



GREENPEACE

# PFC Revolution in the Outdoor Sector

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Photo: Greenpeace

Greenpeace expedition to Haba Snow Mountain, China, to collect water and snow samples and test them for PFC contamination.

## Sounding the alarm on PFCs

Since the beginning of its Detox campaign in 2011, Greenpeace has been calling on the clothing industry to eliminate all hazardous chemicals from its supply chain by 2020, highlighting per- and polyfluorinated chemicals (PFCs) as one of the priority hazardous chemical groups to eliminate. PFCs are used in many industrial processes and consumer products, and are well known for their use by the outdoor apparel industry in waterproof and water-repellent finishes.

PFCs are environmentally hazardous substances, which are persistent in the environment.<sup>1</sup> Studies show that some PFCs can accumulate in living organisms such as the livers of polar bears in the Arctic and are also detected in human blood.<sup>2</sup> Animal studies provide evidence that some PFCs cause harm to reproduction, promote the growth of tumours and affect the hormone system.<sup>3</sup>

Starting in 2012, Greenpeace put the spotlight

on the outdoor industry, with a number of studies which found PFCs are routinely used in outdoor clothing, footwear and other equipment;<sup>4,5</sup> other reports showed the evaporation of volatile PFCs into air<sup>6</sup> and demonstrated significant contamination in the indoor air of stores selling outdoor gear.<sup>7</sup> Greenpeace also found PFC contamination far from the original source of their release, in secluded mountain lakes and snow from three continents,<sup>8</sup> and documented the historic and ongoing contamination of water, air and dust in four locations near PFC manufacturing facilities around the world.<sup>9</sup>

Together with Greenpeace, hundreds of thousands of outdoor enthusiasts from around the world have asked their favourite outdoor brands to stop using hazardous PFCs in outdoor gear. The outdoor sector has started responding to this growing consumer demand; since 2012, when the Greenpeace campaign first addressed the outdoor sector, there has been a dramatic increase in the number of PFC-free alternative technologies and products





Photo : Greenpeace

A Greenpeace Italy action at The North Face store in Milan highlights the company's ongoing failure to eliminate PFCs from its weatherproof products.

on the market, and in the number of outdoor brands which have set PFC elimination timelines, as documented in the following overview.

## An increase in products free from hazardous PFCs

Many outdoor brands use PFCs for their waterproofing and dirt resistant properties, both in Durable Water Repellent (DWR) coatings on the outer layer and in waterproof membranes. However, outdoor brands are increasingly using PFC-free alternatives.

Smaller outdoor brands such as Paramo, Pyua, Rotauf, Fjällräven, R'ADYS and Dannah have led the way, and are among the first brands to have entire collections of functional weatherproof clothing that are PFC-free.

The first outdoor brand to make a commitment to Detox was the UK brand Paramo, followed by Rotauf and Vaude, the first major outdoor

brand to commit: all of Vaude's products will be PFC-free by 2018 with 95% of apparel in its 2017 Summer Collection PFC-free.<sup>10</sup> Jack Wolfskin originally led the way with 75% of its 2015 summer apparel collection PFC-free<sup>11</sup> and aims for 100% of its entire collection to be PFC-free by 2020, although it has not yet agreed a Detox commitment with Greenpeace to eliminate ALL hazardous chemicals by 2020.<sup>12</sup>

So far, no other major outdoor brands have committed to Detox, as detailed on Greenpeace's Detox Outdoor website<sup>13</sup> and in Table 1 (in the Annex); although many have public statements and plan to eliminate PFCs these are mostly limited to apparel only or it's unclear whether membranes are included. Figure 1 and Table 1 show the progress being made by these major brands in comparison to the smaller outdoor brands.

The information in Figure 1 is not comprehensive, but is a snapshot of available information. Other examples of PFC-free products on the market include Helly Hansen,<sup>14</sup> Berghaus<sup>15</sup> Maier Sports,<sup>16</sup> and the "Quintessentshell" jacket from Nau.<sup>17</sup>



Figure 1 : Outdoor brands with PFC-free products on the market and the status of their commitments to eliminate PFCs (for details see Annex. Table 1).

Note : the positioning of the brands in this diagram does not represent a ranking: for Greenpeace's evaluation of the progress being made by major outdoor brands towards Detox see the Detox Outdoors website.





Photo: Greenpeace

Greenpeace's booth at ISPO Beijing, the leading outdoor trade fair in the Asia-Pacific region

## Gore - a new era

In a recent development, the market leader in PFC-based waterproofing technologies, Gore Fabrics, has committed to eliminate hazardous PFCs/PFCs of Environmental Concern from its general outdoor waterproofing laminates (corresponding to 85% of the final product units costumers make from these laminates) by end of 2020 and from its specialized outdoor waterproofing laminates (corresponding to 15% of the final product units) by end of 2023.

To fulfill this commitment, Gore Fabrics will develop new, more environmentally friendly technologies, for both weatherproof membranes and water repellent coatings (DWR). Gore Fabrics will develop both fluorine-free and fluorinated technologies in parallel. Greenpeace and Gore have agreed on a strict set of properties that constitute a hazardous PFC (also called a PFC of

Environmental Concern),<sup>20</sup> following the Precautionary Principle.<sup>21</sup> The chemical group PFCs includes polymers and non-polymeric chemicals. Non-polymeric PFCs are hazardous or potentially hazardous chemicals.

Until now, polymeric PFCs used in textiles have either had the potential to degrade into hazardous PFCs,<sup>22</sup> or their manufacture involved the use and release of hazardous PFCs. For these reasons Greenpeace's Detox campaign called for the elimination of all PFCs. The new process announced by Gore Fabrics will eliminate all releases of PFCs of environmental concern throughout the lifecycle of their PFC polymer, including in the manufacturing process.

Gore Fabrics will publicly document that no hazardous PFCs are released throughout the product lifecycle (eg manufacturing and production process, during use and

disposal at end of life). For further details, Gore Fabrics commitment, “Goal and Roadmap for Eliminating PFCs of Environmental Concern” can be found at [www.gore-tex.com/pfcgoal](http://www.gore-tex.com/pfcgoal)

## PFC - free innovations - the growth of alternative technologies

Since Greenpeace released its report “Chemistry for any weather”<sup>23</sup> in 2012 there has been a dramatic increase in the number of alternative technologies that do not use PFCs available on the market, both for membranes and for DWR finishes. Figure 2 and Table 2 (in the Annex) show some examples of PFC-free technologies and the dates that they came on the market, as far as can be ascertained from researching company websites. This shows a big increase in the number of technologies released on the market in 2015 and 2016.

The technologies listed in Figure 2 are provided as an example and are not exhaustive; all are PFC-free, however, in

general there is not enough public information on hazard assessment and evaluation of the chemicals in the alternative technology being used; therefore the listing of any technology in this table does not imply an endorsement.

Many of these suppliers are also working to increase the sustainability and environmental performance of these technologies on many levels, including: the use of renewable technology;<sup>24</sup> screening of ingredients for hazard using GreenScreen<sup>25</sup> and the inclusion of plant-based materials;<sup>26</sup> and aiming to “close the loop” by increasing the recycled content of the materials used and ensuring their recyclability, as demonstrated by Sympatex.<sup>27</sup>

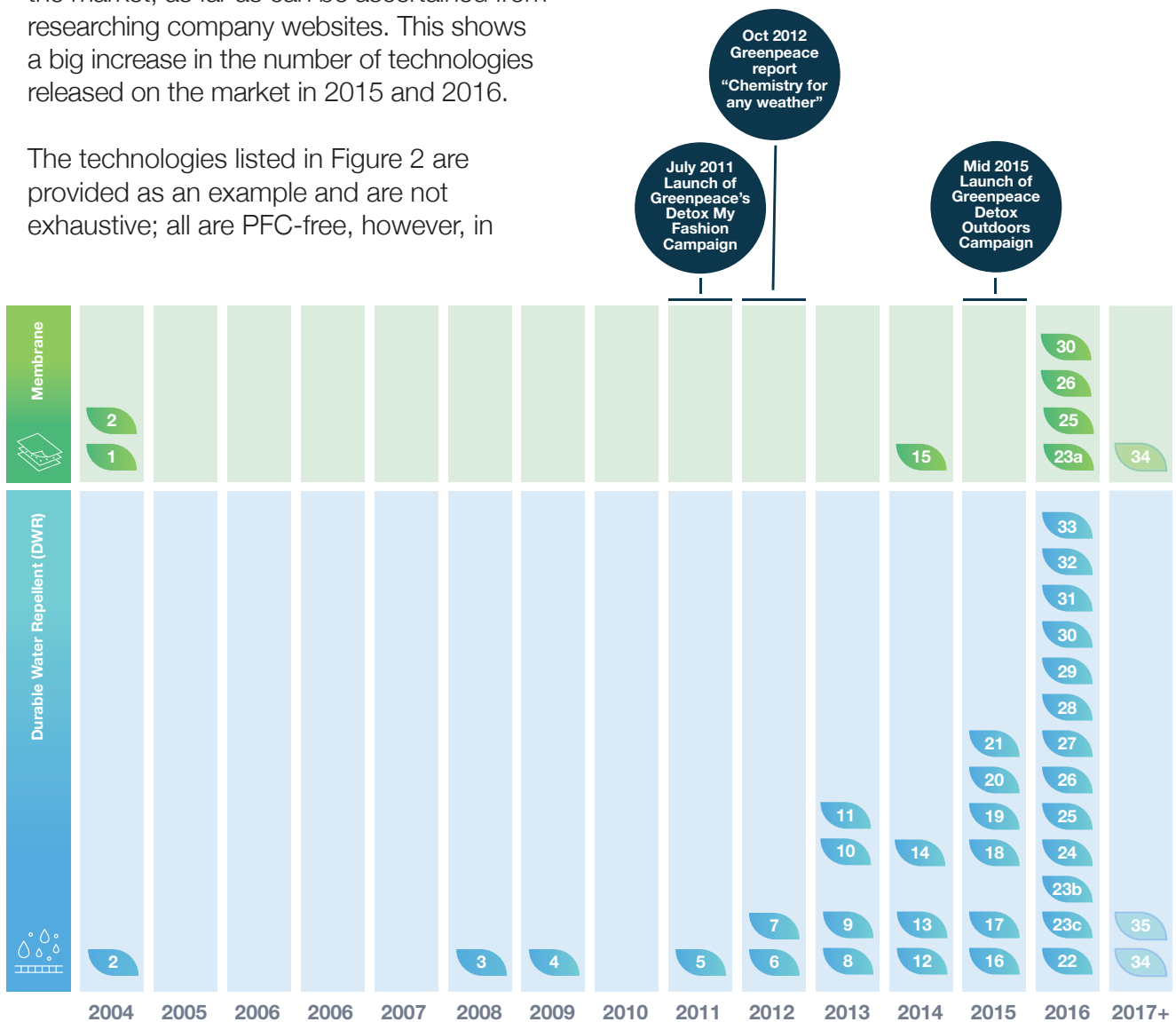


Figure 2 : PFC-free waterproof technology for outdoor products on the market from 2004-2017 (for details see Annex. Table 2)



## Conclusion - a showcase for the elimination of hazardous chemicals

While many major brands have still not taken responsibility for eliminating hazardous PFCs in all of their products, the commitment by Gore, the major supplier of PFC waterproofing technology, is set to transform the sector in the longer term so that ultimately, hazardous PFCs will no longer be used in outdoor products.

The progress so far towards technologies free from hazardous PFCs – though not yet complete - shows that transforming a sector can be achieved in a relatively short time, if the relevant stakeholders are willing to act together responsibly. Consumer demand has driven the need for brands to find alternatives and spurred the rapid development of PFC-free technologies by suppliers. It is a good example of how consumer pressure has encouraged the responsiveness of brands and suppliers to develop and implement better solutions and can be a showcase for other sectors to achieve similar transformations. Other industries that use PFCs, as well as those using other hazardous chemicals, could learn from this example and take on such a challenge to transform their own sector.



## References

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03. Madrid Statement ( 2015). <http://greensciencepolicy.org/madrid-statement/>; The Madrid Statement is based on: M. Scheringer , X. Trier, I. Cousins, P. de Voogt, T. Fletcher e, Z. Wang , T. Webster: Helsingør Statement on poly- and perfluorinated alkyl substances (PFASs), Chemosphere, Volume 114, November 2014, Pages 337–339, <http://www.sciencedirect.com/science/article/pii/S004565351400678X>
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05. Greenpeace (2016a), Leaving Traces; the hidden hazardous chemicals in outdoor gear, 25 January, 2016 <http://www.greenpeace.org/international/en/publications/Campaign-reports/Toxics-reports/Leaving-Traces/>
06. Greenpeace e.V. (2013). Chemistry for any weather, Part II, Executive Summary, December 2013; [http://m.greenpeace.org/italy/Global/italy/report/2013/toxics/ExecSummary\\_Greenpeace%20Outdoor%20Report%202013\\_1.pdf](http://m.greenpeace.org/italy/Global/italy/report/2013/toxics/ExecSummary_Greenpeace%20Outdoor%20Report%202013_1.pdf)
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08. Greenpeace (2015), Footprints in the snow, Hazardous PFCs in remote locations around the globe [http://detox-outdoor.org/assets/uploads/Report%2520RAE/RAE\\_report\\_08\\_2015\\_english\\_final.pdf](http://detox-outdoor.org/assets/uploads/Report%2520RAE/RAE_report_08_2015_english_final.pdf)
09. Greenpeace (2016c), PFC Pollution Hotspots; How these chemicals are entering our bodies, 14 November, 2016 <http://www.greenpeace.org/international/en/publications/Campaign-reports/Toxics-reports/PFC-Pollution-Hotspots/>
10. <http://csr-report.vaude.com/gri-en/product/water-repellent-materials.php>
11. <http://www.jack-wolfskin.co.uk/pfc/> PFC free, water-repellent products are labelled with the '100% fluorocarbon free')
12. Greenpeace is calling on all major outdoor brands to make a commitment to Detox. In a Detox Commitment brands take responsibility for their contribution to pollution from hazardous chemicals and make a comprehensive commitment and action plan to eliminate hazardous chemicals by 2020. PFCs are one of the 11 priority chemical groups highlighted. See <http://www.greenpeace.org/international/en/campaigns/detox/fashion/detox-catwalk/>
13. <http://www.detox-outdoor.org/en/>
14. Helly Hansen has a small selection of PFC-free DWR in its outdoor products and reports that it has “successfully avoided the use of PFCs in our waterproof / breathable membranes, which are 100% polyurethane based since 2007” <https://www.hellyhansen.com/about-us/manufacturing/>
15. Berghaus states that it brought some PFC-free options to the market in 2016. <http://www.berghaus.com/chemicals.html>
16. Maier Sports launched a range of PFC-free jackets in 2014 and aims to eliminate PFCs from its textile production process by 2020 <http://www.maier-sports.com/en/responsibility/pfc-free-equipment/>
17. <http://www.snewsnet.com/news/not-green-enough/>
18. <http://www.detox-outdoor.org/en/>
19. Buck, R.C. et al. (2011) Perfluoroalkyl and Polyfluoroalkyl Substances in the Environment: Terminology, Classification, and Origins. Integrated Environmental Assessment and Management 7(4): 513–541
20. See Annex 1 of Gore’s commitment <http://www.gore-tex.com/pfcgoal>
21. This means taking preventive action before waiting for conclusive scientific proof regarding cause and effect between the substance (or activity) and the damage. It is based on the assumption that some hazardous substances cannot be rendered harmless by the receiving environment (i.e. there are no ‘environmentally acceptable’ / ‘safe’ use or discharge levels) and that prevention of potentially serious or irreversible damage is required, even in the absence of full scientific certainty. The process of applying the Precautionary Principle must involve an examination of the full range of alternatives, including, where necessary, substitution through the development of sustainable alternatives where they do not already exist.
22. For example, non-polymeric fluorosurfactant used in the manufacture of PTFE
23. Greenpeace e.V. (2012), op.cit.
24. See for example Porelle: <http://www.porellemembranes.co.uk/en/about/environmental/>
25. GreenScreen is an example of a credible and transparent screening methodology. An example of best practice is to endorse all hazardous chemicals derived from a GreenScreen full assessment, at least all Benchmark 1/Benchmark 2 - or derived from the GreenScreen List translator, all LT-1 . See GreenScreen® For Safer Chemicals, and <http://greenscreenchemicals.org/> and <http://www.greenscreenchemicals.org/resources/entry/list-translator>
26. See for example Beyond Surface Technologies: <http://www.beyondst.com/bst-about>
27. Sympatex Press Release 6th September 2016; “ Sympatex takes the next consistent step of the sustainability strategy with 100% recycled membrane”and “ ISPO 2017: Sympatex to launch first 100% CO2-neutral membrane” <http://www.sympatex.com/en/information/145/press>



## Annex

**Table 1: Outdoor brands with PFC-free products on the market and the status of their PFC elimination timelines**

Outdoor Brand	Using PFCs	PFC-free products on market	Date	DWR & membrane / or DWR only, other concerns	Detox Commitment	PFC elimination timeline	Further details	Labelling
<b>Pyua</b> <a href="http://www.pyua.de/index.php/about-pyua/climalooptm-laminat">http://www.pyua.de/index.php/about-pyua/climalooptm-laminat</a>	No	Whole collection	Pre-2016	DWR & membrane	-	-	-	CLIMALOOP
<b>Fjällräven</b> <a href="http://www.fjallraven.com/responsibility/nature-environment/free-from-fluorocarbons">http://www.fjallraven.com/responsibility/nature-environment/free-from-fluorocarbons</a>	No	Whole collection	Pre-2016	DWR & membrane	-	-	-	No information
<b>R'ADYS</b> <a href="http://www.radys.com/site/company-4563/story-4712/">http://www.radys.com/site/company-4563/story-4712/</a>	No	Whole collection	Pre-2016	DWR & membrane	-	-	-	Barrier ECO
<b>Paramo</b> <a href="http://www.paramo-clothing.com/blog/en-gb/paramo-detox-commitment-outline/">http://www.paramo-clothing.com/blog/en-gb/paramo-detox-commitment-outline/</a>	No	Whole collection	Pre-2016	DWR & membrane	Yes	-	All products	Analogy Waterproof by Nikwax
<b>Rotauf</b> <a href="https://rotauf.ch/gbp_en/detox">https://rotauf.ch/gbp_en/detox</a>	No	Whole collection	Pre-2016	DWR & membrane	Yes	-	All products	No information
<b>Dannah</b> <a href="http://www.dannah.uk.com/about/eco/">http://www.dannah.uk.com/about/eco/</a> <a href="http://www.dannah.uk.com/products/mens-alpine-jacket/">http://www.dannah.uk.com/products/mens-alpine-jacket/</a>	No	Whole collection	November 2016	DWR & membrane	-	-	-	Porelle Dry
<b>Vaude</b> <a href="http://csr-report.vaude.com/gri-en/product/water-repellent-materials.php">http://csr-report.vaude.com/gri-en/product/water-repellent-materials.php</a> <a href="http://csr-report.vaude.com/gri-wAssets/pdf/en/VAUDE-GreenpeaceDetoxCommitmentFINAL.pdf">http://csr-report.vaude.com/gri-wAssets/pdf/en/VAUDE-GreenpeaceDetoxCommitmentFINAL.pdf</a>	Yes	41% 50% 95% All percentages refer to waterproof apparel products only	2015 2016 2017	DWR & membrane	Yes	PFC-free by 2018	Vaude aims to eliminate any PFCs used in any products by end of 2018.	PFC-free products are labelled "Eco Finish"
<b>Jack Wolfskin</b> <a href="http://www.jack-wolfskin.co.uk/pfc/">http://www.jack-wolfskin.co.uk/pfc/</a> <a href="https://www.jack-wolfskin.com/2014-06-24-Fluorchemie.html">https://www.jack-wolfskin.com/2014-06-24-Fluorchemie.html</a>	Yes	75% of apparel	2015	DWR & membrane	No – falling short A leader 3 years ago but now needs to catch up with the frontrunners	PFC-free by 2020	Entire collection	all PFC-free, water-repellent products are labelled '100% fluorocarbon free'
<b>Haglöfs</b> <a href="http://www.haglofs.com/se/en/gp-detox-campaign-response">http://www.haglofs.com/se/en/gp-detox-campaign-response</a> <a href="http://www.haglofs.com/se/en/chemicals-treatments">http://www.haglofs.com/se/en/chemicals-treatments</a>	Yes	Large part of clothing line PFC-free	Pre-2016	Described as "completely fluorocarbon free"	No – falling short	PFC-free by 2020	Apparel only, unclear if goal is for DWR only	No Information

Outdoor Brand	Using PFCs	PFC-free products on market	Date	DWR & membrane / or DWR only, other concerns	Detox Commitment	PFC elimination timeline	Further Details	Labelling
<b>Salewa</b> <a href="http://www.salewa.ch/it/csr-chemical-management-pf-c#WHY%20HAS%20SALE-WA%20NOT%20SIGNED%20THE%20GREENPEACE%20DETOX%20COMMITMENT">http://www.salewa.ch/it/csr-chemical-management-pf-c#WHY%20HAS%20SALE-WA%20NOT%20SIGNED%20THE%20GREENPEACE%20DETOX%20COMMITMENT</a>	Yes	36% 70%	- 2016 -2017	DWR & membrane	No – falling short	PFC-free by 2020	Apparel collection only; highest performance products are exempted	PFC-free styles are labelled “Bionic Finish ECO”
<b>The North Face</b> <a href="https://www.thenorthface.co.uk/about-us/news/chemical-responsibility.html">https://www.thenorthface.co.uk/about-us/news/chemical-responsibility.html</a>	Yes	30%	Spring 2017	DWR only	No – falling short	PFC-free by 2020	Apparel only; limited to DWR (unclear if membranes are included)	No information
<b>Mammut</b> <a href="https://www.mammut.ch/INT/en/cr/planet/pfc">https://www.mammut.ch/INT/en/cr/planet/pfc</a>	Yes	Some labelled PFC-free products  80% 95% 100%	Summer 2016 onwards  2018 2020 2022	DWR only; Mammut has its own PFC-free DRYtech membrane but also uses PFC based Gore-Tex membranes. Unclear if %age targets are for all apparel or only those requiring waterproofing	No – falling short	PFC-free by 2022	Apparel only, timeline is for PFC-free DWR only, deadlines relate to elimination of PFCs in supply chain – products in stores to follow within 2 years	PFC-free clothing labelled with a symbol
<b>Norrna</b> <a href="https://www.norrna.com/en-GB/Corporate-Social-Responsibility/Products/Elimination-of-fluorocarbons-in-our-products/">https://www.norrna.com/en-GB/Corporate-Social-Responsibility/Products/Elimination-of-fluorocarbons-in-our-products/</a> <a href="https://www.norrna.com/en-GB/Corporate-Social-Responsibility/">https://www.norrna.com/en-GB/Corporate-Social-Responsibility/</a>	Yes	11% 5% 15% 50% 75%	2015 2016 2017 2018 2019	DWR; membranes are not mentioned – though not excluded from goal.	No – falling short	PFC-free by end of 2020	Appears to be limited to apparel, scope is “elimination of fluorocarbons”	No information
<b>Black Yak</b> <a href="http://www.fashionbiz.co.kr/TN/?cate=2&amp;recom=2&amp;idx=153610">http://www.fashionbiz.co.kr/TN/?cate=2&amp;recom=2&amp;idx=153610</a>	Yes	PFC-free pants	2016	DWR only	No – falling short	PFC-free by 2020	Only DWR, not membranes. Scope of statement unclear	PFC-free products labelled “Yak Green”
<b>Columbia</b> <a href="http://blog.columbia.com/preview-outdry-extreme-eco/">http://blog.columbia.com/preview-outdry-extreme-eco/</a>	Yes	OutDry Extreme ECO jacket	Spring 2017	Membrane (need for DWR eliminated)	No – out of the race	Statement, no date	Both DWR & membranes included, across all product lines	OutDry Extreme ECO
<b>Patagonia</b> <a href="http://www.patagonia.com/blog/2015/09/our-dwr-problem-updated/">http://www.patagonia.com/blog/2015/09/our-dwr-problem-updated/</a>	Yes	No information	N/A	N/A	No – out of the race	Statement, no date	Only DWR, not membranes. Scope of statement unclear	N/A
<b>Arcteryx</b> <a href="http://www.arcteryx.com/Article.aspx?country=it&amp;language=de&amp;article=PFC-in-outdoor-products">http://www.arcteryx.com/Article.aspx?country=it&amp;language=de&amp;article=PFC-in-outdoor-products</a>	Yes	No information	N/A	N/A	No – out of the race	Statement that it will continually reduce, no date	Apparel only; DWR only.	N/A

Note: the positioning of the brands in this table does not represent a ranking: for Greenpeace’s evaluation of the progress being made by major outdoor brands towards Detox see the Detox Outdoors website <http://www.detox-outdoor.org/en/>



**Table 2: PFC-free DWR and membrane technologies for outdoor gear, sorted by date on the market, 2004 - 2017**

Company	Technology brand name	DWR or membrane	Chemical basis	Date on the market
<b>01. Sympatex</b> <a href="http://www.sympatex.com/en/company/202/company-profile">http://www.sympatex.com/en/company/202/company-profile</a>	Arnitel (see Royal DSM)	Membrane	-	From 2003 onwards
<b>02. Nikwax/Paramo Directional Clothing</b> Nikwax has been produced since the 1970s <a href="http://www.nikwax.co.uk/en-gb/productselector/waterproofing.php">http://www.nikwax.co.uk/en-gb/productselector/waterproofing.php</a> <a href="http://www.paramo-clothing.com/en-gb/performancecetechnology/">http://www.paramo-clothing.com/en-gb/performancecetechnology/</a>	Nikwax TX.10i	DWR	EVA elastomer	2004-5
	Nikwax Analogy Pump Liner	Membrane/liner	Not stated, could be EVA elastomer	2004-5
<b>03. Sympatex/ Rudolf GmbH</b> <a href="http://www.rudolf.de/en/company/customers/">http://www.rudolf.de/en/company/customers/</a> <a href="http://www.rudolf.de/en/support/news/details/durable-fluorocarbon-free-textile-finish/">http://www.rudolf.de/en/support/news/details/durable-fluorocarbon-free-textile-finish/</a>	BIONIC-FINISH®ECO	DWR	No information	August 2008 by Lundhags,
<b>04. Fibertec – GreenLine range</b> <a href="http://www.fibertec-waterproofing.de/green-line-en.html">http://www.fibertec-waterproofing.de/green-line-en.html</a>	Green Guard Tent and Gear, spray on	DWR	Silicone based	2009
	Green Guard spray on and Green Guard wash in	DWR	PU based	
	Green Line Cotton Guard	DWR	Most likely PU	
	Green Guard Leather (for footwear)	DWR	Combination of silane, siloxane and silicone	
<b>05. Pyua (outdoor brand)</b> <a href="http://www.pyua.de/index.php/about-pyua/climalooptm-laminat">http://www.pyua.de/index.php/about-pyua/climalooptm-laminat</a>	CLIMALOOP™	DWR and membrane	'proprietary laminate' (functional material) in addition to Sympatex membrane and Bionic Finish Eco	2011
<b>06. Archroma</b> <a href="http://www.bpt.archroma.com/arko-phob-ffr/">http://www.bpt.archroma.com/arko-phob-ffr/</a>	Arkophob® FFR	DWR	No information	2012
<b>07. Schoeller</b> <a href="https://www.schoeller-textiles.com/en/technologies/ecorepel">https://www.schoeller-textiles.com/en/technologies/ecorepel</a>	Ecorepel®	DWR	long paraffin chains	Launched January 2012
<b>08. Organoclick</b> <a href="http://www.organoclick.com/products/performance-textiles-nonwoven/">http://www.organoclick.com/products/performance-textiles-nonwoven/</a>	Organotex-using PFC-free additive OC-aquasil Tex™	DWR	Hydrophobic hydrocarbon chains	January 2013 – brand concept launched
	OC-aquasil Tex W™ for woven/knitted fabrics			
	OC-aquasil Tex N™ for non-woven material			
<b>09. Rudolf GmbH</b> <a href="http://www.rudolf.de/en/technology/bionic-finish-eco/">http://www.rudolf.de/en/technology/bionic-finish-eco/</a>	BIONIC-FINISH®ECO - includes finishing products @RUCO-DRY ECO and @RUCO-DRY ECO PLUS	DWR	PUR active ingredient (PU dendrimers) Finishing products use 'comb' polymers	Launch January 2013
<b>10. Huntsman Textile Effects</b> <a href="http://www.huntsman.com/textile_effects/Media%20Library/global/files/phobotex_brochure_LR.pdf">http://www.huntsman.com/textile_effects/Media%20Library/global/files/phobotex_brochure_LR.pdf</a>	PHOBOTEX®	DWR	No information	March 2013

Company	Technology brand name	DWR or membrane	Chemical basis	Date on the market
<b>11. HeiQ</b> <a href="http://hei.com/technologies/hei-eco-dry/">http://hei.com/technologies/hei-eco-dry/</a>	Barrier ECO	DWR	No information	July 2013
<b>12. CHT/Bezema</b> <a href="https://www.cht.com/cht/medien.nsf/gfx/med_MJOS-A7DHU8_4A1700/\$file/CHT-Press-release-ITMA-2015.pdf">https://www.cht.com/cht/medien.nsf/gfx/med_MJOS-A7DHU8_4A1700/\$file/CHT-Press-release-ITMA-2015.pdf</a>	ZeroF	DWR	Unknown - impregnation is produced on a fluorine-free polymer base	2014
<b>13. Allied Feather and Down</b> <a href="http://www.alliedfeather.com/news">http://www.alliedfeather.com/news</a>	HyperDRY ECO	DWR Down	Unknown, fluorocarbon-free	July 2014
<b>14. Sustainable Down Source</b> <a href="http://www.sustainabledown.com/downtek-zeroptic/">http://www.sustainabledown.com/downtek-zeroptic/</a>	DownTek™ ZeroPFC™	DWR Down	A carbon-free DWR option, process uses lipids, an innovative, nature-inspired approach	2014
<b>15. Royal DSM/ Toyota Tsusho</b> <a href="http://www.dsm.com/products/arnitel/en_US/cases/Arnitel-for-outdoor-clothing.html">http://www.dsm.com/products/arnitel/en_US/cases/Arnitel-for-outdoor-clothing.html</a>	Arnitel® VT (also used by Sympatex in combination with Rudolf's BIONIC FINISH ECO)	Membrane	flexible thermoplastic polyester based elastomer	July 2014
<b>16. Beyond Surface Technologies</b> <a href="http://www.beyondst.com/midori-evopel">http://www.beyondst.com/midori-evopel</a>	miDori evoPel	DWR	Unknown, feedstocks are both bio-based and petrochemical	On the market in 2015
<b>17. Fibertec</b> <a href="http://www.innovationintextiles.com/sports-outdoor/fibertec-presents-new-pfcfree-waterproofing-product-for-clothing/">http://www.innovationintextiles.com/sports-outdoor/fibertec-presents-new-pfcfree-waterproofing-product-for-clothing/</a>	Green Guard RT (spray on and wash in)	DWR	Polyurethane dendrimers	March 2015
<b>18. Archroma</b> <a href="http://textiles.archroma.com/smartrepel-hydro/">http://textiles.archroma.com/smartrepel-hydro/</a>	Smartrepel Hydro ( <i>Smartrepel Hydro CMD for cellulosic fibres and blends, and Smartrepel Hydro PM for synthetic fibres.</i> )	DWR	No information (micro-encapsulated technology uses a repelling agent and anchoring agent)	March 2015
<b>19. Huntsman Textile Effects</b> <a href="http://www.huntsman.com/textile_effects/a/Solutions/Product%20Highlights/Chemicals/Zelan%20R3">http://www.huntsman.com/textile_effects/a/Solutions/Product%20Highlights/Chemicals/Zelan%20R3</a>	ZELAN® R3 – the DWR used in Chemours Teflon EcoElite™	DWR	No information, 63% plant based sources	April 2015
<b>20. Rudolf GmbH</b> <a href="http://www.rudolf.de/en/support/press-releases/details/Rruco-dry-eco-plus-one-step-ahead-with-fluorine-free-repellency/">http://www.rudolf.de/en/support/press-releases/details/Rruco-dry-eco-plus-one-step-ahead-with-fluorine-free-repellency/</a>	BIONIC-FINISH-RUDOLF® finishes (earlier generation would have contained fluorine) with ®RUCO-DRY ECO PLUS	DWR	Hyper branched polymers (even more environmentally friendly components used), fluorine-free	September 2015
<b>21. HeiQ</b> <a href="http://hei.com/technologies/hei-eco-dry/">http://hei.com/technologies/hei-eco-dry/</a>	Barrier ECO-DRY (all fibres)	DWR	Fluorine free hyperbranched functionalised polymers	November 2015
	Barrier ECO-CEL (for cotton & cellulotics)		Special modified polymer	
	Barrier ECO-PES (for synthetics such as PES and PA)		Functionalised polymer formulation	
<b>22. Toray Industries</b> <a href="http://www.toray.com/news/fiber/detail.html?key=A059554DB106F19649257F4D-001D03C9">http://www.toray.com/news/fiber/detail.html?key=A059554DB106F19649257F4D-001D03C9</a>	Not known yet	DWR	Unknown, polymer	January 2016
<b>23. Bristex</b> <a href="http://www.bristex.com">http://www.bristex.com</a> - Select 'PRODUCT' then 'Repellof', 'Neoshield' or 'XPL'	Repellof-Eco	DWR	No information	No details (on show at ISPO Beijing February 2016)
	Neoshield	Membrane	No information: 'polymer' & 'nano membrane'	
	XPL	DWR & membrane	PU/TPU membranes and PU hydrophilic / Micro-porous coating	



Company	Technology brand name	DWR or membrane	Chemical basis	Date on the market
<b>24. Chemours</b> <a href="https://www.chemours.com/business-es-and-products/fluoroproducts/teflon-ecoe-lite-water-repellent-finish/index.html">https://www.chemours.com/business-es-and-products/fluoroproducts/teflon-ecoe-lite-water-repellent-finish/index.html</a>	Teflon EcoElite™	DWR	Unknown – based on 60% renewably sourced plant-based raw materials, performance far exceeds other PFC-free technologies, such as paraffin and silicones.	First products expected Q1 2016
<b>25. Huamao</b> ISPO Beijing	LAYTEX®	DWR and membrane	Membrane PU, TPU, PES (although PTFE listed) DWR – no information	No information (displayed at ISPO Beijing February 2016).
<b>26. Jack Wolfskin</b> <a href="http://www.jack-wolfskin.co.uk/pfc/">http://www.jack-wolfskin.co.uk/pfc/</a>	TEXAPORE	DWR and membrane	Both based on PU	Spring 2016
<b>27. Scieissent</b> <a href="http://www.scieissent.com/scieissent-curb-technology">http://www.scieissent.com/scieissent-curb-technology</a>	Scieissent Curb	DWR	No information, completely fluorine free	Mid-2016
<b>28. Schoeller</b> <a href="https://www.schoeller-textiles.com/en/technologies/ecorepel-bio">https://www.schoeller-textiles.com/en/technologies/ecorepel-bio</a>	Ecorepel®Bio	DWR	Biopolymer	September 2016
<b>29. Schoeller</b> <a href="https://www.schoeller-textiles.com/en/technologies/3xdry-bio">https://www.schoeller-textiles.com/en/technologies/3xdry-bio</a>	3XDY®Bio	DWR fabric	Biopolymer	September 2016
<b>30. Sympatex</b> <a href="http://www.sympatex.com/en/membrane/225/properties">http://www.sympatex.com/en/membrane/225/properties</a>	Sympatex membrane	Membrane	100% recycled polyether-ester polymer	September 2016
<b>31. Green Theme Technologies</b> <a href="https://www.greenthemetek.com/why-use-the-gtt-dry-finish/">https://www.greenthemetek.com/why-use-the-gtt-dry-finish/</a>	ChemStik® also described as Evergreen	DWR	Hydrocarbons	November 2016
<b>32. Nikwax</b> <a href="http://www.nikwax.com/en-gb/materials/hydrodown.php">http://www.nikwax.com/en-gb/materials/hydrodown.php</a>	Nikwax Hydrophobic Down	DWR Down	EVA elastomer	November 2016
<b>33. Porelle Membranes</b> <a href="http://www.porellemembranes.co.uk/en/products/sports-and-leisure/porelle-dry/">http://www.porellemembranes.co.uk/en/products/sports-and-leisure/porelle-dry/</a>	Porelle Dry	Membrane	Microporous technology & PU	End 2016
<b>34. Columbia</b> <a href="http://blog.columbia.com/preview-outdry-extreme-eco/">http://blog.columbia.com/preview-outdry-extreme-eco/</a> <a href="http://www.columbia.com/outdry-extreme-eco-landing/">http://www.columbia.com/outdry-extreme-eco-landing/</a>	OutDry Extreme ECO	Membrane & DWR	PFC-free, no other information	Spring 2017
<b>35. Nau</b> <a href="http://www.snewsnet.com/news/not-green-enough/">http://www.snewsnet.com/news/not-green-enough/</a>	Partly Teflon EcoElite, part another product (not described)	DWR	No information, part plant based	Spring 2017

## Glossary

DWR - Durable Water Repellent   EVA - Ethylene Vinyl Acetate   PES - Polyester  
 PU or PUR - Polyurethane   TPU - Thermoplastic polyurethane



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