# References for Brochure
# Burning Issues/Clean Air Revival, Inc.
# www.burningissues.org

One of America's largest sources of pollution that is responsible for 30,000 deaths each year
[1] [2] [3] [4]

Pellet
Stove
Oil
Furnace
Gas
Emission Comparisons of Different Heating Fuels
A wood stove is over 500 times dirtier than a modern oil burner and a 1000 times dirtier than heating with gas! (Puget Sound Air Pollution Control Agency, WA, USA 1996)

Heating with a wood stove for one season generates as much pollution as driving a car 130,000 miles.
[5]

Kerosene
Gas
Electric
Solar Wind
The Energy Pyramid
(Cleanest fuel at the top to the dirtiest fuel at the bottom) Kirk Smith, PhD, University of CA at Berkeley,
[6]

2 With all of this information, wouldn't you think that every child might:
Live in a smoke-free and clean energy, non-wood-burning home and learn in a smoke free environment. Expect education, athletic and recreation facilities to be smoke-free, so that scholastic and athletic achievements are not limited by uncontrolled asthma and lost school days due to infections.

Be cared for by a supportive physician who explains to parents and teachers the dangers of wood smoke and tobacco smoke and their role in causing: asthma, immune system damage leading to auto-immune diseases, respiratory damage, increased risk of infection, aggravation of heart disease, and cancer.
[7] [8] [9] [10] [11] [12]

Learn self-management skills to minimize exposure to smoke and to have confidence they will not be exposed to hazardous combustion toxins contained in tobacco smoke and wood smoke whether at home, school or play. Expect adults entrusted with their care to understand how to handle pollution emergencies and expect public guardians to protect them from smoke and other hazardous pollutants.
[13]

3 In the last 10 years the number of children suffering from asthma has doubled.
According to a survey by the CDC, one child in seven (8.6 million nationwide) has been diagnosed with asthma, and the numbers have been growing at an alarming rate. It is the most common childhood disease and the leading cause of absenteeism from school.
[14] [15] [16] [17] [18] [19] [20] [21]

The largest single source of outdoor fine particles (PM2.5) in many American and Canadian cities is our neighbor's fireplace or wood stove.
[22] [23] [24] [4] [25] [26] [27]

The particulate matter in wood smoke is so small that closed doors and windows cannot stop it from entering, even in newer energy-efficient weather-tight homes. 90% of wood smoke is in the tiny size particle range (PM2.5) averaging less than 1 micron (one millionth of a meter),

[4] [28]

allowing the fine particles to remain airborne for up to 3 weeks. [4] The particles are so small that they can penetrate into the deepest recesses of the lungs.
[4]

These particles become efficient vehicles for transporting toxic gases, bacteria and viruses deep into the lungs where they do the most damage and cannot be coughed up, and from where the chemicals pass directly into the blood stream.
[4] [29]

Tobacco smoke and wood smoke are very similar in chemical composition.
[4] [30]

Breathing the chemicals and gases of wood smoke and tobacco smoke has been linked not only to health problems, but also to substance abuse.
[4] [31] [32] [33]

There is concern that children from areas with high levels of wood smoke may be more likely to begin smoking tobacco.
[34]

Homes in wood burning areas also have increased rates of low birth weight and Sudden Infant Death Syndrome, (SIDS).
[35]

We can reduce our children's exposure to toxic pollutants by taking very simple measures in our daily lives: avoiding the use of wood burning appliances and tobacco. Many lives could be saved at little or no cost.

For more information, full references, and links to EPA data please visit:

4 What's in Wood Smoke?
Wood smoke contains over 100 different chemicals and compounds, including dioxin, as well as lead, cadmium and arsenic.

Below is a partial list:
*+carbon monoxide, methane, VOCs (C2-C7), *aldehydes, +formaldehyde, *+acrolein, +propionaldehyde, butyl aldehyde, +acetaldehyde, furfural, substituted furans, +benzene, +alkyl benzenes, +toluene, acetic acid, formic acid, *nitrogen oxides (NO, NO2), *sulfur dioxide, +methyl chloride, +naphthalene, +substituted naphthalenes, oxygenated monoaromatics, guaiacol (and derivatives), *+phenol (and derivatives), syringol (and derivatives), +catechol (and derivatives), *+particulate organic carbon, oxygenated polycyclic aromatic hydrocarbons, +PAHs: fl uorene, phenanthrene, +anthracene, methylanthracenes, +fl uoranthene, *+pyrene, +benzo(a)anthracene, +chrysene, +benzofl uoranthenes, *+benzo(e)pyrene, *+benzo(a)pyrene, *perylene, +ideno(1,2,3- cd)pyrene, *benz(ghi)perylene, *coronene, +dibenzo(a,h)pyrene, retene, dibenz(a,h)anthracene, trace elements: Na, Mg, Al, Si, S, Cl, K, Ca, Ti, V, +Cr, +Mn, Fe, +Ni, Cu, Zn, Br, +Pb; particulate elemental carbon, normal alkanes (C24-C30), cyclic di-and triterpenoids, dehydroabietic acid, isopimaric acid, lupenone, friedelin, +chlorinated dioxins

** Indicates a chemical also found in cigarette smoke*
*+Indicates a chemical that is classified as toxic by U.S. Law*
[30] [36]

Wood Smoke Chemical Composition

ALL CHEMICALS LISTED BELOW ARE REPORTED PRESENT IN WOOD SMOKE

carbon monoxide, methane, volatile organic compounds (C 2 -C 7 ), aldehydes: formaldehyde, acrolein, propionaldehyde, butyraldehyde, acetaldehyde, furfural; substituted furans, benzene, alkyl benzenes: toluene, acetic acid, formic acid; nitrogen oxides (NO, NO 2 ), sulfur dioxide, methyl chloride, naphthalene, substituted naphthalenes, oxygenated monoaromatics: guaiacol (and derivatives), phenol (and derivatives), syringol (and derivatives), catechol (and derivatives); particulate organic carbon, oxygenated polycyclic aromatic hydrocarbons, polycyclic aromatic hydrocarbons: fluorene, phenanthrene, anthracene, methylanthracenes, fluoranthene, pyrene, benzo(a)anthracene, chrysene, benzofluoranthenes,

benzo(e)pyrene, benzo(a)pyrene, ! perylene, indeno(1,2,3-cd) pyrene, benzo(ghi)perylene, coronene, dibenzo(a,h)pyrene, retene, dibenz(a,h)anthracene; trace elements: Sodium, Magnesium, Aluminum, Silicon, Sulfur, Chlorine, Potassium, Calcium, Titanium, Vanadium, Chromium, Manganese, Iron, Nickel, Copper, Zinc, Bromine, Lead; particulate elemental carbon, normal alkanes (C 24 -C 30 ), cyclic di-and triterpenoids, dehydroabietic acid, isopimaric acid, lupenone, friedelin, chlorinated dioxins

Sources: Larson TV and Koenig JQ. 1994. Wood Smoke: Emissions and Noncancer Respiratory Effects.
Table 1, Chemical composition of wood smoke. Annual Review of Public Health, v.15, p.136-137.
[37] [38] [39]

5 Breathing in wood smoke is comparable to inhaling second-hand cigarette smoke. Many of the pollutants are similar to those produced by burning tobacco. The EPA estimates that wood smoke is 12 times more carcinogenic than equal amounts of tobacco smoke and attacks our body cells up to 40 times longer than tobacco smoke.
[5] [30] [40]

A single fireplace operating for an hour and burning 10 pounds of wood during that time will generate 4,300 times more carcinogenic polycyclic aromatic hydrocarbons than 30 cigarettes.
[5] [41]

The threat to human health comes from the fine particulate matter - tiny particles 1/200th the size of a raindrop. Inhaling wood smoke particulate matter increases the incidence, duration and severity of respiratory disease, striking hardest at children, the elderly and those with lung or heart disorders.
[4] [42] [43] [44] [9] [8]

The EPA warns that there is no safe level of these carcinogens.
US EPA
[5] [45] [3]

Fireplaces and wood stoves are estimated to be the origin of 35% of fine-particle pollution as a national average.
[4]

Each pound of wood burned costs the entire community $2 in increased medical costs and lost work days. That is equivalent to $40 for an average fire burning 20 pounds of wood.
[46]

Air pollutants also cause immune system damage, which can lead to asthma, allergies and auto-immune diseases.
[47] [48] [11]

Air pollutants have also been linked to psychological disorders and toxic damage to the nervous system and the brain, especially in developing fetuses or young children.
[4] [49] [50]

The number of deaths attributed to particulate pollution exceeds the number of deaths from major cancers like breast cancer and prostate cancer and exceeds the deaths occurring from auto accidents by more than 50%.

methane
formaldehyde
sulfur dioxide
benzene toluene
naphthalene
phenol
aldehydes
carbon monoxide
acrolein
propionaldehyde acetaldehyde
alkyl benzenes
methyl chloride
catechol particulate organic carbon

PAHs
benzo(a)pyrene
chlorinated dioxins
anthracene
fluoranthene
pyrene
benzo(a)anthracene
chrysene
benzofluoranthenes
benzo(e)pyrene

6 Wood smoke is more than a nuisance; it is a severe health hazard!

England has banned wood and coal burning in towns since 1956.

The Supreme Court of Iowa declared in 1998 that government bodies do not have the right to allow burning resulting in smoke crossing property lines.
[51]

We have healthier heating and cooking options. Re-establish the right of every citizen in this country to breathe clean air and not be detrimentally impacted by fi ne particulate pollution.
[52]

As population densities increase, wood burning becomes even more inappropriate because smoke toxins cannot be prevented from crossing property lines.
[4]
Indoor PM2.5 levels
[53]

from wood smoke in homes without wood stoves reach at least 50-70% of outdoor levels. When your neighbor is burning wood, deadly pollutants are inside your house as well.
[53]

Protect yourself and your children.

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