Forever chemicals in ski wax are being spread on snowy slopes

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Every February half-term, I think back to the French ski trips I went on

as a teenager. I remember the freshness of the cold, crisp air as I snow-plowed my way down the slopes. Escaping to somewhere seemingly so pristine felt like a world away from where I grew up in London.

Back then, I never considered that snow could be a potential source of exposure to a harmful chemical. However, recent evidence suggests that persistent, synthetic chemicals are being transferred into snow and soil from waxes applied to the surfaces of skis to enhance performance.

Nicknamed forever chemicals, per- and poly-fluoroalkyl substances (PFAS) are a class of more than 10,000 different chemicals, many of which have been used since the 1950s. They repel water and oil, so they make great waterproof coatings for clothing, greaseproof paper, and construction materials.

Some act as surfactants, allowing different liquids to mix more easily. Many resist high temperatures, so they're ideal for making non-stick frying pans and firefighting foams.

Certain PFAS are used in ski wax applied to skis and snowboards as lubrication. By making surfaces of ski kit more slippery, skiers can speed up and make smoother turns as they travel from piste to piste. A new study has found high PFAS concentrations in ski waxes and in the snow and soil sampled from popular skiing areas in Austria.

The problem with persistence

PFAS are organoflourine compounds—their super strong carbon-flourine bonds make them incredibly stable. Because PFAS don't break down easily, they can persist inside our bodies or in the environment for many years.

A single dose of perfluorooctanoic acid or PFOA, one of the most well-

studied PFAS, could take between three and seven years to reduce by half inside the body—that means it could take 100 years to eliminate 99.9% of that dose.

Some PFAS can be toxic to humans and wildlife, with links to cancers, developmental and reproductive problems, hormone disruption, diabetes and obesity.

A slippery slope?

The presence of PFAS in ski waxes is not a new discovery. In 2010, a Swedish study, found high levels of various PFAS in ski wax and in the blood of ski-waxing technicians.

The fascinating thing about the new study is the potential for these chemicals to transfer into the environment from recreational and professional skiing equipment. She reveals that PFAS levels in the snow and soil from skiing areas are consistently higher than in those from the control sample collected away from skiing areas, indicating that skiing can act as a source.

The researchers highlight how the PFAS profiles (the combination of different PFAS found in each sample) differed between locations and sample types. This variability was attributed to differences between ski waxes that had been manufactured at different times or in different places.

I would suggest that additional sources of PFAS are likely in these areas, particularly as PFAS were still sometimes detected in areas of no skiing. They are present in some waterproof clothing, which is worn in abundance by skiers, and in food packaging, paints and cabling—all of which will be found in these areas. These products are likely to display different PFAS profiles.

The new study highlights the difficulty of assessing PFAS globally. There are so many different individual PFAS chemicals. So much so that there's still uncertainty over the true number that exist. With PFAS in so many products, it's hard to identify a singular source.

With so many PFAS in circulation, it's hard to know which ones to test for. The researchers in the new study searched for 34 PFAS chemicals—that's no easy task. For every PFAS measured, analysis takes more time and money and gets more complicated.

The sum of the concentrations of these 34 PFAS represented less than 1% of the total organofluorine present in the same samples, so the true PFAS concentration could be even higher.

A class-based approach

Historically, individual chemicals have been banned depending on toxicity, persistence and resistance to degradation. This has invariably led to the replacement of banned chemicals with structurally similar ones.

Assessing 10,000 PFAS individually would be impossible. PFAS display varying levels of toxicity and persistence with some breaking down quite readily, but in recent years, environmental chemists have called for PFAS to be regulated together as a group or class.

The European Chemicals Agency is considering a proposed restriction to ban the manufacture and use of PFAS, with some exemptions for essential use where no alternatives exist. If accepted by member states, it could prove a significant step towards the beginning of the end for forever chemicals. Meanwhile, UK legislation falls behind by focusing on individual PFAS, with delays in implementing new restrictions.

Interestingly, PFAS-containing waxes were banned by the International Ski and Snowboard Federation at the start of the 2023—2024 season. Norwegian Olympic silver medallist Ragnhild Mowinckel was disqualified last October for competing with fluorinated wax.

But a ban that only applies to professional competition won't stop PFAS chemicals from reaching the slopes. A ban on the manufacture of PFAS-containing products is crucial. Only then can we prevent PFAS reaching the mountains, and even with a comprehensive ban now, PFAS already in the snow won't disappear within my lifetime.

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