Air Quality Report

Pahvant Interagency Fuels Reduction Project

Prepared by L. Chappel, 4/30/03

Affected Environment – Existing Condition

Wildland fires (both prescribed fire and wildfire) are a potentially significant source of air pollutant emissions because of the combustion process, which burns various sizes and types of vegetation. The amount of emissions depends on the size and intensity of the fire, the fuel type and moisture content of the fuel, and the available fuel loading.

Dry fuels (such as dead and down vegetation) are consumed first by fire, followed by live vegetation as it dries through the fire's pre-heating. Under extreme conditions, (high amounts of dry fuels, steep topography and/or high winds) this combustion may create a large, uncontrollable crowning wildfire in fuels such as those in the Pahvant project area. Smoke effects from large, uncharacteristic wildfires usually create more pollutants over a longer time than prescribed burning, due to size and length of burn (smoldering) differences, (Hardy, et.al, 2001, p 93).

Prescribed fires are normally much smaller than uncontrolled wildfires and involve less combustion, since they can only be applied when the fuel type and fuel loading meet preset management prescriptions for conducting the burn. The weather conditions must also meet preset prescriptions to execute the burn safely, enhance efficient fuel consumption and effectively disperse smoke.

National Ambient Air Quality Standards (NAAQS) are set in Section 109 of the Clean Air Act to protect public health and welfare. The NAAQS are set for criteria pollutants such as carbon monoxide (CO), lead (Pb), nitrogen dioxide (Nox), particulate matter (PM), ozone (O3) and sulfur dioxide (SO2). An air quality State Implementation Plan has been written and approved so Utah Department of Environmental Quality can track and enforce the NAAQS.

Non-attainment areas are areas where air quality has been found to violate one or more of the National Ambient Air Quality Standards. Utah has a number of non-attainment zones, primarily east of populated areas in the Wasatch front, which is more than 75 miles north of the project area. Wildland fire smoke's pollutant of highest interest is particulate matter (PM), although fire also creates other criteria pollutants and visibility impacts. The State of Utah, Department of Environmental Quality has monitoring devices deployed in all non-attainment areas as the responsible party for enforcing air quality.

Seasonal Effects on Air Quality

The project area is located east of the communities of Meadow, Fillmore and Holden. Scipio is approximately three miles north of the Grabalt (northern most unit) in this project. Local air quality is generally considered very good. The area is currently attaining national air quality goals for all criteria pollutants.

Topography and weather patterns determine the extent to which airborne particulate matter accumulates within the local airsheds. Diurnal temperature changes affect how pollutants in the region are dispersed. The earth's surface cooling at night creates down slope winds that carry pollutants from higher terrain to lower lying areas where they may concentrate in the more inhabited areas below the burn units. The daytime heating of the earth's surface causes pollutants to rise with the heated air where they are diluted and carried away in the prevailing winds, typically to the north and east.

During the winter, weather conditions can trap emissions in a layer of cold surface air (inversion). Under winter conditions, pollutants can concentrate in the local airshed and along the foothills of the western edge of the project area.

Regional haze affects the area in summer. Local winter inversions can trap particulates close to the surface in the Gunnison and Scipio Valleys. Visibility is also an air quality consideration. However, there is no known visibility monitoring data from any viewpoints in or near the project. Visibility tends to be lowest in the summer due to regional haze and smoke from fires.

Particulate Matter and Public Health

Air pollutants called particulate matter include dust, dirt, soot, smoke and liquid droplets directly emitted into the air by sources such as factories, power plants, cars, construction activity, fires and natural windblown dust. Particles formed in the atmosphere by condensation or the transformation of emitted gases such as sulphur dioxide (SO2) and volatile organic compounds (VOCs) are also considered particulate matter.

Particulate matter is defined as tiny particles of solid or semi-solid material suspended in the air. Particles may range in sized from less than 0.1 microns to 50 microns. Particles larger than 50 microns tend to settle out of the air quickly and are not likely to affect public health. Particles 10 microns and smaller are considered inhalable and have the greatest health effects. Coarse particles, from 2.5 microns to 10 microns in diameter, come from many sources. In many cases windblown dust and dust kicked up on unpaved roads by vehicle traffic account for much of this fine particulate matter. These fine particles are major contributors to visibility problems because of their ability to scatter light.

Based on studies of human populations exposed to high concentrations of particles (sometimes in the presence of SO2) and laboratory studies of animals and humans, there are major effects of concern for human health. These include effects on breathing and respiratory symptoms, aggravation of existing respiratory and cardiovascular disease, alterations in the body's defense systems against foreign materials, damage to lung tissue carcinogenesis and premature death. The major subgroups of the population that appear to be most sensitive to the effect of particulate matter include individuals with chronic obstructive pulmonary or cardiovascular disease of influenza, asthmatics, the elderly and children. Particulate matter also soils and damages materials and is a major cause of visibility impairment in the United States.

Annual and 24-hour National Ambient Air Quality Standards (NAAQS) for particulate matter were first set in 1971. Total suspended particulate (TSP) was the first indicator used to represent suspended particles in the ambient air. EPA used the indicator PM-10 starting in 1987, which included only those particles in the ambient air. In July 1, 1997, however, EPA adopted the indicator PM-2.5, which includes only those particles with aerodynamic diameter smaller than 2.5 micrometers. These smaller particles are likely responsible for most of the adverse health effects of particulate matter because of their ability to reach and remain in the thoracic or lower regions of the respiratory tract.

Class I Air Quality and Non-Attainment Area Status

There are no non-attainment areas within 75 miles of the proposed project area, nor near enough to expect any impairment from this project. The closest non-attainment area is located in Utah County, at the north end of airshed eight on the Utah Airshed map, page 10.

Smoke Sensitive Areas and Sensitive Receptors

Several smoke sensitive areas lay within a 30-mile radius of the Pahvant Project boundary and are displayed below. While these areas do not necessarily meet the official definition of smoke sensitive, experience has shown that these areas need to be considered when planning and executing prescribed fires.

Area	Distance from Boundary	Direction	Reason
Scipio	3 miles	N	Visibility, human habitation
Gunnison	20 miles	E	Visibility, hospital, number of retirees and young children
Yuba Lake State Park	13 miles	S & SW	Visibility
Kanosh, Meadow, Fillmore, Holden,	Within boundaries or directly adjacent	S & W	Visibility, hospital, human habitation, may receive some

Area	Distance from Boundary	Direction	Reason
			evening smoke
I-15	3-5 miles	W	Visibility on road, although unlikely, may receive some evening smoke

Table 1. Smoke Sensitive Areas

In addition to these smoke sensitive areas, there are times of year when smoke may pose a problem, usually as 'nuisance' smoke. These smoke sensitive times include local events, such as the ATV Jamboree and opening weekends of fall hunting seasons.

Environmental Consequences

No Action – Direct and Indirect Effects on Air

In the no action alternative, no further fuels cutting (except what is already covered in previous Environmental Assessments) would occur and no prescribed burning would be utilized to reduce fuels. Uncharacteristic wildfires would be expected to continue at approximately the current increasing rate until much of the analysis area had burned. This could create adverse effects on air quality, in both the short- and long term, depending on when wildfires happened.

Proposed Action – Direct and Indirect Effects on Air

Air quality provides an example of short- and long-term trade offs in implementing fuel management programs. There is a risk of short-term human health impacts from prescribed fire to Clean Air Act health standards. These emissions from prescribed fires, however, can be managed by carefully distributing (prescribed) fire over time and space, as well as under appropriated weather conditions (Cohesive Strategy,2002, p39).

The most effective means of limiting air pollutant emissions from wildfire is to inhibit these large uncharacteristic fires by reducing and breaking up heavy, continuous fuels. The Pahvant project would reduce fuels by cutting and then prescribed burning the downed fuels. This combination of cutting and prescribed fire is an effective method of reducing heavy fuels and creating a vegetative mosaic that would limit future wildfires' area. There is essentially no difference between the No Action and Proposed Action alternatives in terms of expected annual emissions and the area potentially affected.

A prescribed fire is continually monitored to assure that the burning conditions remain within the prescribed burning conditions that create the desired fire behavior and smoke management limits. When properly executed, a prescribed fire would be expected to result in fewer air quality impacts in both the short and

long term than an uncharacteristic wildfire, which could burn through the current fuels.

Prescribed burns are of shorter duration, are done under conditions that disperse smoke, and are in compliance with states' smoke management programs.", (Tenney and Scarlett, 2003). The areas most likely to be affected by smoke produced while burning the proposed units lie north and east of the project area, although some down drainage evening smoke drift is to be expected after igniting. The further the fire is from a given area, the less likely that area would experience high levels of smoke. There are no non-attainment areas within the proposed project area, nor near enough to expect any impairment from this project

Capitol Reef National Park (more than 40 miles south east of the proposed project) is the only Class I airshed within 100 miles of the Pahvant project boundary. It is not expected that any smoke from this project would reach this Class I area, as ignition would not occur within weather parameters that would be conducive to pushing smoke into the Class I area.

The basic control strategies for minimizing the adverse effects of smoke on human health and welfare are avoidance, dilution and emissions reduction. Avoidance uses meteorological conditions when scheduling burning in order to avoid incursions of wildland fire smoke into smoke sensitive areas. Dilution involves controlling the rate of emissions or scheduling for dispersion to assure tolerable concentrations of smoke in designated areas. Emissions reduction uses techniques to minimize the smoke output per unit area treated and decreases the contribution to regional haze as well as intrusions into designated areas, (Hardy, et.al. 2001, p 3).

The central Utah interagency fire group currently uses a range of smoke management and emission reduction best management practices to reduce potential impacts during prescribed burning. Techniques used include:

- cutting and piling before burning where practical to minimize smoke production,
- using rapid ignition techniques
- igniting during daylight hours only,
- burning mostly during off season (spring, fall, winter) months when recreational use is lower
- burning with the highest clearing indices possible (above 500)
- burning only those wildland fuels essential to meet management objectives
- burning during optimum periods to prevent trapping smoke in inversions or diurnal wind flow patterns
- mopping up smoke if down drainage smoke where necessary
- coordinating all burns through the State Smoke Management Coordinator to minimize overall smoke impacts to central Utah airsheds

Smoke production is a direct function of the amount of biomass burned; the more fuel, the more smoke. It is reasonable to expect that an average of not more than 1000 acres/day will be burned during the off-season months when the clearing index is at or above 500. Burning piles and small broadcast units maximizes fuel consumption, decreases periods of smoke impacts and increases smoke dispersion. Slash burning will take place during fall, winter and spring and will not be occurring concurrently with wildfires and wildland fires managed for resource benefit. Smoke production from burning slash will be minimal and of short duration. Broadcast burn units tend to burn less than three days with limited smoke after the first burning period.

Smoke is expected to remain at "nuisance" levels rather than at levels that could impair human health. During the day, when units are ignited, smoke is expected to travel on prevailing winds up over the Pahvant front and dissipate across the Scipio and Gunnison Valleys. Most of that smoke would dissipate, but some may surface. Short-term nighttime nuisance smoke may settle down the drainages into the towns below, particularly during early morning hours. Nighttime smoke would be expected to reside in the very eastern edge of airshed two, while day time smoke would be expected to dissipate mostly into airshed ten with some moving into the southern end of airshed eight. Burn plans for each unit will contain maps of expected daytime and nighttime smoke trajectories.

SASEM results show that under spring and fall burning conditions, National Ambient Air Quality Standards would not be exceeded, even while burning up to 1000 acres of pinyon/juniper or oak brush fuels(see Attachment 1, SASEM modeling).

Nighttime smoke concentrations may be heavier than daytime smoke concentrations, although it is expected that most smoke will dissipate after the first burning period. At night, smoke tends to settle closer to the ground in the cooler air and flow down the nearest drainage. People living along the drainage bottoms would experience some evening smoke.

All ignitions will follow direction set in the specific burn plan for the treatment unit. Burn plans must meet Federal Wildland Fire Management Policy requirements (1995) as well as Bureau of Land Management and Forest Service specific manual direction. Burn plans are prepared by specially trained personnel and reviewed before recommendation in writing by a qualified Line Officer.

All appropriate smoke emission production reporting rules will be adhered to as stated in the State Smoke Management Plan. This occurs as the burn plans are written and implemented.

Smoke management follows all regulations as defined by the Utah Smoke Management Plan (1999). The state implementation plan (State Rule R307-204) has provisions for tracking prescribed fire smoke emissions. The State Rule also describes appropriate smoke management for prescribed fires in Utah. Specifics for state-regulated smoke emission requirements can be found at http://www.utahsmp.net. The Utah Smoke Management Plan is included in the project file.

Cumulative Effects Area

The cumulative effects area encompasses the smoke sensitive areas in the communities west of the Pahvant Front, Scipio valley, and the south end of the Sanpete Valley. The cumulative effects area for the air quality resource involves parts of Utah Smoke Management Airsheds two, eight and ten (attachment 1). The ignition units are on the eastern edge of airshed two and the southwestern edge of airshed eight.

Cumulative Effects Common to Both Alternatives

Other projects planned include an interagency fuels treatment prescribed fire project on Church Hills, just northwest of Holden, Utah. The air quality best management practices described in the Utah State Smoke Management Rule have already been applied on the Church Hills Project.

Prescribed and wildland fire used for resource benefit ignitions and smoke emissions are coordinated both through the local Interagency Fire Management program and through requesting permission to ignite through the Utah State Smoke Manager. The State has responsibility for managing smoke's cumulative effects to airsheds through the burn approval process in the Utah Smoke Management Plan (1999) and State Smoke Management Rule (R307-204). This approval process applies to both prescribed fires and wildland fires managed for resource benefits. Potential prescribed fire and wildland fire use emissions are kept at safe levels through timing ignitions and limiting acreage ignited on any given day. Prescribed and wildland fire used by other agencies would be expected to have little direct impact on the area other than potential visibility reduction with increased regional haze.

Monitoring

Smoke from prescribed fires will be monitored. All burn plans will contain a monitoring plan for smoke, a detailed map of probable smoke trajectories and estimated of emissions by burn unit.. Monitoring can consist of visually tracking smoke plumes by field observers or air borne observers and possibly utilizing PM10/PM2.5 particulate monitors at sensitive receptors.

Thanks to Cyndi Sidles, Brian Bischof, Greg Zschaechner and Steve Zieroth for assistance in writing this document.

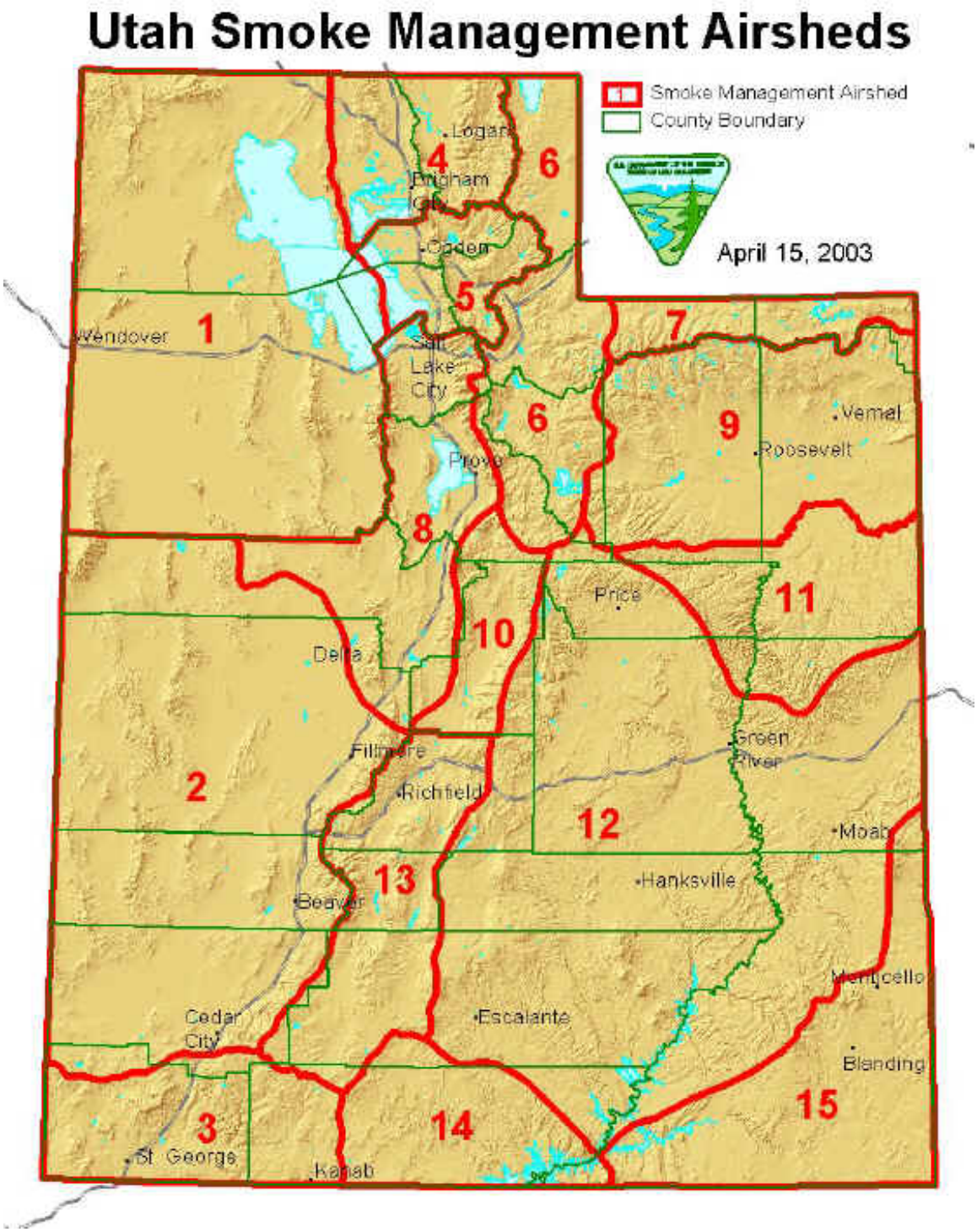
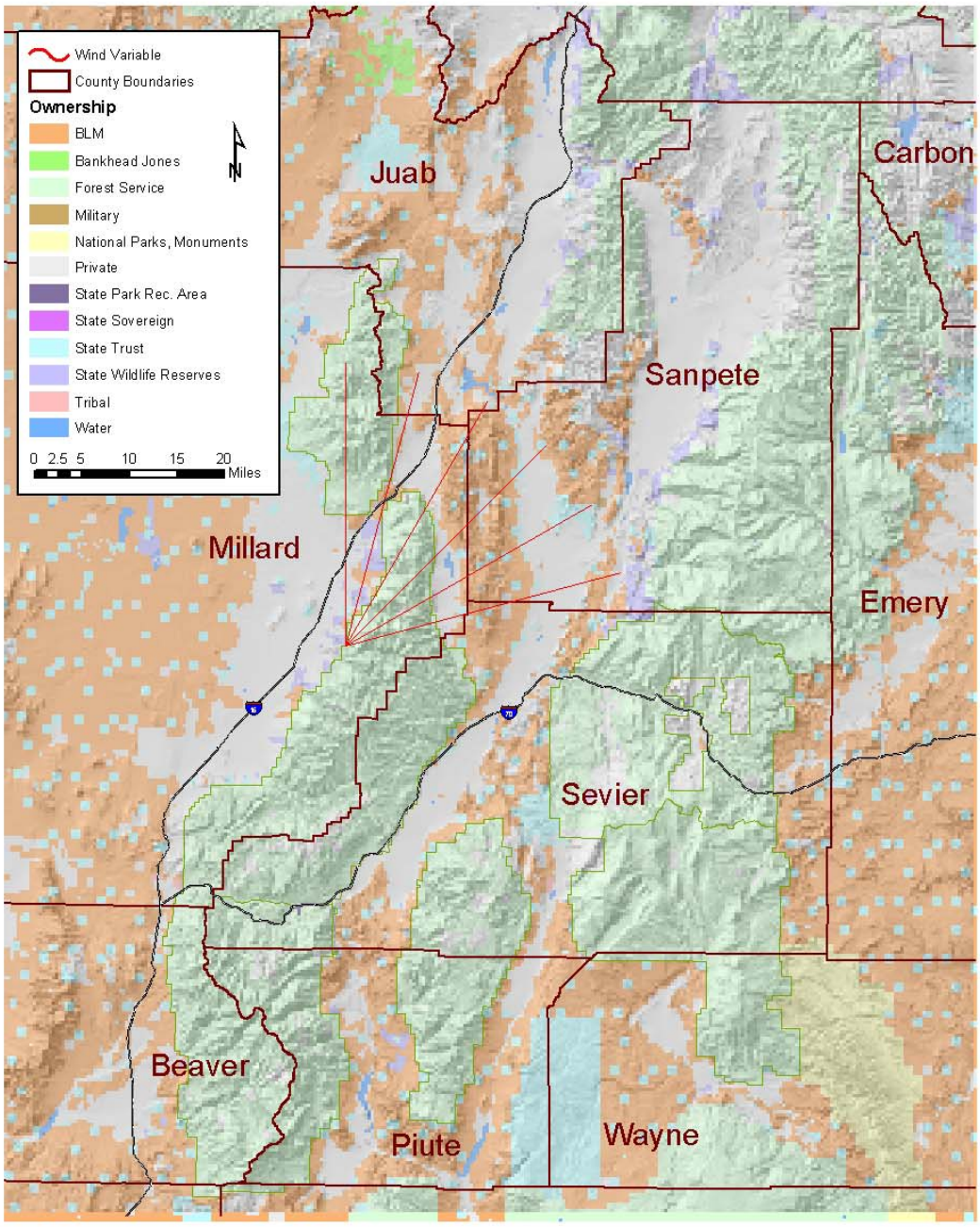


Exhibit 1. Utah Smoke Management Airsheds, Utah State Smoke Management Plan

Pahvant Interagency Fuels Reduction Project

Possible Smoke Trajectories with S to SW Transport Winds



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USDA Forest Service. Restoring Fire-Adapted Ecosystems on Federal Lands, a cohesive strategy for protecting people and sustaining natural resources, 2000. Updated in draft form, 2002.

Air Quality Attachment 1

Simple Approach Smoke Estimation Model (SASEM) Results for the Pahvant Prescribed Burn Project

The SASEM model is a tool for the analysis of smoke dispersion from prescribed fires. It is a screening model, in that is uses simplified assumptions and tends to over predict impacts, yielding conservative results. If violations of air quality standards are not predicted by SASEM, it is unlikely that they will occur.

Inputs to the model include basic descriptions of the fuels, such as type and loading, expected fireline intensity, and expected burn duration. Windspeed and direction, dispersion conditions, and average mixing height are considered, as well as distance and direction of the fire from sensitive receptors. The model calculates fuel consumptions and particulate emission factors from fuel loading and expected fireline intensity.

Model outputs include maximum particulate concentration and the distance from the fire at which it will occur, ranges of distances from the fire and which any primary or secondary particulate standards would be violated, and the reduction in visual range at selected receptors. Outputs are given in tabular form for a range of dispersion and windspeed conditions.

The following inputs were used for the Pahvant project:

The oak and pinyon/juniper fuels were modeled using the National Fire Danger Rating System (NFDRS) model B. The sagebrush/grass/forb fuels were modeled with NFDRS model T. Two burn seasons were modeled, spring and fall, with an assumption of 4 hours ignition time, over no more than 1000 acres. Three sensitive receptors were modeled: Scipio, Gunnison and Yuba Lake, as they could possibly be impacted with project emissions.

SASEM 4.0 Results for spring and fall burning in oak brush and pinyon/juniper.

This is the spring burning window, using Classic Sasem input and calculations.

Burn Name	PahvantOakPJ
Burn Date	4/15/2004
Burn Type	BROADCAST
Fuel Type	WOODY
Fuel Loading	10.000 T/A
Fire Line Intensity	200.000 Btu/ft/s
Burn Duration	4.000 Hr
Burn Area	1000.000 Acres
Wind Speed Min	2.0 mi/hr
Wind Speed Max	10.0 mi/hr
Wind Speed Inc	2.0 mi/hr
Wind Direction Min	S
Wind Direction Max	W
Stability Type	Dispersion Day
Stability Min	Excellent
Stability Max	Fair
Mixing Height	1500.0 m
Met Limitation	Only Valid Combinations
Number of Receptors	3
Receptor Name	Scipio
Receptor Distance	3.00 mi
Receptor Direction	SW
Receptor Name	Gunnison
Receptor Distance	20.00 mi
Receptor Direction	W
Receptor Name	Yuba Lake
Receptor Distance	13.00 mi
Receptor Direction	SSW
Total Fuel Consumed	5.000 T/A
TSP Emission Factor	16.868 g/kg
PM-10 Emission Factor	13.495 g/kg
PM-2.5 Emission Factor	11.133 g/kg
TSP Emission Rate	2.641 g/s/m
PM-10 Emission Rate	2.113 g/s/m
PM-2.5 Emission Rate	1.743 g/s/m
TSP Total Emissions	84.341 T
PM-10 Total Emissions	67.473 T
PM-2.5 Total Emissions	55.665 T
Fireline Length	2011.69 m
Fire Rate of Spread	0.140 m/s
Heat Content of Fuel	7000. Btu/lb
Fireline Width	134.11 m
Number of Plumes	15.
Heat Release Rate	81666632. cal/s
Wind Persistence Factor	0.167
Portion of smoke which rises	60.00 %

Stability	Wind Speed (mi/hr)	Maximum Concen (ug/m**3)	Distance to Maximum Concen (mi)	Exceedences Distance From (mi)	To (mi)	Plume Rise (m)
EXC	2.0	42.5	10.93	No Exceedence		5293.
EXC	4.0	42.5	5.87	No Exceedence		2647.
GOOD	2.0	45.7	55.67	No Exceedence		5293.
GOOD	4.0	42.5	17.78	No Exceedence		2647.
GOOD	6.0	42.5	11.39	No Exceedence		1764.
GOOD	8.0	42.5	8.31	No Exceedence		1323.
GOOD	10.0	42.5	6.50	No Exceedence		1059.
FAIR	4.0	11.5	61.52	No Exceedence		2647.
FAIR	6.0	24.6	61.52	No Exceedence		1764.
FAIR	8.0	33.3	57.68	No Exceedence		1323.
FAIR	10.0	33.3	38.84	No Exceedence		1059.

* The PM-10 standard used is 150. micrograms per cubic meter.

Stability	Wind Speed (mi/hr)	Maximum Concen (ug/m**3)	Distance to Maximum Concen (mi)	Exceedences Distance From (mi)	To (mi)	Plume Rise (m)
EXC	2.0	35.0	10.93	No Exceedence		5293.
EXC	4.0	35.0	5.87	No Exceedence		2647.
GOOD	2.0	37.7	55.67	No Exceedence		5293.
GOOD	4.0	35.0	17.78	No Exceedence		2647.
GOOD	6.0	35.0	11.39	No Exceedence		1764.
GOOD	8.0	35.0	8.31	No Exceedence		1323.
GOOD	10.0	35.0	6.50	No Exceedence		1059.
FAIR	4.0	9.5	61.52	No Exceedence		2647.
FAIR	6.0	20.3	61.52	No Exceedence		1764.
FAIR	8.0	27.5	57.68	No Exceedence		1323.
FAIR	10.0	27.5	38.84	No Exceedence		1059.

* The PM-2_5 standard used is 65. micrograms per cubic meter.

Receptor Name	Dist (mi)	Dir	Stability	Wind Speed (mi/hr)	Range of Wind Dir	P&V* Visual Range (mi)	Kosh** Visual Range (mi)
Scipio	3.00	SW	EXC	2.0	S -W	0.2	22.3
Scipio	3.00	SW	EXC	4.0	S -W	0.4	5.0
Scipio	3.00	SW	GOOD	2.0	S -W	0.2	70.9
Scipio	3.00	SW	GOOD	4.0	S -W	0.4	32.0
Scipio	3.00	SW	GOOD	6.0	S -W	0.6	13.4

Scipio	3.00	SW	GOOD	8.0	S	-W	0.8	7.1
Scipio	3.00	SW	GOOD	10.0	S	-W	0.9	4.6
Scipio	3.00	SW	FAIR	4.0	S	-W	0.4	83.0
Scipio	3.00	SW	FAIR	6.0	S	-W	0.6	70.5
Scipio	3.00	SW	FAIR	8.0	S	-W	0.8	56.2
Scipio	3.00	SW	FAIR	10.0	S	-W	0.9	42.7
Gunnison	20.00	W	EXC	2.0	S	-W	0.6	2.3
Gunnison	20.00	W	EXC	4.0	S	-W	1.1	3.5
Gunnison	20.00	W	GOOD	2.0	S	-W	0.6	3.9
Gunnison	20.00	W	GOOD	4.0	S	-W	1.1	2.2
Gunnison	20.00	W	GOOD	6.0	S	-W	1.7	2.2
Gunnison	20.00	W	GOOD	8.0	S	-W	2.2	2.4
Gunnison	20.00	W	GOOD	10.0	S	-W	2.8	2.7
Gunnison	20.00	W	FAIR	4.0	S	-W	1.1	32.9
Gunnison	20.00	W	FAIR	6.0	S	-W	1.7	13.9
Gunnison	20.00	W	FAIR	8.0	S	-W	2.2	7.3
Gunnison	20.00	W	FAIR	10.0	S	-W	2.8	4.8
Yuba Lake	13.00	SSW	EXC	2.0	S	-W	0.4	2.2
Yuba Lake	13.00	SSW	EXC	4.0	S	-W	0.8	2.5
Yuba Lake	13.00	SSW	GOOD	2.0	S	-W	0.4	7.8
Yuba Lake	13.00	SSW	GOOD	4.0	S	-W	0.8	2.8
Yuba Lake	13.00	SSW	GOOD	6.0	S	-W	1.2	2.2
Yuba Lake	13.00	SSW	GOOD	8.0	S	-W	1.6	2.1
Yuba Lake	13.00	SSW	GOOD	10.0	S	-W	2.0	2.2
Yuba Lake	13.00	SSW	FAIR	4.0	S	-W	0.8	48.0
Yuba Lake	13.00	SSW	FAIR	6.0	S	-W	1.2	23.9
Yuba Lake	13.00	SSW	FAIR	8.0	S	-W	1.6	12.5
Yuba Lake	13.00	SSW	FAIR	10.0	S	-W	2.0	7.6

* Packham, D. R. and R. G. Vines, 1978, JAPCA 28:790-795.
**Koshmieder, 1924, Beitr. Phys. Freien Atm., 12:33-54.
and EPA, 1979, EPA-450/5-79-008.
Based on PM-2.5 emission rates.

This is the Fall burn Window for Oak and P/J Fuels

Using ClassicSasem input and calculations.

Burn Name ..... PahvantOakPJ
Burn Date 10/15/2004
Burn Type ..... BROADCAST
Fuel Type ..... WOODY
Fuel Loading ..... 10.000 T/A
Fire Line Intensity ..... 200.000 Btu/ft/s
Burn Duration ..... 4.000 Hr
Burn Area ..... 1000.000 Acres

Wind Speed Min ..... 2.0 mi/hr
Wind Speed Max ..... 10.0 mi/hr
Wind Speed Inc ..... 2.0 mi/hr
Wind Direction Min ..... S
Wind Direction Max ..... W
Stability Type ..... Dispersion Day
Stability Min ..... Excellent
Stability Max ..... Fair
Mixing Height ..... 1500.0 m

Met Limitation ..... Only Valid Combinations

Number of Receptors 3
Receptor Name ..... Scipio
Receptor Distance ..... 3.00 mi
Receptor Direction ..... SW
Receptor Name ..... Gunnison
Receptor Distance ..... 20.00 mi
Receptor Direction ..... W
Receptor Name ..... Yuba Lake
Receptor Distance ..... 13.00 mi
Receptor Direction ..... SSW

Total Fuel Consumed ..... 5.000 T/A
TSP Emission Factor ..... 16.868 g/kg
PM-10 Emission Factor ..... 13.495 g/kg
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TSP Total Emissions ..... 84.341 T
PM-10 Total Emissions ..... 67.473 T
PM-2.5 Total Emissions ..... 55.665 T
Fireline Length ..... 2011.69 m
Fire Rate of Spread ..... 0.140 m/s
Heat Content of Fuel ..... 7000. Btu/lb
Fireline Width ..... 134.11 m
Number of Plumes ..... 15.
Heat Release Rate ..... 81666632. cal/s
Wind Persistence Factor 0.167
Portion of smoke which rises ..... 60.00 %

Stability	Wind Speed (mi/hr)	Maximum Concen (ug/m**3)	Distance to Maximum Concen (mi)	Exceedences Distance From (mi)	To (mi)	Plume Rise (m)
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GOOD	2.0	37.7	55.67	No Exceedence		5293.
GOOD	4.0	35.0	17.78	No Exceedence		2647.
GOOD	6.0	35.0	11.39	No Exceedence		1764.
GOOD	8.0	35.0	8.31	No Exceedence		1323.
GOOD	10.0	35.0	6.50	No Exceedence		1059.
FAIR	4.0	9.5	61.52	No Exceedence		2647.
FAIR	6.0	20.3	61.52	No Exceedence		1764.
FAIR	8.0	27.5	57.68	No Exceedence		1323.
FAIR	10.0	27.5	38.84	No Exceedence		1059.

* The PM-2_5 standard used is 65. micrograms per cubic meter.

Receptor Name	Dist (mi)	Dir	Stability	Wind Speed (mi/hr)	Range of Wind Dir	P&V* Visual Range (mi)	Kosh** Visual Range (mi)
Scipio	3.00	SW	EXC	2.0	S -W	0.2	22.3
Scipio	3.00	SW	EXC	4.0	S -W	0.4	5.0
Scipio	3.00	SW	GOOD	2.0	S -W	0.2	70.9
Scipio	3.00	SW	GOOD	4.0	S -W	0.4	32.0
Scipio	3.00	SW	GOOD	6.0	S -W	0.6	13.4
Scipio	3.00	SW	GOOD	8.0	S -W	0.8	7.1
Scipio	3.00	SW	GOOD	10.0	S -W	0.9	4.6
Scipio	3.00	SW	FAIR	4.0	S -W	0.4	83.0
Scipio	3.00	SW	FAIR	6.0	S -W	0.6	70.5
Scipio	3.00	SW	FAIR	8.0	S -W	0.8	56.2
Scipio	3.00	SW	FAIR	10.0	S -W	0.9	42.7
Gunnison	20.00	W	EXC	2.0	S -W	0.6	2.3
Gunnison	20.00	W	EXC	4.0	S -W	1.1	3.5
Gunnison	20.00	W	GOOD	2.0	S -W	0.6	3.9
Gunnison	20.00	W	GOOD	4.0	S -W	1.1	2.2
Gunnison	20.00	W	GOOD	6.0	S -W	1.7	2.2
Gunnison	20.00	W	GOOD	8.0	S -W	2.2	2.4
Gunnison	20.00	W	GOOD	10.0	S -W	2.8	2.7
Gunnison	20.00	W	FAIR	4.0	S -W	1.1	32.9
Gunnison	20.00	W	FAIR	6.0	S -W	1.7	13.9
Gunnison	20.00	W	FAIR	8.0	S -W	2.2	7.3
Gunnison	20.00	W	FAIR	10.0	S -W	2.8	4.8
Yuba Lake	13.00	SSW	EXC	2.0	S -W	0.4	2.2
Yuba Lake	13.00	SSW	EXC	4.0	S -W	0.8	2.5
Yuba Lake	13.00	SSW	GOOD	2.0	S -W	0.4	7.8
Yuba Lake	13.00	SSW	GOOD	4.0	S -W	0.8	2.8
Yuba Lake	13.00	SSW	GOOD	6.0	S -W	1.2	2.2
Yuba Lake	13.00	SSW	GOOD	8.0	S -W	1.6	2.1
Yuba Lake	13.00	SSW	GOOD	10.0	S -W	2.0	2.2

Yuba Lake	13.00	SSW	FAIR	4.0	S	-W	0.8	48.0
Yuba Lake	13.00	SSW	FAIR	6.0	S	-W	1.2	23.9
Yuba Lake	13.00	SSW	FAIR	8.0	S	-W	1.6	12.5
Yuba Lake	13.00	SSW	FAIR	10.0	S	-W	2.0	7.6

* Packham, D. R. and R. G. Vines, 1978, JAPCA 28:790-795.
**Koshmieder, 1924, Beitr. Phys. Freien Atm., 12:33-54.
and EPA, 1979, EPA-450/5-79-008.
Based on PM-2.5 emission rates.

These are the results for the spring window in sagebrush/grass/forb

Using Classic Sasem input and calculations.

Burn Name	PahvantSage
Burn Date	4/10/2003
Burn Type	BROADCAST
Fuel Type	BRUSH
Fuel Loading	2.750 T/A
Fire Line Intensity	200.000 Btu/ft/s
Burn Duration	4.000 Hr
Burn Area	1000.000 Acres
Wind Speed Min	2.0 mi/hr
Wind Speed Max	10.0 mi/hr
Wind Speed Inc	2.0 mi/hr
Wind Direction Min	S
Wind Direction Max	W
Stability Type	Dispersion Day
Stability Min	Excellent
Stability Max	Fair
Mixing Height	1500.0 m
Met Limitation	Only Valid Combinations
Number of Receptors	4
Receptor Name	Rec #1
Receptor Distance	5.00 mi
Receptor Direction	S
Receptor Name	Gunnison
Receptor Distance	20.00 mi
Receptor Direction	W
Receptor Name	Scipio
Receptor Distance	3.00 mi
Receptor Direction	SW
Receptor Name	Yuba Lake
Receptor Distance	13.00 mi
Receptor Direction	SSW
Total Fuel Consumed	1.925 T/A
TSP Emission Factor	16.868 g/kg
PM-10 Emission Factor	13.495 g/kg
PM-2.5 Emission Factor	11.133 g/kg
TSP Emission Rate	1.017 g/s/m
PM-10 Emission Rate	0.814 g/s/m
PM-2.5 Emission Rate	0.671 g/s/m
TSP Total Emissions	32.471 T

PM-10 Total Emissions ..... 25.977 T
PM-2.5 Total Emissions ..... 21.431 T
Fireline Length ..... 2011.69 m
Fire Rate of Spread ..... 0.140 m/s
Heat Content of Fuel ..... 6300. Btu/lb
Fireline Width ..... 67.06 m
Number of Plumes ..... 30.
Heat Release Rate ..... 14148744. cal/s
Wind Persistence Factor 0.167
Portion of smoke which rises ..... 60.00 %

Stability	Wind Speed (mi/hr)	Maximum Concen (ug/m**3)	Distance to Maximum Concen (mi)	Exceedences Distance From (mi)	To (mi)	Plume Rise (m)
EXC	2.0	58.5	4.25	No Exceedence		1849.
EXC	4.0	58.5	2.28	No Exceedence		925.
GOOD	2.0	58.5	11.99	No Exceedence		1849.
GOOD	4.0	58.5	5.60	No Exceedence		925.
GOOD	6.0	58.5	3.59	No Exceedence		616.
GOOD	8.0	58.4	2.62	No Exceedence		462.
GOOD	10.0	58.4	4.39	No Exceedence		370.
FAIR	4.0	58.5	56.46	No Exceedence		925.
FAIR	6.0	62.9	50.86	No Exceedence		616.
FAIR	8.0	58.5	16.53	No Exceedence		462.
FAIR	10.0	58.5	11.13	No Exceedence		370.

* The TSP standard used is 150. micrograms per cubic meter.

Stability	Wind Speed (mi/hr)	Maximum Concen (ug/m**3)	Distance to Maximum Concen (mi)	Exceedences Distance From (mi)	To (mi)	Plume Rise (m)
EXC	2.0	46.8	4.25	No Exceedence		1849.
EXC	4.0	46.8	2.28	No Exceedence		925.
GOOD	2.0	46.8	11.99	No Exceedence		1849.
GOOD	4.0	46.8	5.60	No Exceedence		925.
GOOD	6.0	46.8	3.59	No Exceedence		616.
GOOD	8.0	46.7	2.62	No Exceedence		462.
GOOD	10.0	46.7	4.39	No Exceedence		370.
FAIR	4.0	46.8	56.46	No Exceedence		925.
FAIR	6.0	50.3	50.86	No Exceedence		616.
FAIR	8.0	46.8	16.53	No Exceedence		462.
FAIR	10.0	46.8	11.13	No Exceedence		370.

* The PM-10 standard used is 150. micrograms per cubic meter.

Stability	Wind Speed (mi/hr)	Maximum Concen (ug/m**3)	Distance to Maximum Concen (mi)	Exceedences Distance From (mi)	To (mi)	Plume Rise (m)
EXC	2.0	38.6	4.25	No Exceedence		1849.
EXC	4.0	38.6	2.28	No Exceedence		925.
GOOD	2.0	38.6	11.99	No Exceedence		1849.
GOOD	4.0	38.6	5.60	No Exceedence		925.
GOOD	6.0	38.6	3.59	No Exceedence		616.
GOOD	8.0	38.6	2.62	No Exceedence		462.
GOOD	10.0	38.5	4.39	No Exceedence		370.
FAIR	4.0	38.6	56.46	No Exceedence		925.
FAIR	6.0	41.5	50.86	No Exceedence		616.
FAIR	8.0	38.6	16.53	No Exceedence		462.
FAIR	10.0	38.6	11.13	No Exceedence		370.

* The PM-2_5 standard used is 65. micrograms per cubic meter.

Receptor Name	Dist (mi)	Dir	Stability	Wind Speed (mi/hr)	Range of Wind Dir	P&V* Visual Range (mi)	Kosh** Visual Range (mi)
Gunnison	20.00	W	EXC	2.0	S -W	1.4	4.3
Gunnison	20.00	W	EXC	4.0	S -W	2.9	8.2
Gunnison	20.00	W	GOOD	2.0	S -W	1.4	2.0
Gunnison	20.00	W	GOOD	4.0	S -W	2.9	2.7
Gunnison	20.00	W	GOOD	6.0	S -W	4.3	3.8
Gunnison	20.00	W	GOOD	8.0	S -W	5.7	4.9
Gunnison	20.00	W	GOOD	10.0	S -W	7.1	6.0
Gunnison	20.00	W	FAIR	4.0	S -W	2.9	3.5
Gunnison	20.00	W	FAIR	6.0	S -W	4.3	2.3
Gunnison	20.00	W	FAIR	8.0	S -W	5.7	2.0
Gunnison	20.00	W	FAIR	10.0	S -W	7.1	1.9
Scipio	3.00	SW	EXC	2.0	S -W	0.5	2.8
Scipio	3.00	SW	EXC	4.0	S -W	1.0	1.9
Scipio	3.00	SW	GOOD	2.0	S -W	0.5	13.6
Scipio	3.00	SW	GOOD	4.0	S -W	1.0	3.4
Scipio	3.00	SW	GOOD	6.0	S -W	1.5	2.3
Scipio	3.00	SW	GOOD	8.0	S -W	2.0	2.0
Scipio	3.00	SW	GOOD	10.0	S -W	2.4	1.9
Scipio	3.00	SW	FAIR	4.0	S -W	1.0	31.5
Scipio	3.00	SW	FAIR	6.0	S -W	1.5	13.4
Scipio	3.00	SW	FAIR	8.0	S -W	2.0	7.0
Scipio	3.00	SW	FAIR	10.0	S -W	2.4	4.5
Yuba Lake	13.00	SSW	EXC	2.0	S -W	1.1	2.9
Yuba Lake	13.00	SSW	EXC	4.0	S -W	2.1	5.3
Yuba Lake	13.00	SSW	GOOD	2.0	S -W	1.1	2.0
Yuba Lake	13.00	SSW	GOOD	4.0	S -W	2.1	2.2
Yuba Lake	13.00	SSW	GOOD	6.0	S -W	3.1	2.8
Yuba Lake	13.00	SSW	GOOD	8.0	S -W	4.2	3.4
Yuba Lake	13.00	SSW	GOOD	10.0	S -W	5.2	4.2

Yuba Lake	13.00	SSW	FAIR	4.0	S	-W	2.1	5.3
Yuba Lake	13.00	SSW	FAIR	6.0	S	-W	3.1	2.9
Yuba Lake	13.00	SSW	FAIR	8.0	S	-W	4.2	2.2
Yuba Lake	13.00	SSW	FAIR	10.0	S	-W	5.2	2.0

* Packham, D. R. and R. G. Vines, 1978, JAPCA 28:790-795.
**Koshmieder, 1924, Beitr. Phys. Freien Atm., 12:33-54.
and EPA, 1979, EPA-450/5-79-008.

These are the results for the fall window in sagebrush/grass/forb

Based on PM-2.5 emission rates. Using Classic Sasem input and calculations.

Burn Name	PahvantSage
Burn Date	10/10/2003
Burn Type	BROADCAST
Fuel Type	BRUSH
Fuel Loading	2.750 T/A
Fire Line Intensity	200.000 Btu/ft/s
Burn Duration	4.000 Hr
Burn Area	1000.000 Acres
Wind Speed Min	2.0 mi/hr
Wind Speed Max	10.0 mi/hr
Wind Speed Inc	2.0 mi/hr
Wind Direction Min	S
Wind Direction Max	W
Stability Type	Dispersion Day
Stability Min	Excellent
Stability Max	Fair
Mixing Height	1500.0 m
Met Limitation	Only Valid Combinations
Number of Receptors	3
Receptor Name	Gunnison
Receptor Distance	20.00 mi
Receptor Direction	W
Receptor Name	Scipio
Receptor Distance	3.00 mi
Receptor Direction	SW
Receptor Name	Yuba Lake
Receptor Distance	13.00 mi
Receptor Direction	SSW
Total Fuel Consumed	1.925 T/A
TSP Emission Factor	16.868 g/kg
PM-10 Emission Factor	13.495 g/kg
PM-2.5 Emission Factor	11.133 g/kg
TSP Emission Rate	1.017 g/s/m
PM-10 Emission Rate	0.814 g/s/m
PM-2.5 Emission Rate	0.671 g/s/m
TSP Total Emissions	32.471 T
PM-10 Total Emissions	25.977 T
PM-2.5 Total Emissions	21.431 T
Fireline Length	2011.69 m
Fire Rate of Spread	0.140 m/s

Heat Content of Fuel ..... 6300. Btu/lb
Fireline Width ..... 67.06 m
Number of Plumes ..... 30.
Heat Release Rate ..... 14148744. cal/s
Wind Persistence Factor 0.167
Portion of smoke which rises ..... 60.00 %

Stability	Wind Speed (mi/hr)	Maximum Concen (ug/m**3)	Distance to Maximum Concen (mi)	Exceedences Distance From (mi)	To (mi)	Plume Rise (m)
EXC	2.0	58.5	4.25	No Exceedence		1849.
EXC	4.0	58.5	2.28	No Exceedence		925.
GOOD	2.0	58.5	11.99	No Exceedence		1849.
GOOD	4.0	58.5	5.60	No Exceedence		925.
GOOD	6.0	58.5	3.59	No Exceedence		616.
GOOD	8.0	58.4	2.62	No Exceedence		462.
GOOD	10.0	58.4	4.39	No Exceedence		370.
FAIR	4.0	58.5	56.46	No Exceedence		925.
FAIR	6.0	62.9	50.86	No Exceedence		616.
FAIR	8.0	58.5	16.53	No Exceedence		462.
FAIR	10.0	58.5	11.13	No Exceedence		370.

* The TSP standard used is 150. micrograms per cubic meter.

Stability	Wind Speed (mi/hr)	Maximum Concen (ug/m**3)	Distance to Maximum Concen (mi)	Exceedences Distance From (mi)	To (mi)	Plume Rise (m)
EXC	2.0	46.8	4.25	No Exceedence		1849.
EXC	4.0	46.8	2.28	No Exceedence		925.
GOOD	2.0	46.8	11.99	No Exceedence		1849.
GOOD	4.0	46.8	5.60	No Exceedence		925.
GOOD	6.0	46.8	3.59	No Exceedence		616.
GOOD	8.0	46.7	2.62	No Exceedence		462.
GOOD	10.0	46.7	4.39	No Exceedence		370.
FAIR	4.0	46.8	56.46	No Exceedence		925.
FAIR	6.0	50.3	50.86	No Exceedence		616.
FAIR	8.0	46.8	16.53	No Exceedence		462.
FAIR	10.0	46.8	11.13	No Exceedence		370.

* The PM-10 standard used is 150. micrograms per cubic meter.

Stability	Wind Speed	Maximum Concen	Distance to Maximum Concen	Exceedences Distance From	To	Plume Rise

	(mi/hr)	(ug/m**3)	(mi)	(mi) (mi)	(m)
EXC	2.0	38.6	4.25	No Exceedence	1849.
EXC	4.0	38.6	2.28	No Exceedence	925.
GOOD	2.0	38.6	11.99	No Exceedence	1849.
GOOD	4.0	38.6	5.60	No Exceedence	925.
GOOD	6.0	38.6	3.59	No Exceedence	616.
GOOD	8.0	38.6	2.62	No Exceedence	462.
GOOD	10.0	38.5	4.39	No Exceedence	370.
FAIR	4.0	38.6	56.46	No Exceedence	925.
FAIR	6.0	41.5	50.86	No Exceedence	616.
FAIR	8.0	38.6	16.53	No Exceedence	462.
FAIR	10.0	38.6	11.13	No Exceedence	370.

* The PM-2_5 standard used is 65. micrograms per cubic meter.

Receptor Name	Dist (mi)	Dir	Stability	Wind Speed (mi/hr)	Range of Wind Dir	P&V* Visual Range (mi)	Kosh** Visual Range (mi)
Gunnison	20.00	W	EXC	2.0	S -W	1.4	4.3
Gunnison	20.00	W	EXC	4.0	S -W	2.9	8.2
Gunnison	20.00	W	GOOD	2.0	S -W	1.4	2.0
Gunnison	20.00	W	GOOD	4.0	S -W	2.9	2.7
Gunnison	20.00	W	GOOD	6.0	S -W	4.3	3.8
Gunnison	20.00	W	GOOD	8.0	S -W	5.7	4.9
Gunnison	20.00	W	GOOD	10.0	S -W	7.1	6.0
Gunnison	20.00	W	FAIR	4.0	S -W	2.9	3.5
Gunnison	20.00	W	FAIR	6.0	S -W	4.3	2.3
Gunnison	20.00	W	FAIR	8.0	S -W	5.7	2.0
Gunnison	20.00	W	FAIR	10.0	S -W	7.1	1.9
Scipio	3.00	SW	EXC	2.0	S -W	0.5	2.8
Scipio	3.00	SW	EXC	4.0	S -W	1.0	1.9
Scipio	3.00	SW	GOOD	2.0	S -W	0.5	13.6
Scipio	3.00	SW	GOOD	4.0	S -W	1.0	3.4
Scipio	3.00	SW	GOOD	6.0	S -W	1.5	2.3
Scipio	3.00	SW	GOOD	8.0	S -W	2.0	2.0
Scipio	3.00	SW	GOOD	10.0	S -W	2.4	1.9
Scipio	3.00	SW	FAIR	4.0	S -W	1.0	31.5
Scipio	3.00	SW	FAIR	6.0	S -W	1.5	13.4
Scipio	3.00	SW	FAIR	8.0	S -W	2.0	7.0
Scipio	3.00	SW	FAIR	10.0	S -W	2.4	4.5
Yuba Lake	13.00	SSW	EXC	2.0	S -W	1.1	2.9
Yuba Lake	13.00	SSW	EXC	4.0	S -W	2.1	5.3
Yuba Lake	13.00	SSW	GOOD	2.0	S -W	1.1	2.0
Yuba Lake	13.00	SSW	GOOD	4.0	S -W	2.1	2.2
Yuba Lake	13.00	SSW	GOOD	6.0	S -W	3.1	2.8
Yuba Lake	13.00	SSW	GOOD	8.0	S -W	4.2	3.4
Yuba Lake	13.00	SSW	GOOD	10.0	S -W	5.2	4.2
Yuba Lake	13.00	SSW	FAIR	4.0	S -W	2.1	5.3
Yuba Lake	13.00	SSW	FAIR	6.0	S -W	3.1	2.9
Yuba Lake	13.00	SSW	FAIR	8.0	S -W	4.2	2.2

Yuba Lake	13.00	SSW	FAIR	10.0	S	-W	5.2	2.0

* Packham, D. R. and R. G. Vines, 1978, JAPCA 28:790-795.
**Koshmieder, 1924, Beitr. Phys. Freien Atm., 12:33-54.
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Based on PM-2.5 emission rates.

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