

Benetton Group Commitment

As part of its zero discharges pledge, Benetton Group (Benetton) is committed to completely eliminating Per-Fluorinated Chemicals (PFCs) from all its products and processes.

What are PFCs?

Per-Fluorinated Chemicals (PFCs) are a large group of manufactured compounds that are widely used to make everyday products more resistant to stains, grease and water. PFCs break down very slowly in the environment and are often characterized as persistent.

Two PFCs studied at length are *Perfluorooctanoic acid* (PFOA), represented in Figure 1, and *Perfluorooctane sulfonate* (PFOS), two byproducts of other commercial products, meaning they are released into the environment when other products are made, used or discarded. [1]

Durable Water Repellents (DWR) are also used in apparel and footwear manufacturing as tropical finishings, providing to the fabrics protection against water, oil and soil [2].

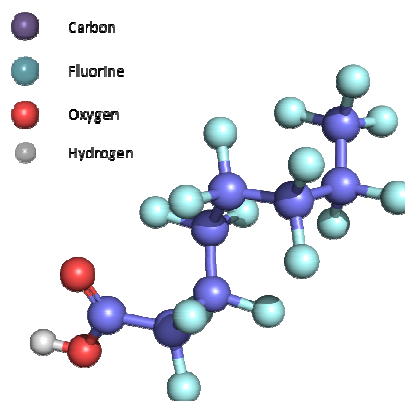


Figure 1: PFOA molecular model

What is Benetton doing?

Benetton has been monitoring and limiting these substances in the supply chain processes and in its products, aiming at achieving zero discharge.

Benetton has carried out an **intensive testing program** to screen the supply chain and to identify materials, products categories, suppliers, processes and geographical areas of higher concern. Moreover, **chemical intensive manufacturing units/suppliers are audited by independent external experts**, who are tasked with highlighting and handling existing or potential risks of PFCs contamination.

What, how and where Benetton tested?

In 2015 a wide number of PFC tests were carried out and this document will report the key findings of a one-year benchmark on raw materials, products and raw wastewater sampled before the treatment plant of the mills actively involved by a wet process.

SAMPLING PERIODS

January 2015 - December 2015

SAMPLES



Raw Materials and Products



Raw Wastewater (Before Treatment Plant)

INVOLVED SOURCING AREAS

- Global North
Central Europe, Eastern Europe
- Global South
China, Bangladesh, India, Turkey, North Africa, South America

LABORATORIES

To get **reliable and comparable results, all samples were tested in globally recognized ISO 17025 testing laboratories**, such as: Bureau Veritas Germany, Bureau Veritas HK, Bureau Veritas India, Bureau Veritas Shanghai, Bureau Veritas Singapore, SGS HK, Intertek Turkey, Intertek Italy, UL-ICQ HK, UL-ICQ Italy.

TEST METHOD

Ultrasonic solvent extraction followed by Gas Chromatography Mass Spectrometry or Liquid Chromatography Mass Spectrometry.

DETECTION LIMITS

- Raw Materials and Products: 1,00* µg/m²
- Wastewater: 0,01* µg/L (ppb)

*best reproducible detection limits currently achievable by all testing laboratories

ANALYTES

Ionic PFCs Name	Abbreviation	Volatile PFCs Name	Abbreviation
Perfluorooctane sulfonates	PFOS	1H,1H,2H,2H-Perfluorohexane-1-ol	4:2 FTOH*
Perfluorooctanesulfonamide	PFOSA	1H,1H,2H,2H-Perfluoro-1-octanol	6:2 FTOH*
Perfluorooctanoic acid	PFOA	1H,1H,2H,2H-Perfluoro-1-decanol	8:2 FTOH*
Perfluorobutanoic acid	PFBA	1H,1H,2H,2H-Perfluorododecane-1-ol	10:2 FTOH*
Perfluoropentanoic acid	PFPeA	1H,1H,2H,2H-Perfluorooctylacrylate	6:2 FTA*
Perfluorohexanoic acid	PFHxA	1H,1H,2H,2H-Perfluorodecylacrylate	8:2 FTA*
Perfluoroheptanoic acid	PFHpA	1H,1H,2H,2H-Perfluorododecylacrylate	10:2 FTA*
Perfluorononanoic acid	PFNA	N-Methyl-Perfluorooctanesulfonamide	N-Me-FOSA
Perfluorodecanoic acid	PFDA	N-Ethyl-Perfluorooctanesulfonamide	N-Et-FOSA
Perfluoroundecanoic acid	PFUnA	N-Methyl-Perfluorooctanesulfonamidoethanol	N-Me-FOSE
Perfluorododecanoic acid	PFDoA	N-Ethyl-Perfluorooctanesulfonamidoethanol	N-Et-FOSE
Perfluorotridecanoic acid	PFTrA		
Perfluorotetradecanoic acid	PFTeA		
Perfluorobutanesulfonate K-salt	L-PFBS*		
Perfluorohexanesulfonate Na-salt	L-PFHxS*		
Perfluoroheptanesulfonate Na-salt	L-PFHpS*		
Perfluorodecanesulfonate Na-salt	L-PFDS*		
Perfluorobutane sulfonic acid	PFBS		
Perfluorohexane sulfonic acid	PFHxS		
Perfluoroheptane sulfonic acid	PFHeS		
Perfluorodecane sulfonic acid	PFDS		
Perfluoro-3,7-dimethyloctanoic acid	PF-3,7-DMOA		
1H,1H,2H,2H-Perfluorooctanesulphonic acid	1H,1H,2H,2H-PFOS		
7H-Dodecafluoroheptanoic acid	HPFHpA		
2H,2H-Perfluorodecanoic acid	H2PFDA*		
2H,2H,3H,3H-Perfluoroundecanoic acid	4HPFUa		

Table 1: Analytes (PFCs)

*Not tested in raw wastewater

The Result?

In order to provide statistically valuable information, this study involved:

- **438 tests** on raw materials/finished products, **11%** of which were found to be **“positive” to PFCs**
- **37 tests** on wastewater sampled in as many factories, **13.5%** of which were found to be **“positive” to PFCs**

RAW MATERIALS AND PRODUCTS RESULTS

7% of the tests were positive to the presence of a single PFC while **4%** of the tests were positive for two or more PFCs. Looking at the more than 14,000 single analytes tested, the “positive” results correspond to **0.5%** and **25 of the 37 different PFCs investigated have never been detected before.**

Tables 2 and 3 show the presence - in percentage – of each analyte related, respectively, to Ionic and Volatile PFCs.

Ionic PFCs	Positive %	Volatile PFCs	Positive %
PFOS	0.7	4:2 FTOH	0.2
PFOSA	n.d.	6:2 FTOH	2.2
PFOA	2.5	8:2 FTOH	4.5
PFBA	0.2	10:2 FTOH	4.3
PFPeA	n.d.	6:2 FTA	n.d.
PFHxA	n.d.	8:2 FTA	1.2
PFHpA	n.d.	10:2 FTA	0.7
PFNA	n.d.	N-Me-FOSA	n.d.
PFDA	n.d.	N-Et-FOSA	n.d.
PFUnA	n.d.	N-Me-FOSE	n.d.
PFDoA	n.d.	N-Et-FOSE	n.d.
PFTrA	n.d.		
PFTeA	n.d.		
L-PFBS	0.7		
L-PFHxS	0.2		
L-PFHpS	n.d.		
L-PFDS	n.d.		
PFBS	n.d.		
PFHxS	n.d.		
PFHeS	n.d.		
PFDS	n.d.		
PF-3,7-DMOA	n.d.		
1H,1H,2H,2H-PFOS	0.2		
HPFHpA	n.d.		
H2PFDA	n.d.		
4HPFUa	n.d.		

Table 3: Positive % per each Volatile PFC

Table 2: Positive % per each Ionic PFC

The most relevant presence in Raw Materials/Finished Products is related to 8:2 FTOH and 10:2 FTOH with a respective value of 4.5% and 4.3% of the total performed tests.

GEOGRAPHICAL DISTRIBUTION

For a better understanding, PFC findings per each sourcing area are represented on a world map (Figure 2).

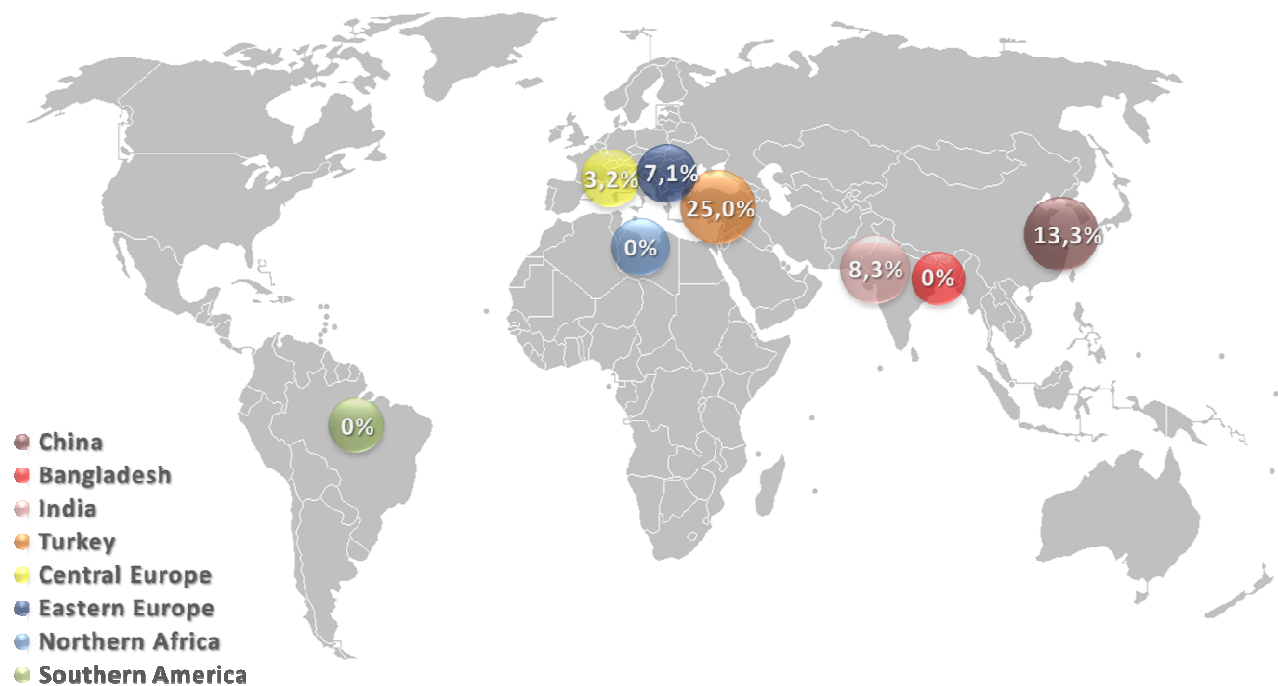
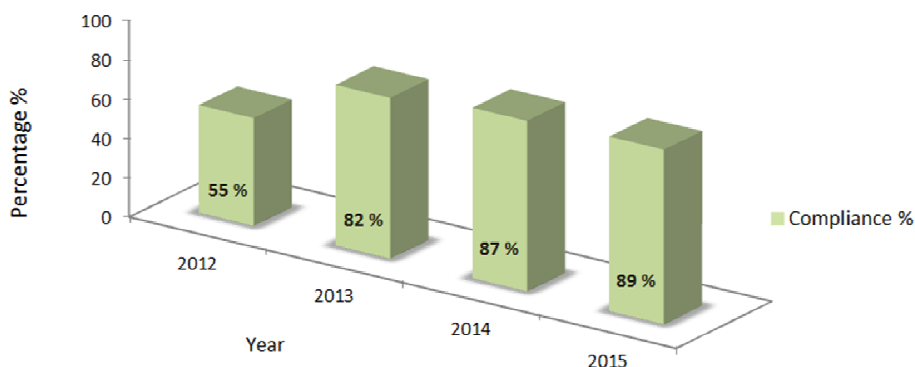


Figure 2: PFC-positive Raw materials/Finished Products samples (percentage distribution)

ELIMINATION PROGRESS

Benetton annually carries out a relevant number of tests on a statistically representative samples selected among its products, demonstrating an increasing compliance trend (Figure 3). Moreover, except in extremely rare cases, the positive results are always related to a PFCs traces contamination.



	2012	2013	2014	2015
Test Number	102	116	95	438

Figure 3: Annual compliance percentage

WASTEWATER RESULTS

13.5% of the tests were positive for PFOA (Table 4). Looking at the more than 900 single analytes tested, the positive results correspond to 0.5% and 24 of the 25 different PFCs investigated, have never been detected before.

PFC Name	Positive %
PFOA	13.5

Table 4: Positive % of found PFCs

The presence of PFCs in wastewater samples was related to traces of PFOA, a byproduct of other PFCs production.

GEOGRAPHICAL DISTRIBUTION

For a better understanding, PFC findings in wastewater samples per each sourcing area are represented on a world map (Figure 4).

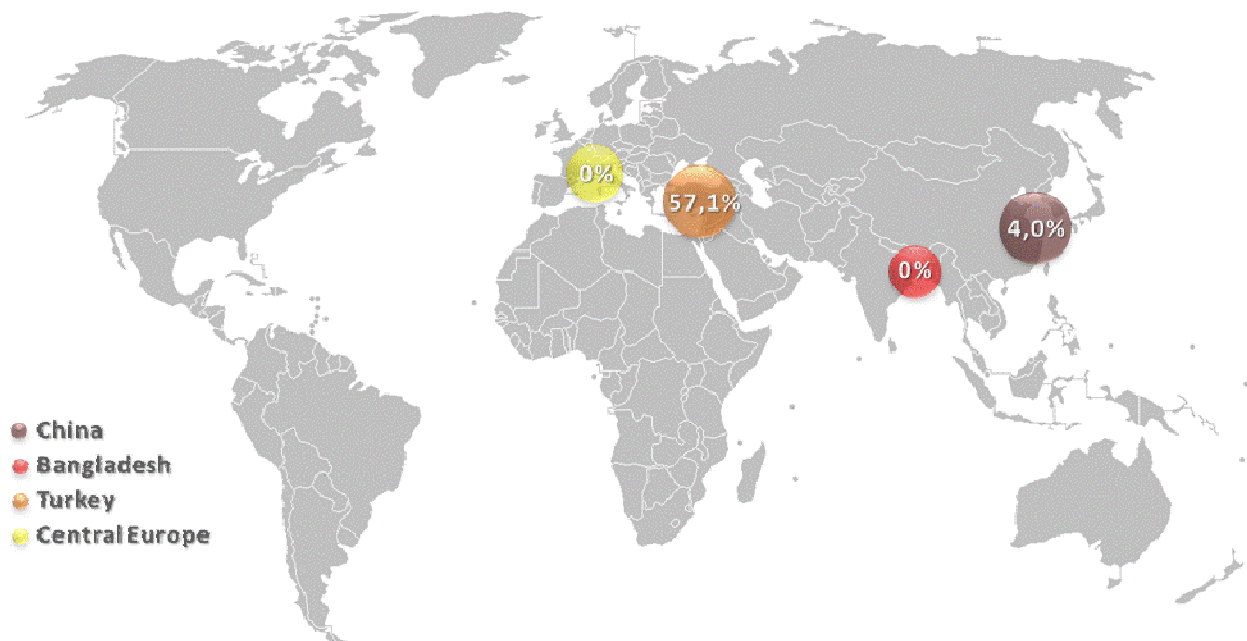


Figure 4: PFC-positive Wastewater samples (percentage distribution)

ELIMINATION PROGRESS

To verify the presence of PFCs and the contamination in the wet process, Benetton tested the wastewater at the end of the production line. Since 2013, the **wastewater of more than 100 factories** has been tested for all the 11 Detox Priority Groups of Hazardous Chemicals. Figure 5 shows the situation of PFCs compliance:

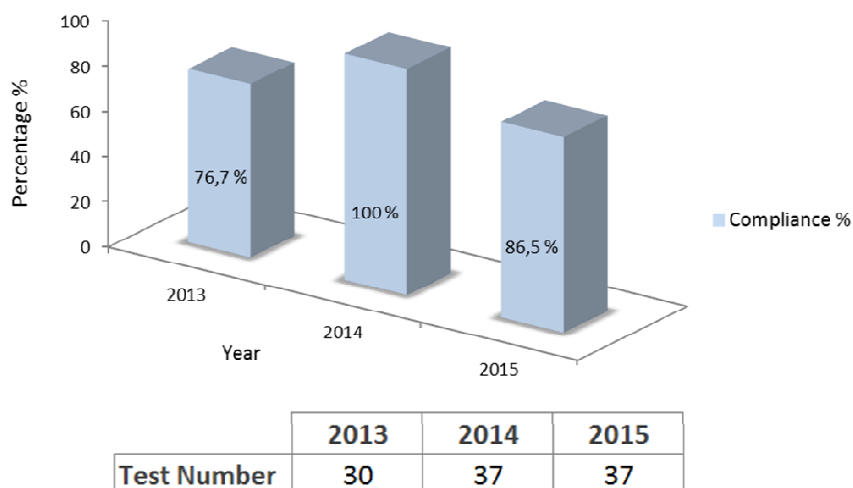


Figure 5: PFC Annual compliance percentage

CONCLUSIONS

The steps carried out until now have shown a progressive enhancement of PFCs elimination in the materials/finished garments and in wastewater. Test results pointed out PFC's contamination localized in particular countries, where it is still possible to find traces of volatile PFCs, whereas the PFOA traces found in the raw wastewater are massively abated by the water treatment plants.

Due to a spread PFCs pollution, suppliers may unintentionally use PFCs containing chemicals or contaminated materials sourced in countries where the use of these substances is not regulated.

It is clear that the complexity of the problem requires a major involvement of the chemical companies who must develop and deliver valid "green" alternatives to PFCs.

Several chemical companies developed "positive lists" of their own commercial chemical products based on specific brands' requirements.

Benetton shared such lists with its whole supply chain in order to give a tangible message about the availability of alternative chemical products.

To reinforce these actions, Benetton appointed certified auditors to verify and improve suppliers' Environmental Management Systems (EMS) according to the following environmental audit criteria:

- Environmental permits and legal requirements
- Emissions
- Sustainable resources use (energy, water, etc.)
- Chemical management practices
- Chemicals and wastes storage and handling
- Training and work practices

This approach, combined with the PFCs usage ban imposed by an increasing number of brands, is expected to lead to a decrease in contamination sources and to increase suppliers' awareness about environmental management.

Environmental audits results on facilities, suppliers' chemical inventories improvement rates and tests on wastewaters are valid Key Performance Indicators (KPI) of PFCs use, and can help understand if the positive reports at low concentrations levels are due to intentional use or to unavoidable traces proper of the persistent nature of these chemicals.

GLOSSARY

Detection Limit: The test method detection sensitivity that a laboratory must be able to achieve when measuring the substance in the product.

RSL: Restricted Substances List

ISO: International Standardization Organization

EMS: Environmental Management System

KPI: Key Performance Indicators

DWR: Durable Water Repellent

µg: micrograms

ppb: part per billion (µg/L)

n.d.: not detected

PFCs: Per-Fluorinated Chemicals

REFERENCES

[1] National Institute of Environmental Health Sciences - September 2012:

https://www.niehs.nih.gov/health/materials/perflourinated_chemicals_508.pdf

[2] ZDHC – Guidance Sheet:

<http://www.roadmaptozero.com/fileadmin/layout/media/downloads/en/LCPFAA.pdf>