Chapter 4

REGULATIONS

Regulations For Smoke Management

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Some of the components of smoke from prescribed fire are regulated air pollutants. And, as with any other rule or regulation, fire managers must understand and follow federal, state, and local regulations designed to protect the public against possible negative effects of air pollution.

Air pollution is defined as the presence in the atmosphere of a substance or substances added directly or indirectly by a human act, in such amounts as to adversely affect humans, animals, vegetation, or materials (Williamson 1973). Air pollutants are classified into two major categories: **primary** and **secondary**. **Primary pollutants** are those directly emitted into the air. Under certain conditions, primary pollutants can undergo chemical reactions within the atmosphere and produce new substances known as **secondary pollutants**.

Emissions from prescribed fire are managed and regulated through an often-complex web of interrelated laws and regulations. The overarching law that is the foundation of air quality regulation across the nation is the Federal Clean Air Act (Public Law 95-95).

Federal Clean Air Act

In 1955, Congress passed the first Federal Clean Air Act with later amendments in 1967, 1970, 1977, and 1990. The Clean Air Act is a legal mandate designed to protect public health and welfare from air pollution. States develop specific programs for implementing the goals of the Clean Air Act through their State Implementation Plans (SIP's). States may develop programs that are more restrictive than the Clean Air Act requires but never less. Burners must know the specifics of state air programs and how fire emissions are regulated to responsibly conduct a prescribed fire program.

Roles and Responsibilities

Although the Clean Air Act is a federal law and therefore applies to the entire country, the states do much of the work of implementation. The Act recognizes that states should have the lead in carrying out provisions of the Clean Air Act, since appropriate and effective design of pollution control programs requires an understanding of local industries, geography, transportation, meteorology, urban and industrial development patterns, and priorities.

The Clean Air Act gives the Environmental Protection Agency (EPA) the task of setting limits on how much of various pollutants can be in the air where the public has access[1] (ambient air). These air pollution limits are the National Ambient Air Quality Standards or NAAQS and

[1] Note that the Occupational Safety and Health Administration (OSHA), rather than EPA, sets air quality standards for worker protection.

are intended to be established regardless of possible costs associated with achieving them, though EPA is allowed to consider the costs of controlling air pollution during the implementation phase of the NAAQS in question. In addition, EPA develops policy and technical guidance describing how various Clean Air Act programs should function and what they should accomplish. States develop State Implementation Plans (SIPs) that define and describe customized programs that the state will implement to meet requirements of the Clean Air Act. Tribal lands are legally equivalent to state lands and tribes prepare Tribal Implementation Plans (TIPs) to describe how they will implement the Clean Air Act. The individual states and tribes can require more stringent pollution standards, but cannot weaken pollution goals set by EPA. The Environmental Protection Agency must approve each SIP/TIP, and if a proposed or active SIP/TIP is deemed inadequate or unacceptable, EPA can take over enforcing all or parts of the Clean Air Act requirements for that state or tribe through implementation of a Federal Implementation Plan or FIP (figure 4.1.1).

National Ambient Air Quality Standards

The primary purpose of the Clean Air Act is to protect humans against negative health or welfare effects from air pollution. National Ambient Air Quality Standards (NAAQS) are defined in the Clean Air Act as amounts of pollutant above which detrimental effects to public health or welfare may result. NAAQS are set at a conservative level with the intent of protecting even the most sensitive members of the public including children, asthmatics, and persons with cardiovascular disease. NAAQS

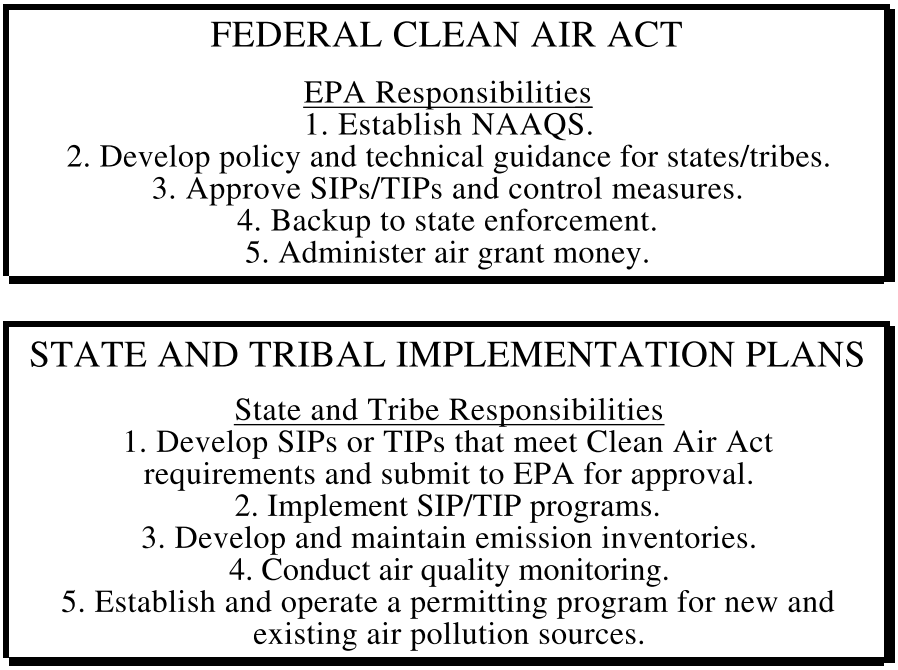

Figure 4.1.1. Role of EPA and the states and tribes in Clean Air Act implementation.

have been established for the following criteria pollutants: particulate matter[2] (PM_{10} and $PM_{2.5}$), sulfur dioxide (SO_2), nitrogen dioxide (NO_2), ozone, carbon monoxide and lead (table 4.1.1). Primary NAAQS are set at levels to protect public health; secondary NAAQS are to protect public welfare. The standards are established for different averaging times, for example, annual, 24-hour, and 3-hour.

The major pollutant of concern in smoke from wildland fire is fine particulate matter, both PM_{10} and $PM_{2.5}$. Studies indicate that 90 percent of smoke particles emitted during wildland burning are PM_{10} and about 90 percent of PM_{10} is $PM_{2.5}$ (Ward and Hardy 1991). The most recent human health studies on the effects of particulate matter indicate that it is fine particles, especially $PM_{2.5}$, that are largely responsible for health effects including

Table 4.1.1. National Ambient Air Quality Standards.

	Standard [a]	
Pollutant / Time-weighted period	Primary	Secondary
PM_{10}		
Annual Arithmetic Mean	50 $\mu g/m^3$	50 $\mu g/m^3$
24-hour Average	150 $\mu g/m^3$	150 $\mu g/m^3$
$PM_{2.5}$		
Annual Arithmetic Mean	15 $\mu g/m^3$	15 $\mu g/m^3$
24-hour Average	65 $\mu g/m^3$	65 $\mu g/m^3$
Sulfur Dioxide (SO_2)		
Annual Average	0.03 ppm	– –
24-hour Average	0.14 ppm	– –
3-hour Average	– –	0.50 ppm
1-hour Average	– –	– –
Carbon Monoxide (CO)		
8-hour Average	9 ppm	– –
1-hour Average	35 ppm	– –
Ozone (O_3)		
1-hour Average	0.12 ppm	0.12 ppm
8-hour Average	0.08 ppm	0.08 ppm
Nitrogen Dioxide (NO_2)		
Annual Average	0.053 ppm	0.053 ppm
Lead (Pb)		
Quarterly Average	1.5 $\mu g/m^3$	1.5 $\mu g/m^3$

[a] $\mu g/m^3$ = micrograms per cubic meter; ppm = parts per million

[2] Particulate matter NAAQS are established for two aerodynamic diameter classes: PM_{10} is particulate matter 10 micrometers or less in diameter, and $PM_{2.5}$ is particulate matter that is 2.5 micrometers or less in diameter.

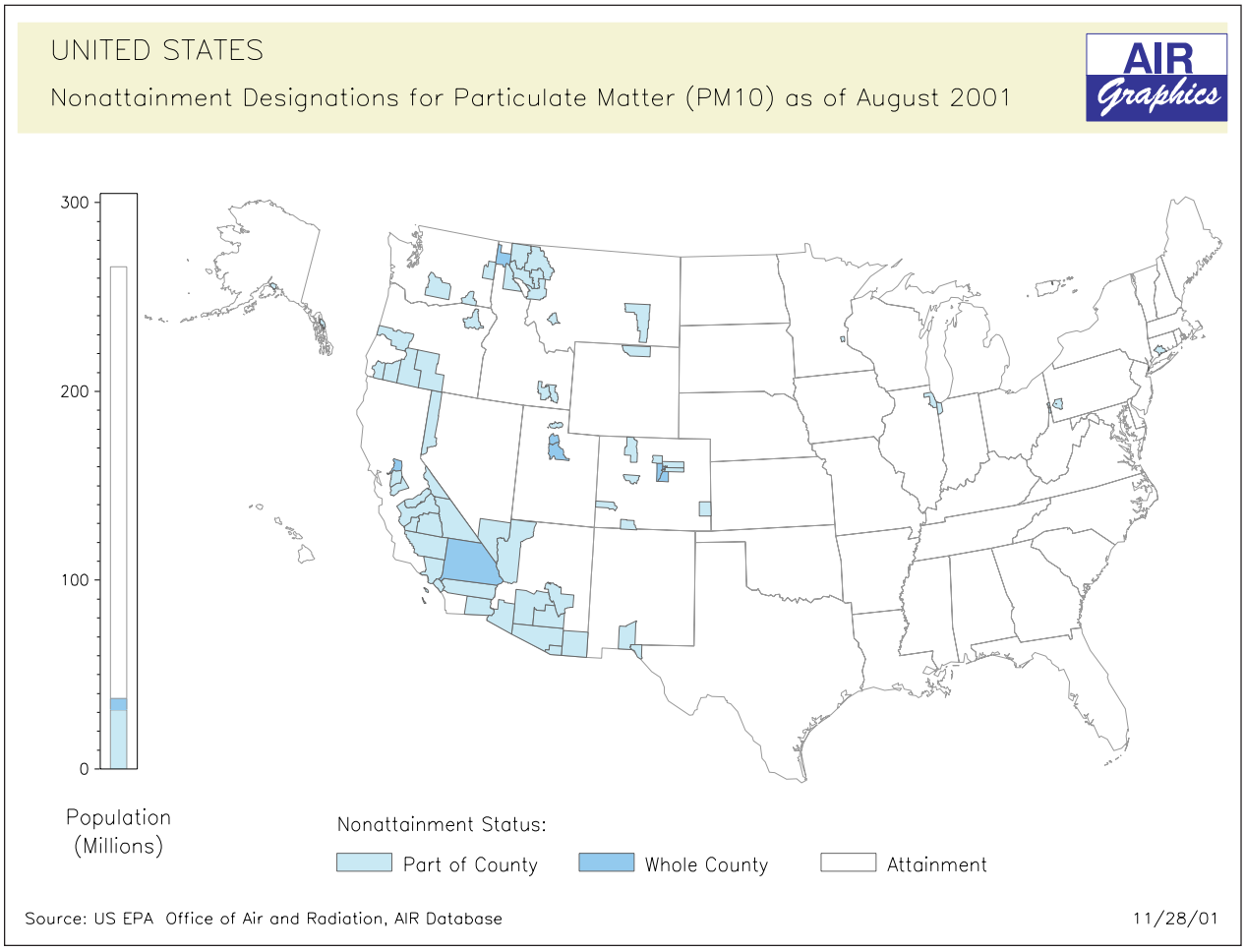

Figure 4.1.2. PM_{10} nonattainment areas as of August 2001. See the EPA AIR*Data* web page for current nonattainment status for PM_{10} and al other criteria pollutants (http://www.epa.gov/air/data/mapview.html).

mortality, exacerbation of chronic disease, and increased hospital admissions (Dockery and others 1993, EPA 1996).

An area that is found to be in violation of a primary NAAQS is labeled a non-attainment area (figure 4.1.2). An area once in non-attainment but recently meeting NAAQS, and with appropriate planning documents approved by EPA, is a maintenance area. All other areas are attainment or unclassified (due to lack of monitoring). State air quality agencies can provide up-to-date locations of local non-attainment areas[3]. States are required through their SIP's to define programs for implementation, maintenance, and enforcement of the NAAQS within their boundaries. A non-attainment designation is a black mark on the states air agency's ability to protect citizens from the negative effects of air pollution so states generally develop aggressive programs for bringing non-attainment areas into compliance with clean air goals. Wildland fire in and near non-attainment areas will be scrutinized to a greater degree than in attain-

[3] $PM_{2.5}$ is a newly regulated pollutant so attainment/non-attainment status has not yet been determined. Monitoring must take place for at least 3 years before a designation can be made.

ment areas (and may be subject to General Conformity rules, see section 4.3: Federal Land Management-Special Requirements). Extra pre-planning, documentation, and careful scheduling of wildland fires will likely be required to minimize smoke effects in the non-attainment area to the greatest extent possible. In some cases, the use of fire may not be possible if significant impacts to a non-attainment area are likely.

Natural Events Policy

PM_{10} NAAQS exceedences caused by natural events are not counted toward non-attainment designation if a state can document that the exceedance was truly caused by a natural event and if the state then prepares a Natural Events Action Plan (NEAP) to address human health concerns during future events[4]. Natural events are defined by this policy as wildfire, volcanic and seismic events, and high wind events. Prescribed fires used to mimic the natural role of fire in the ecosystem are not considered natural events under this policy. In response to this potential conflict of terms, the Interim Air Quality Policy on Wildland and Prescribed Fires (EPA 1998) states that EPA will exercise its discretion not to redisignate an area as non-attainment if the evidence is convincing that fires managed for resource benefits caused or significantly contributed to violations of the daily or annual $PM_{2.5}$ or PM_{10} standards and the state has a formal smoke management program (see Section 4.2: State Smoke Management Programs for more information).

A NEAP is developed by the state air pollution control agency in conjunction with the stakeholders affected by the plan. States should include input from Federal, state, and private land managers in areas vulnerable to fire when developing a wildland fire NEAP. Also, agencies responsible for suppressing fires, local health departments, and citizens in the affected area should be involved in developing the plan. The NEAP should include documented agreements among stakeholders as to planned actions and the parties responsible for carrying out those actions.

A wildfire NEAP should include commitments by the state and stakeholders to:

1. Establish public notification and education programs.
2. Minimize public exposure to high concentrations of PM_{10} due to future natural events such as by:
   - identifying the people most at risk,
   - notifying the at-risk public that an event is active or imminent,
   - recommending actions to be taken by the public to minimize their pollutant exposure,
   - suggesting precautions to take if exposure cannot be avoided.
3. Abate or minimize controllable sources of PM_{10} including the following:
   - prohibition of other burning during pollution episodes caused by wildfire,
   - proactive efforts to minimize fuel loadings in areas vulnerable to fire,
   - planning for prevention of NAAQS exceedances in fire management plans.

[4] Nichols, Mary D. 1996. Memorandum dated May 30 to EPA Regional Air Directors. Subject: Areas Affected by PM_{10} Natural Events. Available from the EPA Technology Transfer Network, Office of Air and Radiation Policy and Guidance at http://www.epa.gov/ttn/oarpg.

4. Identify, study, and implement practical mitigating measures as necessary.
5. Periodic reevaluation of the NEAP.

Preparation of a NEAP provides the opportunity for land managers to formally document, in cooperation with state air agencies, that it is appropriate to consider prescribed fire a prevention, control, and mitigation measure for wildfire (see item 4 above). Prescribed fire can be used to minimize fuel loadings in areas vulnerable to fire so that future wildfires can be contained in a smaller area and will produce less emissions. This can lead to a greater understanding by state air agencies of the potential air quality benefits from some types of prescribed fire in certain ecosystems. A recent NEAP prepared for the Chelan county area of Washington State accomplished this goal[5]. The Chelan County NEAP recognizes planned efforts by the Wenatchee National Forest to reduce fuel loadings through thinning, pruning of lower branches, and careful use of prescribed fire as ways to minimize public exposure to particulate matter during wildfire season.

Hazardous Air Pollutants

Hazardous air pollutants or (HAPs) are identified in Title III of the Clean Air Act Amendments of 1990 (Public Law 101-549) as 188 different pollutants "which present, or may present, through inhalation or other routes of exposure, a threat of adverse human health or environmental effects whether through ambient concentrations, bioaccumulation, deposition, or other routes." The listed HAPs are substances which are known or suspected to be carcinogenic, mutagenic, teratogenic, neurotoxic, or which cause reproductive dysfunction. Criteria pollutants (the six pollutants that are regulated through established National Ambient Air Quality Standards) are excluded from the list of HAPs.

De minimis Emission Levels

Air quality regulations allow omission of certain pollution sources in air quality impact analyses if they are considered very minor and are certain to have no detrimental effects. These sources are considered to emit pollutant amounts below de minimis levels. For example, burning a slash pile with less than 100 tons of material is not subject to permit or regulation in some areas. Emissions below de minimis levels are often excluded from air quality regulations so this is an important concept to define in reference to wildland fire. De minimis levels have been defined for many industrial sources but little guidance is available for many wildland activities including prescribed fire. Some states have locally defined de minimis levels for example in Utah, fires less than 20 acres per day in size and emitting less than 0.5 ton of total particulate per day are considered de minimis and can be ignited without permit if burners register the project and comply with clearing index procedures. Definition of de minimis levels is a topic that needs further discussion between wildland fire managers and regulatory agencies so guidance can be developed at the local and/or national level.

[5] Washington Department of Ecology. June 1997. Natural event action plan for wildfire particulate matter in Chelan County, Washington. 21p. Available from the Washington Department of Ecology, PO Box 47600, Olympia, WA 98504-7600.

Prevention of Significant Deterioration

Another provision of the Clean Air Act that sometimes comes up when discussing wildland burning activities is the Prevention of Significant Deterioration provisions or PSD. The goal of PSD is to prevent areas that are currently cleaner than is allowed by the NAAQS from being polluted up to the maximum ceiling established by the NAAQS. States and tribes use the permitting requirements of the PSD program to manage and limit air pollution increases over a baseline concentration. A PSD baseline is the pollutant concentration at a point in time when the first PSD permit was issued for the airshed. New or modified major air pollution sources must apply for a PSD permit prior to construction and test their proposed emissions against allowable PSD increments.

Three air quality classes were established by the Clean Air Act, PSD provisions, including Class I, Class II, and Class III. Class I areas are subject to the tightest restrictions on how much additional pollution, or increment, can be added to the air. Class I areas include Forest Service wildernesses and national memorial parks over 5000 acres, National parks exceeding 6000 acres, and international parks, all of which must have been in existence as of August 7, 1977, plus later expansions to these areas (figure 4.1.3). These original Class I areas are declared "mandatory" and can never be redesignated to another air quality classification. In addition, a few Indian tribes have redesignated their lands to Class I. Redesignated Class I areas are not mandatory Class I areas so are not automatically protected by all the same rules as defined by the Clean Air Act unless a state or tribe chooses, through a SIP or TIP, to do so. Since no areas have ever been designated Class III, all other lands are Class II, including everything from non-Class I wildlands to urban areas.

Historically, EPA has regarded smoke from wildland fires as temporary and therefore not subject to issuance of a PSD permit, but whether or not wildland fire smoke should be considered when calculating PSD increment consumption or PSD baseline was not defined. EPA recently reaffirmed that states could exclude managed fire emissions from increment analyses, provided the exclusion does not result in permanent or long-term air quality deterioration (EPA 1998). States are also expected to consider the extent to which a particular type of burning activity is truly temporary, as opposed to an activity that can be expected to occur in a particular area with some regularity over a period of time. Oregon is the only state that has thus far chosen to include prescribed fire emissions in PSD increment and baseline calculations.

Visibility

The 1977 amendments to the Clean Air Act established a national goal of "the prevention of any future, and the remedying of any existing, impairment of visibility in mandatory class I Federal areas which impairment results from manmade air pollution" (Public Law 95-95). States are required to develop implementation plans that make "reasonable progress" toward the national visibility goal.

Atmospheric visibility is influenced by scattering and absorption of light by particles and gases. Particles and gases in the air can obscure the clarity, color, texture, and form of what we see. The fine particles most responsible for visibility impairment are sulfates, nitrates, organic compounds, elemental carbon (or soot), and soil dust. Sulfates, nitrates, organic carbon, and soil tend to scatter light, whereas elemental carbon tends to absorb light. Wildland fire

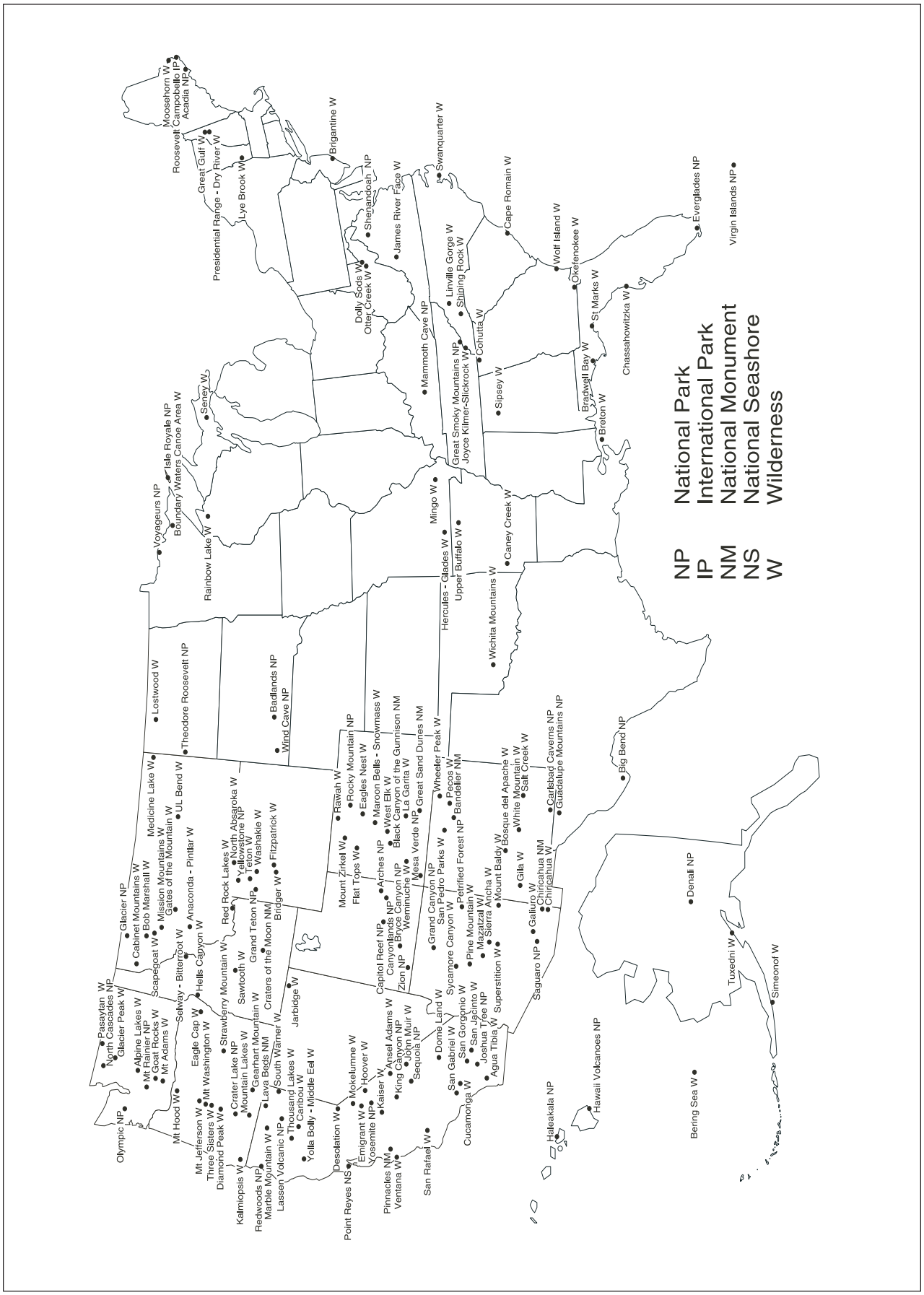

Figure 4.1.3. Mandatory Cass I areas.

smoke is primarily made up of elemental carbon, organic carbon, and particulate matter. Fine particles ($PM_{2.5}$) are more efficient per unit mass than coarse particles (PM_{10} and larger) at causing visibility impairment. Naturally occurring visual range in the East is estimated to be between 60 and 80 miles, while natural visual range in the West is between 110-115 miles (Trijonis and others 1991). Currently, visual range in the Eastern US is about 15 to 30 miles and about 60 to 90 miles in the Western US (40 CFR Part 51). The theoretical maximum visual range with nothing in the air except air molecules is about 240 miles.

Federal Land Managers (FLMs) have somewhat conflicting roles when it comes to protecting visibility in the Class I areas they manage. On the one hand, FLMs are given the responsibility by the Clean Air Act for reviewing PSD permits of major new and modified stationary pollution sources and commenting to the state on whether there is concern for visibility impacts (or other resource values) in Class I areas downwind of the proposed pollution source. In this case FLMs play a proactive role in air pollution prevention. On the other hand, however, FLMs also use wildland fire, which emits visibility-impairing pollutants. In this case the FLM is the polluter and is often in the difficult position of trying to explain why wildland burning smoke may be acceptable in wilderness whereas other types of air pollution are not. The answer to this dilemma is that wildernesses are managed to preserve and protect natural conditions and processes. So in this context, smoke and visibility impairment from wildland fire that closely mimics what would occur naturally is generally viewed as acceptable under wilderness management objectives, whereas visibility impairment from "unnatural" pollutants and "unnatural" pollution sources is not.

The key to successfully promoting this distinction is an honest and scientific definition of how much, and what types, of fire are "natural" that FLMs, air quality regulators, and the public can agree upon. This is a critical area of future cooperation in smoke management and air quality regulation.

Regional Haze

Regional haze is visibility impairment produced by a multitude of sources and activities that emit fine particles and their precursors, and are located across a broad geographic area. This contrasts with visibility impairment that can be traced largely to a single, very large pollution source. Until recently, the only regulations for visibility protection addressed impairment that is reasonably attributable to a permanent, large emission source or small group of large sources. Recently, EPA issued regional haze regulations to manage and mitigate visibility impairment from the multitude of diverse regional haze sources (40 CFR Part 51). The regional haze regulations call for states to establish goals for improving visibility in Class I national parks and wildernesses and to develop long-term strategies for reducing emissions of air pollutants that cause visibility impairment. Wildland fire is one of the sources of regional haze covered by the new rules.

Current data from a national visibility monitoring network (Sisler and others 1996) do not show fire to be the predominant source of visibility impairment in any Class I area (40 CFR Part 51). Emissions from fire are an important episodic contributor to atmospheric loading of visibility-impairing aerosols, including organic carbon, elemental carbon, and particulate matter. Certainly the contribution to visibility impairment from fires can be substan-

tial over short periods of time, but fires in general, occur relatively infrequently and thus have a lesser contribution to long-term averages. Fire events contribute less to persistent visibility impairment than sources with emissions that are more continuous.

Reasonable Progress

The visibility regulations require states to make "reasonable progress" toward the Clean Air Act goal of "prevention of any future, and the remedying of any existing, impairment of visibility…". The regional haze regulations did not define visibility targets, but instead gave the states flexibility in determining reasonable progress goals for Class I areas. States are required to conduct analyses to ensure that they consider the possibility of setting an ambitious reasonable progress goal, one that is aimed at reaching natural background conditions in 60 years. The rule requires states to establish goals for each affected Class I area to 1) improve visibility on the haziest 20 percent of days and 2) ensure no degradation occurs on the clearest 20 percent of days over the period of each implementation plan.

The states are to analyze and determine the rate of progress needed for the implementation period extending to 2018 such that, if maintained, this rate would attain natural visibility conditions by the year 2064. To calculate this rate of progress, the state must compare baseline visibility conditions to estimate natural visibility conditions in Class I areas and determine the uniform rate of visibility improvement that would need to be maintained during each implementation period in order to attain natural visibility conditions by 2064. Baseline visibility conditions will be determined from data collected from a national network of visibility monitors representing all Class I areas in the country for the years 2000 to 2004. The state must determine whether this rate and associated emission reduction strategies are reasonable based on several statutory factors. If the state finds that this rate is not reasonable, it must provide a demonstration supporting an alternative rate.

Regional Visibility Protection Planning

Regional haze is, by definition, from widespread, diverse sources. The regional haze rule encourages states to work together to improve visibility. The Environmental Protection Agency (EPA) has encouraged the 48 contiguous states to engage in regional planning to coordinate development of strategies for controlling pollutant emissions across a multi-state region. This means that groups of states will be addressing groups of "Class I" areas through established organizations. In the West, the Western Regional Air Partnership, sponsored through the Western Governors' Association and the National Tribal Environmental Council is coordinating regional planning and needed technical assessments. In the Eastern U.S., four formal groups address regional planning issues: CENRAP (Central States Response Air Partnership), OTC (Ozone Transport Commission), and VISTAS (Visibility Improvement State and Tribal Association of the Southeast) and the Midwest Regional Planning Organization (figure 4.1.4).

Natural Visibility

Air quality regulations often distinguish between human-caused and natural sources of air pollution. Natural sources of air pollution generally are not responsive to control efforts,

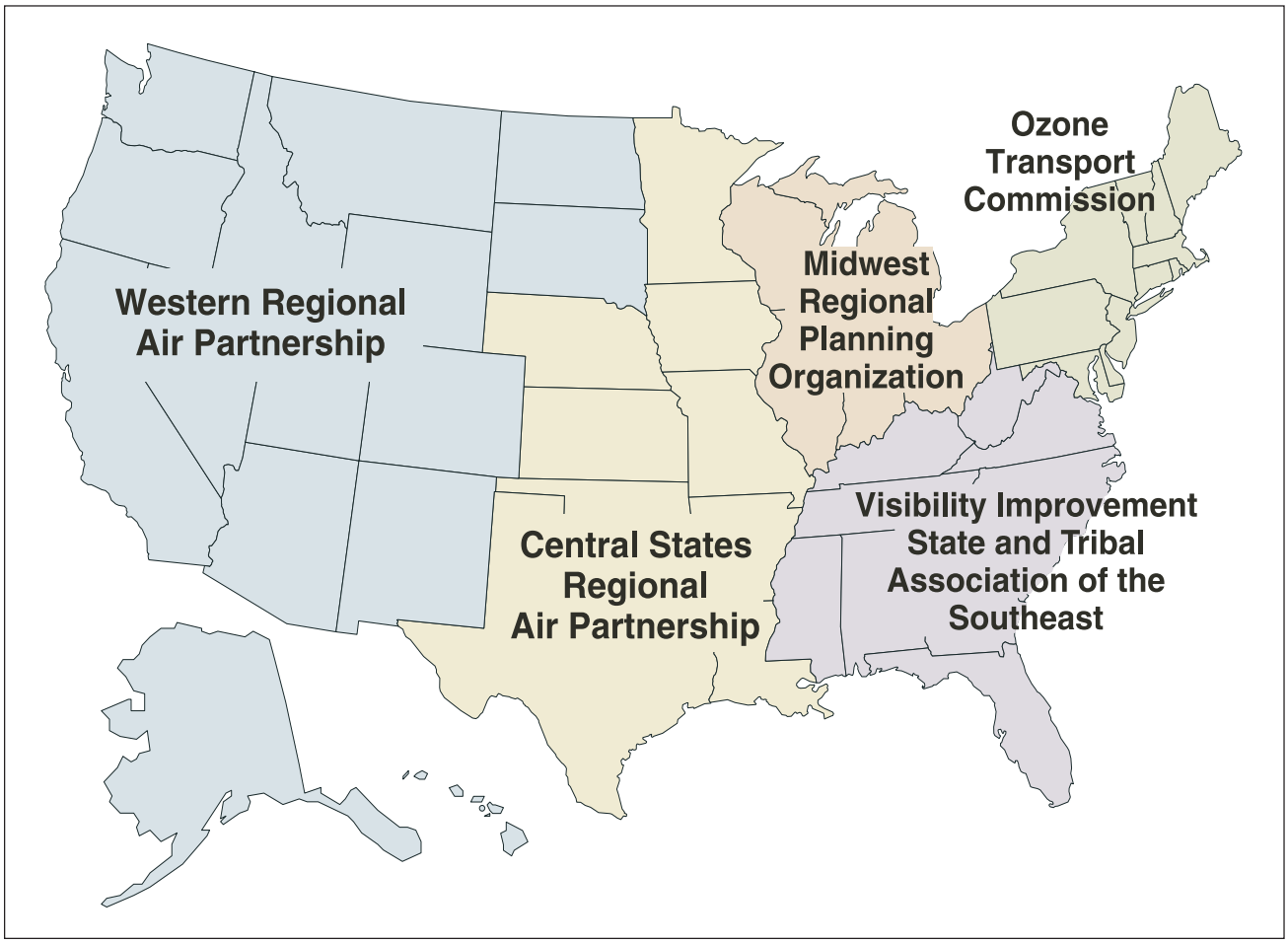

Figure 4.1.4. Regional air quality planning groups.

and state air regulatory agencies manage and monitor them in a manner different from human-caused air pollution. The definition of natural sources of air pollution includes volcanoes, dust, and wildfires. The regional haze regulations propose to measure progress towards achieving natural visibility conditions, but how do we define natural visibility impairment when considering wildland fires as a source?

In most parts of the country, much less fire occurs today than historically. Should natural visibility consider the contribution to haze from these historic, natural fires? And if so, how will we reconcile a definition of natural visibility that includes historic levels of smoke with the need to improve air quality and meet the national visibility goal? Previously, wildfires have been considered natural sources while prescribed fires have generally been classified as human-caused for the purpose of air regulation. That classification is proving to be unsatisfactory because aggressive wildfire suppression and land use changes have made the current pattern of wildfires anything but natural. Are some prescribed fires destined to be categorized as natural emission sources along with the resulting visibility impairment, and how much prescribed burning should be considered natural?

How Much Smoke is Natural?

Few wildlands in the United States are without significant modification by humans, whether by resource utilization, fire suppression, or invasion of exotic species. So in defining natural emissions some possible definitions of natural fire may include: 1) historic fire frequency in vegetation types present on wildlands today, 2) historic fire frequency only on wildlands where the current overriding management goal is to maintain natural ecosystem processes, 3) human-defined fire needed on wildlands to maintain natural ecosystem processes, 4) human-defined fire needed to maximize wildfire controllability, and 5) prescribed fire needed to minimize the sum of prescribed fire and wildfire emissions.[6]

Most any approach to estimating natural emissions from fire will look to historic fire frequencies for preliminary guidance. Historic fire frequency can be defined in numerous ways and called by various terms (fire frequency, fire return interval, natural fire rotation, ecological fire rotation). Fire frequency can vary greatly by vegetative cover type, site-specific meteorology, stand age, aspect, and elevation. Fire frequency is often defined as a range that reflects site variation. For example, a given area of ponderosa pine ecosystem may have a defined fire rotation of 7 to 15 years. The drier southwestern slopes will have an average fire rotation of approximately 7 years, whereas the northern slopes will have an average fire rotation of approximately 15 years. Even within the average site fire rotation interval there can be significant temporal variation depending on weather and ignition potential.

Any change in fire frequency will eventually be expressed by change in the ecosystem. The natural fire regime for an ecosystem may not be the same as the historic fire regime, because neither the current fuel condition nor the climate is the same as in the past. Nor will they be the same in the future.

Wildland fire is highly variable in place and time. Historic fire regimes are well known and described for most major ecosystem types. These historic frequencies can be used as a starting point for definition of natural emissions although, in many parts of the country,historic fire frequency would likely result in much more emissions than would be acceptable in today's society (figure 4.1.5). Prescribed burning in the southeastern US is, in some cases, near the natural rotation and the public has been largely tolerant of the smoke. Burning to maintain natural ecosystem conditions may not need to occur any more frequently than the middle to upper end of the historical average fire frequency. Some areas may be maintained adequately even if the infrequent end of the natural fire frequency range is increased although potential long-term effects of this sort of ecological manipulation are uncertain. On the other hand, the environment is not static. Climate change, for example, may change the frequency of fire necessary to maintain any given ecosystem in the future or make retention of the present ecosystem impossible.

Conclusions

Because smoke from fire can cause negative effects to public health and welfare, air quality protection regulations must be understood and followed by responsible fire managers. Likewise, air quality regulators need an understanding of how and when fire use decisions are

[6] Peterson, Janice; Sandberg, David, Leenhouts, Bill. 1998. Estimating natural emissions from wildland and prescribed fire. An unpublished technical support document to the EPA Interim Air Quality Policy on Wildland and Prescribed Fires. April 23, 1998. (Available from the author).

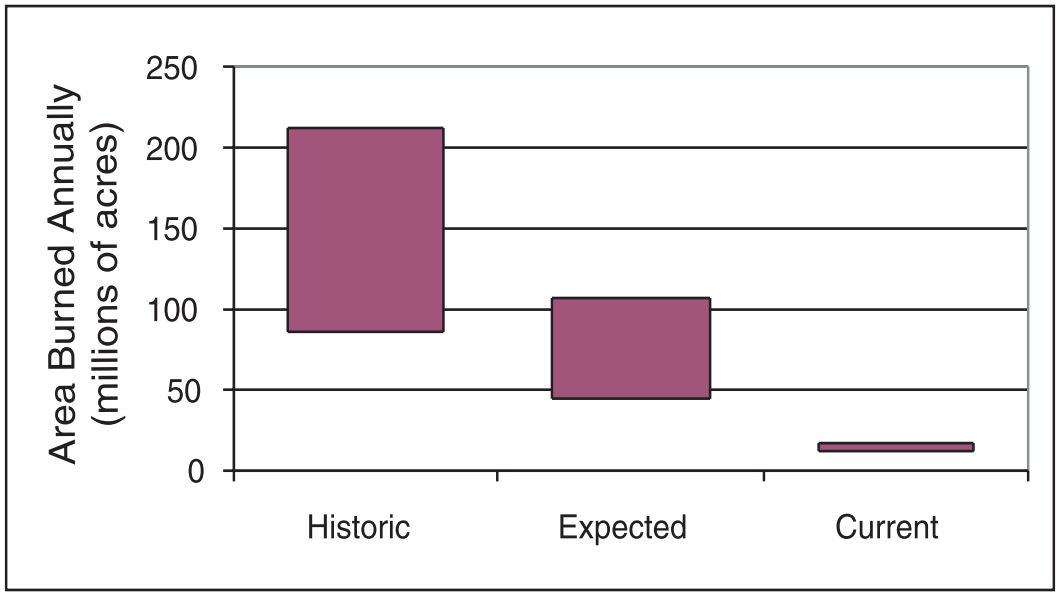

Figure 4.1.5. Estimates of the range of annual area burned in the conterminous United States pre-European settlement (Historic), applying presettlement fire frequencies to present land cover types (Expected), and burning (wildland and agriculture) that has occurred during the recent past (Current). Source: Leenhouts (1998).

Table 4.1.2. Recommended cooperation between wildland fire managers and air quality regulators depending on air quality protection instrument.

Air Quality Protection Instrument	Cooperation[a]	
	Wildland Fire Managers	Air Quality Regulators
NAAQS	Aware	Lead
Attainment Status	Aware	Lead
SIP Planning and Development	Involved	Lead
Conformity	Involved	Lead
Smoke Management Programs	Partner	Lead
Visibility Protection	Involved	Lead
Regional Planning Groups	Partner	Lead
Natural Emissions	Partner	Lead
Natural Events Action Plan (NEAP)	Partner	Lead
Land use planning	Lead	Involved
Project NEPA documents	Lead	Involved
Other Fire Planning Efforts	Lead	Involved

[a] **Lead**: Responsibility to initiate, bring together participants, complete, and implement the particular air quality protection instrument.
Partner: Responsibility to fully participate with Lead organization toward development and implementation of the air quality protection instrument in a nearly equal relationship.
Involved: Responsibility to participate in certain components of development and implementation of the air quality protection instrument although not at full partner status.
Aware: Responsibility to have a complete working knowledge of the air quality protection instrument but likely little or no involvement in it's development or daily implementation.

made and should become involved in fire and smoke management planning processes, including the assessment of when and how alternatives to fire will be used. Many fire and air quality issues need further work including, definition of de minimis emission levels from fire, prescribed fire as BACM for wildfire, clarification of the difference between visibility impairment from fire vs. industrial sources, amounts of smoke from natural ecosystem burning that is acceptable to the public, and definition of natural visibility. Cooperation and collaboration between wildland fire managers and air quality regulators on these and other issues is of great importance. Table 4.1.2 contains recommendations for various types of cooperation by these two groups depending on the applicable air quality protection instrument.

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State Smoke Management Programs

John E. Core

Introduction

Smoke management programs establish a basic framework of procedures and requirements for managing smoke from prescribed fires. The purposes of a smoke management program are to minimize smoke entering populated areas, prevent public safety hazards (such as smoke impairment on roadways or runways), avoid significant deterioration of air quality and National Ambient Air Quality Standards (NAAQS) violations, and to avoid visibility impacts in Class I areas. Smoke management is increasingly recognized as a critical component of a state's air quality program for protecting public health and welfare, while still providing for necessary wildland burning. Sophisticated programs for coordination of burning both within a state and across state boundaries are vital to obtain and continue public support of burning programs. States typically develop these programs, with cooperation and participation from stakeholders. Smoke management programs developed through partnerships are much more effective at meeting resource management goals, protecting public health, and meeting air quality objectives.

Usually, either the state or tribal natural resources agency or air quality agency is responsible for developing and administering the smoke management program. Occasionally, a program may be administered by a local agency and apply to a subset of a state. Generally the administering agency will give daily approval or disapproval of individual bums. All burning may be subject to permit, or only burning exceeding an established de minimis level that could be based on projections of acres burned, tons consumed, or emissions. Multi-day burns may be subject to daily reassessment and reapproval to ensure smoke does not violate program goals.

An advanced smoke management program will evaluate individual and multiple bums; coordinate all prescribed fire activities in an area; consider cross-boundary impacts; and weigh burning decisions against possible health, visibility, and nuisance effects.

With increasing use of fire for forest health and ecosystem management, interstate and interregional coordination of burning will be necessary to prevent poor air quality episodes. Every state has unique needs and issues driving development of smoke management programs so a specific program cannot be defined that is applicable to all. State and land manager development of, and participation in, an effective, locally specific smoke management program will go a long way to build and maintain public acceptance of prescribed burning.

EPA Interim Fire Policy - Recommendations on Smoke Management Programs

In the Interim Air Quality Policy on Wildland and Prescribed Fires (EPA 1998), EPA urges State and tribal air quality managers to collaborate with wildland owners and managers to mitigate the air quality impacts that could be caused by the increase of fires managed to achieve resource benefits. The EPA especially urges development and implementation of at least basic smoke management programs when conditions indicate that fires will adversely impact the public. In exchange for states and tribes proactively implementing smoke management programs, EPA intends to exercise its discretion not to redesignate an area as nonattainment if the evidence is convincing that fires managed for resource benefits caused or significantly contributed to violations of the daily or annual $PM_{2.5}$ or PM_{10} standards. Rather, EPA will call on the state or tribe to review the adequacy of the smoke management program in collaboration with wildland owners and managers and make appropriate improvements to mitigate future air quality impacts. The state or tribe must certify in a letter to the EPA Administrator that at least a basic program has been adopted and implemented in order to receive special consideration for NAAQS violations under this policy.

To be certifiable by EPA, a smoke management program should include the following basic components, some of which are the responsibility of the administering agency and some of which are provided by the land manager:

1. Process for assessing and authorizing burns.

   Reporting of burn plan information to administering agency (not mandatory for states to be compliant with EPA recommendations for a certified smoke management program, but is highly recommended especially for fires greater than a predefined de minimis size), including the following information:

   - location and description of the area to be burned,
   - personnel responsible for managing the fire,
   - type of vegetation to be burned,
   - area (acres) to be burned,
   - amount of fuel to be consumed (tons/acre),
   - fire prescription including smoke management components,
   - criteria the fire manager will use for making burn/no burn decisions, and
   - safety and contingency plans addressing smoke intrusions.

2. Plan for long-term minimization of emissions and impacts, including promotion of alternatives to burning and use of emission reduction techniques.

3. Smoke management goals and procedures to be described in burn plans (when burn plan reporting is required):

   - actions to minimize fire emissions,
   - smoke dispersion evaluation,
   - public notification and exposure reduction procedures to be implemented during air pollution episodes or smoke emergencies, and
   - air quality monitoring.

4. Public education and awareness.

5. Surveillance and enforcement of smoke management program compliance.

6. Program evaluation and plan for periodic review.

7. Optional programs (for example, special protection zones or buffers or performance standards).

Smoke Management Programs

Prescribed burning programs across the nation use both emission reduction methods and smoke management techniques (avoidance and dilution) to minimize the impacts of smoke on air quality as well as concerns about public exposure to smoke. The complexity of these programs varies greatly from state to state, ranging from the comprehensive and well-funded programs found in Oregon and Washington to the far simpler program found in Alaska. While the comprehensive programs gather detailed information on all burning activity needed for burn coordination, emission inventory calculation purposes, and to assure compliance with air quality regulations, many prescribed fire practitioners work independently with mainly self-imposed constraints. In most cases, smoke management programs focus primarily on achieving land management objectives. Other issues in priority order are: minimizing public exposure to smoke, achieving and/or maintaining healthful air quality, and achieving emission reductions. Often, emission reductions are only an important side benefit of a burning technique selected for another management purpose. Few existing smoke management programs quantify emission reductions achieved either intentionally or unintentionally. Table 4.2.1 summarizes a few of the features of the smoke management programs. Significantly, only Oregon and Washington have active, on-going programs to calculate pollutant emissions and pollutant emission reductions on a daily basis for each burn. The Utah program has been certified under the EPA Interim Air Quality Policy on Wildland and Prescribed Fire; Nevada and Florida have incorporated the Policy into the design of their programs. Oregon and Washington have adopted special provisions for prescribed burning for forest health restoration purposes. The Oregon program includes an emissions cap and offset program for Eastern Oregon burning. Although most state air agencies estimate annual emissions from land manager records, only those states that calculate emissions on a daily basis, burn-by-burn, are listed as having an emissions calculation program. The adequacy of each program to the specific state situation is not addressed in table 4.2.1. That issue is best addressed by the stakeholders of each program and the citizens of the state.

A summary of smoke management program reporting attributes related to emissions tracking is shown in table 4.2.2.

As an example, in the Colorado program, field personnel collect pre-burn acreage, predominate fuel type and fuel loading information annually before the burning season begins. A generalized emissions estimate is reported on the SASEM output they submit with their permit application (see Chapter 9 for information on SASEM and other models). Post-burn information including acreage actually burned, fuel types, fuel loading, and fuel consumption is collected in the field at the end of the season. If the project is classified as “High Risk for Smoke Impacts,” the central office Program Coordinator compiles the end-of-year acreage actually burned and fuel actually consumed from all cooperating agencies. The program office then uses this information to calculate annual emissions. The program office has no responsibilities related to fuel type data. The Colorado smoke management program is fairly basic compared to some more complex programs, but is appropriate to the specifics of the state burning programs and their potential impacts to air quality.

Table 4.2.1. Smoke Management Program features. Smoke Management programs are periodically reviewed and revised; the features listed here reflect program status in 2001.

State	Full Time Staff [a]	Program Fees [b]	Annual Reporting	Daily Emissions Calculation	Intrastate Coordination	Air Quality Monitoring	Visibility Protection
Alabama	No	None	Yes	No	Informal	No	No
Alaska	No	None	Yes	No	Informal	Some	No
Arizona	Yes	None	Yes	No	Formal	Yes	Yes
California[c]	Yes	Yes	Yes	Yes	Formal	Yes	No
Colorado	Yes	Yes	Yes	Yes	Informal	Some	Yes
Florida	Yes	None	Yes	No	Formal	Yes	No
Idaho/Montana	Yes	Based on Emissions	Yes	No	Formal	Yes	No
Louisiana	No	None	No	No	No	No	No
Mississippi	No	None	No	No	Informal	No	No
Nevada	No	None	Yes	No	Informal	No	No
New Mexico	No	None	Yes	No	Informal	Yes	Considered
NE Region	No	None	No	No	Informal	No	No
North Carolina	No	None	No	No	No	No	No
Oregon	Yes	Based on Acres	Yes	Yes	Formal	Yes	Yes
Tennessee	No	None	No	No	No	No	No
South Carolina	Yes	None	Yes	No	Informal	No	No
Utah	Yes	None	Yes	Yes	Formal	Some	Considered
Washington	Yes	Based on Emissions	Yes	Yes	Formal	Yes	Yes

[a] Full time staff means a position with duties dedicated only to meteorological forecasting and program administration

[b] The Arizona and Utah programs are funded through an MOU with participating agencies rather than acreage/tonnage fees. Other agency programs not funded by fees are supported through state/agency budget allocations.

[c] Each of California's 35 air pollution control districts have a unique smoke management plan. Features reported here exist somewhere in the state but do not necessarily apply statewide.

Table 4.2.2. Selected Smoke Management Program Emission Inventory Reporting Attributes.

State	Area Burned		Fuel Type		Fuel Loading		Fuel Consumption		Emissions	
	Field	**Program**	**Field**	**Program**	**Field**	**Program**	**Field**	**Program**	**Field**	**Program**
Arizona	$Pre_{d/}Post_d$	$Post_d$	$Pre_{d/}Post_d$	$Post_d$	$Pre_{d/}Post_d$	$Post_d$	$Pre_{d/}Post_d$	$Post_d$	None	$Post_d$
CO-Normal	$Pre_a/Post_a$	None	$Pre_a/Post_a$	None	$Pre_a/Post_a$	None	$Pre_a/Post_a$	None	Pre_a	$Post_a$
CO-High Risk	$Pre_{a/}Post_d$	None	$Pre_{a/}Post_d$	None	$Pre_{a/}Post_d$	None	$Pre_{a/}Post_d$	None	None	$Post_d$
Montana	Pre_a/Pre_a	$Post_a$	Pre_a	None	Pre_a	None	$Post_a$	None	None	$Post_a$
Florida	Pre_d	$Post_d$	None	None	None	None	None	None	None	None
Michigan	Michigan has no statewide program. Forest Service acreage (only) to be burned is tabulated at the beginning of the season. Actual acreage burned is estimated shortly after project completion and reported to their regional office, which then compiles the data annually.									
New York	$Pre_d/Post_d$	$Post_a$	Pre_a	$Post_a$	Pre_a	None	$Post_a$	None	None	None
Washington	$Pre_d/Post_d$	$Post_d$	Pre_d	None	Pre_a	None	None	$Post_d$	None	$Post_a$

Key to subscripts:

Pre_a ----Pre-burn estimate conducted once **annually** at the beginning of the season.

Pre_d ----Pre-burn estimates made on a **daily** basis.

$Post_a$ ---Post-burn estimates made once **annually** at the end of the season.

$Post_d$ ---Post-burn surveys conducted on a **daily** basis soon after completion.

None---Not applicable or no estimate prepared.

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Environmental Protection Agency. 1998. Interim air quality policy on wildland and prescribed fires. Office of Air Quality Planning and Standards, Research Triangle Park, NC 27711. 39p.

Federal Land Management– Special Requirements

Janice L. Peterson

Federal agencies are subject to certain laws and requirements that are not necessarily applicable to states or private entities in the same manner or at all. Federal agencies are required to do long-range planning for management of the lands they manage through numerous agency-specific planning mandates. The National Environmental Policy Act (NEPA) requires Federal agencies to examine and disclose potential impacts of their actions on the environment. The General Conformity regulations require federal agencies to examine the effect of their actions on the ability of a state to reach air quality goals and modify their actions if air quality targets would be delayed. Federal agencies also manage wilderness areas and the Wilderness Act contains language with implications for air quality protection.

Land Management Planning

Each Federal land management agency has some sort of overarching planning mandate. These broad scale, long-term plans define how Federal lands will be managed for many years into the future. For the USDA Forest Service, the National Forest Management Act (NFMA) (Public Law 94-588) requires National Forests to prepare plans for land management that address a long-term planning perspective and provide the opportunity for other agencies and the public to comment on decisions on how these public lands are managed. Forest Plans are to address protection, management, improvement, and use of renewable resources on the National Forests and should "recognize the fundamental need to protect and, where appropriate, improve the quality of soil, water, and air resources." Forest Plans must be updated and revised at least every 15 years and many National Forests are in the process of, or have recently completed this task. Other federal agencies have similar land management planning mandates. For the U.S. Department of the Interior, the Bureau of Land Management has the Integrated Resource Management Plan; the National Park Service has the Resource Management Plan; and the Fish and Wildlife Service has the Comprehensive Conservation Plan.

In some parts of the country, resource management agencies have fairly recently recognized the importance of fire as an ecological process in the maintenance of sustainable ecosystems. Therefore, existing federal land management plans do not always adequately address this topic. Planning revisions provide the opportunity to define and resolve issues that involve wildland fire, its relationship to forest health, and its environmental costs and benefits. Revisions should address the fact that smoke knows no boundaries and alternative management scenarios must be analyzed in this same context.

A Forest Service Example

Forest Plans provide the long-term, big picture view of goals for management of a National Forest. Specific projects are planned at a later date to fit the goals and framework of the Forest Plan and to meet more short term planning horizons. For example, the philosophy of how fire will be used to manage various ecosystems on a National Forest and the general effects of this fire on air quality will be described in the Forest Plan whereas specific prescribed fire projects and specific air quality effects will be defined at a later date. The environmental consequences of specific projects are analyzed through the National Environmental Policy Act (NEPA) planning process.

Recent Forest Service internal guidance[1] advises that air quality status within 100km of the Forest boundary be assessed for attainment/non-attainment status, Class I or Class II, availability of monitoring data, and identification of special smoke sensitive areas (such as airports, hospitals, etc.). The complexity of the subsequent Forest Plan air quality analysis will be determined by what is found in this initial assessment and can range from preparation of a simple emissions inventory and development of standards and guidelines for smoke management if the complexity is low; up to a detailed emissions inventory, standards and guidelines for smoke management including visibility protection, modeling to estimate mitigation benefits and/or consequences, worst case emissions analysis, and identification of possible emissions offsets if complexity is high.

National Environmental Policy Act

The National Environmental Policy Act (NEPA) (Public Law 91-190) directs all federal agencies to consider every significant aspect of the environmental impacts of a proposed action. It also ensures that an agency will inform the public that it has considered environmental concerns in its decision-making process. NEPA does not require agencies to elevate environmental concerns over other appropriate considerations; only that agencies fully analyze, understand, and disclose environmental consequences before deciding to take an action. NEPA is a procedural mandate to federal agencies to ensure a fully informed decision where short- and long-term environmental consequences are not forgotten.

An analysis of possible air quality impacts may be needed in a NEPA analysis if the project:

- raised air quality as a significant issue in scoping[2],
- includes burning,
- includes significant road construction, road use, or other soil disturbing procedures where fugitive dust may be a concern,
- includes significant machinery operation in close proximity to publicly accessible areas,
- may have any impact on air quality in a Class I area,
- may have any impact on sensitive vistas or visibility in a Class I area,

[1] USDA Forest Service. 1999. Draft desk guide for integrating air quality and fire management into land management planning. USDA Forest Service guidance document. Available at: http://www.fs.fed.us/clean/air/

[2] Scoping is the process of determining the issues to be included in NEPA analysis and for identifying any significant issues that will need to be addressed in depth. Scoping requires the lead agency to invite participation of affected Federal, State, and local agencies, any affected Indian tribe, the proponent of the action, and other interested persons (including those who might not be in accord with the action on environmental grounds).

- is in close proximity to a non-attainment area,
- will make a significant amount of firewood available to the public.

The appropriate level of analysis for each project will vary with the size of the project. For example, a small project will likely have a brief analysis and a large project will require a detailed analysis. The complexity and potential effects of the project will determine whether an environmental impact statement (EIS), an environmental assessment (EA), a biological evaluation (BE), or a categorical exclusion (CE) is the appropriate NEPA tool. If an air quality analysis is deemed unnecessary, the NEPA document should state that potential air quality impacts were considered but were determined to be inconsequential. In this case, a justification for this determination must be included.

A project NEPA analysis is where specific environmental effects from specific projects are analyzed and assessed. This process provides a good opportunity for fire managers and air quality regulators to come to a common understanding of how smoke from prescribed fire projects will be managed and reduced. Section 309 of the 1977 Clean Air Act Amendments (Public Law 95-95) gives EPA a role in reviewing NEPA documents and making those reviews public. How actively EPA pursues this role tends to vary between EPA regions and with the complexity and potential environmental risk from the project.

A complete disclosure of air quality impacts in a NEPA document should include the following information:

1. Description of the air quality environment of the project area
2. Description of alternative fuel treatments considered and reasons why they were not selected over prescribed fire.
3. Quantification of the fuels to be burned (areas, tons, types).
4. Description of the types of burning planned (broadcast, piles, understory, etc.).
5. Description of measures taken to reduce emissions and emission impacts.
6. Estimation of the amount and timing of emissions to be released.
7. Description of the regulatory and permit requirements for burning (for example, smoke management permits).
8. Modeled estimates of where smoke could go under certain common and worst case meteorological scenarios and focusing on new or increased impacts on down wind communities, visibility impacts in Class I wildernesses, etc. In some areas and for some fuel types, an appropriate dispersion model is not available. In this situation, qualitative analysis will need to suffice. Qualitative analysis can also be used for simple projects with little risk of air quality impact.

Conformity

"No department, agency, or instrumentality of the Federal Government shall engage in, support in any way or provide financial assistance for, license or permit, or approve, any activity which does not conform to a State Implementation Plan."

Clean Air Act Amendments of 1990

The 1990 Clean Air Act Amendments (Public Law 101-549) require planned federal actions to conform to state or tribal implementation plans (SIPs/TIPs). EPA's General Conformity rule established specific criteria and procedures for determining the conformity of planned federal projects and activities. In so doing, EPA chose to apply general conformity directly to non-attainment and maintenance areas only. EPA continues to consider application of general conformity rules to attainment areas but at present has not done so, although an activity in an attainment area that causes indirect emission increases within a non-attainment area may have to be analyzed for conformity. Federal agencies have the responsibility for making conformity determinations for their own actions.

General conformity rules prohibit federal agencies from taking any action within a non-attainment or maintenance area that causes or contributes to a new violation of air quality standards, increases the frequency or severity of an existing violation, or delays the timely attainment of a standard as defined in the applicable SIP or area plan. If a proposed federal project (non-temporary) were projected to contribute pollution to a non-attainment area the project would likely be canceled or severely modified. Temporary proposed federal projects that could impact a non-attainment area must also pass a conformity determination.

Federal activities must not:

1. Cause or contribute to new violations of any standard.
2. Increase the frequency or severity of any existing violations.
3. Interfere with timely attainment or maintenance of any standard.
4. Delay emission reduction milestones.
5. Contradict SIP requirements.

A conformity determination is required for each pollutant where the total of direct and indirect emissions caused by an agency's actions would equal or exceed conformity de minimis levels (table 4.3.1), or are regionally significant. Regionally significant is defined as emissions representing 10 percent or more of the total emissions for the area.

Table 4.3.1. Particle and carbon monoxide de minimis levels for general conformity.

Pollutant / Attainment level	De minimis level (tons per year)
Non-attainment areas	
CO	100
PM_{10}	
Moderate Non-attainment	100
Serious Non-attainment	70
Maintenance areas	
CO	100
PM_{10}	100

The general conformity rule covers direct and indirect emissions of criteria pollutants or their precursors that are caused by a Federal action, reasonably foreseeable, and can practicably be controlled by the Federal agency through its continuing program responsibility. In general, a conformity analysis is not required for wildland fire emissions at the Forest Plan level because specifics of prescribed fire timing and locations are not known, so at this planning level the reasonably foreseeable trigger is not met. A conformity determination will likely be required at a later date when planning specific projects under NEPA.

Wilderness Act

The Wilderness Act (Public Law 88-157) (and subsequent Acts designating individual Wilderness Areas) was enacted to preserve and protect wilderness resources in their natural condition. Wildernesses are to be administered for "the use and enjoyment of the American people in such manner as will leave them unimpaired for future use and enjoyment as wilderness, and so as to provide for the protection of these areas, the preservation of their wilderness character, and for the gathering and dissemination of information regarding their use and enjoyment as wilderness…" Although air quality is not directly mentioned in the Wilderness Act, the Act requires wilderness managers to minimize the effects of human use or influence on natural ecological processes and preserve "untrammeled" the earth and its community of life. Federal agencies have interpreted the goals of the Wilderness Act to mean that wilderness character and ecosystem health should not be impacted by unnatural, human-caused air pollution. Most Class I areas are entirely wilderness although some Class I National Parks contain areas that are not wilderness.

Literature Citations

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