REGULATORY AFFAIRS
The Challenge
PFOA free
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- Summary
Clariant's textile, paper and emulsions businesses have been acquired in September 2013 by SK Capital and have become: Archroma.

Archroma is a global leader in colour and specialty chemicals with strong market insight, highly talented people and a long history of material excellence and expertise.

Headquartered in Basel/Reinach Switzerland.

Worldwide 3000 employees with global sales of appr. 1.2 Billion CHF
A trusted heritage

1886 - Foundation Kern & Sandoz (dyes)
1995 - New operating structure along Pharma, Nutrition, Agribusiness/Chemicals sectors
1996 - Sandoz and Ciba-Geigy form Novartis
1995 - Acquisition of Hoechst Specialty Chemicals
1997 - Acquisition of BTP
2000 - Divestment of textile, paper and emulsions businesses to SK Capital Partners
2013 - Archroma
### Durable Water Repellent (DWR) in Textile Finishing

- Commercially available DWR finishes are well known and have been widely evaluated for their performance. They include fluorinated, hydrocarbon, silicone, dendrimer, waxes, etc. fabric finishes.

- DWR is well known, valuable finish technology used to protect products and the people wearing them.

- DWR extends a product’s useful life-time and aesthetics - looking new longer

- DWR can significantly reduce aspects of a product’s life-cycle environmental footprint, especially in the use phase.

- Fluorinated finishes are in use for highest DWR performance requirements, include attributes like: water repellency, oil repellency, stain repellency, soil repellency, stain release, soil release, and highest durability (e.g. to laundering, to light exposure, to rain, to abrasion, to dry cleaning, etc.)
Typical Application Areas and Uses
Fluorotelomer based Chemistry used in the Textile Industry

- Awnings
- Health Care
- Filter media
- Furniture coverings
- Outdoor clothing
- Police uniform
- Work wear
- Carpet
The **KEY functionality of side-chain fluorinated Polymers is the perfluoroalkyl chain**

- **A perfluoroalkyl chain** \( F(CF_2)_n^- \), where \( n \) is the number of fluorinated carbons, is attached to a polymer backbone (e.g., acrylic polymer).
- The length of the perfluoroalkyl chain “\( n \)” is important!
- The perfluoroalkyl chain is part of a monomer that is polymerized with additional non-fluorinated monomers to make the polymer.
- The polymer architecture and composition is tailored for both the fiber/fabric and the performance required of the fabric.

- PFOA has never been used as building-block in fluorotelomer based DWR formulations, but could be present as unintended process by-product in traces (<ppm level).
- Historically, fluorinated DWR finishes have been made with raw materials that can break down to form long-chain perfluorinated chemicals such as PFOA and PFOS.
Global Regulatory Action in PFOA related areas

Long chain C8 based products are under re-evaluation and/or restrictions or bans in multiple countries and regions including:

- United States
- Canada
- European Union
- Germany
- Norway
- Australia
- Japan

*) Summary of data compiled by the FluoroCouncil. The FluoroCouncil member (Arkema France; Asahi Glass Co., Ltd.; Clariant International, Ltd.; Daikin Industries, Ltd.; DuPont Company; Solvay Specialty Polymers) represents the world’s leading fluoro-technology manufacturers.

http://fluorocouncil.com
US EPA Regulatory Update
2006-2013

- **2010/2015 PFOA Stewardship Program (2006)**
  U.S.EPA proposes, and the eight major fluorochemical companies voluntary participate, in a program where the companies commit to:
  - Reduce environmental releases and content in products of PFOA by 95% by 2010 compared to a base year
  - Virtually eliminate environmental releases and content in products of PFOA by 2015

- **Long Chain PFC Action Proposal (2009)**
  U.S.EPA proposes to ban manufacture and import of Long Chain Perfluorinated Chemicals and treated articles from 2016, when the Stewardship Program will end.

- **U.S. EPA affirms that C6 is not targeted by the LCPFC Action Plan (2013)**
  “PFAC chemicals with fewer than C8 carbons, such as Perfluorohexanoic Acid (PFHxA), are not considered long chain chemicals. These shorter-chain PFAC are not part of this action plan, because data in non-human primates indicate that they have substantially shorter half-lives in these animals than PFOA and are less toxic than long-chain PFAC chemicals”
2010/2015 PFOA Stewardship Program
Participant Successes

- Source: “EPA Summary Tables”
  http://www.epa.gov/oppt/pfoa/pubs/stewardship/

- Baseline = Year 2000 or other
- Some signatories’ report data ranges
- The graphic summary contains estimates
- Direct Emissions:
  o Manufacturing emissions data for PFOA, PFOA salts and higher homologues
- Product Content:
  o Product content data for PFOA, PFOA salts, higher homologues and precursors
- 2012 data are due October 31, 2013
**EU Regulatory Update**

*German UBA intends to regulate PFOA and related precursors under REACH*

**Harmonized Classification and Labeling**

December 2011, Classification of PFOA/APFO as Carcinogenicity 2, Reproductive Toxic 1B (Classification, Labeling, and Packaging- CLP Regulation).

Expected implementation in January 1, 2015

**Substance of very High Concern**

June 2013, Europe Member states decision to list PFOA/APFO as SVHC (“Kanditatenliste”)

**Restriction of Marketing and Use**

Probable restriction proposal PFOA (and precursors) by year end 2013 or beginning 2014 (Annex XV dossier by German and Norwegian authorities)

**-> restriction expected 2015 !**

Vierke et al. Environmental Sciences Europe 2012, 24:16     http://www.enveurope.com/content/24/1/16
Norway prohibits PFOA in Consumer Products

Norway Bans PFOA in Consumer Products

Recently, the Environmental Agency of Norway has published an amendment to Norway’s consumer products regulation to ban PFOA from consumer products. This includes requirements for articles, textiles specifically, as well as mixtures.

The ban will, in most cases, become effective on 1st June 2014.

The below table sums up the restriction:

**PFOA-Restriction in Norway** (Product regulation FOR 2004-06-01 Nr. 922, § 2-32):

<table>
<thead>
<tr>
<th>Applicable products</th>
<th>Limit</th>
<th>Date of application</th>
</tr>
</thead>
<tbody>
<tr>
<td>Substances and Mixtures</td>
<td>10 mg/kg</td>
<td>1st June 2014</td>
</tr>
<tr>
<td>Textiles, Carpets and other coated consumer products</td>
<td>1 μg/m²</td>
<td>1st June 2014</td>
</tr>
<tr>
<td>Other consumer products</td>
<td>0.1%</td>
<td>1st June 2014</td>
</tr>
<tr>
<td>Adhesive foil or tape in semiconductors; photographic coatings for film, paper or screen</td>
<td>0.1% for foil and tape, 10 mg/kg for coatings</td>
<td>1st January 2016</td>
</tr>
</tbody>
</table>

By this ban, Norway is the first country to restrict PFOA similar to the EU-wide PFOS ban under the POP-regulation EC 850/2004.

In the EU, PFOA and its salts are only classified as Substance of Very High Concern (SVHC) under the REACH-regulation EC 1907/2006 and therefore subject to information obligations if present over 0.1% in an article.

**Additional Information**

Press release regarding the changed regulation (in Norwegian):
http://www.miljodirektoratet.no/no/Nyheter/Nyheter/Old-kli/2013/juni-2013/Forbyr-PFOA-i-norske-forbrukerprodukter/
Historically, fluorinated DWR repellent finishes have been made with raw materials that can break down to form long-chain perfluorinated chemicals such as PFOA and PFOS.

Short-chain fluorinated polymer DWR are commercially available since 2007, approved by regulators as alternatives to historic long-chain products and can deliver required performance.

Short-chain fluorinated polymers cannot break down to form PFOA or PFOS.

Not bioaccumulative, rapid elimination, low toxicity – Ask your DWR Supplier for this Data

**Fluoro based alternatives to C8 chemistry**

**Requirements**
# Alternatives to C8 chemistry
## Requirements & Solutions

<table>
<thead>
<tr>
<th>Technology</th>
<th>Water Repellency</th>
<th>Oil Repellency</th>
<th>Alcohol Repellency</th>
<th>Stain Release (a)</th>
<th>Abrasion Resistance</th>
<th>Self Cleaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>F-(Meth)Acrylates</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+/-</td>
<td>-</td>
</tr>
<tr>
<td>F-Urethanes</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>-</td>
</tr>
<tr>
<td>F-Silicones</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>F-Particle</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>-</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>(Meth)Acrylates/ Urethanes</td>
<td>+</td>
<td>-</td>
<td>-</td>
<td>+/-</td>
<td>+/-</td>
<td>-</td>
</tr>
<tr>
<td>Silicones</td>
<td>+</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Waxes</td>
<td>+</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Dendrimers</td>
<td>+</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>+/-</td>
<td>-</td>
</tr>
<tr>
<td>Particle</td>
<td>+</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>+</td>
<td>+</td>
</tr>
</tbody>
</table>

\(a\) Oil and water based stains

- **Only fluorine chemistry exhibit the required combined repellency & release properties**
  - **Short chain C6-telomer chemistry** adequately meets the criteria for replacement of most current applications of C8 and higher homologues uses. The industry has produced its best available alternatives.
  - **Non-fluorinated materials** sacrifice performance in many high-performance applications, reducing product benefits that can be offered.
Available Data on Short-chain PFCS


- Chemistry and Physical-Chemical Properties
- Monitoring (Human Blood, Biota, Water)
- Exposure Assessment: Human and Environment
- Risk Assessment: Human and Environment
- Emission to and Transport in the Environment
- Environmental Fate (biotic, abiotic)
- Treatment of Polluted Sites/Media (soil, ground water, drinking water)
**Toxicology Profile of C6 fluorotelomer chemistry**

- Strategies are in place to replace PFOA and higher homologues with alternatives with improved environmental and biological profiles.

- These alternatives are effective and have received approvals by regulatory agencies e.g. EPA, FDA, and BfR.

- Significant data on short-chain **C6 based raw materials** and *Perfluorohexanoic Acid C$_5$F$_{11}$COOH PFHxA*, exist *:

- PFHxA is a key part of this transition
  - It is not a commercial product; it is a potential degradant of several fluorotelomer products
  - PFHxA is persistent (P), *not* bioaccumulative (B), *not* toxic (T)
  - There is an extensive database showing it does not have CMR or PBT characteristics

*) Summary of data compiled by the FluoroCouncil. The FluoroCouncil member (Arkema France; Asahi Glass Co., Ltd.; Clariant International, Ltd.; Daikin Industries, Ltd.; DuPont Company; Solvay Specialty Polymers) represents the world’s leading fluoro-technology manufacturers.

[http://fluorocouncil.com](http://fluorocouncil.com)
Elimination Half-life in Plasma
Comparison PFHxA & PFOA

There is a big difference between “long” and short” chain. Short chain eliminate rapidly and are significantly less toxic.

<table>
<thead>
<tr>
<th></th>
<th>Short Chain</th>
<th>Long Chain</th>
</tr>
</thead>
<tbody>
<tr>
<td>Elimination $t_{1/2}$ (Days)</td>
<td>PFHxA</td>
<td>PFOA</td>
</tr>
<tr>
<td>Rat</td>
<td>0.2 - 0.05</td>
<td>5</td>
</tr>
<tr>
<td>Monkey</td>
<td>1</td>
<td>21</td>
</tr>
<tr>
<td>Human</td>
<td>&lt;32*</td>
<td>1,100-1,500</td>
</tr>
</tbody>
</table>

Stain management for textile finishing
What do you need?

Do you need...

Full stain management? (Water and oil)

- Use C6-based PFOA-free* fluorocarbon products

Do you need...

Water repellency?

- Use our fluorine-free new product

Active protection? (Water/oil repellency)
- Nuva® N2114
- Nuva® N2155
- Nuva® N1811

Passive protection? (Soil release)
- Nuva® N4118
- Nuva® N4547

Carpet protection (Soil/water repellency)
- Nuva® N5151

Active protection? (Water repellency)
- Arkophob® FFR

* below limit of detection
Nuva® N2114 liq
Nuva® N series based on C6 chemistry

- **State of the art C6-based formulation**
- Performs in all aspects **like best performing C8 chemistry**
- Provides **excellent initial repellencies**, tested according to
  - AATCC 22 (DIN EN 24920) – Spray (water repellency)
  - AATCC 118 – Oil (hydrocarbon resistance)
  - DIN EN 29865 - Bundesmann test
  - Water/alcohol drop test (Isopropanol – IPA)
- Possesses **excellent long lasting durability** combined with LAD potential
- Ionicity: **cationic**
- **27% Active** water based formulation
Nuva® N2114 liq replacing C8 chemistry
100% PA

- 30 g/L FC, wpu app. 70%, cured 1 min at 165 °C, tumble dried after laundering
Nuva® N2155 liq
Nuva® N series based on C6 chemistry

– Conc. Version; performs like state of the art C8 chemistry
– Provides excellent initial repellencies, tested according to
  - AATCC 22 (DIN EN 24920) – Spray (water repellency)
  - AATCC 118 – Oil (hydrocarbon resistance)
  - DIN EN 29865 - Bundesmann test
  - DIN EN 53886 - Hydrostatic Head / Water column
– Especially for synthetic PES fibers
– Possesses low cure potential
– Shows high finishing chemicals compatibility
– Ionicity: nonionic/amphoteric
– 28% Active water based formulation
Nuva® N2155 liq
100% PES

- 5 g/L FC, wpu app. 85%, cured 1 min at 180 °C, tumble dried after laundering

**Spray:**

**Oil:**

**Water/alcohol (IPA %):**

![Graphs](image-url)
Arkophob® FFR liq
Fluorine-free water repellency

Arkophob® FFR is based on encapsulation wax technology

Provides excellent initial water repellency, tested according to
- AATCC 22 (DIN EN 24920) – Spray (water repellency)
- DIN EN 29865 - Bundesmann test
- AATCC 193 – Water Alcohol Solution Resistance Test

Supplies a very good wash permanence (20 wash cycles)

Soft, bulky hand feel

Improves the abrasion resistance and tear strength of the fabric

Causes no yellowing

Ionicity: weakly cationic
Arkophob® FFR liq
Comparison vs. fluorocarbon & silicone product on cotton

- 50 g/L, wpu app. 70-75%, cured 30 sec at 175 °C, tumble dried after laundering
Ecological Modern Stain Management

Soil release and repellent positioning

- Secure your smooth Ecological transition
- Textile finishing developed in accordance with the bluesign® standard

![Diagram showing soil release and repellent positioning with products like Nuva® N4547, Nuva® N4118, Nuva® N5151, Arkophob® FFR, Nuva® N2114, Nuva® N2155, and Nuva® N1811]
Summary

- DWR finishes add value - Performance
  - Protection: water, oil & soil repellent and release
  - Life-cycle benefits

- Historic Long-Chain DWR technology is being replaced with more environmentally favorable Short-Chain technology
  - Reformulation and optimization required. Re-examining performance requirements.
  - Regulatory and environmental drivers

- For certain DWR applications fluorine free formulations are available, however with a limited performance profile

- NOW is the time to make the change
Thank you for your kind attention!