

Application of the Key Characteristics of Carcinogens to Per- and Polyfluoroalkyl Substances

WHAT DID THE STUDY FIND?

In a paper recently published in the peer-reviewed International Journal of Environmental Research and Public Health, EWG and Indiana University researchers applied the key characteristics of carcinogens framework to the group of chemicals known as PFAS, since some members of this chemical class – PFOA, PFOS and GenX – have been linked to increased cancer risk in human or animal studies.

THE MAJOR FINDINGS INCLUDE:

- Each of the 26 PFAS reviewed, including 11 short-chain PFAS, displays at least one of the key characteristics of carcinogens.
- The type of PFAS that has been studied most – PFOA, formerly used by DuPont to make Teflon, and PFOS, formerly an ingredient in 3M’s Scotchgard – has been the subject of many studies and exhibit up to five key characteristics of carcinogens.
- There is little to no data regarding the key characteristics of carcinogens, and other health effects, for many PFAS currently in use.

The evidence shows that PFOA and PFOS can induce epigenetic alterations and oxidative stress, suppress the immune system, modulate receptor-mediated effects and alter cell proliferation – five of the 10 key characteristics of carcinogens. Each of these characteristics can play a role in cancer development. For instance, cellular processes like growth can be regulated by receptors that, when activated by a chemical, can promote cancer development. Immune suppression can help cancer cells evade the body’s normal defense mechanisms, and oxidative stress can lead to DNA damage.

WHAT ARE PFAS?

Per- or polyfluoroalkyl chemicals, known as PFAS, are a family of thousands of chemicals used to make water-, grease- and stain-repellent coatings for a vast array of consumer goods and industrial applications. These chemicals are notoriously persistent in the environment and contaminate water, food and air.

Most people are contaminated with PFAS, including perfluorooctanoic acid, or PFOA, and perfluorooctanesulfonate, or PFOS, compounds with an eight-carbon



fluorinated chain that are no longer produced in many countries and are restricted by the Stockholm Convention on Persistent Organic Pollutants.

In epidemiological studies, exposure to PFAS, particularly PFOA and PFOS, is associated with changes in hormonal balance and thyroid function, weakened immune response and decreased effectiveness of vaccines, increased cholesterol, harm to the developing fetus and elevated risk of cancer.

WHAT ARE THE KEY CHARACTERISTICS OF CARCINOGENS?

The key characteristics of carcinogens refer to a framework used to identify a chemical's potential to cause cancer. It is used by the International Agency for Research on Cancer, or IARC, an agency within the World Health Organization.

The framework identifies 10 biological traits of known human carcinogens, based on the mechanisms or ways that they can lead to cancer development. The framework defines features of chemicals that, if present in people or laboratory animals, can lead to hallmark features of cancer, such as inflammation, dysregulated metabolism, and change in cellular signaling inside cells and among different cells, as well as weakening or suppression of immune response that is essential for defense against cancer.

HAVE GOVERNMENT AGENCIES ASSESSED PFAS CANCER RISK?

The IARC classifies PFOA as a possible human carcinogen, and the Environmental Protection Agency says both PFOS and the PFOA-replacement chemical GenX show evidence of carcinogenicity. In humans, elevated PFOA levels are associated with a greater risk of non-Hodgkin lymphoma and kidney, testicular, prostate and ovarian cancers.

WHAT ABOUT SHORT-CHAIN PFAS?

Short-chain PFAS are used commercially, but there are no human or animal studies that either the EPA or IARC can use to evaluate their carcinogenicity. This paper highlights the fact that all of the PFAS that have been evaluated can affect processes associated with cancer development.

Although more research is still needed, the study suggests that short-chain PFAS likely pose a risk to human health.

