Inspiration, Experiences and Tools

Conference and Workshop on PFAS Substitutions and Enforcement in the Nordic Countries, September 2024

Nordic Council of Ministers

Contents

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List of abbreviations

19F NMR	19F nuclear magnetic resonance
ChemSec	The International Chemical Secretariat
CIC	Combustion ion chromatograph
EOF	Extractable organic fluorine
ETFE	Ethylene tetrafluoroethylene
FCM	Food contact material
F-gases	Fluorinated gases
FORUM	Forum for Exchange of Information on Enforcement
FIS	The International Ski and Snowboard Federation
FTIR	Fourier Transformed Infrared
INCI	International Nomenclature of Cosmetic Ingredients
LC-MS/MS	Liquid chromatography-tandem mass spectrometry
LOQ	Limit of quantification
NMR	Nuclear magnetic resonance
PARC	Partnership for the Assessment of Risks of Chemicals
PFAAs	perfluoroalkyl acids
PFAS	Per- and polyfluoroalkyl substances
PFCAs	Perfluoroalkyl carboxylic acids
PFOA	Perfluorooctanoic acid
PFOS	Perfluorooctane sulfonic acid

PPWR	EU packaging and packaging waste regulation
Products	In this report, the term 'products' generally includes articles and consumer mixtures
PTFE	Polytetrafluoroethylene
Pyr-GC/MS	Pyrolysis-gas chromatography-mass spectrometry
RISE	Research institutes of Sweden
SIN list	Substitute it now list
SMEs	Small and medium-sized enterprises
TF	Total fluorine
TFA	Trifluoroacetic acid
TOF	Total organic fluorine
TOPA	Total oxidizable precursor assay
TULAC	Textiles, Upholstery, Leather, Apparel, Carpets

Preface

The Nordic Conference on PFAS Substitution – Inspiration, Experiences and Tools was held at the World Trade Center in Stockholm on the 2nd of September 2024. In addition, a back-to-back workshop on enforcement of PFAS in consumer products was held on the 3rd of September 2024. The conference and workshop were part of the programme of the Swedish presidency of the Nordic Council of Ministers in 2024. The activities were commissioned by the Swedish Government and funded by the Nordic Council of Ministers. The Swedish Chemicals Agency organised the events.

A total of 146 participants attended the PFAS substitution conference on site, representing national or regional agencies (53) companies that produce, import and/or sell products (52), research institutes or academia (10), consultancy companies (7), commercial laboratories (6), trade associations (4), waste/recycling industry (4) and other actors (10).

The workshop on enforcement of PFAS gathered 21 participants from Sweden, Norway, Denmark, Finland and Austria, which mostly represented nation agencies.

The conference and the workshop represent two of several activities on PFAS that have been conducted within the Nordic cooperation over the years. The themes for the conference and the workshop were based upon the experiences of these prior Nordic activities and reports.

This report summarises the presentations and discussions at the conference and workshop and does not necessarily reflect the Nordic Council of Ministers' views, opinions, attitudes or recommendations.

1. Short summary and outcome of the conference and workshop

1.1 Background and objectives

The Nordic countries have been part of the forefront on the science of PFAS and played active roles in the regulatory actions taken on PFAS in the EU and globally. For example, in January 2023, Sweden, Norway and Denmark, in collaboration with Germany and the Netherlands, submitted a proposal for a universal PFAS-restriction in the EU. A broad PFAS restriction is urgently needed to minimise the exposure to humans and the environment. The broad scope of the proposal entails that essentially all PFAS will be restricted (with some derogated uses). However, companies and enforcement agencies face many challenges in complying with and enforcing the upcoming restriction (and existing PFAS restrictions) as well as finding and implementing non-PFAS alternatives.

In response to these challenges *the Nordic Conference on PFAS Substitution – Inspiration, Experiences and Tools* was initiated by the Nordic Council of Ministers. The aim of the conference was to gather Nordic companies and agencies to highlight potential challenges and opportunities and to show the way forward toward a PFAS-free future. The goals were to increase the knowledge about the current and upcoming restrictions, spread information about tools for PFAS substitution, share experiences of analytical methods and inspire companies to phase out PFAS.

The aim of the back-to-back workshop was to gather Nordic agencies to share experiences of enforcement project and other activities on PFAS and to discuss challenges and opportunities for enforcement and compliance testing. Furthermore, ideas for possible future Nordic projects were discussed.

1.2 Summary and key messages

Opening speech

The conference was opened by Romina Pourmokhtari, the Swedish Minister for climate and the environment. The Minister highlighted that the Nordic countries lead the way towards phase-out of PFAS. Furthermore, she said that sharing experiences of substitution, analytical methods and tools, which is the aim of the conference, is in line with the Nordic region as a pioneer in a competitive and innovation-driven transition. For the full speech, see Appendix 3.

Introduction

In the first out of two introductory presentations, Professor Ian Cousins from Stockholm University introduced the audience to PFAS - the definition, diversity, properties and uses. In summary, he pointed out that although PFAS comprise a heterogenous group of substances, the high persistence is the underlying driver of Nordic and global PFAS problems. Furthermore, the continuous release of PFAS will lead to accumulation somewhere in the environment until known or unknown effect thresholds are exceeded, and due to the substances' high persistence, the exposure is poorly reversible.

In the second introductory presentation, Audun Heggelund from the Norwegian Environmental Agency gave the audience an overview of the existing and upcoming restrictions of PFAS. He highlighted the active role of the Nordic countries for the regulatory process on PFAS.

KEY MESSEGES – INTRODUCTION

- All PFAS are extremely persistent or transform to other PFAS that are extremely persistent.
- Continuous release of PFAS results in increasing levels in the environment and increased probabilities of known and unknown effects. If harmful levels are reached, exposure is difficult to reverse.
- Regulations are a driver for substitution. A broad PFAS restriction is needed to avoid regrettable substitution to other PFAS while also sets framework for the substitution needed.

Inspiration

There are companies that strive towards offering PFAS-free products on the market. Many of these companies go beyond current legislations on PFAS and essentially already comply with the proposed universal PFAS restriction. At the conference, five companies shared their experiences from their journeys to phase out PFAS, including the challenges and opportunities they have encountered. They also gave advise to other companies that want to embark on the same journey.

KEY MESSEGES – INSPIRATION

- If companies work together and raise similar requirements on suppliers it is possible to impact product development and the market.
- Companies need to have internal policies and goals in place as a foundation for the substitution work. The substitution work needs to permeate the entire organisation, starting with management.
- PFAS should not be used out of old habit. Companies and producers should question whether a product really needs PFAS for a certain treatment or function.
- Knowledge is key for efficient communication down the supply chain. Companies that want to work on substitution of PFAS should consider seeking knowledge and help from external sources.
- Companies are advised to start by mapping the materials that most likely contain PFAS, instead of starting with the whole product line at the same time, which can be overwhelming.
- Companies can precede the legislations. Environmental claims can be a competitive advantage.
- Companies that work with substitution of PFAS consider that the legislations should be strict, set into force faster, and be enforced more frequently. This would help to achieve a level playing field. Enforcement campaigns by agencies and exposure in media may drive companies to change.

Experiences

Several reports, funded by the Nordic Council of Ministers, have reviewed the range of analytical methods available for measuring PFAS in products (Nordic Council of Ministers 2022, 2024a, 2024b). Despite the advances in analytical chemistry of PFAS, compliance testing of products remains challenging due to the (i) need for multiple methods to test different limit values and (ii) general lack of standardised and validated methods for products. This section of the conference provided a brief overview of different types of analytical methods, introduced a workflow for tiered compliance testing of products and presented experiences from PFAS analyses of different products categories, including food contact materials, textiles, consumer electronics, cosmetics and ski wax.

KEY MESSAGES – EXPERIENCES OF ANALYSIS

- Validated and standardised methods for testing of PFAS in products are urgently needed.
- Companies, agencies, commercial laboratories and academia need to cooperate to develop analytical methods for PFAS in products.
- Cheap, real-time screening methods have been developed for PFAS in ski waxes and could potentially be developed for some other product categories.
- A universal PFAS restriction will potentially make compliance testing and enforcement cheaper and less time consuming compared to existing PFAS- restrictions as only one initial test for total organic fluorine may be required.
- A systematic workflow provides a tiered approach for efficiently testing compliance with the proposed universal PFAS restriction. The workflow could be particularly useful for communication with contract laboratories.
- A three-step workflow could be used for compliance testing of PFAS. The workflow includes a combination of analyses of total fluorine (including fluoropolymers), confirmation of PFAS content and target analysis of individual PFAS.

Tools

The group of PFAS is broad and includes substances that degrade into other PFAS. At the same time, the current restrictions each cover a large number of PFAS, which cannot all be measured by targeted analyses. Therefore, it can be difficult for both companies and enforcement agencies to determine if a product contains regulated PFAS. Thus, there is a need for tools that can help to identify PFAS and provide more insight on these substances in products and potential alternatives. In this section of the conference, the services provided by the Swedish Chemicals Agency, the Swedish Centre for Chemical Substitution, the International Chemical Secretariat (ChemSec) and the Nordic Swan Ecolabel were introduced.

KEY MESSAGES – TOOLS

- Tools and other resources to facilitate substitution of PFAS are available, for example the PRIO database from the Swedish Chemicals Agency, the SIN-list, marketplace and the PFAS guide from ChemSec as well as different resources from the Swedish Center for Chemical Substitution. These tools can complement each other.
- Companies can use the criteria of the Nordic Swan Ecolabel, or other Type 1 ecolabels, as part of their product development and at the same time use their active chemical work as a competitive advantage.
- Ambition, goals and acceptance in the organisation is important as a starting point. Then, the tools can be used to reach the goals of the company.
- Identification of suitable alternatives goes hand in hand with product development and is a continuous work. Substitution is a long-term investment.

Workshop on enforcement in the Nordic countries

On the 3rd of September, representatives from Nordic enforcement agencies gathered at a workshop to discuss experiences from enforcement projects and other agency activities on PFAS.

The presentations included examples of enforcement projects on cosmetics, textiles, and food contact materials, an overview of the Danish national bans on PFAS, as well as examples of the use of the product register and the Danish EPAs surveys on consumer products. Furthermore, activities under PARC (Partnership for the Assessment of Risks of Chemicals) were discussed.

See section 3 for further information from the workshop.

2. Summary of the presentations at the conference 2nd September 2024

2.1 Setting the scene

2.1.1 Opening by the Swedish Minister for Climate and the Environment

The conference was opened by the Swedish Minister for Climate and the Environment, Romina Pourmokhtari. The Minister gave a speech that highlighted that the Nordic countries lead the way towards phase-out of PFAS, for example by the active roles of the Swedish, Danish and Norwegian competent agencies in the preparation of the broad PFAS restriction under REACH. This conference was mentioned as another example of Nordic leadership.

The Minister emphasized that sharing of experiences of substitution, analytical methods and tools, which is the aim of the conference, is in line with the ambitions for the Nordic region as a pioneer in a competitive and innovation-driven transition. Furthermore, she said that efficient compliance testing, which is the focus area of the workshop, is a prerequisite for a level playing field.

Furthermore, the minister clarified that the Swedish Government fully supports the commitment to a universal phase-out of PFAS, which is in line with the EU Chemicals Strategy for Sustainability. She also highlighted that future health effects of PFAS are expected to arise and referred to a report commissioned by the Nordic council, which estimated the socio-economic cost of inaction to be between 52 and 84 billion Euros per year (Nordic Council of Ministers, 2019).

The full speech is available in Appendix 3.

> *"This conference will be at the core of the continuing road towards a universal phase-out. Authorities and business now need to share their knowledge and their experiences of detection, identification, and phase-out of PFAS, as you will be doing today. It is indeed encouraging to note that you will hear about the positive experiences from a wide range of sectors, ranging from textiles to consumer electronics."*

"Feasible alternatives to hazardous substances have always been developed when strong legislative pressure has been combined with innovation efforts. I am therefore totally convinced that we will find solutions for the phase-out also of PFAS."

2.1.2 An overview of the problems with PFAS

⇒ Download presentation (PDF)

Professor Ian Cousins from Stockholm University gave an introductory presentation about the definition of PFAS, diversity of the group, properties and uses of PFAS.

Ian Cousins emphasized that the diversity of PFAS is extremely broad. All PFAS share the common property of being very persistent or transform to very persistent terminal transformation products. However, other properties vary between substances. For example, PFAS with longer perfluoroalkyl chains are bioaccumulative, whereas others with shorter perfluoroalkyl chains are mobile in the environment. Furthermore, we do not know the toxicity of most PFAS. The number of PFAS varies depending on how you count. For example, 531 PFAS are registered under REACH, approximately 10,000 PFAS are referred to in the universal PFAS restriction proposal, whereas more than 7 million are available in the PubChem database, where many are only listed in patents.

Continuous releases of PFAS result in increasing environmental levels and increased probabilities of known and unknown effects. Ian Cousins described the case of trifluoroacetic acid (TFA), which is formed from PFAS used in e.g. refrigerants, pesticides, and pharmaceuticals, as a "poster child" for the problems with high persistence. The levels of TFA in the environment have increased sharply over time and there is yet no efficient method to remove TFA from the environment. So far, TFA in the environment has largely been overlooked, but once high levels have been reached the contamination is virtually irreversible and may pose a risk to humans and the environment. In his presentation, Ian Cousins also touched on the problems

with fluoropolymers from a lifecycle perspective, due to the emissions of PFAS during manufacturing and end of life (e.g. incineration).

In summary, the high persistence is the underlying driver of the PFAS problems, both in the Nordic countries and in the rest of the world. If PFAS are not restricted, the continuous release of PFAS will lead to accumulation somewhere in the environment until known or unknown effect thresholds are exceeded.

2.1.3 Current and upcoming PFAS-restrictions

⇒ Download presentation (PDF)

Audun Heggelund, senior advisor at the Norwegian Environmental Agency (Miljødirektoratet), held an introduction to the current and upcoming PFAS restrictions in the EU. The presentation highlighted the active legislative work on PFAS that the Nordic countries have accomplished over recent years, regarding both restrictions and identification of PFAS as Substances of Very High Concern (SVHC). Another example of Nordic action is the universal PFAS restriction that was submitted by Germany, the Netherlands, Sweden, Denmark and Norway in January 2023 and is currently under discussion in ECHAs scientific committees for risk assessment (RAC) and socio-economic analysis (SEAC). The restriction targets PFAS as a broad group and applies to all applications, with derogations for specific uses. According to the restriction proposal, applications of fluorinated gases contribute most to the total emissions (based on tonnage and likelihood for emissions) followed by TULAC (Textiles, Upholstery, Leather, Apparel, Carpets) and medical devices. The restriction proposal includes a set of limit values for PFAS in products (see box). These limit values are central in many of the presentation and discussions that followed during the conference and workshop.

Proposed limit values in the universal PFAS restriction

1. 25 ppb for any PFAS (except polymeric PFASs)
2. 250 ppb for the sum of PFASs, optionally with prior degradation of precursors
3. 50 ppm for PFASs, including polymeric PFASs

Information requirement: If, as a part of an authority enforcement campaign, total fluorine exceeds 50 mg F/kg, the manufacturer, importer or downstream user shall upon request provide to the enforcement agencies a proof for the fluorine measured as content originating of either PFASs or non-PFASs.

2.2 Inspiration

There are companies that strive towards offering PFAS-free products on the market. These companies are progressive and even go beyond the current legislations on PFAS. At the conference, five companies gave insights from their journeys for phasing out PFAS, including the challenges and opportunities they have encountered. They also gave advice to other companies that want to embark on the same journey.

2.2.1 The outdoor company Houdini share their phase-out journey of PFAS

⇒ Download presentation (PDF)

Malin Wetterborg, textile engineer at Houdini Sportswear, shared her experiences from the company's active work to phase out PFAS. Malin said that the company strives away from linearity towards circularity and today 88% of their products are circular by design. She explained that circular from a chemical perspective means that the textiles are pure enough to recycle, which includes that they are PFAS-free. The company started phasing out PFAS in 2013 and all fabrics were PFAS-free by 2018.

Malin Wetterborg said that substitution and development requires time. It can be difficult to find alternatives that do not compromise with quality and performance, especially when they started looking at alternatives back in 2013. All fabrics need to be tested individually at several steps of the development process. Not all alternatives are compatible with the fabrics and when the trials fail, and have to start over, a lot of time is consumed.

Malin Wetterborg said that in traditional outdoor wear, PFAS are primarily used in membranes and in treatment and finishing to give the garments certain properties, such as water resistance. One example of a natural alternative to PFAS in outdoor wear is a shell layer made of 100% merino wool, which is inherently wind- and water resistant. However, new alternatives may entail that costumers need to take better care of their products, which requires the company to provide information and education to end users.

In addition to the known uses of PFAS, hidden sources and contamination along the whole production chain may occur, which is more difficult to identify. Malin Wetterborg said that to overcome this challenge, good communication and even education of the suppliers along the supply chain is key. Furthermore, it is important to question whether for example a treatment really is needed, or if it is, in fact, unnecessary for the purpose of the garment. Another learning from their phase out journey is that cooperation across the industry is positive as it allows to learn from each other and makes it easier to push manufacturers and suppliers towards change.

Looking ahead, the company will work on projects with industry partners and research organisations, keep communicating and educating the suppliers as well as the end users, try to find hidden sources of PFAS, and keep developing technologies and alternatives. Malin Wetterborg said that they will keep thinking outside the box and changing the mindset.

2.2.2 Successful transformation from synthetic to natural refrigerant for Cooling & Heat Pump sector, avoiding environmental impact from ozone depletion, global warming, TFA & PFAS

⇒ Download presentation (PDF)

Fredrik Strengbohm, technical manager at Caverion Sweden AB, talked about the use of natural refrigerants for the cooling and heat pump sector, while at the same time lowering the energy consumption and climate impact. Fredrik says that he started working with natural refrigerants already 20 years ago, despite that his colleagues at the time told him that it would be too expensive.

Refrigeration, air conditioning and heating is the sector with the largest use of fluorinated gases (F-gases). F-gases have undesirable properties as they have a large impact on the global warming and may form trifluoracetic acid (TFA) or other PFAS. Alternatives to F-gases include natural refrigerants, such as propane, carbon dioxide and ammonia. Fredrik Strengbohm introduced an example of supermarkets that started using carbon dioxide already 15 years ago and together with an energy storage integrated system for heating and cooling, managed to lower their energy consumption by 70% compared to using of F-gases. According to Fredrik Strengbohm, these systems can be applicable to all sectors, such as ice skate arenas, gas stations, professional kitchens, and the transport sector.

The transition from F-gases to natural refrigerants are driven by several regulations on the EU-level. Fredrik Strengbohm concludes that natural refrigerants were introduced 200 years ago and after leaving these refrigerants behind in favour of synthetic refrigerants, we are now back with the natural again.

2.2.3 How Coop Denmark led national change on PFAS

⇒ Download presentation (PDF)

Coop Denmark holds one third of the marked share in Denmark and therefore has the size to affect the suppliers. Louisa Raith Sørensen, team leader of non-food quality and sustainability at Coop DK, showed an example of how Coop launched a campaign to urge the Danish Parliament to ban PFAS in food contact materials. As a result, this ban came into force in 2020.

The Coop DK sustainability strategy includes several key issues, including "no one must be exposed to harmful substances". The company has worked systematically to phase out PFAS from their assortment since 2014, when their ban of PFAS in food contact materials of paper and board was launched. At that time, Coop had

to remove microwave popcorn from their shelves since the producers deemed it impossible to find PFAS-free popcorn bags. However, soon after the sales ban, the producers came up with an alternative of slightly thicker PFAS-free paper, and the microwave popcorn could return to the shelves. This is another excellent example of the potential of companies to impact product development. Since then, Coop has proceeded with bans on PFAS in textiles in 2016, cosmetics in 2019 and frying pans in 2024.

When working ahead of legislation, Louisa Raith Sørensen said that it is important to have a quality control system. At Coop DK this includes ongoing dialogues with suppliers to help them understand and comply with the requirements, a random sampling testing program and a description of their PFAS ban in trade contracts.

Learnings from Coop DK's phase out journey include that it possible to produce packaging and goods without PFAS and that innovations happen when the industry is pressured to act. Louisa Raith Sørensen said that in a world of powerful industries and where legislation can be several of years in the making, we need responsible companies.

2.2.4 How Blåbær phased out PFAS at Norway`s largest kids wear brand

⇒ Download presentation (PDF)

Rolf-Erik Lund, managing director at Blåbær Production Norway, told an open and honest story of how the company has worked, failed and succeeded in their journey towards phase-out of PFAS. Blåbær Production is a small design and production company within the textile sector. They work for external clients but follows all steps in the process from draft and ideas to final delivery.

The journey started when the Norwegian Miljødirektoratet found PFAS in their client's kids wear brand. At that time, the company had poor knowledge of chemicals. However, the exposure in media created a motivation to avoid similar cases in the future. In 2015–16, they started communicating about chemicals with their suppliers and a "contract of environmental concern" was distributed to the suppliers. The company also became a member of the Swedish Chemical Group at RISE. According to Rolf-Erik Lund, the tools from the Chemical Group were very helpful.

In 2017–18, they extended the focus from only C8 PFAS to also include C6 PFAS chemistry. They started visiting 2nd and 3rd tier suppliers and updated the chemical contracts with the suppliers. They also increased focus on unauthorized subcontracting and started to perform systematic random testing.

In 2019–22, the company set up clear internal policies and commitments and

created a vision "to be a greener partner through innovative and solution-oriented design, production and logistics". Furthermore, they started performing risk assessments to identify risks and nominated 2nd and 3rd tier suppliers to be used for several factories and products. They also joined the "no to PFAS" movement by ChemSec and broaden the focus from only C6 and C8 to all PFAS in the supply chain.

However, the company's new PFAS policy has brought some drawbacks. The company has faced increased material costs and challenges to reach sufficient functionality. In addition, it has been difficult to find suppliers with good knowledge on PFAS and approximately 1/3 of their suppliers finds Blåbær's chemical requirements "very challenging".

Finally, Rolf-Erik Lund said that the legislations should be stricter and come into force much quicker and that agencies should control the restrictions by testing products more frequently. He also advises other companies to seek knowledge and advise from external sources, decide on clear internal policies, and take one step at the time.

2.2.5 PFAS in Marshall consumer electronics - challenges and opportunities on the road to circularity

⇒ Download presentation (PDF)

Anna Forsgren, product compliance and sustainability manager at Marshall Group, gave her perspective of PFAS substitution in consumer electronics, specifically headphones and speakers. PFAS are used in these products mainly as flame retardants in plastic housing, but also in printed circuit boards and their coatings, plastics of cables and wires, Li-ion batteries, microphones and semi-conductor production. In addition, PFAS can be found in e.g. sensor protection film, switch tape, switch gears, vents, and lubrication oil. In consumer electronics, fluoropolymers are the most frequently used PFAS.

Anna Forsgren said that if we want to phase out PFAS in electronics, we need to understand all the different functions they have. Substitution can be done at several levels, including changing a chemical product, the material, the design or technology. She says that all applications they have identified in consumer electronics so far have a PFAS-free option technically possible, although some applications may need compromises and time for development. At Marshall, flame retardants have been avoided by designing around the flammability requirements and fluoropolymers have been shifted to polyethylene. Furthermore, the lubricant oils could be shifted to silicone or wax-based ones, and adhesives could be changed to acrylates. Development is still ongoing for batteries, cables and plastic additives.

For other widely used components, such as semiconductors, switches and gears, more actors are needed to raise similar requirements to change the production methods.

Anna Forsgren considers that it does not cost much to phase out PFAS. In fact, plastics that are not flame resistant are cheaper. Furthermore, increased knowledge of materials results in more design and component improvement which saves costs. Regarding costs of chemical analyses, the company uses a simple and cheap halogen test to screen for fluorine and identify components that should be investigated further together with the suppliers. She admits that some applications cost more initially due to e.g. developmental costs and lower quantities but says that this difference should decrease over time when other companies start demanding PFAS-free components.

Anna Forsgren highlighted that the electrical safety standards, which she thinks is outdated, hampers the development to PFAS-free electronics. She suggests that the standards should be developed with coming regulations, global acceptance and the high innovation speed of the sector in mind.

Lastly, Anna Forsgren said that companies need to shift focus from lobbying for derogations in the universal PFAS restriction to accelerating the work on finding alternatives. Furthermore, she says, there is a need for more brands to have the courage to compromise.

2.2.6 Panel discussion

Erik Mattsson moderated a panel with Fredrik Strengbohm (Caverion), Malin Wetterborg (Houdini), Rolf-Erik Lund (Blåbær) and Anna Forsgren (Marshall). They shared their experiences and insights on a number of questions posed by the moderator and the audience, some of which are summarised below.

To the question of **what the panelists consider were the main reason for phasing out PFAS**, several examples were given. Malin Wetterborg said that one reason was that her company strives for recyclability and therefore does not want to promote chemicals that harm people and the environment. For Rolf-Erik Lund and his company, the phase-out journey started when the Norwegian Miljødirektoratet found PFAS in the products and the brand got exposed in the media. Fredrik Strengbohm reflected that when bad things are discovered, a window of opportunity opens to do things differently. Science and technology are not the big issue, since we can solve anything, as long as we have demands and regulations in place.

The panelists were asked about the **most important thing when they started the substitution process.** It was emphasized that internal policies and commitments need to be in place. Another learning was that it is good to start by mapping out

the materials that are most likely to contain PFAS, instead of looking at the complete product line at once, which can be overwhelming. One panelist said that it's important to try to increase your knowledge as it is difficult to communicate with suppliers about something you know nothing about. Furthermore, the panelists agreed that it is recommended to take help from external experts.

The panelists were also asked to **say something to companies that have not started to phase out PFAS.** It was stressed that although legislation is an important driver, companies should not wait for the change. Anyone who wants to be in the forefront, just start somewhere and sometimes you go sideways, but you will not go backwards. One reason for all companies to start working with PFAS substitution is that there are worrying health effects that come slowly before we understand the impact. Lastly, it was said on a humoristic note that substitution of PFAS is a nice trip. Bumpy, but nice.

2.3 Experiences

Several Nordic reports have recognised that efficient and reliable analytical methods for PFAS in articles and chemical products are crucial for compliance and enforcement of current and upcoming regulations (Nordic Council of Ministers 2022, 2024a, 2024b). However, there is currently a lack of standardised and validated methods as well as an established workflow for PFAS analyses in articles and chemical products. This section of the conference aimed to give a brief overview of different types of analytical methods, introduce a potential workflow for PFAS analyses and present several examples of PFAS analyses in different products categories.

2.3.1 Challenges and opportunities related to compliance testing of PFAS in chemical products and articles

⇒ Download presentation (PDF)

Robin Vestergren, scientific officer at the Swedish Chemicals Agency, gave an overview of the most important analytical techniques for PFAS, pointed out the challenges for compliance testing of chemical products and articles, and presented a suggestion for a systematic workflow for compliance testing.

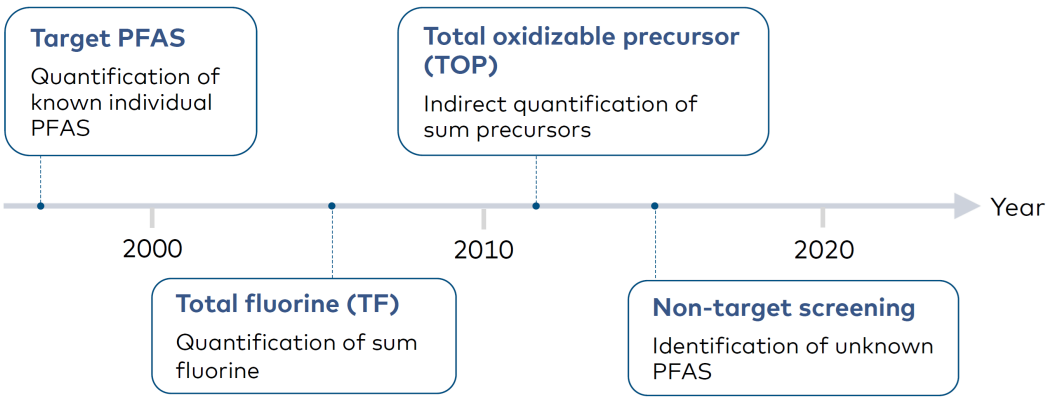

Figure 1 Timeline over the introduction of important analytical methods for PFAS analysis.

The analytical techniques for PFAS have evolved from targeted analysis of a limited number of known individual PFAS, to broader methods that can measure total fluorine, precursors to known PFAS, and so far unknown PFAS (Figure 1).

There are still many challenges for PFAS analysis of products, both for companies that want to know if PFAS are present in their products and for enforcement agencies. For example, advanced non-target methods are currently expensive and time-consuming, and the array of available analytical techniques makes interpretation and communication of results challenging. The limit value for individual PFAS (25 ppb) is relatively low, which requires low limit of quantification (LOQ). Furthermore, the large number of matrices makes standardization challenging. Thus, the ideal method should be a fast, cheap and able to identify and quantify all restricted substances, with sufficiently low LOQ. Furthermore, the method should be standardized and accredited for all matrices of interest.

Robin Vestergren presented a suggestion for a three-step systematic workflow for compliance testing of PFAS, which has been developed together with colleagues from Sweden, Norway, Finland, Germany, Czech Republic, Netherlands, Canada, and the US (Vestergren et al. 2024) (Figure 2).

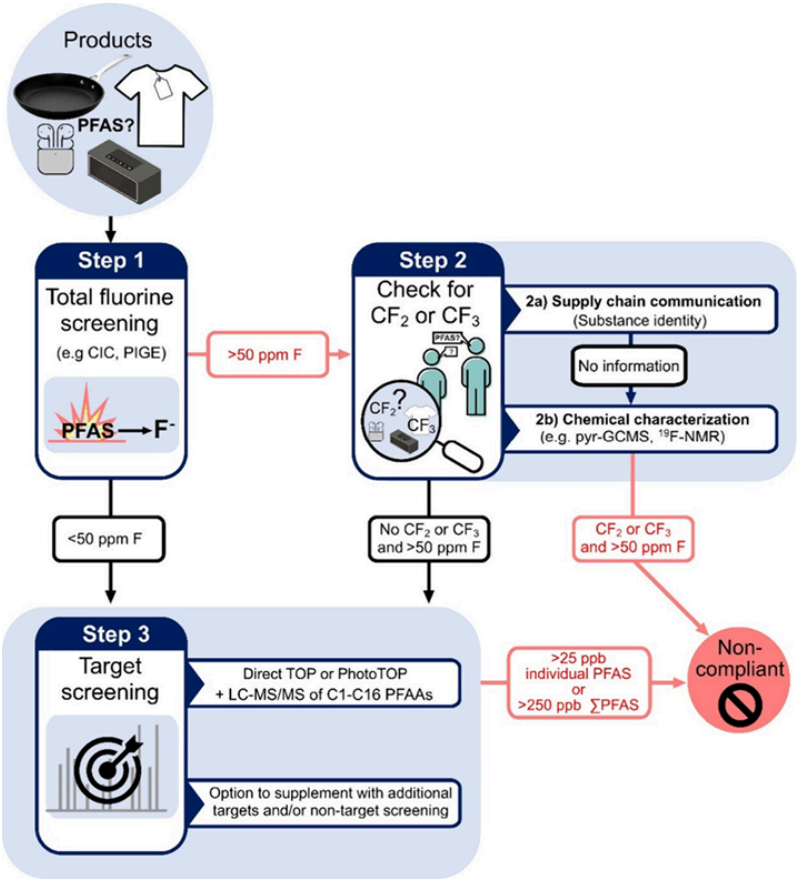

Figure 2 Three-step workflow that companies or agencies could implement to assess noncompliance with the proposed broad restriction of PFAS under REACH (Vestergren et al. 2024). Abbreviations: CIC, combustion ion chromatography; PIGE, particle-induce

Step 1. Screening for total fluorine (TF) provides a relatively fast and inexpensive way to assess whether PFAS may be present in a sample, without requiring sample extraction. There are several techniques available for TF measurement. However, one drawback is that these methods cannot distinguish between PFAS and inorganic or non-PFAS organic fluorine.

Step 2. Confirmation of PFAS. The content of PFAS, inorganic fluorine or non-PFAS organic fluorine can either be ascertained by obtaining information from the supplier. However, if reliable information is not available, the presence or absence of CF2 or CF3 groups may be determined analytically, for example by pyrolysis-gas chromatography-mass spectrometry (pyr-GC/MS) or 19F nuclear magnetic resonance (19F NMR). However, However, while pyr-GC/MS is a more advanced tool than 19F NMR for analysis of PFAS in articles and chemical products, considerable work is still required to validate these approaches for application in a regulatory context.

Step 3. Quantifying individual PFAS or the sum of PFAS. The restrictions include limit values for individual PFAS or the sum of PFAS at much lower levels than the detection limits of TF methods. LC-MS/MS target analysis can be used to test non-compliance with 25 ppb limit values for individual PFAS in the proposed universal PFAS restriction. In addition, TOP analysis together with LC-MS/MS can test non-compliance with 250 ppb limit values for sum PFAS, including precursors. Furthermore, non-target analysis could be used to detect hitherto unknown substances.

According to Robin Vestergren, the way forward involves further testing and development of specific methods and application to different categories of chemical products and articles. Also, work towards accreditation, standardization and validation is crucial. Furthermore, to help the agencies, formal guidance documents for enforcement are needed. Robin said that different actors need to work together to achieve this, both national and European agencies, academic researchers, commercial laboratories and companies.

2.3.2 Screening and identification of PFAS in electronics, textiles and food contact materials

⇒ Download presentation (PDF)

Lisa Skedung, senior researcher and project manager at the Research Institutes of Sweden (RISE), shared learnings from PFAS analyses of different consumer products. The primary methods in these projects were combustion ion chromatography (CIC) and pyrolysis-gas chromatography-mass spectrometry (pyr-GC/MS), which are both methods that use direct thermal breakdown to capture

polymeric PFAS. These methods are described by Skedung et al. 2024. However, whereas CIC measures total fluorine, pyr-GC/MS detects CF_2 and CF_3 fragments, which are indications of the presence of PFAS. Lisa Skedung refers to the three-step workflow that was presented by Robin Vestergren (section 2.3.1) and she presented several case studies were TF was measured in the first step, and presence of PFAS (CF_2 and CF_3) by pyr-GC/MS was verified in the second step.

Lisa Skedung presented results showing TF levels in textile articles in the range 65–1500 ppm. With pyr-GC/MS, the presence of PFAS-chemistry is confirmed, and it is possible to get information about the target PFAS-chemistry in the side-chain fluorinated polymers that are used for water, dirt and stain repellence. In a project on PPE, PFAS was found in 57% of the analysed articles.

In a project on PFAS in food contact materials (FCM), TF at levels above 50 ppm were detected in 8 out of 37 products. By verification with pyr-GC/MS, PFAS (C6 fluorinated carbons) could be detected in 2 products. In the remaining 6 samples with high TF levels, the presence of PFAS could not be verified by pyr-GC/MS. These samples are believed to contain an inorganic source of fluorine. Based on results from the pyr-GC/MS it was concluded that in these types of articles, silicone chemistry has to a large extent replaced PFAS. The FCM samples were also analysed by target analysis of individual PFAS, but these levels did not exceed the proposed limit value for the sum of PFAS. However, when the samples were oxidized (TOPA) prior to the targeted analysis, 2 samples exceeded the limit value for the sum of PFAS (the same two samples where PFAS-chemistry had been verified by pyr-GC/MS). Thus, application of TOPA increases the chance of detecting precursor PFAS, and is therefore suggested as step 3 in the proposed workflow instead of LC-MS/MS target analysis

Lisa Skedung also presented several examples of analyses of consumer electronics. Electronics are generally more complicated than many other consumer products as they often contain several heterogenous components. Thus, one must think about the probable function of PFAS in the products to predict where PFAS are most likely to be found. In one of the projects, high levels of TF were measured in the plastics of head-phones cases, loudspeakers and computer power cables. In these products, subsequent pyr-GC/MS could verify the presence of the fluoropolymer PTFE. In another project on selected components in outdoor electronics (i.e. headlamps, beacons, battery packs and led vests), PTFE was found in the outside battery or battery case and another fluoropolymer (ETFE) was found in 1 out of 9 analysed cables. In another example on consumer electronics, a coffee maker was disassembled and TF levels exceeding 50 ppm were found in wired glass fibre cables, and two coated parts near the heat plate. However, the presence of PFAS could not be confirmed with pyr-GC/MS. A hypothesis is that MICA (inorganic fluorine) have been used in these components as fire protection or insulation.

Throughout her presentation, Lisa Skedung emphasised two key messages:

1. there are analytical methods that capture polymeric PFAS!
2. it is possible to enforce a universal PFAS restriction!

2.3.3 A practical and pragmatic approach for detection of PFAS during ski competitions

⇒ Download presentation (PDF)

Anders Nilsson, application and sales specialist at Bruker Nordic AB, shared a success story of compliance testing of fluor in ski waxes. The background was a decision by the International Ski and Snowboard Federation (FIS) to ban fluorinated ski waxes in competitions by 2023–24. Fluor in ski wax at a concentration of more than 1% provides a competitive time advantage of approximately 4–10%. Therefore, compliance with the ban is crucial not only for environmental and health reasons, but also for competitive reasons.

When the ban was decided, there was no suitable technique for compliance testing. The ideal analytical method needed to be none-disruptive, reliable, accurate, and cheap. Furthermore, it had to work in cold outdoor conditions, and in non-laboratory settings (sometimes in tent next to the ski tracks). It should also be operated by non-experts and had to be easily transported between sites. Specifically, the analysis should not take longer than 10 seconds per ski and have capability to measure 100 skis before a competition.

Anders Nilsson said that to meet all these requirements, a method based on FTIR (Fourier Transformed Infrared) spectroscopy was developed. He says that the method fulfils the requirements of speed, cost, accuracy and reliability. The FTIR method works without touching the skies, and the instrumentation can be fitted into a couple of suitcases for transportation. Furthermore, a detailed standard operational procedure ensures that method can be operated by non-experts and the results are indicated by a simple green-yellow-red alarm system.

During the first season since the implementation of the ban, approximately 100,000 spots in skis were tested and more than 50 athletes had skies with PFAS levels that exceeded the limit value. Most of these athletes claimed that the noncompliance was due to dirty tools or dirty old skis.

2.3.4 PFAS in cosmetics and personal care products from the European Market

⇒ Download presentation (PDF)

Jonathan Benskin, professor at Stockholm University, shared the results from a project on PFAS in cosmetics, conducted by Stockholm University and IVL Swedish Environmental Research Institute. The project used a three-step approach, which included 1) to develop an inventory of PFAS in cosmetics using European cosmetic databases, 2) to analyse a selection of cosmetics using a multiple analytical approach, and 3) to estimate annual emission of PFAS into European wastewater and solid waste from cosmetics (Swedish Chemicals Agency 2021).

In the first step, the CosIng database (European Commission database for information on cosmetic substances and ingredients) was used to search for INCI (International Nomenclature of Cosmetic Ingredients) names containing "fluoro". The search retrieved approximately 170 unique INCI names containing at least a -CF_2- or -CF_3 moity.

These 170 INCI names were then cross referenced against the CosmEthics database to identify PFAS-containing products. The search yielded 1658 products, corresponding to 1.4% of all products in the database. The product types with PFAS were mainly make up, facial care, male grooming and hair care. The most frequently listed PFAS were PTFE and C9-15 fluoroalcohol phosphate.

In the second step, 43 cosmetic products with PFAS in the ingredient lists were purchased and analysed for total fluorine (TF). A subset was also analysed for extractable organofluorine (EOF) and individual PFAS. The levels of TF ranged between <LOD to 13,800 µg F/g and varied considerably across all product types. The results from the multiapproach setup highlighted that a combination of measurements of TF, EOF, and target PFAS is necessary to obtain a full picture of the occurrence of fluorine containing substances in products, including inorganic fluorine and fluoropolymers.

In the third step, the annual PFAS emissions from cosmetics in Europe to wastewater and solid waste were estimated to be 0–0.015 tonnes of C4-C18 PFCAs, 0.04–5.1 tonnes of EOF and 0.02–38 tonnes of TF (Pütz et al. 2022).

Taken together, Jonthan Benskin leaves the audience with a few take-home messages. Firstly, combining total fluorine with targeted analyses is key to obtain upper and lower bounds estimates of PFAS in consumer products. Secondly, inorganic fluorine is prevalent and may confound total fluorine data. And finally, extraction can remove inorganic fluorine but may also remove some PFAS and

therefore the extraction procedures should be aligned with the listed PFAS ingredients.

2.3.5 Panel discussion – experiences

The moderator Erik Mattsson led a panel discussion with the speakers Robin Vestergren (Swedish Chemicals Agency), Lisa Skedung (RISE), Jonathan Benskin (Stockholm University) and Anders Nilsson (Bruker Nordic AB).

Erik started off by asking the panel about **their relation to PFAS.** Robin Vestergren said that he has been working with PFAS for 15 years in different positions, starting with his PhD. Jonathan Benskin similarly said that he has been working with PFAS since 2005, starting in his homeland Canada. He added that it says something about the global aspect of the issue. Lisa Skedung, who has been the project manager of the last POPFREE project, said that she enjoys helping companies in their PFAS substitution work that includes screening products for PFAS-chemistry. She started working with PFAS in 2016 in POPFREE, when they developed and tested PFAS-free ski wax, and together with stakeholders from the ski sport drafted a road map towards a phase-out of PFAS in competitive skiing.

Erik Mattsson asked the panellists **how their work can be of help for companies and agencies in the room.** Lisa Skedung said that she and her colleagues have a lot of dialogues with companies and help out with PFAS analysis and interpretation of the analytical results and also look into alternatives to PFAS. Jonathan Benskin mentioned that his research aims to develop new methods for testing, and that he would like to collaborate with industry partners. Robin Vestergren explained that the Swedish Chemicals Agency works a lot with communication about PFAS, for example through their web site and the PRIO tool. Anders Nilsson honestly said that his contribution to companies is by selling analytical instruments. He advises companies to contact RISE or other experts from the research area if they want to work with substitution as it can be complicated.

The panellists were asked what has surprised them the most. Jonathan Benskin said that the growing range and variety of compounds in the PFAS group has surprised him. Robin Vestergren agreed and added that the researchers thought that they had an understanding of PFAS in early 2000s, but as it turned out, that was only the tip of the iceberg. In fact, we find new PFAS chemistry every day. Lisa Skedung thought that it is positive that many companies have substituted PFAS and that we do not find PFAS in everything today.

Erik Mattsson wondered **if nuclear magnetic resonance (NMR) could that be the solution.** Anders Nilsson said that it is probably not the solution as it is expensive and trained staff are needed. However, NMR is favourable in medical production where high-level analysis is needed. Lisa Skedung said that GC-MS is more

advanced than NMR right now. However, the combination of methods is the beauty.

Can the FTIR, that is used for testing of PFAS on skis, be applicable to other sectors? Lisa Skedung said that in her experience from testing different methods for PFAS, FTIR performs well on kitchenware but is less suitable for samples like textile or paper where the coating that may contain PFAS is very thin and the instrument measures pass the coating layer into the bulk of the material. Pyr-GC/MS is better for the latter and is more versatile for different types of articles and chemical products.

Is there a risk of compliance failure when PFAS are present at low levels? Robin Vestergren said that the relatively high limit value for TF (50 ppm) only captures the intentionally added PFAS. On the other hand, the limit value for targeted PFAS is low enough to catch contamination or active ingredients in for examples cosmetics. Thus, a combination of the methods is ideal. Jonathan Benskin said that for cosmetics, fluorinated compounds were not seen in products where PFAS was not listed in the ingredients list.

2.4 Tools

The group of PFAS is broad and includes substances that degrade into other PFAS. At the same time, the current regulations each cover a large number of PFAS, which cannot all be measured by target analyses. Thus, it is very challenging to identify all PFAS in chemical products and articles and figure out which ones that are restricted or not. Nonetheless, this is the reality for both companies and enforcement agencies. This section of the conference aims to present different tools for identifying PFAS and learning more about these substances in chemical products and articles.

2.4.1 PRIO – a tool for substitution. How to identify more than 10,000 PFAS

⇒ Download presentation (PDF)

Olof Johansson, scientific officer at the Swedish Chemicals Agency, introduced the PRIO tool and explained how it can help companies and other actors to substitute hazardous substances in chemical products and articles.

PRIO consists of two parts. The first part is a substitution guide with a workflow on how stakeholders can work proactively with substitution. The second part is a database that supports stakeholders to identify and prioritise hazardous substances for substitution. The database consists of a large set of substances that fulfil the PRIO criteria. These substances are divided into two priority levels. The first level, *phase out substances,* have the most severe hazardous properties for human health and the environment and consequently should be prioritised for substitution. For the other level, p*riority-risk reduction substances,* the risk should be assessed for the potential need for substitution.

The PRIO database consists of more than 16,600 substances of which nearly 11,000 are PFAS that fulfil the OECD definition (which is also used in the proposal for the universal PFAS restriction). All PFAS in the database are considered as *phase out substances*. The PRIO databased can be searched by standard search, batch search (several chemicals at once), or advanced search (combination of various dropdown variables). In his presentation, Olof Johansson gave hands-on examples of how to use the database.

Links

PRIO database (English)
PRIO database (Swedish)
PRIO tutorial (Swedish)

2.4.2 What support can the Swedish Substitution Centre provide?

⇒ Download presentation (PDF)

The Swedish Centre for Chemical Substitution, located at the Research Institutes of Sweden (RISE), is partly financed by the Swedish Government. The centre was funded in 2018 and currently consists of 5 employees. Their mission is to guide companies, organisations and the public sector in their efforts to identify hazardous chemicals and find better alternatives, in everything from products to processes. Tonie Wickman who is a senior advisor at the centre gave an overview of their activities related to substitution of chemicals in general and PFAS in particular.

The webpage for the Centre for Chemical Substitution offers a substitution guide, support material and inspiring examples from companies. The material is generally in Swedish, except for excel-sheets for risk assessments, mapping of chemical content and supply chains and templates that can be used in communication with suppliers. The Centre for Chemical Substitution do not provide any own tools for substitution but refers the reader to tools and databases available from other organisations. They also offer training courses, and education films on for example alternatives assessments (AoA) and safe- and sustainable by design (SSbD). Regarding PFAS, there is material from several webinars, for example on PTFE in bike chain lubricating oils and PFAS-free kitchenware. The centre also collaborates in research and networking, such as PARC and POPFREE.

Tonie Wickman also gave examples of several relevant networks that are hosted by RISE and in which support in substitution is a part. These networks include Normpack (Food contact and packaging), the Chemical group (textiles and electronics) and the National centre for sustainable plastics.

Links

Centre for Chemical Substitution (English)
Centre for Chemical Substitution (Swedish)
Substitution of PFAS (Swedish)

2.4.3 How can ChemSec tools support companies?

⇒ Download presentation (PDF)

The International Chemical Secretariat (ChemSec), founded in 2002, aims to speed up the transition to a world free of hazardous chemicals. They work through policy, business and investors and tools. Jonathan Kleimark, who is a senior chemicals and business advisor at ChemSec, gave an introduction to their tools for substitution. The overarching aims of ChemSec's tools are to support companies in substitution, be relevant and ahead of regulation, and provide insight to future-proofing businesses.

The SIN (Substitute It Now) list is a database of substances that have been identified by ChemSec as being Substances of Very High Concern, based on the criteria defined within the EU chemicals legislation REACH. The SIN list is used by companies in all parts of the supply chain and consultants as well as academia, governments, ecolabels, and other stakeholders. The list was launched in 2008 and has developed over the years. The SIN list currently includes 416 PFAS that are registered for production or import to the EU and/or the US.

The second tool – Marketplace – is an online platform that connects providers of safer alternatives to potential buyers all over the world. The alternatives can be drop-in substitutes, technological solutions and new processes or materials. Marketplace contains more than 700 alternatives to different (groups of) chemicals. For PFAS, there is a special section that currently includes approximately 100 alternatives to PFAS.

ChemSec also offers an online PFAS guide that aims to facilitate the first steps toward phase out of PFAS. It can be used by companies to understand if, where, and why PFAS are used in their organisation. The guide includes an information part with facts about typical PFAS uses, substitution and alternatives, hazards, and regulations, as well as links to sector-specific reports. The second part of the PFAS guide consists of a database which incorporates information from scientific publications, reports and information from individual companies and links to the SIN list and Marketplace.

Links

ChemSec homepage
PFAS Guide
SIN List
Marketplace

2.4.4 Ecolabels, frontrunners in the green transition

⇒ Download presentation (PDF)

The Nordic Swan Ecolabel, which is the official Nordic ecolabel, was funded by the Nordic Council of Ministers in 1989 and today there are around 40,000 ecolabelled products. Ecolabelling Sweden, which is the Swedish part of the Nordic Ecolabelling, is responsible both for the Nordic Swan Ecolabel and the EU Ecolabel in Sweden. Both ecolabels are Type 1 labels and follow the standard ISO 14024 and are among the world's toughest and most ambitious environmental certifications.

Anna Linusson who is the CEO at Ecolabelling Sweden talked about how the Nordic Swan ecolabel makes it easier for consumers to make sustainable choices. She said that more than 80% of Nordic consumers think that it is difficult to know if products contain hazardous chemicals but trust that a product does not contain hazardous chemicals if it is labelled with the Nordic Swan Ecolabel. Furthermore, she said that 97% of the Nordic consumers recognises the Nordic Swan Ecolabel.

Companies can use the ecolabel criteria as part of their product development at the same time as it enables them to use the "environment" as a competitive advantage and thereby contribute to sustainable society. Furthermore, the ecolabel facilitates sustainable purchases and procurements in the public sector. Anna Linusson specifically urges the public procurers to ask for officially recognized Type 1 ecolabels. She also argued that demands on PFAS-free products in public procurements gives companies incentives to phase out PFAS from their products.

Since 2003 PFAS have been banned in Nordic Swan ecolabelled products where there is knowledge or risk that these substances are used. Example of such product groups are baking paper, personal care products and cosmetics, toys, clothes and other textiles, furniture, paint, construction products, flooring, cleaning products, dishwashing detergents, car care products, ski wax, and packaging for liquid foods.

Links

Ecolabelling Sweden (English)
Ecolabelling Sweden (Swedish)
Nordic Swan Ecolabel (English)

2.4.5 Panel discussion - tools

Erik Mattsson moderated a panel discussion about tools for PFAS substitution, with Olof Johansson (Swedish Chemical Agency), Tonie Wickman (Swedish Center for Chemical Substitution), Jonthan Kleimark (ChemSec) and Anna Linusson (Ecolabelling Sweden). Erik started by asking all panellists about **their relation to PFAS**. Jonathan Kleimark highlighted that PFAS is important and engaging to people. Furthermore, the PFAS issue is an area where they can make a difference right now. Tonie Wickman agreed and said that there is extremely high interest from companies right now due to the upcoming universal PFAS restriction. Olof Johansson said that the PRIO tool at the Swedish Chemicals Agency has evolved in line with the ever-increasing focus and knowledge about PFAS at the agency.

Erik Mattson continued with asking the panelists about **what their tools do best and whom they are suitable for?** Jonathan Kleimark pointed out that ChemSec offers several complementary tools. They aim to give companies an overview that can make it easier for them to start working with substitution and actually do something. For example, the SIN list is fairly broad, and suitable for both companies with low chemical knowledge and companies that work actively with chemical issues. Olof Johansson emphasized that the PRIO database is easy for anyone to use, and that the possibility of batch searches of chemicals can be helpful for the users. Anna Linusson said that ecolabels are for everyone, both those with no knowledge about chemicals as well as for the best companies. Companies should use it to make it profitable to be the best on the market. Also, Anna pointed out, with the ecolabel system, the work on chemical assessment is done by someone else so you don't have to care about it. Tonie Wickman said that the Center for Chemical Substitution works a lot with communication as they try to reach out to small and medium-sized enterprises (SMEs) in Sweden and help them in their substitution work. For example, they use trade and industry associations to reach relevant companies.

Erik Mattsson then turned the question around to asked what the panelists thought were the **best features of the other panelists' tools?** All panelists agreed that the different tools complement each other and that all tools are needed as they offer different perspectives. For example, the Centre for Chemical Substitution can be a good first place to look when a company starts working with substitution. ChemSec have information for example about which chemical groups to focus on and available alternatives, whereas PRIO has a set of substance criteria complemented with a database with can be used by companies to identify and prioritise substances in their substitution work. Ecolabels are more hands on, but the other tools are used for input to the criteria.

How should the companies start when they want to begin a substitution process? Generally, the first crucial step is an inventory of which chemicals you have in your products. Also, ambition, goals and acceptance in the organization is important as a starting point. Then, the tools can be used to reach the goals of the company. Tonie Wickman mentioned that you can start by contacting the Centre for Chemical Substitution and they can direct you further. Anna Linusson stressed that ecolabeling is not cost-free but neither very expensive. Actually, the internal work and changing of the process is what costs the most, especially the first time you do it.

Finally, Erik Mattsson asked **what the panelists would say if someone asks: "it is impossible to substitute"?** Jonathan Kleimark said that this is the most common question, especially regarding the universal PFAS restriction. He claimed that there are alternatives for the vast majority of uses. Anna Linusson pointed out that if one company deems that it is impossible to substitute PFAS, another company will make it possible and succeed on the market. Tonie Wickman mentioned that substitution often takes time, and this is something we must accept. Therefore, it's important to have a clear goal and work consistently towards it. There are several good examples, for example from the textile sector. Olof Johansson agreed that substitution can be a long process but encourages companies to seek inspiration from what other companies have done.

2.5 Closing of the conference

The Director-General of the Swedish Chemicals Agency, Per Ängquist, wrapped up the conference with some closing remarks.

First, he stressed that we should be proud that the Nordic countries are leading the way forward and working towards an EU-wide universal restriction of PFAS. He pointed out that legislation is the driver for substitution and innovation and is a prerequisite for a level playing field.

While waiting for the universal PFAS restriction, he said, companies can be proactive when designing products, choosing suppliers, and setting chemical requirements in procurements, which has been demonstrated in several presentations during the day. Substitution of PFAS can be challenging, but in the end, it is the responsibility of the companies to comply with legislation.

Efficient enforcement is needed to check compliance and ensure a level playing field. A comprehensive strategy for testing different products, together with validated and standardized analytical methods, is urgently needed. However, as we have seen here today, he said, there is rapid development of methods and strategies for PFAS analysis that can be applied already.

Finally, Per Ängquist expressed that he feels hopeful and truly inspired by all the examples from companies working hard to replace PFAS with better solutions. He hopes that everyone will go home from the conference with the insight that we will succeed in reaching our goal – a toxic-free environment!

3. Workshop on 3rd of September 2024

A back-to-back workshop on enforcement of PFAS in the Nordic countries was held on the 3rd of September 2024. The aim of the workshop was to gather Nordic enforcement agencies to share experiences of enforcement projects and other activities on PFAS and to discuss challenges and opportunities for enforcement and compliance testing. Furthermore, ideas for possible future Nordic projects were discussed. A total of 21 participants from Sweden, Norway, Denmark, Finland, and Austria attended the workshop.

3.1 Theme 1: Analyses of PFAS

This section featured experiences from enforcement projects on food contact materials and outdoor textiles, a proposal for a three-step workflow for compliance testing and an overview of evaluation of analytical methods under PARC.

3.1.1 Food Contact Material: An enforcement project – results and challenges

⇒ Download presentation (PDF)

Anders Appelblom, enforcement officer at the Swedish Chemicals Agency, presented the results from an enforcement project on food contact materials (FCM). The project included analyses of 142 FCM products of paper and board, silicone and soft polymers, non-stick coatings, hard plastics and wood. All products were analysed for total fluorine. In addition, 105 products were analysed for target PFAS (half with prior oxidation, i.e. TOPA), and 17 products were analysed with pyr-GC/MS.

The results showed that 3 products (3%) exceeded current regulatory limit values for long-chain PFCAs. Hypothetically, if the proposed universal PFAS restriction had been in force, 10 additional products (mainly cupcake liners/baking cups) would have exceeded the proposed limit values for individual PFAS and/or sum of PFAS. It was apparent that TOPA was required to capture precursors and reach above the limit values. In addition, 43 products had a total fluorine content above 50 ppm and for these products the proposed universal PFAS restriction would require suppliers

to provide proof for the origin of the measured PFAS.

Taken together, the FCM products analysed in this project rarely contain currently regulated PFAS and when these are found, the low levels indicate unintentional use. However, non-regulated PFAS are still used in FCM. Furthermore, TOPA better captures intentional non-polymeric PFAS use compared to standard (MeOH) extraction techniques. There was no correlation between the content of total fluorine and the sum of PFAS after TOPA, as no or only low levels of PFAS were detected in the products with the highest fluorine content. This probably reflects that the total fluorine analysis includes inorganic fluorine and/or fluoropolymers that are not degraded in the TOPA and subsequently captured by target analyses. Anders Appelblom believes that the implementation of a universal PFAS restriction would lower the costs for analyses and solve some of the current issues with the interpretation of "related substances". Finally, Anders stressed that standardisation of analytical methods is needed, which is an observation that was repeated many times by the participants throughout the workshop.

3.1.2 PFOA in Outdoor Textiles: An enforcement project – results and challenges

⇒ Download presentation (PDF)

Ingvild Kvien, enforcement officer at the Norwegian Environmental Agency, shared the results from a project of PFOA and PFOA-related substances in outdoor textiles, including pillows, hammocks, an umbrella, a parasol cover, and a grill cover (Miljødirektoratet 2023). The products were purchased from Norwegian, Swedish, Danish and British online shops. The samples were analysed for individual PFAS with reference standards, both with and without prior oxidation by TOPA.

The results showed that none of the products had detectable levels of PFOA or C9-C14 PFCAs before oxidation (TOPA). However, after TOPA, 6 products had detectable levels, out of which 3 products contained levels above the regulatory limit for C9-C14 PFCAs.

In conclusion, 3 out of 11 (27%) outdoor textile products did not comply with the C9-C14 PFCA restriction (however the products were bought before the restriction entered into force). Another take home message was that the use of TOPA is critical to detect precursors to regulated PFAS. However, Ingvild Kvien raised that there are uncertainties on how efficiently TOPA oxidises the precursors in a sample and how much of the remaining non-oxidised precursors that still go undetected. Furthermore, we can currently not identify which specific PFCA-related substances that are used in the products.

3.1.3 How a systematic three-step workflow can be used for compliance testing in the implementation of current and coming PFAS restrictions

⇒ Download presentation (PDF)

Robin Vestergren, scientific officer at the Swedish Chemicals agency, held a presentation about a proposal for how the systematic three-step workflow could be used for enforcement.

The presentation provided a summary of the challenges and opportunities related to compliance testing of PFAS in products described under 2.3.1 with some discussion points of particular relevance for inspectors at national agencies. The discussion that followed revolved around the regulatory acceptance of non-substance specific and non-targeted analysis for enforcement authorities. Some workshop attendees argued that it might be difficult to use the proposed methods in a court case and validated target methods remain the gold standard for compliance testing. At the same time, the chemical diversity of the proposed universal PFAS restriction, and even the current PFOA restriction, makes it impossible to have targeted methods for all included substances. Some workshop attendees emphasized that the main priority, from their view, was to get non-compliant products off the market. Although some companies may dispute analytical results generated by non-substance specific methods, the number of cases that will be taken to court are very few. It was agreed that it will be important to follow and share experiences from any court cases related to group restrictions of PFAS.

3.1.4 Evaluation of analytical methods within the framework of PARC

⇒ Download presentation (PDF)

Lisa Skedung, senior researcher and project manager at RISE and Robin Vestergren, scientific officer at the Swedish Chemicals Agency, introduced the work done by PARC (Partnership for the Assessment of Risks from Chemicals) on analytical methods of PFAS.

The presentation provided an overview of the products that have been tested by TF, pyr-GC/MS, and TOP. Overall, the pyr-GC/MS offers a good complement to TF analysis for identifying PFAS above the 50 ppm limit value. So far, the method has been tested for several different fluoropolymers and fluorinated side-chain polymers providing unique markers of PFAS chemistry. For chemical products, where PFAS are sometimes used at lower levels, additional analysis by e.g. TOPA is

typically needed. The following discussion touched on the availability of these new methods for companies and enforcement authorities. It was generally concluded that both the pyr-GC/MS and TOPA could be adopted by most laboratories performing PFAS analysis today with small investments and modifications of existed instruments. Further work to test and validate these methods are ongoing in PARC activity 6.4.3.

3.2 Theme 2: National regulation and its implementation

Several European countries, including Denmark and France, precede the European universal PFAS restriction by introducing national bans on PFAS. In this section, the workshop participants learned more about the Danish national restrictions on PFAS in specific products.

3.2.1 The Danish national regulations of firefighting foam and textiles

⇒ Download presentation (PDF)

Kim Boesen, head of unit of the Danish Chemical Inspection Service at the Danish Environmental Protection Agency, informed the workshop attendees that a national action plan for PFAS was agreed in Denmark on 30 May 2024. The plan will run to 2027 and the implementation of the plan will be funded by more than DKK 400 million over 4 years with the aims to clean up, contain and prevent PFAS.

In regard to existing and upcoming national bans on PFAS, a Danish national ban on PFAS in firefighting foam at training sites where there is a high risk of PFAS being released directly into the environment entered into force in 2024. I addition, a Danish national ban on PFAS in clothing and impregnation agents for consumers is planned for July 2026.

3.2.2 The Danish national regulation of PFAS in food contact paper material

⇒ Download presentation (PDF)

Mette Holm, senior scientific adviser at the Danish Veterinary and Food Administration, talked about the Danish ban of PFAS in food contact material (FCM), which entered into force in 2020. The ban only applies to FCM products made of paper and board. Furthermore, the ban specifies that PFAS are allowed in the product if there is a functional barrier that prohibits the substances from migrating into the food. The ban has no legally binding limit values for PFAS, but

there are indicator values of 20 µg total organic fluorine (TOF)/g or 10 µg TOF/dm^2. The indicative values are set to be low enough to capture intentionally added PFAS but high enough to exclude background contamination from e.g. water and wood pulp. In addition to chemical analysis, compliance can be proved by a statement from the provider of the raw material or intermediate material. All FCMs on the Danish market need a declaration of compliance.

Mette also informed about the upcoming ban of PFAS in food packaging in the new EU packaging and packaging waste regulation (PPWR). This EU regulation applies to all food packaging and not only paper and board. There might be FCM of paper and board that does not fall within the definition of packaging, but overall, the ban in PPWR is broader than the Danish national FCM regulation.

3.3 Theme 3: Databases and identification of PFAS

The third section of the workshop handled how databases, i.e. the products registers and the DK EPA consumer product surveys, can help to identify and prioritise PFAS in articles and chemical products. In addition, an example of how of cosmetic products ingredients lists can be used for enforcement was presented. Finally, the participants got introduced to a PARC project on systematic data collection on substances in products.

3.3.1 Data on PFAS in the Swedish Products Register. Which substances and what kind of products?

⇒ Download presentation (PDF)

Erik Diurlin, chemist at the Swedish Chemicals Agency gave an overview of PFAS in the Swedish products register. The register stores information on chemical products and biotechnical organisms that are manufactured in or transferred or imported into Sweden at a volume of more than 100 kg/year. The Swedish products register currently contains about 120,000 active products and about 13,000 substances.

Since 2018 the companies need to declare if their chemical products contain intentionally added PFAS. Since then, 116 companies have registered a total of 762 products that contain PFAS, which represents 0.6% of the total number of products in the register. It can be noted that the question (yes/no) about intentionally added PFAS has not been answered for 27% of the products.

Another way to identify PFAS containing chemical products in the register is to search for PFAS in the reported composition. This approach identified nearly 1,900 products reported by a total of 269 companies. The sectors with the highest

volumes of products with PFAS were plastic products, agriculture, air conditioning and motor vehicles. In total, 168 different PFAS were identified in the product register. These PFAS were not screened for regulatory status, which was identified as a possible follow-up project during the discussions at the workshop.

In conclusion, the approach of identifying PFAS containing chemical products based on the chemical composition resulted in 2.5 times more products than the approach with company notification for intentionally added PFAS (yes/no). The overlap between the two approaches was poor as only 239 products both had PFAS in the chemical composition and a PFAS notification (yes/no) by a company. This indicates that many companies are unaware of that their chemical products contain PFAS. Furthermore, even if companies notify intentionally added PFAS, these substances are rarely given in the registered chemical composition.

Product registers with information on chemical products are available in Norway, Denmark, Finland and Sweden. Based on these registers, information on the use of substances in products in the Nordic countries is publicly available in the joint database **SPIN**.

http://spin2000.net/

3.3.2 Data on chemical content in Danish consumer products

⇒ Download presentation (PDF)

Kim Boesen, head of unit of the Danish Chemical Inspection Service, presented the Danish Environmental Protection Agency's surveys on chemical substances in consumer products. Since 2001, nearly 200 reports on different chemicals (not only PFAS) have been published. These reports are public and searchable on the Danish EPA homepage. Furthermore, the database is used by the Danish EPA for prioritisation of products for enforcement campaigns.

Danish EPA Surveys of chemical substances in consumer products:

https://mst.dk/erhverv/sikker-kemi/kemikalier/forskning-og-kortlaegning/undersoegelser-af-kemi-i-forbrugerprodukter

3.3.3 PFCA in cosmetic products: An enforcement project – results and challenges

⇒ Download presentation (PDF)

Sunitha Vijayalekshmi, enforcement officer at the Swedish Chemicals Agency, presented a FORUM enforcement pilot project of PFCAs in cosmetic products. The project was performed in 13 European countries with the aim to enforce the legal requirements by setting a harmonized approach and establishing common enforcement methods for checking such obligations.

In the project, cosmetic products were first checked for 5 specified restricted PFAS substances on the ingredient lists and one product per restricted substance was purchased from each company. In total, 627 products from 47 companies were checked. Out of these, 77 products were non-compliant with the restrictions of PFOA and C9-C14 PFCAs and their related substances.

Taken together, the project indicates that some companies do not have sufficient information and/or knowledge to decide if PFAS are present in their products. Other experiences include that ingredients lists that are presented at online shops often are poorly updated, and that companies need to be reminded that restrictions apply to the entire supply chain including distributors.

Finally, it was proposed that a possible follow-up project could be to confirm the listed PFAS ingredients in the cosmetics by chemical analysis.

3.3.4 Systematic data collection on substances in chemical products and articles within the framework of PARC

⇒ Download presentation (PDF)

Robin Vestergren, scientific officer at the Swedish Chemicals agency, held a presentation about the work performed under PARC to review databases and information structures related to chemicals in chemical products and articles. A better understanding of substances in chemical products and articles is needed for, enforcement of restricted substances but also to set up for early warning systems, promote substitution actions and the transition to a circular economy. As part of the landscaping activities performed under PARC 6.4.3. a comprehensive review identified and evaluated available databases on chemicals in chemical products and articles from literature using a defined protocol and from European national market surveillance authorities, non-governmental agencies, and industrial sector groups using questionnaires. Among the 57 identified databases, 49 identified

specific substances, and only 30 reported their concentration in their products. The analysis highlights the lack of comprehensive or accessible data on chemicals in chemical products and articles for most categories of products and jurisdictions. The limitations of existing databases were attributed to scattered regulatory information requirements, lack of data for unregulated substances, complexity of supply-chain communication and confidentiality issues.

3.4 Workshop discussion

At the workshop, the main challenges with enforcement of PFAS were brought up and discussed. Some of the identified challenges are listed below.

The workshop participants all agreed that there are uncertainties in the available analytical methods of PFAS and the interpretation of the results in relation to the restrictions. For example, TOPA can be applied prior to targeted analysis to catch the precursors to regulated PFAS. However, it is uncertain to which extent the precursors are oxidised. Most likely, there is an underestimation of the actual PFAS content in the samples even after TOPA.

It was pointed out that the laboratories need incentives and large budgets to develop new methods. Thus, large and transnational enforcement projects are more likely to put pressure on laboratories to develop new methods, compared to small national projects. The participants at the workshop found it surprising that commercial laboratories are not more eager to develop analytical methods for PFAS in products, as such analytical methods are expected to be increasingly requested by companies and agencies. In contrast, there are cheap and fast methods for PFAS analysis in water due to a large demand on such analyses. However, it is recognized that articles and chemical products are more diverse and difficult matrices compared to water.

It was also acknowledged that it is difficult to use academic laboratories for chemical analyses as the researcher often need results that are interesting enough to publish. At the same time, commercial laboratories do not have all the equipment that for example are proposed by the three-step workflow that has been introduced at the conference and workshop (2.3.1). However, Lisa Skedung believes that the pyr-GC/MS could be installed at more laboratories to reasonable costs as the method builds om standard methods (i.e. GC/MS) together with a pyrolysis unit. Several labs most probably have a pyr-GC/MS instrument already to study microplastics.

One participant raised that FORUM[1] and the European Commission need to do

1. Forum for Exchange of Information on Enforcement (Forum) is an ECHA body that coordinates a network of agencies responsible for the enforcement of the REACH, CLP, and PIC, POP and Biocidal Product regulations.

more to ensure that the restrictions are enforceable. Otherwise, they leave the agencies with an impossible task. For example, the European Commission could assign laboratories to develop standardised methods for enforcement of the PFAS restrictions.

3.5 Workshop outcomes – recommendations for the future

There are several examples of Nordic enforcement projects of PFAS in different products groups. Overall, existing restrictions of specific PFAS and their related compounds often require TOPA to elucidate if a product in non-compliant with these restrictions due to the presence of precursors. It was believed that a universal PFAS restriction may simplify enforcement if appropriate and validated methods are available.

Overall, it was agreed that standardised analytical methods for PFAS analysis in articles and chemical products are urgently needed for efficient enforcement. Methods should be developed both for currently restricted PFAS, and for the broader group of PFAS that will be restricted in the future. Agencies, academia, commercial laboratories and companies should collaborate to develop analytical methods for PFAS.

Ideas for Nordic projects on analytical methods and enforcement of PFAS

Large transnational enforcement projects on PFAS. Such collaboration projects have the size to make demands on the involved laboratories, e.g. in terms of method development.

A guidance on procurement of PFAS analyses in articles and chemical products, including how to find laboratories, request analyses and interpret the relevant analyses. This would include communication with commercial laboratories.

Development and evaluation of a testing strategy suitable for enforcement.

Use the Nordic product registers as a source to prioritise product groups. The product registers could also be used to examine if there are restricted PFAS in the registers.

A possible follow-up to the cosmetics project could be to analyse the non-compliant products to confirm the presence of the PFAS that are listed in the ingredients list.

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Appendix 1. Conference Agenda

Nordic Conference on PFAS Substitution – Inspiration, Experiences and Tools, 2 September 2024

08:30 – 09:00
Coffee, sandwich and registration

09:00 – 10:15
SETTING THE SCENE

Opening of the meeting: *Romina Pourmokhtari, Swedish Minister for Climate and the Environment*

An overview of the problems with PFAS: *Ian Cousins, Professor, Stockholm University*

Current and upcoming PFAS-restrictions: *Audun Heggelund, Senior advisor, Norwegian Environmental Agency*

10:15 – 10:30
Short break

10:30 – 11:30
INSPIRATION FROM NORDIC COMPANIES

The outdoor company Houdini share their phase out journey of PFAS: *Malin Wetterborg, Textile engineer, Houdini Sportswear*

Successful transformation from synthetic to natural media for cooling & heat pump sector, avoiding environmental impact from ozone depletion, global warming, TFA & PFAS: *Fredrik Strengbohm, Technical manager, Caverion Sverige AB*

How Coop Denmark led national change on PFAS: *Louisa Raith Sørensen, Team leader nonfood quality & sustainability, Coop DK*

11:30 – 12:30
LUNCH

12:30 – 13:40
TOOLS FOR PFAS SUBSTITUTION AND PRODUCT DEVELOPMENT

PRIO – a tool for substitution – how to identify >10 000 PFAS: *Olof Johansson, Scientific officer, Swedish Chemicals Agency*

What support can the Swedish Substitution Centre provide?*Tonie Wickman, Senior*

advisor, Swedish Centre for Chemical Substitution

How can ChemSec tools support companies? *Jonathan Kleimark, Senior chemicals and business advisor, ChemSec*

Ecolabels, frontrunners in the green transition *Anna Linusson, CEO, Ecolabelling Sweden*

Panel discussion

13:40 – 13:55
Short break

13:55 – 15:45
EXPERIENCES OF PFAS ANALYSIS IN ARTICLES AND MIXTURES

Challenges and opportunities related to compliance testing of PFAS in chemical products and articles: *Robin Vestergren, Scientific officer, Swedish Chemicals Agency*

Screening and identification of PFAS in electronics, textiles and food contact materials: *Lisa Skedung, Project manager, RISE Research Institutes of Sweden*

A practical and pragmatic approach for detection of PFAS during ski competitions: *Anders Nilsson, Application and sales specialist, Bruker Nordic AB*

PFAS in cosmetics and personal care products from the European Market: *Jonathan Benskin, Professor, Stockholm University*

Panel discussion

15:45 – 16:15
Coffee break with fika

16:15 – 17:20
INSPIRATION FROM NORDIC COMPANIES

How Blåbær phased out PFAS at Norway`s largest kids wear brand: *Rolf-Erik Lund, Managing director, Blåbær Production Norway*

PFAS in Consumer Electronics - Challenges and opportunities on the road to circularity: *Anna Forsgren, Product compliance and sustainability manager, Marshall Group*

Panel discussion

17:20 – 17:30
WRAPPING UP

Closing remarks: *Per Ängquist, Director-General, Swedish Chemicals Agency*

Appendix 2. Workshop Agenda 3 September 2024

Workshop on PFAS enforcement in the Nordic Countries. 3 September 2024, World Trade Center, Stockholm

08.30 – 09.00 Morning coffee with sandwiches

09.00 – 09.10 Welcome and practical issues

09.10 – 11.00 Theme 1: **Analyses**

Food Contact Material: An enforcement project – results and challenges, Swedish Chemicals Agency (Anders Appelblom)

PFOA in Outdoor Textiles: An enforcement project – results and challenges, Norwegian Environment Agency (Ingvild Kvien)

How a systematic three-step workflow can be used for compliance testing in the implementation of current and coming PFAS restrictions (see article https://pubs.acs.org/doi/10.1021/acs.est.4c06570), Swedish Chemicals Agency (Robin Vestergren)

Evaluation of analytical methods within the framework of PARC (Partnership for the Assessment of Risks from Chemicals), Swedish Chemicals Agency/RISE (Robin Vestergren, Lisa Skedung)

Discussion

11.00 – 11.30 Theme 2: **National regulation and its implementation**

A short information about the Danish national regulation of firefighting foam and textiles, Danish Environmental Protection Agency (Kim Boesen)

A short information about the Danish national regulation of PFAS in food contact paper material, Danish Veterinary and Food Administration (Mette Holm)

Discussion

11.30 – 12.30 LUNCH

12.30 – 15.00 Theme 3**: Databases and identification of PFAS**

Data on PFAS in the Swedish Products Register – Which substances and what kind of products? Swedish Chemicals Agency (Erik Diurlin)

Data on chemical content in consumer products available in vidensbank.mst.dk,

Danish Environmental Protection Agency (Kim Boesen)

PFCA in cosmetic products: An enforcement project – results and challenges, Swedish Chemicals Agency (Sunitha Vijayalekshmi)

Systematic data collection on substances in chemical products and articles within the framework of PARC, Swedish Chemicals Agency (Robin Vestergren)

Discussion

Appendix 3. Opening speech by Romina Pourmokhtari, Swedish Minister for Climate and the Environment

The spoken word applies

Dear Nordic friends,

I'm very happy to have been asked to open today's conference, arranged by KemI – The Swedish Chemicals Agency. This conference is also a priority of the Swedish Presidency of the Nordic Council of Ministers.

We have highlighted in the Work Programme for our Presidency that the Nordic countries must continue to be a strong and clear voice to promote effective solutions in international environmental and climate negotiations.

We have also underlined that the Nordic countries for many years have successfully collaborated to minimize the risks to people and the environment caused by chemicals.

There was comprehensive Nordic co-operation behind establishing the Stockholm Convention on persistent organic pollutants, as well as the Minamata Convention on mercury. Now, yet again, the Nordics are sticking together, and there is a considerable cooperative Nordic effort underway to promote an agreement in Korea, in November to start negotiations on a new legally binding international instrument for combatting plastic pollution.

Today's conference on substitution of PFAS shows yet another example of Nordic leadership.

When it comes to controlling the large risks from hazardous substances today, at the European as well as at the global level, one of the most important challenges is a universal substitution of all PFAS.

Although there is rather lively public debate on the issue of PFAS, I believe this issue, unfortunately, will only grow in the minds of most ordinary people who are gradually realizing what a mess we've gotten ourselves into. The heart-breaking fact is that a lot of lives will be affected by PFAS contamination. Sadly, a lot of people have high levels of PFAS in their bodies, and it is only a question of time before some of them will start experiencing health issues.

We've only seen the beginning of the harms caused by PFAS, and we've only just begun addressing the issue. There is more to come, that's for sure.

The costs of inaction would be tremendous. In a socio-economic study commissioned by the Nordic Council and published in 2019, they were estimated to be between 52 and 84 billion Euros per year.

Furthermore, the fact that PFAS are extremely persistent and therefore tend to exist "forever", make them inherently unsuitable in a circular economy. That is why the European Union, in its Chemicals Strategy for Sustainability, has committed to a universal phase-out of PFAS. That is also why the Nordic society, once more, has taken a leading role in the phase-out of a group of hazardous substances.

The co-operation between Danish, Norwegian and Swedish competent agencies to submit the dossier for a universal PFAS restriction under REACH, and the agencies' on-going handling of the multitude of comments, is a brilliant example of this leading role. It is an achievement that I am very proud of as a Swedish and Nordic minister.

Our common achievements will benefit not only the peoples of our Nordic countries, but all of Europe. There has been some criticism of the restriction process being slow and lacking transparency. I believe this criticism is unfair and misleading. It is primarily for the European Commission to provide the conditions for further regulation, and for businesses to work on solutions. The Nordic agencies are clearly doing their utmost to fulfil their part of the process.

The Swedish government fully supports the phase-out commitment of the Chemicals Strategy. We believe that restrictions at EU level is the most effective tool for phase-out in Europe and that they also will pave the way for phase-out at global level. We will do our utmost to make sure that the incoming European Commission fulfil this commitment.

The efforts are already yielding results. Step by step, different groups of PFAS have been restricted. In 2023, for example, a restriction came into effect for the PFCA group, which consists of approximately 200 substances and is used in textiles and fire-fighting foam, among other things. In April 2024, the member states also voted through a ban on the group PFHxA, which is used, among other things, in materials in contact with food and in clothing. A proposal for a ban on all use of PFAS in firefighting foam is scheduled for discussion at the December meeting of the REACH committee.

This conference will be at the core of the continuing road towards a universal phase-out. Agencies and business now need to share their knowledge and their experiences of detection, identification, and phase-out of PFAS, as you will be doing today. It is indeed encouraging to note that you will hear about the positive experiences from a wide range of sectors, ranging from textiles to consumer electronics.

To the best of my knowledge, there are very few examples from the past, if any, where society has not been able to come up with alternative substances or techniques for substituting harmful substances in focus. On the contrary, feasible alternatives to hazardous substances have always been developed when strong legislative pressure has been combined with innovation efforts. I am therefore totally convinced that we will find solutions for the phase-out also of PFAS.

The sharing of substitution experiences is also very much in line with the ambitions of our Nordic Presidency as regards competitiveness. The Nordic region should in our view continue to be a pioneer in a competitive and innovation-driven transition, both at home and by promoting Nordic green solutions in the rest of the world. Cooperation and exchange of experience, including methods and tools, within the Nordic business community, like it will be done within this conference, can strengthen our common competitiveness.

Part of the programme of this conference is also about compliance testing and control, which is another key aspect in the phase-out of PFAS. There should, in my view, in principle be zero tolerance for non-compliance. This is a prerequisite for a level playing field. Companies that do not fulfil their responsibilities should face consequences. It will therefore be important that users and agencies share their experiences, like you will do today, with the aim of paving the way for rules that are possible to comply with as well as rules that are enforceable.

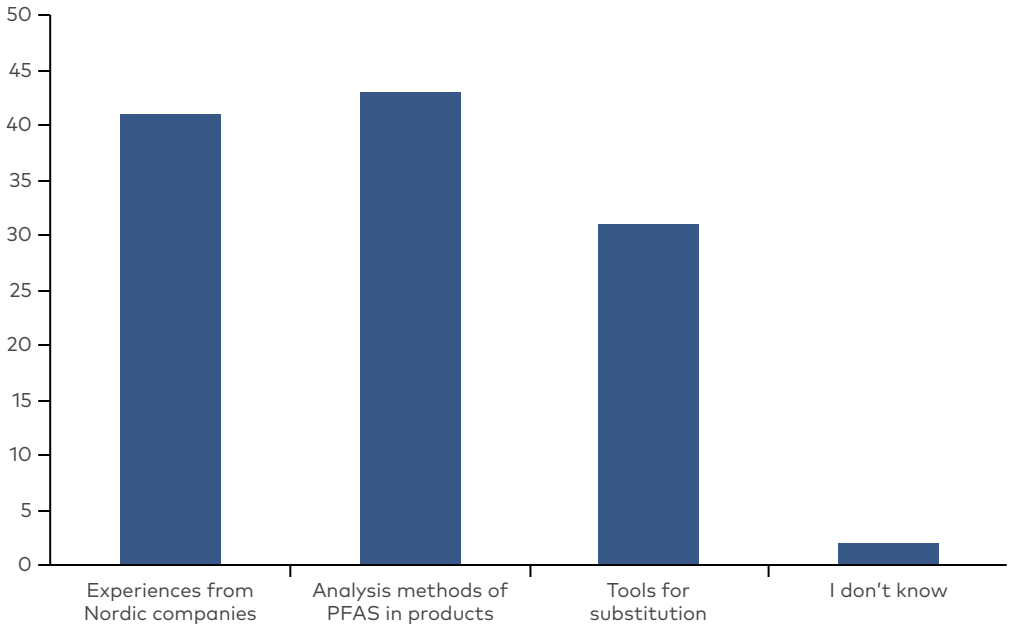
I wish you a fruitful conference and good luck to all of us, working for a world free from PFAS! Thank you!

Appendix 4. Evaluation survey

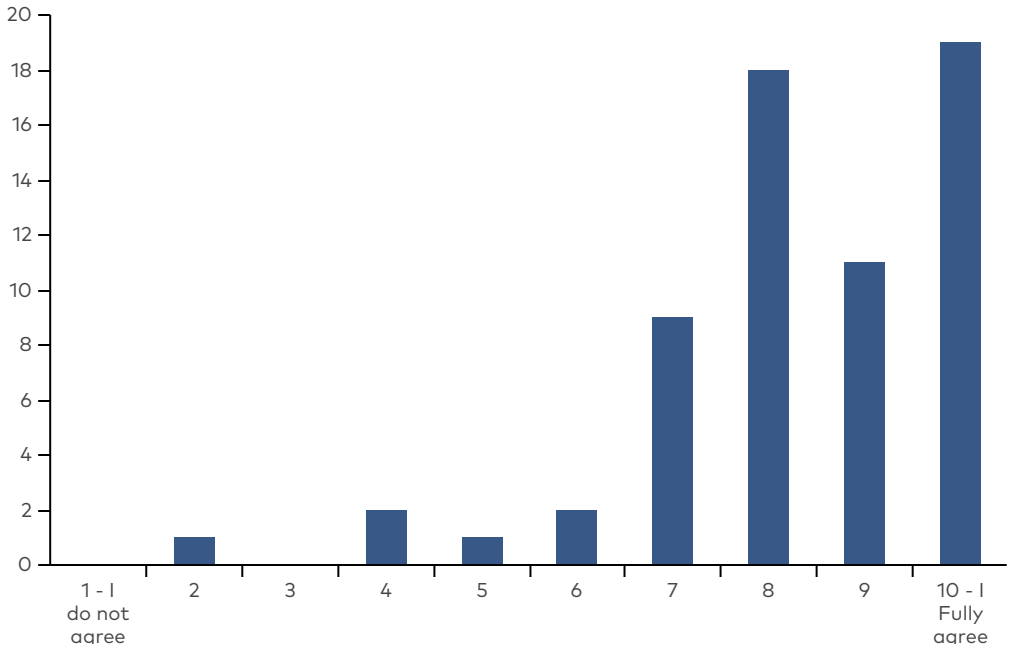
Note that the results from the survey only reflect the 63 persons who answered, and not everyone that joined the conference!

The respondents represented companies that produce, imports and/or sell products (29 pers.), national authorities (18 pers.) and other (16 pers.), such as trade associations, consultants, and commercial laboratories.

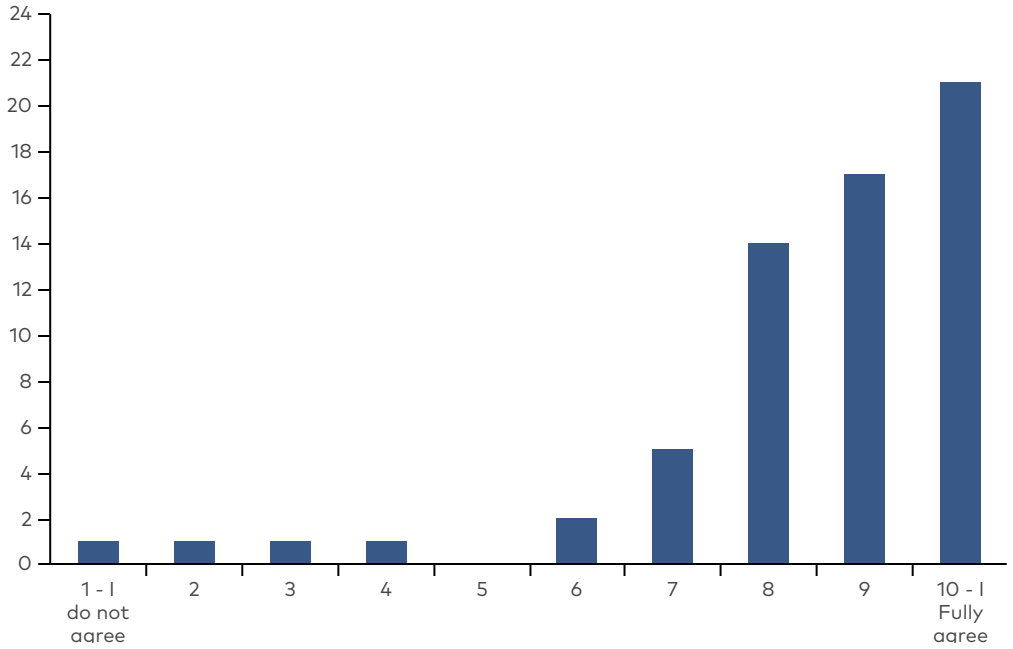
Q1: Which featured theme of the conference did you appreciate the most? (multipel choice question)



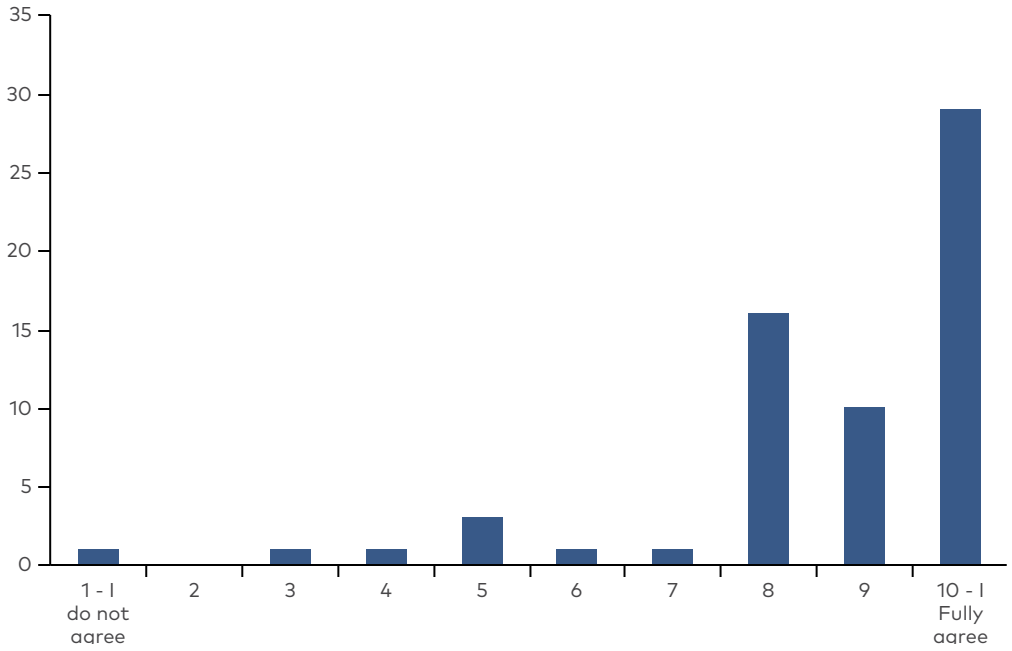
Q2: The content of the conference was relevant to me



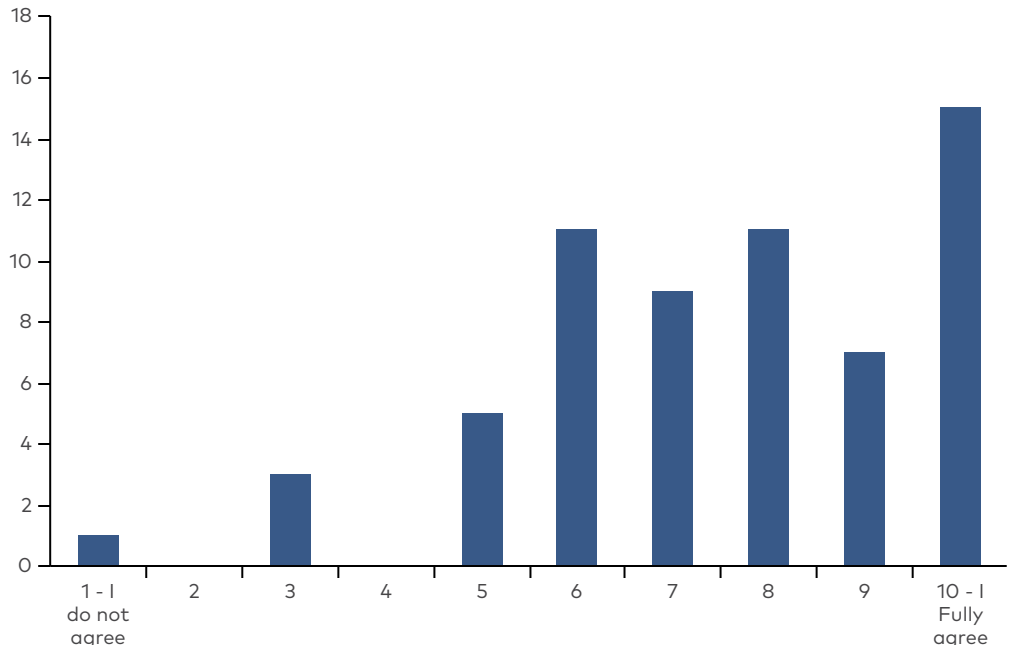
Q3: The conference matched my expectations



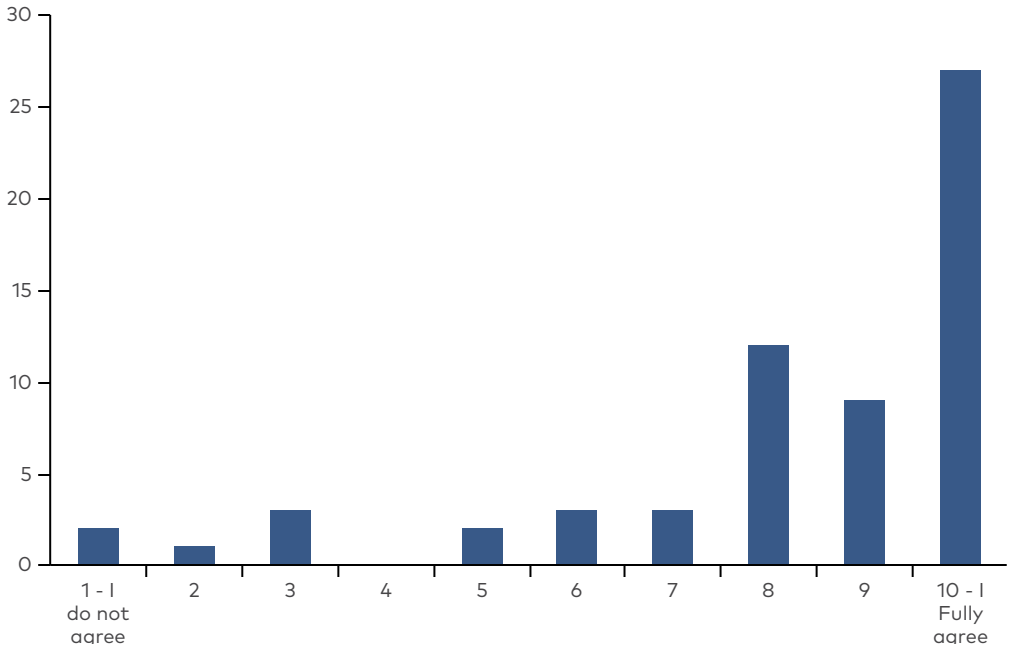
Q4: I got inspiration for my continued work with PFAS



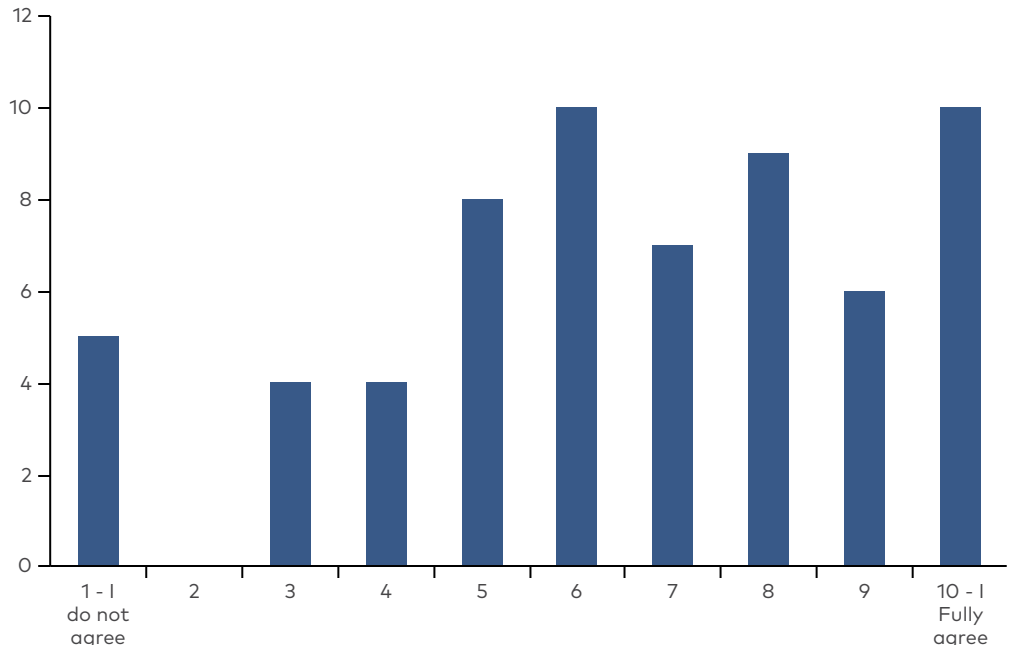
Q5: I learned something new about tools for substitution



Q6: I learned something new about analysis methods of PFAS



Q7: I learned something new about regulation of PFAS



Q8: What was the most important thing that you learned at the conference? (free text)

Upcoming reg draft
Substitutions are not "one mans jobb". Collaborations, collaborations and communications
The extent of pfas included products
Analysis of PFAS, hazard steps of PFAS in the end-of life stage and manufacturing.
Meeting and discussing with other people
tools and regulation
Inspiration about handling the PFAS universe through other's practical experiences.
How companies address this issue, to keep updated with authority actions.
The most important thing was probably the approach to analyzing PFAS and that it is possible to do without it being prohibitively expensive. I also got a better understanding of why identifying PFASes are so complicated for in different types of products.
That when companies decide to do better, there is no obstacle for reaching the goals.
Att det är möjligt att substituera PFAS, även i elektronik
That we are on track with our PFAS understanding within our company.
the work on testing
The different types of PFAS. The regulations so far and the upcoming changes that are expected
Två things. 1. That it is possible with the analytical methods existing today, to enforce the upcoming uPFAS restriction. 2. That there are all ready alternatives for many of the uses for PFAS and that substitution is possible.
Possibilities to substitute PFAS in electrical items.
That there is hope and that there are alternatives out there. Tools and tips on how to tackle the problem.
om analysmetoder och workflow, att det är möjligt att substituera, att den breda definitionen av PFAS att fullt relevant då FTS bildas och dess halter stiger i miljön.

A general picture of PFAS; and its multidimensional use
Research projects
That substitutions are possible and experts are optimistic about that! :)
it is possible to substitute PFAS and it is not so complicated.
The Good News Show seems prioritized
That its important to involve procurement and set clear goals
Tools for PFAS substitution, experience of PFAS
We all need to start the process
Methods for analysis
Fick bekräftat att omställning tar mer tid än vad folk tror
The importance of addressing production, consumption and the need for internalisation of costs; i.e. the polluter pays principle.
How complex it is to define PFAS, that there are ways to analyze PFAS in products and that we have to keep up the work with minimizing sources of PFAS.
Experts
Challenges related to wide spread use of these substances e.g. in electronic. Other requirements may so the replacements difficult (e.g. flammability)
A better overview and that some companies have got far along with phasing out PFAS from their products.
Test procedure for PFAS
That PEFAs is complicated and some PEFAs is not so bad
Water and food are the main exposures.
Att det finns fler definitioner av pfas än vad jag visste och hur pass oklart det fortfarande är. Även hur man kan använda sig av F-tot analys vid utfasningen.
about proposed 3-step workflow

That PFAS is really everywhere and that knowledge is the key to change. And that there are different legislations/definitions in different countries.
Examples about substitution
The Nordic companies are trying to avoid PFAS and the journey is very difficult, but it is possible. Also, its is possible to analyse if products and articles are in compliance with the coming broad PFAS restrictions .
The challenges in analysing PFAS in different materials
Komplexiteten, Skillnader i definition och mellan länder,
testing methodologies
The development of analytical methods of PFAS.
Analysing methods
the need to bring the different actors together to find solutions
A very important message I took home with me was that there is commitment and support from the Swedish government to support the uPFAS ban proposal. In industry many voices share doubt that it will actually happen, but contents from this conference and especially the ministers opening statements strongly indicate that the proposal will go through, even if with derogations
Tools for substitution
practical experience from various stakeholders (companies and others(
Some insight in the challenges that companies face when they start phasing out PFAS.

Q9: What was good? (free text)

Inspirations from "Forerunners" from different industries, practical information on analytical PFAS methods, networks and tools
Networking and some presentations
The whole conference was very well performed
relevant presenters
Introduction to PFAS was great.
Good quality presentations, in all aspects. Good venue. One of the best arrangements in this area of business I have attended.
Almost everything, it was a wonderful conference. I loved the conferencier, ha added a much needed note of fun to an otherwise dense topic. The talks were wonderful, the starting talk from Prof. Ian Cousins was truly fantastic and I was very positively surprised by the talk from Louisa Raith Sorensen of Coop Denmark
The variety of topics concerning PFAS!
Mycket bra föreläsare och konferencier
The moderator was super and made the topic more interesting
the different speakers per topic
Stockholm University presenter was the best. Analysis team with Rise, KEMI and uni,
The spirit, the speakers, the food and people attending the conference. Erik, the conferee, did a great job.
Info re testing of PFAS. Communication with others at the conference.
Overall very good and interesting conference. Well put together. Despite comfortable chairs I didn´t fall a sleep, even after lunch, that´s how interesting an inspiring this was. Good starting point with explaining the complexity and different definitions of PFAS. Very good with examples from companies about their journey in phasing out PFAS, lessons learned, how to use simple analysis methods as a starting point for discussions with suppliers when suspected PFAS was found in products.
optimistisk anda, superbra moderator, tydliga exempel på hur man kan gå tillväga.

The moderator was super good!
info about different projects
Good mix of different subjects, inspirational, good way to network and get to know other working with PFAS. Central location
Good discussions, Great moderator, Comprehensive programme
Overview test methods presented by Robin Vestergren
Everything was good :) Nice atmosphere, interesting topics, good speakers
All
Discussion on the pfas topics am
plats och fika/mat, nätverkande samt konferensier
The open exchange, the desire to approach the problem in a broad manner, and opportunities to start and strengthen.
The moderator was very good, creating a very pleasant day for all attending the conference, interesting topics, exciting to meet people from other nordic countries, good with a possibility to participate in a workshop, the conference centre is nice and had good service
The comprehensive overview
All content fitted together nicely
I think it was very well organized which made the whole experience very positive. Also I think the lecturers were very good and that they were from different sectors enhanced the PFAS problem from different angles. The moderator was very good, he was setting a good atmosphere throughout the conference.
mix of different topics om the Fields of PFAS
Setting the Scene
Ian Cousins
Att få höra andras erfarenheter, både bra och dåliga. Jag uppskattade att det var väldigt öppet, transparent och lättsamt. Bra och rolig stämning trots det allvarliga ämnet!
I think it was a good balance between theory and practice.

It was very good to get an overview and also perspectives from different angles (authority, researchers and retail)
learning about the trends
The combination of presentations from authorities, academia and good examples from companies. The moderator Erik Mattsson was very good in leading through the whole day
The variety of speakers
Allt var professionellt och inspirerande
all presenters were very good and clear in their message
Moderator, the timing was perfect handled. All presentations was on a good level and informative, Good quality of sound. The possibility to send questions during presentation
the positive atmosphere - looking for solution rather than getting stuck with the problems
The combination of input from academia, from authorities, and from industry.
Good and balanced content, a lot of information in one day, speakers kept their time (i.e. no delays in the agenda). Good lunch :)
chemical analysis, practical examples, experience from industry, organisation of the conference and managing it
Good selection of speakers. Good food and fika.

Q10: What could have been better? (free text)

We could have used more info on how ”teknikföretag ” can work with substitutions. This was a bit focused on how consumer products work.
I did not like the NGO mindset from ChemSec on companies being lazy or not working on the phase out. It is not a topic of them to give input on since they have no idea how hard some companies actually ARE working with phasing out PFAS.
Information on human health effects of PFAS to reminds us the reasons of bans and to keep pushing company to moving forward (even thought many of the participants are aware of the issues)

1) A glimpse of the restrictions, where are we today, what happens 2024, what follows after that? 2) How-to PFAS in practice by utilizing said TOOLS.
I would have liked to hear more about legislation in other countries.
More information on what the new legislation will (probably) look like and a rough timeline for when it might come into force.
Not so much focus and not tailored for inspectors. But really interesting and inspiring!
A realistic view about the real world of product sourcing, EU competitiveness, durability of PFAS alternatives its benefits and shortcomings,... In summary, a more honest and realistic picture.
Some presentations could have been more focussed on PFAS issues and less on general presentation.
Maybe there could have been a bit more debate and direct questions from the public, maybe there could be someone from the industrial sector speaking of the challenges to phase out PFAS (since there have been so many comments on the upcoming legislation).
It would have been nice to know more about the waste stream and treatment methods that are being looked into.
The production, waste management, and internalisation of costs.
More balance, less halleluja. At least one seminar on fire fighting products.
Even more overview of production of PFASs and more about where we find them in the environment. But you only had 1 day..
More attendees, detailed examples and longer period
Jag hade förväntat mig mer riktlinjer och mer info om förslaget till restriktioner. vilka PFAS som är reglerade och vilka typer ska regleras, tidslinjer
too much details about analysing methods
I'd like to see more about how to manage data from suppliers. It was presented that there are legal obligations for suppliers to inform customers about presence of chemicals, but in reality this does not always happen. If that information flow becomes more effective and accurate, it would reduce need for expensive testing and increase confidence in whether or not articles/products/materials are in compliance with regulations
send the presentations in advance

A bit more time for questions from the audience would have been nice
There was no ventilation in the lecture hall, after 30 minutes the air got very stuffy and too warm.
Dagen var för lång. Eftermiddagen var kämpig, svårt att hålla koncentrationen efter all information och med brist på syre i lokalen. Jag tyckte synd om föreläsarna under eftermiddagen.
The ventilation in the room was poor, it got really hot towards the end of the day.
Making the conference available for more people, especially from industry, trading companies.
The temperature in the conference room to high!
Större lokal så att eventet kan bli tillgängligt för fler. Det behöver inte vara så påkostat, hellre att fler nås av informationen.
First mail after the conference by the organisators was expected to be the presentations, not a poll
Ventilation vas bad, it was warm in the conference hall, No tap water next to the toilets
The venue or meeting room. Terribly hot in the afternoon sessions
Lokalen kunde ha varit större. Blev fort dålig luft och varmt.
The chairs in the conference room could have been better with support for writing pads or for computers. The chair was not comfortable to sit for a whole day, may be not good for persons with backproblems. It could have been better with if all the toilets had sinks for washing hands or had sinks in the neighbourhood areas.
Possibility to wash hands :)
The room - air condition and windows.
the temperature in the meeting room
Maybe too much content from some speakers that had to rush through their presentation (e.g. Chemsec)
longer fika breaks to get more discussion time with the audience
The air in the conference hall. :)

Nothing
No comments
Don know
-
Can't think of anything
-

About this publication

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Nordic Council of Ministers/Publication Unit
Ved Stranden 18
DK-1061 Copenhagen
Denmark
pub@norden.org

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The Nordic Council of Ministers
Nordens Hus
Ved Stranden 18
DK-1061 Copenhagen
pub@norden.org

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