APPENDIX 19—AIR QUALITY TECHNICAL SUPPORT DOCUMENT

This Air Quality Technical Support Document (AQTSD) describes the processes used to conduct the air quality impact assessment and provides summaries of relevant analysis data. This document served as the basis for air quality impact analyses of all alternatives. The contents of this document are—

- Regulatory Framework
- Agency Roles and Authorities
- Existing Air Quality
- Air Quality Impact Analysis
- Emission Calculations
- Internet Resources
- Mitigation.

Copies of this technical support document and any data files are available upon request from—

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Regulatory Framework

For quantitative analysis, the following air quality criteria apply. Although the criteria listed below do not apply to the qualitative analysis presented in this draft Environmental Impact Statement (EIS), they are identified here for reference purposes. The basic framework for controlling air pollutants in the United States is mandated by the 1970 Clean Air Act (CAA) and its amendments, and the 1999 Regional Haze Regulations. The CAA addresses criteria air pollutants, state and national ambient air quality standards for criteria air pollutants, and the Prevention of Significant Deterioration program. The Regional Haze Regulations address visibility impairment.

Ambient Air Quality Constituents

Air pollutants addressed in this study include criteria pollutants, hazardous air pollutants (HAP), and sulfur and nitrogen compounds that can cause visibility impairment or atmospheric deposition impacts.

Criteria Pollutants

Criteria pollutants are those for which national standards of concentration have been established. Ambient air concentrations of these constituents greater than the standards represent a risk to human health. Criteria pollutants include carbon monoxide (CO), nitrogen dioxide (NO_2), sulfur dioxide (SO_2), ozone (O_3), particulate matter (PM_{10} and $PM_{2.5}$), and lead (Pb).

- **Carbon Monoxide.** CO is an odorless, colorless gas formed during any combustion process, such as operation of engines, fireplaces, and furnaces. High concentrations of CO affect the oxygen-carrying capacity of the blood and can lead to unconsciousness and asphyxiation. Wildland fires are a natural source of CO.

- **Nitrogen Dioxide.** NO_2 is a red-brown gas formed during operation of internal combustion engines. Such engines emit a mixture of nitrogen gases, collectively called nitrogen oxides (NO_x). NO_x can contribute to brown cloud conditions and can convert to ammonium nitrate particles and nitric acid, which can cause visibility impairment and acid rain. Bacterial action in soil can be a natural source of nitrogen compounds.

- **Sulfur Dioxide.** SO_2 forms during combustion from trace levels of sulfur in coal or diesel fuel. It can convert to ammonium sulfate ($(NH_4)_2SO_4$) and sulfuric acid (H_2SO_4), which can cause visibility impairment and acid rain. Volcanoes are natural sources of SO_2. Anthropogenic sources include refineries and power plants.

- **Ozone.** O_3 is a faint blue gas that is generally not emitted directly into the atmosphere but is formed from NO_x and volatile reactive organic compound (VOC) emissions. Internal combustion engines are the main source of NO_x. Volatile organic compounds, like terpenes, are very reactive. Sources of VOCs include, but are not limited to, paint, varnish, and some types of vegetation. The faint acrid smell common after thunderstorms is caused by ozone formation by lightning. O_3 is a strong oxidizing chemical that can burn lungs and eyes, and damage plants.

- **Particulate Matter.** Particulate matter (e.g., soil particles, hair, pollen, etc.) is essentially small particles suspended in the air that settle to the ground slowly and may be resuspended if disturbed. Separate allowable concentration levels for particulate matter are based on the relative size of the particle:
  - PM_{10} particles with diameters smaller than 10 micrometers are small enough to be inhaled and can cause adverse health effects.
  - $PM_{2.5}$ particles with diameters smaller than 2.5 micrometers are so small that they can be drawn deeply into the lungs and cause serious health problems. Particles in this size range are also the main cause of visibility impairment.

- **Lead.** Before the wide use of unleaded fuel for automobiles, lead particles were emitted from tailpipes. Lead is not considered in this draft EIS because no proposed projects are expected to emit lead. The lead standard is not addressed in this Technical Support Document because proposed projects will have no lead emission sources.

Hazardous Air Pollutants

There are a wide variety of HAPs, including N-hexane, ethylbenzene, toluene, xylene, formaldehyde, and benzene. Although HAPs do not have ambient air quality standards associated with them, the Environmental Protection Agency (EPA) has issued reference concentrations (RfC) to evaluate the inhalation risk for cancerous and noncancerous health effects.

Although this draft EIS is a National Environmental Policy Act (NEPA) document and not a regulatory document, there are regulatory issues that should be taken into account in preparing this draft EIS and ensuing project-specific EISs. Actual regulation of HAPs is achieved through compliance with applicable maximum achievable control technology (MACT) standards and not through ambient air quality standards. Regulatory agencies implement control through section 112 programs, specifically section 112(g) case-by-case MACT determinations according to 40 CFR part 63, subpart B and section 112(d) MACT emission standards.

Any source that emits or has the potential to emit 10 tons per year or more of any hazardous air pollutant or 25 tons per year or more of any combination of hazardous air pollutants is considered a major source and would require a Title V, part 70, operating permit review and permit. This may include either compliance with an applicable MACT emission standard or a case-by-case 112(g) MACT determination if the source is new or is the result of major modifications and no applicable MACT emission standard has been promulgated. Specific regulations that would apply in the planning area in 2004 include 40 CFR part 63 subpart HH National Emission Standards for Hazardous Air Pollutants From Oil and Natural Gas Production Facilities; 40 CFR part 63 subpart HHH, National Emission Standards for Hazardous Air Pollutants from Natural Gas Transmission and Storage Facilities; and 40 CFR Part 63 Subpart ZZZZ, National Emission Standards for Hazardous Air Pollutants for Stationary Reciprocating Internal Combustion Engines. This last regulation affects source categories using reciprocating engines for gas compression.

For quantifiable analysis, short-term (1-hour) HAP concentrations would be compared with acute Reference Exposure Levels (REL). RELs are defined as concentrations at or below which no adverse health effects are expected. If no RELs were available, the available Immediately Dangerous to Life or Health (IDLH/10) values would be used. These IDLH/10 values are determined by the National Institute for Occupational Safety and Health (NIOSH) and would be obtained from EPA's Air Toxics Database.

Also for quantifiable analysis, long-term exposure to HAPs emitted by the proposed action would be compared with RfCs. An RfC is defined by EPA as the daily inhalation concentration at which no long-term adverse health effects are expected. RfCs exist for both noncarcinogenic and carcinogenic effects on human health. Annual modeled HAP concentrations for all HAPs emitted would be compared directly with the non-carcinogenic RfCs. RfCs for the suspected carcinogens benzene and formaldehyde are expressed as risk factors. Accepted methods for risk assessment would be used to evaluate the incremental cancer risk for these pollutants.

Annual modeled concentrations would be multiplied by EPA's unit risk factors (URF) (based on 70-year exposure) for those pollutants, and then the product would be multiplied by an adjustment factor that represents the ratio of projected exposure time to 70 years. The adjustment factors represent two scenarios: a most likely exposure (MLE) scenario and one reflective of the maximally exposed individual (MEI).

The MLE duration would be assumed to be 9 years, which corresponds to the mean duration that a family remains at a residence. This duration corresponds to an adjustment factor of 9/70 = 0.13. The duration of exposure for the MEI is assumed to be 50 years (maximum duration at a location), corresponding to an adjustment factor of 50/70 = 0.71.

A second adjustment would be made for time spent at home versus time spent elsewhere. For the MLE scenario, the at-home time fraction is 0.64 (EPA 1993), and it would be assumed that during the rest of the day, the individual would remain in an area where annual HAP concentrations would be one quarter as large as the maximum annual average concentration. Therefore, the MLE adjustment factor would be (0.13) x [(0.64 x 1.0) + (0.36 x 0.25)] = 0.0949. The MEI scenario assumes that the individual is at home 100% of the time, for a final adjustment factor of (0.71 x 1.0) = 0.71.

Hazardous air pollutant emissions are associated with industrial activities, such as oil and gas operations, refineries, paint shops, dry cleaning facilities, and woodworking shops.

Because this analysis is qualitative, no specific impact analyses of either short- or long-term HAPs impacts are conducted.

HAPs emissions are expected to be similar to those found in other EISs and to be composed of benzene, toluene, ethylbenzene, xylene, n-hexane, and formaldehyde.

Atmospheric Deposition Constituents

Sulfur and nitrogen compounds that can be deposited on terrestrial and aquatic ecosystems include nitric acid (HNO_3), nitrate (NO_3^-), ammonium (NH_4^+), and sulfate (SO_4^{--}). HNO_3 and NO_3^- are not emitted directly into the air but form in the atmosphere from industrial and automotive emissions NO_x. SO_4^{--} is formed in the atmosphere from industrial emission of SO_2. Deposition of HNO_3, NO_3^-, and SO_4^{--} can adversely affect plant growth, soil chemistry, lichens, aquatic environments, and petroglyphs. NH_4^+ is primarily associated with feedlots and agricultural fertilization. Deposition of NH_4^+ can affect terrestrial and aquatic vegetation. While deposition may be beneficial as a fertilizer, it can adversely affect the timing of plant growth and dormancy.

Total nitrogen and sulfur deposition is calculated from dry deposition CASTNet data and wet deposition NADP data. Total deposition data are then compared to LOC thresholds developed by the Forest Service (Fox, et al 1989).

Calculation of Total Deposition:

Total N deposition = N/NO_3 dry + N/NH_4 dry + N/HNO_3 dry + N/NO_3 wet + N/NH_4 wet

Where:

- N/NO_3 dry = NO_3 * (7/31)
- N/NH_4 dry = NH_4 * (7/11)
- N/HNO_3 dry = HNO_3 * (7/32)
- N/NO_3 wet = NO_3 * (7/31)
- N/NH_4 wet = NH_4 * (7/11)

Total S deposition = S/SO_2 dry + S/SO_4 dry + S/SO_4 wet

Where:

- S/SO_2 dry = SO_2 * (16/32)
- S/SO_4 dry = SO_4 * (16/48)
- S/SO_4 wet = SO_4 * (16/48)

Although this analysis is qualitative, future specific projects will require quantitative analyses using the following criteria.

Wyoming and National Ambient Air Quality Standards

Wyoming Ambient Air Quality Standards (WAAQS) and National Ambient Air Quality Standards (NAAQS) are health-based standards for the maximum concentration of air pollutants at all locations to which the public has access. The WAAQS and NAAQS are legally enforceable standards. Concentrations above the WAAQS and NAAQS represent a risk to human health. State standards must be equally strict or stricter than federal standards.

The EPA has developed standards for each criteria pollutant for a specific averaging time (Table A19-1). Short averaging times (1, 3, and 24 hours) address short-term exposure, while the annual standards address long-term exposure. Longer term standards are set to lower allowable concentrations than are short-term standards to recognize the cumulative effects of long-term exposure.

Table A19-1. National and Wyoming Ambient Air Quality Standards

Pollutant	Averaging Time	NAAQS			WAAQS		
		(μg/m3)	(ppm)	(ppb)	(μg/m3)	(ppm)	(ppb)
Carbon Monoxide (CO)	1-hour	40,000	35	35,000	40,000	35	35,000
	8-hour	10,000	9	9,000	10,000	9	9,000
Lead (Pb)	Calendar quarter	1.5			1.5		
Nitrogen Dioxide (NO_2)	Annual	100	.053	53	100	.053	53
Ozone (O_3)	8-hour	157	.08	80	157	.08	80
Particulate Matter (PM_{10})	24-hour	150			150		
	Annual	50			50		
Particulate Matter ($PM_{2.5}$)	24-hour	65			65		
	Annual	15			15		
Sulfur Dioxide (SO_2)	3-hour	1,300	.5	500	695	.266	266
	24-hour	365	.14	140	260	.099	99
	Annual	80	.030	30	60	.023	23

On September 21, 2006, EPA announced final revisions to the National Ambient Air Quality Standards for particulate matter. The revision strengthens the 24-hour PM2.5 standard from 65 to 35 ug/m^3 and revokes the annual PM_{10} standard of 50 ug/m^3. EPA retained the existing annual $PM_{2.5}$ standard of 15 ug/m^3 and the 24-hour PM_{10} standard of 150 ug/m^3. The final rule has not yet been published in the Federal Register and is not effective until 60 days after publication in the Federal Register. After the final rule becomes effective, the State of Wyoming will enter into rulemaking to revise the Wyoming Ambient Air Quality Standards.

Prevention of Significant Deterioration

The goal of the Prevention of Significant Deterioration (PSD) program is to ensure that air quality in areas with clean air does not significantly deteriorate while maintaining a margin for future industrial growth. Under the PSD program, each area in the United States is classified by the air quality in that region according to the following system:

- **PSD Class I Areas:** Areas with pristine air quality, such as wilderness areas, national parks, and some Indian reservations, are accorded the strictest protection. Only very small incremental increases in concentration are allowed in order to maintain the very clean air quality in these areas.
- **PSD Class II Areas:** Essentially all areas that are not designated Class I are designated Class II. Moderate incremental increases in concentration are allowed, although the concentrations are not

allowed to reach the concentrations set by Wyoming and federal standards (i.e., WAAQS and NAAQS).

- **PSD Class III Areas:** No areas have yet been designated Class III. Concentrations would be allowed to increase up to the WAAQS and NAAQS.

The incremental increases allowed for specific pollutants in Class I and Class II areas are provided in Table A19-2.

Table A19-2. PSD Increments

Pollutant	Averaging Time	PSD Increment					
		Class I			Class II		
		(µg/m3)	(ppm)	(ppb)	(µg/m3)	(ppm)	(ppb)
Nitrogen Dioxide (NO_2)	Annual	2.5	.0013	1.3	25	.013	13
Particulate Matter (PM_{10})	24-hour	8			30		
	Annual	4			17		
Sulfur Dioxide (SO_2)	3-hour	25	.0096	9.6	512	.1956	196
	24-hour	5	.0019	1.9	91	.0348	35
	Annual	2	.0008	.8	20	.0076	8

Comparisons of potential PM_{10}, NO_2, and SO_2 concentrations in NEPA air quality analyses with PSD concentrations are intended only to evaluate a threshold of concern and do not represent a regulatory PSD Increment Consumption analysis. Regulatory PSD Increment Consumption analyses are solely the responsibility of the State of Wyoming, which has been granted primacy (with EPA oversight).

In project-specific EISs, the Bureau of Land Management (BLM) does not perform a regulatory PSD analysis. The PSD increments are used only as a reference to give the public a better understanding of the level of potential impact.

Regional Haze Regulations

Visibility impairment in the form of regional haze obscures the clarity, color, texture, and form of what one sees. Haze-causing pollutants (mostly fine particles) are directly emitted into the atmosphere or are formed when gases emitted into the air form particles as they are carried downwind. Emissions from human-caused and natural sources can be carried great distances, contributing to regional haze. The Wyoming Department of Environmental Quality–Air Quality Division (WDEQ-AQD) submitted its Regional Haze State Implementation Plan (SIP), in accordance with 40 CFR Part 51.309, in December 2003. The EPA has not yet taken any action on this SIP.

Visual range, one of several ways to express visibility, is the greatest distance at which a person can distinguish a dark landscape feature from a light background like the sky. Without human-caused visibility impairment, natural visual range is estimated to average about 110–115 miles in the western United States and 60–80 miles in the eastern United States (Malm 1999).

The Regional Haze Regulations were developed by the EPA in response to the CAA Amendments of 1977 and 1990. They are intended to maintain visibility on the least impaired days and improve visibility on the most impaired days in mandatory Federal Class I areas across the United States, so that visibility in these areas is returned to natural conditions by 2064. These regulations require states to submit a regional haze SIP and progress reports to demonstrate reasonable progress toward the 2064 goal.

APPLICABILITY TO THE PINEDALE AREA

Air pollution impacts are limited by local, state, tribal, and federal air quality regulations, standards, and implementation plans established under the CAA and administered by the WDEQ-AQD with oversight from the EPA. Air quality regulations require proposed new, or modified existing, air pollutant emission stationary sources (including oil and gas compression facilities) to undergo a permitting review before their construction can begin. Therefore, the WDEQ-AQD has the primary authority and responsibility to review permit applications and to require emission permits, fees, and control devices, before construction and/or operation.

Fugitive dust and exhaust from construction activities, along with air pollutants emitted during operation (i.e., well operations, booster [field] and pipeline [sales] compressor engines, etc.), are potential causes of air quality impacts. These issues are more likely to generate public concern where natural gas development activities occur near residential areas or near PSD Class I and sensitive Class II areas.

The U.S. Forest Service (USFS), National Park Service (NPS), and the U.S. Fish and Wildlife Service (USFWS) have also expressed concerns regarding potential atmospheric deposition (i.e., acid rain) and visibility impacts within downwind PSD Class I and sensitive Class II areas under their administration throughout Wyoming.

As explained earlier, the NAAQS and WAAQS are health-based standards for the maximum acceptable concentrations of air pollutants at locations to which the public has access. The analysis of the proposed alternatives must demonstrate continued compliance with all applicable local, state, tribal, and federal air quality standards. Existing air quality throughout the planning area is in compliance with all ambient air quality standards, as demonstrated by the relatively low concentration levels presented in Table A19-3.

The U.S. Congress (through the CAA section 116) authorized local, state, and tribal air quality regulatory agencies to establish air pollution control requirements more (but not less) stringent than federal requirements. Also, under both the Federal Land Policy and Management Act (FLPMA) and the CAA, BLM cannot authorize any activity that would not conform to all applicable local, state, tribal, and federal air quality laws, regulations, standards, and implementation plans.

Given the planning area's current air quality standards attainment status, future development projects that have the potential to emit more than 250 tons per year of any criteria pollutant (or certain listed sources that have the potential to emit more than 100 tons per year) would be required to undergo a site-specific regulatory PSD Increment Consumption analysis under the federal New Source Review permitting regulations. Development projects that require PSD permits may also be required by the applicable air quality regulatory agencies to incorporate additional emission control measures (including a best available control technology [BACT] analysis and determination) to ensure protection of air quality resources, and to demonstrate that the combined impacts of all PSD sources will not exceed the allowable incremental air quality impacts for NO_2, PM_{10}, and SO_2. Minor sources with emissions below the cutoff rates mentioned above do not require PSD permits; nevertheless, their emissions contribute to increment consumption.

A regulatory PSD Increment Consumption analysis may be conducted as part of a New Source Review, or independently (the WDEQ-AQD is conducting a PSD Increment Consumption analysis in southwest Wyoming for NO_2). The determination of PSD increment consumption is a legal responsibility of the applicable air quality regulatory agencies, with EPA oversight. In addition, an analysis of cumulative impacts resulting from all existing sources and the permit applicant's sources is also required during New Source Review to demonstrate that applicable ambient air quality standards will be met during the operational lifetime of the permit applicant's operations.

Sources subject to the PSD permit review procedure are also required to demonstrate potential impacts on Air Quality Related Values (AQRV). These include visibility impacts, degradation of mountain lakes from atmospheric deposition (i.e., acid rain), and effects on sensitive flora and fauna in the PSD Class I areas. The CAA also provides specific visibility protection procedures for the mandatory federal PSD Class I areas designated by the U.S. Congress on August 7, 1977, which included wilderness areas greater than 5,000 acres in size, as well as national parks and national memorial parks greater than 6,000 acres in size as of that date.

AGENCY ROLES AND AUTHORITIES

Environmental Protection Agency

The EPA administers the federal CAA, (42 USC 7401 et seq.) to maintain the NAAQS that protect human health and to preserve the rural air quality in the region by assuring that the PSD Class I and Class II increments for SO_2, NO_2 and PM_{10}, are not exceeded. EPA has delegated this CAA authority to the State of Wyoming.

Wyoming Department of Environmental Quality

Wyoming regulates pollutants emitted into the air through the Wyoming Environmental Quality Act (W.S. 35-11-101 et. seq.). Wyoming is also authorized by an approved SIP to administer all requirements of the PSD permit program under the CAA. Additionally, the approved Wyoming SIP contains a number of programs that provide for the implementation, maintenance, and enforcement of the NAAQS, including a New Source Review program for minor source permitting, which includes, among its requirements, application of BACT for all new or modified sources, regardless of size or source category. Included as well are authorities for the control of particulate emissions, including fugitive particulate emissions from haul roads, access roads, or general facility boundaries. Wyoming is also delegated responsibility to operate an approved ambient air quality monitoring network for the purpose of demonstrating compliance with the NAAQS and WAAQS.

Bureau of Land Management

NEPA requires that federal agencies consider mitigation of direct, indirect, and cumulative impacts during their preparation of an EIS (BLM Land Use Planning Manual 1601). Under the CAA, federal agencies are to comply with SIPs regarding the control and abatement of air pollution. Prior to approval of Resource Management Plans (RMP) or amendments to RMPs, the State Director is to submit any known inconsistencies with SIPs to the governor of that state. If the governor of the state recommends changes in the proposed RMP or amendments to meet SIP requirements, the State Director shall provide the public an opportunity to comment on those recommendations (BLM Land Use Planning Manual in Section 1610.3-2).

U.S. Forest Service

The USFS administers National Forests, which include three wilderness areas (WA) with mandatory federal PSD Class I designation: Bridger WA; Fitzpatrick WA; and Washakie WA. In addition, the Class II Popo Agie and Wind River Roadless Areas need to be included in the planning area analysis. As Federal Land Managers, the USFS could act in a consultative role to recommend that the BLM impact analysis results, or any future EPA or state-administered PSD refined impact analysis results (if justified), trigger adverse impairment status. Should the USFS determine impairment of WAs, then BLM, the state, and/or EPA may need to mitigate this predicted adverse air quality effect.

National Park Service

Grand Teton National Park and Yellowstone National Park could experience direct effects associated with the Pinedale Field Office BLM emissions. As Federal Land Managers, the NPS could act in a consultative role to recommend that the BLM impact analysis results, or any future EPA or state-administered PSD refined impact analysis results (if justified), trigger adverse impairment status. Should the NPS determine impairment of NPS-administered PSD Class I areas, then BLM, the state, and/or EPA may need to mitigate this predicted adverse air quality effect.

EXISTING AIR QUALITY

As described in Chapter 3, Affected Environment (Air Resources), specific air quality monitoring is not conducted throughout most of the planning area, but air quality conditions are likely to be very good, as characterized by limited air pollution emission sources (i.e., few industrial facilities and residential emissions in the relatively small communities and isolated ranches) and good atmospheric dispersion conditions, resulting in relatively low air pollutant concentrations. Table A19-3 summarizes the ambient air quality background concentrations in the planning area. This information was provided by the WDEQ. Although monitoring is primarily conducted in urban or industrial areas, the data selected are considered to be the best available representation of background air pollutant concentrations throughout the planning area. The assumed background pollutant concentrations are below applicable ambient air quality standards for all pollutants and averaging times. (However, ozone levels approach the standards.) These national and Wyoming standards, and PSD increment values are also presented in Table A19-1 and Table A19-2.

Table A19-3. Assumed Background Concentrations, Applicable Ambient Air Quality Standards, and PSD Increment Values (in $\mu g/m^3$)

Pollutant/Averaging Time Measured	Measured Background Concentration $\mu g/m^3$	Percent of Standards Data		Data Source
		NAAQS	WAAQS	
Carbon Monoxide (CO)				
1-hour	1,979	5	5	Data collected in Yellowstone National Park, WY, monitoring site near “Old Faithful” during 2005 (Pinedale Anticline Draft Supplement EIS, 2006). (Pinedale Anticline Draft
8-hour	931	9	9	

Pollutant/Averaging Time Measured	Measured Background Concentration µg/m^3	Percent of Standards Data		Data Source
		NAAQS	WAAQS	
				Supplement EIS, 2006).
Nitrogen Dioxide (NO_2)				
Annual	19.1	6	6	Data collected in the Jonah Field, approximately 40 miles northwest of Farson, Sublette County, Wyoming. Values are based on a partial year of data (Jan 15 to Dec 31) collected during 2005. (Pinedale Anticline Draft Supplement EIS, 2006).
Ozone				
8-hour	152	97	97	Data collected in the Jonah Field, approximately 40 miles northwest of Farson, Sublette County, Wyoming. Values are based on a partial year of data (Jan 15 to Dec 31) collected during 2005. (Pinedale Anticline Draft Supplement EIS, 2006).
Particulate Matter (PM_{10})[a]				
24-hour	51	34	34	Data collected in the Jonah Field, approximately 40 miles northwest of Farson, Sublette County, Wyoming. Values are based on a partial year of data (Jan 15 to Dec 31) collected during 2005. (Pinedale Anticline Draft Supplement EIS, 2006).
Annual	10	20	20	
Particulate Matter ($PM_{2.5}$)[a]				
24-hour	18	28	28	Data collected in the Jonah Field, approximately 40 miles northwest of Farson, Sublette County, Wyoming.
Annual	6.5	43	43	

Pollutant/Averaging Time Measured	Measured Background Concentration $\mu g/m^3$	Percent of Standards Data		Data Source
		NAAQS	WAAQS	
				Values are based on a partial year of data (Jan 15 to Dec 31) collected during 2005. (Pinedale Anticline Draft Supplement EIS, 2006).
Sulfur Dioxide (SO_2)				
3-hour	132	100	100	Data collected in the Jonah Field, approximately 40 miles northwest of Farson, Sublette County, Wyoming. Values are based on a partial year of data (Jan 15 to Dec 31) collected during 2005. (Pinedale Anticline Draft Supplement EIS, 2006).
24-hour	43	12	17	
Annual	9	11	15	
Carbon Monoxide (CO)				
1-hour	1,979	5	5	Data collected in Yellowstone National Park, WY, monitoring site near "Old Faithful" during 2005 (Pinedale Anticline Draft Supplement EIS, 2006).
8-hour	931	9	9	
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Annual	19.1	6	6	Data collected in the Jonah Field, approximately 40 miles northwest of Farson, Sublette County, Wyoming. Values are based on a partial year of data (Jan 15 to Dec 31) collected during 2005.
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		NAAQS	WAAQS	
				a partial year of data (Jan 15 to Dec 31) collected during 2005.

On September 21, 2006, EPA announced final revisions to the National Ambient Air Quality Standards for particulate matter. The revision strengthens the 24-hour PM2.5 standard from 65 to 35 ug/m3 and revokes the annual PM10 standard of 50 ug/m3. EPA retained the existing annual PM2.5 standard of 15 ug/m3 and the 24-hour PM10 standard of 150 ug/m3. The final rule has not yet been published in the Federal Register and is not effective until 60 days after publication in the Federal Register. After the final rule becomes effective, the State of Wyoming will enter into rulemaking to revise the Wyoming Ambient Air Quality Standards.

Air Quality Impact Assessment

As described in Chapter 4, Environmental Consequences (Air Quality), a qualitative emission comparison approach was used. The emissions calculations were based on the best available engineering data and assumptions; air, visibility, and atmospheric deposition data; and emission inventory procedures, as well as professional and scientific judgment. However, when specific data or procedures were not available, assumptions were applied.

Maximum potential near-field particulate matter emissions from traffic on unpaved roads and during well pad construction were used to estimate emissions for $PM_{2.5}$ and PM_{10} impacts. Maximum air pollutant emissions from each oil and gas well would be temporary (i.e., occurring during a 12-day construction period) and would occur in isolation, without significantly interacting with adjacent well locations. Particulate matter emissions from well pad and resource road construction would be minimized by application of water and/or chemical dust suppressants. The control efficiency of these dust suppressants was estimated at 50% during construction. During well completion testing, natural gas could be burned (flared) for 1 to 6 days.

For any future projects, significance criteria for potential air quality impacts will include local, state, tribal, and federally enforced legal requirements to ensure air pollutant concentrations remain within specific allowable levels. These requirements and legal limits were presented in Table A19-1. Because neither the WDEQ-AQD nor EPA has established ambient HAP standards, only emissions were calculated.

Because the potential air pollutant emission sources constitute many small sources spread over a very large area, discrete visible plumes are not likely to affect the distant sensitive areas, but the potential for cumulative visibility impacts (increased regional haze) are a concern. Regional haze degradation is caused by fine particles and gases scattering and absorbing light. Potential changes to regional haze are calculated in terms of a perceptible “just noticeable change” (1.0 deciview [dv]) in visibility when compared with background conditions. A 1.0-dv change is considered potentially significant in mandatory federal PSD Class I areas, as described in the EPA Regional Haze Regulations (40 CFR §51.300 et seq.) and as originally presented in Pitchford and Malm (1994). A 1.0-dv change is defined as about a 10% change in the extinction coefficient (corresponding to a 2% to 5% change in contrast, for a black target against a clear sky, at the most optically sensitive distance from an observer), which is a small but noticeable change in haziness under most circumstances when viewing scenes in mandatory federal PSD Class I areas.

It should be noted that a 1.0-dv change is not a "just noticeable change" in all cases for all scenes. Visibility changes of less than 1.0 dv are likely to be perceptible in some cases, especially when the scene being viewed is highly sensitive to small amounts of pollution, such as that caused by preferential forward light scattering. Under other view-specific conditions, such as when the sight path to a scenic feature is less than the maximum visual range, a change greater than 1.0 dv might be required to be a "just noticeable change." However, any future project-specific NEPA analyses will not be designed to predict specific visibility impacts for specific views in specific mandatory federal PSD Class I areas based on specific project designs, but rather to characterize reasonably foreseeable visibility conditions that are representative of a fairly broad geographic region, based on emission source assumptions. This approach is consistent with both the nature of regional haze and the requirements of NEPA. At the time of a pre-construction air quality PSD permit review, the WDEQ-AQD may require a much more detailed visibility impact analysis. Factors such as the magnitude of change, frequency, time of the year, and the meteorological conditions during times when predicted visibility impacts are above the 1.0-dv threshold (as well as inherent conservatism in the impact analyses) should all be considered when assessing the significance of predicted impacts.

The USFS, NPS and USFWS have published their "Final FLAG Phase I Report" (*Federal Register*, Vol. 66, No. 2, January 3, 2001), providing *"a consistent and predictable process for assessing the impacts of new and existing sources on AQRVs"* including visibility. For example, the FLAG report states *"A cumulative effects analysis of new growth (defined as all PSD increment-consuming sources) on visibility impairment should be performed,"* and further, *"If the visibility impairment from the proposed action, in combination with cumulative new source growth, is less than a change in extinction of 10% [1.0 dv] for all time periods, the FLMs will not likely object to the proposed action."*

Estimation of Emission Factors

For natural gas compressor engines, the emissions of nitrogen oxides, CO, and formaldehyde are determined by the average permitted emission rate allowed by the state under BACT processes. For fugitive dust impacts, emission rates are obtained from EPA's *AP-42* document entitled *A Compilation of Air Pollutant Emission Factors*. An *AP-42* emission factor is a representative value that is an attempt to relate the quantity of a pollutant released to the atmosphere to an activity associated with the release of that pollutant. Emission factors may be appropriate to use in a number of situations such as making source-specific emission estimates for areawide inventories. These inventories have many purposes, including ambient dispersion modeling and analysis, control strategy development, and in screening sources for compliance investigations. In most cases, these factors are simply averages of all available data of acceptable quality and are generally assumed to be representative of long-term averages for all sources in a specific category.

Emission Assumptions

When reviewing the emission inventory, it is important to understand that assumptions were made regarding development. For example, there is uncertainty regarding ultimate development of energy resources (i.e., number of wells, equipment to be used, specific locations of wells, etc.).

For the qualitative emission comparison approach, the following assumptions were used:

- All emission sources are assumed to operate at their reasonably foreseeable maximum emission rates (as identified in the other resource sections of this document), simultaneously throughout the area. Given the number of sources included in this analysis, the co-probability of such a scenario actually occurring over an entire year (or even 24 hours) is small.

- In developing the emissions inventory, there is uncertainty regarding ultimate development (i.e., number of wells, equipment to be used, specific locations, etc.). All proposed gas wells were assumed to be fully operational and remain operating, except for normal well closures throughout the area. (Well numbers were provided by the BLM Reservoir Management Group.)
- The emissions inventory uses peak years of construction and peak years of operations, which would not occur throughout the entire development region at the same time. However, it is possible that conditions close to these could occur in some isolated areas. In addition, it is assumed that the maximum cumulative emissions will occur in the last year (2021) of the analysis.
- The South Piney EIS estimates for compressor engines are used (McVehil-Monnett Associates 2004) and are 170 horse power (hp) per well for a conventional gas field and 250 hp per well for methane from a coal field.
- Mitigation measures are included in the emissions inventory that may not be achievable in all circumstances. However, actual mitigation decided upon by the developers and local and state authorities may be greater or lesser than those assumed in the analysis. For example, maintaining a construction road speed limit of 15 miles per hour (mph) may be reasonable in a construction zone but difficult to enforce elsewhere. Full (100%) mitigation of fugitive dust from disturbed lands may not be achievable. Further, 50% reduction in fugitive emissions is assumed based on construction road wetting on the unimproved access road to the pad and at the pad, but this level of effectiveness is characterized as the maximum possible. Wetting was assumed for maintenance traffic.
- Induced or secondary growth related to increases in vehicle miles traveled (VMT) is not included in the emissions inventory. Only activities directly related to BLM actions are considered.

The major assumptions used in developing the emissions calculations are—

- Except for those emission factors that have been lowered through the WDEQ-AQD BACT requirements, EPA-recommended emission factors (i.e., *AP-42*) are appropriate for all activities.
- The base year is 2001.
- Activity factors (or the quantification of activity for each resource program as provided by the Pinedale Field Office) are appropriate for the base year and future time frames.
- Any anticipated recreational growth would follow growth trends for Wyoming over the past 10 years.
- For the qualitative analysis, only emissions from Pinedale Field Office BLM-administered activities are included. (For the cumulative analysis, emissions calculated by TRC (TRC 2004) are included for other federal and non-federal actions throughout the state.)
- Criteria pollutants and HAPs are included in the calculations.
- No trona mining activity occurs in the planning area.

Emissions were calculated for the following activities: lands and realty actions, livestock grazing, off-highway vehicles (OHV), resource roads, saleable minerals, vegetation, fire, and natural gas development.

Activities related to weed control, and wildlife and fisheries are assumed to be insignificant sources of air emissions.

A qualitative emission comparison approach was selected for this RMP air quality analysis. This approach was used because: (1) sufficient specific data were not available on future projects; (2) there was limited time available to complete the analysis; (3) as projects are defined, quantitative analysis will be required; and (4) WDEQ-AQD will require demonstration of compliance for any future specific projects. There are limitations associated with this approach. However, given the uncertainties with the number, nature, and specific location of future sources and activities, the emission comparison approach is defensible and provides a sound basis to compare alternatives.

It is important to note that before actual development could occur, the applicable air quality regulatory agencies (including the state, tribe, or EPA) would review specific air pollutant emissions preconstruction permit applications that examine potential project-specific air quality impacts. As part of these permit reviews (depending on source size), the air quality regulatory agencies could require additional air quality impact analyses or mitigation measures. Thus, before development occurs, additional site-specific air quality analyses would be performed to ensure protection of air quality. Federal Land Managers will require a demonstration that potential impacts from proposed projects will not adversely affect air quality related values (including visibility) in PSD Class I and sensitive Class II areas.

Emissions Calculations

Emissions for All Activities Except Fire

A summary of emission inventories for each of the BLM activities for the base year, short-term, and long-term scenarios for all of the alternatives are found in Chapter 4. These emissions were calculated from data provided by the Pinedale Field Office and used the best available information, BACT, AP-42, and the emission studies from other BLM documents.

The assumed numbers of oil and gas wells are provided by the Pinedale Field Office and are shown in Table A19-4. This table accounts for new wells to be drilled in the planning area.

Table A19-4. Numbers of Oil and Gas Wells for the Pinedale Field Office

Well Type	Existing Wells Through 2001	2011 Operational Wells	2021 Operational Wells
Alternative 1 (No Action Alternative)			
Total CBNG Wells	5	256	512
Total Conventional Gas Wells	2,168	3,964	7,927
Total Combined Wells	**2,173**	**4,220**	**8,439**
Alternative 2			
Total CBNG Wells	5	293	586
Total Conventional Gas Wells	2,168	4,233	8,465
Total Combined Wells	**2,173**	**4,526**	**9,051**
Alternative 3			
Total CBNG Wells	5	191	382
Total Conventional Gas Wells	2,168	3,037	6,074
Total Combined Wells	**2,173**	**3,228**	**6,456**

Well Type	Existing Wells Through 2001	2011 Operational Wells	2021 Operational Wells
Alternative 4 (The Preferred Alternative)			
Total CBNG Wells	5	224	547
Total Conventional Gas Wells	2,168	3,918	7,836
Total Combined Wells	**2,173**	**4,192**	**8,383**

Using the well numbers and a well abandonment rate of 12%, individual tables of air emissions for all BLM activities were calculated in linked spreadsheets. These spreadsheets are available at the BLM Pinedale Field Office or Wyoming State Office (see Table A19-5 for a table of contents).

Because oil and gas field activities comprise many phases (i.e., exploration, development, production and closure), the components that need to be included in emission calculations are complex. To understand the elements and assumptions used in the emissions calculations on the emissions CD, the following is a summary list of what is on the emissions CD.

Table A19-5. Table of Contents for Emissions CD

Tab Name	Tab Description
Assumptions **Conventional Oil and Gas Assumptions**	
ng-pad const.-fug dust	Well Pad Construction and Fugitive Dust Short- and Long-Term Development
Well Field Gas Charac	Well Field Gas Characteristics
ng-pad const. exh & flare-shrt	Well Pad Construction Equipment Exhaust and Well Completion Flaring Short-Term Development
ng-pad const. exh & flare-long	Well Pad Construction Equipment Exhaust and Well Completion Flaring Long-Term Development
ng-commuting veh-fug dust-shrt	Well Pad Construction Commuting Vehicles Fugitive Dust Short-Term Development
ng-commuting veh-fug dust-long	Well Pad Construction Commuting Vehicles Fugitive Dust Long-Term Development
ng-commuting veh-exhaust-shrt	Well Pad Construction Commuting Vehicles Exhaust Short-Term Development
ng-commuting veh-exhaust-long	Well Pad Construction Commuting Vehicles Exhaust Long-Term Development
ng-Operations-NG compress-shrt	Well Pad Operations Natural Gas Compressors Short-Term Development
ng-Operations-NG compress-long	Well Pad Operations Natural Gas Compressors Long-Term Development
ng-Op NG Dehyd&Flash&Flare	Well Pad Operations Dehydrators and Tank Flashing and Flaring Short- and Long-Term Development
ng-Ops-Dehyd&Sep-heaters	Well Pad Operations Glycol Dehydrators and Three-Phase Separator Heaters Short- and Long-Term Development
ng-Ops-sta. vis-dust&exh-short	Well Pad Operations Station Visits Fugitive Dust and Vehicle Exhaust Short-Term Development

Tab Name	Tab Description
ng-Ops-sta. vis-dust&exh-long	Well Pad Operations Station Visits Fugitive Dust and Vehicle Exhaust Long-Term Development
ng-Ops-WO-dust&exh-short	Well Pad Operations Well Workover Fugitive Dust and Vehicle Exhaust Short-Term Development
ng-Ops-WO-dust&exh-long	Well Pad Operations Well Workover Fugitive Dust and Vehicle Exhaust Long-Term Development
ng-Ops W&P vis-dust&exh-shrt	Well Pad Operations Well and Pipe Visits Fugitive Dust and Vehicle Exhaust Short Term Development
ng-Ops W&P vis-dust&exh-long	Well Pad Operations Well and Pipe Visits Fugitive Dust and Vehicle Exhaust Long-Term Development
ng-Road maint-dust&exh-shrt	Well Pad Maintenance Roads Fugitive Dust and Vehicle Exhaust Short-Term Development
ng-Road maint-dust&exh-long	Well Pad Maintenance Roads Fugitive Dust and Vehicle Exhaust Long-Term Development
ng-Comp maint-dust&exh-short	Well Pad Maintenance Compressors Fugitive Dust and Vehicle Exhaust Short-Term Development
ng-Comp maint-dust&exh-long	Well Pad Maintenance Compressors Fugitive Dust and Vehicle Exhaust Long-Term Development
Tanks Condensate & Loadout	Well Pad Operations Condensate Tanks VOC Emissions Short- and Long-Term Development
ng-summary-criteria-short	Natural Gas Development Summary of Short-Term Development Emissions
Annual Summary 2011	Natural Gas Development Annual Emissions Summary 2011
Annual Summary 2021	Natural Gas Development Annual Emissions Summary 2021
ng-summary-criteria-long	Natural Gas Development Summary of Long-Term Development Emissions
Assumptions **CBNG Wells Inputs and Assumptions**	
CBNG-pad const.-fug dust	Well Pad Construction and Fugitive Dust Short- and Long-Term Development
CBNG-Well Field Gas Charac	Well Field Gas Characteristics
CBNG-pad const. traff-exh-shrt	Well Pad Construction Equipment Exhaust Short-Term Development
CBNG-pad const. traff-exh-long	Well Pad Construction Equipment Exhaust Long-Term Development
CBNG-commut veh-fug dust-shrt	Well Pad Construction Commuting Vehicles Fugitive Dust Short-Term Development
CBNG-commut veh-fug dust-long	Well Pad Construction Commuting Vehicles Fugitive Dust Long-Term Development
CBNG-commut veh-exhaust-shrt	Well Pad Construction Commuting Vehicles Exhaust Short Term Development
CBNG-commut veh-exhaust-long	Well Pad Construction Commuting Vehicles Exhaust Long-Term Development
CBNG-Ops-NG compress-shrt	Well Pad Operations Natural Gas Compressors Short Term Development

Tab Name	Tab Description
CBNG-Ops-NG compress-long	Well Pad Operations Natural Gas Compressors Long Term-Development
CBNG-Dehy Shrt&long	Well Pad Operations Dehydrators Short and Long Term-Development
CBNG-Ops-Sep Dehy-shrt&long	Well Pad Operations Separator Heaters and Dehydrators Short- and Long-Term Development
CBNG-Ops-sta. vis-dust&exh-shrt	Well Pad Operations Station Visits Fugitive Dust and Vehicle Exhaust Short-Term Development
CBNG-Ops-sta. vis-dust&exh-long	Well Pad Operations Station Visits Fugitive Dust and Vehicle Exhaust Long-Term Development
CBNG-Ops-WO-dust&exh-short	Well Pad Operations Well Workover Fugitive Dust and Vehicle Exhaust Short-Term Development
CBNG-Ops-WO-dust&exh-long	Well Pad Operations Well Workover Fugitive Dust and Vehicle Exhaust Long-Term Development
CBNG-Ops W&P vis-dust&exh-shrt	Well Pad Operations Well and Pipe Visits Fugitive Dust and Vehicle Exhaust Short-Term Development
CBNG-Ops W&P vis-dust&exh-long	Well Pad Operations Well and Pipe Visits Fugitive Dust and Vehicle Exhaust Long-Term Development
CBNG-road maint-dust&exh-shrt	Well Pad Maintenance Roads Fugitive Dust and Vehicle Exhaust Short-Term Development
CBNG-road maint-dust&exh-long	Well Pad Maintenance Roads Fugitive Dust and Vehicle Exhaust Long-Term Development
CBNG-Comp maint-dust&exh-short	Well Pad Maintenance Compressors Fugitive Dust and Vehicle Exhaust Short-Term Development
CBNG-Comp maint-dust&exh-long	Well Pad Maintenance Compressors Fugitive Dust and Vehicle Exhaust Long-Term Development
CBNG Water Reinjection	Well Pad CBNG Water Reinjection Short- and Long-Term Development
CBNG-summary-criteria-short	Coalbed Natural Gas Summary of Short-Term Development Emissions
Annual CBNG Summary 2011	Coalbed Natural Gas Annual Emissions Summary 2011
Annual CBNG Summary 2021	Coalbed Natural Gas Annual Emissions Summary 2021
CBNG-summary-criteria-long	Coalbed Natural Gas Summary of Long Term Development Emissions
Lands and Realty	
L&R-heavyequip-dust-shrt&long	
L&R-heavyequip-exh-shrt&long	
L&R-Commuting-FugDust-short	
L&R-Commuting-FugDust-long	
L&R-Commuting-exhaust-short	
L&R-Commuting-exhaust-long	
Summary-short	
Summary-long	

Tab Name	Tab Description
Livestock Grazing	
LG-heavyequip-dust-shrt&long	
LG-heavyequip-exh-shrt&long	
LG-Commuting-FugDust-shortunpav	
LG-Commuting-FugDust-shortpaved	
LG-Commuting-FugDust-longunpav	
LG-Commuting-FugDust-longpaved	
LG-Commuting-exhaust-short	
LG-Commuting-exhaust-long	
Summary-short	
Summary-long	
Off Highway Vehicles	
ATVs	
OH Motorcycles	
Snow mobiles	
OHV-Summary	
Resource Roads	
res road-dust&exh-short	
res road-dust&exh-long	
Saleable Minerals	
sg-dry,hand,screen,load,etc.	
sg-unpaved roads	
sg-batchdrop	
heavy equipment-all operations	
gran-crush,screen,tx,etc	
gran-unpaved roads	
granite-batchdrop	
lime-crush,screen,tx,etc	
lime-unpaved roads	
limestone-batchdrop	
saleable-summary	
Vegetation	
Veg-heavyequip-dust-shrt&long	
Veg-heavyequip-exh-shrt&long	
Veg-Commuting-FugDust-short	
Veg-Commuting-FugDust-long	
Veg-Commuting-exhaust-short	
Veg-Commuting-exhaust-long	

Tab Name	Tab Description
Summary-short	
Summary-long	

The tables are linked spreadsheets with emissions calculations for the short-term and long-term time frames. Each set of calculations for the non oil and gas spreadsheets are cumulative, that is, the total emissions for all activities cumulative for 10 and 20 years, respectively. At the beginning of each spreadsheet, the emission factors and activity factors are identified in tabular format.

The detailed emissions tables identified above are available on request from Susan Caplan.

(Same analysis and tabs for Base Year as above for 2001)

Prescribed Fire Emissions Estimation

To estimate the total emissions of particulate matter and CO from prescribed fires, the Simple Approach Smoke Estimation Model (SASEM) was used. SASEM is a simple screening level Gaussian dispersion model designed to predict ground-level particulate matter impacts from a single source (fire) in generally flat terrain for the western United States.

Where possible, site-specific information, as provided by the Pinedale Field Office, was used as input to the model. Where such information was not available, either built-in model defaults or professional judgment were used to supply missing data. Because detailed data on vegetation control and burning were lacking, field office personnel estimates were used. It is assumed that 500 acres per year are burned.

It should be noted that the Emission Production Module (EPM) of SASEM was used only to estimate total emissions for each event as input to the qualitative air quality assessment. (See references in Chapter 4, Sestak and Riebau 1988.)

The detailed results for these model runs are available from Susan Caplan.

Planning Area BLM Emissions

Table A19-6 through Table A19-8 show the summary of total BLM emissions estimated for the base year (2001), the short term (2011), and the long term (2021). The tables are broken down by activity for each pollutant for emissions within the time frame referenced (i.e., base year, short term, and long term). The emissions are calculated on an annual basis (i.e., tons per year). Emissions were calculated for each alternative. Because the base year results are the same for all alternatives, only one set of base year emissions was needed. These tables were used to generate the summary tables for Chapter 4.

Table A19-6. Base Year (2001) Emissions Inventory for BLM-Administered Lands Within the Planning Area (tons per year)

Activity	PM_{10} Tons	$PM_{2.5}$ Tons	NOx Tons	SO2 Tons	CO Tons	VOC Tons	HAPs Tons
Base Case							
Coalbed Natural Gas	70	39	226	3	248	120	20
Lands and Realty	186	28	4	0	21	22	2
Livestock Grazing	18	3	1	0	0	0	0
OHV	1	1	0	0	27	15	2
Resource Roads	1	0	1	0	0	0	0

Activity	PM_{10} Tons	$PM_{2.5}$ Tons	NOx Tons	SO2 Tons	CO Tons	VOC Tons	HAPs Tons
Saleable Minerals	129	28	0	0	0	0	0
Vegetation	1	0	0	0	0	0	0
Fire	51	46	0	0	0	0	0
Subtotal: Other Activities	387	106	6	0	82	44	4
Conventional Natural Gas	1,608	886	7,492	87	8,503	13,298	1,579
Total Base Year 2001	**2,065**	**1,031**	**7,724**	**90**	**8,833**	**13,462**	**1,603**

Table A19-7. Short-term (2011) Emissions Inventory for BLM-Administered Lands Within the Planning Area (tons per year)

Activity	PM_{10} Tons	$PM_{2.5}$ Tons	NOx Tons	SO2 Tons	CO Tons	VOC Tons	HAPs Tons
Alternative 1 (Continuation of Existing Management)							
Coalbed Natural Gas	279	216	1,326	7	2,384	1,389	217
Lands and Realty	186	28	4	0	21	22	2
Livestock Grazing	18	3	1	0	0	0	0
OHV	1	1	0	0	76	29	3
Resource Roads	1	0	1	0	0	0	0
Saleable Minerals	129	28	0	0	0	0	0
Vegetation	1	0	0	0	0	0	0
Fire	51	46	0	0	0	0	0
Subtotal: Other Activities	387	106	6	0	97	51	5
Conventional Natural Gas	2,696	1,899	13,995	110	18,802	30,301	3,650
Total Short Term	**3,362**	**2,221**	**15,327**	**117**	**21,283**	**31,741**	**3,872**
Alternative 2							
Coalbed Natural Gas	319	249	1,514	8	2,722	1,585	247
Lands and Realty	186	28	4	0	21	22	2
Livestock Grazing	18	3	1	0	0	0	0
OHV	1	1	0	0	76	29	3
Resource Roads	1	0	1	0	0	0	0
Saleable Minerals	129	28	0	0	0	0	0
Vegetation	1	0	0	0	0	0	0
Fire	51	46	0	0	0	0	0
Subtotal: Other Activities	387	106	6	0	97	51	5
Conventional Natural Gas	2,834	1,987	14,685	117	20,693	31,643	3,811
Total Short Term	**3,540**	**2,342**	**16,205**	**125**	**23,512**	**33,279**	**4,063**
Alternative 3							
Coalbed Natural Gas	210	164	995	5	1,790	1,843	163

Activity	PM_{10} Tons	$PM_{2.5}$ Tons	NOx Tons	SO2 Tons	CO Tons	VOC Tons	HAPs Tons
Lands and Realty	186	28	4	0	21	22	2
Livestock Grazing	18	3	1	0	0	0	0
OHV	1	1	0	0	76	29	3
Resource Roads	1	0	1	0	0	0	0
Saleable Minerals	129	28	0	0	0	0	0
Vegetation	1	0	0	0	0	0	0
Fire	51	46	0	0	0	0	0
Subtotal: Other Activities	387	106	6	0	97	51	5
Conventional Natural Gas	2,223	1,596	11,619	88	16,733	25,274	3,054
Total Short Term	**2,820**	**1,866**	**12,620**	**93**	**18,620**	**27,168**	**3,222**
Alternative 4 (Preferred Alternative)							
Coalbed Natural Gas	298	232	1415	7	2,544	1,482	231
Lands and Realty	186	28	4	0	21	22	2
Livestock Grazing	18	3	1	0	0	0	0
OHV	1	1	0	0	76	29	3
Resource Roads	1	0	1	0	0	0	0
Saleable Minerals	129	28	0	0	0	0	0
Vegetation	1	0	0	0	0	0	0
Fire	51	46	0	0	0	0	0
Subtotal: Other Activities	387	106	6	0	97	51	5
Conventional Natural Gas	2,629	1,880	13,661	105	19,600	29,939	3,609
Total Short Term	**3,314**	**2,218**	**15,082**	**112**	**22,241**	**31,472**	**3,845**

[a] $PM_{2.5}$ assumed = PM_{10} for this activity.
[b] HAP assumed = VOC $\times$ 0.1 for non-oil and gas activities

Table A19-8. Long-Term (2021) Emissions Inventory for BLM-Administered Lands Within the Planning Area (tons per year)

Activity	PM_{10} Tons	$PM_{2.5}$ Tons	NOx Tons	SO2 Tons	CO Tons	VOC Tons	HAPs Tons
Alternative 1 (Continuation of Existing Management)							
Coalbed Natural Gas	496	420	2512	10	4,695	2,745	428
Lands and Realty	186	28	4	0	21	22	2
Livestock Grazing	18	3	1	0	0	0	0
OHV	1	1	0	0	94	35	4
Resource Roads	1	0	1	0	0	0	0
Saleable Minerals	129	28	0	0	0	0	0
Vegetation	1	0	0	0	0	0	0

Activity	PM_{10} Tons	$PM_{2.5}$ Tons	NOx Tons	SO2 Tons	CO Tons	VOC Tons	HAPs Tons
Fire	51	46	0	0	0	0	0
Subtotal: Other Activities	387	106	6	0	115	57	6
Conventional Natural Gas	3,946	3,004	21,006	135	28,100	47,178	5,800
Total Long Term	**4,829**	**3,530**	**23,524**	**145**	**32,910**	**49,980**	**6,234**
Alternative 2							
Coalbed Natural Gas	567	480	2,872	12	5,367	3,138	490
Lands and Realty	186	28	4	0	21	22	2
Livestock Grazing	18	3	1	0	0	0	0
OHV	1	1	0	0	94	35	4
Resource Roads	1	0	1	0	0	0	0
Saleable Minerals	129	28	0	0	0	0	0
Vegetation	1	0	0	0	0	0	0
Fire	51	46	0	0	0	0	0
Subtotal: Other Activities	387	106	6	0	105	57	6
Conventional Natural Gas	4,180	3,169	22,172	144	29,557	49,666	5,614
Total Long Term	**5,134**	**3,755**	**25,050**	**156**	**35,029**	**52,881**	**6,110**
Alternative 3							
Coalbed Natural Gas	375	315	1,880	8	3515	2,055	321
Lands and Realty	186	28	4	0	21	22	2
Livestock Grazing	18	3	1	0	0	0	0
OHV	1	1	0	0	94	35	4
Resource Roads	1	0	1	0	0	0	0
Saleable Minerals	129	28	0	0	0	0	0
Vegetation	1	0	0	0	0	0	0
Fire	51	46	0	0	0	0	0
Subtotal: Other Activities	387	106	6	0	105	57	6
Conventional Natural Gas	3,150	2,443	16,991	107	26,086	39,044	4,738
Total Long Term	**3,912**	**2,864**	**18,877**	**115**	**29,706**	**41,156**	**5,065**
Alternative 4 (Preferred Alternative)							
Coalbed Natural Gas	535	449	2,502	11	5,013	2,931	457
Lands and Realty	186	28	4	0	21	22	2
Livestock Grazing	18	3	1	0	0	0	0
OHV	1	1	0	0	94	35	4
Resource Roads	1	0	1	0	0	0	0
Saleable Minerals	129	28	0	0	0	0	0
Vegetation	1	0	0	0	0	0	0
Fire	51	46	0	0	0	0	0

Activity	PM_{10} Tons	$PM_{2.5}$ Tons	NOx Tons	SO2 Tons	CO Tons	VOC Tons	HAPs Tons
Subtotal: Other Activities	387	106	6	0	105	57	6
Conventional Natural Gas	3,878	2,974	20,662	131	31,683	47,434	5,755
Total Long Term	**4,800**	**3,529**	**23,170**	**142**	**36,801**	**50,422**	**6,218**

[a] $PM_{2.5}$ assumed = PM_{10} for this activity.
[b] HAP assumed = VOC $\times$ 0.1 for non-oil and gas activities

RESULTS OF IMPACT ANALYSIS

Table A19-9 summarizes the existing conditions presented in Chapter 3, Affected Environmental (Air Quality).

Table A19-9. Existing Conditions

Existing Conditions	
Air Pollutant Concentrations	
Criteria Air Pollutants	• Concentrations are in compliance with NAAQS and WAAQS.
Nitrogen Compounds	• HNO_3 concentrations in Pinedale are consistent with concentrations in other remote areas. HNO_3 concentrations in Yellowstone National Park are consistent with other remote areas. • Concentrations of NO_3 and NH_4 in Pinedale and Yellowstone National Park are consistent with other remote areas.
Sulfur Compounds	• SO_2 concentrations in Pinedale are below concentrations typical in remote areas. SO_2 concentrations in Yellowstone National Park are consistent with other remote areas. • SO_4^{--} concentrations in Pinedale and Yellowstone National Park are below typical concentrations in remote areas.
Visibility	
Bridger Wilderness	• 20% cleanest—155–175 miles • Average—112–128 miles • 20% haziest—71–90 miles
Atmospheric Deposition	
Precipitation pH	• Slight precipitation acidification in Pinedale from 1994 through 2004 (pH as low as 4.9) • Precipitation near-natural in Yellowstone National Park from 1980 through 2004 (pH: 5.1 – 5.7)
Total Deposition	• Pinedale: nitrogen deposition from ammonium (NH_4^+) and nitrate ($NO3^-$) is less than 2.0 kg/ha/yr.[2] Sulfur deposition from sulfate ($SO4^{--}$) and sulfur dioxide (SO_2) is less than 1.7 kg/ha/yr.[3]

The emission inventory results and qualitative impacts for the alternatives are included in Chapter 4, and total emissions are shown in Table 19-10. Table A19-11 shows the increases in emissions from alternative to alternative, and year to year.

Table 19-10. Total Emissions for Alternatives (tons per year)

Alternative	2001	2011	2021
Alternative 1	33,777	75,702	117,622
Alternative 2	33,777	80,724	124,360
Alternative 3	33,777	64,543	98,831
Alternative 4	33,777	76,066	121,553

Note: Totals include PM10, NOx, SO2, CO, VOC, and HAP emissions.

Table A19-11. Increase in Annual Air Emissions from Base Year Conditions on BLM-Administered Lands within the Planning Area

Time Frame	PM_{10} [a]	$PM_{2.5}$ [a]	NO_x [a]	SO_2 [a]	CO [a]	VOC [a]	HAP [a]
Alternative 1 (Continuation of Existing Management)							
2011	1,297 (63%)	1,190 (115%)	7,603 (98%)	27 (30%)	12,450 (141%)	18,279 (136%)	2,269 (142%)
2021	2,764 (134%)	2,499 (242%)	15,800 (205%)	55 (61%)	24,007 (273%)	36,518 (271%)	4,631 (289%)
Alternative 2							
2011	1,475 (71%)	1,311 (109%)	8,481 (110%)	35 (39%)	14,679 (166%)	19,817 (147%)	2,460 (153%)
2021	3,069 (149%)	2,724 (264%)	17,326 (224%)	66 (73%)	26,196 (297%)	39,421 (293%)	4,507 (281%)
Alternative 3							
2011	755 (37%)	835 (81%)	4,896 (63%)	3 (3%)	9,787 (111%)	13,706 (102%)	1,619 (101%)
2021	1,847 (89%)	1,833 (178%)	11,153 (144%)	25 (28%)	20,873 (236%)	27,694 (206%)	3,462 (216%)
Alternative 4 (Preferred Alternative)							
2011	1,249 (60%)	1,187 (115%)	7,358 (95%)	22 (24%)	13,408 (152%)	18,010 (134%)	2,242 (140%)
2021	2,735 (132%)	2,498 (242%)	15,446 (200%)	52 (58%)	27,968 (317%)	36,960 (275%)	4,615 (288%)

[a] Constituents increase in tons per year (and in percentage change from base year emissions)

OTHER EMISSIONS DATA

Although only BLM activities were included in the qualitative analysis, other emissions data are being developed for areas that include the planning area. These data were provided by TRC Environmental Corp (Connell 2004) using State of Wyoming air permit information and other information, which includes the potential to emit (PTE) and some actual emissions for point sources throughout Wyoming that were permitted between January 1, 2001, and June 30, 2003. Table A19-12 and Table A19-13 show the calculations of the incremental increase (i.e., change from the base year) in emissions from January 1, 2001 (the base year) through June 30, 2003, for permitted sources.

The Wyoming Statewide Emission Inventory conducted by TRC indicates that there will be a change in future emissions of NO_x, SO_2, PM_{10}, and $PM_{2.5}$ in the planning area and for the State of Wyoming. This study uses different base year dates. The Wyoming statewide complete emissions increases (or decreases) were calculated (1) from all permitted sources, from January 1, 2001, through June 30, 2003, (2) all new oil and gas commission's sources from 2002, and (3) all NEPA authorized and other quantifiable emissions from June 30, 2003. (This last case is referred to as the Wyoming Statewide Reasonably Foreseeable Development [RFD].) It should be noted that not all emissions permitted or authorized during this period are occurring yet.

The RFD case refers only to oil and gas projects and is the change in emissions after June 30, 2003, for authorized NEPA and other quantifiable emissions. (Specifically, the RFD case is defined by TRC as "*…1) the NEPA-authorized but not yet developed portions of the Wyoming NEPA projects and 2) not yet authorized NEPA projects for which air quality analyses were in progress and for which emissions had been quantified.*") Complete (total) emissions are calculated as well. Table A19-12 shows these emissions. It is expected that these data will someday be integrated with the BLM emissions data to depict all emissions in the planning area and can be used for cumulative analysis. Also, this information will be needed if air dispersion modeling is performed in the area.

Table A19-12. Incremental Emissions from Permitted Sources January 2001 through June 2003 for the Planning Area

Area	WDEQ-AQD Permitted Sources				WOGCC Permitted Oil and Gas Wells[2]			
	Change in Emissions (tpy)				Change in Emissions (tpy)			
	NO_x	SO_2	PM_{10}	$PM_{2.5}$	NO_x	SO_2	PM_{10}	$PM_{2.5}$
Planning Area[1]	583	43	22	22	2	--	--	--
Wyoming	20,344	(85)	(1,812)	(1,535)	150.9	--	--	--

[1] Permitted oil and gas wells category includes Sublette and Teton counties.

[2] Emission factors per well were assumed according to the following: 0.045 tpy of NO_x per producing natural gas or coalbed natural gas well, equivalent to well emission rates calculated for the Jonah Infill Project, 2004; and 0.3 tpy NO_x per producing oil well, obtained from Denise Kohtala, WDEQ-AQD, 2003.

Table A19-13. RFD and Complete Emissions for the Planning Area

Area	RFD[3]				Complete Inventory			
	Change in Emissions (tpy)				Change in Emissions (tpy)			
	NO_x	SO_2	PM_{10}	$PM_{2.5}$	NO_x	SO_2	PM_{10}	$PM_{2.5}$
Planning Area[1]	1,135	1	82	80	1,719	44	103	102
Wyoming	6,016	115	741	195	26,511	30	(1,072)	(1,343)

[1] Permitted oil and gas wells category includes Sublette and Teton counties.

[2] Emission factors per well were assumed according to the following: 0.045 tpy of NO_x per producing natural gas or coalbed natural gas well, equivalent to well emission rates calculated for the Jonah Infill Project, 2004; and 0.3 tpy NO_x per producing oil well, obtained from Denise Kohtala, WDEQ-AQD, 2003.

[3] RFD defined as authorized NEPA projects and NEPA projects not yet authorized but for which air emissions have been quantified.

The data in Table A19-12 indicate that permitted sources from January 1, 2001, through June 30, 2003, have contributed to additional NO_x emissions of 583 tons per year and other pollutants were reduced in emissions for the planning area. Further, the oil and gas commission data indicate that an incremental amount of 2 tons per year for NO_x should be added.

CONCLUSIONS AND RECOMMENDATIONS

A qualitative emission comparison approach was selected for analysis of impacts on air quality. This approach was used because: (1) sufficient specific data were not available on future projects, (2) there was limited time available to complete the analysis, (3) quantitative analysis will be required as development projects are defined in the future, and 4) WDEQ-AQD will require demonstration of compliance with federal and state air quality regulations and standards for any future development projects. Given the uncertainties regarding the number, nature, and specific location of future emission sources and activities, the emission comparison approach is defensible and provides a sound basis to compare the potential impacts under the various alternatives. Federal Land Managers will require a demonstration that potential impacts from proposed projects will not adversely affect air quality related values (including visibility) in PSD Class I and sensitive Class II areas.

For the RMP specific air quality analysis, BLM concludes the following:

Under Alternative 1, emissions have been calculated for the base year, 10-year, and 20-year time horizons. These will serve as the basis for comparisons of alternatives. Information in Tables A14-6 through A14-8 indicates that the total emissions of criteria pollutants increase from 33,777 tons per year in the base year (2001) to 117,622 tons per year by 2021. Most of the increase is to the result of oil and gas exploration and development. Alternative 2 produces higher emissions than Alternative 1 (emissions of 124,360 tons per year in 2021), and Alternative 3 produces lower emissions estimates for 2021 (98,831 tons per year). Alternative 4 produces emissions that are between those of Alternatives 2 and 3 (121,553 tons per year).

Given the low ambient concentrations that exist in the planning area for all of the pollutants except O_3, it is expected that, for any alternative, the increase in emissions of CO, NO_2, SO_2, PM_{10}, and $PM_{2.5}$ will not cause any exceedance of state or federal ambient air quality standards. Because a quantitative relationship between the expected air emissions calculated above and the subsequent potential impacts on ambient criteria pollutant concentrations, visibility, atmospheric deposition, or ozone are not known, it is not possible to draw any conclusions regarding potential impacts on these air quality values from any alternative. BLM intends to make quantitative estimates of these impacts for project-specific EISs and in the statewide air quality analysis.

For the cumulative analysis, BLM concludes the following:

- Given the low ambient concentrations that exist in the planning area for criteria pollutants except O_3, it is expected that the cumulative increase in emissions for sources in the region of influence (ROI) of CO, NO_x, SO_2, PM_{10}, and $PM_{2.5}$ would not cause any exceedance of state or federal ambient air quality standards.

Because a quantitative relationship between the expected air emissions calculated above and the subsequent potential cumulative impacts on the air quality values of visibility, atmospheric deposition, or ozone are not known, it is not possible to quantify potential impacts on these air quality values from the sources in the ROI. However, because air quality analyses from recent energy development projects, such as the Pinedale Anticline EIS (1999), estimate potential impacts on visibility, emissions described in Section 4.2 may contribute to significant impacts on visibility.

INTERNET RESOURCES

To develop the data used in this document, a number of Internet resources were accessed. Key information concerning emission factors and emissions was obtained from the EPA websites.

Climate

- Western Regional Climate Center: http://www.wrcc.sage.dri.edu/climsum.html/
- NOAA: http://www.noaa.gov

Stagnation Index: http://www.ncdc.noaa.gov/oa/climate/research/stagnation/stagnation.html

Air Quality: Emissions

- EPA: http://www.epa.gov/ttn/chief/ap42

Air Quality: Concentrations

- EPA: http://www.epa.gov/air/data/geosel.html
- CASTNet: EPA: http://www.epa.gov/castnet
- NPS: http://www2.nature.nps.gov/ard/gas/airatlas-du/viewer_index.htm
- BLM: http://www.blm.gov
- BLM: http://www.wy.blm.gov

Air Quality: Atmospheric Deposition

- NADP: http://nadp.sws.uiuc.edu/
- CASTNet: EPA: http://www.epa.gov/castnet
- NPS: http://www2.nature.nps.gov/ard/gas/airatlas-du/viewer_index.htm
- WARMS (Wyoming Air Resource Monitoring System) http://12.45.109.13/

Air Quality: Visibility

- IMPROVE: http://vista.cira.colostate.edu/improve
- IMPROVE: http://vista.cira.colostate.edu/views
- FLAG: http://www.WDEQ-AQD.nps.gov/ard/flagfree
- Wyoming Visibility Monitoring Network: http://www.wyvisnet.com

MITIGATION OPTIONS

Mitigation may be applied to fugitive dust and NO_x impacts. Fugitive dust refers to any particulate matter that is not deliberately emitted by a well-defined source. Fugitive dust sources typically include windblown dust from unvegetated lands, construction, and unpaved roads. Table A19-14 shows several fugitive dust mitigation options available.

Table A19-14. Effectiveness and Costs of Fugitive Dust Mitigation Measures (PM_{10})

	Dust Sources					
	Disturbed Areas	Unpaved Roads[1]				
Effectiveness	Level proportional to percentage of land cover	0–50% reduction in uncontrolled dust emissions	33–100% control efficiency	80% for 15 mph[3] 65% for 20 mph[3] 25% for 30 mph[3]	30% reduction	90% reduction
Estimated Cost	Unknown	$4,000/mile	$2,000 to $4,000/mile per year	Unknown	$9,000/mile	$11,000 to $60,000/mile

NO_x emissions are associated with combustion. Table A19-15 shows several potential mitigation measures that could reduce impacts from NO_x emissions. The appropriate level of control will be determined by the WDEQ-AQD during the construction permit process.

Table A19-15. Efficiency of Nitrogen Oxides (NO_x) Mitigation Measures

	NO_x Emissions Sources			
	Field Compressors	Sales Compressors	Temporary Diesel Generators[1]	Heavy Equipment
Mitigation Options/Efficiency	Implement BACT Typically results in a NO_x emission rate of about 1 g/bhp-hr	Implement BACT Typically results in a NO_x emission rate of about 1 g/bhp-hr	Register with state; WDEQ regulate as appropriate	Voluntary use of diesel engines

Wyoming is currently registering these generators to determine whether NO_x emissions are significant.

In addition, Table A19-16 shows additional mitigation measures to be considered in the planning area impact assessment. These are general mitigation opportunities that should be considered and applied as appropriate. BLM has no authority to require any application of these measures, although industry is encouraged to implement these measures on its own before they are required by WDEQ. Advances in technology are likely to offer new mitigation options during the time covered by the RMP. Under NEPA, the planners of individual projects in the planning area must recommend mitigations measures that are appropriate for the projects. The WDEQ, as the permitting authority, will review permit applications and require specific emission control devices and measures. All costs shown in this table are approximate.

Table A19-16. Additional Mitigation Measures with Approximate Costs and Benefits

Type of Mitigation	Approximate Cost	Environmental Cost	Potential Limitations	Environmental Benefit
Selective Catalytic Reduction for Compressor Emissions	$4,000 to $27,000 per NO_x ton-year.	Possible NH_3 releases.	May be cost prohibitive for oil and gas applications.	NO_x emission rate reduced to 0.1 g/hp-hr; decreased visibility impact.

Type of Mitigation	Approximate Cost	Environmental Cost	Potential Limitations	Environmental Benefit
"Green Completions" and Flowback Units	Capital cost ranges from $1,000 to $10,000. Operating cost is $1,000/year. Payback 1–3 years.	Moving equipment to and from well completions. Fugitive dust from trucks.		Saves 100,000 cubic feet of gas per well per year. Reduces flaring emissions by 70–90% at completion.
Condenser on Glycol Dehydrator	$1,000 to $10,000	Unknown		95% VOC and HAP reduction.
Activated Carbon Filter on Condensate Storage Tank	$1,000 and up	Energy required to recycle filter.		50–80% VOC reduction.
Electrical Compressors	Capital cost is 40% of gas turbine cost. Operating costs depend on location of transmission lines.	Displaced air emissions from compressor unit to electric power plant.		Moving air emissions away from sensitive PSD Class I areas.
Fugitive Dust Road Treatment	$2,400–$50,000 per mile.	Possible vegetation effects.		20–100% dust control.
Fugitive Dust Administrative Control	$13,000 per well for remote telemetry. A few added work hours per year traveling at enforced speed limits.	Minor/unknown.	Difficult to enforce.	Reduced VMTs with related emission reductions. Slower speeds give 20–50% reductions in dust emissions.
Larger Diameter Sales Pipeline	Capital costs increase with larger pipes. Operating costs decrease with larger pipes.	Larger trench for burying line. Slightly more surface disturbance.	Probably applicable only for large producing operations.	Possibly resulting in lower compressor emissions.
Microhole Drilling	Cost of technology transfer; then potentially less than conventional drilling.	Additional impacts if duplicate drilling is necessary.		Lighter equipment on roads, smaller drilling sites, reduced gaseous emissions during drilling.
Condensate Pipelines	Cost of pipe and installation minus cost of eliminated storage tank and trucking.	Trench for burying line.	The cost may outweigh benefit.	Eliminate emissions from storage vessels; eliminate miles traveled by vacuum trucks.
Stage I Vapor Controls for Condensate Transfer for Truck Loading	$1,000–$3,000	Potential fire risk with improper operation.		90% VOC emission reduction during transfer.
Wind Farm Electric Generation	4 to 5 cents/kW-hr. Capital costs are large.	Visual impacts, impacts on raptors, maintenance.	Large capital costs required	Reduced power plant emissions. (VOC, NO_x, SO_2, CO, CO_2)

Type of Mitigation	Approximate Cost	Environmental Cost	Potential Limitations	Environmental Benefit
Phased oil and gas Development	Short-term loss of state and federal royalties	Emissions averaged over a longer period.		Peak emissions and impacts are reduced.