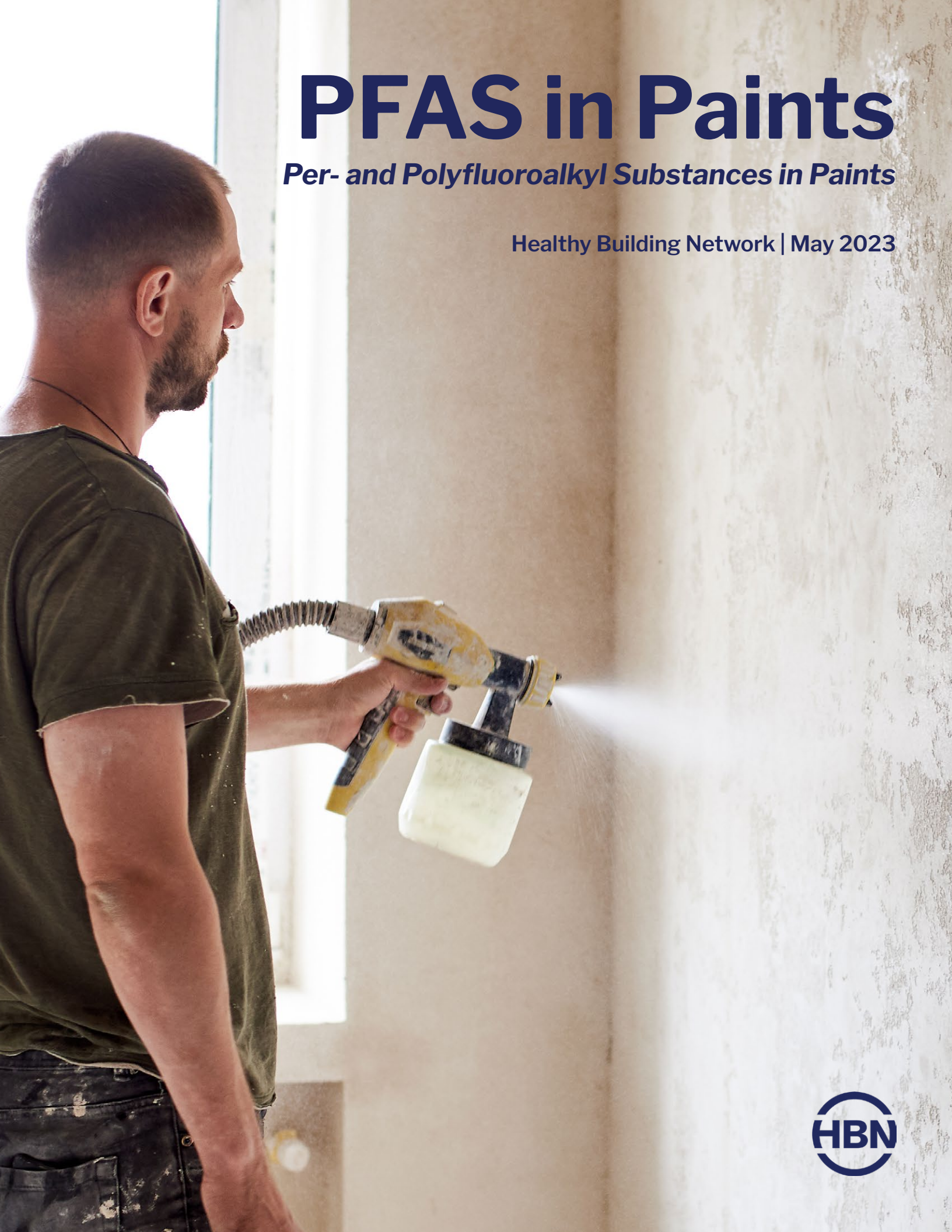

PFAS in Paints

Per- and Polyfluoroalkyl Substances in Paints

Healthy Building Network | May 2023

Executive Summary

Breaking news! New research has discovered that paint products contain 'forever chemicals' called PFAS. Healthy Building Network tested 94 paints and found approximately half tested positive for fluorine, a marker of PFAS.

This comes as disappointing news at a time when the U.S. federal government has proposed the first ever national drinking water standard for certain PFAS[1], while major corporations like REI, McDonald's, and Target are announcing phase-outs of all PFAS.[2] [3] [4] Even 3M, the inventor of these chemicals, has announced they will stop producing PFAS by 2025.[5] We encourage paint companies to follow suit and eliminate PFAS from their products.

What are PFAS?

Per- and polyfluoroalkyl substances (PFAS) are a large class of man-made chemicals used widely across industries as stain-, oil-, and water-repellents, among other functions. PFAS are commonly referred to as "forever chemicals" due to their persistence in the environment. They can also build up in body tissues, showing up in almost every person in the US.[6] They are associated with: negative impacts on cholesterol levels, liver function, and pregnancy and birth outcomes; increased risks of certain cancers; and decreased vaccine response and immune function.[7] [8]

Scale of the PFAS Problem

In 2021 the volume of architectural paint in the United States totaled approximately 868 million gallons, and in 2023, the production volume of the entire paint and coatings industry in the United States will surpass 1.38 billion gallons.[9] [10]

Architectural paints coat the inside and outside our homes, schools, and workplaces, making PFAS in paints a potential exposure concern for everyone from those who manufacture and apply the paints to those who occupy painted spaces. They're a health and environmental concern throughout their lifecycle, from cradle to grave.

Though PFAS additives may be used in small amounts, a variety of factors make paints an unacceptable source of PFAS and an important target for phase-out, including: the scale of the paints and coatings industry, volatility of certain PFAS, the use of paint in interior spaces, and the fact that there are safer alternatives available.

The Solution

If the bad news is that about half of the paints sampled tested positive, the good news is that half of the paints did *not* contain PFAS, suggesting that the paint industry can likely avoid these chemicals and feasibly phase PFAS out of formulations.

We are using these testing results to engage with paint manufacturers to get PFAS out of paints, and to improve transparency so that consumers know what they are buying. We have updated our **paint guidance** and are encouraging large buyers and specifiers to request and specify PFAS-free paints using **HBN's request template**. Read on below for more details on our testing, findings, and what we think paint manufacturers, large buyers, and specifiers can do to help get PFAS out of paint.

a *"PFASs are defined as fluorinated substances that contain at least one fully fluorinated methyl or methylene carbon atom (without any H/Cl/Br/I atom attached to it), i.e. any chemical with at least a perfluorinated methyl group (–CF3) or a perfluorinated methylene group (–CF2–) is a PFAS."*[11]

PFAS

Per- and polyfluoroalkyl substances (PFAS) are a large class of man-made chemicals used widely across industries as surfactants and as stain-, oil-, and water-repellents. PFAS are defined in this report as as they are by the Organisation for Economic Co-operation and Development (OECD).[a] Over ten thousand different chemicals that meet this definition of PFAS have been registered in the US.[12] Collectively, these >10,000 chemicals are referred to as the chemical class of PFAS.

Properties that make PFAS prized in industry, such as their stability, also make them harmful to human and environmental health. PFAS are commonly referred to as "forever chemicals" due to their persistence in the environment. They can also build up in body tissues and are found in almost every person in the US.[6] This ubiquitous and persistent exposure is concerning in light of the negative health effects of certain PFAS including impacts on cholesterol levels, liver function, and pregnancy and birth outcomes; increased risks of certain cancers; and decreased vaccine response and immune function.[7 8]

A Class-based Approach

The persistent, bioaccumulative, and toxic nature of PFAS have made them a target for scrutiny and phase-out. Many prior restriction efforts narrowly focused on specific chemicals, such as perfluorooctanoic acid (PFOA) and perfluorooctane sulfonate (PFOS). These two widely-used and well-studied PFAS have been largely phased out of production in the US since the early 2000s, but may be in imported products from other countries.[13] Well after phase-out of domestic production of PFOA and PFOS, research and advocacy efforts have uncovered these and other PFAS in cosmetics, food packaging, children's products, textiles, and more.[14 15 16 17]

The mounting scientific evidence of adverse health effects has prompted broader regulations such as California's recent ban on textiles containing any PFAS[18] and company commitments, such as 3M and McDonalds, which will stop manufacture and use, respectively, of PFAS in the near future after public and legal pressure.[4] [5] These more recent efforts aim to phase-out the entire chemical class of PFAS, instead of a single PFAS chemical like PFOA or PFOS. Class-based approaches are preferred, as they avoid regrettable substitutions with another member of the PFAS family. However, they have yet to be widely adopted. The paint industry, for one, lacks regulation or manufacturer commitment on PFAS and limited transparency makes it difficult for consumers to know whether the paints they use contain PFAS or not.

Assessing Paints for PFAS

This project aimed to assess the presence of PFAS in paints, an under-studied industry target for PFAS use and exposure. We tested 94 paints for total fluorine (TF) and a subset for extractable organic fluorine (EOF), indicators of PFAS.

We selected 94 paint samples across brands, price tiers, gloss, base, and colorants. Samples represented eight major paints and coatings manufacturers that together have over 65% of the paints and coatings market share in North America: Sherwin-Williams and sub-brands Valspar and Krylon, Benjamin Moore, Kelly Moore, PPG, Rodda, Behr, Miller, and Rust-Oleum. Paint types included interior, exterior, and specialty paints (chalkboard, dry-erase, bathroom/spa, and traffic striping). Dried paint samples were screened for TF using the Particle Induced Gamma Ray Emission (PIGE) method in Dr. Graham Peaslee's lab at the University of Notre Dame. The PIGE measurement methodology has been described elsewhere.[14]

Results from the PIGE testing informed selection of a subset of 21 paint samples for further evaluation of TF and EOF using combustion ion chromatography (CIC) performed by Eurofins Laboratory. See Eurofin's methodology for combustion ion chromatography for details.[19]

Results

Of the 94 samples screened for TF using PIGE, approximately 50% had detectable levels of fluorine, an indicator of PFAS. Fluorine was detected in all brands of paint and within brands, sample detection rates ranged from 30%-92%. In paint products with measurable fluorine, concentrations ranged from 42-688 parts per million (ppm) TF.

Of the paints that tested positive for TF using the PIGE method, we selected 21 for further testing using combustion ion chromatography (CIC). All samples had measurable levels of TF using CIC and 18 of 21 samples contained extractable organic fluorine (EOF), another strong indicator of PFAS. All brands tested had at least one sample with measurable TF and EOF.

Detection Frequencies of Total and Organic Fluorine in Paints

	Brand A	Brand B	Brand C	Brand D	Brand E	Brand F	Brand G	Brand H
Total Fluorine [b] (N=94)	29% (N=38)	92% (N=13)	33% (N=12)	75% (N=12)	83% (N=6)	80% (N=5)	40% (N=5)	33% (N=3)
Extractable Organic Fluorine (N=21) [c]	67% (N=6)	100% (N=4)	100% (N=3)	75% (N=4)	100% (N=2	100% (N=2)	Not tested	Not tested

b *Total fluorine by PIGE method*
c *Extractable organic fluorine by CIC method*

PFAS in Paint Formulations

One potential source of PFAS in paint formulations is fluorinated surfactants, which are advertised for their ability to improve adhesion, cleanability, and chemical resistance and are marketed as providing superior surfactant properties at lower quantities than conventional surfactants.

Though the actual chemical structures of these fluorosurfactants are proprietary, researchers have experimentally uncovered the structures of some name-brand fluorosurfactants commonly marketed for use in paint, namely Capstone FS-30 and Capstone FS-64 by Chemours and S-106A by Chemguard. Capstone FS-30 appears to be the short-chain PFAS 6:2 FTOH.[20] Using this information and the suggested dosing of active ingredient for Capstone FS-30, concentrations of fluorine in paint formulations would be expected in the range of 68-680 ppm F from surfactants based on 6:2 FTOH, which is in line with the data reported here. [d] [21]

There has been an industry shift toward this sub-class of short-chain fluorotelomers after mounting concerns about the persistence and bioaccumulation of long-chain PFAS. While industry has claimed these are safe, recent research into the degradation products of 6:2 FTOH show it can take a long time to eliminate the compounds from the body especially after a period of high exposure, and in 2020 the FDA announced a voluntary phase-out of food packaging products containing 6:2 FTOH due to such concerns, among others.[22] [23] A recent OECD report identified fluorosurfactants as a significant source of PFAS in household paints.

d *Analysis of Capstone FS-30 by NMR spectroscopy reveals it to be 6:2 FTOH with a chemical formula C8H5F13O.[22] 6:2 FTOH has a molecular weight of 364.10 Da. Active ingredient dosing suggested by Chemours is 0.01-0.1% or 100-1000 ppm. Fluorine represents 67.84% of the molecular weight of 6:2 FTOH. Therefore the suspected range of F (ppm) in paints using Capstone FS-30 would be (100 ppm x 0.6784) to (1000 ppm x 0.6784) or 68-680 ppm F.*

Importantly, this report also outlines alternatives to fluorosurfactants in paints suggesting that these persistent, bioaccumulative, and toxic substances are not chemically necessary to formulate paint and can feasibly be phased-out.[11]

6:2 FTOH is a volatile PFAS (boiling point <250 C) which raises concerns about inhalation exposure from paints. Recent research from scientists at Oregon State University found 6:2 FTOH and 6:2 diPAP in interior and exterior paints. Exposure assessment modeling of study data show that at least one paint would likely exceed the reference dose for 6:2 FTOH in children and adults, indicating inhalation exposure potential to these compounds from paints.[24] A paint labeled low-VOC (or low in volatile organic compounds) unfortunately does not mean it is PFAS free. PFAS are not likely captured by current VOC standards. This is a reminder that information on VOCs is only one of several variables to consider when assessing the health of materials, as low-VOC products may contain other harmful chemicals.[25]

Regrettable Substitution

The paint industry has made laudable progress in recent years moving away from the use of alkylphenol ethoxylate (APE) surfactants, chemicals that persist in the environment and can disrupt the body's hormone system.[26] However, suppliers of fluorosurfactants are marketing their products as APE-free, resulting in the potential for regrettable substitution of one toxic chemical for another. Marketing for Chemours' Capstone line of fluorosurfactants include descriptions such as "products that help protect people as well as the environment", "environmentally preferred", and VOC-free while keeping their structures proprietary and not indicating that these chemicals are actually PFAS.[27] A critical step in phasing out PFAS in paints will be ensuring that alternatives undergo full chemical hazard assessments to avoid regrettable substitutions.

Manufacturer Outreach

Manufacturers sampled for this study were contacted but did not comment on the use of PFAS in their formulations. Communications confirmed the use of fluorosurfactants in certain products, establishing that these are a significant source of PFAS in paint and target for phase-out and innovation.

Next Steps

While fluorosurfactants provide one likely source of PFAS in paints, PFAS are used widely and may be introduced at many potential points along the paint supply chain. As a first step, we urge manufacturers to publicly disclose all intentionally added ingredients in their paints. The paint industry has lagged behind others in the building material sector in providing adequate transparency, leaving the end users and policy makers with incomplete data.

Since PFAS concentrations in paints are often below minimum reporting thresholds, they have not been captured by the existing ingredient disclosure efforts. Manufacturers will need supplier transparency to fully participate in product transparency, and they should engage with their suppliers to enable full disclosure. Many manufacturers provide disclosure while maintaining proprietary information. Industry standard documentation such as **Health Product Declarations** provides ways to do this.

Paint manufacturers need to phase-out all use of intentionally-added PFAS. Given that some paints do not contain PFAS, it is clear that PFAS-free alternatives exist. Care should be taken to ensure that PFAS are not replaced with other hazardous chemicals such as alkylphenol ethoxylates (APEs). To avoid regrettable substitution and facilitate informed material selection all alternatives must have full chemical hazard assessments.

Buyers and specifiers are uniquely positioned to request more from manufacturers on product health and transparency. We encourage large scale purchasers to use their purchasing power to shift the market towards healthier products.

Call to Action

Paint industry and suppliers:

Publicly disclose all intentionally added paint ingredients including PFAS at any level.

Immediately phase-out all intentionally-added PFAS and identify sources of unintentional PFAS.

Assess substitute chemicals for hazards using a method such as GreenScreen for Safer Chemicals® or ChemFORWARD to ensure that any replacement chemicals are the safest possible, excluding at a minimum GreenScreen Benchmark 1 chemicals or ChemFORWARD F chemicals. Ask your suppliers to have their trade name solutions assessed by a third-party such as **ChemFORWARD SAFER**.

Retailers, buyers, and specifiers:

Use HBN's **paint guidance** to select safer paints and **use this form** to request a paint that meets the transparency and material health attributes specified by Healthy Building Network (HBN).

Request public disclosure of all intentionally added ingredients, including PFAS at any level, using the Health Product Declaration (HPD) or Declare label.

Support bans on PFAS and requirements for ingredient transparency in the paint industry.

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