BEYOND PFAS – THE SAFER ALTERNATIVES: TECHNICAL TEXTILES
SPEAKERS

- **Dr. Lisa Skedung**, Researcher and Project Manager at Research Institutes of Sweden
- **Louise Svensson**, Technical Development Manager at Tranemo Textil
- **Dr. Rüdiger Fox**, CEO of Sympatex
- **Dr. Jonatan Kleimark**, Senior Chemicals and Business Advisor at ChemSec

- Q&A – use the Q&A function
- A recording of the webinar as well as the slides will be distributed to the registrants of the webinar
Future enforcement of a broad PFAS restriction
A case study on workwear garments and shoes
Lisa Skedung, 2024-05-07
The POPFREE projects (started 2016)
Vision: A systemic shift where PFAS-free is obvious for both producers and consumers

- POPFREE Industry – Towards a PFAS-free and Circular Industry (2021-2023)
- POPFREE - Promotion of PFAS-free Alternatives – UDI stage 3 (2020-2022)
- POPFREE - Promotion of PFAS-free Alternatives – UDI stage 2 (2017-2020)
- POPFAS - UDI stage 1 (2016-2017)

All projects financed by Vinnova, Sweden’s Innovation Agency, and partners.
Analysis of PFAS in products
Both methods use direct thermal breakdown and capture PFAS broadly including polymeric PFAS

PFAS restriction proposal

PFAS shall not be manufactured, used or placed on the market as substances on their own; nor not be placed on the market in another substance, as a constituent; in a mixture, or in an article in a concentration of or above:

- **25 ppb** for any PFAS
- **250 ppb** for the sum of PFASs
- **50 ppm** for PFASs (polymeric PFASs included)

If total fluorine exceeds 50 mg F/kg the manufacturer, importer or downstream user shall upon request provide to the enforcement authorities a proof for the fluorine measured as content of either PFASs or non-PFASs.

Also applies to imported goods and recycled materials!

The levels do not leave room for any intentionally added PFAS!
Total fluorine in textile samples

The 50 ppm level in the restriction proposal makes sense

The TF-levels in the unknown samples indicate intentionally added PFAS.
Pyrolysis-GC/MS
Material analysis to verify presence of organic fluorine (PFAS)
Workwear and shoes
Case study of future enforcement of a broad PFAS restriction

Out of 23 commercially available workwear garments and shoes, 10 garments and 3 shoes displayed a TF-concentration > 50 ppm in the range 65 ppm - 1500 ppm, indicating intentionally added PFAS.

Presence of PFAS was verified in all 13 samples with pyrolysis-GC/MS.

C6-SFP was found in 10 of the samples and C8-SFP was found in 3 of the samples based on retention time of PFAS-fragments, mass spectra and the NIST instrumental database.
One textile sample
Results from analysis with different analytical techniques

<table>
<thead>
<tr>
<th>Method</th>
<th>Quantified level</th>
<th>Compare with</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\Sigma$PFAS$_{22}$ (LC-MS/MS)</td>
<td>15 ppb (ng/g)</td>
<td>250 ppb</td>
</tr>
<tr>
<td>Extractable organic fluorine (EOF)</td>
<td>&lt;Limit of quantification (100 ppm)</td>
<td>50 ppm</td>
</tr>
<tr>
<td>Total fluorine (CIC)</td>
<td>1 500 000 ppb (1 500 ppm)</td>
<td>50 ppm</td>
</tr>
</tbody>
</table>

SFP = side-chain fluorinated polymers

Illustration from Steffen Schellenberger
Methodology also for fluoropolymers
Detection of PTFE as an additive in plastic

Pyrolysis-GC/MS verifies that the quantified fluorine originates from the fluoropolymer PTFE.

PTFE added as anti-dripping agent in the plastic at 0.1-0.2 w%
Concluding remarks

• Analysis of total fluorine (TF) with combustion ion chromatography (CIC) and pyrolysis-GC/MS are promising and complementary analytical methods to screen products for intentionally added PFAS.

• Both methods capture PFAS broadly including polymeric PFAS.

• This presentation focused on textile products, but the methods have successfully been used for PFAS screening in cookware, electronic products, food contact paper, ski wax and hygiene products.

• A TF-concentration over 50 ppm with no PFAS-fragments in the pyrolysis-GC/MS may indicate inorganic source of fluorine.

• For checking compliance with legislation today and to find lower concentrations of PFAS (impurities/contamination) traditional target/TOP analysis is required.
Thank you for your attention!

Lisa Skedung, lisa.skedung@ri.se

Feel free to contact med if you are interested in PFAS analyses!
TRANEMO
ADVANCED WORKWEAR
SINCE 1934

TRANEMO HISTORY
CUSTOMER SEGMENTS

OUR

POWER & UTILITIES
SMELTERS & FOUNDRIES
WELDING
RAILWAY
MINING
CHEMICAL & PETROCHEMICAL
EXPERTS IN FLAME RETARDANT WORKWEAR

ALL FOR A SAFER WORKPLACE SINCE 1934
PFAS in workwear

Where is PFAS used today?

**EN ISO 20471**

**HIGH VISIBILITY CLOTHING**
A finish with PFAS is often used for high visibility clothing to provide dirt and oil repellency.

**EN 343**

**PROTECTIVE CLOTHING AGAINST RAIN**
For taped winter clothing and shell garments, a finish with PFAS is often used for water repellency against rain and snow and/or a PTFE membrane, which also contains PFAS and gives the garments water repellency and good breathability.

**EN 13034**

**PROTECTIVE CLOTHING AGAINST CHEMICALS**
For protective clothing with chemical protection, PFAS is often used to obtain limited protection in case of chemical splashing against the four chemical groups: acid, base, aromatic hydrocarbon and alcohol. In standard EN 13034, the repellency of the fabric is tested against 30% sulfuric acid, 10% sodium hydroxide, O-xylene and butanol. To CE mark a garment, the standard EN 13043 only requires an approved result for one of the four chemicals.

**EN 61482-2**

**FLAME RETARDANT CLOTHING AGAINST THE THERMAL HAZARD OF AN ELECTRIC ARC**
For arc-certified shell garments, membranes with PFAS increase flame and arc protection and thus reach a higher EL/IM value.

TRANEMO ADVANCED WORKWEAR
Where is PFAS used today?

**PFAS in workwear**

**EN ISO 20471**

**HIGH VISIBILITY CLOTHING**
A finish with PFAS is often used for high-visibility clothing to provide dirt and oil repellency.

**Before wash**

**After wash**

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For arc-certified shell garments, membranes with PFAS increase flame and arc protection and thus reach a higher EL/IM value.
The ability to repel

EN 13034 PB[6]

### EN 13034 Type PB[6]
Protective clothing for liquid chemicals

<table>
<thead>
<tr>
<th>Code</th>
<th>Test</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Materials ability to repel chemicals (highest level class 3) Chemicals that are tested: H₂SO₄, 30% (Sulphuric acid) Na OH 10% (Sodium hydroxide also called lye or caustic soda) o-Xylene Butanol</td>
</tr>
<tr>
<td>B</td>
<td>Chemicals’ ability to penetrate the material (highest level class 3) Chemicals that are tested: H₂SO₄, 30% (Sulphuric acid) Na OH 10% (Sodium hydroxide also called lye or caustic soda) o-Xylene Butanol</td>
</tr>
<tr>
<td>C</td>
<td>Abrasion strength (highest level class 6)</td>
</tr>
<tr>
<td>D</td>
<td>Tear strength (highest level class 6)</td>
</tr>
<tr>
<td>E</td>
<td>Tensoil strength (highest level class 6)</td>
</tr>
<tr>
<td>F</td>
<td>Puncture resistance (highest level class 6)</td>
</tr>
</tbody>
</table>

The test results of all codes are specified on the CE label in the garment.

### Acid

- H₂SO₄ (30%)
- NaOH (10%)
- o-Xylene
- Butan-1-ol

### Alcaline

- NaOH (10%)
- Butan-1-ol

### Auromatic Hydrocarbon

- H₂SO₄ (30%)
- NaOH (10%)
- o-Xylene
- Butan-1-ol

### Alcohol

- H₂SO₄ (30%)
- NaOH (10%)
- o-Xylene
- Butan-1-ol

Apex – PFAS C6

Cantex WS - PFAS-FREE
The ability to repel

EN 13034 PB[6]

<table>
<thead>
<tr>
<th>EN 13034</th>
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<th>C</th>
<th>D</th>
<th>E</th>
<th>F</th>
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</thead>
<tbody>
<tr>
<td>Class</td>
<td>6</td>
<td>4</td>
<td>5</td>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>H₂SO₄ (30%)</td>
<td>3</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>NaOH (10%)</td>
<td>3</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>o-Xylene</td>
<td>0</td>
<td>0</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Butan-1-ol</td>
<td>0</td>
<td>0</td>
<td></td>
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</tr>
</tbody>
</table>

PFAS C6 Tera TX

This is how we communicate

<table>
<thead>
<tr>
<th>EN 13034</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
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<td>H₂SO₄ (30%)</td>
<td>3</td>
<td>3</td>
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<tr>
<td>NaOH (10%)</td>
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<tr>
<td>o-Xylene</td>
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<td></td>
<td></td>
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<tr>
<td>Butan-1-ol</td>
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</tbody>
</table>

PFAS-free C0 Tera TX

PFAS & PFAS-free
What can we do

PFAS finish + PFAS-free impregnation = OK

PFAS-free finish + PFAS impregnation = OK
PFAS vs PFAS-FREE

- Water > 70 mN/m
- Cooking Oil 10 - 30 mN/m
- Vinegar 24% 38 mN/m

PFAS = HIGH SURFACE ENERGY - good oil repellency
PFAS FREE = LOWER SURFACE ENERGY - bad oil repellency
The ability to repel

Surface Tension & Surface Energy
PFAS and Gen Z

Ban PFAS

European teenagers are high – on PFAS

Published on 30 July 2022

Teenagers in Europe have high levels of PFAS in their blood, especially Swedish, French and Norwegian ones, an EU human biomonitoring study shows. The reason for these high levels? A large intake of egg, fish, animal intestines and locally produced food.
Ban PFAS

This is Tilda - Gen Z

Known contamination  Known PFAS User  Presumptive contamination  PFAS manufacturing facility
Ban PFAS

This is Tilda again
Ban PFAS

We have to move forward
What can WE do

• **Individuals** – Avoid to buy products containing PFAS

• **Doctors** – Give advice of how to avoid PFAS

• **Companies** – Phase out PFAS and avoid unnecessary use

• **Politicians** – Limit or ban PFAS
What can WE do

• Tranemo maps the use of PFAS. Starting to phase out C8 & switch to C6 chemistry. Phase-out of C8 completed in 2015
• Tranemo begins testing PFAS-free alternatives in 2018 together with FR - fabric supplier
• Tranemo removes PFAS where it is not needed in WI/HV collections
• Tranemo phase out PFAS from majority of FR fabrics and switch to PFAS-free during 2024

In 2021, Tranemo launches the first PFAS-free collection that has protection against splashing chemicals

In 2020 Tranemo performs tests with customers on PFAS vs PFAS-free fabrics to compare the protection

In 2019 Tranemo decides in 2019 to go for PFAS-free where possible

PFAS C8 banned in 2020

C8 up on the SVHC candidate list 2012

TRANEMO

P F A S -> P F A S - f r e e
FOR A SAFE AND HEALTHY FUTURE
THANK YOU
More than a membrane.

We are Sympatex:

Over 35 years in business with a PFAS-free membrane made in the EU
Over 15 years field experience with C0 DWR (Durable Water Repellent)
WE COVER THE COMPLETE FUNCTIONAL TEXTILE RANGE

Our business units

Apparel
- Snow
- Outdoor
- Accessories
- Hiking
- Running
- Lifestyle
- Motorbike
- Fashion

Footwear
- Kids
- City
- Outdoor
- Bike
- Hiking
- Trail Running
- Motorbike

Workwear (Apparel & Footwear)
- Multifunctional Workwear
- Work & Safety
- Contract & Workwear
- Ambulances
- Police
- Military
- Firefighters
- Medical Services
FUNCTIONAL TEXTILES

The Double PFAS Challenge

Area of PFAS application #1: PTFE Membranes
- Release during production
- Toxic in incineration

Area of PFAS application #2: C6 DWR (former C8)
- Release during use phase
- Release during landfill
- Toxic in incineration

We can provide the full study on PTFE (2021):
FUNCTIONAL TEXTILES

The two Solutions

Solution #2: Sympatex C0 DWR
Since >15 years in production/R&D

Solution #1: Sympatex Membrane (Polyester based)
Since >35 years in production

- Waterproof: Over 45,000 mm water column
- Windproof: According to DIN EN ISO 9237
Try to explain to a 5-year-old why we have the right to pollute his future “forever” just to avoid traces of stains on our workwear gear ...

We need to start from a NO to PFAS!

ONLY PFAS FREE TEXTILES CAN GIVE THE “LICENSE TO OPERATE”
Personal Protective Equipment (PPE)

We fully support:

- Strongly limiting PPE derogations where essential for the use case*

* Historic Over-Specifications cannot be a justification
MINIMIZING EXCEPTIONS IS POSSIBLE

Avoidable for most use cases in PPE (if not over-specified)

We can provide the full study on PPE (2023):
“PFAS Restriction process according to REACH
Fluorine-free solutions for personal protective equipment”

<table>
<thead>
<tr>
<th>Requirement</th>
<th>Standard</th>
<th>Applies to</th>
<th>PFAS-relevance</th>
</tr>
</thead>
<tbody>
<tr>
<td>UV-resistance</td>
<td>ISO 105 - 802</td>
<td>Upper fabric, DWR</td>
<td>No significant difference</td>
</tr>
<tr>
<td>UV-resistance</td>
<td>EN 20103-801</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Water repellency</td>
<td>ISO 4920</td>
<td>DWR</td>
<td>No significant difference</td>
</tr>
<tr>
<td></td>
<td>EN 24920</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Waterproof (rain tower test)</td>
<td>EN 14360</td>
<td>Overall structure</td>
<td>No significant difference</td>
</tr>
<tr>
<td>Waterproof (new)</td>
<td>ISO 811</td>
<td>Membrane</td>
<td>No significant difference</td>
</tr>
<tr>
<td></td>
<td>EN 26811</td>
<td></td>
<td></td>
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<tr>
<td>Waterproof after 10x washing</td>
<td>ISO 6330</td>
<td>Membrane</td>
<td>No significant difference</td>
</tr>
<tr>
<td></td>
<td>EN 15797</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>EN 26330</td>
<td></td>
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<tr>
<td>Waterproof after cleaning</td>
<td>ISO 3175-2</td>
<td>Membrane</td>
<td>No significant difference</td>
</tr>
<tr>
<td>Waterproof after abrasion</td>
<td>DIN 53359</td>
<td>Membrane</td>
<td>No significant difference</td>
</tr>
<tr>
<td>Waterproof after bending</td>
<td>EN 7854</td>
<td>Membrane</td>
<td>No significant difference</td>
</tr>
<tr>
<td>Waterproof after contact to oil and fuel</td>
<td>ISO 1817</td>
<td>Membrane</td>
<td>No significant difference</td>
</tr>
<tr>
<td></td>
<td>EN ISO 7854</td>
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<tr>
<td>Waterproof after hydrolysis</td>
<td>DIN 53356</td>
<td>Membrane</td>
<td>Minor difference</td>
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<tr>
<td>Windproof</td>
<td>ISO 9257</td>
<td>Membrane</td>
<td>No significant difference</td>
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<tr>
<td>Physical properties®</td>
<td>ISO 105</td>
<td>Upper fabric</td>
<td>Differences are solvable</td>
</tr>
<tr>
<td>Waterproof after weathering</td>
<td>ISO 4892-2</td>
<td>Membrane</td>
<td>Differences are solvable</td>
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<tr>
<td></td>
<td>EN 12280-3</td>
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<tr>
<td>Water vapour transmission resistance</td>
<td>ISO 11092</td>
<td>Membrane/ Overall structure</td>
<td>Differences are solvable</td>
</tr>
<tr>
<td></td>
<td>EN 31092</td>
<td></td>
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</tr>
</tbody>
</table>
OUR VALUED

Brandpartners in Workwear
SYMPATEX PRODUCT DEVELOPMENT

Our Core Principles

Accelerate Innovation
“Constraints might challenge creativity, but they accelerate innovation”

Good Enough
“We aim to meet the real needs and will not join the Vortex of Higher-Faster-Further”

Extended Responsibility
“There is a transgenerational responsibility throughout the lifecycle of our products”
Sympatex – We call for a comprehensive EU-ban of PFAS in Textiles/Footwear with strongly limited* derogations for selective PPE - and are fully prepared to serve this market.

*Proven essential use/not over-specified with no alternatives available
TIME FOR Q&A!
MORE WEBINARS!

• The **28th of May**, the next webinar in our Beyond PFAS series will take place. The focus will be on alternatives to **F-gases** applications.

• **End of June** we will have a webinar on alternatives to PFAS uses in **solar panels**.

• Stay tuned in our channels for an invitations that will be coming soon
IMPORTANT LINKS

- Website: chemsec.org
- The SIN list: sinlist.chemsec.org
- ChemSec Marketplace: marketplace.chemsec.org
- PFAS guide: pfas.chemsec.org
- ChemSec webinars: youtube
- Newsletter: Sign-up page
- LinkedIn: ChemSec