Friends of the Earth Norway - Report 2/2006

Fluorinated pollutants in all-weather clothing

Swedish Society for Nature Conservation

NORGES NATURVERNFORBUND
FRIENDS OF THE EARTH NORWAY

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FRIENDS OF THE EARTH NORWAY

Norwegian Society for the Conservation of Nature/Friends of the Earth Norway (FoEN) was founded in 1914 and is Norway's largest environmental conservation organisation, with a total of about 20 000 members and supporters. FoEN is a nation-wide organisation with branches in all counties and 150 local groups scattered throughout Norway.

FoEN deals with a whole range of important environmental issues, believes that public participation is necessary to save our environment, and therefore gives public information high priority. It aims to raise public awareness of environmental issues and to promote environmentally-friendly patterns of behaviour.

The Swedish Society for Nature Conservation (SSNC) is the largest non-governmental environmental organisation in Sweden. It was founded in 1909. The SSNC is governed by its 170 000 members and have 270 local bransches. We cooperate directly with a large number of organizations and networks in various parts of the world.

Our international work aims to contribute to an ecologically, socially and economically sustainable development based on respect for human rights and democratic systems of governance.

Fluorinated pollutants in all-weather clothing

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Introduction

Nordic people discover nature regardless of the weather. In our Nordic climate rain is common during all seasons. This means that we need all-weather clothing that work and that you as a consumer can buy with a clear conscience. The Swedish Society for Nature Conservation and Norwegian Society for the Conservation of Nature/Friends of the Earth Norway have therefore investigated all-weather jackets.

All-weather garments are made from breathing materials which also release vapour and are windproof. Often these properties are added by different kinds of textile coatings. Information stated on the garments label was not enough to find out included substances and therefore laboratory tests were necessary. According to the Swedish Chemicals Inspectorate and Norwegian Pollution Control Authority fluorinated compounds are used as impregnating agents in order to get a stain- and water-repellent surface on textiles. PFOS is one substance that has been found in the environment. Due to its properties it has been suggested to be phased-out globally according to the Stockholm Convention on Persistent Organic Pollutants (POPs). It has therefore been important to study if all-weather clothing for children and adults can be a source for spreading environmental pollutants.

The materials investigated by us are Gore-Tex Paclite, HellyTech, Fine Tex/DuPont Teflon, TCS Water and Dermizax. There are also other materials with similar properties which were not included in this investigation. Examples of other trade names are Vent Air, ReimaTec and Beaver Nylon.

Background information

Fluorinated, brominated, chlorinated....

New toxic chemicals do not emerge by accident. They are the inventions of the chemical industry and they are mass-produced because it is profitable. The compounds are often found in products that can be bought in shops and they are intended to fulfil a specific function (stain-repelling, waterproof and breathing materials, flame-retarding). Known hazardous chemicals that have entered the environment because they have leaked out from products during use and waste treatment include polychlorinated biphenyls (PCBs) and brominated flame-retardants (BFRs). Now the alarm is being sounded for a completely new group of problematic micropollutants – the fluorinated substances.

Because fluor is a halogen, with similar chemical properties to the chlor and brom used in the "legacy" micropollutants, it should not come as a surprise to anyone that also these synthetically produced fluorinated substances are hazardous to the environment.

Fluorinated pollutants not produced in the Nordic countries

All such fluorochemicals that are sold in the Nordic countries are imported – either in the form of chemical/technical products or as components of solid processed products. They are used in many types of products to achieve a smooth surface that is preferably stain- and water-repellent. The fluorinated chemicals can be found in certain cleaning agents, paint and varnish, wax, floor polishing agents, impregnation agents for textiles, carpets, paper, furniture and shoes, fire-extinguishing liquids and photo paper.

PBT

As far as known, fluorinated pollutants do not biodegrade in nature at alland some of them are extremely bioaccumulating. They mostly fulfil all the criteria for being considered a classic group of problematic organic so called PBT pollutants (se Box 1) as is the case for PCB and nowadays also BFRs, but the biodegrading period for fluorinated compounds is very much longer. Thus means e.g. that they possess a clear potential for being transported in the environment, and can explain why they are found in polar regions far from the populated areas where they are used.

Unknown consequences

What characterises a PBT chemical?

These are chemicals that can produce insidious poisonous effects even in extremely small amounts. The abbreviation PBT occurs frequently in specialist literature. P stands for persistent, i.e. resistant to biodegrading, B is for bioaccumulating, i.e. collecting in living creatures, and T stands for toxic, which means poisonous.

Fluorinated compounds are widely marketed and sold even though there is almost no knowledge of the effects they cause when they accumulate in humans and animals. The few tests that have been conducted with some of the compounds have surprised researchers. Even small amounts of some of these substances have been shown to have extremely clear harmful effects on reproduction, cell function and the hormone system in the same way as other PBT pollutants.

Recently emerged in the environment

During the past five years, now that methods for analysing such substances in environmental tests have at last been devised, there has been a flood of new research reports on findings in humans and animals. So far the greatest focus among fluorinated environmental pollutants has been on the two variants called perfluorooctanyl sulfonate (PFOS) and perfluorooctanoic acid (PFOA), but during the past year the abbreviations FTOH and PFCA have attracted considerable attention. The collective term for all the groups of substances mentioned is PFAS. Box 2 explains the abbreviations. Total PFAS-levels in biota and the environment are now many places exceeding the levels of "legacy" persistent organic pollutants like PCB.

3M's PFOS is being phased out

Reports in 2000 informed us that the extremely stable fluorinated pollutant variant PFOS had been found in environmental samples worldwide. The levels in wild animals are close to those that have been proved to produce harmful effects in laboratory experiments. This led to the world's largest manufacturer of PFOS compounds – 3M – stopping its production of this substance and also resulted in Norway, Sweden, Denmark and many other countries giving consideration to banning its future use.

The telomer industry

Attention was immediately directed towards the rest of the fluorine industry and to the so-called fluortelomer compounds. Among major producers of these substances are Clariant, Bayer, Ciba, Daikin and DuPont. In the same way as they did for PFOS, the manufacturers have claimed that these are so stable and bonded to the products that they will not spread to the environment. They claim that fluortelomers are harmless and environment-friendly alternatives to PFOS – a claim that has been proved wrong. As was the case with PFOS, biodegraded products and remains of fluortelomers have recently been found in concentration in Arctic top predators such as polar bears. The biodegraded products and remains mostly referred to here consist of PFCA. They are increasing rapidly, and their doubling time in Arctic animals seems at the moment to be about 4 years. Like PFOS, the PFCAs can also be found in the Nordic countries, for example in rainwater and drainage water. Sites for textile production and treatment have been pointed out as potential sources of discharge, together with landfills, but the specific sources are so far not known.

Glossary

PFAS: Perfluoroalkyl sulfonates, which consists of:
PFOS: Perfluorooctanyl sulfonate
PFOA: Perfluorooctanoic acid
FTOH: Fluortelomer alcohols,which represent the cornerstones of commercial products that are often called telomers, fluortelomers, fluorpolymers or fluortensides.
PFCA: Perfluorocarboxylic acids

Telomer products emit fluorinated pollutants

Researchers – and over time telomer producers themselves too – maintain that these fluorinated pollutants are spread in both air and water and that they can disseminate into the environment from telomer products in several ways:

1. Fluorinated pollutants like PFCA are present as unbonded remains in telomer products.

2. The same fluorinated pollutants are also formed when residual FTOH in the products are biodegraded in the environment.
3. It's also possible that the more complex and stable fluorcompounds like teflon are breaking down, ultimately releasing FTOH and PFCA.

Emissions may take place both during production, use and waste treatment.

Frequently used for impregnating textiles

The use of fluortelomers has risen during the past year parallel with the phasing out of PFOS. The Norwegian Pollution Control Authority regards textile impregnation as the definitive largest area of use for fluortelomers in Norway and has loosely estimated that sales of finished textile goods constitute around 10 tonnes of fluortelomers per year. Similar estimates have been made for the Danish and Swedish markets. The annual global fluorotelomer production is around 10.000 tonnes, of which about 50% goes to the impregnation of textile consumer products. No information on fluorochemical content is though given when you buy such a consumer product, so neither consumers nor authorities have got the information needed to navigate in this market and even less for regulating it.

What we know is that fluortelomers are commonly used to give a stain- and water-repellent "finish" to textile surfaces, and are applied during the production of all-weather clothing or other textiles so that they are ready for use when bought. The same protective fluorochemicals commonly used on allweather garments also are commonly used for textiles in i.e. tablecloth, upholstery, carpets and bed linen. Telomer impregnation agents are also sold in aerosol or wash-in cans for subsequent impregnation at home. Some important trade names for the different fluorobased textile coatings are given below in table 1.

Policy and Governmental awareness

Table 1: Overview of commercial names

Producer	3M	Bayer	Ciba	Clariant	DuPont
Trade name	FC brand	Baygard	Oleophobol	Pekophob	Zonyl

In 2004 Canada's environmental protection agency as a precautionary move banned three fluorotelomer chemicals used as stain repellents. This was the first time any government has banned such chemicals, but the fluorotelomer group of chemicals are now under increasing scrutiny by the environmental authorities in USA, UK, Norway, Sweden and Denmark, and have in Norway been added to the list of hazardous chemicals given priority for a phase-out before 2010.

The fluorotelomer industry itself is well aware of the development, and has joined in research programmes that are looking at these chemicals' environmental fate and effects. The chemical industry is of course the first ones to know about the chemical properties of these substances. Unfortunately, the properties that the industry regards as highly valuable, such as high persistence, are the same properties making these fluorochemicals unwanted in nature. The fluorotelomerindustry has when faced with the recent reports on findings the environment started their own research programme, and is arguing that any conclusion regarding continued use or restrictions of the substances has to await these research efforts.

The producers and distributors of allweather garments have on their hand been more concerned with optimising the water repelling properties of the textiles than with considering the fact that they consequently might be using and selling hazardous chemicals.

Our investigations

Samples of all-weather jackets

In a collaboration between The Norwegian, Swedish and Danish Societies for Nature Conservation, textile samples were taken from a range of all-weather jackets for children in the Nordic market, to take part in our screening investigation.

The background for these tests was the suspicion that these types of synthetic textiles continue to be supplied impregnated with fluorinated pollutants, even though there are a number of more environment-friendly impregnation products on the market. We have been informed by the Norwegian Pollution Control Authority, and seen from advertising material on the internet that Gore-Tex and a few other suppliers and dealers of so-called breathing synthetic textiles still recommend the sole use of fluortelomers for impregnation for technical reasons.

Alltogether 6 jackets from 5 different brands were collected from shops or warehouses in Sweden and Norway. The jackets in our investigation came from Norwegian, Swedish and foreign manufacturers. The different types of textiles covered, includes those that are supplied in the Nordic countries from most of the well-known brand names of all-weather garments. Common to the textiles is that they are so-called breathing synthetic textiles, with the exception of one cotton anorak material that was included in the investigation for a comparison. We regard the samples collected as representative of all-weather garments also other than jackets – for example trousers and shoes. It is the first time an investigation of this type has been conducted in the Nordic countries.

Chemical analysis was carried out at the Norwegian Institute for Air Research – one of the world's most advanced laboratories for analysing this newly-discovered group of micropollutants. The laboratory extracted unbound fluorochemicals from the jackets, measured their amounts, and calculated their levels both as fluorochemical per square meter textile and per gram jacket material. During this process the laboratory took care to produce results that gave a valid comparison between the different textile brands, and they also took care not to produce or measure any unwanted fluorinated break down products that could have interferred with the interpretation.

The laboratory regards the amounts of fluorochemicals found in the different jacket textiles as a good indication on their relative potential to directly and quite rapidly (within weeks) contaminate the environment. For a better estimation of total leakage from an allweather garment through its technical lifetime more elaborate test has to be carried out, for example including repeated cycles of washing, drying and wearing.

Table 2: Overview of the jackets textiles.

Jacket	Textile
Polarn O. Pyret	FINE TEX“ / DuPont™ Teflon“
Peak Performance	Gore-Tex“ Pac Lite“
HellyHansen	HellyTech“
EVEREST	TCS WATER 2000

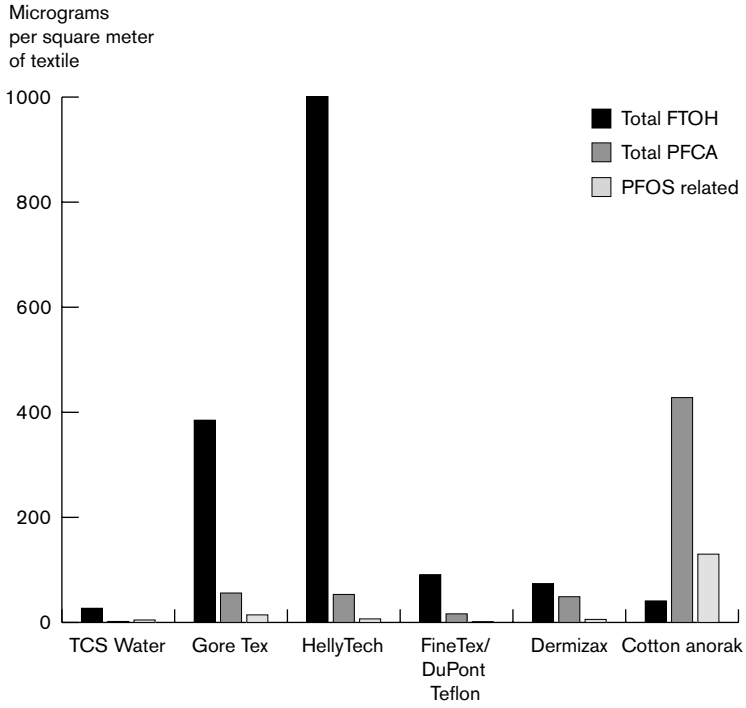

Figure 1: Amounts of fluorinated chemicals extracted from various all-weather jacket textiles

Results

Fluorinated pollutants found in all-weather clothing

Our investigation shows that in addition to PFOS-related compounds it was particularly FTOH and PFCA that were found in all the all-weather clothes examined on the Nordic market. These substances can thus be spread to the environment during the lifecycle of these products.

As the analysis results show (Figure 1), there are clear differences between the various types of textiles in our specific samples, and it is difficult to explain these variations by maintaining they are the result of pure chance:

1. Gore-Tex and HellyTech have extremely high rates of FTOH, and all the others show substantial amounts.
2. All the textiles, with the exception of TCS Water, also have considerable amounts of PFCA.
3. In contrast to the others, the cotton anorak contains a large amount of PFCA and PFOS-related compounds.

These chemical "fingerprints" indicate that the fluorochemicals found in the allweather garments are originating from a suite of very similar commercial products, most likely the telomerimpregnation. The anorak cotton has been treated with a different, but still hazardous fluorochemical mix. More details of the tests and the analysis results are given in Attachment B.

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APPENDIX A

Analysis report T-63

Swedish Society for Nature Conservation

(21 pages this page included)

Analysis report T-63

Customer: Swedish Society for Nature Conservation, attn. Helena Norin

Project no.: T-63

Sampling: Customer

Sample information:

Rain jacket	NILU sample no.	Sample received	Analysed sample material
Polarn O. Pyret	SNF textil 1	12.07.05	10 x 10 cm (1.04 g) dark blue material from the back, double layer jacket, only outer layer analysed
Peak Performance	SNF textil 2	12.07.05	10 x 10 cm (1.17 g) from the back, jacket consists of only one layer (outside red, inside grey)
Helly Hansen	SNF textil 3	12.07.05	10 x 10 cm (1.91 g) only red material from the back, double layer jacket, only outer layer analysed
Stadium	SNF textil 4	12.07.05	10 x 10 cm (1.31 g) only blue material from the back, double layer jacket, only outer layer analysed

Analyses:

Laboratory: Norwegian Institute for Air Research (NILU)
The Polar Environmental Centre
9296 Tromsø / Norway

Sample preparation: Extraction with ethyl acetate for fluorotelomer olefin and fluorotelomer alcohols. Extraction with methanol for carboxylates, sulfonates, sulfonamides and sulfonamidoethanols.

Analytical method: Gas chromatograph coupled to mass spectrometer (GC-MS) for ethyl acetate extracts. High performance liquid chromatograph coupled to mass spectrometer (HPLC-MS) for methanol extracts. Quantification was performed using internal standard method. Extractability of free fluorotelomer alcohols verified by HPLC-MS.

Quality control: Quality control measures included determination of method detection limits for all analytes on the basis of blank extraction experiments and determination of recovery rates for all internal standards.

Analytes

The following compounds were analysed

Abbreviation	Full name	Detection method
10:2 FTolefin	10:2 Fluorotelomer olefin	GC-MS
4:2 FTOH	4:2 Fluorotelomer alcohol	GC-MS/HPLC-MS
6:2 FTOH	6:2 Fluorotelomer alcohol	GC-MS/HPLC-MS
8:2 FTOH	8:2 Fluorotelomer alcohol	GC-MS/HPLC-MS
10:2 FTOH	10:2 Fluorotelomer alcohol	GC-MS/HPLC-MS
6:2 FTS	6:2 Fluorotelomer sulfonate	HPLC-MS
8:2 FTS	8:2 Fluorotelomer sulfonate	HPLC-MS
6:2 FTUCA	6:2 Fluorotelomer unsaturated carboxylate	HPLC-MS
8:2 FTUCA	8:2 Fluorotelomer unsaturated carboxylate	HPLC-MS
6:2 FTCA	6:2 Fluorotelomer carboxylate	HPLC-MS
8:2 FTCA	8:2 Fluorotelomer carboxylate	HPLC-MS
PFBS	Perfluorobutane sulfonate	HPLC-MS
PFHxS	Perfluorohexane sulfonate	HPLC-MS
PFOS	Perfluorooctane sulfonate	HPLC-MS
PFDcS	Perfluorodecane sulfonate	HPLC-MS
PFBA	Perfluorobutanoate	HPLC-MS
PFPA	Perfluoropentanoate	HPLC-MS
PFHxA	Perfluorohexanoate	HPLC-MS
PFHpA	Perfluoroheptanoate	HPLC-MS
PFOA	Perfluorooctanoate	HPLC-MS
PFNA	Perfluorononanoate	HPLC-MS
PFDcA	Perfluorodecanoate	HPLC-MS
PFUnA	Perfluoroundecanoate	HPLC-MS
PFDoA	Perfluorododecanoate	HPLC-MS
PFTeA	Perfluorotetradecanoate	HPLC-MS
PFOSA	Perfluorooctane sulfonamide	HPLC-MS
N-Me-FOSA	N-Methyl-heptadecafluorooctane sulfonamide	HPLC-MS
N-Et-FOSA	N-Ethyl-heptadecafluorooctane sulfonamide	HPLC-MS
N-Me-FOSE	N-Methyl-heptadecafluorooctane sulfonamidoethanol	HPLC-MS
N-Et-FOSE	N-Ethyl-heptadecafluorooctane sulfonamidoethanol	HPLC-MS

Results

Table 1: Concentrations of extractable fluorinated alkyl substances in rain jackets given in µg/m² (microgram extractable analyte per square meter jacket material)

	Polarn O. Pyret SNF textil 1	Peak Performance SNF textil 2	Helly Hansen SNF textil 3	Stadium SNF textil 4
10:2 FTolefin	1.11	0.26	0.85	<0.20
4:2 FTOH	<0.50	<0.50	<0.50	<0.50
6:2 FTOH	<0.54	12.8	<0.50	2.73
8:2 FTOH	50.4	224	954	18.9
10:2 FTOH	40.6	148	47.1	5.46
6:2 FTS	0.16	0.21	0.34	<0.10
8:2 FTS	1.71	1.71	3.53	<0.20
6:2 FTUCA	<0.08	<0.08	<0.08	<0.08
8:2 FTUCA	<0.07	<0.07	<0.07	<0.07
6:2 FTCA	<0.08	<0.08	<0.08	<0.08
8:2 FTCA	<0.07	<0.07	<0.07	<0.07
PFBS	0.02	0.12	0.30	0.08
PFHxS	<0.03	<0.03	0.17	0.12
PFOS	<0.04	0.16	0.20	0.24
PFDcS	<0.02	<0.02	<0.02	<0.02
PFBA	<0.40	0.72	0.83	<0.40
PFPA	<0.40	<0.40	<0.40	<0.40
PFHxA	2.25	8.64	11.8	0.62
PFHpA	2.82	4.42	3.74	0.47
PFOA	4.76	24.6	20.4	0.80
PFNA	5.75	3.52	0.53	<0.20
PFDcA	0.40	10.6	11.4	<0.20
PFUnA	0.42	0.74	3.07	<0.20
PFDoA	<0.20	2.61	1.48	<0.20
PFTeA	<0.50	<0.50	<0.50	<0.50
PFOSA	<0.03	0.07	0.06	<0.03
N-Me-FOSA	<0.04	0.16	<0.04	<0.04
N-Et-FOSA	<0.03	<0.03	<0.03	<0.03
N-Me-FOSE	1.43	13.9	6.04	4.30
N-Et-FOSE	<0.40	<0.40	<0.40	<0.40

<: Concentrations lower than the indicated method detection limit

Comment: The sensitivity of the instrument is different for the different analytes, resulting in compound specific method detection limits.

Table 2: Concentrations of extractable fluorinated alkyl substances in rain jackets given in ng/g (nanogram extractable analyte per gram jacket material)

	Polarn O. Pyret SNF textil 1	Peak Performance SNF textil 2	Helly Hansen SNF textil 3	Stadium SNF textil 4
10:2 FTolefin	10.9	2.2	4.4	<1.2
4:2 FTOH	<4.2	<4.2	<4.2	<4.2
6:2 FTOH	<4.5	110	<4.5	20.8
8:2 FTOH	488	1930	4970	144
10:2 FTOH	394	1270	245	41.6
6:2 FTS	1.6	1.8	1.8	<0.9
8:2 FTS	16.2	14.6	18.5	<0.8
6:2 FTUCA	<0.6	<0.6	<0.6	<0.6
8:2 FTUCA	<0.6	<0.6	<0.6	<0.6
6:2 FTCA	<0.6	<0.6	<0.6	<0.6
8:2 FTCA	<0.6	<0.6	<0.6	<0.6
PFBS	0.2	1.0	1.6	0.6
PFHxS	<0.2	<0.2	0.9	0.9
PFOS	<0.3	1.4	1.1	1.8
PFDcS	<0.1	<0.1	<0.1	<0.1
PFBA	<3.3	6.2	4.3	<3.3
PFPA	<2.9	<2.9	<2.9	<2.9
PFHxA	21.3	73.9	62.0	4.8
PFHpA	26.7	37.8	19.6	3.6
PFOA	45.1	211	107	6.1
PFNA	54.5	30.1	2.8	<1.1
PFDcA	3.8	90.7	59.8	<1.0
PFUnA	4.0	6.4	16.1	<1.8
PFDoA	<1.6	22.3	7.8	<1.6
PFTeA	<4.1	<4.1	<4.1	<4.1
PFOSA	0.2	0.6	0.3	<0.1
N-Me-FOSA	<0.4	1.3	<0.4	<0.4
N-Et-FOSA	<0.3	<0.3	<0.3	<0.3
N-Me-FOSE	14	119	32	33
N-Et-FOSE	<3.1	<3.1	<3.1	<3.1

<: Concentrations lower than the indicated method detection limit

Tromsø, 12 September 2005

Urs Berger
Senior scientist, chemical analysis

FAS analysis results

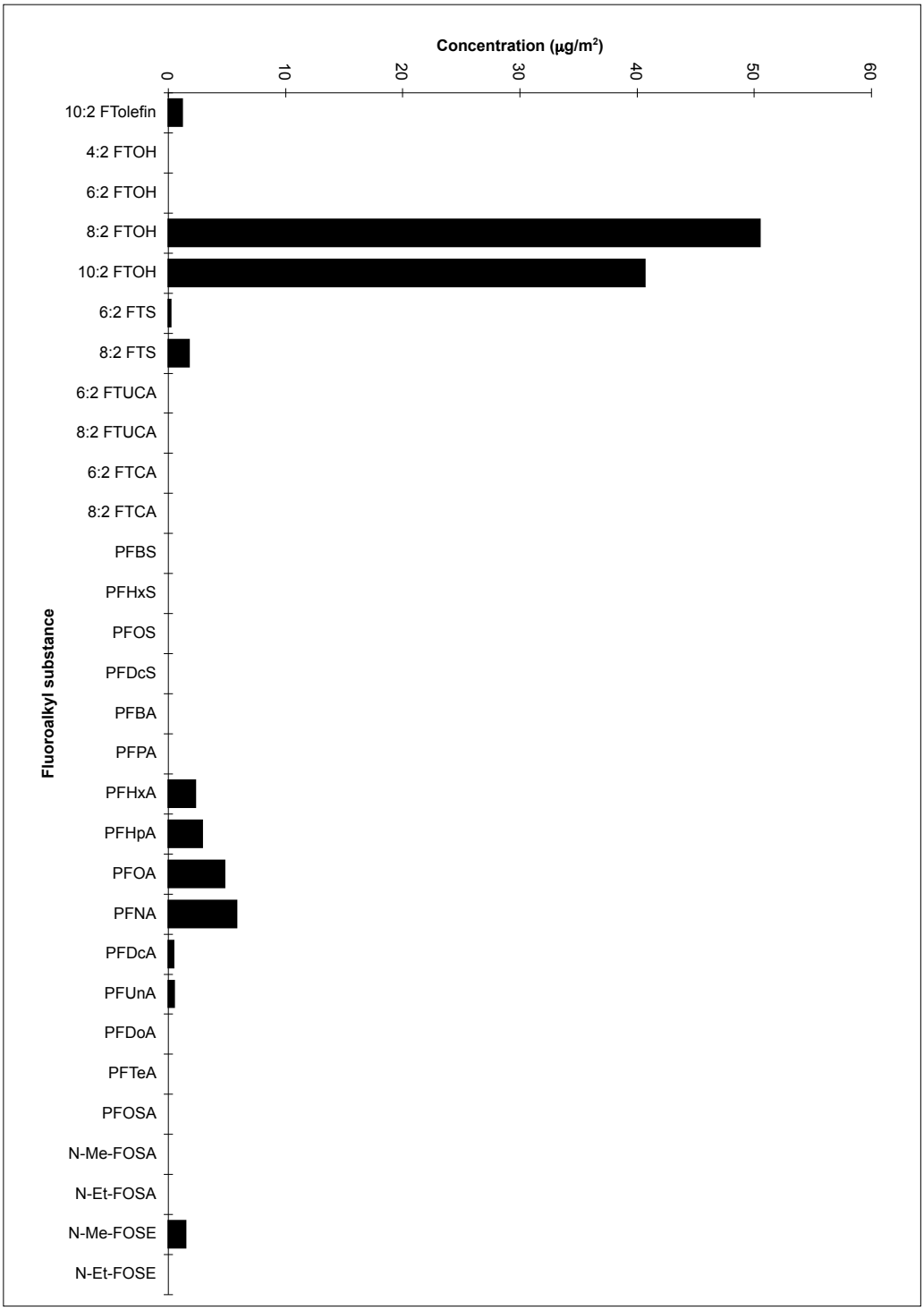
Appendix to report: T-63
NILU sample number: SNF textil 1
Customer: Swedish Soc. for Nature Conservation
Customers sample ID: Polar O. Pyret
Type of sample: Rain jacket
Sample amount (g): 10 x 10 cm (1.04 g)
Measuring unit: $\mu g/m^2$ (microgram extractable analyte per square meter jacket)

Compound		Concentration
Full name	Abbreviation	$\mu g/m^2$
10:2 Fluorotelomer olefin	**10:2 FTolefin**	**1,11**
4:2 Fluorotelomer alcohol	**4:2 FTOH**	**<0,50**
6:2 Fluorotelomer alcohol	**6:2 FTOH**	**<0,54**
8:2 Fluorotelomer alcohol	**8:2 FTOH**	**50,4**
10:2 Fluorotelomer alcohol	**10:2 FTOH**	**40,6**
Sum-FTOHs		***91,0***
6:2 Fluorotelomer sulfonate	**6:2 FTS**	**0,16**
8:2 Fluorotelomer sulfonate	**8:2 FTS**	**1,71**
6:2 Fluorotelomer unsaturated carboxylate	**6:2 FTUCA**	**<0,08**
8:2 Fluorotelomer unsaturated carboxylate	**8:2 FTUCA**	**<0,07**
6:2 Fluorotelomer carboxylate	**6:2 FTCA**	**<0,08**
8:2 Fluorotelomer carboxylate	**8:2 FTCA**	**<0,07**
Sum-FTS and FTCAs		***1,87***
Perfluorobutane sulfonate	**PFBS**	**0,02**
Perfluorohexane sulfonate	**PFHxS**	**<0,03**
Perfluorooctane sulfonate	**PFOS**	**<0,04**
Perfluorodecane sulfonate	**PFDcS**	**<0,02**
Sum-PFS		***0,02***
Perfluorobutanoate	**PFBA**	**<0,40**
Perfluoropentanoate	**PFPA**	**<0,40**
Perfluorohexanoate	**PFHxA**	**2,25**
Perfluoroheptanoate	**PFHpA**	**2,82**
Perfluorooctanoate	**PFOA**	**4,76**
Perfluorononanoate	**PFNA**	**5,75**
Perfluorodecanoate	**PFDcA**	**0,40**
Perfluoroundecanoate	**PFUnA**	**0,42**
Perfluorododecanoate	**PFDoA**	**<0,20**
Perfluorotetradecanoate	**PFTeA**	**<0,50**
Sum-PFCA		***16,4***
Perfluorooctane sulfonamide	**PFOSA**	**<0,03**
N-Methyl-heptadecafluorooctane sulfonamide	**N-Me-FOSA**	**<0,04**
N-Ethyl-heptadecafluorooctane sulfonamide	**N-Et-FOSA**	**<0,03**
N-Methyl-heptadecafluorooctane sulfonamidoethanol	**N-Me-FOSE**	**1,43**
N-Ethyl-heptadecafluorooctane sulfonamidoethanol	**N-Et-FOSE**	**<0,40**
Sum-FOSAs and FOSEs		***1,43***

<: Lower than indicated method detection limit (signal:noise 3:1)

FAS analysis results

Appendix to report: T-63
NILU sample number: SNF textil 1



FAS analysis results

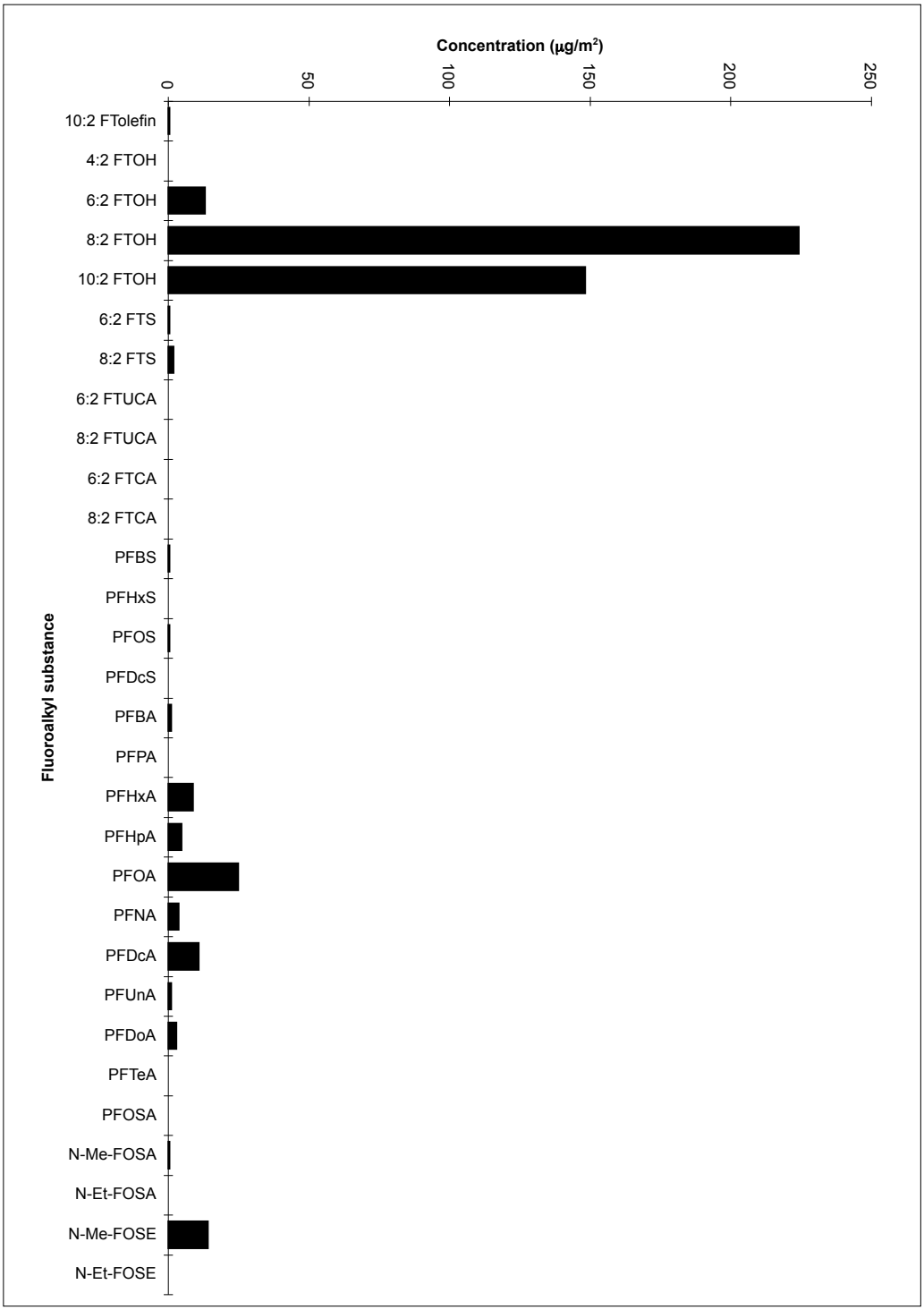
Appendix to report: T-63
NILU sample number: SNF textil 2
Customer: Swedish Soc. for Nature Conservation
Customers sample ID: Peak Performance
Type of sample: Rain jacket
Sample amount (g): 10 x 10 cm (1.17 g)
Measuring unit: µg/m^2 (microgram extractable analyte per square meter jacket)

Compound		Concentration
Full name	Abbreviation	µg/m^2
10:2 Fluorotelomer olefin	**10:2 FTolefin**	**0,26**
4:2 Fluorotelomer alcohol	**4:2 FTOH**	**<0,50**
6:2 Fluorotelomer alcohol	**6:2 FTOH**	**12,8**
8:2 Fluorotelomer alcohol	**8:2 FTOH**	**224**
10:2 Fluorotelomer alcohol	**10:2 FTOH**	**148**
Sum-FTOHs		***385***
6:2 Fluorotelomer sulfonate	**6:2 FTS**	**0,21**
8:2 Fluorotelomer sulfonate	**8:2 FTS**	**1,71**
6:2 Fluorotelomer unsaturated carboxylate	**6:2 FTUCA**	**<0,08**
8:2 Fluorotelomer unsaturated carboxylate	**8:2 FTUCA**	**<0,07**
6:2 Fluorotelomer carboxylate	**6:2 FTCA**	**<0,08**
8:2 Fluorotelomer carboxylate	**8:2 FTCA**	**<0,07**
Sum-FTS and FTCAs		***1,92***
Perfluorobutane sulfonate	**PFBS**	**0,12**
Perfluorohexane sulfonate	**PFHxS**	**<0,03**
Perfluorooctane sulfonate	**PFOS**	**0,16**
Perfluorodecane sulfonate	**PFDcS**	**<0,02**
Sum-PFS		***0,28***
Perfluorobutanoate	**PFBA**	**0,72**
Perfluoropentanoate	**PFPA**	**<0,40**
Perfluorohexanoate	**PFHxA**	**8,64**
Perfluoroheptanoate	**PFHpA**	**4,42**
Perfluorooctanoate	**PFOA**	**24,6**
Perfluorononanoate	**PFNA**	**3,52**
Perfluorodecanoate	**PFDcA**	**10,6**
Perfluoroundecanoate	**PFUnA**	**0,74**
Perfluorododecanoate	**PFDoA**	**2,61**
Perfluorotetradecanoate	**PFTeA**	**<0,50**
Sum-PFCA		***55,9***
Perfluorooctane sulfonamide	**PFOSA**	**0,07**
N-Methyl-heptadecafluorooctane sulfonamide	**N-Me-FOSA**	**0,16**
N-Ethyl-heptadecafluorooctane sulfonamide	**N-Et-FOSA**	**<0,03**
N-Methyl-heptadecafluorooctane sulfonamidoethanol	**N-Me-FOSE**	**13,9**
N-Ethyl-heptadecafluorooctane sulfonamidoethanol	**N-Et-FOSE**	**<0,40**
Sum-FOSAs and FOSEs		***14,1***

<: Lower than indicated method detection limit (signal:noise 3:1)

FAS analysis results

Appendix to report: T-63
NILU sample number: SNF textil 2



FAS analysis results

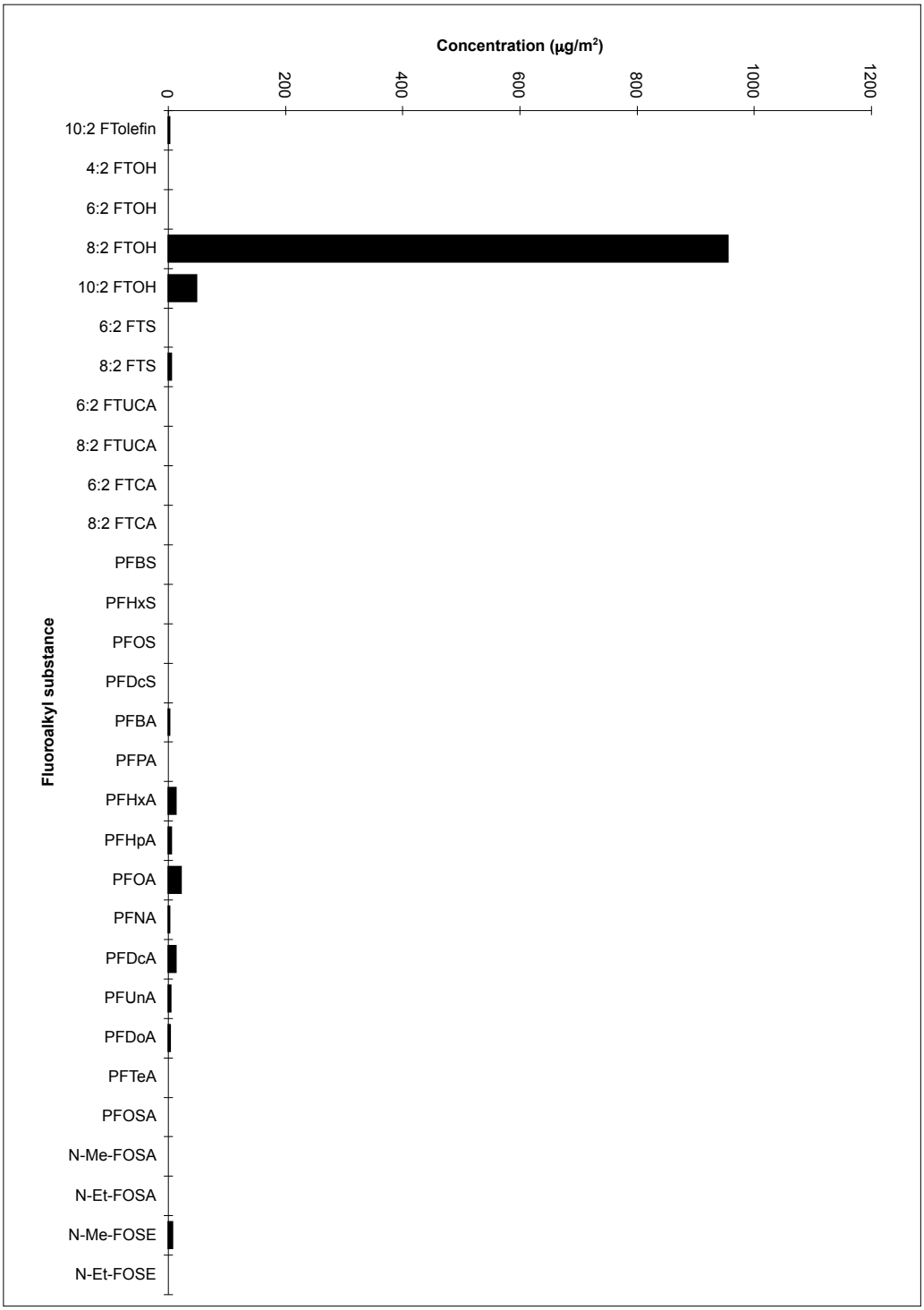
Appendix to report: T-63
NILU sample number: SNF textil 3
Customer: Swedish Soc. for Nature Conservation
Customers sample ID: Helly Hansen
Type of sample: Rain jacket
Sample amount (g): 10 x 10 cm (1.91 g)
Measuring unit: $\mu g/m^2$ (microgram extractable analyte per square meter jacket)

Compound		Concentration
Full name	Abbreviation	$\mu g/m^2$
10:2 Fluorotelomer olefin	**10:2 FTolefin**	**0,85**
4:2 Fluorotelomer alcohol	**4:2 FTOH**	**<0,50**
6:2 Fluorotelomer alcohol	**6:2 FTOH**	**<0,50**
8:2 Fluorotelomer alcohol	**8:2 FTOH**	**954**
10:2 Fluorotelomer alcohol	**10:2 FTOH**	**47,1**
Sum-FTOHs		***1001***
6:2 Fluorotelomer sulfonate	**6:2 FTS**	**0,34**
8:2 Fluorotelomer sulfonate	**8:2 FTS**	**3,53**
6:2 Fluorotelomer unsaturated carboxylate	**6:2 FTUCA**	**<0,08**
8:2 Fluorotelomer unsaturated carboxylate	**8:2 FTUCA**	**<0,07**
6:2 Fluorotelomer carboxylate	**6:2 FTCA**	**<0,08**
8:2 Fluorotelomer carboxylate	**8:2 FTCA**	**<0,07**
Sum-FTS and FTCAs		***3,87***
Perfluorobutane sulfonate	**PFBS**	**0,30**
Perfluorohexane sulfonate	**PFHxS**	**0,17**
Perfluorooctane sulfonate	**PFOS**	**0,20**
Perfluorodecane sulfonate	**PFDcS**	**<0,02**
Sum-PFS		***0,67***
Perfluorobutanoate	**PFBA**	**0,83**
Perfluoropentanoate	**PFPA**	**<0,40**
Perfluorohexanoate	**PFHxA**	**11,8**
Perfluoroheptanoate	**PFHpA**	**3,74**
Perfluorooctanoate	**PFOA**	**20,4**
Perfluorononanoate	**PFNA**	**0,53**
Perfluorodecanoate	**PFDcA**	**11,4**
Perfluoroundecanoate	**PFUnA**	**3,07**
Perfluorododecanoate	**PFDoA**	**1,48**
Perfluorotetradecanoate	**PFTeA**	**<0,50**
Sum-PFCA		***53,3***
Perfluorooctane sulfonamide	**PFOSA**	**0,06**
N-Methyl-heptadecafluorooctane sulfonamide	**N-Me-FOSA**	**<0,04**
N-Ethyl-heptadecafluorooctane sulfonamide	**N-Et-FOSA**	**<0,03**
N-Methyl-heptadecafluorooctane sulfonamidoethanol	**N-Me-FOSE**	**6,04**
N-Ethyl-heptadecafluorooctane sulfonamidoethanol	**N-Et-FOSE**	**<0,40**
Sum-FOSAs and FOSEs		***6,10***

<: Lower than indicated method detection limit (signal:noise 3:1)

FAS analysis results

Appendix to report: T-63
NILU sample number: SNF textil 3



FAS analysis results

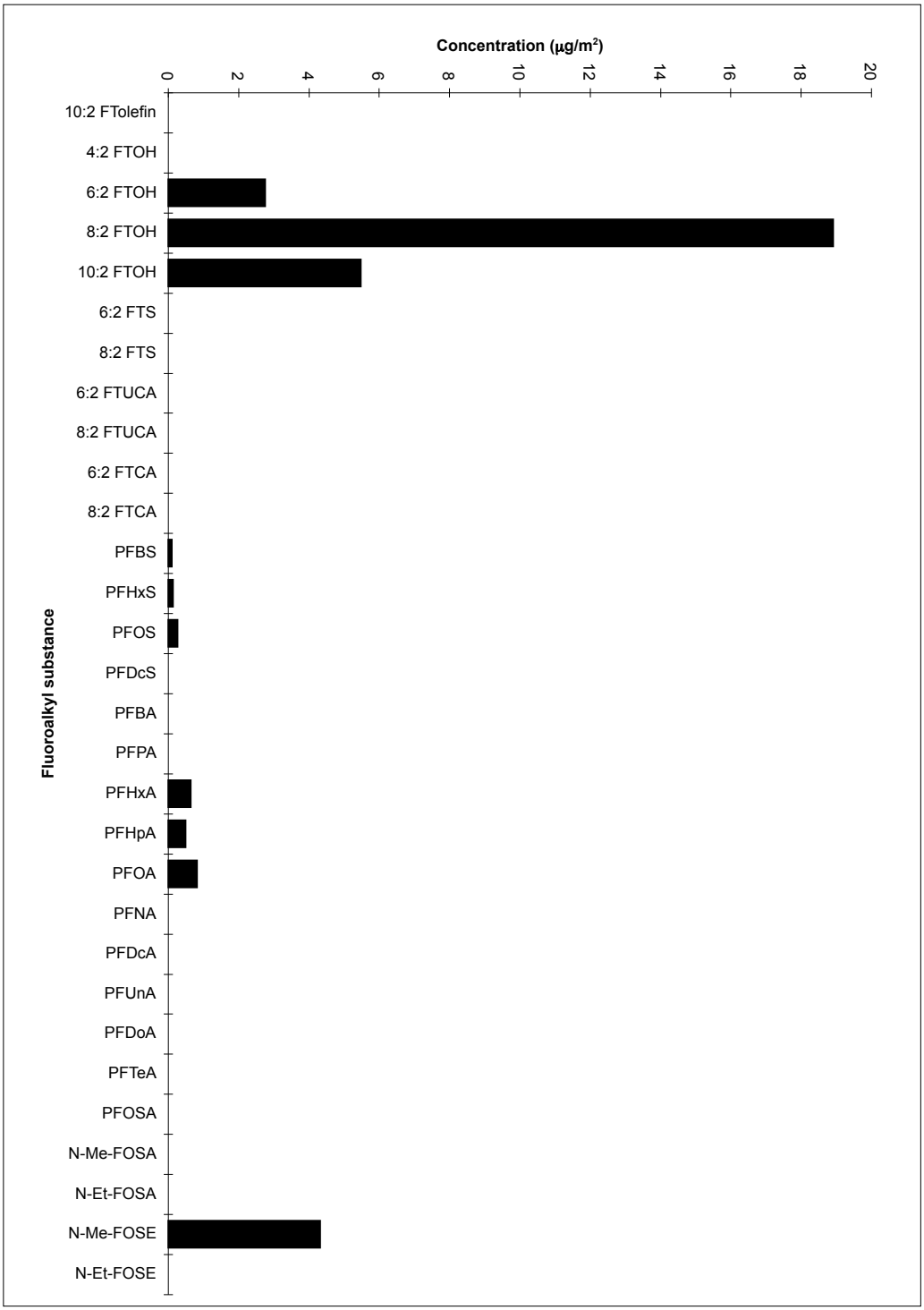
Appendix to report: T-63
NILU sample number: SNF textil 4
Customer: Swedish Soc. for Nature Conservation
Customers sample ID: Stadium
Type of sample: Rain jacket
Sample amount (g): 10 x 10 cm (1.31 g)
Measuring unit: µg/m^2 (microgram extractable analyte per square meter jacket)

Compound		Concentration
Full name	Abbreviation	µg/m^2
10:2 Fluorotelomer olefin	**10:2 FTolefin**	**<0,20**
4:2 Fluorotelomer alcohol	**4:2 FTOH**	**<0,50**
6:2 Fluorotelomer alcohol	**6:2 FTOH**	**2,73**
8:2 Fluorotelomer alcohol	**8:2 FTOH**	**18,9**
10:2 Fluorotelomer alcohol	**10:2 FTOH**	**5,46**
Sum-FTOHs		***27,1***
6:2 Fluorotelomer sulfonate	**6:2 FTS**	**<0,10**
8:2 Fluorotelomer sulfonate	**8:2 FTS**	**<0,20**
6:2 Fluorotelomer unsaturated carboxylate	**6:2 FTUCA**	**<0,08**
8:2 Fluorotelomer unsaturated carboxylate	**8:2 FTUCA**	**<0,07**
6:2 Fluorotelomer carboxylate	**6:2 FTCA**	**<0,08**
8:2 Fluorotelomer carboxylate	**8:2 FTCA**	**<0,07**
Sum-FTS and FTCAs		***0,00***
Perfluorobutane sulfonate	**PFBS**	**0,08**
Perfluorohexane sulfonate	**PFHxS**	**0,12**
Perfluorooctane sulfonate	**PFOS**	**0,24**
Perfluorodecane sulfonate	**PFDcS**	**<0,02**
Sum-PFS		***0,44***
Perfluorobutanoate	**PFBA**	**<0,40**
Perfluoropentanoate	**PFPA**	**<0,40**
Perfluorohexanoate	**PFHxA**	**0,62**
Perfluoroheptanoate	**PFHpA**	**0,47**
Perfluorooctanoate	**PFOA**	**0,80**
Perfluorononanoate	**PFNA**	**<0,20**
Perfluorodecanoate	**PFDcA**	**<0,20**
Perfluoroundecanoate	**PFUnA**	**<0,20**
Perfluorododecanoate	**PFDoA**	**<0,20**
Perfluorotetradecanoate	**PFTeA**	**<0,50**
Sum-PFCA		***1,89***
Perfluorooctane sulfonamide	**PFOSA**	**<0,03**
N-Methyl-heptadecafluorooctane sulfonamide	**N-Me-FOSA**	**<0,04**
N-Ethyl-heptadecafluorooctane sulfonamide	**N-Et-FOSA**	**<0,03**
N-Methyl-heptadecafluorooctane sulfonamidoethanol	**N-Me-FOSE**	**4,30**
N-Ethyl-heptadecafluorooctane sulfonamidoethanol	**N-Et-FOSE**	**<0,40**
Sum-FOSAs and FOSEs		***4,30***

<: Lower than indicated method detection limit (signal:noise 3:1)

FAS analysis results

Appendix to report: T-63
NILU sample number: SNF textil 4



FAS analysis results

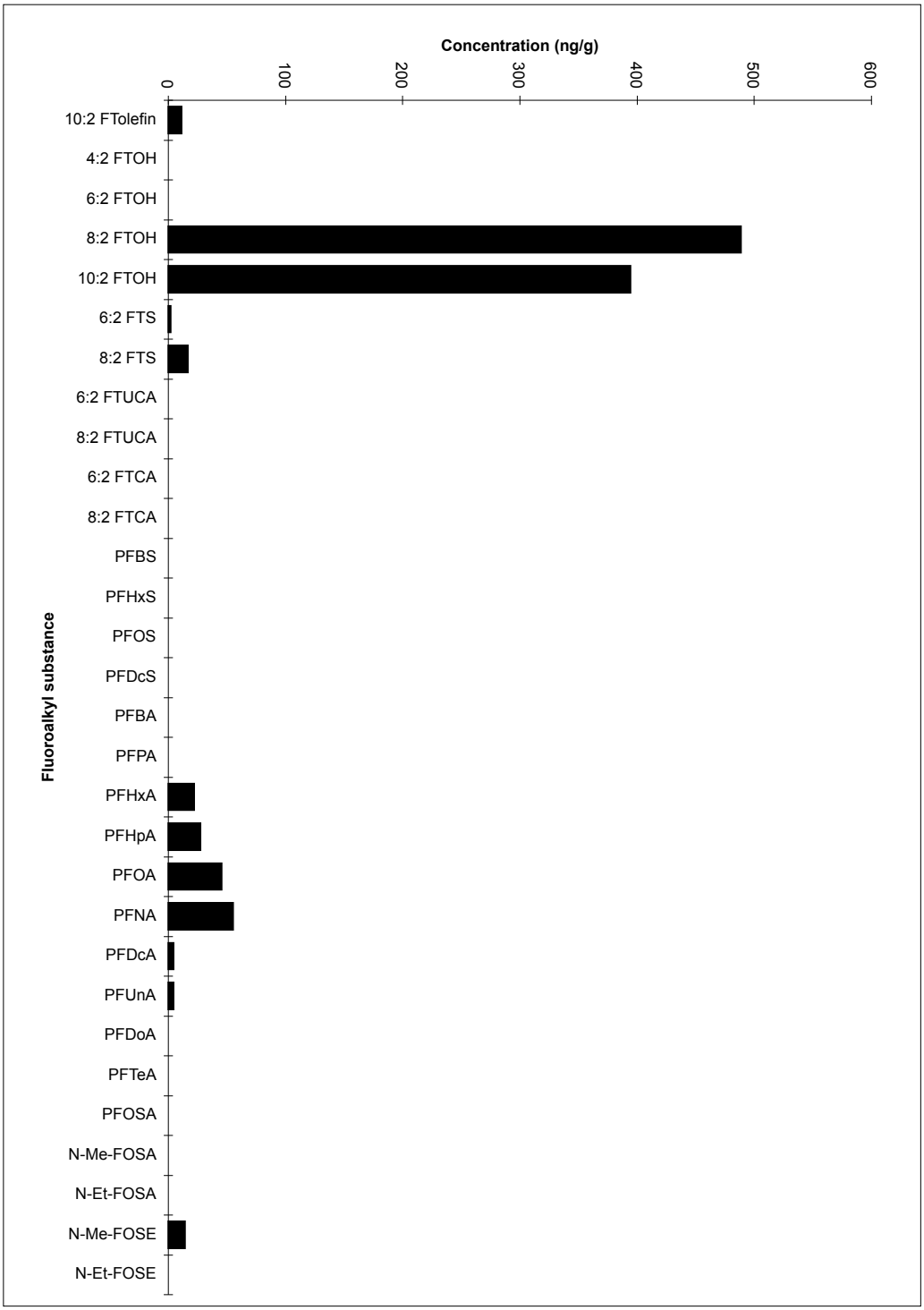
Appendix to report: T-63
NILU sample number: SNF textil 1
Customer: Swedish Soc. for Nature Conservation
Customers sample ID: Polar O. Pyret
Type of sample: Rain jacket
Sample amount (g): 10 x 10 cm (1.04 g)
Measuring unit: ng/g (nanogram extractable analyte per gram jacket material)

Compound		Concentration
Full name	Abbreviation	ng/g
10:2 Fluorotelomer olefin	**10:2 FTolefin**	**10,9**
4:2 Fluorotelomer alcohol	**4:2 FTOH**	**<4,2**
6:2 Fluorotelomer alcohol	**6:2 FTOH**	**<4,5**
8:2 Fluorotelomer alcohol	**8:2 FTOH**	**488**
10:2 Fluorotelomer alcohol	**10:2 FTOH**	**394**
Sum-FTOHs		***882***
6:2 Fluorotelomer sulfonate	**6:2 FTS**	**1,6**
8:2 Fluorotelomer sulfonate	**8:2 FTS**	**16,2**
6:2 Fluorotelomer unsaturated carboxylate	**6:2 FTUCA**	**<0,6**
8:2 Fluorotelomer unsaturated carboxylate	**8:2 FTUCA**	**<0,6**
6:2 Fluorotelomer carboxylate	**6:2 FTCA**	**<0,6**
8:2 Fluorotelomer carboxylate	**8:2 FTCA**	**<0,6**
Sum-FTS and FTCAs		***17,8***
Perfluorobutane sulfonate	**PFBS**	**0,2**
Perfluorohexane sulfonate	**PFHxS**	**<0,2**
Perfluorooctane sulfonate	**PFOS**	**<0,3**
Perfluorodecane sulfonate	**PFDcS**	**<0,1**
Sum-PFS		***0,2***
Perfluorobutanoate	**PFBA**	**<3,3**
Perfluoropentanoate	**PFPA**	**<2,9**
Perfluorohexanoate	**PFHxA**	**21,3**
Perfluoroheptanoate	**PFHpA**	**26,7**
Perfluorooctanoate	**PFOA**	**45,1**
Perfluorononanoate	**PFNA**	**54,5**
Perfluorodecanoate	**PFDcA**	**3,8**
Perfluoroundecanoate	**PFUnA**	**4,0**
Perfluorododecanoate	**PFDoA**	**<1,6**
Perfluorotetradecanoate	**PFTeA**	**<4,1**
Sum-PFCA		***155***
Perfluorooctane sulfonamide	**PFOSA**	**0,2**
N-Methyl-heptadecafluorooctane sulfonamide	**N-Me-FOSA**	**<0,4**
N-Ethyl-heptadecafluorooctane sulfonamide	**N-Et-FOSA**	**<0,3**
N-Methyl-heptadecafluorooctane sulfonamidoethanol	**N-Me-FOSE**	**13,6**
N-Ethyl-heptadecafluorooctane sulfonamidoethanol	**N-Et-FOSE**	**<3,1**
Sum-FOSAs and FOSEs		***13,8***

<: Lower than indicated method detection limit (signal:noise 3:1)

FAS analysis results

Appendix to report: T-63
NILU sample number: SNF textil 1



FAS analysis results

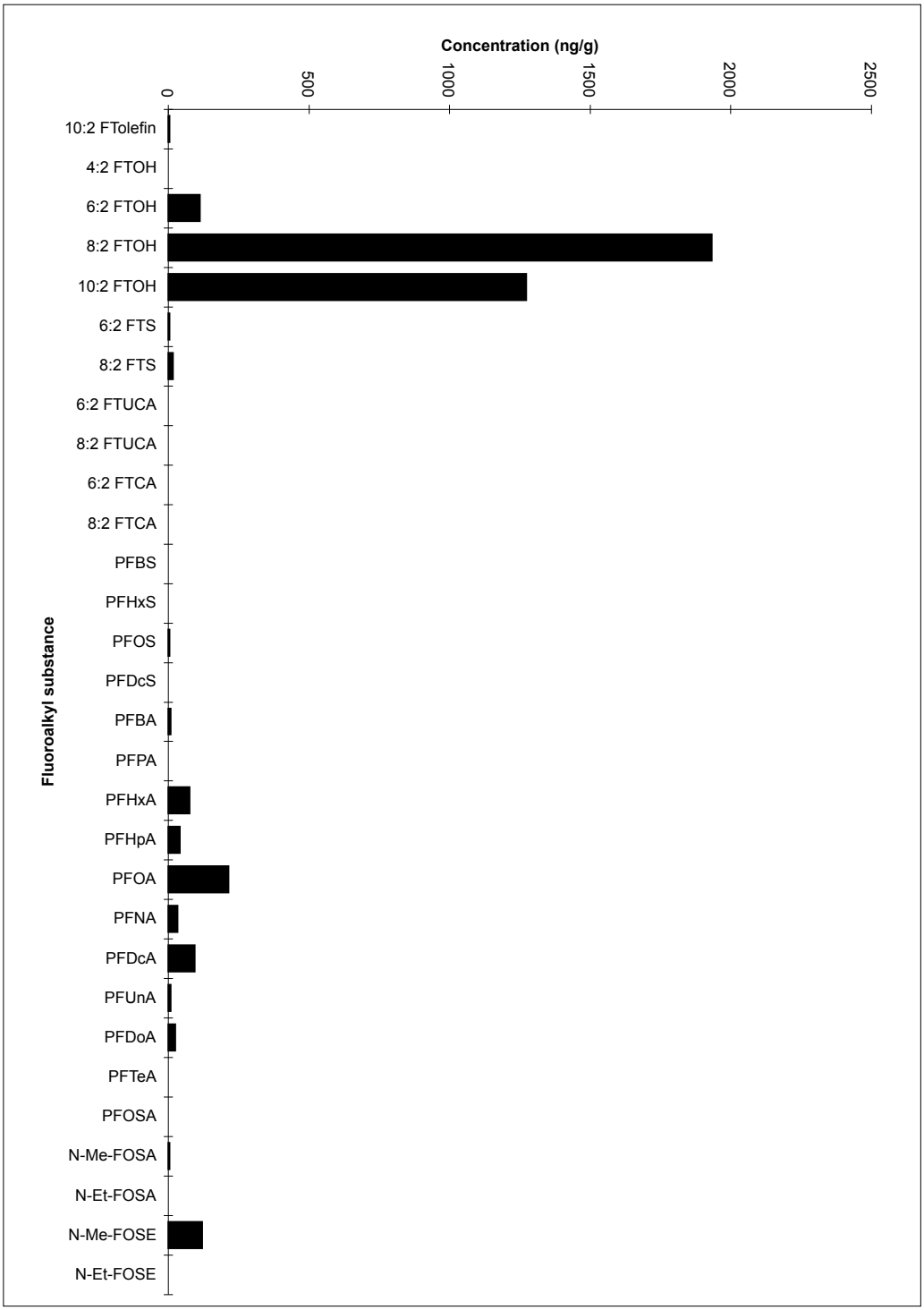
Appendix to report: T-63
NILU sample number: SNF textil 2
Customer: Swedish Soc. for Nature Conservation
Customers sample ID: Peak Performance
Type of sample: Rain jacket
Sample amount (g): 10 x 10 cm (1.17 g)
Measuring unit: ng/g (nanogram extractable analyte per gram jacket material)

Compound		Concentration
Full name	Abbreviation	ng/g
10:2 Fluorotelomer olefin	**10:2 FTolefin**	**2,2**
4:2 Fluorotelomer alcohol	**4:2 FTOH**	**<4,2**
6:2 Fluorotelomer alcohol	**6:2 FTOH**	**110**
8:2 Fluorotelomer alcohol	**8:2 FTOH**	**1930**
10:2 Fluorotelomer alcohol	**10:2 FTOH**	**1270**
Sum-FTOHs		***3310***
6:2 Fluorotelomer sulfonate	**6:2 FTS**	**1,8**
8:2 Fluorotelomer sulfonate	**8:2 FTS**	**14,6**
6:2 Fluorotelomer unsaturated carboxylate	**6:2 FTUCA**	**<0,6**
8:2 Fluorotelomer unsaturated carboxylate	**8:2 FTUCA**	**<0,6**
6:2 Fluorotelomer carboxylate	**6:2 FTCA**	**<0,6**
8:2 Fluorotelomer carboxylate	**8:2 FTCA**	**<0,6**
Sum-FTS and FTCAs		***16,4***
Perfluorobutane sulfonate	**PFBS**	**1,0**
Perfluorohexane sulfonate	**PFHxS**	**<0,2**
Perfluorooctane sulfonate	**PFOS**	**1,4**
Perfluorodecane sulfonate	**PFDcS**	**<0,1**
Sum-PFS		***2,4***
Perfluorobutanoate	**PFBA**	**6,2**
Perfluoropentanoate	**PFPA**	**<2,9**
Perfluorohexanoate	**PFHxA**	**73,9**
Perfluoroheptanoate	**PFHpA**	**37,8**
Perfluorooctanoate	**PFOA**	**211**
Perfluorononanoate	**PFNA**	**30,1**
Perfluorodecanoate	**PFDcA**	**90,7**
Perfluoroundecanoate	**PFUnA**	**6,4**
Perfluorododecanoate	**PFDoA**	**22,3**
Perfluorotetradecanoate	**PFTeA**	**<4,1**
Sum-PFCA		***478***
Perfluorooctane sulfonamide	**PFOSA**	**0,6**
N-Methyl-heptadecafluorooctane sulfonamide	**N-Me-FOSA**	**1,3**
N-Ethyl-heptadecafluorooctane sulfonamide	**N-Et-FOSA**	**<0,3**
N-Methyl-heptadecafluorooctane sulfonamidoethanol	**N-Me-FOSE**	**119**
N-Ethyl-heptadecafluorooctane sulfonamidoethanol	**N-Et-FOSE**	**<3,1**
Sum-FOSAs and FOSEs		***121***

<: Lower than indicated method detection limit (signal:noise 3:1)

FAS analysis results

Appendix to report: T-63
NILU sample number: SNF textil 2



FAS analysis results

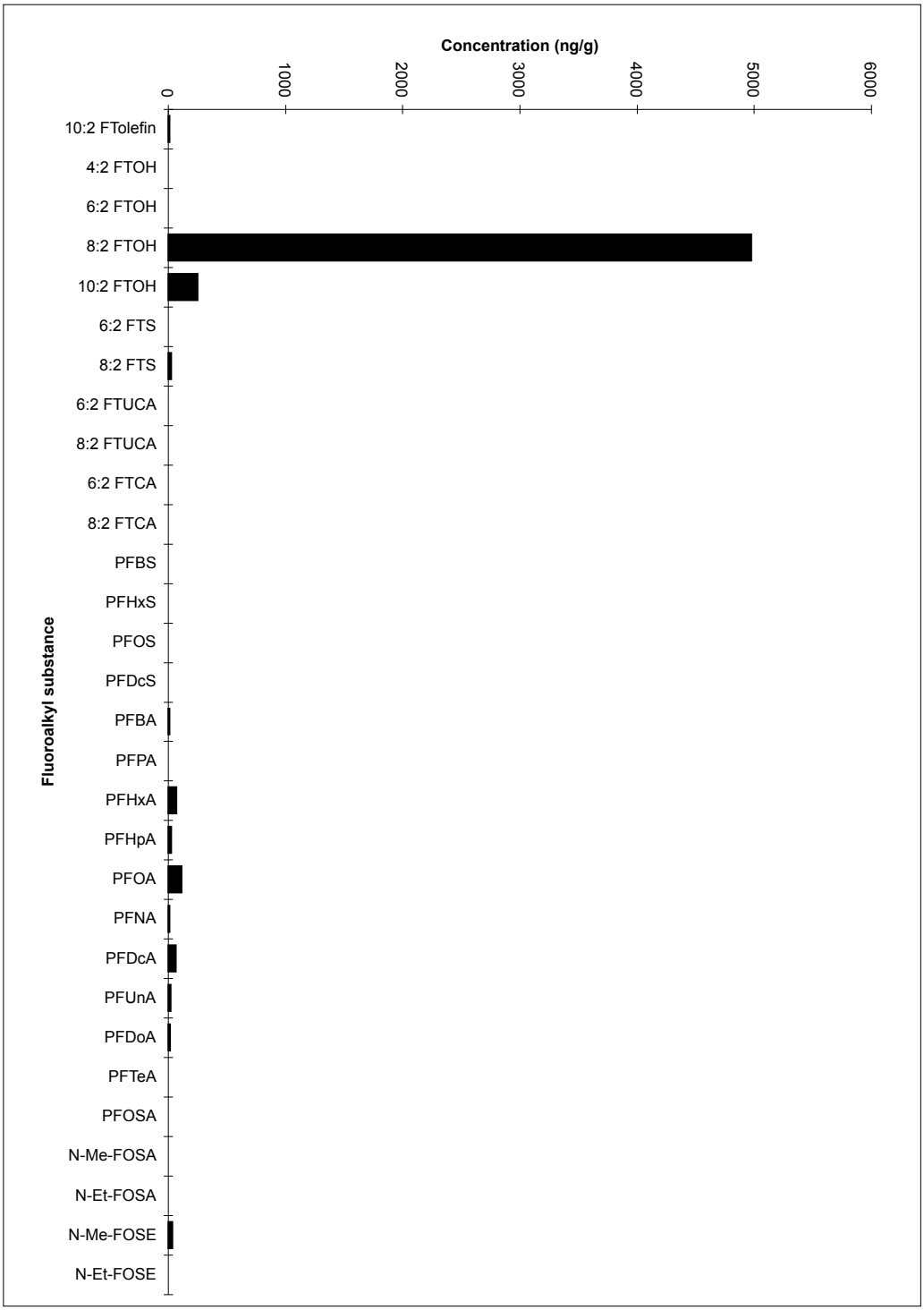
Appendix to report: T-63
NILU sample number: SNF textil 3
Customer: Swedish Soc. for Nature Conservation
Customers sample ID: Helly Hansen
Type of sample: Rain jacket
Sample amount (g): 10 x 10 cm (1.91 g)
Measuring unit: ng/g (nanogram extractable analyte per gram jacket material)

Compound		Concentration
Full name	Abbreviation	ng/g
10:2 Fluorotelomer olefin	**10:2 FTolefin**	**4,4**
4:2 Fluorotelomer alcohol	**4:2 FTOH**	**<4,2**
6:2 Fluorotelomer alcohol	**6:2 FTOH**	**<4,5**
8:2 Fluorotelomer alcohol	**8:2 FTOH**	**4970**
10:2 Fluorotelomer alcohol	**10:2 FTOH**	**245**
Sum-FTOHs		***5215***
6:2 Fluorotelomer sulfonate	**6:2 FTS**	**1,8**
8:2 Fluorotelomer sulfonate	**8:2 FTS**	**18,5**
6:2 Fluorotelomer unsaturated carboxylate	**6:2 FTUCA**	**<0,6**
8:2 Fluorotelomer unsaturated carboxylate	**8:2 FTUCA**	**<0,6**
6:2 Fluorotelomer carboxylate	**6:2 FTCA**	**<0,6**
8:2 Fluorotelomer carboxylate	**8:2 FTCA**	**<0,6**
Sum-FTS and FTCAs		***20,3***
Perfluorobutane sulfonate	**PFBS**	**1,6**
Perfluorohexane sulfonate	**PFHxS**	**0,9**
Perfluorooctane sulfonate	**PFOS**	**1,1**
Perfluorodecane sulfonate	**PFDcS**	**<0,1**
Sum-PFS		***3,6***
Perfluorobutanoate	**PFBA**	**4,3**
Perfluoropentanoate	**PFPA**	**<2,9**
Perfluorohexanoate	**PFHxA**	**62,0**
Perfluoroheptanoate	**PFHpA**	**19,6**
Perfluorooctanoate	**PFOA**	**107**
Perfluorononanoate	**PFNA**	**2,8**
Perfluorodecanoate	**PFDcA**	**59,8**
Perfluoroundecanoate	**PFUnA**	**16,1**
Perfluorododecanoate	**PFDoA**	**7,8**
Perfluorotetradecanoate	**PFTeA**	**<4,1**
Sum-PFCA		***279***
Perfluorooctane sulfonamide	**PFOSA**	**0,3**
N-Methyl-heptadecafluorooctane sulfonamide	**N-Me-FOSA**	**<0,4**
N-Ethyl-heptadecafluorooctane sulfonamide	**N-Et-FOSA**	**<0,3**
N-Methyl-heptadecafluorooctane sulfonamidoethanol	**N-Me-FOSE**	**31,7**
N-Ethyl-heptadecafluorooctane sulfonamidoethanol	**N-Et-FOSE**	**<3,1**
Sum-FOSAs and FOSEs		***32,0***

<: Lower than indicated method detection limit (signal:noise 3:1)

FAS analysis results

Appendix to report: T-63
NILU sample number: SNF textil 3



FAS analysis results

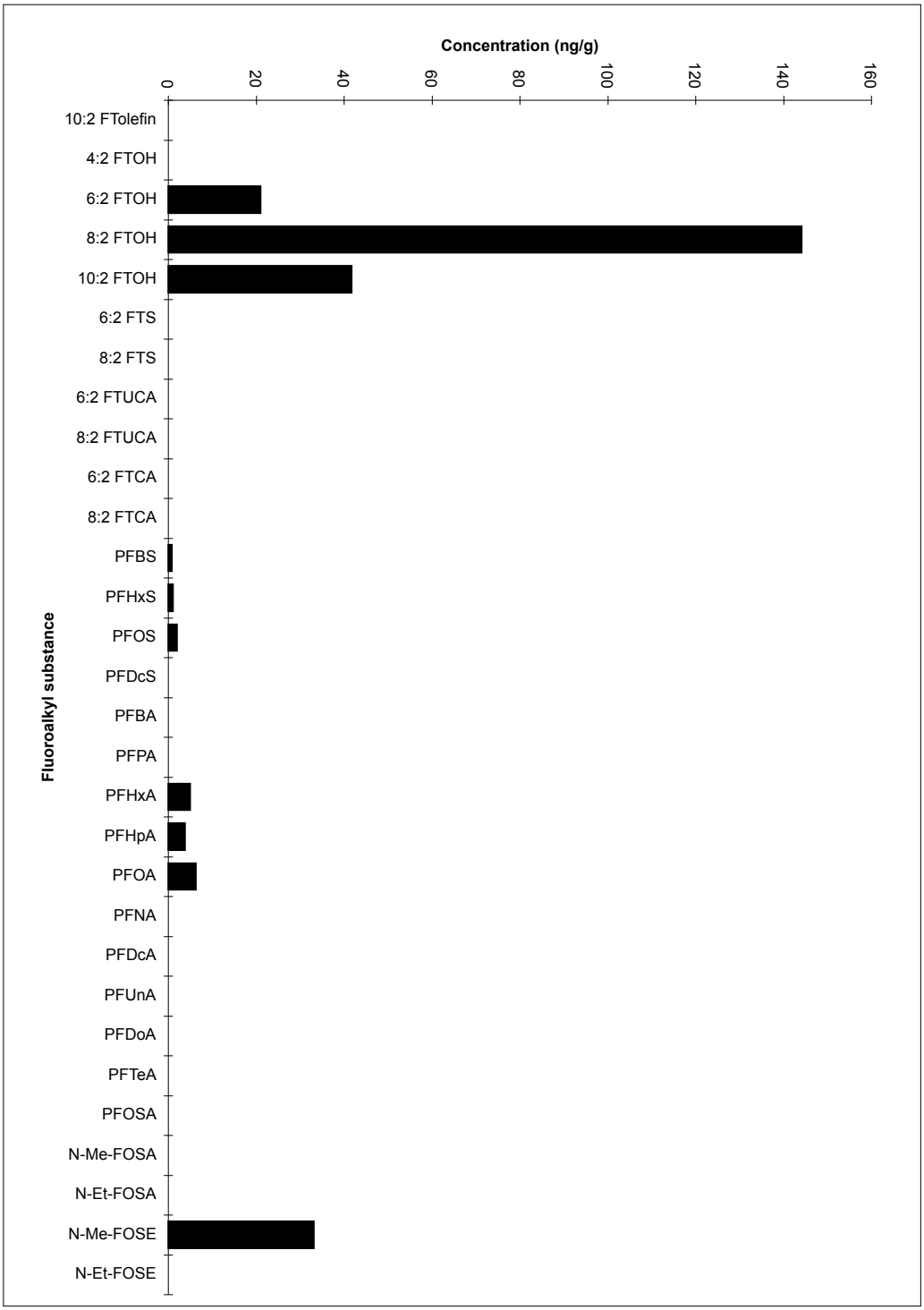
Appendix to report: T-63
NILU sample number: SNF textil 4
Customer: Swedish Soc. for Nature Conservation
Customers sample ID: Stadium
Type of sample: Rain jacket
Sample amount (g): 10 x 10 cm (1.31 g)
Measuring unit: ng/g (nanogram extractable analyte per gram jacket material)

Compound		Concentration
Full name	Abbreviation	ng/g
10:2 Fluorotelomer olefin	**10:2 FTolefin**	**<1,2**
4:2 Fluorotelomer alcohol	**4:2 FTOH**	**<4,2**
6:2 Fluorotelomer alcohol	**6:2 FTOH**	**20,8**
8:2 Fluorotelomer alcohol	**8:2 FTOH**	**144**
10:2 Fluorotelomer alcohol	**10:2 FTOH**	**41,6**
Sum-FTOHs		***206***
6:2 Fluorotelomer sulfonate	**6:2 FTS**	**<0,9**
8:2 Fluorotelomer sulfonate	**8:2 FTS**	**<0,8**
6:2 Fluorotelomer unsaturated carboxylate	**6:2 FTUCA**	**<0,6**
8:2 Fluorotelomer unsaturated carboxylate	**8:2 FTUCA**	**<0,6**
6:2 Fluorotelomer carboxylate	**6:2 FTCA**	**<0,6**
8:2 Fluorotelomer carboxylate	**8:2 FTCA**	**<0,6**
Sum-FTS and FTCAs		***0,0***
Perfluorobutane sulfonate	**PFBS**	**0,6**
Perfluorohexane sulfonate	**PFHxS**	**0,9**
Perfluorooctane sulfonate	**PFOS**	**1,8**
Perfluorodecane sulfonate	**PFDcS**	**<0,1**
Sum-PFS		***3,3***
Perfluorobutanoate	**PFBA**	**<3,3**
Perfluoropentanoate	**PFPA**	**<2,9**
Perfluorohexanoate	**PFHxA**	**4,8**
Perfluoroheptanoate	**PFHpA**	**3,6**
Perfluorooctanoate	**PFOA**	**6,1**
Perfluorononanoate	**PFNA**	**<1,1**
Perfluorodecanoate	**PFDcA**	**<1,0**
Perfluoroundecanoate	**PFUnA**	**<1,8**
Perfluorododecanoate	**PFDoA**	**<1,6**
Perfluorotetradecanoate	**PFTeA**	**<4,1**
Sum-PFCA		***14,5***
Perfluorooctane sulfonamide	**PFOSA**	**<0,1**
N-Methyl-heptadecafluorooctane sulfonamide	**N-Me-FOSA**	**<0,4**
N-Ethyl-heptadecafluorooctane sulfonamide	**N-Et-FOSA**	**<0,3**
N-Methyl-heptadecafluorooctane sulfonamidoethanol	**N-Me-FOSE**	**32,9**
N-Ethyl-heptadecafluorooctane sulfonamidoethanol	**N-Et-FOSE**	**<3,1**
Sum-FOSAs and FOSEs		***32,9***

<: Lower than indicated method detection limit (signal:noise 3:1)

FAS analysis results

Appendix to report: T-63
NILU sample number: SNF textil 4



APPENDIX B

Analysis report T-73

Bergans Norway

(11 pages this page included)

Analysis report T-73

Customer: Bergans Norway, attn. Terje Holden

Project no.: T-73 / O-105126

Sampling: Customer

Sample information:

Textile	NILU sample no.	Sample received	Analysed sample material
Cotton textile Red	Bergans T 1	07.10.05	10 x 10 cm (3.01 g)
Synthetic textile Orange with grey layer inside	Bergans T 2	07.10.05	10 x 10 cm (1.45 g)

Analyses:

Laboratory: Norwegian Institute for Air Research (NILU)
The Polar Environmental Centre
9296 Tromsø / Norway

Sample preparation: Extraction with ethyl acetate for fluorotelomer olefin, fluorotelomer alcohols and alkyl fluorooctane sulfonamides. Extraction with methanol for carboxylates, sulfonates, perfluorooctane sulfonamide and alkyl fluorooctane sulfonamidoethanols.

Analytical method: Gas chromatograph coupled to mass spectrometer (GC-MS) for ethyl acetate extracts. High performance liquid chromatograph coupled to mass spectrometer (HPLC-MS) for methanol extracts. Quantification was performed using internal standard method.

Quality control: Quality control measures included determination of method detection limits for all analytes on the basis of blank extraction experiments and determination of recovery rates for all internal standards.

Analytes

The following compounds were analysed

Abbreviation	Full name	Detection method
10:2 FTolefin	10:2 Fluorotelomer olefin	GC-MS
4:2 FTOH	4:2 Fluorotelomer alcohol	GC-MS
6:2 FTOH	6:2 Fluorotelomer alcohol	GC-MS
8:2 FTOH	8:2 Fluorotelomer alcohol	GC-MS
10:2 FTOH	10:2 Fluorotelomer alcohol	GC-MS
6:2 FTS	6:2 Fluorotelomer sulfonate	HPLC-MS
8:2 FTS	8:2 Fluorotelomer sulfonate	HPLC-MS
6:2 FTUCA	6:2 Fluorotelomer unsaturated carboxylate	HPLC-MS
6:2 FTCA	6:2 Fluorotelomer carboxylate	HPLC-MS
8:2 FTUCA	8:2 Fluorotelomer unsaturated carboxylate	HPLC-MS
8:2 FTCA	8:2 Fluorotelomer carboxylate	HPLC-MS
PFBS	Perfluorobutane sulfonate	HPLC-MS
PFHxS	Perfluorohexane sulfonate	HPLC-MS
PFOS	Perfluorooctane sulfonate	HPLC-MS
PFDcS	Perfluorodecane sulfonate	HPLC-MS
PFBA	Perfluorobutanoate	HPLC-MS
PFPA	Perfluoropentanoate	HPLC-MS
PFHxA	Perfluorohexanoate	HPLC-MS
PFHpA	Perfluoroheptanoate	HPLC-MS
PFOA	Perfluorooctanoate	HPLC-MS
PFNA	Perfluorononanoate	HPLC-MS
PFDcA	Perfluorodecanoate	HPLC-MS
PFUnA	Perfluoroundecanoate	HPLC-MS
PFDoA	Perfluorododecanoate	HPLC-MS
PFTeA	Perfluorotetradecanoate	HPLC-MS
PFOSA	Perfluorooctane sulfonamide	HPLC-MS
N-Me-FOSA	N-Methyl-heptadecafluorooctane sulfonamide	GC-MS
N-Et-FOSA	N-Ethyl-heptadecafluorooctane sulfonamide	GC-MS
N-Me-FOSE	N-Methyl-heptadecafluorooctane sulfonamidoethanol	HPLC-MS
N-Et-FOSE	N-Ethyl-heptadecafluorooctane sulfonamidoethanol	HPLC-MS

Tromsø, 25 October 2005

Urs Berger
Senior scientist, chemical analysis

Enclosure: Eight sheets with analytical results.

FAS analysis results

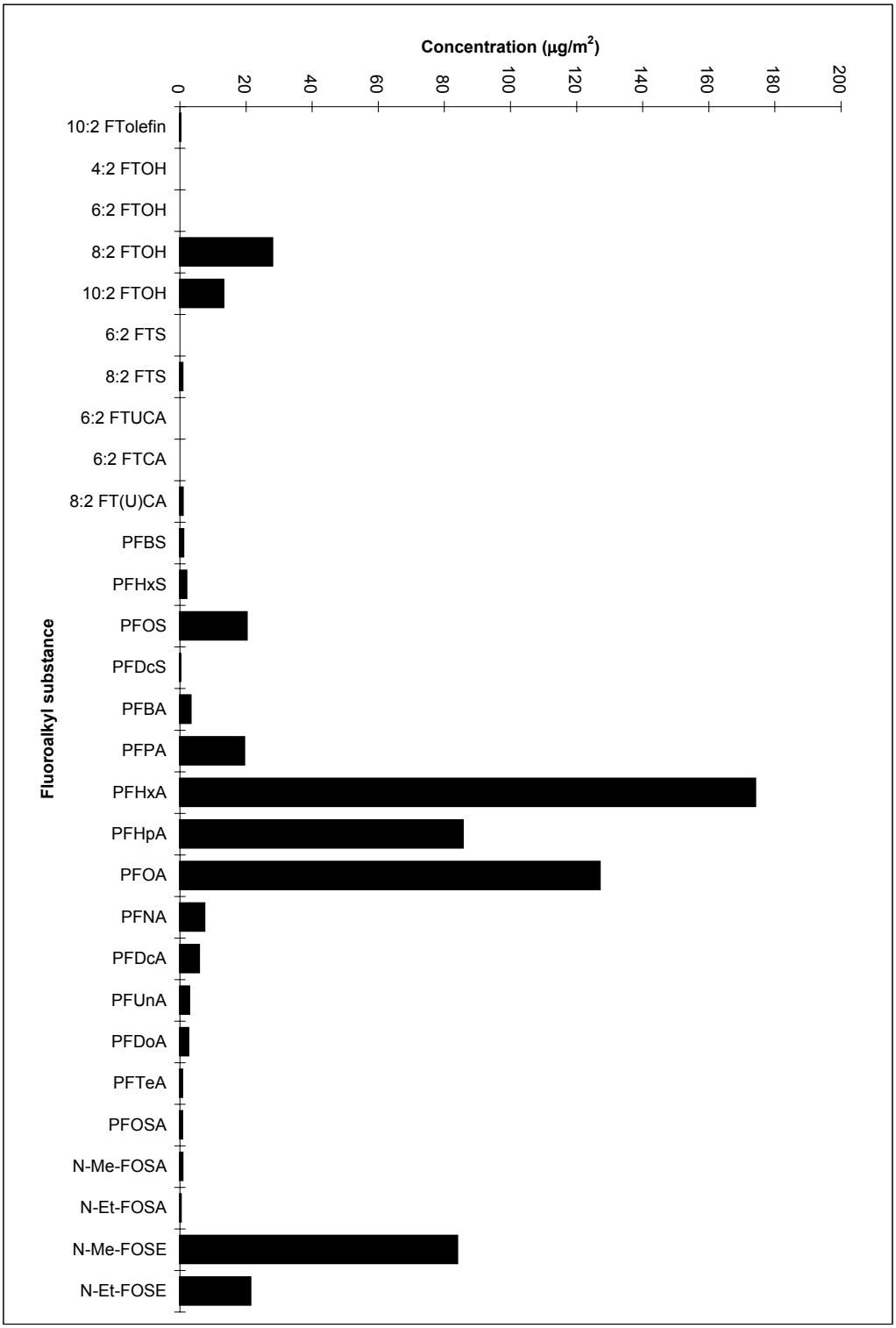
Appendix to report: T-73
NILU sample number: Bergans T 1
Customer: Bergans Norway
Customers sample ID: -
Type of sample: Cotton textile (red)
Sample amount (g): 10 x 10 cm (3.01 g)
Measuring unit: µg/m^2 (microgram extractable analyte per square meter jacket)

Compound		Concentration
Full name	Abbreviation	µg/m^2
10:2 Fluorotelomer olefin	**10:2 FTolefin**	**0,13**
4:2 Fluorotelomer alcohol	**4:2 FTOH**	**<0,50**
6:2 Fluorotelomer alcohol	**6:2 FTOH**	**<0,80**
8:2 Fluorotelomer alcohol	**8:2 FTOH**	**27,9**
10:2 Fluorotelomer alcohol	**10:2 FTOH**	**13,2**
Sum-FTOHs		***41,1***
6:2 Fluorotelomer sulfonate	**6:2 FTS**	**<0,10**
8:2 Fluorotelomer sulfonate	**8:2 FTS**	**0,73**
6:2 Fluorotelomer unsaturated carboxylate	**6:2 FTUCA**	**<0,08**
6:2 Fluorotelomer carboxylate	**6:2 FTCA**	**<0,08**
8:2 Fluorotelomer carboxylate (sum sat. and unsat.)	**8:2 FT(U)CA**	**0,81**
Sum-FTS and FTCAs		***1,54***
Perfluorobutane sulfonate	**PFBS**	**1,01**
Perfluorohexane sulfonate	**PFHxS**	**1,95**
Perfluorooctane sulfonate	**PFOS**	**20,2**
Perfluorodecane sulfonate	**PFDcS**	**0,12**
Sum-PFS		***23,3***
Perfluorobutanoate	**PFBA**	**3,19**
Perfluoropentanoate	**PFPA**	**19,4**
Perfluorohexanoate	**PFHxA**	**174**
Perfluoroheptanoate	**PFHpA**	**85,6**
Perfluorooctanoate	**PFOA**	**127**
Perfluorononanoate	**PFNA**	**7,35**
Perfluorodecanoate	**PFDcA**	**5,74**
Perfluoroundecanoate	**PFUnA**	**2,82**
Perfluorododecanoate	**PFDoA**	**2,56**
Perfluorotetradecanoate	**PFTeA**	**0,70**
Sum-PFCA		***428***
Perfluorooctane sulfonamide	**PFOSA**	**0,68**
N-Methyl-heptadecafluorooctane sulfonamide	**N-Me-FOSA**	**0,78**
N-Ethyl-heptadecafluorooctane sulfonamide	**N-Et-FOSA**	**0,22**
N-Methyl-heptadecafluorooctane sulfonamidoethanol	**N-Me-FOSE**	**83,9**
N-Ethyl-heptadecafluorooctane sulfonamidoethanol	**N-Et-FOSE**	**21,3**
Sum-FOSAs and FOSEs		***107***

<: Lower than indicated method detection limit (signal:noise 3:1)

FAS analysis results

Appendix to report: T-73
NILU sample number: Bergans T 1



FAS analysis results

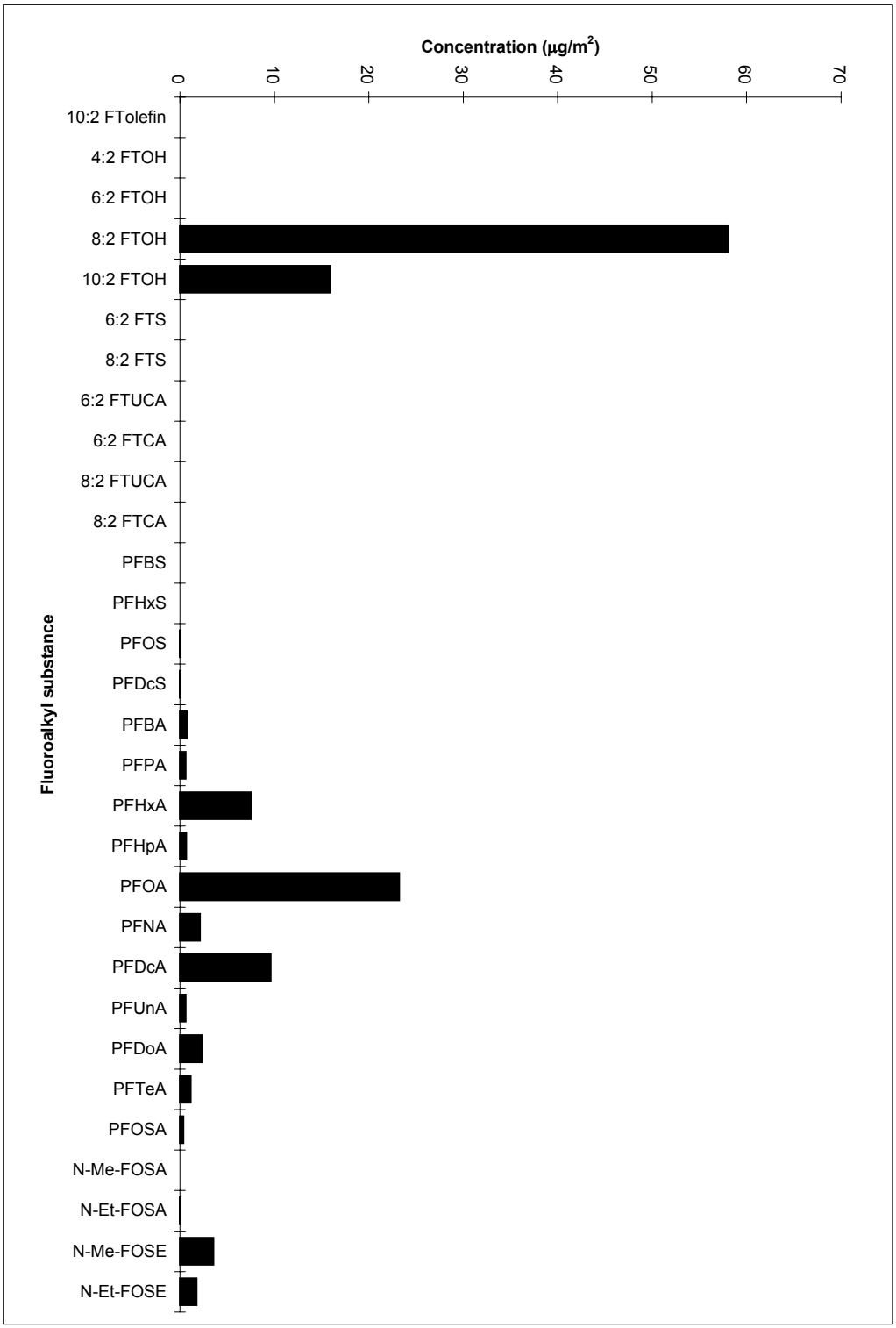
Appendix to report: T-73
NILU sample number: Bergans T 2
Customer: Bergans Norway
Customers sample ID: -
Type of sample: Synthetic textile (orange, inside grey)
Sample amount (g): 10 x 10 cm (1.45 g)
Measuring unit: µg/m^2 (microgram extractable analyte per square meter jacket)

Compound		Concentration
Full name	Abbreviation	µg/m^2
10:2 Fluorotelomer olefin	**10:2 FTolefin**	**<0,10**
4:2 Fluorotelomer alcohol	**4:2 FTOH**	**<0,50**
6:2 Fluorotelomer alcohol	**6:2 FTOH**	**<0,80**
8:2 Fluorotelomer alcohol	**8:2 FTOH**	**58,0**
10:2 Fluorotelomer alcohol	**10:2 FTOH**	**15,9**
Sum-FTOHs		***73,9***
6:2 Fluorotelomer sulfonate	**6:2 FTS**	**<0,10**
8:2 Fluorotelomer sulfonate	**8:2 FTS**	**<0,20**
6:2 Fluorotelomer unsaturated carboxylate	**6:2 FTUCA**	**<0,08**
6:2 Fluorotelomer carboxylate	**6:2 FTCA**	**<0,08**
8:2 Fluorotelomer unsaturated carboxylate	**8:2 FTUCA**	**<0,07**
8:2 Fluorotelomer carboxylate	**8:2 FTCA**	**<0,07**
Sum-FTS and FTCAs		***0,00***
Perfluorobutane sulfonate	**PFBS**	**<0,05**
Perfluorohexane sulfonate	**PFHxS**	**<0,03**
Perfluorooctane sulfonate	**PFOS**	**0,07**
Perfluorodecane sulfonate	**PFDcS**	**0,05**
Sum-PFS		***0,12***
Perfluorobutanoate	**PFBA**	**0,71**
Perfluoropentanoate	**PFPA**	**0,60**
Perfluorohexanoate	**PFHxA**	**7,54**
Perfluoroheptanoate	**PFHpA**	**0,66**
Perfluorooctanoate	**PFOA**	**23,2**
Perfluorononanoate	**PFNA**	**2,12**
Perfluorodecanoate	**PFDcA**	**9,60**
Perfluoroundecanoate	**PFUnA**	**0,58**
Perfluorododecanoate	**PFDoA**	**2,35**
Perfluorotetradecanoate	**PFTeA**	**1,13**
Sum-PFCA		***48,5***
Perfluorooctane sulfonamide	**PFOSA**	**0,36**
N-Methyl-heptadecafluorooctane sulfonamide	**N-Me-FOSA**	**<0,04**
N-Ethyl-heptadecafluorooctane sulfonamide	**N-Et-FOSA**	**0,07**
N-Methyl-heptadecafluorooctane sulfonamidoethanol	**N-Me-FOSE**	**3,55**
N-Ethyl-heptadecafluorooctane sulfonamidoethanol	**N-Et-FOSE**	**1,75**
Sum-FOSAs and FOSEs		***5,73***

<: Lower than indicated method detection limit (signal:noise 3:1)

FAS analysis results

Appendix to report: T-73
NILU sample number: Bergans T 2



FAS analysis results

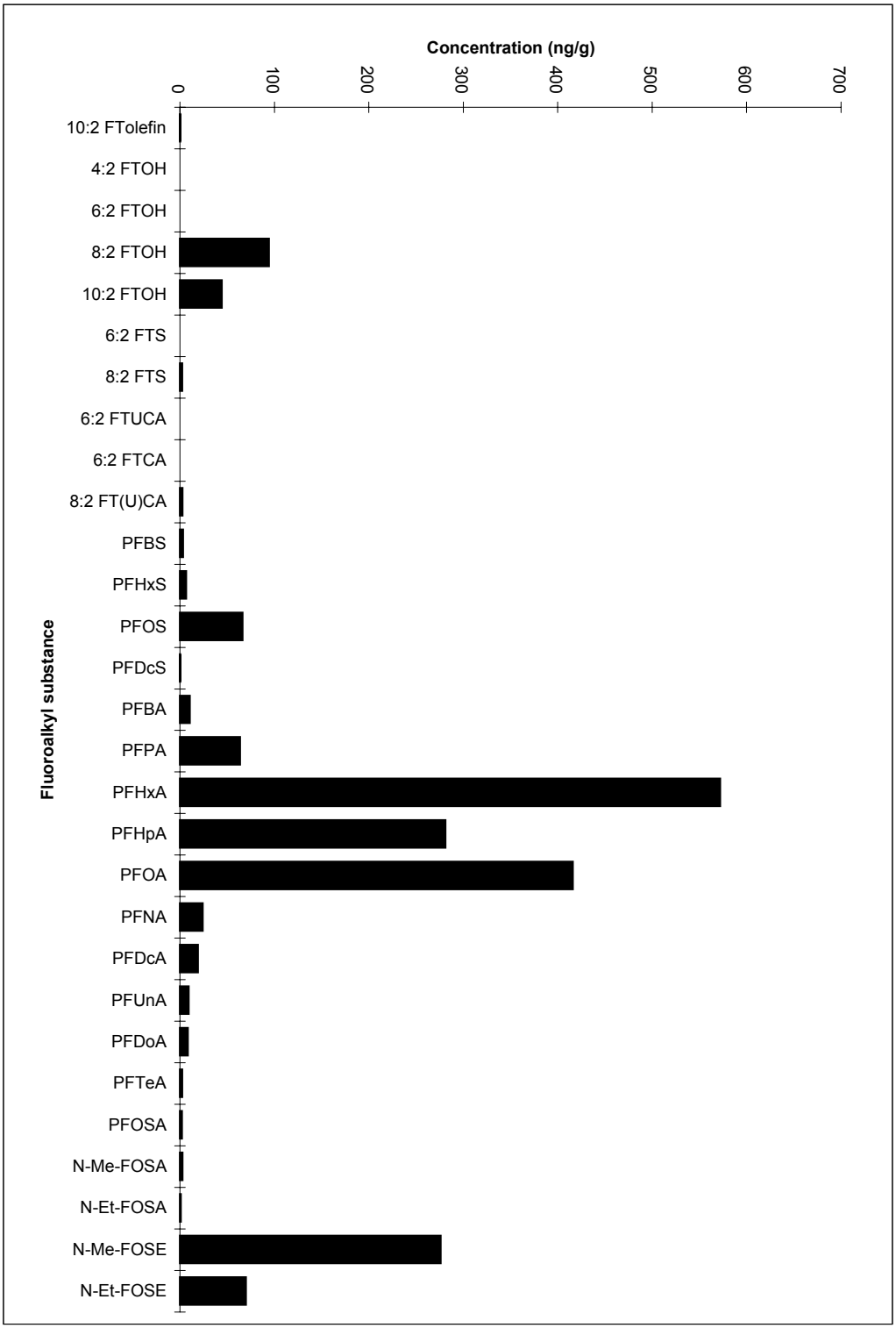
Appendix to report: T-73
NILU sample number: Bergans T 1
Customer: Bergans Norway
Customers sample ID: -
Type of sample: Cotton textile (red)
Sample amount (g): 10 x 10 cm (3.01 g)
Measuring unit: ng/g (nanogram extractable analyte per gram jacket material)

Compound		Concentration
Full name	Abbreviation	ng/g
10:2 Fluorotelomer olefin	**10:2 FTolefin**	**0,4**
4:2 Fluorotelomer alcohol	**4:2 FTOH**	**<4,0**
6:2 Fluorotelomer alcohol	**6:2 FTOH**	**<6,2**
8:2 Fluorotelomer alcohol	**8:2 FTOH**	**94,2**
10:2 Fluorotelomer alcohol	**10:2 FTOH**	**44,4**
Sum-FTOHs		***139***
6:2 Fluorotelomer sulfonate	**6:2 FTS**	**<0,3**
8:2 Fluorotelomer sulfonate	**8:2 FTS**	**2,4**
6:2 Fluorotelomer unsaturated carboxylate	**6:2 FTUCA**	**<0,6**
6:2 Fluorotelomer carboxylate	**6:2 FTCA**	**<0,6**
8:2 Fluorotelomer carboxylate (sum sat. and unsat.)	**8:2 FT(U)CA**	**2,7**
Sum-FTS and FTCAs		***5,1***
Perfluorobutane sulfonate	**PFBS**	**3,3**
Perfluorohexane sulfonate	**PFHxS**	**6,4**
Perfluorooctane sulfonate	**PFOS**	**66,2**
Perfluorodecane sulfonate	**PFDcS**	**0,4**
Sum-PFS		***76,3***
Perfluorobutanoate	**PFBA**	**10,5**
Perfluoropentanoate	**PFPA**	**63,6**
Perfluorohexanoate	**PFHxA**	**572**
Perfluoroheptanoate	**PFHpA**	**281**
Perfluorooctanoate	**PFOA**	**416**
Perfluorononanoate	**PFNA**	**24,2**
Perfluorodecanoate	**PFDcA**	**18,9**
Perfluoroundecanoate	**PFUnA**	**9,3**
Perfluorododecanoate	**PFDoA**	**8,4**
Perfluorotetradecanoate	**PFTeA**	**2,3**
Sum-PFCA		***1406***
Perfluorooctane sulfonamide	**PFOSA**	**2,2**
N-Methyl-heptadecafluorooctane sulfonamide	**N-Me-FOSA**	**2,6**
N-Ethyl-heptadecafluorooctane sulfonamide	**N-Et-FOSA**	**0,8**
N-Methyl-heptadecafluorooctane sulfonamidoethanol	**N-Me-FOSE**	**276**
N-Ethyl-heptadecafluorooctane sulfonamidoethanol	**N-Et-FOSE**	**69,9**
Sum-FOSAs and FOSEs		***352***

<: Lower than indicated method detection limit (signal:noise 3:1)

FAS analysis results

Appendix to report: T-73
NILU sample number: Bergans T 1



FAS analysis results

Appendix to report: T-73
NILU sample number: Bergans T 2
Customer: Bergans Norway
Customers sample ID: -
Type of sample: Synthetic textile (orange, inside grey)
Sample amount (g): 10 x 10 cm (1.45 g)
Measuring unit: ng/g (nanogram extractable analyte per gram jacket material)

Compound		Concentration
Full name	Abbreviation	ng/g
10:2 Fluorotelomer olefin	**10:2 FTolefin**	**<0,3**
4:2 Fluorotelomer alcohol	**4:2 FTOH**	**<4,0**
6:2 Fluorotelomer alcohol	**6:2 FTOH**	**<6,2**
8:2 Fluorotelomer alcohol	**8:2 FTOH**	**399**
10:2 Fluorotelomer alcohol	**10:2 FTOH**	**109**
Sum-FTOHs		***508***
6:2 Fluorotelomer sulfonate	**6:2 FTS**	**<0,3**
8:2 Fluorotelomer sulfonate	**8:2 FTS**	**<0,5**
6:2 Fluorotelomer unsaturated carboxylate	**6:2 FTUCA**	**<0,6**
6:2 Fluorotelomer carboxylate	**6:2 FTCA**	**<0,6**
8:2 Fluorotelomer unsaturated carboxylate	**8:2 FTUCA**	**<0,5**
8:2 Fluorotelomer carboxylate	**8:2 FTCA**	**<0,5**
Sum-FTS and FTCAs		***0,0***
Perfluorobutane sulfonate	**PFBS**	**<0,3**
Perfluorohexane sulfonate	**PFHxS**	**<0,2**
Perfluorooctane sulfonate	**PFOS**	**0,5**
Perfluorodecane sulfonate	**PFDcS**	**0,4**
Sum-PFS		***0,9***
Perfluorobutanoate	**PFBA**	**4,9**
Perfluoropentanoate	**PFPA**	**4,2**
Perfluorohexanoate	**PFHxA**	**52,2**
Perfluoroheptanoate	**PFHpA**	**4,6**
Perfluorooctanoate	**PFOA**	**160**
Perfluorononanoate	**PFNA**	**14,7**
Perfluorodecanoate	**PFDcA**	**66,4**
Perfluoroundecanoate	**PFUnA**	**4,0**
Perfluorododecanoate	**PFDoA**	**16,3**
Perfluorotetradecanoate	**PFTeA**	**7,8**
Sum-PFCA		***335***
Perfluorooctane sulfonamide	**PFOSA**	**2,5**
N-Methyl-heptadecafluorooctane sulfonamide	**N-Me-FOSA**	**<0,4**
N-Ethyl-heptadecafluorooctane sulfonamide	**N-Et-FOSA**	**0,5**
N-Methyl-heptadecafluorooctane sulfonamidoethanol	**N-Me-FOSE**	**24,6**
N-Ethyl-heptadecafluorooctane sulfonamidoethanol	**N-Et-FOSE**	**12,1**
Sum-FOSAs and FOSEs		***39,7***

<: Lower than indicated method detection limit (signal:noise 3:1)

FAS analysis results

Appendix to report: T-73
NILU sample number: Bergans T 2