OUTDOOR INDUSTRY ASSOCIATION
SUSTAINABILITY WORKING GROUP

Outdoor Industry Association Priority Issues Brief:
Durable Water Repellents (DWR)

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1. Overview

Durable Water Repellent (DWR) treatments have long been widely used by the outdoor industry in technical products where getting wet is undesirable or even life-threatening.

Per- and polyfluorinated chemicals, or "PFASs," encompasses a broad and diverse universe of fluorinated substances. (1) A class of PFASs, side-chain fluorinated polymers, includes the polymers that are fluorinated DWR treatments, certain formulations of which are utilized across the outdoor industry and other industries as performance finishes for textiles to provide water, oil and stain/soil repellency.

Concerns have been raised about the possible discharge of certain PFASs, specifically substances referred to as PFOA and PFOS, because of their persistent, bio-accumulative and toxic properties; and "long-chain" substances (2) which may degrade to form them.

As a historical user of long-chain fluorinated DWR products, the outdoor industry recognizes it has a role to play in this issue. The industry is collectively seeking to ensure informed, data-driven decision-making about the DWR treatments it uses, ultimately seeking to replace existing chemistries with less hazardous alternatives (or eliminate their use altogether), while upholding necessary performance and durability requirements and avoiding the potential trap of "regrettable substitutions."

Many promising and innovative alternatives to long-chain DWR are in development and or have been launched, and the industry is moving to pilot test them as performance requirements, costs, design and development timelines, etc. allow. However, at this time, the industry remains challenged to fully replace all fluorinated chemistries currently in use for DWR treatments on performance outerwear and other products while upholding the necessary performance requirements required by outdoor consumers for the most technical products designed for extreme conditions.

2. History

In May 2011, in partnership with the Sustainable Apparel Coalition (SAC), the OIA Sustainability Working Group launched the Chemicals Management Working Group (CMWG) to collaboratively address chemicals management challenges within shared global supply chains, including development of an assessment methodology for chemicals management across the global supply chain for outdoor products (retailer, brand, supplier and chemical supplier) as a critical dimension of the Higg® Index. As of January 2016, the group currently includes more than 140 participants.

In July 2011, Greenpeace International launched its 'Detox' campaign with its first 'Dirty Laundry' report, which called upon some of the largest global brands in the apparel industry to eliminate all releases of hazardous chemicals from their supply chains and products. In response, in August 2011, a number of the brands targeted by the campaign came together to form the Zero Discharge of Hazardous Chemicals (ZDHC) group.

In August 2012, the OIA CMWG, in partnership with the ZDHC group of brands as well as the European Outdoor Group (EOG) and the German Sporting Goods Association (BSI), began a coordinated effort to specifically explore the use of DWR treatments in its shared global supply chains. In June 2013, these organizations released a collaboratively-developed "Request for Proposal" research brief outlining the data gaps and needs of the global apparel industry in the area of fluorinated DWR treatments. A number of other tools and resources have been developed by these collaborative groups and are now in use in the global outdoor, fashion, and sporting goods supply chains (see Key Resources section below.)

In 2015, several key news announcements highlighted the outdoor industry's progress and continued commitment around this issue. Among many others, examples include:

- April 2, 2015 – Patagonia announces $1 Million USD investment in Beyond Surface Technologies
- April 29, 2015 – Huntsman, DuPont team up on renewably sourced, non-fluorinated DWR finish
- August 25, 2015 – Gore invests more than $15 Million USD in R&D for alternative DWR solutions

There is also a history of engagement between the business community and the U.S. Environmental Protection Agency on the issue of PFC's/PFAS. In 2006, the U.S. EPA and eight major chemical companies (Asahi Glass, Arkema, BASF, Archroma/Clariant, Daikin, DuPont/Chemours, Solvay, 3M) together launched the PFOA Stewardship Program, with the goals of reducing global facility emissions and product content of PFOA and related chemicals by 95 percent by 2010 and working toward eliminating emissions and product content by 2015. The signatory companies have ceased global manufacture of long-chain substances, including long-chain DWR, as of 31 December 2015.

3. Key Facts and Context

DWR treatments provide the following performance properties:

- Water repellency
- Oil repellency

- Stain repellency
- Soil repellency
- Stain release
- Soil release
- Durability

DWR treatments are widely used on many textile products ("outdoor" specific and beyond), including but not limited to the following:

- Performance outerwear
- Camping tents
- Khaki pants
- Uniforms and workwear
- Tablecloths

DWR treatments may be categorized as "fluorinated" or "non-fluorinated."

- While research is currently being conducted to describe hazard characteristics on both fluorinated and non-fluorinated DWR chemistries, it is important to note that there is no way possible currently to conclude that non-fluorinated alternatives are "better" than highly fluorinated DWR chemicals in a general way.
- In addition, LCA research conducted by W.L. Gore shows the durability benefits of fluorinated DWR treatments in the consumer use phase vs. non-fluorinated alternatives. (See Key Resources below for links to the research.)

Fluorinated DWR chemistries:

- Per- and polyfluoroalkyl substances, or PFAS (the preferred terminology,) include fluorinated DWR products as a class of substances.(1)

- PFAS is a term that describes a wide and diverse universe of substances with many different uses and applications.(1) In a study conducted by the Swedish Chemicals Agency in 2015 "Occurrence and use of PFAS and alternatives" identified a wide range of commercial uses (see Key Resources below for links to the research.) Some of these uses are listed below:
    - Synthesis Chemicals
    - Electronics Products
    - Printing Products
    - Cosmetic Products
    - Textile / leather impregnation
    - Pharmaceuticals
    - Plant protection
    - Biocides
    - Paints
    - Adhesive raw materials
    - Paper impregnation (i.e. pizza boxes, cash register receipts)
    - Foam-based fire extinguishing agents

- There is much we still do not know about the broad range of uses of PFAS. We do not yet have adequate data to understand the proportion of PFAS used in textiles in proportion to the other uses listed above. Some additional conclusions from the 2015 Swedish Chemicals Agency study:

- Information on how the substance is used (about 3000 substances in total) is unknown for about half of the substances.
- The market information found for most PFAS was often short.
- Information on functionality such as "surfactant" could be linked to 20% of the PFAS substances.
- PFAS that were called “surfactants” had a wide range of applications often briefly described.
- For a third of all the substances that were identified (approximately 1000 PFAS), a bit more detailed market information was available.
- One major conclusion of this study is that there are likely more uses of PFAS for which we still don’t have comprehensive market information, often due to company trade secrets.

<u>“Long-Chain” vs. “Short-Chain” PFAS</u>

The main focus for the outdoor industry currently is on phasing out long-chain PFAS (2); historic long-chain technologies are being widely replaced with more environmentally favorable short-chain technologies. However, research is also ongoing to gain a clearer understanding of the potential impacts of short-chain PFAS.

Every PFAS substance contains a perfluorinated tail, meaning that all hydrogens on these carbons are replaced with fluorine. By definition, long-chain PFAS can be described as follows (2):

Long-chain PFAS – the fluorinated ”tail” contains:

- More than or equal to 7 perfluorinated carbons if a perfluorinated carboxylic acid (PFCA)
  - The most well-known example is **PFOA**:
    - Contains 8 perfluorinated carbons
    - Fluorotelemer - used for <u>DWR surfactants/coatings</u>
    - May also be used as an emulsifier (processing agent) for production of fluoropolymers such as PTFE, which is used for <u>DWR membranes</u>
    - Focus of U.S. EPA Stewardship Program mentioned in History section above – program goal: elimination of PFOA, PFOA precursors, and related chemicals from emissions and products by 2015
- More than or equal to 5 perfluorinated carbons if a perfluorinated sulfonic acid (PFSA)
  - The most well known example is **PFOS**:
    - Contains 8 perfluorinated carbons
    - Surfactant
    - Put on Stockholm Convention POPS list in 2009; has been phased out by major chemical companies but still in use by smaller/Asia-based chemical suppliers and traceable in the environment from previous uses
- Precursors that can degrade to the above compounds
  - Such precursors are mostly alcohols and acrylates

Short-chain PFAS – PFAS with shorter fluorinated ”tails” than above:

- Recognizing the need to move away from long-chain chemistries yet preserve necessary product attributes, many outdoor companies are now using short-chain chemistries for their DWR needs, with the recognition that the industry still needs further data to understand the potential impacts of short-chain DWR solutions (as well as non-fluorinated solutions) in order to determine the most responsible AND functional products for longer-term use.
- Typically 6 or 4 fluorinated carbons ("C6" or "C4" chemistries)
- In many cases, short-chain PFAS are entirely sufficient for use cases and performance requirements. However, given their different makeup, short-chain do not perform the same as long-chain PFAS, and thus have been found to be less effective for some use cases and performance requirements

A note on "C8" vs. "C6" vs. "C4" PFC's
Referencing the number of fluorinated carbons, the term "C8 chemistry" is sometimes used interchangeably with "long-chain chemistry," and "C6 chemistry" with "short-chain chemistry." It is important to note that "C6" chemistry can be *either* long-chain or short-chain according to the definitions above.

Non-Fluorinated DWR chemistries:

- Examples include:
  - Silicone repellants
  - Paraffin waxes
  - Stearic acid / melamine compounds
  - Dendrimers
  - Nanomaterials

- A variety of non-fluorinated solutions are currently being piloted within the outdoor industry. Challenges include achieving the same level of performance effectiveness and durability as traditional fluorinated solutions, as well as ensuring that the non-fluorinated solutions do not carry negative trade-offs and become regrettable substitutions.

- Again, the necessary research is currently being conducted to describe the hazard characteristics of non-fluorinated AND fluorinated DWR chemistries.

4. **What the outdoor industry is doing**

The OIA Sustainability Working Group and Chemicals Management Working Group are actively seeking to help the outdoor industry achieve the following:

- Use data to make informed decisions on the chemistries or other treatments that go into their products, while avoiding "regrettable substitutions."
- Employ chemistries that are necessary for performance as responsibly as possible, including reducing and/or eliminating their use where possible and reducing and/or eliminating the environmental and human health impacts when they are used.
- Ensure necessary product performance requirements are met, including durability
- Promote development of new solutions that can be implemented at scale.

- Develop methods to ensure that the chemistries being spec'd are what are actually ending up on products, including reliable measurement of chemistry levels to certain thresholds and addressing the challenge of residuals.
- Educate product creation teams to spec chemistries appropriate for the level of performance necessary for each specific product – and educate consumers about the level of performance they really need in their products based on their level of activity.
- Gain a clear understanding of our industry's specific role in the issue and our leverage points, so that we can most effectively deploy our efforts.
- Drive the industry to employ green chemistry practices in its products and processes
- Collaboratively developing tools and resources by the industry, for the industry to help manage this issue (see "Key Resources" list below).
- Collaborating with key partner organizations including ZDHC, EOG, BSI, and SAC to share resources and address the challenges as a unified global industry.

The OIA Chemicals Management Working Group collaboratively, pre-competitively develops tools and resources and shares knowledge to achieve the above, via regular working group calls, online forums, webinars, in-person meetings, and other vehicles.

The OIA CMWG is open to all outdoor industry supply chain stakeholders who agree to adhere to the OIA Sustainability Working Group Code of Conduct.

5. Key Resources

A scoping document to articulate the industry's resource needs and data gaps, developed collaboratively by OIA CMWG, ZDHC, EOG and BSI.

- **DWR Request for Proposal**

Supplement report and regulatory resources addendum to the original 2012 Greenpeace report, developed for OIA and with OIA SWG stakeholder input, to provide additional context around Greenpeace claims.

- **Chemistry for Any Weather – Supplement Report for OIA**
- **Chemistry for Any Weather – Supplement Report for OIA – Regulatory Resources Addendum**

2012 Report by ZDHC, with input from OIA CMWG members, on DWR chemistry in the textile industry.

- **DWR Research Report (Developed by ZDHC)**

Questionnaires for brands to use to track their use of DWR internally or to ask a standard set of questions of their DWR suppliers.

1. **DWR Tracking Template for Brands**
2. **DWR Chemical Company Questionnaire For Brands**

Grid of use cases and performance requirements, developed by OIA Chemicals Management Working Group.

- **DWR Chart**

Life Cycle Assessment studies from W.L. Gore

Technical FAQ on PFAS created for European Outdoor Group (EOG), by Stefan Posner, Swerea IVF, January 2016

"Occurrence and use of PFAS and alternatives" – study from the Swedish Chemicals Agency (KEMI), July 2015

DWR Overview for Outdoor Industry Association (presentation at Outdoor Retailer Winter Market): Tony Kingsbury, ChemRisk, January 2013

DWR Overview for Outdoor Industry Association (webinar): Bob Buck, DuPont/Chemours, December 2012

Office of Economic Cooperation and Development (OECD) Portal on Perfluorinated Chemicals

6. Credits and Contacts

OIA website specific to DWR: https://outdoorindustry.org/advocacy/corporate-responsibility/water-repellency-dwr-chemistries/

For more information about the Outdoor Industry Association's efforts, to join the OIA CMWG, or with questions about any of the above, please contact:

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References

1. Perfluoroalkyl and polyfluoroalkyl substances in the environment: Terminology, classification, and origins. *Integrated Environmental Assessment and Management*, **2011** 7: 513-541. http://dx.doi.org/10.1002/ieam.258
2. "Long-chain" definition is available on the OECD Portal on Perfluorinated Chemicals. Available from: http://www.oecd.org/ehs/pfc/.