

Strategies for Reducing Residential Wood Smoke

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I. Introduction

Purpose of Document

This document was written for state, local and tribal air pollution control officials to have a comprehensive list of strategies to help communities reduce wood smoke from residential heating. It provides education and outreach tools, information on regulatory approaches to reduce wood smoke, as well as voluntary programs to change out old, inefficient wood stoves and fireplaces. It includes EPA federal actions like rule making that are being considered and/or implemented to help communities address residential wood smoke throughout the United States. In addition, this document includes possible approaches for funding change out programs, methods for calculating potential emission reductions, and the basic components of a wood smoke reduction plan for fine particles in areas where wood smoke is of concern.

There are a variety of wood smoke reduction programs in existence today. Some communities have implemented woodstove and fireplace changeouts, some have implemented burn bans, while others have implemented a combination of education, wood-burning curtailment and changeout programs. This document provides examples for state, local and tribal air quality planners to consider for addressing residential wood smoke problems. Wood smoke programs may be important in areas working to maintain the National Ambient Air Quality Standards (NAAQS) or areas that are close to exceeding the standard. See Appendix A for a case study that incorporates these different control strategies. For areas that are not meeting or not expected to meet the NAAQS for fine particles a wood smoke reduction plan is encouraged to achieve and track wood smoke emission reductions as soon as possible. Planning for early emission reduction will reduce the likelihood of violations of the NAAQS, may limit the number of mandatory Clean Air Act state implementation plan (SIP) requirements in the future and can be used to develop a SIP if required. Appendix B provides the basic components of a wood smoke reduction plan.

Why Is Wood Smoke a Concern?

Residential wood smoke contains fine particles and toxic air pollutants (e.g., benzene and formaldehyde). Each year, smoke from wood stoves and fireplaces contributes over 420,000 tons of fine particles throughout the country – mostly during the winter months. Nationally, residential wood combustion accounts for 44 percent of total stationary and mobile polycyclic organic matter (POM) emissions and 62 percent of the 7-polycyclic aromatic hydrocarbons (PAH), which are probable human carcinogens and are of great concern to EPA. There is also public concern about the use of older technology hydronic heaters (also known as outdoor wood boilers) and their growing use, particularly in the Northeast and Midwest.

There are a number of communities where residential wood smoke can increase particle pollution to levels that cause significant health concerns (e.g., asthma attacks, heart attacks, premature death). Several areas with wood smoke problems either exceed EPA's health-based standards for fine

particles or are on the cusp of exceeding those standards. For example, residential wood smoke contributes 25 percent of the wintertime pollution problem in Keene, New Hampshire. In places such as Sacramento, California, and Tacoma, Washington, wood smoke makes up over 50 percent of the wintertime particle pollution problem. It may be difficult for these and other areas to meet the national health-based standards without taking steps to significantly reduce residential wood smoke.

The health benefits associated with reducing fine particle emissions, including wood smoke, are significant. If all of the old wood stoves in the U.S. were changed out to cleaner burning hearth appliances, EPA estimates that at least \$35 billion in health benefits per year could be realized. Eliminating these emissions could help avoid thousands of pre-mature deaths, non-fatal heart attacks, chronic bronchitis and asthma attacks for example.

Recommended Wood Smoke Components

As a first step, EPA recommends that air quality personnel evaluate data (e.g., winter time organic carbon) to determine the nature and magnitude of wood smoke contributions in a given airshed. In addition, a local survey to determine important information (e.g., how much wood is burned, percentage of homes with fireplaces, wood stoves and/or hydronic heaters) will prove extremely useful in planning an overall wood smoke program. To ensure the success of a wood smoke reduction program, EPA recommends that the program include the following key components:

1. Public Education: An education campaign that encourages people to burn only dry, seasoned wood or wood pellets and includes messages about cost savings (i.e., burning less wood), improved safety and health benefits. More energy efficient means burning less wood. Depending on the severity of the air quality problem, some areas may want to encourage alternative fuels (e.g., natural gas).
2. Wood Stove/Fireplace Changeouts and Removal: A woodstove and/or fireplace changeout campaign that provides incentives and encourages homeowners to replace their old, high polluting wood stove or retrofit their fireplace with a cleaner burning, more energy efficient heating appliance. EPA-certified wood stoves emit 70 percent less particle pollution and are approximately 50 percent more energy efficient than wood stove manufactured before 1990. There are two key options an area can institute to ensure old wood stoves are removed and destroyed from homes more quickly than otherwise:
 - a. Require that the old stove be removed and destroyed upon resale of a home.
 - b. Ban the use of uncertified wood stoves by a given date, similar to Lincoln County, Montana.
3. Wood-Burning Curtailment Programs: One of the quickest and most effective ways an air quality agency can reduce wintertime wood smoke is by developing a curtailment program or instituting “burn bans.” A curtailment program can be voluntary or mandatory and typically includes exemptions.
 - a. Forecasting and Public Notification: An essential part of implementing a curtailment program includes the ability to forecast air quality and notify the public through

e-mail, radio and TV about “bad air days” so they can adjust their burning practices accordingly.

4. Hydronic Heaters: As traditional sources of fuel (e.g., natural gas and heating oil) prices have gone up over the last several years, the purchase and use of wood-fired hydronic heaters, also known as “outdoor wood boilers” have increased. Hydronic heaters can be very high polluting (one old dirty unit can result in fine particle levels above the NAAQS) and are unregulated in many areas. To control emissions from these units, several states and local governments have passed regulations based on a “Model Rule” outlining emission limits, set back distances from property lines or buildings and stack height. EPA recommends that areas consider adopting the Model Rule or a more stringent approach tailored to the specific needs of the community.

These key components, along with other wood smoke control strategies, are discussed in greater detail in the body of this document.

Growing Demand for Cheaper, More Energy Efficient Residential Home Heating

Over the last several years, the interest and use of biomass (wood, corn, switch grass) to help save money on home heating bills and reduce our dependence on foreign oil has increased. According to the hearth industry, sales of wood and pellet stoves increased 28 percent in the Northeast from 2007 to 2008.

The 2009 American Recovery and Reinvestment Act legislation signed into law on February 17, 2009, by President Barack Obama, includes a 30 percent tax credit (up to \$1,500) for the purchase in 2009 and 2010 of a 75 percent efficient biomass-burning stove. In addition, states such as Idaho, Oregon and Montana, are providing tax incentives to encourage homeowners to switch from non-renewable fuels (e.g., natural gas and heating oil) to renewable, “home-grown” biomass fuels.

Air Quality Improvements from Wood Smoke Reduction Programs

Compared to typical air pollution sources such as industrial factories and commercial operations that may be regulated by states and tribes, existing wood stoves, fireplaces and hydronic heaters emit pollution from sources owned and operated by homeowners. This makes replacement and control very challenging. Today, we believe there are over 12 million wood stoves nationwide, 75 percent of which are older, inefficient stoves that need to be replaced or taken out of service and destroyed. This document provides information on how to develop a wood smoke reduction program based on other’s successes and lessons learned.

Wood smoke programs are resulting in emission reductions and significantly cleaner air quality:

- A wood stove changeout program implemented in Libby, Montana, led by the Lincoln County Health Department, changed out over 1,100 wood stoves and reduced wintertime particle pollution levels by 7 micrograms per cubic meter ($\mu\text{g}/\text{m}^3$). This reduction has helped Libby attain the 1997 annual and 24-hour fine particle national standards.

- The Sacramento Air Quality Management District implemented a wood smoke curtailment program that reduced fine particle pollution levels by 12 ug/m³ from 2008 to 2009.
- Environment Canada implemented a “Burn It Smart” campaign that included conducting community based workshops. Even though they did not calculate emission reductions, a follow-up survey of 174 people indicated that:
 - 73 percent of the respondents said the workshops brought about positive change on how they burned wood.
 - 34 percent have updated their wood burning appliances, 90 percent of those chose EPA-approved appliances.
 - 41 percent of those surveyed have changed out or intend to change out their old wood burning appliances for cleaner technology.

II. Education and Outreach

Wood smoke education is an important non-regulatory component for reducing particle pollution in your community. Engaging the public and giving them the tools to make the right decisions about what they burn and how they burn is the first step in an overall wood smoke plan. With proper burning techniques and well-seasoned wood, emissions (even in older stoves) can be significantly reduced. While a new wood stove or wood-burning fireplace will pollute less than older appliances, it is important to emphasize that how a user operates their new appliance is equally important in maximizing energy efficiency and reducing emissions. Even more efficient and cleaner-burning appliances can cause pollution if operated improperly.

Getting a commitment from local community leaders to support wood smoke reduction programs is important for the viability of an education campaign. When introducing burn ban ordinances or wood stove changeout programs to elected leaders, a plan for education and outreach to the public should be included. The following is an example policy statement from the Bay Area Air Quality Management District that could be used in other communities to help advance education and outreach campaigns.

- “The City shall establish and maintain an on-going program to educate the public on the provisions of this ordinance and the health impact of wood smoke. The education program shall also identify the various types of wood burning appliances and gas fireplaces, and instruct residents how to burn fires more cleanly. The City will educate the public that fireplace and wood stove (proper operation and) maintenance are also effective in minimizing and reducing wood burning emissions, encourage cleaner-burning alternatives such as gas-fueled devices, proper wood burning techniques to build hotter, more efficient fires. The City will investigate ways to assist the public with replacement or removal, through programs or services.”

EPA also recommends that a policy include a commitment to forecast particle pollution and provide reports to the public that includes an e-mail alert system. (See Air Quality Forecasts and Reports to the Public section above for more details).

EPA has partnered with the Hearth, Patio and Barbecue Association (HPBA) to conduct an education and outreach campaign, called “Burn Wise.” We encourage air pollution professionals to work with the local hearth retailers, local firefighters, chimney sweeps, insurance agents, doctors, teachers and others to deliver the Burn Wise message to the public.

- a. Burn Wise Education and Outreach Campaign: The purpose is to promote responsible wood-burning techniques for those who elect to burn wood. The campaign will also educate people on the connection between what they burn, how they burn, and the impacts on their health and the environment. In addition, the campaign promotes safety, cost savings, and energy efficiency. EPA is “fuel neutral” and does not encourage wood heat over gas, electric, propane, or other fuel types. However, if people elect to burn wood, it is important to provide the tools and knowledge so they burn responsibly.

Campaign’s Key Message: If you burn wood, burn as cleanly as possible with the right wood, the right way, in the right appliance.

- What to burn. People should only burn dry seasoned wood (i.e., 20 percent or less moisture) or wood pellets. Dry hardwoods or pellets have the best combustion efficiency and create less smoke inside and outside the home. We recommend that your campaign plan also on what not to burn. People should never burn garbage, plastic, or pressed and treated wood in their wood stove or fireplace. The toxic chemicals released during the burning process are harmful when inhaled and can potentially damage wood-burning appliances. Also, people should never burn wet or “green” wood that has not been properly seasoned. While it may be cheaper and easily available, burning wet or green wood is inefficient and creates smoke and less heat when burned.
- How to burn. When heating with wood, people should maintain a bright, hot fire and not let it smolder. More smoke means decreased efficiency and more creosote build-up in the chimney which could lead to a potential chimney fire. The campaign encourages annual maintenance of the wood stove or fireplace by a certified chimney service technician.
- Choosing the right appliance. People should upgrade their old (i.e., manufactured before 1990) wood stove or fireplace to an energy-saving, EPA-approved appliance (e.g., EPA-certified wood stove, pellet stove, or gas stove) installed by a professional. When choosing a wood stove or fireplace, it should be the right size for the room (or rooms) it is heating. An appliance that is too large or too small will not operate at peak efficiency and thus will create more pollution. To learn more about EPA certified wood stoves, visit <http://www.epa.gov/woodstoves/basic.html>. To learn more about EPA qualified hydronic heaters and fireplaces, visit

<http://www.epa.gov/owhh/models.htm> and
<http://www.epa.gov/fireplaces/models.html> respectively.

To support the Burn Wise education campaign, EPA is working with the hearth industry to develop the following tools and initiatives for use by state, local and tribal communities. These materials will be made available online and can be customized to include community-specific information (e.g. burn bans, local ordinances, changeouts). The following materials are free to use and will help maintain a consistent Burn Wise message when developing a local campaign:

- Web site – to provide information supporting the basic campaign messages and include supporting graphics, links, and local contact information. The web site address will be (www.epa.gov/burnwise) and can be added to any locally distributed materials or listed in your burn ban announcements and other places.
 - Live-read Promotional Ads – which can be delivered via the radio and promote Burn Wise. Scripts will be made available to interested local and regional air quality organizations to air during the heating season, especially in nonattainment areas. The scripts can be tailored to include local information that is specific to the state or community.
 - Fact Sheets – these include “Wood Burning FAQ’s,” “EPA-Certified Wood burning,” and “Responsible Wood Burning” fact sheets. Fact sheets will be available for download online.
 - Educational DVD (approximately 30 minutes in length) – DVD will include the following segments: *Introduction and Overview of Wood Stove Operation (3 to 5 minutes), Buying Seasoned Wood, Splitting and Stacking Wood, Burning Energy and/or Manufactured Logs, Making and Maintaining a Clean Fire, Troubleshooting, Clean Your Stove, Checking Your Chimney and /or Venting Annually, and Do’s/Don’ts of Owning and Operating a stove.* DVDs may be ordered through HPBA and can be used in local hearth retail shops or may be placed in local libraries for checkout.
- b. Air Quality Forecasts and Reports to the Public: EPA has existing tools to help raise awareness about wood smoke, particularly the fine particle pollution found in wood smoke. We recommend that air agencies incorporate these tools in their education campaigns and wood smoke curtailment programs – see “Curtailment Programs” below for details.
- The AIRNow web site, www.AIRNow.gov, provides the public with easy access to national air quality information. The web site offers daily Air Quality Index (AQI) forecasts as well as real-time AQI conditions for over 350 cities across the U.S., and provides links to more detailed state and local air quality web sites.

- As part of the AIRNow Program, EnviroFlash is available in many areas across the Nation. EnviroFlash is a free air quality notification system that sends the air quality forecast to the subscriber's e-mail, cell phone or blackberry. Individuals who receive EnviroFlash notifications can adjust their wood burning practices on unhealthy air quality days. Knowing the air quality forecast is important for everyone, especially for those who are part of a sensitive group: children and older adults, people with heart disease, and people with lung disease such as asthma. State and local agencies can tailor the EnviroFlash messages and send special alerts related to smoke, wildfires, etc.
 - If your area is not already forecasting for particle pollution, you can benefit from this free service and offer your community EnviroFlash notifications. Sign up for EnviroFlash at www.EnviroFlash.info. For more information or to become a partner agency contact Scott Jackson at jackson.scott@epa.gov or Donna Rogers at rogers.donna@epa.gov. For information on air quality forecasting, contact John E. White at white.johne@epa.gov.
- c. Additional Tools Available to States/Local/Tribal Governments for Public Education:
 EPA has wood smoke educational materials available for copying and distribution. Materials may be ordered from the EPA library, or can be printed from the Cleaner Burning Wood Stoves and Fireplaces Web site at: <http://www.epa.gov/woodstoves>.

The following are examples of tools available on EPA's Web site:

- Burn Wise Fact Sheet – Provides information about best burn practices, how to burn a proper fire and keep your home and community safe from wood smoke. This full-color fact sheet is available online at: http://www.epa.gov/woodstoves/pdfs/epa_bcflyer_press_rev4.pdf.
- Wood Stove “Dirty Little Secrets” Brochure and Poster – This tri-fold color brochure and poster provides information on the Great American Wood Stove Changeout campaign. The brochure explains the difference between old and new stoves, health effects from breathing wood smoke, and links to more information on the web site. Meant to accompany the tri-fold brochure, the poster (25”x17”) can be displayed in community centers, libraries, or other public areas. The brochure is available from the EPA library (publication number EPA 430F-08-001) or available for you to print from EPA's web site: http://www.epa.gov/woodstoves/pdfs/dirty_secret_2008.pdf.
- “How to Burn Cleaner” Videos – Developed by Air Watch Northwest, these two 5-minute videos, “A Quick Guide on How to Select a New Stove for Home Heat” and “How to Operate Your Stove More Efficiently,” provide tips on how to select and properly operate a wood stove. The videos may be accessed and downloaded at: <http://www.airwatchnorthwest.org/homeheating/index.htm>.

III. Regulatory Programs

There are a variety of regulatory programs to choose from to address wood smoke. Each community will need to decide what measures are most appropriate given the nature and extent of the problem and how familiar the elected leaders and the public are with air quality and wood smoke issues. A public awareness program along with a voluntary wood smoke curtailment program may be a good first step in an airshed that is close to exceeding the fine particle pollution NAAQS. If a community has conducted wood smoke education and outreach and air quality issues due to wood smoke are still occurring, it may be necessary to implement a mandatory curtailment program.

In addition, there are other types of regulatory programs such as requirements about wood moisture content, visible emissions coming out of a chimney, and restrictions on the use and sale of non-EPA-certified wood stoves, all of which are discussed below.

- a. **Wood Burning Curtailment Programs:** Cold weather often coincides with an increase in wood burning and air inversions which can lead to unhealthy levels of air pollution. One of the quickest and most effective ways an air quality agency can reduce wintertime wood smoke is by developing a mandatory curtailment program or institute “burn bans.” Some communities implement both a voluntary and mandatory curtailment program depending on the severity of their problem. Curtailment programs often have two stages with Stage 1 allowing EPA-certified wood stoves to operate and Stage 2 banning all wood burning appliances, unless it is the homeowner’s only source of heat.
 - Although, curtailment programs are not always popular with the public, this measure can be highly effective at reducing wood smoke. As an example, the Sacramento Air Quality Management District’s Stage 2 program implemented in 2008-2009 reduced fine particle pollution levels by 12 ug/m³.
 - To ensure success of your curtailment program, it is essential to have an air quality forecasting and public notification system in place. To learn more about air quality forecasting go to the AirNow website at www.AirNow.gov.
 - Educating the public on the health benefits of reducing wood smoke in the community is critical to gaining support from the public and elected leaders. The following links provide examples of existing curtailment programs:
 - Puget Sound Clean Air Agency: website outlines a two stage burn ban system and frequently asked questions, like “What is a burn ban?” and “How can I find out when a burn ban is called?” For more information go to: <http://www.pscleanair.org/airq/burnban/default.aspx>.
 - Puget Sound Clean Air Agency wood smoke burn ban rule language: <http://apps.leg.wa.gov/RCW/default.aspx?cite=70.94.473>.

- Sacramento Air Quality Management District implements a two stage “Check before You Burn” curtailment program from November to February. For more information, see: <http://www.sparetheair.com/burncheck.cfm>.
 - Jackson County, OR implements a Wood Burning Advisory program in their small community. This curtailment program designates days as green, yellow, or red depending on the amount of particle pollution in the air. For more information, see: <http://www.co.jackson.or.us/page.asp?navid=2492>.

- b. Opacity Limits and Visible Emission Limits: Opacity means how much your view through the smoke is blocked. One hundred percent opacity means you are not able to see anything through the smoke. At 20 percent opacity, there is very little smoke and you can see almost perfectly through it. To help control smoke from chimneys or flues and to encourage cleaner burning techniques, some states and localities have passed laws and adopted rules that require no “visible emissions” or that limit the “opacity” of emissions. Prohibiting “visible emissions” means no smoke should be seen coming out of a chimney for a given amount of time and if there is, it could be considered a violation. Opacity limits are restrictions on the percentage of light that may be prevented from passing through the smoke plume and require a qualified opacity reader to determine compliance. See EPA Test Method 22 for details on determination of visible emissions (<http://epa.gov/ttn/emc/methods/method22.html>) and EPA Test Method 9 (<http://epa.gov/ttn/emc/methods/method9.html>) for details on determination of opacity.
 - Implementing an opacity limit or visible emissions program requires raising public awareness and having an adequately trained enforcement staff. The effectiveness of these programs will depend on your public education campaign and enforcement capabilities. For more details about this control measure see section 3.7 of EPA’s “Guidance Document for Residential Wood Smoke Combustion Emission Control Measures Document” available at: <http://www.epa.gov/woodstoves/pdfs/EPA-450-2-89-015.pdf>.
 - Opacity: Washington State has an opacity rule that applies to the burning of wood in private residences available at: <http://apps.leg.wa.gov/WAC/default.aspx?cite=173-433-110>. Specific language in their State Implementation Plan requires “a person shall not cause or allow emission of a smoke plume from any solid fuel burning device to exceed an average of 20 percent opacity for six consecutive minutes in any one hour period.” This program has been in use for more than 10 years.
 - Visible Emissions: The Maricopa County Air Quality Department has a wood smoke regulation that prohibits the presence of visible emissions during restricted-burn periods. For specific language, see: http://www.maricopa.gov/aq/divisions/planning_analysis/rules/docs/rwro9911.pdf.

- c. Wood Moisture Content: Wood that is not properly seasoned will burn less efficiently and release more harmful pollutants. To increase the likelihood that stove owners will burn seasoned-wood, some air pollution control agencies have passed regulations making it illegal

for the homeowner to burn wood with a moisture content of 20 percent or more. Homeowners may purchase a basic wood moisture meter at woodworking specialty shops or online. Other areas have made it illegal to sell, advertise or supply wood unless the wood moisture content is 20 percent or less.

- Sacramento Air Quality Management District’s regulation requires the wood moisture content not exceed 20 percent. For more information, see: <http://www.airquality.org/rules/rule417.pdf> (sections 214, 303 and 501.2).
- d. Removal of Old Wood Stove Upon Re-Sale of a Home: Old wood stoves are usually made of metal, weigh 250 to 500 pounds, last for decades and can continue to pollute for just as long. As a result, homeowners are less likely to replace old stoves with a new, cleaner burning technology or remove the old stove especially if they are not using it. To help get these old stoves “off-line,” some local communities have required the removal and destruction of old wood stoves upon the resale of a home. This requirement has proven very effective in locations like Mammoth Lakes, CA; Washoe County, NV; and Jacksonville, OR.
- The Mammoth Lakes, CA, State Implementation Plan (SIP) requires that all non-EPA-certified wood burning appliances (except pellet stoves) be removed or rendered inoperable upon sale of a dwelling. Since 1990, approximately 2,400 wood stoves have been removed and 2,500 fireplaces have been retrofitted.
 - Town of Mammoth Lakes, CA: Link to Rule 431-Particulate Matter, section E; available at: <http://www.gbuapcd.org/rulesandregulations/PDF/Reg4.pdf>.
 - Oregon recently adopted legislation called “Heat Smart” that requires removal of old wood stoves upon re-sale of a home anywhere in the state.
 - Washoe County, NV: Link to Wood stove/fireplace Emissions Rule section 040.051 at: <http://www.washoecounty.us/repository/files/4/prohibitedemissions2.23.06.pdf>
 - Jacksonville, OR: Links to program and a form used to demonstrate the old stove has been removed and properly disposed; available at: <http://www.co.jackson.or.us/Page.asp?NavID=2482>.
- e. Installation of EPA-certified Wood Burning Appliances Only Allowed: Some states have adopted laws that make it illegal to install certain hearth appliances in homes. The Oregon Department of Environmental Quality established a law in 1991 stipulating that uncertified stoves, i.e., those made prior to 1991, cannot be resold or reinstalled in homes or outbuildings and only EPA-certified wood burning appliances may be installed. In Oregon, woodstoves manufactured prior to 1990 are allowed as long as they have not been moved from their original location. Though this measure may be difficult to enforce, if implemented over a long period, it may result in significant emissions reductions. To help address the enforcement challenges, some areas have their building department inspectors enforce this rule.

- f. Ban the Use of Non-EPA-Certified Wood Stoves: For areas that do not meet the NAAQS, the local jurisdiction should give serious consideration to banning the use of non-EPA-certified wood stoves as expeditiously as possible.

The case of Lincoln County Montana is instructive for how to implement a ban. Lincoln County, first waived the full upgrade cost which averaged \$2,900 as an incentive for low-income households to changeout their old stoves. For the rest of the community who had an old wood stove or wood furnace, they provided vouchers up to \$1,750. The Lincoln County Health Department's goal was to encourage all households to voluntarily changeout their old wood stoves to cleaner burning technologies to help address their fine particle pollution challenges.

In 2006, the county passed a regulation that banned the use of old wood stoves that were not EPA-certified. Each home using a "Solid Fuel Burning Device" (e.g., wood stove or fireplace) must have an operating permit. To enforce their regulation, Lincoln County air program personnel periodically "drive by" homes and look for visible emissions coming from chimneys. If there are visible emissions and the homeowner does not have an operating permit on record with the Lincoln County Health Department, the County may issue a notice of violation (NOV) for failure to have a permit. To read the entire regulation, go to: <http://www.lincolncountymt.us/Environmentalpercent20Health/Airpercent20Quality/NewAirOrdinanceFinal.pdf>.

- g. Restrictions on Wood Burning Devices in New Construction: Depending on the current air quality and the projected emissions from new construction, some areas may choose to reduce or prevent further degradation of air quality by banning the installation of any wood burning hearth appliances in new construction or restrict the number and density of new wood-burning appliances in a given area. For an example of such a rule, see California's South Coast Air Quality District rule: <http://www.aqmd.gov/rules/reg/reg04/r445.pdf>. For frequently asked questions related to this rule go to: http://www.aqmd.gov/rules/doc/r445/Builders_FAQ.pdf Areas that allow wood-burning fireplaces can consider only allowing those that meet EPA's voluntary program emission levels or equivalent. For more information go to: <http://www.epa.gov/air/fireplaces/program.html>
- h. Hydronic Heater Rules: State, local and tribal agencies may consider the need to adopt regulations that meet or improve upon the emission limits in the [Northeast States for Coordinated Air Use Management \(NESCAUM\)](#) Outdoor Hydronic Heater model rule. A 2007 study (*Dispersion Modeling Assessment of Impacts of Outdoor Wood Emissions in Support of NESCAUM's Model Rule*) showed that smoke from a single old technology hydronic heater can cause significant air quality problems. As a result some local jurisdictions have chosen to ban hydronic heaters in their townships. Other jurisdictions have chosen to regulate the minimum distances these heaters must be "set-back" from property lines to ensure that they are not used in close proximity to neighbors. Several states have developed proposed rules or adopted emission standards. See: <http://www.nescaum.org/topics/outdoor-hydronic-heaters> for the NESCAUM model rule and

the dispersion modeling analysis that supports the need for local or state regulations to avoid exceedances of the fine particle pollution NAAQS. If hydronic heaters are permitted, EPA recommends that only the [Phase 1 and Phase 2](#) units that meet the voluntary emission levels be allowed in any community.

The following are examples of state or local hydronic heater regulations:

- Maine Department of Environmental Protection at: <http://www.maine.gov/dep/air/regulations/docs/chap150adpfnl.pdf>.
 - Vermont Department of Environmental Conservation at: <http://www.vtwoodsmoke.org/pdf/Final07Rule.pdf>.
 - Town of Rosendale, NY at: <http://www.nescaum.org/topics/outdoor-hydronic-heaters/other-model-regulations>.
- i. Wood-burning Fireplaces: There are over 29 million wood-burning fireplaces in homes throughout the U.S. Although, fireplaces are not typically used for heating homes and are not used as often as wood stoves, fireplaces can contribute significantly to air quality problems, particularly in high density urban settings. EPA and HPBA worked together to develop a voluntary program to encourage manufacturers to develop cleaner burning fireplace units for consumers. The voluntary program sets the same qualifying Phase 1 and Phase 2 emission limits for both low mass (pre-manufactured) fireplaces as well as masonry fireplaces. Low-mass fireplaces are prefabricated and sold to builders for installation during construction of new homes as a lower-cost alternative to masonry fireplaces. Masonry fireplaces are generally built on-site according to certain specifications. Similar to the hydronic heater program, states or local air districts may choose to adopt these emission levels as part of a regulation as needed to help avoid exceedances of the fine particle NAAQS. Also, states and local air districts may consider regulations on existing fireplaces based on installation of retrofit devices that can reduce fireplace emissions to the voluntary program Phase 2 emissions level or better. For example, manufacturers have developed retrofit catalysts, log lighters, wood fiber fire starters and other devices to reduce emissions. For information related to fireplaces go to: <http://www.epa.gov/fireplaces/>.
- j. State/Local/Tribal Wood-Heating Emission Standards: Some state or local government are writing regulations requiring that any wood heating appliance sold in their given jurisdiction meet lower emission levels than the current EPA emission limits. For example, the State of Washington has “solid fuel burning devices” emission limits that are more stringent than EPA’s wood heater NSPS. For details on their emission performance standards go to: <http://apps.leg.wa.gov/RCW/default.aspx?cite=70.94.457>
- k. New Source Performance Standard (NSPS) for Residential Wood Heating Appliances: EPA is currently reviewing the Residential Wood Heaters Standard. This review is considering tightening the air pollution emission limits, adding limits for all pellet stoves, reducing the exemptions, and adding regulations for hydronic heaters, furnaces and fireplaces. EPA expects to complete the review in 2009, propose appropriate revisions by late 2010, and

finalize revisions in 2011. The tightening of the wood heater NSPS has the potential to help reduce future residential wood burning emission throughout the United States.

IV. Voluntary Programs

In addition to conducting education and outreach, there are other voluntary wood smoke control strategies that a community can implement to achieve significant wood smoke reductions. This section provides information on wood stove and fireplace changeouts, hydronic heaters, manufactured (low mass) fireplaces and masonry fireplaces.

- a. Wood Stove and Fireplace Changeouts: EPA strongly encourages states, local and tribal communities to implement wood stove changeouts and fireplace retrofits. EPA has initiated the Great American Wood Stove Changeout campaign to motivate homeowners and communities to replace voluntarily their old, polluting wood stoves with newer, safer, more efficient and cleaner burning technologies. The campaign also educates users about how to burn more efficiently and cleanly. Wood stove changeouts address both indoor and outdoor air quality, reduce fine particle pollution and toxic air pollution, improve energy efficiency, and reduce risk of chimney fires. See: www.epa.gov/woodstoves for more information.

Results: In Libby, Montana where a whole town changeout occurred, wintertime outdoor fine particle pollution levels dropped approximately 7 ug/m^3 after replacing over 1,100 old wood stoves with cleaner burning technologies, according to the Montana's Department of Environmental Quality. Dr. Tony Ward, from the University of Montana, conducted a study of indoor air quality before and after twenty (20) homeowners changed out their old wood stoves. The old stoves were replaced with properly installed and vented EPA-certified wood stoves and indoor fine particle emissions were reduced by 70 percent (See case study below).

Over the last several years, more and more agencies have implemented wood stove and fireplace changeouts to help address wood smoke issues. EPA estimates that more than 7,500 wood stoves and fireplaces have been changed out in 35 communities; resulting in approximately 200 tons of fine particle emissions reduced each year, and an estimated \$100 million per year of health benefits.

Changing out one old, dirty inefficient wood stove is equivalent to the fine particle pollution reduction of taking five old diesel buses off the road.

Case Studies

- Entire Town Wood Stove Changeout and Emissions Reduction Data (Libby, MT): Using significant financial contributions from the hearth industry, EPA, Montana Department of Environmental Quality and funds appropriated by Congress, the Lincoln County Health Department changed out almost every old wood stove in Libby. EPA, the State of Montana, HPBA and Dr. Tony Ward, from the University of Montana, supported the monitoring of air quality before and after the changeout, indoors and out. For a preliminary report, including air quality emissions data, testimonials and a video summarizing this effort, go to: <http://woodstovechangeout.org/index.php>.
 - Annual Wood Stove Changeout Program (Yakima, WA): Yakima Clean Air Authority has partnered with local hearth retailers and others to implement a wood stove changeout campaign. They have changed out over 700 wood stoves. For a summary of their program go to: <http://www.epa.gov/woodstoves/changeout.html#case>.
 - Small Town Low-interest Loan Wood Stove Changeout Program (Pendleton, OR): The City of Pendleton used funds from a Housing and Urban Development (HUD) Community Development Block Grant to provide initial funding for purchase of new stoves. The money was then paid back by homeowners who participated in the program. City contributions provided additional funding. Several programs have been implemented in Pendleton including one in which the property owner borrows money interest free and a lien is placed on the property. The full principal amount of the loan is due at the sale of the home. Approximately 125 wood stoves have been changed out. For more information go to: <http://www.epa.gov/woodstoves/changeout.html#case>.
 - Tribal Wood Stove Changeout Program, Indoor Air Quality Focus (Swinomish Tribe, WA): http://www.epa.gov/woodstoves/pdfs/Case_Study_Swinomish.pdf. The focus of this program was on improving indoor air quality and addressing tribal member's asthma. Before and after indoor air quality sampling was conducted in several homes. Every tribal member's home with an old wood stove was changed out to a cleaner burning appliance.
 - Low-income Weatherization Program, Sacramento, CA: <http://www.epa.gov/woodstoves/changeout.html#case>. The Sacramento Metropolitan Air Quality Management District has partnered with the local weatherization program to changeout stoves in environmental justices areas. The program pays up to \$2,500 for a wood stove/insert and up to \$3,500 for a gas stove, with the low-income weatherization program paying for labor cost. The goal is to changeout 500 wood stoves and/or fireplaces.
- b. Hydronic Heaters: This EPA voluntary program encourages manufacturers to design cleaner and more efficient hydronic heater models. These heaters are commonly referred to as

outdoor wood boilers. See: www.epa.gov/woodheaters for the details of this voluntary program and a current list of the qualified models.

- Phase 1 emissions level qualified models are 70 percent cleaner than unqualified models
- Phase 2 emissions level qualified models are 90 percent cleaner than unqualified models
- Seven models have already qualified at the Phase 2 emission level as of July 2009

Similar to wood stove changeouts EPA supports changeout of old inefficient hydronic heaters with new cleaner burning units, especially those that meet phase 2 emission levels.

- c. Wood-burning Fireplaces: The voluntary EPA wood-burning fireplace program includes low-mass units that are prefabricated and sold to builders for installation during construction of new homes as well as masonry fireplaces that are built to certain specifications. EPA and wood-burning fireplace manufacturers have developed a voluntary program that encourages the manufacture of cleaner emitting units. Similar to the hydronic heater program, states or local air districts may choose to adopt program emissions levels as part of a regulation to help avoid exceedances of the fine particle NAAQS. The voluntary program has a two phase implementation:

- Phase 1 qualified fireplace units are 57 percent cleaner than unqualified models.
- Phase 2 qualified fireplace units are 70 percent cleaner than unqualified models.

To learn more, visit www.epa.gov/fireplaces. Based on results of an air quality modeling analysis, later this year EPA plans to determine whether the Phase 2 emissions level needs to be tightened to help meet the fine particle standards. Also, EPA is considering an additional expansion of the fireplace voluntary program to include qualifying devices that can be installed as retrofits to reduce fireplace emissions to the voluntary program Phase 2 emission level or better. For example, manufacturers have developed retrofit catalysts, log lighters, and other devices to reduce emissions.

V. Funding Mechanisms

Financial incentives may be a necessity to encourage homeowners to replace old wood burning appliances. Such incentives could include a low-cost means to purchase cleaner burning appliances. The following approaches may assist communities:

- a. Discounts/Vouchers: The Hearth, Patio, and Barbecue Association (HPBA), along with their retailers and manufacturers, typically work with organizations to provide discounts if the wood stove changeout campaigns are not implemented during their busy season (i.e., September – January). In the past industry discounts have ranged between 10 to 15 percent off the price of a cleaner burning appliance (Note: Trade association can not suggest that their members coordinate discounts due to potential anti-trust concerns). For more information on how this industry works, contact John Crouch of HPBA at john.crouch.hpba@sbcglobal.net or at 916-536-2390.

- b. Tax Credits: Tax credits can reduce the amount of taxes owed. There are also state and federal tax credits that may be applied to cleaner burning appliances.
- Federal Tax Credit: The 2009 Economic Stimulus legislation was signed into law on February 17, 2009, by President Obama and includes a 30 percent tax credit (up to \$1,500) for the purchase of a 75 percent efficient biomass-burning heater. This credit is available in 2009 and 2010.
 - State Tax Credit:
 - Montana - The State of Montana offers an Alternative Energy Systems Credit (\$500) against income tax liability for the cost of purchasing and installing an energy system in a principal home that uses " . . . a low emission wood or biomass combustion device such as a pellet or wood stove." For more information, go to <http://www.deq.state.mt.us/Energy/renewable/taxincentrenew.asp#15-32-201>.
 - Idaho - The State of Idaho offers taxpayers who buy new wood stoves, pellet stoves, or natural gas or propane heating units for their residences a tax deduction (up to \$5000) to replace old, uncertified wood stoves. For more information go to: http://www.deq.state.id.us/air/prog_issues/burning/wood_stove_tax_deduction_brochure.pdf.
 - Oregon - The State of Oregon offers a Residential Energy Tax Credit Program for the highest energy efficient wood and pellet stoves that meet specific criteria. The tax credit amount is based on the estimated average first year energy savings and cost for equipment. For wood and pellet stoves that qualify, the tax credit amount is 25 percent of the net cost up to \$300. For more information, go to: <http://www.oregon.gov/ENERGY/CONS/RES/tax/HVAC-Biomass.shtml>.
- c. Voluntary Environmental Improvement Bonds: This type of program allows property owners to finance and install energy efficient and other environmental projects with little or no upfront cost. For example, it can be used to replace old wood burning appliances. The property owner repays the money through property tax bills. This program has been used to finance solar panels and other energy efficiency projects in several California cities. For detailed information go to: <http://www.renewfund.com/cityfirst/cityfirst-overview>.

Here's how it works:

- The local government establishes a property secured financing district. This allows the local government to borrow money to buy wood stoves or other energy-related projects at low interest, long term rates by using the homeowners' property as collateral.
- Property owners in the district voluntarily sign up for financing and use the funds to purchase and install cleaner-burning wood stoves, solar panels, tankless water heaters or other environmental improvement projects.

- Loans are repaid through annual assessment of property taxes. The property owner repays the bond through their property tax bill over 20 years, for example.

- d. Federal Programs to Support Changeouts: As a result of the American Recovery and Reinvestment Act, new announcements about funding are available and can be found at: <http://www.recovery.gov/>.
- Department of Energy (DOE): The DOE offers funding to help pay for energy efficiency and weatherization projects. For more information, go to <http://www.energy.gov/recovery/funding.htm>.

DOE: Low-income Weatherization Program enables low-income families to permanently reduce their energy bills by making their homes more energy efficient. New EPA-certified wood stoves are 50 percent more energy efficient than older wood stoves. To pursue a potential partnership with your local weatherization program to changeout old dirty inefficient wood stoves, go to the following website: <http://apps1.eere.energy.gov/states/>.

- Department of Health and Human Services: Low Income Home Energy Assistance Program (LIHEAP): This program is a Federally-funded program that helps low-income households with their home energy bills. The local LIHEAP program determines if a homeowner's income qualifies them for the program. The LIHEAP may offer one or more of the following types of assistance:
 - Bill payment assistance
 - Energy crisis assistance
 - Weatherization
 - Wood stove energy efficiency upgrades and repairs

To pursue a potential partnership with your local LIHEAP office to changeout old dirty inefficient wood stoves, go to the following website: <http://www.acf.hhs.gov/programs/ocs/liheap/>.

- Department of Agriculture: The Rural Housing Repair and Rehabilitation Loan and Grant Programs enable low-income elderly (62+) homeowners to remove health and safety hazards from their homes. Changing out old or improperly installed wood stoves may be eligible under this program. Funding availability is determined by the local service center. For more information and to locate your service center go to: www.rurdev.usda.gov/rhs/.
- Department of Housing and Urban Development: There are several programs that provide funding for wood smoke mitigation. You can find programs located in your area at: <http://www.hud.gov/offices/adm/grants/fundsavail.cfm> and click on "Information by State". You will need to search Housing Preservation Grants, Rural Housing Development Program, Housing Block Grant Program, and the Community Development Block Grant Program. The following are sample programs:

Indian Housing Block Grants: Tribes have discretion to use these funds on most housing related projects. Wood stove changeouts would be an eligible activity for low income households. For more information, go to:
<http://www.hud.gov/recovery/native-american-formula.cfm>.

Rural Housing and Economic Development Program: This program provides support for innovative housing and economic development activities in rural areas. Eligible applicants are local rural non-profits, community development corporations (CDC's), federally recognized Indian tribes, state housing finance agencies (HFA's), and state community and/or economic development agencies. For more information, go to:
<http://www.hud.gov/offices/cpd/economicdevelopment/programs/rhed/>.

Indian Community Development Block Grants: This program funds a variety of community development activities, including wood stove changeouts as part of "housing rehabilitation". For more information go to:
<http://www.hud.gov/offices/pih/ih/grants/icdbg.cfm>.

- e. Supplemental Environmental Projects (SEPs): A SEP is a beneficial environmental project in which a defendant agrees to undertake in settlement of an enforcement action. EPA considers the costs to be incurred by the defendant in performing the SEP as one of the factors in determining the appropriate penalty to be assessed. A wood smoke mitigation project may also be eligible as a SEP.

Several wood stove changeout SEP/mitigation projects have been implemented throughout the country, including a \$750,000 mitigation project for a coal-fired power plant in Arizona. To learn more about this project go to:
<http://www.epa.gov/compliance/resources/decrees/civil/caa/srp-cd.pdf>.

EPA encourages air pollution control personnel to work with and educate air enforcement program personnel about the potential use of wood stove and hydronic heater changeouts in SEPs. In addition, SEPs are often times finalized at the end of long settlement process. With that in mind, EPA recommends that communities interested in a possible wood stove/fireplace SEP have a project plan drafted and ready to share with any company that may want to implement a SEP in that area. For more information about SEPs, go to:
http://www.epa.gov/woodstoves/Documents/Process/Funding/ws_sepguide_042807.pdf.

VI. Partnerships

To implement a wood stove changeout program, EPA has found that partnerships are very helpful in leveraging resources and reaching out to the public. Below are some suggested organizations to contact.

- a. Hearth, Patio and Barbecue Association (HPBA) is the trade organization that represents more than 1,000 hearth retailers and manufacturers across the country. They can potentially help support changeout incentives (i.e., provide industry discounts); market changeout programs and help educate the public about air quality benefits from changing out old wood

stoves/fireplaces and reducing wood smoke emissions. EPA recommends contacting HPBA's John Crouch (john.crouch.hpba@sbcglobal.net or at 916-536-2390) to discuss partnership opportunities.

- b. American Lung Association can help bring experience to your wood smoke public education campaign. In addition to public education, they have been partners and supporters of wood stove changeouts. EPA recommends that you contact your local American Lung Association office to request their assistance in helping raise awareness about your wood smoke control program. Go to www.lungusa.org to find your local American Lung Association office.
- c. Chimney Safety Institute of America (CSIA) is a non-profit, educational organization dedicated to chimney and venting system safety. They represent more than 1,000 chimney sweeps throughout the country that can help disseminate educational materials. Chimney sweeps are also an excellent source of information and can provide insight on local wood burning practices. CSIA can identify chimney sweeps in most communities and connect the air quality agency with those sweeps. Contact Melissa Heeke at mheeke@csia.org or at 317- 837-5362 extension 105 or go to www.CSIA.org for more information.
- d. Other Potential Partners: There are many other organizations that may bring resources and assistance in addressing wood smoke in your community:
 - Firefighters
 - Health Organizations
 - Environmental Groups
 - Local Businesses

VII. Emissions and Air Quality Improvements

- a. Wood Stove and Fireplace Changeout/Retrofit Emissions Calculator: EPA has developed a simple emissions calculator in Microsoft Excel to estimate particle pollution and toxic air emissions reductions from wood stove or fireplace changeouts. Users of the calculator are encouraged to use site specific inputs (e.g., cords of wood burned), if available. However, site specific data must be input in the same units (e.g., pounds of pollutant emission per ton of wood burned) as the default inputs to the calculator. The references for the default inputs to the calculator are defined on the readme tab of the calculator. For a copy of the calculator, go to the EPA web site at: <http://www.epa.gov/woodstoves/Library.html#2air> and click on "Woodstove and Fireplace Change out Emissions Calculator (Excel)." Contact Roy Huntley at Huntley.roy@epa.gov for assistance.

Inputs to the calculator include:

- number of stoves/fireplaces changed out
- cords of wood burned
- the fraction of the changeouts expected to be new certified woodstoves
- woodstove efficiency
- wood density

Wood density is necessary because wood is usually bought by the “cord,” which is a unit of volume, and the emission factors used in the calculator are in units of mass. Default emission factors are included in the calculator in units of pounds of pollution emitted per ton of oven dried wood burned. The default density (1.162 tons per cord) used in the calculator comes from the Energy Information Administration (U.S. Department of Energy).

- b. Reductions Due to Curtailments: As mentioned, the Sacramento Air Quality Management District enacted a mandatory, episodic wood burning curtailment program. The first stage occurs when fine particle concentrations are forecast to exceed the national health standard of 35 ug/m^3 , but not exceed 40 ug/m^3 . The second stage of the curtailment program occurs when fine particle concentrations are forecast to exceed 40 ug/m^3 .

During a Stage 1 no-burn day, burning is prohibited except in EPA-certified stoves or pellet stoves as long as they do not emit visible smoke. During a Stage 2 no-burn day, all wood-burning is prohibited. The rule does not apply to fireplaces and stoves that burn gaseous fuels. Also, the rule exempts burning that is the sole source of heat or in situations when not burning wood would be a financial hardship to a resident.

Results: Over the first two seasons of the two stage curtailment program, there were an average number of thirteen (13) Stage 1 no-burn days and twenty-three (23) Stage 2 no-burn days. The average reduction in 24-hr fine particle concentrations on Stage 1 days is estimated to be 4 ug/m^3 or 10 percent. The average reduction on Stage 2 days is estimated to be 12 ug/m^3 or 23 percent.

- c. Restrictions on Wood Stoves and Fireplaces: The Bay Area Air Quality Management District (BAAQMD) in California developed a wood smoke ordinance for fireplaces and wood stoves to regulate sources of particle pollution in their communities. The ordinance allows the installation of natural gas fireplaces, EPA certified wood heaters, pellet-fueled wood heaters, and fireplaces certified by EPA that have emissions no greater than those of a certified wood heater. According to the BAAQMD website, the Bay Area District staff “calculates that for every 1,000 new homes built in accordance with the provisions of the ordinance, three tons of PM10 (wood smoke is approximately 92 percent fine particles) are avoided each winter based on the assumption that:

- the average residence burns 0.28 cords of wood per winter season;
- 90 percent of the homes have wood burning fireplaces; and
- 38 percent of homeowners’ burn wood during the winter season.”

For more information related to the BAAQMD's model rule go to:
<http://www.baaqmd.gov/Divisions/Communications-and-Outreach/Air-Quality-in-the-Bay-Area/Wood-Burning/Background-On-Model-Wood-Smoke-Ordinance.aspx>

VIII. Other Tools

- a. County-level Emission Inventory for Residential Wood Combustion: EPA, along with state, local, and regional planning organizations, created the methodology to estimate emissions from residential wood burning appliances for the purposes of developing an emission inventory. The result is a tool that runs in Microsoft Access and calculates emissions at the county level from many wood-burning appliances. The five inputs to the tool include: 1) percentage of people that burn wood in each appliance; 2) the number of occupied housing units in the county; 3) the amount of wood burned in each appliance; 4) the density of the wood; and 5) the amount of emissions (per pollutant, in mass units) emitted per ton of wood burned. The result is a county level emission inventory for residential wood combustion appliances.

The tool was initially populated with EPA default data which consists of regional averages. The tool has the capability to use state specific data. To date, 15 states have submitted state-specific data which has been incorporated into the first version of the tool (2005).

The 2005 version can be obtained by contacting Roy Huntley at Huntley.Roy@epa.gov or by calling 919-541-1060. The web address for the CHIEF website is: <http://www.epa.gov/ttn/chief/eiinformation.html>. Any state agency wanting to incorporate state specific inputs is encouraged to contact Roy Huntley for assistance.

- b. Residential Wood Combustion Surveys: Having good wood burning related information (e.g., number of stoves and fireplaces, amount of wood burned) about your community is a critical first step in determining whether to and how to develop a wood smoke reduction program. For examples of past wood smoke related surveys that could assist a local community in developing and conducting their own survey, go to: <http://omni-test.com/publications/Comp2.pdf>.

IX. Summary

Wood smoke contains fine particles and toxic air pollutants and can significantly impact air quality, both indoors and outdoors. Depending on the circumstances in your area, EPA recommends that communities concerned with wood smoke emissions compile wood burning related information take steps to implement an education and outreach campaign, a wood stove changeout and/or fireplace retrofit program, a wood smoke curtailment program as well as adopt the NESCAUM hydronic heater model rule. If your agency or community has other suggestions or "lessons learned" about addressing wood smoke, please share your recommendations with your EPA Regional Office so EPA can continue to update and improve this document as needed.

Appendix A: Example Wood Smoke Program

Introduction

Every winter in Snow Valley, USA, wood smoke can be seen hanging over the valley, particularly on days with freezing temperatures and little wind. As more information about the health problems from breathing fine particle pollution (PM_{2.5}) became available, the health and air quality officials of Snow Valley realized that wood smoke was negatively impacting community members' health and dirtying the skies. As you drive through Snow Valley, you can see smoke streaming out of neighborhood chimneys and, where there is smoke, there is an inefficient fire.

Therefore, Snow Valley air quality officials decided that a multi-pronged approach was the best way for this community of 30,000 people to address its wood smoke problem. That approach included:

1. Implementation of EPA's Burn Wise education and outreach campaign,
2. Incentives to changeout old dirty wood stoves, and
3. Implementation of a wood smoke curtailment program.

The 24-hour design value for PM_{2.5} in Snow Valley is 42 micrograms per cubic meter (ug/m³). This exceeds the 24-hour PM_{2.5} health standard of 35 ug/m³. Through analysis of air quality data, emissions inventory and wood stove survey information, officials identified the exceedances of the health standard in the Snow Valley area as occurring in the winter and influenced by wood smoke. Meeting the 24-hour PM_{2.5} health standard in Snow Valley requires a minimum reduction of 20 percent in the monitored PM_{2.5} air quality concentrations. Local air quality and health officials decided to changeout 50 percent of the non-EPA certified wood stoves in the Snow Valley area and to initiate a two stage burn ban based on the next-day air quality forecast by the Snow Valley area meteorologist and air quality public officials.

Also, to increase the likelihood that the people in Snow Valley would participate in the changeout and wood smoke curtailment program, the air quality officials decided to spend the first six months raising awareness about wood smoke health effects and ways to burn more cleanly and efficiently. The following is an outline of Snow Valley's Education and Outreach Campaign:

Education and Outreach Campaign

Establish a baseline

Before implementing the campaign, Snow Valley established a baseline assessment of residents' wood burning habits. They polled their local hearth retailers to see how many EPA-certified stoves were bought in previous years. They also spoke with local chimney sweeps to understand how often people had their wood-burning appliances inspected and maintained and what type of appliances (e.g., old wood stoves, new stoves, fireplaces) in which people were burning the most wood. To cross check what the chimney sweeps reported and to get additional information, they conducted informal telephone interviews to determine people's perspectives on wood smoke (i.e., is it a health

problem), how much wood do people burn, and what appliances are used in the community. This information allowed Snow Valley officials to target their messages and their audience and provided a baseline to evaluate the program at the end of the winter season.

Enlist local spokespersons

Snow Valley decided to partner with several groups to help convey the Burn Wise messages. First, they targeted physicians, particularly pulmonologists and pediatricians. They provided these physicians with Burn Wise posters and brochures that could be handed out to patients and/or displayed in the waiting room.

Second, they worked with the local fire department to set up two “Burn Wise” workshops. The workshop included a demonstration of an old wood stove next to an EPA-certified wood stove to show the difference in smoke. A local retailer provided the old stove and a new stove at no cost to help demonstrate that the new stoves can be operated with no visible emissions. A county health official spoke about health effects from wood smoke, and a chimney sweep from Snow Valley gave demonstrations about how to choose the best firewood and how to build a hot fire; the firefighter emphasized the importance of annual chimney inspections and proper wood burning techniques to prevent chimney fires.

Tap into the media

The air program officials placed scripted public service announcements (PSA’s) with the local radio station. These PSA’s ran during commuting drive times and throughout the day. Air program officials used the scripts from EPA’s web site and tailored to them with specific information about Snow Valley. The local radio station carried the PSA’s for the entire wood-burning season from September through March.

Snow Valley also placed a Burn Wise banner on the town’s home page. The banner listed the Burn Wise tips and provided links to EPA’s Web site.

In addition to the Burn Wise workshop article, the town worked with the local newspaper to run another story about wood-burning issues in the community. They invited the press to the demonstration at the firehouse to take pictures and interview local citizens.

After one burn season, Snow Valley ran a follow-up survey with local hearth retailers, chimney sweeps, and citizens. From the retailers, the officials learned that sales of EPA-certified wood-burning appliances increased. From the chimney sweeps, they learned that more homeowners had scheduled maintenance checks of their wood-burning appliances after hearing the radio PSA’s, and from another informal telephone survey, Snow Valley found that citizens were now more aware of the Burn Wise messages and had made changes in their wood burning habits.

Wood Stove Changeout Program

Snow Valley has 3,000 wood stoves of which 2,000 are not EPA-certified. Wood stoves in Snow Valley emit 123 tons per year of fine particle pollution. The Snow Valley area will use \$500,000 from a recent Supplemental Environmental Project, federal tax credits (30 percent of stove cost, up to \$1,500) and hearth industry discounts to changeout 1,000 old wood stoves over a four year period. The Snow Valley area plans to changeout 250 of these old wood stoves each year for the next four winters. They expect that the 250 non-EPA-certified wood stoves will be changed out for 200 EPA-certified wood stoves and 50 gas stoves before the next winter. The resulting reduction in PM_{2.5} emissions from the wood stove changeouts in Snow Valley will be 10 tons per winter, or 40 tons (32.5 percent) over the four-year period. Snow Valley officials calculated the emissions reductions with the EPA Woodstove and Fireplace Changeout Emissions Calculator (Excel) found at the EPA Web site: <http://www.epa.gov/woodstoves/Library.html#2air>.

Burn Ban

To increase the likelihood that exceedances of the 24-hour PM_{2.5} health standard will not occur, the public officials of Snow Valley also initiated a two stage burn ban to begin the following winter. The Stage 1 burn ban is implemented when Snow Valley meteorologists and public officials forecast the next day's air quality for PM_{2.5} to reach 30 ug/m³. A Stage 2 burn ban is implemented when PM_{2.5} is forecast for the next day to reach 35 ug/m³. Under a Stage 2 burn ban, no wood-burning can take place, except where it is the only source of home heat. Based on data analysis from other communities that have implemented burn bans, Snow Valley officials anticipate their Stage 2 ban will result in approximately a 10 ug/m³ reduction in the 24-hour PM_{2.5} design value.

Appendix B: Basic Components of a Wood Smoke Reduction Plan

For all areas with residential wood smoke concerns, development and implementation of a wood smoke reduction plan is vital to attaining and/or maintaining healthier air and compliance with the NAAQS. Wood smoke reduction plans are especially important in areas that are already designated nonattainment for the 24-hour particle pollution NAAQS. These plans can provide early emission reduction that may enable the area to redesignate to attainment before state implementation plan (SIP) nonattainment planning documents need to be approved. If redesignation is not possible, the wood smoke reduction plan can readily be used in developing an attainment SIP for the area.

Areas designated as nonattainment for the fine particle NAAQS are required to develop a state implementation plan within three years of the effective date of the designations. In the interim, EPA encourages these areas to develop and implement a wood smoke reduction plan expeditiously to curtail wood smoke emissions where those emissions are the overriding contributor to nonattainment. Those areas may be able to obtain three years of “clean data” before SIP’s are due and thereby be exempt from reasonable further progress, attainment demonstration and contingency measure requirements under the EPA 2004 Clean Data Policy (http://www.epa.gov/pmdesignations/1997standards/documents/Clean_Data_Policy.pdf). The wood smoke reduction plan can readily be augmented for conversion to a CAA section 110(a) maintenance SIP if the area can be redesignated to attainment. Otherwise if the area is still in nonattainment, the wood smoke reduction plan can be converted to an attainment SIP.

In some communities, wood smoke may not be the overriding contributor to nonattainment, but wood smoke emission reductions may provide an opportunity to obtain additional air quality improvements. In addition to the regulatory measures implemented for industrial, commercial and mobile sources, voluntary wood smoke reduction measures may be appropriate. There is a presumptive limit of 6 percent emissions credit in EPA’s policy for Incorporating Emerging and Voluntary Measures in a SIP (http://www.epa.gov/ttncaaa1/t1/memoranda/evm_ievm_g.pdf) and the policy does acknowledge that, “The limit is presumptive in that EPA believes it may approve measures into a SIP in excess of the presumptive 6 percent where a clear and convincing justification is made by the state as to why a higher limit should apply in their case.” A wood smoke reduction plan can be useful as a voluntary measure in such cases.

Below are the basic components of a wood smoke reduction plan that can be used and built upon to develop a SIP if required:

- Area’s description (physical, economic and meteorology)
- Description of public participation and outreach and education efforts
- Emissions inventory and wood burning survey
 - This involves reviewing the composition of fine particle air quality data, understanding topography, and characterizing the days on which high concentrations are expected to occur. It should show how high levels of organic carbon on wintertime days under inversion conditions affect ambient concentrations. Do high

days occur at other times of the year? Are wood stoves and/or fireplaces key source categories?

- Assuming a key source category is wood stoves, then quantify the number of stoves in the area and estimate emissions on a typical “high” day, and annually. Identify and quantify emissions from other key source categories as appropriate. The use of emissions and air quality data from case studies (e.g., Libby, MT) could help identify control measures to be used and the emissions and air quality changes that could be expected. What was air quality improvement after “x” number of woodstove changeouts? How much improvement can be attributed to a burn ban on a specific day?
- Ambient air quality (base year data)
- Projection of emission and air quality with anticipated growth (without controls)
- Analysis of emissions reductions and control measures needed each year to meet the annual emission reduction milestones and to attain or maintain the NAAQS in a timely manner.
 - Identify control measures and develop annual or seasonal emission reduction milestones. Air quality changes can be estimated based on factors relating emission reductions (from woodstove changeouts and burn bans) to air quality change (e.g. from Lincoln County changeout case study). An important issue to consider is the complex topography and unique meteorology associated with the area.
 - Voluntary measures are appropriate for wood smoke affected areas because the sources cannot be controlled with traditional regulatory measures. Stationary or mobile source controls alone would not produce the emissions reductions needed.
 - If a SIP is developed for the area, the voluntary measures can be “credited” for up to 6 percent of the total emission reductions of a SIP attainment plan.
 - Set annual program, emissions, and ambient monitoring milestones and a plan for tracking progress and reporting annually. The milestones may be items such as:
 - Number of noncompliant wood stoves taken out of use or replaced by EPA-certified units
 - Number of wood fireplaces converted to gas
 - Number of problem hydronic heater units shutdown, moved or replaced
 - Estimated wood smoke emissions reductions
 - Target design value

- Percent reduction in number of AQI alert days
 - Reduction in number of monitored violations
 - Reduction of visual smoke reports on burn curtailment days
- Plans for funding, measuring, reporting and ensuring compliance with emission reduction plans (including contingency measures)
 - Describe how changeouts and outreach will be funded
 - Outline contingency measures to be adopted in the plan that will be implemented automatically if the area fails to meet key milestones such as emission reduction or ambient monitoring milestones. Contingency measures could include:
 - Increased funding for changeouts
 - Increased and targeted outreach and education efforts
 - Increased enforcement efforts or fines for burn curtailment violations
 - More protective triggers for burn curtailment days
 - Describe enforceable measures. If included, submit state rules for changeout program and burn curtailment.
- Provisions to maintain attainment
 - Describe what measures will remain in place for the long-term once the area is redesignated.