

Fact sheet - PFAS in skiing

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PFAS exposure in skiing

In all types of skiing, there is exposure risk to per- and polyfluorinated substances (PFAS) which have shown negative impacts on health and environment. PFAS are used in ski wax for their excellent water and dirt repelling properties, and to reduce ski friction against snow. In addition to the direct exposure related mostly to ski waxing, there is diffuse spreading of ski wax in the environment through snow, water and sediment which cause more long-term effects from PFAS. These substances are unable to degrade in nature and humans and other mammals absorb them through air, water and food.

In competitive skiing, voluntary regulations are already underway, and more are likely to follow in the coming years. With regulation, either legal or voluntary, comes the challenge of establishing control systems, acquiring deeper knowledge and creating a dialogue on fair play and reasonable measures to ensure a clean sports environment.

There are over 4700 different PFAS only a handful of which are well documented regarding functional properties, and health and environmental effects. PFAS have previously also been called (per)fluorocarbons, sometimes abbreviated PFC. In ski waxes they are often named “fluor”, “fluoro-“, “fluorine” or “fluorinated”. Abbreviations F, LF and HF are typical signs of PFAS content in ski waxes. This type of organic fluorine should not be confused with the inorganic fluorine used in toothpaste, which does not show similar health risk profiles.

Direct exposure

In the ski waxing work environment, high concentrations of PFAS are often present. Emission of volatile fluoro-organic vapours while heating and airborne dust particles from scraping/brushing are the most clearly identified routes of direct exposure [1-4]. Repeated exposure through inhalation may result in “polymer fume fever” or “Teflon flu”, a flu-like condition with fever, dyspnea and aching which typically subsides after some time away from the waxing shed/truck. Elevated levels of PFAS in blood (50 times higher) and serum have been measured in professional ski wax technicians compared to the general population [4-6]. Many professional ski wax teams are today using air filtering systems, proper breathing masks and protective clothing to address the PFAS air contamination.

Diffuse spreading

A pair of well waxed skis are coated with a very thin layer of ski wax, which through abrasion is worn off in the ski track and spread through the snow [7, 8]. Additionally, PFAS contaminants are present on most surfaces of the waxing area, and can be carried out with shoes, clothing, equipment and skis for further spreading outdoors. The most likely path for this diffuse spreading is via snow into the sediment and soil to ground water, and eventually into drinking water supply [9].

PFAS have the potential to be transported over long distances through the atmosphere or water and are globally distributed in the environment. PFAS have, for example, been detected in species from the Barents Sea food web [10] and in polar bears [11], indicating bioaccumulation high up in the food chain. PFAS have been also been detected in human blood and serum [12, 13], and even in the blood of infants [12, 14].

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Health Effects

The health effects of long-term diffuse PFAS exposure are still to be established over the coming decades. These substances accumulate in the body by binding to proteins, unlike traditional environmental pollutants that accumulate in fat tissue. Available studies today, mainly from animal tests, indicate a link between high levels of some PFAS substances and liver damage, increased levels of cholesterol, cardiovascular effects, endocrine effects, immune effects (lower response to vaccines and asthma) and reproductive and developmental effects [14-17]. Although evidence for cancer is not conclusive, some PFAS are suspected to have carcinogenic potential where increases in testicular and kidney cancer have been observed in highly exposed humans [17, 18]. Even though the studied PFAS have shown negative effects on health, more studies are needed to screen a wider range of PFAS.

Waste handling

To limit release of PFAS in nature, ski wax waste should be collected from the area and sent to specific incineration units. The carbon-fluorine bond in PFAS is extremely strong and stable [19]. The properties of PFAS which make them effective and widely used in consumer products also make them difficult to treat and dispose properly. An incineration temperature over 1000 °C is recommended to completely combust these substances [20].

Legal measures

Two PFAS and their related substances (substances that may degrade to those PFAS) are today restricted in EU. PFOS has been limited to 10 mg/kg in chemical products under EU Persistent Organic Pollutant regulation since 2010. PFOA will be limited to 25 ppb in chemical products on the market from 2020. A few PFAS are listed in the REACH candidate list for Substances of Very High Concern (SVHC) and additional PFAS are likely to enter the list in the near future. Substances on the candidate list are often prioritized for further data collection and risk assessments and may become restricted or prohibited.

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