ELEMENTS OF A SMOKE MANAGEMENT PROGRAM

This paper is a discussion of smoke management programs and is intended to provide interested readers with additional information on the subject of smoke management, and to provide some recommendations for a basic level smoke management program. This paper was developed by members of an EPA sponsored workgroup in response to specific questions raised about smoke management in the development of a policy recommendation to EPA. Although EPA highly recommends and encourages all agencies that use fire as a resource management tool to adopt at least a basic level smoke management program, in no way should any of the information presented in this paper be construed as an EPA requirement. In developing this information two assumptions were made:

- **Every** burn project should be evaluated to reduce the emissions of smoke to the greatest extent possible. Alternatives to burning should be considered and used as much as possible.

- In most cases, these evaluations are conducted by a land management agency in either the State, Tribal, or Federal government, although some State air agencies are the responsible authority.

- When private individuals or non-governmental entities use prescribed burning, they often rely on the responsible land or air management agency to perform these evaluations.

BACKGROUND

The key to successfully balancing the use of prescriptive fire and meeting air quality objectives is an active smoke management program (SMP). SMP's establish a basic framework of procedures and requirements for managing smoke from prescriptive fires and are typically developed by States/Tribes with cooperation and participation by land owners/managers. The purposes of SMP's are to mitigate the nuisance and public safety hazards (e.g., on roadways and at airports) posed by smoke intrusions into populated areas; to avoid significant deterioration of air quality and potential NAAQS violations; and to avoid visibility impacts in Class I areas. The smoke management program can be used to evaluate the potential air quality impacts of individual and multiple projects and coordinate emissions from prescriptive fire activity in an area. The SMP is generally administered by a central agency. Usually, the state natural resources agency, air quality agency or tribal authority is responsible for administering the SMP for the state or tribal lands. Although in some cases the SMP is cooperatively administered by more than one agency. Occasionally, the SMP may cover an airshed and be administered by a local agency. With increased prescriptive fire activity, the necessity for interstate or regional coordination will also increase. Land management agencies, land owners and air quality agencies are encouraged to work together to develop a program tailored to the needs of the area. If programs are developed

through partnerships, the resulting programs will be much more effective in meeting resource management goals, protecting public health and meeting air quality objectives.

The SMP may form the framework for a state- wide program which could apply to all prescriptive burns in that state, or the administering authority may decide that only burns over some deminimis level need to be subject to such a program. Under the umbrella of the SMP and for the purposes of this paper, smoke management on an individual burn basis will be called the smoke management plan (SM Plan). Section VI of the policy uses the terminology smoke management components of burn plans to describe what is meant here by SM plan. The size and complexity of a particular burn usually determines the type of SM Plan developed, but some States do not require a SM plan be developed at all, or they limit this requirement to large burns. For example, for a small pile burn far from any smoke sensitive areas it may be sufficient to ignite the fire on a day with good smoke dispersal, and to visually monitor the smoke impacts. In such cases, many States do not require the agency or individual performing the burn to submit a formal written burn plan. Instead, the agency administering the SMP will use many of the elements described in the SMP section below and in Section VI, and or some or all of the components of a smoke management plan (SM plan) described below and in Section VI to evaluate the burners request. Based on its consideration of these elements and components the administering agency will either approve or disapprove the request. At the other end of the spectrum, for a landscape burn project that has the potential to affect many smoke sensitive areas over multiple days, the administering agency may require that the burners have a SM Plan that includes a very narrow window for meteorological conditions (wind speed, wind direction, and dispersion conditions), an ambient air monitoring program, a notification system for persons with respiratory illnesses, and coordination with highway safety personnel.

INTRODUCTION

States and tribes may follow a variety of approaches to manage the use of fire to avoid NAAQS violations and to ensure progress in meeting long term visibility goals in federally mandated Class I areas. *States or tribes with prescriptive fire projects having the potential to affect smoke sensitive areas are encouraged to develop SMP's with participation by the affected land owners/managers and air managers.* The purpose of a SMP is to establish a basic framework of procedures and requirements for managing smoke from prescriptive fires to avoid:

1) sending smoke into populated areas,
2) violations of the NAAQS,
3) visibility impacts in federally mandated Class I areas, to the extent practicable, and
4) regional haze impacts.

Existing SMPs differ widely among states/tribes, nevertheless, effective SMPs should contain the following basic components:

A. Authorization to Burn

B. Minimizing Air Pollutant Emissions
C. Smoke Management Components Of Burn Plans
    1. Actions to minimize prescriptive fire emissions
    2. Evaluation of smoke dispersion
    3. Public notification and exposure reduction procedures
    4. Air quality monitoring
D. Public Education and Awareness
E. Surveillance and Enforcement
F. Program Evaluation

Once specific procedures and requirements of the SMP for a state/tribe or airshed are determined, they are usually implemented through regulation or through a Memorandum of Understanding between affected parties. As the number, size or complexity of prescriptive fires increases, a state/tribe may find their SMP needs to be revised to ensure protection of the NAAQS and so that visibility goals are met.

A SMP may combine varying degrees of complexity for the basic smoke management components. For example, a program may use a complex method of evaluating smoke dispersal, but have minimal emission inventory requirements. Effective SMPs may treat various types or sizes of prescriptive fire projects differently. A more detailed smoke dispersion evaluation and post-burn emission inventory may be appropriate for a multiple day broadcast burn project. While a small pile burn, expected to last an hour, being done by a landowner may need to establish only basic ignition parameters within which the fire can be ignited. It is recognized that resources to develop a comprehensive SM plan are not always available, especially for the private woodland owner.

ELEMENTS OF THE SMOKE MANAGEMENT PROGRAM

This section provides more detail on each of the elements of a smoke management program (SMP), and on each component of an individual basic SM plan. An example of the minimal requirements of a basic level program is given for each of the elements. Following the basic level requirements are examples of additional methods which might be considered or customized for a state or tribal program. Some of the examples are from existing programs in various states. Since conditions in each area will vary, it is difficult to define specific examples as being at a certain level of complexity. The complexity of the program should be matched to the amount or type of prescriptive burning activity which occurs in the area. States have found that programs are most cost effective when the resources needed to ensure proper smoke management, provide for future planning, and gather information used for evaluation are matched to the amount of activity.

A. Authorization to Burn

The agency administering the SMP establishes a mechanism to review and approve the smoke management portion of the burn plan for specific projects. Authorization to ignite (complete) various types or sizes of projects may be handled in different ways. This evaluation and approval is closely linked to the smoke dispersion evaluation component of the SM plan. In some states evaluation of the two components occurs simultaneously.

Basic Level

A mechanism for notification of the central authorizing agency of planned prescriptive fires is necessary. This notification includes specific information about the planned burn which will be used by the central authorizing agency to evaluate the burn project. An agency may review the burn plan's smoke management components or review specific information from the plan. To review and evaluate the project the authorizing agency will need some or all of the following information such as the size of the burn, type of burn, purpose of the project, fuel type and density, smoke sensitive receptors, and expected season for burn ignition. The amount and type of information required varies from agency to agency. Authorization, conditional authorization, or denial of the project must be given in a timely fashion

Examples of Burn Plan Review and Authorization

- Colorado, New Mexico, and Wyoming are among the states which require submittal of a permit application form which includes details about the project.

- In Washington, review and approval of the smoke management plan and an application form are completed and the approved project filed until scheduling of the project is requested. The state, which has a legislated emission reduction goal, sends Department of Natural Resources inspectors into the field to determine the fuel loading of specific projects before ignition. This information is used to estimate potential smoke impacts, and to evaluate whether the emission reduction goals are met after the burn is completed. Burning done for the restoration of forest health is exempt from these emission reduction goals.

- As a pilot project, land management agencies burning in California's San Joaquin Valley are using a Windows-based computerized program to schedule fires for the airshed. This system, called the Prescribed Fire Incident Reporting System (PFIRS), schedules projects on the basis of information such as expected smoke impacts and availability of safety personnel. Once it is fully developed, the system is intended to be used statewide.

- In New Mexico seasonal permit approval is given and seasonal notification of completed projects is required.

Specialized Problems

Since planning to complete a project on a specific day is not possible, authorizing agencies are often inundated for approval requests on days with favorable meteorological conditions. To ensure adequate review of projects, most states/tribes conduct a review and provide **preauthorization** of proposed projects. When conditions are favorable and the appropriate personnel are available, the burning agency will notify the central authorizing agency, up to a few hours before the preferred ignition time to seek final approval to ignite the project.

B. Minimizing Air Pollutant Emissions

See Science & Technology Workgroup Paper: " What Wildland Fire Conditions Minimize Emissions and Hazardous Air Pollutants and Can Land Management Goals Still be Met?"

C. Smoke Management Components of Burn Plans

1. Actions to minimize prescriptive fire emissions: see reference above under B.

2. Evaluate smoke dispersion:

Evaluation of the potential for the smoke emissions from a project to disperse is probably the single most important component of an effective SM Plan. The centralized authorization agency must match this evaluation to the complexity of individual projects and to the total burning activity occurring in the airshed. Agencies may use different evaluation/approval methods for small projects that will not impact any sensitive receptors or where potential impacts are easily monitored and mitigated.

Basic Level

The burn project is evaluated for the potential of the project to contribute to unacceptable smoke impacts or particulate levels. The agency that implements the SMP is responsible for evaluating the potential impacts of multiple projects and authorizing only as many projects as the atmosphere can handle. If ignition approval of enough individual projects is requested at one time to create potentially unacceptable smoke impacts, the SMP agency schedules the burns to minimize the smoke impact.

Examples Methods of Smoke Dispersion Evaluation

- Arizona, Colorado, New Mexico, Utah and Wyoming are among the states which require submittal of smoke dispersal model inputs and outputs to the air quality agency. The submittal is used to evaluate the smoke and particulate matter impacts of a project.
- New Mexico's Environment Department approves projects and requires notification (by phone, fax, or voice mail) on the day of burn.
- Colorado's Air Pollution Control Division approves specific sized projects with a certain fuel type and loading to be completed when certain meteorological

conditions exist. The land owner/agency can complete the burn when the conditions of the permit are met.

- In Washington, ignition of larger projects (> 100 tons of fuel) must be authorized by a Department of Natural Resources meteorologist who evaluates the capacity of atmospheric conditions to disperse smoke from the project. The agency coordinates scheduling of multiple projects in an airshed.
- Florida's Department of Natural Resources uses a GIS-based dispersion model to evaluate multiple projects and approves or reschedules a project based on the modeled smoke impacts.
- Prioritization of multiple burn projects, where restrictions are necessary, can be based upon predetermined ranking criteria. Examples of prioritization criteria currently in use are:
  - -- projects to reduce the risk of wildfire hazard in the urban/wildland interface zone may be given priority over projects to reduce logging slash,
  - -- projects including air quality research are given priority in several states,
  - -- projects to change a landscape and reduce the size of potential wildfires are given priority.

3. Public notification and exposure reduction:

Notification of potentially affected persons about impending projects is necessary. This notification is usually the responsibility of the land owner/manager, but is sometimes carried out by the air quality agency. Notification reduces the number of calls to emergency lines and/or health agencies. If smoke impacts develop and it becomes necessary to issue health advisories (e.g. alerts, warnings, emergencies), the air quality/health agency and the land owner/manager should be involved. Issuing a health advisory watch at the time of notification should be considered for all projects. A health advisory watch advises people there may be smoke in their area, and suggests ways they can limit their exposure, and provides recommendations for persons with respiratory illnesses. The advisories may be based on real-time ambient monitoring, on visual estimations of smoke impacts, or expected smoke impacts. The cooperating agencies should agree on trigger levels, communication strategies and contingency measures before the project is ignited. If smoke intrusions are causing unacceptable impacts, new ignitions of any new open burning that could impact the area should be halted. As the amount of prescriptive burning and the size of individual projects increases, this component will become more important. Public health advisories are appropriate for situations where the potential for multiple day smoke impacts exists.

Basic Level

The agency responsible for the burn must notify all sensitive receptors such as communities, highways, campgrounds, and airports which may be impacted by the project and appropriate fire safety and health officials.

Examples of Public Notification and Exposure Reduction Procedures

- Notifying the potentially affected public (especially smoke sensitive populations) of elevated pollutant concentrations.
- Suggesting actions to be taken by sensitive persons to minimize their exposure (e.g., remain indoors, avoid vigorous activity, exposure to tobacco smoke and other respiratory irritants).
- Posting warning signs or flag men along potentially impacted roadways.
- Providing clean air facilities for sensitive persons.
- Halting ignitions of any new open burning that could impact the same area.
- Consulting State/Tribal air quality managers regarding appropriate short-term fire management response to abate verified impacts.
- Implementing management responses that will mitigate the adverse impacts to public health.
- Reporting the steps taken to mitigate adverse impacts to the public and appropriate State/Tribal agencies after they have been completed.

4. Monitoring:

All projects should be monitored in some form to ensure the burn is meeting the goals of the smoke management plan and program. There is no reason that visual monitoring of the smoke dispersion and impacts would not be used. In addition to visual monitoring many projects will include other types of monitoring, such as, additional meteorological measurements, ambient air quality, and smoke impacts at various receptors. The surveillance and enforcement and program evaluation components of the SMP will rely heavily on information gathered during the monitoring phase of the project.

Basic Level

A land owner/manager ignites a small test fire to visually determine if conditions are favorable for the dispersion of smoke without impacting sensitive receptors. After ignition of the project, acceptable smoke dispersion conditions continue to be monitored visually. If conditions change and unacceptable smoke impacts develop, immediate fire suppression or rapid “mop-up” is required.

Examples of Monitoring

- Communities with permanent real-time monitoring sites are using the data to monitor the smoke impacts of prescriptive fire projects and to indicate the need for suppression or rapid mop-up.
- Personnel are stationed along roadways to visually monitor for smoke impacts and warn motorists of adverse conditions.
- Persons visually monitor for smoke impacts in communities (or other smoke sensitive areas). These monitors have a method of immediately reporting smoke impacts to the burn boss.
- Special ambient monitoring equipment is installed for a project. (See the Science & Technology Workgroup Paper: "Monitoring for Wildland Fire Operations" for more details.)

D. Public Education and Awareness

In addition to notifying potentially impacted persons of impending projects, there is also a need for education about specific local projects, and in general about the need to burn for ecosystem health concerns. Effective smoke management programs should include both a means to notify that portion of the public that may be directly affected by projects, and an ongoing education program. The program should inform the public not only about the health risks from smoke and how smoke management techniques can protect air quality, but also about the benefits of using fire as a resource management tool. Actions the public can take or that the agency igniting the burn is taking to reduce smoke exposure from specific projects needs to be communicated. Cooperation between the involved agencies is essential to education and awareness. The agencies involved in developing the SMP should also agree on common messages to be used to develop agency specific outreach and communication programs. The National Wildfire Coordinating Group and the EPA Wildland Fire and Air Quality Workgroup have both developed educational packages which are useful.

General Education Program

The agencies involved in prescriptive burning in a state/tribe should work together to develop common messages and educational information on the potential air quality impacts of prescriptive fire in wildlands, and the potential benefits. Together the agencies should provide information on forest health issues, the role of fire in restoring wildlands, air quality concerns and smoke mitigation techniques that may protect air quality. Generally, in areas where a strong emphasis on education about the benefits of prescriptive fire exists, strong support for prescriptive fire programs also exist. It has been the experience of these areas that the need for an educational program never ceases. As new people move into an area, they need to be educated. Continual exposure of the public to wildland fire and air quality issues is needed to maintain interest in and support of prescriptive fire programs. When a prescriptive fire project is completed, follow up

reporting on the objectives met, the response of the wildlands to the fire, and the expected benefits of the fire gives credibility to the project and provides additional education for the public.

Examples of Education

- Public information/input meetings held in communities which may be affected by projects. The proposed projects are described, resource objectives explained, and public input gathered. Once the projects are planned, approved, and tentatively scheduled, flyers are distributed to potentially affected homes. The flyers provide information on burn schedules, objectives of the burn, expected impacts, and the phone number of a contact person.

- In Florida, brochures on the use of fire as a resource management tool are given to property buyers when a property is sold which is in the urban/wildland interface or areas where significant amounts of prescriptive burning occur.

- For burns which will be very visible, provide a safe "viewing area". Public relations/education officers should be available during the burn to provide information about the burn, prescriptive fire in general, and to answer questions.

- Include areas treated with prescriptive fire on guided Nature Walks and show the benefits of fire to landscapes. Some agencies use signs along trails to point out the results of highly publicized projects.

E. Surveillance and Enforcement

The smoke management program needs to have a mechanism to follow up on projects that do not meet the requirements of the SMP or on projects that have caused unacceptable smoke impacts. All incidents which occur should be considered during the periodic review and evaluation of the program. The surveillance component may also be used to provide information on program activity and trends.

Basic Level

Probably the most common surveillance technique is tracking of, and follow-up on, complaints from the public. This does require that enforcement actions be based on "significant complaints." Significance may be defined by the number of persons complaining or the severity of the smoke intrusion. If a project is determined to be causing or to have caused unacceptable smoke impacts, the SMP authorizing agency needs to re-evaluate the smoke management plan and conditions the day of the burn. Even under the best of conditions and despite careful adherence to permit conditions, unacceptable smoke impacts can occur. Unacceptable smoke impacts that occur because the burner was negligent or failed to follow SMP requirements, should result in enforcement action.

Examples of Surveillance and Enforcement

- A mechanism similar to the program air quality agencies use to enforce air quality regulations and air pollution emission permits for industrial sources is used to enforce wildland burning regulations or agreements in some states. Such a program must provide:
    1) A process for notifying land owners/managers of the unacceptable impacts,
    2) An opportunity for the land owners/managers to provide feedback,
    3) The ability to issue a compliance order assessment, and
    4) An appeal process.

- The Arizona Department of Environmental Quality uses aerial surveillance to verify the effectiveness of its smoke management program and the validity of smoke dispersion assumptions, and to assess visual impacts and compliance with permitted conditions.

- Anyone carrying out prescriptive burning in Florida is required by state statute to take a smoke management training course. Once licensed, except in cases of negligence, the land owner/manager responsible for the burn is not liable for damages incurred from the burn.

- Arizona, Colorado, Oregon, and Washington are among the states which require a report of actual burning activity which is used to assess.

F. Program Evaluation

Periodically, the effectiveness of the current program should be evaluated to determine if it is preventing smoke intrusions and ensuring that regional haze goals are met. At a minimum, this review should be based on the number of nuisance or health impact complaints. Evaluation of individual projects or program wide effectiveness may also use information such as ambient air monitoring data, air pollutant emissions or burning activity inventories, and/or photographic documentation.

If unacceptable smoke intrusions have occurred, each project should be evaluated to determine if changes to the Smoke Management Program would help prevent a reoccurrence of a similar situation. Multiple occurrences of unacceptable smoke impacts in sensitive areas are an indication that a more complex program may be needed. The impacted agencies should then consider which component or components of the basic program need to be enhanced. If the level of activity or complexity of the projects is expected to increase, this periodic review should evaluate the potential of the program to remain effective in preventing smoke intrusions.

Basic Level

Periodically, the agencies and parties involved in prescriptive fire activity should meet and evaluate the SMP's effectiveness in meeting stated goals. It will be necessary for the authorized central agency to prepare a summary of past activity and problems which have occurred. All agencies must have an estimate of future activity, if significant changes are expected. Revisions to the SMP should be developed with input from all agencies/parties.

For example, ambient air monitoring may be available to evaluate the program effectiveness. Information which indicates the NAAQS is being approached can be used to institute a more aggressive smoke management program. As this situation indicates the need for better evaluation of smoke dispersion, the agencies reviewing the SMP may decide a different smoke dispersion model should be used for projects with fuel loadings greater than a certain volume. These agencies may also decide that there is a need for real-time monitoring to accompany all projects that exceed a set size and that a meteorologist is needed to coordinate multiple projects.

As the complexity of a program increases, data used for the evaluation and revision of the SMP will become more complex but the need for periodic evaluation and review will continue. A smoke management program which is developed, periodically evaluated and reviewed, and implemented through a partnership of all stakeholders can successfully meet resource management and air quality objectives.