



## PROTECT YOUR HEALTH AFTER A FIRE

### WHAT'S IN SMOKE?



After a fire, you need to be aware of the toxic nature of the smoke, odor, and soot left behind. Although the structural stability of your home may be safe to re-enter, there are other hazards, many of which are invisible that may pose a serious threat to your health.

Structure fire smoke is a complex mixture of toxic gases, chemicals, and particles, which are generated from materials and products that burn. A typical structure fire may generate literally thousands of different

chemicals and gases and many of these can be extremely dangerous to human health. Considering that cigarette smoke alone contains over 7,000 chemicals, with 70 identified as cancer causing, the products and materials that burn after a typical structure fire and their chemical composition, produce innumerable toxins. These products may include plastics, PVC, fiberglass, adhesives, fabrics, electronics, pesticides, household chemicals, etc. The biggest health threat can be from the microscopic particles, which can be inhaled, where they can pass through the lungs into the bloodstream. Here they can cause a range of health problems, including chronic heart and lung diseases, cancer, and even death.

## TIPS TO PROTECT YOURSELF

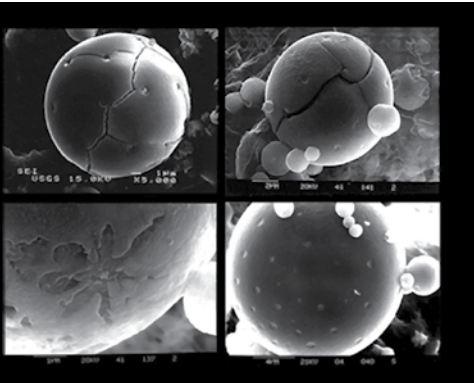
If you need to enter an area affected by fire or smoke, consider the following safety tips:

- 1) Avoid breathing air contaminated by smoke odor and minimize your exposure to contaminated areas.
- 2) If you need to enter a smoke damaged structure, wear a proper fitting respirator with a P-100 HEPA filter designed to filter vapor or gasses (not a dust mask).
- 3) Persons with heart or lung disease should consult their physician before using a mask during post-fire cleanup.
- 4) Avoid handling or coming in contact with items or materials affected by smoke, soot, or ash. If you need to retrieve items damaged by smoke, wear proper personal protection equipment, such as coveralls, eye protection, gloves, proper foot wear, etc.
- 5) Avoid getting ash into the air as much as possible. Do not use leaf blowers or take other actions that will disturb ash or cause it to become airborne.
- 6) Avoid using shop vacuums and other common vacuum cleaners. These do not filter out small particles, but blow them out the exhaust into the air where they can be inhaled.
- 7) Do not allow children or pets to enter areas that have smoke, odor or soot. If children or pets get soot or ash on their skin or hair, wash them immediately with mild soap and warm water.
- 8) If you anticipate that you will need to be inside an area affected by smoke, attempt to ventilate the area by opening windows or doors.
- 9) Have an environmental testing laboratory test for Volatile Organic Compounds (VOC's) and particulates to determine what types and concentrations of toxins may be present.
- 10) Do not eat or drink anything that has signs of heat or smoke damage. When in doubt, throw it out!
- 11) If you experience any adverse health symptoms from exposure to smoke or soot, seek medical attention immediately.

# HAZARDS OF SMOKE

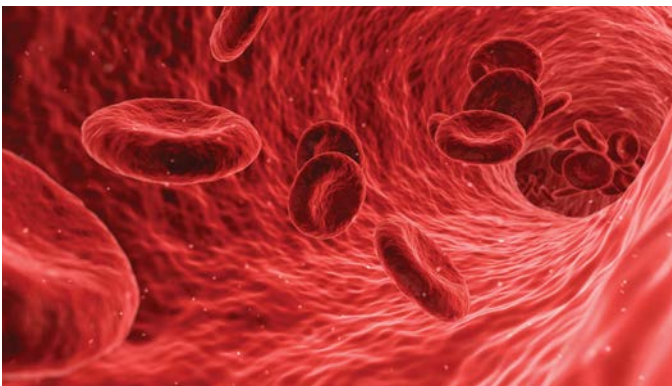
## HAZARDS OF SOOT

As a fire is extinguished, the smoke disperses, leaving behind a residue of quickly cooling particles referred to as soot. Typically, soot is the result of incomplete combustion and is representative of what has burned, but may include byproducts that at first seem unrelated to the original material. For example, hydrogen cyanide, which is an extremely hazardous chemical, is a byproduct of burning wool. When plastics, rubber, or PVC burn, they can produce phosgene, a potentially deadly gas. Then you have chemicals reacting with one another, which creates other toxins. As many products as there are in the world, there are an equal number of byproducts produced in a fire and many are extremely hazardous when inhaled, ingested or absorbed by the skin.



Particle exposure leads to around 20,000 premature deaths in America each year. A particle size is measured in microns and a human hair is roughly 100 microns in width. Inhaled particles

that are approximately 10 microns or larger get trapped in the upper respiratory tract, while particles that are 5 microns or smaller can make it down to the lower lung where the gas exchange occurs in the alveoli. To offer some perspective on the size of these particles, the dust you see flying in the light coming through a sun lit window is about 40 microns, a red blood cell is approximately 7 microns. The particle size of soot is approximately 2.5 microns or less.



## TOXIC CHEMICALS & GASSES



Toxic chemicals and gasses often found in smoke include: carbon monoxide, carbon dioxide, hydrogen cyanide, hydrogen chloride, sulfur dioxide, hydrogen sulfide, and oxides of nitrogen. Other toxins may include ethylene, benzene, methylene chloride, lead, nickel, chromium, and other metals, toluene, acrolein, mercury, formaldehyde, arsenic, chromate, phenol, styrene, polycyclic aromatic hydrocarbons, PCB's, and countless others.

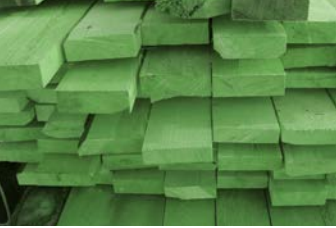
To give you an idea of how toxic some of these chemicals are, chlorine gas was the first lethal chemical to be used in World War I, resulting in thousands of casualties. Then later phosgene and diphosgene were used and also hydrogen cyanide. Both hydrogen cyanide and phosgene are commonly found in structure fire smoke.



In the days following a fire, you may notice a fine layer of rust forming on metal surfaces such as window frames, door hardware, faucets, appliances, electronics, etc. This is usually the result of sulfuric and/or hydrochloric acid that is created when plastics or other products burned. These acids attack metals and begin to corrode them quickly. If you have electronics that have been exposed to smoke, there is a risk that the electrical contacts, circuits, and components could corrode and later cause a short circuit or a fire.

# HAZARDS OF SMOKE

## TREATED LUMBER



Treated wood is the green-tinted lumber used in most residential and commercial construction. Prior to 2004 this lumber was treated with a pressurized solution containing Chromated Copper Arsenate

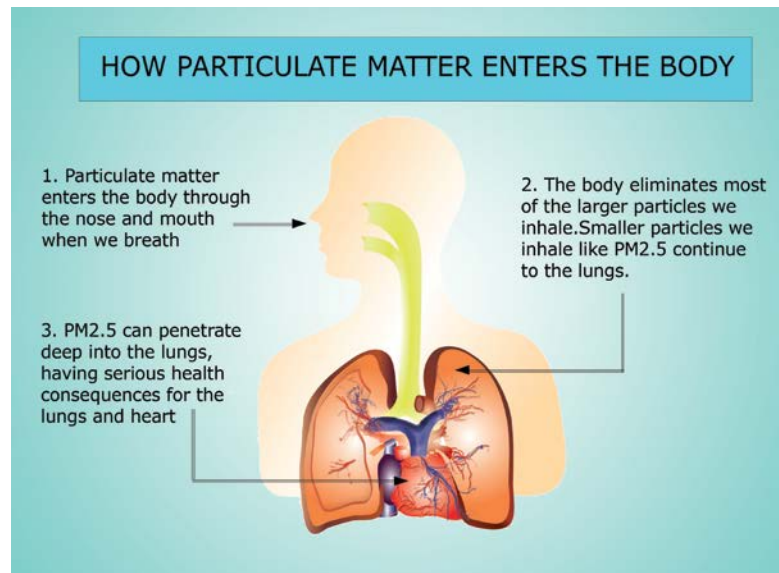
(CCA). During the manufacturing process, wood was injected with a solution of CCA under pressure. The arsenic became chemically bound in the wood by the chromate, and the copper gives it that slight greenish tint. CCA treatment leaves about one ounce of inorganic arsenic in each 12 foot 2 x 6. This is enough arsenic, if released, to kill about 250 adults. When CCA wood burns, it releases the chemical bond holding arsenic in the wood. Minute amounts of 'fly ash' from burning CCA pressure treated wood, can have serious health consequences. The Journal of the American Medical Association reported on a family that burned CCA in a wood stove for winter heating. Their hair fell out, all family members suffered severe, recurring nosebleeds, extreme fatigue and debilitating headaches. The parents complained about 'blacking out' for periods of several hours, followed by long periods of extreme disorientation and both children suffered frequent seizures described as 'grand mal'. The symptoms were finally traced to breathing minute amounts of arsenic laden dust leaking from the furnace as fly ash. The family's houseplants and fish died too, victims of copper poisoning from the same dust. Peters HA, et al: Seasonal exposure to arsenic from burning CCA wood. *JAMA* 251:(18)2393-96, 1984)

## DIOXINS

The most dangerous emissions can be caused by burning plastics containing organochlor-based substances like PVC. When such plastics are burned, harmful quantities of dioxins, a group of highly toxic chemicals are emitted. Dioxins are the most toxic to the human organisms. They are carcinogenic and a hormone disruptor and accumulate in our body-fat and thus mothers give it directly to their babies via the placenta. One dioxin found after a fire are polychlorinated biphenyls or (PCB's). These pollutants are known as Persistent Organic Pollutants (POP's), which means it may take decades or centuries for the chemicals to degrade.

## TOXIC HEALTH EFFECTS

Particles larger than 10 microns do not go into the deepest parts of the lungs, they can normally be coughed out. Smaller particles however, are inhaled into the deepest parts of the lungs, where they become embedded and can cause disease. The smallest ultrafine particles, which are numerous in wood and synthetic material smoke, are so minute they behave like gases, passing through the lungs and directly into the bloodstream. Once in the bloodstream, these ultrafine particles carry toxins around the body and promote inflammation and other adverse health effects.



Ultrafine particles also travel up through the nose and, rather than passing down into the lungs, are delivered directly into the brain and central nervous system via the olfactory nerve, bypassing the body's protective blood/brain barrier.

Toxins can also be ingested or absorbed through the skin. Protect yourself from toxin exposure by avoiding contact with damaged items or entering areas where smoke or soot may be present. If you have to enter an area affected by fire or smoke, be sure to wear proper personal protective equipment, including a proper fitting respirator with a HEPA filter, eye protection, gloves, proper footwear, disposable coveralls, etc.

# HAZARDS OF SMOKE



This pamphlet has the support of:



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For information on how to restore the indoor air quality of your home or questions regarding fire or smoke restoration, call 858-349-2262.

Or send an e-mail to [Sean@TheRedGuideToRecovery.com](mailto:Sean@TheRedGuideToRecovery.com).



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