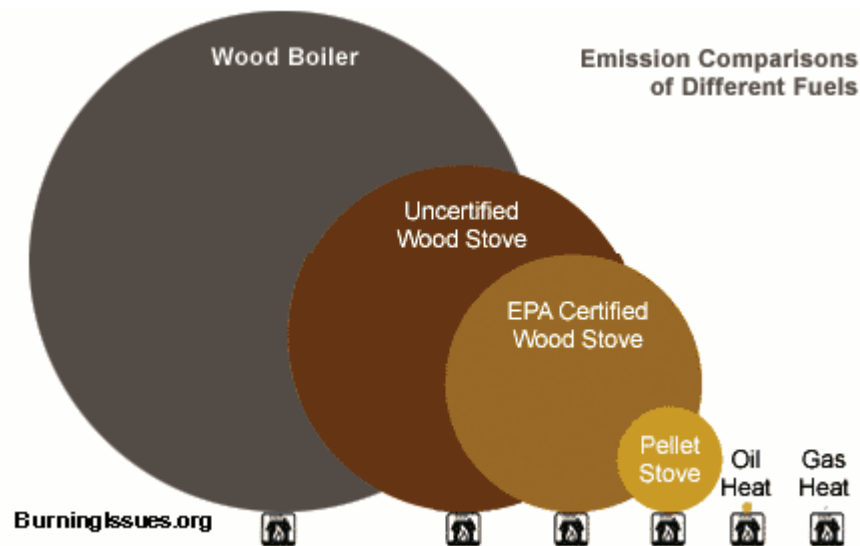


Wood Smoke

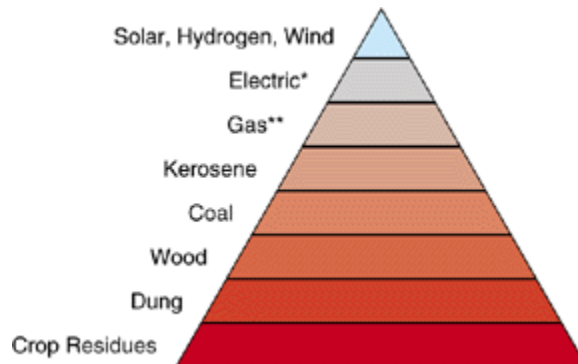
One of America's
Largest Sources of Pollution That
Is Responsible for 30,000 Deaths
Each Year [1] [2] [3] [4]

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.

The Energy Pyramid (Kirk Smith, PhD, University of CA at Berkeley) [6] (cleanest fuel at the top to the dirtiest fuel at the bottom)



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 smokefree 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]

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 cities is our neighbor's fireplace or wood stove. 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 weapon-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. 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.

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])

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])

**Pollution prevention is
disease prevention.**

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]

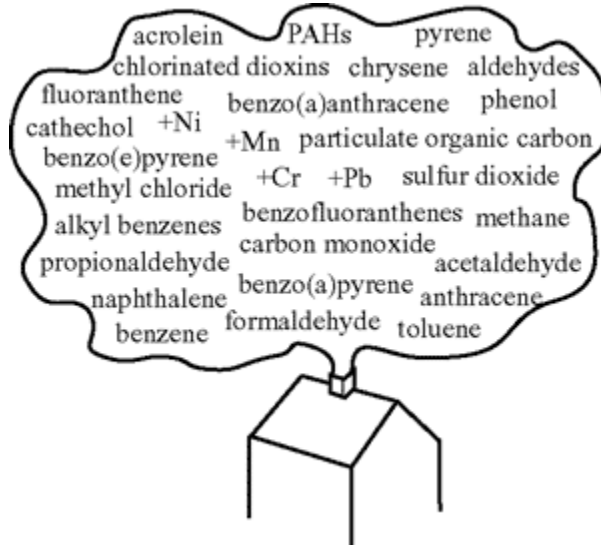
The threat to human health comes from the fine particulate matter - tiny particles 1/200th the size of a raindrop. Inhaling wood smoke particulate matter increases the incidence, duration and severity of respiratory disease, striking hardest at children, the elderly and those with lung or heart disorders. [4] [42] [43] [44] [9] [8] **The EPA warns that there is no safe level of these carcinogens.** [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%.

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 fine 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 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.



Source: CAARB Wood Burning Handbook, 1999

References

1. Schwartz, J., Particulate Air Pollution and Chronic Respiratory Disease, in Environmental Research. 1993. p. PP7-13.
2. USDHHS and D.o.H.a.H. Services, Sudden Infant Death Syndrome (SIDS) Research: A Selected Annotated Bibliography for 1989-1990, in National Center for Ed in Maternal and Child Health. 1990.
3. Schwartz, J., Air Pollution and Daily Mortality: A Review and Meta Analysis. Environmental Research, 1994.
4. Larson, T.V. and J.Q. Koenig, A Summary of the Emissions Characterization and the Noncancer Respiratory Effects of Wood Smoke; 1993: p. 46 pages.
5. Lewtas, J., R.B. Zweidinger, and L. Cupitt. Mutagenicity, Tumorigenicity and Estimation of Cancer Risk from Ambient Aerosol and Source Emissions from Woodsmoke and Motor Vehicles. in Air and Waste Management Association, 84th Annual Meeting and Exhibition, Vancouver, BC, June 16-21, 1991. 1991: US EPA.
6. Smith, K.R., The Biofuel Transition, in Pacific and Asian Journal of Energy. 1987.
7. Fick RB Jr and M.W. Paul ES, Reynolds HY, Loke JS., Alterations in the antibacterial properties of rabbit pulmonary macrophages exposed to wood smoke. *Am Rev Respir Dis.*, 1984. 1984 Jan; 129(1): p. 76-81.
8. Zelikoff, J.T., Wood Smoke Emissions: Effects on Host Pulmonary Immune Defense, in Center for Indoor Air Research (CIAR) Currents. 1994. p. 1-2.
9. Zelikoff, J.T., et al. Compromised Pulmonary and Systemic Immune Responses in the Rat May Help Explain Increased Pulmonary Infections Observed in Woodsmoke-exposed Children. In Society of Toxicology. 1998. Seattle, WA: New York University School of Medicine, Institute of Environmental Medicine, Tuxedo, NY.
10. Larson, T.V. and J.Q. Koenig, An Assessment of the Noncancer Respiratory Risks Resulting from Exposure to Wood Smoke, in Puget Sound APCA. 1992, University of Washington, US EPA.
11. Zelikoff, J., et al., Immunomodulation by metals. *Fund Appl Toxicol*, 1994. 22(1-8): p. 269-286.
12. ALA, A.L.A., The Perils of Particulates, in to order: 1-800-LUNG-USA (1-800-586-4872). 1994, American Lung Association ALA.
13. Guneser, S. and A.N. Atici A, Cinaz P., Effects of indoor environmental factors on respiratory systems of children. *J Trop Pediatr.*, 1994. Apr.; 40(2): p. 114-6.
14. Kou YR, L.C., R.c.i.b.p.e.b.i.o.w.s.i. rats., and J.A.P. 1994, Reflex changes in breathing pattern evoked by inhalation of wood smoke in rats. *J Appl Physiol*, 1994. Jun;76(6):2333-41.
15. Nieman GF, C.W.J., Paskanik A, Feldbaum D., Segmental pulmonary vascular resistance following wood smoke inhalation. *Crit Care Med.*, 1995. Jul; 23(7): p. 1264-71.
16. Maier WC, A.H., Morray B, Llewellyn C, Redding GJ., , and 1997, Indoor risk factors for asthma and wheezing among Seattle school children. *Environ Health Perspect.*, 1997. Feb;105(2): p. 208-14.
17. Robin LF, L.P., Winget M, Steinhoff M, Moulton LH, Santosham M, Correa A., Wood-burning stoves and lower respiratory illnesses in Navajo children. *Pediatr Infect Dis J*, 1996. Oct.15(10): p. 859-65.
18. Wesley AG, L.W., Assessment and 2-year follow-up of some factors associated with severity of respiratory infections in early childhood. *S Afr Med J*, 1996. Apr;86(4): p. 365-8.
19. Hsu TH, L.Y., Kou YR., Smoke-induced airway hyperresponsiveness to inhaled wood smoke in guinea pigs: tachykinergic and cholinergic mechanisms. *Life Sci.*, 1998. 63(17):1513-24.
20. Hsu TH, L.Y., Kou YR., Wood smoke-induced airway hyperreactivity in guinea pigs: time course, and role of leukotrienes and hydroxyl radical. *Life Sci*, 2000. 1(1: 2000;66(11):): p. 971-80.

21. Indoor air pollution and acute respiratory infections in children. *Lancet.*, 1992. Feb 15;339(8790): p. 396-8.
22. Fairley, D., et al., Results from the 1991-92 Pilot Study of Wintertime PM10 in the San Francisco Bay Area, . 1992, Bay Area Air Quality Management District, Technical Memorandum: San Francisco, CA.
23. Fairley, D. and R.D. Mandel, PM10 Particulate Levels in the San Francisco Bay Area, in Technical Memorandum 92003. 1993, Bay Area Air Quality Management District: San Francisco, CA.
24. Flessel, P. and e. al., Seasonal Variations and Trends in Concentrations of Filter-Collected PAH and Mutagenic Activity in the S.F. Bay Area, in *Journal of Air Waste Management Association*, 41:276-281 (1991). 1991.
25. Hildemann, L.M., G.R. Markowski, and G.R. Cass, Chemical Composition of Emissions from Urban Sources of Fine Organic Aerosol. *Environmental Science Technology*, Vol.25, No.4, 1991, 1991. Vol.25(4).
26. Larson, T., et al., Urban Air Toxics Mitigation Study, in University of Washington Dept. of Civil Engineering, Environmental Engineering and Science; submitted to. 1990, Puget Sound APCA: Seattle.
27. Fine, P.M., G.R. Cass, and B.R.T. Simoneit, Chemical Characterization of Fine Particle Emissions from Fireplace Combustion of Woods Grown in the Northeastern United States. *Environmental Science & Technology*, 2001. 35(13): p. 2665-2675.
28. Dasch, J.M., Particulate and Gaseous Emissions from Wood-Burning Fireplaces. *Environmental Science and Technology*,, 1982. 16(10): p. 639-645.
29. Mishra, V., Effect of Indoor Air Pollution from Biomass Combustion on Prevalence of Asthma in the Elderly. *Environmental Health Perspectives*, 2003. 111(1): p. 71-77.
30. EPA, Chemicals identified from Table 3-1 for Mainstream Cigarette Smoke,, . 1992, US EPA.
31. Rozenberg, M., Wood smoke tables and charts., . 2002, Burning Issues/Clean Air Revival, Inc.
32. Pletten, L., Tobacco Addiction Data, . 1999, The Crime Prevention Group.
33. Robinson, S.A. and S.M. Wolfe, Smoking: Its Adverse Effects on Airline Pilot Performance (Carbon Monoxide). *Tobacco Documents Online*, 1976(Jan).
34. Rosen M, H.M. Wall S, and N.L. Lindberg G, Smoking habits and their confounding effects among occupational groups in Sweden. *Scand J Soc Med*, 1987. 15(4): p. 233-40.
35. Boy, E., B. N., and D. H, Birth weight and exposure to kitchen wood smoke during pregnancy in rural Guatemala. *Environ Health Perspect*, 2002. Jan;110(1): p. 109-114.
36. Cooper, J.A., Environmental Impact of Residential Wood Combustion Emissions and Its Implications. *Air Pollution Control Association Journal APCA Journal* 30(8):855-861 (1980), 1980. Vol. 30, No.8,(No.8, August 1980): p. PP.855-861.
37. USSG and S. General, Reducing the Health Consequences of Smoking., . 1989, US Surgeon General: Wash., D.C. p.81-89.
38. USDHHS, et al., Report on Carcinogens. Tenth, . 2002, (ATSDR) Agency for Toxic Substances and Disease Registry.
39. USDHHS, List of Priority Hazardous Substances, . 2001, USDHHS Department of Health and Human Services. Agency for Toxic Substances and Disease Registry.
40. EPA, et al., LONG-TERM PERFORMANCE OF EPA-CERTIFIED PHASE 2 WOODSTOVES, KLAMATH FALLS AND PORTLAND OREGON: 1998-1999, . 2000, National Risk Management Research Laboratory Research Triangle Park, NC 27711. p. pp.65.
41. Lewis, C.W., et al., Contribution of Woodsmoke and Motor Vehicle Emissions to Ambient Aerosol Mutagenicity, in *Environmental Science and Technology*, 22(8):968-971 (1988). 1988.
42. Youn, Y.-K., C. Lalonde, and R. Demling, Oxidants and the pathophysiology of Burn and Smoke Inhalation Injury, in *Free Radical Biology & Medicine*, Vol 12, pp. 409-415. 1992.
43. Puttre, M., Environmental modeling helps clear the air., in *Mechanical Engineering*. 1994.

44. Ozkaynak, et al., Associations Between Daily Mortality, Ozone and Particulate Air Pollution in Toronto, Canada, in Colloquim on Particulates: morbidity & mortality. 1994.
45. Lewtas, J., Emerging Methodologies for Assessment of Complex Mixtures: Application of Bioassays in the Integrated Air Cancer Project. Toxicology and Industrial Health, Vol 5, #5, pp.839-850; copyright Princeton Scientific Publishing Co.,Inc. ISSN:0748-2337, 1989.
46. Hall, J., et al., The Economic Value of Quantifiable Ozone and PM10 Related Health Effects in the San Francisco Bay Area, report to the BAAQMD, . 1994, BAAQMD; to order call (415) 771-6000: San Francisco. p. 80 pages.
47. Pryor, W.A., Review article; reactions in the chem smoke itself. He states wood is 40 times worse than cigarettes.
48. AMA, et al., Airing The Word On Pollution, . 1995, The American Medical Association (AMA).
49. Ryder, R.W., Lead Poisoning Among Children in Katowice, Poland. PSR (Physicians for Social Responsibility) Quarterly (A Journal of Medicine and Global Survival),, 1992. 2(2): p. 77-84.
50. Kinney, H.C., et al., Decreased Muscarinic Receptor Binding in the Arcuate Nucleus in Sudden Infant Death Syndrome. Science, Vol 269, pages, 1995. 269: p. 1446-1450.
51. IOWA, S.C.O. and , No. 192 / 96-2276: taking of private property for public use without just compensation in violation of federal and Iowa constitutional provisions, . 1998, LAVORATO, Justice.
52. Dockery, D., et al., An Association Between Air Pollution and Mortality in Six U. S. Cities. New England Journal of Medicine, 1993. 329(21).
53. Anuszewski, J., T.V. Larson, and J.Q. Koenig, Simultaneous Indoor and Outdoor Particle Light-Scattering Measurements at Nine Homes Using a Portable Nephelometer, in University of Washington, Department of Civil Engineering and Department of Environmental Health. 1992.