

# Case Study on Phase out of Short-Chain C6 Perfluorinated Chemicals (PFCs) from Apparel

Levi Strauss & Co.  
May 2016

## Substitution case story

No.	Field Name	List	Explanations
1.	Title		Phase out of Short- Chain C6 Perfluorinated Chemicals (PFCs) from Apparel
2.	Abstract		The phase-out of PFC containing durable water repellent finishes has been decided by Levi Strauss & Co. For the manufacture of water repellent textile products an alternative PFC free finish is used containing paraffin waxes and blocked isocyanates.
3.	Sector	X	Manufacture of textiles, wearing apparel, leather and related products
4.	Function	X	Other Functions
5.	Process	X	Chemical or Biological treatment
6.	Reliability phrases	X	Select one or several of these options: <ul style="list-style-type: none"> <li>- Convergent opinions: conclusions for similar cases are similar to the ones in this case study</li> <li>- Divergent opinions: not all conclusions for similar cases are similar to the ones in this case study</li> <li>- Evidence of assessment: there is evidence of an official (positive) assessment of the substitution</li> <li>- <b>Evidence of implementation: there is evidence that the solution was implemented and in use at time of publication</b></li> <li>- Internet information: data are from an internet document and only a basic and partial evaluation could be performed</li> </ul>
7.	Substituted substance(s)		C6-Fluorocarbons
8.	Alternative substance(s)		Paraffin waxes melamine resin fat modified oxime-blocked isocyanate
9.	Other type of alternative		
10.	Hazard assessment		According to the producer's self-classification of the alternative product no hazardous ingredients are listed in the MSDSs. It may produce an allergic reaction. It is free of PFC. No details on the substituted products were known to SUBSPORT.
11.	Case description		* (see below)
12.	Case/substitution evaluation		This case story from a user describes the substitution of a short-chain PFC (C6 fluorocarbon) containing textile finish with an alternative PFC free finish that is not classified as hazardous. However, it was not possible to perform a full hazard assessment (e.g. potentially hazardous monomers etc.) as the full compositions are unknown to SUBSPORT. The PFC free finish might be a feasible alternative also for other PFC containing products, which can have severe negative environmental and health impacts.

No.	Field Name	List	Explanations
13.	State of implementation	X	Select one of these options: - Full capacity - <b>In use</b> - Not in use - Partial capacity - Pilot study
14.	Date, when alternative was implemented and country		Spring 2015, Global Distribution
15.	Contact: Enterprise using the alternative		Levi Strauss & Co 1155 Battery Street San Francisco, CA 94111 USA <a href="http://www.levistrauss.com">www.levistrauss.com</a>
16.	Availability of alternative		e.g. on the market
17.	Contact: Producer or supplier of alternative		Schoeller Textil USA, Inc. 38R Merrimac Street, Suite 204 Newburyport, MA 01950 <a href="http://www.schoeller-textiles.com">www.schoeller-textiles.com</a>
18.	Type of information supplier	X	Select one of these options: - Authority - <b>Producer / Distributor</b> - Research - User
19.	Contact: Information supplier		Levi Strauss & Co 1155 Battery Street San Francisco, CA 94111 <a href="http://www.levistrauss.com">www.levistrauss.com</a> Linda Gallegos, <a href="mailto:Lgallegos@levi.com">Lgallegos@levi.com</a>
20.	Other Solutions		<ol style="list-style-type: none"> <li>1. Highly branched dendrimers and polymers</li> <li>2. High molecular weight waxes</li> <li>3. Organic silicon compounds</li> </ol>
21.	Further information		MSDS of the alternative part 1 MSDS of the alternative part 2
22.	Further languages available		
23.	Comments from the information supplier for the project team only		
24.	Document – Type and availability		
25.	Document – Source: author, company, institute, year		
26.	Document – Link URL to document at original source		

## Introduction

\* This case study will show the steps Levi Strauss & Co. (called below "company") took to eliminate short chain, C6, perfluorinated chemicals (PFCs) from its Commuter™ line of denim and non-denim apparel. Commuter™ was successfully launched in Fall 2011 using Nanosphere®, a C6 perfluorinated chemical formulation marketed by Schoeller® Tech, part of Schoeller® Textiles and manufactured by Archroma, previously known as Clariant.<sup>1</sup>

The initial Commuter™ line consisted of men's denim and non-denim pants and jackets targeted for men commuting by bicycle, a growing global trend in the marketplace. The product consisted of denim and non-denim fabric, with performance attributes such as: stretch for mobility and comfort; design details targeted for cyclists; an antimicrobial for odor management; and a durable water repellent (DWR) to provide protection from rain.

Sourcing and developing the fabric with the desired attributes was carefully orchestrated by the company during the development phase of the work. It required strong technical knowledge to get the water repellent performance, while maintaining a product with the desired aesthetics.

For denim, the Nanosphere® chemistry was applied at the mill after the denim was desized and before garments were cut and sewn. The denim jean did not have any garment finishing to ensure the level of DWR performance was maximized for the consumer. For non-denim, the Nanosphere® chemistry was also applied at the mill during the fabric finishing process in a similar manner.

The company used the AATCC 22 water repellency spray test method to test for the performance on the finished fabric as well as garments. Standards were established based on the test results and the expected performance of the products.

## The Case Study Method

1. **Identify the chemical of concern.** The company describes the hazard, the function of the substance, and the current conditions to make it work at the desired performance level.
2. **Set substitution criteria.** Through company's Restricted Substances List (RSL) process, criteria to eliminate alternatives that are not safer have been set. The company also aligns with the regulatory and legal environment of the countries in which the company operates and sells.
3. **Identify alternatives from chemical suppliers.** The company engages with chemical suppliers in dialogue about chemical sustainability, hazard, risk and exposure, and work with them to find safer alternatives for chemicals of concern.
4. **Assess and compare alternatives.** The company asks chemical supplier to share what hazard assessment methodology and tool they use to identify safer substitutions.
5. **Pilot substitution for performance.** The company evaluates the chemical through company's processes to ensure the performance meets consumer expectations.
6. **Encourage chemical supplier to post substitution case study.** After third-party verification, the company encourages the chemical supplier or other organization to post a substitution case story on the SUBSPORT.

## The Problem

The company identified short-chain perfluorinated chemicals (C6) as a class of chemicals to eliminate from its products by December 31<sup>st</sup> 2015. Following this decision, the company immediately began to search for a

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<sup>1</sup> Schoeller's Nanosphere® technology is considered a state of the art, bluesign® approved C6 chemistry

replacement for Nanosphere®. Currently, short-chain PFCs are not regulated, and do not have any harmonized classification according to [Annex VI of Regulation \(EC\) No 1272/2008 \(CLP Regulation\)](#). The evidence that long-chain PFCs, such as perfluorooctanoic acid (PFOA) and perfluorooctanesulfonic acid (PFOS), are both hazardous to human health and the environment is well documented.

The theory held by certain sectors in the science and NGO communities is that the molecular structure between the short-chain and long-chain PFCs is so similar that short-chain PFCs also may be persistent, bioaccumulative and toxic. It should be noted that there is much less available data on short-chain PFCs to demonstrate their hazardous nature. Consistent with the precautionary principle, the company made a decision to replace Nanosphere® with PFC-free alternatives.

### **Substitution Criteria**

The company has established a Restricted Substances List (RSL) that restricts the presence of hazardous chemicals on consumer products. It added long-chain PFCs, such as PFOA and PFOS, to the RSL in 2008. The company RSL meets, and in many cases exceeds, all global regulatory requirements.

As the company began to search for safer alternatives, it was imperative that the alternative formulations not pose any risks to human health and the environment. Of specific concern was to make sure the alternative chemical was not a regrettable substitution, meaning that it could be just as hazardous as the chemical it was trying to replace.

Chemicals that are persistent, bioaccumulative, toxic to the environment, and carcinogenic were particularly important hazard end-points because these are the hazardous attributes associated with long chain PFCs.

### **The Alternative**

The company wanted to maintain its relationship with Schoeller® for several reasons; it is an innovative leader in performance chemistry for textile applications; its marketing strategy is a good fit for the Commuter™ series; and it is a leader in environmental health and safety in the textile industry.

Schoeller® launched a PFC-free replacement technology called ecorepel® in 2013. It is based on long paraffin chains that wrap themselves around the cotton fibers. This reduces surface tension so that water is repelled off the fabric. The paraffin chains are bound to the fiber by a “docking system” that is cross-linked by blocked isocyanates.

The following chemicals make up the ecorepel® system:

1. Schoeller® Protec-FF – A dispersion of paraffin oils and a fat modified melamine resin which is nonionic/cationic in nature. It is not classified as hazardous.
2. Schoeller® Impregmol 6900 – A dispersion containing oxime blocked polyisocyanate –It is not classified as hazardous.

The company uses the GreenScreen® method for Safer Chemicals as a way to assess and evaluate chemicals of concern. In the case of ecorepel®, a certified GreenScreen® profiler conducted a GreenScreen® assessment®. The resulting GreenScreen® assessments demonstrated that the active ingredient of ecorepel® was at least a Benchmark 2 ingredient.<sup>2</sup> This is an acceptable score and meets company’s criteria for choosing the best chemicals in their class.

### **Assess and Compare Alternatives**

During the search for a new replacement for PFCs, the company worked very closely with Schoeller®, requesting the following from Schoeller®

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<sup>2</sup> LS&Co. will not disclose any confidential information from their GreenScreen® assessment. Based on their criteria and evaluation of the Benchmark scores, the results from the assessment were acceptable.

1. Safety data sheets for all components of ecorepel®.
2. Data generated by Schoeller® that demonstrated the replacement was not hazardous. (A REACH registration was determined to be acceptable.)
3. Registration through REACH and access to the REACH dossier.

The company product safety team reviewed the safety data sheets carefully to see if any regulated chemicals were included. In the case of both components, the chemical ingredients were not regulated and considered safe to use.

The company also conducted a review of other alternatives to PFCs available in the marketplace. The technologies included the following:

1. Highly branched dendrimers and polymers
2. High molecular weight waxes
3. Organic silicon compounds

### **Experiment and Pilot**

Once company identified ecorepel® as a suitable replacement to Nanosphere® from a health and safety perspective, the next step was to determine if it was acceptable based on cost and performance criteria.

Two mills were targeted to run trials with ecorepel®. One was chosen to run denim trials due to its equipment capabilities and technical expertise. The other was chosen to run the non-denim substrate due to its familiarity with Nanosphere® and expertise in applying performance chemicals to fabrics.

The application method was similar to Nanosphere® except that ecorepel® was applied in two steps: the paraffin wax and the dosing system.

Three attributes were evaluated during the pilot phase: cost, performance/quality, and aesthetics, specifically as it related to the feel and drape of the garment.

### **Cost**

The cost of the chemicals, the amount needed to get the desired performance, and the application method was similar, but not identical to Nanosphere®. Once a cost analysis was performed, it was concluded that the cost differential between the Nanosphere® and ecorepel® was negligible.

### **Performance/Quality**

The original company spray rating standard for DWR performance on denim based on the AATCC 22 method was 80 “as delivered” and 70 after 10 home launderings. Both Nanosphere® and ecorepel® were able to meet these performance standards.

### **Aesthetics**

There was no difference in hand between garments treated with Nanosphere® and ecorepel®.

### **Implement and Improve**

The company successfully transitioned from Nanosphere® and replaced it with ecorepel® from Schoeller® Chemicals.

Commuter™ jeans treated with ecorepel® were available in the marketplace as part of the Spring 2015 delivery season.

## **Conclusion**

The company successfully transitioned away from short chain PFCs to similar performance using PFC-free technology. It successfully applied the six steps to finding safer alternatives to chemicals of concern.

In addition, company established an internal process to ensure products that require DWR performance are identified at the onset of development, and only non-PFC related chemicals are used.

The company works diligently with its chemical suppliers and manufacturers to focus on safer alternatives to chemicals of concern. It conducts technical workshops with major chemical suppliers twice a year and has established a method to assess and evaluate chemicals based on their hazard. The company is committed to the development of safer alternatives used within the supply chain.

## **Addendum**

Since the company prohibited short- and long-chain perfluorinated compounds (PFCs) and launched this program, the company has not been able to achieve the same performance standards in using other PFC free technologies as achieved using Schoeller® ecorepel®.

For production targeted for season Fall/Winter 2016, the brand was required to reduce performance standards for water repellency when using non-Schoeller chemistry due to the lower and more inconsistent performance of the non-Schoeller technologies. In addition, the brand had to cancel orders, reduced order volumes and is managing fabric inventory that does not meet the desired performance standards. There is also risk to the brand that stems from shipping products with reduced performance attributes to retail.

The product development teams at the company continue to research all PFC free alternatives to improve the current situation and improve product performance. A comprehensive review of PFC free chemistries will be conducted in Spring/Summer 2016 to impact decisions made for products that will be sold during the Spring/Summer 2017 season.