



Short-chain Fluorinated Replacements: Myths versus Facts



Long-chain highly fluorinated chemicals — including PFOA, PFOS and other C8 compounds — were used for decades to give water-repellent, stain-resistant, and non-stick properties to furnishings, carpets, food packaging, outdoor gear and other products. Exposure to PFOA has been linked to kidney and testicular cancer and thyroid problems, while exposure to PFOS is associated with decreased fertility and adverse developmental effects. Both are linked to elevated cholesterol and obesity in adults, and decreased immune response in children¹.

Due to such harmful effects, the long-chain chemicals were recently phased out and replaced by numerous similar compounds, including short-chain molecules called C6 and C4². Industry says these alternatives are safe, sustainable, and well-tested³. A look at the facts shows those claims don't stick.

THE BOTTOM LINE

Highly fluorinated chemicals pose a potential risk to human health and the environment, and should only be used with safeguards and when their function is essential.



MYTH: C6 and other fluorinated replacements have been thoroughly tested and are safe.

FACT: The replacements never break down and may cause similar health problems as the long-chain compounds.

According to the California Department of Public Health⁴, “other than PFOA and PFOS, the potential toxicity of [highly fluorinated chemicals] has not been well characterized.” The data that do exist are cause for concern.

Sixteen reports to the U.S. EPA filed by DuPont⁵ showed that animals exposed to GenX (which replaced PFOA in the manufacture of Teflon) had increased cancer incidence and changes to their liver and immune systems. These effects are similar to those from exposure to PFOA. The replacement compounds are known to adversely impact hormonal systems via a similar mechanism as the long-chain chemicals.⁶ A recent paper concluded that “some fluorinated alternatives have similar or higher toxic potency than their predecessors... ”⁷

In 2015, more than 200 scientists from around the world signed the Madrid Statement, which called for limiting the production and use of all highly fluorinated chemicals⁸.



MYTH: Short-chain highly fluorinated chemicals (e.g., C6, C4) do not accumulate in human tissues, and are therefore not a health concern.

FACT: Scientists are only beginning to understand what happens to short-chain fluorinated alternatives in the human body.

A 2013 study found greater concentrations of short-chain fluorinated chemicals than long-chain chemicals in human kidney, lung, liver, and brain⁹. Other scientists found similar results in mice¹⁰. According to the Danish Environmental Protection Agency¹¹, “the high presence of short-chain [fluorinated chemicals] in human tissue... is worrying.”



MYTH: C6 and other highly fluorinated chemicals are sustainable.

FACT: Short-chain and other fluorinated replacements are as persistent as long-chains and are even more difficult to cleanup.

To be sustainable, chemicals should break down quickly after their intended use. Short-chain highly fluorinated chemicals do not break down in nature⁸. Like their long-chain cousins, they will be with us forever.



Because they do not break down, highly fluorinated chemicals make their way from the products we use into the environment, where they are difficult to remove. Activated carbon filtration, commonly used for removing long-chain compounds from water, is less effective at removing short-chains¹². Highly fluorinated chemicals can move from contaminated water into food crops such as lettuce and strawberries. Short-chain alternatives are found in such crops at higher levels than long-chains¹³.

A recent paper by prominent scientists demonstrated that highly fluorinated chemicals are “**an intractable, potentially never-ending chemicals management issue.**”²



MYTH: “PFOA-free” means safe.

FACT: Products advertised as “PFOA-free” often contain replacement chemicals made with the same problematic chemical building blocks as PFOA.

C8 chemicals have been replaced by numerous related substances that are equally persistent and may pose similar health risks¹⁴. To prevent such “regrettable substitutions”, the entire class of highly fluorinated chemicals should be avoided. Ask for products that do not contain any highly fluorinated chemicals (often labeled “fluorine-free”).



MYTH: Highly fluorinated chemicals are necessary for modern life.

FACT: Many brands are removing all highly fluorinated chemicals from their products: IKEA, Crate & Barrel, Levi Strauss and more than 50 others.

REFERENCES

1. C8 Science Panel. “C8 Probable Link Reports.” Accessed 2/22/17. http://www.c8sciencepanel.org/prob_link.html; ; U.S. EPA. Technical Fact Sheet - Perfluorooctane Sulfonate (PFOS) and Perfluorooctanoic Acid (PFOA). Accessed 6/1/18. https://www.epa.gov/sites/production/files/2017-12/documents/ffrrofactsheet_contaminants_pfos_pfoa_11-20-17_508_0.pdf; Liu, et al. *PLoS medicine* 15.2 (2018): e1002502.
2. Wang, et al. *Environ. Int.* 75 (2015): 172-179; Wang, et al. *Environ. Sci. Technol.* 51.5 (2017): 2508-2518.
3. “DuPont Capstone Surfactants and Repellants – an Overview.” Accessed 10/27/16. [http://www2.dupont.com/Capstone/en_US/assets/downloads/Capstone\(R\)_Overview_Document_rev28march2011.pdf](http://www2.dupont.com/Capstone/en_US/assets/downloads/Capstone(R)_Overview_Document_rev28march2011.pdf)
4. Biomonitoring California. “Potential Designated Chemicals: Perfluoroalkyl and Polyfluoroalkyl Substances (PFAS)”. Accessed 9/9/16. http://www.biomonitoring.ca.gov/sites/default/files/downloads/PotenDesigPFASs_031315.pdf.
5. Lerner, S. “New Teflon Toxin Causes Cancer in Lab Animals.” *The Intercept*, 2015.
6. Rosenmai, et al. *Andrology* 4.4 (2016): 662-672.
7. Gomis, et al. *Environ. Int.* 113 (2018): 1-9.
8. Blum, et al. *Environ. Health Perspect.* 123.5 (2015): A107-A111.
9. Perez, et al. *Environ. Int.* 59 (2013): 354-362.
10. Burkemper, et al. *Environ. Sci. Technol. Lett.* 4.6 (2017): 211-215.
11. Danish Ministry of the Environment. “Short-chain Polyfluoroalkyl Substances (PFAS). A literature review of information on human health effects and environmental fate and effect aspects of short-chain PFAS.” <http://www2.mst.dk/Udgiv/publications/2015/05/978-87-93352-15-5.pdf>. Accessed 10/17/16.
12. Appleman, et al. *Water Res.* 51 (2014): 246-255; Eschauzier, et al. *Environ. Sci. Technol.* 46.3 (2012) 1708-1715; Xiao, et al. *Environ. Sci. Technol.* 51.11 (2017): 6342-6351.
13. Blaine, et al. *Environ. Sci. Technol.* 48.24 (2014): 14361-14368; Blaine, et al. *Environ. Sci. Technol.* 47.24 (2013): 14062-14069.
14. American Public Health Association. Policy Number 20163. (2016); Scheringer, et al. *Chemosphere* 114 (2014): 337-339.