WILDFIRES AND CANCER

This factsheet was developed by the International Association of Fire Fighters and the Firefighter Cancer Support Network.

Wildland-urban interface (WUI) fires are among the most complex incidents facing fire fighters. They occur where the built environment meets natural vegetation, forcing responders to manage both wildland fire behavior and structural fire dynamics.

In many cases, homes and outbuildings ignite not from the advancing flame front, but from wind-driven embers (firebrands) that travel ahead of the front, lodge in vents, roofs, gutter debris, or attachments, and ignite buildings. Once structures ignite, radiant heat, combustible attachments (e.g., decks, fences), and close spacing enable rapid fire spread.

Protecting lives and limiting property loss from wildfires must go hand-in-hand with protecting fire fighters from long-term health risks.

EXPOSURE ELEMENTS & HEALTH RISKS

WUI exposures carry elevated risks of long-term adverse outcomes, including cancer, due to a mix of inhalation and skin/gear contamination pathways.

Fire fighters operating in WUI zones are exposed to a uniquely hazardous smoke mixture. It includes wildland fuel emissions, plus burning structures, vehicles, synthetic materials, treated wood, plastics, and metals.

Studies show elevated exposure to known carcinogens such as benzene, arsenic, asbestos, heavy metals, and polycyclic aromatic hydrocarbons (PAHs). For example, one review found that wildland fire fighters are routinely exposed to multiple carcinogens across many job tasks.[1]

A risk assessment found increased estimates of lung cancer (8–43%) and cardiovascular disease (16–30%) mortality for wildland fire fighters based on particulate exposures.[2] Recent biomarker research in WUI fire fighters found altered microRNA and DNA methylation patterns after exposures – changes linked to inflammation, immune dysfunction, and cancer pathways.[3]

Because gear and vehicles become contaminated with soot/ash laden with carcinogens, dermal uptake and cross-contamination within stations are major concerns.

SOURCES OF EXPOSURE IN WUI SMOKE

Wildland fuels
+
Structural materials
+
Vehicle contents
=
Complex carcinogenic mix

OPERATIONAL RESPONSE & MITIGATION

On-scene tactics must include risk mitigation for both fire behavior and fire fighter health. Key elements include identifying ember-entry vulnerabilities (e.g., vents, eaves, decks/fences), verifying noncombustible zones (0–5 feet) around structures, conducting 360-degree size ups for embers, and anticipating spot fires ahead of the front.

1 Navarro KM, Kleinman MT, Mackay CE, Reinhardt TE, Balmes JR, Broyles GA, Ottmar RD, Naher LP, Domitrovich JW. *Wildland firefighter smoke exposure and risk of lung cancer and cardiovascular disease mortality.* Environ Res. 2019;173:462–468. https://www.fs.usda.gov/pnw/pubs/journals/pnw_2019_navarro001.pdf

2 DuBose K, et al. *A review of occupational exposures to carcinogens among wildland fire fighters.* Ann Work Expo Health. 2025. https://academic.oup.com/annweh/article-abstract/69/8/791/8240449?redirectedFrom=PDF

3 Goodrich J, et al. *Wildland-urban fires trigger biological changes in firefighters, may explain increased cancer risks.* Univ Mich News. 2025. https://sph.umich.edu/news/2025posts/fires-trigger-biological-changes-in-firefighters-may-explain-increased-cancer-risks.html

From a health protection standpoint:

- Ensure SCBA use in smoke and overhaul; treat gear and station contamination seriously (see decon section).
- Off the fireground, preventive mitigation efforts (e.g., defensible space, roof/gutter maintenance, ember-resistant vents) are vital in reducing ignition risk.

DECONTAMINATION, PPE & STATION PRACTICES

Because gear and vehicles transport contamination, a structured decon workflow is critical.

- On-scene gross decon (low-pressure water + mild detergent) should be used to remove visible soot and debris.
- Skin wipes should be done for face/neck/hands immediately after coming out of the hazard area.
- Gear should be bagged/sealed for transport and laundered separately per NFPA 1851 for structural ensembles or NFPA 1877 for wildland ensembles.
- Arrival at station triggers shower ASAP (<1 hour) and transition to clean uniform.
- Establish clean/dirty zones in apparatus and station.

Your gear can become a source of exposure – treat contamination as you would other hazardous materials.

ADVERSE HEALTH OUTCOMES & CANCER RISK SUMMARY

Because of repeated exposures to complex mixtures of carcinogens and other toxins, fire fighters have elevated risks of adverse health outcomes. Key findings include:

- A meta-analysis and occupational review: elevated risk of all-cancer incidence (SMR ≈ 1.12) among fire fighters compared to the general population.[4]
- Specific to wildland/WUI: elevated lung cancer risk (8–43%) and cardiovascular mortality (16–30 %).[5]
- Alterations in biological markers (e.g., microRNA, DNA methylation) following WUI fire exposures – potential mechanisms linking exposure to carcinogenesis.[6]
- Exposure to PAHs, benzene, and heavy metals – agents known or suspected to cause bladder, lung, skin, and liver cancers among others.[6]

4 Fire Fighter Cancer Cohort Study (FFCCS). *Protocol for a Longitudinal Occupational Cohort Study.* JMIR Res Protoc. 2025. https://pmc.ncbi.nlm.nih.gov/articles/PMC12056432/
5 National Wildfire Coordinating Group (NWCG). *Firefighter Health – Carcinogen Exposure Risk.* 2024. https://www.nwcg.gov/6mfs/firefighter-health-and-first-aid/carcinogen-exposure-risk
6 American Cancer Society. *Fire Fighters and Cancer Risk.* 2025. https://www.cancer.org/cancer/risk-prevention/chemicals/firefighting.html