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## *IARC Monographs* evaluate the carcinogenicity of occupational exposure as a firefighter

**Lyon, France, 1 July 2022** – The International Agency for Research on Cancer (IARC), the cancer agency of the World Health Organization (WHO), has evaluated the carcinogenicity of occupational exposure as a firefighter.

A Working Group of 25 international experts, including 3 Invited Specialists, from 8 countries was convened by the *IARC Monographs* programme for a meeting in Lyon.

After thoroughly reviewing the available scientific literature, the Working Group classified occupational exposure as a firefighter as *carcinogenic to humans* (Group 1), on the basis of *sufficient evidence* for cancer in humans.

A summary of the final evaluations has now been published online in *The Lancet Oncology*.<sup>1</sup> The detailed assessment will be published in 2023 as Volume 132 of the *IARC Monographs*.

### **Evidence for cancer in humans**

Occupational exposure as a firefighter causes cancer. There was *sufficient evidence* for cancer in humans for the following cancer types: mesothelioma and bladder cancer.

There was *limited evidence* for cancer in humans for the following cancer types: colon cancer, prostate cancer, testicular cancer, melanoma of the skin, and non-Hodgkin lymphoma.

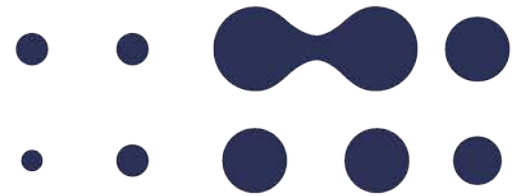
### **Strong mechanistic evidence**

There was *strong* mechanistic evidence in exposed humans that occupational exposure as a firefighter exhibits 5 of the 10 key characteristics (KCs) of carcinogens:<sup>2</sup> “is genotoxic” (KC2), “induces epigenetic alterations” (KC4), “induces oxidative stress” (KC5), “induces chronic inflammation” (KC6), and “modulates receptor-mediated effects” (KC8).

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<sup>1</sup> Demers P, DeMarini D, Fent K, Glass D, Hansen J, Adetona O, et al. (2022). Carcinogenicity of occupational exposure as a firefighter. *Lancet Oncol*, Published online 30 June 2022; [https://doi.org/10.1016/S1470-2045\(22\)00390-4](https://doi.org/10.1016/S1470-2045(22)00390-4)

<sup>2</sup> Evaluating carcinogen mechanisms is a challenging part of hazard identification, because the data on this topic are abundant and diverse. An evaluation approach based on 10 key characteristics of human carcinogens (doi: [10.1158/1055-9965.epi-19-1346](https://doi.org/10.1158/1055-9965.epi-19-1346)) provides a holistic and unbiased way to tackle this challenge. The key characteristics of carcinogens were introduced to facilitate systematic consideration of mechanistic evidence in *IARC Monographs* evaluations.



## Exposure of firefighters

There are more than 15 million firefighters worldwide. The term “firefighters” encompasses a heterogeneous group of paid and unpaid workers in industrial, municipal, and wildland settings, at the wildland–urban interface, and in other situations. In some settings, firefighting exposures have become more prevalent over time, because of the impacts of climate change.

Firefighters respond to various types of fire, such as structure, wildland, and vehicle fires, as well as other events (e.g. vehicle accidents and building collapses).

Firefighters are exposed to a complex mixture of combustion products from fires (e.g. polycyclic aromatic hydrocarbons, volatile organic compounds, metals, and particulates), diesel exhaust, building materials (e.g. asbestos), and other hazards (e.g. heat stress, shift work, and ultraviolet and other radiation). In addition, the use of flame retardants in textiles and of persistent organic pollutants (e.g. per- and polyfluorinated substances) in firefighting foams has increased over time.

This mixture may include many agents already classified by the *IARC Monographs* programme in Group 1 (*carcinogenic to humans*), Group 2A (*probably carcinogenic to humans*), and Group 2B (*possibly carcinogenic to humans*). Dermal exposure, inhalation, and ingestion are common routes of exposure, and biomarker studies among firefighters have found enhanced levels of markers of exposure to polycyclic aromatic hydrocarbons, flame retardants, and persistent organic pollutants.

## *IARC Monographs* classification

The *IARC Monographs* classification indicates the strength of the evidence that a substance or agent can cause cancer. The *IARC Monographs* programme seeks to identify cancer hazards, meaning the potential for the exposure to cause cancer. However, the classification does not indicate the level of cancer risk associated with exposure at different levels or in different scenarios. The cancer risk associated with substances or agents that are assigned the same classification may be very different, depending on factors such as the type and extent of exposure and the size of the effect of the agent at a given exposure level.

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