4.2 AIR QUALITY

The VPA is located in a region currently designated as being in attainment for all air-born pollutants (EPA 2001, UDAQ 2004). The proposed management alternatives discussed below have been evaluated using requirements and assumptions appropriate to ensure accurate identification of potential issues related to air quality for each alternative.

The impacts of implementing the Proposed Action and Alternatives are described in detail in the following sections.

4.2.1 Effects Common to All

Projected emissions common to all development scenarios include particulate matter (PM_{10} and $PM_{2.5}$), SO_2, NO_x, hydrocarbons and combustion by-products.

With the exception of prescribed fire, impacts from management decisions related to the proposed development alternatives are projected to have no effect to a negligible effect on air quality in those regions where they are implemented. Prescribed fire is expected to result in a short-term increase in particulate (primarily $PM_{2.5}$), CO_2 and ozone emissions in burn areas and those locations immediately downwind. The detrimental effects from wildfire would likely be greater than those from prescribed fire and exert a larger negative effect on air quality in the VPA.

The magnitude of air quality emissions (projected to be negligible at most) common to all development scenarios can be further minimized by surface stabilization techniques, replacing/improving surface vegetation, and by air emission restrictions imposed by regulatory agencies and management authorities. The actual pollutant loads produced are dependant on the number and type of pollutant sources, source location, duration of loading, and local topographical and meteorological conditions.

4.2.2 Effects from Alternatives

4.2.2.1 Effects of Cultural, Paleontological, Special Status Species, Visual Resource Management, and Wild Horse Management Decisions

Impacts from cultural, paleontological, special status species, visual resource management, and wild horse management decisions are projected to have no substantial effect on air quality except as they limit development, access or site use through related management decisions. Therefore, the management of these resources will not be discussed under the comparison of alternatives.

4.2.2.2 Effects of Soil and Watershed, Special Designations, Recreation Management, and Wildlife and Fisheries Management Decisions

Many of the areas have proposed management and travel-related decisions that limit or reduce surface and vegetation disturbance, OHV and other off-trail access, and improve existing roadway and trail surfaces. Air quality impacts from these activities are generally projected to result in negligible effects on short-term air quality and negligible to incrementally positive effects on long-term air quality.

The surface disturbing activities related to these decisions are very similar and will be discussed jointly in this section.

4.2.2.2.1 Alternative A

4.2.2.2.1.1 Direct Effects

Proposed management decisions generally include lower overall surface/soil disturbance. Direct air quality impacts from surface disturbing activities would likely be small and most noticeable in a cumulative fashion when coupled with other management decisions. Potentially beneficial outcomes from these management decisions include reduced PM_{10} and other windborne particulate from erosion of exposed soils.

Short Term

Short-term benefits to air quality would most likely not be measurable in the overall project area.

Long Term

Long-term benefits would include incremental site-specific reductions in windborne particulate from reduced erosion of exposed soils as vegetation/soil cohesion improves over time.

4.2.2.2.1.2 Indirect Effects

Indirect effects on air quality would most likely not be measurable in the overall project area.

4.2.2.2.2 Alternative B

Air quality impacts are expected to be comparable to those described for Alternative A.

4.2.2.2.3 Alternative C

Air quality impacts are expected to be comparable to those described for Alternative A.

4.2.2.2.4 Alternative D – Current Management

Air quality impacts are expected to be comparable to those described for Alternative A.

4.2.2.3 Effects of Livestock Grazing, Rangeland Improvement, Riparian Management, Vegetative Management, and Woodland and Forest Management Decisions

Many areas have proposed management decisions that limit or reduce grazing intensity and time, and manage for greater vegetation retention and generation. Air quality impacts from these alternatives are generally projected to result in increased vegetation (density and height) and lower overall surface/soil disturbance. All alternatives are projected to have a negligible to incrementally positive effect on air quality in those regions where they are implemented. Impacts from these decisions may also have an effect on air quality as they impact other management decisions.

The surface disturbing activities related to these decisions are very similar and will be discussed jointly in this section.

4.2.2.3.1 Alternative A

4.2.2.3.1.1 Direct Effects

Proposed management decisions generally include increased vegetation (cover, density and height) and lower overall surface/soil disturbance. Direct air quality impacts from surface disturbing activities would likely be small and most noticeable in a cumulative fashion when coupled with other management decisions. Potential effects from these management decisions include improved vegetative cover in many areas.

Short Term

Short-term benefits to air quality would most likely not be measurable in the overall project area.

Long Term

Long-term benefits would include incremental site-specific reductions in windborne particulate from reduced erosion of exposed soils as vegetation improves over time.

4.2.2.3.1.2 Indirect Effects

Potential indirect effects from these management decisions include reduced PM_{10} and other windborne particulate from erosion of exposed soils due to improved vegetative cover.

4.2.2.3.2 Alternative B

Air quality impacts are expected to be comparable to those described for Alternative A.

4.2.2.3.3 Alternative C

Air quality impacts are expected to be comparable to those described for Alternative A.

4.2.2.3.4 Alternative D – Current Management

Air quality impacts are expected to be comparable to those described for Alternative A.

4.2.2.4 Effects of Land and Realty Management Decisions

Impacts from land and realty management decisions, outside of those specific to compressor stations discussed below, are projected to have no significant effect on air quality except as they impact other management decisions. It should be recognized that some compressor stations are [and would be] authorized by lands-realty while some are [or would be] located on oil and gas leases (BLM). The impacts from compressor stations and other associated activities specific to lands-realty authorization were not modeled separately from those specific to BLM authorization. All were modeled collectively to allow projection of potential cumulative air quality impacts. These projections and modeling assumptions are discussed in detail in Section 4.2.3 and in the TSD (Trinity and Nicholls 2004).

4.2.2.5 Effects of Fire Decisions on Air Quality

Prescribed burning is a useful tool for resource management and may be used to achieve a variety of objectives such as restoring a fire-dependent ecosystem, enhancing forage for cattle, improving wildlife habitat, preparing sites for reforestation, or reducing hazardous fuel loads.

Fire, for any of these reasons, will produce smoke and other air pollutants. Some short-term air pollutant releases are necessary to achieve the benefits related to prescribed burning. Land managers recognize that smoke management is critical to avoid air quality intrusions over sensitive areas and related visibility problems. As a result of careful management, there is usually less smoke from a prescribed fire than from a wildfire burning over the same area.

4.2.2.5.1 Alternative A

This alternative identifies the potential for approximately 156,425 acres to be treated by prescribed fire per decade. As no more specific information on fuel loads, spatial distribution, timing, or vegetative species is available at this time; the evaluation of potential air quality effects is necessarily somewhat general and qualitative rather than quantitative in nature.

4.2.2.5.1.1 Direct Effects

There are several criteria pollutants of concern specific to prescribed burning, chiefly particulate matter and carbon dioxide (CO_2). Particulate matter produced in prescribed burns is predominantly $PM_{2.5}$ (70 percent of the smoke produced on burns falls into this category). Fire also produces CO_2, a gas that is potentially related to global climate change in an incremental fashion. Biomass burning contributes to the release of greenhouse gases (such as CO_2), and eliminates a carbon sink.

Direct effects of prescribed fire fall into two general categories: short-term and long-term.

Short Term

Short-term air quality effects projected from prescribed burns include a general increase in $PM_{2.5}$ particulate and CO_2 emissions specific to the burn area and locations downwind. The magnitude of increase is directly dependent on the size, extent and controlled level of the burn. The type and amount of air pollutants released from burning wildland vegetation varies with type of fuel, moisture content, temperature of the fire, and the amount of smoldering occurring after the fire. If air quality were already approaching the threshold for particulate matter, prescribed burning could cause a region to exceed the daily limits. Since prescribed burning occurs irregularly, it is generally possible to restrict burning in potential non-attainment areas on “bad air quality days“ to avoid violating air quality standards.

Long Term

Long-term, direct air-quality effects projected from prescribed burns include a general increase in airborne particulate materials from the burn site as a result of ash dispersion and transport. This increase would occur only until revegetation is complete and growth matures.

4.2.2.5.1.2 Indirect Effects

Short-term and long-term indirect effects on air quality from prescribed burns include an increase in airborne particulate from the burn site as a result of wind-based erosion of devegetated areas. This effect is expected to be small as vegetation management is an active part of fire management techniques. A greater long-term effect of prescribed burning is a reduction in particulate, CO_2 and ozone emissions specific to wildfire in unmanaged areas. Ozone (a product of biomass combustion formed through the interaction of ozone precursors, volatile organic carbon compounds (VOCs), and nitrogen oxides) is a precursor to greenhouse gases, and a major

constituent of photochemical smog. Although generally ozone produced by prescribed fire is quickly diluted and dispersed into the air, it may act as a contributor to the greenhouse effect. As a criteria pollutant, ozone production may be regulated by a SIP, or burns may be banned under ozone alerts.

The detrimental effects from wildfire would likely be greater than those from prescribed fire and exert a larger negative effect on air quality in the VPA.

4.2.2.5.2 Alternative B

Air quality impacts are expected to be comparable to those described for Alternative A.

4.2.2.5.3 Alternative C

Air quality impacts are expected to be comparable to those described for Alternative A.

4.2.2.5.4 Alternative D – Current Management

Impacts under this alternative would be similar to those discussed for Alternative A, with a difference in magnitude of both impacts and benefits associated with the difference in total acres treated (156,425 acres per decade specified for Alternatives A, B and C; 27,950 acres in the Book Cliffs RMP area and 22,950 acres in the Diamond Mountain RMP area (50,900 acres total) specified for Alternative D – Current Management).

4.2.2.6 Effects of Mineral Decisions on Air Quality

The results of air quality analysis for each alternative specific to mineral decisions are presented in the following sections. The assessment of such air quality impacts is unique and does not easily conform to the established format of direct and indirect, short- and long-term effects. To better clarify the pertinent issues and considerations involved, and to provide the reader with a more direct and understandable summary of the projected air quality effects, the air quality section has been divided into near- and far-field air quality analyses, each with a detailed discussion of model methodology, emission constituents evaluated and overall air quality effects.

This assessment is based on best available engineering data, meteorological data, and EPA dispersion modeling procedures. However, where specific data or procedures were not available, appropriate assumptions have been incorporated.

It should be kept in mind that all dispersion models, regardless of their level of complexity, are mathematical approximations of the behavior of the atmosphere, based largely on fluid dynamics. Therefore, particularly given the uncertain nature of the number and placement of the emission sources used in this analysis, the results need to be viewed as estimates of possible future concentrations and not exact predictions in time and space.

Dispersion modeling is generally conducted in a somewhat conservative manner, attempting to insure that the final results do not underestimate the actual or future impacts, so that appropriate planning decisions can be made. For example, sources may be assumed to operate for longer times or emit more pollutants than might be reasonable to insure that health-based air standards are protected (i.e. the far-field air quality impact assessment assumed that under Alternative A an additional 6,342 new wells would go into production within 15 years, then operate at full production levels with no “dry holes“ or “shut ins“, while in reality a small percentage of dry holes and shut ins would be expected to occur in projects of this size).

On the other hand, analyses are not conducted assuming the worst-case conditions across the board, which would lead to a "false-positive" result. Hence, dispersion modeling analyses are a balancing act, using the best available information and methods (EPA-approved models, emission factors, etc.), and the best scientific and professional judgment where necessary, trying to direct the analysis so that the final results do not under-predict the actual concentrations that would occur in the future.

Detailed modeling results including a more complete discussion of the models used, the modeled scenarios evaluated, boundary conditions utilized, the location and date of each maximum impact, plots showing the receptor grid, terrain, and location of each maximum impact, and the output, input and list files for the post-processing are available in the Air Quality Technical Support Document (TSD) (Trinity and Nicholls 2004).

4.2.2.6.1 Near-field Analysis

4.2.2.6.1.1 Modeling Methodology

The ISCST3 model as contained in Lakes Environmental ISC-AERMOD View software (Lakes 2002) was used for all near-field modeling. All near-field modeling assumed flat terrain, rural dispersion conditions, and building downwash effects for a hypothetical structure. A hypothetical grouping of sources (including wells pads, glycol dehydrators, natural gas compressors, and an unpaved road traversing the source area) was used that provides an estimate of potential near-field pollutant impacts. Details of the source types and configurations are discussed in the TSD (Trinity and Nicholls 2004). Operating parameters used for each source were (unless otherwise stated) the same as those used in the CALPUFF modeling performed by Trinity Consultants. Inventory and RFD sources are not included in the near-field analysis.

The best available air quality monitoring data collected near the VPA were used to compare changes in air quality contributed by the modeled emission sources. There were existing monitoring stations for various pollutants in the vicinity of the VPA. Air quality data were obtained from the EPA AirData database (EPA 2002) and from the state air quality regulatory agencies. Detailed information on the air quality modeling techniques employed, parameters utilized, boundary conditions identified and meteorological conditions incorporated is presented in the TSD (Trinity and Nicholls 2004).

Model receptors (points at which the model estimates concentrations) were placed as outlined in Table 4.2.1 below.

TABLE 4.2.1. RECEPTOR SPACING FOR NEAR-FIELD MODELING

Pollutant(s)	Source Type(s)	Receptor Ranges (m)	Receptor Spacing (m)
PM_{10}, $PM_{2.5}$	Roads	50 – 1, 500	50
	Pad Construction	50 – 1,700	50
All other Criteria Pollutants	Pad Construction, Compressors, and Glycol Dehydrators	100 – 4,000	100
		4,000 – 10,000	2,000
Hazardous Air Pollutants (HAPs)	Compressors and Glycol Dehydrators	100 – 4,000	100
		4,000 – 10,000	2,000

Results of the ISCST3 near-field modeling air quality analysis are common to all alternatives and are presented in the following sections.

4.2.2.6.1.2 Carbon Monoxide (CO)

Maximum potential CO emissions from natural gas-fired compressors were used to determine the maximum potential 1-hour and 8-hour average CO concentrations. The maximum-modeled concentrations were 35.1 μg/m3 (1-hour) and 19.7 μg/m^3 (8-hour). When background concentrations are added (6,984 μg/m^3 and 4,236 μg/m^3 respectively), the total concentrations were 7,019 μg/m^3 (1-hour) and 4,256 μg/m^3 (8-hour). These concentrations are well below the applicable NAAQS for CO of 40,000 μg/m^3 (1-hour) and 10,000 μg/m^3 (8-hour).

4.2.2.6.1.3 Particulate Matter

To address the concerns of some of the stakeholders and cooperating agencies, the modeling analysis for particulate matter (PM_{10} and $PM_{2.5}$) for all proposed alternatives was divided into two parts: an analysis of road-related particulate (*road-only*); and an analysis of all particulate sources grouped together (*roads and other sources*) that included well pads (construction, traffic), compressors and roads. It should be noted that different receptor configurations were used for the two analyses (as discussed in the TSD). All particulate matter sources were modeled with emissions limited to the hours from 7:00 AM to 7:00 PM, the period when these sources are generally active (Trinity and Nicholls 2004). PSD increments do not apply, as the majority of these sources are temporary in nature.

<u>PM_{10}</u>

For the *road-only* analysis, the maximum-modeled potential PM_{10} concentrations were 21.0 μg/m^3 (24-hour) and 1.8 μg/m^3 (annual). When background concentrations are added (28 μg/m^3 and 10 μg/m^3 respectively), the total concentrations were 49 μg/m^3 for the 24-hour average and 12 μg/m^3 for the annual average. These concentrations are well below the applicable NAAQS of 150 μg/m^3 (24-hour) and 50 μg/m^3 (annual).

For the *roads and other sources* analysis, the maximum-modeled potential PM_{10} concentrations were 21 μg/m^3 (24-hour) and 0.9 μg/m^3 (annual). When background concentrations are added (28 μg/m^3 and 10 μg/m^3 respectively), the total concentrations were 49 μg/m^3 for the 24-hour average and 11 μg/m^3 for the annual average. These concentrations are well below the applicable NAAQS of 150 μg/m^3 (24-hour) and 50 μg/m^3 (annual).

<u>$PM_{2.5}$</u>

For the *road-only* analysis, the maximum-modeled potential $PM_{2.5}$ concentrations were 3.2 μg/m^3 (24-hour) and 0.3 μg/m^3 (annual). When background concentrations are added (19 μg/m^3 and 7 μg/m^3 respectively), the total concentrations were 22 μg/m^3 for the 24-hour average and 7.3 μg/m^3 for the annual average. These concentrations are well below the proposed NAAQS for $PM_{2.5}$ of 65 μg/m^3 (24-hour) and 15 μg/m^3 (annual).

For the *roads and other sources* analysis, the maximum-modeled potential $PM_{2.5}$ concentrations were 3.2 μg/m^3 (24-hour) and 0.14 μg/m^3 (annual). When background concentrations are added (19 μg/m^3 and 7 μg/m^3 respectively), the total concentrations were 22 μg/m^3 for the 24-hour

average and 7.1 μg/m^3 for the annual average. These concentrations are well below the proposed NAAQS of 65 μg/m^3 (24-hour) and 15 μg/m^3 (annual).

4.2.2.6.1.4 Sulfur Dioxide (SO_2)

The maximum short-term (3-hour and 24-hour) and long-term (annual average) SO_2 concentration from compressors used to move the gas through the pipelines was modeled to be 20 μg/m^3 (3-hour), 10 μg/m^3 (24-hour), and 5 μg/m^3 (annual), including representative background values. All predicted short-term and long-term SO_2 concentrations were well below the applicable NAAQS 24-hour and annual criteria (1,300 μg/m^3, 365 μg/m^3 and 80 μg/m^3 respectively).

4.2.2.6.1.5 Nitrogen Oxide (NO_2)

Maximum NO_2 impacts during operations were modeled using "reasonably foreseeable" compressor NO_x emission rates. The maximum-modeled concentration for NO_2 reflects an adjustment by a factor of 0.75, in accordance with standard EPA methodology (Federal Register 60:153, p. 40469, dated August 9, 1995) to convert from the modeled NO_x concentration to NO_2 (Trinity and Nicholls 2004). The maximum-modeled annual NO_2 concentration was 7.7 μg/m^3. When the assumed representative background concentration (10 μg/m^3) is added, the resulting projected maximum total impact is 17.7 μg/m^3, which is below the applicable NAAQS of 100 μg/m^3 (annual).

4.2.2.6.1.6 Hazardous Air Pollutants (HAPs)

Maximum HAPs impacts during operations were modeled for the hypothetical arrangement of sources as described above. Emissions sources include compressors (benzene, ethylbenzene, formaldehyde, toluene, and xylene) and glycol dehydrators (benzene, toluene, ethyl benzene, hydrogen sulfide, and xylene).

Since neither the State of Utah nor EPA have established HAP standards, 24-hour and annual HAP concentrations were projected using the ISCST3 model and compared to a range of acceptable ambient concentration levels (AACLs) from other states and/or EPA Reference Concentrations (RfCs) (EPA 1997 and Archer 2001b). These thresholds are presented in Table 4.2.2.

The results of the near-field HAPs modeling show that the maximum modeled annual benzene (10.6 μg/m^3) and formaldehyde concentrations (10.6 μg/m^3 and 0.13 μg/m^3 respectively), and the 24-hour concentration for xylenes (174 μg/m^3) exceed the low end of the range of respective AACLs. However, the background concentration for xylenes recommended for use was greater than the 100 μg/m^3 threshold identified for the 24-hour average.

To better characterize the risk associated with the modeled concentrations of benzene and formaldehyde (xylenes are not considered carcinogenic) in BLM source emissions, two estimates of cancer risk were performed; one that corresponds to a most likely exposure (MLE) condition (related to residents of the area), and one reflective of the maximally exposed individual (MEI) such as compressor station workers. Possible incremental cancer risks were calculated based on the maximum predicted annual concentrations from BLM sources only (excluding background), EPA's unit risk factors for carcinogenic compounds (EPA 1997), and an adjustment for time spent at home or on the job.

This analysis assumed that residential exposure was 20 years (well over the national nine year average duration a family lives at a residence) and worker exposure was 20 years. In addition, it assumed that family members were exposed to the maximum concentrations 64 percent of the day, and to one forth of this concentration for the remaining 36 percent of the day. It should be noted that the modeled concentrations used in these calculations do not include background concentrations because the incremental cancer risk due to BLM sources only is the focus of this portion of the analysis.

TABLE 4.2.2. SUMMARY OF HAP ACCEPTABLE AMBIENT CONCENTRATION LEVELS (AACLS)

Benzene ($\mu g/m^3$)	Ethylbenzene ($\mu g/m^3$)	Formaldehyde ($\mu g/m^3$)	Hydrogen Sulfide ($\mu g/m^3$)	Toluene ($\mu g/m^3$)	Xylenes ($\mu g/m^3$)	Agency
0.12 annual	1,000 24-hour	0.077 annual	0.9 24-hour	400 24-hour	1,500 24-hour	Washington Department of Ecology, WAC 176-460-150
53 24-hour	14,467 24-hour	-	467 24-hour	6,267 24-hour	14,467 24-hour	Utah DEQ Toxic Screening Level [a]
-	-	-	140 24-hour	-	-	North Dakota Department of Health, Division of Environmental Engineering, 33-15-02 or Air Toxics Policy
13-45[b] annual	-	8[b] annual	-	-	-	EPA IRIS Database 1/10000 Risk Level
-	1,000 24-hour	-	1 24-hour	400 24-hour	100 24-hour	EPA IRIS Database RfC [c]

[a] The Toxic Screening Level (TSL) for Utah can be found in Utah Administrative Code R307-401(1)(d).

[b] The range of values shown here represents the air unit risk of 1 in 10,000 taken from EPA's IRIS database.

[c] U.S. EPA's Integrated Risk Information System (IRIS) contains information on reference concentration for chronic inhalation exposure (RfC). (EPA 1997)

Under the MLE scenario, the estimated individual cancer risks associated with long-term exposure to benzene (compressors, dehydrators) and formaldehyde (dehydrators) are 1.7×10^{-5} to 4.9×10^{-6} and 3.6×10^{-7}, respectively. Under the MEI analysis, the individual cancer risks for benzene and formaldehyde are 2.4×10^{-5} to 6.8×10^{-6} and 4.9×10^{-7} respectively. All are at or below the lower end of the threshold range of EPA's presumptively acceptable risks (1.0×10^{-4} to 1.0×10^{-6}, representing one excess cancer per 1 million people to one excess cancer per 10,000 people, respectively) (EPA 1999a). Therefore, the long-term cancer risk analyses for near-field modeling projections indicate no potential for concern.

The above risk calculations are based upon the maximum modeled concentration found anywhere in the vicinity of the hypothetical arrangement of sources. These maximum concentrations will most likely occur only within a few hundred meters of the edge of the sources. It is unlikely that any individual would be living this close to the sources. Therefore, the calculated risk values should be viewed as an upper bound on the range of possible risks associated with near-field impacts, with risks to actual residents likely being much lower.

4.2.2.6.1.7 Natural Gas Flare

A separate modeling exercise was conducted for potential natural gas flaring emissions. The flare modeling was performed with the SCREEN3 model (EPA 1995b), as suggested at a meeting of the air quality stakeholders for this project (BLM 2003). Information provided by the BLM Vernal Field Office (VFO) showed that a significant percentage of proposed new wells would require flaring (60 percent of Natural Gas wells; BLM 2004b). Since the exact locations of wells requiring flaring is not known, these emissions were distributed evenly across existing point sources, weighted by the percent of the total area covered by each sub-region. Flare emissions were modeled as "sweet gas" which is assumed to contain no sulfur. Therefore, no emissions were estimated for SO_2. Detailed information is presented in the TSD (Trinity and Nicholls 2004). Modeled results show that all concentrations are well below the NAAQS.

4.2.2.6.2 Far-field Analysis

4.2.2.6.2.1 Modeling Methodology

The CALPUFF air dispersion model was the preferred model for long-range transport recommended by the Federal Land Manager Air Quality Related Value Workgroup (FLAG) guidance and the Interagency Workgroup on Air Quality Modeling (IWAQM) Phase 2 Summary Report (Trinity and Nicholls 2004).

Specific information on the CALPUFF air dispersion model (Version 5.5, Level 010730-1)[1], the CALMET diagnostic meteorological model (Version 5.2, Level 000602d), and the SCREEN3 flare emissions model (EPA 1995a) used for this analysis is available in the TSD (Trinity and Nicholls 2004). The air quality assessment included an evaluation of potential impacts associated with proposed future development on ambient air quality and on Air Quality Related Values (AQRV) managed by Federal Land Managers (FLM). The following assessments were conducted:

- Projection of potential direct and cumulative air quality impacts of emissions from existing and foreseeable oil, gas, and mineral development scenarios (Alternatives A, B, C and D – Current Management).
- Comparison of potential direct and cumulative air quality impacts, plus the existing background concentration to the applicable NAAQS and those state ambient air quality standards that are more stringent than the NAAQS.
- Visibility impacts within mandatory Federal PSD Class I areas and specific Class II areas of concern.
- Atmospheric deposition of total sulfur and nitrogen within mandatory Federal PSD Class I areas and specific Class II areas of concern.

Best available air quality monitoring data collected near the VPA were used to compare changes in air quality contributed by modeled emission sources. There were existing monitoring stations for various pollutants in the vicinity of the VPA. Air quality data were obtained from the EPA AirData database (EPA 2002) and from the state air quality regulatory agencies. Detailed information on the air quality modeling techniques employed, parameters utilized, boundary

1 http://earthtec.vwh.net/download/cpuff.htm

conditions identified and meteorological conditions incorporated is presented in the TSD (Trinity and Nicholls 2004).

4.2.2.6.3 Air Quality Modeling Assumptions

In the development of this analysis, there was recognized uncertainty regarding the actual magnitude of final resource development. This uncertainty included the number of wells, type and number of equipment used, specific location of development, etc. Due to this uncertainty, actual impacts may vary from the modeled values and would potentially be affected by permit requirements.

All emission sources were assumed to operate at their maximum emission rates simultaneously throughout the lifetime of the project. In reality, some sources would only emit during a portion of any given day or year. It was also assumed that primary road traffic would occur during working, daylight hours (7 AM to 7 PM), particularly during the construction period of the wells[2], and that 50 percent control of particulate emissions would be attained by watering.

The contribution to the degradation of air quality from other [non-oil & gas] mineral development (i.e., from mine plans associated with solid leasables such as Gilsonite and phosphate, mineral materials and surface management), outside of the modeled impacts from dust due to increased activity and road-building, was considered nominal and only oil and gas related activities (the largest component of minerals related activity within the VPA) were considered in assessing impacts to air quality.

Other specific assumptions are detailed in the appropriate sections of this report and the associated sections of the TSD (Trinity and Nicholls 2004). It should be noted that exceedances, over predictions, and under predictions may be caused by limitations within the model. The accuracy of modeled results depends on the representation of sources within the model and accuracy of the state's emission inventory. In long-range transport modeling, modeled impacts are dependent on source location. One limitation of this air quality analysis is that the location of some BLM sources is unknown at this time. Small changes in source location may cause a change in modeled impacts, especially given the complex terrain that exists over much of the project area.

Air quality modeling for this document is based on the initial acreages proposed for Alternatives A, B, C and D (June/July 2004). Projected well numbers and road-related air quality impacts were based on these proposed acreages. The total acreages for potential mineral development for all alternatives and D have changed somewhat over time as additional considerations and information has been brought forward through the assessment process. For Alternatives A, B and C, the changes are very small and represent less than one percent difference from the acreages and well numbers modeled for air quality impacts. In the case of Alternative D – Current Use, the acreage used in the modeling assessment is approximately six percent greater than that currently recognized. This difference is specific to air quality modeling only and is due to a change in proposed total acreage for Alternative D. When the air quality modeling was undertaken, the Hill Creek extension (encompassing approximately 188,500 acres in total) was included in the acreage totals for modeling. However, in the intervening time frame, it was decided that since the Hill Creek Extension was not leased in the Book Cliffs RMP this acreage should have not been included in the modeling for Alternative D. Air quality modeling for

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Alternative D does not reflect the withdrawal of the 188,500 acres and therefore exhibits a slight overestimation of air quality impacts for this alternative. Given the conservative nature of the assumptions used and boundary conditions employed for the air quality modeling, these differences are considered to be minor at most and the modeled air quality impacts for these alternatives remain valid.

4.2.2.6.4 Emission Sources

Two groups of emission sources were modeled for this analysis. The first group, referred to as "inventory sources", included new and modified emission sources that have commenced operation since the monitoring baseline date. Data for inventory-source emissions were provided by the Utah Department of Environmental Quality (UDEQ) and the Colorado Department of Public Health and Environment (CDPHE) state inventories.[3] The second group of sources, referred to as "BLM sources", included those future proposed sources projected to result from BLM oil and gas development. Compressors for gas compression, glycol dehydrators, and fugitive dust from new roads were included in this category.

4.2.2.6.5 Inventory Sources

If a source in the emission inventory was in operation prior to the monitoring date of the background concentration, that source was assumed to be included in the background and was not modeled. Background air quality data were values recommended by UDEQ (Chick 2002)[4] and are detailed in Table 3.2.6 in Chapter 3. The baseline date applied for each pollutant is presented in Table 4.2.3.

TABLE 4.2.3. BASELINE DATE FOR BACKGROUND CONCENTRATIONS

Pollutant	PM_{10}	$PM_{2.5}$	NO_2	CO	SO_2
Proposed Baseline Date	2000	2001	2000	2001	2000

This analysis assumed that reasonable variations in emissions occur through the years. If an emission source showed increases or decreases in emissions that occurred in the year immediately before or after the baseline date, and the inventory information provided by the states did not show modification to the source, the emissions changes were assumed to be a part of expected variation and were not modeled. The following sources in the emission inventory were not considered to be background and were modeled:

- A source that commenced operation after the monitoring baseline date.
- Any emissions increase from a source that had a permit issued after the monitoring baseline date. If the last permit issue date was not available, the emission increase was modeled. The UDEQ inventory did not provide a permit issue date. Therefore, any emissions increase after the monitoring baseline date was modeled.

3 Deborah McMurtrie, SIP/Rules Section, Planning Branch, Division of Air Quality, Department of Environmental Quality, (801) 536-4187. Dave Thayer, Public Health Engineer Colorado Department of Public Health and Environment, Air Pollution Control Division / Stationary Sources Program, david.thayer@state.co.us, Voice: 303-692-3187, FAX: 303-782-0278.

4 Background concentration recommended by CDPHE in the review comments provided by Nancy Chick, dated on December 20, 2002. Background concentrations recommended by the Utah Department of Environmental Quality in memorandum No. DAQP-003-03, dated on January 17, 2003 from Richard W. Sprott to Yu Shan Huang.

A review of all sources provided in the Utah source inventory and all Title V permits available on the UDEQ website was conducted on a per-pollutant basis since each pollutant had a different monitoring baseline date. The modeling domain was set so that it extended 50 km beyond all sources and receptors. Therefore, only sources inside 50 km of the modeling domain boundary were modeled. No sources were placed within 10 km of any modeled sensitive areas in order to provide a more realistic analysis of existing and expected sources.[5] Gravel pits, storage piles, haul roads, and other fugitive sources were modeled as area sources.

A list of all inventory sources that were excluded from the analysis together with the reason for exclusion is available in Appendix C of the TSD (Trinity and Nicholls 2004). Additional information on modeling domains, stack parameters, emission rates and emission factors used is available in the TSD (Trinity and Nicholls 2004).

4.2.2.6.6 BLM Sources

The four proposed development alternatives modeled were based on BLM's proposed plans for resource development, which cover for the lifetime of the projects (15 years) and include estimates of the number of wells drilled for oil and gas, compressor stations, and pipelines, along with other foreseeable development activities by non-BLM entities (Trinity and Nicholls 2004). The modeling analysis is, at most, a prediction of short-term and annual average air quality impacts. Modeling was based on a single year of activity, as little or no variation in activity levels from year to year is expected according to BLM field office personnel (BLM 2004a and 2004b).

Potential emissions specific to BLM sources are summarized in a general fashion in the following sections. A detailed summary of the modeled air quality parameters is available in the TSD (Trinity and Nicholls 2004).

4.2.2.6.7 Alternative A

The following subsections present the CALPUFF modeling results for Alternative A for NAAQS, PSD increments, HAPs, visibility, deposition, and acid neutralizing capacity (ANC) specific to BLM sources.

4.2.2.6.7.1 NAAQS

Modeling results show no exceedances of the NAAQS for any pollutant or averaging period from BLM sources for any of the modeled alternatives.

4.2.2.6.7.2 PSD Increment Thresholds

With recommendations from the states of Utah and Colorado, the BLM identified three mandatory Federal Class I and six Class II areas within the VPA to be considered in the analysis. These selected sensitive areas are listed in Table 3.2.5 in Chapter 3. The modeling results show no potential concentrations predicted that would exceed the Class I or Class II increments for BLM sources only.

5 For sources located within 10 km of any Class I area, the Prevention of Significant Deterioration (PSD) permitting rules consider any net emissions increase that would have an air quality impact greater than 1 $\mu g/m^3$ (24-hour average) at the Class I area to be a significant increase.

4.2.2.6.7.3 HAPs Emissions

HAP concentrations were projected using the ISCST3 model and compared to a range of AACLs from other states and/or EPA RfCs (EPA 1997 and Archer 2001b). These thresholds are presented in Table 4.2.2. Background concentrations for HAPs emissions (Table 4.2.4) were estimated using data from EPA's Urban Air Toxics Pilot Project collected in the city of Grand Junction between May 2001 and April 2002, as recommended by the Colorado Department of Health and Environmental Quality (Chick 2002). As these concentrations were measured in an area that is more urban in nature than the majority of the VPA, they may represent an overestimation of the actual background levels occurring at any single location within the VPA.

TABLE 4.2.4. RECOMMENDED HAPS BACKGROUND CONCENTRATION

Agency	Benzene	Ethylbenzene	Formaldehyde	Toluene	Xylenes
Annual Mean (ppbv) [a]	0.90	0.84	5.78	3.70	3.63[b]
24-hour Maximum (ppbv) [a]	2.72	10.68	14.00	33.26	43.66[b]
Annual Mean (μg/m^3)	2.87	3.65	7.11	13.95	15.75
24-hour Maximum (μg/m^3)	8.68	46.35	17.22	125.39	189.48

[a] ppbv = parts per billion by volume
[b] The xylenes concentration represents the sum of m,p-xylene and o-xylene.

The results of the HAPs modeling show no concentration values (excluding background concentrations) that exceeded any of the AACLs/RfCs for BLM sources only (benzene concentration 0.0375 μg/m^3, formaldehyde concentration 0.0557 μg/m^3). However, when background concentrations were included, the annual concentrations for benzene (2.9 μg/m^3) and formaldehyde (7.2 μg/m^3) as well as the 24-hour concentration for xylenes (192 μg/m^3) exceed their respective AACLs. (The background concentration for xylenes recommended for use was greater than the 100 μg/m^3 threshold identified for the 24-hour average.) BLM sources contribute, at most, 1% to these concentrations, meaning that at least 99% percent of these concentrations are due to assumed background concentrations.

Because one or more of the AACLs/RfCs was exceeded (when background concentrations were included), an incremental cancer risk analysis was performed for benzene and formaldehyde emitted from the proposed sources modeled (xylenes are not considered carcinogenic). Two estimates of cancer risk (MLE and MEI) were completed as discussed previously for near-field modeling. Background concentrations are not included in the risk assessment calculations because the incremental cancer risk due to BLM sources only is the focus of this portion of the analysis.

The MLE range of estimated individual cancer risks for long-term benzene exposure from BLM sources only is 1.7×10^{-8} to 6.1×10^{-8}. For formaldehyde, the MLE risk is 1.5×10^{-7}. These values are well below the lower end of the threshold range (1×10^{-4} to 1×10^{-6}) of presumptively acceptable risks (EPA 1998). Under the MEI analysis, the range of individual cancer risks for benzene is 2.4×10^{-8} to 8.4×10^{-8}. For formaldehyde, the MEI risk is 2.1×10^{-7}. These values are also well below the lower end of the threshold range of presumptively acceptable risks. Therefore, the long-term cancer risk analyses indicate no potential for concern.

It should be noted that these risk calculations are based on the maximum modeled concentration found anywhere in the vicinity of the hypothetical arrangement of sources. It is unlikely that an individual is residing at this exact location for the entire length of time assumed in the calculations. Therefore, the risk values calculated above should be viewed as an upper bound on the range of possible risks associated with near-field impacts, with actual risks to residents likely being lower.

4.2.2.6.7.4 Visibility Analyses

Since emissions from the alternatives constitute many small sources spread out over a very large area, discrete visible plumes are not likely to impact the PSD Class I areas or other wilderness areas.

Regional haze is caused by fine particles and gases scattering and absorbing light. The first level screening analysis for visibility compared daily-modeled primary (PM_{10}) and secondary (sulfate and nitrate) particulate matter concentrations to "natural" background conditions and seasonal relative humidity values, to calculate the potential change in visibility (FLAG 2000).

A 1.0-deciview (dv) change is considered potentially significant in mandatory Federal PSD Class I areas as described in the EPA Regional Haze Regulations (EPA 1999b, Pitchford and Malm 1994). The results of the screening visibility analysis for all alternatives (Trinity and Nicholls 2004) indicate that emissions from proposed BLM sources are not expected to result in a 1.0-dv reduction in visibility at any of the PSD Class I wilderness areas under any of the alternatives.

Comparisons of modeled concentrations to the PSD Class I and II increments in this analysis were intended solely to evaluate a threshold of concern for potential impacts to provide decision makers with as much information as possible upon which to base their decisions. They do not represent regulatory PSD Increment Consumption Analyses. Such regulatory analyses are the responsibility of the state air quality agency (under EPA oversight) and would be conducted during permitting process (Trinity and Nicholls 2004).

In addition, the USDA-Forest Service and other members of the stakeholders group requested that a separate analysis be done, comparing the screening visibility results to the Forest Service's 0.5-dv "Limit of Acceptable Change" threshold to evaluate potential significant visibility impacts at the PSD Class I Areas. The Bureau of Land Management (BLM) performed the analysis of potential visibility impacts at the 0.5 dv level at the request of the USDA-Forest Service and other stakeholders, not based on any legal requirement. The analysis showed that any predicted visibility impacts below 1.0 dv "just noticeable change" threshold would not be perceptible. All visibility results are presented in detail in the TSD (Trinity and Nicholls 2004).

Screening visibility results for a number of Class II areas were added at the request of various members of the stakeholder group and are presented for disclosure purposes only. These Class II wilderness areas, parks, and monuments have no visibility protection under State or Federal Law at this time, and hence, are not required to be included in the visibility analysis. However, inclusion of these areas in the analysis provides BLM decision makers with a more complete picture of potential impacts throughout the region.

At this preliminary resource planning stage, the emission sources in this analysis do not have a defined location. In addition, the U.S. Congress has delegated implementation of the Clean Air Act to applicable local, state and tribal air quality regulatory agencies (with EPA oversight). The regulatory agencies are able to determine the visual impact of the plume from individual

emission sources during the new source review process. Therefore, this analysis did not evaluate the near-field visibility impact of the sources at the resource planning stage (Trinity and Nicholls 2004).

Potential 24-hour primary PM_{10}, and secondary sulfate and nitrate particulate matter concentrations were calculated within mandatory Federal Class I areas and at specific Class II areas of concern. PSD Increments have not yet been established for $PM_{2.5}$ and therefore were not addressed in this analysis.

The Class II areas included in this analysis were incorporated at the request of some of members of the stakeholder group (National Park Service, US Forest Service, etc.). These Class II areas do not have any visibility protection under local, state, or Federal laws. Their inclusion in the analysis is strictly to meet the disclosure requirements under NEPA and to provide decision makers with sufficient information upon which to make decisions (Trinity and Nicholls 2004).

Calculated values were first compared to "natural" background conditions as recommended in the FLAG Guideline document (FLAG 2000). Since this analysis was conducted for multiple emission sources simultaneously, the FLAG 10 percent change in extinction (1.0 deciview) "just noticeable change" threshold was used to assess the significance of potential impacts.

No visibility criteria exceedances were projected for any pollutant or averaging period from BLM sources for any of the modeled alternatives (Table 4.2.5). Because the visibility impacts for BLM sources for all modeled alternatives was below 10 percent (1.0 deciview) for all Class I areas, no refined visibility analysis was conducted.

TABLE 4.2.5. RESULTS OF SCREENING-LEVEL VISIBILITY ANALYSIS FOR ALTERNATIVES A THROUGH D (BLM SOURCES ONLY)

PSD Class	Name of Class I or Class II Area	Days >1.0 Deciview Change	Days >0.5 Deciview Change
I	Arches NP	0	0
I	Canyonlands NP	0	0
I	Capitol Reef NP	0	0
II	Brown NWR	0	0
II	Dinosaur NM	0	0
II	Flaming Gorge NRA	0	0
II	High Uintas WA	0	0
II	Ouray NWR	0	0
II	USFS Request (Areas near Mount Olympus, Twin Peaks, Lone Peak, Mount Timpanogos, Mount Nebo)	0	0

4.2.2.6.7.5 Deposition

All modeled values of sulfur and nitrogen deposition for BLM sources only were well below the applicable thresholds of 3 kilograms per hectare per year (kg/ha-yr) for total sulfur and 5 kg/ha/yr for total nitrogen.

4.2.2.6.7.6 Acid Neutralizing Capacity

Where background lake chemistry data were available, an analysis of potential changes to ANC (the ability of a given lake to neutralize acid precipitation) was performed using the procedure recommended by the USDA - Forest Service (2000). This screening methodology takes deposition values of sulfur and nitrogen estimated by CALPUFF and converts these values into a potential change in the ability of a given lake to neutralize acid precipitation.

ANC thresholds were not exceeded for any of the lakes considered in the analysis of modeled BLM source emissions.

4.2.2.6.8 Alternatives B, C, and D

The following subsections present the CALPUFF modeling results for Alternatives B, C and D for NAAQS, PSD increments, HAPs, visibility, deposition, and ANC from BLM sources.

4.2.2.6.8.1 NAAQS

Modeling results were the same as for Alternative A and show no exceedances of the NAAQS for BLM sources.

4.2.2.6.8.2 PSD Increment Thresholds

Modeling results were the same as for Alternative A and show no exceedances of the Class I or Class II increments for BLM sources.

4.2.2.6.8.3 HAPs Emissions

The results of the HAPs modeling were similar to those for Alternative A and show no concentration values (excluding background concentrations) that exceeded any of the AACLs/RfCs for BLM sources only (benzene concentration 0.0376 $\mu g/m^3$, 0.0056 $\mu g/m^3$, 0.0056 $\mu g/m^3$ for Alternatives B, C and D respectively; formaldehyde concentration 0.0559 $\mu g/m^3$, 0.0555 $\mu g/m^3$, 0.0559 $\mu g/m^3$ for Alternatives B, C and D respectively). However, when background concentrations are included, the annual concentrations for benzene (2.9 $\mu g/m^3$) and formaldehyde (7.2 $\mu g/m^3$) and the 24-hour concentration for xylenes (192 $\mu g/m^3$ for Alternative B and 190 $\mu g/m^3$ for Alternatives C and D) exceed their respective AACLs, as projected for Alternative A. (The background concentration for xylenes recommended for use is greater than the 100-$\mu g/m^3$ threshold identified for the 24-hour average.) BLM sources contribute, at most, 1% to these concentrations, meaning that at least 99% percent of these concentrations are due to assumed background concentrations.

An incremental cancer risk analysis (excluding background concentrations) was conducted for Alternatives B, C and D as for Alternative A. Individual cancer risks for long-term exposure to benzene under the MLE scenario were 1.7×10^{-8} to 6.1×10^{-8} for Alternative B (same as Alternative A), and 2.6×10^{-9} to 9.1×10^{-9} for Alternatives C and D. The results of the risk analysis for formaldehyde show an individual cancer risk value of 1.5×10^{-7} for Alternatives B,

C and D (same as Alternative A). All of the MLE risks are well below the lower end of the range of presumptively acceptable risks (1×10^{-4} to 1×10^{-6}, EPA 1998), indicating no potential for concern.

Under the MEI analysis, the individual cancer risk for benzene was 2.4×10^{-8} to 8.4×10^{-8} for Alternative B (same as Alternative A), and 3.5×10^{-9} to 1.3×10^{-8} for Alternatives C and D for long-term exposure to benzene. The results of the risk analysis for formaldehyde show a risk value of 2.1×10^{-7} for Alternatives B, C and D (same as Alternative A). These risks values are also below the range of presumptively acceptable risks, indicating no potential for concern.

The risk calculations are based on the maximum-modeled concentrations as described for Alternative A.

4.2.2.6.8.4 Visibility Analyses

Modeling results were the same as for Alternative A and show no visibility criteria exceedances. Results using the 0.5-dv threshold requested by USFS are provided in the TSD (Trinity and Nicholls 2004).

4.2.2.6.8.5 Deposition

Modeling results were the same as for Alternative A and show no exceedances of the applicable thresholds for total sulfur and total nitrogen.

4.2.2.6.8.6 Acid Neutralizing Capacity

Modeling results were the same as for Alternative A and show no exceedances of ANC thresholds for any of the lakes considered in the analysis of modeled BLM source emissions.

4.2.2.7 Discussion

Table 4.2.6 contains a relative comparison of physical characteristics and modeled air quality parameters from BLM emission sources for the proposed management alternatives A, B, C and D – Current Management.

TABLE 4.2.6. RELATIVE COMPARISON OF MODELED AIR QUALITY PARAMETERS FROM BLM SOURCES FOR PROPOSED MANAGEMENT ALTERNATIVES

Parameter	Alt. A	Alt. B	Alt. C	Alt. D – Current Management
Physical Characteristics				
Proposed number of wells [a]	6,342.8	6,432.6	6,225.7	6,247.6
Estimated number of new road miles per year [a]	253.8	257.3	249.1	250.0
Modeled PM_{10} fugitive dust impacts associated with new road use and construction (tons/year)	120.9	122.5	118.7	119
Modeled $PM_{2.5}$ fugitive dust impacts associated with new road use and	17.7	18	17.5	17.6

TABLE 4.2.6. RELATIVE COMPARISON OF MODELED AIR QUALITY PARAMETERS FROM BLM SOURCES FOR PROPOSED MANAGEMENT ALTERNATIVES				
Parameter	**Alt. A**	**Alt. B**	**Alt. C**	**Alt. D – Current Management**
construction (tons/year)				
Air Quality Impacts				
Total NAAQS exceedances	none	none	none	None
PSD increment exceedances	None	none	none	none
Hazardous air pollutants (HAPs) benzene	none to negligible	none to negligible	none to negligible	none to negligible
Hazardous air pollutants (HAPs) benzene formaldehyde	none to negligible	none to negligible	none to negligible	none to negligible
Visibility impacts	none to negligible	none to negligible	none to negligible	none to negligible
Deposition of sulfur and nitrogen	None	none	none	none
Acid neutralizing capacity (ANC) exceedances	none	none	none	None
[a] Please see discussion of well numbers under Section 4.2.2.6.3 Air Quality Modeling Assumptions				

The information presented in the preceding sections and summarized in Table 4.2.6 shows that the proposed BLM sources are not projected to cause exceedance of any applicable standards or thresholds. Therefore, air quality effects specific to BLM emission sources from mineral development are expected to be negligible at most.

Also, it should be noted that the multiple conservative assumptions used throughout the modeling further underscore that actual air quality impacts are likely to be less than the modeled values. For example, some pollutant sources were assumed to operate 100 percent of the time throughout the modeled period although it is unlikely that this will occur; the maximum modeled concentration was used for health risk calculations, although it is unlikely that anyone resides at the maximum location; fugitive dust sources were conglomerated into area sources, likely increasing local $PM_{2.5}$ and PM_{10} concentrations, and roads are assumed to emit dust equally throughout the year, when dust emissions are reduced or eliminated when roads are frozen or wet.

4.2.3 Mitigation Measures

No air quality exceedances were projected under the proposed alternatives. However, the following mitigating measures may be implemented to further minimize air quality emissions related to the proposed management decisions.

Prescribed burning would be concentrated in spring (mid-April through mid-June) and fall (mid-September through mid-November) to avoid coinciding with peak summer levels of air pollutants from other anthropogenic activities in the area and winter inversion potential. The increase in local and subregional smoke associated with prescribed burns must be traded off against the large regional smoke plumes of the wildfires that can be expected without prescribed burning. Computer smoke dispersion modeling, and related smoke management techniques can

help to reduce the potential that prescribed burning would result in air quality exceedances within the VPA.

Roads, well locations, and other mineral development-related disturbances in areas with soils susceptible to wind erosion would be appropriately surfaced (covering of piles where appropriate, graveling or surfactants applied to roads, etc.) to reduce fugitive dust generated by traffic and related activities. Such treatments would also be applied as appropriate on local and resource roads that represent a dust problem. Lower speed limits, enforced by the appropriate authority, would also act to limit dust in project and adjacent areas.

In addition, a variety of multi-level regulatory processes exist to ensure that pollutant levels do not increase above identified thresholds and/or air quality criteria. Pre-construction permitting processes are required to consider cumulative impacts of proposed and surrounding future sources to ensure that proposed sources within the project area would not contribute to exceedances of the ambient air quality standards.

4.2.4 Cumulative Impacts

The CALMET/CALPUFF dispersion model was used with the best available meteorological data (1996) plus numerous surface, precipitation, and upper-air data to predict maximum potential far-field cumulative air quality impacts at downwind PSD Class I Wilderness Areas. This assessment was conducted to:

- Determine if the NAAQS and PSD Class I increments might be exceeded,
- Calculate potential nitrate and sulfate deposition (and their related impacts) in sensitive lakes,
- Predict potential impacts to regional visibility.

Emission concentrations were also predicted in the impact analysis area to determine compliance with Class II increments.

Potential emissions from other “reasonably foreseeable“ facilities not represented by the measured background values were added to modeled emissions from implementation of Alternative B (the alternative representing the greatest degree of potential oil and gas development) to determine potential cumulative air quality impacts. Therefore, the cumulative effects analysis represents the highest potential cumulative impact from the four alternatives. Detailed information on the sources outside the VPA is presented in the TSD (Trinity and Nicholls 2004).

4.2.4.1 NAAQS

Modeling results show no exceedances of the NAAQS for any pollutant for any of the modeled alternatives.

4.2.4.2 PSD Increment Thresholds

The modeling results show no potential concentrations that would exceed the Class I or Class II increments for the VPA.

4.2.4.3 HAPs Emissions

The results of the far-field HAPs modeling show that the annual benzene and formaldehyde concentrations (2.92 µg/m^3 and 7.18 µg/m^3 respectively, including background concentrations) and the 24-hour concentration of xylenes (192 µg/m^3, including a background concentration greater than the 100 µg/m^3 24-hour concentration threshold) were the only values that exceeded any of the AACLs. An incremental cancer risk analysis was performed for benzene and formaldehyde emitted from the proposed sources modeled (xylenes are not considered carcinogenic).

Under the MLE scenario, the estimated individual cancer risks associated with long-term exposure to benzene range from 1.4 x 10^{-6} to 5.1 x 10^{-6}, while the formaldehyde risk was estimated to be 2.0 x 10^{-5}. These values are within the EPA (1998) range of presumptively acceptable risks of 1.0 x 10^{-4} to 1.0 x 10^{-6}. Under the MEI analysis, individual cancer risks for benzene were 2.0 x 10^{-6} to 7.0 x 10^{-6}, while the risk for formaldehyde was 2.7 x 10^{-5}. Again, the values are within the range of presumptively acceptable risks and both indicate no potential for concern.

As described for Alternatives A through D, risk calculations are based on the maximum modeled concentrations and should be viewed as an upper bound on the range of possible risks associated with far-field impacts, with risks to actual residents likely being lower.

4.2.4.4 Visibility Analyses

Results of the visibility analysis (Trinity and Nicholls 2004) for all sources are presented in Table 4.2.7.

TABLE 4.2.7. RESULTS OF SCREENING-LEVEL AND REFINED MODELING OF CUMULATIVE VISIBILITY IMPACTS, ALL SOURCES

PSD Class	Name of Class I or Class II Area	Days >1.0 Deciview Change	Days >0.5 Deciview Change
I	Arches NP	0	0
I	Canyonlands NP	0	0
I	Capitol Reef NP	0	0
II	Brown NWR	0	0
II	Dinosaur NM	0	0
II	Flaming Gorge NRA	0	0
II	High Uintas WA	0	0
II	Ouray NWR	0	0
II	USFS Request (Areas near Mount Olympus, Twin Peaks, Lone Peak, Mount Timpanogos, Mount Nebo)	0	0

Results of the screening visibility analysis shown in Table 4.2.7 indicate that potential BLM sources, along with existing inventory sources, do not result in a perceptible (1.0-dv reduction)

impact on visibility at any of the PSD Class I areas in the study domain. Results of an analysis using the USFS threshold of 0.5-dv change may be found in the TSD (Trinity and Nicholls 2004). As with Alternatives A through D, the Class II areas have no visibility protection under existing State or Federal laws but are included to provide decision makers with a more complete picture of potential impacts throughout the region.

No visibility criteria exceedances were projected for any pollutant or averaging period from BLM sources for any of the modeled alternatives. Because the visibility impacts for BLM sources for all modeled alternatives were below 10 percent (1.0 deciview) for all Class I areas, no refined visibility analysis was conducted.

4.2.4.5 Deposition

All modeled values of sulfur and nitrogen deposition for BLM sources only were well below the applicable thresholds of 3 kg/ha-yr for total sulfur and 5 kg/ha/yr for total nitrogen.

4.2.4.6 Acid Neutralizing Capacity

ANC thresholds were not exceeded for any of the lakes considered in the analysis of modeled BLM source emissions.

4.2.5 Air Quality Impact Summary

Management decisions specific to the Proposed Action and Alternatives have the potential to impact air quality to the following degrees:

- Mineral management decisions would emit pollutants during operation (i.e., well operations, compressor engines, etc.), along with fugitive dust from construction and mineral extraction activities. Air quality impacts from the projected levels of emission are expected to be negligible.
- Air quality impacts from prescribed fire management decisions would generally be related to particulate matter (primarily $PM_{2.5}$) and carbon dioxide (CO_2). Impacts would generally be short term and would have long-term benefits for other resources.
- Impacts from forage management decisions, livestock grazing, rangeland improvement decisions, recreation management decisions, riparian management decisions, soils and watershed management decisions, special designations decisions, travel-based decisions, wildlife and fisheries management decisions, and woodland and forest management decisions are projected to have a negligible to incrementally positive effect on air quality in those regions where they are implemented.
- Impacts from cultural resource management decisions, land and realty management decisions, paleontology-based decisions, special status species decisions, visual resource management decisions, and wild horse management decisions are projected to have no significant effect on air quality except as they impact other management decisions.
- The burning of fossil fuels (natural gas, crude oil, etc.) produces many types of emissions, including so-called greenhouse gases (GHGs). These GHGs (primarily carbon dioxide, CO2) are believed to cause global warming. The production and combustion of natural gas associated with the proposed alternatives would produce GHGs. However, the amount of GHGs produced is an extremely small fraction of the global emissions total,

and lower than if other fuels (coal, oil, etc.) were being used. Therefore, no significant adverse impacts to climate are anticipated from implementation of any of the alternatives.

4.2.6 Unavoidable Adverse Impacts

Prescribed fire may result in degradation of air quality through increases in wind-borne particulate (PM10 and PM2.5) due to loss of vegetation unless revegetation measures are adequately monitored and supported for regrowth.

Adverse impacts to air quality are not projected to occur under any of the proposed mineral development alternatives.

4.2.7 Short-term Use Versus Long-term Productivity

Prescribed fire may result in short and long-term (to a lesser degree) degradation of air quality through increases in wind-borne particulate (PM10 and PM2.5) due to loss of vegetation unless revegetation measures are adequately monitored and supported for regrowth.

Adverse impacts to air quality are not projected to occur under any of the proposed mineral development alternatives.

4.2.8 Irreversible and Irretrievable Impacts

With proper management and remediation, there are no projected irreversible or irretrievable air quality impacts associated with the proposed prescribed burning alternatives.

There are no irreversible or irretrievable impacts to air quality projected to occur under any of the proposed mineral development alternatives.

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