

NAPA COUNTY CANCER REPORT: SUPPLEMENT C - WILDFIRE EXPOSURE

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WILDFIRE EXPOSURE AND CANCER

January 2018



A Tradition of Stewardship
A Commitment to Service

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WILDFIRE EXPOSURE AND CANCER

Key Points:

- Particulate matter and carbon monoxide are the major pollutants of wildfire smoke. When these pollutants are inhaled, they can irritate the airways and worsen existing respiratory and cardiovascular conditions. However, they have not been shown to cause cancer among the general public.
- Ash and debris are often more hazardous than wildfire smoke because they come from a variety of burned materials, such as appliances, vehicles, and home structures.
- Based on prior state assessments of home fires and wildfires, components of ash and debris include asbestos and the heavy metals arsenic, lead, and cadmium, which are known human carcinogens. As such, it is important to follow proper ash and debris removal protocol.



Common Wildfire-associated Exposures & Health Effects

Air Pollution & Smoke

Emissions in the air, such as smoke, contain a variety of particles and chemicals from different sources, which can threaten health (1). The health effects associated with smoke from wildfires vary depending on the weather, terrain, type of material or object burned, duration and range of fire and other factors. Principal wildfire emitted pollutants of concern in Napa County are further described in the following sections. Most contaminant information is from the United States and California Environmental Protection Agency (US and CA EPA) and carcinogenic classifications from the nation's Agency for Toxic Substances & Disease Registry (ASTDR); other sources are noted in citations.

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Air Pollution & Smoke (Continued)

Particulate Matter (PM)

Particulate matter (PM) is a broad term for an assortment of suspended solid particles and liquid droplets, such as dust, dirt, mold or soot. They range in size and can be large enough to be visible by the naked eye or so small that they can only be seen with an electron microscope. PM is the major pollutant for relatively short-term exposures from wildfire smoke (hours to weeks). PM influences health differently based on size, with smaller particles having more damaging effects to the respiratory and cardiovascular systems.

Concentrations of PM are much higher during wildfires than they are during ambient or day-to-day air pollution (which is discussed further below) in urban settings. Studies on animal models confirm wildfire PM to be much more toxic than those from ambient air (1). However, compared to the outcomes of chronic exposure to ambient air pollution, the long-term health effects of wildfire smoke are more difficult to investigate as most people are exposed briefly and infrequently. Among the few studies that have explored this topic, model-based assessments have indicated an increased risk of developing cancer only among wildland firefighters and prescribed-burning farmers who are regularly exposed to wildfire smoke (2). Overall, there is a lack of research and insufficient evidence linking exposure to wildfire smoke and cancer among the general public (2).

PM 2.5 and PM 10 are the most studied among wildfire emissions (1). While PM with a diameter larger than 10 micrometers (μm) usually do not get to the lungs and are excluded, they can still irritate the eyes, nose and throat.

PM 2.5: Described as fine particles, they are 2.5 μm , which is about 3% the diameter of human hair, or smaller. Many particles from wildfire smoke fit this category, are very small (less than 1 μm), and are the main cause of reduced visibility or haze. When inhaled, they can enter the deepest recesses of the lungs and lead to a host of conditions, including respiratory and cardiovascular diseases. Additionally, 40-70% of fine particles contain organic or carbon-containing material, some of which are known carcinogens (3). Nonetheless, only a small number of studies have examined limited exposure (1 or 2 events) to PM 2.5 from wildfires, and none have found an association with cancer in the general population (2).

PM 10: Described as coarse particles, these are PM that have a diameter larger than 2.5 μm up to 10 μm , which is about 13% that of human hair. PM 10 can be inhaled into the lungs and affect the respiratory and cardiovascular systems. Compared to PM 2.5, there are fewer studies on limited exposure to wildfire PM 10. None have found an association with cancer (2).

For more information on air quality in Napa County go to the following website:

<https://www.countyofnapa.org/2246/Air-Quality-in-Napa-County>

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Air Pollution & Smoke (Continued)

Carbon Monoxide (CO)

Carbon Monoxide (CO) is a colorless, odorless and tasteless gas that is detrimental when inhaled in large concentrations as it reduces the amount of oxygen that can travel in the blood. CO is produced during the incomplete combustion of wood or other organic material, characterized by yellow flames and remnants of ash, which happens when oxygen is limited and CO forms instead of carbon dioxide. CO concentrations are highest during the smoldering stages of a fire. Depending on CO levels in the environment, it can cause a range of health effects from headaches to death from heart complications. Fortunately, the wildfire smoke that the general public is typically exposed to does not contain high enough CO concentrations to pose a significant hazard. People with pre-existing cardiovascular and respiratory conditions, as well as firefighters, are at an increased risk of experiencing harmful effects from CO produced by wildfire and should take additional precautions. There are limited studies linking CO exposure to cancer. While some animal studies suggest that oxidative stress may lead to DNA damage, the specific cause is not clear and may be due to other lifestyle factors (3). Furthermore, different health agencies nationally and internationally, including the US EPA and International Agency for Research on Cancer (IARC), have not classified CO as a human carcinogen.

Other Wildfire and Ambient Air Pollutants

Other wildfire air pollutants, such as acrolein, aldehydes, hydrocarbons and other chemicals, are at much lower concentrations than PM and CO. These contaminants are respiratory irritants and several forms, such as benzene and formaldehyde, are known human carcinogens based on studies of occupational exposures to these chemicals (e.g., embalmers and exposure to formaldehyde). However, no studies have identified these contaminants, at the level present in wildfire smoke, as causing cancer for people (2). Pollutants in the ambient air are mostly comprised of PM and ozone, which can come from sources like vehicle and industry emissions. Some studies have suggested that ambient air pollution may be a risk factor for lung cancer, but none have identified a causal link in humans (2,4). Moreover, no associations have been identified for other cancer types (5).

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Ash & Debris

Ash and debris from burned structures and the surrounding land may be more hazardous than wildfire smoke. Ash and debris originate from synthetic and miscellaneous materials (e.g., household products and building materials) that can contain irritants and possible or known human carcinogens. Studies on ash and debris exposure have primarily focused on firefighters and other workers who are continually in close contact with these materials. These studies have identified a link to an array of cancers, including lung cancer and multiple myeloma, depending on dose and site of occupational exposure (e.g. respiratory, skin, etc.) (6). The specific nature and magnitude of these contaminants following wildfires is not known until ash sampling results become available. However, elements commonly associated with home fires and wildfires based on prior state assessments include the following. Most contaminant information is from the US and CA EPA and carcinogenic classifications from ASTDR; other sources are noted in citations.

Heavy Metals

Heavy metals listed below are denser than water, which play a part in their toxicity, and can include elements with metal-like properties. Heavy metals can be found directly in ash, debris, and soil but can also be transported through bodies of water in large, high-severity wildfires. Maintaining vegetation and watershed areas or putting temporary erosion control measures in place are important for preventing further water contamination. The County and state agencies are in charge of maintaining the watershed and monitoring the soil and water for harmful contaminants like heavy metals.

Lead has been identified by the IARC as a possible human carcinogen and could be present in paint from houses built before 1979 (7). In Napa County, 60% of housing or approximately 33,000 units, was built before 1979. Lead can also be found in old or foreign containers, merchandise, and other objects (7).

Arsenic is a known human carcinogen. The compound can come from settings such as vineyards, production of glass and ceramics, in preserving wood, and the production of pesticides (7,8).

Cadmium is another known human carcinogen. It is primarily associated with metal industries and cigarettes (7,8).

Other heavy metals, including copper and antimony, are generally classified as possibly carcinogenic (due to lack of research) or not carcinogenic. These metals can be found in batteries, automobiles, plumbing, and building materials (7).

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Ash & Debris (Continued)

Asbestos

Asbestos is a fibrous mineral used in many structures built before 1980 for consolidation, insulation, fireproofing, and sound absorption. However, asbestos is not entirely banned and can still be found in several products like pipeline wrapping and roof coatings. Inhalation or ingestion of fibers from disturbed structures containing asbestos can lead to serious health complications. For this reason, county, state and federal agencies inspect affected properties after wildfires and remove any household hazardous wastes, including materials with asbestos.

Asbestos is classified as a known carcinogen and commonly associated with mesothelioma or informally termed “asbestos cancer,” a rare cancer of the thin membranes lining the chest and abdomen. Studies have also strongly linked asbestos exposure to cancers of the lung, larynx, and ovaries. Some evidence also point to risks of developing stomach, pharynx, and colorectal cancers.

Polycyclic Aromatic Hydrocarbons (PAHs)

Polycyclic aromatic hydrocarbons (PAHs) are chemicals naturally found in fuel (e.g., coal, oil and gas) and are produced when fuel, wood, tobacco, tires, plastics and other products are burned. PAHs normally appear as a mixture and particular molecules are difficult to examine individually. Altogether, PAHs are classified by the IARC as probable human carcinogens. Carcinogenicity of PAHs has been well-established in lab animal studies, but is inconclusive for humans due to a lack of research. The few studies that have investigated human carcinogenicity looked at mixtures (not specifically targeting PAHs) or heavy occupational exposures (e.g., coal miners) and found elevated risks for lung, skin and bladder cancer.

Other Ash & Debris Constituents

If a home or business owner had used pesticides on their lawn or garden or stored the product inside, these chemicals may be present in the ash and debris. Most publicly available pesticides are not definitively identified as human carcinogens. Additionally, polychlorinated biphenyl or PCBs, known carcinogens linked to liver cancer, have not been produced in the US since 1979, but may still be found in appliances, transformers, vehicle parts and other devices. Lastly, dioxins and furans, which are possibly carcinogenic to people, can be created when organic materials are burned.

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Links to government sources:

US EPA

- Air Pollution Emission: <https://www3.epa.gov/airquality/emissns.html>
- Wildfire Smoke: A Guide for Public Health Officials: https://www3.epa.gov/airnow/wildfire_may2016.pdf
- US Federal Bans on Asbestos: <https://www.epa.gov/asbestos/us-federal-bans-asbestos>

CDC

- Agency for Toxic Substances & Disease Registry: <https://www.atsdr.cdc.gov/substances/index.asp>

CA EPA

- Guidance for Conducting Emergency Debris...: <https://calepa.ca.gov/wp-content/uploads/sites/34/2016/10/Disaster-Documents-2011yr-GuideRemoval.pdf>

CA Air Resources Board

- Safe Cleanup of Fire Ash: <https://www.arb.ca.gov/carpa/toolkit/emerg-response/safe-cleanup-fire-ash.pdf>