U.S. Department of the Interior

Bureau of Land Management
Pinedale and Rock Springs Field Offices

August 2005
DES-05-05

JONAH INFILL DRILLING PROJECT DRAFT ENVIRONMENTAL IMPACT STATEMENT AIR QUALITY IMPACT ANALYSIS SUPPLEMENT

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BLM/WY/PL-05/009+1310

JONAH INFILL DRILLING PROJECT
DRAFT ENVIRONMENTAL IMPACT STATEMENT
AIR QUALITY IMPACT ANALYSIS SUPPLEMENT

Prepared for

Bureau of Land Management
Wyoming State Office
Cheyenne, Wyoming

and

Bureau of Land Management
Pinedale Field Office
Pinedale, Wyoming

and

Bureau of Land Management
Rock Springs Field Office
Rock Springs, Wyoming

and

Wyoming Department of Environmental Quality
Air Quality Division
Cheyenne, Wyoming

August 2005

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ACRONYMS AND ABBREVIATIONS

ANC	acid neutralizing capacity
AQRV	air quality related value
AQTSD	air quality technical support document
BLM	U.S. Department of Interior, Bureau of Land Management
DAT	data analysis threshold (deposition)
DEIS	draft environmental impact statement
dv	deciview
EPA	U.S. Environmental Protection Agency
FEIS	final environmental impact statement
FLAG	Federal Land Manager's Air Quality Related Values Workgroup
FLM	Federal Land Manager
JMHP	Jack Morrow Hills Project
JIDP	Jonah Infill Drilling Project
JIDPA	Jonah Infill Drilling Project Area
LAC	level of acceptable change (ANC)
LOC	level of concern (deposition)
LOP	life-of-project
NAAQS	national ambient air quality standard
NO_2	nitrogen dioxide
NO_x	oxides of nitrogen
NPS	National Park Service
PAP	Pinedale Anticline Project
PM	particulate matter
PM_{10}	particulate matter less than 10 microns in diameter
$PM_{2.5}$	particulate matter less than 2.5 microns in diameter
PSD	Prevention of Significant Deterioration
RFFA	reasonably foreseeable future actions
RFD	reasonably foreseeable development
RRP	Riley Ridge Project
SILs	Significant Impact Levels
SO_2	sulfur dioxide
SPP	South Piney Project
TRC	TRC Environmental Corporation
USDA Forest Service	U.S. Department of Agriculture, Forest Service
VOC	volatile organic compound
WAAQS	Wyoming ambient air quality standard
WDEQ-AQD	Wyoming Department of Environmental Quality, Air Quality Division
WDR	well development rate (wells per year)

1.0 INTRODUCTION

This Air Quality Impact Analysis Supplement (AQIAS) was prepared to summarize additional air quality analyses that have been performed for the Bureau of Land Management (BLM) in support of the proposed Jonah Infill Drilling Project (JIDP). These analyses are described in detail in the *Jonah Infill Drilling Project Draft Air Quality Technical Support Document Supplement* (TRC Environmental Corporation [TRC] 2005). The additional air quality modeling analyses supplement the air quality analyses that were performed and presented for a range of project alternatives in the *Draft Environmental Impact Statement, Jonah Infill Drilling Project, Sublette County, Wyoming* (DEIS) (BLM 2005) and summarized in detail in the *Draft Air Quality Technical Support Document for the Jonah Infill Drilling Project Environmental Impact Statement* (AQTSD) (TRC 2004).

The additional air quality analyses quantify project-specific and cumulative air quality impacts from additional configurations of the proposed JIDP Preferred Alternative which were not analyzed as part of the DEIS, and quantify project-specific and cumulative impacts from potential emissions which reflect early-project-development stage conditions existing in the region surrounding the Jonah Infill Drilling Project area (JIDPA). The additional analyses were deemed necessary by the BLM to 1) evaluate alternative potential mitigation strategies for the Preferred Alternative in an effort to identify possible project development requirements to reduce adverse air quality impacts, and 2) identify maximum early-project-development stage regional emissions (i.e., drilling) which could reveal that regional impacts are more severe at this stage due to impacts from the development of other regional projects, which had not been adequately evaluated.

The DEIS analyses utilized the CALMET and CALPUFF models to assess impacts from project and non-project cumulative air emissions of PM_{10}, $PM_{2.5}$, NO_x, and SO_2 on air quality and air quality related values (AQRVs) at far-field and mid-field locations and within the JIDPA. Far-field pollutant impacts were assessed at Prevention of Significant Deterioration (PSD) Class I areas (Bridger, Fitzpatrick, Teton, and Washakie Wilderness Areas and Grand Teton and Yellowstone National Parks), and at sensitive PSD Class II areas (Popo Agie Wilderness Area and Wind River Roadless Area). Far-field analyses included impact assessments of concentration, visibility (regional haze), atmospheric deposition, and lake acidity (at sensitive lakes within the Wilderness Areas). These included Black Joe, Deep, Hobbs, Lazy Boy, and Upper Frozen lakes within the Bridger Wilderness Area, Ross Lake in the Fitzpatrick Wilderness Area, and Lower Saddlebag Lake in the Popo Agie Wilderness Area. Mid-field visibility (regional haze) impact analyses were performed for the Wyoming regional community locations of Big Piney, Big Sandy, Boulder, Bronx, Cora, Daniel, Farson, LaBarge, Merna, and Pinedale although these communities are classified as PSD Class II areas where no visibility protection exists under local, State, or Federal law. In-field analyses included assessments of concentration impacts within the JIDPA.

The Preferred Alternative modeling analyses presented in this document are directly comparable to the analyses conducted for the DEIS. Unlike the Preferred Alternative modeling analyses, early-project-development stage modeling is not directly comparable to either the analyses conducted for the DEIS or the Preferred Alternative modeling analyses.

2.0 PREFERRED ALTERNATIVE MODELING ANALYSES

The Preferred Alternative for the JIDP consists of the development of 3,100 new natural gas wells on approximately 8,316 acres of new surface disturbance in the JIDPA, and assumes approximately 50% directionally drilled wells and 50% straight hole wells. Modeling scenarios were presented in the DEIS for Alternative F that approximated the potential impacts for the Preferred Alternative in 2017, presumed to be the peak emissions year. Assumptions used in that analysis are described in detail in the original AQTSD (TRC 2004). Configurations of the Preferred Alternative that are different from those analyzed in the DEIS have been modeled to provide a representation of a range of impacts possible under the Preferred Alternative. A low emissions scenario and a high emissions scenario were modeled, as were four potential levels of air pollution mitigation through emission reductions within the JIDPA. The modeling analyses for these additional configurations of the Preferred Alternative follow the methodologies described in the original AQTSD (TRC 2004), and are directly comparable to the analyses conducted for the DEIS (BLM 2005).

The low emissions scenario placed all drill rig engines at U.S. Environmental Protection Agency (EPA) Tier 2 emission levels, and the high emissions scenario included 80% of drill rig engines at Tier 0 emission levels (assumed equivalent to emission factors contained in EPA's AP-42 emission factor guidance document) (EPA 1995) and 20% at Tier 1 emission levels. The four mitigation scenarios assumed a specific emissions reduction from the JIDP high emissions configuration at a well development rate (WDR) of 250. Emission reductions of 20%, 40%, 60%, and 80% were modeled separately.

As in the DEIS modeling, the modeling scenarios were based upon anticipated field characteristics in year 2017. Only project emissions differed from those modeled for the DEIS; non-project emissions remained the same. To maintain consistency and comparability with the results reported in the original DEIS (BLM 2005) and AQTSD (TRC 2004), non-project regional emissions were modeled as they were in the DEIS, and as described in detail in the AQTSD Predicted pollutant concentrations were compared to applicable ambient air quality standards, PSD Class I and Class II increments, and proposed PSD Class I significance levels (SILs), and were used to assess potential impacts to AQRVs – atmospheric deposition and visibility (regional haze) – at sensitive PSD Class I and II areas. The PSD demonstrations serve information purposes only and do not constitute a regulatory PSD Increment consumption analysis, which may be completed as necessary by Wyoming Department of Environmental Quality – Air Quality Division (WDEQ-AQD). Ambient background concentrations were added to modeled concentrations for comparison to ambient air quality standards. No ambient background was added to modeled concentrations for comparison to PSD Class I and II Increments.

The National Park Service (NPS) (2001) has identified Deposition Analysis Thresholds (DATs) for total nitrogen (N) and sulfur (S) deposition in the western U.S. as 0.005 kilograms per hectare per year (kg/ha-year) for both N and S. The DAT is used as an analysis threshold for evaluating potential impacts from project-related emissions. The exceedences of this threshold trigger a management concern but are not necessarily indicative of an adverse impact (NPS 2004). The U.S. Department of Agriculture, Forest Service (USDA Forest Service) has defined thresholds below which no adverse impacts from atmospheric deposition are likely (Fox et al. 1989). These thresholds (herein referred to as levels of concern), defined as 5 kg/ha-yr for S and 3 kg/ha-yr for N, are used for comparison of potential impacts from cumulative source emissions. It is understood that the USDA Forest Service no longer considers these levels of concern to be protective; however, in the absence of alternative Federal Land Manager (FLM)-approved values, comparisons with these values were made.

The USDA Forest Service Rocky Mountain Region has also developed a screening method (USDA Forest Service 2000) that identifies a Limit of Acceptable Change (LAC) in lake chemistry. The LACs are 1) no more than a 10% change in acid-neutralizing capacity (ANC) for lakes with an existing ANC of 25 microequivalents per liter (µeq/l) or greater and 2) no more than a 1-µeq/l change for extremely acid-sensitive lakes where the existing ANC is below 25 µeq/l. Of the seven lakes identified by the USDA Forest Service as acid-sensitive, Upper Frozen and Lazy Boy lakes are considered extremely acid-sensitive.

Visibility impacts discussed herein were estimated using methodologies selected by BLM; the *Jonah Infill Drilling Project Draft Air Quality Technical Support Document Supplement* (TRC 2005) documents the results from methodologies favored by other agencies. Potential changes in regional haze at PSD Class I and sensitive PSD Class II areas were estimated by comparing CALPUFF modeled impacts to background visibility conditions in PSD Class I and sensitive PSD Class II areas. This comparison was performed using two different representations of background visibility conditions. One method used visibility values provided in the FLAG Report for each Class I area to represent natural background visibility. The second method used estimated background visibility values from an analysis of recent long-term monitored data (1988–2002) from the IMPROVE program. This analysis consisted of estimating visibility parameters for representative Class I areas corresponding to the monitoring period of record quarterly average of the 20% best visibility days. Background visibility data monitored at the Class I Bridger Wilderness Area, an area more pristine than populated residential areas (i.e., lacking suburban/rural emissions such as those from traffic and wood stoves), were used to estimate potential visibility impairment at Wyoming regional community locations. These data were used because no visibility monitoring has been conducted in the populated areas of the region. Since visibility impacts are calculated as percent increases of modeled concentrations above background values, the use of a more pristine background likely result in an overestimate of potential visibility impacts at these locations.

The BLM considers a 1.0 deciview (dv) change as a significant adverse impact, and if predicted visibility impacts are above this threshold, factors such as magnitude of dv change, frequency, seasonal variations, and meteorological conditions may be considered when assessing the significance of predicted impacts. Although BLM utilizes this 1.0-dv threshold, there are no applicable local, state, tribal, or federal regulatory visibility standards. It is the responsibility of the FLM or Tribal government responsible for that land to determine when adverse impacts are significant or not, and these may differ from BLM levels for significant adverse impacts. Other federal agencies use a 0.5-dv change as a screening threshold for significance. The USDA Forest Service and NPS compare direct project impacts to the 0.5-dv level, and those comparisons are included in the *Jonah Infill Drilling Project Draft Air Quality Technical Support Document Supplement* (TRC 2005).

2.1 IMPACTS SUMMARY

Tables 1 and 2 provide an overall summary of the predicted impacts from three of the ten additional configurations analyzed for the Preferred Alternative. These three scenarios, a high emissions case at WDR250, a low emissions case at a WDR250, and a high emissions mitigation case with an 80 percent emission reduction at a WDR250, are representative of the full range of impacts for those 10 configurations. Table 1 provides a summary of the potential concentration and deposition impacts from these configurations of the Preferred Alternative. Table 2 provides a summary of the potential impacts to visibility (regional haze) for these scenarios. Results summaries shown in green (normal text) in these tables indicate that potential impacts are below ambient air quality standards, PSD increments, significance threshold values, and levels of concern. Results summaries shown in red (**bold text**) indicate that potential impacts are above these levels. A complete disclosure of all modeled impacts for each additional scenario modeled for the Preferred Alternative including additional mitigation runs (60%, 40%, and 20% emissions reductions) and alternate WDRs (150, 75), and a disclosure of days of visibility impairment greater than 0.5-dv (an alternate visibility threshold utilized by other FLMs) for all analyzed scenarios are provided in the *Jonah Infill Drilling Project Draft Air Quality Technical Support Document Supplement* (TRC 2005). A discussion of both the direct impacts and cumulative impacts from the analyzed Preferred Alternative scenarios are provided in the following sections.

Table 1 Preferred Alternative Air Quality Concentrations and Deposition Impacts Summary

Air Quality Component	Criteria	Source Group & Impact Area	Preferred Alternative: WDR250 High Emissions Case	Preferred Alternative: WDR250 Low Emissions Case	Preferred Alternative: WDR250 80% Mitigation Case
Concentrations	Air Quality Standards	Project: In-Field	PM_{10}< NAAQS&WAAQS $PM_{2.5}$ < NAAQS&WAAQS NO_2 < NAAQS&WAAQS SO_2 < NAAQS&WAAQS	PM_{10} < NAAQS&WAAQS $PM_{2.5}$ < NAAQS&WAAQS NO_2 < NAAQS&WAAQS SO_2 < NAAQS&WAAQS	PM_{10} < NAAQS&WAAQS $PM_{2.5}$ < NAAQS&WAAQS NO_2 < NAAQS&WAAQS SO_2 < NAAQS&WAAQS
		Cumulative: In-Field	PM_{10} < NAAQS&WAAQS $PM_{2.5}$ < NAAQS&WAAQS NO_2 < NAAQS&WAAQS SO_2 < NAAQS&WAAQS	PM_{10} < NAAQS&WAAQS $PM_{2.5}$ < NAAQS&WAAQS NO_2 < NAAQS&WAAQS SO_2 < NAAQS&WAAQS	PM_{10} < NAAQS&WAAQS $PM_{2.5}$ < NAAQS&WAAQS NO_2 < NAAQS&WAAQS SO_2 < NAAQS&WAAQS
		Project: Far-Field	PM_{10} < NAAQS&WAAQS $PM_{2.5}$ < NAAQS&WAAQS NO_2 < NAAQS&WAAQS SO_2 < NAAQS&WAAQS	PM_{10} < NAAQS&WAAQS $PM_{2.5}$ < NAAQS&WAAQS NO_2 < NAAQS&WAAQS SO_2 < NAAQS&WAAQS	PM_{10} < NAAQS&WAAQS $PM_{2.5}$ < NAAQS&WAAQS NO_2 < NAAQS&WAAQS SO_2 < NAAQS&WAAQS
		Cumulative: Far-Field	PM_{10} < NAAQS&WAAQS $PM_{2.5}$ < NAAQS&WAAQS NO_2 < NAAQS&WAAQS SO_2 < NAAQS&WAAQS	PM_{10} < NAAQS&WAAQS $PM_{2.5}$ < NAAQS&WAAQS NO_2 < NAAQS&WAAQS SO_2 < NAAQS&WAAQS	PM_{10} < NAAQS&WAAQS $PM_{2.5}$ < NAAQS&WAAQS NO_2 < NAAQS&WAAQS SO_2 < NAAQS&WAAQS
	PSD Class I Increments [1]	Cumulative: Far-Field	PM_{10} < increment NO_2 < increment SO_2 < increment	PM_{10} < increment NO_2 < increment SO_2 < increment	PM_{10} < increment NO_2 < increment SO_2 < increment
	PSD Class II Increments [1]	Cumulative: Far-Field	PM_{10} < increment NO_2 < increment SO_2 < increment	PM_{10} < increment NO_2 < increment SO_2 < increment	PM_{10} < increment NO_2 < increment SO_2 < increment
Atmospheric Deposition	N Deposition	Total: Far-Field	N < LOC, All Areas	N < LOC, All Areas	N < LOC, All Areas
	S Deposition	Total: Far-Field	S < LOC, All Areas	S < LOC, All Areas	S < LOC, All Areas
	Sensitive Lakes	Project: Far-Field	ANC Change < LAC, All Lakes	ANC Change < LAC, All Lakes	ANC Change < LAC, All Lakes
		Cumulative: Far-Field	ANC Change < LAC, All Lakes	ANC Change < LAC, All Lakes	ANC Change < LAC, All Lakes

[1] The PSD demonstrations serve information purposes only and do not constitute a regulatory PSD Increment consumption analysis.

Table 2 Preferred Alternative Visibility (Regional Haze) Impacts Summary

Air Quality Component	Impact Area	Source Group	Preferred Alternative: WDR250 High Emissions Case	Preferred Alternative: WDR250 Low Emissions Case	Preferred Alternative: WDR250 80% Mitigation Case
Visibility (Regional Haze)	PSD Class I and Sensitive Class II Areas	Project	**Bridger WA, >1.0-dv 31 days, max dv = 6.44** **Fitzpatrick WA, >1.0-dv 3 days, max dv = 1.54** **Popo Agie WA, >1.0-dv 2 days, max dv = 1.36** **Wind River RA, >1.0-dv 1 days, max dv = 1.22** Grand Teton NP, >1.0-dv 0 days, max dv = 0.66 Teton WA, >1.0-dv 0 days, max dv = 0.28 Yellowstone NP, >1.0-dv 0 days, max dv = 0.31 Washakie WA, >1.0-dv 0 days, max dv = 0.48	**Bridger WA, >1.0-dv 9 days, max dv = 3.26** Fitzpatrick WA, >1.0-dv 0 days, max dv = 0.61 Popo Agie WA, >1.0-dv 0 days, max dv = 0.59 Wind River RA, >1.0-dv 0 days, max dv = 0.50 Grand Teton NP, >1.0-dv 0 days, max dv = 0.31 Teton WA, >1.0-dv 0 days, max dv = 0.14 Yellowstone NP, >1.0-dv 0 days, max dv = 0.15 Washakie WA, >1.0-dv 0 days, max dv = 0.23	**Bridger WA, >1.0-dv 3 days, max dv = 1.66** Fitzpatrick WA, >1.0-dv 0 days, max dv = 0.33 Popo Agie WA, >1.0-dv 0 days, max dv = 0.29 Wind River RA, >1.0-dv 0 days, max dv = 0.26 Grand Teton NP, >1.0-dv 0 days, max dv = 0.14 Teton WA, >1.0-dv 0 days, max dv = 0.06 Yellowstone NP, >1.0-dv 0 days, max dv = 0.06 Washakie WA, >1.0-dv 0 days, max dv = 0.10
		Cumulative	**Bridger WA, >1.0-dv 39 days, max dv = 6.82** **Fitzpatrick WA, >1.0-dv 3 days, max dv = 1.58** **Popo Agie WA, >1.0-dv 6 days, max dv = 1.67** **Wind River RA, >1.0-dv 5 days, max dv = 1.54** Grand Teton NP, >1.0-dv 0 days, max dv = 0.83 Teton WA, >1.0-dv 0 days, max dv = 0.34 Yellowstone NP, >1.0-dv 0 days, max dv = 0.40 Washakie WA, >1.0-dv 0 days, max dv = 0.58	**Bridger WA, >1.0-dv 15 days, max dv = 3.78** Fitzpatrick WA, >1.0-dv 0 days, max dv = 0.85 Popo Agie WA, >1.0-dv 0 days, max dv = 0.97 **Wind River RA, >1.0-dv 2 days, max dv = 1.19** Grand Teton NP, >1.0-dv 0 days, max dv = 0.49 Teton WA, >1.0-dv 0 days, max dv = 0.23 Yellowstone NP, >1.0-dv 0 days, max dv = 0.25 Washakie WA, >1.0-dv 0 days, max dv = 0.33	**Bridger WA, >1.0-dv 6 days, max dv = 2.62** Fitzpatrick WA, >1.0-dv 0 days, max dv = 0.57 Popo Agie WA, >1.0-dv 0 days, max dv = 0.75 Wind River RA, >1.0-dv 0 days, max dv = 0.96 Grand Teton NP, >1.0-dv 0 days, max dv = 0.35 Teton WA, >1.0-dv 0 days, max dv = 0.17 Yellowstone NP, >1.0-dv 0 days, max dv = 0.18 Washakie WA, >1.0-dv 0 days, max dv = 0.23
	Wyoming Regional Communities	Project	**Big Piney, >1.0-dv 18 days, max dv = 3.93** **Big Sandy, >1.0-dv 62 days, max dv = 5.76** **Boulder, >1.0-dv 33 days, max dv = 4.58** **Bronx, >1.0-dv 9 days, max dv = 3.82** **Cora, >1.0-dv 14 days, max dv = 6.70** **Daniel, >1.0-dv 16 days, max dv = 5.50** **Farson, >1.0-dv 13 days, max dv = 4.88** **Labarge, >1.0-dv 6 days, max dv = 2.59** **Merna, >1.0-dv 5 days, max dv = 1.64** **Pinedale, >1.0-dv 21 days, max dv = 8.48**	**Big Piney, >1.0-dv 4 days, max dv = 1.89** **Big Sandy, >1.0-dv 21 days, max dv = 2.92** **Boulder, >1.0-dv 10 days, max dv = 2.30** **Bronx, >1.0-dv 1 days, max dv = 1.60** **Cora, >1.0-dv 1 days, max dv = 3.03** **Daniel, >1.0-dv 1 days, max dv = 2.42** **Farson, >1.0-dv 5 days, max dv = 2.21** **Labarge, >1.0-dv 2 days, max dv = 1.27** Merna, >1.0-dv 0 days, max dv = 0.75 **Pinedale, >1.0-dv 3 days, max dv = 4.07**	Big Piney, >1.0-dv 0 days, max dv = 0.92 **Big Sandy, >1.0-dv 4 days, max dv = 1.45** **Boulder, >1.0-dv 2 days, max dv = 1.10** Bronx, >1.0-dv 0 days, max dv = 0.89 **Cora, >1.0-dv 1 days, max dv = 1.75** **Daniel, >1.0-dv 1 days, max dv = 1.37** **Farson, >1.0-dv 1 days, max dv = 1.19** Labarge, >1.0-dv 0 days, max dv = 0.57 Merna, >1.0-dv 0 days, max dv = 0.35 **Pinedale, >1.0-dv 1 days, max dv = 2.37**
		Cumulative	**Big Piney, >1.0-dv 36 days, max dv = 4.32** **Big Sandy, >1.0-dv 74 days, max dv = 6.18** **Boulder, >1.0-dv 40 days, max dv = 5.58** **Bronx, >1.0-dv 15 days, max dv = 3.88** **Cora, >1.0-dv 17 days, max dv = 6.77** **Daniel, >1.0-dv 23 days, max dv = 5.56** **Farson, >1.0-dv 21 days, max dv = 5.05** **Labarge, >1.0-dv 16 days, max dv = 3.97** **Merna, >1.0-dv 10 days, max dv = 1.93** **Pinedale, >1.0-dv 27 days, max dv = 8.56**	**Big Piney, >1.0-dv 19 days, max dv = 2.57** **Big Sandy, >1.0-dv 32 days, max dv = 3.48** **Boulder, >1.0-dv 20 days, max dv = 3.60** **Bronx, >1.0-dv 1 days, max dv = 1.68** **Cora, >1.0-dv 7 days, max dv = 3.13** **Daniel, >1.0-dv 11 days, max dv = 2.52** **Farson, >1.0-dv 11 days, max dv = 2.68** **Labarge, >1.0-dv 11 days, max dv = 2.85** **Merna, >1.0-dv 4 days, max dv = 1.11** **Pinedale, >1.0-dv 8 days, max dv = 4.18**	**Big Piney, >1.0-dv 13 days, max dv = 2.28** **Big Sandy, >1.0-dv 12 days, max dv = 2.13** **Boulder, >1.0-dv 9 days, max dv = 3.09** Bronx, >1.0-dv 0 days, max dv = 0.97 **Cora, >1.0-dv 2 days, max dv = 1.86** **Daniel, >1.0-dv 2 days, max dv = 1.47** **Farson, >1.0-dv 10 days, max dv = 1.87** **Labarge, >1.0-dv 6 days, max dv = 2.30** **Merna, >1.0-dv 1 days, max dv = 1.03** **Pinedale, >1.0-dv 6 days, max dv = 2.50**

2.2 DIRECT PROJECT IMPACTS

Direct impacts are the those potential impacts solely from proposed project sources. In this analysis, ten additional configurations of the Preferred Alternative were modeled to provide a representation of the range of potential direct impacts under the Preferred Alternative. As described in earlier, these ten configurations provide a representation of the direct impacts which could occur from a high emissions case, a low emissions case, and four mitigation scenarios which assume varying levels of emission reduction from JIDPA sources at the high emissions case. Mitigation scenarios were based on emission reduction percentages of 20, 40, 60 and 80 percent from the JIDP high emissions configuration. Results from three of these ten scenarios are presented here: the high emissions case; the low emissions case; and the high emissions case with an 80 percent emission reduction. The 80% emission reduction is assumed to occur field-wide and not specific to any individual field activity or operation. These three scenarios are considered representative of the range of impacts from the ten analyzed scenarios, for which complete results are provided in the *Jonah Infill Drilling Project Draft Air Quality Technical Support Document Supplement* (TRC 2005).

Far-field pollutant impacts were assessed at the PSD Class I areas (Bridger, Fitzpatrick, Teton, and Washakie Wilderness Areas and Grand Teton and Yellowstone National Parks), and at the sensitive Class II Popo Agie Wilderness Area and Wind River Roadless Area. Far-field analyses include impact assessments of concentration, visibility (regional haze), atmospheric deposition, and lake acidity (at sensitive lakes within the Wilderness Areas). Mid-field visibility (regional haze) impact analyses were performed for the Wyoming regional community locations of Big Piney, Big Sandy, Boulder, Bronx, Cora, Daniel, Farson, LaBarge, Merna, and Pinedale. In-field analyses include impact assessments of concentration within the JIDPA.

2.2.1 <u>High Emissions</u>

<u>Far-field Impacts</u>

Direct project impacts from Preferred Alternative high emissions scenario source emissions were below the applicable ambient air quality standards and PSD increments (Table 1). NO_2, SO_2, and PM_{10} concentrations were greater than PSD Class I SILs for these pollutants within the Bridger Wilderness Area. PM_{10} concentrations were greater than PSD Class I SIL within the Fitzpatrick Wilderness Area. These SILs are proposed by EPA as an indicator of significance of New Source Review projects to determine additional analysis requirements. PM_{10} was below the proposed SILs at all sensitive areas except the Bridger and Fitzpatrick Wilderness Areas, and NO_2, and SO_2 concentrations were below the SILS at all sensitive areas except the Bridger Wilderness Area.

Direct project source emissions from the Preferred Alternative high emissions case would result in an increase in ANC less than any LAC at all analyzed acid-sensitive lakes. The maximum S deposition impacts were predicted to be above the 0.005 kg/ha-yr DAT at the Bridger Wilderness Area (0.008 kg/ha-yr) and below the DAT at all other sensitive PSD Class I and Class II areas. The maximum N impacts were predicted to be above the 0.005 kg/ha-yr threshold at the Bridger Wilderness Area, Fitzpatrick Wilderness Area, Popo Agie Wilderness Area, and Wind River Roadless Area, and below the DAT at all other sensitive areas. The maximum predicted N deposition impacts are 0.077, 0.006, 0.035, and 0.021 kg/ha-yr at the Bridger, Fitzpatrick, and Popo Agie Wilderness Areas, and Wind River Roadless Area, respectively. The exceedences of this threshold trigger a management concern but are not necessarily indicative of an adverse impact (NPS 2004).

Direct visibility (regional haze) impacts were predicted to be above the "just noticeable visibility change" (1.0-dv) threshold at the Bridger, Fitzpatrick and Popo Agie Wilderness Areas, and at the Wind River Roadless Area using both the FLAG and IMPROVE background visibility data, and below the threshold at all other sensitive areas (Table 2). The highest frequency of predicted visibility impacts occurred at the Bridger Wilderness where there were 23 days per year (FLAG) and 31 days per year (IMPROVE) when visibility impacts where predicted to be above the 1.0-dv threshold. The maximum dv change was estimated as 5.9 dv (FLAG) and 6.4 dv (IMPROVE).

Mid-field Impacts

Model results for the Preferred Alternative high emission scenario indicate impacts above the 1.0-dv threshold at all nearby Wyoming community locations (Table 2). Note that the comparison to the 1.0-dv threshold is for information only; because these communities are within areas classified as PSD Class II, no visibility protection exists under local, State, or Federal law. The highest frequency of predicted visibility impacts occurred at Big Sandy where they were 56 days (FLAG) and 62 days (IMPROVE) estimated to be above the 1.0-dv threshold. The maximum dv change, 7.7 dv (FLAG), and 8.5 dv (IMPROVE) was predicted to occur at Pinedale.

In-field Impacts

Direct impacts of NO_2, SO_2, $PM_{10,}$ and $PM_{2.5}$ within the JIDPA resulting from Preferred Alternative high emissions scenario source emissions, when added to appropriate background concentrations, were predicted to be less than all applicable ambient air quality standards.

2.2.2 Low Emissions

Far-field Impacts

Direct impacts from Preferred Alternative low emissions scenario source emissions were less than all applicable ambient air quality standards and PSD increments (Table 1). Potential NO_2 and PM_{10} concentrations were greater than the proposed PSD Class I SILs at the Bridger Wilderness Area and were below the SILs at all other sensitive areas. These SILs are proposed by EPA as an indicator of significance of New Source Review projects to determine additional analysis requirements.

Direct project source emissions from the Preferred Alternative low emissions case would result in an increase in ANC less than any LAC at all analyzed acid-sensitive lakes. The maximum S deposition impacts were predicted to be below the DAT at all sensitive PSD Class I and Class II areas. The maximum N impacts were predicted to be above the 0.005 kg/ha-yr threshold at the Bridger Wilderness Area, Popo Agie Wilderness Area, and Wind River Roadless Area, and below the DAT at all other sensitive areas. The maximum predicted N deposition impacts are 0.033, 0.016, and 0.010 kg/ha-yr at the Bridger and Popo Agie Wilderness Areas, and Wind River Roadless Area, respectively.

Direct visibility (regional haze) impacts were predicted to be above the "just noticeable visibility change" (1.0-dv) threshold at the Bridger Wilderness Area using both the FLAG and IMPROVE background visibility data, and below the threshold at all other sensitive areas (Table 2). There were 9 days per year (FLAG and IMPROVE) when visibility impacts where predicted to be above the 1.0-dv threshold. The maximum dv change was estimated as 3.0 dv (FLAG) and 3.3 dv (IMPROVE).

Mid-field Impacts

Modeling results for the Preferred Alternative low emission scenario indicate impacts above the 1.0-dv threshold at all nearby Wyoming community locations with the exception of Merna (Table 2). The highest frequency of predicted visibility impacts occurred at Big Sandy where they were 17 days (FLAG) and 21 days (IMPROVE) estimated to be above the 1.0-dv threshold. The maximum dv change, 3.6 dv (FLAG), and 4.1 dv (IMPROVE) was predicted to occur at Pinedale.

In-field Impacts

Direct impacts of NO_2, SO_2, PM_{10}, and $PM_{2.5}$ within the JIDPA resulting from Preferred Alternative low emissions scenario source emissions, when added to appropriate background concentrations, were predicted to be less than all applicable ambient air quality standards.

2.2.3 Mitigation Scenarios

A complete description of mitigation scenario results, including tables, is provided in the *Jonah Infill Drilling Project Draft Air Quality Technical Support Document Supplement* (TRC 2005).

Far-field Impacts

Direct impacts from the Preferred Alternative mitigation scenarios would be below all applicable ambient air quality standards and PSD increments. Under the 20 percent emissions reduction scenario, NO_2, SO_2 and PM_{10} concentrations were greater than the proposed PSD Class I SILs at the Bridger Wilderness Area, PM_{10} concentrations were greater than the PSD Class I SIL at the Fitzpatrick Wilderness Area, and concentrations of all other pollutants were below the SILs at all other sensitive areas. For the 40 percent emissions reduction scenario, NO_2, SO_2 and PM_{10} concentrations were greater than the proposed PSD Class I SILs at the Bridger Wilderness Area and were below the SILs at all other sensitive areas. The 60 percent emissions reduction scenario modeling results indicated potential NO_2 and PM_{10} concentrations above the proposed PSD Class I SILs at the Bridger Wilderness Area and below the SILs at all other sensitive areas. The 80 percent emissions reduction scenario modeling indicated potential PM_{10} concentrations above the proposed PSD Class I SILs at the Bridger Wilderness Area and below the SILs at all other sensitive areas. These SILs are proposed by EPA as an indicator of significance of New Source Review projects to determine additional analysis requirements.

Direct project impacts from all of the mitigation scenarios would result in an increase in ANC less than the LAC at all analyzed acid-sensitive lakes. The predicted maximum S deposition impacts for the 20 percent emission reduction scenario were predicted to be above the DAT at the Bridger Wilderness (0.006 kg/ha-yr) and below the DAT at all other sensitive PSD Class I and Class II areas. All other scenarios predicted S deposition impacts below the DAT at all sensitive areas. The maximum N deposition impacts for the 20 percent emissions reduction case were predicted to be above the DAT at the Bridger Wilderness Area (0.062 kg/ha-yr), Popo Agie Wilderness Area (0.028 kg/ha-yr) and Wind River Roadless Area (0.017 kg/ha-yr), and below the DAT at all other sensitive areas. The maximum predicted N impacts for the 40 percent emissions reduction case were above the DAT at the Bridger Wilderness (0.046 kg/ha-yr), Popo Agie Wilderness (0.021 kg/ha-yr) and Wind River Roadless Area (0.013 kg/ha-yr). The maximum predicted N impacts for the 60 percent emissions reduction case were above the DAT at the Bridger Wilderness (0.031 kg/ha-yr), Popo Agie Wilderness (0.014 kg/ha-yr) and Wind River Roadless Area (0.009 kg/ha-yr), and for the 80 percent emissions reduction case N deposition impacts were predicted above the DAT at the Bridger Wilderness (0.015 kg/ha-yr) and Popo Agie Wilderness (0.007 kg/ha-yr).

Direct visibility (regional haze) impacts for the 20 percent emissions reduction case were predicted to be above the "just noticeable visibility change" (1.0-dv) threshold at the Bridger, Fitzpatrick and Popo Agie Wilderness Areas, and below the threshold at all other sensitive areas. The highest frequency of predicted visibility impacts occurred at the Bridger Wilderness where there were 19 days per year (FLAG) and 20 days per year (IMPROVE) when visibility impacts where predicted to be above the 1.0-dv threshold, with the maximum dv change estimated as 5.0 dv (FLAG) and 5.5 dv (IMPROVE). Direct visibility impacts for the 40 percent emissions reduction case were predicted to be above the 1.0-dv threshold at the Bridger Wilderness Area using both the FLAG and IMPROVE background visibility data. The highest frequency of predicted visibility impacts occurred at the Bridger Wilderness where there were 14 days per year (FLAG) and 15 days per year (IMPROVE) when visibility impacts where predicted to be above the 1.0-dv threshold, with the maximum dv change estimated as 4.0 dv (FLAG) and 4.3 dv (IMPROVE). Direct visibility impacts for the 60 percent emissions reduction case were predicted to be above the 1.0-dv threshold at the Bridger Wilderness Area and at the Wind River Roadless Area. The highest frequency of predicted visibility impacts occurred at the Bridger Wilderness where there were 9 days per year, using both FLAG and IMPROVE data, when visibility impacts where predicted to be above the threshold, with the maximum dv change estimated as 2.8 dv (FLAG) and 3.1 dv (IMPROVE). Direct visibility impacts for the 80 percent emissions reduction case were predicted to be above the 1.0-dv threshold only at the Bridger Wilderness using both the FLAG and IMPROVE background visibility data (2 and 3 days per year, respectively), with the maximum dv change estimated as 1.5 dv (FLAG) and 1.7 dv (IMPROVE).

Mid-field Impacts

Modeling results for the Preferred Alternative 20 percent emissions reduction mitigation scenario indicated that visibility impacts were above the 1.0-dv threshold at all nearby Wyoming community locations with the highest frequency of predicted visibility impacts above the 1.0-dv threshold at Big Sandy (38 days per year – FLAG and 45 days per year – IMPROVE). The maximum dv change of 6.5 dv (FLAG), and 7.3 dv (IMPROVE) was predicted to occur at Pinedale. The 40 percent emissions reduction case indicated impacts above the threshold at all areas with the maximum number of days per year at Big Sandy (28 days – FLAG, and 27 days – IMPROVE) and the maximum dv at Pinedale (5.3 dv – FLAG, 5.9 dv – IMPROVE). The 60 percent emissions reduction case indicated impacts above the threshold at all areas except Merna with the maximum number of days per year at Big Sandy (17 days– FLAG, and 19 days – IMPROVE) and the maximum dv at Pinedale (3.8 dv – FLAG, 4.3 dv – IMPROVE). The 80 percent emissions reduction scenario indicated impacts above the visibility threshold at six of the analyzed ten areas with the maximum number of days per year at Big Sandy (1 days– FLAG, and 4 days – IMPROVE) and the maximum dv at Pinedale (2.1 dv – FLAG, 2.4 dv – IMPROVE).

In-field Impacts

Direct impacts of NO_2, SO_2, PM_{10}, and $PM_{2.5}$ within the JIDPA resulting from Preferred Alternative mitigation scenarios, when added to appropriate background concentrations, were predicted to be less than all applicable ambient air quality standards.

2.3 CUMULATIVE IMPACTS

Cumulative impacts were analyzed for additional configurations of the Preferred Alternative (described in greater detail earlier in this section) in combination with other non-project regional sources. Cumulative analyses include project impacts plus impacts from permitted sources, reasonably foreseeable development (RFD), and reasonably foreseeable future actions (RFFA) which were projected to exist after a specified date and would be located within a defined regional area (see TRC 2004 for further detail). All air emissions sources within the study domain were not explicitly modeled; some sources were considered to already be included ambient air background values. The additional configurations analyzed included a low emissions scenario, a high emissions scenario, and four mitigation scenarios at 20%, 40%, 60%, and 80% emission reductions from the high emission WDR250 scenario. A complete description of mitigation scenario results, including tables, is provided in TRC (2005). Cumulative far-field pollutant impacts were assessed at the PSD Class I areas and at the sensitive PSD Class II Areas. Similar to the analysis of direct project impacts, far-field analyses included impact assessments of concentration, visibility (regional haze), atmospheric deposition, and lake acidity, mid-field visibility impact analyses were performed for the Wyoming regional community locations, and in-field analyses included impact assessments of concentration within the JIDPA.

2.3.1 High Emissions

Far-field Impacts

Cumulative impacts resulting from Preferred Alternative high emissions scenario source emissions would be below all applicable ambient air quality standards and PSD increments.

Cumulative project and non-project source emissions from the Preferred Alternative high emissions case would result in an increase in ANC less than any LAC at all acid-sensitive lakes. Total S and N deposition impacts would not exceed the USDA Forest Service levels of concern (5 kg/ha-yr for S and 3 kg/ha-yr for N). It is understood that the USDA Forest Service no longer considers these levels of concern to be protective; however, in the absence of alternative FLM-approved values, comparisons with these values were made.

Cumulative visibility (regional haze) impacts were predicted to be above the "just noticeable visibility change" (1.0-dv) threshold at the Bridger, Fitzpatrick and Popo Agie Wilderness Areas, and at the Wind River Roadless Area using both the FLAG and IMPROVE background visibility data, and below the threshold at all other sensitive areas. The highest frequency of predicted visibility impacts occurred at the Bridger Wilderness where there were 32 days per year (FLAG) and 39 days per year (IMPROVE) when visibility impacts where predicted to be above the 1.0-dv threshold. The maximum dv change was estimated as 6.3 dv (FLAG) and 6.8 dv (IMPROVE).

Mid-field Impacts

Cumulative modeling results for the Preferred Alternative high emission scenario indicate impacts above the 1.0-dv threshold at all nearby Wyoming community locations. The highest frequency of predicted visibility impacts occurred at Big Sandy where they were 64 days (FLAG) and 74 days (IMPROVE) estimated to be above the 1.0-dv threshold. The maximum dv change, 7.7 dv (FLAG), and 8.6 dv (IMPROVE) was predicted to occur at Pinedale.

In-field Impacts

Direct impacts of NO_2, SO_2, PM_{10}, and $PM_{2.5}$ within the JIDPA resulting from Preferred Alternative high emissions scenario source emissions and non-project emissions, when added to appropriate background concentrations, were predicted to be less than all applicable ambient air quality standards.

2.3.2 Low Emissions

Far-field Impacts

Cumulative impacts resulting from Preferred Alternative low emissions scenario source emissions would be below all applicable ambient air quality standards and PSD increments.

Cumulative impacts for the Preferred Alternative low emissions case would result in an increase in ANC less than any LAC at all acid-sensitive lakes. Total S and N deposition impacts would not exceed the USDA Forest Service levels of concern.

Cumulative visibility (regional haze) impacts were predicted to be above the 1.0-dv threshold at the Bridger Wilderness Area and Wind River Roadless Area using both the FLAG and IMPROVE background visibility data, and below the threshold at all other sensitive areas. There were 11 days per year (FLAG) and 15 days per year (IMPROVE) when visibility impacts where predicted to be above the 1.0-dv threshold. The maximum dv change was estimated as 3.4 dv (FLAG) and 3.8 dv (IMPROVE).

Mid-field Impacts

Cumulative modeling results for the Preferred Alternative low emission scenario indicate impacts above the 1.0-dv threshold at all nearby Wyoming community locations. The highest frequency of predicted visibility impacts occurred at Big Sandy where they were 31 days (FLAG) and 32 days (IMPROVE) estimated to be above the 1.0-dv threshold. The maximum dv change, 3.7 dv (FLAG), and 4.2 dv (IMPROVE), was predicted to occur at Pinedale.

In-field Impacts

Direct impacts of NO_2, SO_2, $PM_{10,}$ and $PM_{2.5}$ within the JIDPA resulting from Preferred Alternative low emissions scenario emissions and non-project regional emissions, when added to appropriate background concentrations, were predicted to be less than all applicable ambient air quality standards.

2.3.3 Mitigation Scenarios

Far-field Impacts

Cumulative impacts resulting from the Preferred Alternative mitigation scenarios would be below all applicable ambient air quality standards and PSD increments.

Cumulative impacts from all of the mitigation scenarios would result in an increase in ANC less than any LAC at all acid-sensitive lakes. Total S and N deposition impacts for any of the scenarios would not exceed the USDA Forest Service levels of concern.

Cumulative visibility (regional haze) impacts for the 20 percent emissions reduction case were predicted to be above the 1.0-dv threshold at the Bridger, Fitzpatrick, and Popo Agie Wilderness Areas and the Wind River Roadless Area, and below the threshold at all other sensitive areas. The highest frequency of predicted visibility impacts occurred at the Bridger Wilderness where there were 25 days per year (FLAG) and 29 days per year (IMPROVE) when visibility impacts where predicted to be above the 1.0-dv threshold, with the maximum dv change estimated as 5.4 dv (FLAG) and 5.9 dv (IMPROVE). Cumulative visibility impacts for the 40 percent emissions reduction case were predicted to be above the 1.0-dv threshold at the Bridger and Popo Agie Wilderness Areas and the Wind River Roadless Area. The highest frequency of predicted visibility impacts occurred at the Bridger Wilderness where there were 16 days per year (FLAG) and 21 days per year (IMPROVE) when visibility impacts where predicted to be above the 1.0-dv threshold, with the maximum dv change estimated as 4.4 dv (FLAG) and 4.8 dv (IMPROVE). Cumulative visibility impacts for the 60 percent emissions reduction case were predicted to be above the 1.0-dv threshold at the Bridger Wilderness Area and at the Wind River Roadless Area. The highest frequency of predicted visibility impacts occurred at the Bridger Wilderness where there were 11 days per year (FLAG) and 15 days per year (IMPROVE) when visibility impacts where predicted to be above the threshold, with the maximum dv change estimated as 3.3 dv (FLAG) and 3.6 dv (IMPROVE). Cumulative visibility impacts for the 80 percent emissions reduction case were predicted to be above the 1.0-dv threshold at the Bridger Wilderness using both the FLAG and IMPROVE background visibility data (5 and 6 days per year, respectively), with the maximum dv change estimated as 2.3 dv (FLAG) and 2.6 dv (IMPROVE).

Mid-field Impacts

Cumulative modeling results for the Preferred Alternative 20 percent emissions reduction mitigation scenario indicated that visibility impacts were above the 1.0-dv threshold at all nearby Wyoming community locations with the highest frequency of predicted visibility impacts at Big Sandy (53 days per year – FLAG and 59 days per year – IMPROVE. The maximum dv change, 6.6 dv (FLAG), and 7.4 dv (IMPROVE) was predicted to occur at Pinedale. The 40 percent emissions reduction case indicated cumulative impacts above the threshold at all areas with the maximum number of days per year at Big Sandy (35 days– FLAG, and 40 days – IMPROVE) and the maximum dv at Pinedale (5.3 dv – FLAG, 6.0 dv – IMPROVE). The 60 percent emissions reduction case also indicated cumulative impacts above the threshold at all areas with the maximum number of days per year at Big Sandy (27 days– FLAG, and 30 days – IMPROVE) and the maximum dv at Pinedale (3.9 dv – FLAG, 4.4 dv – IMPROVE). The 80 percent emissions reduction scenario indicated cumulative impacts above the visibility threshold at all areas except Bronx with the maximum number of days per year at Big Piney (8 days–FLAG, and 13 days – IMPROVE) and the maximum dv at Boulder (2.7 dv – FLAG, 3.1 dv – IMPROVE).

In-field Impacts

Cumulative impacts of NO_2, SO_2, $PM_{10,}$ and $PM_{2.5}$ within the JIDPA resulting from Preferred Alternative mitigation scenarios, when added to appropriate background concentrations, were predicted to be less than all applicable ambient air quality standards.

2.4 MITIGATION STRATEGIES

In an effort to identify mitigation strategies to achieve reductions in emissions from the Preferred Alternative high emissions case, three field development parameters were assessed relative to their potential impact to visibility (regional haze) at the Bridger Wilderness Area. These parameters are: 1) WDR; 2) drill rig engine emissions levels (EPA Tier levels); and 3) number of active flares. The emissions inventory developed for this analysis was reviewed, and an example of how a change in any of these three variables could potentially result in emissions reductions and reduced visibility impacts at the Bridger Wilderness was compiled, as shown in Table 3.

Analyses performed in the original AQTSD (TRC 2004) revealed drill rig engines as the primary emissions source affecting visibility; therefore, mitigation options focus on drill rigs. However, BLM’s authority to regulate flare numbers, drill rig emission rates, and/or WDRs has not been defined. Furthermore, the availability of drill rigs with Tier 2 emission levels is currently limited; therefore, transitional mitigation involving further reductions in WDRs and/or reduced flaring may be appropriate until more Tier 2 or other low emission drill rigs become available.

Table 3 Example Mitigation Options for the Jonah Infill Drilling Project Preferred Alternative

Potential Project Emissions Reduction	Wells Developed per year [1]	Example Mitigation Options	Potential Project Impact to Visibility in Bridger WA (days > 1 dv)
80%	50	100% of drill rigs with Tier 2 emissions levels, 1 completion flare	3
	75	100% of drill rigs with Tier 2 emissions levels, 0 completion flares	
60%	250	100% of drill rigs with Tier 2 emissions levels, 1 completion flare	9
	200	30% of drill rigs with Tier 1 emissions levels & 70% with Tier 2 emissions levels, 1 completion flare	
	150	20% of drill rigs with Tier 0 emissions levels, 20% with Tier 1 emissions levels & 60% with Tier 2 emissions levels, 1 completion flare	
40%	250	10% of drill rigs with Tier 0 emissions levels, 50% with Tier 1 emissions levels & 40% with Tier 2 emissions levels, 2 completion flares	15
	250	10% of drill rigs with Tier 0 emissions levels, 80% with Tier 1 emissions levels & 10% with Tier 2 emissions levels, 1 completion flare	
	200	20% of drill rigs with Tier 0 emissions levels & 80% with Tier 1 emissions levels, 2 completion flares	
20%	250	30% of drill rigs with Tier 0 emissions levels & 70% with Tier 1 emissions levels, 3 completion flares	20
	250	40% of drill rigs with Tier 0 emissions levels & 60% with Tier 1 emissions levels, 2 completion flares	
	250	50% of drill rigs with Tier 0 emissions levels & 50% with Tier 1 emissions levels, 1 completion flare	
	200	70% of drill rigs with Tier 0 emissions levels & 30% with Tier 1 emissions levels, 3 completion flares	
	200	80% of drill rigs with Tier 0 emissions levels & 20% with Tier 1 emissions levels, 2 completion flares	
0%	250	80% of drill rigs with Tier 0 emissions levels & 20% with Tier 1 emissions levels, 3 completion flares	31

[1] Assumes 50% of the wells are straight-hole drilled and 50% of wells directionally drilled.

3.0 EARLY-PROJECT-DEVELOPMENT STAGE MODELING

An analysis of JIDP early-project-development stage air quality conditions in the vicinity of the JIDPA was performed. What has been modeled and presented in the DEIS for the Preferred Alternative and supplemented with additional model runs (described in Section 2.0) considers the "most likely case" maximum emissions scenario for the JIDP. However, when quantifying maximum cumulative impacts regionally, peak regional impacts appear to occur prior to JIDP maximum emissions as a result of the development of other natural gas projects in the region, specifically the Pinedale Anticline Project (PAP), South Piney Project (SPP), Riley Ridge Project (RRP), and Jack Morrow Hills Project (JMHP). The BLM performed this analysis because 1) regional impacts appear to be greatest during the early stages of JIDP development due to accelerated development paces in these nearby project areas, and 2) the emissions from increased drilling near Pinedale had not been adequately characterized in the DEIS. The Record of Decision (ROD) for the Pinedale Anticline EIS (BLM 1999) stated that if emissions of nitrogen oxides (NOx) from the Jonah and Pinedale Anticline gas fields reached 693.5 tons per year, the BLM would perform further air quality analyses. The analysis for the Questar Year-round drilling EA (BLM 2004), published after completion of the DEIS analysis, indicated that NOx emissions had substantially exceeded that level, due mainly to emissions from drill rigs. Drill rig emissions were higher than assumed in the PAPA EIS because:

- there were more drill rigs operating than estimated;
- conditions required drill rig engines to have larger horsepower than estimated; and
- directional drilling required drill rigs to operate for a longer period of time per well than estimated.

Unlike the Preferred Alternative modeling analyses (see Section 2.0), modeling analyses of the early-project-development stage emissions are not directly comparable to the results presented in the DEIS.

The goal of this analysis was to estimate an emissions scenario that could potentially occur within the next few years in the air basin located southwest of the Bridger Wilderness Area, as a result of 1) increased well drilling and flaring activities among several active natural gas field developments, and 2) expanded compression requirements, beyond what was analyzed for the DEIS (BLM 2005). To accomplish this goal a study base year, determined by available background pollutant data, was selected. Emissions estimates of well drilling and flaring were quantified for this baseline year for the JIDP, PAP, SPP, RRP, and JMHP. Emission estimates of well drilling, flaring, and expanded compression for these projects, and other companies operating within these project areas, which are representative of current year or early–project-development stage conditions, were then determined. Emission estimates for the baseline year were subtracted from the early-project stage emissions. This emissions "netting" determined the emissions changes from background to modeled conditions, and avoided "double-counting" existing background conditions in future air quality conditions. These emission changes were then modeled in combination with other JIDP sources and regional sources to estimate both project and cumulative pollutant impacts at far-field PSD Class I and sensitive Class II areas, at mid-field Wyoming regional community locations, and within the JIDPA. Other JIDP sources include expanded compression estimates, beyond what was analyzed for the DEIS, production and construction traffic emissions and wellsite heater emission representative of early project emissions, and wind erosion. Non-project regional emissions, with the exception of the PAP, SPP, RRP, and JMHP, included in the DEIS (BLM 2005) and as described in detail in the AQTSD (TRC 2004) were included in the modeling analyses. For the PAP, SPP, RRP and JMHP, the well drilling and flaring emissions differences were included along with any emissions that were included in the permitted source and RFD inventories for the DEIS analyses. The regional emissions include sources newly permitted by the state agencies through June 30, 2003, reasonably foreseeable development (RFD), reasonably foreseeable future actions (RFFA), and Operator-projected compression estimates. These inventories were updated to include additional source emissions permitted through March 31, 2004, and these additional source emissions were included in the cumulative modeling analyses.

The emissions information available for well drilling and flaring activities and expanded compression requirements, obtained prior to a cut-off date of May 26, 2005, were used in the analysis. A study baseline year of 2002 was used because background visibility data through 2002 was available. Year 2006 was selected as representative of a maximum emissions scenario for regional emissions. The 2006 inventory also included recent expanded compression estimates, in addition to the expanded compression estimates that were obtained prior to the DEIS analyses and included in the DEIS modeling. This analysis is described in detail in the *Jonah Infill Drilling Project Draft Air Quality Technical Support Document Supplement* (TRC 2005). The modeling analyses of the early-project-development stage emissions are not directly comparable to the results presented in Section 2.0 or in the DEIS due to differences (emissions increases) in the regional (non-project) emissions inventories and the expanded compression estimates included in this analysis.

The CALMET and CALPUFF model versions that were used for the DEIS analysis were used to estimate direct JIDP and cumulative pollutant impacts at far-field PSD Class I and sensitive Class II areas, and at mid-field Wyoming regional community locations and within the JIDPA. Model results for the early-project-development stage modeling scenarios are summarized in the following sections.

3.1 IMPACTS SUMMARY

Tables 4 and 5 provide an overall summary of the maximum predicted impacts from the early-project-development stage modeling analyses. Table 4 provides a summary of the potential concentration and deposition impacts for both direct project and cumulative scenarios and Table 5 provides a summary of the potential impacts to visibility (regional haze) for these scenarios. Results summaries shown in green (normal text) in these tables indicate that potential impacts are below ambient air quality standards, PSD increments, and BLM-defined significance threshold values and levels of concern. Results are compared to other agency-defined significance threshold values and levels of concern in the *Jonah Infill Drilling Project Draft Air Quality Technical Support Document Supplement* (TRC 2005). Results summaries shown in red (**bold text**) indicate that potential impacts are above these levels. The PSD demonstrations serve information purposes only and do not constitute a regulatory PSD Increment consumption analysis, which may be completed as necessary by WDEQ-AQD. The modeling analyses are not directly comparable to the results presented earlier in Section 2.0 or in the DEIS due to differences in the regional emissions inventories and the expanded compression estimates included in this analysis. A complete disclosure of all modeled impacts for the early-project-development stage modeling analyses is provided in the *Jonah Infill Drilling Project Draft Air Quality Technical Support Document Supplement* (TRC 2005). A discussion of both the direct impacts and cumulative impacts are provided in the following sections.

3.2 DIRECT PROJECT IMPACTS

CALPUFF modeling was performed to calculate direct JIDP impacts for early-project-development stage conditions. Potential direct project far-field pollutant impacts were assessed at the PSD Class I areas and at the sensitive Class II Areas. Far-field analyses include impact assessments of concentration, visibility (regional haze), atmospheric deposition, and lake acidity. Mid-field visibility impact analyses were performed for the Wyoming regional community locations. In-field analyses include impact assessments of concentration within the JIDPA.

Far-field Impacts

Direct impacts resulting from early-project-development stage source emissions would be below the applicable ambient air quality standards and PSD increments. PM_{10} concentrations exceed the proposed PSD Class I SILs at the Bridger Wilderness Area and at Grand Teton National Park and are below the SILs at all other sensitive areas. These SILs are proposed by EPA as an indicator of significance of New Source Review projects to determine additional analysis requirements.

Table 4 Early-Project-Development Stage Air Quality Concentrations and Deposition Impacts Summary

Air Quality Component	Criteria	Source Group & Impact Area	Early-Project-Development Stage
Concentrations	Air Quality Standards	Project: In-Field	PM_{10} < NAAQS&WAAQS $PM_{2.5}$ < NAAQS&WAAQS NO_2 < NAAQS&WAAQS SO_2 < NAAQS&WAAQS
		Cumulative: In-Field	PM_{10} < NAAQS&WAAQS $PM_{2.5}$ < NAAQS&WAAQS NO_2 < NAAQS&WAAQS SO_2 < NAAQS&WAAQS
		Project: Far-Field	PM_{10} < NAAQS&WAAQS $PM_{2.5}$ < NAAQS&WAAQS NO_2 < NAAQS&WAAQS SO_2 < NAAQS&WAAQS
		Cumulative: Far-Field	PM_{10} < NAAQS&WAAQS $PM_{2.5}$ < NAAQS&WAAQS NO_2 < NAAQS&WAAQS SO_2 < NAAQS&WAAQS
	PSD Class I Increments [1]	Cumulative: Far-Field	PM_{10} < increment NO_2 < increment SO_2 < increment
	PSD Class II Increments [1]	Cumulative: Far-Field	PM_{10} < increment NO_2 < increment SO_2 < increment
Atmospheric Deposition	N Deposition	Total: Far-Field	N < LOC, All Areas
	S Deposition	Total: Far-Field	S < LOC, All Areas
	Sensitive Lakes	Project: Far-Field	ANC Change < LAC, All Lakes
		Cumulative: Far-Field	ANC Change < LAC, All Lakes

[1] The PSD demonstrations serve information purposes only and do not constitute a regulatory PSD Increment consumption analysis.

Table 5 Early-Project-Development Stage Visibility (Regional Haze) Impacts Summary

Air Quality Component	Impact Area	Source Group	Early-Project-Development Stage
Visibility (Regional Haze)	PSD Class I and Sensitive Class II Areas	Project	**Bridger WA, >1.0-dv 9 days, max dv = 2.42** Fitzpatrick WA, >1.0-dv 0 days, max dv = 0.95 **Popo Agie WA, >1.0-dv 2 days, max dv = 1.06** **Wind River RA, >1.0-dv 1 days, max dv = 1.01** Grand Teton NP, >1.0-dv 0 days, max dv = 0.67 Teton WA, >1.0-dv 0 days, max dv = 0.37 Yellowstone NP, >1.0-dv 0 days, max dv = 0.32 Washakie WA, >1.0-dv 0 days, max dv = 0.43
		Cumulative	**Bridger WA, >1.0-dv 61 days, max dv = 6.57** **Fitzpatrick WA, >1.0-dv 11 days, max dv = 3.37** **Popo Agie WA, >1.0-dv 23 days, max dv = 3.35** **Wind River RA, >1.0-dv 15 days, max dv = 3.39** **Grand Teton NP, >1.0-dv 8 days, max dv = 2.63** **Teton WA, >1.0-dv 4 days, max dv = 1.33** **Yellowstone NP, >1.0-dv 3 days, max dv = 1.22** **Washakie WA, >1.0-dv 2 days, max dv = 1.70**
	Wyoming Regional Communities	Project	**Big Piney, >1.0-dv 24 days, max dv = 6.62** **Big Sandy, >1.0-dv 24 days, max dv = 3.66** **Boulder, >1.0-dv 18 days, max dv = 3.37** **Bronx, >1.0-dv 8 days, max dv = 1.79** **Cora, >1.0-dv 11 days, max dv = 2.17** **Daniel, >1.0-dv 14 days, max dv = 2.93** **Farson, >1.0-dv 33 days, max dv = 5.18** **Labarge, >1.0-dv 11 days, max dv = 5.73** **Merna, >1.0-dv 7 days, max dv = 2.46** **Pinedale, >1.0-dv 14 days, max dv = 2.94**
		Cumulative	**Big Piney, >1.0-dv 85 days, max dv = 14.43** **Big Sandy, >1.0-dv 108 days, max dv = 8.42** **Boulder, >1.0-dv 131 days, max dv = 10.59** **Bronx, >1.0-dv 63 days, max dv = 9.60** **Cora, >1.0-dv 73 days, max dv = 9.95** **Daniel, >1.0-dv 88 days, max dv = 12.68** **Farson, >1.0-dv 77 days, max dv = 10.85** **Labarge, >1.0-dv 39 days, max dv = 11.12** **Merna, >1.0-dv 33 days, max dv = 6.25** **Pinedale, >1.0-dv 113 days, max dv = 10.32**

Direct project source emissions from the early-project-development stage would not result in an increase in ANC above any LAC at the acid-sensitive lakes. The predicted maximum S deposition impacts are below the DAT at all sensitive PSD Class I and Class II areas. The maximum N impacts were predicted to be above the 0.005 kg/ha-yr threshold at the Bridger and Popo Agie Wilderness Areas and below the DAT at all other sensitive areas. The maximum predicted N deposition impacts are 0.014, and 0.009 kg/ha-yr at the Bridger and Popo Agie Wilderness Areas, respectively. The exceedances of this threshold trigger a management concern but are not necessarily indicative of an adverse impact (NPS 2004).

Direct visibility (regional haze) impacts were predicted to be above the "just noticeable visibility change" (1.0-dv) threshold at the Bridger and Popo Agie Wilderness Areas, and at the Wind River Roadless Area, and below the threshold at all other sensitive areas. The highest frequency of predicted visibility impacts occurred at the Bridger Wilderness where there were 8 days per year (FLAG) and 9 days per year (IMPROVE) when visibility impacts where predicted to be above the 1.0-dv threshold. The maximum dv change was estimated as 2.2 dv (FLAG) and 2.4 dv (IMPROVE).

Mid-field Impacts

Modeling results for the early-project-development stage indicate impacts above the 1.0-dv threshold at all nearby Wyoming community locations. The highest frequency of predicted visibility impacts occurred at Farson where they were 31 days (FLAG) and 33 days (IMPROVE) estimated to be above the 1.0-dv threshold. The maximum dv change, 5.9 dv (FLAG), and 6.6 dv (IMPROVE) was predicted to occur at Big Piney.

In-field Impacts

Direct impacts of NO_2, SO_2, PM_{10}, and $PM_{2.5}$ within the JIDPA resulting from early-project-development stage conditions emissions, when added to appropriate background concentrations, were predicted to be less than all applicable ambient air quality standards.

3.3 CUMULATIVE IMPACTS

CALPUFF modeling was performed to calculate cumulative impacts from potential project and regional sources. Regional emissions inventories of existing state-permitted, RFD, and RFFA sources were modeled in combination with project sources to provide cumulative impact estimates. Cumulative far-field pollutant impacts were assessed at the PSD Class I areas and at the sensitive Class II Areas. Far-field analyses include impact assessments of concentration, visibility (regional haze), atmospheric deposition, and lake acidity. Mid-field visibility impact analyses were performed for the Wyoming regional community locations. In-field analyses include impact assessments of concentration within the JIDPA.

Far-field Impacts

Cumulative impacts resulting from early-project-development stage conditions source emissions would be below all applicable ambient air quality standards and PSD increments.

Cumulative project and non-project source emissions resulting from early-project-development stage conditions would not result in an increase in ANC above any LAC at the acid-sensitive lakes. Total S and N deposition impacts would not exceed the USDA Forest Service levels of concern (5 kg/ha-yr for S and 3 kg/ha-yr for N), for comparison of potential impacts from cumulative source emissions. It is understood that the USDA Forest Service no longer considers these levels of concern to be protective; however, in the absence of alternative FLM-approved values, comparisons with these values were made.

Cumulative visibility (regional haze) impacts were predicted to be above the 1.0-dv threshold at the Bridger, Fitzpatrick, Popo Agie, Teton, and Waskakie Wilderness Areas, at Grand Teton and Yellowstone National Parks, and at the Wind River Roadless Area using both the FLAG and IMPROVE background visibility data. The highest frequency of predicted visibility impacts occurred at the Bridger Wilderness where there were 61 days per year (FLAG) and 59 days per year (IMPROVE) when visibility impacts where predicted to be above the 1.0-dv threshold. The maximum dv change was estimated as 6.0 dv (FLAG) and 6.6 dv (IMPROVE).

Mid-field Impacts

Cumulative modeling results for the early-project-development stage indicate impacts above the 1.0-dv threshold at all nearby Wyoming community locations. The highest frequency of predicted visibility impacts occurred at Boulder where they were 131 days (FLAG) and 130 days (IMPROVE) estimated to be above the 1.0-dv threshold. The maximum dv change, 13.3 dv (FLAG), and 14.4 dv (IMPROVE) was predicted to occur at Big Piney.

In-field Impacts

Cumulative impacts of NO_2, SO_2, $PM_{10,}$ and $PM_{2.5}$ within the JIDPA resulting from early-project-development stage emissions and non-project emissions, when added to appropriate background concentrations, were predicted to be less than all applicable ambient air quality standards.

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