

BRA

Raising Community Awareness about the health effects of Burning wood in Residential Areas

2nd December 2003

COAG Bushfire Inquiry
Department of Prime Minister and Cabinet
3-5 National Circuit
BARTON ACT 2600



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INQUIRY ON BUSHFIRE MITIGATION AND MANAGEMENT

CABRA is a community group formed initially to raise awareness about the impact on neighbours from unhealthy wood heater emissions and the inability or reluctance of government to protect our health - refer website www.rag.org.au/cabra. Since then it has been brought to our attention that other forms of unnecessary burning are also affecting people's health.

This submission is to voice our concern and protest against what appears to be an increasing "burn more and burn often" attitude which is being promoted to prevent bushfires.

Although smoke from burning wood and vegetation is often looked upon as being "natural", it is far from harmless. Breathing air containing wood smoke contributes to cardiovascular problems, lung diseases like asthma, emphysema, pneumonia and bronchitis, irritation of the lungs, throat, sinuses and eyes, headaches and allergic reactions. The fine particles of wood smoke can lodge deep in the lungs where they can cause structural damage and chemical changes to lung tissue and reduce resistance to infection.

Prescribed burning also releases high amounts of greenhouse emissions - which influences climate change and drought conditions.

Regular burning can also adversely affect our native flora and fauna which need to be considered as Australia's natural assets. The loss of property through bushfire is undesirable and costly (and traumatic for the property owners) but additionally, environmental damage caused by regular burning is also undesirable and costly. Some people advocate regular burning because Aboriginal people used fire to manage the land, however there may sometimes be a misinterpretation of traditional Aboriginal land management. Also, the Australia of today, with increased population and housing, is far different to pre-European settlement.

It has been reported that burning off regimes result in changing the natural bushland into larger amounts of grassed areas and leaving dry undergrowth - a perpetual fire hazard.

Reports in the media have shown that many fuel reduction burns "escape" and develop into destructive bushfires.

Many people in the community are fascinated by fire and a "burn more and burn often" attitude may influence and inflame such fascination.

In short, regular burning can cause detrimental effects -

- Serious health problems, especially for vulnerable people
- High levels of greenhouse gases
- Adversely affects biodiversity
- Creates greater areas of grass and dry material which in turn become fire hazards requiring more burning - a perpetual fire hazard
- Out-of-control bushfires which started initially as "hazard reduction burns"
Increasing incidents of arson
- Danger to Fire Brigade personnel from smoke inhalation and fighting "escaped" fires

We acknowledge that back-burning/prescribed burning will always play a part in protecting life and property from threatening bushfires, however we also believe that the effect on air quality, human health and the environment from regular burning practices must be considered in any strategy that comes from this Inquiry. Prescribed burning is only one option of fuel reduction and we believe that other alternatives should play a greater role.

We hope the following recommendations will be considered.

- **MINIMISE BURNING PRACTICES FOR THE BENEFIT OF CLEAN AIR, HUMAN HEALTH AND THE ENVIRONMENT**
- Where feasible, aim to locate and extinguish fires while small
- Greater use of machinery and manual labour to create fire breaks and reduce fuel loads (perhaps Work for the Dole could be involved)
- Better "house-keeping" by people living near bushland areas to prevent build up of fuel
- Better house design and construction near bushland areas
- Better planning so that housing and other developments are not permitted next to, or amongst fire prone areas
- Mowing/slashing/mulching in plantation/forestry areas to reduce fuel load
- Prohibiting the lighting of fires in camping areas - many a campfire has resulted in a bushfire (most campers have gas stoves for cooking purposes)
- Tougher penalties for arsonists
- Consultation undertaken so that all parties considering burning are made aware of the effect on air quality, human health (and the resulting cost to the health care system) and the environment, to understand why **MINIMAL BURNING** and **ALTERNATIVE METHODS FOR FUEL REDUCTION** are required.

Yours faithfully

/s/ - 

Diane McGill

CABRA - raising Community Awareness about the health effects of Burning wood in Residential Areas

Encl. *Health Effects of Wood Smoke*



WASHINGTON STATE
DEPARTMENT OF
EC'LOGY

Prepared By:

Fred Greef

For More Information Write:

Department of Ecology
Air Quality Program
P.O. Box 47600
Olympia, WA 98504-7600
Woodsmoke Hotline
1-800-523-4636



Health Effects Of Wood Smoke



VVM aS WOOD SMOKE A PROBLEM?

The particles in wood smoke are too small to be filtered by the nose and upper respiratory system, so they wind up deep in the lungs. They can remain there for months causing structural damage and chemical changes. Poisonous and cancer-causing chemicals often enter the lungs by adhering to tiny particulate matter (such as wood smoke particles).

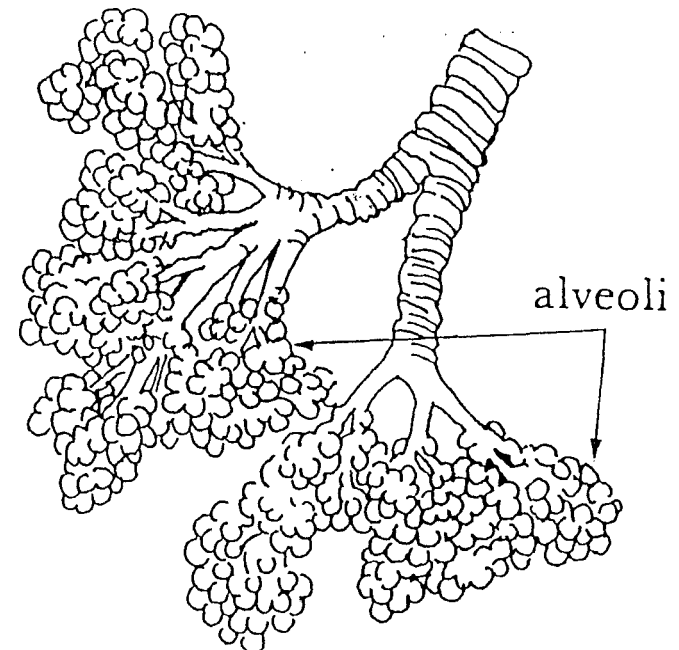
These tiny particles are emitted in neighborhoods, both indoors and out, where people spend most of their time. Unfortunately, wood smoke is not only in the outdoor air we breathe. The particulate matter in wood smoke leaving chimneys is so small that it is not stopped by closed doors and windows, and often seeps into neighbors' houses. Even more smoke is sometimes released inside homes which heat with wood.

WHAT PARTS OF WOOD SMOKE CAUSE PROBLEMS?

Many organic compounds are produced by combustion of wood. Some burn completely, some are changed chemically, and some leave the stove without burning. Some of these compounds deposit in the chimney as creosote, some condense as very tiny particles of smoke, and some are released into the air as gases. Some of these organic compounds are poisonous, some irritate the respiratory tract, and some may cause cancer or mutations. The primary pollutants from wood smoke are carbon monoxide, particulate matter, and organic gases (including aldehyde gases such as acrolein,

GENERAL EFFECTS OF WOOD SMOKE

Wood smoke exposure cause a decrease in lung function and an increase in the severity of existing lung disease with increases in smoke concentration or exposure time? It also aggravates heart conditions and carbon monoxide (a component of wood smoke) causes heart pain. The occurrence of respiratory illness in children has been shown to increase with increased exposure to wood smoke. This includes lower respiratory infections such as acute pneumonia, or bronchiolitis, which are major causes of disease and death in young children.^{1°} Wood smoke aggravates asthma, emphysema, pneumonia, and bronchitis. It irritates the eyes and triggers headaches and allergies. Long-term exposure may lead to emphysema, chronic bronchitis, arteriosclerosis, and nasal, throat, lung, blood, and lymph system cancers (based on animal studies).^{z a'''s1'}



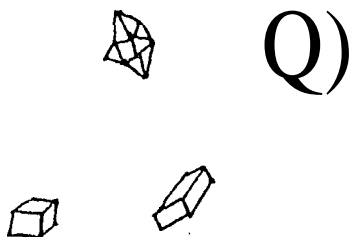
Carbon monoxide is a colorless, odorless gas produced when any carbon-containing fuel such as gasoline or wood is burned. It reduces the ability of blood to carry oxygen to body tissues. High exposures can lead to death. Lower levels, common in highly polluted urban areas, lead to increased hospitalizations for individuals with heart and circulatory disease, lower birth weights, and increased deaths of newborns^a

Particulate matter larger than 10 microns in diameter collects in the upper respiratory system (throat and nose) and is eliminated by sneezing, coughing, noseblowing, spitting, or the digestive system. The particulate matter from wood smoke is a much more serious health threat due to the small particle size. Wood smoke particles are less than 10 microns (a micron is one millionth of a meter) in diameter. Most of them are less than 2.5 microns in diameter. The period at the end of this sentence is about 500 microns in diameter.

CARBON MONOXIDE



ORGANIC GASES



PARTICULATE MATTER



Wood smoke particles are so small that they get past the cilia or hair-like structures on the respiratory tract cells. Cilia bear mucous and catch and help remove larger particulate matter from the lungs with a rhythmic motion. Tiny wood smoke particles evade the cilia and collect in the most remote portions of the lungs, called alveoli - the tiny air sacs where oxygen enters the blood stream. Wood smoke particles cause structural and chemical changes deep in the lungs. Other toxic and cancer causing compounds can attach to the smallest smoke particles and enter the lungs at the same time.

Because of the health threat from tiny particulate air pollution, the federal government regulates all particulate matter less than 10 microns in diameter (PM₁₀) as one of six major air pollutants.

Irritants in wood smoke (such as phenols, aldehydes; quinones, nitrogen oxides, and sulphur oxides) contribute to health problems in the respiratory tract. Irritants interfere with the cilia and disrupt the flow of the particle-trapping mucus stream, resulting in more particulate matter entering the lungs. Exposure to wood smoke irritants can lead to inflammation and pulmonary edema (swelling of lung tissue). Irritants can also cause allergic reactions and may contribute to long-term health effects.'

WOOD SMOKE AND CANCER

The cancer threat from air pollution is a serious public health concern. Most of the wood smoke cancer research before 1985 focused on identifying the components of soot or the particulate portion of wood smoke, including carcinogens such as benzo(a)pyrene, best known from tobacco smoke research. The first known human carcinogens were from coal tars and chimney soot. The particle or soot component of air pollution has been clearly implicated as a human carcinogen from studies of human cancer victims?²

Many substances on the U.S. Environmental Protection Agency's (EPA) priority pollutant list, many suspected human carcinogens, co-carcinogens (cancer initiators or promoters), and cilia-toxic agents (poisonous to the hair-equipped cells which filter most particles out of the respiratory tract) have been identified from wood smoke particles." However, many of the compounds in wood smoke particles have not been identified and even less is known about the toxic organic gases which are also released by wood burning.

Burning of fossil fuels, wood, tobacco, or garbage produces hundreds of different compounds associated with the soot, or particle phase of air pollution. Also produced are many gaseous compounds which are carcinogenic, such as benzene, aldehydes, alkenes, and numerous semi-volatile organic compounds?¹ Recent research has focused on the health effects from wood smoke as a whole, rather than further studies of its component parts.

In 1985 the EPA started a major long-term research program to clarify the sources of air pollution and population exposure, and to estimate future cancer risk (the Integrated Air Cancer Project).¹⁰ Studies include human cancer victims, as well as laboratory mice, and bacteria and mammal cells exposed to the total mixture of particulate matter from urban air samples.

This research found motor vehicles and wood stoves to be the major sources of cancer risk from particulate air pollution in all the urban airsheds studied ⁸³⁴

Human cancer risks have now been estimated for lifetime exposure to diesel vehicle, leaded and catalyst-equipped gas vehicle, wood stove, cigarette smoke, coke oven (coal), and roofing tar emissions.' EPA researchers suggest that the lifetime cancer risk from wood stove emissions may be 12 times greater than the lifetime cancer risk from exposure to an equal amount of cigarette smoke. We must keep in mind that this is not actual cancer risk, but rather an estimate based on bacteria and animal studies comparing the potency of wood smoke to cigarette smoke and other better documented carcinogens. The lifetime human cancer risk estimates from exposure to wood smoke and motor vehicle emissions are theoretical based on such comparative potency tests.

The lifetime cancer risk estimate from exposure to motor vehicle emissions is more than three times that from equal exposure to wood stove emissions, based on recent EPA research in Boise, Idaho²³ However, we also know that wood stoves produce much more particulate air pollution in the winter than motor vehicles in all Pacific Northwest cities studied by the EPA.^{23 a33a}

With all of these cancer risk estimates we must also keep in mind that we do not yet have much information on actual yearly levels of human exposure to various types of particulate air pollution.

MUTAGENS IN WOOD SMOKE

Mutagens cause biological mutations or changes in cells such as chromosome defects or genetic damage. Mutagenicity is often used as a screening test for human cancer risk from compounds in air pollution. However, mutagens and carcinogens are not the same thing and not all mutagenic substances cause cancer. Motor vehicles and wood heating emissions cause mutations. These two sources are also major contributors to the human cancer risk from air pollution.'

A 1988 EPA study found that wood heat and motor vehicle emissions account for nearly all of the mutagenicity in winter air samples from Albuquerque, NM, Raleigh, NC, and Juneau, AK, over a wide range of climate and wood species ^{sa}. This study found that biological mutations in bacteria exposed to winter air samples increased with higher concentrations of fine particulate matter and were most numerous at times of coldest temperatures, weekends and holidays - when many wood stoves were in use. One would expect this to be true in Washington State as well.

In the United States more than 30% of mutagenic material emitted to the atmosphere each year comes from wood combustion, according to 1981 calculations.''' In Washington State the contribution from wood smoke is greater than this national average since Washington has the third highest percentage of households burning wood in the United States, behind Oregon and Maine, according to a 1983 U.S. Forest Service survey ³¹¹

PPARTICULATE AIR POLLUTION AND DEATH RATES

London's "Black Fog" in December 1952 killed 4,000 people and led to the British Clean Air Act. Tiny particulate air pollution from coal stoves was largely to blame. London is once again in the news with a new study linking particulate air pollution to death rates.

This year an EPA researcher applied statistical techniques to daily particulate air measurements and daily death records in London, as well as U.S. cities where daily particulate measurements were available.''' These cities vary vastly in size, climate, and mixes of air pollutants, *including* wood smoke. This study found an increase in deaths by 6% for each 100 micrograms of total particulate air pollution measured.

This same EPA study also found that, for every 100 micrograms of total particulate per cubic meter of air, the risk of dying goes up 32% from emphysema, 19% from bronchitis and asthma, 12% from pneumonia, and 9% from cardiovascular disease. Sulfur dioxide, an air pollutant which has often been suspected of causing deaths, showed no effect on death rates. These new findings suggest that particulate matter is more toxic than ozone (commonly called smog). Confirmation of these findings would make particulate air pollution the largest known "involuntary environmental insult" and should encourage a stricter federal particulate standard."

INDOOR AIR QUALITY

Wood smoke does not rise and disperse during winter temperature inversions. At these times, wood smoke hangs close to the ground and enters neighbors' yards and houses, schools and hospitals. Areas with winter atmospheric inversions and valley locations with poor air circulation are most affected. Wood smoke particles are so tiny that they remain suspended for long periods of time and readily penetrate into buildings with incoming cold air, even with today's "air-tight" construction.

Wood stove fumes are released into the outdoor air through chimneys, but fumes are also released directly into the homes where stoves are used. Wood smoke and fumes also enter homes where stoves are not used. Indoor PM_{2.5} levels from wood smoke in homes without wood stoves reach at least 50% to 70% of outdoor levels, according to a recent University of Washington study in Seattle and an EPA study in Boise, Idaho neighborhoods."

Wood stove use not only degrades the air quality inside neighbors' homes, but causes additional air quality impairment in the home using the stove. Klamath Falls, Oregon has the highest measured PM_{2.5} pollution from wood stoves in the United States. A 1991 study in Klamath Falls by the Oregon Health Division found that children with wood stoves in their own homes have even greater declines in lung function than other children living in the same smoky neighborhood.

Indoor and outdoor air can be degraded significantly by the use of poorly designed non-certified airtight stoves and non airtight stoves.⁶³ Poor burning practices, improper stove operation, improper stove installation, lack of maintenance, and burning wet wood create much indoor and outdoor air pollution even with the newest certified stove models. Backdrafting and "accidents" while loading fuel or opening stove doors can cause substantial amounts of indoor air pollution with any wood stove. Backdrafting can usually be eliminated by proper stove installation and/or regular

POPULATIONS MOST AT RISK

Infants, children, pregnant women, senior citizens, cigarette smokers and ex-smokers, and all those suffering from allergies, asthma, bronchitis, emphysema, pneumonia, or any other heart or lung illness are most affected by wood smoke and are sensitive to low levels.⁴¹⁴⁸ Even the most healthy citizens should refrain from heavy outdoor physical exercise (such as jogging) during periods of very poor air quality or high levels of particulate air pollution.

Lung ailments are the leading cause of disease and death in the United States among newborns, accounting for 37% of all deaths in the first year of life, according to the American Lung Association. Lung diseases accounted for 28.3% of all hospitalizations of children under 15 in the United States in 1988. A total of 738,000 children in this age group were hospitalized for lung disease in 1988.¹

Wood smoke interferes with normal lung development in infants and young children. In addition, several studies have found that home use of wood burning stoves increases the risk of lower respiratory tract infections (LRTIs) such as bronchiolitis and pneumonia in young children." LRTIs are a major cause of early childhood disease and death. Parental smoking, especially during the first year of life, is another well-demonstrated risk factor for lower respiratory tract infections.'

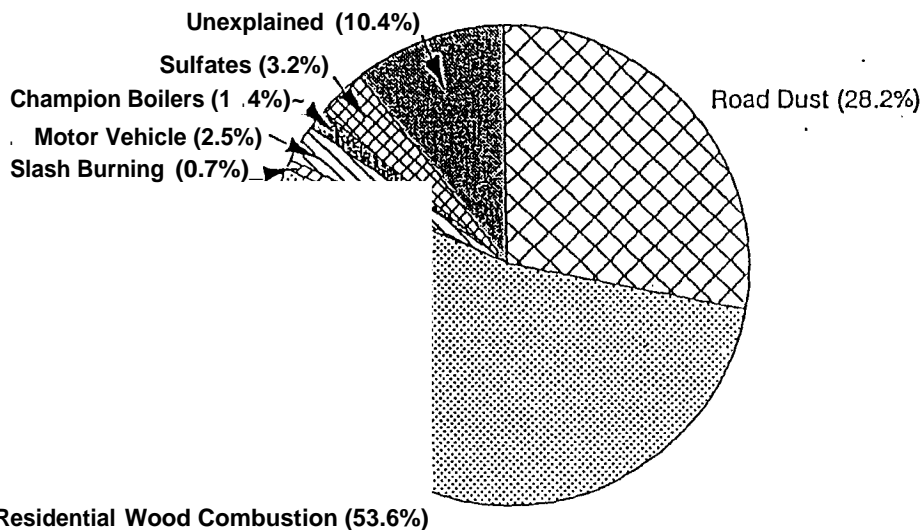
... utluxen round that those living in homes with a wood burning stove have a higher risk of bronchiolitis and pneumonia (lower respiratory tract infections) than children living in homes without wood stoves."-" Childhood LR'TIs have also been linked with chronic lung disease in later life. Wood smoke exposure causes a chronic reduction in lung function, increasing the rate of decline with age in adults'

Researchers at the University of Washington in 1990 documented more symptoms of respiratory disease in Seattle preschool children living in high wood smoke residential areas than in children living in areas with lower wood smoke levels? This demonstrates the effect of community wood smoke pollution on the occurrence of respiratory illness. Tests have also demonstrated measurable reductions in lung function among both healthy children and asthmatics in smoky Seattle neighborhoods in the winter."

Lourthouse Parking Lot
December 1, 1987 - February 17, 1988
and December 26, 1988
(Winter Average 82.1 ug/m3)

From Jan Gilman-
Pm-10 Mass Balance
Study. for Libby Montai
Montana Air Quality
Bureau. April, 1990.

Note Libby, Montana
with a 1980 population
of only 3286, has very
high PM-10 levels=
a e e woo
burning.



HIDDEN COSTS OF WOOD HEAT

Most people realize that direct costs of wood heat include the purchase price, installation, and maintenance of the heater. Floor protection, the building permit, installation, fuel supply, and chimney sweeping are other direct costs. Time spent culling, splitting, stacking, and moving wood (as well as cleaning out ashes and maintaining the stove) are also direct costs. However, few people realize the possible extent of hidden or indirect costs.

Indirect costs of wood heat include both fire insurance and health insurance. Fire insurance costs have been climbing. The 1984 statistics from the Washington State Fire Marshall show that nearly half of all fires reported in one- and two-family dwellings were caused by wood stoves or fireplaces. These insurance losses help push up the cost of insurance on a home.

Health insurance costs have been rising rapidly in recent years. Health insurance claims raise the cost of health insurance. Wood smoke exposure leads to more frequent and extended hospital visits, as well as more emergency ward or physician visits, and increased use of medications. Lung diseases are second only to heart disease as a cause of disability under social security. Wood smoke adversely affects the cardiovascular system and heart patients, as well as those suffering from lung disease. JAZQ8



In 1989 an estimated 85 million people - more than one-third of the U.S. population - were afflicted with chronic respiratory disease, from chronic sinusitis to chronic bronchitis and emphysemas. The direct and indirect costs of lung disease were about \$45 billion in 1988 according to the American Lung Association.

The National Health Interview Survey estimates 25.6 million people suffer from severe lung diseases such as chronic bronchitis, emphysema, or asthma. The total number of deaths attributed to these diseases increased 57% between 1979 and 1987. Lung cancer now accounts for more cancer deaths in the United States for both men and women than any other form of cancers.

Obviously wood smoke does not account for all of the lung disease in this country. Tobacco, radon, car and truck exhaust, asbestos, and other substances share much of the blame. However, the medical evidence is growing each year that wood smoke plays a larger role than was previously thought, and the tiny particulate matter from wood smoke cannot be kept out of your home if you live in a neighborhood where there is much wood stove use.

particulate Emissions From Home Heating Devices

(Normalized to 9,000 btu/hr heat output)

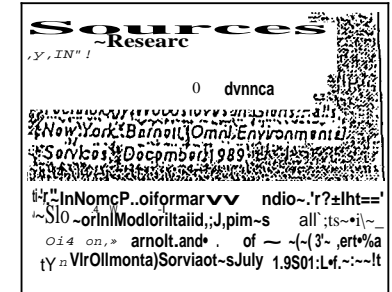
Noncertified Woodstove

10 g/hr

Do not heat with uncertified woodstoves at much particulate pollution as 30,000 houses heating with natural gas.



Source: 1990 EPA Emission Factors



Certified Woodstove

4 g/hr

30 houses heating with certified stoves cause as much particulate pollution as 1,000 houses heating with natural gas.

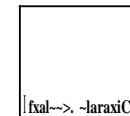


Source: Giant Falls Woodstove Study

Pellet Stove

1 g/hr

130 houses heating with pellet stove, cause as much particulate pollution as 3,000 houses heating with natural gas.



Source: Klamath Falls Pellet Stove Study

Oil

Furnace

0.02 g/hr

Gas

Furnace

0.01 g/hr

Source: 1990 EPA Emission Factors

Source: 1990 EPA Emission Factors



Puget Sound Air Pollution Control Agency

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