

### **Composition of Fire Smoke:**

Smoke from fires comprises suspended liquid and solid particulate matter, gases, and vapors that result from the combustion or pyrolysis of material.

- **ALL** types of fire release toxic and carcinogenic substances.

Overall Evaluation: The agent is described according to the wording of one of the following categories, and the designated group is given. This categorization of an agent is a matter of scientific judgment that reflects the strength of evidence derived from studies in humans and in experimental animals and from mechanistic and other relevant data.

Group 1	Carcinogenic to humans
Group 2A	Probably carcinogenic to humans
Group 2B	Possibly carcinogenic to humans
Group 3	Not classifiable as to its carcinogenicity to humans
Group 4	Probably not carcinogenic to humans

Carcinogens Found in Smoke at Fires	
Chemicals measured in fires	Classification
2-Nitroanisole	2B
Benz[ <i>a</i> ]anthracene	2B
Benzo[ <i>b</i> ]fluoranthene	2B
Benzo[ <i>k</i> ]fluoranthene	2B
Benzofuran	2B
Carbon black	2B
Chrysene	2B
Ethylbenzene	2B
Furan	2B
Indeno-1,2,3-[ <i>cd</i> ]pyrene	2B
Isoprene	2B
Lead	2B
Naphthalene	2B
Polychlorophenols	2B
Styrene	2B
Toluene diisocyanates	2B

Trichloromethane (chloroform)	2B
Lead compounds, organic	3
Silica (amorphous)	3
Triphenylene	3

Carcinogens Found in Smoke at Fires	
Chemicals measured in fires	Classification
1,3-Butadiene	1
2,3,7,8-tetrachloro dibenzo- <i>para</i> -dioxin	1
Arsenic	1
Asbestos	1
Benzene	1
Benzo[ <i>a</i> ]pyrene	1
Cadmium	1
Formaldehyde	1
Polychlorinated biphenyls	1
Radioactivity ( $\gamma$ activity)	1
Radionuclides ( $\alpha$ -particle-emitting)	1
Radionuclides ( $\beta$ -particle-emitting)	1
Silica (crystalline)	1
Trichloroethylene	1
Dibenz[ <i>a,h</i> ]anthracene	2A
Dichloromethane (methylene chloride)	2A
Lead compounds, inorganic	2A
Tetrachloroethylene (perchloroethylene)	2A
Acetaldehyde	2B

Several studies have been conducted with the purpose of identifying the chemicals and known carcinogens found **during the overhaul phase of a structure fire**.

- Characterization of Firefighter Exposures During Fire Overhaul (Phoenix FD and the University of Arizona Prevention Center and Arizona State University).
- A Study on Chemicals found in the Overhaul Phase of Structure Fires using Advanced Portable Air Monitoring available for Chemical Speciation (Tualatin Valley Fire & Rescue – Oregon)

Chemicals measured in overhaul environment	IARC Classification
1,3 Butadiene	1
Arsenic	1
Asbestos	1
Benzene	1
Benzo(a)pyrene	1
Coal Tar Pitch	1
Diesel Exhaust	1
Formaldehyde	1
Vinyl Chloride	1
Dibenz(a,h)anthracene	2A
N-Nitrodimethylamine	2A
1,2 Dichloroethane	2B
Acetaldehyde	2B
Benz(a) anthracene	2B
Benzo(b)fluoranthene	2B
Benzo(k)fluoranthene	2B
Benzo(furan)	2B
Ethyl benzene	2B
Furan	2B
Indeno(1,2,3-cd)pyrene	2B
Lead	2B
Napthalene	2B
Styrene	2B
Mercury	3
Hydrochloric Acid	3

Toluene	3
Acrolein	3
Furfural	3
Acenaphthene	3
Anthracene	3
Benzo(ghi)perylene	3
Fluoranthene	3
Fluorene	3
Phenanthrene	3
Pyrene	3

### **Diesel Engine Exhaust:**

On June 12, 2012, the International Agency for Research on Cancer (IARC), part of the World Health Organization and the authority on cancer, classified diesel engine exhaust as a Group 1 Carcinogen, meaning that it causes cancer in humans.

Diesel engine exhaust in fire stations has been and continues to be a serious health problem for firefighters. This exhaust is generated whenever a fire apparatus leaves or returns to the station. If not properly captured and removed, it will remain in the apparatus bay as well as enter the firefighters' living quarters. As a result, firefighters can be exposed to diesel engine exhaust for a considerable portion of their shift.

Diesel exhaust contains multiple cancer-causing chemicals such as (Source IARC Monograph 105):

Metals	IARC Classification
Antimony Compounds	2B
Arsenic and inorganic arsenic compounds	1
Beryllium and beryllium compounds	1
Cadmium and cadmium compounds	1
Chromium (VI)	1
Cobalt and cobalt compounds	2B
Lead compounds (inorganic/organic)	2A/3

Nickel (metallic/compounds)	2B/1
Organic Chemicals	IARC Classification
1,3-Butadiene	1
Acetaldehyde	2B
Benzene	1
Bis(ethylhexyl)phthalate	2B
Ethylbenzene	2B
Formaldehyde	1
Propylene oxide	2B
Halogenated and other chemicals	IARC Classification
Dioxin/dibenzofurans	1
Polycyclic aromatic hydrocarbons	IARC Classification
Benz(a) anthracene	2B
Benzo(b)fluoranthene	2B
Benzo(k)fluoranthene	2B
Benzo(a)pyrene	1
Chrysene	2B
Dibenz(a,h)anthracene	2A
3,7-Dinitrofluoranthene	2B
3,9-Dinitrofluoranthene	2B
1,3-Dinitropyrene	2B
1,6-Dinitropyrene	2B
1,8-Dinitropyrene	2B
Indeno(1,2,3- <i>cd</i> )pyrene	2B
Napthalene	2B
3-Nitrobenzanthrone	2B
6-Nitrochrysene	2A
2-Nitrofluorene	2B
1-Nitropyrene	2A
4-Nitropyrene	2B
Styrene	2B

### **Soot:**

Soot is a byproduct of the incomplete burning of organic (carbon-containing) materials, such as wood, fuel oil, plastics, and household refuse.

Soot particles absorb many hazardous chemical vapors that are released during fires, holding them in place on surfaces including firefighter's personal protective equipment (PPE), clothing and skin.

As firefighters work, their body temperature rises and they begin to sweat. Skin becomes more permeable and soot particles are more easily absorbed into the body.

- For every 5° increase in skin temperature, absorption increases by 400%.

The International Agency for Research on Cancer, part of the World Health Organization, lists soot in the Group 1 category meaning that the agent is ***“Carcinogenic in Humans.”***

In their *13th Report on Carcinogens* which was released on October 2, 2014, the U.S. Department of Health and Human Services continues to list **soots** as a substance under the category of ***“Known To Be Human Carcinogens.”***