

Table 3: Wood Smoke Pollutant Health Effects

<b>Wood Smoke Pollutant</b>	<b>Health effect</b>
Carbon Monoxide <sup>1</sup>	Poison: resulting change of oxyhemoglobin carboxyhemoglobin. Tissue hypoxia, cellular death, damages to the central nervous system, death. <sup>14</sup> Causes reproductive toxicity. <sup>15</sup> Reduces ability of blood to bring oxygen to body cells and tissues; cells and tissues need oxygen to work. May be particularly hazardous to people who have heart or circulatory (blood vessel) problems and people who have damaged lungs or breathing passages. <sup>11</sup>
Methane <sup>1</sup>	
VOCs (C2-C7) <sup>1</sup>	Volatile Organic Compounds cause serious health problems such as cancer and other effects. All VOCs contain carbon. They can cause serious human illness. Hazardous. Causes ozone. Ozone causes breathing problems, reduced lung function, asthma, irritates eyes, stuffy nose, reduced resistance to colds and other infections, may speed up aging of lung tissues. Causes fatigue, generalized depression, increased lethargy or sleep, headaches, substernal pressure, generalized aches and accelerated cardiac action. <sup>17</sup> Environmental Effects - ozone can damage plants and trees; smog can cause reduced visibility
Aldehydes <sup>1</sup>	
Formaldehyde <sup>1</sup>	The gas is toxic if inhaled or absorbed through the skin and is carcinogenic. <sup>14</sup> Can Harm Plants. <sup>11</sup>
Acrolein <sup>1</sup>	Toxic, Bronchopneumonia, aveolitis, swelling and hemorrhaging of tiny vessels. <sup>16</sup>
Propionaldehyde <sup>1</sup>	Toxic <sup>11</sup>
Butryaldehyde <sup>1</sup>	
Acetaldehyde <sup>1</sup>	Toxic <sup>11</sup> , degeneration of olfactory epithelium, liver lesions, nasal cancer, growth retardation. <sup>16</sup>
Furfural <sup>1</sup>	Irritates mucous membranes, causes headaches and photosensitivity and affects sugar metabolism. <sup>14</sup>
Substituted Furans <sup>1</sup>	
Benzene <sup>1</sup>	Colorless volatile liquid. Harmful by transdermal absorption and acutely toxic by ingestion or inhalation, causing mucous membrane irritation, neurological symptoms, and death due to respiratory failure; chronic exposure may result in bone marrow depression and anemia. <sup>14</sup> Causes reproductive toxicity. <sup>15</sup>
Alkyl Benzenes <sup>1</sup>	
Toluene <sup>1</sup>	Toulene is a well known addictive substance. (Glue

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	sniffing) It gives feelings of intoxication. Causes sleepiness, dizziness, headache, muscular weakness, confusion, impaired co-ordination, and visual impairment. It is neurotoxic causing neurobehavioural changes. Causes changes in Liver and kidneys, erosion of the nose, degeneration of respiratory tract skin. Chronic abuse causes damage to the brain in the cerebral area and causes brain stem atrophy. <sup>16</sup> Causes reproductive toxicity. <sup>15</sup> Accumulates in blood and subcutaneous fat if insufficient clearance time between exposures. Irritates eyes and upper respiratory tract. Toulene intereacts with other human exposures such as alcohol ingestion. Pattern recognition is disturbed, by both Alcohol and Toulene. Toulene effects accuracy more than Alcohol. Toulene combined with Alcohol caused performance and mood to decline more than for either one separately.
Acetic Acid <sup>1</sup>	Irritant
Formic Acid <sup>1</sup>	More irritating than acetic acid. Dangerously caustic to the skin. <sup>14</sup>
Nitrogen Oxides (NO,NO <sub>2</sub> ) <sup>1</sup>	Lung damage. Illnesses of breathing passages and lungs (respiratory system). Acid aerosol which damages trees and lakes. <sup>11</sup>
Sulfur Dioxide <sup>1</sup>	Insecticide. Breathing problems, may cause permanent damage to lungs. Environmental effects - SO <sub>2</sub> is an ingredient in acid rain (acid aerosols), which can damage trees and lakes. Acid aerosols can also reduce visibility.
Methyl chloride <sup>1</sup>	Toxic <sup>11</sup>
Napthalene <sup>1</sup>	Toxic <sup>11</sup> , Carcinogenic. Acts like alcohol. <sup>14</sup>
Substituted Napthalenes <sup>1</sup>	Toxic <sup>11</sup>
Oxygenated Monoaromatics <sup>1</sup>	
Guaiacol (and derivatives) <sup>1</sup>	
Phenol (and derivatives) <sup>1</sup>	Poison: colic, seizures, cardiac arrhythmias, shock, respiratory arrest. <sup>14</sup> Toxic <sup>11</sup> , tremors, lower fetal body weight, possible skin carcinogen, EPA Inhalation data insufficient. <sup>16</sup>
Syringol (and derivatives) <sup>1</sup>	

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Catechol (and derivatives) <sup>1</sup>	Toxic <sup>11</sup>
Total Particle Mass <sup>1</sup>	
Particulate Organic Carbon <sup>1</sup>	Toxic <sup>11</sup>
Oxygenated PAHs <sup>1</sup>	
PAHs <sup>1</sup>	Toxic <sup>12</sup>
Fluorene <sup>1</sup>	
Phenanthrene <sup>1</sup>	Also in coal. It is toxic and carcinogenic.
Anthracene <sup>1</sup>	Toxic <sup>12</sup>
Methylanthracenes <sup>1</sup>	
Fluoranthene <sup>1</sup>	Toxic <sup>12</sup>
Pyrene <sup>1</sup>	Toxic <sup>12</sup>
Benzo(a)anthracene <sup>1</sup>	Toxic <sup>12</sup> , probable human carcinogen. DNA damage and Gene mutation in mammalian cell cultures. <sup>16</sup>
Chrysene <sup>1</sup>	Toxic <sup>12</sup>
Benzofluoranthenes <sup>1</sup>	Toxic <sup>12</sup>
Benzo(e)pyrene <sup>1</sup>	Toxic <sup>12</sup>
Benzo(a)pyrene <sup>1</sup>	Toxic <sup>12</sup> , Highly carcinogenic.
Perylene <sup>1</sup>	
Ideno(1,2,3-cd)pyrene <sup>1</sup>	Toxic <sup>12</sup>
Benz(ghi)perylene <sup>1</sup>	
Coronene <sup>1</sup>	
Dibenzo(a,h)pyrene <sup>1</sup>	Toxic <sup>15</sup>
Retene <sup>1</sup>	
Dibenzo(a,h) Anthracene <sup>1</sup>	
Trace Elements <sup>1</sup>	
Strontium <sup>1</sup>	Bone loss, calcification of cartilage. No EPA inhalation data exist.
Magnesium <sup>1</sup>	
Aluminum <sup>1</sup>	Excessive amounts in bloodstream may lead to neurological symptoms that can be fatal. Fumes may cause pulmonary fibrosis. <sup>14</sup>
Silicon <sup>1</sup>	
Sulphur <sup>1</sup>	
Chlorine <sup>1</sup>	
Potassium <sup>1</sup>	
Calcium <sup>1</sup>	
Titanium <sup>1</sup>	
Vanadium <sup>1</sup>	Absorption via lungs; symptoms include irritation of

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	the respiratory tract, pneumonitis, conjunctivitis, and anemia.
Chromium <sup>1</sup>	Toxic <sup>11, 12</sup>
Manganese <sup>1</sup>	Concentrates in mitochondria. Activates enzymes. <sup>14</sup> Acts on the Central Nervous System. Impairment of neurobehavior function: slowed visual reaction time, erratic fine hand, and forearm movement, finger tremor, affects audio verbal short term memory. Causes fatigue, tinnitus, irritability, and more coughs and acute bronchitis. <sup>16</sup> Central nervous system is the primary target. Lodges in lung, providing a pool of slowly released manganese that eventually penetrated the brain. Half-life in the brain of about one year, concentrating in the basal ganglia, which are the brain structures critical for movement. Even modest levels are cumulative. <sup>17</sup>
Iron <sup>1</sup>	
Nickle <sup>1</sup>	Toxic <sup>11, 12,15</sup>
Copper <sup>1</sup>	Toxic <sup>12</sup>
Zinc <sup>1</sup>	Toxic <sup>12</sup> Poison. Fever, vomiting, chills, myalgia, headache and pneumonitis. Looks like lead poisoning. <sup>14</sup>
Bromine <sup>1</sup>	
Lead <sup>1</sup>	Poisoning = Loss of appetite, weight loss, colic, constipation, insomnia, headache, dizziness, irritability, moderate hypertension, albuminuria, anemia, a blue line at the edge of the gums, encephalopathy (especially in children) and peripheral neuropath leading to paralysis. <sup>14</sup> Causes reproductive toxicity. <sup>15</sup> Toxic <sup>11, 12</sup> . Health Effects - brain and other nervous system damage; children are at special risk. Some lead-containing chemicals cause cancer in animals. Lead causes digestive and other health problems. Environmental Effects - Lead can harm wildlife. <sup>11</sup>
Particulate Elemental Carbon <sup>1</sup>	
Normal alkanes <sup>1</sup>	
Cyclic di-and triterpenoids <sup>1</sup>	
Dehydroabietic acid <sup>1</sup>	
Lupenone <sup>1</sup>	
Friedelin <sup>1</sup>	

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Chlorinated Dioxins <sup>1</sup>	Toxic <sup>12,15</sup> Wasting syndrome, fetal abnormalities or death, and problems with the immune and endocrine systems in humans, Mammals, in fish and in birds.
Particulate Acidity <sup>1</sup>	
<b>Additional wood smoke emmissions found in other studies</b>	
Cresol <sup>3</sup>	Toxic & corrosive <sup>14,11,15</sup>
Isopimaric acid	-
Ethylbenzene <sup>3</sup>	Toxic <sup>11</sup> Causes changes in human blood. <sup>16</sup>
Arsenic <sup>4</sup>	Toxic <sup>11,12</sup> Cause <sup>ss</sup> skin eruptions, vomiting, diarrhea, abdominal pain, muscular cramps, and swelling of eyelids, feet, and hands. Chronic arsenic poisoning pigmentation of the skin accompanied by scaling, hyperkeratosis of the palms and soles, transverse white lines on the fingernails, headache, peripheral neuropathy and confusion. <sup>14</sup> Causes reproductive toxicity. <sup>15</sup>
Cesium	Metallic <sup>14</sup>
Cadmium <sup>4</sup>	Poison Pneumoniosis <sup>14</sup> . Causes reproductive toxicity. <sup>15</sup> Toxic <sup>11,12</sup> Affects memory, attention concentration and joint pain. <sup>16</sup>
Molybdenum <sup>5</sup>	Poison, electron redox transport in the body. <sup>14</sup>
Selenium <sup>5</sup>	Cirrhosis, anemia, loss of hair, erosions of long bones. <sup>14</sup>
Carbozole	Toxic <sup>15</sup>
Acridine	
Barium	Poison, acid soluble salt <sup>14</sup>
Phosphorus	Poison toothache, mandibular necrosis, anorexia, anemia. <sup>14</sup> Toxic <sup>11</sup>
Sodium	
Phenathrol	
Phenathrene	A PAH, Toxic and carcinogenic. Also in coal tar.
<sup>d</sup> 10-phenanthrene	
acenaphthylene	Toxic, probable human carcinogen. Possible liver changes, vascular disorder, and Central Nervous System effects. More toxic than Napthyene. <sup>16</sup>
nitronaphthalene	Vapor may cause blistering and opacity of the cornea <sup>14</sup> .
<sup>d</sup> 12-chrysene	
3-methylcholanthrene	A PAH, pro carcinogen , highly carcinogenic, requires metabolic acceleration. Widely used in

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	studies of carcinogenesis. <sup>14</sup>
acenaphthene	Toxic <sup>11</sup> probable human carcinogen. Possible liver changes, vascular disorder, and Central Nervous System effects. More toxic than Naphthylene. <sup>16</sup>
Indeno (1,2,3,c,d) pyrene	Probable human carcinogen. <sup>16</sup>
Molds	
Thermoactinomyces vulgaris <sup>13</sup>	P 962. Farmers lung" = Breathlessness with dry cough, loss of appetite, weight loss. <sup>14</sup>
Aspergillus fumigatus <sup>13</sup>	"Malt workers lung" = allergic aveolitis <sup>14</sup>
Cladosporium herbarium <sup>13</sup>	Possible central nervous system - abscesses & meningitis <sup>14</sup>
Penicillium sp mixture <sup>13</sup>	"Cheese handlers lung" <sup>14</sup>
Micropolyspora faeni <sup>13</sup>	Grows best at high temperatures. Bacteria occurring in branching filaments and forming a spore-producing mycelium. Principle cause of farmers lung. <sup>14</sup>
Alternaria tenuis <sup>13</sup>	Plant disease. Diseases of the lungs and in skin infection in man also a common allergen in human bronchial asthma. <sup>14</sup>
Additional pollutants from Open Burning, Forest Fires, Brush Burning	
Poison Oak	Poison <sup>14</sup>
Poison Sumac	Poison <sup>14</sup>
Poison Ivy	Poison <sup>14</sup>
Bracken	Poison <sup>14</sup>