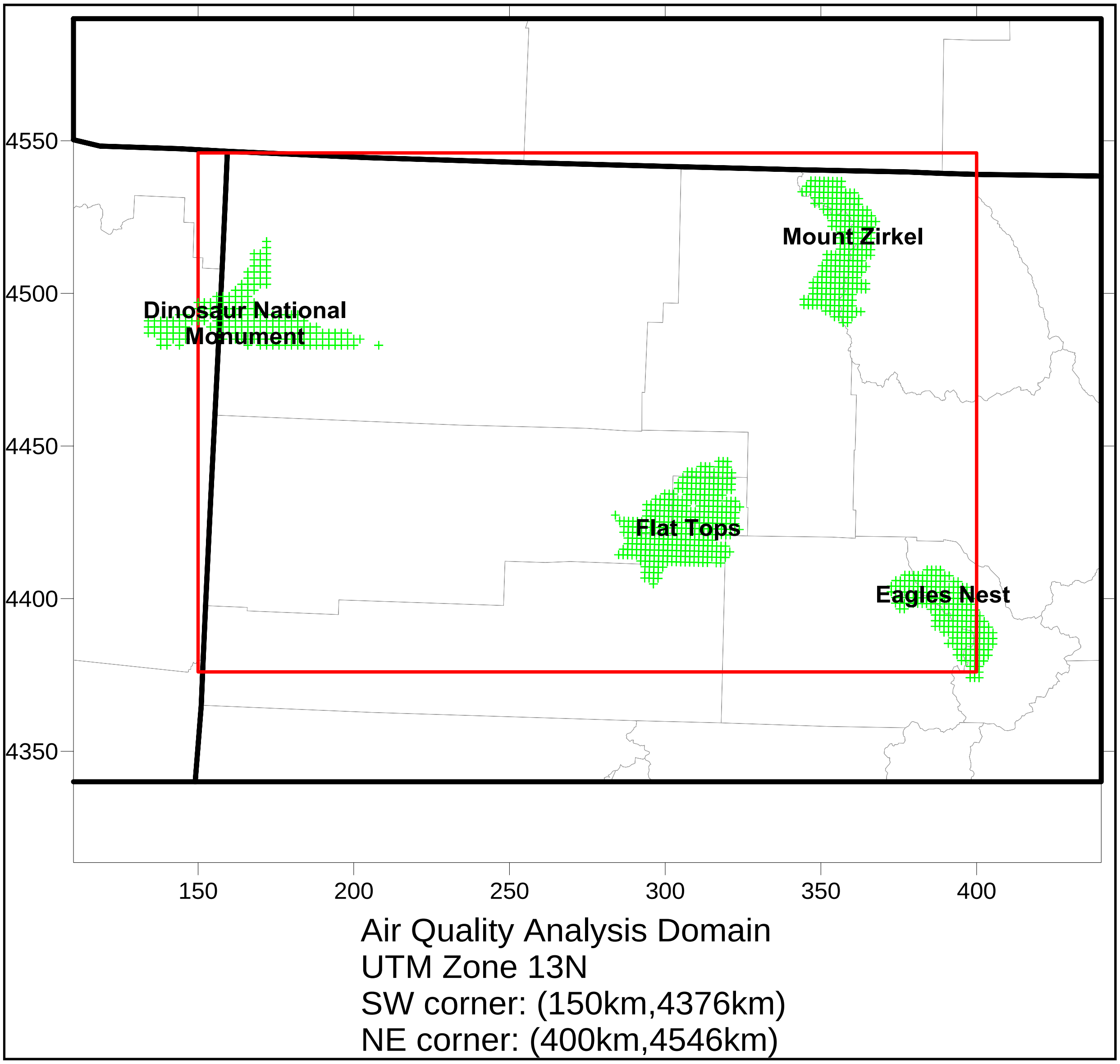
In addition, discrete receptors were placed at the following sensitive lakes identified as the most sensitive to acid deposition (Table 3-2).

Table 3-2. Distance and Direction to Sensitive Lakes

Sensitive Lake Receptors	Distance from LSRMP Centerpoint (km)	Direction from LSRMP Centerpoint
Lake Elbert, Mount Zirkel Wilderness	90	Northeast
Seven Lakes, Mount Zirkel Wilderness	90	Northeast
Lower NWL Packtrail Pothole, Flat Tops Wilderness	55	Southeast
Ned Wilson Lake, Flat Tops Wilderness	55	Southeast
Ned Wilson Spring #1, Flat Tops Wilderness	55	Southeast
Trappers Lake, Flat Tops Wilderness	55	Southeast
Upper Ned Wilson Lake, Flat Tops Wilderness	55	Southeast
Upper NWL Packtrail Pothole, Flat Tops Wilderness	55	Southeast

Sensitive Lake Receptors	Distance from LSRMP Centerpoint (km)	Direction from LSRMP Centerpoint
Booth Lake, Eagles Nest Wilderness	150	Southeast
Upper Willow Lake, Eagles Nest Wilderness	150	Southeast

Figure 3-1. CALPUFF Domain and Receptors for the Little Snake RMP Air Quality Analysis



3.2.4 Emissions Processing

As previously indicated, emissions were developed for the construction and operations phases of the hypothetical oil and gas development. Using best available data and EPA-approved emissions factors, construction and operations activities were broken down into the individual components (see Appendix B for the emission inventory spreadsheets).

For all alternatives, it is assumed that the additional wells would be drilled conventionally, i.e., a single well per pad with vertical well bores. The estimated size of each drill site location is 2.75 acres, of which approximately 1.75 acres would be reclaimed after the well is completed and the gas gathering pipeline is installed. All proposed wells are anticipated to be drilled during an approximate 20-year period. The average life of a well is expected to be 40 years. Because of the lack of any specific project proposal (with the exception of the Hiawatha Regional Energy Development Project), EPA Region 8 agreed that the BLM could combine assumed oil and gas activity into hypothetical distribution zones, based primarily on the major oil and gas formations in the RMPPA. This is the only possible approach where future development locations are generally unknown, and will not be known until future site-specific NEPA analyses are performed.

CALPUFF source parameters were determined for emissions from oil and gas development activities in the Little Snake oil and gas development zones as shown in Figure 3-2. The estimate of well numbers per distribution zone was determined using an analysis of Applications for Permit to Drill (APDs) for the time period of January 2001 through September 2007. APDs were grouped into five general zones: four zones representing the major oil and gas formations/existing fields in the Little Snake RMPPA. The fifth zone would represent all the other areas outside of the four zones, within the area of high oil and gas potential. The results of the analysis of modern development trends and the projected well numbers are shown on Table 3-3. The breakdown of federal wells versus private wells is shown in Table 3-4.

Table 3-3. Past Oil and Gas Activity and Projected Development

Area	Township & Range	Number of APDs – 01/01/01 to 09/10/07	Percentage of APDs – 01/01/01 to 09/10/07	Projected Federal Wells – Alts A/B/C	Projected Federal Wells – Alt D
Powder Wash	T11N–T12N R97W	21	11%	322	250
Hiawatha, Vermillion, Sugar Loaf	T11N–T12N R100W– R101W	71	37%	1,185	841
Great Divide, East of Godiva Rim	T7N–T12N R92W–R95W	55	29%	850	659
Sand Wash & Vermillion Basins	T8N–T10N R97W– R100W	22	12%	352	273
Other		21	11%	322	250
Total		**190**	**100%**	**3,031**	**2,273**

Table 3-4. Number of Federal versus Private Wells

Alternative	Number of Federal Wells	Number of Private Wells	Total Wells
A/B/C	2,122	909	3,031
D	1.591	682	2,273

Note: It was assumed that 70% of all wells in every zone are federal and 30% of all wells in every zone are private.

Assumed RMP sources were input to CALPUFF as area sources defined by the geographic extent of these zones to idealize well operation and construction emissions. The number of natural gas, oil, and nonproducing (e.g., dry holes, water wells) wells and the number of central and wellhead compressors expected in each of zones was specified by the BLM (Jeremy Casterson, personal communication 2008). Tables 3-5 and 3-6 show the number of wells of each type for Alternatives A/B/C and D, respectively.

It was assumed that during construction, air pollutant emissions would include the following:

- Well pad and resource road construction and traffic
- Rig-move/drilling and associated traffic
- Completion/testing and associated traffic
- Pipeline installation and associated traffic
- Wind erosion during construction activities.

It was also assumed that during production, air emissions 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
- 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
- Natural gas-fired reciprocating internal combustion compressor engines.

It was assumed that each well would have a three-phase separator and glycol dehydrator to process an average of 50 million British Thermal units (MBtu)/hour/product. Condensate and water would be stored in tanks, which would be serviced weekly by a tanker truck traveling on approximately 6 miles of unpaved access road. In addition, 5,000 horsepower (hp) central (pipeline or sales) compressors would also be used, for a total of 50,000 hp for Alternatives A/B/C, and 40,000 hp for Alternative D. Central compressor stations were treated as area sources, not point sources, and their emissions contribution was added to those of the wellhead compressors and well construction and production emissions in that grid cell. It was determined that year 20 would have the highest assumed air pollutant emissions, combining the greatest amount of production with a linear rate of construction.

Once the wells had been located in the zones, the wells were assigned to a particular grid cell of the CALPUFF modeling domain, and the total emissions for each grid cell were taken to be the sum of the emissions from all wells that lay within that 4-km grid cell. Because the exact location of the wellhead compressors was not provided prior to the analysis, wellhead compressors were sited within the project area based on the randomly chosen well locations. According to the Protocol, there were to be 30 wellhead compressors for every 1,000 wells, so groups of 33 wells were formed, and a wellhead compressor placed in the centroid of each group of 33 wells (Appendix A). Once a wellhead compressor had been located within a 4 km^2 grid cell, the emissions from that wellhead compressor were added to those of the project wells within that grid cell.

Based on these assumptions, total construction- and production-related air pollutant emissions are presented in Table 3-7.

Figure 3-2. Map of Little Snake Oil and Gas Development Zones (shown in blue)

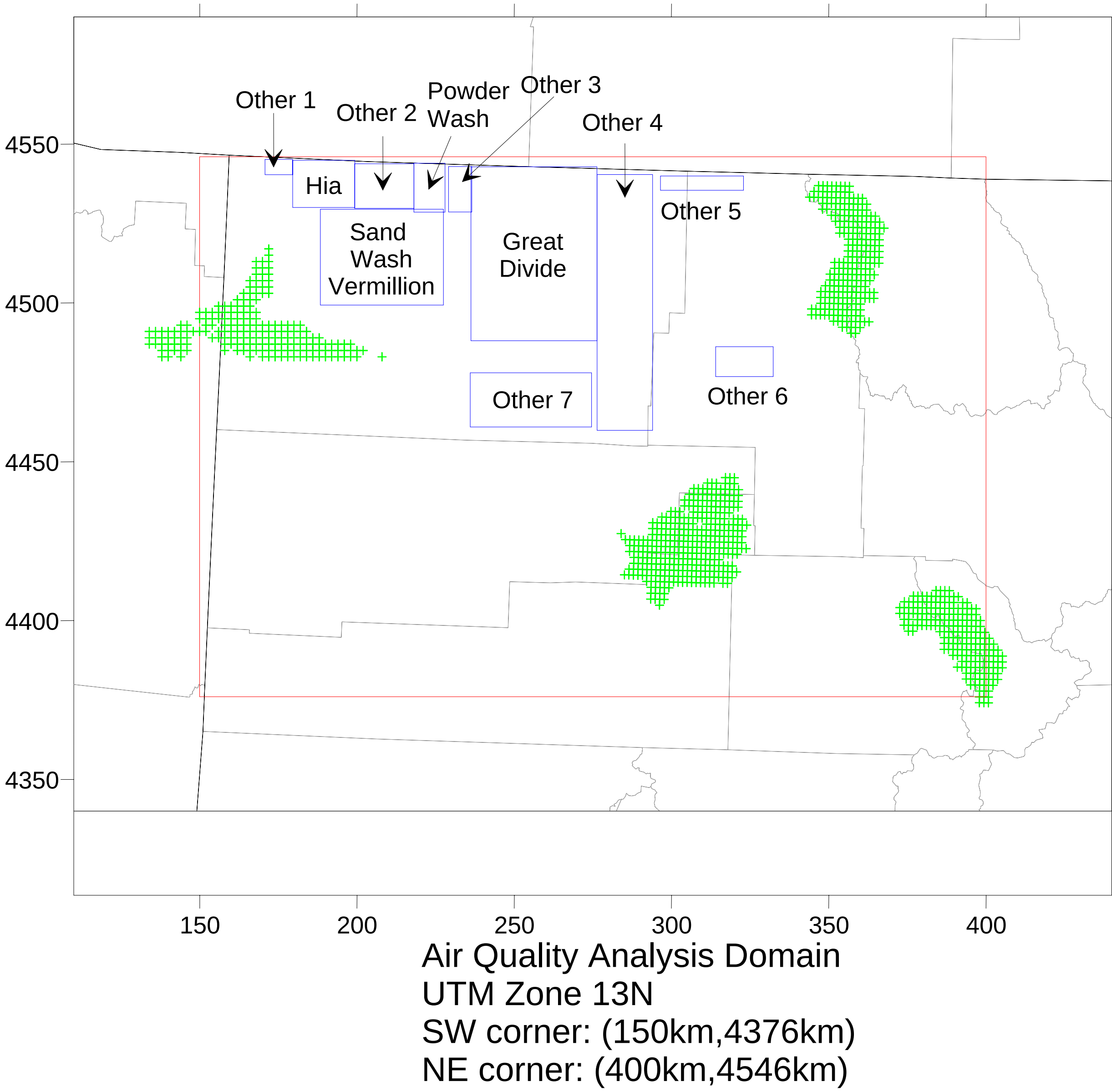


Table 3-5. Number of Gas, Oil, and Nonproducing Wells for Alternative A/B/C

	Gas Wells	Oil Wells	Nonproducing Wells	Total Wells	Wellhead Compressors	Central Compressors
Sand Wash	196	73	95	364	6	1
Hiawatha	606	224	292	1,122	19	4
Powder Wash	180	67	87	334	5	1
Great Divide	475	176	229	880	14	3
Other 1	3	1	1	5	0	0
Other 2	18	7	9	34	1	0
Other 3	9	3	4	16	0	0

	Gas Wells	Oil Wells	Nonproducing Wells	Total Wells	Wellhead Compressors	Central Compressors
Other 4	35	13	17	65	1	0
Other 5	93	34	44	171	3	1
Other 6	11	4	5	20	0	0
Other 7	11	4	5	20	0	0
Total	**1,637**	**606**	**788**	**3,031**	**49**	**10**

Table 3-6. Number of Gas, Oil, and Nonproducing Wells for Alternative D

	Gas Wells	Oil Wells	Nonproducing Wells	Total Wells	Wellhead Compressors	Central Compressors
Sand Wash	147	55	71	273	4	1
Hiawatha	454	168	218	840	13	4
Powder Wash	135	50	65	250	4	1
Great Divide	356	132	172	660	11	2
Other 1	3	1	1	5	0	0
Other 2	13	5	6	24	1	0
Other 3	6	2	3	11	0	0
Other 4	26	10	13	49	1	0
Other 5	70	26	34	130	2	0
Other 6	8	3	4	15	0	0
Other 7	9	3	4	16	1	0
Total	**1,227**	**455**	**591**	**2,273**	**37**	**8**

Table 3-7. Assumed Little Snake RMP Maximum Annual In-field Emissions Summary, Construction and Production

Alternative	Annual Development Rate Per Year	Pollutant	Annual Construction Emissions (tpy)	Total Producing Wells	Annual Production Emissions (tpy)	Total Emissions (tpy)
Preferred Alternative A/B/C	152	PM_{10}	1,543 [1]	1,637	501	2,044
		$PM_{2.5}$	538 [1]		70	608
		NO_x	85		982	1,066
		SO_2	8		7	15
Alternative D	114	PM_{10}	1,158 [1]	1,223	376	1,533
		$PM_{2.5}$	404 [1]		52	456
		NO_x	63		761	825
		SO_2	6		5	11

[1] Includes wind erosion emissions.

4.0 BASELINE (EXISTING ENVIRONMENT) ANALYSIS

4.1 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 (Table 4-1). Regional monitoring-based background values for criteria pollutants (PM_{10}, $PM_{2.5}$, carbon monoxide [CO], NO_x, and SO_2) were collected at monitoring sites in northwestern Colorado and Wyoming. Direct modeled pollutant concentrations were compared to PSD Class I and Class II increments. However, comparison to PSD increments is intended to indicate potential significance and is not intended to represent a regulatory PSD Increment Consumption Analysis. Ambient air background concentrations shown in Table 4-1 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 National Ambient Air Quality Standards (NAAQS) and Colorado Ambient Air Quality Standards (CAAQS).

Table 4-1. Analysis Background Ambient Air Quality Concentrations ($\mu g/m^3$)

Pollutant	Averaging Period	Measured Background Concentration
Carbon monoxide (CO)	1-hour	2,299
	8-hour	1,148
Nitrogen dioxide (NO_2)	Annual	3.4
Ozone (O_3)	8-hour	68
PM_{10}	24-hour	119
	Annual	25
$PM_{2.5}$	24-hour	20
	Annual	8
Sulfur dioxide (SO_2)	3-hour	132
	24-hour	43
	Annual	9

Source: LSRMP DEIS (BLM 2007)

4.2 VISIBILITY

Potential visibility impacts were estimated by comparing predicted atmospheric extinction (derived from modeled speciated aerosols and observed daily Relative Humidity factor [f(RH)] values) to observed data collected by the IMPROVE Program. The visibility methodology used an established approach used by the BLM in previous studies. Both the Seasonal Federal Land Managers' Air Quality-Related Values Workgroup (FLAG) Screening Analysis Spreadsheet Method (Archer 2003) and the Daily FLAG Refined Analysis Spreadsheet Method (Archer 2008) were used.

The Seasonal FLAG Screening Analysis Spreadsheet was prepared based on the FLAG published method to evaluate potential visibility impacts at mandatory federal PSD Class I areas (FR 66:2 pp 382–383; Wednesday, January 3, 2001), as well as monthly f(RH) values subsequently provided by FLAG.

The Daily FLAG Refined Analysis Spreadsheet was prepared based on the FLAG published method to evaluate potential visibility impacts at mandatory federal PSD Class I areas (FR 66:2 pp 382–383;

Wednesday, January 3, 2001), using available speciated aerosol measurements collected on the White River National Forest, and representative measured hourly average relative humidity measurements.

4.3 LAKE CHEMISTRY

The most recent lake chemistry background ANC data were obtained from the USFS for each sensitive lake listed in Table 3-2 of this document. The 10th percentile lowest ANC values were calculated for each lake, and potential impacts were calculated following procedures provided by the USFS (2000).

5.0 ASSESSMENT OF AIR QUALITY IMPACTS

The purpose of the hypothetical CALPUFF analyses was to quantify impacts on air quality and AQRV at nearby Class I and sensitive Class II areas from oil and gas activities within the RMP area, as a result of assumed air pollutant emissions of NOx, PM_{10}, $PM_{2.5}$, and SO_2. The Class I and sensitive Class II receptor areas analyzed were Eagles Nest Wilderness Area (Class I); Flat Tops Wilderness Area (Class I); Mount Zirkel Wilderness Area (Class I); and Dinosaur National Monument (federal Class II, Colorado SO_2 increment same as federal Class I).

For each far-field sensitive area, CALPUFF-modeled concentration impacts were post-processed to derive (1) concentrations for comparison to ambient air quality standards (CAAQS and NAAQS) and PSD 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.

5.1 AMBIENT AIR QUALITY CONCENTRATIONS

5.1.1 Ambient Air Quality Standards

Under federal and state regulations, total ambient air quality concentrations are limited to ambient air quality standards. In addition, increases in ambient air concentrations in Class I and II areas are limited by PSD increments. Specifically, emissions associated with a particular development may increase ambient concentrations above baseline levels only within those specific increments developed for SO_2, PM_{10}, and NO_2. Table 5-1 lists the ambient standards and PSD increments to which the potential concentration impacts were compared.

Table 5-1. Ambient Standards, Class II PSD Increments, and Class I PSD Increments ($\mu g/m^3$)

Pollutant/Averaging Time	Ambient Air Quality Standards		PSD Class II Increment	PSD Class I Increment
	National	Colorado		
Carbon monoxide (CO)				
1-hour [1]	40,000	40,000	--	--
8-hour [1]	10,000	10,000	--	--
Nitrogen dioxide (NO_2)				
Annual [2]	100	100	25	2.5
Ozone (O_3)				
8-hour [3]	157	157	--	--
PM_{10}				
24-hour [1]	150	150	30	8
Annual	--	--	17	4
$PM_{2.5}$				
24-hour	35	--	--	--
Annual [2]	15	--	--	--
Sulfur dioxide (SO_2)				
3-hour [1]	1,300	700 [4]	512	25
24-hour [1]	365	100 [4]	91	5
Annual [2]	80	15 [4]	20	2

1 No more than one exceedance per year.
2 Annual arithmetic mean.
3 Average of annual fourth-highest daily maximum 8-hour average.
4 Colorado Ambient Air Quality Standards are more stringent than the federal standards.
Note: On September 21, 2006, EPA announced final revisions to the National Ambient Air Quality Standards for particulate matter. The revision strengthens the 24-hour $PM_{2.5}$ standard from 65 to 35 $\mu g/m^3$ and revokes the annual PM_{10} standard of 50 $\mu g/m^3$. EPA retained the existing annual $PM_{2.5}$ standard of 15 $\mu g/m^3$ and the 24-hour PM_{10} standard of 150 $\mu g/m^3$.
Maximum modeled direct air pollutant concentrations may be compared to the PSD Class I increments as an indication of potential significance; however, these comparisons are for informational purposes only and do not constitute a regulatory PSD increment consumption analysis. The PSD Class I SO_2 increments are applicable in Dinosaur National Monument under Colorado law, but less stringent Class II NO_2 and SO_2 federal increments apply within Dinosaur National Monument. Background measured concentrations (Table 4-1) must be added to the modeled direct air pollutant concentrations for comparison to ambient air quality standards (Table 5-1.)

5.1.2 Far-Field Concentration Results

Table 5-2 shows the maximum CALPUFF-estimated potential impacts from all alternatives occurs at the Dinosaur National Monument Class II area, but all maximum direct modeled impacts are below the PSD Class I increments. The analysis also shows compliance with all Colorado and federal ambient air quality standards when the maximum direct far-field modeled impacts are added to the maximum background concentrations to obtain a total predicted concentration. This comparison is limited because of a lack of reasonably foreseeable well pad and compressor engine locations. If future development locations are identified, site-specific NEPA analyses will be performed, and near-field comparisons to Colorado and federal ambient air quality standards can be made. In summary, the modeling results indicate that, for the Alternative A/B/C and Alternative D scenarios, impacts would not exceed any air quality standards (CAAQS and NAAQS) or PSD increments within the PSD Class I and sensitive PSD Class II areas analyzed. The PSD increment analyses are for informational purposes only and do not constitute a regulatory PSD increment consumption analysis.

The PSD Class I SO_2 increments are applicable in Dinosaur National Monument under Colorado law, but less stringent Class II NO_2 and SO_2 federal increments apply within Dinosaur National Monument.

Table 5-2. CALPUFF Estimated Air Quality Impacts ($\mu g/m^3$).

Alternatives A/B/C													
Pollutant	**Averaging Time**	**Maximum Direct Modeled Impacts**				**PSD Class I Increment**	**Background Concentration**	**Maximum Total Predicted Impact**				**NAAQS**	**CAAQS**
		EANE	**FLTO**	**MOZI**	**DINO[a]**			**EANE**	**FLTO**	**MOZI**	**DINO**		
NO_2	Annual	0.0001	0.0011	0.0229	0.0275	2.5	3.4	3.4	3.4	3.4	3.4	100	100
PM_{10}	Annual	0.0020	0.0096	0.0723	0.0958	4	25	25.0	25.0	25.1	25.1	--	--
	24-hour	0.0578	0.1713	0.4162	1.1395	8	119	119.1	119.2	119.4	120.1	150	150
$PM_{2.5}$ [b]	Annual	0.0020	0.0096	0.0723	0.0958	--	8	8.0	8.0	8.1	8.1	15	--
	24-hour	0.0578	0.1713	0.4162	1.1395	--	20	20.1	20.2	20.4	21.1	35	--
SO_2	Annual	0.0000	0.0001	0.0006	0.0007	2	9	9.0	9.0	9.0	9.0	80	15
	24-hour	0.0004	0.0011	0.0040	0.0090	5	43	43.0	43.0	43.0	43.0	365	100
	3-hour	0.0018	0.0037	0.0094	0.0240	25	132	132.0	132.0	132.0	132.0	1,300	700
Alternative D													
Pollutant	**Averaging Time**	**Maximum Direct Modeled Impacts**				**PSD Class I Increment**	**Background Concentration**	**Maximum Total Predicted Impact**				**NAAQS**	**CAAQS**
		EANE	**FLTO**	**MOZI**	**DINO[a]**			**EANE**	**FLTO**	**MOZI**	**DINO**		
NO_2	Annual	0.0001	0.0009	0.0125	0.0307	2.5	3.4	3.4	3.4	3.4	3.4	100	100
PM_{10}	Annual	0.0015	0.0074	0.0522	0.0966	4	25	25.0	25.0	25.1	25.1	--	--
	24-hour	0.0441	0.1285	0.2963	0.8736	8	119	119.0	119.1	119.3	119.9	150	150
$PM_{2.5}$ [b]	Annual	0.0015	0.0074	0.0522	0.0966	--	8	8.0	8.0	8.1	8.1	15	--
	24-hour	0.0441	0.1285	0.2963	0.8736	--	20	20.0	20.1	20.3	21.9	35	--
SO_2	Annual	0.0000	0.0000	0.0004	0.0007	2	9	9.0	9.0	9.0	9.0	80	15
	24-hour	0.0003	0.0008	0.0029	0.0069	5	43	43.0	43.0	43.0	43.0	365	100
	3-hour	0.0014	0.0028	0.0067	0.0182	25	132	132.0	132.0	132.0	132.0	1,300	700

Abbreviations: NO_2 – nitrogen dioxide

PM_{10} – Particulate Matter less than 10 micrometers in effective diameter

$PM_{2.5}$ – Particulate Matter less than 2.5 micrometers in effective diameter

SO_2 – sulfur dioxide

EANE – Eagles Nest Wilderness

FLTO – Flat Tops Wilderness

MOZI – Mt. Zirkel Wilderness

DINO – Dinosaur National Monument

NAAQS – National Ambient Air Quality Standards

CAAQS – Colorado Ambient Air Quality Standards

Notes:

[a] – PSD Class II NO_2 and PM_{10} increments apply at DINO (see Table 5-1)

[b] – $PM_{2.5}$ modeled values are conservatively assumed to equal PM_{10} values

5.2 Sulfur and Nitrogen Deposition

Maximum predicted total sulfur and nitrogen deposition impacts were estimated for each of the RMP alternatives at the nearby Class I and sensitive Class II areas (Table 5-3). Total deposition impacts from the RMP alternatives and background values were compared to USFS levels of concern, defined as 5 kilograms (kg)/hectares (ha)/year for sulfur and 3 kg/ha/year for nitrogen (Fox et al. 1989). Based on the modeled maximum direct atmospheric deposition values, plus the assumed background deposition rates, none of the alternatives are predicted to exceed significance thresholds.

Table 5-3. Maximum Nitrogen and Sulfur Deposition (Kg/Ha/Year) for 5-Year CALPUFF Modeling for All of the Alternatives

Pollutant	Alternative	Maximum Direct Modeled Impacts				Assumed Background
		EANE	FLTO	MOZI	DINO	
Nitrogen	A/B/C	0.0001	0.0005	0.0059	0.0080	2.0
	D	0.0001	0.0004	0.0034	0.0066	2.0
Sulfur	A/B/C	0.0000	0.0000	0.0002	0.0003	1.5
	D	0.0000	0.0000	0.0002	0.0002	1.5

5.3 Acid Neutralizing Capacity Calculations for Sensitive Lakes

Annual deposition fluxes of sulfur and nitrogen were also predicted at sensitive lake receptors to estimate the potential change in sensitive lake ANC. Potential changes in lake chemistry were calculated following a procedure recommended by the USFS (2000). The predicted changes in ANC were compared with significance thresholds of 10 percent for lakes with existing 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 analyzed, only Upper Ned Wilson Lake has an ANC value of less than 25 μeq/l. ANC calculations were performed for each of the RMP alternatives, with the results presented in Table 5-4. For the sensitive lakes that have background ANC above 25 μeq/l, the maximum change in ANC was 0.08 percent. For Upper Ned Wilson Lake, the predicted change was 0.002 μeq/l for both the Alternative A/B/C and Alternative D scenarios. Thus, neither Alternatives A/B/C nor Alternative D is estimated to have an adverse impact on lake acidity at any lake analyzed.

Table 5-4. Changes in Sensitive Lakes' Acid Neutralizing Capacity (ANC)

Sensitive Lake	Background ANC (μeq/l)	Alternatives A/B/C		Alternative D	
		Δ ANC (percent)	Δ ANC (μeq/l)	Δ ANC (percent)	Δ ANC (μeq/l)
Booth Lake	85.8	0.0007	n/a	0.0005	n/a
Upper Willow Lake	132.8	0.0004	n/a	0.0003	n/a
Lower NWL Packtrail Pothole	29.6	0.0083	n/a	0.0064	n/a
Ned Wilson Lake	39.6	0.0059	n/a	0.0045	n/a
Ned Wilson Spring	740.6	0.0003	n/a	0.0002	n/a
Trappers Lake	661.2	0.0005	n/a	0.0004	n/a
Upper Ned Wilson Lake	12.7	n/a	0.002	n/a	0.002
Upper NWL Packtrail Pothole	47.9	0.0051	n/a	0.0040	n/a
Lake Elbert	60.2	0.0252	n/a	0.0182	n/a
Seven Lakes	36.2	0.0768	n/a	0.0490	n/a

5.4 VISIBILITY

The hypothetical CALPUFF model-predicted concentration impacts at far-field PSD Class I and sensitive Class II receptors were post-processed to estimate potential impacts on visibility (regional haze) for each analyzed alternative and cumulative sources for comparison to visibility impact thresholds. Visibility impacts were predicted using concentrations of PMC, PMF, SO_4, and NO_3 and the original IMPROVE reconstructed mass extinction equation (Malm, et al. 2000) as recommended by FLAG (2000) and EPA (2003a, b).

5.4.1 Visibility Guidance

Change in atmospheric light extinction relative to background conditions is used to measure regional haze. Analysis thresholds for atmospheric light extinction 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 percent from a single emission source and 10 percent from multiple source changes over the measured reference background condition. Potential visibility impacts are also expressed as a change in deciviews (dv) over natural background where 1.0 dv represents a “just noticeable change,” numerically equal to a 10 percent change in extinction over natural background. The BLM uses a 1.0 dv “just noticeable change” as a significance threshold; however, there are no applicable local, state, tribal, or federal regulatory visibility standards. Other federal agencies use a 0.5 dv change as a screening threshold for significance. The USFS and National Park Service (NPS) compare direct project impacts to the 0.5 dv level, and those comparisons are included in the Air Quality Technical Support Document (TSD). Class II areas are not subject to the National Visibility Goal of no manmade impairment of visibility within federal mandatory Class I areas.

5.4.2 Visibility Impacts Resulting From the Little Snake RMPPA Alternatives

Changes in atmospheric light extinction relative to background conditions are used to evaluate potential visibility (regional haze) impacts. As described by Pitchford and Malm (1994), a just noticeable change in visibility corresponds to a 1.0 dv visibility change (numerically equivalent to a 10 percent change in extinction) where sensitive scenic targets are assumed to occur throughout the view. The BLM uses a 1.0 dv “just noticeable change” as a significance threshold; however, there are no applicable local, state, tribal, or federal regulatory visibility standards. The potential number of days per year that greater than a “just noticeable change” in visibility is predicted to occur is shown in Table 5-5. The Dinosaur National Monument PSD Class II area is not subject to the National Visibility Goal of no manmade impairment of visibility within federal mandatory Class I areas.

Table 5-5. Days Above a “Just Noticeable Change” in Visibility (days per year)

Alternative	Mandatory Federal PSD Class I Area			PSD Class II Area[a]
	EANE	FLTO	MOZI	DINO
A/B/C	none	none	0 to 2	0 to 5
D	none	none	0 to 1	0 to 3

Abbreviations: EANE – Eagles Nest Wilderness
FLTO – Flat Tops Wilderness
MOZI – Mt. Zirkel Wilderness
DINO – Dinosaur National Monument

Notes: [a] – As a PSD Class II area, Dinosaur National Monument is not subject to the National Visibility Goal.

5.5 CUMULATIVE IMPACTS RESULTING FROM LITTLE SNAKE RMPPA ALTERNATIVES

The background conditions included in this hypothetical Air Quality Impact Assessment reflect observed impacts from cumulative air pollutant emission sources. Additionally, this is a cumulative analysis in the sense that it considers all reasonable foreseeable oil and gas development in the planning area regardless of surface or mineral ownership. However, this type of analysis is not able to address other reasonably foreseeable future activities (such as coal mine expansions, new power plant facilities). If future development locations are identified, site-specific NEPA analyses (including direct, indirect, and cumulative quantitative air quality impact analysis) will be performed.

However, it is useful to point out there are a limited number of air pollutant emission sources located within the RMPPA; there are a few cities and towns, very limited oil and gas extraction activities, a few coal mines, and two coal-fired power plants. In the past, the Hayden and Craig Power Plants have historically been shown to have a significant impact on visibility at the Mount Zirkel Class I area (Watson et al. 1996). As a result of that study, and a subsequent legal consent decree, the Hayden and Craig Power Plants have installed pollution controls resulting in emission reductions of approximately 14,000 tons/year SO2 and 7,000 tons/year NOx for each plant. The Little Snake RMP Alternatives A/B/C and D are projected to bring a maximum increase of 15 and 11 tons/year SO2 to the region, respectively (approximately 0.2 percent of the total power plants' SO2 reductions). The Little Snake RMP Alternatives A/B/C and D are also projected to increase NOx emissions in the study area by 1,066 and 825 tons/year, respectively (approximately 8 percent of total power plants' SO2 reductions). Thus, as total SO2 and NOx emissions in the Little Snake RMPPA are lowered in the future, cumulative air quality and AQRV impacts are likely to be reduced from historic levels.

5.6 MITIGATION

This hypothetical air quality assessment analyses the possible effects of oil and gas development portrayed in the RFD Scenario for the Little Snake RMP. This is not a field development EIS, and the projected development is not based on reasonably foreseeable project proposals (with the exception of the Hiawatha Regional Energy Development Project). Therefore, without being able to take into account site-specific project proposals, it is not appropriate to require mitigation at the land use plan level. However, the BLM is committed to reducing visibility impacts at the implementation level when specific project proposals do arise.

A comparison of the results of the two scenarios of the assessment provides a rough estimate of the level of oil and gas development related emissions that would be need to be reduced to achieve nearly 0 days of impacts to visibility on Class I areas. The predicted visibility impacts on Mount Zirkel Wilderness Area are reduced to 0 to 1 day under Alternative D. Therefore, according to the hypothetical assessment, as the number of total new wells drilled within the planning boundary approaches 2,273, mitigation may be warranted to reduce these effects.

While the hypothetical air quality impact assessment shows the potential for visibility impairment to mandatory Class I areas, mitigative measures could be used to offset these model predicted increases with the goal of 0 days of increased visibility impairment above 1 dv due to BLM-authorized sources. Mitigation requirements could be implemented at the project stage (APD or field development proposal) as Best Management Practices (BMPs), Conditions of Approval (COAs), or operator committed mitigation. Examples of types of mitigation measures that could be employed to reduce potential visibility impacts include—

- Reduce source emissions from drilling operations by minimizing the number of wellpads using improved drilling technologies, such as horizontal drilling or other similar approaches that may become available during the expected oil and gas development and operation duration. This would result in decreased emissions of PM during the construction of wellpads and associated roads, and reduce PM emissions from travel along roads to wellpads during the operation phase.
- Increase spacing between wellpads, which would cause a decrease in localized ambient impacts.
- Require the use of alternate fuels, such as low nitrogen content fuels, to minimize NOx formation.
- Maximize the number of wells connected to each compressor and require the use of natural-gas-fired or electrical compressors or generators.
- Post and enforce speed limits for the operator’s employees and contractors to reduce dust during travel to and from the wellpad. Operators could work with local government to use dust suppression techniques on roads.
- Require the use of a liquids gathering system to collect condensate and water from existing and future well pads, which would nearly eliminate trucking of produced water and condensate.
- Require the use of “green completions” involving recovery and clean-up of natural gas, unless the need for an exemption can be documented. Flaring and venting of natural gas would not be allowed, except in emergency situations.
- Drill rig engines would meet EPA tiered emission standards requirements reflective of the year they begin operation in the LSFO. For example, drill rig engines starting operation in LSFO between 2008 and 2010 would have to meet Tier 2 emission standards.
- Emission controls would be required for glycol dehydrators and condensate tanks, without regard to the quantity of uncontrolled VOC emissions from the equipment. VOC emissions from new glycol dehydrators would be reduced by achieving at least 95 percent control of VOC emissions from glycol dehydrator vents. VOC emissions from condensate tanks would be reduced by at least 95 percent from uncontrolled emission levels.
- Require twice daily watering (or equivalent) of construction areas and associated roads to prevent fugitive dust from vehicular traffic, equipment operations, or wind events. The authorized officer may direct the operator to change the level and type of treatment if dust abatement measures are observed to be insufficient to prevent fugitive dust.

Additionally, as stated in the Little Snake Draft RMP/EIS, when specific activities are proposed at the implementation stage, a more quantitative analysis would be performed and appropriate mitigation would be applied.

6.0 LIST OF PREPARERS

Name	Qualifications and Experience
ENVIRON	
Ralph Morris	29 years experience MA, Mathematics, University of California, Davis BA, Mathematics, University of California, Berkeley
Susan Kemball-Cook	11 years experience PhD, Atmospheric Science, University of California, Davis MS, Physics, San Francisco State University BA, Physics, Yale University
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Bureau of Land Management	
Scott F. Archer	27 years experience BS, Chemistry and Environmental Science, Northern Arizona University
Craig L. Nicholls	20 years experience MS, Atmospheric Sciences, University of Michigan BS, Atmospheric Sciences, University of California, Davis
Aaron Worstell	15 years experience BS, Chemical Engineering, Virginia Tech
Booz Allen Hamilton	
Warner Reeser	41 years experience Ph.D., Earth Resources, Colorado State University MS, Atmospheric Science, Colorado State University BA, Mathematics, Colorado College

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APPENDIX A—AIR QUALITY MODELING PROTOCOL

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APPENDIX B—TECHNICAL SUPPORT DOCUMENT

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