

THE DANGERS OF SMOKE PARTICULATES

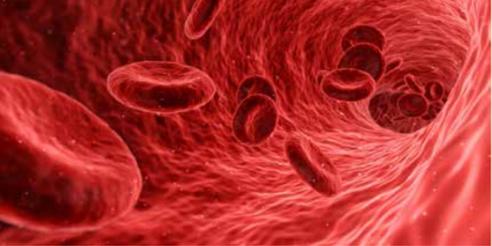


WHAT IS SMOKE?

Smoke is a complex mixture of toxic gases, chemicals, and particles, which are generated from various materials that burn in a fire. A typical structure fire may generate thousands of chemicals and gases and studies haven't scratched the surface to determine all the adverse health effects that may result from exposure. To illustrate how many chemicals may be present after a fire, cigarette smoke contains over 7,000 chemicals, with 70 identified as cancer causing. Now think about the various products and materials found in a typical home today and their chemical composition. Plastics, PVC, foams, fiberglass, wood products, synthetic fabrics, electronics, household chemicals, etc. The toxicity of the smoke produced from products like these are extremely dangerous to human health and the biggest health threat from smoke after a fire is from the microscopic particles, which can penetrate deep into your lungs. Here they can cause a range of health problems, from burning eyes and a runny nose to aggravated chronic heart and lung diseases and even death.

HIDDEN HAZARDS OF SOOT

Smoke is the result of incomplete combustion, which produces tiny particles of carbon in the air. The particle size of soot is approximately 2.5 microns, a size that is associated with deep lung penetration. Particles that are approximately 10 microns or larger get trapped in the upper respiratory tract. 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 in size and a red blood cell is about 7 microns. Airborne soot is too small to be seen with the naked eye and is easily inhaled. As a fire dies down, the smoke will disperse, leaving behind a residue of quickly cooling particles referred to as soot. Typically, soot 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 wood burns it can produce manganese and benzene. Then you have chemicals reacting with one another, which creates other gasses and 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 or absorbed by the skin.

Research has shown that many premature deaths are directly related to soot in the environment. **Particle exposure leads to around 20,000 premature deaths in America each year. Many of these deaths were caused by soot-related diseases.**

TOXIC CHEMICALS AND GASES

The toxic mixture of chemicals and gasses contained in fire smoke is comprised primarily of carbon monoxide, carbon dioxide, hydrogen cyanide, ammonia, hydrogen chloride, sulfur dioxide, hydrogen sulfide, and oxides of nitrogen. Other toxins may include ethylene, benzene, methylene chloride, lead, chromium, and other metals, toluene, acrolein, mercury, formaldehyde, sulfuric and hydrochloric acid, arsenic, chromate, phenol, styrene, polycyclic aromatic hydrocarbons, and the list goes on.

To give you an idea of how toxic many 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. Hydrogen cyanide was also produced, but its physical properties were found to be unsuitable for use as an effective chemical warfare agent. **(Hydrogen cyanide and phosgene are both commonly found in structure fire smoke)** Phosgene was first used as a chemical weapon by the Germans, but was later used by the French, Americans, and British. Phosgene was responsible for the majority of deaths that resulted from chemical warfare.

HEALTH EFFECTS OF TOXIC PARTICULATES

Particles larger than 10 microns do not go into the deepest parts of the lungs, and they can 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 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.

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.

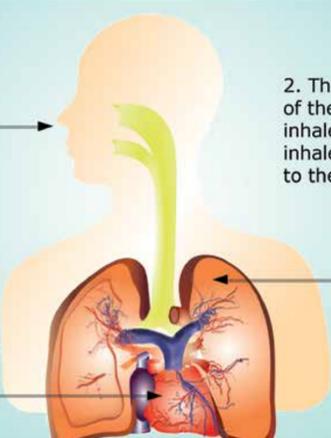
For more information on toxic smoke particulates, download our free white paper titled ["Addressing Toxic Smoke Particulates in Fire Restoration"](#).

HOW PARTICULATE MATTER ENTERS THE BODY

1. Particulate matter enters the body through the nose and mouth when we breathe

2. The body eliminates most of the larger particles we inhale. Smaller particles we inhale like PM2.5 continue to the lungs.

3. PM2.5 can penetrate deep into the lungs, having serious health consequences for the lungs and heart



To be completely prepared for a disaster, you need to know how to recover before a disaster strikes. **The Red Guide to Recovery** and **Secrets of The Insurance Game** are packed with insight and powerful information that will strengthen your resiliency. Only two types of people emerge from disasters – survivors and victims and a little knowledge can make all the difference!

